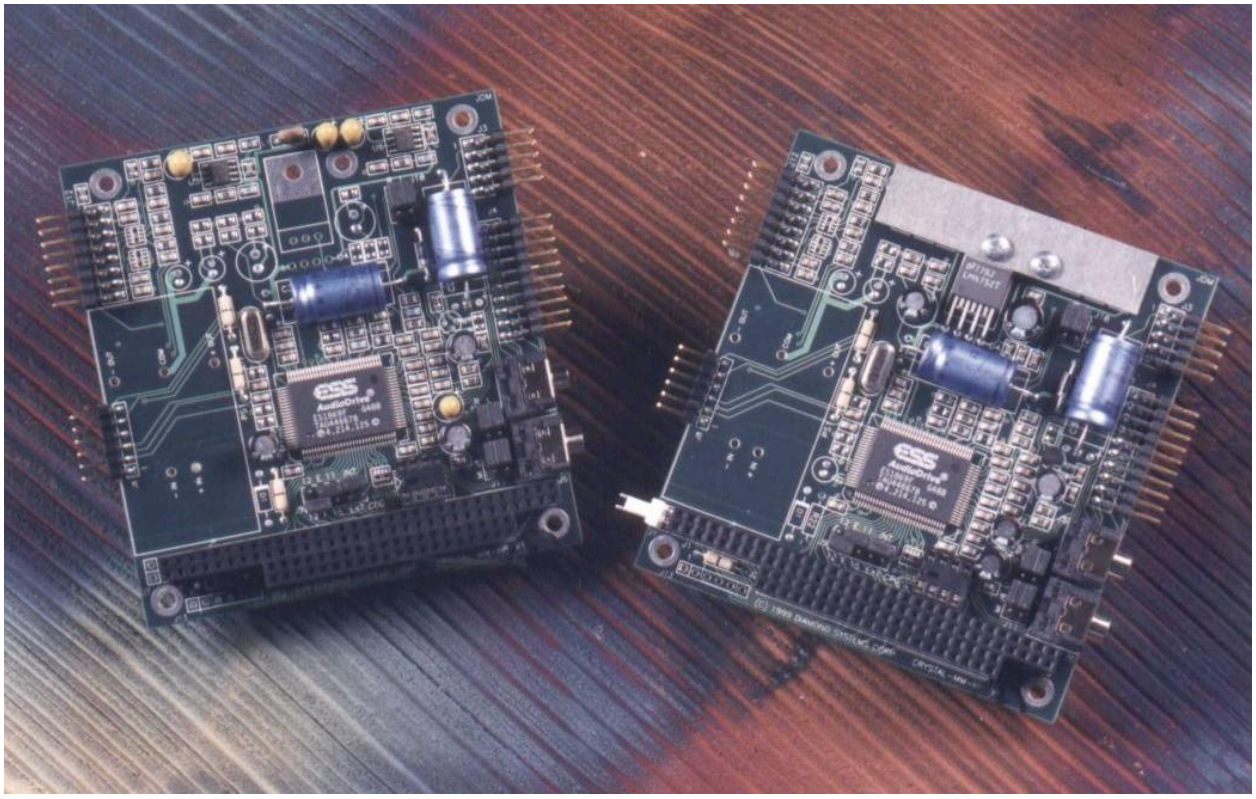
DIAMOND SYSTEMS CORPORATION

CRYSTAL-MM-HP

PC/104 Format
SoundBlaster Pro Compatible
High-Power Stereo Audio Module

User Manual V2.0



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1. Features and Specifications

Crystal-MM-HP is a dual-channel audio module for PC/104 embedded systems. It provides 16-bit stereo recording and playback with sample rates up to 44.1kHz. Features include full-duplex (simultaneous record and playback) capability, plug and play configuration, multiple input and output channels, multiple input and output user connection options, on-board 6-channel mixer, and built-in 20-voice FM synthesizer compatible with the Yamaha OPL3. The board can also perform ADPCM compression and decompression of .WAV files. The board uses ESS Technology Inc.'s ES1868/1869 AudioDrive chip.

Inputs include stereo line in, stereo CD in (connected to auxiliary input), mono microphone in, and mono PC speaker in. Outputs include stereo line out, stereo amplified speaker out, and analog version of PC speaker out.

Crystal-MM-HP provides full SoundBlaster Pro™ and Windows Sound System™ compatibility and will operate with applications designed for those environments. Software drivers and applications from ESS Technology are included for Windows 95™, 98™, and NT™.

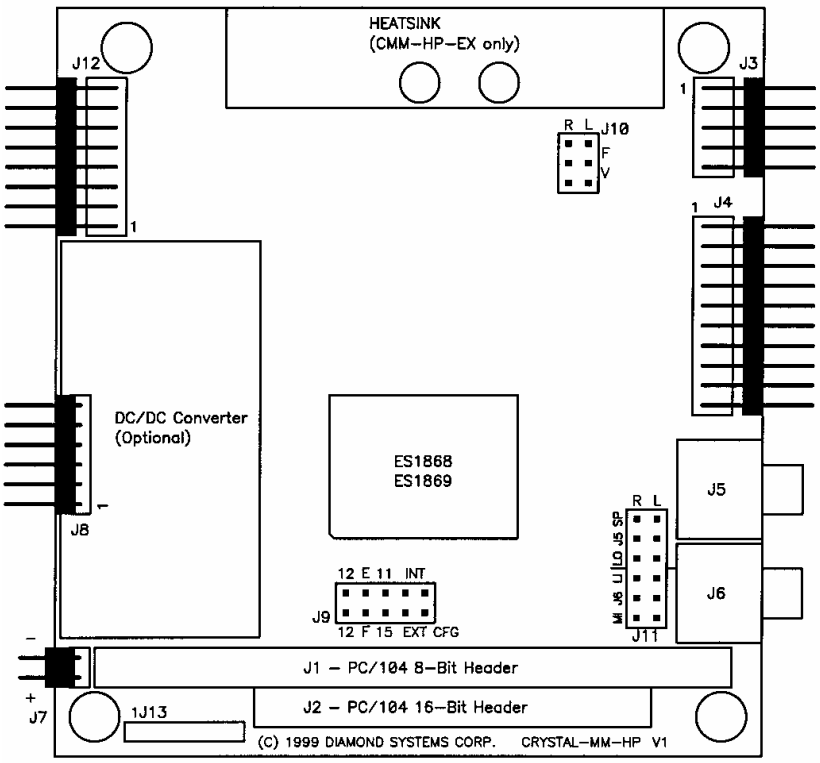
Crystal-MM-HP requires +5V from the PC/104 bus. Output power is 0.5W RMS per channel into 8Ω.

CMM-HP-EX contain a heatsink to dissipate the higher levels of heat generated by the higher output levels of the audio amplifier. This heatsink fits within the envelope of the PC/104 specification and will provide ample clearance for stacking a board above.

Features

SoundBlaster, SoundBlaster Pro, Windows Sound System compatibility
Full duplex capability
Plug and play configuration
4KHz to 44.1KHz sample rates
16-bit and 8-bit stereo recording and playback
On-board ADPCM compression/decompression
Yamaha OPL3 compatible FM music synthesis
Built-in stereo audio power amplifier
Built-in dual PC game port
Manual and/or software volume control
Hardware volume up/down/mute controls
Windows 95, Windows 98, and Windows NT driver and application software included

2. Board Diagram



Legend

J1	PC/104 8-bit bud header
J2	PC/104 16-bit bus header (only used for interrupt level)
J3	Speaker / Volume control
J4	Speaker / Line in / Line out / Mic in / Midi in/out
J5	Speaker / Line out jack
J6	Line in / Mic in jack
J8	PC speaker / Mono I/O
J9	Address / Interrupt / DMA configuration
J10	Volume control selection
J11	Stereo jack configuration
J12	PC dual gameport connector
J13	Alternate PC speaker / Mono I/O connector (not installed)
DC/DC	Provides 24VDC power to audio amplifier (optional)

3. I/O Header and Jack Pinouts

In the header pinouts described below, note that the audio speaker amplifier outputs appear on three headers: J3, J4, and J5. Also note that Line In has two connection points (J4 and J6) and Line Out has two connection points (J4 and J5).

Configuration information for all headers is shown on pages 8-10.

Caution: Only one Speaker connection may be used at one time. If more than one connection is used, the load impedance on the audio amplifier will be too low, and the audio amplifier could be damaged.

Caution: Only one Line In connection may be used at one time. If more than one connection is used, the line impedance will be too low. This could cause distortion or other malfunction.

Caution: Only one Line Out connection may be used at one time. If more than one connection is used, the line impedance will be too low. This could cause distortion or other malfunction.

J3: Speaker connections with optional volume control, 2x5-pin right-angle header

Volume Left Out	1	2	Volume Left In (Wipe)
Analog Ground	3	4	Volume Right Out
Volume Right In (Wipe)	5	6	Analog Ground
Speaker Out Left +	7	8	Analog Ground (Speaker Out L -)
Speaker Out Right +	9	10	Analog Ground (Speaker Out R -)

This header enables the user to control volume with an external stereo 100KΩ potentiometer. The output volume on each channel is directly proportional to the resistance between the wiper for that channel and ground.

J4: Main I/O header, 2x10-pin right-angle header

Speaker Out L +	1	2	Analog Ground (Speaker Out L -)
Speaker Out R +	3	4	Analog Ground (Speaker Out R -)
CD In L	5	6	CD In R
Mic In +	7	8	Analog Ground (Mic in -)
Line In L +	9	10	Aux In L
Line In R +	11	12	Aux In R
Line Out L +	13	14	Analog Ground (Line Out L -)
Line Out R +	15	16	Analog Ground (Line Out R -)
Digital Ground	17	18	Mute Input
Volume Up Input	19	20	Volume Down Input

This header provides connections to all the most commonly used I/O signals on Crystal-MM-HP. The notations next to the various analog ground pins shows the preferred / conventional connections for those signals.

J8 and J13: Mono and PC speaker input/output, standard 1x6-pin right-angle header

PC Speaker Out	1
Mono Out	2
Mono In	3
Agnd	4
PC Speaker In	5
Dgnd	6

This header provides standard PC speaker in (2-pin) and out (4-pin) connections on a single header. The user may connect the PC speaker either to this point or to the main CPU connection point. The Mono In/Out signals are available only on versions of the board with the ES1869 chip.

If **PC Speaker Out** is used on this header, then the main CPU **PC Speaker Out** signal must be connected to **PC Speaker In** on this header. Otherwise there will be no signal on **PC Speaker Out** on this header.

Both J8 and J13 are identical and are wired in parallel. Only one of these locations has a pin header installed, depending on which version of the board you have.

J5 & J6: Stereo 3.5mm jacks

J5: Output Jack

Speaker Out L + or Line Out L +	Tip
Speaker Out R + or Line Out R +	Ring
Agnd (Speaker / Line Out -)	Shield

J6: Input Jack

Line In L + or Microphone in	Tip
Line In R + or NC	Ring
Agnd (Line / Mic In -)	Shield

These jacks are provided for user convenience. Many PC speakers and microphones use standard 3.5mm diameter stereo jacks for connection. The signals appearing on these jacks are controlled by configuration header J11 located immediately to the left of these jacks.

J12: Game port and MIDI I/O

+5V	1	2	+5V
SW A	3	4	SW C
TA	5	6	TC
Ground	7	8	MIDI Out
Ground	9	10	TD
TB	11	12	SW D
SW B	13	14	MIDI In
+5V	15	16	N/C

4. Hardware Configuration

Quick List of Configuration Options

Base address options:	220, 230, 240, 250 Hex; Selected via plug and play configuration
Interrupt levels:	5, 7, 9, 10, 11, 12, 15; Selected via plug and play configuration
DMA levels:	0, 1, 3; Selected via plug and play configuration
Volume control:	A. Full volume, volume controlled in software only. B. External stereo potentiometer control plus software control. Volume control method is selected via jumper setting
Stereo jacks:	Output jack can be either stereo speaker output or stereo line out; Input jack can be either stereo line in or mono microphone in

Address / Interrupt / DMA Configuration

The board's base address, interrupt level, and DMA level are set at driver installation time. Jumper block J9 is used to select which plug and play options are available. The diagram on page 8 explains all the valid jumper settings. For normal installation, select IRQ E = 11, IRQ F = 12, and Internal ROM.

Speaker Configuration

The audio amplifier volume is always controllable in software via the volume control application included, as well as other SoundBlaster Pro compatible volume control software. It can be additionally controlled with an external stereo 100KΩ potentiometer, if desired. J10 selects this option. See page 8 for configuration instructions.

Stereo Jack Configuration

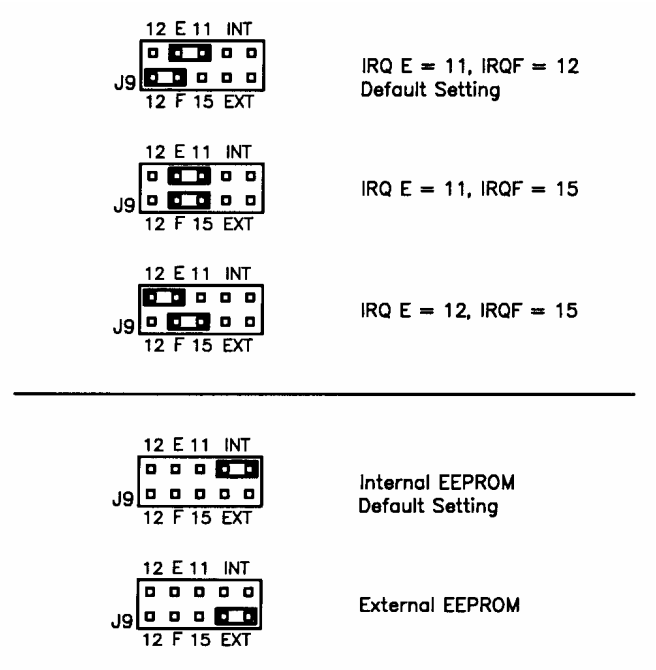
Crystal-MM-HP provides two 3.5mm stereo jacks for convenience. Many PC speakers and microphones use standard 3.5mm diameter stereo jacks for connection. The signals appearing on these jacks are controlled by configuration header J11 located immediately to the left of these jacks near the bottom of the board. Refer to the drawing on page 9 for valid jumper settings.

J5 (upper jack) is the output jack and can be configured for either Speaker Out or Line Out. Both settings are stereo, with the following conventions: Tip = Left, Ring = Right, and Shield = Common.

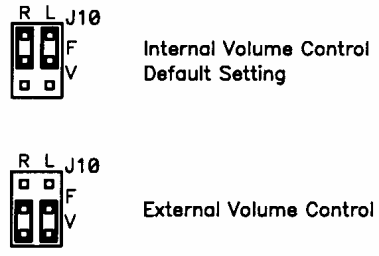
J6 (lower) is the input jack and can be configured for either Line In or Microphone In. Note that Crystal-MM-HP supports only a *mono* microphone input. If a mono microphone is used, then either jumper setting will provide the same connection. If a stereo microphone is used, then either the left or right channel can be used, but not both. For Line In configuration, Tip = Left, Ring = Right, and Shield = Common.

J9: Base Address / Interrupt Level / DMA Level Configuration

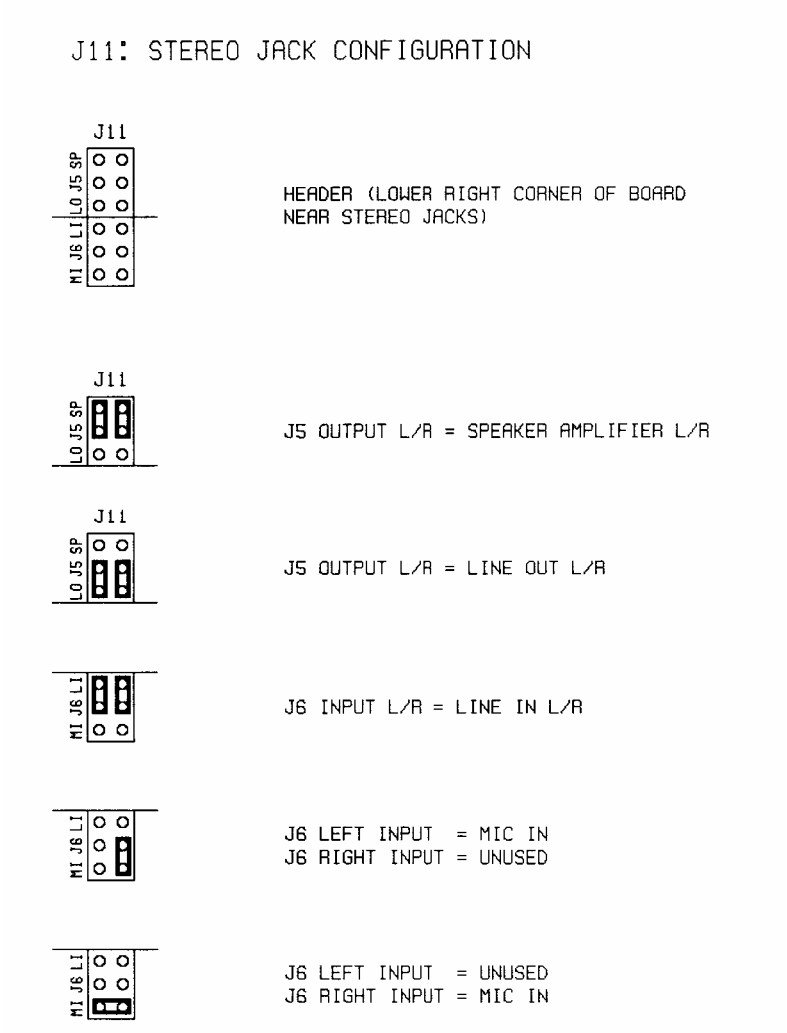
Select one configuration from the upper 3 choices AND one configuration from the lower 2 choices.



J10: Speaker Volume Control Configuration



J11: 3.5mm Stereo Jack Configuration Header



5. Installation

Before installing the board in your computer, make the following configuration selections:

Select the desired interrupt options with jumper block J9.
The default setting is IRQ E = 11, IRQ F = 12.

Select the desired plug and play ROM option with jumper block J9.
The default setting is internal ROM.

Select the desired volume control option with jumper block J10.
The default setting is Internal.

Select the desired stereo jack configuration with jumper block J11.
The default settings are J5 = speaker out, J6 = line in.

Add the board onto your stack and power up.

For DOS, run CMMHPDOS.EXE to extract the DOS configuration utility program ESSCFG.EXE. Follow the instructions in the file readme.txt. The default extract directory is CMMHP\DOS.

For Windows 95, the system should detect the board automatically and install the default ESS driver. Installation procedures will vary from system to system. Windows 95 may or may not ask for the Windows diskettes and may or may not ask for the driver diskette shipped with the board. Note that the driver diskette includes a self-extracting file CMMHPWin95.exe. Run this program to extract the driver files prior to installation of the board. The default extract directory is CMMHP\Win95.

There are three devices seen by Windows 95: The audio board, the game port, and the control device. The control device is used to configure the audio board and game port. On some systems it may be necessary to configure the devices independently in Control Panel / System / Device Manager.

Also remember that since this board is plug and play, the CPU BIOS must support plug and play operations. On some systems, the plug and play features must be enabled in the BIOS setup screens that are accessed at boot time.

6. Specifications

Input and Output Specifications

Mono microphone input:	Input voltage range: Input impedance:	10mV to 125mV p-p 30KΩ min, 100KΩ max
Stereo CD input:	Input voltage range: Input impedance:	0V to 4V p-p 30KΩ min, 100KΩ max
Stereo line / aux inputs:	Input voltage range: Input impedance:	0V to 4V p-p 30KΩ min, 100KΩ max
Stereo line / aux outputs:	Output voltage range: Output impedance:	0V to 3.5V p-p 30KΩ typical
PC speaker input:	TTL input from CPU	
Stereo speaker output:	0.5W per channel into 8Ω	

General Specifications

Dimensions:	PC/104 format: 3.55” x 3.775” L x W
PC/104 Bus:	8 bit J1 header standard, 16-bit J2 header optional (order –B16 version)
Temperature:	-20 to 70^{o}C operating
Power supply:	+5VDC ±5% from PC/104 bus