BitCtrl Systems GmbH

QNX6.5.0SP1/6.6.0/7.0 BSP for PHYTEC i.MX6 boards (RDK/MIRA)

Release Notes

BSP Version 1.4.4

Document History

Date	Ver.	Description	Author
July 24, 2013	0.1	Initialization from internal documentation	A. Uhlmann
July 25, 2013	1.0	Final reading and approval	J. Winter
January 10, 2014	1.1	Documentation of Release v1.1	A. Uhlmann
April 11, 2014	1.2	Documentation of Release v1.2	A. Uhlmann
January 29, 2015	1.3	Documentation of Release v1.3.1	A. Uhlmann
July 16, 2015	1.3.2	Documentation of Release v1.3.2	A. Uhlmann
September 13, 2016	1.4.0	Documentation of Release v1.4.0	A. Uhlmann
November 30, 2016	1.4.1	Documentation of Release v1.4.1	A. Uhlmann
June 23, 2017	1.4.2	Documentation of Release v1.4.2	A. Uhlmann
April 27, 2018	1.4.3	Documentation of Release v1.4.3	A. Uhlmann
December 7	1.4.4	Documentation of Release v1.4.4	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 v1.4.3, date December 7, 2018, of the BSP. This is a maintenance release of the v1.4 baseline but it also 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, 3 and 5).

1.3 Host OS

You can install and use this package on Hosts running MS Windows 7 or MS Windows 10, with the QNX Momentics IDE v4.7 service pack 1 (for QNX6.5.0SP1), QNX Momentics IDE v5.0 (for QNX6.6.0) or QNX Momentics IDE v7 (for QNX 7) installed. There has to be a valid development license installed and activated in order to build the BSP binaries from source.

We have also validated the build for the QNX 6.6 and QNX 6.5 versions under Ubuntu 14.04 LTS and for QNX 7 under Ubuntu 16.04 LTS.

Using the package on other Linux hosts or self-hosted under QNX Neutrino (QNX6.5 only) should work also, but currently we do not officially support it.

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/FreescaleImx6QSabreLite

[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.

[I2CMAP] This document is a list of I²C devices with their corresponding addresses. (I2C-Map_13Sep2016.pdf)

1.5 Contact and Support

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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/

2 Tested Devices

No.	Device	Command line, Comments
1	Barebox Boot Loader	Part of the PHYTEC development kit. We tested Barebox version 2013.08.0 (PD13.2.3), 2015.11.0 (PD15.3.0) and 2016 (PD16.1.0). Only one barebox script is needed to boot QNX instead of Linux. The installation process is fully automated for SD card and NAND flash based root file system.
2	startup	Same as in [REFBSP]

3	Serial Driver	X51 (UART0, used for console, no RTS/CTS support):
		`devc-sermx1 -e -F -S -c80000000 0x021F0000,61`
		X50 (UART1, has RTS/CTS support, free for industrial protocols)
		`devc-sermx1 -E -F -S -c80000000 0x021EC000,60`

4	Flash driver (FFS3)	**phyFLEX:** devf-norspi-N25Q128A, Read: 1350 KB/s, Write: 14 KB/s. Derivative work from the NORSPI driver found in the Sabrelite reference BSP [REFBSP] `devf-norspi-N25Q128A –r` **phyCORE:** Not yet supported.
5	Boot images	There are three images in the System Builder [QNXDOC] project: A large one containing almost all drivers to get started easily, and a much smaller one, containing only the driver for the MMC/SD port. It expects a QNX6 file system and mounts it to /, expecting all further software in the usual /sbin, /bin/, /lib, /usr directories. A similar boot image exists but works for hosting the root file system in NAND flash. The large boot image is also used for automatic installation of an SD card.
6	SPI Driver	We provide an experimental version of an SPI driver which is based on the SPI archive release on Foundry27, patch number 3305:

7	I²C driver	Taken from original BSP
		• RTC is usable, QNX-conform via rtc utility on i.MX6 I²C instance 2
		`i2c-mx35 -p 0x021A4000 -i69 -c66000000 --u 0`
		• EEPROM 24C32 (as static library), on i.MX6 I²C instance 1:
		`i2c-mx35 -p 0x021A0000 -i68 -c66000000 --u 2`
		• Camera VM-010-BW, on i.MX6 I²C instance 3:
		`i2c-mx35 -p 0x021A8000 –i70 -c66000000 --u 1`
		(See [I2CMAP])

8	MMC/SD-Driver	Taken from original BSP
		For QNX 6.5:
		modified `variant.h` to match board layout. Transcend SDHC Card 4GB. Read: 13900 KB/s, Write: 4000 KB/s
		Command line:
		`devb-mmcsd-phyFLEX-iMX6 blk cache=8M,automount=hd0t179:/ dos exe=all`
		For QNX 6.6:
		No modifications. Transcend SDHC Card 4GB. Read: 13900 KB/s, Write: 4000 KB/s
		Command line:
		`devb-sdmmc-mx6_generic cam pnp,verbose blk rw,cache=8M,automount=hd0t179:/ dos exe=all sdio addr=0x02194000,irq=55`
		For phyBOARD MIRA: Not all cards are supported. We tested Transcend 4GB class 10, Intenso 4 GB Class 10, Sony 8 GB Class 10. See issue#16

		For QNX 7: Use generic driver from [REFBSP] without modifications.
9	USB-Host-Driver	Taken from original BSP, available in binary format only: • USB-Stick. Read: 18 MB/s, Write: 12000 KB/s. (command line: `devb-umass cam quiet blk automount=hd0t6:/fs/usb2`). • USB-Ethernet-Dongle D-Link D-100.
10	rtc utility	phyFLEX: RTC8564, DA9063 phyBOARD MIRA: RV-4162-C2 via m41t6x backward compatibility
11	GPIO	gpt-phyFLEX-iMX6 Trigger Instance: `gpt-phyFLEX-iMX6 -p 5 -v` Consumer Instance: `on -p 50 gpt-phyFLEX-iMX6 -r 1 -N 4` Pin-2-ISR Latency: 4 … 30 µs (depending on interrupt load in the rest of the system) ISR-2-Thread Latency: 20 … 35 µs (depending on rest of system load and distribution of thread priorities) (@396 MHz)
12	FPU	Enabled by default. The libm has FPU support compiled in, no extra-versions as with ARMv6 devices like the i.MX35. Benchmarks (@396MHz): 65536 Samples: 0.956s (x86 1.6GHz: 0.625s) 131072 Samples: 2.078s (x86 1.6GHz: 1.313s) 262144 Samples: 4.503s (x86 1.6GHz: 2.812s) Under QNX 7 Hard-FPU operations are used, resulting in about 30% performance boost, depending on application.

13	TEMPMON	i.MX6 has on-chip temperature sensor. Driver is part of the new Slowsensor framework and periodically samples this sensor and publishes results under `/pps/system/sensors/temperatures/cpu/values`. The attributes are like this:
		`@values`
		`description::CPU Core Temperature`
		`inode::1`
		`publishTimeStamp::08.03.2018 13:31:49.841`
		`sensorTimeStamp::08.03.2018 13:31:49.841`
		`unit::deg C`
		`value::75.6098`
		Driver start: `devs-imx6x.`

14	S-ATA	Seagate ST35 500 GB with QNX6 file system. Write: 23 MB/s, Read: 33MB/s @396 MHz (phyFLEX RDK only).
15	Graphics	phyFLEX Hardware: QNX Screen running on DVI and on LVDS Touch Panel (PHYTEC LCD-018, PL 1365.1 using LVDS channel) To switch between DUAL Display operation, LCD only, LVDS only and DVI monitor only, use this command: `switch_display.sh` Note: You need to reboot the board to make it take effect. phyBOARD MIRA: QNX Screen running on HDMI output, tested resolution 1920x1080. ETM0700G08 display via LCD pins with touch support. Mitsubishi AA084SC01ADA11 LVDS display with USB touch support
16	ETFS	NAND flash driver using ETFS file system. Tested devices: - AMD/Spansion S34ML08G2 - Micron 29F4G08
17	PCIe	(QNX 6.6 only) Using QSS-supplied experimental PCIe driver JBN 35. This is not the latest release because this currently does not work.
18	CAN	Derivative work of QSS-supplied CAN driver found in the Sabrelite reference BSP [REFBSP]

		`dev-can-mx6x-phyFLEX -x -M -b 100K can0` `dev-can-mx6x-phyFLEX -x -M -b 100K can1` (not on RDK, but tested on customer boards) OR: `can-restart` (located in `/usr/sbin`) We have created a demo program that allows stress testing the interface.
19	Push Buttons	Newly developed driver for supporting pushbuttons on i.MX6 GPIO lines. On the MIRA Evaluation carrier two buttons are present. For example: pushbutton service for S2 (as unit 2), routed to GPIO bank 6, pin 18: `pushbtn-mx6x -u2 -b6 -p18` On RDK buttons can be connected to the GPIO pinout header. See rc.devices for defaults.

Table 1: Tested Devices

3 List of new features, enhancements and fixes for this release

No.	Description	Reference
	New Features	
1	Supply driver for handling pushbuttons for various purposes of user interaction	
2	DA9062 RTC on the phyCORE module is now supported	BCM5691
3	Provide a scheme to protect access shared resources like GPIO banks across process boundaries (resourcesync library and seeding tool). The scheme is automatically launched on system boot.	BCM5692
4	Hosting the root file system in eMMC on phyCORE is now fully supported	BCM5589
	Enhancements	
1	The graphics configuration file is no longer copied on every boot, making it possible to put the entire directory read-only.	BCM5702
2	Configuration of pinmux for displays and touch interfaces has been moved to startup, making the use of the pinmux tool on boot unnecessary.	BCM5527
3	Disable the cursor in all graphics configurations, which resolves the issue of flickering displays when using the touch screen	BCM5654
4	Added new carrier-callout for setting up the GPIO. It is used on the RDK to configure the GPIO pinout header, which can be used as a template.	
5	Added a hook to show a splash screen at the earliest possible point in time	BCM5689
	Fixes	
1	The switch_display.sh script now handles the state transitions between all four possible graphics configurations correctly.	BCM5439
2	I2C communications on phyCORE on-module bus (EEPROM, DA9062) is now working correctly	BCM5695
3	Various small fixes in the build process	
4	Move several other pinmux configurations to startup. The need for using the pinmux tool on boot is thereby eliminated for the standard interfaces.	BCM5658
5	PWM is operational in all low-power modes	BCM5645

Table 2: New features, enhancement and fixes

4 BSP History (older releases)

No.	Date	Description
1.4.3	April 27, 2018	Maintenance release for V1.4 baseline with support for QNX 7
1.4.2	June 23, 2017	Maintenance release for V1.4 baseline with several new features
1.4.1	November 30, 2017	First maintenance release of v1.4 baseline
1.4.0	October 10, 2016	First Release of v1.4 baseline

1.3.2	July 16, 2015	Last release of v1.3 baseline
1.3.1	January 29, 2015	GA release of the v1.3 baseline
1.3	November 11, 2014	Internal Release for some customer-specific projects
1.2	April 11, 2014	Release to support latest hardware version 1362.2, introduced TEMPMON driver and I²C map.
1.1	January 10, 2014	First release with camera and QNX Screen support
1.0	May 24, 2013	Initial GA release

Table 3: BSP History

5 Known Issues for this release

No.	Description	Reference
1	Text files in /etc, specifically /etc/hosts, /etc/TIMZONE and /etc/net.cfg, have to be in UNIX file format, otherwise qconn may crash under certain conditions.	QSS86687
4	USB automount is not configured, the tools (enum-*) are partly contained on the SD-card, though. (QNX6.5 only; QNX6.6/7 have a completely different handling of USB devices)	
5	The priorisation of the interrupts is not implemented.	QSS112556
7	Writing to the SPI NOR Flash is very slow (14 KB/s). One reason might be that every write cycle requires a 4KB Block ERASE. Whether this can be substantially improved, e.g. by enlarging the Erase-Unit to 64KB, is subject to further analysis.	BCM3711
9	CPU-frequency cannot be adjusted using standard option -f to startup	BCM3356
10	'Write Protect' and 'Card Detect' doesn't work in old-style SD card driver (used for 6.5 only). Under QNX 6.6/7, we use the new QNX-supplied driver which supports CD and WP signals correctly.	BCM3450, 51625
11	Auto-Negotiation at 1 GBit/s takes very long (10s or more) on QNX6.5	BCM4002
13	Running two independent Qt5 applications on two displays is currently not possible.	
16	Older variants of the MIRA carrier don’t support all MicroSD HC cards. Contact PHYTEC directly for details.	
17	Using the `-I` option to ETFS driver currently leads to a lockup inside ETFS. There is currently no other workaround than abandoning using `-I` option	BCM5095
18	Latest core network patches for QNX 6.5 SP1 and ASIX USB-2-Ethernet driver do not seem to work properly.	
19	CAN driver's TX messageboxes can get stuck under heavy load with messages never transmitted	BCM5378
20	It is currently not easy to develop against the BSP. Certain parts of the source tree must be present in the workspace.	BCM5424
21	First touch on a touch screen can get lost if connected via I²C	BCM5550

Table 4: Known Issues

6 Usage Restrictions

No.	Description	Reference
1	Be aware that running the processor at speeds above ~600 MHz can cause so much heat that the processor automatically shuts down. Use proper cooling equipment if you plan to continuously run on higher clock rates	
2	For QNX 6.6, we recommend to use the network driver of the BSP released February 25, 2014 (JBN 5) since newer versions of the driver tend to cause kernel crashes under heavy load conditions.	
3	It is not recommended to store a continuous stream of data at high rates (e.g. several 100 KB/s or above) on the NAND flash since this conflicts with the NAND management being on the host side. Consider using managed flash in this type of usage scenario.	
4	We have validated Winbond W29N08GV and Macronix MX60LF8G18AC NAND flash chips. The driver supports them, but the required ECC level of 4 Bits per 528 Byte page is not met by the software implementation of the QSS-supplied ETFS library. If you plan to use ETFS for root file system or for critical storage please contact us to advise the best approach.	BCM5522

Table 5: Usage Restrictions

7 Discontinued Items

No.	Description	Reference
3	We plan to remove support for IDE 4.7 because IDE 4.7 and IDE 5.0 are based on different versions of Eclipse and CDT that are in part incompatible in the project structure. Since we maintain only one source tree for both QNX 6.5 and QNX 6.6 we have a problem. To be clearer, we do not plan to remove support for QNX 6.5 in any way. Only support for the IDE 4.7 will be discontinued. QNX 6.5 users should upgrade to the latest IDE 5.0 and choose the 6.5 toolchain as target to build for 6.5. Support for this is available via helpdesk.	
4	The old API to the CPU temperature sensor declared in devs.h is deprecated. Use the new API in slowsensapi.h. Currently, we keep the header devs.h for compatibility but plan to remove in a later release. The new API is very similar to the old one so porting should be straight forward.	
5	Drop usage of ‘nocamera’ cookie. Replaced with ‘usecamera’ but the meaning has changed.	
6	Dropped support for installation on and running from left SD card port (SD2)	

Table 6: Discontinued Items

8 Glossary

Term	Description
BitCtrl	BitCtrl Systems GmbH
BSP	Board Support Package
DMA	Direct Memory Access
FPU	Floating Point Unit, part of processor that supports calculation of floating-point values in hardware
GA	Generally-available
GPIO	General-Purpose Input/Output
IPU	Image Processing Unit. Subsystem on the i.MX6 processor that connects displays and cameras to the core.

IRQ	Interrupt request
MB	Megabytes (=1024*1024=2^{20} bytes)
PHYTEC	PHYTEC Messtechnik GmbH. Manufacturer of the phyFLEX-i.MX6 module and development kit.
PIO	Programmed I/O
QSS	QNX Software Systems. Manufacturer of the QNX Neutrino RTOS which the BSP is developed for.
RAM	Random Access Memory
SPI	Serial Peripheral Interface. i.MX6 has five controllers on-board. On phyFLEX-i.MX6 module, instance 3 is used for on-board NOR flash AND is wired to external X_SPI0. Instance 5 is entirely free for external devices on X_SPI1 On phyCORE-i.MX6, instance 1 is used for on-board NOR flash

Table 7: Glossary

List of Tables