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USB-ML-PPCBDM, PowerPC BDM Multilink Rev. B (USB 2.0)

Technical Summary

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1.0 Introduction

P&E's USB POWERPC BDM MULTILINK Rev. B is a high-speed USB 2.0 interface which provides access to the Background Debug Mode (BDM) on Freescale PowerPC MPC5xx/8xx processors. It is the hardware interface between a USB port on a Windows 2000, 2003, XP, or Vista 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 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 by using the appropriate software packages. The pin-out of the connector as specified by Freescale is:

VFLS0* - 1	. .	2 - ~SRESET
GND - 3		4 - DSCK
GND - 5		6 - VFLS1*
~HRESET- 7		8 - DS DI
VDD - 9		10 - DS DO

*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 2.0.

There are two LEDs located on top 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. PIN 1 is indicated by the red stripe running down one side of the ribbon cable.



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

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 July 1, 2005. A copy of the driver installation program may also be downloaded from the "downloads" section of P&E's online "Support Center" located at <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,2000,2003,Vista

When the USB PowerPC BDM Multilink is detected by the PC, 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 to have 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 reconnect the device, Windows will automatically disable it even if you have installed the drivers. To force Windows to try to 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 to have Windows automatically install the driver.

If you have purchased one of P&E’s software development packages prior to July 1, 2005, contact P&E to obtain the latest version which supports the USB PowerPC BDM Multilink interface (software support for the cable is separate from Windows USB driver support). 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, or NT

The USB PowerPC BDM Multilink is not supported under Windows 95 or NT. The USB PowerPC BDM Multilink is not tested under Windows 98 and Windows ME, although drivers for these operating systems are included in the install. For these operating systems, P&E produces the Parallel Port CABLEPPC which connects the parallel port of the PC to the 10-pin debug connector on the target. For more information, visit <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).

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. PIN 1 is indicated by the red stripe running down the ribbon cable.
- 3) Connect the Multilink to the PC via a USB extension cable. This should light the Blue LED on the Multilink.

- 4) Turn the target power on. This should light the Yellow LED on the Multilink.

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 with 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 "Cannot enter background mode." If you get this message, you should first refer to the troubleshooting section of this document. You should then 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

P&E produces a set of interface libraries which allow 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 (UNITPPCZ) may be found at http://www.pemicro.com/products/product_processor.cfm?family=9.

9.0 Firmware Updates

The latest version of the firmware for the Multilink interface is included in P&E's 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 permission is granted, the update happens automatically.

Alternately, the latest version of the firmware may be downloaded from the "Firmware Updates" section of P&E's online "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. This 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). This flash programmer is supported by 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 are provided to read and write memory, start and stop the processor, load code, single step, and more. Also, examples are provided for some development environments including the Microsoft Visual Studio. The libraries 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.

11.0 Rev. A to Rev. B Changes

The main difference between Rev. A and Rev. B is that Rev. B is a high-speed USB 2.0 device, whereas Rev. A is only a USB 1.1 full-speed device. The Rev. B unit should be significantly faster than the Rev. A unit.