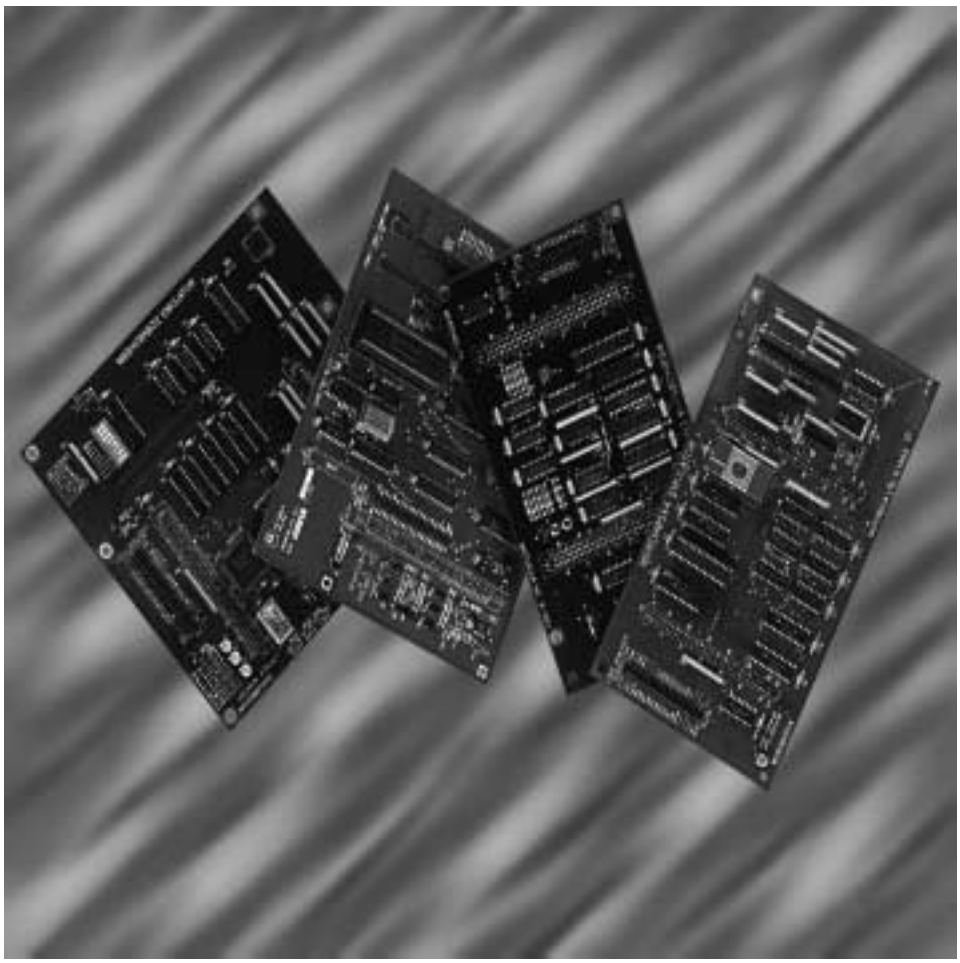
EM08MR32UM/D

M68EM08MR32

EMULATION MODULE
USER'S MANUAL



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Section 1. General Description

1.1 Contents

1.2 Introduction

This user's manual explains connection, configuration, and operation information specific to the M68EML08MR32 emulator module (MR32EM). The MR32EM allows emulations and debugging of target systems based on these microcontroller units (MCUs):

- MC68HC908MR16
- MC68HC908MR32

This section describes Motorola's two development systems that use the MR32EM, and it explains the MR32EM's layout.

1.3 Development Systems

The MR32EM can be part of two Motorola development systems:

- M68MMDS0508 modular development system (MMDS)
- M68MMEVS0508 evaluation system (MMEVS)

1.3.1 Motorola Modular Development System (MMDS)

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 debugger.

A complete MMDS consists of:

- Station module — The metal MMDS enclosure containing the control board and the internal power supply
- Emulator module (EM) — A separately purchased 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 — Software on 3-1/2 inch diskettes
- 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 selected by the user at 2400, 4800, 9600, 19,200, 38,400, or 57,600.

As mentioned, the MR32EM gives the MMDS the ability to emulate target systems based on MC68HC908MR16 and MC68HC908MR32 MCUs. By substituting a different EM, MMDS can be enabled to emulate target systems based on a different MCU. (A local Motorola representative can explain all the EMs available.)

1.3.2 Motorola Modular Evaluation System (MMEVS)

An 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; has connectors for power and for a terminal or host computer
- Emulator module (EM) — A separately purchased printed circuit board that enables system functionality for a specific set of MCUs; fits onto the PFB
- RS-232 serial cable — A separately purchased cable that connects the PFB to the host computer RS-232 port
- System software — Software on 3-1/2 inch diskettes
- 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 MMDS0508 software package; and this emulator user's manual

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

With a MR32EM, the MMEVS emulates target systems based on MC68HC908MR16 and MC68HC908MR32 MCUs. By substituting a different EM, the MMEVS can be enabled to emulate target systems based on a different MCU. (A local Motorola representative can explain all the EMs available.)

Section 2. Configuration and Operation explains how to configure and use the MR32EM as part of an MMDS or MMEVS system.

1.4 EM Layout

Figure 1-1 shows the layout of the MR32EM.

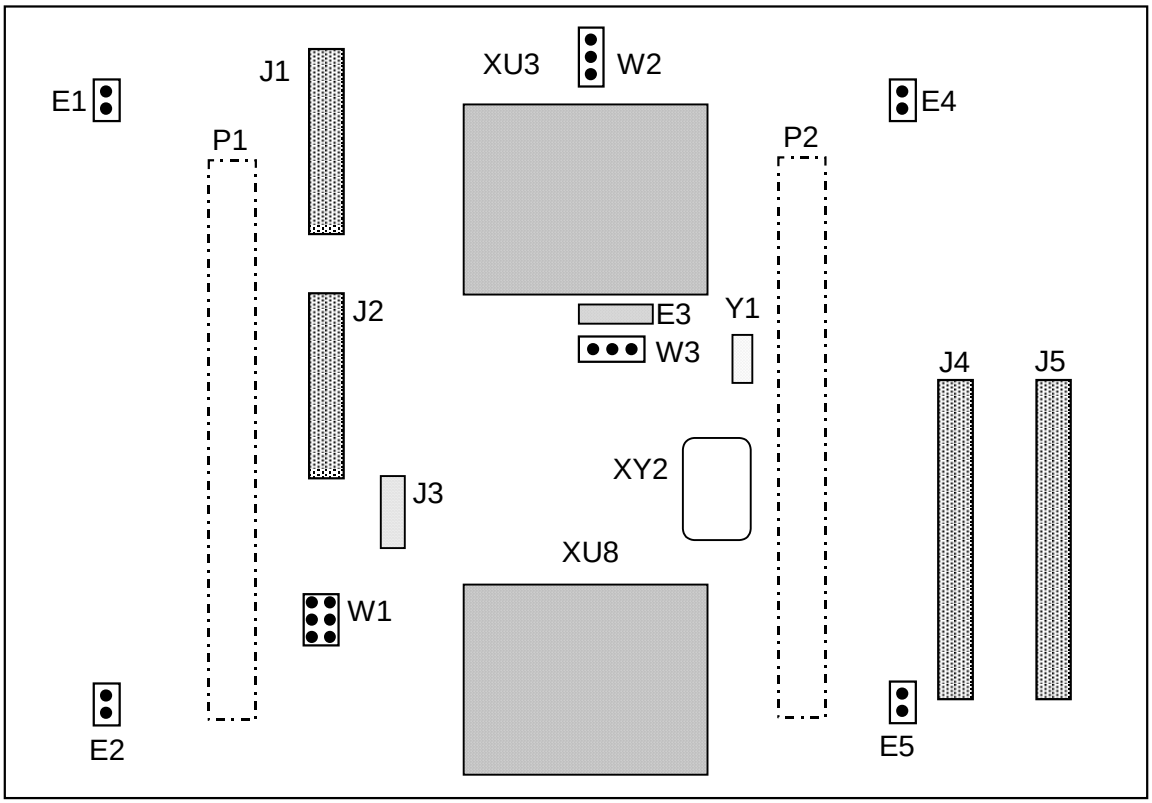


Figure 1-1. M68EML08MR32 Emulator Module

The main elements of the MR32EM are:

- DIN connectors P1 and P2 — Connect the EM to the MMDS control board or the MMEVS platform board
- Connectors J1 and J2 — Permits connection to a logic analyzer
- Connectors J4 and J5 — Customer specific interfaces to the target system
- Jumper header W1 — Selects the source of the oscillator frequency
- Jumper header W2 — Selects the analog-to-digital (A/D) mode

- Jumper header W3 — Defines the type of MCU to be emulated
- Location XU8 — Resident MCU installed in this socket
- Location XU3 — Port replacement unit (PRU) installed in this socket
- Location XY2 — EM's canned oscillator
- Location Y1 — Socket for a user-supplied crystal (an alternative clock-signal source)

The MR32EM requires a user-supplied 80-lead target cable and target head adapter to connect the target system to connectors P6 and P7.

1.5 Specifications

Table 1-1 lists MR32EM specifications.

Table 1-1. M68EML08MR32 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 volts dc, provided from the MMDS control board or MMEVS platform board
Dimensions	5.5 x 8.2 inches (140 x 208 mm)
Weight	6.3 ounces (178.6 g)

General Description

Section 2. Configuration and Operation

2.1 Contents

2.2 Introduction

This section explains configuration and operation of the M68EM08MR32 (MR32EM) when it is installed 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.

NOTE: *An MR32EM already installed in an MMDS station module can be reconfigured. To do so, switch off station-module power, then follow the guidance in this section. Similarly, an MR32EM that is already installed on the MMEVS platform board can be reconfigured, provided that platform-board power is disconnected.*

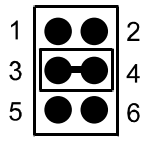
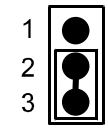
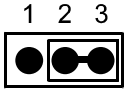
CAUTION: *Be sure to switch off or disconnect power when reconfiguring an installed EM. Reconfiguring EM jumper headers with the power on can damage system circuits.*

ESD CAUTION: *Ordinary amounts of static electricity from clothing or the work environment can damage or degrade electronic devices and equipment. For example, the electronic components installed on printed circuit boards are extremely sensitive to electrostatic discharge (ESD). Wear a ground wrist strap whenever handling any printed circuit board. This strap provides a conductive path for safely discharging static electricity to ground.*

2.3 Setting Jumper Headers

The MR32EM has three jumper headers. **Table 2-1** contains a summary of settings for these headers. **2.3.1 Clock Source Selection Header (W1)**, **2.3.2 ADC Mode Selection Header (W2)**, and **2.3.3 MCU Device Selection Header (W3)** give additional information about each jumper header.

Table 2-1. Jumper Headers

Jumper Header	Type	Description
W1		Jumper header installed on pins 1 and 2 – selects the control board or platform board as the source of the clock signal. Jumper header installed on pins 3 and 4 (factory setting) – selects the XY2 canned oscillator as the source of the clock signal. Jumper header installed on pins 5 and 6 – Selects a user-supplied crystal (at location Y1) as the source of the clock signal.
W2		Jumper header installed on pins 1 and 2 – selects 8-bit mode as the default out of reset. Jumper header installed on pins 2 and 3 (factory setting) – selects 10-bit, right-justified mode as the default out of reset.
W3		Jumper header installed on pins 1 and 2 – selects the EM08MR16 as the resident MCU. Jumper header installed on pins 2 and 3 (factory setting) – selects the EM08MR32 as the resident MCU.

2.3.1 Clock Source Selection Header (W1)

Jumper header W1 in **Figure 2-1** determines the clock signal source. The factory configuration (the fabricated jumper between pins 3 and 4) selects the canned oscillator at board location XY2. (The factory installs a 4.9152-megahertz oscillator at location XY2, but any other appropriate oscillator may be substituted.)

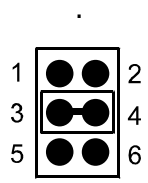


Figure 2-1. Jumper Header W1

Alternately, two other clock signal sources can be selected, as shown in **Figure 2-1**. To use the MMDS as your clock source:

1. Install the jumper between pins 1 and 2 on jumper header W1
2. Use the appropriate system software command to select a frequency.

You may also use a user-supplied crystal as your clock-signal source. To use your own crystal:

1. Install the jumper between pins 5 and 6 on jumper header W1
2. Install a C-2 size crystal at board location Y1
3. Install these additional components:
   - A 9.1 MΩ resistor at location R9
   - A 200 kΩ resistor at location R12
   - A 27 pf capacitor at location C28
   - A 22 pf capacitor at location C32

NOTE: *Only one jumper should be inserted on jumper header W1 at a time. Inserting multiple jumpers in W1 might damage the MR32EM.*

2.3.2 ADC Mode Selection Header (W2)

Jumper header W2 selects the A/D converter mode out of reset. The diagram below shows the factory configuration: the jumper between pins 2 and 3 selects 10-bit, right-justified mode

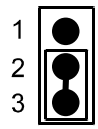


Figure 2-2. Jumper Header W2

Alternatively, eight-bit mode may be selected. To select the eight-bit mode install the jumper between pins 1 and 2.

2.3.3 MCU Device Selection Header (W3)

Use jumper header W3 to configure the MR32EM to emulate either the MC68HC908MR16 or MC68HC908MR32 MCU. The diagram below shows the MR32EM set to emulate the MR32 (factory default); the jumper between pins 2 and 3.

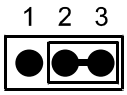


Figure 2-3. Jumper Header P8

Alternatively, the MR16 mode may be selected. To emulate the MR16, install an MC68HC908MR16 MCU in the socket at location XU8 and install the jumper between pins 1 and 2.ve the jumper from P8 and connect an external power supply to P8 pin 1

2.4 Remaining System Installation

When all jumper headers are configured, follow these steps to complete the MR32EM installation:

- To install the MR32EM in an MMDS station module, remove the entire top half of the station-module enclosure. Fit together EM connectors P1 and P2 (on the bottom of the board) and control-board connectors P1 and P2. Snap the corners of the EM onto the plastic standoffs.
- To install the MR32EM on an MMEVS platform board, fit together EM connectors P1 and P2 (on the bottom of the board) and platform-board connectors P3 and P4. Snap the corners of the EM onto the plastic standoffs.
- You may use either the P&E or MCUez software with your MMDS or MMEVS: Copy the personality file from the provided P&E or MCUez CD-ROM to the directory that contains the debugging software. The personality files for the MR32EM are:
  - When using the P&E software, copy personality files 0042CV0x.MEM and 0042DV0x.MEM from the P&E CD-ROM to the directory that contains file MMDS08.EXE.
  - When using MCUez development software, copy personality files 0042CV0x.MEM and 0042DV0x.MEM from the MCUez CD-ROM to the …\prog\mem subdirectory of the MCUez main directory.

NOTE: *Additionally, a register file (MCU042C.REG and MCU042D.REG) may be necessary when using MCUez development software. MCUez software uses these files to implement optional functionality: letting you view or modify register contents by name, rather than by address. A register file is an ASCII text file, which can be customized. (The MCUez user's manual explains how to create and use such files.)*

At this point, make any system cable connections and restore power. For instructions, consult the MMDS or MMEVS operations manuals.

Configuration and Operation

Section 3. Connector Information

3.1 Contents

3.2 Introduction

This section consists of pin assignments and signal descriptions for M68EM08MR32 target and logic analyzer connectors.

3.3 Logic Analyzer Connector (J1 and J2)

Connectors J1 and J2 are the MR32EM logic analyzer connectors.

Figure 3-1 shows the pin assignments for connector P1. **Table 3-1** and **Table 3-2** gives the logic analyzer connectors signal descriptions.

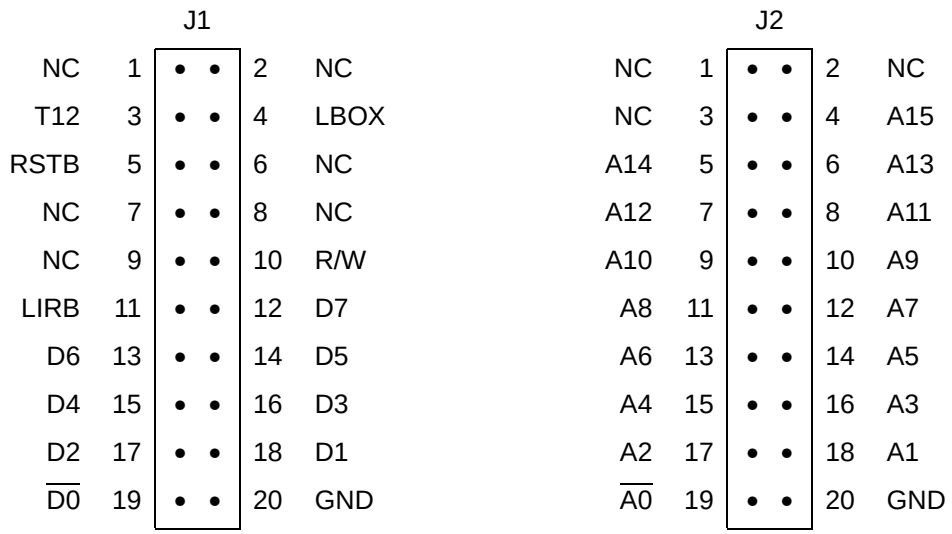


Figure 3-1. Logic Analyzer Connectors J1 and J2 Pin Assignments

Table 3-1. Logic Analyzer Connector J1 Signal Descriptions

Pin	Mnemonic	Signal
1, 2	NC	No connection
3	T12	SYSTEM CLOCK – Clock signal (selected by jumper header W4).
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	$\overline{\text{RSTB}}$	RESET – Active-low signal asserted during resets.
6 – 9	NC	No connection
10	R/W	Read/Write — Output signal that indicates the direction of data transfer
11	$\overline{\text{LIR}}$	Load instruction register — Active-low output signal, indicating that an opcode fetch is in progress
12 – 19	AD4	Data bus (bits 7 – 0)— MCU bidirectional data bus
20	GND	GROUND

Table 3-2. Logic Analyzer Connector J2 Signal Descriptions

Pin	Mnemonic	Signal
1, 3	NC	No connection
4 – 19	A15 – A0	ADDRESS (bits 15–0) – MCU output address bus.
20	GND	GROUND

3.4 Target Connectors (J4 and J5)

MR32EM has two target connectors: J4 and J5, each a 2-row by-20-pin connector.

Figure 3-2, **Table 3-3**, and **Table 3-4** give the pin assignments and signal descriptions for these connectors.

J4

GND	1	2	PB4	
PB7	3	4	GND	
NC	5	6	NC	
PB0	7	8	PB1	
PA5	9	10	PA6	
PA1	11	12	PA2	
NC	13	14	NC	
NC	15	16	NC	
PTF5	17	18	PTF4	
GND	19	20	PTF1	
EVDD	21	22	PTE7	
PTE4	23	24	GND	
PTE1	25	26	PTE0	
PWM5	27	28	NC	
PWM2	29	30	PWM1	
PTD4	31	32	PTD5	
NC	33	34	NC	
PC6	35	36	PTD0	
PC4	37	38	GND	
PC2	39	40	GND	

J5

PB2	1	2	PB3	
PB5	3	4	PB6	
PC0	5	6	PC1	
NC	7	8	NC	
GND	9	10	PA7	
PA3	11	12	PA4	
PA0	13	14	GND	
CLKB	15	16	NC	
RSTB	17	18	IRQ1B	
PTF3	19	20	PTF2	
PTF0	21	22	GND	
PTE6	23	24	PTE5	
PTE3	25	26	PTE2	
GND	27	28	PWM6	
PWM4	29	30	PWM3	
PTD6	31	32	GND	
PTD2	33	34	PTD3	
PTD1	35	36	NC	
PC5	37	38	GND	
PC3	39	40	GND	

Figure 3-2. Target Connectors J4 and J5 Pin Assignments

Table 3-3. Target Connectors J4 Signal Descriptions

Pin	Mnemonic	Signal
1	GND	GROUND — Ground signal of the EM board
2, 3	PB4, PB7	PORT B (bits 4 and 7) — General-purpose I/O lines controlled by software via data direction and data registers
4	GND	GROUND — Ground signal of the EM board
5, 6	NC	No connect
7, 8	PB0, PB1	PORT B (bits 0 and 1) — General-purpose I/O lines controlled by software via data direction and data registers
9 – 12	PA5, PA6, PA1, PA2	PORT A (bits 5, 6, 1, and 2) — General-purpose I/O lines controlled by software via data direction and data registers
13 – 16	NC	No connect
17, 18	PTF5, PTF4	PORT F (bits 5 and 4) — General-purpose I/O lines controlled by software via data direction and data registers
19	GND	GROUND — Ground signal of the EM board
20	PTF1	PORT F (bit 1) — General-purpose I/O lines controlled by software via data direction and data registers
21	EVDD	EXTERNAL VOLTAGE DETECT – VDD input signal from the target. The EM uses this signal to detect the target-system voltage.
22, 23	PTE7, PTE4	PORT E (bits 7 and 4) — General-purpose I/O lines controlled by software via data direction and data registers
24	GND	GROUND — Ground signal of the EM board
25, 26	PTE1, PTE0	PORT E (bits 1 and 0) — General-purpose I/O lines controlled by software via data direction and data registers
27	PWM5	PULSE WIDTH MODULATOR (bit 5) – Output signals from the MCU PWM module.
28	NC	No connect
29, 30	PWM2, PWM1	PULSE WIDTH MODULATOR (bits 2 and 1) – Output signals from the MCU PWM module.

Table 3-3. Target Connectors J4 Signal Descriptions (Continued)

Pin	Mnemonic	Signal
31, 32	PTD4, PTD5	PORT D (bits 4 and 5) — General-purpose I/O lines controlled by software via data direction and data registers
33, 34	NC	No connect
35	PC6	PORT C (bit 6) — General-purpose I/O lines controlled by software via data direction and data registers
36	PTD0	PORT D (bit 0) — General-purpose I/O lines controlled by software via data direction and data registers
37	PC4	PORT C (bit 4) — General-purpose I/O lines controlled by software via data direction and data registers
38	GND	GROUND — Ground signal of the EM board
39	PC2	PORT C (bit 2) — General-purpose I/O lines controlled by software via data direction and data registers
40	GND	GROUND — Ground signal of the EM board

Table 3-4. Target Connectors J5 Signal Descriptions

Pin	Mnemonic	Signal
1 – 4	PB2, PB3, PB5, PB6	PORT B (bits 2, 3, 5, and 6) — General-purpose I/O lines controlled by software via data direction and data registers
5, 6	PC0, PC1	PORT C (bits 0 and 1) — General-purpose I/O lines controlled by software via data direction and data registers
7, 8	NC	No connect
9	GND	GROUND — Ground signal of the EM board
10 – 13	PA7, PA3, PA4, PA0	PORT A (bits 7, 3, 4, and 0) — General-purpose I/O lines controlled by software via data direction and data registers
14	GND	GROUND — Ground signal of the EM board
15	CLKB	INVERTED BUS CLOCK
16	NC	No connect
17	RSTB	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).
18	IRQ1B	
19 – 21	PTF3, PTF2, PTF0	PORT F (bits 3, 2, and 0) — General-purpose I/O lines controlled by software via data direction and data registers
22	GND	GROUND — Ground signal of the EM board
23 – 26	PTE6, PTE5, PTE3, PTE2	PORT E (bits 6, 5, 3, and 2) — General-purpose I/O lines controlled by software via data direction and data registers
27	GND	GROUND — Ground signal of the EM board
28 – 30	PWM6, PWM4, PWM3	PULSE WIDTH MODULATOR (bits 6,4, and 3) – Output signals from the MCU PWM module.
31	PTD6	PORT D (bit 6) — General-purpose I/O lines controlled by software via data direction and data registers
32	GND	GROUND — Ground signal of the EM board

Table 3-4. Target Connectors J5 Signal Descriptions (Continued)

Pin	Mnemonic	Signal
33 – 35	PTD2, PTD3, PTD1	PORT D (bits 2, 3, and 1) — General-purpose I/O lines controlled by software via data direction and data registers
36	NC	No connect
37	PC5	PORT C (bit 5) — General-purpose I/O lines controlled by software via data direction and data registers
38	GND	GROUND — Ground signal of the EM board
39	PC3	PORT C (bit 3) — General-purpose I/O lines controlled by software via data direction and data registers
40	GND	GROUND — Ground signal of the EM board

3.5 Target Cable Assembly

To connect the MR32EM to a target system, a separately purchased target cable assembly is needed, plus the appropriate target head and target-head/adapter package.

Figure 3-3 shows how one end of the flex cable plugs into the MR32EM module, and it also shows how the target head connects into the target system.

If the MR32EM is installed in the MMDS station module, run the flex cable through the slit in the station-module enclosure.

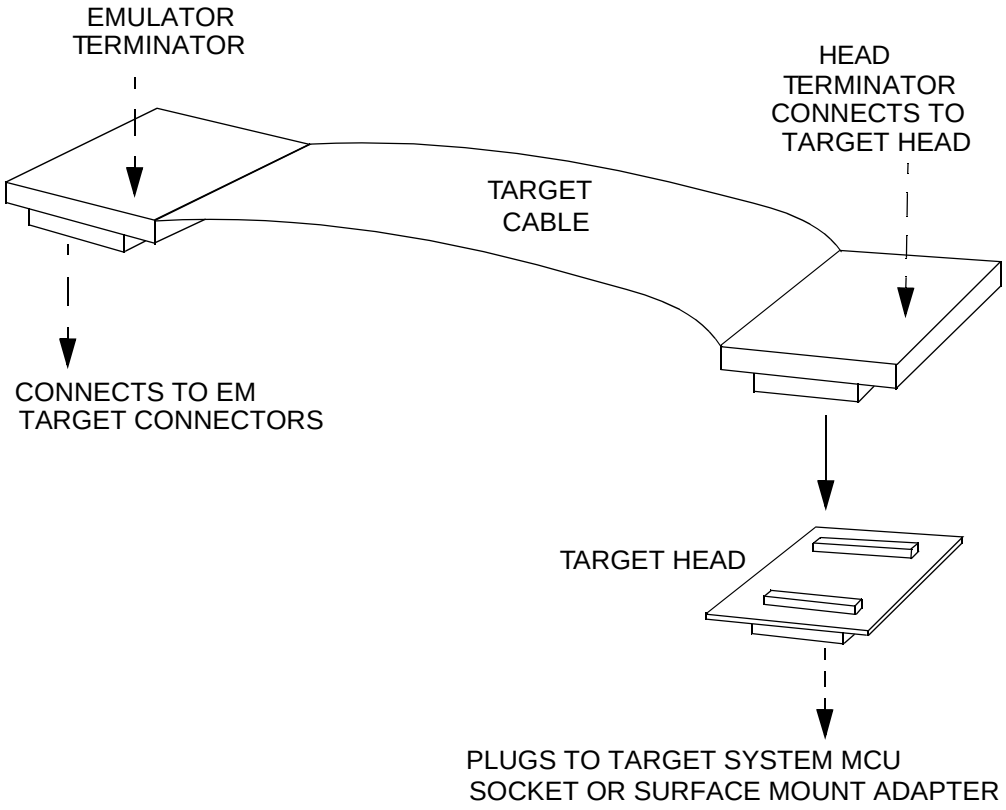


Figure 3-3. Target Cable Assembly

Connector Information

Section 4. Schematics

This chapter contains the M68EM08MR32 emulator module schematic diagrams.

These schematic diagrams are for reference only and may deviate slightly from the circuits on the MR32EM.

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