

# Freescale MQX™ RTOS 4.1.0 TWR-K22F120M128R Release Notes

## 1 Introduction

These are the Release Notes for the K22F120M128R standalone package for Freescale MQX™ RTOS 4.1.0. Freescale PK22J7VDC belongs to the Kinetis K series processor family of 32-bit microcontrollers. The software is built based on MQX™ RTOS version 4.1.0. It includes the full set of RTOS services and a standard set of peripheral drivers. Prior installation of MQX™ RTOS 4.1.0 is not required to install this package.

For more information, see *Freescale MQX™ RTOS 4.1.0 Release Notes* (MQXRN) and *Getting Started with Freescale MQX™ RTOS* (MQXGSRN).

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## 1.1 Development tools

The TWR-K22F120M128R release was tested with the following development tools:

- IAR Embedded Workbench® for ARM® Version 6.70.1
  - Support available for Kinetis ARM Cortex®-M4 devices
  - See build projects in `iar` subdirectories
- ARM-MDK - Keil  $\mu$ Vision® Version 5.0
  - Support available for Kinetis ARM Cortex-M4 devices
  - See build projects in `uv4` subdirectories
- GNU Tools for ARM Embedded Processors version 4.7-2013-q3
  - Support available for Kinetis and Vybrid devices
  - Makefile build option: `TOOL=gcc_arm`
- Makefile support (mingw32-make version 3.8.2)
  - Library makefiles are located in `<MQX_library_dir>/build/<board>/make`
  - Application makefiles are located in `<example_dir>/build/make/<board>`

For instructions on setting up development tools, including installing processor support patches, see Section 4 “Other notes”.

## 1.2 System requirements

The system requirements are defined by the development tool requirements. There are no special host system requirements for the Freescale MQX™ RTOS distribution.

## 1.3 Target requirements

The TWR-K22F120M128R package was tested with the following hardware configurations:

- TWR-K22F120M system module Rev. B with a PK22J7VDC processor
- TWR-SER serial system module Rev. G
- TWR-SER2 serial system module Rev.D
- TWR-ELEV primary and secondary elevator system modules
- TWR-MEM Rev. B memory extension system module

## 2 Features

### 2.1 Key features

This package provides support for the TWR-K22F120M tower system module with a PK22J7VDC processor and a standard set of features and example applications.

This section describes the major changes and new features implemented in this release.

- Core clock: 96 MHz (High Speed Run mode, default)
- Bus clock: 48 MHz (High Speed Run mode, default)
- BSP Timer: SysTick
- Default console: ttyb (OpenSDA)

The package supports these features:

- PSP support for the PK22J7VDC Microcontroller
- BSP for the TWR-K22F120M tower system module with a PK22J7VDC processor
- Standard set of I/O drivers supporting the K22F120M128R peripherals including:
  - LWGPI/O driver
  - Serial interrupt and polled driver
  - DMI SPI driver
  - I2C interrupt and polled driver
  - ADC
  - LWADC
  - Flash Driver
  - RTC Driver
  - PIT Timer
  - LPT Timer
- USB Device, Host and OTG drivers and stacks
- Example and demo applications demonstrating MQX™ RTOS, USB and MFS usage
- MFS file system
- Shell command line interface

## 2.2 Limitations

This release does not support this feature:

- CodeWarrior v10

## 2.3 Example applications

This package contains applications demonstrating kernel, peripheral, and file system on the TWR-K22F120M Tower System kit with a PK22J7VDC processor. The applications can be found at the following locations:

- `<install_dir>/mqx/examples`: standard set of examples for kernel features and basic peripheral drivers
- `<install_dir>/usb_v2/example`: examples demonstrating USB stack features and class drivers
- `<install_dir>/mfs/examples`: example applications demonstrating the MFS file system features

## 2.4 Release contents

This section provides an overview of the release content.

Deliverable	Location
<b>MQX PSP Source Code and Examples</b>	<code>&lt;install_dir&gt;/mqx/...</code>
MQX PSP source code for Kinetis	<code>.../mqx/source/psp/cortex_m</code>
MQX PSP build projects	<code>.../mqx/build/&lt;compiler&gt;/psp_twrk22f120m128r /...</code>
MQX example applications	<code>.../mqx/examples/...</code>
<b>MQX BSP Source Code</b>	<code>&lt;install_dir&gt;/mqx/...</code>
MQX BSP source code for TWR-K22F120M128R	<code>.../mqx/source/bsp/twrk22f120m128r</code>
MQX BSP build projects	<code>.../mqx/build/&lt;compiler&gt;/bsp_twrk22f120m128r /...</code>
<b>USB Host Drivers Source Code and Examples</b>	<code>&lt;install_dir&gt;/usb_v2/usb_core/host/...</code>
USB Host source code and class drivers	<code>.../usb_v2/usb_core/host/source</code>
HUB Class Driver	<code>.../usb_v2/usb_core/host/source/classes/hub</code>
Human Interface Device (HID) Class Driver	<code>.../usb_v2/usb_core/host/source/classes/hid</code>
Mass Storage (MSD) Class Driver	<code>.../usb_v2/usb_core/host/source/classes/msd</code>
Communications Device Class (CDC) Class Driver	<code>.../usb_v2/usb_core/host/source/classes/cdc</code>
USB Host build projects	<code>.../usb_v2/usb_core/host/build/&lt;compiler&gt;/usbh_mqx_twrk22f120m128r</code>
USB Host example applications	<code>.../usb_v2/example/host</code>
<b>USB Device Drivers Source Code and Examples</b>	<code>&lt;install_dir&gt;/usb_v2/usb_core/device/...</code>
USB Device source code	<code>.../usb_v2/usb_core/device/source</code>
USB Device build projects	<code>.../usb_v2/usb_core/device/build/&lt;compiler&gt;/usbd_mqx_twrk22f120m128r</code>
USB Device example applications	<code>.../usb_v2/example/device</code>
<b>USB OTG Drivers Source Code and Examples</b>	<code>&lt;install_dir&gt;/usb_v2/usb_core/otg/...</code>
USB OTG source code	<code>.../usb_v2/usb_core/otg/source</code>

USB OTG build projects	.../usb_v2/usb_core/otg/build/<compiler>/usbd_mqx_twrk22f120m128r
USB OTG example applications	.../usb_v2/example/otg
<b>RTCS Source Code and Examples</b>	<b>&lt;install_dir&gt;/rtcs/...</b>
RTCS source code	.../rtcs/source
RTCS build projects	.../rtcs/build/<compiler>/rtcs_twrk22f120m128r
<b>Shell Library Source Code</b>	<b>&lt;install_dir&gt;/shell/...</b>
Shell source code	.../shell/source
Shell build projects	.../shell/build/<compiler>/shell_twrk22f120mf128r
<b>PC Host Tools</b>	<b>&lt;install_dir&gt;/tools</b>
TFS Make Utility	.../tools/mktfs.exe
Check for Latest Version tool	.../tools/webchk.exe
<b>Documentation</b>	<b>&lt;install_dir&gt;/doc</b>
User guides and reference manuals for the MQX™ RTOS, MFS, IO Drivers, USB, etc.	.../doc

## 3 Installation Instructions

### 3.1 Installation guide

Run the TWR-K22F120M128R package installer and proceed according to instructions. This package can be used independently of the current MQX™ RTOS 4.1.0 folder.

#### 3.1.1 Build procedure

For build procedures, see *Getting Started with Freescale MQX™ RTOS* (document MQXGSRTOS).

#### 3.1.2 Default jumper settings

These are the default jumper settings for TWR-K22F120M with a PK22J7VDC processor standalone operation:

- J18, J37, J36, J10, J7, J9, J17, J12, J15, J28, J26 on
- J21, J13, J11, J38, J34, J33 off
- J29, J30, J35 on position 2-3
- J27, J19, J22 on position 1-2
- J16 1-2, 3-4, 5-6, 7-8

#### 3.1.3 Important jumper settings

For basic operations, ensure that the following jumper settings are applied:

- For USB:
  - J4 1-2: enables the P3V3\_VOUT.
  - J26 1-2: enables 5V VBUS for the Host mode.

For TWR-K22F120M board rev. A:

- J27 1-2: uses the mini USB receptacle on the TWR-SER board.
- J27 2-3: uses the micro USB receptacle on the TWR-K22F120M board.

For TWR-K22F120M board rev. B or later:

- J27 1-2: uses the micro USB receptacle on the TWR-K22F120M board.
- J27 2-3: uses the mini USB receptacle on the TWR-SER board.

### 3.1.4 Board-specific build targets

Internal Flash (Debug and Release): These targets enable building applications suitable for booting the system from the Internal Flash memory. After reset, the code is executed from the Internal Flash.

## 4 Other Notes

### 4.1 Keil (Uv4) patch

Because the Keil version 5.00 does not support the K22F120M128R device, a patch is required for this device.

1. Install the patch by following the installer instructions:  
`<install_dir>/tools/keil_extensions/uVision4/MDK-ARM_AddOn_K22FN128xxx10.exe`
2. Select the J-LINK/J-Trace Cortex as the debug tool in the Debug tab of the Options for Target window.
  - a. Add the target MKXX 128kB Prog Flash to the J\_LINK/J-Trace driver setting.
  - b. In the **Operating system** text box on the **Target** tab, select **Freescale MQX** and click **OK**.

### 4.2 LWGPIO

The Lwgpio example has been moved to the gpio directory. The old Posix IO gpio example was removed as the driver and is no longer supported.

### 4.3 IAR 6.70.1

IAR 6.70.1 does not support the K22F120M128R device. Select the MK22FX512xxx12 and FlashK60Dxxx16K board as the workaround for the flash loader.



## 5 Known Issues

- The external crystal oscillator needs some time to stabilize itself before generating smooth clock cycles. A delay of few ms is needed after the clock is changed from wait mode (run at 2 MHz) into the normal run mode (run at 48 MHz).
- Because of the poor clock accuracy of CSTCE8M00G55-R0 on the TWR-K22F120M board, there is noise when the audio example (including USB audio example) is running.
- USB
  - The TWR-SER2 board is not tested.
  - The installation folder of the GCC Tool Chain needs to be modified to the correct path manually by the customer. Otherwise, the GCC tool chain cannot work.
  - The GCC Tool Chain is only verified on the Windows7 system, not verified on any other systems.
  - All the examples on Keil only have the Flash target version, no RAM target version provided.
  - External power supply of HUB must be provided before it can be used.
  - The installation folder name of the release package cannot contain blank spaces. Otherwise, the GCC Tool chain will fail to get the correct path of source files and fail to compile.
  - Because of poor clock accuracy of CSTCE8M00G55-R0 on the TWR-K22F120 board, there are noises when USB audio example is running.
  - There is a post build for USB library generation, which intends to copy the header files and binary library file to the OUTPUT folder. If the USB stack is installed to a deep folder, this copy operation may fail because of the 260 characters limitation of command line on Windows, and then you get a build error. Please keep the root folder name of USB stack as short as possible to avoid this issue.
  - Parsing HID report descriptor is not implemented in all the HID examples of USB Host, the key mapping of some HID devices may not be correct and the key mapping for Audio volume control of some Audio devices may not be correct.
  - Due to USB PLL removal on 128R, the external 48 MHz canned oscillator is needed for the Host mode. For the detailed information on how to configure the tower board TWR-K22F120M to operate as USB Host, see the *USB Configuration for TWR-K22F120M (USBCFK22F120)*.
- Due to the small RAM and ROM sizes on the K22F120M128R device, some demos will not fit and return an overflow error when compiled.

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