# MPDEMON™

# USER'S MANUAL

## *M*ULTI-*P*ORT OCD INTERFACE

Using OCDemon™ technology
from
Macraigor Systems LLC

**Macraigor Systems LLC**
**P.O. Box 471008**
**Brookline Village, MA 02447**
**(617) 739 - 8693**
**www.macraigor.com**

# Important Notice



MPDEMON User's Manual version 2.0

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# 1. Introduction

This guide describes all of the tasks necessary to connect your new MPDEMON to your host computer system and your target under test. The actual steps needed will depend on the host software you will be using and the connection method that you select (serial, parallel, or Ethernet).

## 1-1 What exactly is the MPDEMON?

Many modern CPUs have one or another form of On Chip Debug (OCD). This may take the form of BDM (Background Debug Mode), JTAG (IEEE 1149.x), EJTAG (Extended JTAG), OnCE (On Chip Emulation), COP, or one of many others depending on the specific target processor. All of these interfaces comprise an electrical/timing specification as well as a communication specification.

The MPDEMON is a device that "translates" commands from a host debugger into the appropriate OCD format and communicates with the target CPU under test. The MPDEMON communicates with the host debugger via Ethernet, serial, or parallel communication channels and then communicates with the target CPU in a wide variety of OCD formats including all of those previously mentioned as well as others.

Because there are so many OCD formats, each with its own electrical characteristics and pin-outs, the MPDEMON uses a "personality module." This is a small external module that connects to the front of the MPDEMON and provides the correct signals, pin-outs, and voltage levels to the specific target CPU being debugged.

## 1-2 What software is available for the MPDEMON?

There are many debuggers available that support the MPDEMON as well as various other applications such as Flash memory programmers and general JTAG test utilities. See our website for updated lists of our third-party partners, but some of the companies that have software compatible with the MPDEMON are:

- Accelerated Technology Embedded Systems Division of Mentor Graphics
- ARM Ltd. (Allant Software)
- CAD-UL
- Green Hills Software
- ARC (formerly Metaware)
- Metrowerks
- Microsoft
- Red Hat
- Any version of GDB that supports the GDB Remote Debugging Protocol

Macraigor Systems specializes in Flash memory programming technology and test software and also has free software that is available for the MPDEMON. The free debuggers available from Macraigor Systems include a low-level, command-line debugger called OCD Commander, and full GNU toolsets for ARM7, ARM9, MIPS32, MIPS64, PowerPC, and XScale. All of these tools may be downloaded from our website: www.macraigor.com.

# 2. Getting Started

## 2-1 Unpacking your MPDEMON

The MPDEMON is shipped with the following items. Verify that you have received these items in your package.

- MPDEMON
- Six foot RS-232 male DB-9 to female DB-9 cable
- Six foot IEEE-1284 male DB-25 to female DB-25 cable
- Six foot 10 BaseT Ethernet cable
- 5V International switching power supply
- One target processor Personality Module (see Chapter 4 for a further description of Personality Modules)

## 2-2 Features and Specifications

- Small footprint (5” x 3.5” excluding cables)
- Weighs less than 1 lb.
- Uses 5V 2 amp International switching power supply
- Set up and configuration via either serial connection or web-based user interface
- RS-232 serial interface at up to 115200 Baud
- IEEE 1284 parallel interface supporting all parallel communication modes
- 10-BaseT Ethernet with Link and Activity indicators
- Built-in support for GDB remote protocol
- LED indicators for power, host communications and target running/stopped
- Interchangeable Personality Modules to support different processors
- Automatic target voltage detection (down to 1.8V)
- Supports up to 200 target devices on one scan chain
- Supports JTAG clock rates up to 16 MHz
- Long (18”) target connection cable
- Field upgradeable firmware

## 2-3 Connecting cables

Note that no part of the MPDEMON is designed to be “hot plugged”. All parts of the system, including the target,
MPDEMON , and the host PC should be turned off when connecting cables.

In order to minimize noise while using the MPDEMON with the serial or parallel connections, it is best to plug the target, the MPDEMON and the host computer into the same outlet. If you are using the Ethernet interface, the target and MPDEMON should be plugged into the same outlet.

Both the quality and the length of cables can make a large difference as to the overall system performance. Use only the cables supplied with the MPDEMON. Longer or inferior cables will almost certainly introduce noise and, possibly, errors in data transfers.

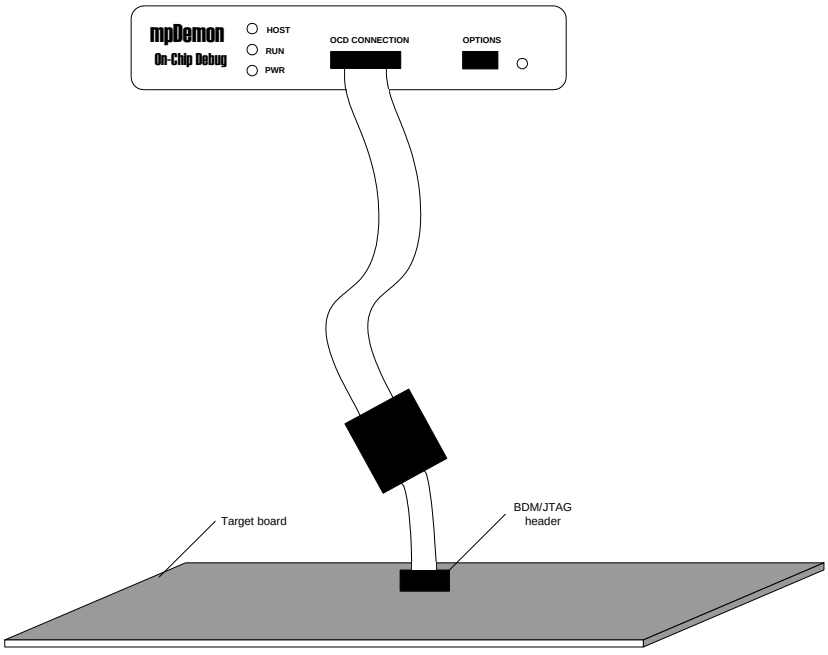
### 2-3-1 Personality Module

The Personality Module consists of the long, red or blue cable, small black box and the shorter target connection cable. A different Personality Module is needed for each type of target processor. The module is responsible for converting signals into the correct pin-out and voltage levels for a particular processor. For details of the
pinouts that are used for each type of processor, see Appendix A.

With both the target system and the MPDEMON off, plug the longer side of the Personality Module into the front, black connector on the MPDEMON and make sure that the locking tabs close securely.

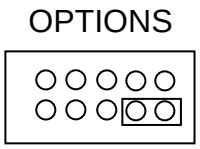
Now connect the short target cable end of the module to the header on your target system making sure that the connection is secure and that pin 1 on the cable matches pin 1 on the header. Pin 1 on the cable is identified by either a red wire or by a darker coloring on one wire.

The connections on the front of the MPDEMON should look similar to the diagram below. Please note that the Personality Module cables for ARM-20 and XScale processors have the same number of pins on each side of the pod and, therefore, the module CAN be plugged in backwards. Make sure that the longer side of the cable is plugged into the MPDEMON or the Personality Module will probably be damaged.



### 2-3-2 Host connection

The serial connection on the MPDEMON is used for two purposes. It can initially be used to set up some configuration items for the MPDEMON and can subsequently be used as the debug connection. If you intend to use the serial connection for setup, then it must be connected to a serial terminal with parameters
set to 19200, N, 8, 1. This is most typically done by connecting to the serial port on a PC and running a terminal emulation program such as Hyperterm. Also,
the OPTIONS jumpers on the front of the MPDEMON must be configured as in the following diagram.



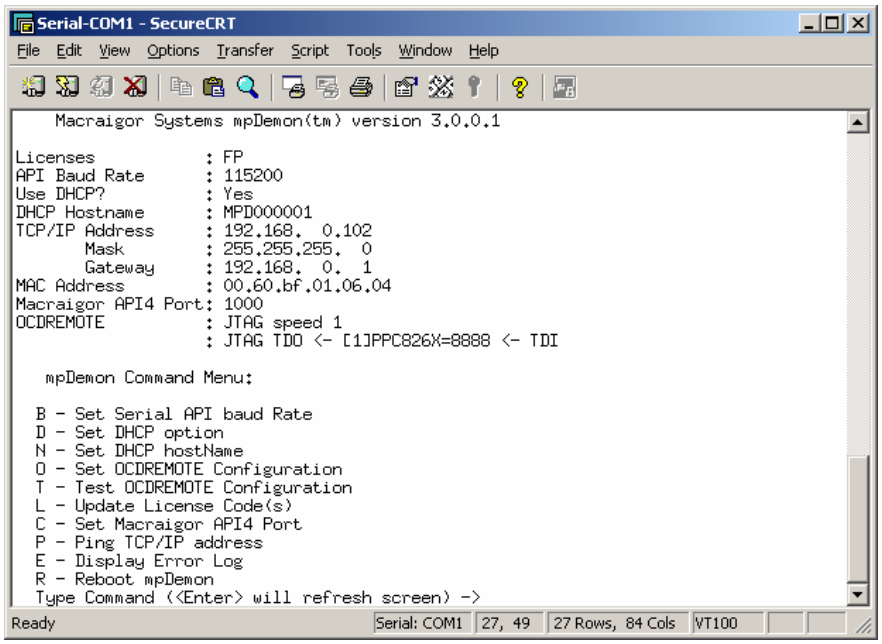

If you will be using the parallel connection, plug in the parallel cable to the MPDEMON and to your host computer.

If you will be using the Ethernet connection for either setup or as the debug connection, locate and plug into an appropriate network connection. You may need to talk to your network administrator in order to locate a free connection.

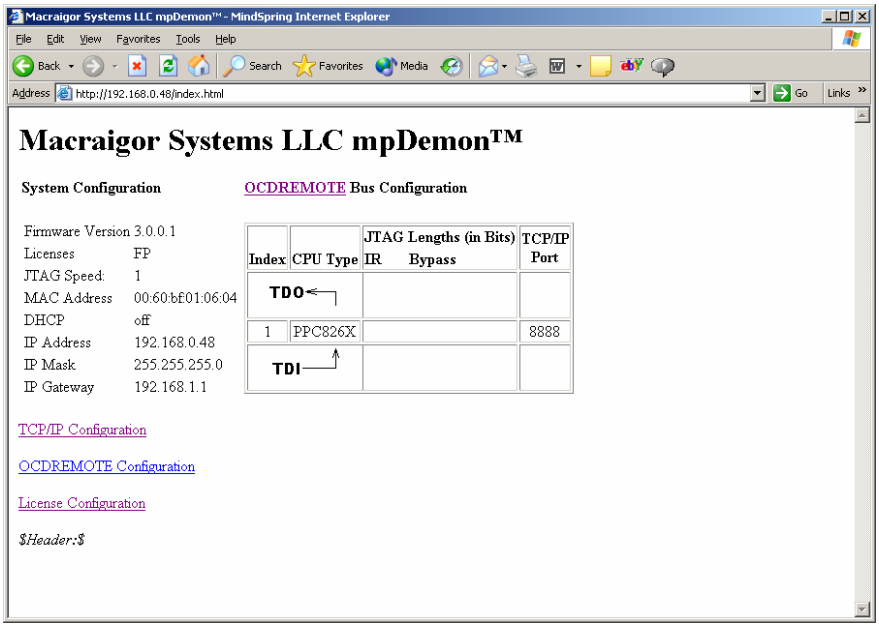
### 2-3-3 Power connection

The MPDEMON is turned on by plugging in the 5V power connection. There is no separate power switch.

When you plug in the power connection, you should see all three LED indicators on the front of the MPDEMON turn on for about five seconds and then the HOST and RUN LEDs should turn off, leaving only the PWR LED on. At this point, if you are using the serial connection for setting up and configuring the MPDEMON**,** you should see a banner and menu on your serial terminal that looks like the following:



If you want to use the web-based interface to configure the MPDEMON, you can now plug in an Ethernet cable to your network and point a browser to the TCP/IP address shown in the menu and you should see a web page that looks like the following:



# 3. Configuring Your Host Connection

## 3-1 Ethernet

The Ethernet connection on the MPDEMON is a standard 10-baseT jack. Communication with the MPDEMON is via a TCP/IP network connection.

Before you can use the MPDEMON with the Ethernet connection, several network parameters must be configured. You must set the TCP/IP address, the network mask and, if necessary, the default gateway address. Configuration of these parameters is done using the menu selections shown in the previous screen shots of either the serial menu interface or the web-based interface.

There are two ways to configure the network parameters for your MPDEMON. You can either obtain the necessary parameters from your network administrator and enter them using the menu, or you can turn on DHCP mode and have the MPDEMON attempt to obtain its network parameters from a DHCP server on your network. If you aren't sure if your network has a DHCP server, ask your network administrator.

### 3-1-1 Manual Ethernet Configuration

For manual configuration via the serial interface:

1. Make sure that the *Use DHCP?* option is set to **No**. If it is not set to **No** then select "d" and then "n" and then reboot the MPDEMON.
2. Select "a" to set the *TCP/IP Address* and enter the address that your network administrator gave you. Note that there will already be an address configured. This address is used in manufacturing and testing the MPDEMON and will not work on your network.
3. Select "m" to set the *TCP/IP Mask* that your network administrator gave you. As with the *TCP/IP Address*, there will already be a value in this field, but it is unlikely to work on your network.
4. In some cases, you will need to enter a *Gateway* address. This is not necessary if the MPDEMON is on the same subnet as your host machine. Again, you should check with your network administrator to be sure. To enter the *Gateway* address, select "g" and enter the address.
5. Once you have entered these parameters, you must reboot the MPDEMON before they will take effect.

For manual configuration via the web interface:

1. Click on the "TCP/IP Configuration" link.
2. Make sure that the drop-down box at the top of the screen is set to "Use static IP".
3. Fill in the "IP Address", "IP Mask", and "IP Gateway" fields.
4. Click on the "Submit" button and then reboot the MPDEMON as instructed.

### 3-1-2 DHCP Ethernet Configuration

For DHCP configuration via the serial interface:

1. Enter "d" at the menu prompt and then "y" to turn on DHCP.
2. Once you change *Use DHCP?* to **Yes**, you must reboot the MPDEMON (i.e. unplug the power connector and then plug it back in, or select the "R" menu option).

For DHCP configuration via the web interface:

1. Click on the "TCP/IP Configuration" link on the main page.

2. In the drop-down box at the top of the page, select “Use DHCP”
3. If your network’s DHCP and DNS servers are properly configured, then the MPDEMON can request a host name for itself. Enter your choice of host name in “Host name” box.
4. Click on the “Submit” button and then reboot as directed.

When the MPDEMON boots this time it will attempt to obtain its network parameters from a DHCP server. While it is in the process of retrieving the parameters, you will see a serial screen on which the IP parameters are listed as “Resolving…”.

Once the MPDEMON has obtained the parameters, the screen will change and display the new values. You need the TCP/IP address from this screen in order to connect from your host software, so make a note of it. Note that, if you are using the web interface, the TCP/IP address of the MPDEMON will be different now, so you need to browse to the new address, which can be viewed on the serial terminal. If your network’s DHCP and DNS servers are working properly, you should also be able to browse to the name that you entered in the “Host name” field.

If, for some reason, the MPDEMON is unable to get a response from a DHCP server, then it will timeout after about 30 seconds and display an error message.

In this case, you can try again by rebooting the MPDEMON or you can change the DHCP selection back to **No** and enter fixed network parameters as described in section 3-1-1.

This error is usually due to the lack of a DHCP server on your network or an unplugged or improperly connected Ethernet connection. Make sure that the “Lnk” LED is lit on the back of the MPDEMON. If it is not, then you don’t have a connection to the network.

There is one other DHCP failure that can occur. If the DHCP server offers the MPDEMON an address that is already being used by another device on your network, the MPDEMON will show an error message indicating this. This failure is generally caused by a DHCP server that is not correctly configured. Contact your network administrator to resolve the issue.

## 3-2 Parallel

The parallel port on the MPDEMON is an IEEE-1284 compatible port but does not support daisy chaining. It can communicate in all standard parallel modes including “compatible”, “nibble”, “EPP”, and “ECP” modes. We have thoroughly tested the device using the Windows drivers that we make available to all of our third party partners and the drivers that are installed with our software. Most versions of Linux also support multiple parallel port modes including EPP and ECP.

The mode of your parallel port is set in your BIOS setup utility. This utility is typically accessed by pressing a particular key when the computer is booting up. There will normally be a message shown on the screen during startup that will say something like “Press <key> to enter setup”. Different computers use different keys for this purpose so you must read the message.

For the best performance, set your parallel port mode to ECP. If ECP is not available, then EPP is next best choice.

You should only use a parallel port cable that is rated for IEEE 1284, such as that included with the MPDEMON. Inferior cables are prone to data errors.

Most parallel ports are actually on an ISA bus inside of a PC. This is due to legacy design. Because of inherent wait states associated with the ISA bus, you will find that you can get much better performance using an add-in PCI card that has a standard parallel port. These are readily available on the open market and are generally worth the cost (around $50 US or less).

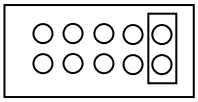
If you have multiple parallel ports on your computer, make a
note of which port you have the MPDEMON plugged into. You will need this information when you configure your host software.

## 3-3 Serial

The serial port on the MPDEMON is used for two purposes. It is first used to connect to a serial terminal to configure the MPDEMON and can then be used as the debug interface.

In order to use the serial connection as the debug interface, you must first connect it as the terminal as discussed in section 2-3-2. Configure the *Serial API baud Rate* parameter to set the baud rate at which you want to communicate with the MPDEMON. The default baud rate of 115200 is usually the best selection since it provides the best performance. However, you may need to decrease this rate if you find that you are getting communication errors or if your host software cannot support this baud rate.

Select “b” from the menu and then enter the desired rate from the displayed list. You must now switch the MPDEMON into a different mode in which it will use the serial port as the debug connection. Unplug the MPDEMON and change the OPTIONS jumper on the front of the box to look like this:



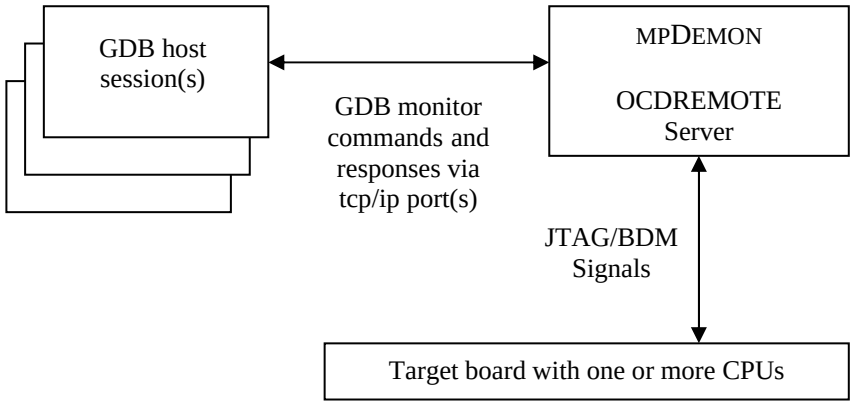
Plug the MPDEMON back in. You should see the three LEDs come on and then change to just the PWR LED as usual, but nothing will be displayed on your terminal screen. The MPDEMON is now ready to debug using the serial port.

Close your terminal emulator so that the serial port is freed for another application and then start your host software and configure it with the baud rate that you just setup in the MPDEMON.

# 4. Setting up the GDB Remote Server

The MPDEMON has a built-in GDB Remote Server that allows any GDB that supports the remote protocol to connect directly to the device via a TCP/IP connection. In addition, the MPDEMON supports debugging target systems that have more than one processor or other device(s) on the same JTAG scan chain. When multiple processors on a single scan chain are being debugged, a separate GDB session must be created for each processor.

Prior to starting an Insight/GDB session(s) on your host, you must first configure the MPDEMON's OCDREMOTE GDB interface for your target board. OCDREMOTE converts GDB commands to JTAG/BDM signals that control your target board's CPU(s) as shown in the following diagram:




To configure OCDREMOTE, you must tell it:

1. The JTAG/BDM Clock Rate - this is the rate at which the MPDEMON clocks the JTAG/BDM lines on the target.
2. The JTAG scan chain configuration - what devices are on the target's JTAG/BDM scan chain and, if there are multiple devices on the scan chain (two or more CPUs/TAP controllers/FPGAs/etc.), what order the devices are in.

Using this information, the MPDEMON creates a GDB monitor tcp/ip port for each active CPU on the target board's JTAG/BDM scan chain. Your GDB session's "gdb.ini" file should have the line:

remote target < MPDEMON 's ethernet address>:<cpu's GDB monitor tcp/ip port>

This tells GDB to send its monitor commands to the GDB monitor tcp/ip port on the MPDEMON. These commands will be routed by the MPDEMON to a single target CPU. Multiple GDB sessions can be run simultaneously, each controlling a different CPU on the target board.

For example, to debug two MPC8248 CPUs on a target system connected to an MPDEMON at tcp/ip address 192.168.1.4, configured so that CPU 1 uses port 8888 and CPU 2 uses port 8889, you would start two GDB sessions. The first session would control CPU 1 and its "gdb.ini" file would contain the line:

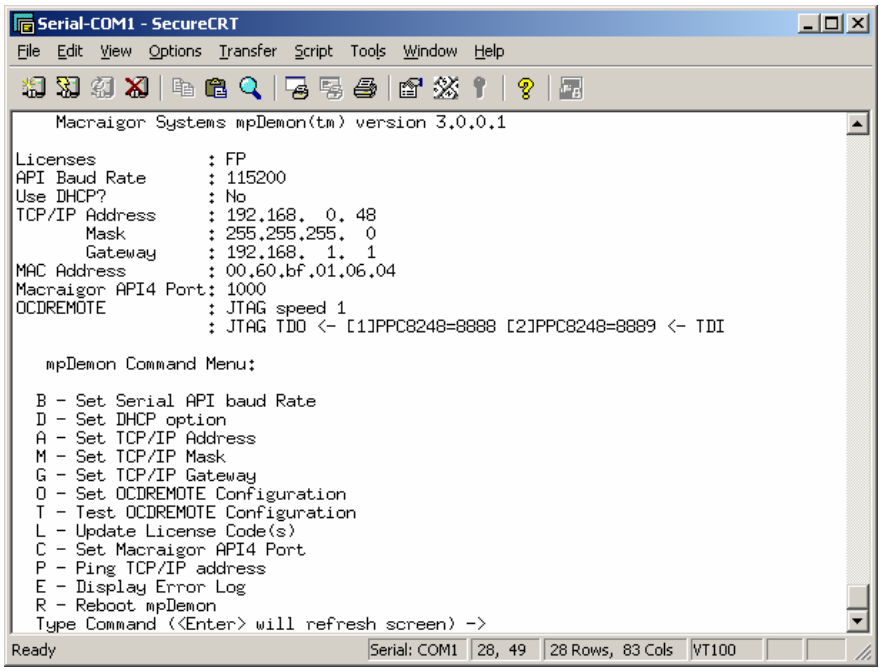
remote target 192.168.1.4:8888

The second session would control CPU 2 and its "gdb.ini" file would contain the line:

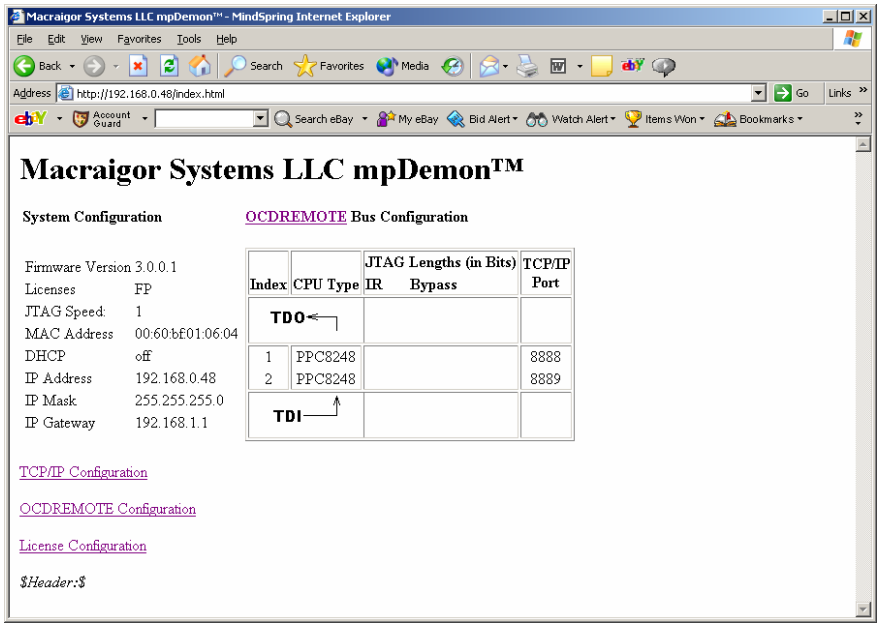
remote target 192.168.1.4:8889

The current scan chain configuration and the port(s) assigned to each
CPU are displayed on both the MPDEMON 's web page and on the serial terminal interface. The following screen shots show the example configuration discussed above:

Serial interface showing OCDREMOTE configured for two PPC8248 processors.




Web interface showing OCDREMOTE configured for two PPC8248 processors.



This configuration information only has to be entered once for a given target system. It is stored in the MPDEMON 's flash memory and will remain active until it is changed by the user.

Modifying the JTAG/BDM Clock Rate:

The JTAG speed parameter can have a value from 1 (the fastest: ~15 mhz) to 8 (the slowest: ~8 Khz).

On the Web page:

1. Click on the “OCDREMOTE Configuration” link.
2. Select the new JTAG/BDM speed from the "JTAG Speed" dropdown list.
3. Click the Submit Button to store the new value into flash.
4. Click the Reboot Button to restart the MPDEMON, the new value will now take effect.

On the Serial Port Display

1. Enter "0<cr>" to go to the OCDREMOTE menu.
2. Enter the new JTAG/BDM clock rate (1 - 8).
3. Enter "n<cr>" after "Do you want to change the JTAG chain?".
4. Enter "r<cr>" to restart the MPDEMON, the new value will now take effect.

Modifying the JTAG Scan Chain Configuration:

On the Web page :

1. Click on the “OCDREMOTE Configuration” link.
2. To change the type of CPU already in the list, select the new CPU type from the "CPU Type" dropdown list for that position in the scan chain. If the device you wish to add is not a CPU (e.g. a TAP controller, FPGA, etc.) select the "UNKNOWN" device type and enter the length in bits of the device's JTAG Instruction Register in the JTAG Parameters IR column, and the length in bits of the device when it is placed in bypass mode (this is typically “1”) in the JTAG Parameters Bypass length column.
3. To add a new CPU to the list, click the “Add CPU button”. A new CPU of "UNKNOWN" type will be added to the bottom of the list. Change the type of CPU to the one you need as described above.
4. To delete a CPU from the list, click the “Delete” button next to the CPU you want to remove from the scan chain list. That entry will be removed from the list. The port numbers will change to reflect the new list order.
5. Click the Submit button to store the new scan chain configuration into flash memory.
6. Click the “Reboot” button to restart the MPDEMON. The new values will now take effect

On the Serial Port Display

1. Enter "0<cr>" to go to the OCDREMOTE menu
2. Enter "<cr>" to retain the current JTAG/BDM clock rate
3. Enter "y<cr>" after "Do you want to change the JTAG chain?"
4. At the "Number of Devices in Scan Chain" prompt enter the number of devices (CPUs and other devices) in the JTAG/BDM scan chain. If you enter "<cr>" the current value shown in brackets [] will be retained.
5. At each "Device [<scan chain index>]" prompt enter the name of the CPU/device at this location in the scan chain. If the device you wish to add is not a CPU (e.g. a TAP controller, FPGA, etc.), enter the "UNKNOWN:<ir length in bits>:<bypass length in bits>" device type, where <ir length in bits> = the length in bits of the device's JTAG Instruction Register and <bypass length in bits> = the length in bits of the device when it is placed in bypass mode (this is typically “1”).
6. At each "TCP/IP port number : [<cpu's GDB monitor tcp/ip port>]" prompt enter "<cr>" this will let OCDREMOTE assign a port number to the CPU.
7. After all the CPUs have been entered, enter any key to return to the main menu.
8. Enter "r<cr>" to restart the MPDEMON. The new values will now take effect.

# 5. Personality Modules

The Personality Module is responsible for communicating with the target under test with both the proper voltages and the proper pin out.

Under most circumstances, the addition of a new Personality Module is all that is needed to use your MPDEMON with a different processor. Firmware updates are not typically needed since the MPDEMON has all the information needed to communicate with a wide variety of target processors.

A partial list of available Personality Modules is:

- AMD SC-520
- AMD Athlon
- AMD Opteron
- ARM 14 pin
- ARM 20 pin
- BDM for Motorola MPC 5xx/8xx
- COP for Motorola and IBM PPC 6xx,7xx,82xx
- IBM PPC 4xx
- MIPS EJTAG (there are several variations of this connection for various company's MIPS processors)
- XScale Microarchitecture

For the most current list of available personality modules, visit our web site at www.macraigor.com.

New Personality Modules for the MPDEMON may be purchased at a price that is significantly lower than the cost of a new MPDEMON.

# 6. Upgrades

The MPDEMON is microprocessor-based and its firmware resides in Flash memory. This enables the firmware to be field programmable. When available, upgrades may be found on the Macraigor Systems' web site, www.macraigor.com.

Download the upgrade package and upzip the files into a directory that you will remember. Read the readme.txt file for directions on how to perform the upgrade.

In some cases, an upgrade may not be compatible with your existing MPDEMON hardware and you will get errors when trying to install the
new firmware. If this is the case, you need to contact Macraigor
Systems and we will swap out your existing MPDEMON for one that is updated with the most current hardware and firmware.

# 7. Trouble Shooting

If the MPDEMON is not working after following the directions in this manual, try the suggestions below before contacting Macraigor Systems..

- No lights come on or PWR light is not on.

  Make sure that the power supply is plugged into an outlet and
  that the 5V power connector is plugged into the MPDEMON. If
  this problem persists, then the MPDEMON is probably either damaged or has experienced an internal failure. Contact Macraigor Systems.

- PWR light is flashing and an error message is displayed on the terminal.

  The MPDEMON has experienced an internal failure. This typically means that the MPDEMON hardware is broken in some way. Contact Macraigor Systems and report the error message that is displayed on the serial terminal screen.

- Lights come on correctly but nothing is displayed on the serial terminal connection.

  1. Verify that a straight-through RS-232 cable (such as the one supplied with the MPDEMON) is connected to the MPDEMON and the host computer.
  2. Verify that your terminal emulator is configured to use the correct COM port if your computer has more than
     one (e.g. COM1 or COM2) and that the parameters are set to 19200 baud, no parity, 8 data bits, 1 stop bit and no flow control.

- Host computer cannot communicate with the MPDEMON

  - Parallel port connection

    1. Verify that the port is enabled via the CMOS setup for your computer and set the mode for ECP if available.
       Verify that your cable is connected to the port that you are specifying in your host software
       (ie: LPT1, LPT2, etc.).
    2. Verify the use of an IEEE-1284 rated parallel port cable.
    3. Verify that no other application has the parallel port open. For instance, a printer driver may be using the port already.

  - Ethernet connection

    1. Verify that the Ethernet cable is securely
       plugged in to the MPDEMON and the network jack.
    2. Verify that the LNK light on the MPDEMON is
       on. If it is not, then you don't have a connection to your network and you should contact your network administrator.
    3. Try to "ping" the TCP/IP address of the MPDEMON from your host computer.
    4. Try to ping another computer on your network from the MPDEMON (there is a selection on the serial menu to do this).
    5. Unplug the MPDEMON from the network and
       then try to ping the MPDEMON's address again.
       If you get a response, then the MPDEMON is
       using an address that is already in use on your network and you must change the MPDEMON's address.

6. Check with your network administrator to verify that the gateway address is set correctly.

- Serial connection

1. Verify that the MPDEMON is configured to use the same baud rate as the rate that you are specifying in your host software.
2. Verify that the OPTIONS jumper is in the correct position (see section 3-3).
3. Verify that your host software is configured to use the correct COM port (e.g. COM1, COM2, etc.)

# Appendix A: OCD Pinouts

## Common OCD pinouts as used by MPDEMON Personality Modules

NOTE: Macraigor Systems accepts NO responsibility for the accuracy of the following information. These are the pinouts that our Personality Modules use, but a semiconductor manufacturer may change these specifications at any time. We strongly recommend that you use the OCD header specified by the semiconductor manufacturer and refer to this list before connecting to your target. If the pinouts shown below do not match the OCD connection on your board, do NOT attempt to connect the Personality Module to your target as this may damage your board. Contact Macraigor Systems to alert us of this situation.

General Notes:

- Unless otherwise indicated, all headers are male dual-row Berg style connectors on 0.1" centers.
- We do not specify the use of pull ups or pull downs on any signals although they may be needed. Check with the chip manufacturer.
- TVcc pins should be the I/O ring voltage. This signal is used to determine the electrical characteristics of the other signals. If you must current limit this line, allow the probe at least 2 mA.
- Unless otherwise indicated, RESET\ or HRESET\ is an open collector signal from the probe to the target. It should directly drive the target processor and not drive power-on reset circuits or the like.
- If you are building your own board, place the header as close to the processor as possible, use short traces of approximately equal length on all clock and data signals.

Pins are identified by number and type.

- o = output from target processor to OCD interface
- i = input to target processor from OCD interface
- p = power pin
- oc = open collector driven from OCD interface, either floating or actively held low
- nc = not connected, ie: not driven nor read by OCD interface
- k = key, pin is typically missing from the target board

**"COP" pinout for Motorola PowerPC 6xx, 7xx, 8xxx and IBM PowerPC 6xx and 7xx. IBM also refers to this connection as RISCWatch.**

| | | | | | |
|---|---|---|---|---|---|
| TDO | o | 1 | 2 | i | QACK |
| TDI | i | 3 | 4 | i | TRST\ |
| HALTED | o | 5 | 6 | p | TVcc |
| TCK | i | 7 | 8 | nc | |
| TMS | i | 9 | 10 | nc | |
| SRESET\ | i | 11 | 12 | p | GND |
| HRESET\ | oc | 13 | 14 | nc | |
| CKSTP_OUT | o | 15 | 16 | p | GND |

**IBM 4xx (IBM also calls this RISCWatch)**

| | | | | | |
|---|---|---|---|---|---|
| TDO | o | 1 | 2 | i | QACK |
| TDI | i | 3 | 4 | i | TRST\ |
| HALTED | o | 5 | 6 | p | TVcc |
| TCK | i | 7 | 8 | nc | |
| TMS | i | 9 | 10 | nc | |
| HRESET\ | i | 11 | 12 | p | GND |
| SRESET\ | oc | 13 | 14 | nc | |
| CKSTP_OUT | o | 15 | 16 | p | GND |

**"BDM" for Motorola MPC8xx, MPC5xx**

NOTE: It is vital that pins 1 and 6 properly reflect the status of the target processor immediately following RESET. Some processors have configurable pins (MPC8xx, etc.) that are specified by a reset configuration word at the time of reset. These pins must be set properly and must ALWAYS reflect the status of the processor correctly. Check the 'hardware reset configuration word' in the Motorola User's manual.

| | | | | | |
|---|---|---|---|---|---|
| FRZ or VFLS0 | o | 1 | 2 | o | SRESET\ |
| GND | p | 3 | 4 | i | DSCK |
| GND | p | 5 | 6 | o | FRZ or VFLS1 |
| RESET\ | oc | 7 | 8 | i | DSDI |
| TVcc | p | 9 | 10 | o | DSDO |

**"OnCE" – On Chip Emulation for Motorola DSP, M•CORE**

| | | | | | |
|---|---|---|---|---|---|
| TDI | i | 1 | 2 | p | GND |
| TDO | o | 3 | 4 | p | GND |
| TCK | i | 5 | 6 | p | GND |
| | nc | 7 | 8 | nc | |
| RESET\ | oc | 9 | 10 | i | TMS |
| TVcc | p | 11 | 12 | p | GND |
| | nc | 13 | 14 | i | TRST\ |

**ARM**

There are two standard ARM pinouts, and older 14 pin specification and a newer 20 pin specification.

| | | | | | |
|---|---|---|---|---|---|
| TVcc | p | 1 | 2 | p | GND |
| TRST\ | i | 3 | 4 | p | GND |
| TDI | i | 5 | 6 | p | GND |
| TMS | i | 7 | 8 | p | GND |
| TCK | i | 9 | 10 | p | GND |
| TDO | o | 11 | 12 | oc | RESET\ |
| TVcc | p | 13 | 14 | p | GND |

***OR***

| | | | | | |
|---|---|---|---|---|---|
| TVcc | p | 1 | 2 | nc | |
| TRST\ | i | 3 | 4 | p | GND |
| TDI | i | 5 | 6 | p | GND |
| TMS | i | 7 | 8 | p | GND |
| TCK | i | 9 | 10 | p | GND |
| | nc | 11 | 12 | p | GND |
| TDO | o | 13 | 14 | p | GND |
| RESET\ | oc | 15 | 16 | p | GND |
| | nc | 17 | 18 | p | GND |
| | nc | 19 | 20 | p | GND |

**MIPS – EJTAG 2.5**

There are many MIPS OCD headers in use. This is the one specified by MTI for EJTAG 2.5

| | | | | | |
|---|---|---|---|---|---|
| TRST\ | i | 1 | 2 | p | GND |
| TDI | i | 3 | 4 | p | GND |
| TDO | o | 5 | 6 | p | GND |
| TMS | i | 7 | 8 | p | GND |
| TCK | i | 9 | 10 | p | GND |
| RESET\ | oc | 11 | 12 | k | key |
| DINT | I | 13 | 14 | p | TVcc |

**Toshiba's MIPS header**

This header uses a pin spacing of 0.05".

| | | | | | |
|---|---|---|---|---|---|
| TRST\ | i | 1 | 2 | p | GND |
| TDI | i | 3 | 4 | p | GND |
| TDO | o | 5 | 6 | p | GND |
| TMS | i | 7 | 8 | p | GND |
| TCK | i | 9 | 10 | nc | |
| TVcc | p | 11 | 12 | nc | |
| RESET\ | oc | 13 | 14 | nc | |
| | nc | 15 | 16 | nc | |
| | nc | 17 | 18 | nc | |
| | nc | 19 | 20 | nc | |

**Phillips' MIPS header**

| | | | | | |
|---|---|---|---|---|---|
| TRST\ | i | 1 | 2 | p | GND |
| TDI | i | 3 | 4 | p | GND |
| TDO | o | 5 | 6 | p | GND |
| TMS | i | 7 | 8 | p | GND |
| TCK | i | 9 | 10 | p | GND |
| RESET\ | oc | 11 | 12 | p | GND |
| | nc | 13 | 14 | p | GND |
| | nc | 15 | 16 | p | GND |
| | nc | 17 | 18 | p | GND |
| | nc | 19 | 20 | p | GND |

**AMD – Èlan SC520**

This header uses a pin spacing of 2mm.

| | | | | | |
|---|---|---|---|---|---|
| GND | p | 1 | 2 | p | TVcc |
| TCK | i | 3 | 4 | o | CMDACK |
| TMS | i | 5 | 6 | i | BR/TC |
| TDI | I | 7 | 8 | o | STOP/TX |
| TDO | o | 9 | 10 | o | TRIG/TRACE |
| SRESET\ | i | 11 | 12 | k | KEY |

**AMD – Athlon**

This header uses a pin spacing of 0.05"

| | | | | | |
|---|---|---|---|---|---|
| TVcc | p | 1 | 2 | i | TCK |
| | nc | 3 | 4 | i | TMS |
| | nc | 5 | 6 | nc | |
| | nc | 7 | 8 | i | TDI |
| | nc | 9 | 10 | i | TRESET\ |
| GND | p | 11 | 12 | o | TDO |
| DBREQ\ | i | 13 | 14 | o | DBRDY |
| RESET\ | p | 15 | 16 | i | PLLTEST\ |

**AMD – Opteron**

This header uses a pin spacing of 0.05”

| | | | | | |
|---|---|---|---|---|---|
| GND | p | 1 | 2 | p | GND |
| RSVD1 | o | 3 | 4 | p | GND |
| RSVD0 | i | 5 | 6 | p | GND |
| DBREQ\ | i | 7 | 8 | p | GND |
| DBRDY | o | 9 | 10 | p | GND |
| TCK | i | 11 | 12 | p | GND |
| TMS | i | 13 | 14 | p | GND |
| TDI | i | 15 | 16 | p | GND |
| TRST\ | i | 17 | 18 | p | GND |
| TDO | o | 19 | 20 | p | GND |
| TVcc | p | 21 | 22 | p | GND |
| TVcc | p | 23 | 24 | nc | |
| KEY | k | 25 | 26 | nc | |