Debugger

Serial Debug

Interface

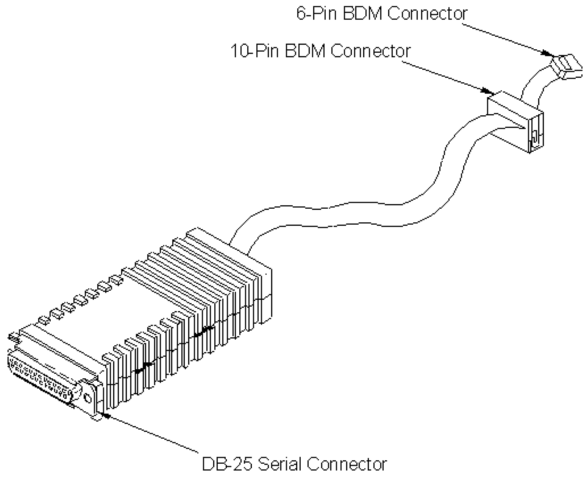
SDI target

Product Manual	Manual Date
Debugger - SDI	6-Aug-2003

SDI Target Component

Introduction

An advanced feature of this debugger for the embedded system development world is the ability to load different Framework targets. This document introduces the SDI Serial Debug Interface. The SDI is a Motorola interface that the debugger uses to communicate with an external system (also called a *target system*).



With this interface, you can download an executable program from the environment. The destination of this program is an external target system, based on a Motorola MCU, that executes the program. the debugger receives feedback of real target-system behavior.

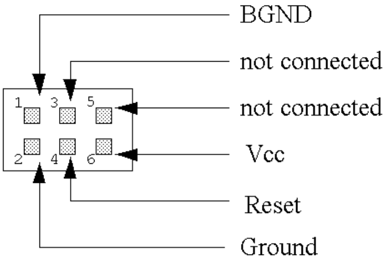
The debugger fully supervises and monitors the target-system MCU. That is, the debugger controls the CPU execution. You can read and write in internal or external memory (even when the

CPU is running); single-step, run, or stop the CPU; and set breakpoints in the code.

> *Note:* **Uninvolved Components** *As an external MCU executes the code, the SDI cannot provide memory statistics. This means that you cannot use the SDI for profiling, coverage analysing, watchpoints, or I/O simulation.*

Interfacing Your System and a Target

Motorola designed the SDI around a serial communication link. Any available communication device of your system (PC or SUN) supports the SDI. The SDI target driver fully handles the communication protocol between the SDI and your system; loading the SDI target component automatically includes loading the SDI target driver.
The target hardware must have a BDM connector, for connection to the SDI. You can set the baud rate (Please see the *SDI Default Environment* section). The diagram below shows the BDM port 6-pin connector.

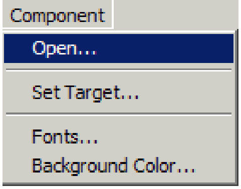


SDI-to-target-system communication is serial. Motorola defines the communication protocol in the *CPU 12 Reference Manual, section 8 (Development and Debug Support)*. However, you do not need to know this protocol to conduct an SDI debugging session.
The target system supplies power to the SDI, provided that target-system power conforms to the TTL norm. If it does not, the SDI should have its own supply. Please refer to the SDI hardware manual, *SDI INTERFACE USER'S MANUAL*, from Motorola.

Loading the SDI Target

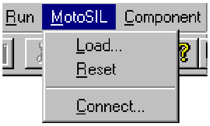
Usually, the `PROJECT.INI` file specifies the target: `Target=Motosil`. The MotoSIL driver automatically detects the SDI target connection to your system. However, if the driver detects nothing, an error message informs you that the target is not connected or that the target is connected to a different port. A *Communication Configuration* dialog appears, so that you can set the correct baud-rate and communication-port parameter values. Please see the *Communication Configuration* section, below.

If the `PROJECT.INI` file target setting is incorrect, load the SDI driver. From the main menu, select *Component | Set Target...*, as shown below. Then choose *MotoSIL* from the list of possible targets.

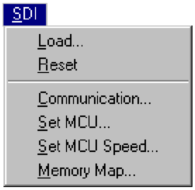


The MotoSIL driver automatically ties to find the SDI target, behaves as described above for automatic detections.

If MotoSIL does not detect any target, the *MotoSIL* menu remains in the main menu bar:



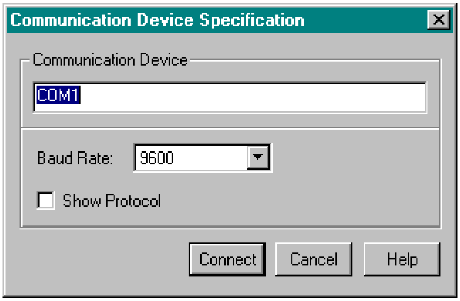
After successful target loading, the SDI menu replaces the *Target* or *MotoSIL* menu.



Communication Configuration

In most situations, the debugger uses its default values to set communication with SDI automatically. In case of any problem, the dialog box below appears, so that you can correct settings. Make sure that your host-computer parameter values are correct; make sure that the serial communication setting is correct.

Communication Device If your host and target are not connected, or if the connection is not via the expected device, this dialog box appears:



Communication Device: COM1

Baud Rate: 9600

□ Show Protocol

Type the name of an available communication device in the *Communication Device* edit box, use the drop-down control to set the baud rate, then click *Connect*. (The default communication device is COM1.) If the debugger cannot establish connection with the specified device, a message box lets you try a different communication device. Once communication succeeds, the debugger saves the communication device as the default for a later debugging session. To exit the dialog box and the environment, click *Cancel*.

> *Note: Saving the communication device and the baud rate through this dialog box overrides environment variables* `BAUDRATE` *and* `COMDEV` *of the* `DEFAULT.ENV` *file.*

Data Format The SDI data format is 8 data bits, 1 stop bit, no parity, and a variable baud rate. The default speed is 9600 baud, unless you change this default via the Target-menu selection *SDI | Communication...* (please see the dialog box below).
Communication speeds of 1200 through 57600 baud are available, depending on the host-computer hardware.

Default Target Setup

As with any target, you can use the *Target* menu to load the SDI target component, or you can set the SDI target as a default in the `PROJECT.INI` file. This file should be in the working directory.

Example of `PROJECT.INI` file.

```
[DEFAULTS]
Window0=Source     0   0  50  40
Window1=Assembly  50   0  50  40
Window2=Register  50  40  50  30
Window3=Memory    50  70  50  30
Window4=Data       0  40  50  25
Window5=Command    0  65  50  20
Window6=Module     0  85  50  15
Target=Motosil

[Motorola ESL]
COMDEV=COM2
BAUDRATE=57600
SHOWPROT=1
```

> *Note: Please see the core debugger manual for more information about the* `PROJECT.INI` *file.*

Motorola ESL Parameters

In normal use, you set these parameters in the `PROJECT.INI` file once, interactively, during installation. You use these parameter values in subsequent debugging sessions.

COMDEV This parameter specifies the host-computer communication port. `COM1` is the default communication device for PCs; `/dev/ttya` is the default communication device for UNIX systems. To set a different device, follow the appropriate pattern:

For a PC:	Any valid communication device (`COM1,COM2,etc.`).
Example:	`COMDEV=COM2`
For SUN:	Any valid communication device (`/dev/ttya, etc.`).
Example:	`comdev=/dev/ttyb`

BAUDRATE This parameter specifies the communication baud rate between the host computer and the target. The default is 9600 baud, but you may set any of these baud rates:

`1200, 2400, 4800, 9600, 19200, 28800, 38400, 57600, 115200.`

Example:	`BAUDRAUTE=19200`

SHOWPROT This parameter controls reporting of commands and responses in the command line window. The `SHOWPROT` value 0 specifies *not* reporting commands and responses. The

SHOWPROT value 1 specifies reporting commands and responses. The *Show Protocol* checkbox, of the *Communication Device Specification* dialog box, is another way to control this feature. Please see the section *Communication Configuration, Communication Device Specification.*

EEPROM Programming

To download code or data into on-chip EEPROM, the debugger must know the EEPROM address range. Use environment variables EEPROM_START and EEPROM_END to convey this information.

EEPROM_START specifies the address of the first byte of EEPROM; EEPROM_END specifies the address of the last byte of EEPROM.

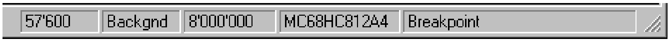
Example:

```
EEPROM_START=0x0D00
EEPROM_END=0xFFF
```

This example specifies EEPROM in the memory range 0xD000 to 0x0FFF. During writes to these addresses, EEPROM programming automatically downloads a program to modify memory or variables interactively.

> *Note: You cannot use these environment variables to program FLASH memory.*

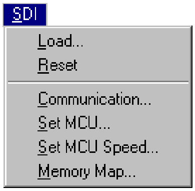
The Debugger Status Bar for the SDI



57'600 | Backgnd | 8'000'000 | MC68HC812A4 | Breakpoint

Once you have loaded the SDI target component, the debugger status bar gives specific information. From left to right, this information is: the serial-communication baud rate, the running mode, the target E-clock frequency, and the current MCU-Id.

SDI Target Component Menu Entries



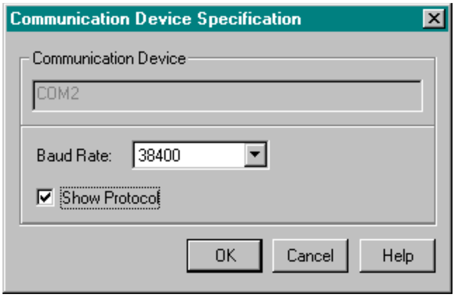
Loading an Application

Choose *SDI* | *Load...* to load the application you want to debug, such as a.ABS file.

Communication Baud Rate

You should specify the baud rate for host-computer-to-SDI communication early in a session. The system operates most efficiently at the maximum baud rate that the host computer supports. The debugger sets this baud rate automatically when it starts communication with the SDI. However, you can modify this baud rate, as text below explains.

Communication Select *SDI* | *Communication...* to display the dialog box below. If you know the maximum rate your host supports, use the drop-down control to select that rate. (The SDI does not support 115200). Otherwise, select 57600. If communication fails, the debugger automatically reduces the baud rate communication succeeds with the host computer.



Communication Device
COM2

Baud Rate: 38400

☑ Show Protocol

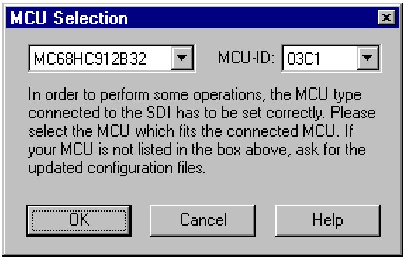
Maximum Baud Rate The maximum baud rate depends on the speed and interrupt load of the host computer. For slow notebook computers, or for computers running in a network, the maximum baud rate may be as low as 19200. A buffered I/O card may allow the maximum rate of 57600 for any host computer. The default value is 9600.

Show Protocol If you check the *Show Protocol* checkbox, the system reports all commands and responses in the command line window.

> *Note: Motorola or Metrowerks support personnel use this feature.*

MCU Selection

To specify the MCU, choose *SDI | Set MCU...*. This open the MCU Selection dialog box.



MCU Selection

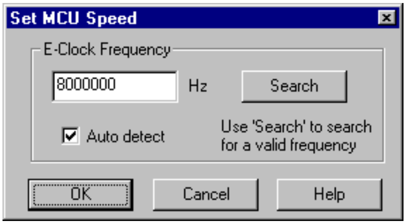
MC68HC912B32 MCU-ID: 03C1

In order to perform some operations, the MCU type connected to the SDI has to be set correctly. Please select the MCU which fits the connected MCU. If your MCU is not listed in the box above, ask for the updated configuration files.

This dialog box contains drop-list combo controls for the name and MCU-ID of the currently selected MCU. Use these controls to make any appropriate changes.
The control selections are from the file `MDSEMCU.INI`. If the drop-lists do not include the name or MCU-ID you want, you must update your installation.
The debugger saves your selections, to be the defaults for your next session.

E-clock Frequency

To specify the E-clock frequency, choose *SDI | Set MCU Speed...*. This opens the Set MCU Speed dialog box.



Set MCU Speed

E-Clock Frequency

8000000 Hz

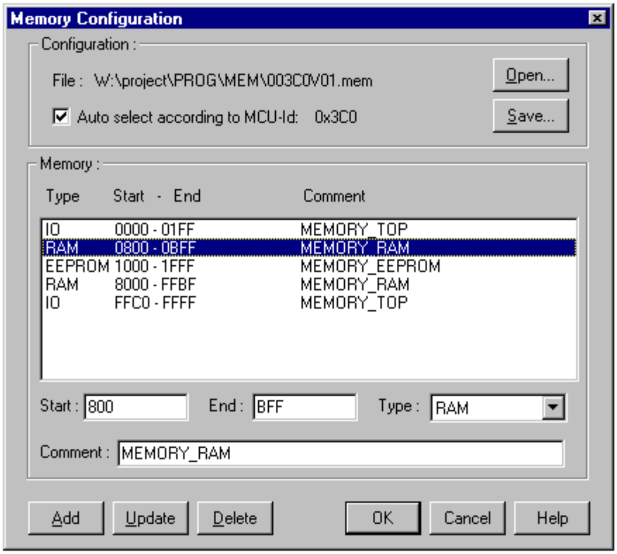
☑ Auto detect

Use 'Search' to search for a valid frequency

This dialog box shows the E-clock frequency that the MCU is to use, typically half the oscillator frequency. The SDI must know the E-clock frequency for proper BDM communication.
You can type a specific frequency in the edit box. Optionally, you can click the *Search* button, to have the debugger test communication with several frequencies, in this order:
8 MHz, 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz, 6 MHz, 3 MHz, 1.5 MHz, 750 kHz, 375 kHz, 187.5 kHz, 93.75 kHz, 46.875 kHz, 7 MHz, 3.5 MHz, 1.75 MHz, 875 kHz, 437.5 kHz, 218.75 kHz, 109.375 kHz, 54.687 kHz, 5 MHz, 2.5 MHz, 1.25 MHz, 625 kHz, 312.5 kHz, 156.25 kHz, 78.125 kHz, 39.062 kHz, 32.768 kHz, 16.384 kHz.
If the debugger cannot verify communication, a message so informs you.
At startup, the debugger uses the specified frequency. Should this frequency fail, and if you have checked the *Auto detect* checkbox, the debugger tries to find an appropriate frequency.
The debugger saves your selections, to be the defaults for your next session.

Memory Configuration

To view the memory layout, choose *SDI | Memory Map...*. This opens the Memory Configuration dialog box.



Configuration :

File : W:\project\PROG\MEM\003C0V01.mem

☑ Auto select according to MCU-Id: 0x3C0

Memory :

Type	Start - End	Comment
IO	0000 - 01FF	MEMORY_TOP
RAM	0800 - 0BFF	MEMORY_RAM
EEPROM	1000 - 1FFF	MEMORY_EEPROM
RAM	8000 - FFBF	MEMORY_RAM
IO	FFC0 - FFFF	MEMORY_TOP

Start : 800   End : BFF   Type : RAM

Comment : MEMORY_RAM

This dialog box shows the default memory configuration for the MCU being used. Check the *Auto select* box to have the system load this setup automatically. The system reads memory-layout information from the specific MCU personality file. The personality-file decomposition is:
`00nnnVvv.MEM – nnn is the 3-digit hexadecimal representation of the MCUid, and vv is the version number.`
The system looks up the personality file in the “`PROG\MEM`” subdirectory of your installation.

> *Note: In this product version, the Memory Configuration dialog box only displays the default memory layout.*

SDI Target Startup File

The debugger executes startup command file STARTUP.CMD right after the system loads the SDI target driver. This file must be in the working directory. You can use any command in this file, taking advantage of the large set of commands that *Core Debugger User guide* introduces.
Example of startup.cmd file contents:

```
wb 0x0035   0x00
wb 0x0012   0x11
```

SDI Reset Command File

Choose *Reset*, from the *Target/SDI* menu, to execute SDI reset command file RESET.CMD. This file must be in the working directory. You can use any command in this file.

> *Note: Entering the* RESET *command in the Command Line does NOT execute the reset command file.*

Loading the SDI Component

The debugger target component monitors the SDI interface. Loading the SDI target component includes loading the SDI driver. Load the SDI target component through the PROJECT.INI file. Alternatively, go to the main menu, select *Component* | *Set Target...*, then choose *Motosil*. The debugger base installation does not include installation of the SDI target DLL.

On-chip Hardware Breakpoint

You can use an on-chip hardware breakpoint module implement breakpoints. To do so, you must initialize the environment variable HWBPMODULEADR (in the DEFAULT.ENV file) with the address of the hardware breakpoint module. Make sure that the line is not in a remark. If you will not use hardware breakpoints, you may remove the environment-variable line.
Example:

```
HWBPMODULEADR=0x20
```

This example shows the value to be used for the M68HC12B32.

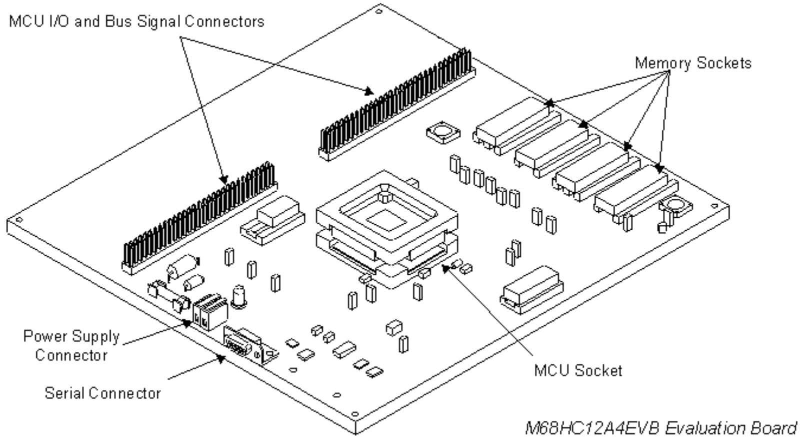
.

Note: The SDI supports only two hardware breakpoints at the same time. Additional breakpoints must software breakpoints.

Note: If you debug code in FLASH memory, do not set more than two breakpoints.

Note: Actions such as "stepping over” and “stepping out” use one internal breakpoint, so restrict you to just one hardware breakpoint.

Running Motorola’s EVBs with the SDI


MCU I/O and Bus Signal Connectors
Memory Sockets
Power Supply Connector
Serial Connector
MCU Socket
M68HC12A4EVB Evaluation Board

Introduction

You can use the SDI with any target system that has a background debug mode (BDM) connector, such as a Motorola evalution boards (EVB).
Please see the section *Interfacing Your System and a Target*.

MC68HC812A4EVB Evaluation Board

This EVB supports an HC12A4 processor.

- **Hardware setup** (taken from the Motorola ***HC12A4EVBUM/D*** hardware manual, ***Appendix F***) to run the SDI with the MC68HC812A4EVB:

  1. Remove the CSD jumper from header W11.
  2. Move the CSP0 jumper to W11 pins 2 and 3.
  3. Remove the BKGD jumper (W30).
  4. The MODA jumper (W34) must connect pins 1 and 2.
  5. The MODB jumper (W42) must connect pins 1 and 2.

- **Software setup** to be inserted in the `RESET.CMD` file of your current project directory:

```
wb 0x000B 0xF0 //MODE: forces Normal
Exp Wide mode
wb 0x000B 0xF0 //    : this forcing
```

```
                must be done twice!!
                wb 0x0011 0x00 //INITRG
                wb 0x0010 0x08 //INITRM
                wb 0x0012 0x11 //INITEE, move on-chip
                EEPROM from $F000
            //       to $1000
```

> *Note: Motorola's hardware setup steps 4 and 5 force the HC12A4 operating mode to* ***Single Chip****. This enables starting the background debugger. Subsequently, you must* ***force by software*** *(as shown above in the* `RESET.CMD` *file) the* ***Expanded Wide*** *mode to access the 16 kilobytes of on-board RAM (*`$C000 - $FFFF`*).*

After the setup above, the new SDI memory map is:
`$0000-$01FF`, CPU registers, on-chip (MCU)
`$0800-$0BFF`, user data area, 1 Kilobyte on-chip RAM (MCU)
`$1000-$1FFF`, user code area, 4 Kilobyte on-chip EEPROM (MCU)
`$C000-$FFFF`, user code/data area, 16 Kilobytes external RAM (U4, U5A)
Please see as well Motorola's *SDI INTERFACE USER'S MANUAL* and MC68HC812A4EVB manual.
The SDI installation disk includes demo programs; you can load and run all these demos with the SDI and on the MC68HC812A4EVB.

MC68HC912B32EVB Evaluation Board

This EVB supports an HC912B32 processor.
To run the SDI with the MC68HC912B32EVB:
-You do not need to set any jumpers.
-If necessary, software can download the ROM monitor program directly to the processor EEPROM.
Please see as well Motorola's *SDI INTERFACE USER'S MANUAL* and MC68HC912B32EVB manual.

Connection between SDI and HC12B32EVB

Boards such as the HC12A4EVB have a 10-pin BDM male connector. But boards such as the HC12B32EVB have a 6-pin BDM male connector. For a 6-pin board connector, use the 6-pin female connector of the SDI ribbon cable.
Note that the ribbon cable red wire (wire number 1) does not extend to the 6-pin connector. The 6-pin connector wires are 4 through 9. Accordingly, cable wire number 4 must connect to pin 1 of the HC12B32EVB **BDM-in / W9** connector.
The number "1" beside the **BDM-in** connector identifies pin 1. Another way to identify pin 1 of the connector is to note the square solder pad under the connector, on the top side of the board.

Power Supply

The *SDI INTERFACE USER'S MANUAL,* section 2 (*INTERFACE HOOKUPS*), explains the SDI standard interface hook-up, low-voltage interface hook-up, and alternative hook-up conversions.

SDI COMMANDS

This section explains the commands specific to the SDI.

Use these commands as you would any others, typing them in the Command Line component or inserting them into a command file.

For further details about commands, please see the debugger manual appendix, Debugger Commands, as well as the section Command Line Component.

BAUD

Short Description

sets the communication baud rate

Syntax

```
  BAUD [rate]
```

`rate`: Specifies the new baud rate; must be one of these decimal integer constants:
1200, 2400, 4800, 9600, 19200, 28800, 38400, 57600.

Description

The **`BAUD`** command sets or displays the baud rate for communication between the system controller and the host computer. For maximum performance, the baud rate should be as high as the host computer can accommodate. The maximum rate is 57600; the default baud rate is 9600. Without a rate value, the command displays the Communications Baud Rate Specification dialog box for interactive rate selection. If the host computer cannot support the requested rate, an “Out of synchronization” alert box appears. Select the RETRY option to retry communication at 9600 baud. Select the ABORT option to exit to the operating system. You also may use the menu to open the baud rate dialog box.

example: `BAUD 57600`

Changes the communication baud rate to 57600, the maximum rate.

RESET

Short Description

resets the emulation processor

Syntax

```
RESET
```

Description

The **RESET** command resets the emulator and the emulation processor. The system does *not* execute the reset command file (`RESET.CMD`).

TARGETRESET

Short Description

resets the SDI target interface

Syntax

```
TARGETRESET
```

Description

The **TARGETRESET** command:

- Resets the target interface,
- Resets the emulation processor,
- Initializes the debugger program counter to the reset vector value, and
- Executes the reset command file (`RESET.CMD`).

Contents

Index