1. Introduction

P&E’s USB POWERPC BDM MULTILINK Interface provides access to the Background Debug Mode (BDM) on Motorola PowerPC MPC5xx/8xx processors. It is the hardware interface between a USB port on a Windows 2000 or XP machine and the standard 10 pin “Berg” debug connector on the target. By using the USB PowerPC BDM Multilink, the user can take advantage of the 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 with the appropriate software packages. The pinouts of the connector as specified by Motorola are:

```
VFLS0* - 1   . .  2 - ~SRESET
GND - 3   . .  4 - DSCK
GND - 5   . .  6 - VFLS1*
~HRESET- 7   . .  8 - DSDI
VDD - 9   . .  10 - DSDO
```

*P&E does not use the VFLS0 and VFLS1 pins and these do not need to be connected to the header.
2.0 Usage of the USB PowerPC BDM Multilink Interface

The USB POWERPC BDM MULTILINK can communicate with a PowerPC 5xx/8xx processor.

The Multilink interface will work with targets whose processor power supply is in the range of 1.8V to 5.25V. The Multilink interface derives its power from the USB port and as such draws less than 10mA from the target.

The USB PowerPC 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 PowerPC 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 1.1.

There are two LEDs which protrude through the housing of the USB PowerPC 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 10-pin ribbon cable, which allows connection to the target debug connector, is fixed within the Multilink housing. The pin 1 is denoted by the red stripe running down the ribbon cable.
3.0 **Driver Installation on Windows XP/2000**

Before connecting the USB PowerPC 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 PowerPC 5xx/8xx development packages built after August 1, 2004. 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](http://www.pemicro.com). P&E installs the following USB drivers/files on your system:

- PEUSBFTDUN.EXE --
  - [Windows\System]
- PEUSBV1.DLL --
  - [Windows\System]
- PEUSBV1.SYS --
  - [Windows\System]\Drivers
- PEMICRO_USBCABLE_AUTO.INF --
  - [Windows]\inf

**Note:** In general [Windows\System] = \WINNT\SYSTEM32 for XP,2000

When the USB PowerPC BDM Multilink is detected, the operating system will automatically scan all the .INF files in the [Windows]\inf directory to try and find a match for the detected hardware. The operating system should then indicate that it has found a driver for the attached “P&E USB Device”. 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 and re-plug in the device, Windows will automatically disable it even if you have installed the drivers. To force windows to try and load the driver again, perform the following steps while the USB PowerPC 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 “P&E PowerPC BDM Multilink” device will be shown with an exclamation mark next to it. Double click this device.
6.) Click the “Reinstall Driver…” button and follow the dialog instructions for having windows automatically install the driver.

If you have purchased one of P&E’s software development packages prior to July 1, 2003, contact P&E to obtain the latest version which supports the USB PowerPC BDM Multilink 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 PowerPC BDM Multilink interface.

4.0 **Computers running Windows 95, 98, ME, and NT**

The USB PowerPC BDM Multilink is not supported under Windows 95 and Windows NT. The USB PowerPC BDM Multilink is not tested under Windows 98 and Windows ME, although drivers for these operating system are included in the install. For these operating systems, P&E produces the Parallel Port CABLECFLV which connects the parallel port on the PC to the 26-pin debug connector on the target. For more information, visit [http://www.pemicro.com](http://www.pemicro.com).
5.0 Using a USB Hub

The USB PowerPC 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 PowerPC BDM Multilink. Details may be found at http://www.pemicro.com.

6.0 Connecting to the target

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

1) Make sure the target power is OFF and the USB PowerPC 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. The pin 1 is denoted by the red stripe running down the ribbon cable.
3) Connect the Multilink to the PC via a USB extension 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.

7.0 Startup Reset Sequence

In order to use the Background Debug Mode of the microcontroller, it must be initialized coming out of reset. This is accomplished by P&E's ICD (In Circuit Debugger) software on the host PC by generating the following reset sequence:

1. DSCK is driven high and DSI is driven low. (to processor)
2. Delay ~1ms.
3. HRESET or SRESET is driven low. (Usually this will be HReset)
4. Delay ~20ms.
5. HRESET is released (tri state, should be pulled up on target).
6. Shifting activity appears on DSCLK, DSI and DSO. (PC Software communicating to target to determine if debug mode was successfully entered.)

Note that if the device does not enter debug mode, the ICD debugger issues the error message "Can not enter background mode". If you get this message, you should first refer to the troubleshooting section of this document. Then you should check your hardware with a scope, logic analyzer or logic probe. First check for power on. Then check to make sure the processor oscillator is running. Finally, look for the startup sequence given above.

8.0 Interface Libraries

One of the products P&E produces is a set of interface libraries which allows the user to directly control the USB PowerPC 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 PowerPC 5xx/8xx (UNITCFZ) may be found at http://www.pemicro.com/products/product_processor.cfm?family=7.

9.0 Firmware Updates

The latest version of the firmware for the Multilink interface is included in the 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 given, 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. This firmware includes a utility which may be used to run the firmware update.

10.0 Software Packages

P&E provides several software packages which work through the PowerPC interface cable:

**ICDPPCZ** - Source level PowerPC Debugger. The simple and easy to use debugger supports source level debugging on PowerPC devices including: source level debug, software load, hardware breakpoints, watch and memory windows, CPU display, special purpose register read/write and more…

**PROGPPCZ** - Flash programmer (both interactive and automated for production). The flash programmer supports a large library of flash configurations. New flash configurations are constantly being created and the latest can be downloaded from: http://www.pemicro.com. The flash programmer automates the task of programming flash and does not require a boot-loader to be resident in the target.

**UNITPPCZ** - DLL based drivers allowing PC based application control of the PowerPC processor through the debug interface. Routines provided to read and write memory, start and stop the processor, load code, single step and more. Examples are provided for some development environments including the Microsoft Visual studio, and can be used from any development/test platform which can link to a DLL.

The UNITPPCZ library is used by other third party vendors such as Metrowerks to enable their software packages to work via P&E’s BDM interfaces.