HC11E20

EMULATOR MODULE

USER'S MANUAL

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CHAPTER 1

INTRODUCTION

This user's manual explains connection, configuration, and operation information specific to the HC11E20EM Emulator Module (E20EM). The E20EM makes possible emulation and debugging of target systems based on these microcontroller units (MCUs):

MC68HC11A0	MC68HC11A1	MC68HC11A8
MC68HC11E0	MC68HC11E1	MC68HC11E9
MC68HC11E20	MC68HC11E32	MC68HC711E9
MC68HC711E20	MC68HC711E32	MC68HC811E20

Your E20EM can be part of two Motorola development systems. This chapter describes those systems and explains the layout of the E20EM.

1.1 DEVELOPMENT SYSTEMS

Your E20EM can be part of two Motorola development tools: the HC11 Motorola Modular Development System (MMDS11) or the M68HC11EVS Evaluation System (HC11EVS).

1.1.1 Motorola Modular Development System (MMDS11)

The MMDS11 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 MMDS11 consists of:

- **a station module** — the metal MMDS11 enclosure, containing the control board and the internal power supply. Most system cables connect to the MMDS11 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 the E20EM: 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, 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 cables.

- **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-lead cable to a 25-pin serial port.

- **system software** — software, on 3-1/2 inch diskettes.

- **MMDS11 documentation** — an MMDS11 operations manual (MMDS11OM/D) and the appropriate EM user's manual.

You select the MMDS11 baud rate: 1200, 2400, 4800, 9600, 19200, 38400, or 57600.

As mentioned, your E20EM gives the MMDS11 the ability to emulate target systems based on several MC68HC11Ax- and Ex-family MCUs. By substituting a different EM, you can enable your MMDS11 to emulate an MCU of a different series. (Your Motorola representative can explain all the EMs available.)

Chapter 2 explains how to configure and use your E20EM as part of an MMDS11 system. For information about MMDS11 software or the station module, see the MMDS11 operations manual. For layout and configuration information pertaining to a different EM, see the corresponding EM user's manual.

1.1.2 M68HC11EVS Evaluation System (HC11EVS)

An HC11EVS is an economical, two-board tool for designing, debugging, and evaluating target systems based on an MC68HC11 MCU. A complete HC11EVS 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 the E20EM: 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** — software, on 3-1/2 inch or 5-1/4 inch diskettes.

- **HC11EVS documentation** — an HC11EVS operations manual (HC11EVSOM/D) and the appropriate EM user's manual.

An HC11EVS features automatic baud rate selection: 2400, 4800, 9600, or 19200.

As mentioned, your E20EM gives the HC11EVS the ability to emulate target systems based on several MC68HC11Ax- and Ex-family MCUs. By substituting a different EM, you can enable your HC11EVS to emulate an MCU of a different series. (Your Motorola representative can explain all the EMs available.)

Chapter 3 explains how to configure and use your E20EM as part of an HC11EVS system. For information about HC11EVS software or the platform board, see the HC11EVS operations manual. For layout and configuration information pertaining to a different EM, see the corresponding EM user's manual.

1.2 EM LAYOUT

Figure 1-1 shows the layout of the E20EM. Jumper headers J1 and J2 select the MCU device type to be emulated. Jumper header J3 selects the correct modes for MMDS11 or HC11EVS operation. Jumper headers J4 and J5 let you select the clock-signal source. Jumper header J6 selects the MMDS11 or HC11EVS target interrupt arrangement.
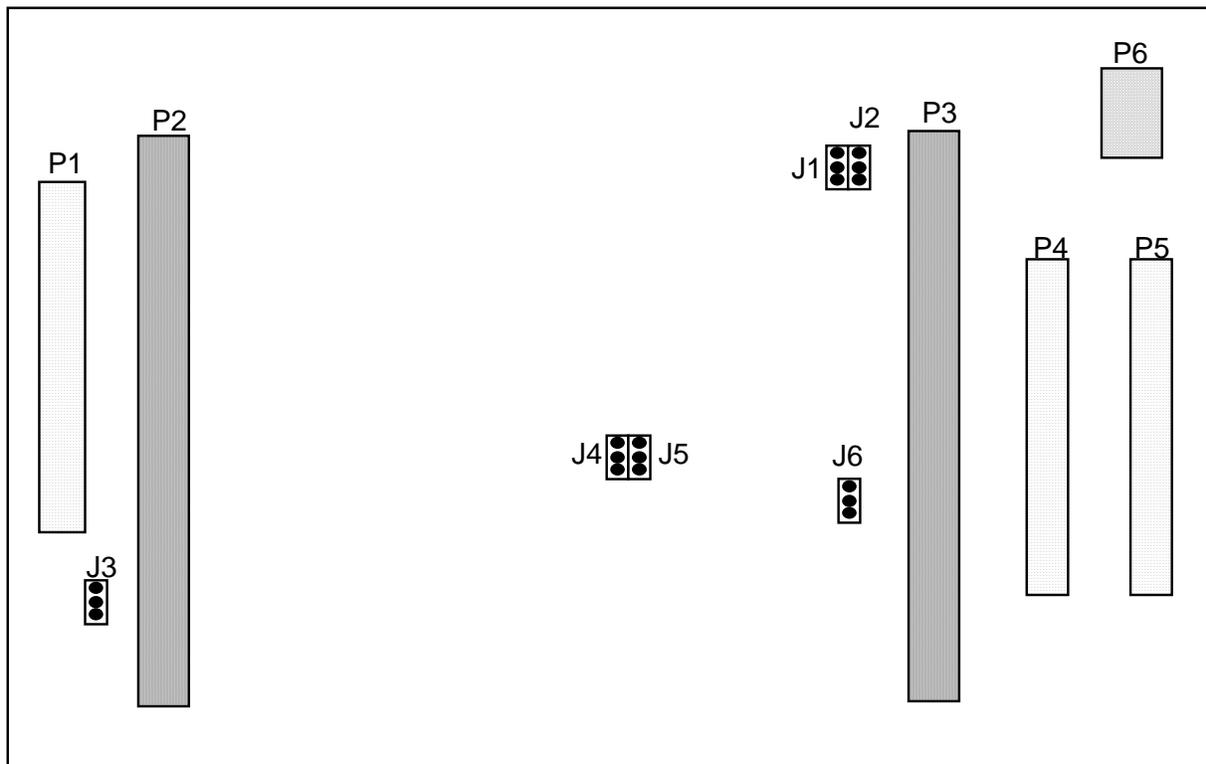

Figure 1-1. HC11E20 Emulator Module

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Target connectors P4 and P5, for a separately purchased flex cable assembly, are the interface to a target system. If you install the E20EM in the MMDS11 station module, the target cable passes through the slit in the station module enclosure. Connector P1 connects to a logic analyzer. (Connector P1 has more significance for an HC11EVS, as an MMDS11 includes a bus analyzer.) Expansion header connectors P2 and P3 connect together the EM and the control board (for an MMDS11) or the EM and the platform board (for an HC11EVS). Connector P6 is for extended address input lines (for an HC11EVS only).

1.3 TARGET CONNECTOR PIN ASSIGNMENTS

Figure 1-2 shows the pin assignments for target connectors P4 and P5. Tables 1-1 and 1-2 list signal descriptions for these connectors.

```
        P4                              P5
     A8/Ex PIN                      A8/Ex PIN

  GND     1  ● ●   2  EXTAL      R/W/STRB  1  ● ●   2  NC
   NC     3  ● ●   4  GND               E  3  ● ●   4  NC
  PC0     5  ● ●   6  PC1          AS/STRA  5  ● ●   6  NC
  PC2     7  ● ●   8  PC3              GND  7  ● ●   8  NC
  PC4     9  ● ●  10  PC5              GND  9  ● ●  10  MDA
  PC6    11  ● ●  12  PC7              Vrl 11  ● ●  12  MDB
   NC    13  ● ●  14  RESET*           Vrh 13  ● ●  14  GND
 XIRQ*   15  ● ●  16  IRQ*             PE7 15  ● ●  16  PE3
   NC    17  ● ●  18  NC               PE6 17  ● ●  18  PE2
  GND    19  ● ●  20  PD0               NC 19  ● ●  20  NC
  PD1    21  ● ●  22  PD2              PE5 21  ● ●  22  PE1
  PD3    23  ● ●  24  GND              PE4 23  ● ●  24  PE0
  PD4    25  ● ●  26  PD5               NC 25  ● ●  26  NC
   NC    27  ● ●  28  VDD DETECT       GND 27  ● ●  28  PB0
  PA7    29  ● ●  30  PA6              PB1 29  ● ●  30  PB2
  PA5    31  ● ●  32  PA4              PB3 31  ● ●  32  GND
  PA3    33  ● ●  34  PA2              PB4 33  ● ●  34  NC
  PA1    35  ● ●  36  PA0              PB5 35  ● ●  36  NC
   NC    37  ● ●  38  GND              PB6 37  ● ●  38  GND
   NC    39  ● ●  40  GND              PB7 39  ● ●  40  GND
```

Figure 1-2. Connector P4, P5 Pin Assignments

Table 1-1. Target Connector P4 Signal Descriptions

Pin	Mnemonic	Signal
1, 4, 19, 24, 38, 40	GND	GROUND
2	EXTAL	MCU clock input line.
3, 13, 17, 18, 27, 37, 39	-----	No connection
5 — 12	PC0 — PC7	PORT C (bits 0—7) - General-purpose I/O lines.
14	RESET*	RESET - Active-low bidirectional control line that initializes the MCU.
15	XIRQ*	X INTERRUPT REQUEST - Active-low input line for requesting MCU asynchronous non-maskable interrupts.
16	IRQ*	INTERRUPT REQUEST - Active-low input line for requesting MCU asynchronous non-maskable interrupts.
20 — 23, 25, 26	PD0 — PD5	PORT D (bits 0—5) - General-purpose I/O lines controlled by software via data direction and data registers.
28	VDD DETECT	VOLTAGE DETECT - VDD input signal from the target system, for detection of target voltage.
29 — 36	PA7 — PA0	PORT A (bits 7—0) - General-purpose I/O lines controlled by software via data direction and data registers.

Table 1-2. Target Connector P5 Signal Descriptions

Pin	Mnemonic	Signal
1	R/W /STRB	READ/WRITE / STROBE B - In expanded-multiplexed or special-test mode, buffered output signal that indicates the direction of data transferred on the bus. In single-chip mode, output strobe for port C and D handshake I/O functions.
2, 4, 6, 8, 19, 20, 25, 26, 34, 36	-----	No connection
3	E	E ENABLE - Output control line for timing reference.
5	AS/STRA	ADDRESS STROBE / STROBE A - In expanded-multiplexed or special-test mode, buffered enable output signal to an external address latch. In single-chip mode, edge-detecting input that latches port C data into a special internal register.
7, 9, 14, 27, 32, 38, 40	GND	GROUND
10	MODA	MODE A SELECT - Mode select line
11	Vrl	VOLTAGE REFERENCE LOW - Reference for A/D circuitry.
12	MODB	MODE B SELECT - Mode select line
13	Vrh	VOLTAGE REFERENCE HIGH - Reference for A/D circuitry.
15 — 18, 21 — 24	PE7 — PE0	PORT E (bits 7—0) - General-purpose I/O lines controlled by software via data direction and data registers.
28 — 31, 33, 35, 37, 39	PB0 — PB7	PORT B (bits 0—7) - General-purpose I/O lines controlled by software via data direction and data registers.

As connector P1 has more importance for an HC11EVS than for an MMDS11, pin assignments for connector P1 are in Chapter 3.

To configure your E20EM for use as part of an MMDS11, follow the instructions of Chapter 2. To configure your E20EM for use as part of an HC11EVS, follow the instructions of Chapter 3.

CHAPTER 2

MMDS11 CONFIGURATION AND OPERATION

This chapter explains how to configure and use your E20EM as part of an MMDS11. For other parts of system installation or configuration, see the MMDS11 operations manual (MMDS11OM/D). (If you will use your E20EM as part of an HC11EVS, go to Chapter 3 for corresponding information.)

Paragraph 2.1 explains how to set E20EM jumper headers. Paragraph 2.2 explains considerations about emulating an MCU. Paragraph 2.3 explains remaining system installation.

Note that you can configure an E20EM already installed in the MMDS11 station module enclosure. To do so, switch off station-module power, remove the panel, then follow the guidance of this chapter.

CAUTION

Be sure to switch off power if you reconfigure an installed EM. Reconfiguring EM jumper headers with power left on can damage MMDS11 circuits.

2.1 SETTING E20EM JUMPER HEADERS

Your E20EM has six jumper headers, J1 through J6. Paragraphs 2.1.1 through 2.1.4 explain how to configure these headers.

2.1.1 Device Select Headers (J1, J2)

Jumper headers J1 and J2 configure the E20EM for the MCU device type to be emulated. The diagram below shows the factory configuration: the fabricated jumpers between J1 pins 1 and 2, and J2 pins 2 and 3, configure the E20EM for emulation of an MC68HC11E20 or MC68HC711E20 MCU.
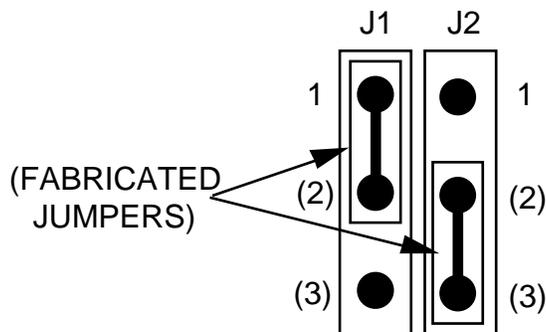

To emulate a target system based on another MCU type, reposition the J1 and J2 jumpers, per Table 2-1.

Table 2-1. Device Emulation Configuration

MCU Device Type	J1 Jumper Position	J2 Jumper Position
MC68HC11A0, -A1, -A8; MC68HC811E2	Pins 2 and 3	Pins 2 and 3
MC68HC(7)11E0, -E1, -E9	Pins 2 and 3	Pins 1 and 2
MC68HC(7)11E20	Pins 1 and 2	Pins 2 and 3
MC68HC(7)11E32	Pins 1 and 2	Pins 1 and 2

2.1.2 Modes Select Header (J3)

Jumper header J3 configures modes for your development system. For use with an MMDS11, position the fabricated jumper between pins 2 and 3, per the diagram below. (This is the only correct J3 configuration for an E20EM that is part of an MMDS11.)

J3

PFB   ●   1

(FABRICATED JUMPER)   ●   (2)
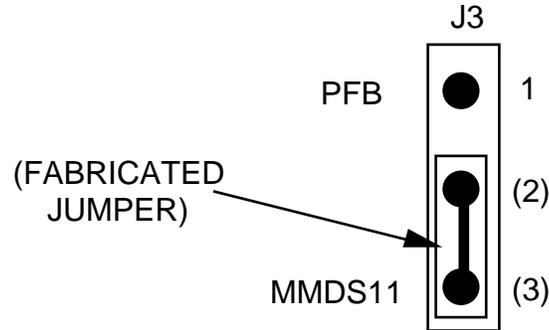
MMDS11   ●   (3)

NOTE

The J3 pins 1-and-2 configuration is not correct for an E20EM that is part of an MMDS11.

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2.1.3 Clock Source Select Headers (J4, J5)

Jumper headers J4 and J5 determine the clock-signal source. The diagram below shows the factory configuration: the J4 jumper between pins 1 and 2 selects the E20EM canned oscillator clock source. (The J5 configuration does not matter if the J4 jumper is between pins 1 and 2.)
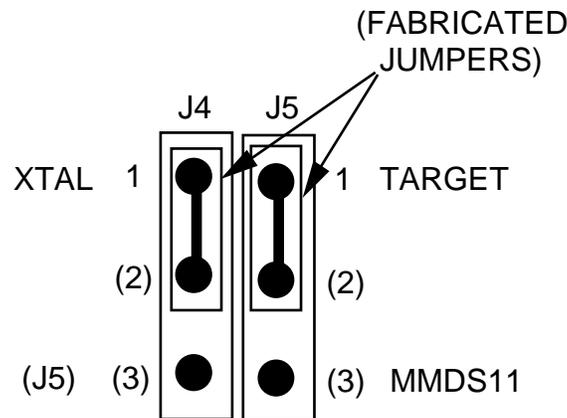

Alternatively, you may select the clock signal from the MMDS11 control board. To do so, reposition both fabricated jumpers between pins 2 and 3. In this configuration, the J4 jumper selects the jumper header J5 source, and the J5 jumper selects the clock signal from the control board.

The third possible clock-signal source is the target system. For this configuration, position the J4 jumper between pins 2 and 3 and position the J5 jumper between pins 1 and 2. Then, connect the target-system clock signal to the EXTAL pin (pin 2 of connector P4). The target-system clock signal must have the appropriate frequency for the frequency of bus operation:

- For 1 MHz bus operation, the EXTAL-pin frequency must be 4 MHz.

- For 2 MHz bus operation, the EXTAL-pin frequency must be 8 MHz.

- For 3 MHz bus operation, the EXTAL-pin frequency must be 12 MHz (the maximum for this signal.

2.1.4 Target Interrupt Select Header (J6)

Jumper header J6 configures the EM for handling target interrupts. For use with an MMDS11, position the fabricated jumper between pins 2 and 3, per the diagram below. This disconnects target interrupts, which do not pertain to an MMDS11 system. (This is the only correct J6 configuration for an E20EM that is part of an MMDS11.)
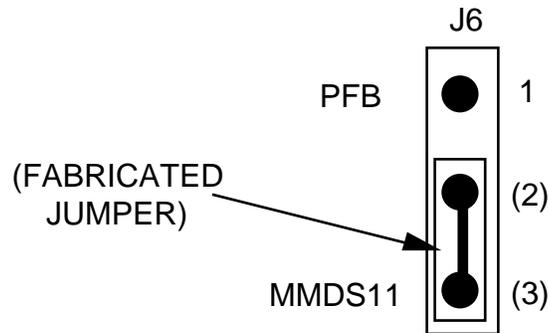
NOTE

The J6 pins 1-and-2 configuration is not correct for an E20EM that is part of an MMDS11 system.

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2.2 EMULATING AN MCU

Your MMDS11 uses a specific personality file for the MCU type being emulated. For example, to emulate an MC68HC11E20 MCU, the system uses personality file 10086Vxx.MEM. Table 2-2 lists all the personality files that pertain to the E20EM. Note that personality file names follow the pattern `100ZZVxx.MEM`, where `ZZ` corresponds to one or more MCUs, and `xx` is the version of the file.

Table 2-2. MCUs and Personality Files

Emulated MCU	Personality File
MC68HC11A0, -A1, -A8, -811E2	10084Vxx.MEM
MC68HC(7)11E0, -E1, -E9	10085Vxx.MEM
MC68HC(7)11E20	10086Vxx.MEM
MC68HC(7)11E32	10087Vxx.MEM

MMDS11 software loads the personality file upon powerup; the default personality file is 10086Vxx.MEM. To replace this file with a different one, use the LOADMEM command. (For more information about the LOADMEM command, see the explanation in the MMDS11 operations manual.)

Alternatively, you can insert the line LOADMEM 100ZZVxx.MEM in the STARTUP.11 script file. This way, the system automatically loads the specified personality file as part of system startup. (For more information about the STARTUP.11 script file, see the SCRIPT command explanation in the MMDS11 operations manual.)

Make sure that you properly configure all control registers of the MCU being emulated; you also should know the corresponding memory map. For more information, see the technical data book for the MCU.

2.3 REMAINING SYSTEM INSTALLATION

Once you have configured headers J1 through J6, and verified that the personality file is correct, you are through with E20EM configuration:

- To install the E20EM in an MMDS11 station module, remove the panel from the station-module top. Fit together EM connectors P2 and P3 (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. Replace the panel.

- If your E20EM already is installed in the station module, reconnect the target cable (if necessary). Replace the panel.

- If you will use extended address lines (which do not pertain to the HC11EVS), connect them to the appropriate terminals of connector P6. Run the wires or cable through the target-cable aperture of the station module enclosure.

At this point, you are ready to make remaining cable connections, as necessary, and restore power. For instructions, consult the MMDS11 operations manual (MMDS11OM/D).

CHAPTER 3

HC11EVS CONFIGURATION AND OPERATION

This chapter explains how to configure and use your E20EM as part of an HC11EVS. For other parts of system installation or configuration, see the HC11EVS operations manual (HC11EVSOM/D). (If you will use your E20EM as part of an MMDS11, go to Chapter 2 for corresponding information.)

Paragraph 3.1 explains how to set E20EM jumper headers. Paragraph 3.2 explains limitations on using the E20EM in an HC11EVS. Paragraph 3.3 explains pin assignments and signal descriptions for the logic analyzer connector (P1). Paragraph 3.4 explains remaining system installation.

Note that you can configure an E20EM already installed on the HC11EVS platform board. To do so, disconnect platform-board power, then follow the guidance of this chapter.

CAUTION

Be sure to disconnect power if you reconfigure an installed EM. Reconfiguring EM jumper headers with power left on can damage HC11EVS circuits.

3.1 SETTING E20EM JUMPER HEADERS

Your E20EM has six jumper headers, J1 through J6. Paragraphs 3.1.1 through 3.1.4 explain how to configure these headers.

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3.1.1 Device Select Headers (J1, J2)

Jumper headers J1 and J2 configure the E20EM for the MCU device type to be emulated. The diagram below shows the factory configuration: the fabricated jumpers between J1 pins 1 and 2, and J2 pins 2 and 3, configure the E20EM for emulation of an MC68HC11E20 MCU.
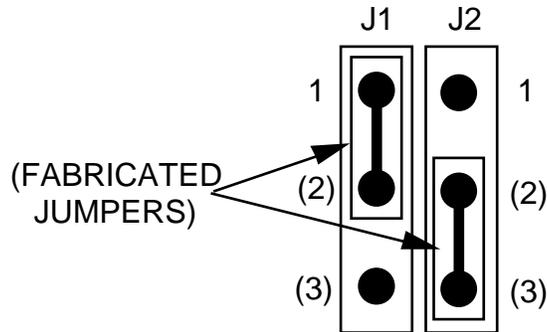

To emulate a target system based on another MCU type, reposition the J1 and J2 jumpers, per Table 3-1.

Table 3-1. Device Emulation Configuration

MCU Device Type	J1 Jumper Position	J2 Jumper Position
MC68HC11A0, -A1, -A8; MC68HC811E2	Pins 2 and 3	Pins 2 and 3
MC68HC(7)11E0, -E1, -E9	Pins 2 and 3	Pins 1 and 2
MC68HC(7)11E20	Pins 1 and 2	Pins 2 and 3
MC68HC(7)11E32	Pins 1 and 2	Pins 1 and 2

3.1.2 Modes Select Header (J3)

Jumper header J3 configures modes for your development system. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 configures modes for an HC11EVS. (This is the only correct J3 configuration for an E20EM that is part of an HC11EVS.)
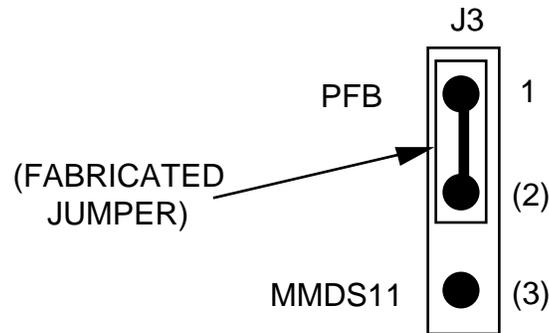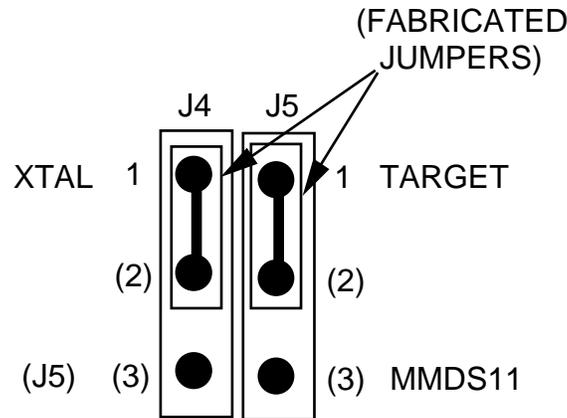

NOTE

The J3 pins 2-and-3 configuration is not correct for an E20EM that is part of an HC11EVS.

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3.1.3 Clock Source Select Headers (J4, J5)

Jumper headers J4 and J5 determine the clock-signal source. The diagram below shows the factory configuration: the J4 jumper between pins 1 and 2 selects the E20EM canned oscillator clock source. (The J5 configuration does not matter if the J4 jumper is between pins 1 and 2.)

```
                          (FABRICATED
                            JUMPERS)

                   J4    J5

          XTAL  1  [●    ●]  1   TARGET
                   [|    |]
                   [●    ●]
             (2)   [      ]  (2)

      (J5)   (3)  [●    ●]  (3)   MMDS11
```

Alternatively, you may select a clock source from the target system. To do so, position the J4 jumper between pins 2 and 3 and position the J5 jumper between pins 1 and 2. Then, connect the target-system clock signal to the EXTAL pin (pin 2 of connector P4). The target-system clock signal must have the appropriate frequency for the frequency of bus operation:

- For 1 MHz bus operation, the EXTAL-pin frequency must be 4 MHz.

- For 2 MHz bus operation, the EXTAL-pin frequency must be 8 MHz.

- For 3 MHz bus operation, the EXTAL-pin frequency must be 12 MHz (the maximum for this signal.

NOTE

The pins 2-and-3 configuration for both headers J4 and J5 is not correct for an E20EM that is part of an HC11EVS.

3.1.4 Target Interrupt Select Header (J6)

Jumper header J6 configures the E20EM for handling target interrupts. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 configures the E20EM for HC11EVS target interrupts. This is the only correct J6 configuration for an E20EM that is part of an HC11EVS.
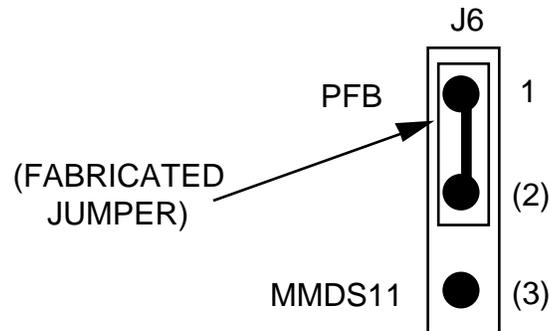
NOTE

The J6 pins 2-and-3 configuration is not correct for an E20EM that is part of an MMDS11 system.

3.2 EVS LIMITATIONS

To use your E20EM as part of an HC11EVS, you must properly configure all control registers of the MCU being emulated; you also should know the corresponding memory map. For more information, see the technical data book for the MCU.

Limitations 1 through 7, below, also apply to using your E20EM in an HC11EVS.

Limitation 1. CLI/RTI. You may not trace a clear interrupt mask (CLI) or return from interrupt (RTI) instruction with an interrupt enabled and pending, due to MCU interrupt handling. Attempting such a trace causes an interrupt in the monitor map; this forces a software reset of the HC11EVS. User breakpoints remain in the user map as SWI instructions; you must remove such SWI instructions.

Limitation 2. Branch. Do not trace a conditional branch instruction (such as BRCLR) that branches to itself. As the monitor places an SWI instruction on the object of the branch, the system never would execute the instruction. However, it would appear to you that the instruction had executed. You may enter a G command while the program counter points to this type of instruction as long as the instruction is not a breakpoint address.

Limitation 3. Internal RAM. Do not trace instructions in internal MCU RAM. Do not insert breakpoints in internal MCU RAM. You may execute code out of internal RAM, provided that the code starts at address $0001 or greater. (Such code starting at internal RAM address $0000 would cause an HC11EVS malfunction.)

Limitation 4. IRQ/SWI. Whenever possible, avoid mixing interrupt requests (IRQs) and user software interrupts (SWIs). This prevents a possible IRQ-SWI timing problem: a concurrent hardware interrupt and SWI could cause an HC11EVS failure that could stop program execution. To recover from such a failure (which occurs very infrequently, statistically), press the master reset switch (SW3).

Limitation 5. Remapping. To remap register locations, you first must issue an INIT command via the monitor. In special-test mode, the monitor automatically updates the initialization register. This restriction applies even if you use the user reset function. For proper HC11EVS operation, you always must update the monitor (via the INIT command) when you remap the initialization register, before you perform any INIT write operations. Such updates are necessary as the monitor must know register locations to access programmable chip selects, and to update the computer operating properly (COP) watchdog timer.

Limitation 6. Breakpoint Debugging. To debug via breakpoints, you must use the G or T command. If you press the platform-board user reset switch (SW2), the monitor ignores breakpoints during program execution.

Limitation 7. Protected Registers. Normally, it is not possible to write to 64-cycle protected registers, such as INIT and TMSK2 in single-chip or expanded mode. This is because the monitor initialization routines need more than 64 cycles: protection would be restored before the write could be carried out. But you may use the one-line assembler/disassembler to bypass this restriction:

    1. Enter this code:

```
>ASM  E000
 LDS     #$FF
 LDAA    # (INIT value)
 STAA    $103D
 LDAA    # (OPTION value)
 STAA    $1039
 LDAA    # (TMSK2 value)
 STAA    $1024
 LDAA    # (BPROT value)
 STAA    $1035
 LOOP    BRA     LOOP
```

    2. Use the MM command to define the user reset vector as the start of the code entered:

```
>MM  FFFE
 FFFE    E0
 FFFF    00
```

    3. Press the platform-board user reset switch (SW2), then press the abort switch (SW1). This initializes the protected registers. Note however, that the next master, user, or target reset will return the registers to their default state.

Note that 64-cycle protection does not apply to special-test mode. In special-test mode, you may write directly to such registers as INIT and TMSK2.

3.3 LOGIC ANALYZER CONNECTOR (P1)

Figure 3-1 shows the pin assignments for logic analyzer connector P1. Table 3-2 lists the signal descriptions for this connector.
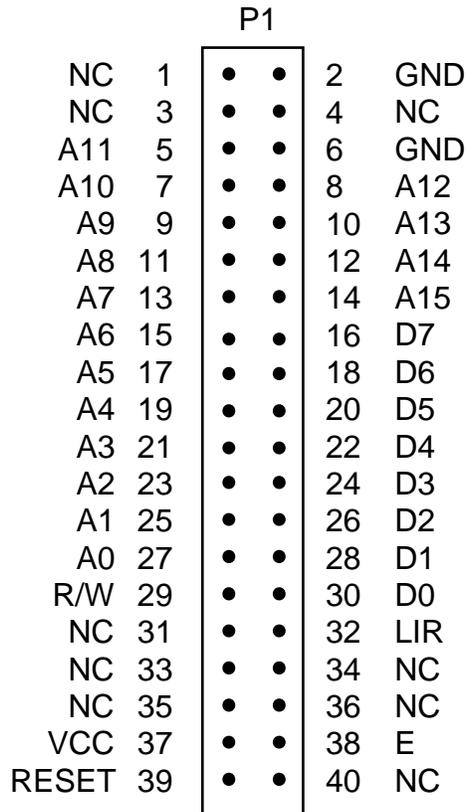
P1

NC	1	● ●	2 GND
NC	3	● ●	4 NC
A11	5	● ●	6 GND
A10	7	● ●	8 A12
A9	9	● ●	10 A13
A8	11	● ●	12 A14
A7	13	● ●	14 A15
A6	15	● ●	16 D7
A5	17	● ●	18 D6
A4	19	● ●	20 D5
A3	21	● ●	22 D4
A2	23	● ●	24 D3
A1	25	● ●	26 D2
A0	27	● ●	28 D1
R/W	29	● ●	30 D0
NC	31	● ●	32 LIR
NC	33	● ●	34 NC
NC	35	● ●	36 NC
VCC	37	● ●	38 E
RESET	39	● ●	40 NC

Figure 3-1. Connector P1 Pin Assignments

Table 3-2. Logic Analyzer Connector P1 Signal Descriptions

Pin	Mnemonic	Signal
1, 3, 4, 31, 33 — 36, 40	-----	No connection
2, 6	GND	GROUND
5, 7 — 15, 17, 19, 21, 23, 25, 27	A0 — A15	ADDRESS (bits 0—15) - MCU output address bus.
16, 18, 20, 22, 24, 26, 28, 30	D7 — D0	DATA BUS (bits 7—0) - Multiplexed address (A7—A0) and I/O data bus (D7—D0) lines.
29	R/W	READ/WRITE - Output signal that indicates the direction of data transferred on the bus.
32	LIR	LOAD INSTRUCTION REGISTER - Open-drain, active-low output signal indicating that an instruction is starting.
37	VCC	+5 VDC POWER - Input voltage (+5 Vdc @ 1.0 A) used by EVS logic circuits.
38	E	EXTERNAL CLOCK - Internally generated output clock signal used as a timing reference. The frequency of E clock is 1/2 the input frequency of the signal on the OSC1 pin.
39	RESET	RESET - Active-low bidirectional signal for starting an EVS reset.

3.4 REMAINING SYSTEM INSTALLATION

Once you have configured headers J1 through J6, you are through with E20EM configuration.

To install the E20EM on the HC11EVS platform board, fit together EM connectors P2 and P3 (on the bottom of the board) and platform-board connectors P4 and P5. Reposition the plastic standoffs as necessary, then snap the corners of the EM onto the standoffs.

At this point, you are ready to make cable connections, as necessary, and restore power. For instructions, consult the HC11EVS operations manual (HC11EVSOM/D).

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