P&E Microcomputer Systems, Inc.

www.pemicro.com

Technical Summary for

USB Multilink ACP, Rev. B (PART# USB-ML-ACP)

Support for ARM Cortex processors (complete list at pemicro.com/arm)

Document# PE3514, Version 1.04c

USB Multilink ACP Debug Probe

1   Introduction

The USB Multilink ACP is a low-cost debug interface supporting a wide range of ARM Cortex processors. The Multilink provides access to debug modes by communicating between the target device and a laptop/PC via the target's standard debug header and a laptop/PC's USB port.

2   Device Support

Multilink ACP supports ARM Cortex-M devices from these manufacturers:

· NXP	· ON Semiconductor
· AutoChips	· Qorvo
· Cypress Semiconductor	· Raspberry Pi
· GigaDevice	· Redpine Signals
· indie Semiconductor	· Renesas
· Infineon	· Silergy Teridian (Maxim)
· Maxim Integrated	· Silicon Labs
· MindMotion	· STMicroelectronics
· Microchp (Atmel)	· Texas Instruments
· Nordic Semiconductor	· Toshiba
· Nuvoton	· WizNET
· OnBright	· ZHIXIN

For a complete listing of supported ARM Cortex-M devices or to request support for a device, visit PEmicro at:

http://www.pemicro.com/arm

3   Debug Headers

Three standard ARM headers are located inside the unit. Port A is a dual-row header with a .100" pitch, while Ports B-C are dual-row with a .050" pitch.

PORT A - STANDARD ARM			PORT B - MINI-20			PORT C - MINI-10		
ARM Cortex devices			ARM Cortex devices			ARM Cortex devices		
TVCC **1**	• •	**2** NC	TVCC **1**	• •	**2** TMS/SWD_DIO	TVCC **1**	• •	**2** TMS/SWD_DIO
$\overline{TRST}$ **3**	• •	**4** GND	GND **3**	• •	**4** TCK/SWD_CLK	GND **3**	• •	**4** TCK/SWD_CLK
TDI **5**	• •	**6** GND	GND **5**	• •	**6** TDO	GND **5**	• •	**6** TDO
TMS/SWD_DIO **7**	• •	**8** GND	NC **7**	• •	**8** TDI	NC **7**	• •	**8** TDI
TCK/SWD_CLK **9**	• •	**10** GND	NC* **9**	• •	**10** $\overline{RESET}$	NC* **9**	• •	**10** $\overline{RESET}$
NC **11**	• •	**12** GND	NC **11**	• •	**12** TRACE_CLKOUT			
TDO **13**	• •	**14** GND	NC **13**	• •	**14** TRACE_D0			
$\overline{RESET}$ **15**	• •	**16** GND	GND **15**	• •	**16** TRACE_D1			
NC **17**	• •	**18** GND	GND **17**	• •	**18** TRACE_D2			
NC **19**	• •	**20** GND	GND **19**	• •	**20** TRACE_D3			

PORT C — *PIN 9 is reserved for internal use within the PEmicro Multilink interface*

PORT B — *PIN 9 is reserved for internal use within the PEmicro Multilink interface*

Multilink ACP Pin-Outs, Ports A, B, C

The user can take advantage of debug modes to halt normal processor execution and use a computer 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.

4   Usage

The USB Multilink ACP can communicate with ARM Cortex microprocessors by connecting a ribbon cable between the target's debug header and one of the multiple ports on the Multilink. Do not attempt to use multiple ports at once, as this may damage both the target processors as well as the Multilink.

The USB Multilink ACP interfaces will work with targets whose processor power supply is in the range of 1.8V to 5V.
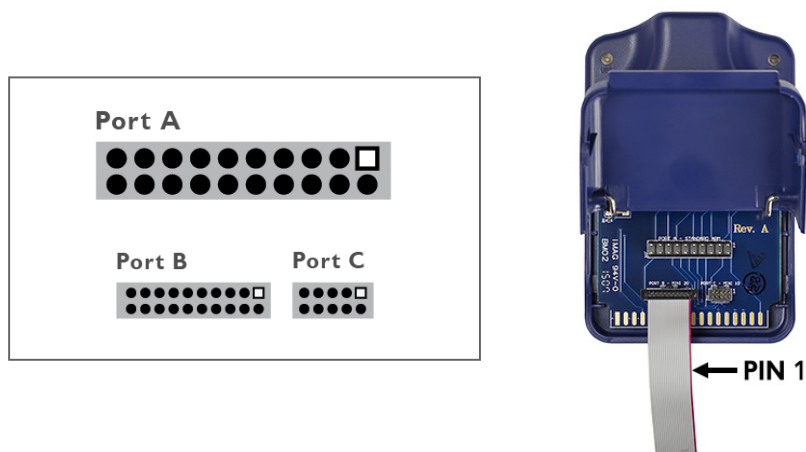
Multilink ACP Header Layout (Pin 1 Highlighted)

There are two LEDs on the Multilink interface. The blue LED indicates that the interface is powered and running. The yellow LED indicates that target power has been detected.

Note: To avoid improper connections, the red stripe of the ribbon cable should always be oriented towards Pin 1, both on the Multilink port and the target processor header.

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

5   Driver Installation

Before connecting the Multilink to the PC, the appropriate drivers need to be installed on the PC. The Multilink drivers are supported on Windows XP, 2000, 2003, Vista, 7, 8, and 10. These drivers are automatically installed when installing NXP's CodeWarrior or any of PEmicro's recent software development packages. If you have installed a recent version of these then the instructions for manual installation that follow are not necessary. However, Windows 7 users who are installing software distributed before December 28, 2009 will need to obtain the latest version of the drivers and install them manually. A copy of the driver installation program may be downloaded from the "Downloads" section of PEmicro's "Support Center" located at http://www.pemicro.com. If you are using third-party software, make sure you have a version which supports your specific interface (Multilink ACP). Once you have obtained the latest version of the driver installation program, please use the instructions below to manually install the drivers.

When the cable is plugged in, the operating system should indicate that it has found a driver for the attached interface. 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 Multilink interface is plugged into the computer:

1. Open the Control Panel: Start Button [->Settings] ->Control Panel. (You will not need to select "Settings" on Vista and Windows 7).

2. Double Click the "System" Icon. (Windows 7: "System and Security")

3. Select the "Hardware" Tab. (Windows 7: "Hardware and Sound", Windows Vista: skip this step)

4. Click the "Device Manager" Button. (Windows 7: "Devices and Printers -> Device Manager")

5. The "USB Multilink 2.0" 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. (Windows 7: First click the "Driver" tab, then select "Update 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.

6   Connecting To The Target

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

1. Make sure the target power is OFF and the USB Multilink ACP is not connected to either the target or the PC

2. Open the Multilink and connect a ribbon cable from the correct Multilink port to the target. Make sure that the ribbon cable is plugged into the target with the proper orientation. PIN 1 is indicated by a 1 next to the port.

3. Connect the Multilink to the PC via a USB cable. The Blue LED on the Multilink should illuminate.

4. Turn the target power on. The Yellow LED on the Multilink should illuminate.

Before disconnecting the setup, turn the target power off.

7   Troubleshooting

Note that if the Multilink does not enter debug mode, the program issues the error message "Cannot enter background mode." If you receive this message you should check your hardware with a scope, logic analyzer or logic probe.

1. Check that the board is powered on. The voltage value of the TVCC pin on the header should equal the logic high value - usually 3.3V or 5V.

2. Monitor the activity of the debug signals:

   JTAG: TCK, TDI and TDO

   SWD: SWD_CLK and SWD_DIO

   During correct operations, these signals will toggle between GND and logic high voltage levels. Look out for signals that do not toggle or do not fully transition all the way to GND or logic high.

3. Disconnect the Multilink ribbon cable from the board. Power on the board and monitor the RESET signal on the header. Normally this signal should be high or toggling due to a watchdog. Look out for a situation where the RESET signal is permanently low.

8   Firmware Updates

A utility called *PEFirmwareConfig.exe* is used to manually update the Multilink firmware. This application is included with the "USB Multilink Resources Install" which can be downloaded from the pemicro.com Support tab, the Multilink product page, or directly from the link below:

http://www.pemicro.com/downloads/download_file.cfm?download_id=346

9   Interface Libraries

PEmicro produces a set of interface libraries which allow the user to directly control the USB Multilink ACP 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. More details can be found on the Interface Libraries page on the PEmicro website: http://www.pemicro.com/products/product_processor.cfm?category=9

10   Third-Party IDEs & Other Compatible Software

The USB Multilink ACP is supported by recent versions of NXP's MCUXpresso, CodeWarrior, Kinetis Design Studio, S32 Design Studio, STM32CubeIDE, and DAVE IDE, as well as third-party toolchains such as those from IAR, Keil, Silicon Labs. Cosmic, and Mentor Graphics. A list of third party ARM IDEs can be found at:

http://www.pemicro.com/arm/3rd-party/index.cfm

Multilinks also work with PEmicro software, including our no-cost, fully-featured GDB Server Plug-in for Eclipse-based ARM IDEs.

It is recommended that you check with the vendor regarding support for your specific part. Information on compatible PEmicro software can be found in the "Products" section of PEmicro's website: pemicro.com.

11   Transition To Production Programming

The USB Multilink ACP is intended for development and is not designed to accommodate the demands of production programming. However, PEmicro's Cyclone LC and Cyclone FX programmers are specifically engineered to withstand the rigors of a production environment and will provide a seamless transition from the Multilink. Both include PEmicro's Cyclone Control Suite for Cyclone control and automation. In addition, Cyclone FX programmers offer an extended feature set including larger internal storage, expandable storage, faster communications, enhanced security, advanced Cyclone Control Suite features, and extension ports.More information is available online at pemicro.com/cyclone.

Cyclone Programmer