

M68ICS08SOM/D

June 2000

**M68ICS08
68HC08 In-Circuit Simulator
Operator's Manual**

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

This chapter provides an overview of Motorola's M68ICS08 in-circuit simulator packages, and a quick-start guide for setting up a development project.

The ICS packages (e.g., RKICS, GPICS) are stand-alone development and debugging aids for designers using various MC68HC908 microcontroller unit (MCU) devices. Each package contains both the hardware and software needed to develop and simulate source code for, and to program, one type of Motorola MC68HC908 microcontroller. For example, the RKICS contains the M68ICS08RK2 (hardware) and ICS08RK[®] (software), which allow the user to develop for Motorola's MC68HC908RK2 microcontroller. Refer to the proper *M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL* for detailed information about your specific M68ICS08 hardware.

The ICS hardware and software form a complete simulator and limited real-time I/O (input/output) emulator for a particular MC68HC908 MCU device.

- With the ICS08Z[®] in-circuit simulator, the ICS can be used to input/output signals from the simulator engine.
- With the ICD08SZ[®] software, the ICS can be used as a limited real-time emulator.
- With the PROG08SZ[®] software, the ICS can be used to program MCU FLASH memory.

Use the ICS package with any IBM Windows 95, Windows 98, or Windows NT-based computer with a serial port.

1.2 ICS08 INTERFACE SOFTWARE PACKAGE

Windows-optimized software components, in this example collectively referred to as the ICS08**RK** software, include:

- WINIDE.EXE — Integrated development environment (IDE) software interface to the MC68HC908-based hardware for editing and performing software or in-circuit simulation
- CASM08Z.EXE — CASM08Z[®] command-line cross-assembler
- ICS08**RK**Z.EXE* — In-circuit/stand-alone simulator software for the MC68HC908**RK**2 MCU
- PROG08SZ.EXE — FLASH memory programming software
- ICD08SZ.EXE — Limited, real-time, in-circuit debugging software

***If your package is for a different MCU part, substitute the name of your part for RK.**

Note: In this documentation, the part number **ICS08Z** will be understood to refer to the In-Circuit Simulator component of the software package, while **ICS08** will refer to the *entire* software package.

1.2.1 Software Requirements

The ICS08 software requires this minimum hardware and software configuration:

- An IBM-compatible host computer running Windows 95, Windows 98 or Windows NT operating system
- Approximately 5 MBytes of available random access memory (RAM) and 5 MBytes of free disk space
- A serial port for communications between the ICS board and the host computer

1.3 ICS08 PACKAGE FEATURES

The ICS08 package is a low-cost development system that supports editing, assembling, in-circuit simulation, in-circuit emulation, and FLASH memory programming. Its features include:

- Editing with WinIDE[®]
- Assembling with CASM08Z
- FLASH memory programming with PROG08SZ

- In-circuit and stand-alone simulation of a particular MC68HC908 MCU with ICS08Z software, including:
 - Simulation of all instructions, memory, and peripherals
 - Optional simulator pin inputs from the hardware
 - Conditional breakpoints, script files, and logfiles
- Limited real-time emulation and debugging with ICD08SZ, including:
 - Loading code into RAM
 - Executing real-time in RAM or FLASH
 - One hardware breakpoint in FLASH, if supported by your specific processor
 - Multiple breakpoints in RAM
- On-line help documentation for all software
- Software integrated into the WinIDE environment, allowing function key access to all applications
- Emulation connection to the hardware

1.4 ABOUT THIS OPERATOR'S MANUAL

1.4.1 Chapter Organization

This manual covers the M68ICS08 package software, hardware, and reference information:

Chapter 2— Software Installation and Initialization

Chapter 3— WinIDE User Interface

Chapter 4— CASM08Z Assembler Interface

Chapter 5— ICS08Z In-Circuit Simulator

Chapter 6— PROG08SZ FLASH memory Programmer

Chapter 7— ICD08SZ In-Circuit Debugger

Chapter 8— Debugging Command Set

Appendix A — S-Record Information

Appendix B— Glossary

Note: The procedural instructions in this operator's manual assume that you are familiar with the Windows interface and selection procedures.

Figures in this manual show the ICS08 software's windows and dialog boxes as they appear in the Windows 95 environment.

1.4.2 Document Conventions

This manual uses the following conventions to enhance readability:

- Filenames, program names, code, and commands are indicated in regular Courier New font:

SETUP . EXE

MYPDA . ASM

\$INCLUDE "INIT . ASM"

- Parameters and strings are indicated in italic Courier:

%FILE%

- Buttons, icons, functions, and keyboard keys are indicated in small caps:

Press the ENTER key.

Type CTRL + N or click the NEW toolbar button.

Double-click on the PROGRAM GROUP icon for your particular ICS08 software.

The RESET function of the ICS package is both an input and an output.

- Menu names, options, and tabs are indicated in bold:

Do this by checking the **Main File** option in the *Environment Settings* dialog's **General Options** tab.

- Dialog, edit, text, and lists boxes are indicated in initial cap italics:

Open the *Open File* dialog.

Select the filename in the *File Name* list.

Use the filename in the *Main filename* edit box.

- Statement, confirmation, data entry, and field text are indicated in Courier:

This option displays an Exit Application confirmation message.

This new filename replaces the [NONAME#] in the title bar.

1.5 SOFTWARE QUICK START INSTRUCTIONS

For users experienced in installing Motorola or other development tools, the following steps provide a quick start installation procedure for the ICS Package hardware and software.

For more complete instructions, refer to the ***M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL*** for your specific

part.

1. Install the ICS08 software package.

To start the software installation, run the `SETUP.EXE` program on diskette 1. During installation, follow the instructions in the installation wizard.

2. Connect the board as described in the *M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL* for your specific part.

3. Start the WinIDE editor.

Start the editor either from the Windows **Start** menu or by double-clicking its icon.

WinIDE is an editing application which allows seamless integration of several different programs into one development environment.

Function keys are provided which allow one touch code assembly (F4), as well as switching to other applications such as the Simulator (F6), Programmer (F7), and Debugger (F8).

WinIDE is shipped so that it will open a `.PPF` demo project when it is run for the first time. If you have the ICS08RKZ, for example, this file will be called `HC08RK2.PPF`.

A project in WinIDE keeps track of what editing files are open, as well as settings that indicate which external programs are currently configured to run from WinIDE. Upon running WinIDE, two files will be open for editing:

- `WELCOME.ASM` – This file contains an overview of the ICS08 package, and briefly describes the different software components installed in the package. It is strongly recommended that you read this file before continuing.
- `DEMO[xxx].ASM` – This is a sample application for your particular part that can be compiled and run, and provides a framework for you to create your own application. In the ICS08JLZ package, for example, this file would be called `DEMOJL3.ASM`

The following file is not open, but is used in the assembly process.

- `[xxx]REGS.INC` – This is an include file which is used by the sample application. It defines symbols for all the registers on the particular MC68HC908 processor. In the ICS08JLW package, for example, this file would be called `JL3REGS.INC`.

- For more information, see the “Getting Started” section in the **Manual Addendum** for your specific processor.

4. Assemble the code

Press the ASSEMBLE/COMPILE FILE button (see **Figure 1-1**) on the WinIDE Toolbar to assemble the source code in the active WinIDE window. Additional information about the CASM08Z assembler can be found in **CHAPTER 4 – CASM08Z ASSEMBLER INTERFACE**.



Figure 1-1. WinIDE Assemble/Compile File Toolbar Button

Alternative: Press the F4 function key.

5. Run the ICS08Z simulator.

With a project or source file open in the WinIDE main window, click the IN-CIRCUIT SIMULATOR button (see **Figure 1-2**) on the WinIDE Toolbar to start the ICS08 debugger. This will debug the contents of the active source window after they have been assembled

If communications are not established with the ICS board, it may be necessary to select the proper port (COM1...COM8) and baud rate (4800...28800). When communications are established, the board's SOCKET POWER LED will light.

For more information about debugging with ICS08Z, refer to **CHAPTER 5 – ICS08Z IN-CIRCUIT SIMULATOR**.



Figure 1-2. WinIDE In-Circuit Simulator Toolbar Button

Alternative: Press the F6 function key.

6. Run the PROG08SZ programmer.

Press the PROGRAM button (see **Figure 1-3**) on the WinIDE Toolbar to start the programmer. Additional information about PROG08SZ can be found in **CHAPTER 6 – PROG08SZ FLASH PROGRAMMER**.



Figure 1-3. WinIDE Program Toolbar Button

Alternative: Press the F7 function key.

7. Run the ICD08SZ real-time debugger.

Press the IN-CIRCUIT DEBUGGER button (see **Figure 1-4**) on the WinIDE Toolbar to start the ICD08SZ in-circuit debugger and emulator. Additional information can be found in **CHAPTER 8 – ICD08SZ IN-CIRCUIT DEBUGGER**.



Figure 1-4. WinIDE In-Circuit Debugger Toolbar Button

Alternative: Press the F9 function key.

For a step-by-step guide to getting started, refer to the “Example Project” topic in the **Manual Addendum** for your specific ICS08 Kit

1.6 MC68HC908 SECURITY FEATURE

Monitor mode is a special mode on the 68HC08 device which allows an external host to control the 68HC08 microcontroller via an asynchronous serial interface. This feature allows a host computer to query and modify the state of the processor including to load, debug, and program code. Without any protection mechanism, this same feature could be used to read out the internals of the microcontroller’s ROM.

The M68HC08 microcontrollers have an additional built-in mechanism to protect a programmed device from being read and disassembled. The mechanism allows a user who knows the security unlock code to enter monitor mode and access the internal ROM/Flash. This is often desirable to allow real-time debugging of a programmed device. The ICD08SZ allows just such functionality.

The security mechanism also allows a user who does not know the security code to enter monitor mode, but it does not give them access to the ROM. Upon failing the security protocol, the ROM/Flash is removed from the memory map until the next POWER-ON reset, in which case the host has to bypass security again. The advantage of this is that even though any on-chip flash is not READ accessible, it is erasable. Forgotten what you programmed into your device? The answer is simple: erase it.

A device is automatically protected in this manner. The 8 bytes from address \$FFF6 to \$FFFD constitute the security unlock code which can be used to pass the security check and get access to the Rom/Flash. Hence, if a user knows what has been programmed into a device, they implicitly know the security

unlock code.

In order to facilitate the security check on a 68HC08 device, the PROG08SZ software continually records any changes to these security bytes and stores them in the file SECURITY.INI. The information in this file is also shared with P&E's In-Circuit Debugger and In-Circuit Simulator Software. This allows the user to reset the device and still have access to the monitor mode.

Sometimes the software cannot pass security mode. The Target Connection and Security Dialog has a "STATUS" section which describes the different failures and what to check in each case.

The most common reasons for not passing security are:

- You are not choosing the proper security code to pass security.
- On a power on reset, the device is not powering down to below 0.1 volts. With a class I board (ICS with processor), you may be driving the pins on the emulation header while the device is being powered down. This back-drives current through the ports and doesn't let the device fully power down. On other classes of boards, when prompted to power down the device, the supply voltage might not be dropping lower than 0.1v which it must to have a power-on reset.
- Make sure the "Target hardware type" is set to the proper class of hardware.

There are several ways you can specify the proper security bytes:

- If you know the programmed security bytes, i.e. the bytes from \$FFF6-\$FFFD, you can enter them in the edit box listed "User:" and click OK(Retry).
- You can use the "Load from S19" to specify the s-record file which contains the object information currently programmed into the MCU. P&E's software will automatically extract the security information from this file and use it to pass security. Once you have specified the s-record file, click the OK(Retry) button.
- You can erase the device. Run the PROG08SZ application, and when the above box appears, select the "IGNORE security failure..." option and click OK. Use the Choose Module command to select the appropriate programming algorithm, and select Erase Module. This should erase the device. You will have to execute the Choose Module command again before you can access the blank device.

Note: on some older revisions of silicon, you cannot ignore the security failure, and it will bring this box back up every time you click OK(Retry). If this is the case, you should obtain the latest silicon revision from Motorola.

For more information on passing security and establishing communications, please read **Section 2.4 TARGET CONNECTION AND SECURITY DIALOG** carefully.

1.7 CUSTOMER SUPPORT

To obtain information about technical support or ordering parts, call the Motorola help desk at 800-521-6274.

CHAPTER 2

SOFTWARE INSTALLATION AND INITIALIZATION

2.1 OVERVIEW

This chapter summarizes and explains how to install and initialize the ICS08 software package that is used with the Motorola ICS08 board. See the *M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL* for your specific part for information about the your ICS08 board.

2.2 THE ICS08 SOFTWARE COMPONENTS

The following is a sample list of product components for the M68ICS08RK package.

If your package is for a different MCU part, substitute the name of your part for "RK."

- WINIDE.EXE — Windows integrated development environment editor
- CASM08Z.EXE — 68HC08 cross assembler
- ICS08RKZ.EXE — In-circuit simulator software, optimized for the HC08 Family of Motorola microcontrollers
- ICD08SZ.EXE — Limited real-time debugger and emulator
- PROG08SZ.EXE — FLASH memory programmer

Note: In this documentation, the part number **ICS08Z** will be understood to refer to the In-Circuit Simulator component of the software package, while **ICS08** will refer to the *entire* software package.

2.2.1 WinIDE Editor

The WinIDE editor is a text-editing application that lets you use several different programs from within a single development environment. Use the WinIDE editor to:

- Edit source code
- Launch a variety of compatible assemblers, compilers, debuggers, or programmers
- Configure the environment to read and display errors from such programs

If you select error detection options in the *Environment Settings* dialog box, the WinIDE editor will highlight errors in the source code, and display the error messages from the compiler or assembler in the editor.

2.2.2 CASM08Z Assembler

CASM08Z is a cross assembler that creates Motorola S19 object files and MAP files from assembly files containing 68HC08 instructions.

To debug source code in the simulator or debugger code window, load compatible source-level map files. CASM08Z produces such map files as an output by default.

The CASM08Z assembler supports all 68HC08 instructions and addressing modes. It can produce .S19 object files, .MAP files, and .LST absolute listing files. The listing files can be configured to show cycle counts.

The assembler also supports macros and conditional assembly. **CHAPTER 4 – CASM08Z ASSEMBLER INTERFACE** provides additional information about the assembler options and how to use them.

2.2.3 ICS08Z In-Circuit Simulator Software

The ICS08Z software simulates all instructions, interrupts, and peripherals for a particular M68HC908 MCU. This simulator software can get inputs and outputs (I/O) for the device when the external ICS08 board is attached to the host computer. I/O from a target board can be used when the user attaches the board to the target with the extension cable that comes with the toolkit.

Some peripherals, such as the SCI and SPI, transmit characters based on the exact frequency of the ICS board, whereas the timer pins are controlled cycle by cycle as the PC application simulates cycles.

The simulator can also work in stand-alone mode, without the board attached to the host computer. In this case, simulator inputs can be specified using the INPUTx commands.

You can start or move to the ICS08Z in-circuit simulator software from the WinIDE editor. The ICS08Z software also can be started using standard Windows techniques and run independently of the WinIDE editor.

The ICS08Z simulator software accepts standard Motorola .S19 object code

files as input for object code simulation and debugging. If you are using a third-party assembly- or C-language compiler, the compiler must be capable of producing source-level map files to allow source-level debugging.

2.2.4 ICD08SZ In-Circuit Debugger

ICD08SZ allows limited real-time debugging of MC68HC908 MCUs. Unlike the simulator, the ICD allows reading, writing, and controlling execution of the actual processor. Code can be loaded into RAM, and code in RAM or FLASH can be executed in real time or in single steps. For debugging in RAM, multiple software breakpoints are available. For debugging in FLASH memory, one hardware breakpoint is available if it is supported by your specific MCU. For more details, see the **Manual Addendum** for your specific M68HC908 device.

2.2.5 PROG08SZ FLASH Programmer

PROG08SZ allows erasing, programming, and verification of the MCU's FLASH memory. Individual bytes may be programmed or a .S19 object file may be used as the source.

2.3 INSTALLING THE ICS08 SOFTWARE PACKAGE

The ICS08 software package is supplied on three 3.5-inch diskettes. Diskette 1 contains a setup program that automatically installs the software into the host PC's hard drive.

2.3.1 Installation Steps

To install the software on the host computer's hard drive, follow these steps:

1. Insert floppy disk 1 or CD into the appropriate drive:
2. From the **Start Menu**, select the **Run** option.
3. In the *Run* dialog box, enter Setup (or click the BROWSE button to select a different drive and/or directory) and press OK.
4. In the ICS08 **Setup Wizard**, follow the instructions that appear on the screen.

Table 2-1 lists the files and directories required to control the ICS08RK program modules.

If your package is for a different M68HC908 MCU part, substitute the name of your part for “RK” where it appears below:

Table 2-1. ICS08RK Software Files

Filename	Description
casm08z.exe casm08z.hlp	Windows cross assembler for the 68HC08 Help for CASM08Z
icd08sz.exe icd08sz.hlp	Windows in-circuit debugger Help for ICD08SZ
ics08rkz.exe ics08rkz.hlp	Windows in-circuit simulator (ICS08Z) Help for ICS08RKZ
prog08sz.exe prog08sz.hlp	Windows FLASH programmer Help for PROG08SZ
winide.exe winide.hlp	Windows integrated development environment (WinIDE) Help for WinIDE
rkzstart.pdf	Getting Started document for 68HC908RK2

2.3.2 Starting the ICS08 Software

From the Windows 95, 98, or NT **Start Menu**, select the WINIDE and/or ICS08 icon(s).

The other ICS08 software components may be started alone or from within the WinIDE editor. If CASM08Z is started alone, a list of command line options appears. On the first attempt to connect to the ICS08 board after installing the ICS08Z in-circuit simulator software, you are prompted to select the chip from the *Pick Device* dialog box (see **Figure 2-1**):



Figure 2-1. Pick Device Dialog Box

2.4 TARGET CONNECTION AND SECURITY DIALOG

The following is an explanation of each part of the target connection dialog. For information on passing security mode, read this topic carefully, and refer to **Section 1.6 MC68HC908 SECURITY FEATURE**.

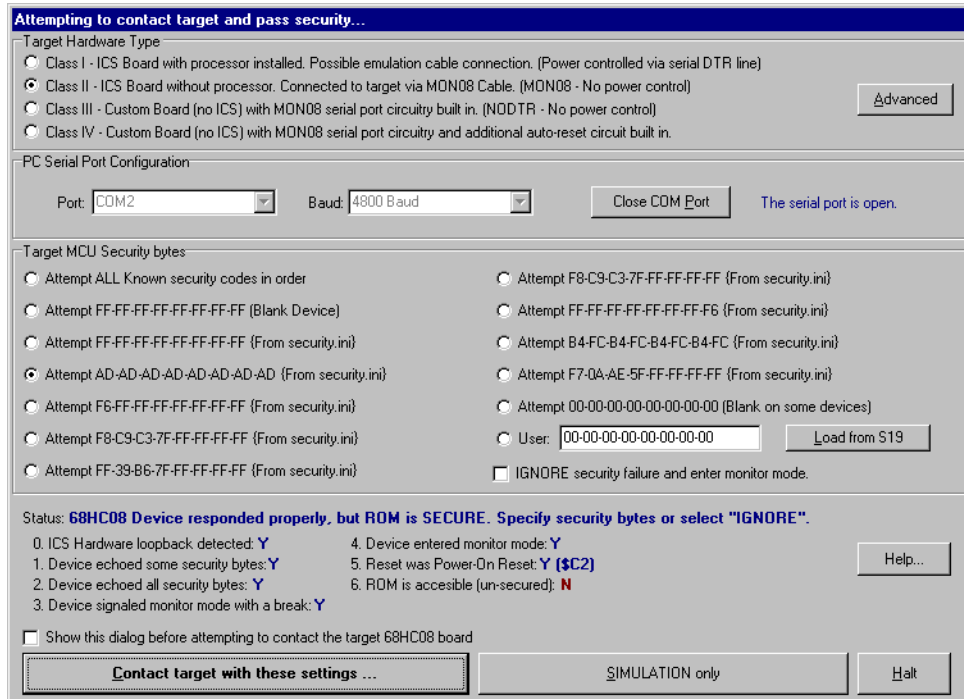


Figure B-2. Target Connection And Security Dialog Box

2.4.1 TARGET HARDWARE TYPE

This section of the dialog allows you to select the type of hardware configuration to which you are trying to connect, as well as modify specific protocol settings.

2.4.1.1 Class Of Target Board

There are several different configurations of target boards, and P&E's MON08-based applications communicate to each type of hardware a little differently. Almost all configurations are Class I or Class II. The options are:

Class I

ICS Board with processor installed. This is the standard and most common configuration of the ICS08 boards. In this configuration, the processor is resident in one of the sockets on the ICS board itself. The processor can be debugged and programmed in this configuration, and an emulation cable containing all the processor I/O signals can be connected to the user's

target board. In this configuration, the ICS board hardware can automatically power up and down the processor in order to pass security in the simplest fashion. The user has to be sure **not** to provide power from the target, up through the emulation cable, to the processor pins themselves, when this dialog appears. This is so that the software, when attempting to establish communications, can fully power the processor down. The software running on the PC controls power to the target via the serial port DTR line. This configuration can be specified at startup in the software by using the **ICS08** command-line parameter; otherwise the software will remember the hardware configuration from session to session.

Class II

ICS Board without processor, connected to target via MON08 Cable. In this configuration, there is no processor resident in any of the sockets of the ICS board itself. The processor is mounted down in the target system. The connection from the ICS board to the target is accomplished via the 16-pin MON08 connector. In this configuration, since the ICS does not control power to the processor, the user will be prompted to turn the processor's power supply on and off. Turning off the power supply is necessary in order to be able to pass the initial security mode check and access the flash on the processor. A simple reset is not enough; to pass the security check, you must first force the processor to encounter a POR (power-on reset) which requires that the processor's voltage dip below 0.1v. Once security has been passed, resetting the device or re-entering the software should be easier. This configuration can be specified at startup in the software by using the **MON08** command-line parameter; otherwise the software will remember the hardware configuration from session to session.

Class III

Custom Board (no ICS) with MON08 serial port circuitry built in. In this configuration, the ICS board is not used at all. The user must provide a serial port connection from the PC, and provide all hardware configuration necessary to force the processor into MON08 mode upon reset. This includes resets both internal and external to the processor. In this configuration, because the software does not directly control power to the processor, the user will be prompted to turn the processor's power supply on and off. The user will also be prompted to turn power on and off to reset the target processor, as the PC doesn't have control of the target reset. Turning off the power supply is necessary mainly to be able to pass the initial security mode check and access the flash on the processor. A simple reset is not enough; to pass the security check, you must first force the processor to encounter a POR (power-on reset) which requires that the processor's voltage dip below 0.1v. Once

security has been passed, resetting the device or re-entering the software should be easier. This configuration can be specified at startup in the software by using the **NODTR** command-line parameter; otherwise the software will remember the hardware configuration from session to session. The Class III selection also applies to use of the ICS board with the two-pin blank part programming connector.

Class IV

Custom Board (no ICS) with MON08 serial port circuitry and additional auto-reset circuit built in. In this configuration, the ICS board is not used at all. The user must provide a serial port connection from the PC and all hardware configuration necessary to force the processor into MON08 mode upon reset. In addition, the user must include an extra circuit which allows the reset line of the processor to be driven low from the DTR line of the serial port connector (Pin 4 on a DB9). The following diagram shows the additional connection needed to reset from a DB9 serial connector.

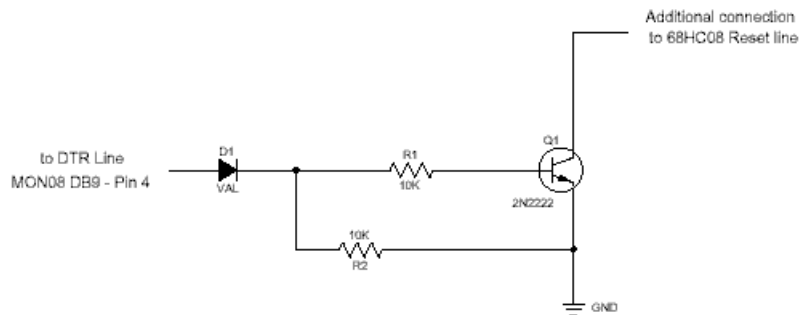


Figure B-3. Additional Connection To Reset From DB9

In this configuration, because the software does not directly control power to the processor, the user will be prompted to turn the processor's power supply on and off. Turning off the power supply is necessary in order to be able to pass the initial security mode check and access the flash on the processor. A simple reset is not enough; to pass the security check, you must first force the processor to encounter a POR (power-on reset) which requires the processor's voltage to dip below 0.1v. Once security has been passed, resetting the device should be facilitated by the above circuitry. This configuration can be specified at startup in the software by using the **NODTRADD** command-line parameter;

otherwise the software remembers the hardware configuration from session to session.

Also:

For the simulator, the `/SIM08` command-line parameter causes the software to disconnect from the target and enter Simulation Only mode.

For information on passing security mode, read this topic carefully and also refer to **Section 1.6 MC68HC908 SECURITY FEATURE**.

2.4.1.2 Advanced Settings Dialog

The Advanced Button brings up a dialog which allows the user to set specific protocol settings. The following is an explanation of each part of the advanced settings dialog.

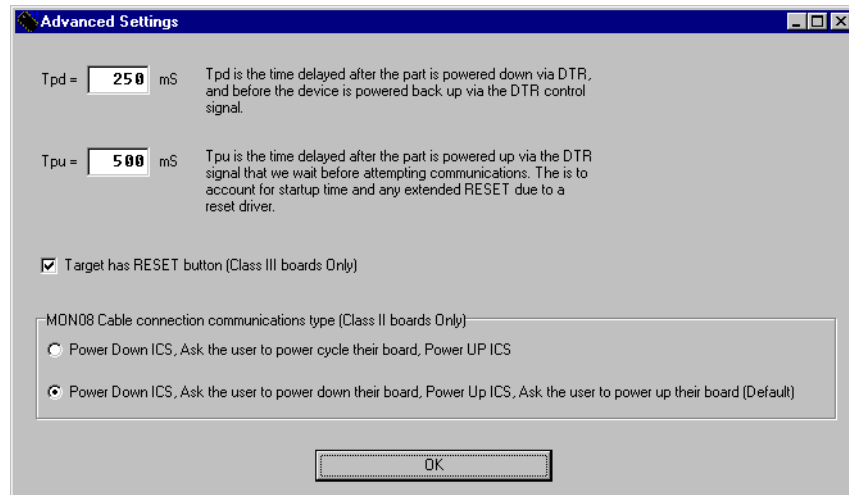


Figure B-4. Target Hardware Type: Advanced Settings Dialog

2.4.1.3 Tpd and Tpu Timing

These timing parameters are mostly designed for Class I boards, although the delays are valid for all classes of boards. Many of the ICS boards and user target boards need time to power down and power up.

Whenever power is automatically switched off, or is manually requested to be switched off, the software waits for an amount of time equal to the Tpd delay time before proceeding to the connection protocol. This is because a board or power supply may have capacitance which holds the power up for a short time after the supply has been switched off, but the supply voltage must reach less than 0.1v before it is turned back on if a Power-On reset is to occur.

Whenever power is automatically switched on, or is manually requested to be switched on, the software waits for an amount of time equal to the Tpu delay

time before attempting to contact the 68HC08 processor. This is to allow time not only for power to be fully available, but to wait until any reset driver has finally released the RESET line. On many ICS08 boards (such as the ICS08RK, M68ICS08JL3, M68ICS08JLJK, and ICS08GP20) the Tpu can be decreased to as little as 250ms with no adverse affects .

Target has RESET button (class III boards only): The software occasionally needs to get control of the target. On systems which are Class III boards with the monitor mode circuitry built-in (including RS-232 driver), there is no means to reset the target to gain control. If the board has a reset button, the software can use this to gain control of the target system. If this option is checked, the software will prompt the user to push the target reset button when a reset of the target system is desired. If the option is unchecked, the software will ask the user to power cycle the target system to achieve a reset.

2.4.1.4 **MON08 Cable connection communications type (Class II boards Only)**

This selection box is valid only for Class II hardware configurations using the MON08 cable. It allows the user to specify the sequence that the software uses to power up the ICS system. When the software tries to create a power-on reset condition, two events must occur:

1. Power of the target MCU must go below 0.1v. This means that the processor can not be receiving power from its power pins, nor can it have a significant voltage being driven on port pins or the IRQ line, as these will drive the MCU power back through these pins. It is crucial, therefore, to have the ICS and the Target both powered down at some point in time.
2. The processor MON08 configuration pins, including IRQ, must be properly driven when the target processor resets to drive it into monitor mode. If these pins are not set up properly before the processor powers up, the processor may start up in user mode.

Power Down ICS, Ask the user to power down their board, Power Up ICS, Ask the user to power up their board

This is the default option and should work for most, if not all, ICS08/Target Board solutions. Refer to the manual addendum under startup for the settings for a specific ICS board. It requires the user go through two dialog stages, and requires more time than simply cycling the power.

1. Software automatically powers down the ICS.

2. Software Asks the user to power down the board as follows:

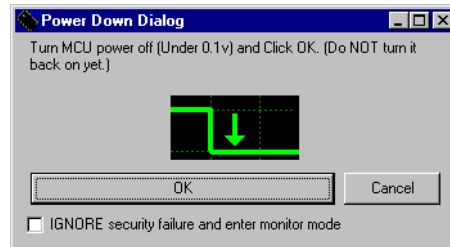


Figure B-5. Power Down Dialog

3. Software automatically powers up the ICS, which configures the processor's MON08 configuration pins.
4. Software asks the user to power up the board as follows:

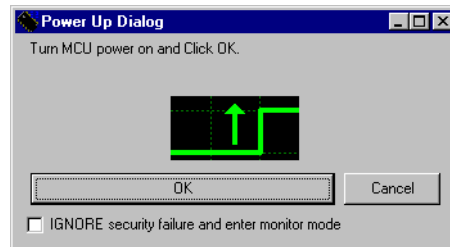


Figure B-6. Power Up Dialog

Power Down ICS, Ask the user to power cycle their board, Power UP ICS

This option will work for many ICS boards as well, but relies on the fact that while the ICS is powered off, it will hold the target in reset until it is powered up itself and has configured the MON08 configuration pins. The sequence of events in this mode is:

1. Software automatically powers down the ICS.
2. Software asks the user to power cycle their board as follows:

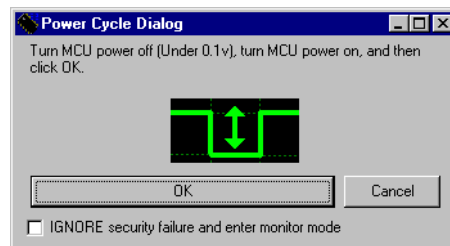


Figure B-7. Power Cycle Dialog

3. Software automatically powers up the ICS, which configures the processors MON08 configuration pins.

2.4.2 PC SERIAL PORT CONFIGURATION

This allows configuration of the COM port and baud rate that the PC uses to attempt communication to the target. The baud rate depends on the processor's port pin values during reset, and the frequency of the oscillator connected to the processor. Refer to your microcontroller part specification for information on baud rates for particular processor frequencies.

A sample list of ICS boards with targets of different frequencies is listed here:

M68ICS08JL3	4.9152MHZ	9600 Baud
M68ICS08JL3	9.8304MHZ	19200 Baud
M68ICS08JLJK	4.9152MHZ	4800 Baud
M68ICS08JLJK	9.8304MHZ	9600 Baud
ICS08GP20	4.9152MHZ	9600 Baud
ICS08GP20	9.8304MHZ	19200 Baud

If the “Port” and “Baud” setting are grayed out and cannot be changed, this is because the COM port is currently open by the software. Click the “Close COM Port” button and you will then be able to change these values.

Note that if you are using a Class II or III board and you are connecting to a target without an oscillator or crystal (i.e., the processor has an internal oscillator such as the 68HRC08JL3), you will have to provide an external clock source to the processor because, in monitor mode, an internal oscillator is automatically bypassed.

For information on passing security mode, read this topic carefully and also refer to **Section 1.6 MC68HC908 SECURITY FEATURE**.

2.4.3 TARGET MCU SECURITY BYTES

One of the steps that is necessary to properly bypass security is to provide the proper security code for the information that is programmed into the part. This holds true even when the part is blank.

The security code consists of the 8 values which are currently stored in flash locations \$FFF6 - \$FFFD of the processor. The PROG08SZ flash programming software continually records any changes to these security bytes and stores them in the file SECURITY.INI. The information in this file is shared with P&E's In-Circuit Debugger and In-Circuit Simulator software, and will appear in the dialog box. This allows the user to specify which security code to use to pass security.

This dialog can also be used by the user to manually enter the proper security bytes via the USER setting, or to load the security bytes from the same .S19 file which was programmed. The bytes are loaded from an .S19 file by

clicking the “Load from S19” button.

IGNORE security failure and enter monitor mode

This checkbox can be used to cause the software to ignore a failure to properly pass the 68HC08 security check. If the checkbox is set, the software will attempt to establish monitor mode communications regardless of the security status. As long as the Baud and Port are correct, and the device has been properly powered, this will allow monitor mode entry. Note that by ignoring the security check failure, you may use monitor mode, but the ROM/Flash will not be accessible.

The checkbox can be set to be checked on startup via the **FORCEBYPASS** command-line parameter, which will cause the software to ignore security check failure. This checkbox can be overridden to be *unchecked* on startup via the **FORCEPASS** command-line parameter, which will cause the software to pop-up the connection dialog when the security check has failed. Note that if a connection is not established for a reason other than security failure, the connection dialog will always appear.

2.4.4 STATUS

The status area consists of one status string following the “Status:” label, and seven items which list the state of the last attempt to connect to a target and pass security. The description for these items is as follows:

0 – ICS Hardware loopback detected:

Every ICS or board which supports MON08 has a serial loopback in hardware which, by connecting the transmit and receive lines, automatically echoes characters from the PC. A valid character transmitted from the PC should be echoed once by the loopback circuitry on the board and once by the monitor of the target processor itself. This status indicates whether or not the first echoed character from the hardware loopback was received when one of the security bytes was transmitted. If the status is ‘N’, which indicates that the character was not received, it is most likely due to one of the following reasons:

1. Wrong Com Port specified.
2. The baud rate specified was incorrect (probably too low).
3. The ICS/Target is not connected.
4. No Power to the ICS.

If this status bit responded with an ‘N’, you must correct this before analyzing the reset of the status bits.

1 – Device echoed some security bytes :

The monitor resident in a 68HC08 device automatically echoes every incoming character when it is in monitor mode. A valid character transmitted from the PC should be echoed once by the loopback circuitry on the board and once by the monitor of the target processor itself. This status indicates whether or not the second echoed character from the monitor response was received when one of the security bytes was transmitted. If the status is ‘N’, which indicates that the character was not received, or not received properly, it is most likely due to one of the following reasons:

1. The baud rate specified was incorrect.
2. The part did not start the monitor mode security check on reset. Signals to force monitor mode may be incorrect.
3. No Power to the ICS.

If this status bit responded with an ‘N’, you must correct this before analyzing the reset of the status bits.

2 – Device echoed all security bytes:

In order to pass security, the software must send 8 security bytes to the processor. The processor should echo each of these eight bytes twice. If all 8 bytes did not get the proper two-byte echo, this flag will be ‘N’. Reasons for this include:

1. The part did not start the monitor mode security check on reset. Signals to force monitor mode may be incorrect.
2. The baud rate specified was incorrect.
3. The processor was not reset properly. Check the “Target Hardware Type” and if you are connecting to a class II board, check the “MON08 cable communication connections type” in the “advanced settings” dialog.

3 – Device signaled monitor mode with a break:

Once the processor has properly received the 8 bytes from the PC software to complete its security check, it should transmit a break character to the PC signaling entry into monitor mode. This break should be sent regardless of whether the security check was successfully passed. If a break was not received from the processor, this flag will be ‘N’. Reasons for this include:

1. The baud rate specified was incorrect.
2. The processor was not reset properly. Check the “Target Hardware

Type”. If you are connecting to a class II board, check the “MON08 cable communication connections type” in the “advanced settings” dialog.

4 – Device entered monitor mode:

Once the software has received, or failed to receive, a break from the processor, it attempts to communicate with the monitor running on the 68HC08 processor. It tries to read the monitor version number by issuing a monitor mode read. If the processor fails to respond properly to this command, this flag will be ‘N’.

5 – Reset was Power-On Reset:

If the device properly entered monitor mode (4), the software will read the reset status register (RSR). This read does not affect the security sequence, and occurs purely for diagnostic reasons. The reset status register indicates the conditions under which the processor underwent the last reset. For the software to pass the security check properly, it **MUST** first cause the processor to undergo a Power-On Reset. The software reads the reset status register to determine if the last reset was indeed caused by power-on. The result of the reset status register is indicated in parentheses after the flag value. If the highest bit is not set then the reset was not a power on reset, and the flag will indicate ‘N’. Reasons for this include:

1. The processor did not power all the way down because power was being supplied to the processor through either the port pins, IRQ line, RESET line, or power pins.
2. The voltage driven on the power pin of the processor did not go below 0.1 volts.
3. The processor was not reset properly. Check the “Target Hardware Type”. If you are connecting to a class II board, check the “MON08 cable communication connections type” in the “advanced settings” dialog.

6 – ROM is accessible (un-secured):

If the device properly entered monitor mode (4), the software reads locations \$FFF6-\$FFFF to determine if the processor passes the security check. Memory locations which are invalid or protected read back from the device as \$AD. If all bytes from \$FFF6-\$FFFF read a value of \$AD, it is assumed the device is secure, and the flag value is an ‘N’. If all flags 0-5 register a value of ‘Y’ and flag 6 register a value of ‘N,’ then the reset process has gone correctly except that the security code used to pass security was incorrect. Specify the correct security code and try again, or IGNORE the security failure and erase the device. Once you erase a secured device, you must exit the software and restart it in order to pass

security.

2.4.5 ADDITIONAL DIALOG BUTTONS

The following buttons are also available:

Contact target with these settings – This causes the software to attempt to cause a power on reset of the target, and to attempt to pass security with the settings in this dialog.

Simulation Only – This button is only visible in In-Circuit Simulation. This causes the In-Circuit Simulator not to use the target and, instead, to do completely software-based simulation. The **/SIM08** command-line parameter has the same function.

Halt – This causes the software to terminate and return to the calling environment.

CHAPTER 3

THE WinIDE USER INTERFACE

3.1 OVERVIEW

This chapter is an overview of the WinIDE windows, menus, toolbars, dialog boxes, options, and procedures for using each.

3.2 WINDOWS INTEGRATED DEVELOPMENT ENVIRONMENT

The Windows integrated development environment (the WinIDE editor) is a graphical interface for editing, compiling, assembling, and running these external ICS08 programs:

- CASM08Z assembler
- ICS08Z in-circuit simulator
- PROG8SZ FLASH programmer
- ICD08SZ real-time in-circuit debugger

The WinIDE user interface consists of standard Windows title and menu bars, a WinIDE toolbar, a main window containing any open source or project file windows, and a status bar. The WinIDE components are labeled in **Figure 3-1** and described in **Section 3.3.2 Main Window Components**.

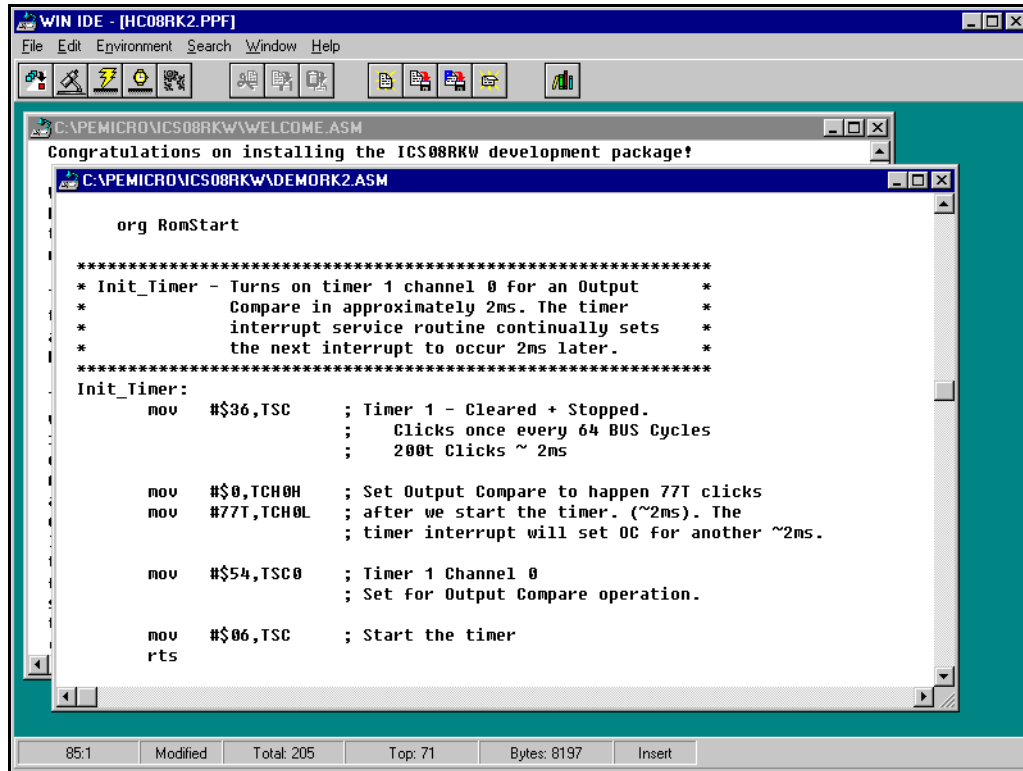


Figure 3-1. WinIDE Window Components

3.3 WinIDE MAIN WINDOW

3.3.1 Main Window Functions

When you first start the WinIDE editor, a project is loaded, and several assembly source files are automatically opened for editing. As you open or create source files or a project, they appear as subordinate windows in the main window. You can move, size, and arrange subordinate windows using standard Windows techniques and the WinIDE Window menu options.

Use the WinIDE main window to:

- Open, create, edit, save, or print source (*.ASM, *.LST, *.MAP, and *.S19) or project (*.PPF) files.
- Configure the desktop and environment settings for the editor, assembler, compiler, debugger, and other programs.
- Launch the in-circuit simulator, compiler, debugger, programmer, or another program.

3.3.2 Main Window Components

Figure 3-1 shows how the WinIDE main window might look during a typical editing project and labels the standard window components:

- **Title bar** — The title bar appears at the top edge of the main window and contains:
 - The application title
 - The name of the currently open project file
 - Windows control buttons for closing, minimizing, or maximizing the window
- **Menu bar** — The menu bar appears immediately below the title bar and contains the names of the WinIDE menus.
- **Toolbar** — The WinIDE toolbar appears just below the menu bar and contains shortcut buttons for frequently used menu options.
- **Main window** — The main window area is the inside portion of the main window which contains the open subordinate windows that you can resize, reposition, minimize, or maximize using standard Windows techniques or Window menu options.
- **Status bar** — The status bar (see **Figure 3-2**) appears along the bottom edge of the main window and contains a number of fields (depending on the project) that show:
 - Source file line and column numbers of the blinking insertion point cursor
 - System status or progress of the current window; for example, when the window is edited, the status will be modified
 - Total number of lines in the active window
 - Top — the current line position in the file of the top of the active window
 - Bytes — displays the total number of bytes in the active window
 - Insert/overwrite mode — indicates the current typing mode

The status fields expand and contract as client area contents change and files become active.

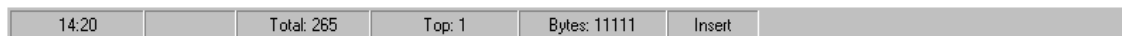


Figure 3-2. WinIDE Status Bar

3.4 GETTING STARTED

3.4.1 Prerequisites for Starting the WinIDE Editor

Before you can start the WinIDE editor, the Windows operating environment must be running and the ICS08 software package must be installed on the host computer.

Remember that for the ICS08 In-Circuit Simulator to run with the ICS08 board, the asynchronous communications cable must connect the ICS08 board to the host computer, and the power to the board must be on. See the *M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL* for your specific part for instructions on connecting the board to the host computer. Stand-alone simulation can be done without the ICS board using Simulation Only mode.

3.4.2 Starting the WinIDE Editor

To start the editor, select the WinIDE icon by double-clicking the PROGRAM GROUP icon for your ICS08 software in the Windows 3.1 program manager or by selecting the icon from the Windows 95 **Start** menu.

3.4.3 Opening Source Files

To open files within WinIDE, choose the **Open** option from the **File** menu (or click the FILE button on the WinIDE toolbar). In the *Open File* dialog box, choose the files that will make up your project:

1. Select the drive and the directory folder containing the files to be opened.
2. You may use the *Filename* text box to specify a filename or a wildcard/extension to filter the list of filenames (or choose a file type from the *List files of type* list). The default file type is .ASM, but you can also choose:
 - *.c — source code files
 - *.lst — listing files
 - *.txt — text files
 - *.* — all files

To add more filter types, change the environment settings with the **General Editor** tab in the main menu.

When all of the project files have been selected, click the OK button to open the files in the WinIDE main window.





3.4.4 Navigating in the WinIDE Editor

To navigate among the several subordinate windows in which the project files are displayed in the WinIDE main window:

- Choose the subordinate window’s filename from the **Window** menu or click on the file’s title bar to bring it to the front of the cascaded stack.
- If you have multiple files open in the editor, you may choose the **Tile** option from the **Window** menu to lay out all of the sub-windows so that all are visible, or choose the **Cascade** option to arrange all windows so that only the top window is entirely visible.
- Regardless of how you arrange the windows, the title bars of all windows are visible.

To move between the WinIDE editor and the external ICS08 software components, use the toolbar buttons or function keys shown in **Table 3-1**. To switch back to the editor from a program, click the program’s BACK TO EDITOR toolbar button.

Table 3-1. Navigating Between External Programs

Switch To	Toolbar Button	EXE Tab	Function Key
CASM08Z Assembler		—	F4
ICS08Z Simulator		EXE1	F6
PROG08SZ Programmer		EXE2	F7
ICD08SZ Debugger		EXE3	F8

For a complete description of all the WinIDE toolbar buttons, see **Table 3-2**.

3.4.5 Using Markers

Markers provide a convenient way to mark multiple points in a file for navigating between frequently visited locations while you are editing. You can set as many as 10 markers in source files in the WinIDE editor. A marker appears in the file as a small button labeled with the marker number.

When you save the project, the WinIDE editor saves the markers for all open edit files as well, so that when you open the project again, the markers are still set.

To set a marker anywhere in the file:

1. Place the cursor on the line where you want the marker to be.
2. Press CNTL + SHIFT + *N*, where *N* is a value from 0 to 9 indicating the marker number. A marker appears at the far left of the line.

To move to a marker, press CNTL + *N*, where *N* denotes a marker number between 0 and 9. This feature is useful when editing a large file.

Markers can also be set, changed, navigated to, or cleared using options on the **Edit** shortcut menu (see **Figure 3-3**). Open the **Edit** shortcut menu by clicking the right mouse button in any edit window.

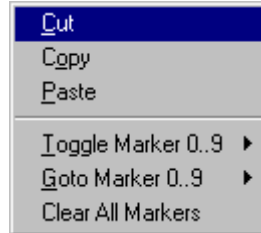


Figure 3-3. WinIDE Edit Shortcut Menu

To set or clear a marker using the **Edit** shortcut menu options, follow these steps:

1. With the cursor in any editing window, click the right mouse button to open the shortcut menu.
2. Position the cursor on the line where the marker should appear. Click the right mouse button to display the shortcut menu.
3. Click the **Toggle Marker 0-9** option to open the list of markers.
4. Click once on the marker to toggle. When the marker number is checked, it is toggled on; when the marker number is unchecked, it is toggled off.

To move to a marker number using the shortcut menu options:

1. With the cursor anywhere in the edit file, click the right mouse button to open the **Edit** shortcut menu.
2. Click on the **Go To Marker 0-9** option to open the **Marker** sub-menu (see **Figure 3-4**), and choose the marker number to move to.

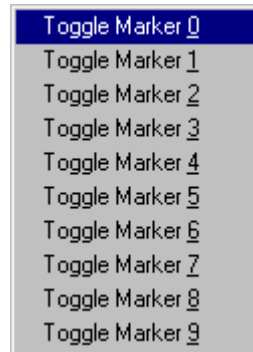


Figure 3-4. Marker Sub-menu

You can execute many WinIDE menu options using either keyboard commands or toolbar buttons. For example, to move to a marker, press the CTRL + SHIFT + *N* key combination, where *N* is the marker number.

3.5 COMMAND-LINE PARAMETERS

The WinIDE editor lets you specify command-line options to pass to each executable program. The name of the currently edited file, or some derivative thereof, can be passed within these options. To pass the current filename, specify a parameter `%FILE%`. The WinIDE editor substitutes this string with the current filename at execution time. You may also change the extension of the passed filename, by specifying it within the `%FILE%` parameter. For example, to specify an `.S19` extension on the current filename, specify a `%FILE.S19%` parameter. For example, if the current filename being edited is `MYPDA.ASM`:

Parameters Specified	Parameters Passed (w/o quotes)	Parameters Passed (w/ quotes)
<code>%FILE% S L D</code>	<code>MYPDA.ASM S L D</code>	<code>"MYPDA.ASM" S L D</code>
<code>%FILE.S19% 1 @2</code>	<code>MYPDA.S19 1 @2</code>	<code>"MYPDA.S19" 1 @2</code>

Although it is by default the currently edited filename that is used in the `%FILE%` parameter substitution, the environment can be configured always to pass the same filename. Do this by checking the **Main File** option in the *Environment Settings* dialog box's **General Options** tab. This technique is useful if you want to pass a specific filename to the external program without regard to what is being edited.

Note: All external programs have a checkbox option to allow the user to specify whether or not to enclose the filename in double quotes. Double quotes are necessary if your filename has spaces in it, so that the computer will interpret multiple words as one parameter.

3.6 WinIDE TOOLBAR














The WinIDE toolbar (see **Figure 3-5**) provides a number of convenient shortcut buttons that duplicate the function of the most frequently used menu options. A tool tip or label pops up when the mouse button lingers over a toolbar button, identifying the button's function.



Figure 3-5. WinIDE Toolbar

Table 3-2 identifies and describes the WinIDE toolbar buttons and function keys.

Table 3-2. WinIDE Toolbar Buttons

Icon	Button Label	Button Function
	EXTERNAL PROGRAM 1 Function Key: F6	Call the External Program 1 specified in the <i>Environment Settings</i> dialog box's EXE 1 tab. Default: ICS08 Simulator
	EXTERNAL PROGRAM 2 Function Key: F7	Call the External Program 2 specified in the <i>Environment Settings</i> dialog box's EXE 2 tab. Default: PROG08SZ
	EXTERNAL PROGRAM 3 Function Key: F8	Call the External Program 3 specified in the <i>Environment Settings</i> dialog box's EXE 3 tab. Default: ICD08SZ
	EXTERNAL PROGRAM 4 Function Key: F9	Call the External Program 4 specified in the <i>Environment Settings</i> dialog box's EXE 4 tab.
	ASSEMBLE/COMPILE FILE Function Key: F4	Assemble or compile the active source window, using CASM08Z.
	CUT	Cut the selected text from the active source window (this button is a shortcut for the Edit - Cut menu option).
	COPY	Copy the selected text in the active source window to the Windows clipboard (this button is a shortcut for the Edit - Copy menu option).
	PASTE	Paste the contents of the Windows clipboard at the insertion point location in the active source window (this button is a shortcut for the Edit - Paste menu option).
	OPEN FILE	Close the active source window (this button is a shortcut for the File - Open menu option).
	SAVE FILE	Save the file in the active source window (this button is a shortcut for the File - Save menu option).
	SAVE PROJECT (ALL FILES & SETUP)	Save the active project (this button is a shortcut for the Environment - Save Project As menu option).
	CLOSE FILE	Close the active source window (this button is a shortcut for the File - Close menu option).
	VIEW REGISTER FILES	Set up peripheral registers interactively.

3.7 WinIDE MENUS

Table 3-3 summarizes WinIDE menu titles and options.

Table 3-3. WinIDE Menus and Options Summary

Menu Title	Option	Description
File	New File	Open a new file window (No name).
	Open File	Display the <i>Open File</i> dialog box to choose a file to open.
	Save File	Save the current file.
	Save File As	Open the <i>Save As</i> dialog box to choose a directory and filename in which to save the current file.
	Close File	Close the current file.
	Print	Open the <i>Print</i> dialog box to print the current file.
	Print Setup	Open the <i>Print Setup</i> dialog box to choose printer options.
	Exit	Close the WinIDE editor.
Edit	Undo	Undo the last action.
	Redo	Redo the last action.
	Cut	Cut the selection to the clipboard.
	Copy	Copy the selection to the clipboard.
	Paste	Paste the contents of the clipboard.
	Delete	Delete the selection.
	Select All	Select all text in the current window.

Table 3-3. WinIDE Menus and Options Summary (Continued)

Menu Title	Option	Description
Environment	Open Project	Open the <i>Specify Project File to Open</i> dialog box.
	Save Project	Save the current project.
	Save Project As	Open the <i>Specify Project File to Save</i> dialog box.
	Close/New Project	Close the current project file or open a new project file if no current file.
	Set Up Environment	Open the <i>Environment Settings</i> dialog box to change these settings: <ul style="list-style-type: none"> – General Environment – External EXE 2 – General Editor – External EXE 3 – Assembler/Compiler – External EXE 4 – External EXE 1
	Set Up Font	Open the <i>Font</i> dialog box to specify font options for the text in the current file.
Search	Find	Open the <i>Find</i> dialog box to enter a search string.
	Replace	Open the <i>Replace</i> dialog box to enter a search and replacement string.
	Find Next	Go to the next occurrence of the search string.
	Go to Line	Open the <i>Go to Line Number</i> dialog box and enter a line number to go to in the current file.
Window	Cascade	Cascade open windows with active window on top.
	Tile	Tile open windows with active window on top.
	Arrange Icons	Arrange minimized window icons along the bottom edge of the main window.
	Minimize All	Minimize all open windows.
	Split	Toggle a split window in the active file.
	Windows (by name)	Itemize the open and minimized windows by name in order of opening.
Help	Contents	Opens the <i>WinIDE Help Contents Page</i> of the help file.
	About	Displays the WinIDE About Window.

3.8 WinIDE FILE OPTIONS

This section describes the WinIDE **File** menu options for managing and printing source files or exiting the WinIDE editor.

To select a **File** option, click once on the **File** menu title to open the **File** menu (see **Figure 3-6**). Click on an option to perform the operation. Use accelerator or shortcut keystrokes to execute the option.

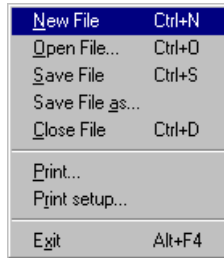


Figure 3-6. WinIDE File Menu

3.8.1 New File

Choose **New File** from the **File** menu to open a new client window in the WinIDE main window. The title of the new window in the title bar defaults to [NONAME#], where # reflects the number of new source windows created during this session. If there is an active project, the project name appears in the title bar. If there is no project, [No Project] precedes the window name.

Use this new window to enter source code. When you save the contents of this window, the WinIDE editor prompts you for a new filename. This new filename replaces the [NONAME#] in the title bar.

Alternatives: Type CTRL + N or click the NEW toolbar button. This is the keyboard equivalent to choosing the **File - New File** menu option.

3.8.2 Open File

Choose **Open File** from the **File** menu to open the *Open File* dialog box (Figure 3-7) and choose an existing filename, file type, directory, and network (if applicable) to open.

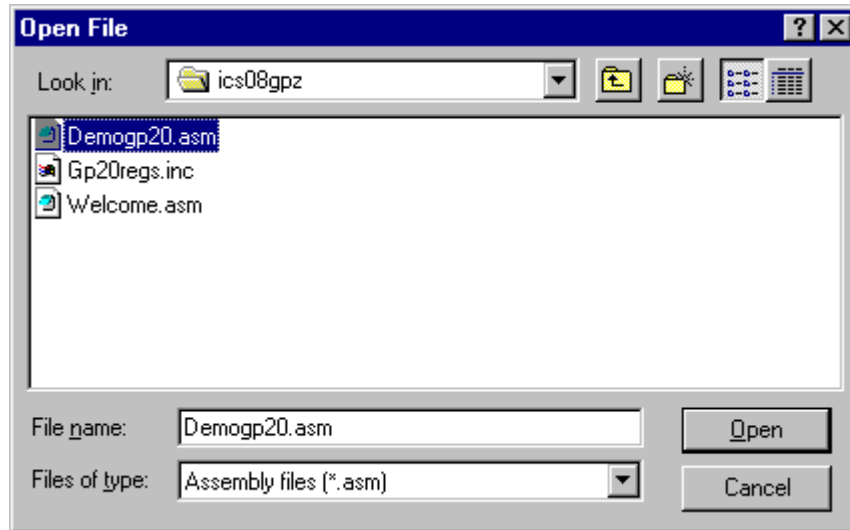


Figure 3-7. Open File Dialog Box

Each file opens in its own client window within the main WinIDE window.

Alternatives: Type CTRL + O or click the OPEN button on the toolbar. This is the keyboard equivalent to choosing the **File - Open File** menu option.

3.8.3 Save File

Choose **Save File** from the **File** menu to save the file in the active source window.

- If you are saving the file for the first time (that is, it has not yet been named), the *Save As* dialog box appears. Enter a new filename for the file and accept the current file type, directory or folder, and drive, or choose new options. Press the OK button to save the file to the selected drive/directory.
- If the file has been saved previously (and has a name), the file is saved with the filename, in the directory and drive previously specified, and the source window remains open.

Alternatives: Type CTRL + S or click the SAVE button on the toolbar. This is the keyboard equivalent to choosing the **File - Save File** menu option.

3.8.4 Save File As

Choose **Save File As** from the **File** menu to save the contents of the active source window and assign a new filename. The *Save As* dialog box opens. Enter a new file name in the **File Name** field and click the OK button to save the file and return to the source window.

To save the file with the name of an existing file, select the filename in the *File Name* list, and click the OK button. A *Confirmation* dialog box will ask you to confirm that you want to overwrite the existing file.

3.8.5 Close File

Choose **Close File** from the **File** menu to close the file in the active source window.

If you chose the **Give user option to save each file** option in the **General Environment** tab in the *Environment Settings* dialog box, the *Information* dialog box will display, reminding you to save changes to the .ASM file.

Alternatives: Type CTRL + D or click the CLOSE toolbar button. This is the keyboard equivalent to choosing the **File - Close File** menu option.

3.8.6 Print File

Choose **Print** from the **File** menu to open the *Print* dialog box (see **Figure 3-8**) and choose options for printing the active source window.

The *Print* dialog box for your operating system and printer capabilities opens for you to choose **Print range** and **Print quality**. Open the *Print Setup* dialog box to change printer settings.

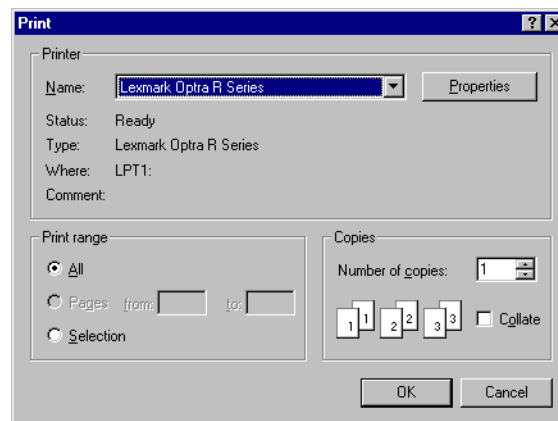


Figure 3-8. Print Dialog Box

Note: The **Print** option is active when at least one source window is open. The WinIDE editor disables the option if no window is open.

3.8.7 Print Setup

Choose the **Print Setup** option from the **File** menu to open the *Print Setup* dialog box for your operating system and printer. Use this dialog box to choose the printer, page orientation, paper size, and other options for your printer.

3.8.8 Exit

Choose the **Exit** option from the **File** menu to close the editor. If a project or source window is open, the editor closes the files and exits.

Alternatives: Type ALT + F4. This is the keyboard equivalent to choosing the **File - Exit** menu option.

3.9 WinIDE EDIT OPTIONS

This section describes the WinIDE Edit menu options for creating or editing source file contents. To perform an edit operation, click once on the **Edit** menu title to open the **Edit** menu (see **Figure 3-9**). Click on an option to perform the operation.

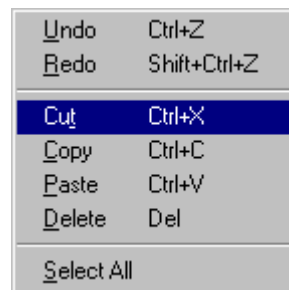


Figure 3-9. WinIDE Edit Menu

3.9.1 Undo

Choose **Undo** to undo or reverse the last action or change you made in the active source window.

Changes that you make to the contents of the window (and that are undoable or reversible) are saved in an undo stack, where they accumulate, up to a maximum of 20 instances. You can reverse your changes in descending order of the sequence in which they were made. If no more changes remain in the stack, the **Undo** option is disabled.

Reversible actions are local to each source window. Commands that are not reversible do not contribute to the undo stack. You cannot, for example, undo the command to open a new window using the **Undo** command.

Alternatives: Type CTRL + Z. This is the keyboard equivalent to selecting the **Edit - Undo** menu option.

3.9.2 Redo

Choose **Redo** to restore the most recently undone action in the active window.

The **Redo** option restores actions undone or reversed by the **Undo** option, in ascending order, that is, last action first. Reversible changes to the window's contents accumulate in the window's undo stack. Once a change has been reversed using the **Undo** option, the change can be reversed, using the **Redo** option. When no more changes remain (that is, the top of the **Redo** stack is reached) the **Redo** option is disabled.

Some commands are not reversible. They do not contribute to the undo stack and therefore cannot be redone. For example, because reversible actions are local to each source window, opening a new window is an action that cannot be undone using the **Undo** command, or redone using the **Redo** command.

Note: The **Redo** option is active only if you have used the **Undo** option to modify the contents of the active source window.

Alternative: Type SHIFT + CTRL + Z. This is the keyboard equivalent to selecting the **Edit - Redo** menu option.

3.9.3 Cut

Choose **Cut** from the **Edit** menu to cut the currently selected text from the active source window and place it on the system clipboard.

Note: The **Cut** option is active only when you have selected text in the active source window.

Alternative: Type CTRL + X. This is the keyboard equivalent to selecting the **Edit - Cut** menu option.

3.9.4 Copy

Choose **Copy** from the **Edit** menu to copy the selected text from the active source window to the Windows clipboard.

Note: The **Copy** option is available only if you have selected text in the active source window.

Alternatives: Type CTRL + C or click the COPY toolbar button. This is the keyboard equivalent to selecting the **Edit - Copy** menu option.

3.9.5 Paste

Choose **Paste** from the **Edit** menu to paste the contents of the Window's clipboard into the active source window at the insertion point location.

Alternatives: Type CTRL + V or click the PASTE button on the toolbar. This is the keyboard equivalent to selecting the **Edit - Paste** menu option.

3.9.6 Delete

Choose **Delete** from the **Edit** menu to delete the selected text from the active source window without placing it on the Windows clipboard. Text you delete using the **Delete** option can be restored only by using the **Undo** option.

Alternatives: Press the DELETE key. This is the keyboard equivalent to selecting the **Edit - Delete** menu option.

3.9.7 Select All

Choose **Select All** from the **Edit** menu to select all text in the active source window.

3.10 WinIDE ENVIRONMENT OPTIONS

This section describes the WinIDE Environment menu options for managing project information and setting up environment and font settings for a project.

Environment settings represent the current environment and configuration information for the WinIDE editor. These settings are stored in the WINIDE.INI file, from which they are loaded each time you start the editor, and saved each time you exit from the editor.

When you start the editor, the application opens the WINIDE.INI file and reads the project information. If there is an open project, the project file's environment settings are read and used instead. This permits different environment configurations for different projects.

Environment information stored in the WINIDE.INI file includes:

- If a project is open, its name
- Current font information
- Current source directory and project directory paths
- The preferences and options you set in the *Environment Settings* dialog box tabs, including:
 - **General Environment** options
 - **General Editor** options
 - Executable options for assembler, debugger, compiler, and programmer

To choose an environment option, click once on the **Environment** menu title (see **Figure 3-10**) to open the menu. Click on the option to execute.

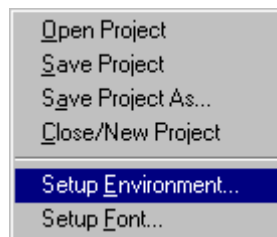


Figure 3-10. WinIDE Environment Menu

Project files have the extension .PPF; they store two kinds of information:

- Environment settings — User settings and WinIDE configuration parameters
- Desktop information open edit windows, size and location, markers

3.10.1 Open Project

Choose **Open Project** from the **Environment** menu to choose the project file in the *Specify project file to open* dialog box (**Figure 3-11**).

1. Enter the project name in the *File name* text box or select the project name from the list box below the text box.
2. Press the OK button to open the new project file (or press the CANCEL button to close the dialog box without opening a file).

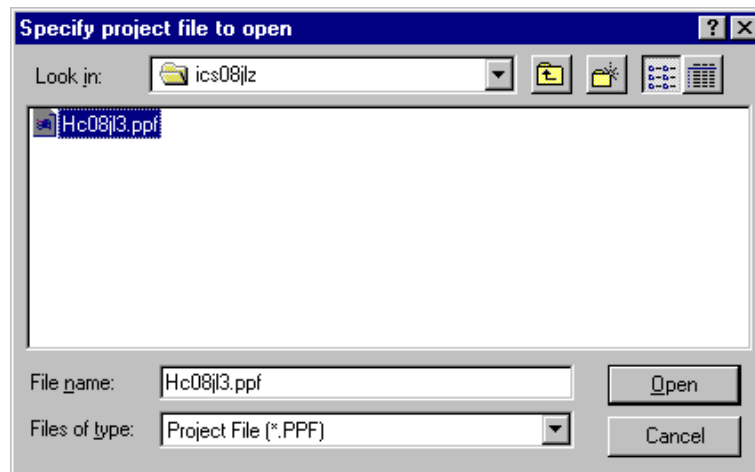


Figure 3-11. Specify project file to open Dialog Box

3.10.2 Save Project

Choose **Save Project** from the **Environment** menu to save the current project in the currently specified file and pathname.

3.10.3 Save Project As

Choose **Save Project As** from the **Environment** menu to display the *Specify project file to save* dialog box (see **Figure 3-12**).

1. Enter the project name in the *File name* text box or select the project name from the list box below the text box.
2. Press the OK button to open the new project file (or press the CANCEL button to close the dialog box without opening a file).

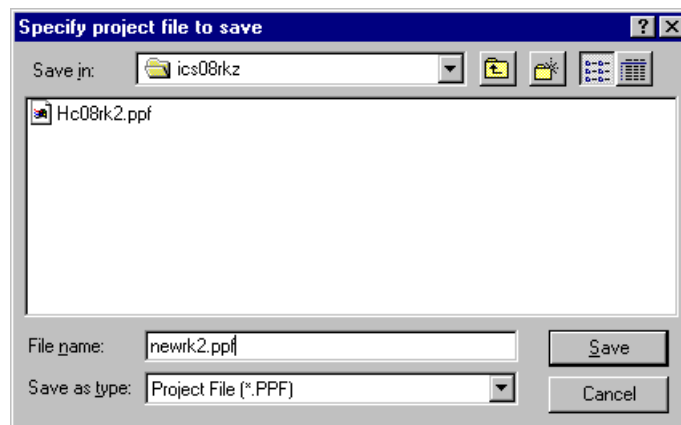


Figure 3-12. *Specify project file to save* Dialog Box

3.10.4 Close/New Project

Choose **Close/New Project** from the **Environment** menu to:

- Close an active current project file
- Open a new project

3.10.5 Setup Environment

Choose **Setup Environment** from the **Environment** menu to display the *Environment Settings* dialog box.

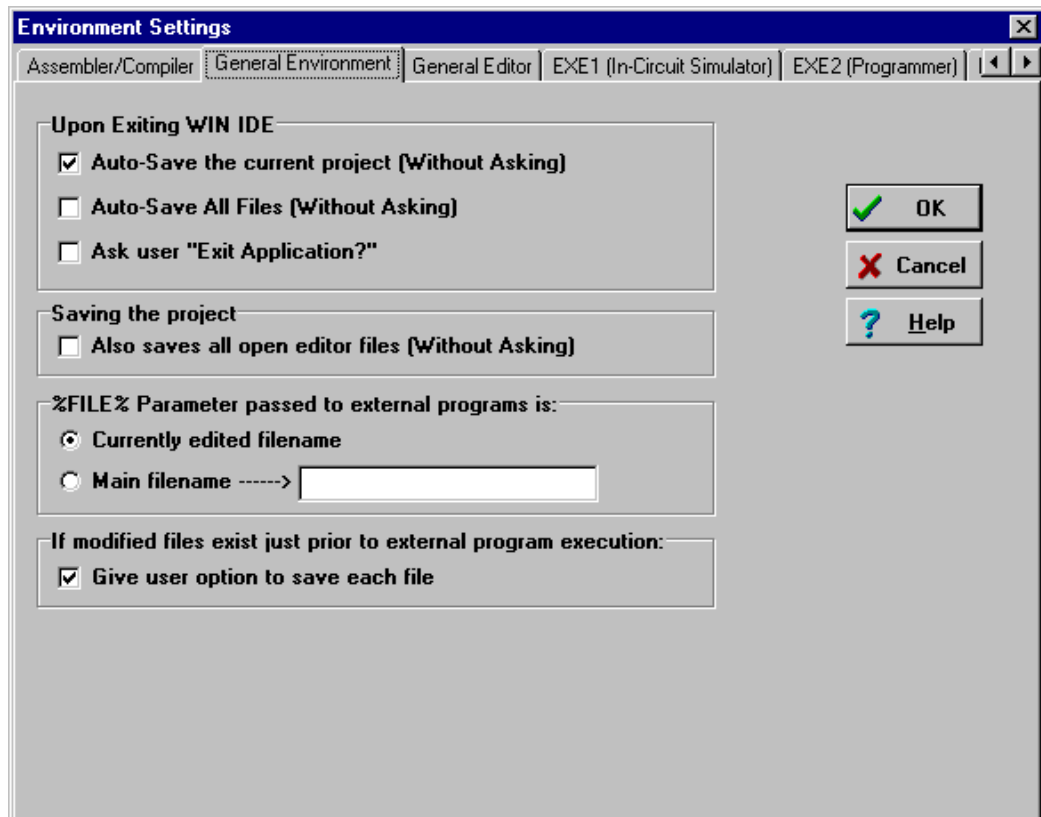
The *Environment Settings* dialog box contains these tabs:

- **General Environment**
- **General Editor**
- **Assembler/Compiler**
- **EXE 1** (default: ICS08 in-circuit simulator software)
- **EXE 2** (default: PROG08SZ programmer)
- **EXE 3** (default: ICD08SZ debugger)
- **EXE 4**

In the **Environment Settings** tabs, choose options by marking option buttons (sometimes called radio buttons), check boxes, and entering information in text boxes.

3.10.5.1 General Environment Tab

Click the **General Environment** tab in the *Environment Settings* dialog box (see **Figure 3-13**) to change options for saving the project files, exiting the WinIDE editor, and storing a filename to be passed to an external program as a parameter.



**Figure 3-13. Environment Settings Dialog Box:
General Environment Tab**

Clicking the OK button on any tab saves all changes made in the *Environment Settings* dialog box and closes the dialog box.

The **General Environment** tab offers these options:

- **Upon Exiting WinIDE**
 - **Auto-Save the Current Project** — Select this option to save the currently open project automatically, with the file extension .PPF, without prompting. The editor saves all currently open files with the current project. If you do not select this option, the editor prompts you to save the open project when you exit. This setting only has an effect if a project is open when you exit.
 - **Auto-Save All Files** — Select this option to save all open editor files automatically, without prompting, when you exit. If you do not select this option, the editor will prompt you to save open files when you exit.
 - **Ask user “Exit Application?”** — Select this option to display an Exit Application confirmation message when you exit. If you do not select this option, the editor will close without asking for confirmation when you choose the **Exit** option from the **File** menu.
- **Saving the Project**
 - **Also save all open editor files** — Select this option to save all open editor files whenever you save the project file. If you do not select this option, project/environment information is written to the project files, but editor files are not saved when you choose the **Save Project** option from the **Environment** menu.
- **%FILE% Parameter passed to executable programs is**

The *%FILE%* parameter specifies what is passed on the command line in place of the *%FILE%* string. You may specify the *%FILE%* string as a command line parameter for executable programs launched from within the WinIDE editor.

 - **Currently edited filename** — Select this option to use the name of the current active file (the window with focus) as the *%FILE%* parameter substitution.
 - **Main Filename** — Select this option to use the filename in the *Main filename* edit box as the *%FILE%* parameter substitution.

Note: When using include files, you must enter the full pathname of the file containing the included files in the *Main filename* edit box.

- **If Modified files exist just prior to external program execution**

All executable programs which you can launch from the WinIDE editor offer the option to save all open editor files before the executable is launched.

- **Give user option to save each file** — Select this option to be prompted to save each modified file before the external program is launched. If you do not select this option, the external program runs without asking for confirmation. The result may be that an external program runs while modified files exist in the editing environment, a circumstance that may be undesirable and lead to incorrect results.

3.10.5.2 General Editor Tab

Click the **General Editor** tab in the *Environment Settings* dialog box (see **Figure 3-14**) to bring the **General Editor** tab to the front. Use the **General Editor** tab to change editing options such as indentation, word wrap, tab settings, and filename types.

Note: To change font options, choose the **Setup Fonts** option from the **Environment** menu.

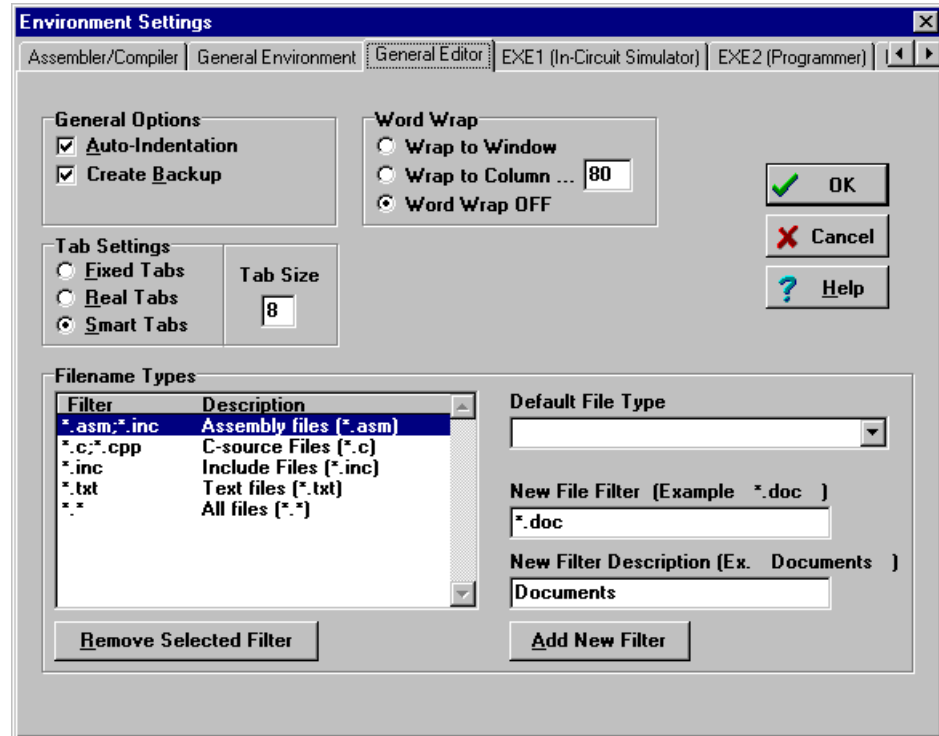


Figure 3-14. *Environment Settings* Dialog Box: *General Editor* Tab

-
-
- **General Options**
 - **Auto-Indentation** — Select this option to place the cursor in the column of the first non-space character of the previous line when the ENTER key is pressed. If this option is not checked, the cursor goes to the first column. For example, if the current line begins with two tab spaces, pressing the ENTER key will begin the next line with two tab spaces, aligning the new line under the first text of the previous line.
 - **Create Backup** — Select this option to create a backup file whenever a file is saved. The WinIDE editor will copy the current disk version of the file (the last save) to a file of the same name with the .BAK extension, then save the current edited copy over the editing filename. The default (and recommended) setting for this option is ON, giving you the option to return or review the previous version of the file. If you do not select this option, the currently edited file will be saved, but no backup will be made.
 - **Word Wrap**
 - **Wrap to Window** — Select this option to have the cursor to wrap to the left when it reaches the far right side of the window. This lets you see all the text in the file, without scrolling the line. If you do not select this option, text wraps only when you press the ENTER key.
 - **Wrap to Column** — Select this option to wrap text to the left side when the cursor reaches a specified column. This lets you see all the text in the file, without scrolling the line. Set the column number at which text wrapping should occur in the edit box to the right of this option.
 - **Word Wrap OFF** — Select this option to turn text wrapping off. To view or edit text, which does not fit horizontally in the window, use the scroll controls. In general, this option should be on when you are writing or editing code.
 - **Tab Settings**
 - **Fixed Tabs** — Select this option to use spaces to emulate tabs. Pressing the tab key inserts a number of spaces to bring the cursor to the position of the next tab stop. Changing the tab size affects only future tab spacings. Past tabs remain unchanged.
 - **Real Tabs** — Select this option to use actual tab characters. Pressing the tab key inserts a tab character. The tab character is displayed as a number of spaces determined by the tab size, but is really a tab character. Changing the tab size affects the display of all tabs in the

file, present and future.

- **Smart Tabs** — Select this option to enable smart tabs:
 - ◆ If the previous line contains text, pressing the tab key advances the cursor to the same column as the beginning of the next character group on the previous line.
 - ◆ If the previous line does not contain text, smart tabs behave as fixed tabs.
- **Tab Size** — Enter the number of spaces in a tab. This setting affects how all tabs operate: fixed, real, or smart tabs. This number is the default display size of all tab characters, and the size in spaces of a tab in both fixed and smart modes. If the tab size is N, the tab stops are at 1, N+1, 2N+1, 3N+1, and so on.

- **Filename Types**

As part of the **Environment Settings / General Editor** options, WinIDE lets you set a default file type by using the file filter. This is useful when working primarily with one type of file (although a filter may also include a group of extensions). A list of the filter descriptions and their corresponding extensions is displayed to the left.

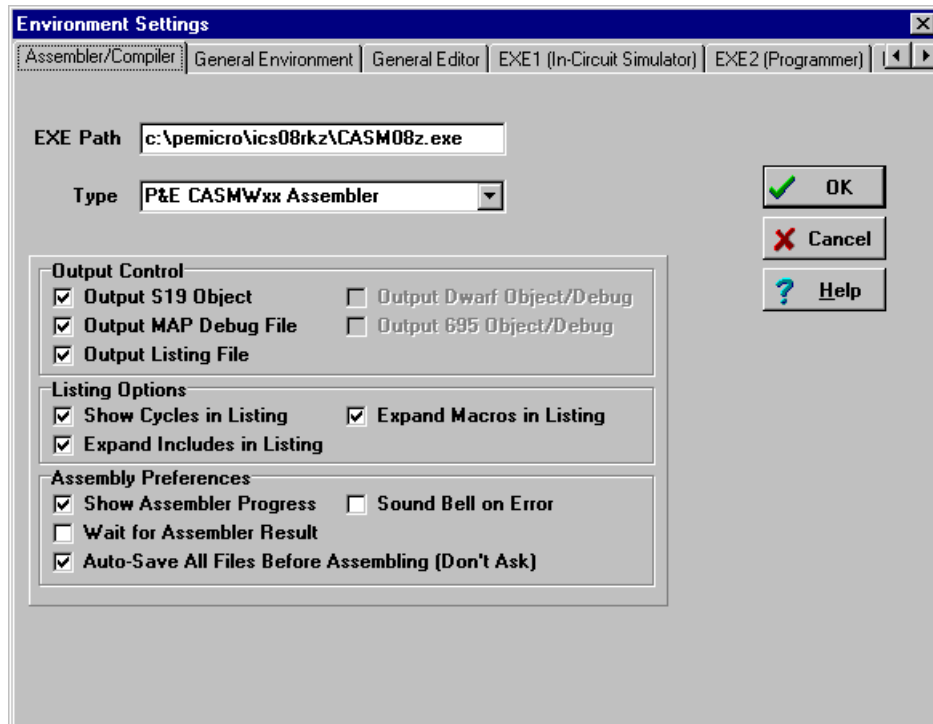
To select a filter, use the *Default File Type* pull-down box on the right to choose the file type. Define your own filters and add them to the list by first entering the appropriate information into the boxes for *New File Filter* and *New Filter Description* on the lower right, then selecting the ADD NEW FILTER button. You may remove filters by highlighting a filter and using the REMOVE SELECTED FILTER button.

3.10.5.3 Assembler/Compiler Tab

In addition to running an external compiler, you may need to run other external programs such as programmers, debuggers, or simulators. The WinIDE editor lets you configure as many as five external programs: four general-purpose programs and one compiler. Use the settings on the **Assembler/Compiler** tab of the WinIDE *Environment Settings* dialog box to set up external programs.

Click the **Assembler/Compiler** tab heading in the *Environment Settings* dialog box (see **Figure 3-15**) to bring the tab to the front. Use the options on this tab to change the settings and parameters for the assembler or compiler path and type, and specify output, listing, and assembly preferences.

- **EXE Path** — Enter the full path and executable name of the compiler in the text box. The extensions EXE/COM/BAT are legal. For a DOS executable or BAT (batch) file, you may want to create a PIF file to prevent the screen from changing video modes when the executable runs.



**Figure 3-15. Environment Settings Dialog Box:
Assembler/Compiler Tab**

- **TYPE** — Click on the downward-pointing arrow to the right of the *Type* list box to display the compiler types. Click on the compiler type to select it. The options in the **Assembler/Compiler** tab change according to the compiler type chosen:
 - If you select a CASM-compatible compiler, a number of compiler options are available.
 - If you select a different compiler, options allow you to specify the parameters to pass to the compiler.
- **Output Control** — These options specify the output files that the assembler will create:
 - **Output S19 Object** — Select this option to have the assembler output an S19 object file. The S19 object file contains the compiled instructions from the program assembled. The output S19 file has the same name as the assembly file, but with the .S19 extension.

APPENDIX A S-RECORD INFORMATION gives more information about the S19 file format.

- **Output .MAP Debug File** — Select this option to have the assembler produce a debug .MAP file. The debug .MAP file contains symbol information as well as line number information for source level debugging from the program assembled. The output debug file has the same name as the assembly file, but with the .MAP extension.
- **Output Listing File** — Select this option to have the assembler produce a listing file. The listing file shows the source code as well as the object codes that were produced from the assembler. Listing files are useful for debugging, as they show exactly where and how the code assembled. The output listing file has the same name as the assembly file, but with the .LST extension.

- **Listing Options**

The following options specify how the assembler generates the listing file:

- **Show Cycles in Listing** — Select this option to include cycle information for each compiled instruction in the listing (.LST) file. View the cycle information to see how long each instruction takes to execute. The cycle count appears to the right of the address, enclosed in brackets.
 - **Expand Includes in Listing** — Select this option to expand all include files into the current listing file. This lets you view all source files in a main listing file. If this option is not checked, you will see only the *\$Include* statement for each included file, not the source file.
 - **Expand Macros in Listing** — Select this option to expand all macros into the listing file. Each time the macro is used, the listing will show the instructions comprising the macro. If you do not select this option, you see only the macro name, not its instructions.
- **Assembly Preferences**
 - **Show Assembler Progress** — Select this option to display a pop-up window showing the current assembly status, including:
 - ◆ The pass the assembler is currently on
 - ◆ The file that is currently being assembled
 - ◆ The line that is currently being assembled

If this option is not checked, you must wait for the assembly result to be

displayed on the status bar at the bottom of the environment window.

- **Wait for Assembler Result** — Select this option and the **Show Assembler Progress** option to cause a progress window displaying the assembly result to stay up when assembly is done. The assembly result window will remain until you dismiss it by clicking the OK button. In general, do not select this option, as the assembler results are shown in the status bar at the bottom of the WinIDE window.
- **Auto-Save All Files Before Assembling (Don't Ask)** — Select this option to save all open files to disk before running the assembler, without being asked. Files need to be saved before assembly. This is important because the assembler/compiler reads the file to be compiled from the disk, not from the open windows in the WinIDE editor. If you do not save the file before assembling it, the assembler will assemble the last saved version. Note, however, that when this option is checked, the WinIDE will **not** prompt you before the files are saved.
- **Sound Bell on Error** — Select this option to have the assembler beep if it encounters an error.
- **Other Assembler/Compiler**

If you choose **Other Assembler / Compiler** from the *Type* list, the WinIDE editor offers these additional options:

- **Options** — Enter the options to pass to the compiler on the command line. Such options generally consist of a filename and switches that instruct the compiler. Enter the *%FILE%* string in the command line to insert either the current filename or the filename specified in the **Main Filename** option in the *EXE Path* text box of the **General Environment** tab options (see **Figure 3-13**).
- **Confirm command line** — Select this option to display a window describing the executable you want to run and the parameters you want to pass to the executable, just before the assembler/compiler is run. This gives the options to cancel the assemble/compile, continue as described, or modify parameters before you continue with the assembly. If you do not select this option, the assembler/compiler runs without prompting you to confirm parameters.
- **Recover Error from Compiler** — Select this option to have the WinIDE editor attempt to recover error/success information from the assembler/compiler, and open the file with the error line highlighted (and displayed in the status bar) when an error is encountered. For this feature to work, the **Error Filename** and **Error**

Format options must also be set in this tab. If this option is not checked, the WinIDE editor will not look for a compiler result and will not display the results in the status bar.

- **Wait for compiler to finish** — Select this option to have the WinIDE editor disable itself until the compiler terminates. Select this option for the editor to attempt to recover error/success information from the assembler/compiler. Further, turning this option on prevents you from running external programs from the editor that may require compilation or assembly results. If you do not select this option, the editor starts the assembler/compiler, and continues, letting Windows' multitasking capabilities take care of the program.
- **Save files before Assembling** — Select this option to save all open files to disk before running the assembler. This can be very important since the assembler/compiler reads the file to be compiled from the disk and not from the memory of the WinIDE editor. If the file being assembled isn't saved, the assembler or compiler will assemble the last saved version. For this reason, leave this option checked.
- **Add Double Quotes Around Filename Parameters**— Check this to enclose the %*FILE*% filename with double quotes. See **Section 3.5 COMMAND-LINE PARAMETERS** for more information.

- **Error Format**

Click the down arrow to the right of the *Error Format* list box to display the list of error formats. If the WinIDE editor is to attempt to read back an error from a compiler, it must understand the error syntax. This option lets you select an error format from a list of supported formats. If the **Recover Error from compiler** option is checked, and the filename specified in the *Error Filename* text box is found, the editor parses that file from end to beginning looking for the error. If the editor finds an error, it opens the file, highlights the error line, and displays the error in the status bar.

- **Error Filename**

Enter the filename to which the editor pipes the compiler/assembler error output. Some compilers provide a switch for piping error output to a file; others require that you handle this manually. As many compilers are DOS-based, you can create a batch file into which to pipe the output. For example:

```
COMPILER OPTIONS > ERROR.TXT
```

This batch file creates the file ERROR.TXT and sends the assembler/compiler output to that file. Many C-compilers require a batch file to

run the compiler through its various steps (compiling, linking), to which you may add a pipe for error output.

Once the environment reads this error file, the WinIDE editor displays the results, and deletes the error file. To keep a copy of the file, add such instructions to the batch file.

3.10.5.4 Executable Tabs - EXE 1-4

Choose either the **EXE 1 (In-Circuit Simulator)**, the **EXE 2 (Programmer)**, the **EXE 3 (Debugger)**, or the **EXE 4** tab in the *Environment Settings* dialog box to bring the tab to the front. Enter options for the general-purpose external programs that will be used with this project. **Figure 3-16** illustrates the tabs. The options are the same for all tabs.

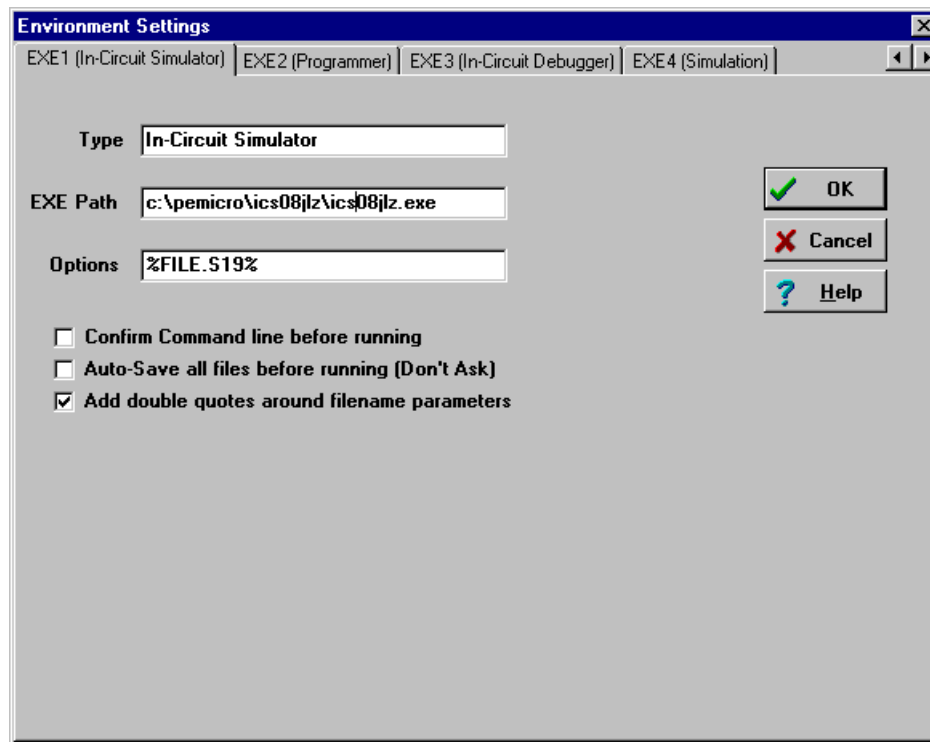


Figure 3-16. Environment Settings Dialog Box: EXE Tabs

- **Type** — Enter a description of the executable type in the *Type* text box. This string will appear in other parts of WinIDE editor. The default for Executable 1 is Debugger. For the ICS08 simulator software, change the **Type** to ICS to change the label on this tab and elsewhere in the dialog box.
 - **EXE Path** — Enter the full path and executable name of Executable 1 in the *EXE Path* text box. The executable name may have a

.EXE, .COM, or .BAT extension. For a DOS-based executable or batch file, you may choose to create a PIF file to prevent the screen from changing video modes when the file is run.

- **Options** — Enter the options to pass to the executable on the command line in the *Options* text box. In general, options will consist of switches that instruct the executable from the command line. Add a filename using the *%FILE%* string. The *%FILE%* string inserts either the currently active filename, or the filename specified by the *%FILE%* parameter, set in the *%FILE%* parameters to pass to external programs field in the **General Environment** tab.
- **Confirm command line before running** — Select this option to display a window describing the executable to be run and the parameters which will be passed, just before the assembler/compiler is run. This gives the option to cancel the assemble/compile, continue as described, or modify parameters before continuing. If you do not select this option, the assembler/compiler will be run without prompting you to confirm parameters.
- **Save all files before running** — Select this option to save all open files to disk before running the executable, without being asked. Files should be saved if they are referenced from external programs. If this option is not selected, the user will be asked if they want the modified files to be saved.
- **Add Double Quotes Around Filename Parameters**— Check this to enclose the *%FILE%* filename with double quotes. See **Section 3.5 COMMAND-LINE PARAMETERS** for more information.

3.10.6 Setup Fonts

Select the **Setup Fonts** option in the **Environment** menu to open the *Setup Fonts* dialog box (see **Figure 3-17**) to change font options in the editor

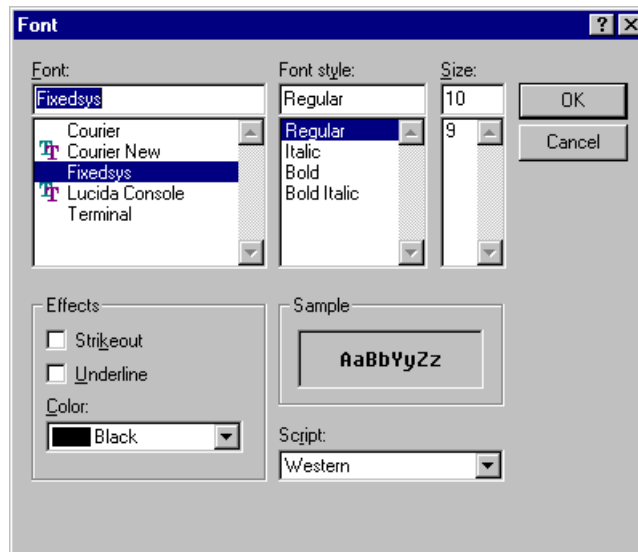


Figure 3-17. Setup Fonts Dialog Box

- **Font** — The *Font* text box displays the name of the current font. To change the current font, select another font name from the *Font* list. Use the scroll arrows if necessary to view all the font choices.
- **Font Style** — The *Font Style* text box displays the name of the current font style. To change the current font style, select another font style name from the *Font Style* list.
- **Size** — The *Size* text box displays the current font size. To change the size, enter a new number in the text box or choose a font size from the list.
- **Effects** — Toggle special font effects:
 - **Strikeout** — Choose this option to produce a horizontal strike-through line in the selected text.
 - **Underline** — Choose this option to produce a horizontal underline below the selected text.
- **Color** — Choose the text color from the drop-down list box. Click on the downward pointing arrow to display the *Color* list. Use the scrolling arrows to view all of the choices, if necessary.
- **Sample** — As you choose **Font** options, an example of the text that will result is shown in the *Sample* area.
- **Script** — If you have installed multilingual support, use this option to choose a non-western script.

3.10.7 WinIDE SEARCH OPTIONS

This section describes the WinIDE **Search** menu options for specifying search criteria and entering a line number to go to in a source file.

To perform a search operation, click once on the **Search** menu to open the menu (see **Figure 3-18**). Click on the option to execute.

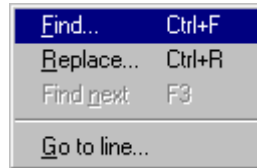


Figure 3-18. Search Menu

3.10.8 Find

Choose the **Find** option from the **Search** menu to open the *Find* dialog box (**Figure 3-19**). In the *Find what:* box, enter the string to search for. The search will be performed in the active WinIDE editor source window.

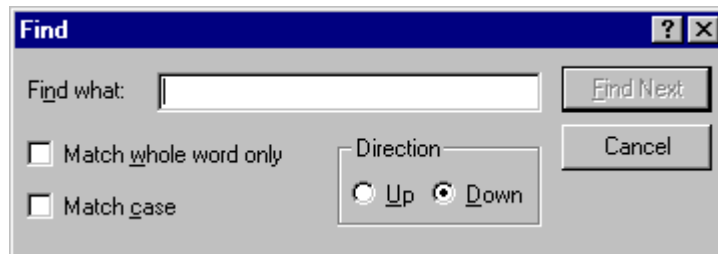


Figure 3-19. Find Dialog Box

Enter the search string and choose from the following options to refine the search:

- **Match Whole Word Only** — Choose this option to limit the search to whole “words” and not character strings that are part of a longer word or string.
- **Match Case** — choose this option to perform a case sensitive search, that is, to find words with a specific uppercase and/or lowercase arrangement.
- **Direction: Up/Down** — Click on an option to direct the search:
 - Choose the **Down** option to direct the search from the current cur-

sor position in the text to the end or bottom of the file.

- Choose the **Up** option to direct the search from the current position in the text to the beginning or top of the file.

Press the **FIND NEXT** button to start the search.

Note: The Find window is modeless and can remain open, allowing interaction with either the *Find* dialog box or the source window.

Alternatives: Press **CTRL + F**. This is the keyboard equivalent to selecting the **Search - Find** menu option.

3.10.9 Replace

Select the **Replace** option to open the *Replace* dialog box (see **Figure 3-20**) to search for and substitute text in the active source window.

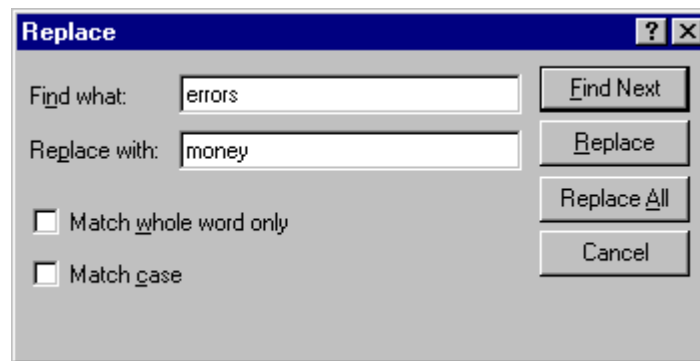


Figure 3-20. Replace Dialog Box

In the *Find what* text box, enter the text string to find; in the *Replace with* text box, enter the text string to replace it with. Refine the search using the **Match whole word only** or **Match case** options.

- **Match Whole Word Only** — Choose this option to limit the search to whole “words” and not character strings that are part of a longer word or string
- **Match Case** — Choose this option to perform a case sensitive search, that is, to find words with a specific uppercase and/or lowercase arrangement.

Press the **CANCEL** button to close the *Replace* dialog box.

Alternative: Press **CTRL + R**. This is the keyboard equivalent to selecting the **Search - Replace** menu option.

3.10.10 Find Next

Select the **Find Next** option from the **Search** menu to find the next occurrence of the previous search string without displaying the *Find* dialog box.

Alternative: Press F3. This is the keyboard equivalent to selecting the **Search - Find Next** menu option.

3.10.11 Go to Line

Select the **Go to Line** option from the **Search** menu to open the *Go to Line Number* dialog box (see **Figure 3-21**). Note line numbers in the *Status Bar* and use the dialog box to navigate between points in the text.

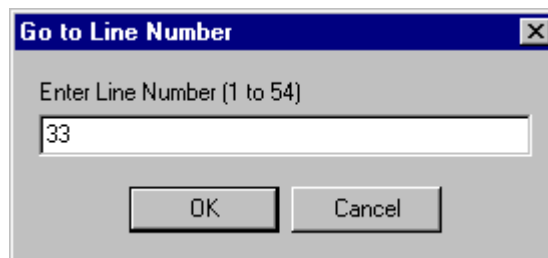


Figure 3-21. Go to Line Number Dialog Box

The dialog box instruction includes the range of line numbers available in the active window. Enter the *Line Number* desired, and press the OK button.

3.11 WinIDE WINDOW OPTIONS

This section describes the WinIDE Window menu options for managing the arrangement of open client windows in the main WinIDE window.

To perform a window operation, click once on the **Window** menu to open the menu (see **Figure 3-22**). Click on the option to execute.

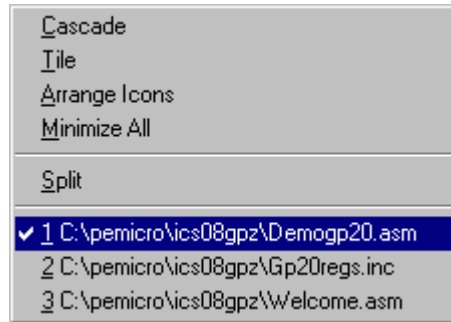


Figure 3-22. WinIDE Window Menu

3.11.1 Cascade

Select the **Cascade** option from the **Window** menu to arrange the open source windows in overlapping or “cascaded” style (see **Figure 3-23**), like fanned cards. In this arrangement, open source windows are all set to the same size and shape, one overlapping the other from the upper left hand to the lower right hand corner of the WinIDE main window, with their title bars visible.

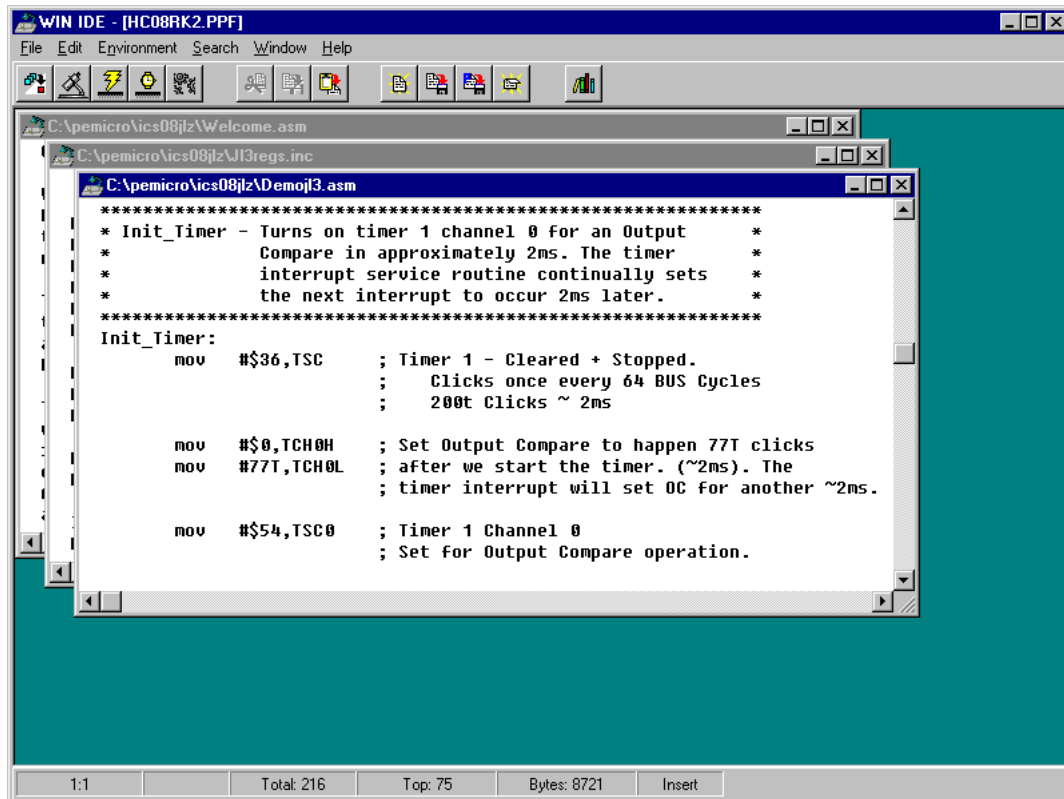


Figure 3-23. WinIDE with Subordinate Windows Cascaded

To choose a window from the cascaded display, click on its title bar. This moves the selected window to the top of the stack and makes it the active window.

3.11.2 Tile

Select the **Tile** option from the **Window** menu to arrange the open source windows in tiled fashion (see **Figure 3-24**). You will be able to see the entire window border for each, although not necessarily the window's entire contents.

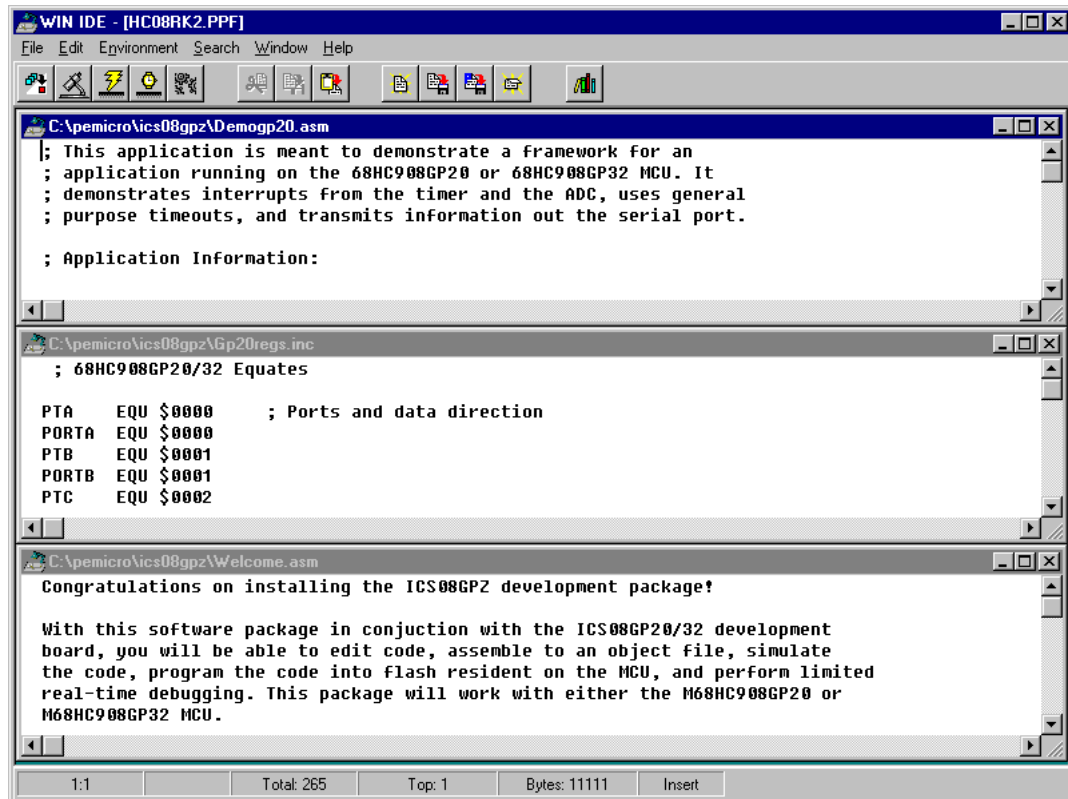


Figure 3-24. WinIDE with Subordinate Windows Tiled

If the contents of a source window cannot be displayed in their entirety, use the scroll bars.

The tiled arrangement is practical to use when cutting and pasting from one window to another.

3.11.3 Arrange Icons

Select the **Arrange Icons** option from the **Window** menu to rearrange the icons of minimized windows into columns and rows at the bottom of the WinIDE main window (see **Figure 3-25**).

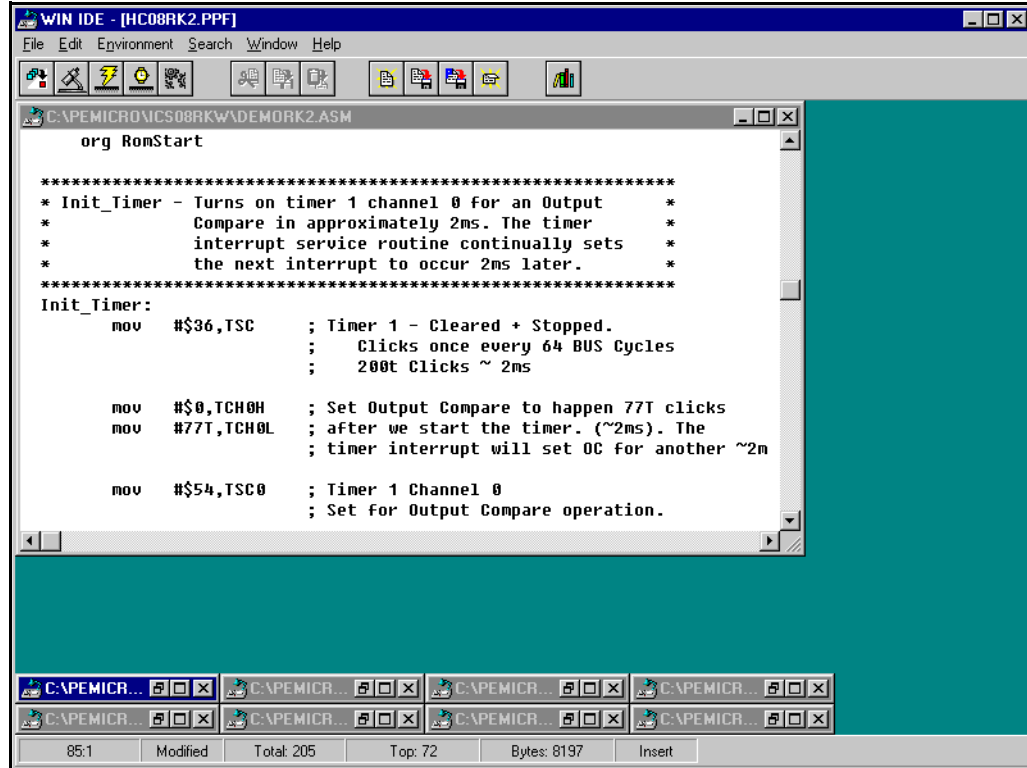


Figure 3-25. WinIDE: One Source Window Displayed, Remaining Windows Minimized

3.11.4 Minimize All

Select the **Minimize All** option from the **Window** menu to minimize all open source windows and display them as icons at the bottom of the WinIDE main window (see **Figure 3-26**).

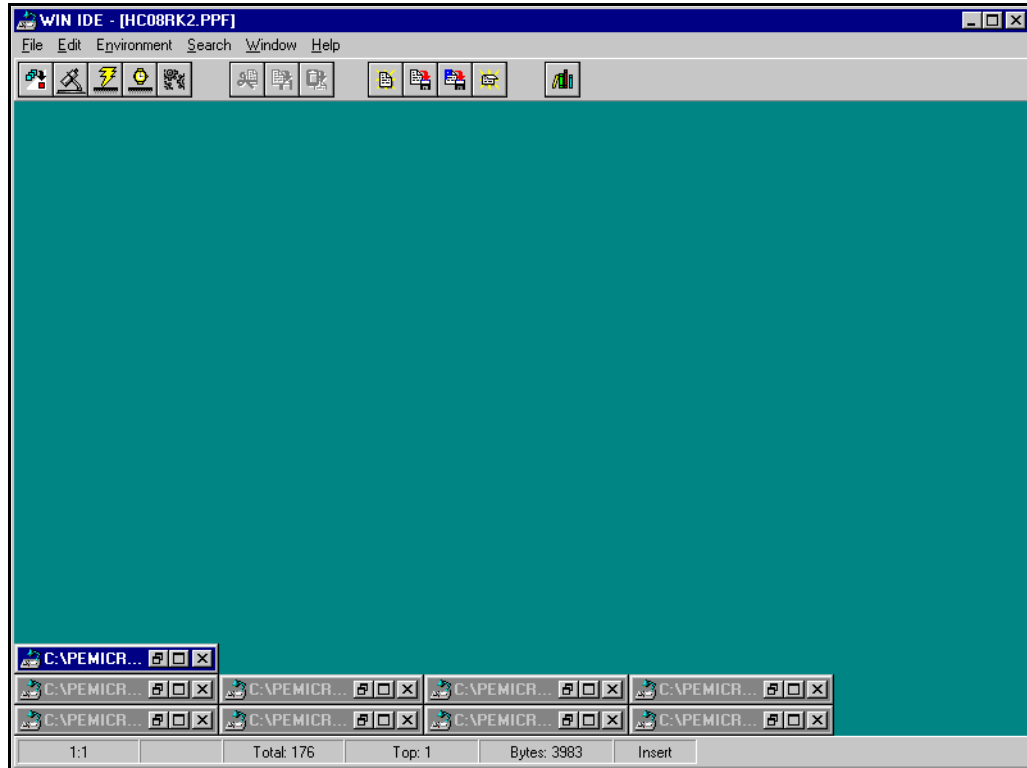


Figure 3-26. WinIDE with Subordinate Windows Minimized

3.11.5 Split

Select the **Split** option from the **Window** menu to divide the active source window into two or more separate panes, each capable of displaying a different view of the same file. To toggle the split window view, click on the **Split** option. A check mark appears beside the option when the split view is in effect.

Adjust the relative size of the panes by dragging the split bar, a double horizontal line separating the panes. Position the pointer over the split bar until it changes to the split pointer (see **Figure 3-27**).

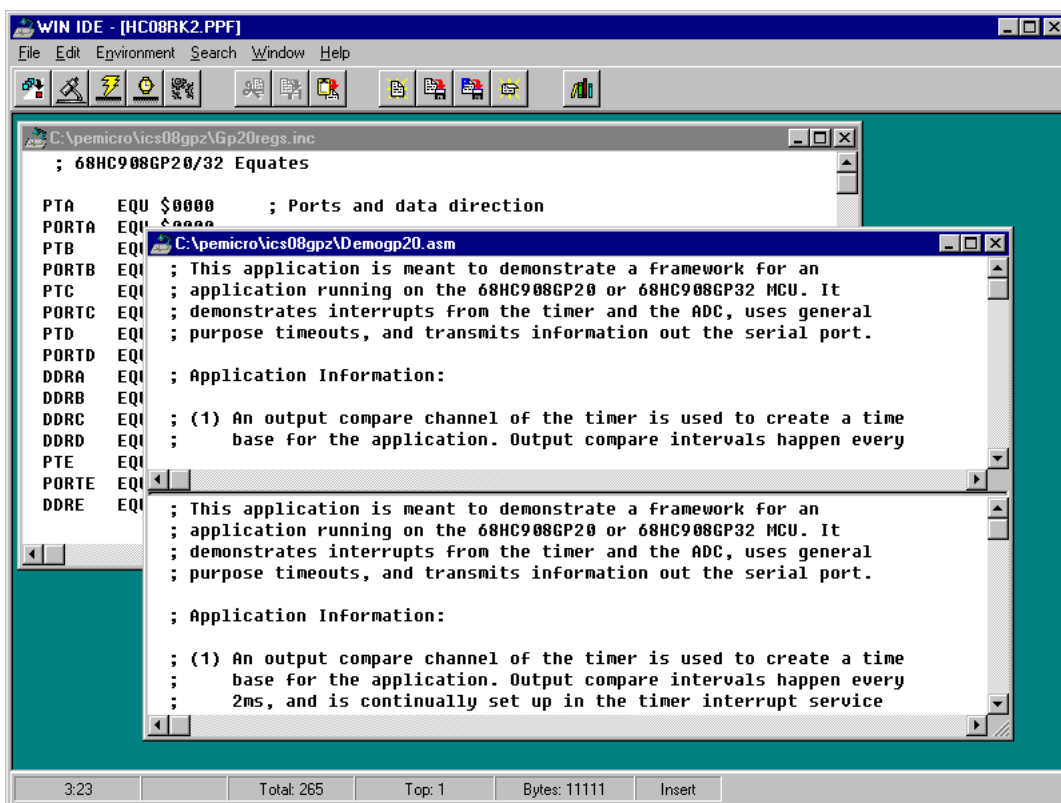


Figure 3-27. WinIDE Cascaded Windows with Active Window Split

CHAPTER 4

CASM08Z ASSEMBLER INTERFACE

4.1 OVERVIEW

This chapter describes the operation of the CASM08Z assembler, including methods for interfacing with the assembler from the WinIDE, setting assembler options and directives, generating and using output files and formats, and understanding assembler-generated error messages.

To be used in the target microcontroller CPU, you must convert the source code for your program from its mnemonic codes to the machine code that the target CPU can execute. The CASM assembler program accomplishes this by reading the source code mnemonics and assembling an object code file that can be programmed into the memory of the target microcontroller. Depending on the parameters you specify for the assembler, other supporting files can be produced that are helpful in the debugging process.

When you click on the ASSEMBLE/COMPILE FILE button or use the F4 function key in WinIDE, the CASM cross assembler is activated to process the active file in the WinIDE main window according to the parameters you have entered. In addition to two kinds of object code files, you may choose to have the assembler produce .MAP and/or .LST files as well.

Listing files show the original source code, or mnemonics, including comments, as well as the object code translation. You can use this listing during the debugging phase of the development project. It also provides a basis for documenting the program.

To view the assembler help, click on the “CASM08Z - 68HC08 Assembler Help” icon in the **Start** menu.

4.2 CASM08Z ASSEMBLER USER INTERFACE

The assembler interface consists of a window that appears briefly in the WinIDE main window during assembly. This window (see **Figure 4-1**) contains information about the file being assembled. For example:

- Main File — Path and filename of the main file being assembled
- Current File — Path and filename of the current file being assembled
- Status — Assembler status as the assembly proceeds
- Current Line — Current line position of the assembler
- Total Lines — Total number of lines in the file being assembled

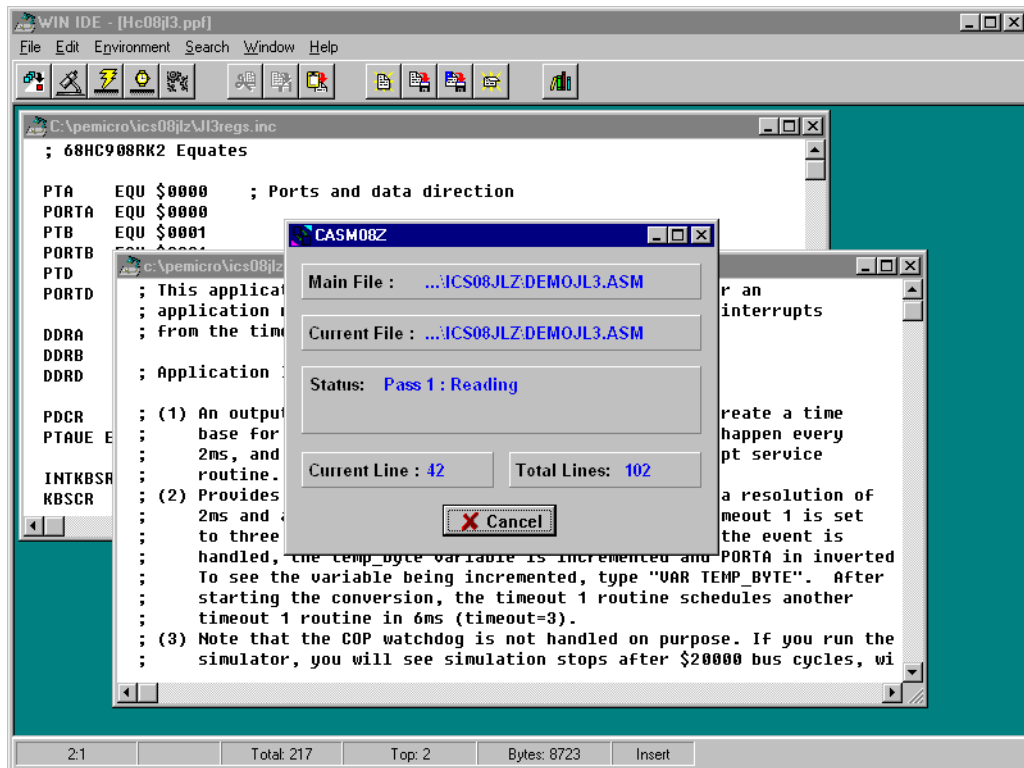


Figure 4-1. WinIDE with CASM08Z Assembler Window Displayed

4.3 ASSEMBLER PARAMETERS

The CASM08Z assembler may be configured by passing parameters to it in either of two ways:

- From the WinIDE editor, as described in **Section 3.5 COMMAND-LINE PARAMETERS** and **Section 3.10.5.3 Assembler/Compiler Tab**.
- From the command line, by using the Windows 95, 98, or NT *Program Item Property* dialog box. Refer to the Windows documentation for information on this procedure.

The following parameters may be entered in any order. To specify multiple parameters, separate them with spaces. All parameters default to off.

Parameter	Description
<i>Filename</i>	Required parameter specifying the pathname and filename of the CASM08Z assembler executable
<i>S</i>	Optional parameter to general Motorola .S19 S-record object file
<i>L</i>	Optional parameter to general an .LST listing file
<i>D</i>	Optional parameter to generate P&E .MAP debugging file
<i>H</i>	Optional parameter to generate Intel .HEX object file
<i>C</i>	Optional parameter to show cycle counts in listing file
<i>M</i>	Optional parameter to expand MACROS in listing file
<i>I</i>	Optional parameter to expand INCLUDE files in listing file
<i>Q</i>	Optional parameter to suppress screen writes except errors
<i>^</i>	Don't wait to show assembler result

Example

C:\CASM\CASM08Z.EXE MYFILE S L D

4.4 ASSEMBLER OUTPUTS

4.4.1 Object Files

If you specify an object file in the command-line in the *Program Item Property* dialog box, using the *S* or *H* parameters, the object file is created during assembly. The object file has the same name as the file being assembled, with the extension *.HEX* or *.S19*, depending on the specification given:

- Motorola uses the S-record 8-bit object code file format for object files. For more information, see **CHAPTER A – S-RECORD INFORMATION**.
- *.HEX* is the Intel 8-bit object code format.

In either case, the object code file produced by the CASM08Z assembler is a text file containing numbers that represent the binary opcodes and data of the assembled program. This object code file can be sent to the MCU using a programmer or bootstrap program, at which time it is converted to the binary format required by the target CPU.

The object filename depends on the choice made in the command line of the *Program Item Property* dialog box. By default, the object filename is that of the file being assembled, with the proper object file format extensions. An existing file with the same name will be overwritten.

4.4.2 Map Files

If you specify a map file using the *D* parameter, the P&E Debug *.MAP* file is created during the assembly. P&E Microcomputer products (such as debuggers and simulators) use these map files during the source-level debugging process.

Map files contain the directory path information under which they are created, and cannot, therefore, be moved to a new directory. If you must use the map file from a different directory, place the file in the new directory and reassemble, using the map file option *D* in the *Windows* command line.

4.4.3 Listing Files

Listing files display each line of source code and the resulting (assembled or compiled) object code. Listing files show exactly how and where each code was assembled.

If you specify a listing file in the environment settings, it is created during assembly. The listing file will have the same name as the file being assembled, with the *.LST* extension, and will overwrite any previous file with the same name.

Listing files contain these fields in the following format:

AAAA [CC] VVVVVVVV LLLL Source Code

- AAAA — First four hexadecimal digits are the address of the command in the target processor memory.
- [CC] — The number of machine cycles used by the opcode. This value, which always appears in brackets, is a decimal value. If an instruction has several possible cycle counts (as would be the case when the assembler encounters a branch instruction) and the assembler cannot determine the actual number of cycle counts, the CC field will show the best case (lowest number).
- VVVVVVVV — Hexadecimal digits (the number of which depends on the actual opcode) representing values put into that memory address.
- LLLL — The line count.
- Source code — The actual source code.

At the end of the listing file is the symbol table listing every label and its value.

If you specify a listing file using the *L* parameter in the *Windows* command line, a file with the same name as the file being assembled and the extension *.LST* can be produced by the assembler. This file serves as a program listing showing the binary numbers that the CPU needs, alongside the assembly language statements from the source code.

For more information about using the assembler listing directives, see the summary of Assembler Directives in **Table 4-2**.

4.4.4 Error Files

Error files contain assembly error information. The CASM08Z highlights any errors that it encounters during the assembly, and displays the error message in the CASM08Z window. Depending on the environment settings, the assembler may also open the file in which the error was encountered, and create an error file with the assembly filename and the *.ERR* extension.

4.4.5 Files from Other Assemblers

It is possible to use files produced by another assembler with the CASM08Z assembler, providing they are properly prepared before using. To prepare a source file from a third-party assembler for use with the CASM08Z, follow these steps:

1. Precede all comments by a semicolon.
2. Using the WinIDE (or other editor) global search and replace command, change any assembler-specific directives, listing directives, pseudo operations, etc., as required to create a file which is compatible with the CASM08Z. Remember that assembler directives must begin with the characters \$, /, ., or #, and must begin in column 1.
3. If necessary, use the BASE directive to change the default base for the operands (CASM08Z defaults to hexadecimal base).

4.5 ASSEMBLER OPTIONS

The CASM08Z assembler supports all Motorola opcode mnemonics.

Note: Opcodes mnemonics cannot start in column one. If a label begins the line, there must be at least one space between the label and the opcode.

4.5.1 Operands and Constants

Operands are addresses, labels, or constants, as defined by the opcode. Assembly-time arithmetic is allowed within operands. Such arithmetic may use these operations:

*	multiplication
/	division
+	addition
-	subtraction
<	left shift
>	right shift
%	remainder after division
&	bitwise and
	bitwise or
^	bitwise xor

Operator precedence follows algebraic rules. Use parentheses to alter precedence. If your expression contains more than one operator, parenthesis, or embedded space, put the entire expression inside braces ({ }).

```

jmp start           ;start is a previously defined label
jmp start+3        ;jump to location start + 3
jmp {start > 2}    ;jump to location start divided by 4

```

Constants are specific numbers in assembly-language commands. The default base for constants is hexadecimal.

- To change the default base use the \$BASE directive.
- To change the default base to decimal, use the \$BASE 10T directive.
- To temporarily override the default base, use either the appropriate prefix or suffix (see **Table 4-1**), but not both.

The assembler also accepts ASCII constants. Specify an ASCII constant by enclosing it in single or double quotes. A character ASCII constant has an equivalent value: 'A' is the same as 41H. An example of a string constant is:

```
db 'this is a string'
```

Table 4-1. Change Base Prefixes/Suffixes

Base	Prefix	Suffix
2	%	Q
8	@	O
10	!	T
16	\$	H

4.5.2 Comments

Use semicolons to delineate comments. A comment may start in any column and runs until the end of its line. Additionally, if any line has an asterisk (*) or semicolon (;) in column 1, the entire line is a comment.

4.6 ASSEMBLER DIRECTIVES

Assembler directives are keywords that control the progress and the modes of the CASM08Z assembler. To invoke an assembler directive, enter a /, #, or \$ as the first character of a line. Enter the directive immediately after this initial character, along with the appropriate parameter values.

Directives supported by the assembler vary according to manufacturer. **Table 4-2** summarizes the CASM08Z assembler directives. A caret (^) indicates that a parameter value must follow the directive.

Note: A space must separate a directive and its parameter value.

4.6.1 BASE

The BASE assembler directive changes the default base of the current file. The parameter specified must be in the current base or have a base qualifier (prefix or suffix). The next base remains in effect until the end of the file, or until you enter another BASE directive.

The original default base is hexadecimal, but you can change the default to binary, octal, or decimal default bases instead. It is good practice to specify a base explicitly to ensure the desired base is currently in effect.

The BASE assembler directive changes the default base of the current file. The parameter specified must be in the current base or have a base qualifier (prefix or suffix). The next base remains in effect until the end of the file or until you enter another BASE directive.

The original default base is hexadecimal, but you can change the default to binary, octal, or decimal default bases instead. It is good practice to specify a base explicitly to ensure the desired base is currently in effect. To specify a base of decimal, use \$BASE 10T.

4.6.2 Cycle Adder

The CASM08Z assembler contains an internal counter for instruction cycles called the cycle adder. Two assembler directives, CYCLE_ADDER_ON and CYCLE_ADDER_OFF, control this counter.

When the assembler encounters the CYCLE_ADDER_ON directive, it clears the cycle adder. The cycle adder starts a running total of instruction cycles as subsequent instructions are assembled. For instructions that have variable numbers of instruction cycles, the cycle adder uses the smallest number.

When the assembler encounters the CYCLE_ADDER_OFF directive, it writes the current cycle-adder value to the .LST file and disables the cycle adder.

Table 4-2. Assembler Directives

Directive	Action
BASE ^	Change the default input base to binary, octal, decimal, or hexadecimal.
CYCLE_ADDER_OFF	Stop accumulating instruction cycles and print the total.
CYCLE_ADDER_ON	Start accumulating instruction cycles.
INCLUDE ^	Include specified file in source code.
MACRO ^	Create a macro.
MACROEND	End a macro definition.
Conditional Directive	Action
SET	Sets the value of its parameter to true. The maximum number of SETs is 25.
SETNOT	Sets the value of its parameter to false. The maximum number of SETNOTs is 25.
IF or IFNOT	Determines the block of code to be used for conditional assembly; the code between the IF and ENDIF will be assembled if the given parameter value is true; the code between IFNOT and ENDIF will be assembled if the parameter value is false.
ELSEIF	Provides alternative to ENDIF when precedes ENDIF; for example, if the parameter value is true, the code between IF and ELSEIF will be assembled, but the code between ELSEIF and ENDIF will not be assembled. If the parameter value is false, code between IF and ELSEIF will not be assembled, but code between ELSEIF and ENDIF will be assembled. ELSEIF gives the same alternative arrangement to a directive sequence that begins with IFNOT.
ENDIF	See IF, IFNOT, ELSEIF

4.6.3 Conditional Assembly

The CASM08Z assembler allows you to specify blocks of code to be assembled only upon certain conditions. To set up such conditional assembly procedures, use the conditional assembler directives summarized in **Table 4-2**.

Example of Conditional Assembly Directives

\$SET debug	;sets debug = true
\$SETNOT test	;sets test = false
nop	;always assembles
nop	;always assembles
\$IF debug	;if debug = true
jmp start	;assembles
\$ELSEIF	;if debug = false
jmp end	;does not assemble
\$ENDIF	;
nop	;always assembles
nop	;always assembles
\$IF test	;if test = true
jmp test	;does not assemble
\$ENDIF	;

4.6.4 INCLUDE

If the CASM08Z assembler encounters the INCLUDE directive, it takes source code from the specified file and continues until it encounters another INCLUDE directive or until it reaches the end of the main file. When the assembler reaches the end of the main file, it continues taking source code from the file that contained the include directive.

The file specification of the INCLUDE directive must be in either single or double quotes. If the file is not in the current directory, the specification should also include the full path name as well as the filename.

You may nest includes to a maximum depth of 10.

Examples:

```
$INCLUDE "INIT.ASM"
$INCLUDE "C:\project\init.asm"
```


4.6.5 MACRO

A macro is a named block of text to be assembled. Similar in some ways to an included file, the macro allows labels and parameter values.

The **MACRO** directive begins the macro definition. The name of the macro is the parameter value for the **MACRO** directive. All subsequent code, until the assembler encounters the **MACROEND** directive, is considered the macro definition.

No assembler directives may be used within a macro, nor does the definition require parameter names. Instead, the macro definition includes the sequential indicators *%n* for the *n*th parameter values of the macro call. The assembler will ignore parameter values on the **MACRO** directive line, so such values may be helpful for internal documentation.

Examples:

This macro example illustrates a macro that divides the accumulator value by 4:

```

$MACRO divide_by_4      ;starts macro definition
    asra                ;divides accumulator by 2
    asra                ;divides quotient by 2
$MACROEND              ;ends macro definition

```

This macro example illustrates a macro that creates a time delay:

```

$MACRO delay           count
                        ldaa #1
loop:                  deca
                        bne loop
$MACROEND

```

In this macro, the CASM08Z assembler ignores the parameter *count* on the **MACRO** directive line. The parameter *count* merely indicates the role of the parameter value passed to the macro. That value is substituted for the sequential indicator *%1*. The first time this macro is called, the CASM08Z assembler changes the label *loop*, on lines 3 and 4, to *loop:0001*. If the calling line

```

    delay 100t

```

invokes this macro, the loop would occur 100 times. The suffix *t* represents the decimal base.

The CASM08Z assembler ignores extra parameter values sent to a macro. If the macro does not receive enough parameter values, the assembler issues an error message.

Labels change automatically each time they are used. Labels used within

macros may not be longer than 10 characters, because the assembler appends a 4-digit hexadecimal number to the label to ensure label uniqueness.

Although code may not jump into a macro, it may jump out of a macro. Macros cannot be forward referenced.

4.7 LISTING DIRECTIVES

List directives are source-code keywords that control output to the .LST listing file. These directives pertain only to viewing the source-code output; the directives, which may be interspersed anywhere in source code, do not affect the actual code assembled. **Table 4-3** summarizes the listing directives.

Table 4-3. Listing Directives

Directive	Action
eject or page	Begins a new page
header ^	Specifies a header on listing pages; the header can be defined only once; the default header is blank; the header string is entered in quotes.
list	Turns on the .LST file output.
nolist	Turns off the .LST file output. This directive is the counterpart of the list directive; at the end of a file, this directive keeps the symbol table from being listed.
pagelength ^	Sets the length of the page; the default parameter value is 166 lines (! = decimal)
pagewidth ^	Sets the width of the output, word wrapping additional text; the default parameter value is 160 columns (! = decimal).
subheader ‘^’	Makes the string specified in quotes (double or single) a subheader on the listing pages; the subheader takes effect on the next page.
Note: The caret (^) character following a directive indicates a mandatory parameter value that must be supplied.	

4.7.1 Listing Files

If a listing file is requested using the *L* parameter in the command line of the *Program Item Property* dialog box, or the **Output Listing File** option is checked in the **Assembler/Compiler** tab in the *Environment Settings* dialog box, the listing file (.LST) is created during the assembly.

This listing file has the same name as the file being assembled, but with the

extension .LST. Any existing file with the same name will be overwritten.

The listing file has the following format (file fields shown in the example are described in **Table 4-4**):

```
AAAA [CC] VVVVVVVVLLLL Source Code . . . . .
```

Example:

```
0202 [05] 1608 37 bset 3,tcsr ;clear timer overflow flag
```

The listing file fields are described in **Table 4-4**.

Table 4-4. Listing File Fields

Field Contents	Field Description
AAAA	The first field contains four hexadecimal digits indicating the address of the command in the target processor (MCU) memory. The assembler generates this field.
[CC]	The second field indicates the number of machine cycles used by the opcode. The assembler generates this field. Note that this value appears only if the cycle counter (Cycle Cntr) was turned on before assembly. Also note that the CC value, which always appears in brackets, is a decimal value. If a command has several possible cycle counts and the assembler cannot determine the actual number, the CC field shows the best case (lowest number). An example of a command that may have several possible counts is a branch command.
VVVVVVVV	The third field contains a label consisting of four hexadecimal digits indicating the values placed into that memory address (and, possibly, the next several memory addresses). Refer to this label in other commands. The size of this field depends on the actual opcode. The assembler derives this field from the source code.
LLLL	The fourth field may contain up to four digits indicating the line count. The assembler derives this field from the source code.
Source code	The last field contains the actual source code from the source code file.
Listing table	The listing table provides a summary of every label and its value, displayed in table format at the end of each listing file.

Example Listing Table:

```

MAIN1.ASM      Assembled with CASM08Z 2/27/97 12:06:39 PM PAGE 2
    0000                26      porta      equ      $0000
    0000                27      portb     equ      $0001
    0000                28      portc     equ      $0002
    0000                29      portd     equ      $0003
    0000                30      ddra      equ      $0004
    0000                31      ddrb     equ      $0005
    0000                32      ddrc     equ      $0006
    0000                33      ddrd     equ      $0007
    . . . .
    Symbol Table

    DONSCN              08DD
    DONSCN1             08EE
    OPTSC1              0866
    OPTSC2              0877
    OPTSC3              0888
    . . . .
  
```

4.7.2 Labels

As you write the program code, you will not necessarily know the addresses where commands will be located. The assembler solves this problem using a system of labels, providing a convenient way to identify specific points in the program without knowing the exact addresses. The assembler later converts these mnemonic labels into specific memory addresses and even calculates the offsets for branch commands in order for the CPU to use them.

Labels within macros must not exceed 10 characters in length.

Examples:

```

Label:
ThisIsALabel:
Loop_1
This_label_is_much_too_long:
  
```

The assembler would truncate the last example to 16 characters.

4.8 PSEUDO OPERATIONS

The CASM08Z assembler also allows pseudo operations in place of opcode mnemonics. The operations that the assembler allows are summarized in **Table 4-5**.

Table 4-5. Pseudo Operations Allowed by CASM08Z

Pseudo Op Code	Action
equ	Associates a binary value with a label.
fcb <i>m</i> or db <i>m</i>	Defines byte storage, where <i>m</i> = label, number, or string. Strings generate ASCII code for multiple bytes. Number and label parameters receive single bytes. Separate multiple parameters with commas.
fdb <i>n</i> or dw <i>n</i>	Defines word storage, where <i>m</i> = label, number, or string. Two bytes are generated for each number or label. Separate multiple parameters with commas.
org <i>n</i>	Sets the origin to the value of the number or label <i>n</i> . No forward references of <i>n</i> are allowed.
rmb <i>n</i> or ds <i>n</i>	Defines storage, reserving <i>n</i> bytes, where <i>n</i> = number or label. No forward references of <i>n</i> are allowed.

4.8.1 Equate (EQU)

The equate directive associates a binary value with a label. The value may be either an 8-bit value or a 16-bit address value. This directive does not generate any object code.

During the assembly process, the assembler must keep a cross-reference list where it stores the binary equivalent of each label. When a label appears in the source program, the assembler looks in this cross-reference table to find the binary equivalent. Each EQU directive generates an entry in this cross-reference table.

An assembler reads the source program twice. On the first pass, the assembler just counts bytes of object code and internally builds the cross-reference table. On the second pass, the assembler generates the listing file and/or the S-record object file, as specified in the command line parameters for the assembler. This two-pass arrangement allows the programmer to reference labels that are defined later in the program.

EQU directives should appear near the beginning of a program, before their labels are used by other program statements. If the assembler encounters a

label before it has been defined, the assembler has no choice but to assume the worse case and assign the label a 16-bit address value. This would cause the extended addressing mode to be used in places where the more efficient direct addressing mode could have been used. In other cases, the indexed 16-bit offset addressing mode may be used where a more efficient 8-bit or no offset indexed command could have been used.

4.8.2 Form Constant Byte (FCB)

The arguments for this assembler directive are labels or numbers (separated by commas) that the assembler can convert into a single byte of data. Each byte specified by the FCB directive generates a byte of machine code in the object code file. Use FCB directives to define constants in a program.

4.8.3 Form Double Byte (FDB)

The arguments for this assembler directive are labels or numbers (separated by commas) that the assembler can convert into 16-bit data values. Each argument specified in an FDB directive generates two bytes of machine code in the object code file.

4.8.4 Originate (ORG)

The originate directive sets the location counter for the assembler. The location counter keeps track of the address where the next byte of machine code will be stored in memory.

As the assembler translates program statements into machine code commands and data, it advances the location counter to point to the next available memory location.

Every program has at least one ORG directive to establish the program's starting place. Most complete programs also will have a second ORG directive near the end of the program to set the location counter to the address where the reset and interrupt vectors are located. Always specify the reset vector. It is good practice to also specify interrupt vectors, even if you do not expect to use interrupts.

4.8.5 Reserve Memory Byte (RMB)

Use this assembler directive to set aside space in RAM for program variables. The RMB directive does not generate any object code, but it normally generates an entry in the assembler's internal cross-reference table.

4.9 ASSEMBLER ERROR MESSAGES

You can configure the CASM08Z assembler to highlight any errors that it encounters during assembly and display an error message on the prompt line. **Table 4-6** summarizes these messages.

Table 4-6. Assembler Error Messages

Message	Probable Cause	Corrective Action
Conditional assembly variable not found	The variable in the IF or IFNOT statement has not been declared via a SET or SETNOT directive.	Declare the variable using the SET or SETNOT directive.
Duplicate label	The label in the highlighted line already has been used.	Change the label to one not used already.
Error writing .LST or .MAP file – check disk space	Insufficient disk space or other reason prevents creation of an .LST or .MAP file.	Make sure there is sufficient disk space. Make sure that your CONFIG.SYS file lets multiple files be open at the same time (see the DOS or Windows manual for commands).
Error writing object file –check disk space	Insufficient disk space or other reason prevents creation of an object file.	Make sure there is sufficient disk space. Make sure the CONFIG.SYS file allows multiple files to be open at the same time (see your DOS or Windows manual for commands).
Include directives nested too deep	Includes are nested 11 or more levels deep.	Nest includes no more than 10 levels deep.
INCLUDE file not found	Assembler could not find the file specified in the INCLUDE directive.	Make sure that quotes enclose the filename to be included; if necessary, specify the full pathname as well.
Invalid base value	Value is inconsistent with current default base (binary, octal, decimal, or hexadecimal).	use a qualifier prefix or suffix for the value or change the default base.
Invalid opcode, too long	The opcode on the highlighted line is wrong.	Correct the opcode.

Table 4-6. Assembler Error Messages (Continued)

Message	Probable Cause	Corrective Action
MACRO label too long	A label in the macro has 11 or more characters.	Change the label to have no more than 10 characters.
MACRO parameter error	The macro did not receive sufficient parameter values.	Send sufficient parameter values to the macro.
Out of memory	The assembler ran out of system memory	Create a file that consists only of an INCLUDE directive, which specifies the primary file. Assembling this file leaves the maximum memory available to the assembler.
Parameter invalid, too large, missing or out of range	Operand field of the highlighted line has an invalid number representation. Or the parameter value evaluates to a number too large for memory space allocated to the command.	Correct the representation or change the parameter value.
Too many conditional assembly variables	There are 26 or more conditional variables.	Limit conditional variables to 25 or fewer.
Too many labels	The assembler ran out of system memory.	Create a file that consists only of an INCLUDE directive, which specifies the primary file. Assembling this file leaves the maximum memory available to the assembler.
Undefined label	The label parameter in the highlighted line has not been declared.	Declare the label.
Unrecognized operation	The highlighted opcode is unknown or is inconsistent with the number and type of parameters.	Correct the opcode or make it consistent with parameters.
'}' not found	A mathematical expression is missing its closing brace.	Insert the closing brace.

4.10 USING FILES FROM OTHER ASSEMBLERS

To prepare a source file made by another assembler with CASM08Z, follow these steps:

1. Make sure all comments in the source file are preceded by a semicolon.
2. Use the global find-and-replace operation in the editor to change any assembler directives, listing directives, and/or pseudo operations, if they exist in the source code. Remember that assembler directives must begin with the character \$, /,., or #, and must start in column 1.
3. If necessary, use the BASE directive to change the default base for operands (CASM08Z defaults to hexadecimal).

CHAPTER 5

ICS08Z IN-CIRCUIT SIMULATOR

5.1 OVERVIEW

This chapter describes the in-circuit simulator user interface, toolbar buttons, windows, sub-windows, messages, and menu options.

5.2 ICS08Z DESCRIPTION

The ICS08Z in-circuit simulator software is the debugging component of a complete development environment when used in conjunction with the WinIDE editing environment, the CASM08Z command-line assembler, the PROG08SZ FLASH memory programmer, and the ICD08SZ in-circuit debugger.

The ICS08Z software simulates all instructions, interrupts, and peripherals for a particular M68HC908 MCU. The software can run with the ICS08 board, via the communications cable, or in stand-alone simulation without the board.

With this package, designers can create source code, assemble the code, debug the code, and program Motorola M68ICS08 in-circuit simulator devices. The WinIDE environment operates as a standard ASCII file (such as assembly file) editor for Windows and includes some speed buttons for calling upon customized assemblers, compilers, and debuggers. In conjunction with the CASM08Z assembler and the ICD08SZ in-circuit debugger, this environment can allow assembled files to be downloaded and tested while the original source code is modified and assembled.

The ICS08Z simulator software gets input and output for the device from the external hardware ICS08 board attached to the host computer. I/O from a custom target system can be used by attaching the ICS08 board to the target board with the appropriate cables. 68HC08 devices can be programmed through the ICS08 board using the PROG08SZ software. See the ***M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL*** for

your specific part for information about the ICS08 board.

ICS08Z is a non-real-time debugger. MCU code runs only as fast as it can be simulated by the host PC. For real-time execution, use the ICD08SZ real-time, in-circuit debugger. The transmission data rate of communications peripherals is determined by the ICS board oscillator.

The ICS08Z software accepts any standard Motorola .S19 S-Record files as input for simulation. These object files can be created by any HC08 assembler, such as CASM08Z. However, to perform source-level debugging through these files (in the code window), P&E-compatible source-level map files must be loaded. These map files can be generated through CASM08Z. If a third-party compiler (assembly or C) is being used, the compiler must be able to produce P&E-compatible source-level map files.

5.2.1 ICS08 Simulation Speed

You should be aware of a difference in speed between simulation and in-circuit simulation.

Simulation — Generally faster but does not involve real input and output. The software can be set for simulation at startup by using the SIM08 command. In addition, if power to the board is off at startup, the user will have the option of choosing simulation from the buttons in the communications error window.

In-circuit simulation — Slower but involves real input and output. The POD command lets the user reconnect to the module for in-circuit simulation. Real input includes communications characters and A/D values, if supported by your particular MCU.

5.2.2 System Requirements for ICS08Z Software

The ICS08Z software runs under Windows 95, 98, or NT.

The host computer should have a minimum of 5 Mbytes of RAM (system memory) available for assembly processes, as well as sufficient disk space to store the files that the ICS08Z software creates.

5.2.3 File Types and Formats

You can use a number of file types in conjunction with the ICS08 in-circuit simulator. The following topics describe the use and structure of each type.

- **.S19 (Object) Files** — The ICS08Z software accepts any standard Motorola .S19 files as input for simulation. These .S19 object files can be created by any HC08 assembler (such as CASM08Z) and contain the actual object code that is simulated by the ICS08Z software. Specify the .S19 files to use on the command line or load it using the

LOAD command in the ICS08Z Status Window.

- The object file has the same name as the file assembled, with the extension .HEX or .S19, and contains the actual assembled (or object) code to debug. If you specify an object file in the environment settings, it is created during assembly.
- The CASM08Z (and some other assemblers) produce object files in the .S19 format. The Motorola .S19 object code format is described in detail in **CHAPTER A – S-RECORD INFORMATION**. .HEX files are the Intel 8-bit object code format.
- **Map Files** — Contain source level debugging information. To debug symbolic or source code in the code window you must also load one or more P&E map-files. The *.MAP source-level map file can be generated by specifying the map files option on the command line when running the CASM08Z assembler or loaded using the LOADMAP command in the ICS08Z Status Window. If you specify a map file in the environment settings, it is created during assembly.

Note: Map files contain directory information, so they cannot be moved. To debug source code out of another directory, move the source file to the new directory and reassemble the file in the new directory so the new map file will contain the correct directory information.

When using a third-party assembly language or C compiler, it must be able to produce compatible source-level map files.

- **Script Files** — Plain ASCII text files containing ICS08Z simulator commands. Use any command in the ICS08Z command set in script files. Running the script file then has the effect of entering the commands in it in the ICS08Z command line. You can create script files in the WinIDE editor or use files created by other text editors following these rules:
 - Enter each command on its own line.
 - Preface comments with a semi-colon.
 - Use commands from the ICS08Z command set and WAIT.
- **Logfiles** — Simple ASCII text files, sometimes called scratch pad files. The logfile records the sequence and content of commands executed, and the debugger responses to the commands. View logfiles from within the WinIDE editor. The ICS08Z simulator creates logfiles if the LOGFILE or LF command is active.

5.3 STARTUP AND PARAMETERS

The ICS08Z software can be started from within the WinIDE environment or by itself in stand-alone mode. Simply double click on the ICS08Z for Windows icon to run it in stand-alone mode or modify the ICS08Z simulator environment in the WinIDE editor.

- To run the simulator from the WinIDE editor press the F6 function key.
- To modify how the software starts from WinIDE editor:
 1. From the WinIDE **Environment** menu, choose the **Setup Environment** option to open the *Environment Settings* dialog box.
 2. Select the **EXE1 Debugger** tab heading, if it is not already on top, to set options for the ICS08Z simulator. For more information about the options in the tab, see **Section 3.10.5.4 Executable Tabs - EXE 1-4**.
- To run the simulator directly from Windows, choose the ICS08Z icon from the ICS08 group in the **Start** menu.

5.3.1 Startup Parameters

Place the path of the ICS08Z for Windows executable in the *EXE Path* edit box. The options for the software are placed in the *Options* edit box as follows:

[option] [option] ...

In both cases, *[option]* is a parameter as follows:

1..8	Specifies the serial COM port on the PC that connects to the ICS08 board (default = 1).
file.s19	The object file that is immediately loaded into the ICS08 software during startup along with its map file (if any).
/b(<i>n</i>)	Set the baud rate between the ICS board and PC to (<i>n</i>) baud, where (<i>n</i>) is 4800, 9600, 14400, 19200, or 28800. The initial default rate is 9600. Thereafter, default is the last rate used in a debug session (see Note).
FORCEPASS	Overrides the last used setting of whether to ignore security failure, and forces the software to not enter monitor mode until security has been successfully passed. This is the factory default setting, and can be overridden in the startup dialog if communication problems exist.

FORCEBYPASS	Overrides the last used setting of whether to ignore security failure and forces the software to not enter monitor mode until security has been successfully passed. This is the factory default setting. This can be overridden in the startup dialog if communication problems exist.
ICS08	Overrides the last used target connection mode to communicate to the standard CLASS I target (CLASS I = ICS Board with processor installed. Possible emulation cable connection). This is the factory default setting, and can be overridden in the startup dialog if communication problems exist.
MON08	Overrides the last used target connection mode to communicate to a CLASS II target (CLASS II = ICS Board without processor connected to target via MON08 Cable). This can be overridden in the startup dialog if communication problems exist.
NODTR	Overrides the last used target connection mode to communicate to a CLASS III target (CLASS III = Target Board with MON08 circuitry built in). This can be overridden in the startup dialog if communication problems exist.
NODTRADD	Overrides the target connection mode that was last used to communicate with a Class IV target (CLASS IV = Custom Board (not ICS) with MON08 serial port circuitry and additional auto-reset circuit built in). This can be overridden in the startup dialog if communication problems exist.
/SIM08	Starts the software in simulation only mode.

If more than one option is given, they must be separated by spaces.

Note: The user should choose the baud rate according to the target configuration. For more information, consult the MON08 chapter of the *CPU08 Manual*, Motorola document order number CPU08RM/D.

The following examples are for the M68HC908RK2 - if you have a different part, substitute the name of your part for “RK” below:

Examples:

ICS08RKZ.EXE myprog

Start simulator, load files myprog.s19 and myprog.map.

ICS08RKZ.EXE 2 myprog Start simulator with the same files as the previous example, but use serial port COM2.

ICS08RKZ.EXE /b14400 Start simulator, communicate at 14400 baud.

After startup the software will attempt to communicate with the board at the given parameters. If the software is not able to connect with the board, the *Can't Contact Board* dialog box (see **Figure 5-1**) appears:

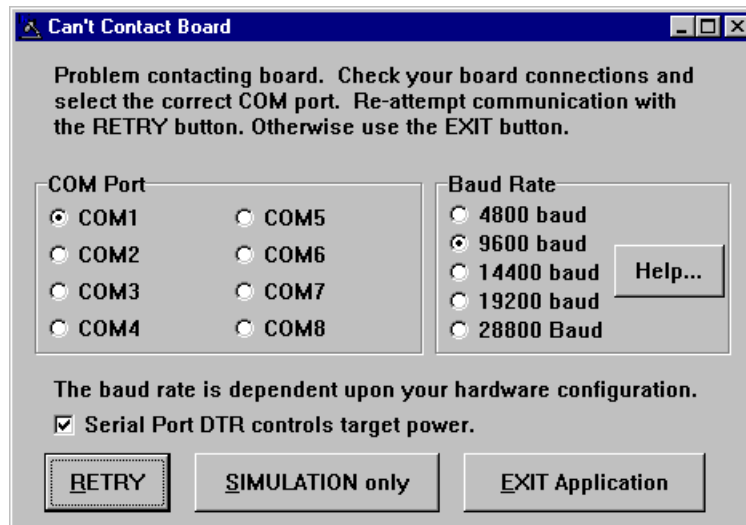


Figure 5-1. Can't Contact Board Dialog Box

If the communication parameters are incorrect in the screen, change them and then click on the RETRY button. If the user does not wish to use I/O from the board, then click the SIMULATION ONLY button. Otherwise, click the EXIT APPLICATION button.

On some MCU devices, peripherals can be clocked by either the BUS clock or the CGMXCLK. To properly simulate these modules with respect to the clock, set the CGMXCLK to BUS clock relationship using the CGMXCLK command. If applicable, see the **Manual Addendum** for your specific M68HC908 part.

To change the colors of the simulator, use the COLORS command to change the colors of windows and text.

Note: If a file named STARTUP.08 exists in the current directory, it will be run as a macro file on startup. See the MACRO command in **Section 9.1 COMMAND DESCRIPTIONS** for more information.

5.4 ESTABLISHING COMMUNICATION

After startup, the software will establish communication with the board at the given parameters and the status bar will read *Attempting to contact COM 1*.

- If the ICS08Z software can communicate with the ICS board through the serial port, the status bar displays a confirmation message that contact has been established.
- If the software is not able to connect with the ICS board, the *Can't Contact Board* dialog box (see **Figure 5-1**) appears.

If the communication parameters for the communications port and baud rate are incorrect in the *Can't Contact Board* dialog box, change them and then press the RETRY button. If the board is not connected or you do not wish to use I/O from the board, then click the SIMULATION ONLY button. Otherwise, press the EXIT APPLICATION button.

The MON08 monitor will communicate with the PC only if the target is run at specific frequencies. Based upon this frequency, and the configuration of certain processor pins on reset, the user can determine the baud rate with which to talk to the target. Most processor manuals give the default baud rates for the processor oscillator of 4.9152 MHz. To connect to the target at a baud rate that is an integer multiple of this oscillator, just multiply the documented baud rate by the integer multiple.

The following additional option is represented by a checkbox. If checked, it means that the power supply of the target is not controlled by the PC serial port DTR line. You should check this box if the processor is mounted on your target board (as it will not have its power supply controlled by DTR). The box should be unchecked if the ICS is being used in emulator mode (the processor is in the ICS).

Serial Port DTR Controls target power

When you start the ICS08 software for the first time, the *Pick Device* dialog box offers choices of different M68HC908 devices (chips). To open this dialog box and change the device later, enter the CHIPMODE command in the ICS08 Status Window command line.

Note: If a file named STARTUP.08 exists in the current directory, the WinIDE runs it as a macro file on startup. See the MACRO command in **CHAPTER 9 – DEBUGGING COMMAND SET** for more information.

5.5 ICS08Z WINDOWS

The ICS08Z user interface consists of windows in which system and code information is shown and into which the ICS08Z command set can be entered

(see **Figure 5-2**).

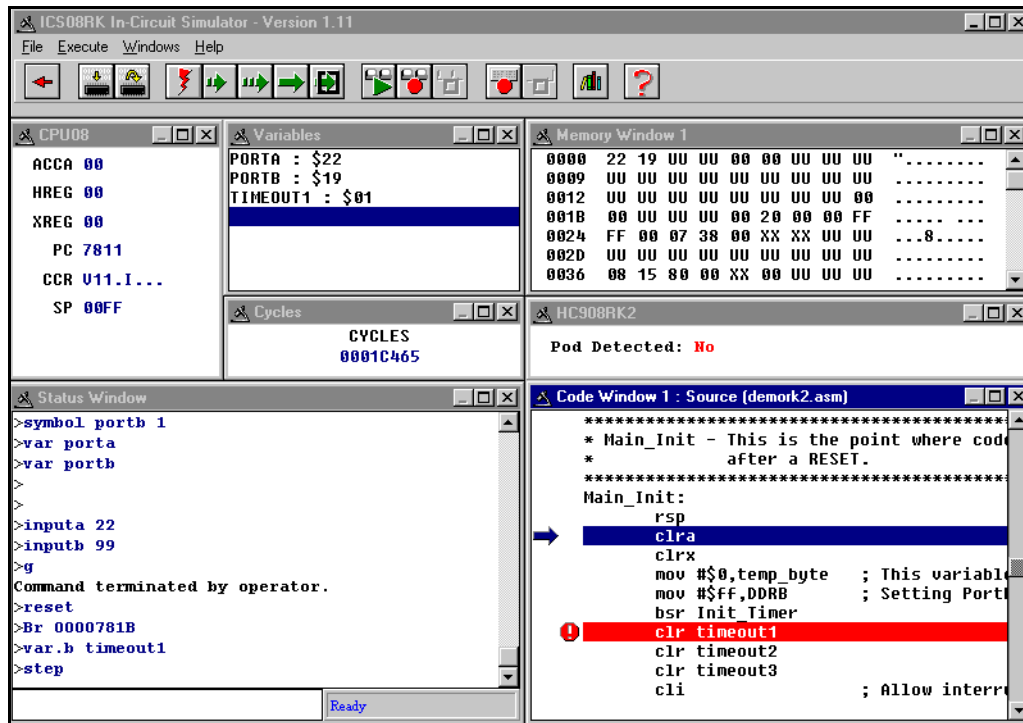


Figure 5-2. ICS08Z Windows Default Positions

The ICS08Z software also displays these sub-windows when appropriate:

- Stack window
- Trace window
- Breakpoint window
- Programmer windows
- Register Block window

5.6 CODE WINDOWS

You can set the code windows (Code Window 1 and Code Window 2) to display source code in either source or disassembly modes. Code windows also give visual positions of the current program counter (PC) and all breakpoints within the source code. You can display both code windows simultaneously. Each code window is independent: you can configure each window to display different parts of the source code or different assembly modes.

Figure 5-3 shows the code windows' menu, which contains options for working in the code window.

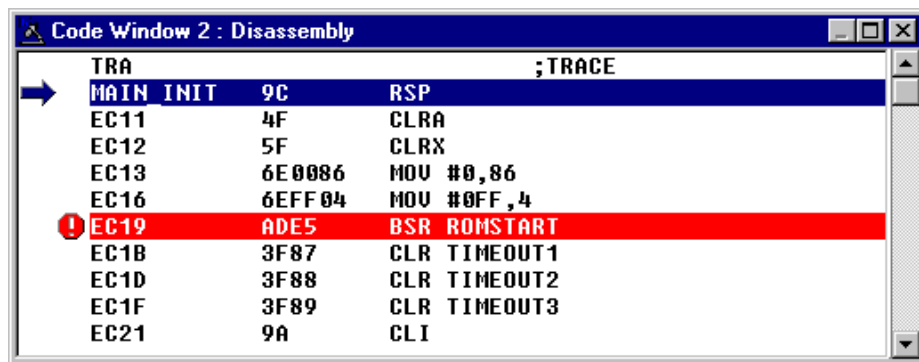


Figure 5-3. Code Window in Disassembly Mode with Breakpoint Toggled

5.6.1 To Display the Code Windows Shortcut Menus

To display the shortcut menu for the code windows (see **Figure 5-4**), position the cursor in either code window and click the right mouse button. Some options will not be active unless you have first selected a line of code in the window the using the left mouse button.

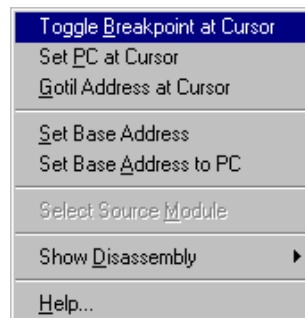


Figure 5-4. Code Window Shortcut Menu

5.6.2 Code Window Shortcut Menu Functions

The shortcut menu for the code windows (see **Figure 5-4**) offers these options:

Toggle Breakpoint at Cursor — Choose this option to set or remove the breakpoint at the current cursor location. This option is enabled only if the user has clicked on a line of code to select it.

Set PC at Cursor — Choose this option to set the program counter (PC) to the current cursor location. This option is enabled only if the user has clicked on a line of code to select it.

Gotil Address at Cursor — Choose this option to execute the source code until the program counter (PC) gets to the line at the current cursor location. When PC gets to that point, execution stops. This option is enabled only if the user has clicked on a line of code to select it.

Set Base Address — Choose this option to open the *Window Base Address* dialog box (**Figure 5-5**) and set the new address for the first code line in the code window.

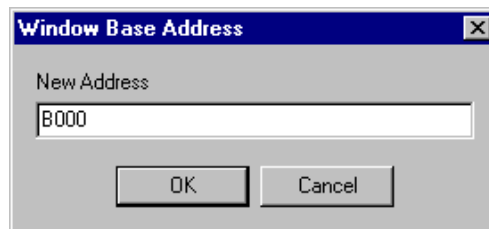


Figure 5-5. Window Base Address Dialog Box

Set Base Address to PC — Choose this option to set the program counter (pc) to the address of the first line in the code window.

Select Source Module — Choose this option to select a source module (if a MAP file has been loaded into memory).

Show Disassembly — Choose this option to display the code window contents in disassembly mode.

Show Source/Disassembly — Choose this option to display the code window contents in both disassembly and source modes.

Help — Display code window help information.

5.6.3 Code Window Keyboard Commands

Use these keys to navigate in the code windows:

- Press the UP ARROW (↑) key to scroll the code window contents up one line.
- Press the DOWN ARROW (↓) key to scroll the code window contents down one line.
- Press the HOME key to scroll to the code window's base address.
- Press the END key to scroll to the code window's last address.
- Press the PAGE UP key to scroll the code window up one page.
- Press the PAGE DOWN key to scroll the code window down one page.
- Press the F1 key to show the Help Contents topic.
- Press the ESCAPE (Esc) key to move the cursor to the command line of the Status Window.

5.7 VARIABLES WINDOW

The Variables window (see **Figure 5-6**) displays current variables during execution. Use the **Variables** shortcut menu to add or remove variables from the current list.

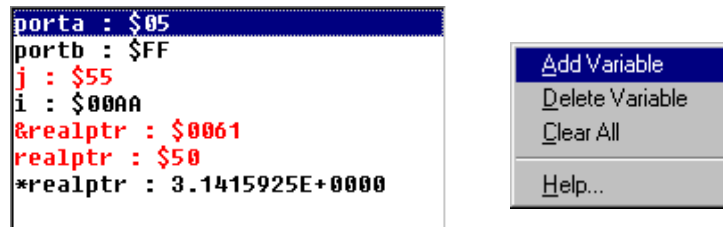


Figure 5-6. Variables Window with Shortcut Menu

5.7.1 Displaying the Variables Shortcut Menu

To display the **Variables** shortcut menu, position the cursor in the Variables window and click the right mouse button.

5.7.2 Variables Window Shortcut Menu Options

The **Variables** shortcut menu offers these options for managing variables:

- **Add Variable** — Choose this option to open the *Add Variable* dialog box (see **Figure 5-7**) to add a variable or address to the current variable list. Select the variable type (size) and base.

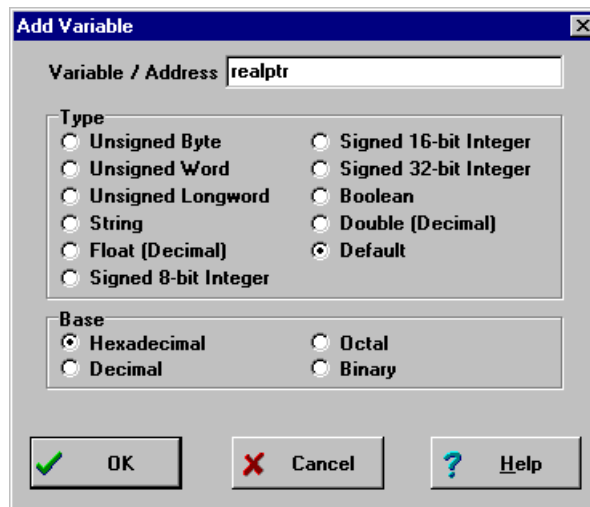


Figure 5-7. Add Variable Dialog Box

Enter values for commands in the simulator as either numbers or labels (which you have defined in the map file or with the SYMBOL command). Specify the base in which variables are shown using the options in the *Add Variable* dialog box (**Figure 5-7**). The default number format for the ICS08 software is hexadecimal.

- **Delete Variable** — Choose this option to remove the selected (highlighted) variable from memory and from the current variable list.
- **Clear All** — Choose this option to clear all variables in the current variable list.

5.7.3 Variables Window Keyboard Commands

Use these keys to navigate in the Variables window:

- Press the INSERT key to add a variable.
- Press the DELETE key to delete a variable.
- Press the UP ARROW (↑) key to scroll the Variables window up one variable.
- Press the DOWN ARROW (↓) to scroll the Variables window down one variable.

- Press the HOME key to scroll the Variables window to the first variable.
- Press the END key to scroll the Variables window to the last variable.
- Press the PAGE UP key to scroll the Variables window up one page.
- Press the PAGE DOWN key to scroll the Variables window down one page.
- Press the F1 key to shows the Help Contents topics.
- Press the ESCAPE (Esc) key to move the cursor to the command line of the Status Window.

5.8 MEMORY WINDOW

Use the Memory Window (see **Figure 5-8**) to view and modify the memory in ICS08Z software. View bytes by using the scrollbar on the right side of the window.

To modify a set of bytes:

1. Double click on the bytes to open the *Modify Memory* dialog box for that address.
2. Enter the MM command in the command line of the Status Window.

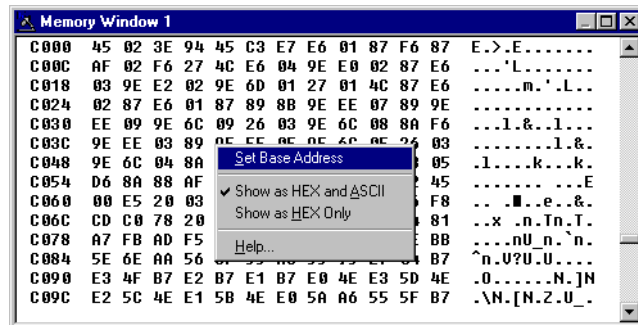


Figure 5-8. Memory Window with Shortcut Menu

Note: The value xx means that the memory location is un-initialized and indeterminate. The value UU means that it is un-implemented, invalid memory.

Use the options from the Memory Window Shortcut menu to perform these memory functions:

Set Base Address — Choose this option to set the first memory address to display in the Memory window.

Show as HEX and ASCII — Choose this option to display memory

values in both HEX and ASCII formats.

Show as HEX Only — Choose this option to display memory values in HEX format only, allowing more bytes per row.

Use these keys to navigate in the Memory Window:

- Press the UP ARROW (↑) to scroll the Memory Window up one line.
- Press the DOWN ARROW (↓) to scroll the Memory Window down one line.
- Press the HOME key to scroll the Memory Window to memory address \$0000.
- Press the END key to scroll the Memory Window to the last address in the memory map.
- Press the PAGE UP key to scroll the Memory Window up one page.
- Press the PAGE DOWN key to scroll the Memory Window down one page.
- Press the F1 key to show the Help Contents topic.
- Press the ESCAPE (Esc) key to move the cursor to the command line of the Status Window.

5.9 STATUS WINDOW

Figure 5-9 shows the Status Window, which accepts ICS08Z commands entered on the command line, executes them, and returns an error message or status update message, as in the message area of the window.

The Status Window message area displays all ICS08Z commands (including implemented ICS08Z menu options and toolbar buttons), and command results.

Use these scroll controls on the right side of the Status Window to view previous commands or use these keys to scroll the message area if the message area is active within the Status Window:

- Press the UP ARROW (↑) key to scroll the window up one line.
- Press the DOWN ARROW (↓) key to scroll the window down one line.
- Press the HOME key to scroll the window to the first status line.
- Press the END key to scroll the window to the last status line.
- Press the PAGE UP key to scroll the window up one page.
- Press the PAGE DOWN key to scroll the window down one page.
- Press the F1 key to display the Help Contents topic.

If the command line edit box is active in the Status Window, the following functionality is enabled:

- Press the UP ARROW (↑) key to scroll back in the buffer of previously executed commands. Use this to repeat commands.
- Press the DOWN ARROW (↓) key to scroll forward in the buffer of previously executed commands. Use this to repeat commands.

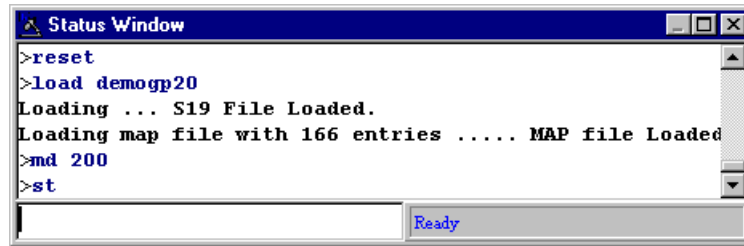


Figure 5-9. Status Window

Follow these steps to save the information displayed in the Status Window by enabling logging:

1. Choose the **Start Logfile** option from the ICS08Z File menu, or enter the LF command in the Status Window command line (see **Figure 5-10**).

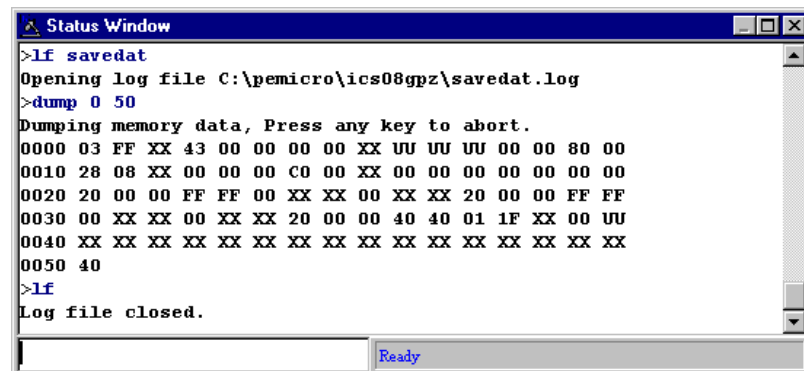


Figure 5-10. Results of Entering the LF Command in the Status Window

2. The *Specify output LOG file!* dialog box (see **Figure 5-11**) opens.

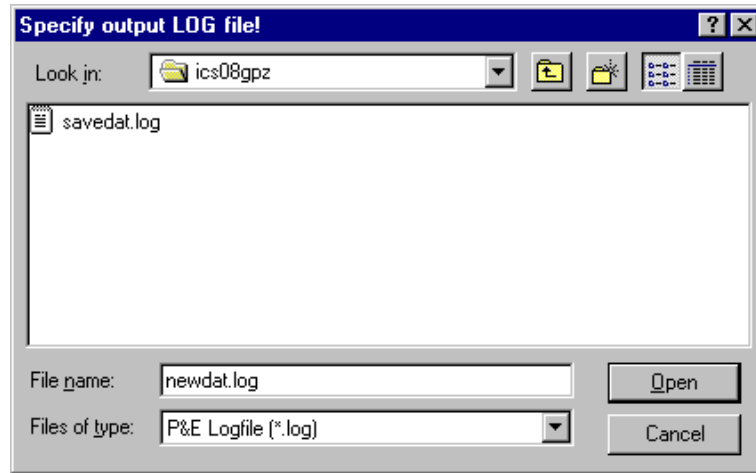


Figure 5-11. Specify Output LOG File! Dialog Box

3. In the dialog box, choose a path and filename for the logfile. Press OK to create the file (or CANCEL to close the dialog box without opening the logfile).
4. If you choose a logfile that already exists, the *Logfile Already Exists* message (see **Figure 5-12**) appears, asking if you wish to overwrite the existing file or append the status messages to the end of the existing file. Choose **Overwrite** or **Append** to begin logging in the file or **Cancel** to close the dialog box without opening the logfile.

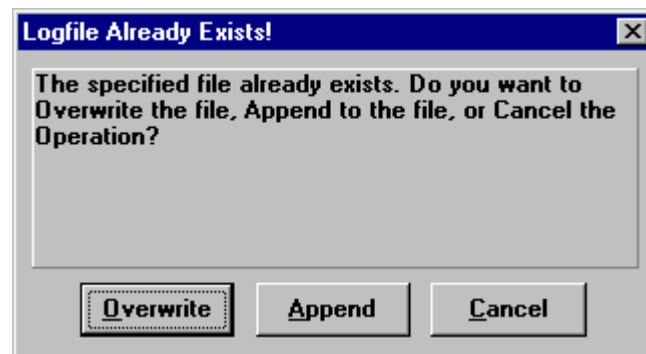


Figure 5-12. Logfile Already Exists! Message

5. Status Window messages are added to the logfile while logging is enabled.
6. To end logging, choose the **End Logfile** option from the ICS08 File menu or enter the LF command in the ICS08Z Status Window command line.

5.10 CPU08 WINDOW

The CPU08 window displays the current register values.

5.10.1 Changing Register Values

Use the CPU08 window (see **Figure 5-13**) or its **Shortcut** menu options to view and modify the current state of registers within the CPU.

To change CPU register values using the **Shortcut** menu options:

1. Position the cursor in the CPU08 window and click the right mouse button.
2. Choose the option from the shortcut menu shown on the right of **Figure 5-13**.
3. Enter the new value in the dialog box
4. Press OK to close the dialog box and save the new value.

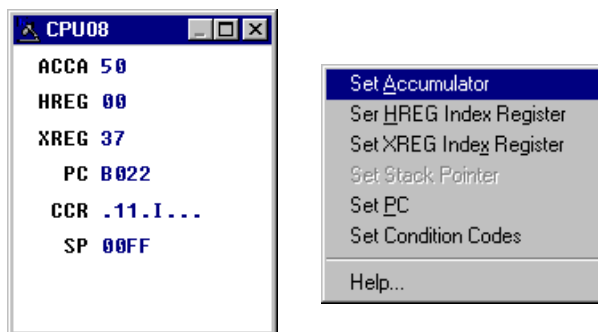


Figure 5-13. CPU Window with Shortcut Menu

To change CPU register value in the CPU08 window:

- To change the CPU accumulator (ACCA), HREG index register, XREG index register, and program counter (PC) values from the CPU08 window, double click on the value and enter the new value in the dialog box. Press OK to close the dialog box and save the new value.
- To change the CPU CCR values, double click the CCR value in the CPU08 window to open the *Change CCR* dialog box (see **Figure 5-14**). Change the H, I, N, V, Z, or C CCR bits by pressing the button below each to toggle condition code register bits between 1 (on) and 2 (off). Press OK to close the dialog box and save the values.

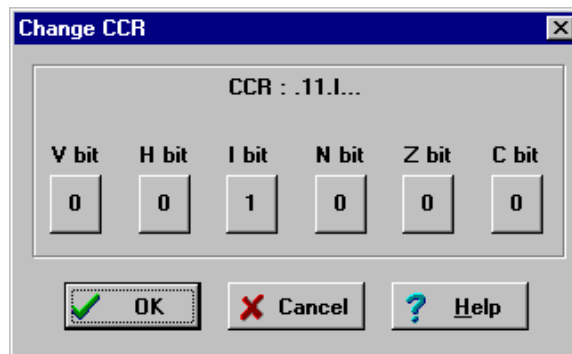


Figure 5-14. *Change CCR* Dialog Box

5.10.2 CPU08 Window Keyboard Commands

Use these keyboard commands to navigate in the CPU08 window:

- Press the F1 key to shows the Help Contents topics.
- Press the ESCAPE (Esc) key to move the cursor to the command line of the Status Window.

5.11 CYCLES WINDOW

Use the Cycles window (see **Figure 5-15**) to view the number of processor cycles that passed during execution of code in the simulator. This is valuable when counting the number of cycles that a section of code requires. To calculate the timing of code for a device, take the number of cycles shown in the window and multiply it by the amount of time that a cycle represents in the target system. For an HC08 with a 4-MHz bus speed, the time per cycle is 250 ns.

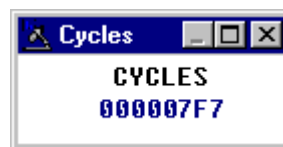


Figure 5-15. Cycles Window

5.12 STACK WINDOW

Use the Stack Window (see **Figure 5-16**) to view:

- Values that have been pushed on the stack

- The stack pointer value
- CPU results if an RTI or RTS instruction is executed at that time

To display the Stack Window, enter the STACK command in the ICS08 Status Window command line.

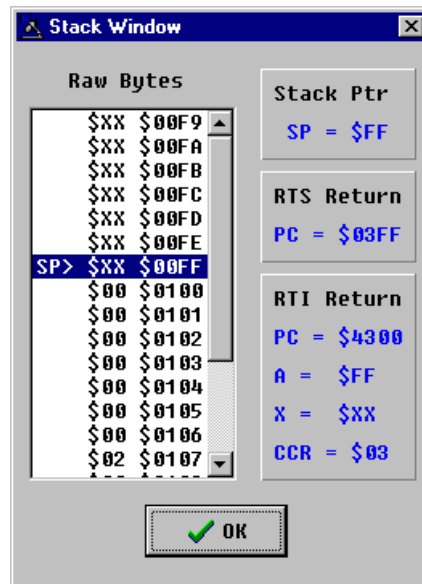


Figure 5-16. Stack Window

Note: The value xx means that the memory location is un-initialized and indeterminate. The value UU means that it is un-implemented, invalid memory.

5.12.1 Interrupt Stack

During an interrupt, the Stack window displays:

- The interrupt stack
- Data values in the stack
- Values of the condition code register (CCR), accumulator (A), and index register (X)

This information indicates the restored state of the stack upon the return from the interrupt.

Note: M68HC08 MCUs store information in the stack (1) during an interrupt or (2) during execution of a subroutine. The stack window shows both these possible interpretations of stack data. To know which stack data interpretation is valid, it is important to know whether program execution is in an interrupt or in a subroutine.

5.12.2 Subroutine Stack

During execution of a subroutine, the stack window displays the subroutine stack that indicates the restored state of the CPU upon return from a subroutine.

Note: M68HC08 MCUs store information in the stack (1) during an interrupt or (2) during execution of a subroutine. The stack window shows both these possible interpretations of stack data. To know which stack data interpretation is valid, it is important to know whether program execution is in an interrupt or in a subroutine.

5.13 TRACE WINDOW

Use the Trace Window (see **Figure 5-17**) to view instructions captured while tracing is enabled.

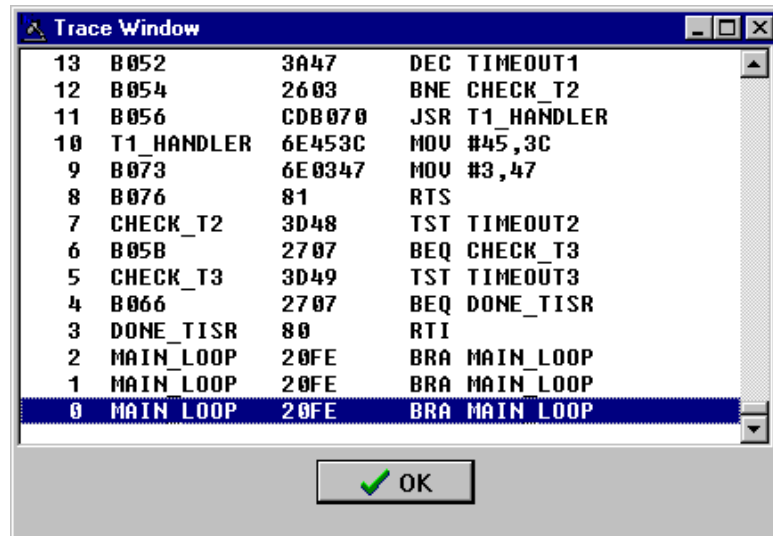


Figure 5-17. Trace Window

To display the Trace Window, enter the SHOWTRACE command in the command line of the ICS08Z Status Window.

To enable or disable tracing, enter the TRACE command. If tracing is off, the command will toggle tracing on; if tracing is on, the command toggles tracing off.

The trace buffer is a 1024 instruction circular buffer that contains all addresses that have been executed. When the trace window displays instructions, it disassembles instructions at the addresses stored in the trace buffer. For this reason, the tracing function cannot be used for self-modifying code. If a buffer slot does not have an address stored in it, the trace window displays the phrase *No Trace Available*. The number in the beginning of a trace line is the slot number in the trace buffer. The slot number is an offset for the instruction in that slot compared to the current instruction executing (slot number = 0).

5.14 BREAKPOINT WINDOW

Use the Breakpoint Window (see **Figure 5-18**) to view all breakpoints currently set in the current debugging session, and to add, modify, delete, or

count breakpoints. You can set a maximum of 64 breakpoints.

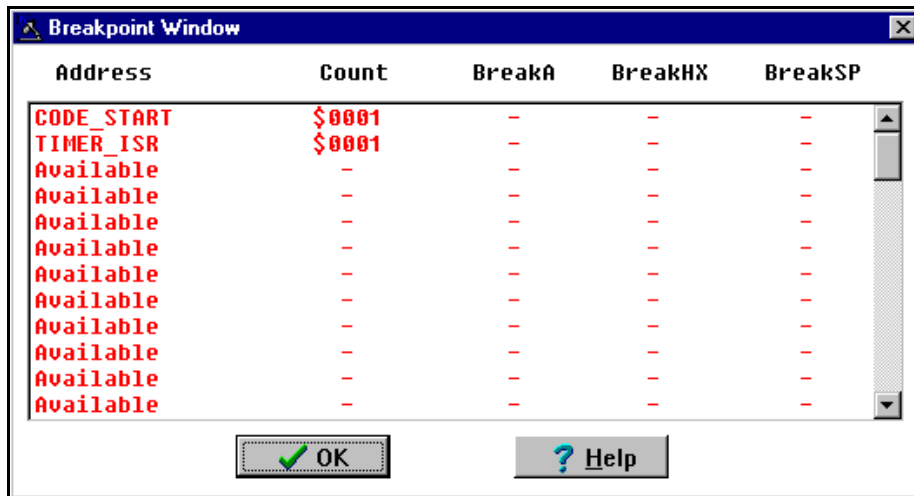


Figure 5-18. Breakpoint Window with Shortcut Menu

To display the Breakpoint Window, enter the SHOWBREAKS command in the ICS08Z Status Window command line.

If a breakpoint slot is empty, the word *Available* appears under the *Address* column.

5.14.1 Adding a Breakpoint

To add a breakpoint, with the cursor in the Breakpoint Window, click the right mouse button to open the **Breakpoint Shortcut** menu. Select the **Add Breakpoint** option from the **Breakpoint Shortcut** menu. In the *Edit Breakpoint* dialog box (see **Figure 5-19**), enter the address for the new breakpoint in the *Address* text box. Press the OK button to close the dialog box and save the new breakpoint.

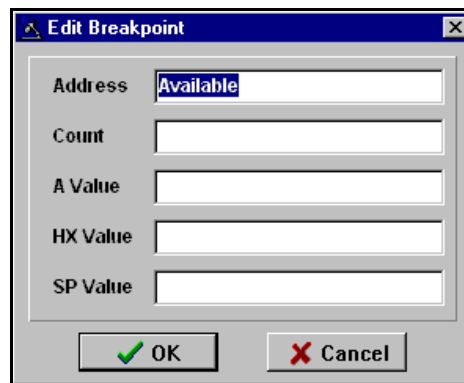


Figure 5-19. Edit Breakpoint Dialog Box

Qualify the breakpoint using these qualifiers:

- **Count** — Enter the number of times the address will be reached before breaking (for example, break after n times (the default is $n = 1$)).
- **Accumulator value** — Enter the number the accumulator value must reach before breaking (for example, break if address and $A = n$).
- **HX index register value** — Enter the number the index register value must reach before breaking (for example, break if address and $HX = n$).
- **SP value** — Enter the number the stack pointer value must reach before breaking (for example, break if address and $SP = n$).

Breakpoints can also be set with the **BR**, **BREAKA**, **BREAKHX**, and **BREAKSP** commands.

5.14.2 Editing a Breakpoint

To edit a breakpoint or view address information, double click on any empty breakpoint slot in the *Breakpoint Window* listbox. The *Edit Breakpoint* dialog box (see **Figure 5-19**) displays address information for the empty breakpoint slot. Enter the appropriate address and other conditional qualifiers and press the OK button to exit.

In the Breakpoint Window, select the breakpoint to edit. Then use one of these methods to open the **Breakpoint Shortcut** menu and edit the breakpoint:

- Click the right mouse button to open the **Breakpoint Shortcut** menu and select the **Edit Breakpoint** menu option.
- Press the INSERT key.
- Double click on the breakpoint in the listbox. In the *Edit Breakpoint* dialog box, enter the new breakpoint address and conditional qualifiers. Press the OK button to close the dialog box and store the new settings or press the CANCEL button to close the dialog box without saving new settings.

5.14.3 Deleting a Breakpoint

In the Breakpoint Window, choose the breakpoint to delete, and use one of the following methods to delete the breakpoint:

- Click the right mouse button to open the Breakpoint Shortcut Menu and select the **Delete Breakpoint** menu option.
- Press the DELETE key to remove the selected breakpoint from the breakpoint list.

Press the OK button to close the Breakpoint Window and store the changes or press CANCEL to close the window without saving the changes.

5.14.4 Removing All Breakpoints

In the Breakpoint Window, click the right mouse button to open the **Breakpoint Shortcut** menu. Choose the **Remove All Breakpoints** menu option to clear all breakpoints. Press the OK button to store changes and close the Breakpoint Window (or press the CANCEL button to close the Breakpoint Window without saving changes). You can also clear breakpoints via the NOBR command.

5.15 REGISTER BLOCK WINDOW

The Choose a Register Block or press ESC window (see **Figure 5-20**) can be opened by pressing the REGISTER FILES button on the ICS08 toolbar or by entering the R command in the Status Window command line.

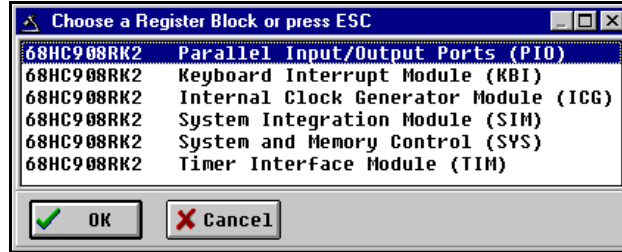


Figure 5-20. Choose a Register Block or Press ESC Window

If register files have been installed on the host computer, selecting a block brings up the Register Block register listing (see **Figure 5-21**), which shows a list of the files, their addresses, and their descriptions. This begins interactive setup of system registers such as I/O, timer, and COP watchdog.

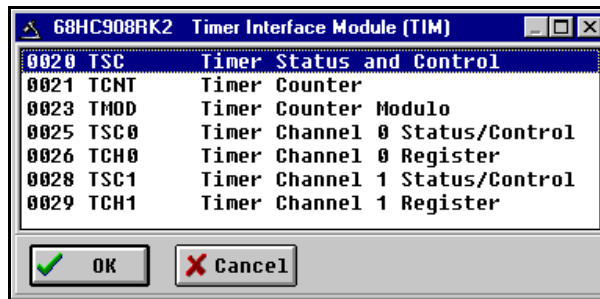


Figure 5-21. Register Block Register Listing

Selecting a file brings up the Register Window (see **Figure 5-22**), which displays the values and significance for each bit in the register. The registers can be viewed and their values modified, and the values can be stored back into debugger memory.

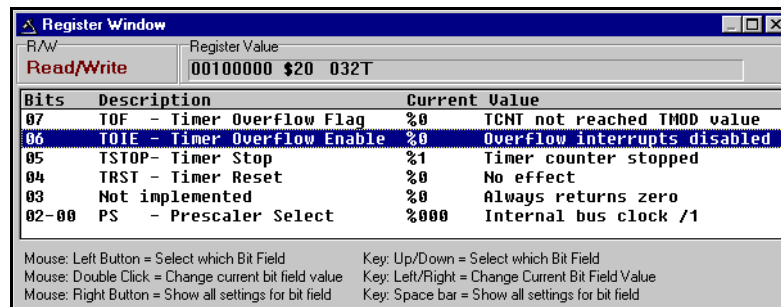


Figure 5-22. Register Window

5.16 ENTERING DEBUGGING COMMANDS

To enter commands in the ICS08Z Status Window command line:

1. Type the command and its options and/or arguments in the text area (the command line).
2. When the command is complete, press the ENTER key to execute the command.
3. If the command has not been entered correctly, the Status Window will display a message such as *Invalid command or parameter*. If the command has been entered correctly, other prompts, messages, or data appropriate to the command entered are displayed in the Status Window text area.
4. After the command has been executed, a new blank line appears in the command line.
5. The ICS08Z software maintains a command buffer containing the commands and system responses to the commands entered on the command line. Use the UP ARROW (↑) or DOWN ARROW (↓) keys to sequence forward or backward through the command buffer.
6. Press the DOWN ARROW (↓) key

For more instructions on using the ICS08Z command set, see **Section 5.22 ICS08Z DEBUGGING COMMANDS**.

5.17 ICS08Z TOOLBAR
















The ICS08Z Toolbar (see **Figure 5-23**) provides a number of convenient shortcut buttons that duplicate the function of the most frequently used menu options. A tool-tip or label pops up when the mouse button lingers over a toolbar button, identifying the button's function.



Figure 5-23. ICS08Z Toolbar

Table 5-1 identifies and describes the ICS08Z toolbar buttons.

Table 5-1. ICS08Z Toolbar Buttons

Icon	Button Label	Button Function
	BACK TO EDITOR	Returns to the WinIDE editor.
	LOAD S19 FILE	Opens the <i>Specify S19 File to Load</i> dialog box.
	RELOAD CURRENT S19	Reloads the last (most currently loaded) S19 file.
	RESET	Simulates a reset of the MCU and sets the program counter (PC) to the contents of the reset vector (does not start execution of user code).
	STEP	Executes the STEP command.
	MULTIPLE STEP	Executes the STEPFOR command.
	Go	Executes the GO command.
	STOP	Stops execution of assembly commands.
	PLAY MACRO	Opens the <i>Specify Macro File to Execute</i> dialog box.
	RECORD MACRO	Opens the <i>Specify Macro File to Record</i> dialog box.
	STOP MACRO FUNCTION	Stops recording the macro.
	OPEN LOGFILE	Executes the LOGFILE command. Opens the <i>Specify Output Logfile</i> dialog box.
	CLOSE LOGFILE	Executes the LOGFILE command; closes the current logfile.
	REGISTER FILES	Opens the Register Block window.
	HELP	Displays ICS08 Help.

5.18 ICS08Z MENUS

Table 5-2 summarizes WinIDE menu titles and options.

Table 5-2. ICS08Z Menus and Options Summary

Menu	Option	Description
File	Load S19 File	Opens the <i>Specify S19 File to Open</i> dialog box.
	Reload Last S19	Reloads the last S19 file used, or (if none loaded) displays the <i>Specify S19 File to Open</i> dialog box.
	Play Macro	Opens the <i>Specify Macro File to Execute</i> dialog box.
	Record Macro	Opens the <i>Save As</i> dialog box.
	Stop Macro	Closes the macro or script file.
	Open Logfile	Executes the LOGFILE command.
	Close Logfile	Executes the LOGFILE command.
	Exit	Closes the ICS08 simulator.
Execute	Reset Processor	Resets the emulation MCU and program counter to the contents of the reset vector.
	Step	Executes the STEP command.
	Multiple Step	Executes the STEPFOR command.
	Go	Executes the GO command.
	Stop	Stops code execution.
	Repeat Command	Repeats the last command entered in the Status Window command line.

Table 5-2. ICS08Z Menus and Options Summary (Continued)

Menu	Option	Description
Windows	Code 1	Toggles the Code 1 Window open/closed.
	Code 2	Toggles the Code 2 Window open/closed.
	Memory	Toggles the Memory Window open/closed.
	Memory 2	Toggles the Memory Window 2 open/closed.
	Variables	Toggles the Variables Window open/closed.
	Cycles	Toggles the Cycles Window open/closed.
	Status	Toggles the Status Window open/closed.
	Chip Window	Shows the connection to hardware ICS board as yes or no.
	CPU	Toggles the CPU Window open/closed.
	Change Colors	Opens the <i>Changes Windows Colors</i> dialog box.
	Reload Desktop	Executes the LOADDESK command to load the desktop settings from a file.
	Save Desktop	Executes the SAVEDESK command to save the current desktop settings to a file.

5.19 FILE OPTIONS

Use the ICS08Z **File** menu options to load, reload, open, or close files, play or record macros, or exit the ICS08Z application.

To perform a **File** operation, click once on the **File** menu (see **Figure 5-24**) title to open the menu. Click on the option to execute.

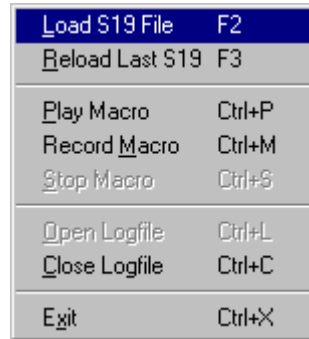


Figure 5-24. File Menu

The following topics describe and explain the ICS08 **File** operations and dialog boxes.

5.19.1 Load S19 File

Select the **Load S19 File** option from the **File** menu to open the *Specify S19 File to Load* dialog box (see **Figure 5-25**). If the S19 file is not in the default directory, choose a filename and drive/directory, and network path of an object file or source file to load in the Debugger main window. Loading an .S19 file automatically loads the debug .MAP file of the same name.

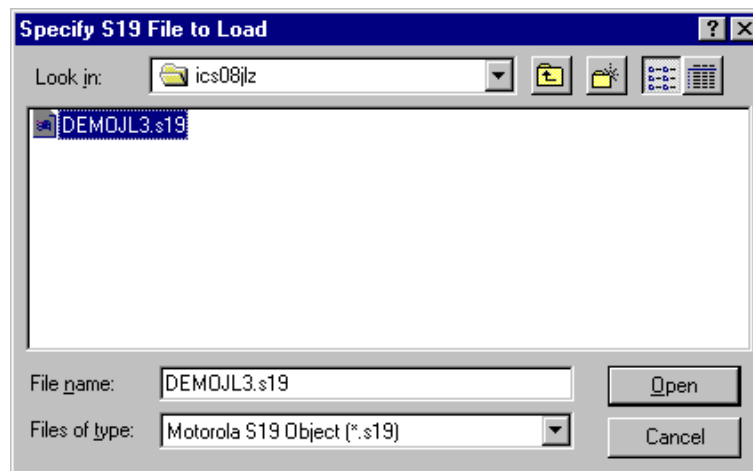


Figure 5-25. Specify S19 File to Load Dialog Box

To load an .S19 file, choose the **Load S19 File** option from the **File** menu to open the *Specify S19 File to Load* dialog box. Choose the path and filename and press OK to open the selected file in the ICS08 software (or press CANCEL to close the dialog box without making a selection).

Alternatives: Press the F2 function key or click the LOAD S19 FILE toolbar button, or enter the LOAD command and filename and other arguments in the Status Window command line.

5.19.2 Reload Last S19

Select the **Reload Last S19** option from the **File** menu to open the *Specify S19 File to Load* dialog box (see **Figure 5-25**) and select the most recently opened .S19 file to open in the Debugger main window. Follow the procedure for loading an S19 file (see **Section 5.19.1 Load S19 File**).

Alternatives: Press the F3 function key or click the RELOAD CURRENT S19 Toolbar button. These are the keyboard equivalents to choosing the **File - Reload Last S19** menu option.

5.19.3 Play Macro

Select the **Play Macro** option from the **File** menu to open the *Specify MACRO File to Execute* dialog box (see **Figure 5-26**) to specify a macro filename and drive/directory path to play.

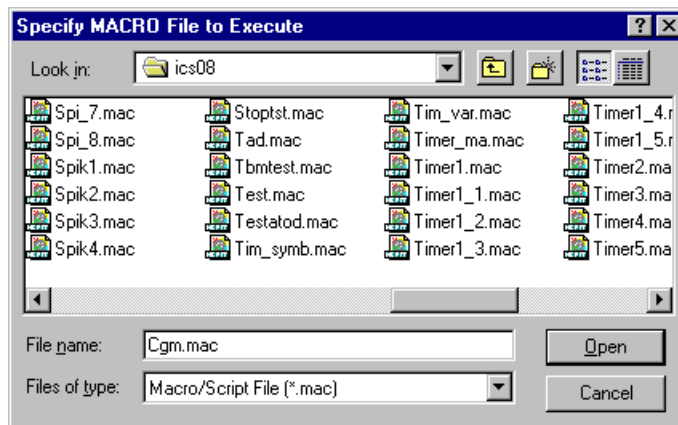


Figure 5-26. Specify MACRO File to Execute Dialog Box

Alternatives: Press the CTRL + P key combination or click the PLAY MACRO toolbar button. These are the keyboard equivalents to choosing the **File - Play Macro** menu option.

5.19.4 Record Macro

Select the **Record Macro** option from the **File** menu to open the *Specify MACRO File to Record* dialog box (see **Figure 5-27**) and specify a macro filename and drive/directory path to record.

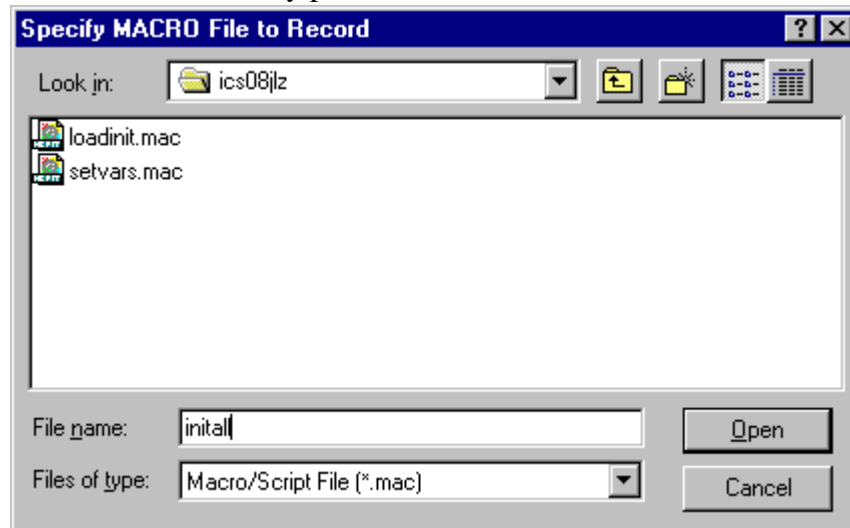


Figure 5-27. Specify MACRO File to Record Dialog Box

After the macro file has been chosen, all keyboard commands entered in the Debugger window will be recorded in the macro file and can be repeated by playing “back” the macro using the **File - Play Macro** menu option.

Alternatives: Press the CTRL + M key combination or click the RECORD MACRO toolbar button. These are the keyboard equivalents to choosing the **File - Record Macro** menu option.

5.19.5 Stop Macro

Select the **Stop Macro** option from the **File** menu to stop the active macro’s execution.

5.19.6 Open Logfile

Select the **Open Logfile** option from the **File** menu to open the *Specify Output LOG File* dialog box (see **Figure 5-28**). Use this dialog box to specify a logfile name and directory/drive path in which to save output log information for the current debugging session.

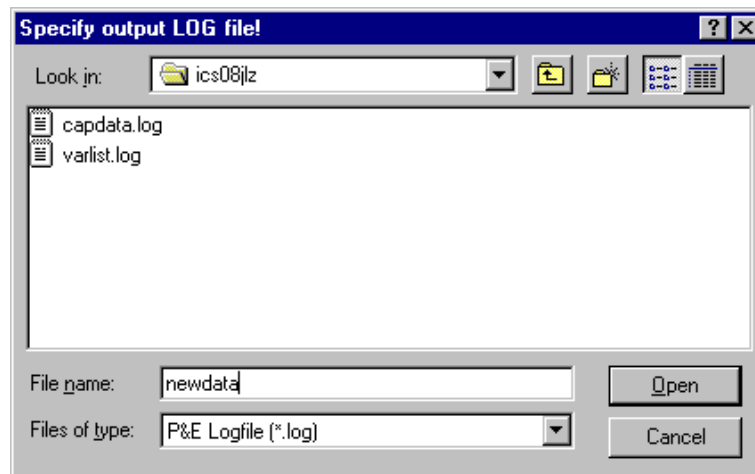


Figure 5-28. Figure 6-28. Specify Output LOG File Dialog Box

If the specified logfile exists, a message box (see **Figure 5-29**) prompts you to:

- Overwrite the existing logfile with current logging information
- Append the current logging information at the end of the existing logfile
- Cancel the Open Logfile command without saving logging information

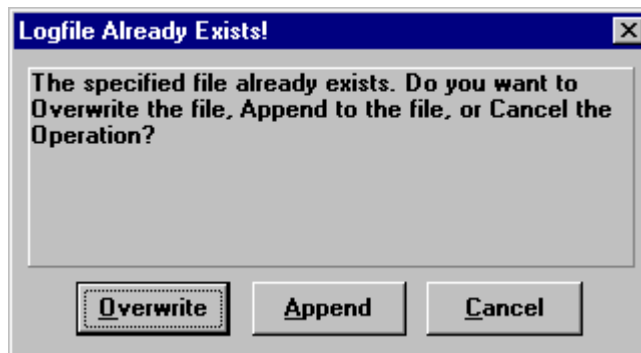
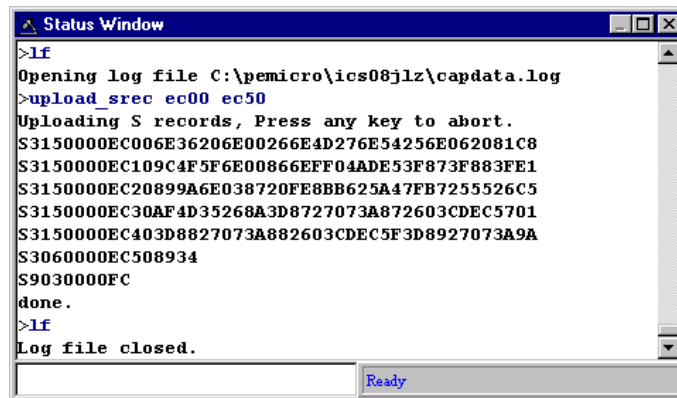


Figure 5-29. Logfile Already Exists! Dialog Box

Opening the logfile begins logging of commands and responses to the specified external. While logging is enabled, any line appended to the command log window is also written to the logfile (see **Figure 5-30**). Logging to the external file continues until you close the logfile.



```
>lf
Opening log file C:\pemicro\ics08j1z\capdata.log
>upload_src ec00 ec50
Uploading S records, Press any key to abort.
S3150000EC006E36206E00266E4D276E54256E062081C8
S3150000EC109C4F5F6E00866EFF04ADE53F873F883FE1
S3150000EC20899A6E038720FE8BB625A47FB7255526C5
S3150000EC30AF4D35268A3D8727073A872603CDEC5701
S3150000EC403D8827073A882603CDEC5F3D8927073A9A
S3060000EC508934
S9030000FC
done.
>lf
Log file closed.
```

Figure 5-30. Sample Output Logfile

You may view the logfile in the WinIDE editor or in any program that displays text files.

Alternatives: Press the CTRL + L key combination or click the OPEN LOGFILE toolbar button. These are the keyboard equivalents to choosing the **File - Open Logfile** menu option.

5.19.7 Close Logfile

Choose **Close Logfile** from the **File** menu to stop logging and close the active logfile.

Alternatives: Type CTRL + C, click the CLOSE LOGFILE toolbar button or enter the LF command in the Status Window command line. These are the keyboard equivalents to choosing the **File - Close Logfile** menu option.

5.19.8 Exit

Choose **Exit** from the **File** menu to close the debugger application.

Alternative: Type CTRL + X to exit the debugger application and close the subordinate and main windows. This is the keyboard equivalent to choosing the **File - Exit** menu option.

5.20 ICS08Z EXECUTE OPTIONS

Use the ICS08Z **Execute** menu options to reset the emulation microcontroller and perform debugger routines. To perform an execute operation, select **Execute** in the menu bar to open the **Execute** menu (see **Figure 5-31**). Click on an option to perform the operation.

R	eset Processor	F4
S	tep	F5
M	ultiple Step	F6
G	o	F7
S	top	F8
R	epet Command	F9

Figure 5-31. ICS08Z Execute Menu

5.20.1 Reset Processor

Choose **Reset Processor** from the **Execute** menu to send the RESET command to the emulation MCU and reset the program counter (PC) to the contents of the reset vector.

Alternative: Press the F4 function key. This is the keyboard equivalent of the **Execute - Reset Processor** menu option.

5.20.2 Step

Choose **Step** from the **Execute** menu to send the SINGLE STEP (TRACE) command to the MCU. The STEP command executes a single instruction, beginning at the current program counter (PC) address value.

Note: The Step command does not execute instructions in real-time, so timer values cannot be tested using this command.

Alternative: Press the F5 function key. This is the keyboard equivalent to choosing the **Execute - Step** menu option.

5.20.3 Multiple Step

Choose **Multiple Step** from the **Execute** menu to send the STEPFORM command to the MCU. The STEPFORM command begins continuous instruction execution, beginning at the current program counter (PC) address value, and continuing until any key is pressed.

Note: The Multiple Step command does not execute instructions in real-time, so timer values cannot be tested using this command.

Alternative: Press the F6 function key. This is the keyboard equivalent to choosing the **Execute - Multiple Step** menu option.

5.20.4 Go

Choose **Go** from the **Execute** menu to start execution of code in the ICS08 software at the current address. Code execution continues until a **STOP** command is entered, a breakpoint is reached, or an error occurs.

Alternative: Press the F7 function key. This is the keyboard equivalent to choosing the **Execute - Go** menu option.

5.20.5 Stop

Choose **Stop** from the **Execute** menu to stop program execution and update the ICS08Z simulator windows with current data.

Alternative: Press the F8 function key. This is the keyboard equivalent to choosing the **Execute - Stop** menu option.

5.20.6 Repeat Command

Choose **Repeat Command** from the **Execute** menu to repeat the execution of the last command entered in the Status Window command line.

Alternative: Press the F9 function key. This is the keyboard equivalent to choosing the **Execute - Repeat Command** menu option.

5.21 ICS08Z WINDOW OPTIONS

Use the **Window** menu options to change the window displays in the ICS08Z simulator.

To make changes to the windows, select **Window** in the menu bar to open the **Window** menu (see **Figure 5-32**). Click on an option to perform the operation.

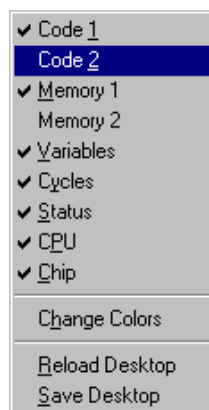


Figure 5-32. ICS08Z Window Menu

5.21.1 Open Windows

The **Window** menu options itemize the source file windows that can be opened in the ICS08Z software. A check beside the window name toggles that window display to on. Uncheck the window name to close the window; check the window name to open it.

For example, **Figure 5-32** indicates that all ICS08Z windows are open except the Code 1 Window. To open the Code 1 Window, click on the **Code 1** option. To close it, click on the **Code 1** option to remove the check and close the window.

5.21.2 Change Colors

Choose **Change Colors** from the **Window** menu to open the *Change Window Colors Dialog Box* (see **Figure 5-33**).

The *Change Window Colors* dialog box displays the color settings for the ICS08Z debugger windows or window components. To see the current settings, select the window or window element from the list on the left. To change the foreground or background color setting for this window or element, uncheck the *Use Defaults for Foreground/Background* checkbox, and use the left mouse button to select a foreground color, or use the right mouse button to select a background color. Press the OK button to save the color changes or press the CANCEL button to close the dialog box without saving changes.

Some window items allow only the foreground or background to be changed.

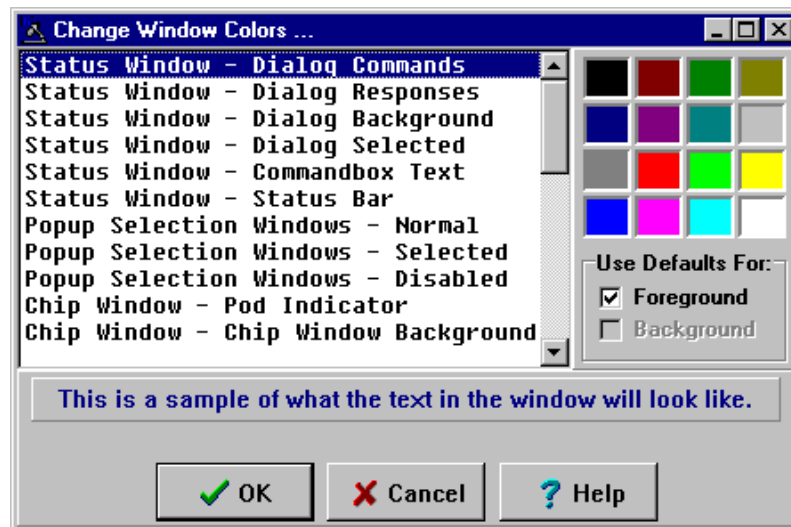


Figure 5-33. *Change Window Colors* Dialog Box

5.21.3 Reload Desktop

Choose **Reload Desktop** from the Windows menu to reload the stored configuration for the current project.

This option is useful for restoring desktop windows to their stored sizes and locations after making changes. To make changes permanent, choose the **Save Desktop** option. The new window sizes and locations will be written over the old settings and stored with other project files.

5.21.4 Save Desktop

Choose **Save Desktop** from the Windows menu to save the current configuration of the desktop and the position and size of the windows in the ICS08Z simulator.

5.22 ICS08Z DEBUGGING COMMANDS

This section consists of:

- A logical overview of the ICS08Z software debugging command set
- An explanation of rules for using the command set, including command syntax and arguments
- A summary of commands by type and function

The ICS08Z simulator command set consists of commands for simulating, debugging, analyzing, and programming microcontroller programs. Use the commands to:

- Initialize simulated memory
- Display and store data
- Debug user code
- Control the flow of code execution
- View/control peripherals

5.23 ICS08Z DEBUGGING COMMAND SYNTAX

A command is a line of ASCII text you enter from the computer keyboard. For ICS08Z debugging commands, enter the command and its arguments in the ICS08Z Status window command line. Press ENTER to terminate each line and activate the command. The typical command syntax is:

command [*<argument>*]...

Where:

command	A command name, in upper- or lower-case letters
<i><argument></i>	An argument indicator; when arguments are italicized, they represent a placeholder for the actual value you enter; when not italicized, they indicate the actual value to enter. Table 5-3 explains the possible argument values.

In command syntax descriptions:

[]	Brackets enclose optional items.
	A vertical line means 'or'.
...	An ellipsis means you can repeat the preceding item.
()	Parentheses enclose items only for syntactical purposes.

Except where otherwise noted, numerical values in debugging command examples are hexadecimal.

5.24 COMMAND SET SUMMARY

Table 5-3 lists the argument types used for commands. **Table 5-4** lists the commands alphabetically and summarizes their functions.

5.24.1 Argument Types

Table 5-3. Argument Types

Type	Syntax Indicators	Explanation
Numeric	<n> <rate> <data> <signal> <frame> <frequency><count> <value>	Hexadecimal values, unless otherwise noted. For decimal values, use the prefix ! or the suffix T. For binary values, use the prefix % or the suffix Q. Example: 64 = !100 = 100T = %1100100 = 1100100Q
Address	<address>	Four or fewer hexadecimal digits, with leading 0s when appropriate. If an address is decimal or binary, use a prefix or suffix, per the explanation of numeric arguments.
Range	<range>	A range of addresses or numbers. Specify the low value, then the high value, separated by a space. Use leading 0s if appropriate.
Symbol	<symbol> <label>	Symbols of ASCII characters, usually symbols from source code.
Filename	<filename>	The name of a file. If the file is not in the current directory, precede the name with one or more directory names.
Operator	<op>	+ (add) - (subtract) * (multiply) / (divide)

5.24.2 Command Summary

Table 5-4 summarizes the debugging commands for use with ICS08Z software. For detailed descriptions of the individual commands, refer to **CHAPTER 9 – DEBUGGING COMMAND SET**. In addition, **additional commands** that are specific to a particular M68HC908 part are contained in **APPENDIX B**.

Table 5-4. ICS08Z Software Command Summary

Command	Description
A ACC	Set the accumulator to specified value and display new value in CPU Window (identical to the ACC command).
ASM	Bring up a window allowing instructions to be assembled into memory.
BELL	Sound PC bell the specified number of times.
BF	Fill a block of memory with a specified byte, word, or long value.
BR	Display or set instruction breakpoint to specified values or at cursor location.
BREAKA	Set accumulator breakpoint to halt code execution when the accumulator value equals the specified value.
BREAKHX	Set an HX register breakpoint to halt code execution when the value of the HX register equals the specified value.
BREAKSP	Set stack pointer breakpoint to halt code execution when the SP equals the specified value.
C	Set or clear the C bit of the CCR.
CAPTURE	Specify location to be monitored for changes in value.
CAPTUREFILE CF	Open a capture file to record changes to locations specified by the CAPTURE command.
CCR	Set the CCR in the CPU to the specified hexadecimal value.
CHIPMODE	Set chip for simulation.
CLEARMAP	Remove the current MAP file from memory (identical to the NOMAP command).
CLEARSYMBOL	Remove all user-defined symbols from memory.
COLORS	Set simulator colors.
CY CYCLES	Change the value of the cycles counter.
DASM	Disassemble machine instructions. Display addresses and contents as disassembled instructions in the Status Window.

Table 5-4. ICS08Z Software Command Summary (Continued)

Command	Description
DDR[x]	Assign the specified byte value to the port [x] data direction register (DDR[x]), where [x] is a letter representing a particular port.
DUMP	Send contents of a block of memory to the Status Window in bytes, words or longs.
EVAL	Evaluate a numerical term or expression and give the result in hexadecimal, decimal, octal, and binary format.
EXIT	Terminate the software and close all windows (identical to QUIT).
G GO	Start execution of code at the current PC address or at an optional specified address (identical to the GO and RUN commands).
GOMACRO	Execute the program in the simulator beginning at the address in the PC and continue until a keypress, Stop command (from the Toolbar), breakpoint, or error occurs.
GOTIL	Execute code beginning at the PC address and continue until the PC contains the specified ending address or until a keypress, STOP command (from the Toolbar), breakpoint, or error occurs.
GOTOCYCLE	Execute code beginning at the current PC and continue until the cycle counter is equal to or greater than the value specified.
H	Set or clear the half-carry bit in the CCR.
HREG	Set the upper byte of the HX index register pair.
HELP	Open the ICS08Z Help File.
HX	Set both bytes of the concatenated index register H:X to the specified value.
I	Set or clear the I bit of the CCR.
INFO	Display information about the line highlighted in the source window.
INPUT[x]	Set the simulated inputs to port [x], where [x] is a letter representing a particular port.
INT IRQ	View or assign the state value of the MCU IRQ pin.
LF	Open a new or specified external file to receive log entries of commands and responses in the Status Window (identical to the LOGFILE command).
LISTOFF	Turn off screen listing of stepping information.
LISTON	Turn on screen listing of stepping information.
LOAD	Load .S19 object file and associated MAP file into the ICS08 software.
LOADDESK	Load the desktop settings for window positions, size, and visibility.

Table 5-4. ICS08Z Software Command Summary (Continued)

Command	Description
LOADMAP	Load a MAP file containing source level debug information into the ICS08Z software.
LOGFILE	Open a new or specify an existing external file to receive log entries of commands and responses from the Status Window (identical to the LF command).
MACRO	Execute a macro file containing debug command sequences.
MACROEND	Close the macro file in which the debug command sequences are being saved.
MACROSTART	Open a macro file and save all subsequent debug commands to this file until closed by the MACROEND command during an active ICS08Z simulator session.
MAP	View information from the current MAP file stored in memory (identical to the SHOWMAP command).
MD1 MD2	Display the contents of memory locations in the respective Memory Window, beginning at the specified address.
MEM MM	Modify contents of memory beginning at the specified address and/or select bytes, words, longs.
N	Set or clear the N bit of the CCR.
NOBR	Remove one or all active breakpoints.
NOMAP	Remove the current MAP file from memory, forcing the ICS08 software to show disassembly in the code windows instead of user source code (identical to the CLEARMAP command).
NOSYMBOL	Remove all user-defined symbols from memory; symbols defined in a loaded MAP file are not affected by the NOSYMBOL command.
PC	Assign the specified value to the MCU program counter.
POD	Attempt to connect with the ICS08Z circuit board through the specified COM port; when successful, the POD command returns the current status of ports, reset, and IRQ pins on the ICS08 board and the MCU monitor version.
PORT[x] PRT[x]	Assign the specified value to the port [x] output register latches, where [x] is a letter representing a particular port.
QUIT	Terminate the ICS08Z application and close all windows (identical to the EXIT command).
R	Open window for Register files and start interactive setup of system registers such as I/O, timer, COP.
REG	Display contents of CPU registers in the Status Window (identical to the STATUS command).

Table 5-4. ICS08Z Software Command Summary (Continued)

Command	Description
REM	Enter comments in a macro file.
RESET	Simulate a reset of the MCU and set the PC to the contents of the reset vector. Does not start execution of user code.
RESETGO	Simulate a reset of the MCU, set PC to contents of the reset vector, and start execution from the PC address.
RUN	Start execution of code at the current PC current or specified address (identical to the G and GO commands).
SAVEDESK	Save the desktop settings for the ICS08Z program when it is first opened or for use with the LOADDESK command.
SCRIPT	Execute a macro file containing debug command sequences (identical to the MACRO command).
SHOWBREAKS	Open window displaying breakpoints used in the current debug session, and allow modifying breakpoints.
SHOWCODE	Display code in the Code Windows beginning at the specified address, but without changing the value of the PC.
SHOWMAP	View current MAP file.
SHOWPC	Display code starting from address in the PC in the Code Window.
SHOWTRACE	Display the Trace Window with the last 1024 instructions executed since the TRACE command issued.
SIM08	Switch from in-circuit simulation (hardware board connected) to stand-alone simulation (no board connected).
SNAPSHOT	Save window data to the open logfile.
SP	Assign specified value to the stack pointer used by the CPU and display in the CPU Window.
SS	Step through a specified number of source code instructions, starting at the current PC address value, then halt.
ST	Step through a specified number of assembly instructions, starting at the current PC address value, then halt (identical to the STEP and T commands).
STACK	Open the HC08 Stack Window showing the stack pointer value, data stored on the stack, and the results of RTS or RTI instruction.
STATUS	Display the contents of the CPU registers in the Status Window (identical to the REG command).

Table 5-4. ICS08Z Software Command Summary (Continued)

Command	Description
STEP	Step through a specified number of assembly instructions, starting at the current program counter address value, then halt (identical to the ST and T commands).
STEPFOR	Execute instructions continuously, one at a time, starting at the current PC address and continuing until an error condition, breakpoint, or keypress occurs.
STEPTIL	Step through instructions starting at current PC address and continue until PC value reaches the specified address, or until keypress, breakpoint, or error occurs.
SYMBOL	View current symbols or create new symbols.
T	Step through a specified number of assembly instructions, starting at the current PC address, then halt (identical to the ST and STEP commands).
TRACE	Toggle tracing.
UPLOAD_SREC	Upload the content of the specified memory block (range) in .S19 file format, display the contents in the Status Window, and enter information into the current logfile.
V	Set or clear the V bit in the condition code register (CCR).
VAR	Display specified address and contents in the Variables Window for viewing during code execution.
VER VERSION	Display program version and date.
WAIT	Delay simulator MACRO execution by a specified number of cycles.
WHEREIS	Display value of the specified symbol.
X XREG	Set the X register to the specified value and display in the CPU Window.
Z	Toggle the Z bit in the CCR.

CHAPTER 6

PROG08SZ FLASH PROGRAMMER

6.1 OVERVIEW

PROG08SZ is a programmer for FLASH memory internal to a CPU08 processor. The programmer communicates with the processor in monitor mode (MON08) using an ICS08 board, which connects via a DB9 connector to the serial port of a PC or compatible computer. See the *M68ICS08 IN-CIRCUIT SIMULATOR HARDWARE OPERATOR'S MANUAL* for your particular part for information about the ICS08 board.

PROG08SZ is a general-purpose CPU08 programmer that provides for device specific programming algorithms to be loaded. These are used to control the erasing, verifying, programming, and viewing of modules to be programmed.

The ICS08 board can be configured to program a processor resident in a target system.

The programming routines for a particular module are loaded into the CPU08 on-chip RAM for execution during erasure, programming, verification, and showing of the module. The routines and associated comments for a particular module are in the form of Motorola S-records stored in a file with a .08P extension.

Any of the enabled features of the PROG08SZ programmer can be selected using the mouse or the up and down arrow keys or by typing the selection letters to the left of the selection display. Pressing ENTER or double clicking the mouse will execute the highlighted entry if it is enabled. You will be prompted for any additional information required to execute the selected function. Before programming a module from an S-record file, you must select such a file. If you try to do a program module function and you have not selected a file, you will be asked to select one.

The programming and erasing functions are built into either one or two programming modules. Refer to the **Manual Addendum** for your specific MCU device to determine the exact algorithm names and features. For

example, the 68HC908GP20 uses the 908_GP20.08P programming algorithm for blank check, erase, and program functions. The 68HC908RK2 uses the RK2PROG2.08P for program functions, and the RK2ERASE.08P for blank check and erase functions.

6.2 STARTUP AND PARAMETERS

Start the PROG08SZ FLASH programmer, and pass parameters to it, in either of these ways:

- From the WinIDE editor, as described in **Section 3.10.5.4 Executable Tabs — EXE 1-3**.
- From the command line, by using the Windows 95, 98, or NT *Program Item Property* dialog. Refer to the Windows documentation for information on this procedure.

These parameters may be entered in any order. To specify multiple parameters, separate them with spaces.

[com(n)]	The optional parameter com(n), where (n) is a value from 1 to 8, specifies which communications port to use.
[v]	If the optional parameter v is specified as either V or v, then the range of S-records is not verified during the programming or verification process. This can help speed up these functions.
/b(n)	Sets the baud rate between the ICS08 board and the PC to (n) baud, where (n) is 4800, 9600, 14400, 19200, or 28800. The initial default rate is 9600. Thereafter, the default is the last rate used in a debug session.
FORCEPASS	Overrides the last used setting of whether to ignore security failure, and forces the software to not enter monitor mode until security has been successfully passed. This is the factory default setting, and can be overridden in the startup dialog if communication problems exist.

FORCEBYPASS	Overrides the last used setting of whether to ignore security failure and forces the software to not enter monitor mode until security has been successfully passed. This is the factory default setting. This can be overridden in the startup dialog if communication problems exist.
ICS08	Overrides the last used target connection mode to communicate to the standard CLASS I target (CLASS I = ICS Board with processor installed. Possible emulation cable connection). This is the factory default setting, and can be overridden in the startup dialog if communication problems exist.
MON08	Overrides the last used target connection mode to communicate to a CLASS II target (CLASS II = ICS Board without processor connected to target via MON08 Cable). This can be overridden in the startup dialog if communication problems exist.
NODTR	Overrides the last used target connection mode to communicate to a CLASS III target (CLASS III = Target Board with MON08 circuitry built in). This can be overridden in the startup dialog if communication problems exist.
NODTRADD	Overrides the target connection mode that was last used to communicate with a Class IV target (CLASS IV = Custom Board (not ICS) with MON08 serial port circuitry and additional auto-reset circuit built in). This can be overridden in the startup dialog if communication problems exist.

Examples:

PROG08SZ com2 v	Com2 port is selected and S-records range is not verified.
PROG08SZ com7	Com7 port is selected and S-records range is verified.

6.3 PROGRAMMING COMMANDS

Programming commands are executed by selecting them from the pick list. You do this by either using the up and down arrow keys or by typing the first letter(s) on the line to select a command. Pressing ENTER causes the selected command to execute. You can also execute commands from the menus or from the button bar. Any additional information needed for the command will be prompted in a window which opens for that purpose. Errors caused by a command and any responses are presented in the Status Window.

Some of the programming commands may not be active, depending upon whether your particular silicon supports those specific functions.

In addition, one function is allowed to be unique to the module being programmed. The selection menu name and the length of up to one hexadecimal parameter may be specified in a supporting .08P file.

6.3.1 BM – Blank-check Module

This command checks the entire module to see if it has been erased. If not, the address of the first non-blank location is given along with its contents.

6.3.2 CM – Choose Module .08P

Presents a list of available .08P files. Each .08P file contains information on how to program a particular module. Usually, the name of the file indicates what kind of module it relates to. For example, for the **JL3** part, the **JL3ERASE.08P** allows blank checking and erasure of the MC68HC908**JL3** device, while the **JL3_PROG.08P** allows programming of the MC68HC908**JL3** device. Setup information and further descriptions of the module are provided in ASCII text within the module file. You can look at this information with any standard text editor. This information is also presented in the status window when a .08P file is selected. A particular .08P file is selected by using the arrow keys to highlight the filename and then pressing ENTER key. The currently selected .08P file is shown in the .08P file selected window.

6.3.3 EM – Erase Module

This command erases the entire module. If the entire module is not erased, an error message is given.

6.3.4 PB – Program Bytes

Prompts for a starting address, which must be in the module. You are then shown an address and a byte. Pressing the ENTER key shows the next location. You can also enter in hexadecimal a byte to be programmed into the current

location. Failure to program a location, entering an invalid hex value, or exceeding the address range of the module will exit the program bytes window. If a location fails to program, an error message is given. The symbols +, –, and = may be appended to the value being written. Respectively, they increase the address (default), decrease the address, and hold the address constant.

6.3.5 PM – Program Module

For this command to work, you must have previously selected an S-record file. The S-records are then checked to see if they all reside in the module to be programmed. If not, you are asked for permission to continue. If the answer is yes, only those S-record addresses that lie in the module are programmed. If a location could not be programmed, an error message is given.

6.3.6 SM – Show Module

Prompts for a starting address. If this address is not in the module, an error is given. A window is opened that shows the contents of memory as hexadecimal bytes and ASCII characters if printable. Non-printing characters are shown as periods (.). This window stays on the screen until you press the ESCAPE key.

6.3.7 SS – Specify S-record

Asks for the name (and/or path) to a file of Motorola S-records to be used in programming or verifying a module. If the file is not found, an error message is given. The currently-selected file is shown in the S19 file selected window. The programmer accepts S1, S2, and S3 records. All other file records are treated as comments. If you do not specify a file-name extension, a default of .S19 is used.

6.3.8 UM – Upload Module

Asks for a file name in which to upload S records. The default filename extension is set to .S19 if none is specified. Motorola S-records for the entire module are then written to the specified file.

6.3.9 UR – Upload Range

Prompts for a starting address, which must be in the module. Next, you are asked for an ending address, which must also be in the module. You are then asked for a file name in which to upload S records. The default file-name extension is set to .S19 if none is specified. Motorola S records are then written to the specified file.

6.3.10 VM – Verify Module

For this command to work, you must have previously selected an S-record file. The S-records are then checked to see if they all reside in the module to be programmed. If not, you are asked for permission to continue. If the answer is yes, only those S-record addresses that lie in the module are verified. If a location could not be verified, an error message is given indicating the address, the contents of that address, and the contents specified in the S-record file.

6.3.11 VR – Verify Range

For this command to work, you must have previously selected an S-record file. You are prompted for a starting address, which must be in the module. Next, you are asked for an ending address, which must also be in the module. S-record addresses that lie in the module are verified. If a location could not be verified, an error message is given indicating the address, the contents of that address, and the contents specified in the S-record file.

6.3.12 QU – Quit

Terminates the programmer and returns to Windows.

6.3.13 RE – Reset Chip

Causes a hardware reset to the CPU08 chip. This command can be used to recover from errors that cause the programmer not to be able to communicate with the processor through the MON08 monitor interface.

6.3.14 HE – Help

Opens a window of help topics on the screen. You can then select a particular topic and page through its text description.

6.4 PROGRAMMING EXAMPLE

The programming steps in this section illustrate a typical sequence for using the PROG08SZ commands.

1. Start the PROG08SZ software, as described in **Section 6.2 STARTUP AND PARAMETERS**.

When PROG08SZ starts, it performs an automatic reset RE command (**Section 6.3.13 RE – Reset Chip**) and brings up the **Choose Module** selection window.

2. Select an algorithm that supports Erase from the Choose Module window. For example, 908_GP20.08P for the **GP20** part.
3. Execute the blank-check module BM command (**Section 6.3.1 BM – Blank-check Module**).
4. If the results from the BM command indicate that the module is not blank, execute the erase module EM command (**Section 6.3.3 EM – Erase Module**). Then repeat the BM command, which should now indicate that the module is blank.
5. With the specify S-record SS command (**Section 6.3.7 SS – Specify S-record**), select the S-record file to load into the module.
6. Execute the choose module CM command (**Section 6.3.2 CM – Choose Module .08P**), and select the algorithm that supports programming functions. If this is the same algorithm as in Step 3, you can skip this step.
7. Execute the program module PM command (**Section 6.3.5 PM – Program Module**).
8. To verify that the S-record file has been loaded correctly, execute the

verify module VM command (**Section 6.3.10 VM – Verify Module**), which compares the S-record file with the contents of the module.

CHAPTER 7

ICD08SZ IN-CIRCUIT DEBUGGER

7.1 OVERVIEW

This chapter describes the use of the ICD08SZ in-circuit debugger. The debugger employs a command set that allows real-time debugging within the limitations of the MON08 on-chip debugging monitor.

7.2 MON08 DEBUGGING LIMITATIONS AND TIPS

7.2.1 Limitations

The following limitations are inherent in MON08 debugging and should be observed carefully.

- Do not step an instruction that branches to itself.
- Do not step an SWI (software interrupt) instruction.
- The hardware breakpoint registers are reserved for use by the ICD08SZ debugger. Attempting to use these registers for other purposes may not work.
- Be careful about showing peripheral status and data registers in the memory or variables window. A refresh of the window will read these registers and may cause the clearing of flags.
- The debug monitor built into CPU08 processors uses up to 13 bytes of the stack. Do not write to these addresses from (SP-13) to SP. To load a program into RAM, move the stack to the end of RAM.
- If interrupts are turned on during stepping, the ICD08SZ debugger will not step into the interrupt. Instead, it will execute the whole interrupt and stop on the instruction returned to after the interrupt.
- Do not set hardware breakpoints within the monitor ROM area itself, or

they will not function properly.

Note: See additional restrictions in the **Manual Addendum** for your specific MCU device.

7.2.2 Tips

The following tips provide useful insight:

- Single stepping is allowed in both RAM or ROM.
- The first breakpoint set is always a hardware breakpoint, and any additional breakpoints set are software breakpoints. To make sure that a hardware breakpoint is being set, use the NOBR command before setting it. See **CHAPTER 9 – DEBUGGING COMMAND SET** for a description of the commands.
- Hardware breakpoints will stop execution in ROM or RAM. Software breakpoints will stop execution only in RAM.
- Experiment with the register interpreter. Use the R command for this.
- Code may be loaded only into RAM. When doing this, observe limitations in **Section 7.2.1 Limitations**. To load code into FLASH memory, use the PROG08SZ programmer included in this kit.
- Executing an SWI instruction while running is functionally equivalent to hitting a breakpoint, except that execution stops at the instruction following the SWI.
- A hardware breakpoint may be used to trap a data read/write to anywhere in the memory map. The ICD08SZ debugger stops at the instruction after the one that accesses the data location.
- To trap a read/write to address 22, for example, first use the NOBR command to make sure that no breakpoints are set. Then, set the hardware breakpoint by using the BR 22 command. This is the same way that a hardware instruction breakpoint would be set. Clear the hardware breakpoint by using the NOBR command.
- The LOADALL command in ICD08SZ is the same as LOAD in the ICS08Z simulator software. The LOAD command loads only the object information, not the debug information.
- To debug from ROM and see source code while stepping, use the LOADMAP command. This loads source-level information about the source file without loading the object file, which should have been programmed into FLASH with PROG08SZ. Files with the extension .MAP are debug-format map files.
- To write a byte to memory, use the MM addr value command. For

example, to write \$00 to address \$4, enter MM 4 0.

- The default base of the debugger is hexadecimal. See **HELP** for prefixes and suffixes to override the default.
- To create a variable, use the VAR command. To clear all variables, use CLEARVAR.
- CPU register values can be changed by entering a register name followed by a value. For example, to set the accumulator to \$44, type either A 44 or ACCA 44 and press ENTER.
- When the ICS08 board is reset by the debugger, power to the microcontroller is turned off for a short duration. Although much of RAM may look the same, some values may have changed. To verify code that was loaded prior to the reset, use the VERIFY command.
- All windows have right-button mouse menus, which allows access to much of the debugger's functionality. To open, place the mouse over the window and click the right mouse button.
- If a GO command is entered without setting a breakpoint, the only way to regain control of the processor is to reset it.
- The watchdog is not active while running ICD08SZ. When a device is programmed and powered without the debugger, for example, on a target board – the watchdog is active by default.
- If the security bytes (see **Section 1.6 MC68HC908 SECURITY FEATURE**) are programmed with the PROG08SZ programmer, the ICD08SZ debugger automatically knows the security bytes. In this way, ICD08SZ is able to reset the processor even if it has been programmed.
- All security information is stored in the file SECURITY.INI.
- To save the ICD08SZ desktop settings, use the SAVEDESK command. Retrieve them by using the LOADDESK command. The desktop settings are automatically retrieved upon startup.

7.3 STARTUP AND PARAMETERS

The ICD08SZ debugger may be started, and parameters may be passed to it, in either of these ways:

- From the WinIDE editor, as described in **CHAPTER 3 – THE WinIDE USER INTERFACE**
- From the command line, by using the Windows 95, 98, or NT *Program Item Property* dialog. Refer to the Windows documentation for information on this procedure.

These optional parameters may be entered in any order. To specify multiple parameters, separate them with spaces.

com < <i>n</i> >	Chooses the serial port, where <i>n</i> is a value between 1 and 8.
/b(<i>n</i>)	Sets the baud rate between the ICS board and the PC to (<i>n</i>) baud, where <i>n</i> is 4800, 9600, 14400, 19200, or 28800. The initial default rate is 9600. Thereafter, the default is the last rate used in a debug session.
FORCEPASS	Overrides the last used setting of whether to ignore security failure, and forces the software to not enter monitor mode until security has been successfully passed. This is the factory default setting, and can be overridden in the startup dialog if communication problems exist.
FORCEBYPASS	Overrides the last used setting of whether to ignore security failure and forces the software to not enter monitor mode until security has been successfully passed. This is the factory default setting. This can be overridden in the startup dialog if communication problems exist.
ICS08	Overrides the last used target connection mode to communicate to the standard CLASS I target (CLASS I = ICS Board with processor installed. Possible emulation cable connection). This is the factory default setting, and can be overridden in the startup dialog if communication problems exist.

MON08	Overrides the last used target connection mode to communicate to a CLASS II target (CLASS II = ICS Board without processor connected to target via MON08 Cable). This can be overridden in the startup dialog if communication problems exist.
NODTR	Overrides the last used target connection mode to communicate to a CLASS III target (CLASS III = Target Board with MON08 circuitry built in). This can be overridden in the startup dialog if communication problems exist.
NODTRADD	Overrides the target connection mode that was last used to communicate with a Class IV target (CLASS IV = Custom Board (not ICS) with MON08 serial port circuitry and additional auto-reset circuit built in). This can be overridden in the startup dialog if communication problems exist.
quiet	Starts the ICD without filling the memory windows and the disassembly window. Can be used for speed reasons or to avoid DSACK errors on startup until windows are positioned or chip selects enabled.

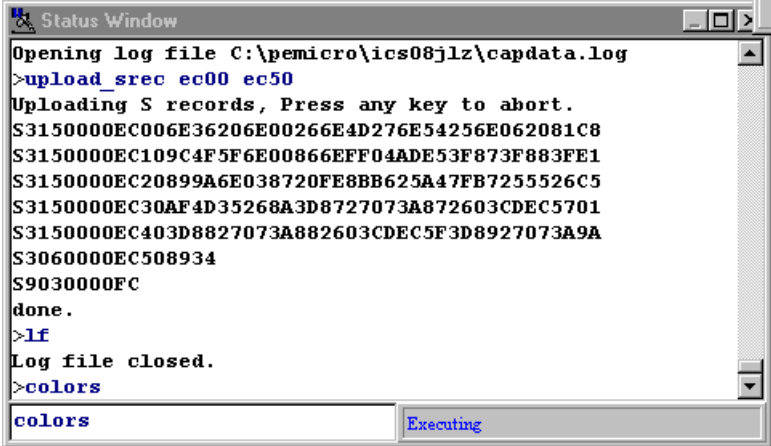
7.4 USER INTERFACE

The following sections describe the Windows user interface for the ICD08SZ in-circuit debugger:

- Status Window
- Code Window
- Variables Window
- Memory Window
- Colors Window
- CPU Window

7.4.1 Status Window

The Status Window, shown in **Figure 7-1**, serves as the command prompt for the application. It takes keyboard commands given by you, executes them, and returns an error or status update when needed.



```

Status Window
Opening log file C:\pemicro\ics08j1z\capdata.log
>upload_src ec00 ec50
Uploading 5 records, Press any key to abort.
S3150000EC006E36206E00266E4D276E54256E062081C8
S3150000EC109C4F5F6E00866EFF04ADE53F873F883FE1
S3150000EC20899A6E038720FE8BB625A47FB7255526C5
S3150000EC30AF4D35268A3D8727073A872603CDEC5701
S3150000EC403D8827073A882603CDEC5F3D8927073A9A
S3060000EC508934
S9030000FC
done.
>lf
Log file closed.
>colors
colors
Executing

```

Figure 7-1. ICD08SZ Status Window

Commands can be typed into the window or a series of commands can be played from a macro file. This lets you have a standard sequence of events happen the same way every time. Refer to the MACRO command for more information.

It is often desirable to have a log of all the commands and command responses that appear in the status window. The LOGFILE command allows you to start/stop the recording of all information to a text file, which is displayed in the status window.

Pop-Up Menu

By pressing the right mouse button while the cursor is over the status window,

you are given a pop-up menu, which has this option:

Help — Displays this help topic.

Keystrokes

These keystrokes scroll the message area if the message area is active within the status window:

UP ARROW	Scrolls the window up one line.
DOWN ARROW	Scrolls the window down one line.
HOME	Scrolls the window to first status line.
END	Scrolls the window to last status line.
PAGE UP	Scrolls the window up one page.
PAGE DOWN	Scrolls the window down one page.
F1	Shows this help topic.

If the command line edit box is active in the status window, the following functionality is enabled:

- Press the UP ARROW (↑) key to scroll back in the buffer of previously executed commands. Use this to repeat commands.
- Press the DOWN ARROW (↓) key to scroll forward in the buffer of previously executed commands. Use this to repeat commands.

7.4.2 Code Window

The Code Window, shown in **Figure 7-2**, displays either disassembled machine code or your source code if it is available. The **Disassembly** mode will always show disassembled code regardless of if a source file is loaded. The **Source/Disassembly** mode will show source code if source code is loaded and the current PC points to a valid line within the source code; otherwise, disassembly is shown. To show both modes at once, you should have two code windows open, one set to **Disassembly** and the other to **Source/Disassembly**.

```

Code Window 1 : Source [demo]3.asm
*****
* T_ISR - Timer Interrupt Service Routine.          *
*          after a RESET.                          *
*****
T_ISR:
pshh
lda  tsc0
and  #$7F
sta  tsc0          ; Clear O.C. Flag
ldhx tch0h
aix  #77T         ; Setup another interrupt in ~2ms
sthx tch0h
pulh

Check_t1:
tst  timeout1
beq  check_t2     ; Is Timeout 1 currently active?
dec  timeout1     ; yes
bne  check_t2     ; Did it just finish counting down?

```

Figure 7-2. ICD08SZ Code Window

Code windows also give visual indications of the program counter (PC) and breakpoints. Each code window is independent of the other and can be configured to show different parts of your code.

Pop-Up Menu

By pressing the right mouse button while the cursor is over the code window, you are given a pop-up menu with the following options:

Toggle Breakpoint at Cursor — This option is enabled if you have already selected a line in the code window by clicking on it with the left mouse button. Choosing this option will set a breakpoint at the selected location or, if there is already a breakpoint at the selected location, will remove it.

Set PC at Cursor — This option is enabled if you have already selected a line in the code window by clicking on it with the left mouse button. Choosing this option will set the program counter (PC) to the selected location.

Gotil Address at Cursor — This option is enabled if you have already selected a line in the code window by clicking on it with the left mouse button. Choosing this option will set a temporary breakpoint at the selected line and start processor execution (running mode). When execution stops, this temporary breakpoint is removed.

Set Base Address — This option allows the code window to look at different locations in your code or anywhere in the memory map. You will be prompted to enter an address or label to set the code window's base address. This address will be shown as the top line in

the Code Window. This option is equivalent to the **SHOWCODE** command.

Set Base Address to PC — This option points the code window to look at the address where the program counter (PC) is. This address will be shown as the top line in the Code Window.

Select Source Module — This option is enabled if a source-level map file is currently loaded and the windows mode is set to **Source/Disassembly**. Selecting this option pops up a list of all the map file's source filenames and allows you to select one. This file is then loaded into the code window for you to view.

Show Disassembly or Show Source/Disassembly — This option controls how the code window displays code. The **Show Disassembly** mode always shows disassembled code, regardless of whether a source file is loaded. The **Show Source/Disassembly** mode shows source-code if source code is loaded and the current PC points to a valid line within the source code. Otherwise, disassembly is shown.

Help – Displays help for this topic.

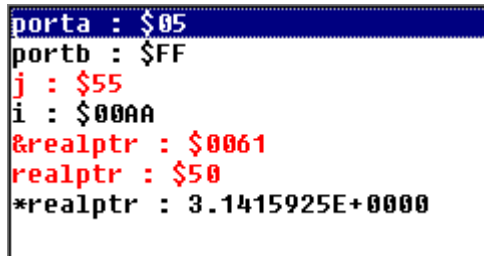
Keystrokes

These keystrokes are valid while the code window is the active window:

UP ARROW	Scroll window up one line.
DOWN ARROW	Scroll window down one line.
HOME	Scroll window to the Code Window's base address.
END	Scroll window to last address the window will show.
PAGE UP	Scroll window up one page.
PAGE DOWN	Scroll window down one page.
F1	Display help for this topic.
ESC	Make the Status window the active window.

7.4.3 Variables Window

The Variables window, shown in **Figure 7-3**, is used to view variables while the part is not running. You may add or remove variables through the INSERT or DELETE keys, the pop-up menu, or the VAR command. Variables can be viewed as bytes (8 bits), words (16 bits), longs (32 bits), or strings (ASCII).



```

porta : $05
portb : $FF
j : $55
i : $00AA
&realptr : $0061
realptr : $50
*realptr : 3.1415925E+0000

```

Figure 7-3. ICD08SZ Variables Window

Pop-Up Menu

By pressing the right mouse button while the cursor is over the variables window, you are given a pop-up menu which has these options:

Add Variable — Adds a variable to the variables window at the currently selected line. A pop-up window allows you to specify the variable's address, type, and base.

Delete Variable — Removes the selected variable from the variables window. A variable is selected by placing the mouse cursor over the variable name and clicking the left mouse button.

Clear All — Removes all variables from the variables window.

Help — Displays help for this topic.

Keystrokes

These keystrokes are valid while the variables window is the active window:

INSERT	Add a variable.
DELETE	Delete a variable.
UP ARROW	Scroll window up one variable.
DOWN ARROW	Scroll window down one variable.
HOME	Scroll window to the first variable.
END	Scroll window to the last variable.
PAGE UP	Scroll window up one page.
PAGE DOWN	Scroll window down one page.
F1	Display help for this topic.
ESC	Make the Status Window the active window.

7.4.4 Memory Window

The Memory Window, shown in **Figure 7-4**, is used to view and modify the memory map of a target. View bytes by using the scrollbar on the right side of the window. To modify a particular set of bytes, double click on them. Double clicking on bits brings up a byte modification window.

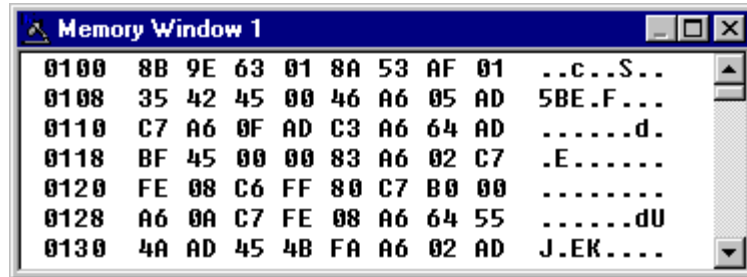


Figure 7-4. ICD08SZ Memory Window

Pop-Up Menu

By pressing the right mouse button while the cursor is over the memory window, you are given a pop-up menu which has these options:

Set Base Address — Sets the memory window scrollbar to show whatever address you specify. Upon selecting this option, you are prompted for the address or label to display. This option is equivalent to the Memory Display (MD) command.

Show Memory and ASCII — Sets the current memory window display mode to display the memory in both HEX and ASCII formats.

Show Memory Only — Sets the current memory window display mode to display the memory in HEX format only.

Help — Displays help for this topic.

Keystrokes

These keystrokes are valid while the memory window is the active window:

- | | |
|------------|--|
| UP ARROW | Scroll window up one line. |
| DOWN ARROW | Scroll window down one line. |
| HOME | Scroll window to address \$0000. |
| END | Scroll window to last address in the memory map. |
| PAGE UP | Scroll window up one page. |
| PAGE DOWN | Scroll window down one page. |
| F1 | Display this help topic. |
| ESC | Make the Status window the active window. |

7.4.5 Change Window Colors Window

The Change Window Colors window, shown in **Figure 7-5**, shows the colors that are set for all of the debugger windows. To view the current color in a window, select the item of interest in the listbox and view the text in the bottom of the window. To change the color in a window, select the item; then, use the left mouse button to select a color for the foreground or use the right mouse button to select a color for the background. Some items will allow only the foreground or background to be changed. Press the OK button to accept the color changes. Press the CANCEL button to decline all changes.

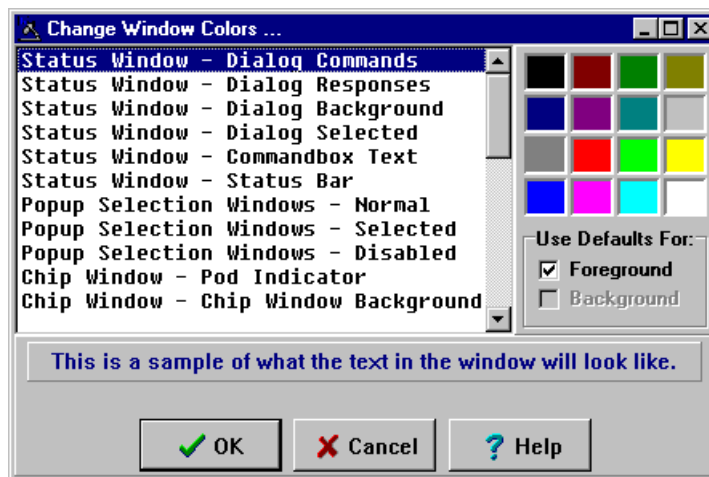


Figure 7-5. ICD08SZ Colors Window

7.4.6 CPU08 Window

The CPU08 window, shown in **Figure 7-6**, displays the current state of the 68HC08 CPU registers. The pop-up window allows modification of these values.

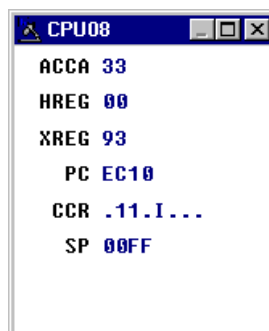


Figure 7-6. ICD08SZ CPU Window

Pop-Up Menu

By pressing the right mouse button while the cursor is over the CPU window, a pop-up menu appears with these options:

Set Accumulator — Sets the accumulator to a user-defined value. Upon selecting this option, you are prompted for a value.

Set HREG Index Register — Sets the H index register to a user-defined value. Upon selecting this option, you are prompted for a value.

Set XREG Index Register — Sets the X index register to a user-defined value. Upon selecting this option, you are prompted for a value.

Set Stack Pointer — This option is disabled and is shown only for convention.

Set PC — Sets the Program Counter (PC) to a user-defined value. Upon selecting this option, you are prompted for a value.

Set Condition Codes — Allows you to toggle bits within the CCR. Upon selecting this option, the Change CCR window is displayed, as shown in **Figure 7-7**.

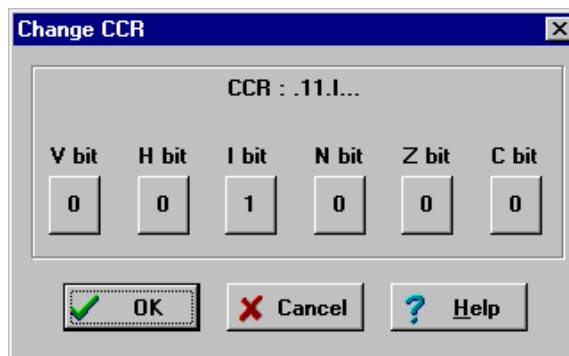


Figure 7-7. ICD08SZ Set CCR Window

Keystrokes

These keystrokes are valid while the CPU window is the active window:

- F1 Displays help for this topic.
- ESC Make the Status Window the active window.

7.5 DEBUGGING COMMANDS

Debugging commands for use with the ICD08SZ in-circuit debugger are described in the following sections. The individual commands are defined in detail in **CHAPTER 9 – DEBUGGING COMMAND SET**.

7.5.1 Syntax and Nomenclature

A command is a line of ASCII text that you enter from the computer keyboard. For ICD08SZ debugging commands, enter the command and its arguments in the Status Window command line. Press ENTER to terminate each line and activate the command. The typical command syntax is:

command [*<argument>*]...

where:

command	A command name, in upper- or lower-case letters.
<i><argument></i>	An argument indicator; when arguments are italicized, they represent a placeholder for the actual value you enter; when not italicized, they indicate the actual value to enter. Table 7-1 explains the possible argument values.

These nomenclature conventions apply to the ICD08SZ in-circuit debugging commands:

<i>n</i>	Any number from 0 to 0FFFF (hex). The default base is hexadecimal. To enter numbers in another base, use the suffixes T for base 10, O for base 8, or Q for base 2. You may also use the prefixes ! for base 10, @ for base 8, and % for base 2. Numbers must start with either one of these prefixes or a numeric character.
----------	---

Example:

0FF = 255T = 377O = 11111111Q = !255 = @377 = %11111111

<i>add</i>	Any valid address (default hex)
[]	Optional parameter
PC	Program Counter points to the next instruction to be fetched
<i>str</i>	ASCII string
;	Everything on a command line after and including the semicolon character is considered a comment. This helps in documenting macro (script) files.

7.5.2 Command Recall

You can use the PGUP and PGDN keys to scroll through the past 30 commands issued in the debug window. Saved commands are those typed in by you or those entered through macro (script) files. You may use the ESC key to delete a currently-entered line, including one selected by scrolling through old commands.

Note: Only the command lines entered by you are saved. Responses to other ICD prompts are not. For example, when you give a memory modify command with just an address, the ICD prompts you for data to be written in memory. Your responses are not saved for scrolling; however, the original memory modify command is saved.

7.5.3 Command Set Summary

Table 7-1 summarizes the debugging commands that may be used with ICD08SZ. For detailed descriptions of each command, refer to **CHAPTER 9 – DEBUGGING COMMAND SET**.

Table 7-1. ICD08SZ Command Overview

Command	Description
A ACC	Set the accumulator to specified value and display new value in CPU Window (identical to the ACC command).
ASCIIF3 ASCIIF6	Toggle memory windows between displaying data only and data with ASCII characters.
ASM	Assemble M68HC08 instruction mnemonics and place resulting machine code in memory at the specified address.
BELL	Sound PC bell the specified number of times.
BF	Fill a block of memory with a specified byte, word, or long value.
BR	Display or set instruction breakpoint to specified values or at cursor location.
C	Set or clear the C bit of the CCR.
CCR	Set the CCR in the CPU to the specified hexadecimal value.
CLEARMAP	Remove the current MAP file from memory.
CLEARSYMBOL	Remove all user-defined symbols from memory.
CODE	Show disassembled code in the code window starting at address add. Specifying an address in the middle of an intended instruction may cause improper results.
COLORS	Set debugger colors.

Table 7-1. ICD08SZ Command Overview (Continued)

Command	Description
DASM	Disassemble machine instructions, display addresses and contents as disassembled instructions in the Code Window.
DUMP	Send contents of a block of memory to the Status Window in bytes, words, or longwords.
EVAL	Evaluate a numerical term or expression and give the result in hexadecimal, decimal, octal, and binary formats.
EXIT	Terminate the software and close all windows (identical to QUIT).
G GO	Start execution of code at the current PC address or at an optional specified address. The G, GO, and RUN commands are identical.
GOEXIT	Similar to GO command except that the target is left running without any breakpoints, and the debugger software is terminated.
GONEXT	Execute from the current PC address until the next instruction is reached. Used to execute past a subroutine call or past intervening interrupts.
GOTIL	Execute code beginning at the PC address and continue until the PC contains the specified ending address or until a keypress, Stop Macro command (from the toolbar), breakpoint, or error occurs.
H	Set or clear the half-carry bit in the CCR.
HREG	Set the upper byte of the HX index register pair.
HELP	Open the ICD08SZ Help File.
HX	Set both bytes of the concatenated index register H:X to the specified value.
I	Set or clear the I bit of the CCR.
INFO	Display information about the line highlighted in the source window.
INT IRQ	Display the value of the IRQ pin.
LF LOGFILE	Open a new or specified external file to receive log entries of commands and responses in the Status Window (identical to the LOGFILE command).
LOAD	Load S19 object file into the ICD08SZ.
LOADALL	Execute both the LOAD and LOADMAP commands.
LOADDESK	Load the desktop settings for window positions, size, and visibility.
LOADMAP	Load a MAP file containing source level debug information into the ICD08SZ.
LOADV	Execute the LOAD command, then automatically execute the VERIFY command.
LOAD_BIN	Loads a binary file of bytes starting at a specified address.

Table 7-1. ICD08SZ Command Overview (Continued)

Command	Description
LOADV_BIN	Execute the LOAD_BIN command, then automatically execute the VERIFY command.
MACRO	Execute a macro file containing debug command sequences (identical to the SCRIPT command).
MACROEND	Close the macro file in which the debug command sequences are being saved.
MACROSTAR T	Open a macro file and save all subsequent debug commands to this file until closed by the MACROEND command during an active ICS08 simulator session.
MACS	Bring up a window with a list of macros.
MAP	View current MAP file. The SHOWMAP command is identical.
MD MD1	Display the contents of memory locations in Memory Window 1, beginning at the specified address.
MD2	Display the contents of memory locations in Memory Window 2, beginning at the specified address.
MM MEM	Modify contents of memory beginning at the specified address and/or select bytes, words, longwords.
N	Set or clear the N bit of the CCR.
NOBR	Remove one or all active breakpoints.
PC	Assign the specified value to the MCU program counter.
QUIET	Toggles refresh of memory-based windows.
QUIT	Terminate the ICD08SZ application and close all windows (identical to EXIT).
R	Open window for register files and start interactive setup of system registers such as I/O, timer.
REG	Display contents of CPU registers in the Status Window (identical to the STATUS command).
REM	Enter comments in a macro file.
RESET	Simulate a reset of the MCU and set the PC to the contents of the reset vector. Does not start execution of user code.
RUN	Start execution of code at the current PC current or specified address. The G, GO, and RUN commands are identical.
SAVEDESK	Save the desktop settings for the ICS08 software when it is first opened, or for use with the LOADDESK command.
SHOWCODE	Display code in the Code Windows beginning at the specified address, but without changing the value of the PC.

Table 7-1. ICD08SZ Command Overview (Continued)

Command	Description
SHOWMAP	View current MAP file. The MAP command is identical.
SHOWPC	Display code in the Code Window, starting from the address in the PC.
SNAPSHOT	Save window data to the open logfile.
SOURCEPATH	Determine the path for source code that is not in the current working directory.
SP	Assign specified value to the stack pointer used by the CPU and display in the CPU Window.
SS	Step through a specified number of source code instructions, starting at the current PC address value, then halt.
ST	Step through a specified number of assembly instructions, starting at the current PC address, then halt (identical to the STEP and T commands).
STATUS	Display the contents of the CPU registers in the Status Window (identical to the REG command).
STEP	Step through a specified number of assembly instructions, starting at the current program counter address, then halt (identical to the ST and T commands).
STEPFOR	Execute instructions continuously, one at a time, starting at the current PC address and continuing until reaching an error condition, breakpoint, or keypress.
STEPTIL	Step through instructions starting at current PC address and continue until PC value reaches the specified address, or until keypress, breakpoint, or error occurs.
SYMBOL	View current symbols or create new symbols.
T	Step through a specified number of assembly instructions, starting at the current PC address, then halt (identical to the ST and STEP commands).
UPLOAD_SRE C	Upload the content of the specified memory block (range) in S19 file format and display the contents in the Status Window, and enter information into the current logfile.
V	Set or clear the V bit in the condition code register (CCR).
VAR	Display specified address and contents in the Variables Window for viewing during code execution.
VERIFY	Compare the contents of program memory with an S-record file.
VER VERSION	Display program version and date.
WHEREIS	Display value of the specified symbol.
X XREG	Set the X register to the specified value and display in the CPU Window.

Table 7-1. ICD08SZ Command Overview (*Continued*)

Command	Description
Z	Toggle the Z bit in the CCR.

CHAPTER 8

DEBUGGING COMMAND SET

8.1 COMMAND DESCRIPTIONS

The debugging sections in this chapter are arranged alphabetically by command name and describe the commands in detail.

A or ACC

Set Accumulator Value

Use with: ICS08Z and ICD08SZ

The ACC command sets the accumulator to a specified value. The value entered with the command is shown in the CPU window. The ACC and A commands are identical.

Syntax:

ACC <n>

where:

<n> The value to be loaded into the accumulator.

Example:

A 10 Set the accumulator to \$10.

ASCIIF3 and ASCIIF6

Toggle ASCII Display

Use with: ICD08SZ only

The ASCIIF3 and ASCIIF6 commands toggle the memory windows between displaying data only and data and ASCII characters.

ASCIIF3 toggles memory window 1. ASCIIF6 toggles memory window 2.

Syntax:

ASCIIF3

Example:

ASCIIF3 Toggles memory window 1 between displaying data only and data with ASCII characters.

ASM

Assemble Instructions

Use with: ICS08Z and ICD08SZ

The ASM command assembles MC68HC908 Family instruction mnemonics and places the resulting machine code into memory at the specified address. The command displays a window with the specified address (if given) and current instruction, and prompts for a new instruction. Enter the new instruction in the *New Instruction* text box. Press the ENTER key to assemble the new instruction, store and display the resulting machine code, then move to the next memory location, where you will be prompted for another instruction.

If there is an error in the instruction format, the address stays at the current address and an assembly error flag appears. To exit assembly, press the EXIT button.

Syntax:

ASM [<address>]

where:

<address> Address where machine code is to be generated. If you do not specify an <address> value, the system checks the address used by the previous ASM command, then uses the next address for this ASM command.

Example:

With an address argument:

ASM 100

The Assembly Window appears as shown in **Figure 8-1**.

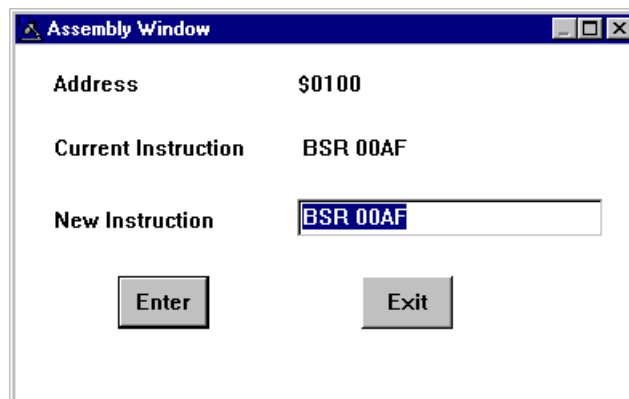


Figure 8-1. Assembly Window

BELL

Sound PC Bell

Use with: ICS08Z and ICD08SZ

The BELL command sounds the PC bell the specified number of times. With no argument, the bell sounds once. To turn off the bell as it is sounding, press any key.

Syntax:

BELL [*<n>*]

where:

<n> The number of times to sound the bell.

Example:

BELL 3 Ring the PC bell three times.

BF or FILL

Block Fill Memory

Use BF with: ICS08Z and ICD08SZ

Use FILL with: ICD08SZ only

The BF or FILL command fills a block of memory with a specified byte, word, or long value. The optional argument specifies whether to fill the block in bytes (.B, the default, 8 bits) or in words (.W, 16 bits).

The ICD08ZW debugger can also supply the argument as type long (.L, 32 bits).

Syntax:

```
BF [.B | .W | .L] <startrange> <endrange> <n>
```

where:

<startrange>	Beginning address of the memory block (range).
<endrange>	Ending address of the memory block (range).
<n>	Byte, word, or longword value to be stored in the specified block.

- If the byte variant (.B) is used, then <n> must be an 8-bit value.
- If the word variant (.W) is used, then <n> must be a 16-bit value.
- If the long variant (.L) is used, then <n> must be a 32-bit value. (ICD08SZ only)

Examples:

BF C0 CF FF	Store FF in bytes at addresses C0-CF.
BF.W 300 31F 4143	Store word value 4143 at addresses 300-31F.

BR

Set Instruction Breakpoint

Use with: ICS08Z and ICD08SZ

The BR command displays or sets instruction breakpoints, according to its parameter values:

- If no parameter is entered, the BR command displays a list of all current breakpoints in the status window.
- If an *<address>* value is entered, the BR command sets a breakpoint at the specified address.

An optional value *<n>* may be entered with the address to specify a break count. The BR command sets a breakpoint at the specified address, but code execution does not break until the *n*th time it arrives at the breakpoint.

Note: The maximum number of breakpoint addresses is 64. Each BR, BREAKA, BREAKSP, or BREAKHX command that includes an address value uses an additional breakpoint address, unless the address is a duplicate. For example, if 64 BR commands already have taken up 64 addresses, the only way to include an address value in a BREAKA, BREAKSP, or BREAKHX command is to duplicate one of those 64 addresses.

If source code is displayed in either code window, mouse, or keyboard commands can be used to set, remove, or clear all breakpoints. Follow these steps:

1. Position the cursor on the line of code for which you want to set a breakpoint.
2. Click the left mouse button to select the line.
3. Press the right mouse button once to open the **Code Window Shortcut** menu.
4. Select **Toggle Breakpoint at Cursor** option. If no current breakpoint is set at this line of code, a breakpoint will be set. If there is a current breakpoint set at this line of code, the breakpoint will be removed.

To remove all breakpoints, enter the NOBR command in the Status Window command line.

BR*(continued)***Syntax:**

```
BR [<address> [<n>]]      ;set a breakpoint
BR                        ;list current breakpoints
```

where:

<address> The address for a breakpoint

<n> Break after value: Code execution passes through the
breakpoint n-1 times, then breaks the nth time it arrives at
the breakpoint.

Examples:

```
BR 300            Set a breakpoint at address 300.
BR 330 8         Set a breakpoint at address 330; break on eighth arrival at
330.
```

BREAKA

Set Accumulator Breakpoint

Use with: ICS08Z only

The BREAKA command sets an accumulator breakpoint to halt code execution when the value of the accumulator equals the specified *n* value. For instance:

- With an *n* value, the command forces a break in execution as soon as the accumulator value equals *n*.
- With *n* and *address* values, the command forces a break in execution when the accumulator value equals *n* and execution arrives at the specified address. If the accumulator value changes from *n* by the time execution arrives at the address, no break occurs.

Note: The maximum number of breakpoint addresses is 64. Each BR, BREAKA, BREAKSP, or BREAKHX command that includes an address value uses an additional breakpoint address, unless the address is a duplicate. For example, if 64 BR commands already have taken up 64 addresses, the only way to include an address value in a BREAKA, BREAKSP, or BREAKHX command is to duplicate one of those 64 addresses.

If the BREAKA command is entered without an address value, the halt in code execution clears the accumulator breakpoint. To cancel the accumulator breakpoint before the halt occurs, enter the BREAKA command without any parameter values. If the BREAKA command is entered without an address value, the accumulator breakpoint does not show in the Breakpoint Window.

If the BREAKA command is entered with an address value, the accumulator breakpoint may be cleared by one of these methods:

- Enter the NOBR command.
- Position the cursor on that address in the code window. Then press the right mouse button and select **Toggle Breakpoint at Cursor** menu item.

Syntax:

BREAKA [*<n>* [*<address>*]]

where:

<i><n></i>	Accumulator value that triggers a break in execution.
<i><address></i>	Optional address for the break in execution (provided that the accumulator value equals <i>n</i>).

BREAKA*(continued)***Examples:**

BREAKA 55	Break execution when the accumulator value equals 55.
BREAKA	Cancel the accumulator breakpoint.
BREAKA 55 300	Break execution at address 300 if accumulator value equals 55.

BREAKHX

Set HX Register Breakpoint

Use with: ICS08Z only

The BREAKHX command sets an HX register breakpoint and breaks code execution when the value of the HX register equals the specified *n* value.

With an *n* value, the command forces a break in execution as soon as the accumulator value equals *n*.

With *n* and *address* values, the command forces a break in execution when the accumulator value equals *n* and execution arrives at the specified address. If the accumulator value changes from *n* by the time execution arrives at the address, no break occurs.

Note: The maximum number of breakpoint addresses is 64. Each BR, BREAKA, BREAKSP, or BREAKHX command that includes an address value uses an additional breakpoint address, unless the address is a duplicate. For example, if 64 BR commands already have taken up 64 addresses, the only way to include an address value in a BREAKA, BREAKSP, or BREAKHX command is to duplicate one of those 64 addresses.

If the BREAKHX command is entered without an address value, the break in code execution clears the accumulator breakpoint. To cancel the accumulator breakpoint before the break occurs, enter the BREAKHX command without any parameter values. If the BREAKHX command is entered without an address value, the accumulator breakpoint does not show in the Breakpoint Window.

If the BREAKHX command is entered with an address value, the accumulator breakpoint may be cleared by:

1. Entering the NOBR command
2. Positioning the cursor on that address in the code window, then pressing the right mouse button and selecting the **Toggle Breakpoint at Cursor** menu item

Syntax:

BREAKHX [<*n*> [<*address*>]]

where:

- | | |
|--------------------|---|
| < <i>n</i> > | Index register value that triggers a break in execution. |
| < <i>address</i> > | Optional address for the break in execution when the index register value equals <i>n</i> . |

BREAKHX*(continued)***Examples:**

BREAKHX A9	Break execution when the HX register value equals A9.
BREAKHX	Cancel the HX register breakpoint.
BREAKHX A9 400	Break execution at address 400 if HX register value equals A9.

BREAKSP

Set Stack Pointer Breakpoint

Use with: ICS08Z only

The BREAKSP command sets a stack pointer breakpoint to halt code execution when the value of the stack pointer equals a specified value.

- With an *n* value, the command forces a break in execution as soon as the stack pointer value equals *n*.
- With *n* and *address* values, the BREAKSP command forces a halt in execution when the stack pointer value equals *n* and execution arrives at the specified address. If the stack pointer value changes from *n* by the time execution arrives at the address, no break occurs.

Note: The maximum number of breakpoint addresses is 64. Each BR, BREAKA, BREAKSP, or BREAKHX command that includes an address value uses an additional breakpoint address, unless the address is a duplicate. For example, if 64 BR commands already have taken up 64 addresses, the only way to include an address value in a BREAKA, BREAKSP, or BREAKHX command is to duplicate one of those 64 addresses.

If the BREAKSP command is entered without an address value, the halt in code execution clears the stack pointer breakpoint. To cancel the stack pointer breakpoint before the halt occurs, enter the BREAKSP command without any parameter values. If the BREAKSP command is entered without an address value, the stack pointer breakpoint does not show in the Breakpoint Window.

If the BREAKSP command is entered with an address value, the stack pointer breakpoint may be cleared by one of these methods:

- Enter the NOBR command.
- Position the cursor on that address in the code window. Then press the right mouse button and select **Toggle Breakpoint at Cursor** menu item.

BREAKSP*(continued)***Syntax:**

BREAKSP [<n> [<address>]]

where:

<n> Stack pointer value that triggers a break in execution.
<address> Optional address for the break in execution when the stack pointer value equals *n* .

Examples:

BREAKSP E0	Break execution when the stack pointer (SP) value equals E0.
BREAKSP	Cancel the SP breakpoint.
BREAKSP E0 300	Break execution at address 300 if SP value equals E0.

C

Set/Clear Carry Bit

Use with: ICS08Z and ICD08SZ

The C command sets or clears the C bit of the condition code register (CCR).

Note: The CCR bit designators are in the lower portion of the CPU window. The CCR pattern is V11HINZC (V is overflow, H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit of the CCR is set; a period means that the corresponding bit is clear.

Syntax:

C 0|1

Examples:

C 0	Clears the C bit of the CCR.
C 1	Sets the C bit of the CCR.

CAPTURE

Capture Changed Data

Use with: ICS08Z only

The CAPTURE command specifies locations to be monitored for changes in value. If the value of such a location changes and if a capture file is open, the file records the change in value. (See the **CAPTUREFILE** or **CF** command for more information about capture files).

To stop monitoring a location, specify that same location in another CAPTURE command, or close the capture file. Closing the capture file undoes the specifications for all monitoring locations.

Note: Before you enter the CAPTURE command, open a capture file via the CAPTUREFILE or CF command. The CAPTURE command has no effect unless a capture file is open.

Syntax:

CAPTURE <address> [<address>...]

where:

<address> Location to be monitored for a change in value.

Examples:

CAPTURE PORTA	Monitor location PORTA for any value changes.
CAPTURE C0	Monitor RAM location C0 for any value changes.
CAPTURE D0 D1 D2	Monitor for any value changes in an array of locations.

CAPTUREFILE or CF

Open/Close Capture File

Use with: ICS08Z only

The CAPTUREFILE or CF command opens a capture file to record changed values. If the specified file does not yet exist, this command creates the file. If the file already exists, an optional parameter can be used to specify whether to overwrite existing contents (R) or to append the log entries (A). If parameter is omitted, a prompt asks for this overwrite/append choice.

The command interpreter does not assume a filename extension for the capture file. To close the capture file, enter this command without any parameter values.

The CF and CAPTUREFILE commands are identical. If no CAPTURE command has specified locations to be monitored, the CF and CAPTUREFILE commands have no effect.

Note: The CAPTURE command specifies the location to be monitored for value changes. Closing the capture file deletes the location specification. The simulator continues writing to an open capture file. Syntax:

```
CAPTUREFILE [<filename> [R | A]]
```

where:

<filename> Name of the capture file.

Examples:

```
CAPTUREFILE TEST.CAP      Open capture file TEST.CAP  
CF TEST4.CAP A            Open capture file TEST4.CAP;  
                             append new entries
```

CCR

Set Condition Code Register

Use with: ICS08Z and ICD08SZ

The CCR command sets the condition code register (CCR in the CPU) to the specified hexadecimal value. The value entered with the command displays in the CPU Window.

Note: The CCR bit designators are in the lower portion of the CPU window. The CCR binary pattern is V11HINZC (V is overflow, H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit is set; a period means that the corresponding bit is clear.

Syntax:

CCR <n>

where:

<n> New hexadecimal value for the CCR.

Example:

CCR E4 Assign the value E4 to the CCR. This makes the binary pattern 11100100; the N bit set, other bits clear.

CHIPMODE

Choose Device for Simulation

Use with: ICS08Z only

The CHIPMODE command brings up a pop-up window containing all of the HC08 devices that can be simulated with ICS08Z for Windows. The device can be selected from the window.

Note: After issuing the command you should quit, and restart the debugger.

Syntax:

CHIPMODE

Example:

CHIPMODE Brings up a window for selecting the device for simulation.

CLEARMAP

Clear .MAP File

Use with: ICS08Z and ICD08SZ

The CLEARMAP command removes the current MAP file from memory, forcing the debugger to show disassembled code in the Code Windows instead of source code. Symbols defined using the SYMBOL command are not affected by this command.

For the ICS08Z, the NOMAP command is identical to CLEARMAP.

Syntax:

CLEARMAP

Example:

CLEARMAP Clears symbols and their definitions.

CLEARSYMBOL

Clear User Symbols

Use with: ICS08Z and ICD08SZ

The CLEARSYMBOL command removes all the user-defined symbols (created with the SYMBOL command). Debug information from MAP files, used for source level debugging, is not affected by the CLEARSYMBOL command.

Note: List the current user-defined symbols using the SYMBOL command.

Syntax:

CLEARSYMBOL

Example:

CLEARSYMBOL Clears user-defined symbols.

CODE

Show Disassembled Code

Use with: ICD08SZ only

The CODE command shows disassembled code in the code window, starting at address *add*. Specifying an address in the middle of an intended instruction may cause improper results.

Syntax:

CODE *<add>*

where:

<add> Your code's starting address.

Example:

CODE 100 Shows the disassembled code in the code window, starting at hex address 100.

COLORS

Set Simulator Colors

Use with: ICS08Z and ICD08SZ

The COLORS command opens the *Change Window Colors* dialog box that allows choosing the text and background colors for windows in the ICS08Z simulator and ICD08SZ debugger. After setting the colors options for the windows, save the changes using the SAVEDESK command.

For more information about using the *Change Window Colors* dialog box, see **CHAPTER 5 – ICS08Z IN-CIRCUIT SIMULATOR**.

Syntax:

COLORS

Example:

COLORS Open the colors window.

CYCLES

Set Cycles Counter

Use with: ICS08Z only

The CYCLES command changes the value of the cycle counter. The cycle counter counts the number of processor cycles that have passed during execution. The Cycle Window shows the cycle counter. The cycle count can be useful for timing procedures.

If no parameter is specified, the current cycle count is displayed in the Status Window. This is useful for capturing the cycle count to a logfile.

Syntax:

CYCLES [*<n>*]

where:

<n> Integer value for the cycles counter.

Examples:

CYCLES 0 Reset cycles counter.

CY 1000 Set cycle counter value to 1000.

DASM

Disassemble Memory

Use with: ICS08Z and ICD08SZ

The DASM command disassembles machine instructions, displaying the addresses and their contents as disassembled instructions in the debug window.

- If the command includes an address value, one disassembled instruction is shown, beginning at that address.
- If a command is entered without any parameter values, the software finds the most recently disassembled instruction then shows the next instruction, disassembled.
- If the command includes start range and end range values, the software shows disassembled instructions for the range.

Note: If the DASM command is entered with a range, sometimes the disassembled instructions scroll through the status window too rapidly to view. In this case, enter the LF command to record the disassembled instructions in a logfile or use the scroll bars in the status window.

Syntax:

DASM [*<address>* | *<startrange>* *<endrange>*]

where:

<i><address></i>	Address of a single instruction to be disassembled.
<i><startrange></i>	Starting address for a range of instructions to be disassembled.
<i><endrange></i>	Ending address for a range of instructions to be disassembled.

Examples:

```
DASM 300
0300      A6E8  LDA #0E8
DASM 200 208
0200      5F    CLRX
0201      A680  LDA #80
0203      B700  STA PORTA
0205      A6FE  LDA #FE
0207      B704  STA DDRA
```

DDR[x]**Set Port [x] Direction Register**

Use with: ICS08Z only

The DDR[x] command assigns the specified byte value to the port [x] data direction register, where [x] is a letter representing a particular port. Please consult the **Appendix** for your specific MCU device to determine which ports are available. Bits assigned 0 denote input pins; bits assigned 1 denote output pins.

Syntax:

DDR[x] <n>

where:

[x] A letter representing the particular port whose data direction register you wish to change.

<n> The byte value to be placed into the data direction register.

Examples:

DDRA FF Set all port A pins to be outputs.

DDRA 00 Set all port A pins to be inputs.

DUMP

Dump Memory to Screen

Use with: ICS08Z and ICD08SZ

The DUMP command sends contents of a block of memory to the status window, in bytes, words, or longs. The optional variant specifies whether to fill the block in bytes (.B, the default), in words (.W), or in longs (.L).

Note: Sometimes the DUMP command causes the memory contents to scroll through the debug window too rapidly to view. In this case, enter the LF command to record the memory locations in a logfile or use the scroll bars in the status window.

Syntax:

DUMP [.B | .W | .L] <startrange> <endrange> [<n>]

where:

<startrange>	Beginning address of the memory block.
<endrange>	Ending address of the memory block (range).
<n>	Optional number of bytes, words, or longs to be written on one line.

Examples:

DUMP C0 CF	Dump array of RAM values, in bytes.
DUMP.W 300 375	Dump ROM code in address 300-375 in words.
DUMP.B 200 300	Dump contents of addresses 200-300 in rows of eight bytes.

EVAL

Evaluate Expression

Use with: ICS08Z and ICD08SZ

The EVAL command evaluates a numerical term or simple expression, giving the result in hexadecimal, decimal, octal, and binary formats. In an expression, spaces must separate the operator from the numerical terms.

Note: Octal numbers are not valid as parameter values. Operand values must be 16 bits or less. If the value is an ASCII character, this command also shows the ASCII character as well. The parameters for the command can be a number, or a sequence of: number, space, operator, space, and number. Supported operations are addition (+), subtraction (-), multiplication (*), division (/), logical AND (&), and logical OR (^).

Syntax:

EVAL <n> [<op> <n>]

where:

<n> Alone, the numerical term to be evaluated, otherwise, either numerical term of a simple expression.

<op> The arithmetic operator (+, -, *, /, &, or ^) of a simple expression to be evaluated.

Examples:

```
EVAL 45 + 32
0077H 119T 0001670 0000000001110111Q "w"
EVAL 100T
0064H 100T 0001440 0000000001100100Q "d"
```


EXIT or QUIT

Exit/Quit Application

Use with: ICS08Z and ICD08SZ

The EXIT or QUIT command terminates the software and closes all windows.

Syntax:

EXIT

Example:

EXIT Finish working with the program.

G, GO, or RUN

Begin Program Execution

Use with: ICS08Z and ICD08SZ

The identical G, GO, and RUN commands start execution of code at the current program counter (PC) address or at an optional specified address.

If only one address is entered, that address is the starting address. Execution continues until a key is pressed, until it arrives at a breakpoint, or until an error occurs.

If a second address is entered, execution stops at that address.

In the ICS08Z simulator, this command causes the host computer to simulate instructions as fast as it can. However, execution will be much slower than real-time execution.

In the ICD08Z debugger, this command starts real-time execution by the MC68HC908 processor.

Note: To see the windows updated with information during execution of code, use the STEPFOR command.

Syntax:

```
G [[startaddr] [endaddr]]
GO [[startaddr] [endaddr]]
```

where:

<i><startaddr></i>	Optional execution starting address. If the command does not have a <i>startaddr</i> value, execution begins at the current PC value.
<i><endaddr></i>	Optional execution ending address.

Examples:

GO	Begin code execution at the current PC value.
GO 346	Begin code execution at address 346.
G 300 371	Begin code execution at address 300. End code execution just before the instruction at address 371.
RUN 300	Begin code execution at address 300.

GOEXIT Execute Without Breakpoints/Debugger

Use with: ICD08SZ only

The GOEXIT command is similar to the GO command, except that the target is left running without any breakpoints and the debugger software is terminated.

Syntax:

GOEXIT <addr>

where:

<addr> Starting address of user code.

Example:

GOEXIT 100 Sets the program counter to location 100 hex, runs the program, and exits from the application.

GOMACRO

Execute Macro after Break

Use with: ICS08Z only

The GOMACRO command executes the program in the simulator beginning at the address in the program counter (PC). Execution continues until you press a key, until it arrives at a breakpoint, or until an error occurs. Afterwards it runs the specified macro file just like the MACRO command.

Syntax:

GOMACRO *<filename>*

where:

<filename> The name of a script file to be executed, with or without extension .MAC, or a pathname that includes an asterisk (*) wildcard character. When the asterisk is entered, the command displays a list of appropriate files, from which the required file can be selected.

Example:

GOMACRO AVCALC.MAC Begin code execution at the current PC value; at breakpoint execute macro AVCALC.MAC.

GONEXT

Execute Past Subroutine/Interrupt

Use with: ICD08SZ only

The GONEXT command executes from the current PC address until the next instruction is reached. It is used to execute past a subroutine call or past intervening interrupts. Some debuggers refer to this functionality as “step over”. Executing a GONEXT command on a branch or jump instruction is the equivalent of executing a GO command.

Syntax:

GONEXT

Example:

GONEXT

GOTIL

Execute Until Address

Use with: ICS08Z and ICD08SZ

The GOTIL command executes code beginning at the address in the program counter (PC). Execution continues until the program counter contains the specified ending address, until a key or the STOP button on the ICS08Z toolbar is pressed, until it reaches a breakpoint, or until an error occurs.

Syntax:

GOTIL <endaddr>

where:

<endaddr> The address at which execution stops.

Example:

GOTIL 2F0 Executes code up to address 2F0.

GOTOCYCLE Execute to Cycle Counter Value

Use with: ICS08Z only

The GOTOCYCLE command executes the program in the simulator beginning at the address in the program counter (PC). Execution continues until the cycle counter is equal to or greater than the specified value, until a key or the STOP button on the ICS08Z toolbar is pressed, until it reaches a breakpoint, or until an error occurs.

Syntax:

GOTOCYCLE <n>

where:

<n> Cycle-counter value at which execution stops.

Example:

GOTOCYCLE 100 Execute the program until the cycle counter equals
100.

H

Set/Clear Half-Carry Bit

Use with: ICS08Z and ICD08SZ

The H command sets or clears the half-carry bit in the CCR.

Note: The CCR bit designators are in the lower portion of the CPU window. The CCR pattern is V11HINZC (V is overflow, H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit of the CCR is set; a period means that the corresponding bit is clear.

Syntax:

H 0|1

Examples:

H 1 Sets the H bit in the CCR.

H 0 Clears the H bit of the CCR.

HELP

Open Help

Use with: ICS08Z and ICD08SZ

The HELP command opens the Windows help file for the program. An alternative way to open the help system is to press the F1 key. If entered with an optional parameter, help appears for the specified topic. If no parameter is entered, the entire help file appears.

Syntax:

HELP <topic>

where:

<topic> A debug command or assembly instruction.

Examples:

HELP Open the help file.

HELP asm Displays help for the ASM debugging command.

HREG Set Upper Byte of H:X Register Pair

Use with: ICS08Z and ICD08SZ

The HREG command sets the upper byte of the H:X index register pair.

Syntax:

HREG <value>

where:

<value> New value for the H register.

Examples:

HREG 05 Sets the H index register value to 05.

HREG F0 Clears the H index register value to F0.

HX

Set H:X Index Register Pair

Use with: ICS08Z and ICD08SZ

The HX command sets both bytes of the concatenated index register (H:X) to the specified value.

Syntax:

HX <value>

where:

<value> New value for the X register.

Example:

HX 0400 Set the H:X index register value to \$0400.

I**Set/Clear Interrupt Mask****Use with:** ICS08Z and ICD08SZ

The I command sets or clears the I bit of the condition code register (CCR).

The CCR bit designators are in the lower portion of the CPU window. The CCR pattern is V11HINZC (V is overflow, H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit of the CCR is set; a period means that the corresponding bit is clear.

Syntax:

I <0 or 1>

Examples:

I 1	Set the I bit in the CCR.
I 0	Clear the I bit of the CCR.

INFO

Display Line Information

Use with: ICS08Z and ICD08SZ

The INFO command displays information about the line highlighted in the source window. Information displayed includes the name of the file in the window, the line number, the address, the corresponding object code, and the disassembled instruction.

Before executing this command, select a line of code in the Code window by clicking on it with the left mouse button.

Syntax:

INFO

Examples:

INFO

Display information about the cursor line.

Filename:PODTEST.ASM

Line number: 6

Address:\$0100

Disassembly:START

5F CLRX

INPUT[x]

Set Port [x] Inputs

Use with: ICS08Z only

The INPUT[x] command sets the simulated inputs to a particular port, specified by [x]. The CPU reads this input value when the port is set as an input port. Please consult the **Appendix** for your particular MCU device to determine which ports are available.

Note: If the ICS08 circuit board is connected, the port inputs come from the board, so this command has no effect.

Syntax:

INPUT[x] <n>

where:

[x] A letter representing the particular port whose simulated inputs you wish to set.

<n> 8-bit simulated value for the port.

Example:

INPUTA AA Simulate the input AA on port A.

INT or IRQ

Set IRQ Pin State

Use with: ICS08Z and ICD08SZ

The INT or IRQ command reads the state value of the MCU IRQ pin. To see the current simulated value on the pin, enter this command without any parameter value. The external interrupt is simulated as a level or edge/level triggered interrupt, depending on the IRQ bit in the MOR (mask option register).

In ICS08Z only, a value of 1 or 0 can be specified on the command line. If no ICS08 board is attached, this is used as the simulated IRQ input value. If it is set low, at least one cycle must pass for the simulator to latch the value.

Note: If the ICS08 board is connected, then the IRQ pin level comes from the circuit board, and this command cannot be used to modify its value.

Syntax:

IRQ [0 | 1]

Examples:

INT 0	Assign 0 to the IRQ pin.
IRQ 1	Assign 1 to the IRQ pin.

LOGFILE or LF

Open/Close Logfile

Use with: ICS08Z and ICD08SZ

The LOGFILE or LF command opens an external file to receive log entries of the commands entered in the command line of the Status Window and the system responses to those commands that appear in the Status Window message area.

- If the specified file does not exist, this command creates the file.
- If the specified file exists, an optional parameter can be entered to specify whether to overwrite existing contents (R) or to append the log entries (A). If this parameter is omitted, a prompt window asks whether to overwrite the existing file or append information to the existing file.

While logging is in effect, any line appended to the Status Window is also written to the logfile.

Logging continues until another LOGFILE or LF command is entered without any parameter values. This second command disables logging and closes the logfile.

Data can be captured by opening a logfile, executing a command that dumps data to the Status window, and then closing the logfile.

The command interpreter does not assume a filename extension.

Syntax:

```
LF [<filename> [<R | A>]]
```

where:

<filename> The filename of the logfile (or logging device to which the log is written).

Examples:

```
>LF TEST.LOG R      Start logging. Overwrite file TEST.LOG (in the
                    current directory) with all lines that appear in the
                    status window.

>LF TEMP.LOG A      Start logging. Append to file TEMP.LOG (in the
                    current directory) all lines that appear in the status
                    window.

>LOGFILE            If logging is enabled: Disable logging and close the
                    logfile.
```


LISTOFF

Turn Off Step Listing

Use with: ICS08Z only

The LISTOFF command turns off the screen listing of the step-by-step information for stepping. Register values and program instructions do not appear in the status window as code runs. This display state is the default when the software is first started.

To turn on the display of stepping information, use the LISTON command.

Syntax:

LISTOFF

Example:

LISTOFF Do not show step information.

LISTON

Turn On Step Listing

Use with: ICS08Z only

The LISTON command turns on the screen listing of the step-by-step information during stepping. The register values and program instructions are displayed in the status window while running code. The values shown are the same values seen by the REG instruction.

To turn off this step display, use the LISTOFF command.

Syntax:

LISTON

Example:

LISTON Show step information.

LOAD

Load S-Records

Use with: ICS08Z and ICD08SZ

The LOAD command loads an S-record (*.S19) object file into the debugger. Entering this command without a filename brings up a list of .S19 files in the current directory. Select a file for loading from this list. Upon loading, if the reset vector is defined in the code, the debugger sets the PC to that address.

When used with ICS08Z, the associated map file is also loaded. When used with ICD08SZ, the map file is not loaded; use the LOADALL or LOADMAP command for this purpose.

Syntax:

LOAD [*<filename>*]

where:

<filename> The name of the .S19 file to be loaded. The .S19 extension can be omitted. The filename value can be a pathname that includes an asterisk (*) wildcard character. If so, the command displays a window that lists all files in the specified directory having the .S19 extension.

Examples:

LOAD PROG1.S19	Load file PROG1.S19 and its map file into the simulator at the load addresses in the file.
LOAD PROG2	Load file PROG2.S19 and its map file into the simulator at the load addresses in the file.
LOAD A:	Display the names of the .S19 files on the diskette in drive A, for user selection.
LOAD	Display the names of the .S19 files in the current directory, for user selection.

LOADALL

Load S-Records and Map File

Use with: ICD08SZ only

The LOADALL command loads both the S19 object file and the map file into the debugger. It is equivalent to executing both the LOAD and LOADMAP commands.

Syntax:

```
LOADALL [<filename>]
```

where:

<filename> File name of your source code.

Example:

```
LOADALL myprog Loads both the .S19 object file and the map file.
```

LOADDESK

Load Desktop Settings

Use with: ICS08Z and ICD08SZ

The LOADDESK command loads the debugger window (desktop) settings for window position, size, and visibility, allowing a choice of how to set up the windows for the project.

This command executes automatically whenever the debugger is started.

Use the SAVEDESK command to save the debugger window settings to the desktop file.

Syntax:

LOADDESK

Example:

LOADDESK Get window settings from desktop file.

LOADMAP

Load Map File

Use with: ICS08Z and ICD08SZ

The LOADMAP command loads into the debugger a map file that contains source level debug information. Entering this command without a filename parameter brings up a list of .MAP files in the current directory. From this a file can be selected directly for loading map file information.

This command does not load an object file. It is useful in ICD08SZ when the object file has been programmed previously into FLASH memory.

Syntax:

LOADMAP [*<filename>*]

where:

<filename> The name of a map file to be loaded. The .MAP extension can be omitted. The filename value can be a pathname that includes an asterisk (*) wildcard character. If so, the command displays a lists of all files in the specified directory that have the .MAP extension.

Examples:

LOADMAP PROG.MAP	Load map file PROG.MAP into the host computer.
LOADMAP PROG1	Load map file PROG1.MAP into the host computer.
LOADMAP A:	Display the names of the .MAP files on the diskette in drive A.
LOADMAP	Display the names of the .MAP files in the current directory.

LOADV

Load and Verify

Use with: ICD08SZ only

The LOADV command first executes the LOAD command, then automatically executes the VERIFY command.

Syntax:

LOADV [*<filename>*]

where:

<filename> Filename of your source code.

Example:

LOADV myprog Loads the .S19 into the target. The contents of the .S19 file on the target board are then compared with the file myprog.

LOAD_BIN

Load Binary File

Use with: ICD08SZ only

The LOAD_BIN command loads a binary file of bytes starting at address *add*. The default filename extension is .BIN.

Syntax:

LOAD_BIN *<filename>* *<add>*

where:

<filename> Name of the binary file.

<add> Starting address.

Example:

LOAD_BIN myfile 100 Loads a binary myfile of bytes starting at
hex address 100.

LOADV_BIN

Load and Verify Binary File

Use with: ICD08SZ only

The LOADV_BIN command first executes the LOAD_BIN command, then automatically executes the VERIFY command.

Syntax:

LOADV_BIN <filename> <add>

where:

<filename> Name of the binary file.

<add> Starting address.

Example:

LOADV_BIN myfile 100 Loads a binary myfile of bytes starting at hex address 100, then executes a VERIFY command.

MACRO

Execute Batch File

Use with: ICS08Z and ICD08SZ

The MACRO command executes a macro file, which is a text file that contains a sequence of debug commands. Executing the macro file has the same effect as executing the individual commands, one after another. The SCRIPT command is identical.

Entering this command without a filename value brings up a list of macro (.MAC) files in the current directory. The file for execution can be selected directly from this list.

Note: A macro file can contain the MACRO command, allowing nested macro files up to 16 levels deep.

The most common use of the REM and WAIT (ICS08Z only) commands is within macro files. The REM command displays comments while the macro file executes. The WAIT command establishes a pause between the execution of the macro file commands.

If a startup macro file is in the directory, startup routines run the macro file each time the application starts. See the STARTUP command for more information.

To create a macro file, use either a text editor or the MACROSTART and MACROEND commands.

Syntax:

MACRO <filename>

where:

<filename> The name of a macro file to be executed, with or without extension .MAC. The filename can be a pathname that includes an asterisk (*) wildcard character. If so, the software displays a list of macro files, for selection.

Examples:

MACRO INIT.MAC	Execute commands in file INIT.MAC.
SCRIPT *	Display names of all .MAC files (then execute the selected file.
MACRO A:*	Display names of all .MAC files in drive A then execute the selected file.
MACRO	Display names of all .MAC files in the current directory, then execute the selected file.

MACROEND Stop Saving Commands to Batch File

Use with: ICS08Z and ICD08SZ

The MACROEND command stops recording of the macro file in which the software has saved debug commands. (The MACROSTART command opened the macro file.) The recorded macro file is closed and left ready for use by the MACRO command.

Syntax:

MACROEND

Example:

MACROEND Stop saving debug commands to the macro file, then close the file.

MACROSTART Save Debug Commands to Batch File

Use with: ICS08Z and ICD08SZ

The MACROSTART command opens a macro file and saves all subsequent debug commands to that file for later use. This file is closed by the MACROEND command.

Syntax:

MACROSTART [*<filename>*]

where:

<filename> The name of the macro file to save commands. The .MAC extension may be omitted. The filename can be a pathname followed by the asterisk (*) wildcard character. If so, the command displays a list of all files in the specified directory that have the .MAC extension.

Example:

MACROSTART TEST.MAC Save debug commands in macro file
TEST.MAC.

MACS

List Macros

Use with: ICD08SZ only

The MACS command brings up a window with a list of macros. These are files with the extension .ICD (such as the STARTUP.ICD macro). Use the arrow keys and the ENTER key or the mouse to select. Cancel with the ESCAPE key.

Syntax:

MACS

Example:

MACS Displays a window with a list of macros.

MAP

Show Information in Map File

Use with: ICS08Z and ICD08SZ

The MAP command lets you view information from the current map file stored in memory. All symbols defined in the source code used for debugging will be listed. The debugger-defined symbols, defined with the SYMBOL command, will not be shown.

The MAP and SHOWMAP commands are identical.

Syntax:

MAP

Example:

MAP Shows symbols from the loaded map file and their values.

MD or MD1

Display Memory at Address

Use MD and MD1 with: ICS08Z and ICD08SZ

The MD or MD1 command displays (in the memory window) the contents of memory locations beginning at the specified address. The number of bytes shown depends on the size of the window and whether ASCII values are displayed. If a logfile is open, this command also writes the first 16 bytes to the logfile.

For ICS08Z, the SHOW command is identical.

Syntax:

MD <address>

where:

<address> The starting memory address for display in the upper left corner of the memory window.

Examples:

MD 200 Display the contents of memory beginning at address 200.
SHOW 100 Display the contents of memory beginning at address 100.

MD2 Display Memory (Window 2) at Address

Use with: ICS08Z and ICD08SZ

The MD2 command displays (in memory window 2) the contents of memory locations beginning at the specified address. The number of bytes shown depends on the size of the window and whether ASCII values are displayed. If a logfile is open, this command also writes the first 16 bytes to the logfile.

For ICS08Z, the SHOW command is identical.

Syntax:

MD2 <address>

where:

<address> The starting memory address for display in the upper left corner of the memory window.

Example:

MD2 1000 Display the contents of 32 bytes of memory in the second memory window, beginning at address 1000.

MEM or MM

Modify Memory

Use with: ICS08Z and ICD08SZ

The MEM or MM command directly modifies the contents of memory beginning at the specified address. The optional variant specifies whether to write bytes (.B, the default), words (.W), or longs (.L). If the command has only an address value, the *Modify Memory* dialog box (see **Figure 8-2**) appears, showing the specified address and its present value. Use the dialog to enter a new value for the address or to modify the address type by selecting 8-bit bytes, 16-bit words, or 32-bit longwords. To modify several memory locations from this dialog, enter the new value in the *New Value* text box and click the >> button to increment the current address, the << button to decrement the current address, or the = button to display the same address. For the ICD08SZ, the MEM command is identical.

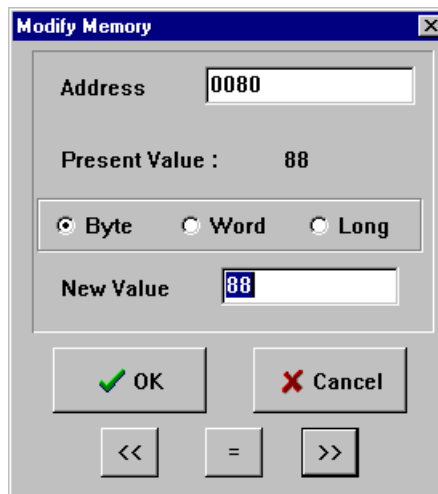


Figure 8-2. Modify Memory Dialog Box

If macro recording is on, all the values written to memory are recorded and will be properly written to memory when the macro is played back. See the MACROSTART command.

If the MM command includes optional data values, the software assigns the values to the specified addresses sequentially, then the command ends. No window appears in this case.

MEM or MM*(continued)***Syntax:**

MEM [.B|.W|.L] <address>[<n> ...]

where:

<address> The address of the first memory location to be modified.
<n> The value(s) to be stored (optional).

Examples:

MM 90	Start memory modify at address \$90.
MM 300 00	Assign value 00 to address \$300.
MM 100 00 01 10 11	Assign values \$00, \$01, \$10, \$11 to bytes 100-103.
MM.L 200 123456	Place long value \$00123456 at address \$200.

N

Set/Clear Negative Bit

Use with: ICS08Z and ICD08SZ

The N command sets or clears the N bit of the condition code register (CCR).

Note: The CCR bit designators are in the lower portion of the CPU window. The CCR pattern is V11HINZC (V is overflow, H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit of the CCR is set; a period means that the corresponding bit is clear.

Syntax:

N 0|1

Example:

N 1 Set the N bit of the CCR.

N 0 Clear the N bit of the CCR.

NOBR

Remove Breakpoints

Use with: ICS08Z and ICD08SZ

The NOBR command removes one or all active breakpoints. If this command is entered with an address value, it removes the breakpoint at that address. Without the address parameter, it removes all current breakpoints. To set breakpoints, use the BR command.

An alternative way for clearing a breakpoint in the code window is to position the cursor on a line of code, click the left mouse button to select the line, then press the right mouse button and select the **Toggle Breakpoint at Cursor** menu item. This removes the breakpoint from the line.

Syntax:

NOBR [*<address>*]

where:

<address> Optional address of a single breakpoint to be removed.

Examples:

NOBR Remove all current instruction breakpoints.

NOBR 120 Remove the instruction breakpoint at address 120.

NOMAP

Clear .MAP File

Use with: ICS08Z and ICD08SZ

The NOMAP command removes the current MAP file from memory, forcing the debugger to show disassembled code in the code windows instead of source code. Symbols defined using the SYMBOL command are not affected by this command.

For the ICS08Z, the NOMAP command is identical to CLEARMAP.

Syntax:

NOMAP

Example:

NOMAP Clears symbols and their definitions.

NOSYMBOL

Clear User Symbols

Use with: ICS08Z and ICD08SZ

The NOSYMBOL command removes all user-defined symbols created using the SYMBOL from memory. Symbols are created using the SYMBOL command. Symbols defined via a loaded MAP file are not affected.

Syntax:

NOSYMBOL

Example:

NOSYMBOL Clears user-defined symbols and their definitions.

PC

Set Program Counter

Use with: ICS08Z and ICD08SZ

The PC command assigns the specified value to the MCU program counter. As the PC always points to the address of the next instruction to be executed, assigning a new PC value changes the flow of code execution; the code windows change accordingly. The value entered with the command is displayed in the CPU Window.

An alternative way for setting the PC in a code window is to position the cursor on a line of code, click the left mouse button to select the line, then press the right mouse button and select the **Set PC at Cursor** menu item. This assigns the address of that line to the PC.

Syntax:

PC <address>

where:

<address> The new PC value.

Example:

PC 0200 Sets the PC value to 0200.

POD

Change Serial Port

Use with: ICS08Z only

The POD command connects to the ICS08 circuit board through the specified serial (COM) port. If successful, this command responds with the current status of ports, reset, and IRQ pins on the board. The command also shows the version of the board.

This command is used to change from stand-alone mode (no hardware board attached to the host computer) to in-circuit simulation mode (board attached). To change back to stand-alone mode, use the SIM08 command.

Syntax:

POD <n>

where:

<n> The number (1...8) of a serial port (COM1 through COM8) on the PC.

Example:

```
POD 1                    Connect to serial port COM1.  
Port A - 80  
Port B - 00  
Reset - 1  
IRQ - 1  
Version - 01
```


PORT[x] or PRT[x]

Set Port[x] Output Latches

Use with: ICS08Z only

The PORT[x] or PRT[x] command assigns the specified value to a particular port's output register latches. Please consult the **Appendix** for your specific MCU device to determine which ports are available.

Note: If the ICS08 board is connected, the system sends the n parameter value of this command to the board.

Syntax:

PORT[x] <n>

where:

[x] A letter representing the particular port to whose output register you wish to assign a value.

<n> The new value for the port output latches.

Example:

PORTA FF Set all port A output latches high.

QUIET

Toggle Window Refresh

Use with: ICD08SZ only

The QUIET command toggles the refresh of memory-based windows on or off. The default is ON. This command can be used on the startup command line.

Turning refresh off dramatically increases the stepping rate, since the data windows are not continually updated.

Syntax:

QUIET

Example:

QUIET Turns refresh of memory-based windows on or off.

R

Use Register Files

Use with: ICS08Z and ICD08SZ

The R command pulls up windows for the register files and starts interactive setup of such system registers as I/O, timer, and COP.

Entering this command opens the register files window, which can present a list of peripheral modules for your specific M68HC908 MCU. You can view any of the registers, modify their values, and store the results back into memory.

An alternate way to bring up the register files window is to click the REGISTER FILES button.

Syntax:

R

Example:

R Start interactive system register setup.

REG

Show Registers

Use with: ICS08Z and ICD08SZ

The REG command displays the contents of the CPU registers in the Status Window. The STATUS command is identical to the REG command.

This command is useful for capturing the CPU state to an open logfile.

Syntax:

REG

Example:

REG Displays the contents of the CPU registers.

REM Place Comment in Batch/Macro File

Use with: ICS08Z and ICD08SZ

The REM command lets you display comments in a macro file. When the macro file executes, the text comment appears in the status window. The text parameter does not need to be enclosed in quotes.

This command is useful for recording comments in a logfile.

Syntax:

REM <text>

where:

<text> A comment to be displayed when a macro file is executing.

Example:

REM Program executing;	Display the message Program executing during macro file execution.
------------------------	---

RESET

Simulate Processor Reset

Use with: ICS08Z and ICD08SZ

The RESET command resets the MCU and sets the program counter (PC) to the contents of the reset vector. This command does not start execution of user code.

Syntax:

```
RESET
```

Example:

```
RESET      Reset the MCU.
```

RESETGO

Reset and Restart MCU

Use with: ICS08Z only

The RESETGO command causes a reset of the MCU, sets the program counter (PC) to the contents of the reset vector, and then starts execution from that address.

Syntax:

RESETGO

Example:

RESETGO Simulate reset of the MCU and start execution of code.

SAVEDESK

Save Desktop Settings

Use with: ICS08Z and ICD08SZ

The SAVEDESK command saves the window size/position and desktop settings for the application when it is first opened or for use with the LOADDESK command. Opening the application or entering the LOADDESK command loads the saved settings.

Syntax:

SAVEDESK

Example:

SAVEDESK Save window settings for the application.

SHOWBREAKS

Display Breakpoint Window

Use with: ICS08Z only

The SHOWBREAKS command brings up the Breakpoint Window that displays the breakpoints used in the current debugging session. Breakpoints can be modified through this window.

Syntax:

SHOWBREAKS

Example:

SHOWBREAKS Open the breakpoint window.

SHOWCODE

Display Code at Address

Use with: ICS08Z and ICD08SZ

The SHOWCODE command displays code in the code windows beginning at the specified address, without changing the value of the program counter (PC). The code window shows either source code or disassembly from the given address, depending on which mode is selected for the window. This command is useful for browsing through various modules in the program. To return to code where the PC is pointing, use the SHOWPC command.

Syntax:

SHOWCODE <address>

where:

<address> The address or label where code is to be shown.

Example:

SHOWCODE 200 Show code starting at location \$200.

SHOWMAP

Show Information in Map File

Use with: ICS08Z and ICD08SZ

The SHOWMAP command lets you view information from the current map file stored in memory. All symbols defined in the source code used for debugging will be listed. The debugger-defined symbols, defined with the SYMBOL command, will not be shown.

The MAP and SHOWMAP commands are identical.

Syntax:

SHOWMAP

Example:

SHOWMAP Show symbols from the loaded map file and their values.

SHOWPC

Display Code at PC Address

Use with: ICS08Z and ICD08SZ

The SHOWPC command displays code in the code window starting from the address in the program counter (PC). The code window shows either source code or disassembly from the given address, depending on which mode is selected for the window. All values, registers, and code currently displayed are recorded in the logfile.

This command is often useful immediately after the SHOWCODE command.

Syntax:

SHOWPC

Example:

SHOWPC Show code from the PC address value.

SHOWTRACE

Display Trace Window

Use with: ICS08Z only

The SHOWTRACE command displays the trace window, showing the last 1024 instructions that were executed after the TRACE command is used.

Syntax:

SHOWTRACE

Example:

SHOWTRACE Open the trace window.

SIM08

Switch Simulation Mode

Use with: ICS08Z only

The SIM08 command allows switching from in-circuit simulation (with the ICS08 board connected to the host computer) to stand-alone simulation (without the board connected).

Syntax:

SIM08

Example:

SIM08 Switch from in-circuit simulation to stand-alone simulation.

SNAPSHOT

Save Window Data to Logfile

Use with: ICS08Z and ICD08SZ

The SNAPSHOT command sends textual information about the debugger windows to the open logfile. If no logfile is open, the command has no effect. This command is useful for documentation and testing.

Syntax:

SNAPSHOT

Example:

LOGFILE SNAPSHOT	Opens a logfile named SNAPSHOT.LOG and stores all information that appears in the Status Window.
SNAPSHOT	Takes a snapshot of all open windows and stores it in the file SNAPSHOT.LOG.
LF	Close the SNAPSHOT.LOG file.

The SNAPSHOT.LOG file can now be opened with any text editor.

SOURCEPATH

Set Path for Source Code

Use with: ICD08SZ only

The SOURCEPATH command sets the default path for source code that is not in the current directory.

Syntax:

```
SOURCEPATH <pathname>
```

where:

<pathname> The full path and filename of the source file.

Example:

```
SOURCEPATH      d:\mysource\myfile.asm
```


SP

Set Stack Pointer

Use with: ICS08Z and ICD08SZ

The SP command assigns the specified value to the stack pointer (SP) used by the CPU. The value entered with the command should be reflected in the CPU Window.

Syntax:

SP <n>

where:

<n> The new stack pointer value.

Example:

SP \$E0 Set the stack pointer value to \$E0.

SS**Execute Source Step(s)**

Use with: ICS08Z and ICD08SZ

The SS command steps through a specified number of source code instructions, beginning at the current program counter (PC) address value, then halts. All windows are refreshed as each instruction is executed. This makes the SS command useful for high level language compilers (such as C) so that you can step through compiler source code instead of assembly instructions.

If the number argument is omitted, one source instruction is executed. If the SS command is entered with an n value, the command steps through n source instructions.

Syntax:

SS [<n>]

where:

<n> Number of instructions to step through.

Examples:

SS Step through the instruction at the PC address value.

SS 8 Step through eight instructions, starting at the current PC address value.

ST or STEP or T

Execute Single Step

Use with: ICS08Z and ICD08SZ

The identical ST, STEP, and T commands step through a specified number of assembly instructions, beginning at the current program counter (PC) address, then halt. All windows are refreshed as each instruction is executed. If the number argument is omitted, one instruction is executed. If the command is entered with a parameter value, the command steps through that many instructions.

Syntax:

STEP [<n>]

where:

<n> The hexadecimal number of instructions to be executed by each command.

Examples:

STEP Execute the assembly instruction at the PC address value.
ST 2 Execute two assembly instructions, starting at the PC address value.

STACK

Show Stack Window

Use with: ICS08Z only

The STACK command opens the HC08 Stack Window, which shows the stack pointer (SP) value, data stored on the stack, and results of an RTS or RTI instruction.

Syntax:

STACK

Example:

STACK Open the stack window.

STATUS

Show Registers

Use with: ICS08Z and ICD08SZ

The STATUS command displays the contents of the CPU registers in the Status Window. The STATUS command is identical to the REG command.

This command is useful for saving the CPU state to a logfile.

Syntax:

STATUS

Example:

STATUS Display the contents of the CPU registers.

STEPFOR

Step Forever

Use with: ICS08Z and ICD08SZ

The STEPFOR command continuously executes instructions, one at a time, beginning at the current program counter (PC) address. Execution continues until an error condition occurs, until it reaches a breakpoint, or until you press a key or the STOP button on the ICS08Z toolbar. All windows are refreshed as each instruction is executed.

Syntax:

STEPFOR

Example:

STEPFOR Step through instructions continuously.

STEPTIL

Step Until Address

Use with: ICS08Z and ICD08SZ

The STEPTIL command continuously steps through instructions beginning at the current program counter (PC) address until the PC value reaches the specified address. Execution continues to the specified address or until you press a key or the STOP button on the debugger's toolbar, or it reaches a breakpoint, or until an error occurs.

Syntax:

STEPTIL <address>

where:

<address> Execution stop address. This must be an instruction address.

Example:

STEPTIL 0200 Execute instructions continuously until PC value is 0200.

SYMBOL

Add Symbol

Use with: ICS08Z and ICD08SZ

The SYMBOL command creates a new symbol, which can be used anywhere in the debugger, in place of the symbol value. If this command is entered with no parameters, it will list the current user-defined symbols. If parameters are specified, the SYMBOL command will create a new symbol.

The symbol label is case insensitive. It can be used with the ASM and MM commands and replaces all addresses in the code (when displaying disassembly) and variables windows.

Syntax:

SYMBOL [*<label>* *<value>*]

where:

<label> The ASCII character string label of the new symbol.

<value> The value of the new symbol (label).

Examples:

SYMBOL	Show the current user-defined symbols.
SYMBOL timer_control \$08	Define new symbol “timer_control”, with value \$08. Subsequently, to modify the value of “timer_control”, enter the command: MM timer_control new_value
MM timer_control \$33	Write \$33 to address \$08.

TRACE

Enable/Disable Tracing

Use with: ICS08Z only

The TRACE command enables or disables instruction captures. When tracing is enabled, the debugger records instructions in a 1024-element circular buffer.

The debugger disassembles captured information when buffer contents are viewed through the trace window. To view tracing results, use the SHOWTRACE command. If tracing is not enabled or if a trace slot is empty, the Trace Window will display the message No Trace Available. To clear the Trace Window, toggle tracing OFF and then ON using the TRACE command.

Syntax:

TRACE

Example:

TRACE Enable (or disable) instruction tracing.

UPLOAD_SREC

Upload S Record to Screen

Use with: ICS08Z and ICD08SZ

The UPLOAD_SREC command uploads the contents of the specified memory block (range), in .S19 object file format, displaying the contents in the status window. If a logfile is opened, UPLOAD_SREC puts the information into the logfile as well.

Note: If the UPLOAD_SREC command is entered, sometimes the memory contents scroll through the debug window too rapidly to view. Accordingly, use either the LOGFILE command, which records the contents into a file, or the scroll bars in the Status Window.

This command is particularly useful in ICD08SZ, where data from the real MCU can be captured to a logfile.

Syntax:

UPLOAD_SREC <startrange> <endrange>

where:

<startrange> Beginning address of the memory block.

<endrange> Ending address of the memory block (range).

Example:

UPLOAD_SREC 300 7FF Upload the 300-7FF memory block in .S19 format.

V

Set or Clear V Bit (CCR)

Use with: ICS08Z and ICD08SZ

The V command sets (1) or clears (0) the V bit in the condition code register (CCR).

The CCR bit designators are at the lower right of the CPU window. The CCR pattern is V11HINZC (V is overflow, H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit of the CCR is set; a period means that the corresponding bit is clear.

Syntax:

V [*<value>*]

where:

<value> The value of the new symbol (label).

Examples:

V 0 Clear the CCR V bit.

V 1 Set the CCR V bit.

VAR

Display Variable

Use with: ICS08Z and ICD08SZ

The VAR command displays the specified address and its contents in the variables window for viewing during code execution. Variants of the command display a byte, a word, a long, or a string. As the value at the address changes, the Variables window updates the value.

Syntax:

```
VAR [.B|.W|.L|.S] <address> [<n>]
```

where:

<address>	The address of the memory variable.
<n>	Optional number of characters for a string variable; default value is 1, does not apply to byte or word variables.

Examples:

VAR C0	Show byte value of address C0 (hex and binary).
VAR.B D4	Show byte value of address D4 (hex and binary).
VAR.W E0	Show word value of address E0 (hex & decimal).
VAR.S C0 5	Show the five-character ASCII string at address C0.

VERIFY

Verify S-Record File

Use with: ICD08SZ only

The VERIFY command compares the contents of program memory with an S-record file. The name of the file is prompted.

The comparison stops at the first memory location that differs from the file.

Syntax:

VERIFY

Examples:

LOADALL test.s19

VERIFY

Displays the message Verifying....verified

VERSION or VER**Display Software Version**

Use with: ICS08Z and ICD08SZ

The VERSION or VER command displays the version and date of the software.

Syntax:

VERSION

Examples:

VERSION Display version and date of the software.

VER Display version and date of the software.

WAIT

Wait for n Cycles

Use with: ICS08Z only

The WAIT command delays simulator command execution by the specified number of cycles. This command is used in macro files to control when inputs come into the simulator. If a WAIT command is encountered, control is passed back to the keyboard. Then the macro file execution waits for a command to be entered such as GO or STEP, which starts MCU execution once again. As soon as the number of cycles that pass is equal to the *n* value of the WAIT command, the simulator resumes executing commands of the macro file until another WAIT is encountered or the two mentioned conditions happen again.

Syntax:

WAIT <*n*>

where:

<*n*> The hexadecimal number of cycles to wait.

Example:

WAIT A Delay command execution for 10 MCU cycles.

WHEREIS

Display Symbol Value

Use with: ICS08Z and ICD08SZ

The WHEREIS command displays the value of the specified symbol. Symbol names are defined through source code or the SYMBOL command. Alternatively, this command returns the symbol at a specified address.

Syntax:

WHEREIS <symbol> | <address>

where:

<symbol> A symbol listed in the symbol table.
<address> Address for which a symbol is defined.

Examples:

WHEREIS START Display the symbol START and its value.
WHEREIS 0300 Display the value 0300 and its symbol name if any.

X or XREG

Set X Register Value

Use with: ICS08Z and ICD08SZ

The X command sets the index (X) register to the specified value. The value entered with the command is displayed in the CPU Window. The X command is identical to the XREG command.

Syntax:

X <value>

where:

<value> The new value for the X register.

Examples:

X 05 Set the index register value to 05.

XREG F0 Set the index register value to F0.

Z**Set/Clear Zero Bit**

Use with: ICS08Z and ICD08SZ

The Z command sets or clears the Z bit in the condition code register (CCR).

Note: The CCR bit designators are in the lower portion of the CPU window. The CCR pattern is 111HINZC (H is half-carry, I is IRQ interrupt mask, N is negative, Z is zero and C is carry). A letter in these designators means that the corresponding bit of the CCR is set; a period means that the corresponding bit is clear.

Syntax:

Z 0|1

Examples:

Z 0 Clear the Z bit of the CCR.

Z 1 Set the Z bit of the CCR.

APPENDIX A

S-RECORD INFORMATION

A.1 OVERVIEW

The Motorola S-record format was devised to encode programs or data files in a printable format for transport between computer platforms. The format also provides for editing of the S-records and monitoring the cross-platform transfer process.

A.2 S-RECORD CONTENT

Each S-record is a character string composed of several fields which identify:

- Record type
- Record length
- Memory address
- Code/data
- Checksum

Each byte of binary data is encoded in the S-record as a 2-character hexadecimal number:

- The first character represents the high-order four bits of the byte.
- The second character represents the low-order four bits of the byte.

The five fields that comprise an S-record are shown in **Table A-1**.

Table A-1. S-Record Fields

TYPE	RECORD LENGTH	ADDRESS	CODE/DATA	CHECKSUM
------	---------------	---------	-----------	----------

The S-record fields are described in Table A-2.

Table A-2. S-Record Field Contents

Field	Printable Characters	Contents
Type	2	S-record type — S0, S1, etc.
Record Length	2	Character pair count in the record, excluding the type and record length.
Address	4, 6, or 8	2-, 3-, or 4-byte address at which the data field is to be loaded into memory.
Code/Data	0-2n	From 0 to n bytes of executable code, memory loadable data, or descriptive information. For compatibility with teletypewriter, some programs may limit the number of bytes to as few as 28 (56 printable characters in the S-record).
Checksum	2	Least significant byte of the one's complement of the sum of the values represented by the pairs of characters making up the record length, address, and the code/data fields

Each record may be terminated with a CR/LF/NULL. Additionally, an S-record may have an initial field to accommodate other data such as line number generated by some time-sharing systems.

Accuracy of transmission is ensured by the record length (byte count) and checksum fields.

A.3 S-RECORD TYPES

Eight types of S-records have been defined to accommodate the several needs of the encoding, transport, and decoding functions. The various Motorola upload, download, and other record transport control programs, as well as cross assemblers, linkers, and other file-creating or debugging programs, utilize only those S-records which serve the purpose of the program. For specific information on which S-records are supported by a particular program, consult the user manual for the program.

Note: The ICS08 software supports only the S0, S1, and S9 record types. All data before the S1 record is ignored. Thereafter, all records must be S1 type until the S9 record, which terminates data transfer.

An S-record format may contain the record types in **Table A-3**.

Table A-3. Record Types

Record Type	Description
S0	Header record for each block of S-records. The code/data field may contain any descriptive information identifying the following block of S-records. The address field is normally 0s.
S1	Code/data record and the 2-byte address at which the code/data is to reside.
S2-S8	Not applicable to the ICS08 software.
S9	Termination record for a block of S1 records. Address field may optionally contain the 2-byte address of the instruction to which control is to be passed. If not specified, the first interplant specification encountered in the input will be used. There is no code/data field.

Only one termination record is used for each block of S-records. Normally, only one header record is used, although it is possible for multiple header records to occur.

A.4 S-RECORD CREATION

S-record format programs may be produced by dump utilities, debuggers, cross assemblers, or cross linkers. Several programs are available for downloading a file in the S-record format from a host system to an 8- or 16-bit microprocessor-based system.

A.5 S-RECORD EXAMPLE

A typical S-record format, as printed or displayed, is shown in this example:

Example:

```
S00600004844521B
S1130000285F245F2212226A00042429008237C2A
S11300100002000800082529001853812341001813
S113002041E900084#42234300182342000824A952
S107003000144ED492
S9030000FC
```

In the example, the format consists of:

- An S0 header
- Four S1 code/data records
- An S9 termination record

A.5.1 The S0 Header Record

The S0 header record is described in **Table A-4**.

Table A-4. S0 Header Record

Field	S-Record Entry	Description
Type	S0	S-record type S0, indicating a header record.
Record Length	06	Hexadecimal 06 (decimal 6), indicating six character pairs (or ASCII bytes) follow.
Address	0000	4-character 2-byte address field, 0s.
Code/Data	484452	Descriptive information identified these S1 records: ASCII H D R — "HDR"
Checksum	18	Checksum of S0 record.

A.5.2 The First S1 Record

The first S1 record is described in **Table A-5**.

Table A-5. S1 Header Record

Field	S-Record Entry			Description	
Type	S1			S-record type S1, indicating a code/data record to be loaded/verified at a 2-byte address.	
Record Length	13			Hexadecimal 13 (decimal 19), indicating 19 character pairs, representing 19 bytes of binary data, follow.	
Address	0000			4-character 2-byte address field; hexadecimal address 0000, indicates location where the following data is to be loaded.	
Code/Data	Opcode			Instruction	
	28	5F		BHCC	\$f0161
	24	5F		BCC	\$0163
	22	12		BHI	\$0118
	22	6A		BHI	\$0172
	00	04	24	BRSET	0, \$04, \$012F
	29	00		BHCS	\$010D
	08	23	7	BRSET	4, \$23, \$018C
Checksum	2A			Checksum of the first S1 record.	

The 16 character pairs shown in the code/data field of **Table A-5** are the ASCII bytes of the actual program.

The second and third S1 code/data records each also contain \$13 (19) character pairs and are ended with checksum 13 and 52, respectively. The fourth S code/data record contains 07 character pairs and has a checksum of 92.

A.5.3 The S9 Termination Record

The S9 termination record is described in **Table A-6**.

Table A-6. S-9 Header Record

Field	S-Record Entry	Description
Type	S9	S-record type S9, indicating a termination record.
Record Length	03	Hexadecimal 04, indicating three character pairs (three bytes) follow.
Address	0000	4-character 2-byte address field, 0s.
Code/Data		There is no code/data in an S9 record.
Checksum	FC	Checksum of S9 record.

A.5.4 ASCII Characters

Each printable ASCII character in an S-record is encoded in binary. **Table A-6** gives an example of encoding for the S1 record. The binary data is transmitted during a download of an S-record from a host system to a 9- or 16-bit microprocessor-based system.

APPENDIX B GLOSSARY

—0-9—

8-bit MCU

A microcontroller whose data is communicated over a data bus made up of eight separate data conductors. Members of the MC68HC908 Family of microcontrollers are 8-bit MCUs.

—A—

A

An abbreviation for the accumulator of the MC68HC908 MCU.

accumulator

An 8-bit register of the MC68HC908 CPU. The contents of this register may be used as an operand of an arithmetic or logical instruction.

assembler

A software program that translates source code mnemonics into opcodes that can then be loaded into the memory of a microcontroller.

assembly language

Instruction mnemonics and assembler directives that are meaningful to programmers and can be translated into

an object code program that a microcontroller understands. The CPU uses opcodes and binary numbers to specify the operations that make up a computer program. Humans use assembly language mnemonics to represent instructions. Assembler directives provide additional information such as the starting memory location for a program. Labels are used to indicate an address or binary value.

ASCII

American Standard Code for Information Interchange. A widely accepted correlation between alphabetic and numeric characters and specific 7-bit binary numbers

—B—

breakpoint

During debugging of a program, it is useful to run instructions until the CPU gets to a specific place in the program, and then enter a debugger program. A breakpoint is established at the desired address by temporarily substituting a software interrupt (SWI) instruction for the instruction at that address. In response to the SWI, control is passed to a

debugging program.

byte

A set of exactly eight binary bits.

—C—

C

An abbreviation for carry/borrow in the condition codes register of the MC68HC908 MCUs. When adding two unsigned 8-bit numbers, the C bit is set if the result is greater than 255 (\$FF).

CCR

An abbreviation for condition code register in the MC68HC908. The CCR has six bits (V, H, I, N, Z, and C) that can be used to control conditional branch instructions. The values of the bits in the CCR are determined by the results of previous operations. For example, after a load accumulator (LDA) instruction, Z will be set if the loaded value was \$00.

clock

A square wave signal that is used to sequence events in a computer.

command set

The command set of a CPU is the set of all operations that the CPU knows how to perform. One way to represent an instruction set is with a set of shorthand mnemonics such as LDA meaning load A. Another representation of an instruction set is the opcodes that are recognized by the CPU.

condition codes register

The CCR has five bits (H, I, N, Z, and C) that can be used to control conditional branch commands. The values of the bits in the CCR are determined by the results of previous operations. For example, after

a load accumulator (LDA) instruction, Z will be set if the loaded value was \$00.

CPU

Central processor unit. The part of a computer that controls execution of instructions.

CPU cycles

A CPU clock cycle is one period of the internal bus-rate clock. Normally, this clock is derived by dividing a crystal oscillator source by two or more so the high and low times will be equal. The length of time required to execute an instruction is measured in CPU clock cycles.

CPU registers

Memory locations that are wired directly into the CPU logic instead of being part of the addressable memory map. The CPU always has direct access to the information in these registers. The CPU registers in an MC68HC908 are A (8-bit accumulator), X (8-bit index register), CCR (condition code register containing the V, H, I, N, Z, and C bits), SP (stack pointer), and PC (program counter).

cycles

See CPU cycles

—D—

data bus

A set of conductors that are used to convey binary information from a CPU to a memory location or from a memory location to a CPU; in the MC68HC908, the data bus is 8-bits.

development tools

Software or hardware devices used to develop computer programs and

application hardware. Examples of software development tools include text editors, assemblers, debug monitors, and simulators. Examples of hardware development tools include simulators, logic analyzers, and PROM programmers. An in-circuit simulator combines a software simulator with various hardware interfaces.

—E—

EPROM

Erasable, programmable read-only memory. A non-volatile type of memory that can be erased by exposure to an ultra-violet light source. MCUs that have EPROM are easily recognized by their packaging: a quartz window allows exposure to UV light. If an EPROM MCU is packaged in an opaque plastic package, it is termed a one-time-programmable OTP MCU, since there is no way to erase and rewrite the EPROM.

—F—

—G—

—H—

H

Abbreviation for half-carry in the condition code register of the MC68HC908. This bit indicates a carry from the low-order four bits of an 8-bit value to the high-order four bits. This status indicator is used during BCD calculations.

—I—

I

Abbreviation for interrupt mask bit in the condition code register of the MC68HC908.

index register

An 8-bit CPU register in the MC68HC908 that is used in indexed addressing mode. The index register (X) also can be used as a general-purpose 8-bit register in addition to the 8-bit accumulator.

input-output (I/O)

Interfaces between a computer system and the external world. For example, a CPU reads an input to sense the level of an external signal and writes to an output to change the level on an external signal.

instructions

Instructions are operations that a CPU can perform. Instructions are expressed by programmers as assembly language mnemonics. A CPU interprets an opcode and its associated operand(s) as an instruction.

—J—

—K—

—L—

listing

A program listing shows the binary numbers that the CPU needs alongside the assembly language statements that the programmer wrote. The listing is generated by an assembler in the process of translating assembly language source statements into the binary information

that the CPU needs.

—M—

MCU – Microcontroller unit

Microcontroller. A complete computer system including CPU, memory, clock oscillator, and I/O on a single integrated circuit.

—N—

N

Abbreviation for negative, a bit in the condition code register of the MC68HC908 MCUs. In two's-complement computer notation, positive signed numbers have a 0 in their MSB (most significant bit) and negative numbers have a 1 in their MSB. The N condition code bit reflects the sign of the result of an operation. After a load accumulator instruction, the N bit will be set if the MSB of the loaded value was a 1.

—O—

object code file

A text file containing numbers that represent the binary opcodes and data of a computer program. An object code file can be used to load binary information into a computer system. Motorola uses the S-record file format for object code files.

operand

An input value to a logical or mathematical operation.

opcode

A binary code that instructs the CPU to do a specific operation in a specific way. The

MC68HC908 CPU recognizes 210 unique 8-bit opcodes that represent addressing mode variations of 62 basic instructions.

OTPROM

A non-volatile type of memory that can be programmed but cannot be erased. An OTPROM is an EPROM MCU that is packaged in an opaque plastic package. It is called a one-time-programmable MCU because there is no way to expose the EPROM to a UV light.

—P—

PC

Abbreviation for program counter CPU register of the MC68HC908.

program counter

The CPU register that holds the address of the next instruction or operand that the CPU will use.

—Q—

—R—

RAM

Random Access Memory. Any RAM location can be read or written by the CPU. The contents of a RAM memory location remain valid until the CPU writes a different value or until power is turned off.

registers

Memory locations that are wired directly into the CPU logic instead of being part of the addressable memory map. The CPU always has direct access to the information in these registers. The CPU registers in the MC68HC908 are A (8-bit

accumulator), X (8-bit index register), CCR (condition code register containing the H, I, N, Z, and C bits), SP (stack pointer), and PC (program counter). Memory locations that hold status and control information for on-chip peripherals are called I/O and control registers.

reset

Reset is used to force a computer system to a known starting point and to force on-chip peripherals to known starting conditions.

—S—

S-record

A Motorola standard format used for object code files.

simulator

A computer program that copies the behavior of a real MCU.

source code

See source program

SP

Abbreviation for stack pointer CPU register in the MC68HC908 MCU.

source program

A text file containing instruction mnemonics, labels, comments, and assembler directives. The source file is processed by an assembler to produce a composite listing and an object file representation of the program.

stack pointer

A CPU register that holds the address of the next available storage location on the stack.

—T—

—U—

—V—

V_{DD}

The positive power supply to a microcontroller (typically 5 volts dc).

V_{SS}

The 0 volt dc power supply return for a microcontroller.

—W—

Word

A group of binary bits. Some larger computers consider a set of 16 bits to be a word but this is not a universal standard.

—X—

X

Abbreviation for index register, a CPU register in the MC68HC908.

—Y—

—Z—

Z

Abbreviation for zero, a bit in the condition code register of the MC68HC908. A compare instruction subtracts the contents of the tested value from a register. If the values were equal, the result of this subtraction would be 0 so the Z bit would be set; after a load accumulator instruction, the Z bit will be set if the loaded value was \$00.

