

Technical Summary For USB BDM MULTILINK, Rev. C Supporting Freescale RS08/HCS08/HC(S)12(X)/ColdFire® V1 Families

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1 Introduction

P&E's USB BDM MULTILINK Interface provides access to Background Debug Mode (BDM) on Freescale RS08, HCS08, HC12, HCS12, and ColdFire® V1 microcontrollers. It is the hardware interface between a USB port on a Windows 2000/XP/2003/Vista machine and the standard 6-pin "Berg" debug connector on the target. By using the USB BDM MULTILINK, the user can take advantage of Background Debug Mode to halt normal processor execution and use a PC to control the processor. The user can then directly control the target's execution, read/write registers and memory values, debug code on the processor, and program internal or external FLASH memory devices.

The pin-out of the connector as specified by Freescale is:

BGND 1	• •	2 GND
NC 3	• •	4 RESET
NC 5	• •	6 VDD

2 Usage Of The USB BDM MULTILINK Interface

The USB BDM MULTILINK can communicate with an RS08, HCS08, HC12, HCS12 or ColdFire V1 processor. P&E's software packages will automatically detect the proper communication rate to establish a connection with the target. For HC12/HCS12 devices, the BDM communication speed may be set (instead of being auto-detected) by setting the value of the IO_DELAY_CNT variable. The proper IO_DELAY_CNT may be calculated by the equation:

$$\text{IO_DELAY_CNT} = (120000000 / \text{Fbus}) - 1$$

where Fbus is the bus frequency in hertz.

Note: RS08 and HCS08 frequencies are always detected automatically.

The Multilink interface will work with targets whose processor power supply is in the range of 1.6V to 5.25V. The Multilink interface derives its power from the USB port and as such draws less than 1mA from the target.

The USB BDM MULTILINK has a female type B USB connector. Use a Type A to Type B USB extension cable to connect the interface to the PC.

The USB BDM MULTILINK is a high-power USB device. If a USB Hub is used, it must be a self-powered hub (i.e. with a power supply). By default, the USB protocol used is 2.0.

There are two LEDs which protrude through the housing of the USB BDM MULTILINK interface. The Blue LED indicates that the Multilink interface is powered and running. The Yellow LED indicates that target power has been detected.

The 6-pin ribbon cable, which allows connection to the target debug connector, is fixed within the Multilink housing. PIN 1 is denoted by the red stripe running down the ribbon cable.

3 Driver Installation On Windows XP/2000/2003/Vista

Before connecting the USB BDM MULTILINK to the PC, the appropriate drivers need to be installed on the PC. The drivers are automatically installed when installing any of P&E's RS08/HCS08/HC12/HCS12 development packages built after January 1, 2005. A copy of the driver installation program may also be downloaded from the "Downloads" section of P&E's "Support Center" located at <http://www.pemicro.com>.

When the cable is plugged in, the operating system should indicate that it has found a driver for the attached "USB Multilink 2.0". Follow the instructions in the "Found New Hardware Wizard" dialog for having Windows automatically install the driver.

If you connected the Multilink interface prior to installing the drivers, Windows will not have been able to find the appropriate driver and may have disabled the device. If you unplug the device and then plug it in again, Windows will automatically disable it even if you have installed the drivers. To force Windows to attempt to load the driver again, perform the following steps while the USB BDM MULTILINK interface is plugged into the computer:

1. Open the Control Panel (Start Button->Settings->Control Panel).
2. Double Click the "System" Icon.
3. Select the "Hardware" Tab.
4. Click the "Device Manager" Button.
5. The "USB-ML-12 Rev. C" device will be shown with an exclamation point next to it. Double-click this device.
6. Click the "Reinstall Driver..." button and follow the dialog instructions to have Windows automatically install the driver.
7. If the hardware still has a yellow exclamation mark next to it, right click on it and select uninstall. The USB Multilink should disappear from the list. Unplug the USB Multilink and then plug it into the PC again. A new Hardware Found dialog will pop up; follow the dialog instructions and have Windows automatically install the driver.

If you have purchased one of P&E's software development packages prior to January 1, 2005, contact P&E to obtain the latest version which supports the USB BDM MULTILINK Rev. C interface (support for the cable is

separate from the Windows USB drivers). If you are using third-party software, make sure you have a version which supports the USB BDM MULTILINK Rev. C interface.

4 Computers Running Windows 98/ME

The USB BDM MULTILINK is supported under Windows 98 and Windows Millenium Edition (ME). The driver installation is similar to that of Windows XP/2000/2003/Vista.

5 Computers Running Windows 95/NT

Windows NT and Windows 95 do not have support for USB, and therefore the USB Multilink is not supported under these operating systems. For these operating systems, P&E produces the BDM Multilink, which connects the parallel port on the PC to the 6-pin debug connector on the target. For more information, visit:

<http://www.pemicro.com>.

6 Using A USB Hub

The USB BDM MULTILINK is classified as a high power USB device, which is powered from the USB bus. A high power device requires that if a USB hub is used, it must be a self-powered hub. This means that it has a separate power supply from which it derives its operating power (as opposed to deriving its power from the PC). It must be able to supply 500mA per port (a high power USB device may derive up to 500mA from the port). P&E has made a powered hub available as an accessory, which has been tested with the USB BDM MULTILINK. Details may be found at <http://www.pemicro.com>.

7 Connecting To The Target

The following is the proper connection sequence to connect the PC to the target system via the USB BDM MULTILINK interface:

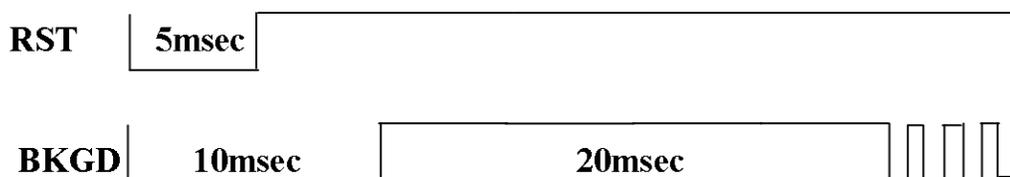
1. Make sure the target power is OFF and the USB BDM MULTILINK is not connected to either the target or the PC
2. Connect the Multilink to the target via its ribbon cable. Make sure that the ribbon cable is plugged into the target with the proper orientation. PIN 1 is denoted by the red stripe running down the ribbon cable.
3. Connect the USB Multilink to the PC via a USB cable. The Blue LED on the Multilink should become lit.
4. Turn the target power on. The Yellow LED on the Multilink should become lit.

Before disconnecting the setup, turn the target power off.

8 Startup Reset Sequence

In order to use the Background Debug Mode of the microcontroller, it is initialized into debug mode via a reset sequence.

This is accomplished by P&E's software via the following reset sequence:



1. Initially the BKGD (pin-1) and Reset (pin-4) are pulled low.

2. After 5 milliseconds, the RESET (pin-4) goes high.
3. After 10 milliseconds, the BKGD (pin-1) goes high.
4. Wait for 20 milliseconds, followed by activities on BKGD (pin-1).

9 Interface Libraries

One of the products P&E produces is a set of interface libraries which allows the user to directly control the USB BDM MULTILINK from any Windows Development Environment which can interact with a DLL. The interface libraries come with examples for controlling the Multilink interface from Microsoft Visual C as well as Borland Delphi. Details of the libraries for the RS08 may be found at P&E's RS08 Product Page. Details of the libraries for the HCS08 may be found at P&E's HCS08 Product Page. Details of the libraries for the HC12 and HCS12 may be found at P&E's HC(S)12 Product Page.

10 Firmware Updates

The latest version of the firmware for the Multilink interface is included in P&E software development kits. When the debugger or programmer is run, if it detects that the Multilink interface firmware needs to be updated, it will ask the user's permission to do this. If granted, the update happens automatically.

Alternately, the latest version of the firmware may be downloaded from the "Firmware Updates" section of the "Support Center" located at <http://www.pemicro.com>.

11 Transition To Production Programming

The USB BDM MULTILINK is intended for development and is not designed to accommodate the demands of production programming. However, P&E's Cyclone programmers are specifically engineered to withstand the rigors of a production environment and will provide a seamless transition from the USB BDM MULTILINK. More information is available at: <http://www.pemicro.com/cyclone>



P&E's Cyclone PRO