M68EM08MR8

Emulator Module

User's Manual

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MR8EM Quick Start Guide

Your M68EM08MR8 Emulator Module (MR8EM) gets power from the dual inline (DIN) connectors of the Motorola Modular Development System (MMDS) or the Motorola Modular Evaluation System (MMEVS). Make sure to disconnect power from the MMDS or MMEVS boards. Then follow these quick-start steps to make your MR8EM ready for use as quickly as possible.

ESD CAUTION: *Motorola development systems include open-construction printed circuit boards that contain static-sensitive components. These boards are subject to damage from electrostatic discharge (ESD). To prevent such damage, you must use static-safe work surfaces and grounding straps, as defined in ANSI/EOS/ESD S6.1 and ANSI/EOS/ESD S4.1. All handling of these boards must be in accordance with ANSI/EAI 625.*

1. Set the configurable jumper headers to their factory defaults.

Your MR8EM has five configurable jumper headers. Table 1 provides a summary of the factory settings for these jumper headers.

Table 1. Quick Start Jumper Settings

Jumper Header	Factory Default	Description
W1 (A/D Mode Select)	Jumper between pins 1—2	Jumper header W1 specifies the A/D mode for the MC68HC908MR8 micro controller unit (MR8 MCU). The jumper between pins 1 and 2 (factory default) specifies truncated 8-bit A/D mode.
W2 (Clock Source Select)	Jumper between pins 3—4	Jumper header W2 specifies the clock source for the MR8 MCU. The jumper between pins 3 and 4 (factory default) selects the clock oscillator on the MR8EM board.
W3 (VSSA Enable)	Jumper between pins 1—2	Jumper header W3 allows you to specify whether the low voltage reference signal (VSSA) should reach the target headers. The jumper between pins 1 and 2 (factory default) disables the reference VSSA from reaching the target headers.

Table 1. Quick Start Jumper Settings (Continued)

Jumper Header	Factory Default	Description
W4 (OSC2 Enable)	Jumper between pins 1—2	Jumper header W4 allows you to specify whether the inverted MCU source clock signal should reach the target headers. The jumper between pins 1 and 2 (factory default) disables the inverted MCU source clock signal from reaching the target headers.
W10 (MCU Select)	Jumper between pins 1—2	Jumper header W10 allows you to select the MCU to be emulated. The jumper between pins 1 and 2 (factory default) selects the MR8 MCU.

3. Install the MR8EM in your development system.

The factory ships your MR8EM with a 32-pin, QFP version of the MC68HC908MR8 MCU soldered directly onto the M68EM08MR8 emulation module board.

To use the MR8EM in an MMDS0508 Motorola Modular Development System (MMDS):

- Remove the access panel of the station-module enclosure.
- Insert the MR8EM through the access-panel opening.
- Fit together MR8EM connectors P1 and P2 (at the bottom of the board) and connectors P11 and P12 of the MMDS control board.
- Snap the corners of the MR8EM onto the plastic standoffs.

Alternatively, to use the MR8EM in an MMEVS0508 Motorola Modular Evaluation System (MMEVS):

- Fit together MR8EM connectors P1 and P2 (at the bottom of the board) and connectors P11 and P12 of the MMEVS platform board.
- Snap the corners of the MR8EM onto the plastic standoffs.

4. Connect the MR8EM to your target system.

Use the supplied type C target flex cable assembly (M68CBL05C), the appropriate target head, and the target head/adapter package (TC08MRFA32 or TC08MR8P28) to connect your MR8EM to a target system. For information on installing an adapter on the target board, refer to the engineering bulletin (EB416) on the CD-ROM that accompanies the M68EM08MR8 kit.

Plug the appropriate end of the flex cable plugs into MR8EM connectors J3 and J4.

If the MR8EM is in an MMDS station module enclosure, run the flex cable through the slit in the station-module enclosure, then replace the access panel.

Plug the other end of the flex cable into the target head adapter. Then plug the target head into the MCU socket or surface-mount adapter of your target system.

5. Connect the MMDS/MMEVS board to the serial port of the host computer.

Use the RS-232 cable supplied with the MMDS/MMEVS kit to connect MMDS or MMEVS platform board to the serial port of the host computer.

6. Copy the personality files to your computer.

The factory ships MR8 MCU personality files for MCUez™ software and P&E Microcomputer System, Inc.'s software on a floppy diskette. Find the computer directory that contains your debugging software, then copy the *0042FV01.MEM* and *00C2FV01.MEM* personality files and the *MCUIOC2F.REG* register file to this directory.

This completes the quick start for your MR8EM.

When you make sure that cable connections between your development system and your computer are sound, you are ready to apply power and use your MR8EM.

Section 1. General Information

1.1 Description

This user's manual explains connection, configuration, and operation information specific to the M68EM08MR8 Emulator Module (MR8EM). The MR8EM lets you emulate and debug target systems based on MC68HC908MR8 or MC68HC08MR4 microcontroller units (MCUs).

The MR8EM can be part of two development systems. This section describes those systems and explains the layout of the MR8EM.

1.2 Development Systems

The MR8EM can be part of two Motorola development systems:

- MMDS0508 Motorola Modular Development System (MMDS)
- MMEVS0508 Motorola Modular Evaluation System (MMEVS)

1.2.1 Motorola Modular Development System

The MMDS is an emulator system that provides a bus state analyzer and real-time memory windows. The unit's integrated design environment includes an editor, an assembler, user interface, and source-level debug.

A complete MMDS consists of:

- Station module — The metal MMDS enclosure containing the control board and the internal power supply
- Emulator module (EM) — A printed circuit board that enables system functionality for a specific set of MCUs
- Two logic clip cable assemblies — Twisted-pair cables that connect the station module to the target system, a test fixture, a clock, an oscillator, or any other circuitry useful for evaluation or analysis. One end of each cable assembly has a molded connector, which fits into station-module pod A or pod B. Leads at the other end of each cable terminate in female probe tips. Ball clips come with the cable assemblies.
- 9-lead RS-232 serial cable — Cable that connects the station module to the host computer RS-232 port

- 9- to 25-pin adapter — A molded assembly that connects the 9-pin cable to a 25-pin serial port
- System software — MCUez™ software and P&E Microcomputer System, Inc. software.
- MMDS documentation — *MMDS Operations Manual*, Motorola document order number MMDS0508OM/D; the MCUez software manual, included with the MCUez software package; a system software manual, included with the P&E Microcomputer System, Inc.'s MMDS0508 software package; and this EM user's manual (this manual)

MMDS baud rates are user-selectable: 2400, 4800, 9600, 19,200, 38400, or 57600.

As mentioned, the MR8EM gives the MMDS the ability to emulate target systems based on MC68HC908MR8 and MC68HC08MR4 MCUs. By substituting a different EM, you can enable your MMDS to emulate target systems based on a different MCU. (Your Motorola representative can explain all the EMs available.)

1.2.2 Motorola Modular Evaluation System

The MMEVS is an economical, two-board tool for designing, debugging, and evaluating target systems based on MC68HC05 or MC68HC08 MCUs.

A complete MMEVS consists of:

- Platform board (PFB) — The bottom board, which supports the emulator module, and has connectors for power and for a terminal or host computer
- Emulator module (EM) — A printed circuit board that enables system functionality for a specific set of MCUs
- RS-232 serial cable — A supplied cable that connects the PFB to the host computer RS-232 port
- System software — MCUez software and P&E Microcomputer System, Inc. software.
- MMEVS documentation — *MMEVS Operations Manual*, Motorola document order number MMEVSOM/D; the MCUez software manual, included with the MCUez software package; a system software manual, included with the P&E Microcomputer System, Inc.'s MMEVS0508 software package; and this emulator user's manual

The MMEVS features automatic selection of the communication baud rate: 2400, 4800, 9600, 19,200, 38,400, or 57,600.

With an MR8EM, the MMEVS emulates target systems based on MC68HC908MR8 and MC68HC08MR4 MCUs. By substituting a different EM, you can enable your MMEVS to emulate target systems based on a different MCU. (Your Motorola representative can explain all the EMs available.)

1.3 Emulator Module Layout

Figure 1-1 shows the layout of the MR8EM.

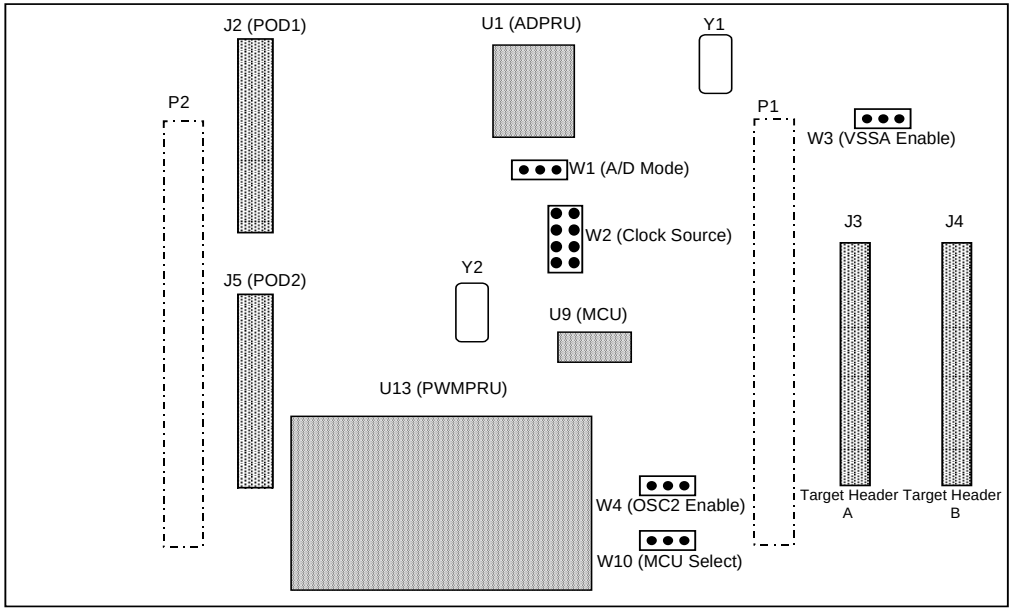


Figure 1-1 M68EM08MR8 Emulator Module Layout

The MR8EM has five configurable jumper headers. Jumper header W1 enables you to select the analog-to-digital (A/D) mode. Jumper header W2 enables you to specify the MCU clock source. Jumper header W3 allows you to specify whether the low voltage reference signal (VSSA) should reach the target headers. Jumper header W4 allows you to specify whether the inverted MCU

source clock signal should reach the target headers. Jumper header W10 allows you to select the MCU to be emulated.

Dual inline (DIN) connectors P1 and P2, which are at the bottom of the board enable you to connect the MR8EM to the MMDS control board or the MMEVS platform board.

Connectors J3 and J4 provide an interface to the target system. Connectors J2 (POD1) and J5 (POD2) enable connection to a logic analyzer.

Your MR8EM is shipped with a 32-pin quad flat pack (QFP) version of the MC68HC908MR8 MCU soldered directly at location U9 of the M68EM08MR8 emulation module board.

The A/D port replacement unit (ADPRU) and the PWM port replacement unit (PWMPRU) are installed at EM locations U1 and U13, respectively. The MR8EM contains a clock oscillator at location Y2. Additionally, solder pads are provided at EM location Y1 for a user-supplied crystal to be used as an alternative clock source.

1.4 System and User Requirements

The MR8EM requires these user-supplied cables for connection to other components of a development system:

- Two 40-lead target cables and target head adapters, for connecting the target system to connectors J3 and J4
- Two logic analyzer termination adapters for connecting to connectors J2 and J5

1.5 MR8EM Specifications

Table 1-1 lists MR8EM specifications.

Table 1-1 MR8EM Specifications

Characteristics	Specifications
MCU extension I/O ports	HCMOS compatible
Operating temperature	0° to 40°C
Storage temperature	–40° to +85°C
Relative humidity	0 to 90% (non-condensing)
Power requirements	+5 VDC, provided from the MMDS control board or MMEVS platform board
Dimensions	5.5 x 8.0 inches (140 x 203 mm)
Weight	6.14 ounces (174g)

Section 2. Preparation and Installation

2.1 Introduction

This section explains how to configure your MR8EM, and how to install it in an MMDS (Motorola modular development system) or MMEVS (Motorola modular evaluation system). For other parts of system installation or configuration, see the MMDS or MMEVS hardware manuals.

ESD CAUTION: *Motorola development systems include open-construction printed circuit boards that contain static-sensitive components. These boards are subject to damage from electrostatic discharge (ESD). To prevent such damage, you must use static-safe work surfaces and grounding straps, as defined in ANSI/EOS/ESD S6.1 and ANSI/EOS/ESD S4.1. All handling of these boards must be in accordance with ANSI/EAI 625.*

2.2 MR8EM Limitations

PORT C bit 0 of the MCU becomes a floating input after reset. A weak pull down resistor is connected to PORT C bit 1. If PORT C pins are at a logic level high after reset, the fault flags will be set and the pulse width modulator (PWM) output will be disabled. The PWM output remains disabled even if you turn the functionality of the fault pins off by changing the PORT C pins to output by writing to the data direction register (DDRx). The PWM output is not enabled until the flags are cleared.

One way to avoid this is to pull the two PORT C pins to a logic level low. Another way is to acknowledge the fault flags in the Fault Flag Registers (FSR) out of reset.

2.3 MR8EM Configuration

The MR8EM board was factory-tested and shipped with jumpers installed in their default positions. The MR8EM has five configurable jumper headers. Figure 2-1 shows the locations of these jumper headers and Table 2-1 is a summary of jumper header settings.

You can also install an external filter capacitor on the board to filter phase corrections.

Subsections 2.3.1 through 2.3.5 provide additional information about configuring the jumper headers. Subsection 2.3.6 provides information about installing an external filter capacitor on the board.

CAUTION: *Be sure to switch off or disconnect power when reconfiguring an installed* MR8EM. *Reconfiguring jumper headers with the power on can damage system circuits.*

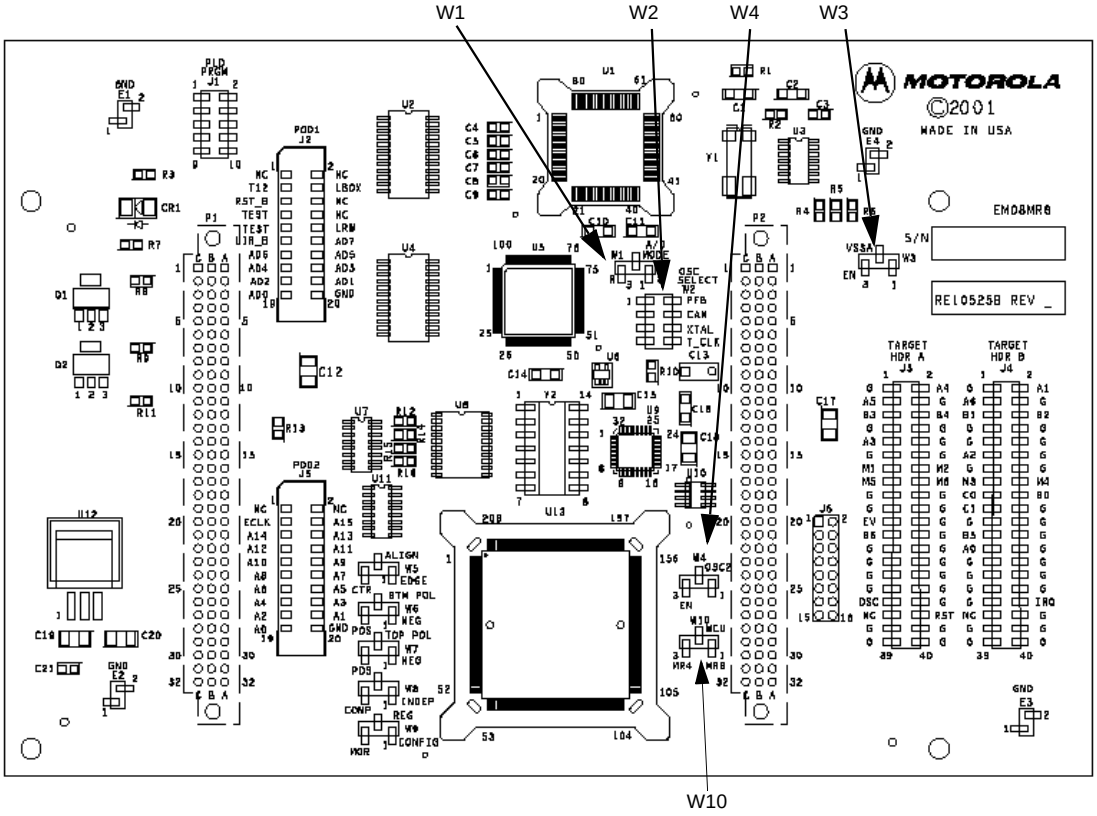
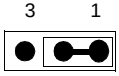
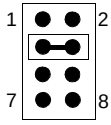
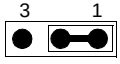
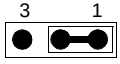
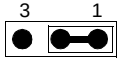


Figure 2-1 Jumper Header Locations

Table 2-1 Jumper Settings

Jumper Header	Type (Default Settings shown)	Description
W1 (A/D Mode Select)		Jumpers between pins 1—2 (factory default): Selects 8-bit A/D mode. Jumpers between pins 3—2: Selects right justified A/D mode.
W2 (Clock Source Select)		Jumpers between pins 1—2: Selects the clock signal from MMEVS platform board or MMDS control board. Jumpers between pins 3—4 (factory default): Selects the clock oscillator at location Y2 on the MR8EM board. Jumpers between pins 5—6: Selects the user supplied crystal at location Y1 as clock source. Jumpers between pins 7—8: Selects the clock signal from the target system.
W3 (VSSA Enable)		Jumpers between pins 1—2 (factory default): disables the reference VSSA to target headers Jumper between pins 2—3: enables the reference VSSA to target headers
W4 (OSC2 Enable)		Jumpers between pins 1—2 (factory default): disables the inverted MCU source clock signal to target headers Jumper between pins 2—3: enables the inverted MCU source clock signal to target headers
W10 (MCU Select)		Jumpers between pins 1—2 (factory default): selects the MC68HC908MR8 microcontroller unit (MR8 MCU.) Jumper between pins 2—3: selects the MC68HC08MR4 microcontroller unit (MR4 MCU.)

2.3.1 Setting the A/D Mode Select Header (W1)

Jumper header W1 selects the A/D mode. Figure 2-2 shows the factory configuration. The jumper between pins 1 and 2 specifies the 8-bit truncated A/D mode out of the reset of the ADPRU at location U1.

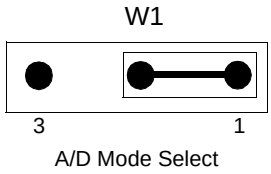


Figure 2-2 Jumper Header W1

Alternatively, you can reposition the jumper between pins 2 and 3 to select the right justified A/D mode.

2.3.2 Setting the External Clock Source Header (W2)

Jumper header W2 selects the source of the external clock signal. Figure 2-3 shows the factory configuration. The jumper between pins 3 and 4 specifies the clock oscillator at location Y2.

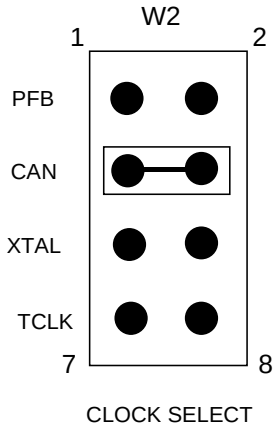


Figure 2-3 Jumper Header W2

Alternatively, you may select three other clock signals:

- To select the clock signal from the MMEVS platform board (or MMDS control board), reposition the W2 jumper between pins 1 and 2. Use your system software to specify the frequency.

- To select the user supplied crystal as the clock source, solder the crystal oscillator on the board at location Y1 and add the appropriate resistors, capacitors, and inverters to make an oscillator circuit. The components for the oscillator circuit are not populated on the board. Next, reposition the W2 jumper between pins 5 and 6.
- To select the clock signal from a target system, connect the target system to the MR8EM target headers. Next, reposition the W2 jumper between pins 7 and 8.

2.3.3 Setting the VSSA Enable Header (W3)

Jumper header W3 allows you to specify whether the reference VSSA signal should reach the target headers. VSSA is the analog ground on the MR8 MCU. If the analog ground and digital ground on the target board are separate, it is possible to have all the analog circuitry at the same low reference voltage by connecting VSSA to the target headers. This provides accurate analog to digital conversions.

However, if the analog ground and digital ground on the target board are not separate, then you do not need to connect VSSA to the target headers.

Note *When VSSA is connected to the target headers, noise may be coupled to the A/D channels through VSSA across the flex cable.*

Figure 2-4 shows the factory configuration. The jumper between pins 1 and 2 disables the reference VSSA to pin 36 of target header J4. Pin 36 is grounded in this case.

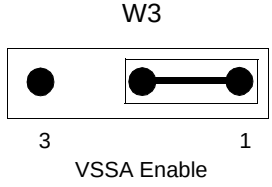


Figure 2-4 Jumper Header W3

Alternatively, you can reposition the W3 jumper between pins 2 and 3 to allow the reference VSSA to reach pin 36 of target header J4.

2.3.4 Setting the OSC2 Enable Header (W4)

Jumper header W4 allows you to specify whether the inverted MCU source clock signal should reach the target headers. Figure 2-5 shows the factory configuration. The jumper between pins 1 and 2 disables the OSC2 signal, which is the inverted MCU source clock signal OSC1, to pin 35 of target header J3. Pin 35 is a no connection pin in this case.

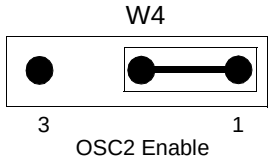


Figure 2-5 Jumper Header W4

Alternatively, you can reposition the W4 jumper between pins 2 and 3 to enable the OSC2 signal to reach pin 35 of target header J3.

2.3.5 Setting the MCU Select Header (W10)

The MR8EM lets you emulate and debug target systems based on MR8 or MR4 MCUs. Jumper header W10 allows you to select the type of MCU to be emulated. Figure 2-6 shows the factory setting of the jumper at W10. A jumper between pins 1 and 2 selects the MR8 MCU.

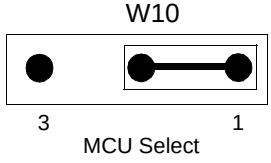


Figure 2-6 Jumper Header W10

Alternatively, you can select the MR4 MCU by repositioning the W10 jumper between pins 2 and 3.

2.3.6 Installing an External Filter Capacitor

The CGMXFC pin (pin number 4) of the MR8 MCU enables you to connect the appropriate filter capacitor (C_F) to the phase locked loop (PLL) filter for filtering the phase corrections. The MR8EM has two capacitors connected to

the CGMXFC pin at C73 and C13. The capacitor at C73 is a surface mount capacitor whereas the capacitor at C13 is a through-hole capacitor, which is not populated on the board.

To change the value of C_F, replace the capacitor at C73 with a capacitor of the desired value. Alternatively, remove capacitor at C73 and install a capacitor of the desired value at C13. For details on selecting the correct value of C_F for your application, refer to the MC68HC908MR8/MR4 chip specification, which is on the CD-ROM that accompanies the M68EM08MR8 kit.

2.4 System Connection

When all the jumper headers are configured, you are ready to complete the system connections.

Connect the MR8EM as follows:

- To install the MR8EM in an MMDS station module,
  - Remove the access panel of the station-module enclosure by turning the two Philip's head screws by one third of a revolution counter clockwise.
  - Insert the MR8EM through the access-panel opening.
  - Fit together MR8EM connectors P1 and P2 (at the bottom of the board) and connectors P11 and P12 of the MMDS control board.
  - Snap the corners of the MR8EM onto the plastic standoffs.
- To use the MR8EM on an MMEVS platform board, fit together MR8EM connectors P1 and P2 (at the bottom of the board) and connectors P11 and P12 of the MMEVS platform board. Snap the corners of the MR8EM onto the plastic standoffs. For instructions refer to the MMDS or MMEVS operations manuals.
- Use the RS-232 cable supplied with the MMDS/MMEVS kit to connect the MMDS or MMEVS platform board to the serial port of the host computer.
- The factory ships the MCUez™ software personality files and register files and P&E Microcomputer System, Inc.'s software personality files on a floppy diskette. Find the computer directory that contains your debugging software, then copy these files to this directory.

The personality files for the MCU being emulated should be included as displayed in Table 2-2.

Table 2-2 Personality Files

MCU	P&E File	MCUez File
MR8	0042FV01.MEM	00C2FV01.MEM
MR4	0042EV01.MEM	00C2EV01.MEM

The MCUez software register file to be included for MR8 MCU emulation is *MCUIOC2F.REG*. The register file for MR4 MCU emulation is *MCUIOC2E.REG*.

After copying the files, make any remaining system cable connections and restore power.

Section 3. Connector Information

3.1 Introduction

This section consists of pin assignments and signal descriptions for MR8EM logic analyzer and target connectors.

3.2 Logic Analyzer Connectors J2 and J5

The MR8EM has two, 20-pin logic analyzer connectors: J2 and J5. Figure 3-1 shows the pin assignments for these connectors. Table 3-1 and Table 3-2 give the signal descriptions for the logic analyzer connectors J2 and J5, respectively.

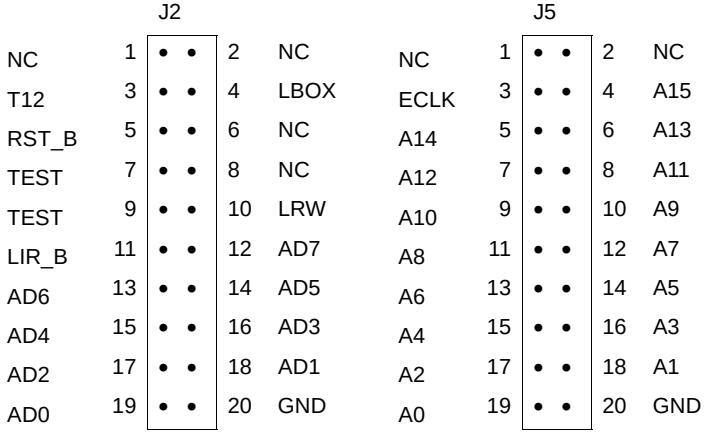


Figure 3-1 Logic Analyzer Connector J2 and J5 Pin Assignments

Table 3-1 Logic Analyzer Connector J2 Signal Descriptions

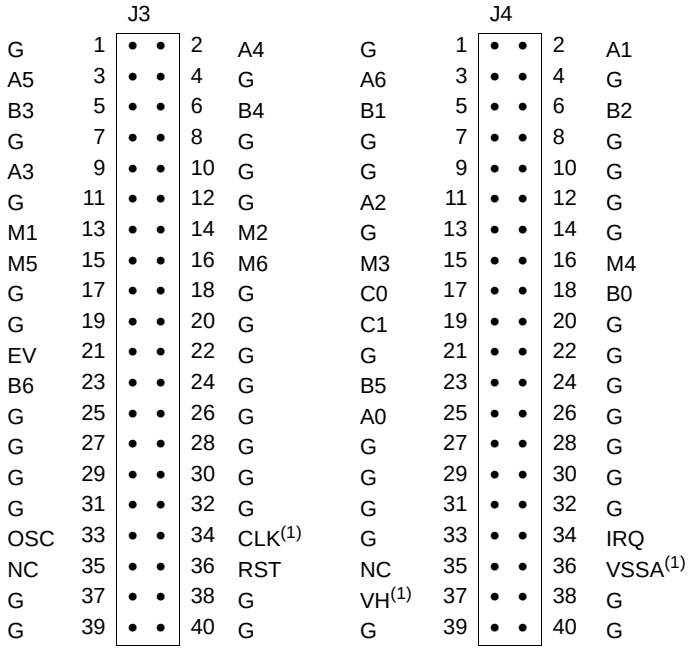
Pin	Mnemonic	Signal
1, 2, 6, 8	NC	No connection
3	T12	SYSTEM CLOCK — Clock signal selected by jumper header W4. This signal is four times faster than the clock signal selected by jumper header W2.
4	LBOX	Last bus cycle — Input signal that the emulator asserts to indicate that the target system MCU is in the last bus cycle of an instruction
5	RST_B	RESET – Active-low signal asserted during resets.
7, 9	TEST	Test pins (not for customer's use)
10	LRW	Latched read/write signal of the MCU — This signal is high if the MCU is reading and low when the MCU is writing.
11	LIR_B	Load instruction register — Active-low output signal, indicating that an opcode fetch is in progress
12—19	D7—D0	DATA BUS (bits 7 to 0) — MCU bidirectional data bus
20	GND	EM GROUND — Ground signal of the EM board

Table 3-2 Logic Analyzer Connector J5 Signal Descriptions

Pin	Mnemonic	Signal
1, 2	NC	No connection
3	ECLK	EMULATION CLOCK – Clock signal selected by jumper header W4. THis clock signal is twice as fast as the clock signal selected by jumper header W2.
4 —19	A15 — A0	ADDRESS BUS (bits 15 to 0) — MCU output address bus
20	GND	EM GROUND — Ground signal of the EM board

3.3 Target Connectors J3 and J4

The MR8EM has two, 2-row by 20-pin target connectors: J3 and J4. Figure 3-2 shows the pin assignments for these connectors. Table 3-3 and Table 3-4 give the signal descriptions for the target connectors J3 and J4, respectively.



1. This pin is incorrectly labelled as ground (G) on the silkscreen of the printed circuit board.

Figure 3-2 Target Connectors J3 and J4 Pin Assignments

Table 3-3 Target Connector J3 Signal Descriptions

Pin	Mnemonic	Signal
1, 4, 7, 8, 10—12, 17—20, 22, 24—32, 37—40	G	EM GROUND — Ground signal of the EM board
2, 3, 9	A4, A5, A3	PORT A (bits 4, 5, and 3) — General-purpose I/O and A/D channels controlled by software via data direction register, data register, and A/D registers
5, 6, 23	B3, B4, B6	PORT B (bits 3, 4, and 6) — General-purpose I/O channels controlled by software via data direction and data registers
13—16	M1, M2, M5, M6	PULSE WIDTH MODULATOR (bits 1, 2, 5, and 6) – Output signals from the MCU PWM module
21	EV	EXTERNAL VOLTAGE DETECT – VDD input signal from the target. The MMDS/MMEVS boards use this signal to detect the target-system voltage
33	OSC	OSCILLATOR — Inverted MCU source clock signal
34(1)	CLK	TARGET CLOCK — Clock signal from the target board
35	NC	No connection
36	RST_B	TARGET RESET – Active-low, low-voltage signal that initiates an MCU reset. This signal is bi-directional between the target system and the MMDS (or MMEVS)

1. This pin is incorrectly labelled as ground (G) on the silkscreen of the printed circuit board

Table 3-4 Target Connector J4 Signal Descriptions

Pin	Mnemonic	Signal
1, 4, 7—10, 12—14, 20—22, 24, 26—33, 38—40	G	EM GROUND — Ground signal of the EM board
2, 3,11, 25	A1, A6, A2, A0	PORT A (bits 1, 6, 2, and 0) — General-purpose I/O and A/D channels controlled by software via data direction register, data register, and A/D registers
5, 6,18, 23	B1, B2, B0, B5	PORT B (bits 1, 2, 0, and 5) — General-purpose I/O channels controlled by software via data direction and data registers
15, 16	M3, M4	PULSE WIDTH MODULATOR (bits 3 and 4) — Output signals from the MCU PWM module
17, 19	C0, C1	PORT C (bits 0 and 1) — General-purpose I/O and PWM fault pins lines controlled by software via data direction register, data register, and PWM registers
34	IRQ	INTERRUPT REQUEST — Active-low input line for requesting MCU asynchronous non-maskable interrupt
35	NC	No connection
36(1)	VSSA	Analog ground pin for ADC converter
37(1)	VH	ADC high voltage reference

1. This pin is incorrectly labelled as ground (G) on the silkscreen of the printed circuit board

3.4 Target Cable Assembly

Use the supplied type C target flex cable assembly (M68CBL05C), the appropriate target head, and the target head/adapter package (TC08MRFA32 or TC08MR8P28) to connect your MR8EM to a target system. For information on installing an adapter on the target board, refer to the engineering bulletin (EB416) on the CD-ROM that accompanies the M68EM08MR8 kit.

Plug the appropriate end of the flex cable plugs into MR8EM connectors J3 and J4 as shown in Figure 3-3.

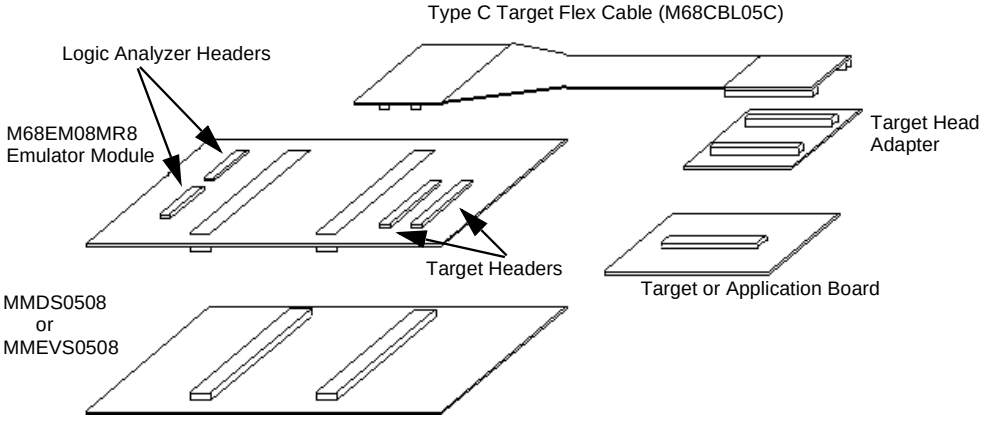


Figure 3-3 Target Cable Assembly

If the MR8EM is in an MMDS station module enclosure, run the flex cable through the slit in the station-module enclosure, then replace the access panel.

Plug the other end of the flex cable into the target head adapter. Then plug the target head into the MCU socket or surface-mount adapter of your target system.

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