Demo Quick Start Guide

ColdFire Based IEEE® 1588

How to set up the ColdFire MCF5234-based IEEE 1588 demo

freescale semiconductor

Introduction

The M5234BCCKIT comes configured to run the IEEE 1588 Precision Time Protocol Demonstration. This guide describes how to download the software to the evaluation board and how to access the demo and the tools.

The default communications interface with the M5234BCCKIT is a USB port connected via the P&E multilink interface, which is supplied in the kit. This link allows debug communication to the BCC kit and the FreeMASTER tool.

The FreeMASTER tool, running on a host PC, allows the IEEE 1588 data packets to be monitored during data transfer and provides the user interface to the demo. This interface allows users to configure and manage the demo application.

Step-by-Step Installation Instructions

STEP 1

IEEE 1588 Demo Concept, HW Setup

The demo application, showing the Precision Time Protocol (PTP) implementation on ColdFire processors, consists of several boards and components. Some of these are essential, while others are optional. The minimum configuration includes:

1. M5234BCC board with the PTP stack configured as the master device
2. A second M5234BCCKIT M5234BCC board with the PTP stack configured as the slave device
3. PC with the FreeMASTER software installed, a serial line cable or the P&E USB Multilink debug module
4. Power supplies and Ethernet crossover type cable
5. Oscilloscope (optional)

The demo can be configured in a “back-to-back” configuration, where two boards are connected directly using the crossover Ethernet cable. The user interface to the applications, running on both the master and the slave, is managed through the FreeMASTER GUI. FreeMASTER is a visualization tool, which runs on a PC. There are two ways to establish the connection between FreeMASTER and the BCC boards—either through a standard RS-232 serial line, or through the P&E USB BDM Multilink debugger. The “back-to-back” configuration is illustrated in Figure 1.

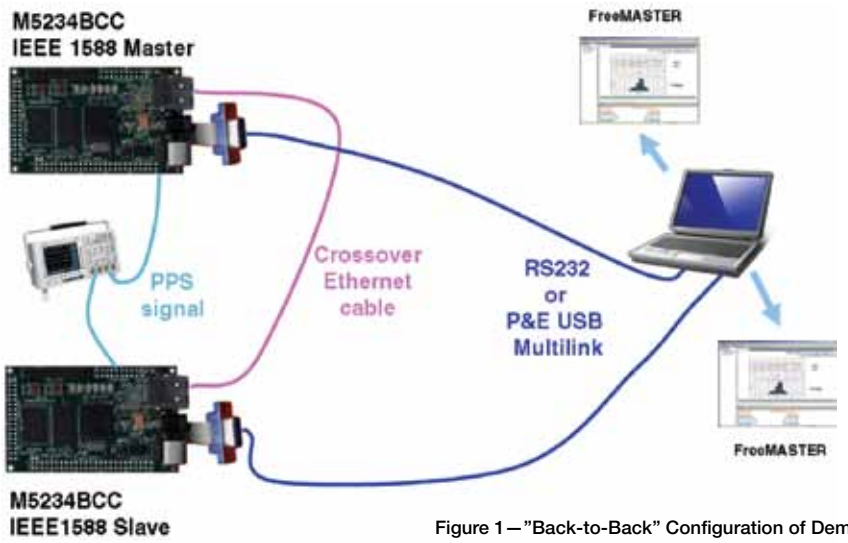


Figure 1—”Back-to-Back” Configuration of Demo

It is possible to extend the system to include additional “PTP slaves” (one or several). An Ethernet switch provides the connection between all ColdFire BCC boards. As an alternative to the FreeMASTER GUI, a Telnet console can be used for monitoring and control of the PTP activities. Figure 2 shows a configuration with one master and two slave devices. All boards can be interfaced via FreeMASTER (the preferred option), or via a Telnet console. To set-up the hardware, connect all M5234BCC boards and the PC using an Ethernet Switch with the Ethernet cables (pink color in Figure 2). Decide what type of connection will be used for the FreeMASTER communication (blue color in Figure 2). To use the serial line option, connect the board with the PC using the serial cable(s using COM header on the M5234BCC.

To use the P&E USB BDM Multilink option, connect the PC with the P&E USB BDM Multilink using the USB cable, and then attach the Multilink device to the BCC board using the BDM header.

If Telnet is used to communicate with the boards, no additional cables are required, as the communication is performed through the Ethernet. Once all cables are connected, apply power to the BCC boards.

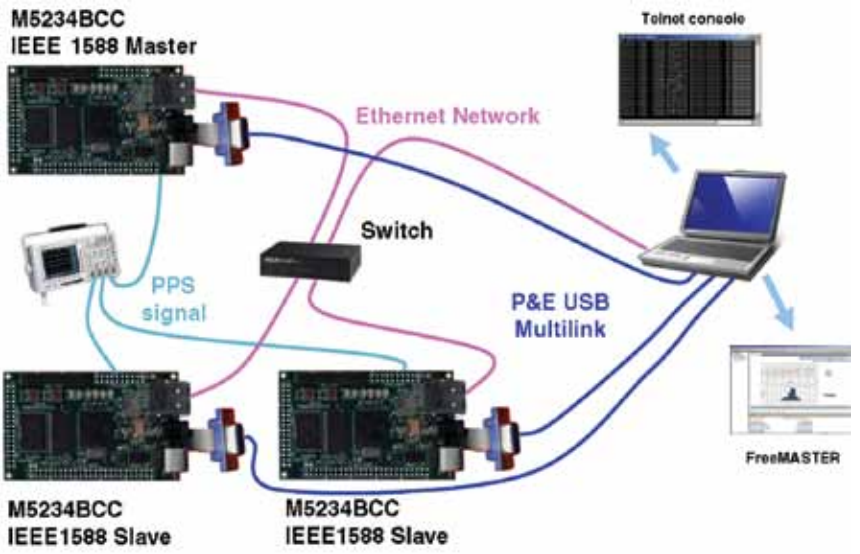


Figure 2—Demo extended to include multiple nodes

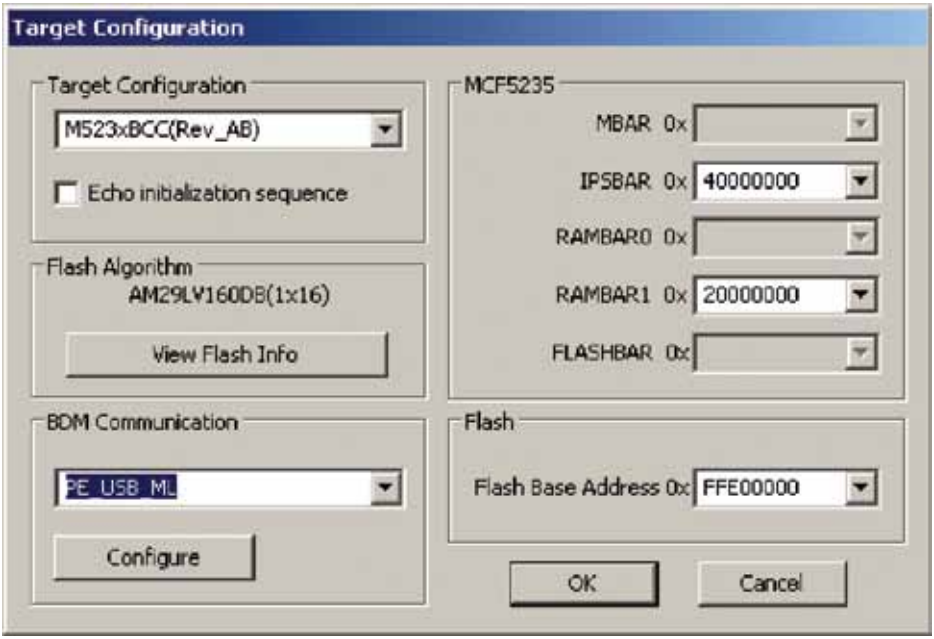
STEP 2

Programming the Demo Code into the M5234BCC On-Board Flash

The application code and tools required for the demonstration are available for download at www.freescale.com/coldfire1588demo. Before the application can be run on any board, the application code must be programmed into the flash memory on the M5324BCC boards.

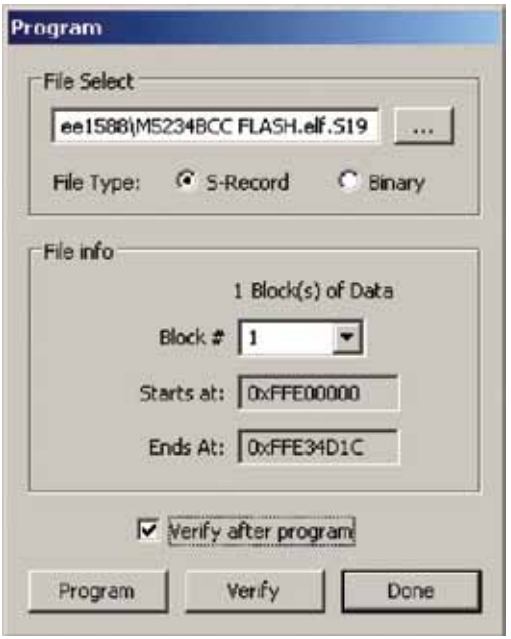
This is done as follows:

1. Download the latest version of the IEEE 1588 demo software from www.freescale.com/coldfire1588demo.
2. Start the CF Flasher application and click on the Target Configuration button to open the Target Configuration pane.
3. Select the correct board configuration (M523xBCC(Rev_AB)) from the “Target Configuration” pull-down menu.



4. Program the evaluation board using the BDM interface by selecting the “BDM Communication” pull-down menu.
5. Click on “OK” button to close the window and choose “Program” from the main menu.
6. Open the file selector and select the M5234BCC FLASH.elf.S19 demo application binary image from your downloaded location. Select the “Verify After Program” option and click “Program” to start device programming.

The programming and verification will take a few moments. If you face any difficulties at this point, check that the P&E USB BDM Multilink driver is properly installed, following the instructions on the P&E CD included in the kit. Once programming has been completed successfully, remove the BDM interface from the M5234BCC and reset the board. Repeat this process for all M5234BCC boards.



STEP 3

FreeMASTER interface

If you do not have the FreeMASTER software installed on your computer, visit www.freescale.com/coldfire1588demo, and click “Downloads,” and select the FreeMASTER application installation. This application is provided free of charge. Note that FreeMASTER version 1.3.6. (or later) is required. Install the commercial plugins (BDM for Freescale HCS08, HC(S)12 and ColdFire V1, V2, V3 and V4 ColdFire microcontrollers).

Once the FreeMASTER software is installed on your computer, open the appropriate FreeMASTER project file:

IEEE 1588_demo_RS232.pmp—if using serial line communication

IEEE 1588_demo_USBMultilink.pmp—if using the P&E USB BDM Multilink-based communication.

The main FreeMASTER control page is illustrated in Figure 3.

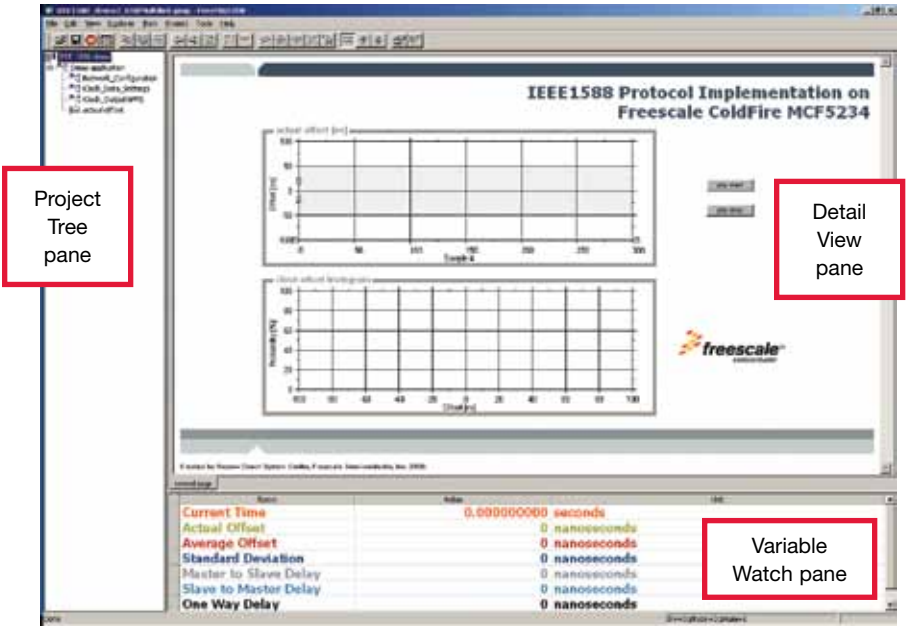


Figure 3—Main FreeMASTER control page

The FreeMASTER window consists of three panes: the Project Tree pane on the left side, Detail View pane on the top and the Variable Watch pane at the bottom.

If there are question marks displayed in the Variable Watch pane, this indicates that the communication between the PC and the target device was not established. Click on “Start/Stop communication (CTR+K)” button of the toolbar to (re-)connect (or go to Project-> Options (CTRL+T) and select the “Open port at startup” option) and then save the FreeMASTER project (CTRL+S). The communication will be established immediately after the FreeMASTER project is restarted. If there are still problems with the communication, go to Project-> Options (CTRL+T) and check the communication setting. When there are several BCC boards connected through the P&E USB BDM Multilink, check that all drivers are properly installed, the Multilink device is not used by any other application (CF Flasher opened), and that the FreeMASTER application is associated with the right Multilink device. This can be done by clicking the “Configure” button in the Project->Options panel (see Figure 4).

Figure 4 - Configuring BDM communication

Once the FreeMASTER communication is established, the Project Tree pane can be used for the configuration of the application. There are several sub-blocks under the “Demo application” block. The user can click on the defined sub-block and then switch from the “control page” to the “algorithm block description” page/panel to display the settings.

a) Network configuration—The default network configuration, after the demo binary code image is programmed, is shown in Figure 5

The user needs to ensure that each board has a unique Ethernet and IP address. The settings can be changed by the user, and permanently saved into the flash memory by clicking the “change” button in Figure 5.

Figure 5—Default network settings

b) Clock data settings—The Clock Data Settings panel enables several IEEE 1588 protocol stack parameters to be modified. The most important is the “Is clock preferred to be master” option. This determines whether the selected device is configured as the “PTP Slave” or the “PTP Master.”

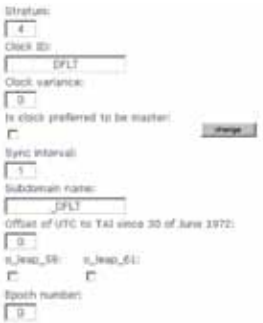


Figure 6—Clock data settings

c) Clock output and PPS—No NSC PHYTER GPIO pins are routed to any M5234BCC board header. If the user wishes to observe the PPS signal and the PHYTER clock output signals, they must do so directly on the PHYTER pins. These signals can however be enabled from the Clock_Output&PPS panel shown in Figure 7.

Once the necessary configuration has been completed, reset the board, wait until the FreeMASTER communication is re-established, and then switch to the main FreeMASTER control page and start the ptp stack by clicking on the “ptp start” button. When the ptp stack is running, the time courses of the selected parameters and the clock offset histogram can be observed in

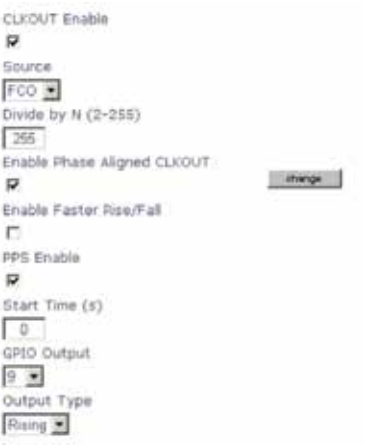


Figure 7—Clock Output and PPS panel

the Detail View pane. If the graphs are not displayed press the “F5” function key to reload the content of the Detail View pane (html page).

Selected PTP stack variables are displayed on the Variable Watch pane. It deals with:

- Current Time (in sec)
- Actual Offset (in nsec)
- Average Offset (in nsec)
- Standard Deviation (in nsec)
- Master to Slave Delay (in nsec)
- Slave to Master Delay (in nsec)
- One Way Delay (in nsec)

These variables can not be modified using FreeMASTER. The actual values can only be viewed.

The actual offset can be also displayed in graphical form using the “Oscilloscope” native component of FreeMASTER. Click on the “actual offset” sub-block on the Project Tree pane. The Detail View pane will now display the scope.

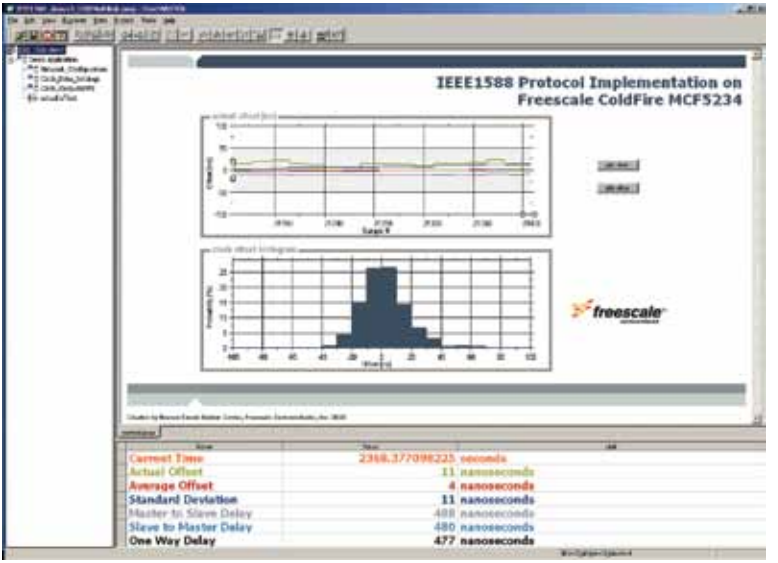


Figure 8—Detail view pane

Figure 9—Detail view pane showing oscilloscope trace

Recorded offset values can be exported to a separate file in FreeMASTER. Go to the menu Scope -> Data Capture Setup, and the Data Capture Setup dialog (shown in Figure 10) will open.

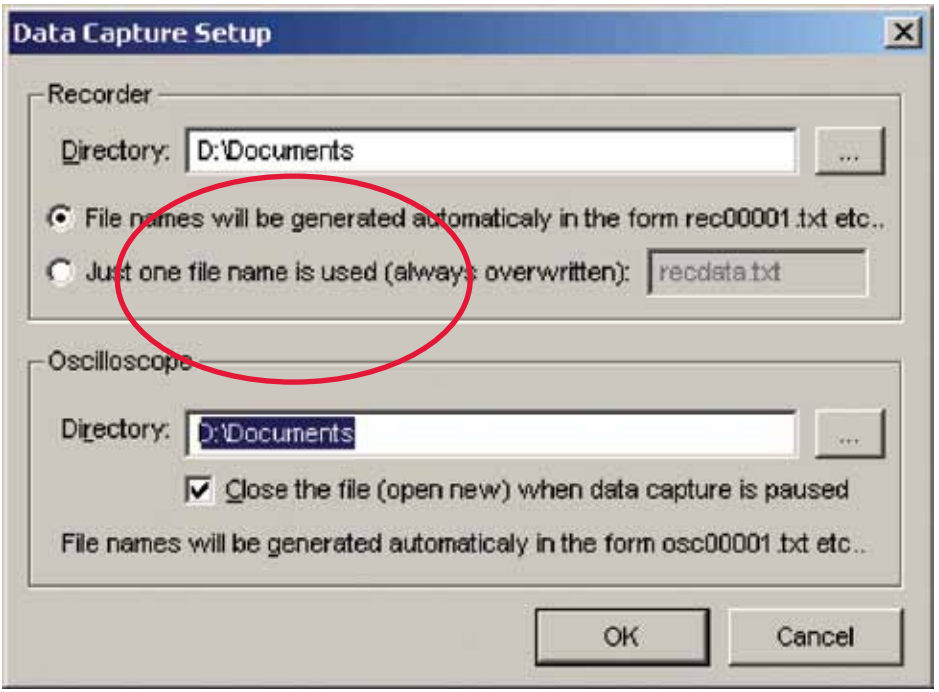


Figure 10—Data capture setup dialog

Select the directory in the Oscilloscope section and click “OK.” Go back to the Scope menu and click the “Toggle Data Capture On/Off” item. From this time, data is loaded into the oscxxxx.txt file in the selected directory. To stop it, click on the “Toggle Data Capture On/Off” item again. Now, you can edit the txt file.

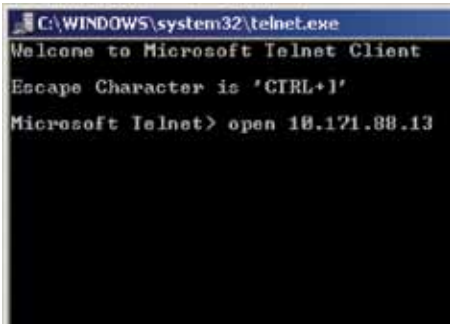
STEP 4

Telnet interface

The other option to interface to the IEEE 1588 demo application and to monitor and control the PTP activities, is to use the Telnet console. Open the Windows Start menu and select “Run.”

In the following dialog enter **telnet**. The Telnet console is now started.

Communication with the M5234BCC board is established by entering the “open <defined IP address>.”



Entering “help” will display a list of supported commands from the command shell. The most commonly used commands are those enabling the configuration of the network interface. Apply the following commands to change the essential network configuration and the clock data settings parameters:

ifconfig eth0 <IP address> changes the IP address

ifconfig eth0 netmask <netmask> changes the NETMASK

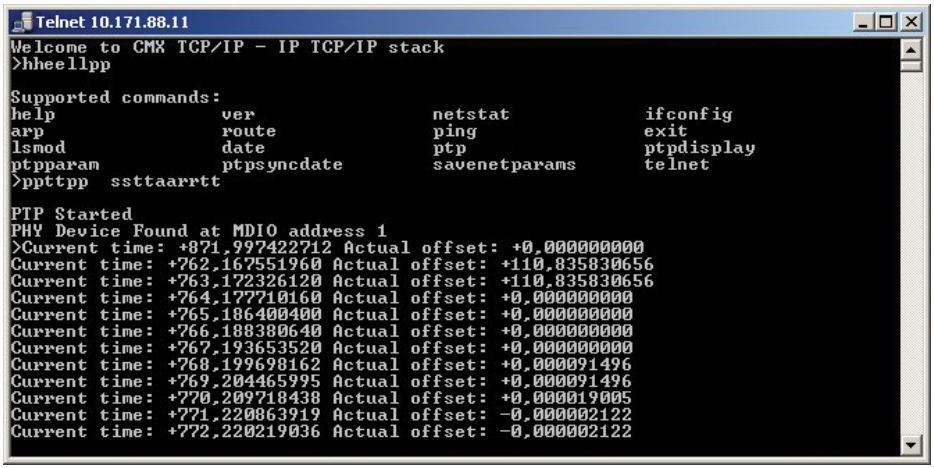
route add default <gateway> changes the GATEWAY

ptpparam preferred < 0=no, 1=yes > defines whether the clock is preferred to be a master or a slave

savenetparams saves the basic network configuration parameters into the flash

It is not possible to change the MAC address of the board through the command shell. This can only be done through the FreeMASTER GUI. Once the MAC address is changed and saved into the flash memory, the Telnet console can be started and used as the IEEE 1588 demo application interface.

After applying the ptp start command, the IXXAT implementation of the IEEE 1588 protocol starts and the Current time and the Actual offset are displayed on the screen.



Learn More: For more information about the ColdFire family, please visit **freescale.com/coldfire**.

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