



# **OS-9 for SuperH EBX7709 Board Guide**

## **Version 3.2**

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# Chapter 1: Installing and Configuring OS-9

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This chapter details the procedures for creating an OS-9 bootfile for the SuperH evaluation board. The following sections are included:

- **Development Environment Overview**
- **Requirements and Compatibility**
- **Target Hardware Setup**
- **Connecting the Target to the Host**
- **Building the ROM Image**
- **Creating a Startup File**
- **Optional Procedures**

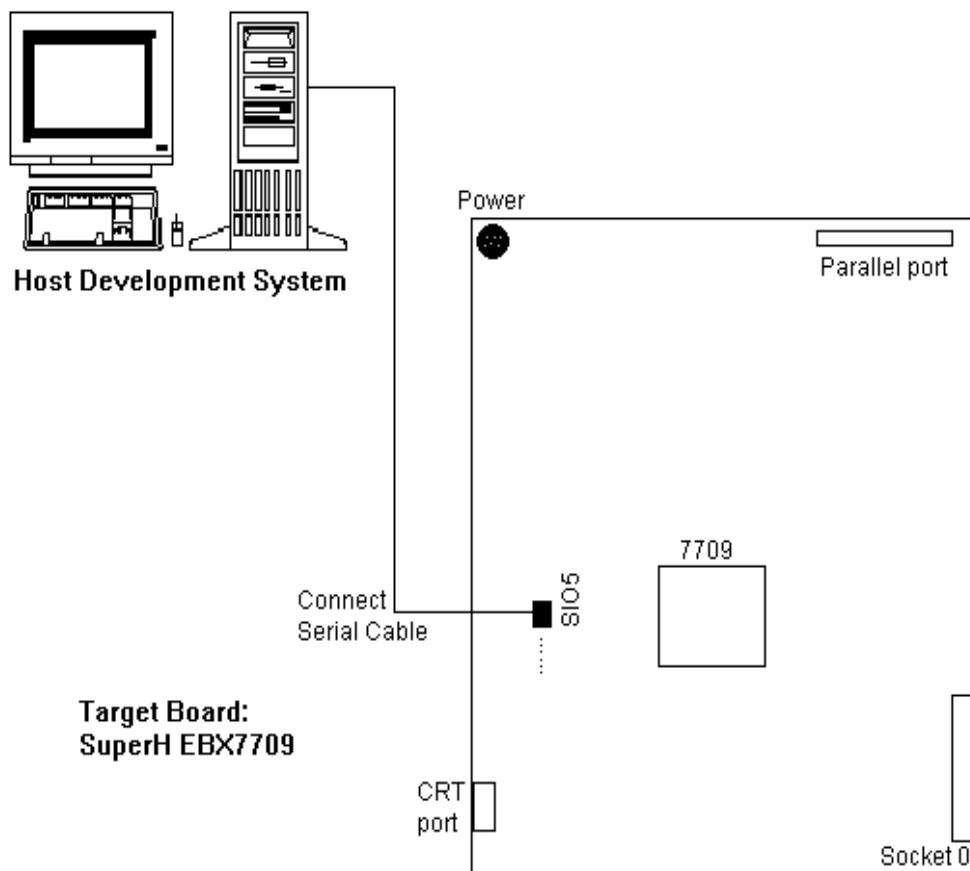


MICROWARE SOFTWARE

## Development Environment Overview

**Figure 1-1** shows a typical development environment for the SuperH board. The component include the minimum required to enable OS-9 to run on the SuperH EBX board.

**Figure 1-1 EBX Development Environment**





# Requirements and Compatibility

---

## Host Hardware Requirements (PC Compatible)

Your host PC should have the following hardware:

- a minimum of 32MB of free disk space (an additional 235MB of free disk space is required to run Java for OS-9)
- an Ethernet network card
- a PCMCIA card reader/writer
- the recommended amount of RAM for the host operating system

## Host Software Requirements (PC Compatible)

Your host PC should have the following software:

- Windows 95, 98, ME, 2000, or NT
- Enhances OS-9 for SH-3

## Target Hardware Requirements

Your SuperH evaluation board requires the following hardware:

- 3COM Etherlink III required (Ethernet PCMCIA card)
- an RS-232 null modem serial cable
- RS-232 terminal software (such as HyperTerminal)
- PCMCIA ATA FlashDisk

## Java Target Hardware Requirements

Your SuperH evaluation board must have the following to run Java for OS-9:

- 16MB of RAM
- 4MB of FLASH (Boot)
- VGA display and PS/2 mouse
- keyboard (optional)

## Software Compatibility

Enhanced OS-9 for SuperH is compatible with the following Microware software:

- OS-9 for SH-3
- Microware Hawk
- HawkEye
- SoftStax

# Target Hardware Setup

---

## Settings

The factory default jumper settings may not work with OS-9 for SuperH. Be sure the jumpers and switches agree with the following settings:

### Jumpers

Most of the jumpers on the EBX7709 reference board are either connectors or should be left on their factory defaults. Therefore, they will not be listed in this section. The following jumpers should be set to the appropriate setting to insure that OS-9 will work on your reference board.

JP15 (set to closed)

This jumper sets the endian mode for the board. With the jumper open, the board is set to Little Endian mode. With the jumper closed, the board is set to Big Endian mode.

### Switches

There is only one eight switch dip switch on the EBX7709 reference board. Refer the Hitachi EBX7709 User Manual for more information on the switches.

# Connecting the Target to the Host

---



## Note

Please refer to the Hitachi documentation for information on hardware preparation and installation, operating instructions, and functional descriptions prior to installing OS-9 on your SuperH evaluation board.

---



## Note

The factory default settings for the DIP switches and jumpers may not work with OS-9. Be sure the DIP switches and jumpers agree with the settings in the **Settings** section.

---

## Establishing a Serial Connection

To connect the SuperH evaluation board to your host PC, complete the following steps:

- 
- Step 1. Connect a serial cable to the serial port (SIO5) on the EBX7709 board.
- Step 2. Connect the other end of the serial cable to one of the COM ports on the host PC. Depending on your PC system, you may need either a straight or a reversed serial cable to make this connection.



---

### Note

If you do not know what type of serial cable your machine uses, try a reversed cable first. If the connection fails (no boot messages appear in the communication program's window), then try a straight serial cable.

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## Building the ROM Image

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The directions in this section will enable you to create a coreboot image and a bootfile image that can support user state debugging.

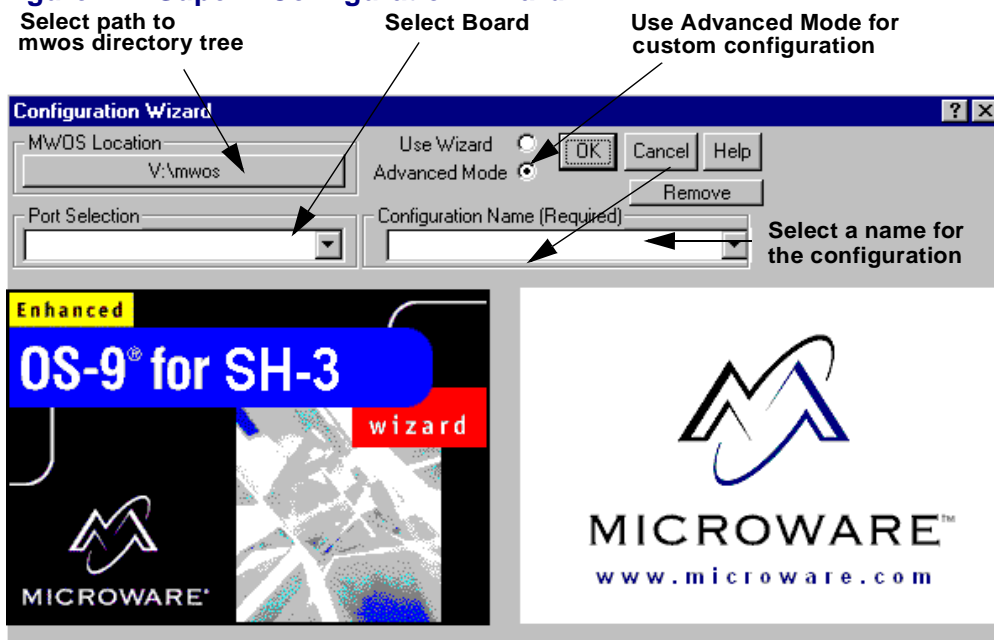
### Using the Configuration Wizard

The OS-9 coreboot image in the supplied EPROMs allows for booting from PCMCIA IDE cards. To boot from a PCMCIA IDE card, you need to place an OS-9 bootfile image on the card. The Configuration Wizard, a utility included with this package, is used to create this bootfile image.

To prepare the Wizard, complete the following steps:

- Step 1. Select **Start** -> **Programs** -> **Microware** -> **Enhanced OS9 for SH-3 v3.0.3** -> **Microware Configuration Wizard**. The window below appears:

**Figure 1-2 SuperH Configuration Wizard**



- Step 2. From the Configuration Wizard opening window, select the path in which the MWOS directory structure can be located by clicking the MWOS location button.
- Step 3. Select the target board from the **Port Selection** pull-down menu.
- Step 4. Select a name for your configuration in the **Configuration Name** field. Your settings will be saved. This enables you to modify the ROM image incrementally, without having to reselect every option for each change.
- Step 5. Select **Advanced Mode** and click **OK**. The Main Configuration window is displayed. Advanced mode enables you to make more detailed and specific choices about what modules are included in your ROM image.

## Configuring the Coreboot Image

This section explains how to configure the coreboot portion of the ROM image that will support user state programming. To configure the coreboot image, complete the following steps:

- 
- Step 1. While in **Advanced Mode** in the Configuration Wizard, click the **Main Configuration** button. A window titled **EBX7709:<configuration name>** appears.
- Click on the **Debugger** tab and click on the **Ethernet** option button in the **Remote Debug Connection** group box. The debugger in the **Select Debugger** group box changes to **Remote** when either the Ethernet or Slip option button is selected.
- Step 2. Click on the **Ethernet** tab and enter the address information in the address text boxes. For most situations you will need to fill out the following text boxes:
- **IP Address**
  - **IP Broadcast**
  - **Subnet Mask**
  - **IP Gateway**
  - **MAC Address** (optional)
- If you are unsure of the values for these text boxes, contact your system administrator.
- Step 3. Verify that the console port is 7709 p1 and that the communication port is 7709 p2. Both ports should be set to 9600.
- Step 4. Make sure only the following check boxes are selected:
- **Override Booter**
  - **Add to Boot Menu** (In the 'bo' Boot embedded OS-9000 in place group box)
  - **Auto boot** (in the 'bo' Boot embedded OS-9000 in place group box)



- Add to Boot Menu (in the 'lr' Copy embedded OS-9000 to RAM and Boot group box)
- Break - Enter System Debugger
- Quit - Restart System

Step 5. Click **OK** to close the window.

Step 6. Click the **Disk Configuration** button found in the **Coreboot Configuration Buttons** group.

Step 7. Make sure the **Add to Menu** check box in the PCMCIA IDE group box is selected.

Step 8. Click **OK** to close the window.

---

## Configuring the Bootfile Image

After configuring a coreboot image, you need to configure a bootfile image. This section focuses on configuring the bootfile part of the ROM image.



### Note

The SanDisk 4MB and 20MB PCMCIA ATA IDE cards do not work correctly with PCMCIA IDE interrupts enabled. To make sure that all cards (including the SanDisk cards) work with OS-9, the default mode for accessing the PCMCIA IDE cards is set to polled mode. If you need to enable PCMCIA IDE interrupts, see **Enabling PCMCIA IDE Interrupts** in Chapter 2.

---



## Note

The instructions in this section cover only those Configuration Wizard options that need to be changed to enable application development with Microware Hawk. If a default option is suitable for use with Microware Hawk, then that option is not mentioned.

## Bootfile System Options

To configure the bootfile system options, complete the following steps:

- Step 1. While in **Advanced Mode** of the Configuration Wizard, click on the **Configure System Options** button.
- Step 2. Verify that the **7709p1** option button is selected as the console port and the bps rate is 9600.
- Step 3. Click on the **Bootfile Options** tab and select the following check boxes:
  - sc16550
  - Parallel port
- Step 4. Click on the **MAUI Options** tab and select the MAUI demos you want to run. If you do not want to run the demos, leave the check boxes deselected.
- Step 5. Click **OK** to save your changes and return to the Configuration Wizard window.

## Bootfile System Network Configuration

To configure the network, complete the following steps:

- 
- Step 1. While in **Advanced Mode** of the Configuration Wizard, click on the **System Network Configuration** button.
  - Step 2. Click on the **Interface** tab.
  - Step 3. Click on **Ethernet Connection** in the **Select Interface** list.
  - Step 4. Select **Specify an IP Address** and verify the correctness of the address information in the address text boxes. They should contain the same information you entered when you created the coreboot image. If they do not contain the correct information, you should enter it now.
  - Step 5. Click the **Ethernet** check box to enable the Ethernet interface in the **Disable/Enable Interface** group box.
  - Step 6. Make sure the Ethernet PCMCIA card is displayed in the combo box under the note about the MAC address. If it is not visible, the Ethernet modules will not be included in the build.
  - Step 7. Click on the **SoftStax Setup** tab, and select the **Enable SoftStax** option button.
  - Step 8. Click **OK** to close the dialog box.
- 

## Bootfile System Disk Configuration

To configure the disk, complete the following steps:

- 
- Step 1. While in **Advanced Mode** of the Configuration Wizard, click on the **System Disk Configuration** button that is found in the Bootfile Configuration button group. This enables the PCMCIA IDE function.
  - Step 2. Click on the **RAM Disk** tab.
  - Step 3. Select the **Enable RAM disk** and the **Map RAM disk as /dd** check boxes.

- Step 4. Select the size of the RAM disk in the drop-down list box immediately below the **Map RAM disk as /dd** check box.
- Step 5. Click on the **IDE Configuration** tab and select **Enable IDE Disk**.
- Step 6. Click on the **Init Options** tab and make sure the **/dd** option button in the **Initial Device Name** group box is selected.
- Step 7. Click **OK** to close the dialog box.
- 

## Building the ROM Image

Now that you have configured the coreboot and bootfile images, it is time to build the ROM image. To do this, complete the following steps:

- 
- Step 1. While in **Advanced Mode** of the Configuration Wizard, click the **Build Image** button to display the **Master Builder** window.
- Step 2. Click on the **Coreboot + Bootfile** option button in the **Build Type/Options** group box. The **Coreboot + Bootfile** option button is used to build ROM images.
- Step 3. Select the following check boxes. The last three items are needed only if you included MAUI demos in the boot.
- Disk Support
  - Disk Utilities (fdisk, format....)
  - SoftStax (SPF) Support
  - User State Debugging Modules
  - MAUI Support (optional)
  - Keyboard Support (optional)
  - Mouse Support (optional)
- Step 4. Click **Build**. The ROM image is built and saved in the following directory:
- MWOS\OS9000\SH3\PORTS\EBX7709\BOOTS\INSTALL\PORTBOOT.



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**Note**

You should make sure the combined ROM image fits into the flash memory built into the EBX Reference Platform.

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Step 5. Click **Finish** to dismiss the **Master Builder** window.

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## Creating a Startup File

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When the Configuration Wizard is set to use a hard drive, or another fixed drive such as a PC Flash Card, as the default device, it automatically sets up the `init` module to call the `startup` file in the `SYS` directory in the target (For example: `/h0/SYS/startup`, `/mhcl/SYS/startup`). However, this directory and file will not exist until you create it. To create the startup file, complete the following steps:

- 
- Step 1. Create a `SYS` directory on the target machine where the `startup` file will reside (for example: `mkdir /h0/SYS`, `mkdir /dd/SYS`).
- Step 2. On the host machine, navigate to the following directory:  
`MWOS/OS9000/SRC/SYS`
- In this directory, you will see several files. The files related to this section are listed below:
- `motd`: Message of the day file
  - `password`: User/password file
  - `termcap`: Terminal description file
  - `startup`: Startup file
- Step 3. Transfer all files to the newly created `SYS` directory on the target machine. (You can use Kermit, or FTP in ASCII mode to transfer these files.)
- Step 4. Since the files are still in DOS format, you will be required to convert them into the OS-9 format with the `cudo` utility. The following command is an example:  
`cudo -cdo password`
- This will convert the `password` file from DOS to OS-9 format.



## For More Information

For a complete description of all the `cuDo` command options, refer to the ***Utilities Reference Manual*** located on the Enhanced OS-9 CD.

- Step 5. Since the command lines in the startup file are system-dependent, it may be necessary to modify this file to fit your system configuration. It is recommended that you modify the file before transferring it to the target machine.

## Example Startup File

Below is the example startup file as it appears in the `MWOS/OS9000/SRC/SYS` directory:

```
-tnxnp
tmode -w=1 nopause
*
*OS-9 - Version 3.0
*Copyright 2001 by Microware Systems Corporation
*The commands in this file are highly system dependent and
*should be modified by the user.
*
*setime </term                ;* start system clock
setime -s                    ;* start system clock
link mshell csl              ;* make "mshell" and "csl" stay in memory
* iniz r0 h0 d0 t1 p1 term    ;* initialize devices
* load utils                  ;* make some utilities stay in memory
* tsmon /term /t1 &           ;* start other terminals
list sys/motd
setenv TERM vt100
tmode -w=1 pause
mshell<>>>/term -l&
```



## For More Information

Refer to the **Making a Startup File** section in Chapter 9 of the *Using OS-9* manual for more information on startup files.



## Optional Procedures

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The following procedures may be performed once you have installed and configured OS-9.

### Loading the ROM Image into Flash Memory



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#### Note

You should reprogram the flash memory sparingly because the flash memory can be reprogrammed only a finite amount of times.

---

### Embedding the ROM Image in a Bootfile

To embed the ROM image in a bootfile, complete the following steps:

- 
- Step 1. In the SuperH Configuration Wizard window, click the **Configure System Options** button. A window named **SH3:<your configuration name>** appears.
  - Step 2. Click on the **Bootfile Options** tab.
  - Step 3. Click **PF-ROM**. **PF-ROM** will include the ROM image in the new bootfile as a data module.
  - Step 4. Click **OK** to close the window.
  - Step 5. Click **Build Image** to open the **Master Builder** window.
  - Step 6. Click **Bootfile Only Image** and then click **Build**. The bootfile containing the ROM image is built and saved in the following directory.  
MWOS\OS9000\SH3\PORTS\EBX7709\BOOTS\INSTALL\PORTBOOT  
The **Save As** button is enabled when the build is completed.
  - Step 7. Save the bootfile to the root directory of the PCMCIA IDE card. Use the name `os9kboot`.

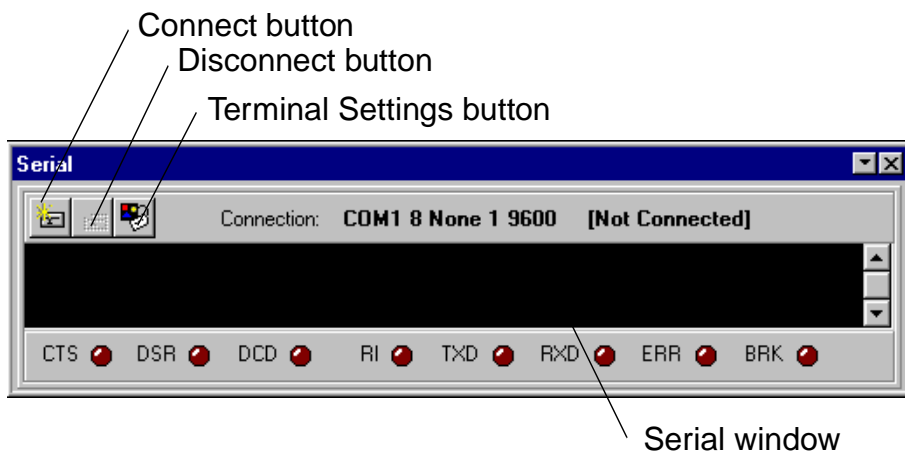
- Step 8. Click **Finish** to close the **Master Builder** screen, and select **File->Save Settings** to save the configuration.
- Step 9. Select **File->Exit** to quit from the wizard.

## Setting Up Hawk's Serial Console

Once the bootfile is created you will need to connect to the EBX7709 Reference Platform. To set up Hawk's Serial output window as a serial console, complete the following steps:

- Step 1. Start Microware Hawk from the Windows Start menu. Click **Start** and select **Programs -> Microware -> Enhanced OS-9 for SH-3 v3.0.3 -> Microware Hawk IDE**.
- Step 2. Once the Hawk IDE has started, open the **Serial** window by selecting **Customize -> Toolbars...**. The **Toolbar Customization** dialog box appears.
- Step 3. Select **Serial** in the **Toolbars** list box and click the **Visible** check box. Click **Close**. The **Toolbar Customization** dialog box disappears and the **Serial** window appears.

**Figure 1-3 The Microware Hawk Serial window.**



- Step 4. Click on the **Connect** button to open the **Com Port Options** dialog box.
- Step 5. Click on the **OK** button. The dialog box closes and the connection information is displayed at the top of the **Output** window. You will not see any output until you boot OS-9 on your reference board.



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**Note**

If you use your host computer's COM1 port, it is not necessary to change any of the settings in the **Com Port Options** dialog box. The default settings are correct. If you use COM2, make sure **Direct to COM2** is displayed in the **ComPorts** group box. The rest of the default settings would stay at their default values.

---

## Programming the ROM Image into FLASH Memory

---

- Step 1. Make sure power is removed from the EBX7709 reference board.



---

**WARNING**

If you insert a PCMCIA card into either PCMCIA socket of the EBX7709 reference board with power applied to the board, you will damage the PCMCIA card.

---

- Step 2. Remove the cover from the EBX7709 reference board.
- Step 3. Set switch SW1-1 (switch 1 on SW1) to the ON position. This tells the system to boot from the 128K removable flash part instead of the flash memory.
- Step 4. Remove the PCMCIA IDE card from the PC host and insert the card into the upper PCMCIA socket (socket 1) on the SuperH board.
- Step 5. Insert the 3COM Etherlink III card into the lower PCMCIA socket (socket 0) and attach an Ethernet cable to the 3COM Etherlink III card.

- Step 6. Connect a serial cable to the serial port (SIO5) on the EBX7709 board and to one of the COM ports on the host PC. Depending on your PC system, you may need either a straight or a reversed serial cable to make this connection.



## Note

If you do not know what type of serial cable your machine uses, try a reversed cable first. If the connection fails (no boot messages appear in the communication program's window), then try a straight serial cable.

- Step 7. If your application requires a video display, attach the VGA monitor or LCD display to the EBX7709 reference board.
- Step 8. Connect the AC adaptor to the power connector and apply power to the board. The EBX7709 reference board will boot automatically to a shell prompt "\$". You should see the shell prompt in Hawk's Serial Output window one to two minutes after applying power.
- The new bootfile containing the ROM image is now loaded into the SuperH evaluation board's RAM memory, and you are ready to load the ROM image into flash memory.
- Step 9. At the shell prompt "\$" type the following command:
- pflash**
- The command erases flash memory, loads the new ROM image into the flash memory, and verifies the contents of the flash memory.
- Step 10. When you get the shell prompt "\$" again, remove power from the SuperH evaluation board.
- Step 11. Set switch SW1-1 to the OFF position. This tells the EBX7709 Reference Board to boot from the flash memory.
- Step 12. Reboot the system. The EBX7709 Reference Board will boot OS-9 to the shell prompt "\$".

- Step 13. Type the following commands to start the NDP Server and the NDP I/O Server:

```
spfn dpd <>>>/nil&
ndpio<>>>/nil&
```

---

## Loading the Coreboot Image into Flash Memory



### Note

You should reprogram the flash memory sparingly because the flash memory can be reprogrammed only a finite amount of times.

---

## Embedding the Coreboot Image into a Bootfile

- Step 1. In the SuperH Configuration Wizard window, click **Configure System Options**. A window named **SH3:<your configuration name>** appears.
- Step 2. Click on the **Bootfile Options** tab.
- Step 3. Click **PF-CORE**. **PF-CORE** will include the coreboot image in the new bootfile as a data module.
- Step 4. Click **OK** to close the window.
- Step 5. Click **Build Image** to open the **Master Builder** window.
- Step 6. Click **Bootfile Only Image** and then click **Build**. The bootfile containing the coreboot image is built and saved in the following directory.  
 MWOS\OS9000\SH3\PORTS\EBX7709\BOOTS\INSTALL\PORTBOOT  
 The **Save As** button is enabled when the build is completed.
- Step 7. Save the bootfile to the root directory of the PCMCIA IDE card. Use the name **os9kboot**.

- Step 8. Click **Finish** to close the **Master Builder** screen, and select **File** -> **Save Settings** to save the configuration.
- Step 9. Select **File** -> **Exit** to quit from the Wizard.

## Programming the Coreboot Image into Flash Memory

- Step 1. Make sure power is removed from the EBX7709 reference board.



### WARNING

If you insert a PCMCIA card into either PCMCIA socket of the EBX7709 reference board with power applied to the board, you will damage the PCMCIA card.

- Step 2. Set switch SW1-1 (switch 1 on SW1) to the ON position. This tells the system to boot from the 128K removable flash part instead of the flash memory.
- Step 3. Remove the PCMCIA IDE card from the PC host and insert the card into the upper PCMCIA socket on the SuperH board.
- Step 4. Start Hawk's serial console.
- Step 5. Connect the AC adaptor to the power connector and apply power to the board. The EBX7709 reference board will boot automatically to the shell prompt "\$". The bootfile containing the coreboot image is now loaded into the SuperH evaluation board's RAM memory. You are ready to load the coreboot image into flash ROM.
- Step 6. At the shell prompt "\$" type the following command:
- pflash**
- The command erases flash memory, loads the new coreboot into the flash memory and verifies the contents of the flash memory.
- Step 7. When you get the shell prompt "\$" again, turn off the SuperH reference board.

- Step 8. Set switch SW1-1 to the OFF position. This tells the EBX7709 Reference Board to boot from flash memory.
- Step 9. Build a new bootfile that does not contain the coreboot image (deselect **PF-CORE**) and save it to the root directory of the PCMCIA IDE card as `os9kboot`.
- Step 10. Reboot the system. The EBX7709 Reference Board will boot to a menu like the one in the following illustration.

```

OS-9000 Bootstrap for the SuperH
MICROWARE PCMCIA SOCKET SERVICES
ATA IDE disk found in socket 00
Now trying to Override autobooters

BOOTING PROCEDURES AVAILABLE ----- <INPUT>
Boot from PCMCIA PCCARD ----- <pcm_pc>
Enter system debugger ----- <break>
Restart the System ----- <q>
Select a boot method from the above menu:

```

- Step 11. Type `pcm_pc` to finish booting OS-9 to the shell prompt “\$”.
- Step 12. Type the following commands to start the NDP Server and the NDP I/O Server:

```

spfndpd <>>>/nil&
ndpio<>>>/nil&

```

---





---

## Chapter 2: Board Specific Reference

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This chapter covers three topic areas that are applicable to the EBX7709 reference platform:

- **Boot Menu Options**
- **PC/104 and Super I/O Interrupts**
- **The Fastboot Enhancement**
- **Enabling PCMCIA IDE Interrupts**



## Boot Menu Options

---

You select your boot device menu options using Configuration Wizard. For each boot device option, you can select whether you want it to be displayed on a boot menu, set up to autoboot, or both. The autoboot option enables the device selected to automatically boot up the high-level bootfile, bypassing the boot device menu.



### Note

When using Configuration Wizard, we recommend that you select only one device for autoboot on your system.

---

Following is an example of the Boot Menu displayed in the terminal emulation window (using Hyperterminal):

```
OS-9000 Bootstrap for the SuperH

MICROWARE PCMCIA SOCKET SERVICES
ATA IDE disk found.

Now trying to Override autobooters.

BOOTING PROCEDURES AVAILABLE ----- <INPUT>

Boot from PCMCIA PCCARD ----- <pcm_pc>
Enter system debugger ----- <break>
Restart the system ----- <q>
```

What you select for boot options in Configuration Wizard determines what modules are included in the coreboot image. The supported boot device for Enhanced OS-9 for SuperH is a PCMCIA card.

## PC/104 and Super I/O Interrupts

---

The SH3 on the EBX7709 Reference Platform is set up for IRQ mode. The ISA interface contains both PC/104 and Super I/O. The ISA interface is controlled by a Xilinx FPGA. Before the ISA interface is active, the FPGA code must first be downloaded to it. The ISA interface also generates only one interrupt, and this is supplied to IRQ1 on the SH3 processor. The ISA interface has a simple interrupt controller in order to determine which ISA interrupt needs to be serviced.

The OS-9 port to the SH3 EBX7709 Reference Platform contains a p2 module named `fpga`, which will download the FPGA code to the Xilinx FPGA and activate the ISA interface. `fpga` also initializes the Super I/O device. This OS-9 port also contains another p2 module named `isa_intc` that will handle ISA interrupts and the interrupt controller accordingly. The `isa_intc` module will also handle dispatching operating system ISA interrupts to the correct ISA interrupt vector. As with any ISA interface, these ISA vectors are from \$40-\$4f. The `isa_intc` module will set the IRQ1 interrupt level in the IPRC register to 14.

The Super I/O device on the EBX7709 Reference Platform is wired to support four devices. These are COM2, parallel port, PS/2 mouse, and keyboard. The ISA vectors these devices use are as follows:

- COM2           \$44
- Parallel port   \$47
- Mouse           \$4C
- Keyboard       \$41

The Wizard will automatically include the `fpga` and `isa_intc` p2 modules for the EBX7709 when it builds a boot. After OS-9 boots, the ISA interface will be activated and interrupts handled accordingly. This will be done after the Pre-I/O extension module list is done. Since this ISA interface initialization is done during the kernel's own initialization, COM2 cannot be used as a console port for booting or rombug. It can be used as a term device, however.

## The Fastboot Enhancement

---

The Fastboot enhancements to OS-9 were added to address the needs of embedded systems that require faster system bootstrap performance than what is normally seen. OS-9's normal bootstrap performance is mostly attributable to its flexibility. OS-9 can handle many different runtime configurations to which it dynamically adjusts during the bootstrap process.

The Fastboot concept consists of informing OS-9 that the defined configuration is static and valid. These assumptions eliminate the dynamic searching OS-9 normally performs during the bootstrap process and allow the system to perform a minimal amount of runtime configuration. As a result, a significant increase in bootstrap speed is achieved.

### Overview

The Fastboot enhancement consists of a set of flags that control the bootstrap process. Each flag informs some portion of the bootstrap code that a particular assumption can be made and that the associated bootstrap functionality should be omitted.

One very important feature of the Fastboot enhancement is that not only can the control flags be statically defined when the embedded system is initially configured, but they may also be dynamically altered during the bootstrap process itself. For example, the bootstrap code could be configured to query dip switch settings, respond to device interrupts, or respond to the presence of specific resources which would indicate different bootstrap requirements.

Also, the Fastboot enhancement's versatility allows for special considerations under certain circumstances. This versatility would be useful in a system where normally all resources are known, static and functional, but additional validation is required during bootstrap for a particular instance such as a resource failure. The low-level bootstrap code could respond to some form of user input that would inform it that additional checking and system verification is desired.

## Implementation Overview

The Fastboot configuration flags have been implemented as a set of bit fields. An entire 32-bit field has been dedicated for bootstrap configuration. This four-byte field is contained within the set of data structures shared by the ModRom sub-components and the kernel. Hence, the field is available for modification and inspection by the entire set of system modules (high-level and low-level). Currently, there are just six bit flags defined with eight bits reserved for user-definable bootstrap functionality. The reserved user-definable bits are the high-order eight bits (31-24). This leaves bits available for future enhancements. The currently defined bits and their associated bootstrap functionality are listed below:

### **B\_QUICKVAL**

The B\_QUICKVAL bit indicates that only the module headers of modules in ROM are to be validated during the memory module search phase. This causes the CRC check on modules to be omitted. This option is potentially a large time saver due to the complexity and expense of CRC generation. If a system has many modules in ROM, where access time is typically longer than RAM, omitting the CRC check on the modules will drastically decrease the bootstrap time. It is fairly rare that corruption of data occurs in ROM. Therefore, omitting CRC checking will usually be a safe option.

### **B\_OKRAM**

The B\_OKRAM bit informs both the low-level and high-level systems that they should accept their respective RAM definitions without verification. Normally, the system probes memory during bootstrap based on the defined RAM parameters. This allows system designers to specify a possible RAM range which the system will validate upon startup. Thus the system can accommodate varying amounts of RAM. But in an embedded system where the RAM limits are usually statically defined and presumed to be functional, there is no need to validate the defined RAM list. Bootstrap time is saved by assuming that the RAM definition is accurate.

## B\_OKROM

The B\_OKROM bit causes acceptance of the ROM definition without probing for ROM. This configuration option behaves just like the *B\_OKRAM* option except that it applies to the acceptance of the ROM definition.

## B\_1STINIT

The B\_1STINIT bit causes acceptance of the first `init` module found during cold-start. By default, the kernel searches the entire ROM list passed up by the ModRom for `init` modules before it accepts and uses the `init` module with the highest revision number. In a statically defined system, a good deal of time can be saved by using this option to omit the extended `init` module search.

## B\_NOIRQMASK

The B\_NOIRQMASK bit informs the entire bootstrap system that it should not mask interrupts for the duration of the bootstrap process. Normally, the ModRom code and the kernel cold-start mask interrupts for the duration of the system startup. But some systems that have a well defined interrupt system (i.e. completely calmed by the `sysinit` hardware initialization code) and also have a requirement to respond to an installed interrupt handler during system startup can enable this option to prevent the ModRom and the kernel cold-start from disabling interrupts. This is particularly useful in power-sensitive systems that need to respond to “power-failure” oriented interrupts.



---

### Note

Some portions of the system may still mask interrupts for short periods during the execution of critical sections.

---

## B\_NOPARITY

If the RAM probing operation has not been omitted, the B\_NOPARITY bit causes the system to not perform parity initialization of the RAM. Parity initialization occurs during the RAM probe phase. The B\_NOPARITY option is useful for systems that either require no parity initialization at all or systems that only require it for “power-on” reset conditions. Systems that only require parity initialization for initial “power-on” reset conditions can dynamically use this option to prevent parity initialization for subsequent “non-power-on” reset conditions.

## Implementation Details

This section describes the compile-time and runtime methods by which users can control the bootstrap speed of their system.

### Compile-time configuration

The compile-time configuration of the bootstrap is provided by a pre-defined macro (BOOT\_CONFIG) which is used to set the initial bit-field values of the bootstrap flags. Users can redefine the macro for recompilation to create a new bootstrap configuration. The new over-riding value of the macro should be established by redefining the macro in the `rom_config.h` header file or as a macro definition parameter in the compilation command.

The `rom_config.h` header file is one of the main files used to configure the ModRom system. It contains many of the specific configuration details of the low-level system. Here is an example of how a user can redefine the bootstrap configuration of their system using the BOOT\_CONFIG macro in the `rom_config.h` header file:

```
#define BOOT_CONFIG (B_OKRAM + B_OKROM + B_QUICKVAL)
```

And here is an alternate example showing the default definition as a compile switch in the compilation command in the makefile:

```
SPEC_COPTS = -dNEWINFO -dNOPARITYINIT  
-dBOOT_CONFIG=0x7
```

This redefinition of the `BOOT_CONFIG` macro would result in a bootstrap method which would accept the RAM and ROM definitions as they are without verification, and also validate modules solely on the correctness of their module headers.

## Runtime Configuration

The default bootstrap configuration can be overridden at runtime by changing the `rinf->os->boot_config` variable from either a low-level P2 module or from the `sysinit2()` function of the `sysinit.c` file. The runtime code can query jumper or other hardware settings to determine what user-defined bootstrap procedure should be used. An example P2 module is shown below.



### Note

If the override is performed in the `sysinit2()` function, the effect is not realized until after the low-level system memory searches have been performed. This means that any runtime override of the default settings pertaining to the memory search must be done from the code in the P2 module code.

```
#define NEWINFO
#include <rom.h>
#include <types.h>
#include <const.h>
#include <errno.h>
#include <romerrno.h>
#include <p2lib.h>

error_code p2start(Rominfo rinf, u_char *glbls)
{
    /* if switch or jumper setting is set... */
    if (switch_or_jumper == SET) {
        /* force checking of ROM and RAM lists */
        rinf->os->boot_config &= ~(B_OKROM+B_OKRAM);
    }
    return SUCCESS;
}
```



## Enabling PCMCIA IDE Interrupts

---

Due to a problem with losing interrupts when using certain PCMCIA IDE cards with the SuperH board, the default configuration of OS-9 has been set to polled mode for accessing PCMCIA IDE type devices.

The following PCMCIA IDE cards are known to have problems with interrupts:

- the SanDisk PCMCIA PC CARD ATA 4MB card
- the SanDisk PCMCIA PC CARD ATA 20MB card

The following PCMCIA IDE cards have not shown any problems with interrupts:

- the Viking PCMCIA PC CARD ATA 12MB card
- the EXP Disk Traveler HDG-1.4GB card
- the Maxtor Hard Card series

All of the above cards (including the SanDisk cards) will work with polled mode. If you need to enable interrupts for use with your applications, you will need to follow the steps outlined in this section.

### Before You Start

You need to test to see if your PCMCIA IDE card will work with PCMCIA interrupts enabled. If the following sequence of three commands work, then you can safely enable interrupts on your system.

```
$chd/mhcl
```

```
$save kernel
```

```
$ident kernel
```

## Enabling PCMCIA IDE Interrupts on the SuperH

To enable interrupts on PCMCIA IDE devices the Microware Socket Services and device descriptors must be updated.

The Microware PCMCIA Socket Services are included in a p2module called `llcis` as well as in the `pcmcia` utility's module. Both of these modules should be compiled with interrupts enabled to use PCMCIA IDE interrupts.

### Updating the `llcis` module

First you need to update the makefile for the `llcis` module.

- 
- Step 1. Change to the `LLCIS` directory. The `LLCIS` directory is found in the following path: `MWOS\OS9000\SH3\PORTS\EBX7709\ROM\LLCIS`. `LLCIS` contains a file named `makefile`.
  - Step 2. Using a text editor, open `makefile`.
  - Step 3. Remove the '#' character from the following line:  
`SPEC_COPTS = -dSINGLE_SOCKET # -dUSE_IRQ`
  - Step 4. Type `os9make` from the `LLCIS` directory to build a new `llcis` module.
- 

### Updating the PCMCIA utility

After you update the makefile for the `llcis` module, you need to update the makefile for the PCMCIA utility. The path to the PCMCIA utility's makefile is as follows:  
`MWOS\OS9000\SH3\PORTS\EBX7709\UTILS\PCMCIA\makefile`.

- 
- Step 1. Change to the PCMCIA directory.
  - Step 2. Using a text editor, open the file named `makefile`.

- Step 3. In the following line, move the switch '-dUSE\_IRQ' to in front of the '#' character (we want to leave -dSINGLE\_SOCKET commented out):  
`SPEC_COPTS = -k #-dSINGLE_SOCKET -dUSE_IRQ`
- Step 4. Type **os9make** from the PCMCIA directory to build a new `pcmcia` module.
- 

## Updating the RBF/PCF PCMCIA IDE device descriptors

After you update the modules `llcis` and `pcmcia`, you need to update the PCMCIA IDE device descriptors. The PCMCIA IDE device descriptors are found in the `config.des` file. The path to the `config.des` file is as follows:

`MWOS\OS9000\SH3\PORTS\EBX7709\RBF\RB1003\config.des`

---

- Step 1. Change to the `RB1003` directory.
- Step 2. Using a text editor, open the file named `config.des`.
- Step 3. Find the following section of code in the file:
- ```
init dev_specific {
    ds_idetype = IDE_TYPE_PCMCIA;
    ds_polled = IDE_POLLED;
    ds_altstat = HD_ALTSTAT;
    ds_timeout = 30;
};
```
- Step 4. Change `IDE_POLLED` to `IDE_INTERRUPTS` in the following line:  
`ds_polled = IDE_POLLED;`
- Step 5. Change to the following directory:  
`MWOS\OS9000\SH3\PORTS\EBX7709\RBF\RB1003\DESC` directory
- Step 6. Type **os9make**. This will build the RBF descriptors.
-



---

## Note

If you are only creating a bootfile image, select `llcis` from the **Bootfile Options** tab in the wizard. This will allow the `llcis` **Microware Socket Services** to start after the system is booted. When using this option, you do not need to re-create the FLASH `coreboot` image.

---

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# Appendix A: Board Specific Modules

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This chapter describes the modules specifically written for the target board. It includes the following sections:

- **Low-Level System Modules**
- **High-Level System Modules**
- **Common System Modules List**



## Low-Level System Modules

---

The following low-level system modules are tailored specifically for the SuperH EBX board. The functionality of many of these modules can be altered through changes to the configuration data modules (cnfgdata). These modules are located in the following directory:

MWOS/OS9000/SH3/PORTS/EBX7709/CMD5/BOOTOBJS/ROM

|            |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| cnfgdata   | standard cnfgdata module                                                         |
| cnfgfunc   | configuration function module                                                    |
| commcnfg   | communications port configuration module                                         |
| conscnfg   | console port configuration module                                                |
| iosh7708   | ROM based serial IO driver                                                       |
| iosh7709   | ROM based serial IO driver                                                       |
| llcis      | SH7709 PCMCIA ROM services<br>PCMCIA IDE and 3COM Ethernet support               |
| lle509_pcm | Ethernet ROM driver                                                              |
| portmenu   | boot system support module                                                       |
| sh3timer   | ROM timer services                                                               |
| usedebug   | use debug support module<br>allows system to enter ROMbug or<br>SNDP on power-up |

## High-Level System Modules

---

The following OS-9 system modules are tailored specifically for the SuperH EBX board. Each module is located in a file of the same name in the following directory:

MWOS/OS900/SH3/PORTS/EBX7709/CMD5/BOOTOBJS

pwrent power management extension

pwrplcy decides and initializes power states

## PCMCIA Support for IDE Type Devices

### Module

rb1003

### Descriptors

|          |                                                                                                   |
|----------|---------------------------------------------------------------------------------------------------|
| /hc1.h0  | PCMCIA RBF type device, primary master (default device)*                                          |
| /hc1fmt  | PCMCIA RBF type device, primary master partition 1, format enabled *                              |
| /hcfmt   | PCMCIA RBF type device, primary master entire disk, format enabled. *                             |
| /mhc1    | PCMCIA PC file system type device, primary master partition 1 (PCMCIA socket #1)                  |
| /mhc1.h0 | PCMCIA PC file system type device, primary master partition 1, default device (PCMCIA socket #1)  |
| /mhc1fmt | PCMCIA PC file system type device, primary master partition #1, format enabled (PCMCIA socket #1) |

|          |                                                                                                     |
|----------|-----------------------------------------------------------------------------------------------------|
| /mhcfmt  | PCMCIA PC file system type device, primary master entire disk, format enabled (PCMCIA socket #1)    |
| /mhel    | PCMCIA PC file system device, secondary master partition 1 (PCMCIA socket #0)                       |
| /mhel.h0 | PCMCIA PC file system type device secondary master partition 1, default device (PCMCIA socket #0)   |
| /mhelfmt | PCMCIA PC file system type device, secondary master partition #1, format enabled (PCMCIA socket #0) |
| /mhelfmt | PCMCIA PC file system type device, primary master entire disk, format enabled (PCMCIA socket #0)    |



---

### Note

Configuration Wizard does not support the configuration of PCMCIA IDE cards for use with RBF. For items marked with an \* the PC file system is assumed.

---

## Real Time Clock

### Module

rtc7709



## Ticker (System Clock) Support

### Module

tk7709

## Serial Support

### Module

sc7708

### Descriptors /t3

t3 is assigned to port 1 of the sc7708 module. This port is labeled as SIO3 on connector JP12. Connector JP12 is located near the video card

t3: serial port #3

Default Baud Rate: 9600

Default Parity: None

Default Data Bits: 8

Device Name: SCI

To use it: Select **7708p1** in the Configuration Wizard.

## Baud Rates

The following OS-9 baud rates are supported by the SC7708 driver:

**Table 2-1 Supported SC7709 Baud Rates**

|      |      |      |       |       |      |
|------|------|------|-------|-------|------|
| 50   | 75   | 110  | 134.5 | 150   | 300  |
| 600  | 1200 | 1800 | 2000  | 2400  | 3600 |
| 4800 | 7200 | 9600 | 19200 | 38400 |      |

The following OS-9 baud rates are not supported by the SC7708 driver:

**Table 2-2 SC7709 Baud Rates Not Supported**

|       |       |       |       |        |
|-------|-------|-------|-------|--------|
| 31250 | 56000 | 57600 | 64000 | 115200 |
|-------|-------|-------|-------|--------|

## Module

sc7709

## Descriptors /term /t1

t1 is assigned to port 1 of the internal UART for the sc7709. This port is labeled as SIO5 on connector JP12. Connector JP12 is located near the video card.

t1: serial port #1

Default Baud Rate: 9600

Default Parity: None

Default Data Bits: 8

Device Name: SCIF1

Software/Hardware/Auto handshaking is supported.

To use it: Select 7709p1 in the Configuration Wizard.

Descriptors /t2

t2 is assigned to port 2 of the internal UART for the sc7709. This port is labeled as SIO4 on connector JP12. Connector JP12 is located near the video card.

t2: serial port #2

Default Baud Rate 9600

Default Parity: None

Default Data Bits: 8

Device Name: SCIF2

To use it: Select 7709p2 in the Configuration Wizard.

Baud Rates

The following OS-9 baud rates are supported by the SC7709 driver:

Table 2-3 Supported SC7709 Baud Rates

|      |      |      |       |       |      |
|------|------|------|-------|-------|------|
| 50   | 75   | 110  | 134.5 | 150   | 300  |
| 600  | 1200 | 1800 | 2000  | 2400  | 3600 |
| 4800 | 7200 | 9600 | 19200 | 38400 |      |

The following OS-9 baud rates are not supported by the SC7709 driver:

Table 2-4 SC7709 Baud Rates Not Supported

|       |       |       |       |        |
|-------|-------|-------|-------|--------|
| 31250 | 56000 | 57600 | 64000 | 115200 |
|-------|-------|-------|-------|--------|

## Module

sc16550

## Descriptors /t4

t4 is assigned to the sc16550. The connector is located near the parallel port on the back of the EBX enclosure. It is labeled as **CN2 RS232C Ch0**.

t4: serial port #4

Default Baud Rate: 9600

Default Parity: None

Default Data Bits: 8

Device Name: COM2

To use it: Select **16550p1** in the Configuration Wizard.

## Baud Rates

The following OS-9 baud rates are supported by the SC16550 driver:

**Table 2-5 Supported SC7709 Baud Rates**

|      |      |      |       |       |      |
|------|------|------|-------|-------|------|
| 50   | 75   | 110  | 134.5 | 150   | 300  |
| 600  | 1200 | 1800 | 2000  | 2400  | 3600 |
| 4800 | 7200 | 9600 | 19200 | 38400 |      |

The following OS-9 baud rates are not supported by the SC16550 driver:

**Table 2-6 SC7709 Baud Rates Not Supported**

|       |       |       |       |        |
|-------|-------|-------|-------|--------|
| 31250 | 56000 | 57600 | 64000 | 115200 |
|-------|-------|-------|-------|--------|

## Power Management Support

### Module

`sysif`

## Parallel Port Support

### Module

`scp87303`

### Descriptors

`/p`

## Keyboard Support

### Module

`sc8042k`

### Descriptors

`/kx0`

## Mouse Support

### Module

sc8042k

### Descriptors

/m0

## Common System Modules List

---

The following system modules provide generic services for OS9000 Modular ROM. They are located in the following directory:

MWOS/OS9000/SH3/CMDS/BOOTOBS/ROM

|           |                                                                                                        |
|-----------|--------------------------------------------------------------------------------------------------------|
| bootsys   | provides booter registration services.                                                                 |
| console   | provides console services.                                                                             |
| dbgentry  | inits debugger entry point for system use.                                                             |
| dbserv    | provides debugger services.                                                                            |
| excp tion | provides low-level exception services.                                                                 |
| fdc765    | provides PC style floppy support.                                                                      |
| fdman     | is a target-independent booter support module providing general booting services for RBF file systems. |
| flboot    | is a SCSI floptical drive disk booter.                                                                 |
| flshcach  | provides low-level cache management services.                                                          |
| fsboot    | is a SCSI TEAC floppy disk drive booter.                                                               |
| hlproto   | provides user level code access to protoman.                                                           |
| hsboot    | is a SCSI hard disk drive booter.                                                                      |
| ide       | provides target-specific standard IDE support, including PCMCIA ATA PC cards.                          |
| llbootp   | provides bootp services.                                                                               |
| llip      | provides low-level IP services.                                                                        |
| llkermi t | provides a booter that uses kermit protocol.                                                           |
| llsllip   | provides low-level SLIP services.                                                                      |

|          |                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------|
| lltcp    | provides low-level TCP services.                                                                   |
| lludp    | provides low-level UDP services.                                                                   |
| notify   | provides state change information for use with LL and HL drivers.                                  |
| override | provides a booter that allows choice between menu and auto booters.                                |
| parser   | provides argument parsing services.                                                                |
| pcman    | provides a booter that reads MS-DOS file system                                                    |
| protoman | provides a protocol management module.                                                             |
| restart  | provides a booter that causes a soft reboot of system.                                             |
| romboot  | provides a booter that allows booting from ROM.                                                    |
| rombreak | provides a booter that calls the installed debugger.                                               |
| rombug   | provides a low-level system debugger.                                                              |
| scsiman  | is a target-independent booter support module that provides general SCSI command protocol services |
| sndp     | provides low-level system debug protocol.                                                          |
| srecord  | provides a booter that accepts S-Records.                                                          |
| swtimer  | provides timer services via software loops                                                         |
| tsboot   | is a SCSI TEAC tape drive booter.                                                                  |
| type41   | is a primary partition type.                                                                       |
| vsboot   | is a SCSI archive viper tape drive booter.                                                         |



---

# Product Discrepancy Report

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To: Microware Customer Support

FAX: 515-224-1352

From: \_\_\_\_\_

Company: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_ Email: \_\_\_\_\_

Product Name:

Description of Problem:

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Host

Platform \_\_\_\_\_

Target

Platform \_\_\_\_\_



MICROWARE SOFTWARE