M68EML08APUM
Rev A, 03/2005

M68EML08AP
User's Manual

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User's Manual — M68EML08AP User's Manual

M68EML08AP Quick Start Guide

M68EML08AP Emulator Module (EML08AP) can be part of three HC08 processor family development systems: the Freescale In-Circuit Emulator Base (FSICEBASE); the MMDS0508 Motorola Modular Development System (MMDS) and the MMEVS0508 Evaluation System (MMEVS). This quick start guide is for connecting to the FSICEBASE only.

Make sure that power is disconnected from your EML08AP and from your target system. Then follow these quick-start steps to make your M68EML08AP ready for use as quickly as possible.

1 - Set Header Jumpers

Jumper headers J4 specify the ground source for the VSSA in analog module.

- Place the jumpers between pins 2 and 3 (factory default) on headers J4 to specify the on-board GND for the AP64/AP64A MCU VSSA in analog module
- Place the jumpers between pins 1 and 2 on headers J4 to specify the target systen ground from target connector P3(7) for the AP64/AP64A MCU VSSA in analog module.

Jumper header J8 specifies the clock source for the MCU when you enable its external clock.

- Place the jumper between pins 5 and 6 of header J8 (factory default) to specify the debugger-controlled oscillator from the FSICEBASE.
- Place the jumper between pins 1 and 2 to specify the 32 MHz on-board crystal oscillator.
- Place the jumper between pins 3 and 4 to specify the 32.768 KHz on-board crystal oscillator.
- Place the jumper between pins 7 and 8 to specify the on-board oscillator socket which can be populated with an oscillator of a different value.

Jumper headers J9 specify the MCU family to be emulated on M68EML08AP.

- Place the jumper between pins 1 and 2 of header J9 (factory default) to specify AP8A/16A/32A/64A MCU emulation
- Remove the jumper between pins 1 and 2 of header J9 to specify AP8/16/32/64 MCU emulation

Jumper headers J10 specify the CGMXFC filter for CGM module.

- Place the jumpers between pins 2 and 3 (factory default) on headers J10 to specify the on-board CGMXFC filter for AP64A MCU
- Place the jumpers between pins 1 and 2 on headers J10 to specify the on-board CGMXFC filter for AP64 MCU

2 - Install the Emulation Module into the Development System

To install the EML08AP in a Freescale In-Circuit Emulator Base (FSICEBASE), take the following steps:

- Power off the FSICEBASE.
- Fit together EM connectors J1 and J2 (on the bottom of the EM board) and the mating connectors on the top of the FSICEBASE box, respectively. The other connectors on the top of the FSICEBASE are not used with this EM.

3 - Connect the Emulation Module to the Target System

Use the supplied target flex cable, appropriate target head adapter, and surface mount adapter to connect the emulation module to your target system.

When the EML08AP is in a FSICEBASE:

- Plug the appropriate end of the flex cable plugs into EML08AP connectors P2 & P3.
- Plug the free end of the flex cable into the target head.
- Solder the appropriate surface mount adapter to your target if necessary. Plug the target head into the surface mount adapter on your target system.

4 - Install the Development Software

Please refer to the software manual (Code Warrior IDE or P&E) for proper installation onto your PC.

5 - Copy Personality Files to your Computer

The factory ships MC68HC908AP16 and MC68HC908AP64A MCU family personality files on the documentation CD-ROM.

- If you will be using the CodeWarrior IDE development software, copy personality files `00E42Vxx.MEM`, `00E43Vxx.MEM` and `00E44Vxx.MEM` from the documentation CD-ROM to the `...\prog\mem` subdirectory of the CodeWarrior IDE installation directory.
- If you will be using the P&E development system, copy personality files `00642Vxx.MEM`, `00643Vxx.MEM and 00644Vxx.MEM` from the documentation CD-ROM to the installation directory that contains file `MMDS08.EXE or MMEVS08.EXE`.

6 - Connect FSICEBASE to your Computer and Re-apply Power

There are three ways to connect a host computer to the FSICEBASE:

- directly from the USB port of a host computer to the FSICEBASE USB port
- directly from the Ethernet port of a host computer to the FSICEBASE Ethernet port (crossover connection)
- from the host computer, through a Local Area Network (LAN), to the FSICEBASE Ethernet port (straight-through connection)

The following steps are the details of connecting your host computer directly to FSICEBASE using the USB port. Please refer to **Section 2.4.1**. for the details of connecting FSICEBASE using the Ethernet port.

- Make sure power supply is not connected to FSICEBASE
- Connect square-shaped end of USB cable to FSICEBASE
- Connect other end of USB cable to host computer

NOTE: *You must first install the CodeWarrior software for your PC to properly recognize the FSICEBASE USB device.*

Make sure that cable connections between your development system and your computer are sound before re-applying power.

- Reconnect power supply to FSICEBASE.

You are now ready to use your EML08AP. This completes the quick start for your EML08AP.

Section 1. General Information

1.1 Introduction

This user's manual explains the connection and configuration of the Motorola M68EML08AP Emulator Module (EML08AP).

The M68EML08AP emulator module (EML08AP) is a low-voltage emulator operating in the range 2.7 to 5 Vdc (5V only for MC68HC908AP64A). It makes possible the emulation and debugging of target systems based on MC68HC908AP64 and MC68HC908AP64A HC08 microcontroller family.

The EML08AP can be part of three development systems. This section describes those systems and explains the layout of the EML08AP.

1.2 Development Systems

Your EML08AP can be part of three HC08 processor family development systems: the Freescale In-Circuit Emulator base (FSICEBASE); the MMDS0508 Motorola Modular Development System (MMDS) and the MMEVS0508 Evaluation System (MMEVS). Refer to the specific development system user's manual for more information.

1.2.1 Freescale In-Circuit Emulator Base

A FSICEBASE is functionally similar to the Motorola Modular Development System (MMDS). FSICEBASE is a full-featured development system that provides in-circuit emulation. A complete FSICEBASE system consists of:

Base station — the connectors on the top of the box let you connect an emulation module (EM).

- **An emulator module (EM)** — such as the EML08AP, a separately purchased printed circuit board that enables system functionality for a specific set of MCUs. The EM fits onto the FSICEBASE and has connectors for the target cable and for cables to a logic analyzer.
- **Crossover Ethernet cable, Straight-through Ethernet cable or Universal Serial Bus (USB) cable** — cables that connect the base station to the host computer ethernet or USB port.

- **Bus state analyzer logic clip cable assemblies** — twisted-pair cables and hooks that connect the station module to your target system. One end of each cable assembly has a molded connector, which fits into FSICEBASE. Leads at the other end of each cable terminate in female probe tips. Hooks come with the cables.
- **System software** — CodeWarrior development software.
- **Documentation** — a Freescale In-Circuit Emulator Base manual and the online Help and PDFs.

Substituting a different EM enables your FSICEBASE to emulate target systems based on different MCUs or MCU families. (Your Freescale representative can explain all the EMs available.).

1.2.2 Motorola Modular Development System

An MMDS is an emulator system that provides a bus state analyzer and real-time memory windows for designing and debugging a target system. A complete MMDS consists of:

- **A station module** — the metal MMDS enclosure, containing the platform board and the internal power supply. Most system cables connect to the MMDS station module.
- **An emulator module (EM)** — such as the EML08AP, 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 removable panel in the enclosure top. The EM has connectors for a target cable and for cables to a logic analyzer. The cable runs to an optional target system through an aperture in the station-module enclosure, to connect directly to the emulator module.
- **Two logic clip cable assemblies** — two twisted-pair cables that connect the station module to your target system, a test fixture, 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 and may be attached to the female probe tips.
- **A 9-lead RS-232 serial cable** — the cable that connects the MMDS to the host computer RS-232 port.
- **System software** — CodeWarrior development software.

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

You could select the MMDS baud rate in the system software: 1200, 2400, 4800, 9600, 19200, 38400, or 57600.

Substituting a different EM enables your MMDS to emulate target systems based on different MCUs or MCU families. (Your Freescale representative can explain all the EMs available.)

1.2.3 Motorola Modular Evaluation System

An MMEVS is an economical tool for designing, debugging, and evaluating target systems. The system described here is the MMEVS0508. 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 the the terminal or host computer.
- **An emulator module (EM)** — such as the EML08AP, a separately purchased printed circuit board that enables system functionality for a specific set of MCUs. The EM fits onto the PFB and has connectors for the target cable and for cables to a logic analyzer.
- **A 9-to-25-pin adapter** — a molded assembly that lets you connect the 9-pin cable to a 25-pin serial port.
- **A 9-lead RS-232 serial cable** — the cable that connects the station module to the host computer RS-232 port.
- **System software** — CodeWarrior development software.
- **MMEVS0508 documentation** — an MMEVS operations manual (MMEVSOM/D) and the appropriate EM user's manual.

An MMEVS features automatic baud rate selection: 2400, 4800, 9600, 19200, 38400, or 57600.

Substituting a different EM enables your MMEVS to emulate target systems based on different MCUs or MCU families. (Your Freescale representative can explain all the EMs available.).

1.3 System Requirements

Proper board operation requires a host computer with the following minimum specifications:

- Processor — 200 Mhz Pentium® II processor or AMD-K6® processor
- Operating System — Microsoft® Windows 2000/XP®
- RAM — 128MB
- Hard drive space — Compact software installation: 232MB, Full software installation: 344MB
- USB port or Ethernet Port to connect host computer to the FSICEBASE
- RS-232 serial port to connect host computer to the MMDS or MMEVS

1.4 EML08AP Layout

Figure 1-1 shows the layout of the EML08AP:

- Jumper header J8 specifies the clock signal source.
- Jumper header J9 specifies the MCU family.
- Jumper header J10 specifies the CGMXFC filter.
- Jumper headers J4 specify the ground source for analog modules on the M68EML08AP.
- Target interface connectors P2 and P3 connect the EML08AP to a target system via the included target cable assembly. If you use your EML08AP as part of an MMDS, run the target cable assembly through the slit in the station module enclosure.
- Connector P1 connects to a logic analyzer.
- DIN connectors J1 and J2, on the bottom of the board connect the EML08AP to the FSICEBASE, MMDS, or MMEVS.
- The emulation MCU (AP64 or AP64A) is installed in a 48 LQFP clamshell socket at location U11.
- The FPGA U26 is the logic control of the emulation modules on the EML08AP.
- Jumper header J7 is used for EM board design and factory use only.

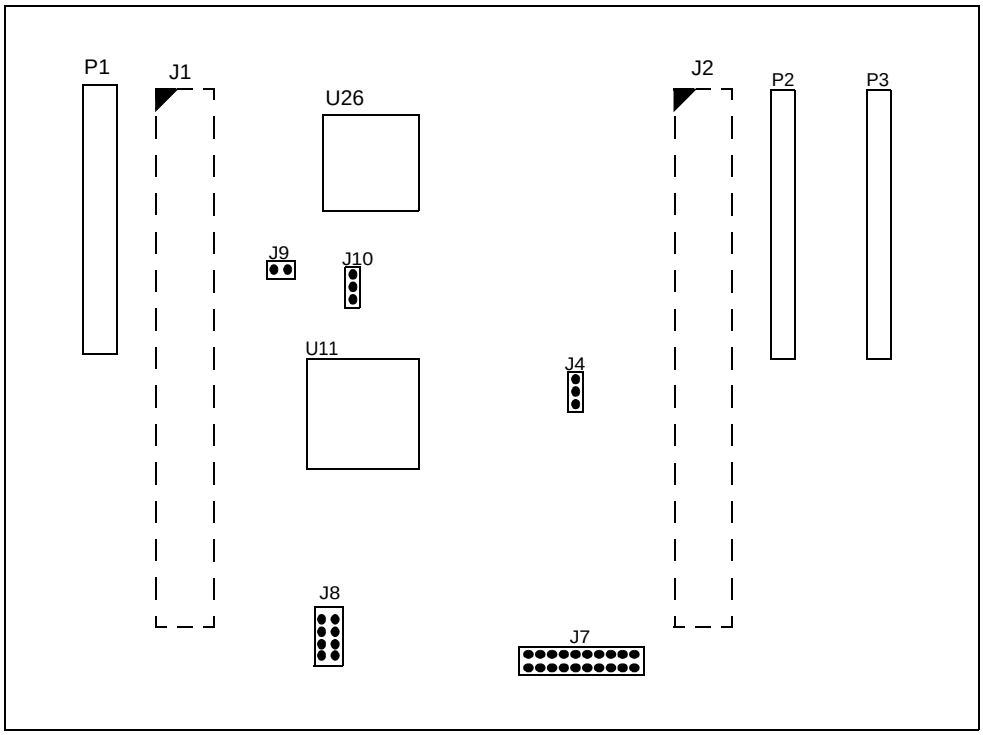


Figure 1-1 M68EML08AP Emulator Module

1.5 Specifications

Table 1-1 lists EML08AP specifications

Table 1-1 Specifications

Characteristic	Specifications
Maximum Clock speed	28 MHz at 5V***, 16 MHz at 3V (For AP64 family only)
Temperature operating storage	 -10° to +50° C -40° to +85° C
MCU Extension I/O	HCMOS Compatible at MCU voltage (5V or 3V)
Relative humidity	0 to 90% (noncondensing)
Power requirements	5VDC supplied from the FSICEBASE, MMDS or MMEVS
Dimensions	5.5 X 7.68 X 0.83 inches (140 x 195 x 21 mm)

*** Please refer to Section2.3 for the bus speed limitation on EML08AP.

1.6 Target Cable Assemblies

To connect your EML08AP to a target system, you need the included target cable and adapters shown in Figure 1-2.

The cable assembly for a 48-pin thin quad flat pack (LQFP) package consists of: a flex cable, a target head adapter, a socket-saver and a LQFP surface mount adapter.

One end of the target cable plugs onto EML08AP connectors P2 and P3. The other end of the flex cable plugs onto the target head adapter, which plugs onto the LQFP surface mount adapter.

You should solder the LQFP surface mount adapter directly onto the target-system board in place of the MCU.

The socket-saver goes between the target head adapter and surface mount adapter. If you use the socket-saver, it will reduce wear on the target head adapter. After many insertions, you can replace the socket-saver without replacing the entire target head adapter.

Table 1-2 lists the target cable and head part numbers that are appropriate for the EML08AP.

Table 1-2 EML08AP Target Cable and Head Assemblies

MCU Package	Flex Cable Part Number	Target Head Adapter Part Number	Surface Mount Adapter Part Number	Socket-Saver Part Number
42-pin SDIP	M68CBL05B	M68TB08AP64B42	None	None
44-pin QFP	M68CBL05C	M68TC08AP64FB44	M68TQP044SAMO1	M68TQS044SAG1
48-pin LQFP	M68CBL05C	M68TC08AP64FA48	M68TQP048SD1	M68TQS048SDG1

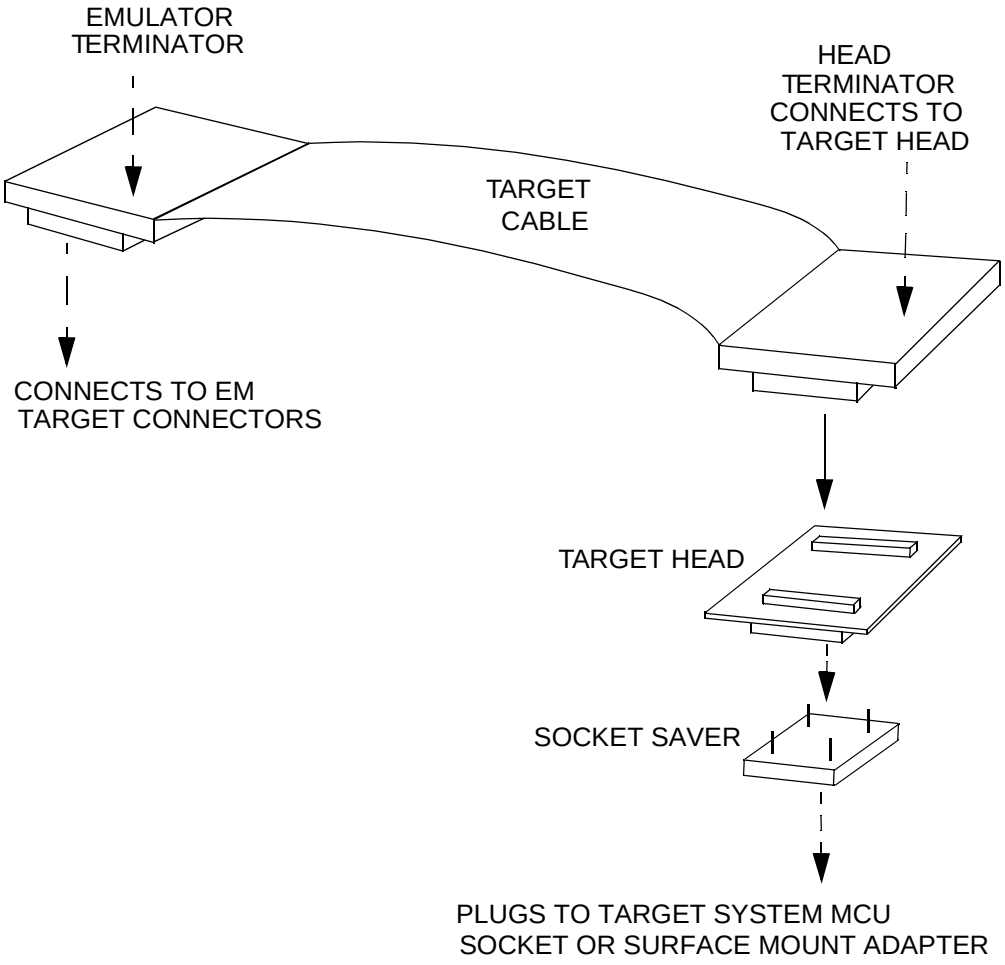


Figure 1-2 Target Cable Assembly

Section 2. Preparation and Operation

2.1 Introduction

This section explains EML08AP preparation: how to set board jumpers and how to make system connections.

Note that you can reconfigure an EML08AP already installed in FSICEBASE. To do so, switch off the FSICEBASE and target power, then follow the guidance of this section. Similarly, you can reconfigure an EML08AP already installed on the MMDS station module or MMEVS platform board. For MMDS, switch off station-module power and target power and remove the panel, for MMEVS, disconnect platform-board power and target power, follow the guidance of this section.

CAUTION: ESD Protection

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

2.2 Configuring Board Components

Table 2-1 is a summary of configuration settings.

Table 2-1 Configuration Components

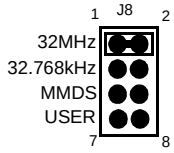
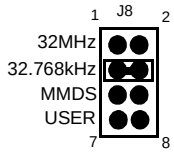
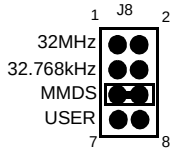
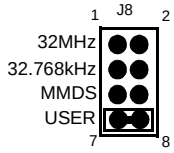
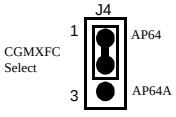
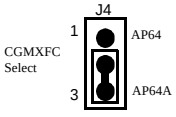
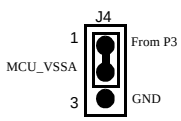
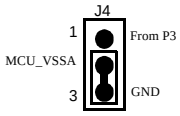
Component	Position	Effect
Clock Select Header, J8 (Use only one jumper in this header.)		**32MHz:** Specifies the clock signal from the 32 MHz on board crystal oscillator.
		**32.768kHz:** Specifies the clock signal from the 32.768 kHz on board crystal oscillator.
		**MMDS:** Specifies the oscillator clock signal from the FSICEBASE, MMEVS or MMDS. **Factory setting**
		**USER:** Specifies the clock signal from the user-supplied oscillator of the EM board at U12.
CGMXFC Select Header, J10		**AP64:** Specifies the CGMXFC filter for AP64 MCU family.
		**AP64A:** Specifies the CGMXFC filter for AP64A MCU family. **Factory setting** Note: Please select the CGMXFC filter correspond to MCU family on J9
MCU VSSA Select Header, J4		**VSSA:** Specifies the AP64/AP64A MCU VSSA from target system (VSSA) on target connector P3(7).

Table 2-1 Configuration Components (Continued)

Component	Position	Effect
		**GND:** Specifies the AP64 MCU VSSA from on board GND. **Factory setting**
MCU Select Header, J9		**AP64A:** Specifies AP64A MCU family emulation **Factory setting** Note: Please select the MCU family correspond to CGMXFC filter on J10
		**AP64:** Specifies AP64 MCU family emulation

2.3 Limitations

Limitations listed here apply to using your EML08AP emulator, as opposed to using the actual MCU in your target system:

Limitation 1 - Continuous Autoscan Mode in ADC module:

The emulator may not be able to obtain correct ADC conversion value on ADC channel ATD0 to ATD3 if the ADC module is configured in continuous autoscan mode.

Limitation 2 - Low voltage inhibit interrupt in LVI module:

The emulator can not emulate the LVI interrupt in AP64/AP64A LVI module.

Limitation 3 - Frequency Limitation below nominal supply voltages at 5V

Every effort has been made in the design of the EML08AP emulator to provide emulation over the full frequency range of the MCU however limitations exist at the high end of the frequency range.

The emulator module will likely not be able to operate at the 32MHz clock frequency as specified for the MCU at a supply voltage of 5V. The most common symptom is unreliable memory accesses. Since the program is in memory a typical manifestation of the symptom is an inability to load code or data or to execute code.

Maximum emulator module frequency is affected by emulator module supply voltage. Raising the emulator module supply voltage will increase the maximum operating frequency. You may check the emulator module supply voltage by measuring between P2 pin 6 (LVDD) and P2 pin 1 (GND).

The emulation module power supply tracks the voltage in the target system so raising the target voltage will raise the emulation module voltage. It may not be possible to obtain obtain 32MHz operation even at the maximum specified operating voltage of 5.5V. Do not exceed 5.5V for the emulator module. (If the emulator is not connected to a target system the emulation module runs at at an internally fixed nominal voltage of 5V.)

2.4 Remaining System Installation

Once you have configured the jumper headers, you are ready to complete EML08AP installation.

2.4.1 FSICEBASE Installation

To install the EML08AP on a FSICEBASE system, fit together EM connectors P2 and P3 (on the bottom of the EM board) and the mating connectors on the top of the FSICEBASE box, respectively. The other connectors on the top of the FSICEBASE are not used with this EM.

There are three ways to connect a host computer to the FSICEBASE, they are

1. directly from the USB port of a host computer to the FSICEBASE USB port:
   a. Make sure power supply is not connected to FSICEBASE
   b. Connect square-shaped end of USB cable to FSICEBASE
   c. Connect other end of USB cable to host computer

NOTE: *You must first install the CodeWarrior software for your PC to properly recognize the FSICEBASE USB device.*

2. directly from the Ethernet port of a host computer to the FSICEBASE Ethernet port (crossover connection)

   If you are using an Ethernet connection to connect your host computer directly to the FSICEBASE (not through a LAN):

   a. Make sure power supply is not connected to FSICEBASE
   b. Connect one end of Ethernet cable to Ethernet port of FSICEBASE (make sure to use the cross-over Ethernet cable when connecting directly to a Network Interface Card (NIC))
   c. Connect other end of Ethernet cable to host computer

NOTE: *The host computer (PC) must have an assigned IP address and a subnet mask that matches the FSICEBASE.*

3. from the host computer, through a Local Area Network (LAN), to the FSICEBASE Ethernet port (straight-through connection)
   a. Connect host computer to LAN

b. Connect FSICEBASE to LAN

i. Make sure power supply is not connected to FSICEBASE

ii. Connect one end of Ethernet cable to Ethernet port of FSICEBASE (make sure to use the straight-through Ethernet cable when connecting to LAN)

iii. Connect other end of Ethernet cable to Local Area Network (LAN)

NOTE: *To complete the connection through a LAN, you will need to obtain the IP address, subnet mask, and default gateway information from your network administrator. You will use this information in a later step.*

You will need to connect power supply to FSICEBASE as follow:

- Connect round end of 5-volt power cord to barrel connector on FSICEBASE
- Plug power supply into surge-protected strip
- Connect surge-protected strip to AC outlet

Make sure that cable connections between your development system and your computer are sound. Switch power switch to on. The Power and Ready LED lights after the base station finished start-up sequence.

There are three status LEDs on the box: busy, ready, and error. The FSICEBASE base station takes about 5-10 seconds to start up. After powering the unit, you must wait for the ready LED to light before attempting to communicate.

The FSICEBASE is now ready to accept communication with a host computer. You will need to install the CodeWarrior software, create a project, and start the debugger to establish communication between your host computer and the FSICEBASE.

2.4.2 MMDS Installation

To install the EML08AP in an MMDS0508 station module:

- Remove the panel from the station module top
- Fit together EM connectors J1 and J2 (on the bottom of the board) and platform-board connectors P11 and P12, respectively.

- Snap the corners of the EM onto the plastic standoffs.
- Connect the target cable, if appropriate, then replace the panel.

If your EML08AP is already installed in the station module:

- Reconnect the target cable (if necessary)
- Replace the panel

2.4.3 MMEVS Installation

To install the EML08AP on an MMEVS platform board:

- Fit together EM connectors J1 and J2 (on the bottom of the board) and platform-board connectors P6 and P7, respectively.
- Snap the corners of the EM onto the plastic standoffs
- Connect the target cable, if appropriate.

2.4.4 CodeWarrior Software Installation

If you will be using the CodeWarrior IDE development software, you must copy the personality file `00E42Vxx.MEM, 00E43Vxx.MEM and 00E44Vxx.MEM` from the documentation CD-ROM to the `...\prog\mem` subdirectory of the CodeWarrior IDE installation directory.

Additionally, if you will be using CodeWarrior IDE development software, you will need to copy the EML08AP register file `MCU0E42.REG`, `MCU0E43.REG and MCU0E44.REG` from the documentation CD-ROM to the `...\prog\reg` subdirectory of the CodeWarrior IDE installation directory.

The CodeWarrior IDE uses these files to implement optional functionality such as letting you view or modify register contents by name rather than by address.

A register file is an ASCII text file, which you may customize. The CodeWarrior IDE user's manual explains how to create and use such files.

2.4.5 P & E Software Installation

If you will be using the P&E development system, you must copy the personality file 00642Vxx.MEM, 00643Vxx.MEM and 00644Vxx.MEM from

the documentation CD-ROM to the installation directory that contains file MMDS08.EXE or MMEVS08.EXE.

2.4.6 Finish Installation

At this point, you are ready to make any remaining cable connections and re-apply power. For specific instructions, consult the FSICEBASE, MMDS or MMEVS operations manual.

Section 3. Support Information

3.1 Introduction

This section consists of connector pin assignments, connector signal descriptions, and other information that may be useful in your development activities.

3.2 Logic Analyzer Connector (P1)

Connector P1 is the EML08AP logic analyzer connector. **Figure 3-1.** shows the pin assignments for connector P1. **Table 3-1** gives the signal descriptions.

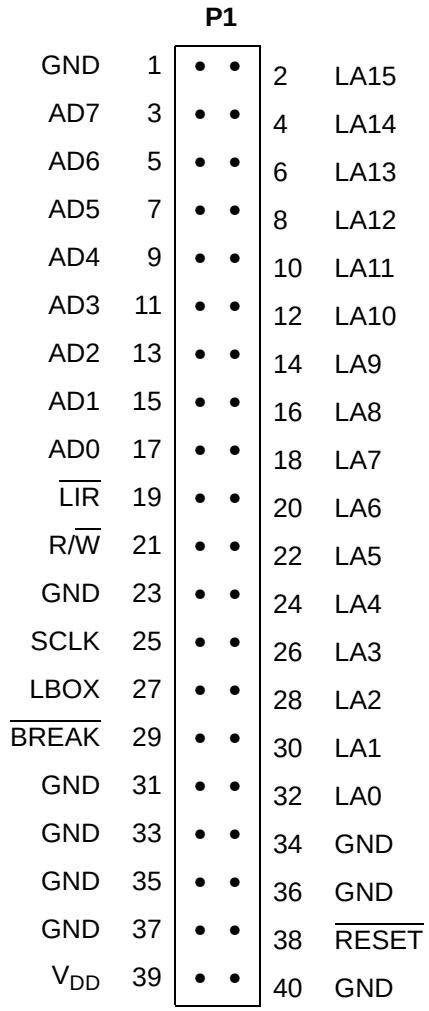


Figure 3-1. Logic Analyzer Connector (P1) Pin Assignments

Table 3-1 Logic Analyzer Connector (P1) Signal Descriptions

Pin	Mnemonic	Signal Description
1	GND	GROUND
2	LA15	Address bus bit 15 — MCU output address bus
3	AD7	Data bus bit 7 — MCU bidirectional data bus
4	LA14	Address bus bit 14 — MCU output address bus
5	AD6	Data bus bit 6 — MCU bidirectional data bus
6	LA13	Address bus bit 13 — MCU output address bus
7	AD5	Data bus bit 5 — MCU bidirectional data bus
8	LA12	Address bus bit 12 — MCU output address bus
9	AD4	Data bus bit 4 — MCU bidirectional data bus
10	LA11	Address bus bit 11 — MCU output address bus
11	AD3	Data bus bit 3 — MCU bidirectional data bus
12	LA10	Address bus bit 10 — MCU output address bus
13	AD2	Data bus bit 2 — MCU bidirectional data bus
14	LA9	Address bus bit 9 — MCU output address bus
15	AD1	Data bus bit 1 — MCU bidirectional data bus
16	LA8	Address bus bit 8 — MCU output address bus
17	AD0	Data bus bit 0 — MCU bidirectional data bus
18	LA7	Address bus bit 7 — MCU output address bus.
19	$\overline{\text{LIR}}$	Load instruction register — Active-low output signal, asserted when an instruction starts
20	LA6	Address bus bit 6 — MCU output address bus
21	R/$\overline{\text{W}}$	Read/Write — Output signal that indicates the direction of data transfer
22	LA5	Address bus bit 5 — MCU output address bus
23	GND	GROUND
24	LA4	Address bus bit 4 — MCU output address bus
25	SCLK	System clock — Internally generated output clock signal used as a timing reference
26	LA3	Address bus bit 3 — MCU output address bus

Table 3-1 Logic Analyzer Connector (P1) Signal Descriptions

Pin	Mnemonic	Signal Description
27	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
28	LA2	Address bus bit 2 — MCU output address bus
29	$\overline{\text{BREAK}}$	Active low signal that the EM asserts to stop the target system MCU from running user code
30	LA1	Address bus bit 1 — MCU output address bus
31	GND	GROUND
32	LA0	Address bus bit 0 — MCU output address bus
33	GND	GROUND
34	GND	GROUND
35	GND	GROUND
36	GND	GROUND
37	GND	GROUND
38	$\overline{\text{RESET}}$	Active-low bidirectional signal for starting an EVS reset
39	V_{DD}	Input voltage (+5 Vdc @ 1A (max)) used by the EM logic circuits
40	GND	GROUND

3.3 Target Connectors (P2 and P3)

Figure 3-2. shows the pin assignments for connectors P2 and P3. **Table 3-2.**, and **Table 3-3.** give the signal descriptions for these pins.

Figure 3-2. Target Connectors (P2 and P3) Pin Assignments

Table 3-2. Target Connector (P2) Signal Descriptions

Pin	Mnemonic	Signal Description
1	GND	Ground signal of the EM board
2	VDD	5V DC HIGH — Used for factory testing only
3	PTC5	PORT C (bit 5) — General-purpose I/O lines controlled by software via data direction and data registers
4	GND	Ground signal of the EM board
5	PTC6	PORT C (bit 6) — General-purpose I/O lines controlled by software via data direction and data registers
6	LVDD	AP64EM Voltage HIGH — Used for factory testing only
7-10	NC	No connect
11	PTA3	PORT A (bit 3) — General-purpose I/O lines controlled by software via data direction and data registers
12	NC	No connect
13	PTA1	PORT A (bit 1) — General-purpose I/O lines controlled by software via data direction and data registers
14-15	NC	No connect
16	PTB6	PORT B (bit 6) — General-purpose I/O lines controlled by software via data direction and data registers
17	NC	No connect
18	PTB4	PORT B (bit 4) — General-purpose I/O lines controlled by software via data direction and data registers
19	GND	Ground signal of the EM board
20	NC	No connect
21	PTC2	PORT C (bit 2) — General-purpose I/O lines controlled by software via data direction and data registers
22	PTD6	PORT D (bit 6) — General-purpose I/O lines controlled by software via data direction and data registers
23	NC	No connect
24	GND	Ground signal of the EM board
25	PTD7	PORT D (bit 7) — General-purpose I/O lines controlled by software via data direction and data registers
26	PTB3	PORT B (bit 3) — General-purpose I/O lines controlled by software via data direction and data registers
27	NC	No connect

Table 3-2. Target Connector (P2) Signal Descriptions

Pin	Mnemonic	Signal Description
28	PTB1	PORT B (bit 1) — General-purpose I/O lines controlled by software via data direction and data registers
29	NC	No connect
30	PTD3	PORT D (bit 3) — General-purpose I/O lines controlled by software via data direction and data registers
31	NC	No connect
32	$\overline{\text{RESET}}$	Active-low bidirectional control line that initializes the MCU
33	NC	No connect
34	$\overline{\text{IRQ}}$	INTERRUPT REQUEST — Active-low input line for requesting MCU asynchronous non-maskable interrupt
35	NC	No connect
36	GND	Ground signal of the EM board
37	NC	No connect
38	GND	Ground signal of the EM board
39	NC	No connect
40	GND	Ground signal of the EM board

Table 3-3. Target Connector (P3) Signal Descriptions

Pin	Mnemonic	Signal Description
1	NC	No connect
2	PTC3	PORT C (bit 3) — General-purpose I/O lines controlled by software via data direction and data registers
3	PTA5	PORT A (bit 5) — General-purpose I/O lines controlled by software via data direction and data registers
4	PTD0	PORT D (bit 0) — General-purpose I/O lines controlled by software via data direction and data registers
5	PTC4	PORT C (bit 4) — General-purpose I/O lines controlled by software via data direction and data registers
6	EV_{DD}	Target system Voltage high
7	V_{SSA}	Analog Module Power Ground
8	NC	No connect
9	GND	Ground signal of the EM board
10	NC	No connect
11	PTA4	PORT A (bit 4) — General-purpose I/O lines controlled by software via data direction and data registers
12	NC	No connect
13	PTA2	PORT A (bit 2) — General-purpose I/O lines controlled by software via data direction and data registers
14	GND	Ground signal of the EM board
15	NC	No connect
16	PTB7	PORT B (bit 7) — General-purpose I/O lines controlled by software via data direction and data registers
17	PTC7	PORT C (bit 7) — General-purpose I/O lines controlled by software via data direction and data registers
18	PTB5	PORT B (bit 5) — General-purpose I/O lines controlled by software via data direction and data registers
19	PTA0	PORT A (bit 0) — General-purpose I/O lines controlled by software via data direction and data registers
20	NC	No connect
21	PTC1	PORT C (bit 1) — General-purpose I/O lines controlled by software via data direction and data registers
22	PTC0	PORT C (bit 0) — General-purpose I/O lines controlled by software via data direction and data registers

Table 3-3. Target Connector (P3) Signal Descriptions

Pin	Mnemonic	Signal Description
23	PTA7	PORT A (bit 7) — General-purpose I/O lines controlled by software via data direction and data registers
24	PTD5	PORT D (bit 5) — General-purpose I/O lines controlled by software via data direction and data registers
25	PTA6	PORT A (bit 6) — General-purpose I/O lines controlled by software via data direction and data registers
26	PTD4	PORT D (bit 4) — General-purpose I/O lines controlled by software via data direction and data registers
27	GND	Ground signal of the EM board
28	PTB2	PORT B (bit 2) — General-purpose I/O lines controlled by software via data direction and data registers
29	NC	No connect
30	PTB0	PORT B (bit 0) — General-purpose I/O lines controlled by software via data direction and data registers
31	NC	No connect
32	GND	Ground signal of the EM board
33	NC	No connect
34	PTD2	PORT D (bit 2) — General-purpose I/O lines controlled by software via data direction and data registers
35	NC	No connect
36	PTD1	PORT D (bit 1) — General-purpose I/O lines controlled by software via data direction and data registers
37	NC	No connect
38	GND	Ground signal of the EM board
39	NC	No connect
40	GND	Ground signal of the EM board

3.4 Board Factory Test Connector J7

Place the jumper between pins 7 and 8 of header J7. Factory tests use this connector. The setting of J7 must not be changed.

3.5 Clock Oscillator U12

When you select the USER option on header J8 by placing a jumper on pins 7-8, the clock signal generated by the clock oscillator at U12 is supplied to the external clock inputs of the MCU. You can replace the clock oscillator U12 with another compatible 5V clock oscillator to provide a different clock frequency.

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