Freescale Semiconductor, Inc.

HC08 Mon08

Target Interface

How to Contact Metrowerks

Corporate Headquarters	Metrowerks Corporation 9801 Metric Blvd. Austin, TX 78758 U.S.A.
World Wide Web	`http://www.metrowerks.com`
Ordering & Technical Support	Voice: (800) 377-5416 Fax: (512) 997-4901

Table of Contents

1

HC08 Mon08 Target Interface

Overview

This document includes information on using the **Mon08 Target Interface.** This document has these sections:

- The Mon08 Target Interface Demo section helps you to "quick" start and connect the debugger with your hardware target, step by step.
- The Introduction section introduces the Mon08 Target Interface concept.
- The Interfacing Your System and a Target section gives a small overview on serial communication and supported hardware.
- The Communication Configuration section describes the minimal setup to start communicating with your hardware.
- The Loading the Mon08 Interface Component section explain how to set the Mon08 target interface within the debugger.
- The Mon08 Target Interface Menu Entries section describes the different entries of the MON08 menu.
- The Advanced Mon08 Environment Setup section gives all details of the Setup menu entry.
- The Supported Evaluation Hardware section gives a larger overview on supported hardware and communication circuitry.
- The Typical Initial Baudrates and Programming Rates section gives you tables with baudrates of typical CPU08 derivatives and masks.
- The Resources Used by the Mon08 Target Interface section explains the Mon08 mechanism and resource requirements.
- The ROM Workspace Setup section explains how to handle undefined ISR when debugging in ROM/Flash.

- The Mon08 Target Interface Commands section lists all Command Line commands bound to the Mon08 Target Interface.
- The Mon08 Target Interface Environment Variables section lists all `.PJT` project-file environment variables bound to the Mon08 Target Interface.
- The FLASH PROGRAMMING section explains programming CPU08 derivatives using internal FLASH and EEPROM modules.
- The Target Interface Command Files section describes the **Mon08** Target Interface command files.

Highlights

The **HC08 Mon08 Target Interface** currently supports this hardware:

- CanKit, M68HC08AZ32EVB Motorola Evaluation Board.
- ICS08GP20/32 In-Circuit Simulator Board + M68HC08 Serial Programmer (SPGMR).
- any hardware target using a CPU08 derivative with onchip MON08 monitor. The section Supported Evaluation Hardware gives the Motorola-defined serial interface and RS-232 circuitry
- MMC08 Monitor Mode Cable for interfacing the debugger and an HC08.

Requirements

The **HC08 Mon08 Target Interface** communicates with the hardware target using the RS-232 serial communication port of your computer. Therefore, your computer should have an available COM port. You need a minimal circuitry defined by Motorola (given in the section Supported Evaluation Hardware) to interface your CPU08 derivative. More powerful interfaces like the MMC08 Monitor Mode Cable can provide "hardware external pin reset" and "debugger stop/halt" features, using an "RTS" RS-232 line and IRQ chip pin through the RS-232 "break" signal.

Mon08 Target Interface Demo

1. Before starting the debugger, you must configure your hardware target (based on CPU08 derivative) with the required serial interface and RSR-232 leveller as shown in the section Supported

Evaluation Hardware. Some targets, like the Cankit or the Serial Programmer (SPGMR), initially have this interface.

2. Do NOT add a power supply to the hardware. Instead, connect your target to your computer's COM port using a standard serial cable.
3. After installation, you can use three Metrowerks HC08 Demo Projects:
   Cankit08: this project applies to the Cankit, M68HC08AZ32EVB Motorola Evaluation Board.
   MMC08 with AT60: this project applies to the AT/AS/AZ60 with MMC08 Monitor Mode Cable. If you do not have an MMC08 interface, you can still start with this project.
   Mon08 for GP20: this project applies to the GP20/GP32 with the Serial Programmer (SPGMR). If you do not have a Serial Programmer, you can still start from this project.
4. Open the demo project that corresponds to your available hardware.
5. When using AT/AS/AZ60 derivatives, you must configure the processor in the desired mode: set the onchip **CONFIG-2** register to AS or AZ emulation and set the **AZxx** bit and the **MSCAND** bit in the "**startup.cmd**" command text file of your current project. The debugger requires these settings in order to start the processor immediately in the proper mode. For example, in this command file, insert the command "**wb 0xFE09 0x01**" to force CAN and AZ60 mode. You can edit the "`startup.cmd`" file with the current text editor for your project.
6. Start the debugger.
7. As the hardware has no power yet, the Communication Configuration dialog box automatically appears. At this point, set the correct communication port in the **Communication Device** field, such as **COM1** or **COM2**.
8. You must provide a correct initial baudrate to open communications with the onchip MON08 monitor. The Typical Initial Baudrates and Programming Rates section gives you tables with baudrates of typical CPU08 derivatives and masks. Check this table to find the initial baudrate that matches your hardware, derivative mask, and so on.
9. Set the initial baudrate value in the **Initial Baud Rate** field.
10. Check the **Password** checkbox and fill the password boxes with 00 00 00 00 00 00 00 00 for GP20, AT/AS/AZ60. If you use a GP32, the factory password is FF FF FF FF FF FF FF FF.
11. If you connect the PTC3 pin of your derivative to logical 1, you can speed up communications by using the valid values given in the

Typical Initial Baudrates and Programming Rates section. Therefore, check the **Initialize PLL** checkbox. This feature does not work with GP20/GP32 derivatives.

12. More hardware-related settings:
13. Check the **Use RTS** checkbox **only** when using the MMC08 Monitor Cable.
14. Check the **Use DTR** checkbox **only** when using the M68HC08 Serial Programmer (SPGMR).
15. All other checkboxes and editboxes do not apply to establishing initial communications with your CPU08 derivative. Leave these settings as initially configured for the project.
16. Power on your hardware target, then press the **Connect** button in the dialog. box. The debugger starts communicating with the onchip monitor. The **Memory** component window fills with values. CPU registers appear in the **Register** component window. Assembler instructions appear in the **Assembly** component window.
17. **Loading application in RAM**: At this point, you can load a demo application into RAM by choosing the **MON08 > Load...** menu command.
18. Set a breakpoint in your source code. You can run the debugger by clicking the **Start/Continue** button. You cannot always "halt" the debugger/derivative without setting a breakpoint, however, using the Cankit or the MMC08 Monitor Cable does allow breakpoint-free halting. Otherwise, you need specific hardware to forward RS-232 break signals to the IRQ pin of the derivative. See the section Supported Evaluation Hardware for further details.
19. **Loading application in FLASH**: You can load a demo application in onchip FLASH (AT/AS/AZ60, GP20/32) or Cankit AM29F010 external flash by choosing the **MON08 > Flash...** menu command. In the **Non Volatile Memory Control Dialog**, click the **Load...** button and choose the application to load in flash. Note that you need a license for the **Flash Programming** utility. In demo mode, it has a 1-kilobyte limit.

Introduction

Another advanced feature of the debugger for embedded-system development is its ability to load different Framework targets. This document introduces the **Mon08 Target Interface** for the M68HC08.

The **Mon08 Target Interface** component is an interface the debugger uses to communicate with an external system known as the **target system**.

With this interface, you can download an executable program from the debugger environment to an external target system based on a Motorola MCU that executes it. The debugger also reflects feedback of the real target-system behaviour.

The debugger supervises and monitors the MCU of the target system, that is, it controls CPU execution. You can read and write internal/external memory, single-step/run/stop the CPU, and set breakpoints in the code.

NOTE Unconcerned Components As the code executes on an external MCU, memory statistics are not available to the **Mon08 Target Interface** component. Therefore, Profiling, Coverage analysing, watchpoints and I/O simulation do not work with the Mon08 component.

Interfacing Your System and a Target

Hardware Connection

The host is set up as a data terminal, that is, it sends data on the TxD lead and receives data on the RxD lead. A normal serial cable connects the CanKit Evaluation Board (M68HC08AZ32EVB), Serial Programmer (SPGMR), or AVNET ADS boards. However, if you connect another target system (like AZ_EVA MOTHER BOARD + HC08 derivatives like AT60/AS60/AZ60), you need an additional communication hardware interface in order to connect to the on-chip monitor of the 68HC08 (Mon08). Please see also Supported Evaluation Hardware section.

Please refer to the **Monitor** section of the **CPU08 Manual**, section 11: **MONITOR ROM** from Motorola for additional information.

WARNING! To use all features available from the **Mon08 Target Interface**, you need some additional hardware. The evaluation board M68HC08AZ32EVB already includes this hardware. Please see the section Supported Evaluation Hardware for additional information.

NOTE The M68HC08AZ32EVB (CanKit) has 2 serial-port connectors. You must connect your PC to the P2 connector of the EVB board.

NOTE There are other available target-interface components (such as for the MMDS0508 and MMEVS0508).

Communication Configuration

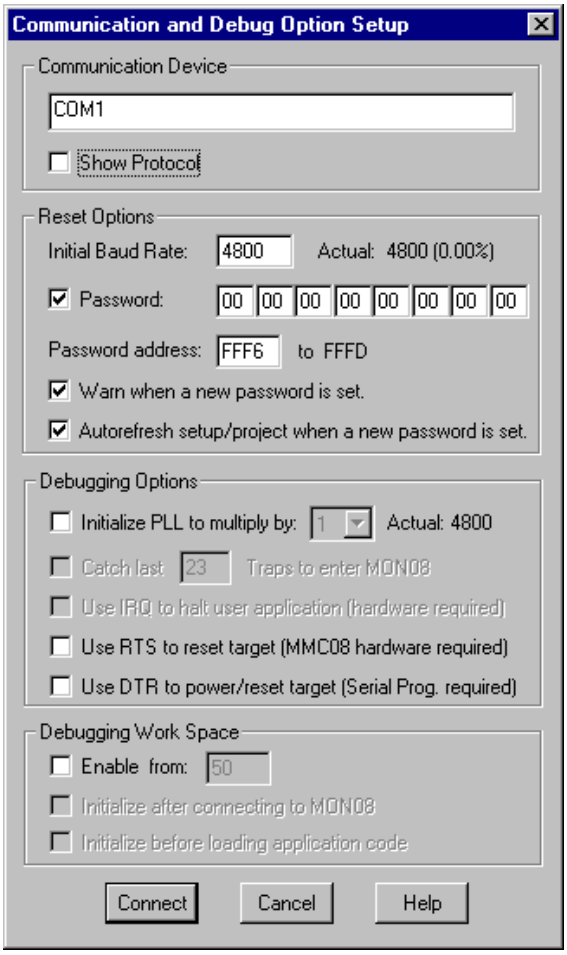
In a general way, the debugger automatically configures communication with the Target System. If you configure the default communication setup, the following dialog appears. You can also open this dialog by choosing **MON08 > Setup...** or **MON08 > Connect...** from the debugger menu.

Ensure that you correctly configure the parameters on your host computer. Make sure to set the correct serial-communication device, otherwise, the debugger cannot communicate with the target.

Communication Device

If the host and target are disconnected, the expected communication device does not establish the connection, or, in a general way, the communication fails, the dialog box shown in Figure 1.1 appears in the debugger.

Figure 1.1 Communication and Debug options Setup



Settings in this dialog box vary according to the demo projects delivered with your installation.

1. Enter an available communication device in the **Communication Device** edit box. For a PC, enter any valid communication device (`COM1, COM2, etc.`).
2. Set the **Initial Baud Rate** of your HC08 board, as specified by the Motorola Evaluation board User's Manual, in the **Reset Options** group.

WARNING! The initial baudrate depends on the ROM monitor version and the supplied oscillator. You should specify an exact initial baudrate value and not round it. The "Actual" field shows the baudrate and the percentage of baudrate error. Keep this error under 2.5%. The Typical Initial Baudrates and Programming

Rates section gives you tables with baudrates of typical CPU08 derivatives and masks.

NOTE Note that the board baudrate depends on the supplied oscillator. If you change the oscillator frequency, the baud rate scales accordingly, potentially resulting in unsupported PC serial-communication rates

3. Check the password checkbox and enter the Mon08 password. Some HC08 MCUs (AT/AS/AZ60, GP20, and so on) have security measures built into the Mon08 that prevent unauthorized access to onchip FLASH EEPROM. To enter the Mon08 of these devices with FLASH access, you must supply a password after **Power-On** reset, before executing any command. You must supply the password values within the dialog box.

```
Enter: 00 00 00 00 00 00 00 00
```

This example always matches when the flash memory is empty (not programmed, with all bytes set to 0x00).

IMPORTANT: The GP32 derivative has all bytes set to 0xFF when not programmed. Therefore blank/factory password is `FF FF FF FF FF FF FF FF`.

NOTE Some derivatives require a password in order to allow access to the MCU, even if those derivatives do not check values. In such cases, you have to set the password option, but the value of all bytes can be 00!

NOTE You must establish the connection immediately following MCU Power-on reset (power off + power on, NOT software or Reset pin toggle!). In this case, only the onchip Mon08 monitor checks the password.

1. Set **Debugging Options** group: check the **Initialize PLL** checkbox and choose the the baudrate multiplier from the dropbox (like “6” to reach “28800” baud in a debugging session, with an initial baudrate of 4800 baud). This configuration sets up the MUL bits in the PLL programming register (PPG) to increase the CPU clock rate and therefore the debugging baudrate. Note that the dropbox contains only estimated possible baudrate factors. Do not overspeed the CPU, otherwise the PC will no longer communicate with the

board. The Typical Initial Baudrates and Programming Ratessection gives you tables with baudrates of typical CPU08 derivatives and masks.

NOTE This feature is not available on GP20 and GP32 derivatives, so uncheck the "Initialize PLL" checkbox when using these derivatives.

2. Usage of RTS: check this checkbox only when using the MMC08 Monitor Cable.
3. Usage of DTR: check this checkbox only when using the M68HC08 Serial Programmer (SPGMR).
4. All other checkboxes and editboxes do not apply to establishing initial communication with your HC08 MCU.

If the debugger loses the connection with the target, choose **MON08 > Connect...** from the menu to open the Advanced Mon08 Environment Setup dialog to re-connect.

NOTE f the MCU requires a password, you must reset the target (hardware reset) before attempting to connect!

Loading the Mon08 Interface Component

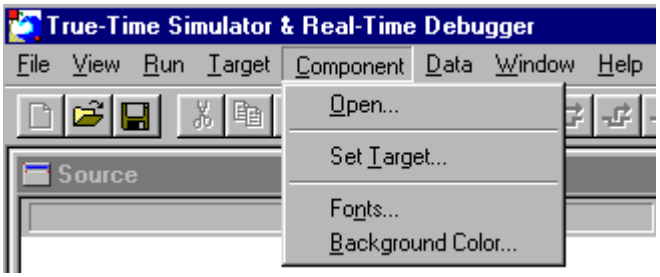
As with any other target, you can use the **Target** menu to load the **Mon08 Target Interface** component by choosing **Component > Set Target... Mon08**, or you can set it as a default target in the `.PJT` project file that resides in the current project directory.

Example of `.PJT` project file.

```
[Environment Variables]
...
Target=mon08
...
```

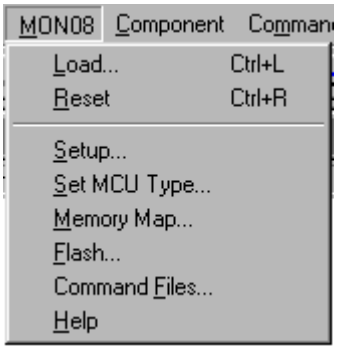
Set the target in the `.PJT` project file as shown above. If the target is undefined, load the **Mon08 Target Interface** component interactively by clicking the **Component** menu, choosing **Set Target...** like shown in Figure 1.2**,** and selecting the ***Mon08*** target component.

Figure 1.2 Set Target



The MON08 menu shown in Figure 1.3**,** item replaces the **Target** menu item after loading completes.

Figure 1.3 Mon08 menu



A subsequent section, Mon08 Target Interface Menu Entries, explains the different entries in the MON08 menu.

The Debugger Status Bar for the Mon08

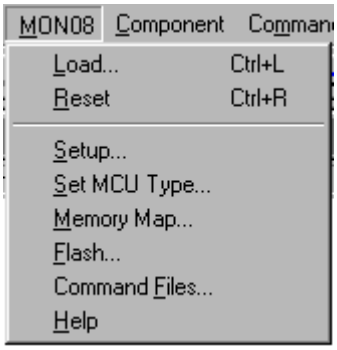
After the IDE loads the **Mon08 Target Interface** component, specific information appears in the debugger status bar shown in Figure 1.4 . The baudrate of the serial communication, the selected CPU derivative (according to selected MCU ID), and the debugger status (target status) appear from left to right in the status bar.

Figure 1.4 Debugger Status Bar for the Mon08

Mon08 Target Interface Menu Entries

This section describes the **Mon08 Target Interface** Menu Entries shown in Figure 1.5

Figure 1.5 Mon08 Target Interface Menu Entries



Loading an application

Choose **MON08 > Load...** to load the application you wish to debug, such as an `.ABS` file or an S-Record file (see also the debugger user manual).

Reset

The command **MON08 > Reset...** initializes the PC with the reset-vector value and sets the status register to the reset value. Since you cannot use a Mon08 command to execute a real target reset, the debugger directly sets the registers, but does not reset any external hardware. The debugger can set the stack pointer (SP) to the reset value (0xFF) only after you enable the workspace.

Mon08 Setup

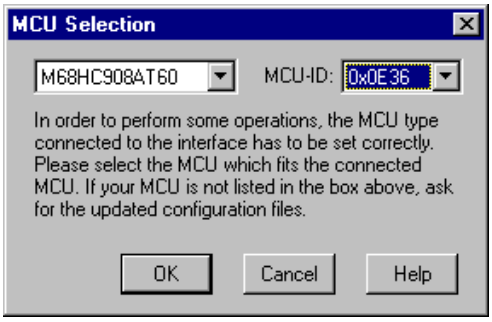
Choosing **MON08 > Setup...** opens the Communication Configuration dialog. Please see the section Advanced Mon08 Environment Setup.

Set MCU Type

The **Set MCU Type..**. entry lets you choose your application's current CPU derivative like shown in Figure 1.6. You must perform this task

manually. The selected CPU derivative appears in the status bar. This selection is important, as it determines the matching memory-map file for the loaded CPU derivative. Please see the Memory Map section below.

Figure 1.6 MCU selection

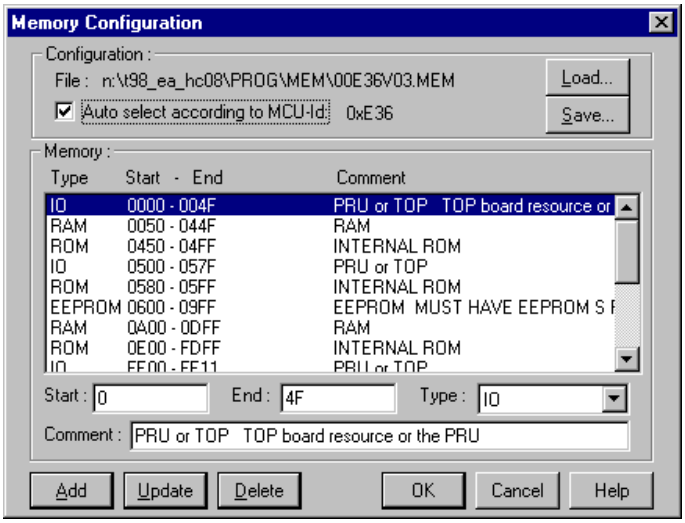


NOTE Select the AT60 MCU type even when using AS60 or AZ60 derivatives, as the AT60 emulates both MCUs.

Memory Map

The **Memory Map...** entry lets you choose the CPU-derivative memory map according to the CPU derivative you selected in the **MCU Selection** dialog box shown in Figure 1.7 (if you checked the **Auto select according to MCU-Id** checkbox) or according to the latest file you loaded by clicking the **Load...** button.

Figure 1.7 MCU selection



NOTE The CanKit board settings contain an adapted CanKit08.mem memory-map file.

You can edit the memory-map file: click the **Add**, **Update**, and **Delete** buttons to modify an item in the memory-module list. A well-defined memory map prevents debugger memory-access problems, as it does not access undefined areas and ignores defined area **types**. Note that accessing protected areas on some HC08 derivatives resets the on-chip Monitor. You must not declare these areas in the memory map.

Click the **Save...** button to save your memory-map file. The IDE saves the latest memory-map dialog-box settings in your current project. To reload in a next session your personalized memory-map file, save it with a new name and uncheck the **Auto select according to MCU-Id** checkbox before closing the dialog box.

After installation, the IDE stores in the `\PROG\MEM` directory the predefined memory-map files (`*.MEM`) that match MCU-IDs.

FLASH

- The **Flash...** entry applies to the **FLASH / Non Volatile Memory Control Utility** and opens the NVMC Dialog, which lets you write and erase FLASH and EEPROM modules. Please see the FLASH PROGRAMMING section, which explains how to program a CPU08 derivative's internal FLASH and EEPROM modules.

Command Files

Select **Command Files...** to display the Command Files dialog dialog box.

Help

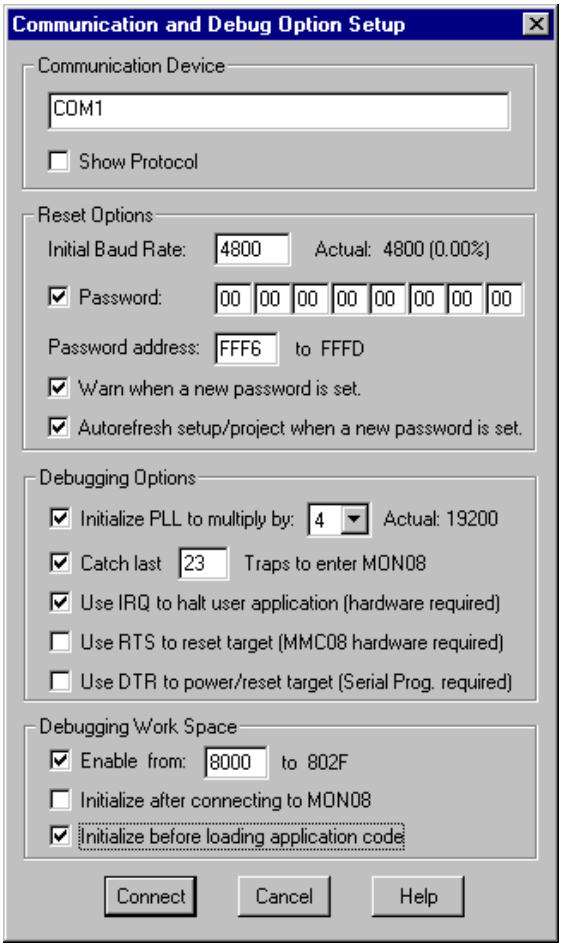
Select **Help** to open the **Mon08 Target Interface** Help File.

Advanced Mon08 Environment Setup

The Mon08 target lets you set up debugging features, such as catching traps/interrupts, halting programs using external IRQ servicing, placing debugger workspaces with different workspace init modes, backing up passwords and warnings, and multiplying baudrates.

Choosing **MON08 > Setup...** opens the **Communication and Debug Option Setup** dialog shown in Figure 1.8.

Figure 1.8 Communication and Debug Option Setup



Communication Device and Reset Options Groups

Communications Baudrate

Early in a session, choose the baudrate at which the host computer communicates with the Mon08 target, because the system most efficiently operates at the maximum baudrate that the host computer and target MCU support. The debugger automatically detects the current baudrate when starting to communicate with the Mon08 target. If communication fails, the debugger automatically adapts the baudrate until communication begins with the host computer. If automatic detection fails, you can manually modify the baudrate.

Baudrate Modification:

1. Enter an available communication device in the **Communication Device** edit box. For a PC, enter any valid communication device (`COM1, COM2, etc.`).
2. Set the **Initial Baud Rate** of your HC08 board as specified in your HC08 derivative datasheet (General Release Specification book) in the **Reset Options** group. The Typical Initial Baudrates and Programming Rates section gives you tables with baudrates of typical CPU08 derivatives and masks.

WARNING! **The initial baudrate** depends on the ROM monitor version, the constructor chip mask, and the supplied oscillator. You should specify an exact initial baudrate value and **not** be round it. The "***Actual***" field shows the baudrate and the percentage of baudrate error. Keep this error under 2.5%.

NOTE Note that the board baudrate depends on the supplied oscillator. If you change the oscillator frequency, the baud rate scales accordingly, potentially resulting in unsupported PC serial-communication rates.

You can increase the communication baudrate between the debugger and the MCU when changing the MCU's PLL configuration. Please refer to the following sections, **Debugging Options Group** and **PLL Baudrate Multiplying**.

Password

Some HC08 MCUs (AT/AS/AZ60, GP20, and so on), have security measures built into the Mon08 that prevent unauthorized access to onchip FLASH EEPROM. To enter the Mon08 of these devices with FLASH access, you must supply a password after **Power-On** reset, before executing any command. You must supply the password values within the dialog box.

Changing password:

Check the password checkbox and enter the Mon08 password.

```
Enter: 00 00 00 00 00 00 00 00
```

This example always matches when the flash is empty for AZ/AS/AT and GP20 (not programmed, with all bytes set to 0x00).

WARNING! The GP32 derivative has all bytes 0xFF when not programmed. Therefore blank/factory password is `FF FF FF FF FF FF FF FF`

NOTE Some derivatives require a password in order to allow access to the MCU even if the values are not checked. In such a case, the password option also has to be set but the value of all bytes can be 0x00!

NOTE The connection must be done right after MCU Power-on reset (power off + power on, NOT software or Reset pin toggle!): The password is only checked by the onchip Mon08 monitor in this case.

Each time the debugger starts communicating with the on-chip Mon08 monitor, it backs up the memory-vector password specified in the **Password address** edit box (`$FFF6-$FFFD`) to a log file called `PWLOG.TXT`. This log file resides in your current project directory. The debugger performs this backup each time you erase or program the flash memory. If you do NOT require this logfile, insert the environment variable '`NOPWLOGFILE=1`' in the `.PJT` project file (in your current project directory) at section `[MON08]`. Note that, for security purposes, the debugger does not provide a dialog box for disabling this log file.

In the setup dialog box, you can also check the **Warn when...** checkbox to have the debugger warn you when a password mismatch (at connection) or modification (after programming or erasing) occurs.

You can also check the **Autorefresh...** checkbox to have the debugger automatically update the password edit boxes with the newly modified password.

NOTE If you cannot access the Flash memory because you lost your password, you can still use the Flash Programming dialog box to erase the Flash modules. After erasing the modules, the Flash Programming dialog box returns "Bad Device" due to the fact that the debugger still cannot access the Flash modules while reading (always reading "AD"), and blank verification fails. To reset the Monitor onchip security measures, power reset (power off + power on) your HC08 derivative, then set up the Monitor HC08 with a "00 00 00 00 00 00 00 00" password (or FF FF FF FF FF FF FF FF for GP32), and connect again to the hardware.

Show Protocol

If you check the **Show Protocol** checkbox, the command-line window reports all the commands and responses sent and received.

NOTE Metrowerks support personnel may ask you to check the Show Protocol checkbox and provide the command-line window information.

Debugging Options Group

PLL Baudrate Multiplying

Check the **Initialize PLL** checkbox and choose the baudrate multiplier from the dropbox (like “6” to reach “28800” baud in a debugging session, with an initial baudrate of 4800 baud). This configuration sets up the MUL bits in the PLL programming register (PPG) to increase the CPU clock rate and therefore the debugging baudrate. Note that the dropbox contains only estimated possible baudrate factors. Do not overspeed the CPU, otherwise the PC will no longer communicate with the board. The Typical Initial Baudrates and Programming Ratessection gives you tables with baudrates of typical CPU08 derivatives and masks.

NOTE This feature is not available on GP20 and GP32 derivatives, so uncheck the "Initialize PLL" checkbox when using these derivatives.

Traps catching

This option lets you pass control to the Mon08 for "not initialised" exceptions or interrupts when checking **Catch last...**. For details, see the section Debugging Work Space Group.

Use of IRQ

The Mon08 cannot halt a running program except when it hits a breakpoint (SWI or break hardware) or when you reset it, however, using an additional external circuit, you can generate an interrupt (IRQ) to stop the application (if you enable interrupts). For details, please see the section Supported Evaluation Hardware.

Use of RTS

The Mon08 cannot reset some CPU derivatives (like AT60/AS60/AZ60), however, with an additional external circuit (MMC08 Interface), you can decode the RS-232 RTS signal and reset the CPU derivative. **Check this checkbox only when using the MMC08 Monitor Cable.** For details see the section Supported Evaluation Hardware.

Use of DTR

The M68HC08 Serial Programmer (SPGMR) can decode the RS-232 DTR signal to reset the CPU derivative. **Check this checkbox only when using the M68HC08 Serial Programmer (SPGMR)**. For details see the section Supported Evaluation Hardware.

Debugging Work Space Group

Debugging Work Space

You need a small debugging workspace for trap catching (including IRQ) and stack-pointer editing in the Register component.

Check the **Enable from...** checkbox to extend **Mon08 Target Interface** component features with a minimal workspace. Without a workspace, the component cannot catch interrupts/traps and halt the application using the external IRQ special hardware.

NOTE The trap-catching mechanism involves making all interrupt vectors (without ISR) point to an SWI - RTI instruction pair in a table, therefore, when an unhandled interrupt occurs, program execution halts on an SWI instruction execution. The monitor regains MCU control. The debugger can then use the current PC to identify the falling interrupt.

This workspace can reside in RAM or in ROM/FLASH.

If you set a workspace in RAM and your vectors reside in RAM (debug hardware), check the 2 lower check boxes (**Initialize...**) to have the debugger initialize the workspace and vectors accordingly.

If the workspace and vectors reside in ROM or in Flash, you must program them separately into this device, or you must initialise them at linking time. You can link a workspace to the application (for an example, see the

section ROM Workspace Setup). In this case, **DO NOT** check the 2 lower check boxes (**Initialize...**).

With trap catching enabled and the MCU in monitor mode, the Mon08 uses an SWI interrupt to automatically catch any hardware reset or software interrupt. If you want to catch other interrupts/traps, enter in the **Catch last** edit box the last vector that you want the debugger to intercept. Vectors are numbered in decreasing vector addresses (that is, Reset = vector 0, SWI = vector 1, IRQ = vector 2, and so on). This configuration sets up the vector table to point all vectors from vector 3 (after IRQ) to the specified vector into the workspace, where the Mon08 enters and halts the target program.

The Mon08 cannot halt a running program except when it hits a breakpoint (SWI or break hardware) or when you reset it, however, you can use an additional circuit to generate an interrupt on the IRQ input pin of the MCU. If the vector for the IRQ points to a SWI in the workspace, the Mon08 activates and stops the application. Do not check the '**Use IRQ'** check box **unless** you have the required hardware (see the section Resources Used by the Mon08 Target Interface and the section Supported Evaluation Hardware). With the appropriate external hardware connected to the IRQ pin of the MCU, the debugger sends a **Break** instruction through the serial-communication link and raises an **IRQ** interrupt to stop the current running application and transfer control back to the Mon08.

The **Mon08 Target Interface** component uses a minimal workspace of 4 bytes (for code to set the stack and reset the CPU). If you uncheck the **Enable...** checkbox, the component uses no resources, but it deactivates all extended features.

If you set the workspace address to a value like 0xFF00, the dialog box displays an automatically evaluated range for external IRQ pin use, which it determines according to the number of traps caught (see the section Resources Used by the Mon08 Target Interface and the section Supported Evaluation Hardware).

In summary,

Checking **Enable....**

- requires only 4 bytes for stack user handling using the Register window

Then checking **Using IRQ...**

- requires 3 additional bytes to trap the IRQ interrupt

Then checking **Catch last...**

- requires no resources from last **1** to **3**, as these are the last 3 ones: the **RESET** interrupt, usually pointing the program-entry code in the linker-parameter file (reserved by the program), the **SWI** interrupt (reserved for the Monitor), and the **IRQ** (already reserved when checking **Using IRQ...**). Then these traps require 2 more bytes per trap.

NOTE In the HC08A?60 demo sample files delivered with the CodeWarrior Installation, IRQ use is disabled, since the Work Space is unused. On AT60/AS60/AZ60 derivatives, unset vectors reside in Flash EEPROM. As a consequence, the RESET and IRQ vectors point to address 0x0000 (address 0xFFFF for GP32). Without proper IRQ behaviour, the debugger cannot halt a program without using breakpoints. Stopping the debugger generates an IRQ and call address 0x0000, and eventually the communication fails, however, resetting the target generates a hardware reset and restarts the Monitor. The Monitor then sets the PC to address 0x0000. Loading an application (.ABS) file sets the PC to the code-entry point.

See the section ROM Workspace Setupfor information about using `wsp.c` and setting up the linker-parameter file.

Another Way to Trap "Undesired" Interrupts

You can create in your source program "Interrupt Service Routine" functions for all derivative vectors. These functions must have the instruction "asm SWI;" in order to stop the monitor. A matching vector in a function triggers halting of the program.

For example, a C-source file with the code

```
#pragma TRAP_PROC
void Vector_5_ISR void {
     asm SWI;
     ...
}
```

would have this corresponding code in the linker `.PRM` file:

```
...
VECTOR 5  Vector_5_ISR  /* ISR setup for vector 5 */
```

. . .

Supported Evaluation Hardware

The **Mon08 Target Interface** component can communicate with any hardware target using an HC08 derivative with onchip Mon08 monitor.

You need a minimal circuitry to support serial communication between the host PC and the HC08 derivative, as shown in Figure 1.9 (from the Motorola Data Sheet).

Figure 1.9 Mon08 Target Interface component

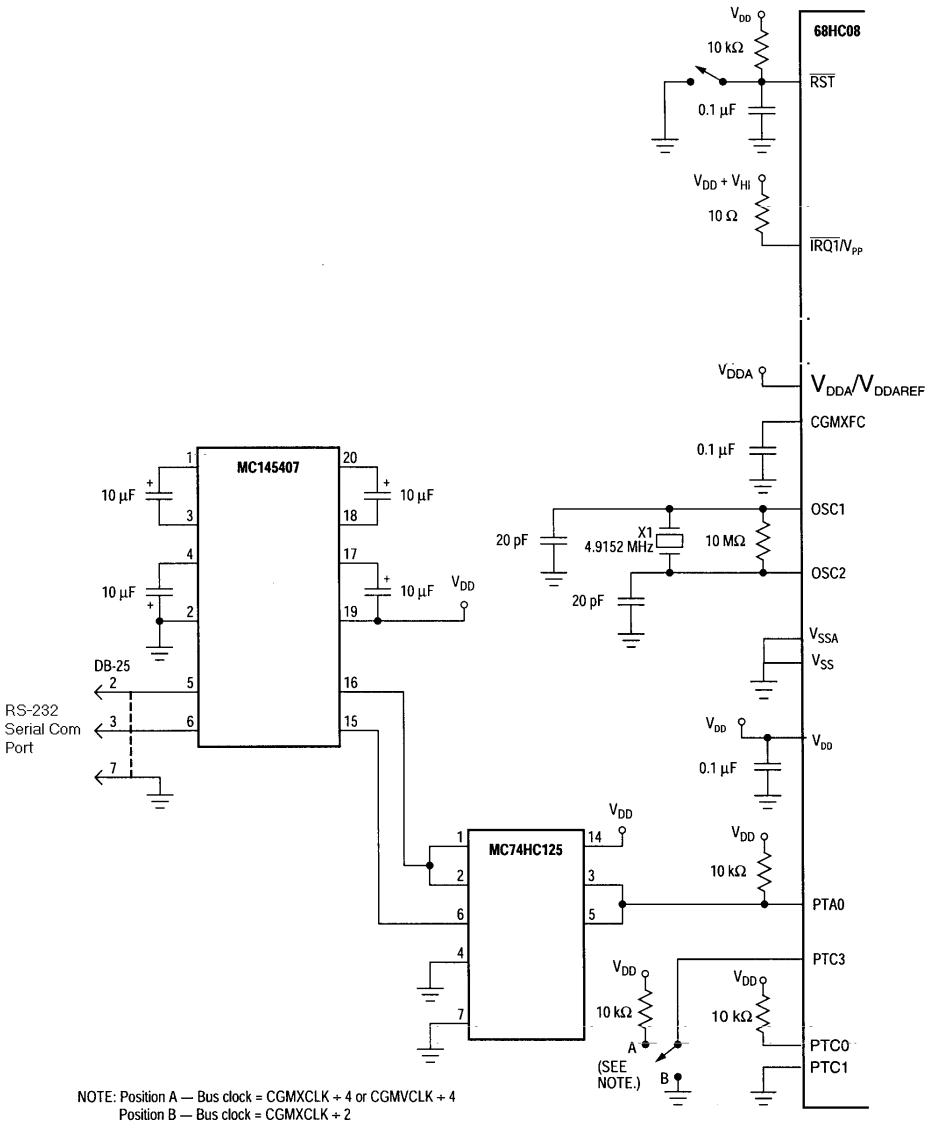


Figure 14-1. Monitor Mode Circuit

ICS08GP20/32 In-Circuit Simulator Board + M68HC08 Serial Programmer (SPGMR)

The **Mon08 Target Interface** is fully compatible with Motorola's Serial Programmer. The DTR signal of the RS-232 line carries out the hardware. power reset.

You must check the **Use DTR...** checkbox to use this feature

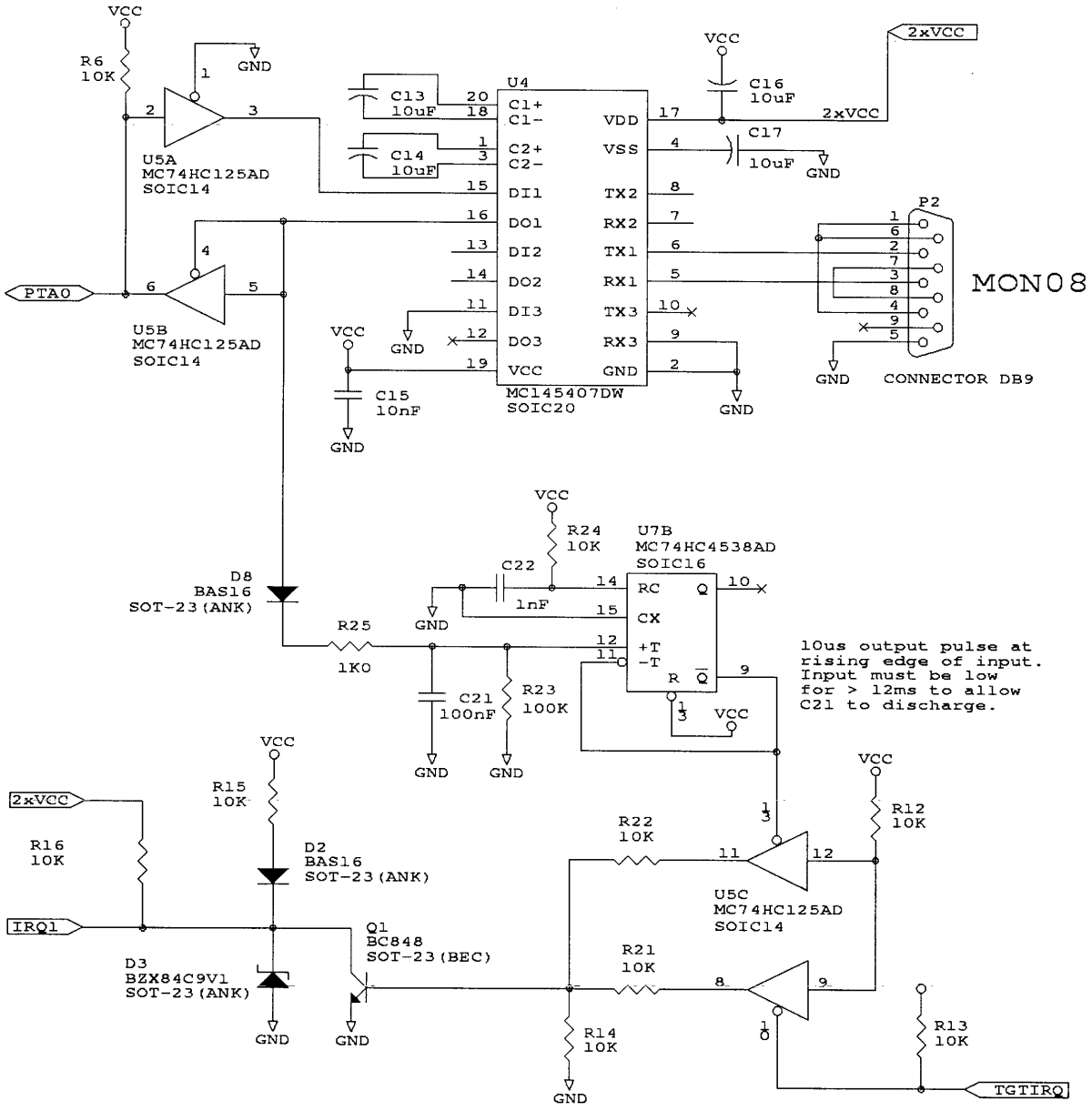
NOTE The "PLL Baudrate Multiplying" feature is not available on GP20 and GP32 derivatives, so uncheck the "Initialize PLL" checkbox when using these derivatives.

M68HC08AZ32EVB / CanKit

This evaluation board contains a special circuit that can halt your application and enter the Mon08, as explained in the section Advanced Mon08 Environment Setup (using an external IRQ on the MCU). To use this feature, check/enable/set up a minimal workspace and check the **Use IRQ...** checkbox in the Advanced Mon08 Environment Setup dialog box.

The following schematic is a simplified derivative of the M68HC08AZ32EVB Motorola Evaluation Board. The main addition to the interface above is the handling of the IRQ signals. It detects a break signal (> 10..20 ms) on the serial-communication interface and generates a short pulse on the IRQ line (~10 µs). This pulse causes the evaluation board to interrupt (halt) a running application program. See the electronic chart shown in Figure 1.10.

Figure 1.10 Simplified schematic from the Motorola Evaluation Board 'M68HC08AZ32EVB'.



MMC08 Monitor Mode Cable

The MMC08 Monitor Mode Cable (Every Design Consultancy Ltd, `www.everydesign.com`) accesses the Monitor mode of the 68HC08 microcontroller.

In addition to providing the required RS-232 level shifting debugger communication with the 68HC08, the cable contains additional circuitry that gives the debugger additional control over the target system. When using the MMC08, the debugger can generate an **IRQ interrupt to halt the 68HC08** and also **reset** (using the RS-232 **RTS** signal) **the target system** (MCU pin RESET) as needed.

To use this feature, check/enable/setup a minimal workspace and check the **Use IRQ...** checkbox in the Advanced Mon08 Environment Setup dialog box.

You also need to check the **Use RTS...** checkbox to use the MCU reset feature with the MMC08.

The HC08 Monitor Target Interface is fully compatible with the MMC08 interface.

NOTE Other Metrowerks Target Interface components available for MMDS0508 and MMEVS0508 can help you develop software for HC08 derivatives.

Typical Initial Baudrates and Programming Rates

Rates given below are average measured rates. When no value appears for a PLL factor and a given Xtal, it indicates an unavailable setting.

Note that the PTC3 pin setup changes the communication rates by factors of 2. When PTC3 = 0, the initial baudrate doubles, but you cannot use the PLL module to increase communication rates, since the debugger derives the internal clock signal from CGMXCLK (Xtal) and never from CGMVCLK (PLL). When PTC3 = 0, DO NOT check the "Initialize PLL..." checkbox. When PTC3 = 1, the debugger can derive the internal clock signal from CGMVCLK (PLL) and multiply the initial baudrate (when you check the "Initialize PLL..." checkbox).

```
IBR = initial baudrate
```

PLLx = PLL factor (only when PTC3=1). PLLx=2 column rates are also valid for PTC3=0.
av = available but not measured.

HC908AZ60 mask 2J74Y
==========

Xtal (Mhz)	IBR (PTC3=1)	IBR (PTC3=0)	> PLLx=1 (PTC3=0)	PLLx=2	PLLx=3	PLLx=4	PLLx=7	PLLx=8	PLLx=9	PLL=13
			available flash programming rates (bytes/s)							
2	1811	3623		25	32	40	67	73		
4	3623	7246	25	40		70		114		
4.9152	4452	8904	35	47						
188										
8	7246	14492	40	70		110		186		

HC908AZ60 mask 8H62A
==========

Xtal (Mhz)	IBR (PTC3=1)	IBR (PTC3=0)	> PLLx=1 (PTC3=0)	PLLx=2	PLLx=3	PLLx=4	PLLx=5	PLLx=6	PLLx=8	PLLx=10	PLLx=12	PLLx=15
			available flash programming rates (bytes/s)									
2	1953	3906		34	34	46	55	65	98	115	137	
4	3906	7812	34	43	66		99	115	166		221	
4.9152	4800	9600	26	50	78	96		131	168	221		
8	7812	15624	43		115		160					

HC908GP20 mask 0J82S
==========

Xtal (Mhz)	IBR	Prog. rate(bytes/s)
4.9152	9600	57 (48 with SPGMR)

HC908GP32 mask 3J20X

```
====================

Xtal      IBR        Prog. rate(bytes/s)
(Mhz)

 4.9152   9600        61 (with SPGMR)
M68HC08AZ32EVB (CanKit) HC908AZ0 mask 0H56A
=========================================
with external AM29F010 flash
============================

                                available flash programming rates (bytes/s)

Xtal     IBR        PLLx=1  PLLx=2  PLLx=3  PLLx=4   PLLx=6  PLLx=8   PLLx=12
(Mhz)

4.9152   4800         33      av      av      av       av      av      305
```

WARNING!

The `FASTFLASH` command (Fast flash programming option in NVMC dialog) calls an alternate algorithm to program internal flash modules. Alternate algorithms are (at this document edition time) available for HC908AZ60 (AS/AT) and HC908GP32 derivatives. This alternate algorithm is usually faster and might use a non standardised communication protocol on the same standardised (by Motorola) physical layer.

Current performances (programming rates) with any mask and any initial baudrate:

-HC908AZ60: 500 Bytes/s.

-HC908GP32: 2.4 kBytes/s.

Resources Used by the Mon08 Target Interface

The monitor program uses some target-system resources. There are four basic monitor-program elements:

- Monitor code and vector table
- `PTA0` pin

- Stack and work space
- SWI (used for breakpoints)

Program Code

The monitor (Mon08) program code and some control registers reside in the address range from `0xFE00` to `0xFEFF` (see the **CPU08 Manual**, section 11: **MONITOR ROM**). You must activate the code by applying a high logic level on the `IRQ` pin. A part of the vector table gets remapped in order to pass control to the monitor code (Reset and SWI vectors).

PTA0

For communication between host and target, serial communication occurs through the `PTA0` pin (see the **CPU08 Manual**, section 11: **MONITOR ROM**).

Vector Table

The vector table resides in the address range from `0xFFC0` to `0xFFFF`. You should implement it as RAM (during development) to provide these features:

1. loading the vector table of the user application
2. catching undefined traps and interrupts using the debugger
3. using the IRQ vector to stop the user code (see the **Note** below)

When you set the appropriate options and load the target component, the monitor initializes the IRQ vector and 7 bytes of the workspace in order to allow the debugger to modify the stackpointer (SP) and to catch the IRQ, which it can use to halt your program. The monitor can initialize the rest of the vector table (vectors 3 to 31) to allow the debugger to catch some or all of the interrupts or exceptions (see the `CATCHTRAPS` command).

If your application does not initialize and use a vector, the Mon08 keeps control (halts the application) and in response the debugger displays the corresponding message.

If the vector table resides in Flash or (E)PROM, the monitor initializes the vector table at link time and loads it together with the application (See the section ROM Workspace Setup).

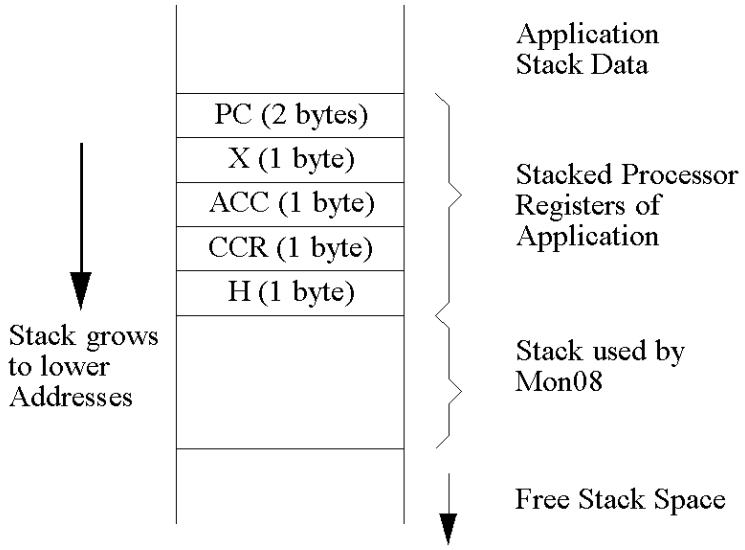
NOTE No Mon08 command stops your application from running (except when running on a breakpoint or by a reset). To stop your application, you must add an additional circuit to detect a break on the serial communication and generate an IRQ. The Debugger then catches the IRQ and enters Mon08 (by initializing the IRQ vector to point to the SWI instruction that enters the Mon08).

Work Space

The workspace extends Mon08 features. Allocate it in RAM to activate these useful extensions. You can also allocate it in Flash or (E)PROM (see the Advanced Mon08 Environment Setup and ROM Workspace Setup sections).

Stack

The Mon08 and the application share the same stack. When Mon08 is active, the monitor program occupies the top of the stack (see the figure below).



The Mon08 occupies at most 13 bytes of the stack. It uses the first 6 bytes to store the application registers and up to the following 7 bytes for temporary storage of the Mon08. When the application runs, the Mon08 does not occupy any space in RAM (since no global variables exist).

NOTE The stack pointer must always point to a RAM area to maintain stable Mon08 and debugger behaviour!

Breakpoints

Use the software interrupt (SWI) instruction to implement breakpoints and single-stepping of code. Your application cannot use the SWI.

ROM Workspace Setup

Read the section Debugging Work Space Group before reading this section.

When the Workspace resides in RAM, the debugger should initialize that workspace prior to using it. To configure this initialization, check the corresponding option in the Setup dialog box. Checking these options allow the debugger to initialize the workspace and the vector table.

When the Workspace resides in ROM or Flash memory, you must program the workspace content into the device. You can accomplish this task together with your application by linking the "`wsp.o`" file with your application.

The Monitor demo files also include the "`wsp.c/o`" files.

Listing 1.1 Source code of "`wsp.c`" file

```
#define USE_IRQ         1
#define CATCH_TRAPS     1
#define WSP_SRT    (3 + 4*USE_IRQ)
#pragma CONST_SEG WorkSpace
const char _WSP_[] = {
            0x94,       /* TXS      ; move H:X into SP                          */
            0x83,       /* SWI      ; enter monitor                             */
            0x80       /* RTI      ; back to caller (done with DisabledStep)   */
#if USE_IRQ
            ,
            0x2E,       /* BIL  *0  ; wait until IRQ pin is high                */
             0xFE,
            0x83,       /* SWI      ; enter monitor                             */
            0x80       /* RTI      ; back to caller (done with DisabledStep)   */
#endif
#if CATCH_TRAPS
```

```
      ,
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
      0x80,      /* RTI     ; back to caller (done with DisabledStep)   */
      0x83,      /* SWI     ; enter monitor                              */
     0x80      /* RTI     ; back to caller (done with DisabledStep)  */
#endif
};
```

Listing 1.2 Example with `LEDS.PRM` sample

```
LINK leds.abs

NAMES  leds.o start08.o wsp.o ansi.lib END
SECTIONS
    Z_RAM  = READ_WRITE  0x0080 TO 0x00FF;
    MY_RAM = READ_WRITE  0x0100 TO 0x01FF;
    MY_ROM = READ_ONLY   0xF000 TO 0xFEFF;
PLACEMENT
    DEFAULT_ROM                  INTO  MY_ROM;
    DEFAULT_RAM                  INTO  MY_RAM;
    _DATA_ZEROPAGE, MY_ZEROPAGE  INTO  Z_RAM;
    WorkSpace                    INTO  READ_ONLY   0xFF00 TO 0xFF30;
END
STACKSIZE 0x60
VECTOR 0  _Startup
VECTOR 1  0x0000 /* SWI, used by the Mon08, not by user  */
VECTOR 2  _WSP_ OFFSET 3   /* IRQ vector handler */
VECTOR 3  _WSP_ OFFSET 7   /* PLL */
VECTOR 4  TimerInterrupt   /* PIT */     /* PIT int points to TimerInterrupt
function
VECTOR 5  _WSP_ OFFSET 11  /* TIMA CH0 */
VECTOR 6  _WSP_ OFFSET 13  /* TIMA CH1 */
VECTOR 7  _WSP_ OFFSET 15  /* TIMA CH2 */
VECTOR 8  _WSP_ OFFSET 17  /* TIMB CH0 */
VECTOR 9  _WSP_ OFFSET 19  /* TIMB CH1 */
VECTOR 10 _WSP_ OFFSET 21  /* TIMB Overflow */
VECTOR 11 _WSP_ OFFSET 23  /* SPI Receive */
VECTOR 12 _WSP_ OFFSET 25  /* SPI Transmit */
VECTOR 13 _WSP_ OFFSET 27  /* msCAN Wakeup */
VECTOR 14 _WSP_ OFFSET 29  /* msCAN Error */
VECTOR 15 _WSP_ OFFSET 31  /* msCAN Receive */
VECTOR 16 _WSP_ OFFSET 33  /* msCAN Transmit */
VECTOR 17 _WSP_ OFFSET 35  /* SCI Error */
VECTOR 18 _WSP_ OFFSET 37  /* SCI Receive */
VECTOR 19 _WSP_ OFFSET 39  /* SCI Transmit */
VECTOR 20 _WSP_ OFFSET 41  /* Keyboard */
VECTOR 21 _WSP_ OFFSET 43  /* ADC */
```

Initially in `WSP.C`, the Monitor catches all traps, as all vectors appear in the `.PRM` files and point to the `_WSP_` section. Note that each vector points to different `SWI/RTI` instructions that the Monitor can properly identify upon entry. In the `.PRM` file example above, the PIT timer vector gets redirected to the `TimerInterrupt` function (in `LEDS.C` file).

See the sample files `LEDS.*` for further details about interrupt handling.

You can undefine `USE_IRQ` and `CATCHTRAPS` if you choose not to use them, but make sure to configure the correct offsets (all offsets decremented by 4) if `USE_IRQ` is undefined. If `CATCHTRAPS` is undefined, make sure to properly redirect the vectors in the `.PRM` file.

Mon08 Target Interface Commands

You can use the commands explained in this section in any command file, such as `STARTUP.CMD`, or enter them in the Command Line component. The debugger executes the startup command file `STARTUP.CMD` after the **Mon08 Target Interface** loads. This file must reside in the current project directory. You can use any debugger command in this file and use the commands introduced in the debugger manual to set up the target hardware before loading any application.

The **Mon08 Target Interface** has these specific commands:

BAUDRATE

CATCHTRAPS

FASTFLASH

RESET

WORKSPACE

You can enter these commands in the `STARTUP.CMD` file or in the debugger **Command Line** component.

BAUDRATE

Short Description

sets the communication baud rate and the PLL factor

Syntax

```
BAUDRATE rate [PLLfactor]
```

rate: Specifies the baud rate immediately after reset. You must specify the exact baudrate and **not** round it:

PLLfactor: Specifies an initialization factor for the PLL (default value of 1).

Description

The **BAUDRATE** command sets the baud rate for communication between the Mon08 and the host computer.

Set the Initial Baud Rate of your HC08 board (as specified by the Motorola Evaluation board User's Manual) in the **Reset Options** group.

NOTE Note that the board baudrate depends on the supplied oscillator. If you change the oscillator frequency, the baud rate scales accordingly, potentially resulting in unsupported PC-serial communication rates!

The Typical Initial Baudrates and Programming Rates section gives you tables with baudrates of typical CPU08 derivatives and masks.

```
example:BAUDRATE 4800 6
```

Changes the communication baud rate to 4800 and sets the debugging rate to 28800.

CATCHTRAPS

Short Description

Initializes the vector table in order to allow the debugger to catch traps and interrupts on vectors that the target application does not initialize.

Syntax

```
CATCHTRAPS <MaxVector>
```

where `MaxVector` defines a range of vectors, from 2 .. MaxVector.

Examples:

```
CATCHTRAPS 7   catches vectors 2 to 7.
```

Description

The `CATCHTRAPS` command initializes selected exception vectors to point to an exception handler which stops the target application. This halt allows you to detect hardware or programming errors caused by unexpected exceptions or interrupts.

The command allows you to specify a range of vectors that the debugger must catch.

You need a workspace to store the exception handlers for each specified vector. The `WORKSPACE` command sets up the base address of the workspace.

Example

```
CATCHTRAPS 23   catches all vectors in the range 2 to 23
(included).
```

FASTFLASH

The selected application should only contain code matching ROM/FLASH sections defined in the Memory Map dialog.

Example

```
FASTFLASH "c:\temp\all908gp32flash.sx"
```

RESET

Short Description

resets the target MCU.

Syntax

```
RESET
```

Description

The **RESET** command initializes the PC with the value of the reset vector and sets the status register to the reset value. Since no Mon08 command can execute a real target reset, the debugger directly sets the registers and does not reset any external Hardware. With the workspace enabled, you can set the stack pointer (SP) to the reset value (0xFF) only.

Example

```
 RESET
```

WORKSPACE

Short Description

defines the location and initialization of the workspace.

Syntax

```
WORKSPACE WSPAdr [;C][;L][;I][;D]
```

`WSPAdr` is the workspace address.

`[;C]` initializes the workspace after connecting to the Mon08.

`[;L]` initializes the workspace before loading the application code.

`[;I]` uses the IRQ to halt your application.

`[;D]` disables the workspace.

Description

This command defines the parameters of the Workspace (location, activation, and initialization).

Example

```
WORKSPACE 0xFF00 ;C ;L
```

Creates the workspace at address 0xFF00 and initializes vectors after connecting to the Mon08 and before each load of the application.

Mon08 Target Interface Environment Variables

All environment variables that the **Mon08 Target Interface** component uses reside in the `.PJT` project file of your current project directory, section `[MON08]`, or section `[Environment Variables]`. Some variables match settings from the Advanced Mon08 Environment Setup dialog box. You must set them within this dialog box.

In the matching environment file, manually set only the `NOPWLOGFILE`, `HC08GP20`, and `HWBPMODULEADR` variables.

HC08GP20

Short Description

Sets up the debugger for the HC08GP20 derivative.

Syntax

```
HC08GP20= 0 > 1 > OFF > ON > NO > YES > FALSE > TRUE
```

Location

section `[Environment Variables]` in your `.PJT` project file.

Description

This variable sets up the debugger for the HC08GP20 derivative hardware **Break Module (BRKH, BRKL, BRSCR)** that resides at address 0xFE09 on GP20 or 0xFE0C on other derivatives like AS/AZ/AT60.

Example

```
HC08GP20=1
```

This line configures the debugger for the HC08GP20 hardware.

NOTE `HC08GP20` is now deprecated. Use the `HWBPMODULEADR` variable instead.

HWBPMODULEADR

Short Description

Sets the **Break Module** address.

Syntax

```
HWBPMODULEADR=<address>
```

Location

section `[Environment Variables]` in your `.PJT` project file.

Description

This variable sets the address of the hardware **Break Module (BRKH, BRKL, BRSCR)**. The **Break Module** resides at address 0xFE09 on GP20/ GP32 and 0xFE0C on other derivatives like AS/AZ/AT60.

Example

```
HWBPMODULEADR=0xFE09
```

This line sets the **Break Module** address at **0xFE09** (for the HC08GP20/GP32).

NOTE This variable has a higher priority than the deprecated HC08GP20 variable.

NOPWLOGFILE

Short Description

Disables the password log file.

Syntax

```
NOPWLOGFILE= 0 > 1
```

Location

section [MON08] of the .PJT project file.

Description

Each time the debugger starts communicating with the on-chip Mon08 monitor, it backs up the memory-vector password specified in the **Password address** editbox (residing in $FFF6-$FFFD) in a log file called PWLOG.TXT. located in your current project directory. This backup also occurs each time you erase or program the flash memory.

This command disables the password log file called PWLOG.TXT. in your current project directory. When you set the variable is set to '1,' the debugger does not create PWLOG.TXT. or detect the new password.

Example

```
NOPWLOGFILE=1
```

This line disables the password logging in PWLOG.TXT.

Dialog Variables

Dialog boxes handle these variables for settings backup. Avoid editing these variables outside of the dialog boxes:

- `AutoSelectMapFile`

Syntax: `AutoSelectMapFile=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Memory Map dialog box

Short description: If set, the memory map loads automatically according to the MCUID.

- `BAUDRATE`

Syntax: BAUDRATE=<exact (calculated) baudrate value>

Location: section [Environment Variables] of your `.PJT` project file (lower priority).

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: Initialize transmission rate with monitor before pll multiplication.

- `CATCHTRAPS`

Syntax: `CATCHTRAPS=0>1`

Location: section `[MON08]` of the `.PJT` project file and section `[Environment Variables]` of your `.PJT` project file (lower priority)

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, catches vectors defined by `FIRSTVECTOR`.

- `COMDEV`

Syntax: `COMDEV=COMn`

Location: section `[MON08]` of the `.PJT` project file and section `[Environment Variables]` of your `.PJT` project file (lower priority)

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: Serial port `n` used for communication.

- `FIRSTVECTOR`

Syntax: `FIRSTVECTOR=<number of first vectors>`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: Number of vectors to catch after the IRQ.

- `INITWSPONCONNECT`

Syntax: `INITWSPONCONNECT=0>1`

Location: section `[MON08]` of the `.PJT.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, the catchtrap workspace initializes after connection.

- `INITWSPONLOAD`

Syntax: `INITWSPONLOAD=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, the catchtrap workspace initializes after the application loads.

- `MapFileName`

Syntax: `MapFileName=<path to the specified map file>`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Memory Map dialog box

Short description: Contains the path of the map file, if you disable the load automatic map file option.

- `MCUID`

Syntax: `MCUID=<MCUID>`

Location: section `[MON08]` of the `.PJT` project file

Associated with: **MCU Selection** dialog box

Short description: MCUID of the currently connected device.

- `NEWPWREFRESH`

Syntax: `NEWPWREFRESH=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, automatically refreshes the dialog-box setup with the new password.

- `NEWPWWARN`

Syntax: `NEWPWWARN=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, warns at connection if the password does not match with the dialog box and also warns when a new password writes to flash memory.

- `PASSWORD`

Syntax: `PASSWORD=<val> <val> <val> <val> <val> <val> <val> <val>`

Location: section `[MON08]` of the `.PJT` project file and section `[Environment Variables]` of your `.PJT` project file (lower priority)

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: Monitor password for onchip flash access

- `PLLFACTOR`

Syntax: `PLLFACTOR=<value>`

Location: section [MON08] of the .PJT project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: Multiplication factor (default value: 1)

- PWADR

Syntax: PWADR=<password block address>

Location: section [MON08] of the .PJT project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: The address of the password block (default value: 0xFFF6).

- SHOWPROT

Syntax: SHOWPROT=0>1 (.PJT project file) and SHOWPROT=ON>OFF (section [Environment Variables] of your .PJT project file)

Location: section [MON08] of the .PJT project file and section [Environment Variables] of your .PJT project file (lower priority)

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: The Command Line component window reports the commands and responses sent and received.

- USEDTR

Syntax: USEDTR=0>1

Location: section [MON08] of the .PJT project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, uses the RS-232 DTR line to power-reset the target (serial programmer)

- USEIRQ

Syntax: USEIRQ=0>1

Location: section [MON08] of the .PJT project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, the RS-232 line generates break signals that special hardware detects to halt the target (with IRQ interrupt), using an external pulse on an IRQ pin.

- `USEPASSWORD`

Syntax: `USEPASSWORD=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, sends the flash password for communication with the monitor

- `USEPLL`

Syntax: `USEPLL=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, the internal PLL multiplies the baudrate

- `USERTS`

Syntax: `USERTS=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: If set, uses the RS-232 RTS line to reset the target (MMC08 hardware required)

- `USEWSP`

Syntax: `USEWSP=0>1`

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: When set, allows use of a catchtrap workspace defined at address `WSPADR`.

- `WSPADR`

Syntax: `WSPADR`=<catchtrap workspace address>

Location: section `[MON08]` of the `.PJT` project file

Associated with: Advanced Mon08 Environment Setup dialog box

Short description: Address of the workspace for the catchtrap (default value: 0xFF00).

2

FLASH PROGRAMMING

Non Volatile Memory Control Utility

Introduction

In order to write to flash memories, EEPROMs, or other non-volatile memory modules found in modern MCUs, you must use special algorithms that microprocessor designers define. Also, you must erase the Flash devices before writing to them. The Flash devices may require initialization for accessibility and may be protected.

The Component specified in this document is an extension for all HI-WAVE targets that allows you to control the on-chip Flash devices.

This flexible component supports a large number of MCUs and Flash modules. A generic HI-WAVE component achieves this flexibility by calling a graphical user interface and loading an MCU-specific module that implements the details (structure, access algorithms, location, and so on) of a certain MCU.

The NVMC component lists in its window or on the command line all the non-volatile memory devices and their structure, state, and location. It allows you to change the state (enabled/disabled, blank, programmed, protected, unprotected, arm, disarm) and to program data into these modules.

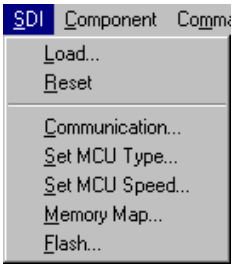
The NVMC Graphical User Interface

Introduction

The NVMC Component is integrated into HI-WAVE as an extension of some target interface Components. If the NVMC component is available,

the **Flash...** entry appears in the target component menu from the HI-WAVE menu bar.

Example with the SDI target



About Modules and Module States

In the section below, by convention, **available** modules are FLASH/EEPROM on-chip modules listed in the dialog box. The module definitions correspond to the CPU derivative technical summary and special technical considerations. If a module consists of several independent blocks, each of these blocks appears.

NOTE See the section Hardware Considerations at the end of this manual for more information about the Flash modules of the CPU derivative that you use.

Subsequent sections introduce module-state combinations, however, an **Enabled** module is an active on-chip module, that is, it can read (as a ROM) and program. A **Disabled** module is an inactive on-chip module, that is, it cannot program and reading it returns invalid values. To summarize, **Enabled** means that the module is on and **Disabled** means that the module is off. Set/clear a flag in a special register of the CPU derivative to toggle the state, but note that you cannot always perform this operation (if the module is always active). In this case, these states never appear in the dialog-box **State** field.

Blank means that a module has no code (all bytes set to 0xFF or 0x00, depending on hardware) and can use its full address range for programs. **Programmed** means that a module has partial programming (not all bytes set to 0xFF or 0x00, depending on hardware) and can use either part or none of its address range for programs. You must track the available programming space.

Protected means that a module is partially protected from erasing and programming and **Unprotected** means that this protection is off. Set/clear

a flag in a special register of the CPU derivative to toggle this feature, but note that you cannot always perform this operation on a module (if the module is always unprotected). In this case, these states never appear in the dialog box **State** field.

Selections

Flash module/item **selection**: To select a list item (module), point to the item with the mouse cursor and left-click. To unselect a list item (module), point to the item with the mouse cursor, press the "Ctrl" keyboard key, and left-click.

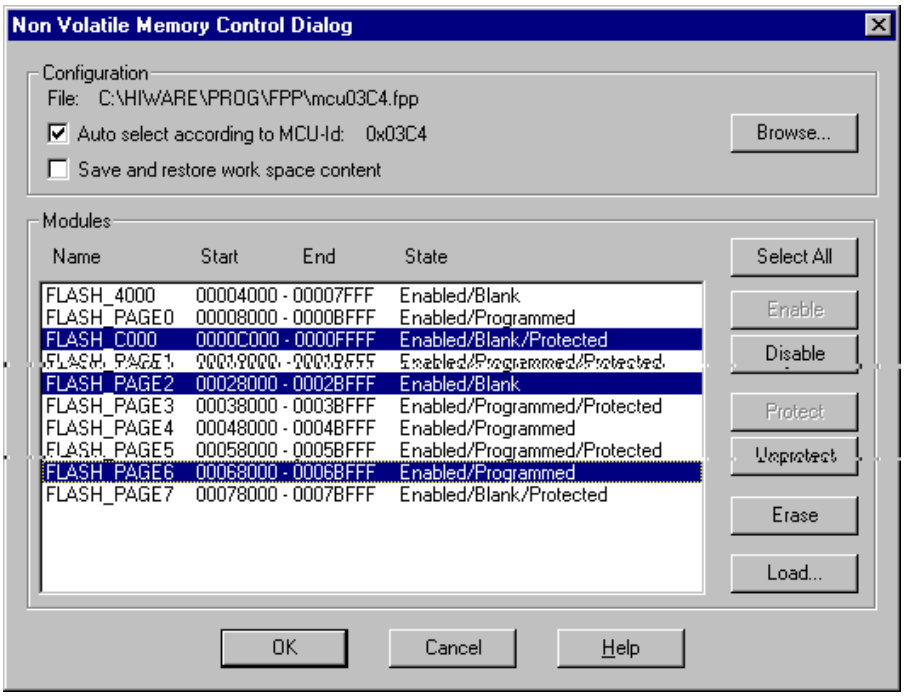
You can also perform multiple selections or "unselections" with "Ctrl" and "Shift" keyboard keys and the mouse.

By convention, a **selected** module is the module you select with the mouse cursor + left-click. Selected modules appear in “inverted blue” style in the dialog list.

NVMC Dialog

The NVMC dialog box consists of a wide listbox that displays all the Flash or EEPROM modules of a CPU derivative. Note that some derivatives (like HC12B32) have only one on-chip Flash module; others might have 2 (HC12D60) or more Flash modules.

NOTE “Select” and “Unselect” buttons do not appear in the dialog box, since you click to select a module in the dialog list, however, when doing operations from the command-line component, you must select a module by using the **SELECT** command before performing any operation on it (see the **FLASH SELECT**, **FLASH UNSELECT** command in the Appendix). Therefore selecting/unselecting does not occur automatically from the command line.



For each block, a line contains this information:

1. The *Name* field contains the name of the module.
2. The *Start* field contains the start address of the module.
3. The *End* field contains the end address of the module.
4. The *State* field contains the states of the module, such as *disabled, enabled, blank, programmed, protected,* and *unprotected*.

Available states combinations are:

- **Bad Device** (if the interface could not detect a correct device)
- **Disabled** (when one or all modules are disabled)
- [Enabled] / <Blank | Programmed> / [Unprotected | Protected]

Note that a state appears only if it is meaningful, for example, "Enabled" appears only if you can "Disable" a module, "Unprotected" appears only if you can "Protect" a module, as explained in previous sections.

In the **Configuration** group, the current `.FPP` parameter file (see below) appears. You can check/uncheck **Auto select according to MCU-Id**. See the section **Configuration: FPP loading** for more information about this option.

You can also check/uncheck **save and restore workspace content** (equivalent to the command **SAVECONTEXT**, **LOADCONTEXT**) to save the current RAM data, since flash programming applications load into RAM and overwrite it. Saving the context (checking this option) slows the NMVC.

Flash Module Handling

Files called flash parameter files (extension `*.FPP`) contain code applets that describe flash operations. The `*.FPP` files contain MCU- dependent parameters and programs that handle internal flash modules. See the section **FPP Files.**

Flash operations are also available from the Command Line component. The section **NVMC Commands** describes the corresponding commands.

The following commands apply to each block, made possible by clicking the **Enable, Disable, Protect, Unprotect,** and **Erase** buttons in the NVMC dialog box. The appropriate operation depends on the hardware implementation. All buttons are dynamic, that is, they become enabled if they can apply the associated operation to at least one of the selected items. Otherwise, buttons are disabled.

- Enable/Disable (depend on the features and context)

Clicking the "**Enable**" button enables all the selected modules that are currently “Disabled”. Clicking the "**Disable**" button disables all the selected modules that are currently “Enabled”. You cannot always enable/ disable a flash module; it depends on the MCU features and context.

- Protect/Unprotect (depend on the features and context)

Clicking the "**Protect**" button protects all the selected modules that are currently “Unprotected”. You cannot always protect/unprotect a flash module; it depends on the MCU features and context, involving a module protection bit internal to the MCU. Clicking the "**Unprotect**" button unprotects all the selected modules that are currently “Unprotected”.

For some MCUs, flash modules are only partially protected for Boot section and boot routines. Therefore, the protection is only valid for this section, not for the entire module. See the section Hardware Considerations at the end of this manual for more information about the Flash modules of the CPU derivative that you use.

NOTE For some MCUs, flash modules are only partially protected for Boot section and boot routines. Therefore, the protection is only valid for this section, not for the entire module. See the section Hardware Considerations at the end of this manual for more information about the Flash modules of the CPU derivative that you use.

- Erase (Flash only, makes the flash status "blank" if successful)

The "**Erase**" button is enabled only for selected modules that are not “blank”.

Clicking the "**Select All..**." button selects all the modules listed in the list box.

Clicking the “**Load**...” button arms all selected modules, executes a “**LOAD**” command, then disarms the modules. If you do not select a flash module, clicking “**Load...**” loads all files into flash memory.

NOTE The “Select” and “Unselect” buttons do not appear in the dialog box, since selecting modules involves clicking them in the dialog-box list, however, when doing operations from the command-line component, you must select a module using the **SELECT** command before performing any operation on it (see the **FLASH SELECT** and **FLASH UNSELECT** commands in the Appendix). Therefore, selecting/unselecting does not occur automatically from the command line.

Configuration: FPP file loading

When you open the dialog box, the IDE loads the `*.FPP` configuration file according to this algorithm:

1. The IDE reads the entry "`NV_PARAMETER_FILE`" from the "`project.ini`" file in the target-specific section (such as`[Motorola ESL]`).

Example:

```
[Motorola ESL]
NV_PARAMETER_FILE=C:\MYINSTALL\PROG\FPP\mcu03C4.fpp
```

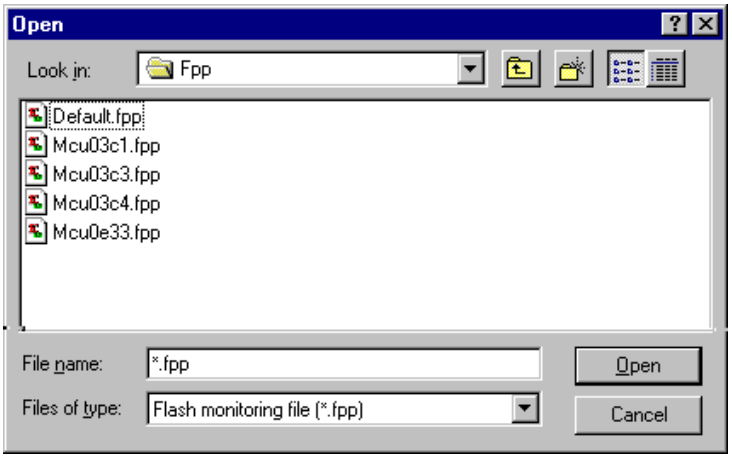
2. If the IDE retrieves a valid `*.FPP` file name, it loads the file.
3. If the IDE cannot find this file, or if the file has the wrong format, an error message that indicates the problem appears.
4. If the IDE cannot find the entry, or if the entry is empty, the IDE automatically checks the check box "**Auto select according to MCU Id:**"

in the NVMC dialog box, and the IDE loads the parameter file from the "\FPP" subdirectory of the METROWERKS installation (see above), according to the MCU ID.

5. If the IDE finds the file, but the file has the wrong format, an error message that indicates the problem appears.
6. In all cases, the MCU ID appears when available from the target.

After selecting the "**Browse..**." button, the standard file open dialog box pops up to let you select the *.FPP parameter file, like shown in Figure 2.1.

Figure 2.1 Open FPP file dialog



If this dialog box returns a valid file name, the IDE loads the file and automatically unchecks the "**Auto select according to MCU Id:**" check box. If an error occurs while loading, an error message that indicates the problem appears.

When checking the check box "**Auto select according to MCU Id:**", the IDE finds and loads the corresponding *.FPP parameter file (see above).

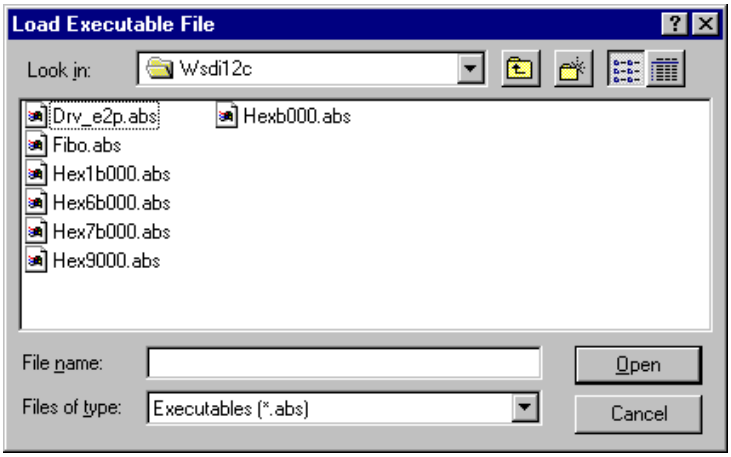
When clicking the **OK** button, the dialog box closes and, if the check box "**Auto select according to MCU Id:**" is unchecked, the name of the selected configuration file gets saved under the entry "NV_PARAMETER_FILE" in the project.ini file. If the check box is checked, no *.FPP gets saved in the project file.

When clicking the **Cancel** button, the dialog box closes without saving changes.

Loading an application in flash

The "**Load...**" button has the same function as the menu command from the Target-specific menu: It pops up the standard file open dialog box and lets you select a file to load.

Before opening the dialog box, the IDE selects all blocks.

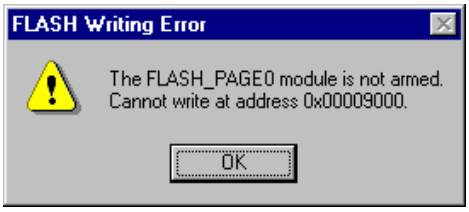


If a problem occurs while loading an application into flash memory, Error messages appear, such as shown in Figure 2.2.

Figure 2.2 Flash Programming Error

When no programming voltage is available, or like shown in Figure 2.3.

Figure 2.3 Flash Writing Error



when trying to load a program into a section not previously selected. Therefore, using the selecting/unselecting feature, the NVMC module prevents hazardous module overwriting, erasing, unprotecting, and so on.

Prepare and Load Your Application in Flash

You can either use the Flash commands introduced in the **Appendix** (possibly within a command file) or use the NVMC graphical user interface as introduced in the section **NVMC Dialog**.

Link your application with the appropriate memory model if necessary. The example below shows a `.PRM` file for HC12DG128 application, where the default rom resides in page 2 and page 4, using a banked memory model. In any case, make sure that your code properly loads in a Flash address range.

```
LINK my_appli.abs
```

```
NAMES my_appli.o ansib.lib start12b.o END
SECTIONS
    MY_RAM = READ_WRITE 0x2010 TO 0x23FF;
    MY_ROM = READ_ONLY  0xC000 TO 0xFEFF;
    PAGE_2 = READ_ONLY 0x28000 TO 0x2BFFF;
    PAGE_4 = READ_ONLY 0x48000 TO 0x4BFFF;
PLACEMENT
    _PRESTART, STARTUP,
    ROM_VAR, STRINGS,
    NON_BANKED, COPY              INTO  MY_ROM;
    DEFAULT_RAM                   INTO  MY_RAM;
```

```
                    MyPage, DEFAULT_ROM           INTO  PAGE_2,
                PAGE_4;
                END
                STACKSIZE 0x50
VECTOR ADDRESS 0xFFFE _Startup  /* set reset vector IN FLASH on
_Startup */
```

For loading information, see the **Appendix** for command examples or read below for an example using the menu.

In the target menu entry (example: **SDI**) in the HI-WAVE menu, choose **Flash...** to open the NVMC Dialog Box.

If you know the absolute path to your application, you do not need to select a module. Make sure that if you program in a protected area (boot block), the matching module is unprotected.

Click the "**Load...**" button (all modules get automatically selected) then use a browser to choose your .ABS file to load in Flash. A progress bar appears and informs you about load progress. When loading completes, the dialog box displays the new module states.

You can close the dialog box and start running your application. On some hardware, you may need to first perform a target reset by clicking the reset button in HI-WAVE.

Hardware Considerations

This section contains hardware-specific information about currently delivered FPP flash programming files. New FPP-file features and information appear in the release notes. Refer to the on-line documentation in your toolkit installation.

NOTE Always read the latest Flash Programming release note to have latest hardware implementation (fpp files upgrade, and so on).

HC12B32

fpp file name: mcu03c1.fpp

number of Flash modules: 1

-applet code currently not relocatable, loaded at 0x800, using 0x400 bytes.

module name: FLASH_B32 / module number: 0

-32 kilobytes flash located in 0x8000-0xFFFF or in 0x0000-0x7FFF (both handled according to MAPROM bit in MISC register).

-boot sector unprotectable/protectable (2 kilobytes in range 0xF800-0xFFFF or in range 0x7800-0x7FFF) (using BOOTP bit in FEEMCR register and LOCK bit in FEELCK register).

-flash enable/disable using ROMON bit in MISC register.

HC12D60

fpp file name: mcu03c3.fpp

number of Flash modules: 2

-applet code currently not relocatable, loaded at 0x400, using 0x400 bytes.

module name: FEE28 / module number: 0

-28 kilobytes flash located in 0x1000-0x7FFF or in 0x9000-0xFFFF (both handled, according to MAPROM bit in MISC register).

-boot sector unprotectable/protectable (8 kilobytes in range 0x6000-0x7FFF or in range 0xE000-0xFFFF) (using BOOTP bit in FEE28MCR register and LOCK bit in FEE28LCK register).

-flash enable/disable using ROMON28 bit in MISC register.

module name: FEE32 / module number: 1

-32 kilobytes flash located in 0x8000-0xFFFF or in 0x0000-0x7FFF (both handled, according to MAPROM bit in MISC register).

-boot sector unprotectable/protectable (8 kilobytes in range 0xE000-0xFFFF or in range 0x6000-0x7FFF) (using BOOTP bit in FEE32MCR register and LOCK bit in FEE32LCK register).

-flash enable/disable using ROMON32 bit in MISC register.

HC12DG128

fpp file name: mcu03c4.fpp

number of Flash modules: 10

-applet code currently not relocatable, loaded at 0x2000, using 0x400 bytes.

-all flash modules simultaneously enable/disable using the ROMON bit in the MISC register.

module name: FLASH_4000 / module number: 0

- 16 kilobytes unpaged Flash accessed in 0x4000-0x8000 matching even 11FEE even page (6), that is, FLASH_PAGE6.

module name: FLASH_PAGE0 / module number: 1

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 00FEE Flash even page (0).

module name: FLASH_C000 / module number: 2

- 16 kilobytes unpaged Flash accessed in 0xC000-0xFFFF matching even 11FEE odd page (7), that is, FLASH_PAGE7.

-boot sector unprotectable/protectable (8 kilobytes in range 0xE000-0xFFFF or paged range 0xA000-0xBFFF) (using BOOTP bit in FEEMCR register and LOCK bit in FEELCK register).

module name: FLASH_PAGE1 / module number: 3

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 00FEE Flash odd page (1).

-boot sector unprotectable/protectable (8 kilobytes in range 0xA000-0xBFFF) (using BOOTP bit in FEEMCR register and LOCK bit in FEELCK register).

module name: FLASH_PAGE2 / module number: 4

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 01FEE Flash even page (2).

module name: FLASH_PAGE3 / module number: 5

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 01FEE Flash odd page (3).

-boot sector unprotectable/protectable (8 kilobytes in range 0xA000-0xBFFF) (using BOOTP bit in FEEMCR register and LOCK bit in FEELCK register).

module name: FLASH_PAGE4 / module number: 6

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 10FEE Flash even page (4).

module name: FLASH_PAGE5 / module number: 7

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 10FEE Flash odd page (7).

-boot sector unprotectable/protectable (8 kilobytes in range 0xA000-0xBFFF) (using BOOTP bit in FEEMCR register and LOCK bit in FEELCK register).

module name: FLASH_PAGE6 / module number: 8

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 11FEE Flash even page (6). Also equivalent to FLASH_4000 module.

module name: FLASH_PAGE7 / module number: 9

- 16 kilobytes paged Flash accessed in bank window 0x8000-0xBFFF, equivalent to (cf Technical Summary) 11FEE Flash odd page (7). Also equivalent to FLASH_C000 module.

-boot sector unprotectable/protectable (8 kilobytes in range 0xA000-0xBFFF) (using BOOTP bit in FEEMCR register and LOCK bit in FEELCK register).

AM29F010 on HC08AZ32EVB (CanKit)

fpp file name: cankit08.fpp

number of Flash modules: 1

-applet code currently not relocatable, accessed at 0x100, using 0x200 bytes.

-enable/disable/unprotect/protect through jumper setting only. See below.

module name: AM29F010 / module number: 0

-32 kilobytes external optional Flash module chip on CanKit board M68HC08AZ32EVB, located in 0x8000-0xFFFF. To add on U3 board socket. N.B. Hard-select the Flash module using jumper JP3 in position 1-2. In position 2-3, select the 32 kilobytes on board RAM.

Flash Programming CPU08 Derivatives and Password Security Issue

Some HC08 MCUs (AT/AS/AZ60, GP20, and so on), have a security mechanism built into the Mon08 that prevents unauthorized access to onchip FLASH EEPROM. To enter the Mon08 of these devices with FLASH access, specify a password after **Power-On** reset, before executing any command. You must specify the password values within the HC08 Mon08 Target Interface setup dialog box. If the password is incorrect, reading/scrolling the Flash memory always returns "**AD**".

IMPORTANT: All settings below pertain to the HC08 Mon08 Target Interface setup dialog box ("**Communication and Debug Option Setup"**).

Changing password:

Check the password checkbox and enter the Mon08 password.

Example: `Enter: 00 00 00 00 00 00 00 00`

This example always matches when the flash is empty for AZ/AS/AT and GP20 (not programmed/blank/factory default, with all bytes set to 0x00).

IMPORTANT: The GP32 derivative has all bytes set to 0xFF when not programmed, therefore, the blank/factory password is **FF FF FF FF FF FF FF FF**

Some derivatives require a password in order to allow access to the MCU even if the values are unchecked. In such cases, you must set the password option, but you can leave the value of all bytes as 0x00!

You must connect right after MCU Power-on reset (power off + power on, NOT software or external Reset pin toggle!): in this case, only the onchip Mon08 monitor checks the password.

Each time the debugger starts communicating with the on-chip Mon08 monitor, it backs up the memory-vector password specified in the **Password address** editbox (usually residing in **$FFF6-$FFFD**) in a log file called `PWLOG.TXT` located in your current project directory. This backup also occurs each time you erase or program the flash memory. If you DO NOT want this logfile, insert the environment variable '**NOPWLOGFILE=1**' in the `PROJECT.INI` file (in your current project directory) at section **[MON08]**. For security reasons, note that the debugger has no user interface for this disabling method

In the setup dialog, you can also check the **Warn when...** checkbox to have the IDE warn you when a password mismatch (at connection) or modification (after programming or erasing) occurs.

You can also check the **Autorefresh...** checkbox to have the password editboxes in the dialog box automatically update with the newly modified password.

If, for any reason, you can no longer access the Flash because you lost the password, you can still use the Flash Programming dialog box to erase the Flash modules. After erasing, the Flash Programming dialog box returns "Bad Device" due to the fact that Flash modules are inaccessible while reading (always reading "AD"), and blank verification fails. To reset the Monitor onchip security measures, perform a power reset (power off + power on) on your HC08 derivative to, then set up the Monitor HC08 with a "00 00 00 00 00 00 00 00" password (or FF FF FF FF FF FF FF FF for GP32) and connect again to the hardware.

HC08AT60 / AS60-AZ60 Emulation

fpp file name: mcu0e36.fpp

number of Flash modules: 5

-applet code currently not relocatable, loaded at 0x50, using 0x200 bytes.

module name: EEPROM_2 / module number: 0

- 512 Bytes EEPROM located in 0x600-0x7FF.

module name: EEPROM_1 / module number: 1

- 512 Bytes EEPROM located in 0x800-0x9FF.

module name: FLASH_2 / module number: 2

- flash located in 0x450-0x5FF, 0xE00-0x7FFF, 0xFF81.

module name: FLASH_1 / module number: 3

- flash located in 0x8000-0xFDFF, 0xFF80.

module name: VECTORS / module number: 4

- flash vectors located in 0xFFCC-0xFFFF.

HC08GP20

fpp file name: mcu0c26.fpp

number of Flash modules: 2

-applet code currently not relocatable, loaded at 0x50.

module name: FLASH / module number: 0

-about 20 kilobytes flash located in 0xB000-0xFDFF.

module name: VECTORS / module number:1

-vectors in 0xFFDC-0xFFFF.

HC08GP32

fpp file name: mcu0c55.fpp

number of Flash modules: 2

-applet code currently not relocatable, loaded at 0x50.

module name: FLASH / module number: 0

-about 32 kilobytes flash located in 0x8000-0xFDFF.

module name: VECTORS / module number:1

-vectors in 0xFFDC-0xFFFF.

About FPP Files

Introduction

MCU-specific files called flash parameter files (extension `*.FPP`) parametrize the flash operations (described in the Appendix). The `*.FPP` files contain MCU- dependant parameters and applets that handle internal flash modules.

The `*.FPP` files are simple text files that you can edit with any text editor.

Applets are small programs loaded into the on-chip RAM. They run at well-defined speed (corresponding to the MCU clock speed) and can collect data about the state of memory modules and can control them (including erasing and programming them).

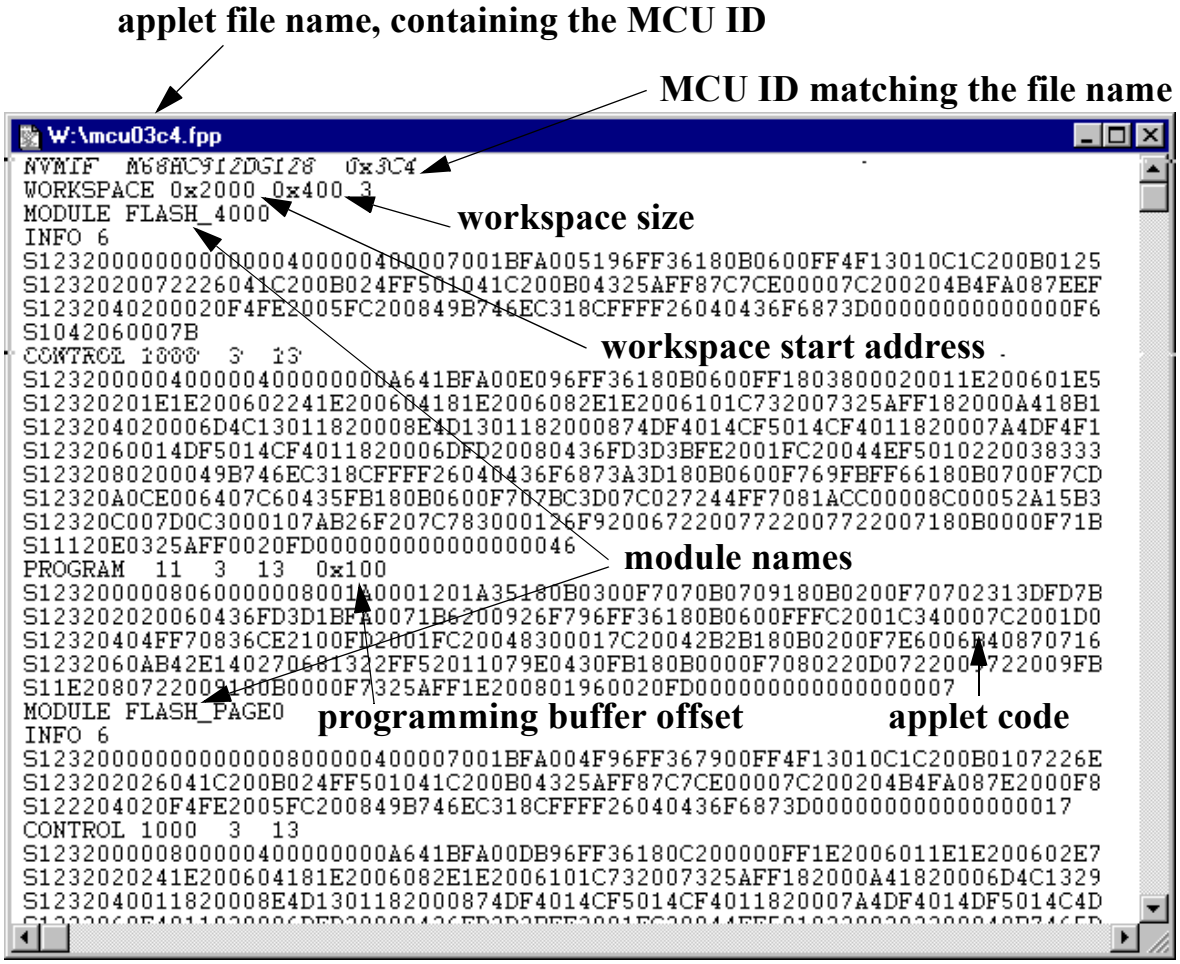
There are three applets for each flash module: the first (INFO applet) collects information about the module, the second (CONTROL applet) controls the module (including erasing it), and the third one (PROGRAM applet) programs the module. Parameters get passed to these applets at fixed memory addresses (relative to the workspace).

The MCU designer and METROWERKS create the `*.FPP` files. They appear within the installation.

Appendix A

Structure of the FPP File

The figure below shows the contents of a `*.FPP` file and identifies the parameters that you can be edit for particular reasons.



Never modify the applet file name, the MCU ID, the applet code, the programming buffer offset, or the last parameter of the **WORKSPACE** definition line (here "**3**").

You can, however, modify the module names and sort the module applets in a particular order in the NVMC dialog box. A module starts from the **MODULE** keyword and ends before the next **MODULE** keyword.

The applets load into the MCU RAM/SRAM, therefore, the default workspace start address (here **0x2000**) set in the FPP file is the default RAM start address of the MCU. If your MCU allows moving the RAM block into the memory map, use this dialog box to set your new workspace starting address.

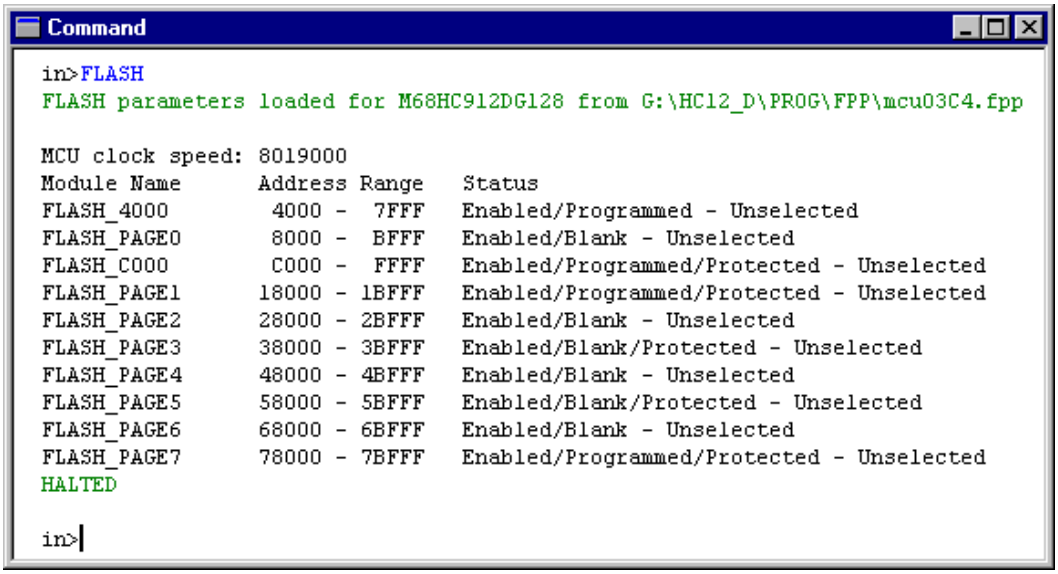
NOTE See the section Hardware Considerations for more information about applet-code relocation for the Flash modules of the CPU derivative that you use.

The workspace size (here **0x400**) matches either the full MCU RAM size or a part of it. Never set this value lower than the programming buffer offset (here **0x100**). Make the programming buffer size (the programmed application first loads in RAM into a buffer placed after the applet code and gets copied by the applet to the desired location) as large as possible for faster programming speed. To change the size, you can increase your workspace size up to the available space on the MCU. Here the buffer size is (workspace size **0x400** − offset **0x100** = **0x300**)

Saving and loading the RAM contents takes a longer period of time, if enabled (by the **FLASH LOADCONTEXT** and **FLASH SAVECONTEXT** commands).

Appendix B

Figure 2.4 NVMC Commands



FLASH

Short Description

displays flash modules, loads a `*.FPP` file, or performs flash operations.

Syntax

FLASH

```
[(SELECT|UNSELECT|ERASE|ENABLE|DISABLE|PROTECT|
UNPROTECT) [<blockNo>]]
|[ARM|DISARM|SAVECONTEXT|LOADCONTEXT]
|[INIT <fileName>|<mcuId>]
```

Description

The **FLASH** command displays all the available modules with their name, location, and state, if the IDE already loaded a parameter file (`*.FPP`).

If the IDE did not yet load a parameter file, it loads the file according to the current MCU ID or else loads the last used `*.FPP` file.

FLASH INIT <**fileName**>**|AUTOID** loads the parameter file according to **fileName** file (you can specify the path). If you specify **AUTOID**, the IDE bases the parameter file on the MCU ID (**autocheck** is checked in the NVMC dialog box).

FLASH ENABLE enables the specified modules. If you do not specify a parameter, this option enables all available blocks. You cannot enable/ disable all Modules. The IDE ignores your attempt to enable or disable such modules.

FLASH DISABLE disables the specified modules. If you do not specify a parameter, this option enables all available blocks. You cannot disable all modules. The IDE ignores your attempt to disable such modules.

FLASH ERASE erases the specified modules. If you do not specify a parameter, the IDE erases all available blocks.

FLASH UNPROTECT unprotects the specified modules. If you do not specify a parameter, all available blocks become unprotected. You cannot unprotect all modules. The IDE ignores your attempt to unprotect such modules.

FLASH PROTECT protects the specified modules. If you do not specify a parameter, all available blocks become protected. You cannot protect all modules. The IDE ignores your attempt to protect such modules.

FLASH SELECT chooses the specified modules for flash-programming. If you do not specify a parameter, all available blocks become selected.

FLASH UNSELECT does not choose the specified modules for flash-programming. If you do not specify a parameter, all available blocks become unselected. Note that the "unselected" internal state is a HI-WAVE flash-programming protection against accidental flash programming.

FLASH ARM prepares the NMVC to start loading, which you can perform with a normal **LOAD** command. The **VPPON.CMD** file executes. You must issue this command before beginning the load into flash.

FLASH DISARM ends a loading. The **VPPOFF.CMD** file executes.

FLASH SAVECONTEX backs up the current SRAM context into a buffer.

FLASH LOADCONTEX restores the current buffer context into the MCU's SRAM.

[<blockNo>]

blockNo is a list of flash block/module numbers using the following syntax:

```
blockNo = {number["-"number][","]}
```

Examples:

FLASH ERASE 2,7 this erases the memory blocks 2 and 7.

FLASH ERASE 2,4-6 8 this erases the memory blocks 2, 4, 5, 6 and 8.

FLASH ERASE this erases all available memory blocks.

While flash modules remain armed, you cannot execute your code (including running, stepping, and so on). If you attempt to enter such a command, a message box appears and asks you to either click "**OK**" to disarm the modules and execute the command or click "**CANCEL**" to abort the command.

On "**OK**", all flash modules become disarmed and the pending command executes. On "**CANCEL**", the command does not execute. The flash modules stay armed.

Example of flash programming from the Command Line component

```
in>flash
FLASH parameters loaded for M68HC912DG128 from
J:\HC12_EA\PROG\FPP\mcu03C4.fpp

MCU clock speed: 8025000
Module Name      Address Range   Status
FLASH_4000        4000 -  7FFF   Enabled/Blank - Unselected
FLASH_PAGE0       8000 -  BFFF   Enabled/Blank - Unselected
FLASH_C000        C000 -  FFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE1      18000 - 1BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE2      28000 - 2BFFF   Enabled/Blank - Unselected
FLASH_PAGE3      38000 - 3BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE4      48000 - 4BFFF   Enabled/Blank - Unselected
FLASH_PAGE5      58000 - 5BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE6      68000 - 6BFFF   Enabled/Blank - Unselected
FLASH_PAGE7      78000 - 7BFFF   Enabled/Blank/Protected -
Unselected
HALTED
```

The FLASH command loads the applet according to the CPU derivative (MCU ID) and displays all modules states. We unprotect the module number 7, that is, FLASH_PAGE5, as our application is for this area.

```
in>flash unprotect 7

MCU clock speed: 8025000
Module Name      Address Range   Status
FLASH_4000        4000 -  7FFF   Enabled/Blank - Unselected
FLASH_PAGE0       8000 -  BFFF   Enabled/Blank - Unselected
FLASH_C000        C000 -  FFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE1      18000 - 1BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE2      28000 - 2BFFF   Enabled/Blank - Unselected
```

```
FLASH_PAGE3       38000 - 3BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE4       48000 - 4BFFF   Enabled/Blank - Unselected
FLASH_PAGE5       58000 - 5BFFF   Enabled/Blank/Unprotected -
Unselected
FLASH_PAGE6       68000 - 6BFFF   Enabled/Blank - Unselected
FLASH_PAGE7       78000 - 7BFFF   Enabled/Blank/Protected -
Unselected
```

The FLASH_PAGE5 is unprotected. We select FLASH_PAGE5 for programming.

```
in>flash select 7
```

We arm the program.

```
in>flash arm
Arm FLASH for loading.
```

Now we can load our application.

```
in>load a:\my_page5.sx
RUNNING
```

We stop the loading process and disarm the program.

```
in>flash disarm
FLASH disarmed.
Halted
```

We display the final module state with the FLASH command.

```
in>flash

MCU clock speed: 8025000
Module Name       Address Range   Status
```

```
FLASH_4000          4000 -  7FFF   Enabled/Blank - Unselected
FLASH_PAGE0         8000 -  BFFF   Enabled/Blank - Unselected
FLASH_C000          C000 -  FFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE1        18000 - 1BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE2        28000 - 2BFFF   Enabled/Blank - Unselected
FLASH_PAGE3        38000 - 3BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE4        48000 - 4BFFF   Enabled/Blank - Unselected
FLASH_PAGE5       58000 - 5BFFF   Enabled/Programmed/Unprotected -
Selected
FLASH_PAGE6        68000 - 6BFFF   Enabled/Blank - Unselected
FLASH_PAGE7        78000 - 7BFFF   Enabled/Blank/Protected -
Unselected
HALTED
```

The FLASH_PAGE5 module is programmed. We protect the module again and unselect it.

```
in>flash protect 7

MCU clock speed: 8025000
Module Name        Address Range   Status
FLASH_4000          4000 -  7FFF   Enabled/Blank - Unselected
FLASH_PAGE0         8000 -  BFFF   Enabled/Blank - Unselected
FLASH_C000          C000 -  FFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE1        18000 - 1BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE2        28000 - 2BFFF   Enabled/Blank - Unselected
FLASH_PAGE3        38000 - 3BFFF   Enabled/Blank/Protected -
Unselected
FLASH_PAGE4        48000 - 4BFFF   Enabled/Blank - Unselected
FLASH_PAGE5        58000 - 5BFFF   Enabled/Programmed/Protected -
Selected
FLASH_PAGE6        68000 - 6BFFF   Enabled/Blank - Unselected
FLASH_PAGE7        78000 - 7BFFF   Enabled/Blank/Protected -
Unselected
```

```
in>flash unselect 7
```

3

Target Interface Command Files

Click any of the following links to jump to the corresponding section of this chapter:

Target Interface Command introduction

The Target Interface offers the possibility to play specific command files on different events:

- at connection: Startup Command File,
- at reset: Reset Command File,
- right before a file loads: Preload Command File,
- right after a file loads: Postload Command File.

You can specify the command file's full name and status (enable/disable) either with the `CMDFILE` Command Line command or by using the Command Files dialog.

You can use any of the Debugger commands in those files and use the commands introduced in the Debugger manual to set up the target hardware on one of those events. An example of command file appears in Listing 3.1

Listing 3.1 Example of a command file content:

```
WB 0x0035 0x00
WB 0x0012 0x11
PROTOCOL OFF
```

- The **WB 0x0035 0x00** command sets memory location **0x35 to 0**.
- The **WB 0x0012 0x11** command sets memory location **0x12 to 0x11**.
- The command **PROTOCOL OFF** disables the Show Protocol option.

Target Interface Command Files Description

The command files are very useful for debugging your HC08 board. They let you configure your board at startup and make the debugging session possible. They play commands after a reset in order to recover the initial state. They play commands for you to open and close the flash session.

Startup Command File

The Debugger executes the **Startup** Target Interface Command Files after the Target Interface loads.

You can specify the **Startup** command file's full name and status (enable/disable) either with the `CMDFILE STARTUP` **Command Line** command or by using the **Startup** index of the Command Files dialog.

The default `STARTUP.CMD` file resides in the current project directory and gets enabled as the current **Startup** command file.

To ensure a proper connection, make sure that the startup file contains the command `RESET`. This way, the `RESET` command file plays and configures your target for debugging.

Reset Command File

The Debugger executes the **Reset** Target Interface Command Files after you select the reset button, menu entry, or **Command Line** command.

You can specify the **Reset** command file's full name and status (enable/disable) either with the `CMDFILE RESET` **Command Line** command or by using the **Reset** index of the Command Files dialog

The default `RESET.CMD` file residing in the current project directory gets enabled as the current **Reset** command file.

Use this file to properly configure your board, before re-starting the debugging cession.

For example,

- To disable a watchdog

Preload Command File

The Debugger executes the **Preload** Target Interface Command Files before an application loads into the target system through the Target Interface.

You can specify the **Preload** command file's full name and status (enable/disable) either with the `CMDFILE PRELOAD` **Command Line** command or by using the **Preload** index of the Command Files dialog.

The `PRELOAD.CMD` file residing in the current project directory gets enabled as the current **Preload** command file.

The **Preload** command is useful when you use the The NVMC Graphical User Interface. The Example of a Preload command file, with use of flash commands demonstrates how to choose the non-volatile memory driver, erase a part of the flash memory, and arm the debugger before loading an application into the FLASH memory. It may also contain a RESET command that ensures a clean initial state.

Listing 3.2 Example of a *Preload* command file, with use of flash commands

Postload Command File

The Debugger executes the **Postload** Target Interface Command Files after an application load into the target system through the Target Interface.

You can specify the **Postload** command file's full name and status (enable/disable) either with the `CMDFILE POSTLOAD` Command Line command or by using the **Postload** index of the Command Files dialog.

The default `POSTLOAD.CMD` file residing in the current project directory gets enabled as the current **Postload** command file.

In the example below, Example of a Postload command file, with use of flash commands, the **Postload** command file automatically closes the "non volatile memory loading session".

Listing 3.3 Example of a *Postload* command file, with use of flash commands

Vppon Command File

The **Vppon** Target Interface Command Files is executed by the debugger before a "Non Volatile Memory" is erased or before a file is programmed in "Non Volatile Memory" to the target system through the target interface Non Volatile Memory Control NVMC Dialog dialog (**Flash**... menu entry) or FLASH PROGRAM/ERASE commands from Flash programming, Non Volatile Memory Control Utility.

The **Vppon** command file full name and status (enable/disable) can be specified either with the `CMDFILE VPPON` Command Line command or by using the **Vppon** index of the Command Files dialog.

By default, the `VPPON.CMD` file located in the current project directory is enabled as the current **Vppon** command file.

This command file can be used to enable a programming voltage by software.

This command file is not available for all target interfaces.

Vppoff Command File

The **Vppoff** Target Interface Command Files is executed by the debugger after a "Non Volatile Memory" has been erased or after a file has been programmed in "Non Volatile Memory" to the target system through the target interface Non Volatile Memory Control (NVMC Dialog) (**Flash**...

menu entry) or FLASH PROGRAM/ERASE commands from Flash programming, Non Volatile Memory Control Utility.

The **Vppoff** command file full name and status (enable/disable) can be specified either with the `CMDFILE VPPOFF` Command Line command or by using the **Vppoff** index of the Command Files dialog.

By default, the `VPPOFF.CMD` file located in the current project directory is enabled as the current **Vppoff** command file.

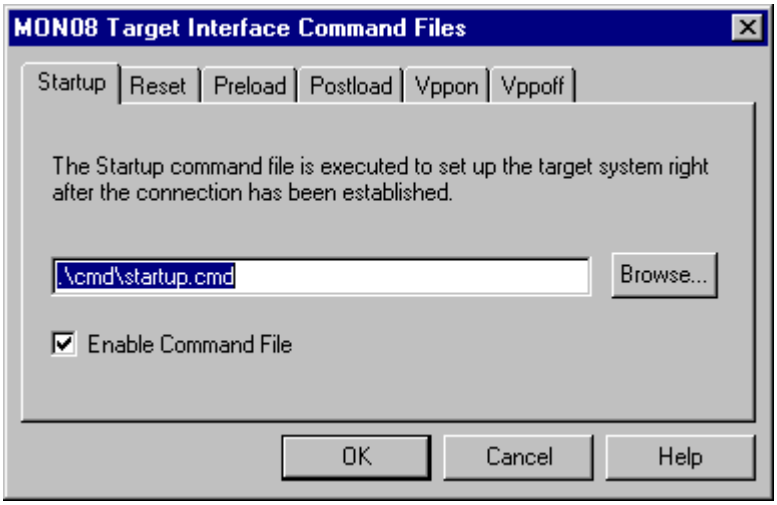
This command file can be used to disable a programming voltage.

This command file is not available for all target interfaces.

Command Files dialog

You can open the **Target Interface Command Files** dialog shown in Figure 3.1 by selecting the menu entry **"TargetName">Command Files.** (In this section, **TargetName** is the name of the target, like **MON08**.

Figure 3.1 Command Files dialog



Each index of this dialog box corresponds to an event on which a Target Interface Command Files can automatically run from the Debugger: Startup Command File, Reset Command File, Preload Command File, and Postload Command File.

The command file in the edit box executes when the corresponding event occurs.

Using the **Browse** button, you can set up the path and name of the command file.

The **Enable Command File** check box lets you enable/disable a command file on a event. The IDE enables these default command files:

- the default **Startup** command file `STARTUP.CMD`,
- the default **Reset** command file `RESET.CMD`,
- the default **Preload** command file `PRELOAD.CMD`,
- the default **Postload** command file `POSTLOAD.CMD`.

NOTE You can store the settings performed in this dialog box for a later debugging session in the **["targetName"]** section of the PROJECT file by using the variables **CMDFILE0**, **CMDFILE1, ... CMDFILEn**

Associated Commands

This section describes the Command Files commands that you can use after setting the Target Interface:

- CMDFILE

You can enter these commands in the Target Interface Command Files or the **Command Line** component of the Debugger.

The commands appear alphabetical order. Table 3.1 gives the description format.

Table 3.1 Command description format

Topic	Description
Short Description	Provides a short description of the command.
Syntax	Specifies the syntax of the command in a EBNF format.
Description	Provides a detailed description of the command and how to use it.

Topic	Description
Example	Provides a small example of how to use the command.

CMDFILE

Short Description

Defines a command file path, name, and status (enable/disable).

Syntax

CMDFILE <file kind> ON>OFF ["<file name and path>"]

and

file kind = STARTUP>RESET>PRELOAD>POSTLOAD

Description

The CMDFILE command sets up the full name and status (disabled/enabled) of Target Interface Command Files.

This command lets you perform the same settings as using the Command Files dialog through the Command Line component.

The ["**MON08**"] section of the PROJECT file store the settings of a command file, using variable CMDFILEn.

You can get the list of available command files (and their status) by typing CMDFILE without any parameters in the Command Line component.

```
in>CMDFILE
MON08 Target Interface Command Files:
STARTUP ON startup.cmd
RESET ON reset.cmd
PRELOAD ON preload.cmd
```

You can change the status of the **Startup** command file:

```
in>CMDFILE STARTUP OFF "my own startup.cmd"
in>CMDFILE
MON08 Target Interface Command Files:
STARTUP OFF my own startup.cmd
RESET ON reset.cmd
```

```
PRELOAD ON preload.cmd
POSTLOAD ON postload.cmd
```

Associated Environment Variables

This section describes the Command Files dialog environment variables that the Target Interface uses.

"CMDFILEn"

The **[MON08]** section from the project file stores these variables.

Example of the **[MON08]** target section from the project file:

```
[MON08]
CMDFILE0=CMDFILE STARTUP ON "startup.cmd"
CMDFILE1=CMDFILE RESET ON "reset.cmd"
CMDFILE2=CMDFILE PRELOAD ON "preload.cmd"
```

The following section describes the available Command Files dialog environment variables. The variables appear in alphabetical order. Table 3.2 gives the variable description format.

Table 3.2 Variable description format

Topic	Description
Short Description	Provides a short description of the variable.
Syntax	Specifies the syntax of the variable in a EBNF format.
Default	Shows the default setting for the variable.
Description	Provides a detailed description of the variable and how to use it.
Example	Provides a small example of how to use the variable.

CMDFILEn

Short Description

Contains a CMDFILE Command Line command that you can use to define a command file on a event.

Syntax

CMDFILEn=<command file you specify by using CMDFILE Command Line command>

Default

The IDE enables these default command files.

The default Startup command file `STARTUP.CMD`,

The default Reset command file `RESET.CMD`,

The default Preload command file `PRELOAD.CMD`,

The default Postload command file `POSTLOAD.CMD`.

Description

The CMDFILEn variable specifies a command file definition using the CMDFILE Command Line command. Four of these entries should exist.

These variables store the command file's status (enable/disable) and full name that you specify either with the CMDFILE Command Line command or by using the Command Files dialog.

```
CMDFILE0=CMDFILE STARTUP ON "startup.cmd"
CMDFILE1=CMDFILE RESET ON "reset.cmd"
CMDFILE2=CMDFILE PRELOAD ON "preload.cmd"
CMDFILE3=CMDFILE POSTLOAD ON "postload.cmd"
```

Index

Symbols

A

B

C

D

E

F

G

H

I

L

M

N

P

R

S

T

U

V

W