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USB HCS08/HCS12 Multilink Rev A
Technical Summary



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1.0 Introduction

P&E's USB HCS08/HCS12 MULTILINK Interface provides access to the Background Debug Mode (BDM) on Motorola HCS08, HC12 and HCS12 microcontrollers. It is the hardware interface between a USB port on a Windows 2000 or XP machine and the standard 6 pin "Berg" debug connector on the target. By using the USB HCS08/HCS12 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. The pinouts of the connector as specified by Motorola are:

| | | |
|--------|-----|---------|
| BKGD 1 | • • | 2 GND |
| NC 3 | • • | 4 RESET |
| NC 5 | • • | 6 VDD |

**For More Information On This Product,
Go to: www.freescale.com**

2.0 Usage of the USB HCS08/HCS12 Multilink Interface

The USB HCS08/HCS12 MULTILINK can communicate with an HCS08, HC12, or HCS12 processor whose bus frequency is between 32 KHz and 35 MHz. P&E's software packages will automatically detect the proper communications rate to establish a connection with the target. For HC12/HCS12 devices, the BDM communications 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:

$$\text{IO_DELAY_CNT} = (100000000 / \text{Fbus}) - 1$$

Fbus is the bus frequency in hertz. The HCS08 frequency is 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 HCS08/HCS12 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 HCS08/HCS12 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 HCS08/HCS12 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. The pin 1 is denoted by the red stripe running down the ribbon cable. The proper orientation of this ribbon cable is shown in the following picture.



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3.0 Driver Installation on Windows XP/2000

Before connecting the USB HCS08/HCS12 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 HCS08/HCS12/HCS12 development packages built after July 1, 2003. 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>. 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 HCS08/HCS12 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 HCS08/HCS12 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 HCS08/HCS12 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 HCS08/HCS12 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 HCS08/HCS12 Multilink interface.

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

The USB HCS08/HCS12 Multilink is not supported under Windows 95, Windows 98, Windows Millenium Edition (ME), and Windows NT. 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>.

5.0 Using a USB Hub

The USB HCS08/HCS12 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 HCS08/HCS12 Multilink. Details may be found at <http://www.pemicro.com>.

6.0 Connecting to the target

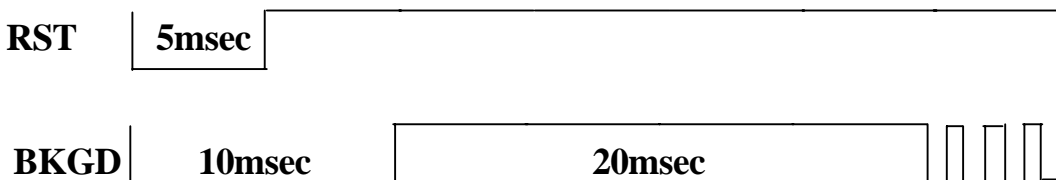
The following is the proper connection sequence to connect the PC to the target system via the USB HCS08/HCS12 Multilink interface:

- 1) Make sure the target power is OFF and the USB HCS08/HCS12 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.
- 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 is initialized into debug mode via a reset sequence. This is accomplished by P&E's software via the following reset sequence:



- a) Initially the BKGD (pin-1) and Reset (pin-4) are pulled low.
- b) After 5 milliseconds, the RESET (pin-4) goes high.
- c) After 10 milliseconds, the BKGD (pin-1) goes high.
- d) Wait for 20milli second followed by activities on BKGD (pin-1).

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 HCS08/HCS12 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 HCS08 may be found at <http://www.pemicro.com/products/68hcs08.html>. Details of the libraries for the HCS12 and HC12 may be found at <http://www.pemicro.com/products/68hc12.html>.

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.