M68EM08 A-FAMILY

EMULATOR MODULE

USER'S MANUAL

CONTENTS

CHAPTER 1 INTRODUCTION

CHAPTER 2 CONFIGURATION AND OPERATION

CHAPTER 3 SCHEMATICS

FIGURES

TABLES

CHAPTER 1

INTRODUCTION

This manual explains connection, configuration, and operation information for M68EM08-series emulator modules (EMs) specific to A-family microcontroller units (MCUs). As Table 1-1 shows, the resident MCU determines which MCUs your EM emulates.

Table 1-1. A-Family Emulation

Resident MCU	MCUs Emulated (Package)
MC68HC908**AS60**FU64	MC68HC08**AS20** (52-pin PLCC)[1]
	MC68HC08**AS32** (52-pin PLCC)
	MC68HC08**AS32** (64-pin QFP)[2]
	MC68HC908**AS32** (52-pin PLCC)
	MC68HC908**AS60** (52-pin PLCC)
	MC68HC908**AS60** (64-pin QFP)
MC68HC908**QA24**FN52	MC68HC908**QA24** (52-pin PLCC)
MC68HC908**AZ60**FU64[3]	MC68HC08**AZ32** (64-pin QFP)
	MC68HC908**AZ32** (64-pin QFP)
	MC68HC908**AZ60** (52-pin PLCC)
	MC68HC908**AZ60** (64-pin QFP)
(1) Plastic Leaded Chip Carrier (2) Quad Flat Pack (3) For this resident MCU, disreagard any printed AT60 indication.	

NOTE

Even if you will emulate MCUs other than the QA24, your EM bears the part number M68EM08QA24.

For emulation of a particular MCU:

- The appropriate resident MCU must be installed in socket U2 or socket U3,

- Jumper header W6 must be configured correctly,

- Jumper header W7 must be configured correctly, and

- The appropriate personality file must be downloaded to the directory that contains your debugging software.

(Table 2-5, in Chapter 2 lists each such requirement or setting for each MCU to be emulated.

1.1 DEVELOPMENT SYSTEMS AND SOFTWARE

Your EM can be part of two Motorola development systems, which paragraphs 1.1.1 and 1.1.2 explain.

Your A-family EM is compatible with the development software that comes with a Motorola development system, or with separately acquired MCUez™ development software. (Software from other firms also may be compatible with your EM.)

1.1.1   Motorola Modular Development System (**MMDS0508**)

The MMDS0508 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 MMDS0508 consists of:

- **a station module** — the metal MMDS0508 enclosure, containing the control board and the internal power supply. Most system cables connect to the MMDS0508 station module. (The cable to an optional target system, however, runs through an aperture in the station module enclosure to connect directly to the emulator module.)

- **an emulator module (EM)** — such as your A-family EM: a separately purchased printed circuit board that enables system functionality for a specific set of MCUs. The EM fits into the station module through a sliding panel in the enclosure top. The EM has a connector for the target cable.

- **two logic clip cable assemblies** — twisted-pair cables that connect the station module to your 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.

- **a 9-lead RS-232 serial cable** — the cable that connects the station module to the host computer RS-232 port.

- **a 9- to 25-pin adapter** — a molded assembly that lets you connect the 9-pin cable to a 25-pin serial port.

- **system software** — development software, on 3-1/2 inch diskettes. (Instead of this default software, you may use separately purchased MCUez software from Motorola, or compatible development software from still another firm.)

- **MMDS0508 documentation** — an MMDS0508 operations manual (MMDS0508OM/D) and the appropriate EM user's manual.

An MMDS0508 supports these communication baud rates: 2400, 4800, 9600, 19200, 38400, or 57600.

By substituting a different EM, you can enable your MMDS0508 to emulate target systems based on still other MCUs. (Your Motorola representative can explain all the EMs available.)

1.1.2 M68MMEVS Evaluation System (MMEVS)

An MMEVS is an economical, two-board tool for designing, debugging, and evaluating target systems based on an MC68HC0508 MCU. A complete MMEVS consists of:

- **a platform board (PFB)** — the bottom board, which supports the emulator module. The platform board has connectors for power and for the terminal or host computer.

- **an emulator module (EM)** — such as your A-family EM: a separately purchased printed circuit board that enables system functionality for a specific set of MCUs. The EM fits onto the PFB. The EM has connectors for a target cable and for a cable to a logic analyzer.

- **an RS-232 serial cable** — a separately purchased cable that connects the PFB to the host computer RS-232 port.

- **system software** — development software, on 3-1/2 inch diskettes. (Instead of this default software, you may use separately purchased MCUez software from Motorola, or compatible development software from still another firm.)

- **MMEVS documentation** — an MMEVS operations manual (MMEVSOM/D) and the appropriate EM user's manual.

An MMEVS supports these communication baud rates: 2400, 4800, 9600, 19200, 38400, or 57600.

By substituting a different EM, you can enable your MMEVS to emulate target systems based on still other MCUs. (Your Motorola representative can explain all the EMs available.)

1.2 EM LAYOUT

Figure 1-1 shows the layout of an A-family EM. Jumper header W1 selects the MCU clock source. Jumper header W2 selects the voltage-reference-high (VREFH) source for the A/D converter.

Test point W3 lets you measure analog voltages to the port B I/O-pin A/D conversion function, or to insert a voltage directly. Test point W4 lets you measure analog voltages to the port D I/O-pin A/D conversion function, or to insert a voltage directly.

Jumper header W5 configures (or selectively disconnects) the port B I/O pins. Jumper header W6 configures (or selectively disconnects) the port D I/O pins; additionally, this header must be configured correctly for MCU emulation.

Jumper header W7 configures the EM for the MCU to be emulated.
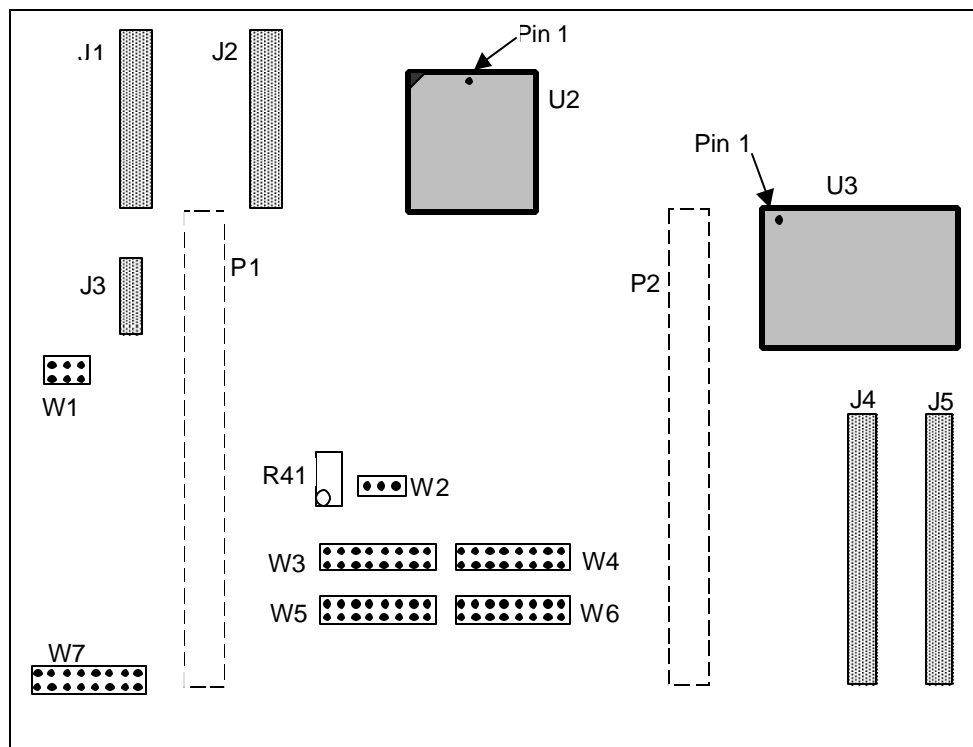
Figure 1-1. A-Family Emulator Module

Connectors J1 and J2 give access to MCU address, data, and other such signals. (These connectors are compatible with HP 01650-63203 logic analyzer terminators or equivalents. These connectors also support single-pin socket-style logic analyzer connection.)

Connectors J4 and J5 are the target cable connectors. (Connector J3 is for factory use only.)

The EM has two sockets for the resident MCU:

- Use the U2 (PLCC) socket for an MC68HC908QA24FN52 resident MCU.

- Use the U3 (QFP) socket for either an MC68HC908AS60FU64 resident MCU or an MC68HC908AZ60FU64 resident MCU.

DIN connectors P1 and P2, on the bottom of the board, connect the EM to the control board (for an MMDS0508) or to the PFB (for an MMEVS).

Table 1-2 lists EM specifications.

Table 1-2. A-Family EM Specifications

Characteristic	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 8.13 inches (140 x 210 mm)
Weight	6.6 ounces (187 g)

1.3 TARGET CABLE ASSEMBLIES

To connect your A-family EM to a target system, you need a separately purchased target cable assembly, plus the appropriate target head and target-head/adapter package. Figure 1-2 shows how one end of the flex cable plugs onto either target head. This figure also shows how the target head plugs into a TQ socket, which in turn plugs into a TQ pack. The TQ pack is a disposable adapter that plugs into the target-system MCU socket.
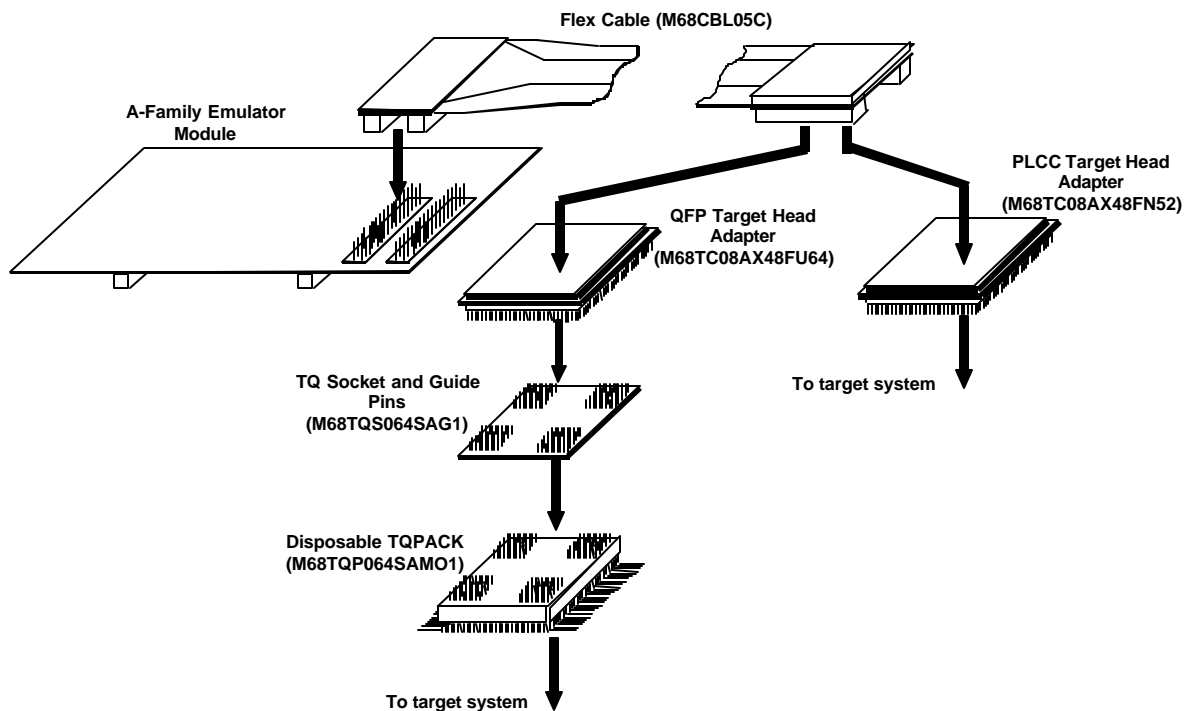

Figure 1-2. Target Cable Assembly

If you install the EM in the MMDS0508 station module, run the flex cable through the slit in the station-module enclosure.

1.4 CONNECTOR PIN ASSIGNMENTS

Your EM has target cable connectors J4 and J5, and logic analyzer connectors J1 and
J2. Figures 1-3 and 1-4 show the pin assignments for these connectors. Tables 1-3
through 1-6 give signal descriptions for these connectors.

		J4						J5			
GND	1	• •	2	RST		TPC4	1	• •	2	IRQ
TPF2	3	• •	4	GND		TPF0	3	• •	4	TPF1
RX	5	• •	6	TX		TPF3	5	• •	6	TPF4
TPC3	7	• •	8	TPC5		TPF5	7	• •	8	TPF6
TPC0	9	• •	10	TPC1		GND	9	• •	10	TPC2
GND	11	• •	12	NC		OSC2	11	• •	12	OSC1
TVRH	13	• •	14	NC		NC	13	• •	14	GND
TPD5	15	• •	16	TPD4		TPD7	15	• •	16	TPD6
TPD3	17	• •	18	TPD2		TPH1	17	• •	18	TPH0
GND	19	• •	20	TPD1		GND	19	• •	20	NC
TPB6	21	• •	22	TPB5		TPD0	21	• •	22	TPB7
TPB2	23	• •	24	GND		TPB4	23	• •	24	TPB3
TPA7	25	• •	26	TPA6		TPB1	25	• •	26	TPB0
TPA4	27	• •	28	TPA3		GND	27	• •	28	TPA5
TPA0	29	• •	30	TPG2		TPA2	29	• •	30	TPA1
EVDD	31	• •	32	TPG0		TPG1	31	• •	32	GND
NC	33	• •	34	NC		TPE7	33	• •	34	GND
TPE4	35	• •	36	TPE5		TPE6	35	• •	36	NC
TPE2	37	• •	38	GND		TPE3	37	• •	38	GND
TPE0	39	• •	40	GND		TPE1	39	• •	40	GND

Figure 1-3. Target Connector J4, J5 Pin Assignments

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Table 1-3. Target Connector J4 Signal Descriptions

Pin	Mnemonic	Signal
1, 4, 11, 19, 24, 38, 40	GND	GROUND
2	RST	RESET — Active-low input signal that starts a system reset.
3	TPF2	PORT F (bit 2) — General-purpose I/O line controlled by software via data direction and data registers. (Other port F lines are on connector J5.)
5	RX	RECEIVE DATA — For a QA24, AT32, or AZ60 MCU, the data-receive signal from the controller area network (CAN) For an AS20, AS32, or AS60 MCU, the data-receive signal from the byte data link controller (BDLC).
6	TX	TRANSMIT DATA — For a QA24, AT32, or AZ60 MCU, the data-transmit signal to the controller area network (CAN) For an AS20, AS32, or AS60 MCU, the data-transmit signal to the byte data link controller (BDLC).
7 — 10	TPC3, TPC5, TPC0, TPC1	PORT C (bits 3, 5, 0, 1) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port C lines are on connector J5.)
12, 14, 33, 34	NC	No connection.
15 — 18, 20	TPD5 — TPD1	PORT D (bits 5—1) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port D lines are on connector J5.)
21 — 23	TPB6, TPB5, TPB2	PORT B (bits 6, 5, 2) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port B lines are on connector J5.)
25 — 29	TPA7, TPA6, TPA4, TPA3, TPA0	PORT A (bits 7, 6, 4, 3, 0) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port A lines are on connector J5.)
30, 32	TPG2, TPG0	PORT G (bits 2, 0) — General-purpose I/O lines controlled by software via data direction and data registers. (Another port G line is on connector J5.)
31	EVDD	EXTERNAL VOLTAGE DETECT — VDD input signal from the target. The emulator uses this signal to detect the target-system voltage.
35 — 37, 39	TPE4, TPE5, TPE2, TPE0	PORT E (bits 4, 5, 2, 0) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port E lines are on connector J5.)

Table 1-4. Target Connector J5 Signal Descriptions

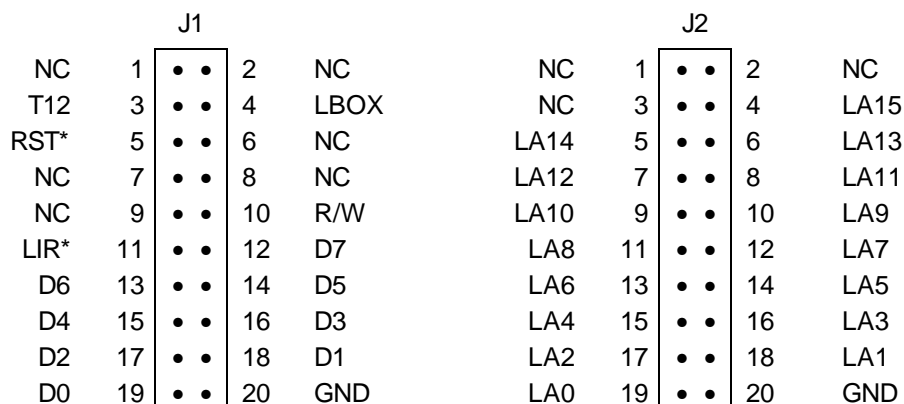| Pin	Mnemonic	Signal
1, 10	TPC4, TPC2	PORT C (bits 4, 2) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port C lines are on connector J4.)
2	IRQ	INTERRUPT REQUEST — Active-low input signal from the target that asynchronously applies an MCU interrupt.
3 — 8	TPF0, TPF1, TPF3 — TPF6	PORT F (bits 0, 1, 3—6) — General-purpose I/O lines controlled by software via data direction and data registers. (Another port F line is on connector J4.)
9, 14, 19, 27, 32, 34, 38, 40	GND	GROUND
11	OSC2	OSCILLATOR 2 — Output clock signal at 2 times the internal bus frequency.
12	OSC1	OSCILLATOR 1 — Output clock signal.
13, 20, 36	NC	No connection.
15, 16, 21	TPD7, TPD6, TPD0	PORT D (bits 7, 6, 0) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port D lines are on connector J4.)
17, 18	TPH1, TPH0	PORT H (bits 1, 0) — General-purpose I/O lines controlled by software via data direction and data registers.
22 — 26	TPB7, TPB4, TPB3, TPB1, TPB0	PORT B (bits 7, 4, 3, 1, 0) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port B lines are on connector J4.)
28 — 30	TPA5, TPA2, TPA1	PORT A (bits 5, 2, 1) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port A lines are on connector J4.)
31	TPG1	PORT G (bit 1) — General-purpose I/O line controlled by software via data direction and data registers. (Other port G lines are on connector J4.)
33, 35, 37, 39	TPE7, TPE6, TPE3, TPE1	PORT E (bits 7, 6, 3, 1) — General-purpose I/O lines controlled by software via data direction and data registers. (Other port E lines are on connector J4.)

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              J1                                              J2
NC    1  • •  2   NC              NC    1  • •  2   NC
T12   3  • •  4   LBOX            NC    3  • •  4   LA15
RST*  5  • •  6   NC              LA14  5  • •  6   LA13
NC    7  • •  8   NC              LA12  7  • •  8   LA11
NC    9  • •  10  R/W            LA10  9  • •  10  LA9
LIR*  11 • •  12  D7              LA8   11 • •  12  LA7
D6    13 • •  14  D5              LA6   13 • •  14  LA5
D4    15 • •  16  D3              LA4   15 • •  16  LA3
D2    17 • •  18  D1              LA2   17 • •  18  LA1
D0    19 • •  20  GND            LA0   19 • •  20  GND
```

Figure 1-4. Logic Analyzer Connector J1, J2 Pin Assignments

Table 1-5. Logic Analyzer Connector J1 Signal Descriptions

Pin	Mnemonic	Signal
1, 2, 6 — 9	NC	No connection
3	T12	SYSTEM CLOCK — Clock signal.
4	LBOX	LAST BUS CYCLE — Input signal that the EM asserts to indicate that the target-system MCU is in the last bus cycle of an instruction.
5	RST*	RESET — Active-low signal asserted during resets.
10	R/W	READ/WRITE — Signal indicating whether the MCU is reading or writing.
11	LIR*	LOAD INSTRUCTION REGISTER — Active-low signal indicating that an opcode fetch is in progress.
12 — 19	D7 — D0	DATA BUS (bits 7—0) — MCU multiplexed I/O data bus.
20	GND	GROUND

Table 1-6. Logic Analyzer Connector J2 Signal Descriptions

Pin	Mnemonic	Signal
1 — 3	NC	No connection
4 — 19	LA15 — LA0	LATCHED ADDRESSES (bits 15—0) — MCU latched output address bus.
20	GND	GROUND

1.5 CUSTOMER SUPPORT

For information about a Motorola distributor or sales office near you call:

AUSTRALIA, Melbourne – (61-3)887-0711
Sydney – 61(2)906-3855

BRAZIL, Sao Paulo – 55(11)815-4200

CANADA, B. C., Vancouver – (604)606-8502
ONTARIO, Toronto – (416)497-8181
ONTARIO, Ottawa – (613)226-3491
QUEBEC, Montreal – (514)333-3300

CHINA, Beijing – 86-10-68437222

DENMARK – (45)43488393

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Langenhagen/Hannover – 49(511)786880
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HONG KONG, Kwai Fong – 852-6106888
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ISRAEL, Herzlia – 972-9-590222

ITALY, Milan – 39(2)82201

JAPAN, Fukuoka – 81-92-725-7583
Gotanda – 81-3-5487-8311
Nagoya – 81-52-232-3500
Osaka – 81-6-305-1802
Sendai – 81-22-268-4333
Takamatsu – 81-878-37-9972
Tokyo – 81-3-3440-3311

KOREA, Pusan – 82(51)4635-035
Seoul – 82(2)554-5118

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UNITED STATES, Phoenix, AZ – 1-800-521-6274

For a list of the Motorola sales offices and distributors: **http://www.mcu.motsps.com**

CHAPTER 2

CONFIGURATION AND OPERATION

This chapter explains how to configure and use your A-family EM, whether part of an MMDS or an MMEVS. For other parts of system installation or configuration, see the MMDS or MMEVS hardware user's manual.

Paragraph 2.1 explains how to install the resident MCU. Paragraph 2.2 explains how to set EM jumper headers and test points. Paragraph 2.3 explains remaining system installation. Paragraph 2.4 gives special instructions for emulating an MC68HC908QA24 MCU. Paragraph 2.5 summarizes the requirements and settings for each MCU to be emulated.

Note that you can configure an EM already installed in an MMDS0508 station module enclosure. To do so, switch off station-module power, remove the panel, then follow the guidance of this chapter. Similarly, you can configure an EM already installed on the MMEVS platform board, provided that you disconnect platform-board power.

CAUTION

Be sure to switch off or disconnect power if you reconfigure an installed EM. Reconfiguring EM jumper headers with power left on can damage system circuits.

ESD PRECAUTIONS

This equipment use devices extremely sensitive to Electro-Static Discharge (ESD). A grounded wrist strap should be worn while handling and operating this equipment to prevent ESD damages.

2.1 INSTALLING THE RESIDENT MCU

Your EM's resident MCU comes in a separate package. Before you can use the EM, you must install the resident MCU in the appropriate socket, by following these steps:

Step 1. Make sure that power is *not* applied to the EM.

Step 2. Note the part number and package of the resident MCU:

- If the part number is MC68908QA24FN52, its package is PLCC: you must install it in the U2 socket. Proceed to Step 3.

- If the part number is MC68HC908AS60FU64 or MC68HC908AZ60FU64, its package is QFP: you must install it in the U3 socket. Proceed to step 6.

Step 3. Using a vacuum pen, place the PLCC resident MCU into the U2 socket, with the pins down. Match MCU pin 1 with pin 1 of the socket:

- MCU pin 1 is centered above the part number or centered on the edge to the right of the chamfered corner. A dot or dimple also may identify pin 1.

- EM silk-screen markings (and Figure 1-1) identify pin 1 of the socket.

Step 4. Check contacts for proper alignment; press the MCU down into the socket.

Step 5. This completes installation of the PLCC resident MCU. You are ready to configure EM jumper headers and test points, per other instructions of this chapter. You are ready to set jumper headers, per paragraph 2.2, and to do remaining system installation, per paragraph 2.3. (Disregard Steps 6 through 9, which pertain to the QFP socket.)

Step 6. Unlatch and open the top of the U3 (QFP) socket.

Step 7. Using a vacuum pen, place the QFP resident MCU into the U3 socket, with the pins down. Match MCU pin 1 with pin 1 of the socket:

- The corner dimple identifies MCU pin 1.

- EM silk-screen markings (and Figure 1-1) identify pin 1 of the socket.

Step 8. Check contacts for proper alignment. Close and latch the socket top.

Step 9. This completes installation of the QFP resident MCU. You are ready to configure EM jumper headers and test points, per other instructions of this chapter. You are ready to set jumper headers, per paragraph 2.2, and to do remaining system installation, per paragraph 2.3.

2.2 SETTING JUMPER HEADERS AND TEST POINTS

Your A-family EM has five jumper headers, two test points, and a variable resistor. Table 2-1 is a summary of settings for these components. Paragraphs 2.1.1 through 2.1.5 give additional information.

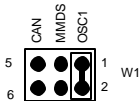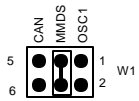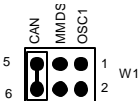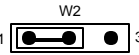**Table 2-1. Jumper Header, Test Point Positions**
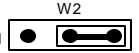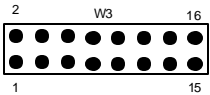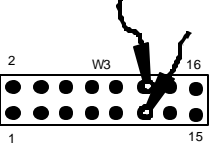
Header	Position	Effect
Clock Source Select, W1	CAN MMDS OSC1 — 5 6 1 2 W1	Selects the clock frequency from the target system, input to the EM through the target cable and the OSC1 pin of connector J5.
	CAN MMDS OSC1 — 5 6 1 2 W1	Selects the clock frequency from the MMDS control board or the MMEVS platform board. **Factory setting.**
	CAN MMDS OSC1 — 5 6 1 2 W1	Selects the oscillator socket at board location Y1. (Requires a user-supplied canned oscillator.)
ADC VREFH, W2, R41	W2 — 1 3	Selects the EM as the voltage-reference-high source for the A/D converter. (Resistor R41 permits voltage adjustment.) **Factory setting.**
	W2 — 1 3	Selects the target system as the voltage-reference-high source for the A/D converter. (Resistor R41 has no effect for this configuration.)
Port B Measurement, W3	2 W3 16 — 1 15	Selects normal operation of A/D conversion port B pins — no voltage measurement, no direct voltage insertion. **Factory setting.**
	2 W3 16 — 1 15	Voltmeter connection for voltage measurement of port B channel 5 pins. (One of eight possible port B voltage measurements.)

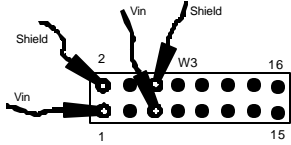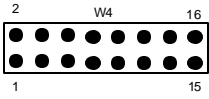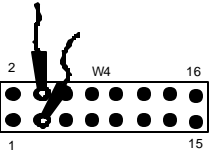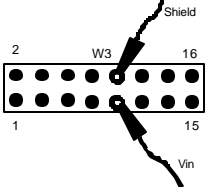**Table 2-1. Jumper Header, Test Point Positions (continued)**
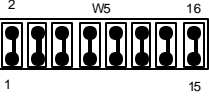
Header	Position	Effect
Port B Measurement, W3 (continued)		Connection for direct insertion of analog volatage to port B channels 0 and 2. (One of many possible direct-insertion configurations.) (To isolate the direct-insertion channels from the target system, you should remove the jumper from the corresponding pins of jumper header W5.)
Port D Measurement, W4		Selects normal operation of A/D conversion port D pins — no voltage measurement, no direct voltage insertion. **Factory setting.**
		Voltmeter connection for voltage measurement of port D channel 1 pins. (One of eight possible port D voltage measurements.)
		Connection for direct insertion of analog volatage to port D channel 4. (One of many possible direct-insertion configurations.) (To isolate the direct-insertion channels from the target system, you should remove the jumper from the corresponding pins of jumper header W6.)
Port B Select, W5		Selects all port B lines. **Factory setting.**
		Isolates port B lines for channels 0 and 2 from the target system. (Appropriate for direct analog voltage insertion to those channels, via test point W3.)

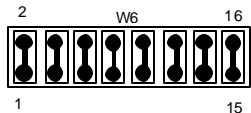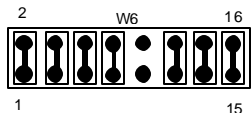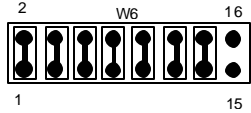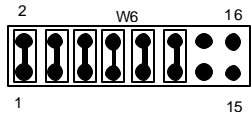**Table 2-1. Jumper Header, Test Point Positions (continued)**
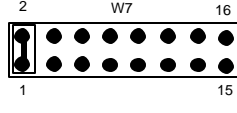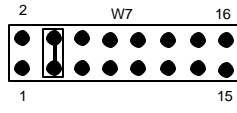
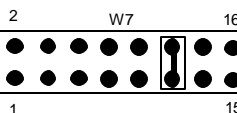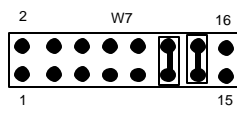| Header	Position	Effect
Port D Select and Emulation, W6	W6 (pins 1–16)	Selects all port D lines. Configures for emulation of any of these 64-pin QFP MCUs: 08AZ32, 908AZ32, 908AS60, or 908AZ60. **Factory setting.**
	W6 (pins 1–16)	Isolates port D lines for channel 4 from the target system. (Appropriate for direct analog voltage insertion to that channel, via test point W4.)
	W6 (pins 1–16)	Configures for emulation of any of these MCUs: 08AS20, 52-pin PLCC; 08AS32, 52-pin PLCC, 08AS32, 64-pin QFP; 908AS32, 52-pin PLCC; 908AS60, 52-pin PLCC; or 908AZ60, 52-pin PLCC.
	W6 (pins 1–16)	Configures for emulation of 52-pin PLCC 908QA24 MCUs.
Emulation Select, W7	W7 (pins 1–16)	Configures the EM to emulate an 08AS20, 52-pin PLCC MCU.
	W7 (pins 1–16)	Configures the EM to emulate any of these MCUs: 08AS32, 52-pin PLCC; 08AS32, 64-pin QFP; or 908AS32, 52-pin PLCC.
	W7 (pins 1–16)	Configures the EM to emulate either of these MCUs: 908AS60, 52-pin PLCC, or 908AZ60, 52-pin PLCC.
	W7 (pins 1–16)	Configures the EM to emulate either of these MCUs: 908AS60, 64-pin QFP; or 908AZ60, 64-pin QFP.

Table 2-1. Jumper Header, Test Point Positions (continued)

Header	Position	Effect
Emulation Select, W7 (continued)	2 W7 16 ● ● ● ▮ ● ● ● ● ● ● ● ▮ ● ● ● ● 1 15	Configures the EM to emulate a 908QA24, 52-pin PLCC MCU. **Factory setting.**
	2 W7 16 ● ● ● ● ▮ ● ● ▮ ● ● ● ● ▮ ● ▮ ● 1 15	Configures the EM to emulate either of these MCUs: 08AZ32, 64-pin QFP, or 908AZ32, 64-pin QFP.

2.2.1   Setting the External Clock Source Header (W1)

Jumper header W1 selects the source of the external clock signal. The diagram below shows the factory configuration: the fabricated jumper between pins 3 and 4 selects the clock signal from the MMDS control board (or MMEVS platform board). (For this configuration, use the appropriate software command to specify the frequency.)
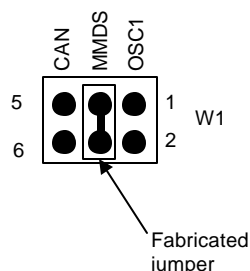
Alternatively, you may select a clock signal from a canned oscillator. To do so:

1. Install the oscillator you wish in the socket at board location Y1.

2. Reposition the W1 fabricated jumper between pins 5 and 6.

The third clock-signal source is a signal coming through target-cable connector J5. For this configuration:

1. Reposition the W1 fabricated jumper between pins 1 and 2, and

2. Supply a CMOS-level square wave through the OSC1 line of the target cable.

2.2.2   Setting ADC VREFH (W2, R41)

Jumper header W2 selects the source of the voltage-reference-high (VREFH) signal for the A/D converter. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 selects the EM itself as the VREFH source. This configuration lets you use variable resistor R41 to adjust the voltage.
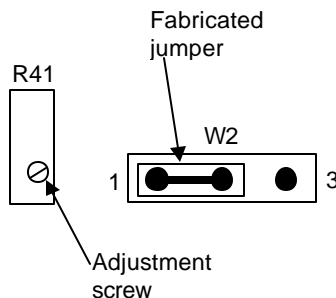

Alternatively, you may select the target system as the VREFH source. To do so, reposition the W2 jumper between pins 2 and 3. (In this configuration, resistor R41 has no effect.)

2.2.3   Configuring the Port B Measurement Test Point (W3)

Test point W3 lets you measure analog voltages that the target system sends to the A/D conversion function port B I/O pins. Additionally, you may use this same test point for direct insertion of an analog voltage to particular A/D channels.

The diagram below shows the factory configuration: no lines are connected to the test point. This is the appropriate W3 configuration if you are not measuring or inserting voltages.

MOTOROLA
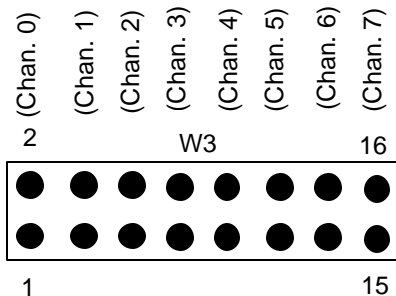
The odd-numbered pins of this test point connect directly to the port B I/O pins of the A/D port replacement unit. The even-numbered pins connect to analog ground (VSSA).

- To measure the voltage to port B I/O pins, connect a voltmeter to the corresponding W3 pins. For example, the diagram below illustrates measurement of the analog voltage to the channel 5 pins.
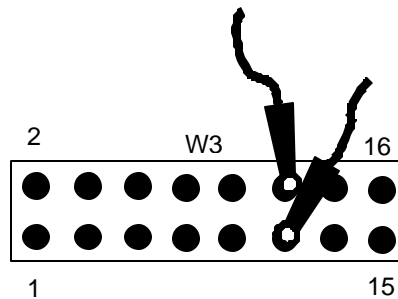
- To insert an analog voltage directly, connect the voltage-in lead to the appropriate W3 *odd-numbered* pin, and connect the shield lead to the corresponding W3 *even-numbered* pin. For example, the diagram below illustrates direct insertion to the channel 0 and channel 2 pins.
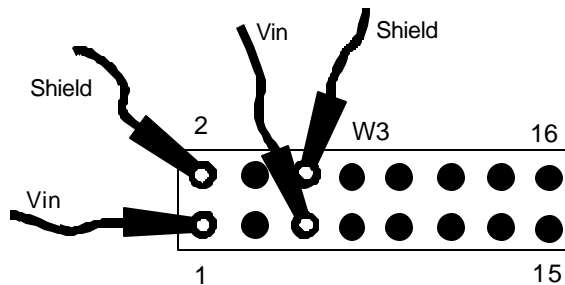
NOTE

If a target system is connected to your EM when you directly insert an analog voltage to any port B I/O pins, you should remove the fabricated jumpers from the corresponding pins of jumper header W5. This isolates the A/D channels from the target system. For example, if you are inserting voltages directly to channels 0 and 2, as in the diagram above, you should remove the fabricated jumpers from W5 pins 1 and 2, and 5 and 6.

2.2.4   Configuring the Port D Measurement Test Point (W4)

Test point W4 works for A/D port D I/O pins the way test point W3 works for port B I/O pins. That is, test point W4 lets you measure analog voltages that the target system sends to the port-D I/O pins. You also may use test point W4 for direct insertion of an analog voltage to particular A/D channels.

The diagram below shows the factory configuration: no lines are connected to the test point. This is the appropriate W4 configuration if you are not measuring or inserting voltages.

The odd-numbered pins of this test point connect directly to the port D I/O pins of the A/D port replacement unit. The even-numbered pins connect to analog ground (VSSA).

- To measure the voltage to port D I/O pins, connect a voltmeter to the corresponding W4 pins.

- To insert an analog voltage directly, connect the voltage-in lead to the appropriate W4 *odd-numbered* pin, and connect the shield lead to the corresponding W4 *even-numbered* pin.
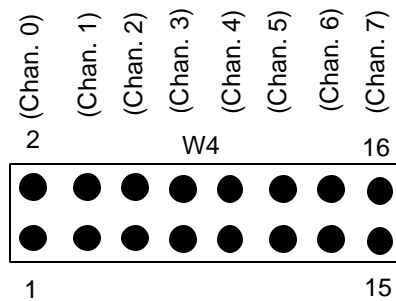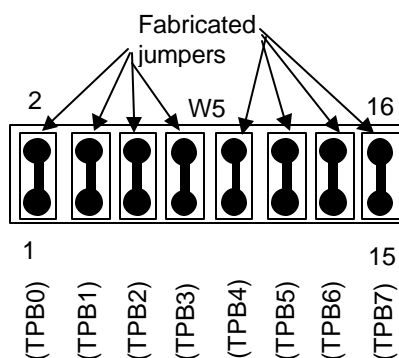
NOTE

If a target system is connected to your EM when you directly insert an analog voltage to any port D I/O pins, you should remove the fabricated jumpers from the corresponding pins of jumper header W6. This isolates the A/D channels from the target system.

2.2.5 Configuring the Port B Select Header (W5)

Jumper header W5 selects or disconnects A/D port B lines TPB0 through TPB7. The diagram below shows the factory configuration: the eight fabricated jumpers in select all eight port-B lines.
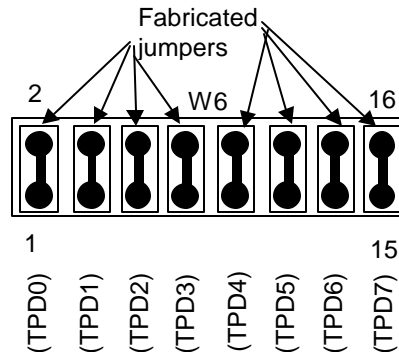

To disconnect port B lines, remove the appropriate W5 jumper. This isolates the lines from the target system.

NOTE

Be sure to remove the appropriate W5 jumpers if you are inserting analog voltage directly, via test point W3. For example, if you use W3 to insert voltages directly to channels 0 and 2, you should remove the fabricated jumpers from the W5 TPB0 and TPB2 positions.

2.2.6 Configuring the Port D Select and Emulation Header (W6)

Jumper header W6 selects or disconnects A/D port D lines TPD0 through TPD7, just as header W5 does for A/D port B lines. Additionally, header W6 must be configured correctly for MCU emulation. The diagram below shows the factory configuration: the eight fabricated jumpers in select all eight port D lines.

To disconnect port D lines, remove the appropriate W6 jumper. This isolates the lines from the target system. Table 2-2 explains which W6 jumpers must be removed for emulation of specific MCUs.

Table 2-2. Header W6 Emulation Configuration

Emulated MCU	W6 Configuration
MC68HC08**AS20** (52-pin PLCC)	Remove jumper from pins 15 and 16; make sure jumpers are in all seven other positions.
MC68HC08**AS32** (52-pin PLCC)	Remove jumper from pins 15 and 16; make sure jumpers are in all seven other positions.
MC68HC08**AS32** (64-pin QFP)	Remove jumper from pins 15 and 16; make sure jumpers are in all seven other positions.
MC68HC908**AS32** (52-pin PLCC)	Remove jumper from pins 15 and 16; make sure jumpers are in all seven other positions.
MC68HC908**AS60** (52-pin PLCC)	Remove jumpers from pins 15 and 16; make sure jumpers are in all seven other positions.
MC68HC908**AS60** (64-pin QFP)	Use jumpers in all eight positions.

MOTOROLA

Table 2-2. Header W6 Emulation Configuration (continued)

Emulated MCU	W6 Configuration
MC68HC908**QA24** (52-pin PLCC)[1]	Remove jumpers from pins 13 and 14, and pins 15 and 16; make sure jumpers are in all six other positions.
MC68HC08**AZ32** (64-pin QFP)	Use jumpers in all eight positions.
MC68HC908**AZ32** (64-pin QFP)	Use jumpers in all eight positions.
MC68HC908**AZ60** (52-pin PLCC)	Remove jumpers from pins 15 and 16; make sure jumpers are in all seven other positions.
MC68HC908**AZ60** (64-pin QFP)	Use jumpers in all eight positions.
(1) Note paragraph 2.4, which lists extra requirements for emulating a QA24 MCU.	

NOTE

Be sure to remove the appropriate W6 jumpers if you are inserting analog voltage directly, via test point W4. For example, if you use W4 to insert voltages directly to port D channels 1, 3, and 5, you should remove the fabricated jumpers from the W6 TPD1, TPD3, and TPD5 positions.

2.2.7   Configuring the Emulation Select Header (W7)

Jumper header W7 configures the EM for the MCU to be emulated. The diagram below shows the factory configuration: the fabricated jumper between pins 5 and 6 is correct for emulation of an MC68HC908QA24 MCU.
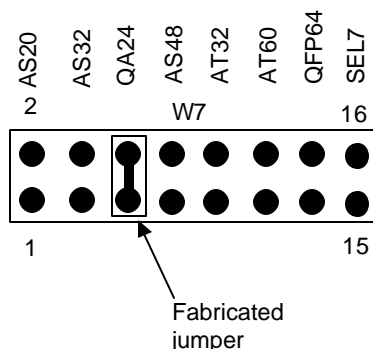

Fabricated jumper

Table 2-3 explains which W7 jumpers must be installed for emulation of specific MCUs.

Table 2-3. Header W7 Emulation Configuration

Emulated MCU	W7 Configuration
MC68HC08**AS20** (52-pin PLCC)	One jumper, between pins 1 and 2.
MC68HC08**AS32** (52-pin PLCC)	One jumper, between pins 3 and 4.
MC68HC08**AS32** (64-pin QFP)	One jumper, between pins 3 and 4.
MC68HC908**AS32** (52-pin PLCC)	One jumper, between pins 3 and 4.
MC68HC908**AS60** (52-pin PLCC)	One jumper, between pins 11 and 12.
MC68HC908**AS60** (64-pin QFP)	Two jumpers, between pins 11 and 12, and pins 13 and 14.
MC68HC908**QA24** (52-pin PLCC) [1]	One jumper, between pins 5 and 6. [1]
MC68HC08**AZ32** (64-pin QFP)	Two jumpers, between pins 9 and 10, and pins 13 and 14.
MC68HC908**AZ32** (64-pin QFP)	Two jumpers, between pins 9 and 10, and pins 13 and 14.
MC68HC908**AZ60** (52-pin PLCC)	One jumper, between pins 11 and 12.
MC68HC908**AZ60** (64-pin QFP)	Two jumpers, between pins 11 and 12, and pins 13 and 14.
(1) Note paragraph 2.4, which lists extra requirements for emulating a QA24 MCU.	

NOTES

Do not rely on silk-screen markings to configure header W7. For example, the EM does not support AS48 emulation, as you might expect from the W7 pin 7-and-8 marking.

2.3 REMAINING SYSTEM INSTALLATION

When you have configured your EM, you are ready to complete EM installation:

- To install the EM in an MMDS0508 station module, remove the panel from the station-module top. 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. Connect the target cable, if appropriate, then replace the panel.

- If your EM already is installed in the station module, reconnect the target cable (if necessary). Replace the panel.

- To install the EM on an MMEVS platform board, fit together EM connectors P1 and P1 (on the bottom of the board) and platform-board connectors P3 and P4. Snap the corners of the EM onto the plastic standoffs.

- Follow the instructions of paragraph 2.3.1 or 2.3.2 to copy the appropriate personality file (and possibly register file) from the transmittal diskette to the appropriate directory. (If you will use development software from a non-Motorola source, consult that software's documentation for instructions about personality file location and naming.)

- Note the EEPROM information of paragraph 2.3.3.

2.3.1   Copying the Personality File (for Default Software)

If you will use the software that came with your Motorola development system, copy the appropriate personality file to the directory that contains file `MMDS08.EXE`.) Table 2-4 lists the personality files that correspond to each MCU.

You may arrange for the software to load this personality file automatically, each time you launch the software. To do so, rename the personality file `00422v02.MEM`.

Table 2-4. Personality and Register Files

Emulated MCU	Personality File	Register File[1]
MC68HC08**AS20** (52-pin PLCC)	AS20v02.MEM	08AS20.REG
MC68HC08**AS32** (52-pin PLCC)	AS32v02.MEM	08AS32.REG
MC68HC08**AS32** (64-pin QFP)	AS32v02.MEM	08AS32.REG
MC68HC908**AS32** (52-pin PLCC)	A352v02.MEM	908AS32.REG
MC68HC908**AS60** (52-pin PLCC)	A652v02.MEM	908AS60.REG
MC68HC908**AS60** (64-pin QFP)	A652v02.MEM	908AS60.REG
MC68HC908**QA24** (52-pin PLCC)	QA24v02.MEM	908QA24REG
MC68HC08AZ32 (64-pin QFP)	AZ32v02.MEM	08AZ32.REG
MC68HC908**AZ32** (64-pin QFP)	A364v02.MEM	908AZ32.REG
MC68HC908**AZ60** (52-pin PLCC)	A664v02.MEM	908AZ60.REG
MC68HC908**AZ60** (64-pin QFP)	A664v02.MEM	908AZ60.REG
(1) Only MCUez development software uses regiser files.		

2.3.2 Copying the Personality and Register Files (for MCUez Software)

If you will use MCUez development software, copy the appropriate personality file to the ...\prog\mem subdirectory of the MCUez main directory. Table 2-4 lists the personality files that correspond to each MCU.

You may arrange for the MCUez software to load this personality file automatically, each time you launch the software. To do so, rename the personality file 00C22v02.MEM.

Table 2-4 also lists the register files that come with your A-family EM. MCUez software uses such files to implement optional functionality: letting you view or modify MCU register contents by *name*, rather than by address. A register file is an ASCII text file, which you may customize. (The MCUez user's manual explains how to create and use such files.)

You may arrange for the MCUez software to load the appropriate register file automatically, each time you launch the software. To do so, copy the personality file to the ...\prog\reg subdirectory of the MCUez main directory. Then rename the file MCU0C22.REG.

2.3.3 Loading Code into EEPROM

Your development software actually *enables*, not merely emulates, MCU EEPROM arrays. The personality files that come with your A-family EM let you load user code into MCU EEPROM, just as you can load other code. But you cannot use the debugger command line to modify EEPROM contents.

The documentation that came with your development software included specific information about loading user code.

At this point, you are ready to make any remaining cable connections and restore power. For instructions, consult the MMDS or MMEVS operations manual. (If you will emulate a QA24 MCU, note the extra instructions of paragraph 2.4.)

MOTOROLA

2.4 QA24 SYSTEM STARTUP

The dual CPU of the MC68HC908QA24 causes an automatic reset if you try to start the MMDS the way you do for other MCUs. Accordingly, if you use your A-family EM to emulate a 908QA24 MCU, you must follow these special steps:

Step 1. Configure your EM for QA24 emulation, per the other instructions of this chapter.

Step 2. Install an extra fabricated jumper between pins 15 and 16 (the SEL7 position) of jumper header W7.

Step 3. Start the MMDS; wait until a debugger communication error message appears.

Step 4. Exit the MMDS, but *do not remove power from the MMDS*.

Step 5. Remove the jumper from W7 pins 15 and 16.

Step 6. *Without cycling power*, restart the MMDS.

2.5 EMULATION REQUIREMENTS AND SETTINGS

Table 2-5 lists the requirements and setting for each MCU to be emulated.

Table 2-5. Emulation Requirements and Settings

Emulated MCU	Resident MCU and Socket	W6 Configuration	W7 Configuration	Personality File [Register File][1]
MC68HC08**AS20** (52-pin PLCC)	908**AS60**FU64, U3	Jumpers in all positions but pins 15 and 16.	One jumper: pins 1 and 2.	AS20v02.MEM [08AS20.REG]
MC68HC08**AS32** (52-pin PLCC)	908**AS60**FU64, U3	Jumpers in all positions but pins 15 and 16.	One jumper: pins 3 and 4.	AS32v02.MEM [08AS32.REG]
MC68HC08AS32 (64-pin QFP)	908**AS60**FU64, U3	Jumpers in all positions but pins 15 and 16.	One jumper: pins 3 and 4.	AS32v02.MEM [08AS32.REG]
MC68HC908AS32 (52-pin PLCC)	908**AS60**FU64, U3	Jumpers in all positions but pins 15 and 16.	One jumper: pins 3 and 4.	A352v02.MEM [908A32.REG]
MC68HC908**AS60** (52-pin PLCC)	908**AS60**FU64, U3	Jumpers in all positions but pins 15 and 16.	One jumper: pins 11 and 12.	A652v02.MEM [908AS60.REG]
MC68HC908**AS60** (64-pin QFP)	908**AS60**FU64, U3	Jumpers in all eight positions.	Two jumpers: pins 11 and 12, pins 13 and 14.	A652v02.MEM [908AS60.REG]
MC68HC908**QA24** (52-pin PLCC)	908**QA24**FN52, U2	Jumpers in first six positions, none between pins 13 and 14, or pins 15 and 16.	One jumper: pins 5 and 6.	QA24v02.MEM [908QA24.REG]
MC68HC08**AZ32** (64-pin QFP)	908**AZ60**FU64, U3	Jumpers in all eight positions.	Two jumpers: pins 9 and 10, pins 13 and 14.	AZ32V02.MEM [08AZ32.REG]
MC68HC908**AZ32** (64-pin QFP)	908**AZ60**FU64, U3	Jumpers in all eight positions.	Two jumpers: pins 9 and 10, pins 13 and 14.	A364v02.MEM [908AZ32.REG]
MC68HC908**AZ60** (52-pin PLCC)	908**AZ60**FU64, U3	Jumpers in all positions but pins 15 and 16.	One jumper: pins 11 and 12.	A664v02.MEM [908AZ60.REG]
MC68HC908**AZ60** (64-pin QFP)	908**AZ60**FU64, U3	Jumpers in all eight positions.	Two jumpers: pins 11 and 12, pins 13 and 14.	A664v02.MEM [908AZ60.REG]
(1) Register files are optional, only for use with MCUez software.				

CHAPTER 3

SCHEMATICS

This chapter consists of schematics for the A-family EM. The 13 schematic pages begin on the next page of this manual.

INDEX

system components:

    MMDS0508: 1-2, 1-3

    MMEVS: 1-3

system startup, QA24: 2-16

target cable assembly: 1-6

target connectors: 1-7 —1-9

VREFH jumper header (W2): 2-7