

SoundMan™ Wave



Advanced technology for the most realistic sound available

For IBM Compatibles

Breakthrough wave table synthesis — coupled with state-of-the-art 16-bit stereo — brings you a whole new standard in true-to-life sound. Now you can enhance your experience of today's popular games and music with a totally realistic new sound dimension. Leading edge wave table technology makes the music in your games and multimedia applications actually sound like real instruments, instead of computer-generated sounds.

Best of all, thanks to SoundMan Wave's unique MIDI interpreter, you can hear superior wave table quality right now — in many of today's hottest games, including X-Wing, 7th Guest and Space Quest 5.

State-of-the-art 16-bit quality for recording and playback The music, narration and effects you record with SoundMan Wave will also have the professional quality of your home stereo CDs. SoundMan Wave actually uses the same 16-bit 44.1 kHz sampling technology used on digitally mastered CDs.

No need to worry about becoming obsolete If you want to move up to surround sound in the future...or add reverb or chorus effects to your music, simply add Logitech's DSP chip upgrade to your SoundMan Wave.

100% Sound Blaster, Sound Blaster Pro, and AdLib compatible Because SoundMan Wave includes a Yamaha OPL4 chip (not an FM emulation used with some boards), you are guaranteed it will work perfectly with any of your games.

Popular SCSI CD-ROM interface

If you're adding a single or double speed CD-ROM drive, SoundMan Wave's widely accepted SCSI interface gives you more options than any other CD-ROM interface.

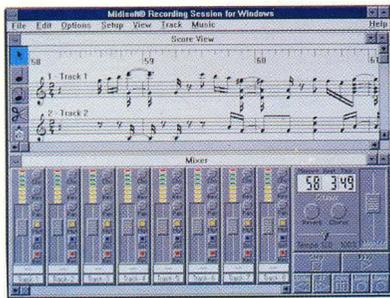
Hardware-based audio compression standards

SoundMan Wave's hardware compression not only meets or exceeds the accepted IMA compression/decompression standard, it also supports ADPCM and CCITT A-Law and u-Law — for dramatic disk space savings without slowing down your computer.

Easy installation SoundMan Wave's sound-enhanced, jumperless installation program makes it the easiest to install.

High quality output SoundMan Wave provides a 6 watt amplified output for great sound when driving headphones or unamplified speakers. Plus, it includes a line out connector for minimum external noise for use with amplified speakers.





Includes valuable bonus software

MCS MusicRack™ from Animation®

Control all Windows 3.1 sound features from a convenient window that looks and works like a home stereo system. The intuitive MCS MusicRack interface makes it all easy. The most complete PC stereo software available, it includes: mixing console; CD software player for CD-ROM drives with audio playback capabilities; digital recorder for recording and editing WAV files; MIDI player.

Recording Session® from Midisoft®

Record, edit and playback MIDI music with this powerful, easy-to-use program. It displays your musical files or performance as standard music notation in real time during recording and playback.

BeSTspeech® ReadOut™ from

Berkeley Speech Technologies Use this high quality text-to-speech utility to read text from OLE applications such as word processing, electronic mail and presentation software. Used with OLE spreadsheets, it makes double checking figures easy.

SoundMan Annotator™ from

Voyetra™ Annotate messages into any Windows OLE application in a snap.

Icon Hear-It™ Lite from Moon

Valley™ Personalize your Windows desktop by replacing regular icons with these outrageous icons and sound effects.

DOS software and driver Record, play back and mix sound in DOS. The recording utility offers high-quality recording. The playback utility provides superior output quality. The mixer blends CD-audio, synthesized audio,

digital audio, external line-in, and microphone. It also controls bass, treble and volume.

SoundMan Wave Specifications

Wave Table Synthesis

Yamaha OPL-4 stereo synthesis with 44 voices offering both FM and wave table synthesis
 Supports 16 MIDI channels
 2MB of wave table samples in ROM on board
 128 General MIDI instruments
 Advanced MIDI interpreter for General MIDI/MPU-401 interface

CD-Quality Sound

16-bit and 8-bit stereo recording and playback
 Sampling/playback rate from 4kHz to 44.1kHz

Advanced Hardware Features

Dynamic filtering
 Hardware compression techniques include IMA, ADPCM and CCITT A-Law and u-Law
 SCSI CD-ROM interface (cable kit available separately)

High Performance 16-bit DMA

Software selectable DMA and IRQ settings for optimal and easy installation

Compatibility

100% Sound Blaster, Sound Blaster Pro and AdLib compatible
 General MIDI compatibility through MPU-401 interface
 Windows 3.1 and DOS 3.3 or higher compatible
 MPC (1 and 2) and MPU-401 (UART) compatible

Input/Output

5-channel stereo mixer
 Stereo amplifier outputting 6 watts per channel
 Line out connector for best signal/noise ratio
 Microphone and line-in inputs for recording from external sources
 Input jacks accept CD-audio input from internal and external CD-ROM drives (cables available separately)
 IBM-standard joystick port for 1 or 2 players/MIDI interface (optional MIDI kit available separately)

Software

- Animation MCS MusicRack
- Midisoft Recording Session
- Berkeley Speech Technologies BeSTspeech ReadOut
- Voyetra SoundMan Annotator
- Moon Valley Icon Hear-It Lite
- Windows 3.1 driver
- DOS driver
- DOS mixer
- DOS recording utilities
- DOS playback utility

System Requirements

IBM PC compatibles with 386 processor or above
 DOS 3.3 or above, or Windows 3.1 or higher
 640KB RAM (4MB recommended for Windows use)
 Open slot for 16-bit interface board
 One 3.5" high density disk drive
 Speakers or headphones for output
 Microphone or CD-player for input
 Logitech or compatible mouse for Windows use

Warranty

SoundMan Wave is backed by Logitech's three-year warranty, with limited lifetime warranty afterward.

Product Support

Call Logitech 7 days a week for technical support, or use our 24-hour electronic bulletin board. Take advantage of the FaxBack line to receive product information by return fax. There is also a Logitech Forum on CompuServe.

Product Support Hotline: (510) 795-8100

Electronic Bulletin Board: (510) 795-0408

FaxBack Line: (800) 245-0000

Satisfaction Guarantee

Logitech wants you to be perfectly happy with your SoundMan Wave Sound Board. If you are not completely satisfied, return it to your reseller within 60 days with the complete contents of the package and proof of purchase for a full refund. (Full details inside the package.)

Sales Information and Support

Call us for the dealer nearest you, or sales/dealer information during normal business hours.

In U.S.A. and Canada: (800) 231-7717



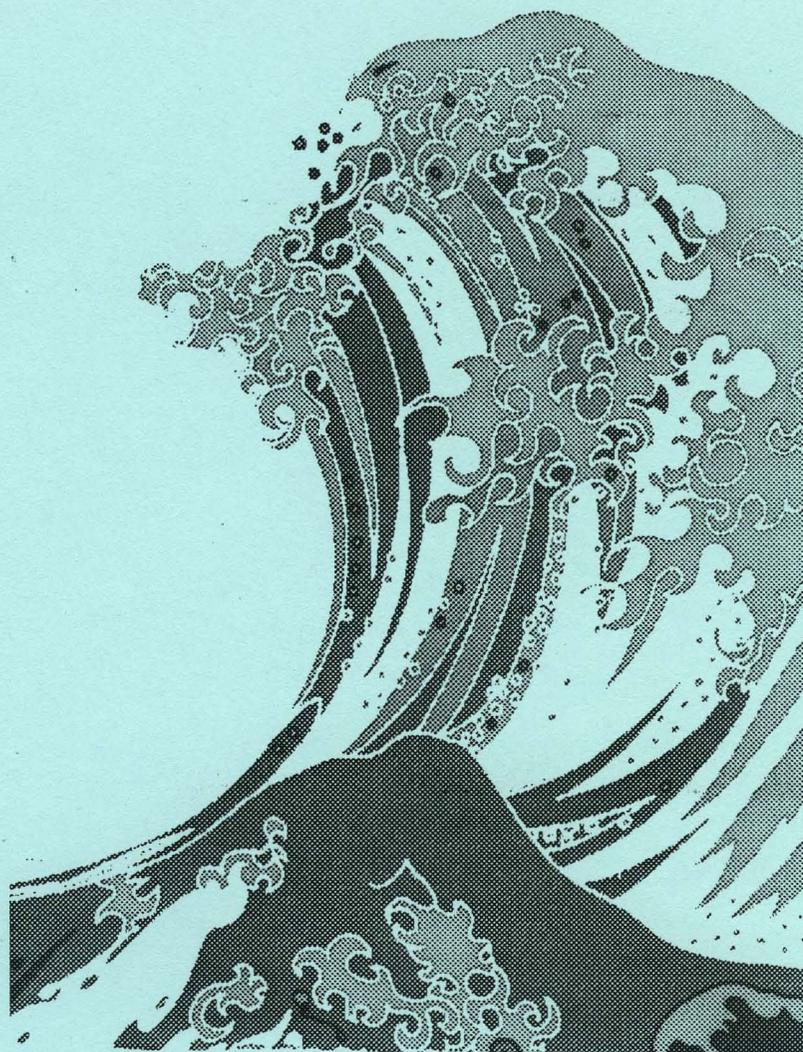
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SoundMan Wave Technical Reference

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Document. ---
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Introduction

Purpose

This document is a reference to the Logitech SoundMan Wave sound board, for programmers and developers. It is intended to provide developers with all of the information they need to fully support the Logitech SoundMan Wave sound board in their products.

Scope

This document describes the primary programmatic interfaces of the SoundMan Wave sound board, including the hardware (register level) interface. The SoundMan Wave sound board has extensive compatibility with existing industry standards - this document does not reproduce those standards in their entirety, but provides precise references and sources for those standards.

The external electrical and electronic interfaces of the SoundMan Wave sound board are also described in this document.

Document Organization

This document is composed of the following sections:

Section 1: Introduction

Section 2: Technical Overview

Section 3: Architecture

Section 4: Programming

Section 5: External Interfaces

Section 6: Technical Notes

Appendix A: Logitech Developer Support

Appendix B: References

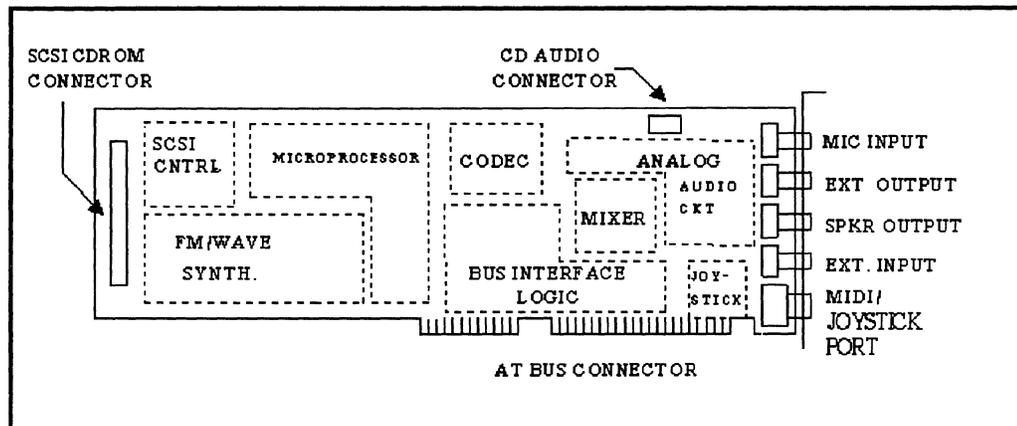


Technical Overview

Summary

- Full SoundBlaster compatibility
- Yamaha YMF278 (OPL4) Wave Table synthesizer
- Register-compatible with earlier generation OPL3 and OPL2 FM synthesizers
- Can simultaneously produce a total of 44 voices (20 FM + 24 wave table)
- Wave synthesizer generates up to 512 tones
- 2MB of wave table (OPL4 patch) ROM
- MIDI MPU-401 transmit and receive interface
- General MIDI via MPU-401 for Roland Sound Canvas compatibility
- Supports 16-bit/8-bit stereo or mono digital audio at rates up to 44.1KHz
- Capable of 16-to-8 or 8-to-16 bit file conversion
- Supports stereo to mono file conversion
- A-law, u-law, IMA ADPCM, and Sound Blaster Compression/Decompression
- 5-channel stereo mixer
- Software programmable Base Address, IRQ and DMA channels
- External MIDI port (with optional adapter)
- SCSI interface for internal and external CD-ROM drives (with optional kits)
- CD-Audio connector on card, for audio input from CD-ROM drives
- Games-compatible joystick interface
- Mini-jacks for Line In, Line Out, Speaker Out and Microphone on back panel
- Microphone Pre-Amp

Card Layout



7-2-94

Hardware

SoundMan Wave is an AT Bus adapter card which supports synthesized music, and digital audio recording/playback electronics. The music is generated by use of FM and Wave Table synthesizers. The FM synthesizer can support OPL2/OPL3 functions, and it provides ADLib/SoundBlaster compatible hardware. The Wave Table synthesizer is based on the Yamaha OPL4 (YMF278), and it is interfaced through the MIDI UART. The common MIDI commands are used to generate general MIDI sounds. The Digital Audio section implements both 8-bit and 16-bit PCM record and playback in stereo or mono format. The digital audio section can provide 2:1, 3:1, and 4:1 compression/decompression for PCM files in both mono and stereo samples.

A mixer circuit is provided to combine the outputs of the FM synthesizer, the Wave Table synthesizers, the Digital Audio system, a Microphone, a CD player, and an external audio source. The mixer output is amplified for external speaker connections. A SCSI bus controller supports CD ROM interface for internal and external drives. Both MIDI and joystick interface are available on an external 15-pin DSUB connector.

In the future, Logitech may support the addition of RAM to the SoundMan Wave via a daughter-board, allowing custom patches to be downloaded to the synthesizer.

Firmware

A MIDI interpreter resides in RAM on the board. It will be downloaded from the DOS drivers to make sure that it is present when needed.

The MIDI interpreter may include a number of features to enhance the rendering of instruments by the OPL4 chip. For this reason, the firmware may be revised and distributed with new updates of the drivers.

Software

Microsoft Windows 3.1:

WAVE driver 8 and 16 bit, mono and stereo record and playback.
MID driver since the board handles General MIDI via on-board firmware, the
 MID driver is a relatively generic MPU-401 driver.
MIXER driver
MCS MusicRack for Windows
Midisoft Recording Session
Annotator
BeSTspeech ReadOut

DOS:

SMWSET.SYS - hardware initialization driver, *not required after boot-up*.
SETUP - setup utility
SMWVOL.EXE - TSR for hot-key volume control.
MPLAY.EXE - command line MIDI player, uses MPU-401 interface.
WPLAY.EXE - command line WAV player.
RECORD.EXE - command line WAV recorder.

MSCDEX and low-level SCSI driver - not shipped with SoundMan Wave, but included with separate CD-ROM accessory kit available from Logitech.

Options

Internal CD-ROM Kit

Includes ribbon cable, audio cable, CD-ROM drivers.

External CD-ROM Kit

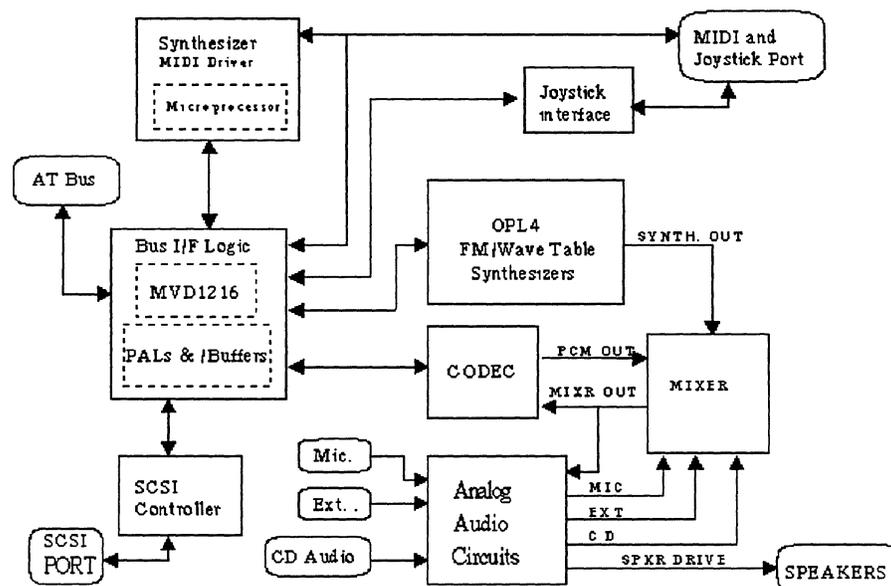
Includes dummy board with SCSI and audio connectors, internal ribbon cable, internal audio cable, external CD-ROM cable, 2 external audio cables, and CD-ROM drivers.

SoundMan MIDI Adapter

Optional adapter available from Logitech. The adapter provides input opto-isolation, output line drivers, and the physical MIDI connectors: DIN 5-pin (180 degree) female. The UART is on the SoundMan Wave board.

Architecture

Functional Block Diagram



SoundMan Wave

SCSI/CD-ROM Controller

The SCSI controller is a Zilog Z5380, an 8-bit single-chip controller that meets MPC requirements. The on-board SCSI connector is a standard 50-pin header.

SoundMan Wave has been tested successfully with many different double-speed drives - at the time of publication there is reportedly a 'glitch' with Hitachi and Texel drives, but a driver fix is expected soon. Contact Logitech Product Support for information - see Appendix A.

Logitech recommends NOT programming directly to the SCSI controller on-board. Use DOS/MSCDEX services, or low-level SCSI services instead. Contact Logitech Developer Support (see Appendix A) if you require information on these API's.

FM+ Wave Table Synthesizer

The FM/Wave Table synthesizer consists of Yamaha's YMF278 (OPL4) chip, 2Mbytes of ROM for wave patches, and the YAC513 D/A converter. The FM synthesizer produces up to 20 voices, and it is register compatible with previous generation OPL2 and OPL3 synthesizers. The wave table synthesizer produces up to 24 voices. The 2Mbyte ROM section provides sound patches to support the general MIDI set.

Both synthesizers can be played simultaneously to produce up to 44 voices. The output of the FM synthesizer and the wave table synthesizer are digitally mixed to produce a single 16-bit stereo output. The YAC513 is utilized to convert the synthesizer outputs to stereo analog output.

CODEC/Digital Audio

The CODEC is the core of the Digital Audio subsystem. The CODEC section includes a MediaVision MVA416 16-bit CODEC, a PLL, an Input Buffer, and an Output Buffer. The 16-bit CODEC converts stereo analog signals to PCM digital data and vice versa. During PCM recording, the CODEC generates 16-bit PCM samples for both the left and the right inputs. During PCM playback, the CODEC converts the stereo 16-bit data points to analog. The recording and playback data rate can be adjusted to 11KHz, 22KHz, and 44.1KHz speeds. The PLL circuit generates the Sample Rate clock for the CODEC. The Input Buffer and the Output Buffer interface the CODEC to the Mixer section.

MIDI Microprocessor

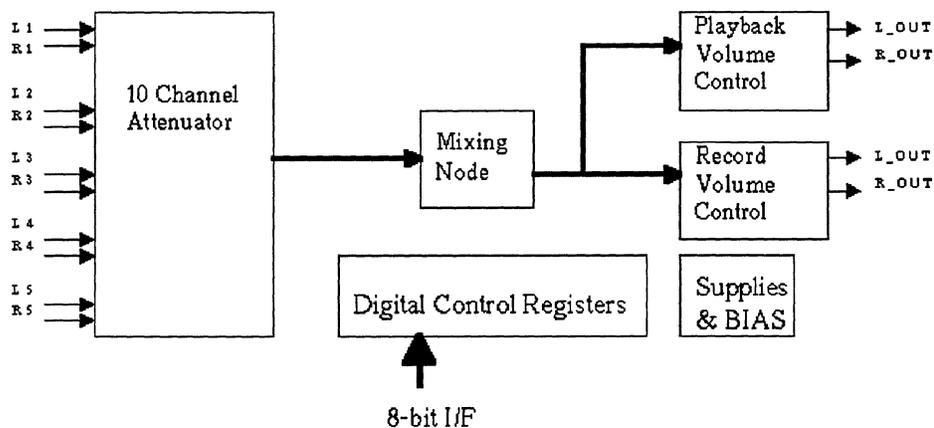
An Intel 8031 microprocessor unit provides control for the OPL4 synthesizer through the MIDI bus. The microprocessor monitors data transactions on the MIDI bus, and it responds to MIDI commands that are sent to the on-board synthesizer. The microprocessor section includes an 8K byte SRAM, three AT Bus interface registers, and an OPL4 bus multiplexer. The AT bus registers are used for downloading the microprocessor's code at power up, and the OPL4 bus multiplexer is utilized for switching the synthesizer control lines between the microprocessor and the AT bus.

Bus Interface Logic

The Bus Interface Logic provides address decoding and signal buffering. A MediaVision 1216 chip provides: a Sound Blaster compatible digital audio interface, an MPU-401 MIDI port, a game compatible joystick port, an OPL4 synthesizer interface, and programmable IRQ and DMA lines. Other Programmable Logic Arrays (PALs) interface the MIDI Microprocessor and the SCSI controller to the AT bus.

Mixer

A Sierra Semiconductor SC18076 provides mixing functions. The Mixer controls the gain of individual sound sources, and combines all sources to produce two stereo outputs. The mixer has five stereo sources: Synthesizer, digital audio (CODEC), CD audio, external audio (Line In), and microphone (Mic). One mixer output (playback) goes to the speaker output amplifier (Line Out), the other goes to the Digital Audio subsystem for digital recording.



Mixer Subsystem Diagram

Programming

Finding Board Configuration

Environment Variables

For DOS applications, the SoundMan Wave installation and configuration software sets two environment strings:

```
SET BLASTER = Axxx Dd Ii Tn Hh Pxxx
```

```
SET LSOUND = directory containing SoundMan software
```

where:

Axxx	SoundBlaster base address (hex).
Dd	SoundBlaster DMA channel, for 8-bit DMA.
Ii	Sound Blaster IRQ, used for digital audio/PCM interrupts.
Tn	SoundBlaster version number.
Hh	DMA channel for 16-bit audio (if not specified, same as 8-bit DMA).
Pxxx	MPU-401 base address (hex).

There is at least one space between configuration parameters - your code should ignore any parameter that begins with a letter you do not recognize or care about. The parameters are not guaranteed to be in the order given above. The default values are:

```
A220 D1 I7 T1 H5 P330
```

SOUNDMAN.INI Parameter File

Other configuration information is stored in the file SOUNDMAN.INI - follow the LSOUND environment variable. The format of SOUNDMAN.INI is as follows:

```
[Global]
Type = SMW                                board type: SoundMan Wave

[WAVE]
Address = 240                             SoundBlaster base address
IRQ = 7                                   SoundBlaster IRQ
DMA8 = 1                                  SoundBlaster DMA channel
DMA16 = 5                                 16-bit audio DMA channel

[MIDI]
Firmware = TSUNAMI.BIN                   General MIDI interpreter code
Address = 330                             MPU-401 base address
IRQ = 2                                   MPU-401 IRQ

[MIXER]                                    Mixer levels
WAVE = 100
MIDI = 100
CDROM = 100
MIC = 100
IN = 100
OUT = 100
Treble = 50
Bass = 50
```

We strongly recommend that developers take board configuration information from the environment variables and files described above, and avoid the practice of scanning hardware registers to locate and recognize equipment.

Detecting and Resetting the Board

Address (Hex)	Register	Access
SBA+06	Reset Register	W
SBA+0A	Read Data Port - PCM Data Register (8-bit)	R
SBA+0B	PCM Data Register (16-bit)	R
SBA+0C	Status Register	R
SBA+0C	Command Register	W
SBA+0E	Data Available Register	R

Standard procedure recommended by Creative Labs and Media Vision, for detecting and resetting a Sound Blaster compatible board:

1. Write 01h to the **Reset Register** at SBA (Sound Blaster register base address) + 6.
Held for 3 μ s, this forces a hardware reset.
2. Wait 3 μ s (microseconds).
A good way to guarantee a 3 μ s delay is to issue three I/O reads from the **Reset Register** address (it isn't a readable register, so it doesn't matter what comes back.) I/O reads will slow the CPU to an effective 8MHz, no matter how fast it normally runs.
3. Write 00h to the **Reset Register**, releasing the reset state.
4. Read the **Data Available Register** (at SBA+0Eh) until bit 7 is 1.
This bit is the Data Available bit, and it signals that a byte is ready to be read. If no data is available after 'about' 100 μ s, you can assume that either (a) there is no SoundMan Wave board at that address or (b) the board is failing to reset i.e. there is a hardware failure. The sample code from Creative Labs tests the **Data Available Register** 65536 times before giving up...
5. Read from the **Read Data Port** (at SBA+0Ah).
The returned byte will be 0AAh to indicate successful board reset. Treat a returned value other than 0AAh as a 'no response' failure in step 4 above.

Relocatable Base Address

Address (Hex)	Register	Access
201	BACR: Base Address Configuration Register	W

SoundMan Wave provides two programmable Base Addresses (SBA & BAM) for its I/O register map.

SBA is the base address for what might be called the 'SoundBlaster' registers, including the OPL3 synthesizer.

BAM is the base address for the MPU-401, SCSI controller, 8031 MIDI microprocessor, and the Control register.

In the tables on the following pages, register addresses that are relative to one of these base addresses are written in the form *SBA+xx* or *BAM+xx*.

These base addresses are defined by programming the Base Address Configuration Register at location 201h. The BACR is cleared after power up (BACR=00). This disables all I/O accesses to this board except write accesses to location 201h. The BACR can be programmed by writing three consecutive bytes to location 201h. The first two bytes must be AFh followed by 50h, the third byte should be configured according to the tables below.

Bit	7	6	5	4	3	2	1	0
Def.	0	OPA2	OPA1	0	0	0	MPA1	MPA0

OPA[2:1]	Base Address 1 (SBA)
00	- disabled -
01	220h
10	240h
11	260h

MPA[2:1]	Base Address 2 (BAM)
00	- disabled -
01	310h
10	320h
11	330h

SCSI Controller Registers

Address (Hex)	Register	Access
BAM+10h-17h	Zilog 5380 Controller	R/W
BAM+18h	Zilog 5380 DACK Reg.	R/W
BAM+19h	Zilog 5380 DRQ Reg.	R
BAM+1Ah	Zilog 5380 DACK/EOP Reg.	R/W
BAM+1Bh	Zilog 5380 RESET Reg.	W

No programming information provided in this release.

Microprocessor Registers

Address (Hex)	Register	Access
BAM+04	MP Data	R/W
BAM+05	MP Lower Address	W
BAM+06	MP Upper Address	W

MP Data Register

This 8-bit data register provides access to the 8K byte RAM area of the 8031 microprocessor. Writing to, or reading from this register writes or reads the location in 8031 RAM determined by the MP Lower Address and MP Upper Address registers. MP Data Register accesses are denied while the 8031 microprocessor is active. The processor must be in reset state before the RAM area can be accessed - see **Control Register**.

MP Lower Address Register, MP Upper Address Register

These two registers are concatenated to form the address in 8031 RAM accessed by the MP Data Register. The address is formed by taking the low 5 bits of MP Upper Address, and appending the 8 bits of MP Lower Address.

The upper 3 bits of MP Upper Address are reserved, and must be zero.

Control Register

Address (Hex)	Register	Access
BAM+07	Control Register Data	R/W

This register controls the reset state of the 8031 micro, and selects the IRQ channels for the SCSI controller and OPL4 synthesizer. It is cleared to 0 on system reset.

This register must be accessed by Read-Modify-Write so that any initialization software will not interfere with the microprocessor driver program, or vice versa.

Bit	7	6	5	4	3	2	1	0
Def.	SCSI SEL1	SCSI SEL0	OPL4 SEL1	OPL4 SEL0	DSP SEL1	DSP SEL0	MP- DRST	MP- RST

Control Register Fields

Both MPRST and MPDRST bits control the reset state of the 8031 microprocessor. The microprocessor's RAM space can be accessed only if the reset state is active. To activate the reset state, do the following: first assert MPRST (MPRST=0), wait for 1mS, then assert MPDRST (MPDRST=0). The microprocessor can be activated by negating both MPDRST and MPRST simultaneously (MPRST=1 & MPDRST=1).

OPL4 SEL0 enables the OPL4 registers and IRQ channel connection. OPL4 SEL1 selects between IRQ12 (OPL4 SEL1 = 0) and IRQ7 (OPL4 SEL1 = 1).

The SCSI SEL bits control the SCSI IRQ as follows:

SCSI SEL	IRQ Selection
0 0	Interrupt Disabled
0 1	IRQ3
1 0	IRQ10
1 1	IRQ9

SCSI IRQ Selection

The DSP SEL bits control the IRQ channel for the DSP section - this feature is reserved for a possible Effect Processor daughter card. Logitech makes no commitment to develop or market such a product. Contact Logitech Developer Support (see Appendix A) for current information.

DSP SEL	IRQ Selection
0 0	Interrupt Disabled
0 1	IRQ5
1 0	IRQ15
1 1	IRQ11

DSP Section IRQ Selection

Joystick Registers

Address (Hex)	Register	Access
200-207	Joystick Data	R
200-207	Joystick Timer Enable	W

No programming information provided in this release - see Appendix B: References.

OPL2/OPL3/OPL4 Synthesizer

Address (Hex)	Register	Access
SBA+00	OPL3: FM Status Port	R
SBA+00	OPL3: FM Address Port	W
SBA+01	OPL3: FM Data Port	W
SBA+02	OPL3: Adv. FM Status Port	R
SBA+02	OPL3: Adv. FM Address Port	W
SBA+03	OPL3: Adv. FM Data Port	W
SBA+08-09	OPL2 Chip	R/W
380-381	OPL4 Chip (Status, Address, Data?)	R/W
388	OPL3: Status Port	R
388	OPL3: Address Port	W
389	OPL3: Data Port	W

OPL4 Registers

No programming information provided in this release - see Appendix B: References.

Programming the MVD1216

Address (Hex)	Register	Access
SBA+06	Reset Register	W
SBA+0A	Read Data Port - PCM Data Register (8-bit)	R
SBA+0B	PCM Data Register (16-bit)	R
SBA+0C	Status Register	R
SBA+0C	Command Register	W
SBA+0E	Data Available Register	R

MVD1216 Registers

Many features of the SoundMan Wave are accessed by sending commands to the MVD1216. Creative Labs calls this subsystem of the Sound Blaster the *DSP*. The MVD1216 provides emulation for many Sound Blaster commands, and adds some of its own.

Sending command and data bytes to the MVD1216 and reading data back follows the standard Sound Blaster procedures.

To send a byte to the MVD1216

1. Read repeatedly from the **Write Status Register** until bit 7 is 0.
2. Write the byte to the **Command Register**.

To read a byte from the MVD1216

1. Read repeatedly from the **Data Available Register**, until bit 7 is 1.
2. Read the incoming byte from the **Read Data Port**.

Programming Digital Audio (PCM) Transfers

The digital audio or PCM capabilities of the SoundMan Wave are similar to those provided by the Sound Blaster. Programming 16-bit PCM operations on the SoundMan Wave is similar to programming 8-bit PCM on the Sound Blaster, but is *not* the same as programming 16-bit PCM on the Sound Blaster.

Data Formats

Digitized sound data can be processed in a large number of formats by the SoundMan Wave.

8-bit mono uncompressed

byte 0	byte 1	byte 2	byte 3
sample1	sample2	sample3	sample4

8-bit stereo uncompressed

byte 0	byte 1	byte 2	byte 3
sample1 left	sample1 right	sample2 left	sample2 right

16-bit mono uncompressed

word 0	word 1
sample1	sample2

16-bit stereo uncompressed

word 0	word 1
sample1 left	sample1 right

DMA Overview

Audio data is transferred between RAM and the SoundMan Wave under supervision of the PC system DMA controller (DMAC) - details of programming that chip are available in many sources and are not reviewed here.

There are two important modes supported by the DMA Controller:

Single-Cycle or 'Automatic' DMA

In this mode, the sound board and DMA Controller are programmed to make a single DMA transfer, of a single block. The board generates an interrupt to signal the end of the transfer. To transfer multiple blocks, software must quickly program the next block transfer when the interrupt signals that the current block is done.

Auto-initialize or 'Continuous' DMA

In this mode, the sound board and DMA Controller cooperate to continuously transfer data until stopped, generating interrupts each time a block has been transferred.

General Procedure

1. Set up an interrupt service routine (ISR). This routine will be invoked at the end of each block transfer.
2. Program the system DMA controller.
3. Set the sampling rate.
4. If doing output (DAC), program the speaker on/off state as needed.
5. Program the MVD1216 for 8-bit or 16-bit PCM, and mono or stereo data.
6. Program the MVD1216 chip for the DMA channel and IRQ you will use. (See **Selecting DMA and IRQ Channels** below.)
7. Program the MVD1216 for DMA transfer length and DMA mode, in 8-bit or 16-bit PCM mode. This starts the transfer.
8. Process interrupts in your ISR, moving data into or out of data buffers.

The details of these steps that are specific to SoundMan Wave are described in the following sections.

Setting the Sampling Rate

Send command byte 40h, followed by a parameter byte S computed as follows:

$$S = 256 - (1000000 / (\text{frequency} * \text{channels}))$$

For example, for stereo (2 channels) at 11025 samples/second:

$$S = 256 - (1000000 / (11025 * 2)) = 45.35 = 2Dh$$

Controlling the Speaker

Turn Speaker On: Send command 0D1h.

Turn Speaker Off: Send command 0D3h.

Setting the DMA transfer length

Send the following sequence of command bytes, being careful to send the number of bytes in your data block *less 1*.

48h	Set DMA Transfer Size
xx	low 8 bits of (block size - 1)
xx	high 8 bits of (block size - 1)

Pausing and Finishing DMA

Suspend DMA Transfer: send command 0D0h

Resume DMA Transfer: send command 0D4h

End Continuous DMA Mode: send command 0DAh.

When using continuous or auto-init DMA mode, send this command in your interrupt service routine after the next-to-last block has completed transfer (so the last block has started transfer.) This command tells the board to end DMA transfers at the end of the current block.

Selecting 8/16-bit and Mono/Stereo

Use the following commands to switch between 8-bit and 16-bit PCM modes, and to select between mono and stereo data formats.

8-bit Mono	0A0h
8-bit Stereo	0A8h
16-bit Mono	0A4h
16-bit Stereo	0ACh

Starting a PCM Transfer

The following commands start PCM transfers - their interpretation depends on whether 8-bit or 16-bit mode has been selected (see above.)

command	in 8-bit mode	in 16-bit mode
14h	play uncompressed	play uncompressed
16h	play 2-bit ADPCM	play 16-bit A-law
17h	play 2-bit ADPCM with ref. byte	same as 16h
1Ch	play uncompressed, continuous	play uncompressed, continuous
1Fh	play 2-bit ADPCM, continuous	play 16-bit A-law, continuous
20h	record 8-bit single sample	record 16-bit single sample
24h	record uncompressed	record uncompressed
26h		record 16-bit A-law
2Ch	record uncompressed, continuous	record uncompressed, continuous
...		

Selecting DMA and IRQ Channels

- There are two DMA channel settings: 8-bit DMA (typically the SoundBlaster PCM), the other for 16-bit DMA.

Similarly, there are two IRQ channels: One used to signal DMA transfer complete, the other is used by the MPU-401 to signal MIDI input.

These settings are programmed using the following sequence, where '2xC' is the address of the MVD1216 Command Register, determined as SBA + 0Ch:

out to 2xC: 0FBh ('reserved' command for SoundBlaster)
out to 2xC: DMA selection byte
out to 2xC: IRQ selection byte

The upper four bits of the DMA byte set the 16-bit digital audio DMA channel, and the low four bits select the 8-bit digital audio channel, coded as follows:

1	DMA 1
2	DMA 3
3	DMA 5
4	DMA 7

The upper four bits of the IRQ selection byte set the MPU-401 IRQ, and the low four bits set the 1216 DMA IRQ, coded as follows:

1	IRQ 5	
2	IRQ 2 (or 9)	(eh?)
3	IRQ 3	
4	IRQ 7	
5	IRQ 10	<i>Note: cannot be used for MPU-401</i>
6	IRQ 15	<i>Note: cannot be used for MPU-401</i>

Reading the DMA and IRQ Settings

There is a command 0FDh which is used to read the DMA and IRQ settings (see preceding section.) The only problem is - it comes back in another format! The "first 4 bits" from the write command are now found one bit to the right, and the first 2 bits should be ignored. Here's a sketch of the procedure:

Out to 2xC: 0FDh command to read DMA and IRQ
 In from 2xA: DMA byte
 In from 2xA: IRQ byte

Bit	7	6	5	4	3	2	1	0
DMA	-	-	DMA-16	DMA-16	DMA-16	DMA-8	DMA-8	DMA-8
IRQ	-	-	MPU	MPU	MPU	EOT	EOT	EOT

DMA and IRQ - Read Back Encoding

- 'DMA-16 = 16-bit DMA channel *encoded per Selecting DMA and IRQ Channels.*
- DMA-8 = encoded 8-bit DMA channel.
- MPU = encoded IRQ for the MPU-401.
- EOT = encoded IRQ for DMA End-Of-Transfer.

Mixer

Address (Hex)	Register	Access
SBA+04	Mixer Address Port	R/W
SBA+05	Mixer Data Port	R/W

Mixer Registers

The Mixer registers are accessed through the MVD1216's Mixer Address and Mixer Data registers. The mixer channel address is stored in the Mixer Address register, and the channel gain and configuration setting is programmed via the Mixer Data register. The following table shows the mixer channel assignments.

Addr	Channel
00	Telephone (not used)
01	Microphone Left
02	Microphone Right
03	Line In Left
04	Line In Right
05	OPL4 Left
06	OPL4 Right
07	CD Audio Left
08	CD Audio Right
09	PCM D2A Left
0A	PCM D2A Right
0B	Master Volume Left
0C	Master Volume Right
0D	Bass/Treble Left
0E	Bass/Treble Right
0F	Configuration Register 1
10	Configuration Register 2

MPU-401

BAM+0	MIDI Transmit Data	W
BAM+0	MIDI Receive Data	R
BAM+1	MIDI Command Port	W
BAM+1	MIDI Status Port	R

MPU-401 I/O Registers

The MPU-401 UART interface has become a popular means of interfacing to MIDI devices on the PC. This interface provides a 1-byte command register, a 1-byte read/write data register, and a read-only status port.

The MIDI UART of SoundMan Wave contains a 32-byte input FIFO, and an 8-byte output FIFO. The format of the status port is as follows:

Bits 0-5	- not defined -
Bit 6	Output Ready: 1=FIFO Full, 0=OK to send
Bit 7	Input Data Ready: 0=Available, 1=No Data

MIDI Status Port

Detecting the MPU-401: To detect and verify the MPU-401 UART, send the **Reset Command (0FFh)** to the command port. If the MPU-401 is present at that address, it will respond with a **Command Acknowledge (0FEh)** sent to the data port. Here's a code example:

```
        mov     dx, MPUbase    ; i.e. 330, 320, 310...
        inc     dx             ; status port addr
        xor     cx, cx
busy:   in      al, dx         ; read status
        test    al, 40h       ; OK to output?
        loopz   busy         ; wait, but not too long
        jnz    mp401         ; oops, too long.
        mov     al, 0ffh     ; reset command..
        out     dx, al        ; ..send it.
        xor     cx, cx       ; wait for ack - not too long!
zzz:   in      al, dx         ; read status
        test    al, 80h       ; input ready?
        jnz    no_dat        ; nope
; read byte and check for proper ack
        dec     dx           ; back down to data port
        in      al, dx        ; read data byte
        cmp     al, 0feh     ; so - it's an ack?
        je     mpu_OK        ; yes, MPU-401 detected
no_dat: loop    zzz          ; keep checking 'till timeout
no401:                ; no MPU-401 at this address
```

CAUTION: Other devices are sometimes found at port address 330, in particular some Adaptec SCSI adapters. In this case running the code sequence above could result in a fatal crash or even damage to the data on the user's hard disk - please take all necessary steps to avoid this!

Enabling MIDI I/O: At system reset, the UART goes into 'smart' mode - the external MIDI In is connected directly to the external MIDI Out - so the SoundMan Wave acts as a pass-through. Before MIDI data can be sent and received through the interface, it must be switched into 'UART' mode, with the **UART Mode Command (03Fh)**. To exit UART mode, send the **Reset Command** as above. Note that the UART mode command generates a Command Acknowledge byte, which will cause an interrupt request - see Note below.

Example Code to activate UART Mode:

```

        mov     dx, MPUbase    ; i.e. 330, 320, 310...
        inc     dx             ; status port addr
        xor     cx, cx
busy:   in      al, dx         ; read status
        test    al, 40h       ; OK to output?
        loopz  busy          ; no
        jnz    noluck
        mov     al, 03fh      ; UART Mode command..
        out    dx, al        ; ..send it.
        xor     cx, cx       ; wait for ack - not too long!
zzz:    in      al, dx         ; read status
        test    al, 80h       ; input ready?
        jnz    no_dat        ; nope
; read byte and check for proper ack
        dec     dx            ; back down to data port
        in      al, dx        ; read data byte
        cmp     al, 0feh      ; so - it's an ack?
        je     UARTok        ; yes, in UART mode
no_dat: loop   zzz           ; keep checking 'till timeout
noluck:                                     ; could not enter UART mode

```

Sending MIDI data: Once the MPU-401 interface is in UART mode, sending MIDI data is ... simple - here's a code example:

```
        mov     dx, MPUbase    ; i.e. 330, 320, 310...
        inc     dx             ; status port addr
        xor     cx, cx
busy:   in      al, dx         ; read status
        test    al, 40h       ; OK to output?
        loopz   busy
        jnz     timeout       ; MPU not responding
        dec     dx            ; back down to data port
        mov     al, MIDI_out   ; byte to output
        out    dx, al         ; ..send it.
```

Note: Whenever Input Data Ready goes low to signal that data is available, an interrupt is requested on the MPU-401 interrupt. If you have not enabled the IRQ, this has no effect. After the data port is read, the interface clears the interrupt request, and will not issue another IRQ for approximately 0.5 μ s, even if data is available in the input FIFO. Note that data can come from either a **Command Acknowledge** to a **Reset** or **UART Mode Command**, or from the external MIDI In.

General MIDI

The following includes information derived from an electronic document in the MIDI/Music forum of CompuServe, credited to Jeff Mallory (jeff@millie.loc.gov), dated 14 January 1992. Any errors or omissions are the responsibility of Logitech.

What is General MIDI (GM)? Within the wonderful and bewildering variety of the MIDI universe, General MIDI prescribes a kind of 'generic MIDI synthesizer' - It defines a standard set of sounds, mapped in a standard way, and a standard set of capabilities and messages that must be supported.

Maps: General MIDI (GM) defines a standard Instrument Patch Map with 128 sounds arranged into roughly 16 families, plus a Percussion Key Map.

Channels: GM requires that a sound module respond to all sixteen MIDI channels, with dynamic voice allocation and a minimum of 24 voices. Percussion is restricted to MIDI channel 10.

Messages: A GM synthesizer must respond to velocity, mod wheel, aftertouch, sustain and expression pedal, main volume and pan, and the All Notes Off and Reset All Controllers messages. It must also respond to Pitch Bend and Pitch Bend Sensitivity (a MIDI registered parameter). The default pitch bend range is ± 2 semitones.

Middle C (C3) corresponds to MIDI key 60, and master tuning must be adjustable. Finally, the MIDI Manufacturers Association (MMA) has defined a Universal System Exclusive message to turn General MIDI on and off.

For more information about General MIDI see **Appendix B: References**.

General MIDI Instrument Patch Map

Prog#	Instrument	Prog#	Instrument
	(PIANO)		(CHROM PERCUSSION)
1	Acoustic Grand	9	Celesta
2	Bright Acoustic	10	Glockenspiel
3	Electric Grand	11	Music Box
4	Honky-Tonk	12	Vibraphone
5	Electric Piano 1	13	Marimba
6	Electric Piano 2	14	Xylophone
7	Harpsichord	15	Tubular Bells
8	Clav	16	Dulcimer

	(ORGAN)		(GUITAR)
17	Drawbar Organ	25	Acoustic Guitar(nylon)
18	Percussive Organ	26	Acoustic Guitar(steel)
19	Rock Organ	27	Electric Guitar(jazz)
20	Church Organ	28	Electric Guitar(clean)
21	Reed Organ	29	Electric Guitar(muted)
22	Accordion	30	Overdriven Guitar
23	Harmonica	31	Distortion Guitar
24	Tango Accordion	32	Guitar Harmonics

	(BASS)		(STRINGS)
33	Acoustic Bass	41	Violin
34	Electric Bass(finger)	42	Viola
35	Electric Bass(pick)	43	Cello
36	Fretless Bass	44	Contrabass
37	Slap Bass 1	45	Tremolo Strings
38	Slap Bass 2	46	Pizzicato Strings
39	Synth Bass 1	47	Orchestral Strings
40	Synth Bass 2	48	Timpani

	(ENSEMBLE)		(BRASS)
49	String Ensemble 1	57	Trumpet
50	String Ensemble 2	58	Trombone
51	SynthStrings 1	59	Tuba
52	SynthStrings 2	60	Muted Trumpet
53	Choir Aahs	61	French Horn
54	Voice Oohs	62	Brass Section
55	Synth Voice	63	SynthBrass 1
56	Orchestra Hit	64	SynthBrass 2

	(REED)		(PIPE)
65	Soprano Sax	73	Piccolo
66	Alto Sax	74	Flute
67	Tenor Sax	75	Recorder
68	Baritone Sax	76	Pan Flute
69	Oboe	77	Blown Bottle
70	English Horn	78	Skakuhachi
71	Bassoon	79	Whistle
72	Clarinet	80	Ocarina

	(SYNTH LEAD)		(SYNTH PAD)
81	Lead 1 (square)	89	Pad 1 (new age)
82	Lead 2 (sawtooth)	90	Pad 2 (warm)
83	Lead 3 (calliope)	91	Pad 3 (polysynth)
84	Lead 4 (chiff)	92	Pad 4 (choir)
85	Lead 5 (charang)	93	Pad 5 (bowed)
86	Lead 6 (voice)	94	Pad 6 (metallic)
87	Lead 7 (fifths)	95	Pad 7 (halo)
88	Lead 8 (bass+lead)	96	Pad 8 (sweep)

	(SYNTH EFFECTS)		(ETHNIC)
97	FX 1 (rain)	105	Sitar
98	FX 2 (soundtrack)	106	Banjo
99	FX 3 (crystal)	107	Shamisen
100	FX 4 (atmosphere)	108	Koto
101	FX 5 (brightness)	109	Kalimba
102	FX 6 (goblins)	110	Bagpipe
103	FX 7 (echoes)	111	Fiddle
104	FX 8 (sci-fi)	112	Shanai

	(PERCUSSIVE)		(SOUND EFFECTS)
113	Tinkle Bell	121	Guitar Fret Noise
114	Agogo	122	Breath Noise
115	Steel Drums	123	Seashore
116	Woodblock	124	Bird Tweet
117	Taiko Drum	125	Telephone Ring
118	Melodic Tom	126	Helicopter
119	Synth Drum	127	Applause
120	Reverse Cymbal	128	Gunshot

General MIDI Percussion Key Map

(assigns drum sounds to note numbers. MIDI Channel 10 is for percussion)

Key	MIDI Drum Sound	Key	MIDI Drum Sound
35	Acoustic Bass Drum	59	Ride Cymbal 2
36	Bass Drum 1	60	Hi Bongo
37	Side Stick	61	Low Bongo
38	Acoustic Snare	62	Mute Hi Conga
39	Hand Clap	63	Open Hi Conga
40	Electric Snare	64	Low Conga
41	Low Floor Tom	65	High Timbale
42	Closed Hi-Hat	66	Low Timbale
43	High Floor Tom	67	High Agogo
44	Pedal Hi-Hat	68	Low Agogo
45	Low Tom	69	Cabasa
46	Open Hi-Hat	70	Maracas
47	Low-Mid Tom	71	Short Whistle
48	Hi-Mid Tom	72	Long Whistle
49	Crash Cymbal 1	73	Short Guiro
50	High Tom	74	Long Guiro
51	Ride Cymbal 1	75	Claves
52	Chinese Cymbal	76	Hi Wood Block
53	Ride Bell	77	Low Wood Block
54	Tambourine	78	Mute Cuica
55	Splash Cymbal	79	Open Cuica
56	Cowbell	80	Mute Triangle
57	Crash Cymbal 2	81	Open Triangle
58	Vibraslap		

General MIDI Percussion Key Map

External Interfaces

This section describes the external electrical/electronic interfaces to the SoundMan Wave sound board.

Speaker Output (Speaker Jack)

Mechanical:	Mini stereo headphone jack.
Power:	4 W per channel stereo to a 4 Ω load.
Frequency Response:	20 Hz to 20 kHz
Dynamic Range:	30 dB
S/N Ratio:	50 dB at max gain, 80 dB at min gain.
THD:	0.5% at 4W
Recommended Load:	4 Ω - 8 Ω , or self-amplified.

Stereo Line Output (LINE OUT Jack)

Mechanical:	Mini stereo headphone jack.
Output Level:	1 V RMS.
Frequency Response:	20 Hz to 20 kHz
Dynamic Range:	80 dB
S/N Ratio:	88 dB
THD:	0.05% at 4W
Recommended Load:	4 Ω - 8 Ω , or self-amplified.

Stereo Line Input (IN Jack)

Mechanical:	Stereo mini-jack.
Input Level:	2V RMS maximum.
Input Impedance:	100 k Ω
Frequency Response:	20 Hz to 50 kHz
Dynamic Range:	80 dB
S/N Ratio:	88 dB at minimum gain
THD:	0.015%

Microphone Input (MIC jack)

Input Level: 100 μ V to 100 mV
Input Impedance: 5 k Ω
Frequency Response: 20 Hz to 20 kHz
Mechanical: Mono mini-jack. (Stereo plug will not work.)
AGC Gain: 20 dB min, 80 dB max
Dynamic Range: 30 dB
S/N Ratio: 50 dB at max gain, 80 dB at min gain
THD: 0.015%
Suitable Microphone: 600 Ω dynamic monaural microphone

Game (Joystick) Port

Standard DB-15 connector, female.

PIN	SIGNAL	PIN	SIGNAL
1	+5v Supply	9	+5v Supply
2	Joystick 1 Fire 1	10	Joystick 2 Fire 1
3	Joystick 1X	11	Joystick 2X
4	GND	12	MIDI TXD
5	GND	13	Joystick 2Y
6	Joystick 1Y	14	Joystick 2 Fire 2
7	Joystick 1 Fire 2	15	MIDI RXD
8	+5v Supply		

Joystick pin assignments

MIDI Port

Requires optional adapter, which connects to the DB-15 game port on the back panel. The adapter provides MIDI IN, MIDI OUT 1, MIDI OUT 2, and MIDI THRU, as well as a pass-thru for the game port. The optoisolation and line drivers required for MIDI are in the adapter, not on the SoundMan board.

CD Audio Connector (J2)

Pin Assignments

Pin	Signal
1	unused
2	Left Audio
3	Ground
4	Right Audio
5	unused

SCSI Connector

The SCSI connector conforms mechanically and electrically to the SCSI standard, but Logitech does not support connection of any device other than a CD-ROM to this connector. Contact Logitech Developer Support (see Appendix A) if you require more details.

Board Specifications

Dimensions: 10 cm x 18 cm expansion card format

Slot Type: 16-bit IBM AT bus.

Compatibility: SoundBlaster and AdLib compatible

Operating Temperature and Humidity: 10° C to 55° C at 20% to 80%.

Storage Temperature and Humidity: -10° C to 60° C at 20% to 90%.

Technical Notes

This section contains miscellaneous technical notes that don't fit into the preceding sections, as well as answers to common questions about programming and supporting the SoundMan Wave.

Make MIDI (MPU-401) Configurable

Developers should not hard-code the base address and IRQ of the MPU-401. While the original Roland MPU-401 may have been hardwired to 330h, IRQ 2, these are configurable on modern sound boards e.g. SoundMan Wave, Creative Labs Sound Blaster 16. Conflicts at 330h are not unusual: Adaptec SCSI controllers are often found at this address.

To determine the MPU-401 base address, examine the BLASTER = environment variable. Details are in *Finding Board Configuration* on p. 11

To determine the MPU-401 IRQ, you can either read the configuration from the hardware (see *Reading the DMA and IRQ Settings*, p. 25.) or find and parse the entry from SOUNDMAN.INI - again see *Finding Board Configuration*, p. 11.

Separate Digital Audio from Music Synthesis

Developers should either allow the user to choose separate drivers for digital audio and synthesis e.g. digital audio = Soundblaster, synthesis = General MIDI. Or, offer a series of combinations e.g. Gen MIDI + Soundblaster, Gen MIDI + PAS 16, etc.

This avoids a problem seen in some games: The user can select "General MIDI", but this turns off the digital audio on the assumption that the output device is something like a Roland Sound Canvas.

Is SoundMan Wave Compatible with (any) ProAudio Spectrum?

No. Strictly off the record - this is a change from SoundMan 16.

Appendix A

Logitech Developer Support

Logitech aids its developers with an automated fax service, electronic bulletin board services, and developer support.

If you need support for your Logitech toolkit, we recommend that you read this appendix first, so you'll know how and where to get it.

The following sections describe the available Logitech developer support services.

Customer Service, Technical Support or Developer Relations?

This section tells you who to contact for appropriate support.

Customer Service. Logitech Customer Service provides *non-technical* product support, such as product pricing, product replacement, upgrade and update information, product warranty, and order status.

Technical Support. Logitech Technical Support provides *technical* product support, such as software or hardware questions.

Developer Support. Logitech Developer Relations provides developer support, such as toolkit questions or how to register as a developer.

Sending a Fax to Logitech Developer Relations

The fax number for Logitech Developer Relations is

(510) 713-5038

Please address all communication to: Attn. Developer Relations.
--

Internet E-mail to Logitech Developer Relations

The Internet address for Logitech Developer Relations is

developer_support@logitech.com

Logitech FaxBack Service

FaxBack™ is a toll-free, automated fax response service. Using your touch-tone telephone and fax machine, you can request many types of documents: most commonly-asked questions, available toolkits, technical notes, and developer services. FaxBack sends the documents to your fax machine in minutes.

First, call FaxBack and order the Logitech Developer FaxBack catalog that lists the latest available developer support documents. For the catalog, request document number 4700. To reach FaxBack, call:

(800) 245-0000 (in the US)

Logitech On-Line

If you have a modem, you can communicate with Logitech on the following electronic bulletin boards.

LBBS (Logitech Bulletin Board Service)

With a 300, 1200 or 2400 baud modem, call LBBS 24 hours a day, 7 days a week. Set the communication parameters on your modem to either: 7 bits, 1 stop bit, and even parity; or 8 bits, 1 stop bit, and no parity.

In the United States, call: **(510) 795-0408**
In Europe, call: **++41 (0) 21-869-98-17**

CompuServe

If you are a member of CompuServe Information Service, you can get the latest Logitech Product Support information.

From the CompuServe system prompt, type:

GO LOGITECH

Support Phone Numbers and Addresses Worldwide

This section includes support addresses and telephone numbers. The Logitech Developer Support phone line connects you to an automated attendant, which is monitored throughout the day in order to provide timely response from Logitech.

You can also write for support. Address your letter to the appropriate Logitech address and to the attention of Developer Relations and your toolkit (i.e. Attn: Developer Relations, SoundMan Toolkit). Please include your daytime phone number and the best time to reach you.

U.S.A. and Canada

Product Support: (510) 795-8100
Developer Support: (510) 713-5338
Logitech Inc.
Attn: Developer Relations
6505 Kaiser Drive
Fremont, CA 94555

Switzerland, Europe, Africa, & Middle East

Product Support and Developer Support
(Switzerland): ++41 (0) 21-869-98-51
For the rest of Europe: ++41 (0) 21-869-98-55
Logitech SA
CH-1122 ROMANEL/MORGES

Logitech Far East Ltd.

Product and Developer Support: ++886 (0) 2 746-6601
No. 2 Creation Road 4, Science - Based Industrial Park
Hsinchi Taiwan R.O.C.

Appendix B

References

DOS Drivers

Several companies sell 3rd-party DOS sound drivers and libraries, and a VESA standard for DOS sound drivers has recently been approved. Contact Logitech Developer Support (see Appendix A) for up-to-date information and advice.

General MIDI - see MIDI Standards, below

Joystick/Game Port Programming

IBM PC/AT Technical Reference Manual

IBM Corporation
PC Technical Books
1-800-IBM-PCTB

MIDI Programming

MIDI Programmer's Handbook, Steve De Furia and Joe Scacciaferro, M&T Publishing, Inc, Redwood City, California - 1989. ISBN 1-55851-068-0.

This book includes a nice Programmer's Reference chapter with a summary of every defined MIDI message (as of 1989 anyway).

Standard MIDI File Programmer's Reference (booklet + disk)

Music Quest, Inc.
P.O. Box 260963
Plano, TX 75026
(214) 881-7408 voice
(214) 422-7094 fax
(214) 881-7311 BBS

MIDI (Musical Instrument Digital Interface) Standards

MIDI 1.0 Detailed Specification

This book is the **official technical document on the MIDI interface** written by the MIDI Manufacturers Association and the Japan MIDI Standards Committee. It contains the entire hardware and software protocol for MIDI.

Standard MIDI Files 1.0

Level 1 Specification for General MIDI

International MIDI Association (IMA)
5306 W. 57th Street
Los Angeles, CA 90056-1339 USA
(310) 649-6434
(310) 215-3380 fax

Mixer Chip - Sierra Semiconductor SC18076

Sierra SC18075/SC18076 Multimedia Analog Mixer Chip

Sierra Semiconductor
2075 North Capitol Ave.
San Jose, CA 95132
U.S.A.
(408) 263-9300

MVD1216 Controller Chip - aka Jazz or JAZZ16 Chip Set

Jazz Chip Set Hardware Programmer's Reference

Media Vision, Inc.
3185 Laurelview Court
Fremont, CA 94538
U.S.A.
(510) 770-8600
(510) 623-5749 (fax)
(510) 770-0968 (BBS: 1200/2400, 8-1-N)

OPL2/OPL3/OPL4 - see Synthesizer Chip, below.

SCSI Controller - Zilog Z5380

Z5380 SCSI Small Computer Systems Interface

Zilog Inc.
210 East Hacienda Ave.
Campbell, CA 95008
U.S.A.
(408) 370-8000

Sierra Semiconductor SC18076 - see Mixer Chip above.

Synthesizer Chip - Yamaha YMF278 aka OPL4

Yamaha LSI
981 Ridder Park Drive
San Jose, CA 95131
U.S.A.
(408) 437-3133

Yamaha YMF278 - see Synthesizer Chip above.

Zilog Z5380 - see SCSI Controller above.

