DIGITAL RECORDING PROCESSOR

CBX-D5

Owner's Manual 2

OPERATING MANUAL

FCC INFORMATION (U.S.A.)

1. IMPORTANT NOTICE: DO NOT MODIFY THIS UNIT!
   This product, when installed as indicated in the instructions contained in this manual, meets FCC requirements. Modifications not expressly approved by Yamaha may void your authority, granted by the FCC, to use the product.
2. IMPORTANT: When connecting this product to accessories and/or another product use only high quality shielded cables. Cable/s supplied with this product MUST be used. Follow all installation instructions. Failure to follow instructions could void your FCC authorization to use this product in the USA.
3. NOTE: This product has been tested and found to comply with the requirements listed in FCC Regulations, Part 15 for Class "B" digital devices. Compliance with these requirements provides a reasonable level of assurance that your use of this product in a residential environment will not result in harmful interference with other electronic devices. This equipment generates/uses radio frequencies and, if not installed and used according to the instructions found in the users manual, may cause interference harmful to the operation of other electronic devices. Compliance with FCC regulations does not guarantee that interference will not occur in all installations. If this product is found to be the source of interference, which can be determined by turning the unit "OFF" and "ON", please try to eliminate the problem by using one of the following measures:

   Relocate either this product or the device that is being affected by the interference.

   Utilize power outlets that are on different branch (circuit breaker or fuse) circuits or install AC line filter/s.

   In the case of radio or TV interference, relocate/reorient the antenna. If the antenna lead-in is 300 ohm ribbon lead, change the lead-in to co-axial type cable.

   If these corrective measures do not produce satisfactory results, please contact the local retailer authorized to distribute this type of product. If you can not locate the appropriate retailer, please contact Yamaha Corporation of America, Electronic Service Division, 6600 Orangethorpe Ave, Buena Park, CA 90620

* This applies only to products distributed by YAMAHA CORPORATION OF AMERICA

Dette apparat overholder det gaeldende EF-direktiv vedrørende radiostøj.

Cet appareil est conforme aux prescriptions de la directive communautaire 87/308/CEE.

Diese Geräte entsprechen der EG-Richtlinie 82/499/EWG und/oder 87/308/EWG.

This product complies with the radio frequency interference requirements of the Council Directive 82/499/EEC and/or 87/308/EEC.

Questo apparecchio è conforme al D.M.13 aprile 1989 (Direttiva CEE/87/308) sulla soppressione dei radiodisturbi.

Este producto está de acuerdo con los requisitos sobre interferencias de radio frequencia fijados por el Consejo Directivo 87/308/CEE.

YAMAHA CORPORATION

IMPORTANT NOTICE FOR THE UNITED KINGDOM

Connecting the Plug and Cord

IMPORTANT: The wires in this mains lead are coloured in accordance with the following code:

GREEN-AND-YELLOW	:	EARTH
BLUE	:	NEUTRAL
BROWN	:	LIVE

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The wire which is coloured GREEN and YELLOW must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol or coloured GREEN and YELLOW.

The wire which is coloured BLUE must be connected to the terminal which is marked with the letter N or coloured BLACK.

The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

SPECIAL MESSAGE SECTION

PRODUCT SAFETY MARKINGS: Yamaha electronic products may have either labels similar to the graphics shown below or molded/stamped facsimiles of these graphics on the enclosure. The explanation of these graphics appears on this page. Please observe all cautions indicated on this page and those indicated in the safety instruction section.

CAUTION: TO REDUCE THE RISK OF ELEC
TRIC SHOCK, DO NOT REMOVE COVER (OF
BACK). NO USER-SERVICEABLE PARTS
INSIDE. REFER SERVICING TO QUALIFIED
SERVICE PERSONNEL.

- Explanation of Graphical Symbols

  The exclamation point within the equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

  The lightning flash with arrowhead symbol within the equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electrical shock.

IMPORTANT NOTICE: All Yamaha electronic products are tested and approved by an independent safety testing laboratory in order that you may be sure that when it is properly installed and used in its normal and customary manner, all foreseeable risks have been eliminated. DO NOT modify this unit or commission others to do so unless specifically authorized by Yamaha. Product performance and/or safety standards may be diminished. Claims filed under the expressed warranty may be denied if the unit is/has been modified. Implied warranties may also be affected.

SPECIFICATIONS SUBJECT TO CHANGE: The information contained in this manual is believed to be correct at the time of printing. However, Yamaha reserves the right to change or modify any of the specifications without notice or obligation to update existing units.

ENVIRONMENTAL ISSUES: Yamaha strives to produce products that are both user safe and environmentally friendly. We sincerely believe that our products and the production methods used to produce them, meet these goals. In keeping with both the letter and the spirit of the law, we want you to be aware of the following:

Battery Notice: This product MAY contain a small nonrechargeable battery which (if applicable) is soldered in place. The average life span of this type of battery is approximately five years. When replacement becomes neccessary, contact a qualified service representative to perform the replacement.

Warning: Do not attempt to recharge, disassemble, or incinerate this type of battery. Keep all batteries away from children. Dispose of used batteries promptly and as regulated by applicable laws. Note: In some areas, the servicer is required by law to return the defective parts. However, you do have the option of having the servicer dispose of these parts for you.

Disposal Notice: Should this product become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of products that contain lead, batteries, plastics, etc.

NOTICE: Service charges incurred due to lack of knowledge relating to how a function or effect works (when the unit is operating as designed) are not covered by the manufacturer's warranty, and are therefore the owners responsibility. Please study this manual carefully and consult your dealer before requesting service.

NAME PLATE LOCATION: The graphic below indicates the location of the name plate. The model number, serial number, power requirements, etc., are located on this plate. You should record the model number, serial number, and the date of purchase in the spaces provided below and retain this manual as a permanent record of your purchase.

Model _____

Serial No. _____

Purchase Date _____

IMPORTANT SAFETY INSTRUCTIONS

INFORMATION RELATING TO PERSONAL INJURY, ELECTRICAL SHOCK, AND FIRE HAZARD POSSIBILITIES HAS BEEN INCLUDED IN THIS LIST.

WARNING — When using any electrical or electronic product, basic precautions should always be followed. These precautions include, but are not limited to, the following:

1. Read all Safety Instructions, Installation Instructions, Special Message Section items, and any Assembly Instructions found in this manual BEFORE making any connections, including connection to the main supply.

2. Main Power Supply Verification: Yamaha products are manufactured specifically for the supply voltage in the area where they are to be sold. If you should move, or if any doubt exists about the supply voltage in your area, please contact your dealer for supply voltage verification and (if applicable) instructions. The required supply voltage is printed on the name plate. For name plate location, please refer to the graphic found in the Special Message Section of this manual.

3. This product may be equipped with a polarized plug (one blade wider than the other). If you are unable to insert the plug into the outlet, turn the plug over and try again. If the problem persists, contact an electrician to have the obsolete outlet replaced. DO NOT defeat the safety purpose of the plug.

4. Some electronic products utilize external power supplies or adapters. DO NOT connect this type of product to any power supply or adapter other than one described in the owners manual, on the name plate, or specifically recommended by Yamaha.

5. **WARNING**: Do not place this product or any other objects on the power cord or place it in a position where anyone could walk on, trip over, or roll anything over power or connecting cords of any kind. The use of an extension cord is not recommended! If you must use an extension cord, the minimum wire size for a 25' cord (or less) is 18 AWG. NOTE: The smaller the AWG number, the larger the current handling capacity. For longer extension cords, consult a local electrician.

6. Ventilation: Electronic products, unless specifically designed for enclosed installations, should be placed in locations that do not interfere with proper ventilation. If instructions for enclosed installations are not provided, it must be assumed that unobstructed ventilation is required.

7. Temperature considerations: Electronic products should be installed in locations that do not significantly contribute to their operating temperature. Placement of this product close to heat sources such as; radiators, heat registers and other devices that produce heat should be avoided.

8. This product was NOT designed for use in wet/damp locations and should not be used near water or exposed to rain. Examples of wet/damp locations are; near a swimming pool, spa, tub, sink, or wet basement.

9. This product should be used only with the components supplied or; a cart, rack, or stand that is recommended by the manufacturer. If a cart, rack, or stand is used, please observe all safety markings and instructions that accompany the accessory product.

10. The power supply cord (plug) should be disconnected from the outlet when electronic products are to be left unused for extended periods of time. Cords should also be disconnected when there is a high probability of lightening and/or electrical storm activity.

11. Care should be taken that objects do not fall and liquids are not spilled into the enclosure through any openings that may exist.

12. Electrical/electronic products should be serviced by a qualified service person when:

    a. The power supply cord has been damaged; or
    b. Objects have fallen, been inserted, or liquids have been spilled into the enclosure through openings; or
    c. The product has been exposed to rain; or
    d. The product does not operate, exhibits a marked change in performance; or
    e. The product has been dropped, or the enclosure of the product has been damaged.

13. Do not attempt to service this product beyond that described in the user-maintenance instructions. All other servicing should be referred to qualified service personnel.

14. This product, either alone or in combination with an amplifier and headphones or speaker/s, may be capable of producing sound levels that could cause permanent hearing loss. DO NOT operate for a long period of time at a high volume level or at a level that is uncomfortable. If you experience any hearing loss or ringing in the ears, you should consult an audiologist. IMPORTANT: The louder the sound, the shorter the time period before damage occurs.

15. Some Yamaha products may have benches and/or accessory mounting fixtures that are either supplied as a part of the product or as optional accessories. Some of these items are designed to be dealer assembled or installed. Please make sure that benches are stable and any optional fixtures (where applicable) are well secured BEFORE using. Benches supplied by Yamaha are designed for seating only. No other uses are recommended.

This information on safety is provided to comply with U.S.A. laws, but should be observed by users in all countiries.

Safety, Warnings & Notes

Please read the following information before operating your CBX-D5.

Safety information

- **Make sure** the CBX-D5's power cord is not located in a position where it is likely to be walked on and/or pinched by other equipment placed near to it.
- **Do not** expose the CBX-D5 to extremes of humidity.
- **Do not** place the CBX-D5 near water.
- **Do not** place the CBX-D5 in areas subject to extremely low temperatures.
- **Do not** place the CBX-D5 in locations subject to excessive dust.
- **Do not** place the CBX-D5 in an area subject to vibration.
- **Do not** expose the CBX-D5 to severe shocks.
- **Do not** place the CBX-D5 in direct sunlight, close to heating units, or in areas subject to high temperatures.
- The ambient temperature where the CBX-D5 is located should be between 10°C and 35°C (50°F and 95°F).

Warnings

- The CBX-D5 **should only** be connected to an AC receptacle of the type described in this *Operating Manual* or as marked on the CBX-D5.
- To reduce the risk of electric shock, **do not** remove the cover of the CBX-D5.
- To reduce the risk of fire or electric shock, **do not** expose the CBX-D5 to rain or moisture.
- The CBX-D5 contains no user serviceable parts. **Refer all** servicing to qualified personnel.
- The CBX-D5 uses digital circuits that operate at high frequencies. When used close to TV and radio equipment, reception may be affected. If this is the case, simply relocate the CBX-D5, or the affected equipment to a different location.
- If any of the following should occur, the CBX-D5 should be serviced by qualified personnel:

  The CBX-D5's power cord or plug becomes damaged in any way.

  Metal objects or liquids get inside the CBX-D5.

  The CBX-D5 is exposed to rain.

  The CBX-D5 is dropped and/or the enclosure is damaged.

  The CBX-D5 does not operate normally or a marked change in performance is noticed.

Cleaning the CBX-D5

If the CBX-D5 should require cleaning use a soft, lightly moistened cloth. Stubborn marks can be removed using a mild detergent. Do not use abrasive cleaners or solvent based cleaning fluids such as alcohol and benzine.

Table of Contents

1 Introduction

Welcome to the CBX-D5

Thank you for purchasing a CBX-D5 Digital Recording Processor. Connecting the CBX-D5 to a controlling computer with supporting software and an external hard disk will provide up to four channels of CD quality audio recording, processing, and playback.

CBX-D5 features

- 4-channel system: 2-channel simultaneous recording, 4-channel playback.
- A/D conversion: 16-bit linear ΔΣ modulation.
- D/A conversion: 18-bit with 8-times oversampling digital filter.
- Multi-band parametric DEQ for each channel.
- DSP provides 82 different reverb and modulation type effects.
- 4-input, 4-bus, 2-send digital mixer.
- Sampling frequencies: 48kHz, 44.1kHz, 32kHz, (22.05kHz analog input only).
- Analog inputs and outputs use professional style XLR type connectors.
- Digital I/O includes AES/EBU, CD/DAT & Y2 Yamaha format.
- 10 minutes of stereo audio requires approximately 100MB hard disk (fs=44.1kHz).
- Total recording time can be increased by adding more SCSI hard disks.
- All audio data processing is carried out within the CBX-D5, so much less is demanded of the computer, eliminating data bottlenecks and slow screen redraws.
- Host computer connection allows direct connection to a computer without a MIDI interface.

Operating manual organization

The CBX-D5 is supplied with three manuals: this *Operating Manual*, the *System Setup Guide*, and a *Test Program manual.*

This *Operating Manual* contains full details about the CBX-D5 Digital Recording Processor: what it is, how it works, and how to use it. It also contains an index that will allow you to locate information quickly, and also a glossary of CBX-D5 terminology.

The *System Setup Guide* describes how to set up a recording system using the current supporting computers and music programs. From time to time this guide will be updated using single sheet supplements. Please see your Yamaha dealer for the latest supplement.

The *Test Program manual* should be used in conjunction with the *Hardware Test Program Disk* for testing the CBX-D5 hardware.

Important Notice

YAMAHA AND THE SOFTWARE COMPANIES THAT PRODUCE CBX-D5 CONTROLLING SOFTWARE CANNOT BE HELD RESPONSIBLE FOR ANY LOSS OF DATA OR FOR ANY DIRECT, INDIRECT, SPECIAL INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES SUFFERED BY THE USER OR OTHERS RESULTING FROM THE USE OR PURCHASE OF THE CBX-D5, ITS DOCUMENTATION, OR SUPPORTING SOFTWARE.

Unpacking

The CBX-D5 packaging should contain the following items.

1	CBX-D5	Serial No:
1	Power cable	
1	8-pin mini DIN cable	
1	MIDI cable	
1	SCSI cable (50 to 50 Amphenol)	
1	SCSI terminator	
1	Rack-mount kit (L & R set)	
1	*Hardware Test Program Disk*	
1	*Test Program Manual*	
1	This *Operating Manual*	
1	*System Setup Guide*	
1	User Registration Card	

Store the packaging materials for future use.

Installation

The cosmetic appearance of the CBX-D5 has been designed to match typical computer hardware. Its “footprint” size matches that of many computers so that it can easily be installed with your other computer equipment.

The CBX-D5 should be placed on a flat, stable surface.

The CBX-D5 can also be rack mounted using the supplied rack-mount kit. When installed in the rack-mount kit the CBX-D5 requires 3U of rack space.

Trademarks

Powering up a CBX-D5 System

Some computer systems are a little bit fussy about which devices are switched on first, especially when a SCSI daisy chain is introduced into the system. As a good rule of thumb, switch on all connected SCSI devices first, then the computer.

NOTE: While using your CBX-D5 computer music system, do not switch off or disconnect any device connected in the SCSI chain. Doing so will probably lead to a system crash and you could loose valuable data.

2 CBX-D5 Terminology

SCSI

Pronounced scuzzy, the Small Computer System Interface is a connection format used for connecting peripheral devices such as hard disks, printers, scanners, etc., to a computer. Up to eight SCSI devices can be connected together in a daisy chain including the controlling computer. Each device is given its own identity number from 0 to 7, this is called the SCSI ID number.

The CBX-D5, a computer, and a hard disk are all connected as part of a SCSI daisy chain. The SCSI connection carries audio data between the CBX-D5 and hard disk for recording and playback, and also control data from the computer to the CBX-D5. The controlling computer can also access the hard disk to perform basic sound file copy, delete, and backup type functions. With the necessary software, digital audio data could be transferred directly to the computer for on-screen waveform editing, etc.

The SCSI standard is quite a robust format, although, some care must be taken when connecting and setting up SCSI devices. For full details about connecting SCSI hard disk drives to the CBX-D5 see “Connecting Hard Disk Drives” on page 13.

Sound files

Just like other types of computer data, digital audio data is stored in files – sound files. When recording starts, a sound file is created on the hard disk. This sound file can be given a name, copied, and deleted just like any other computer file.

AES/EBU format

AES/EBU is a digital interface format established by the AES (Audio Engineering Society) and EBU (European Broadcasting Union). It is used to transfer digital audio data between professional digital audio equipment. Usually, two channels of digital audio (left & right) are carried in one XLR type connection.

Although similar to the CD/DAT format, it is primarily intended for professional usage. AES/EBU format connections can be found on most professional digital audio equipment including hard disk recorders, digital mixers, professional DAT recorders, and many digital VTRs.

CD/DAT format

Similar to the professional AES/EBU format, CD/DAT, or S/PDIF (Sony/Philips Digital Interface Format) as it is otherwise known, is a digital interface format that is used to transfer digital audio data between consumer type digital audio equipment such as CD players, consumer DAT recorders, and the new DCC recorders.

Like the AES/EBU format, two channels of digital audio (left & right) are carried in one connection, usually a phono/RCA jack type connection. Some MIDI samplers are fitted with a CD/DAT connection so that sample data can be transferred directly to a DAT recorder for storage.

Y2 format

Y2 Yamaha format is a digital interface format developed by Yamaha that is used to transfer digital audio data between Yamaha’s professional digital audio equipment. Two channels of digital audio (left & right) are carried in one connection, usually an 8-pin DIN type connection.

Yamaha’s professional digital audio products usually include the AES/EBU and CD/DAT type formats as well as Y2, and the Y2 format can also be found on some other manufacturers’ digital audio products. Yamaha’s professional digital audio products that use Y2 include the DMR8 Digital Mixer/Recorder, DMC1000 Digital Mixing Console, DRU8 Digital Recorder, and the DMP series of Digital Mixers.

Sampling frequency (REC FREQ)

During the analog to digital conversion process, the level of the analog audio signal is sampled (measured) many times per second. Each of these sample measurements is then stored as a 16-bit binary value. For digital to analog conversion (playback), these 16-bit binary values are used to reconstruct the analog audio signal. The rate at which these sample measurements take place is called the sampling frequency and you may already know that the sampling frequency used by CD players is 44.1kHz.

The CBX-D5 can record audio using any one of four sampling frequencies: 48kHz, 44.1kHz, 32kHz, and 22.05kHz. The audio quality (bandwidth) of a digital system is directly affected by the sampling frequency. Essentially, the audio bandwidth will be roughly half the chosen sampling frequency. See “Sampling frequency (REC FREQ)” on page 20 for more details.

Word clock

When a number of digital audio devices are connected together and data is digitally transferred between them, it is essential that the data processing circuits of all devices are synchronized. To achieve this, one device operates as a word clock master and all other devices operate as word clock slaves. The frequency of the word clock corresponds directly to the digital audio data’s sampling frequency.

If you only connect two digital audio devices, say the CBX-D5 to a DAT recorder, word clock setup is quite straight forward and no word clock connections will be required. However, when three devices are connected, serious thought will need to be given as to which device is word clock master and how to make the word clock connections. See “WORD CLK IN/OUT” on page 28 for more details.

NOTE: Word clock signals should not be confused with other synchronizing signals such as SMPTE timecode and MTC (MIDI Timecode). Although both may be used in a digital audio system, word clocks are for synchronizing digital audio data processing circuits such as CPUs, D/A, A/D converters, etc., while SMPTE and MTC timecodes are for synchronizing audio and video tape machines, MIDI sequencers, etc., relative to time – hours, minutes, seconds, and frames.

To Host

An 8-pin mini DIN connector that allows direct connection to a computer that is running CBX-D5 supporting software. This can be used when your computer does not have a MIDI interface, i.e. MIDI input and output connections. See “TO HOST connection” on page 30 for more details.

NOTE: Not all CBX-D5 supporting music software can use this type of connection, so please consult your Yamaha dealer before making a purchase.

3 What is the CBX-D5?

The CBX-D5 is a Digital Recording Processor that, when connected to a controlling computer with supporting software and an external hard disk, provides up to four channels of CD quality audio recording, processing, and playback.

Computer based

The CBX-D5 is controlled by a computer that is running CBX-D5 supporting software. All audio data processing takes place inside the CBX-D5, so there is very little demand on the controlling computer. For this reason the CBX-D5 can be used with some of the less powerful, less expensive computers such as the Apple Macintosh SE/30, Classic II, and LC; and the Atari ST/STE. It also leaves the computer free to get on with other jobs such as processing MIDI sequence data and screen updates.

The CBX-D5, computer, and hard disk are all connected as part of a SCSI daisy chain. The SCSI connection carries audio data between the CBX-D5 and hard disk for recording and playback, and also control data from the computer to the CBX-D5. A MIDI connection between the CBX-D5 and computer carries continuous controller information for real-time volume, EQ, and pan control of the CBX-D5's digital mixer.

Four-channel system

The CBX-D5 is a 4-channel system, i.e., 2-channel simultaneous recording and 4-channel playback. Channels can be recorded while other channels playback.

The CBX-D5 needs about 100Mbytes of hard disk space to record 10 minutes of stereo digital audio (fs = 44.1kHz). The available recording time can be increased by simply adding more, or larger hard disk drives to the SCSI daisy chain.

CD quality & editing

The CBX-D5 records audio data at a 16-bit resolution, and with 44.1kHz and 48kHz sampling frequencies it provides all the sound quality benefits of the Compact Disc format such as faithful reproduction, low noise, minimal distortion, etc.

Analog input and output signals are processed by 16-bit linear $\Delta\Sigma$ modulation A/D and 18-bit 8-times oversampling D/A converters. Analog connections use balanced XLR type connectors. Digital I/O consists of AES/EBU, CD/DAT, and Y2. Allowing digital audio data transfer between the CBX-D5 and other digital audio equipment.

As well as the A/D, D/A converters, the CBX-D5 also contains a 4-input, 4-bus, 2-send digital mixer; a DSP for digital effects; DEQ for real-time EQ control; and sampling frequency converters that allow recording and playback at differing sampling frequencies.

As well as the sound quality, two other benefits of recording with a CBX-D5 system as opposed to analog tape are, the ability to nondestructively edit recordings and being able to move audio data relative to time, a feature often referred to as audio time slip.

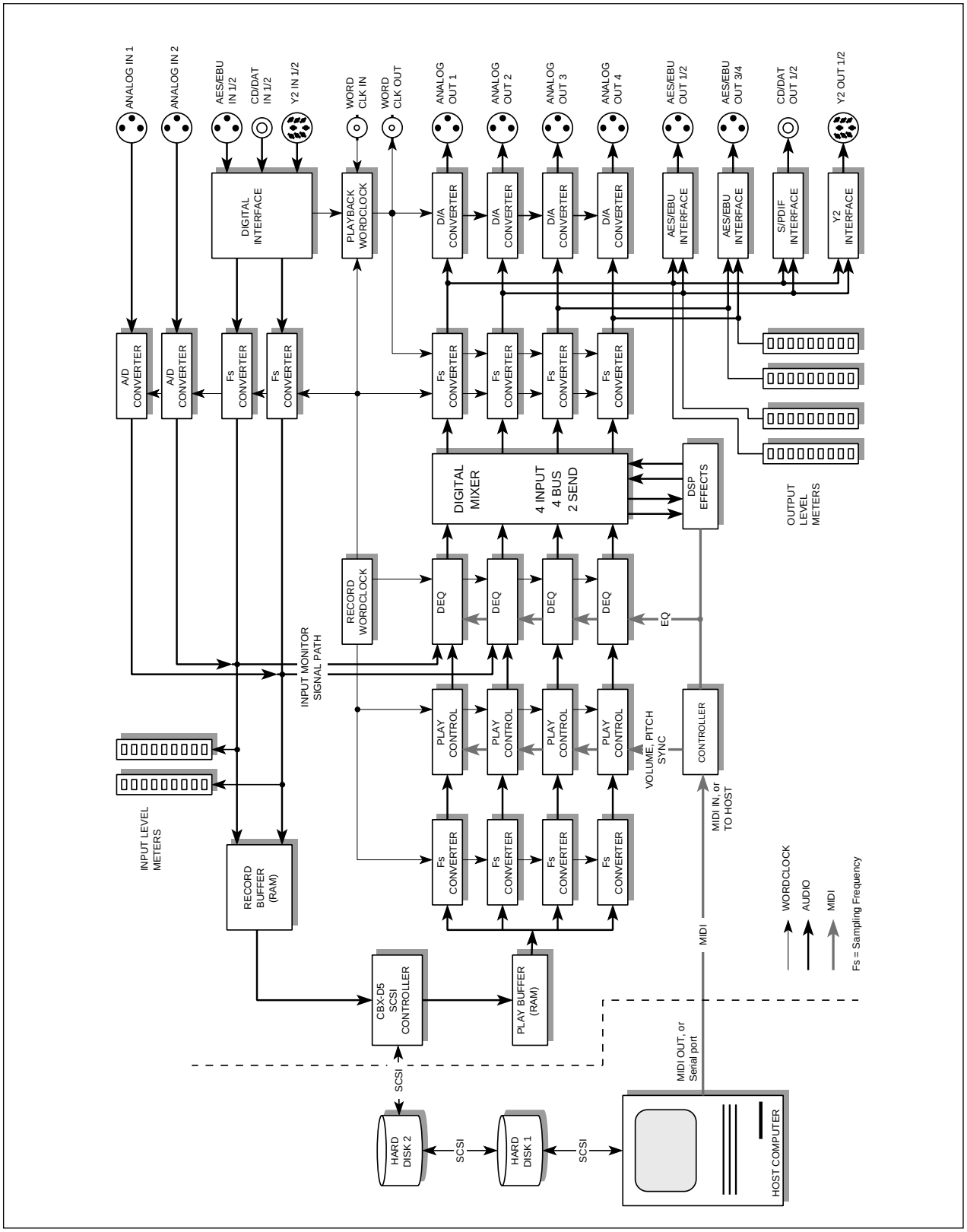
For a listing of some other CBX-D5 features, see "CBX-D5 features" on page 1.

The future

The CBX-D5 is a software dependent device, so with future supporting software it may be possible to use the CBX-D5 for digital mixing with digital EQ and effects, sampling, 2-track mastering, waveform editing, and multimedia type applications.

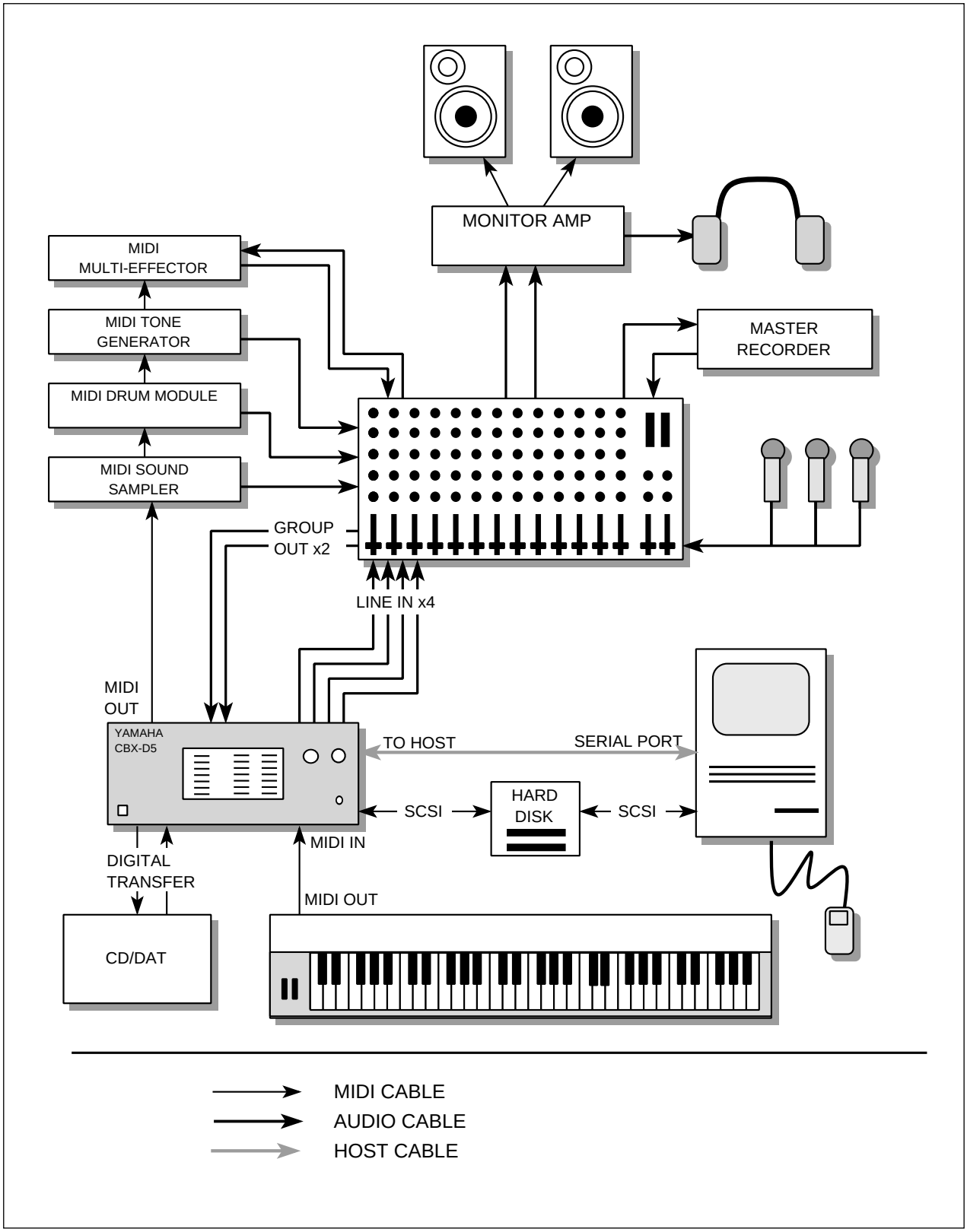
Inside the CBX-D5

The following block diagram shows how the CBX-D5 processes audio data as it travels from input to output and to the external SCSI hard disks.



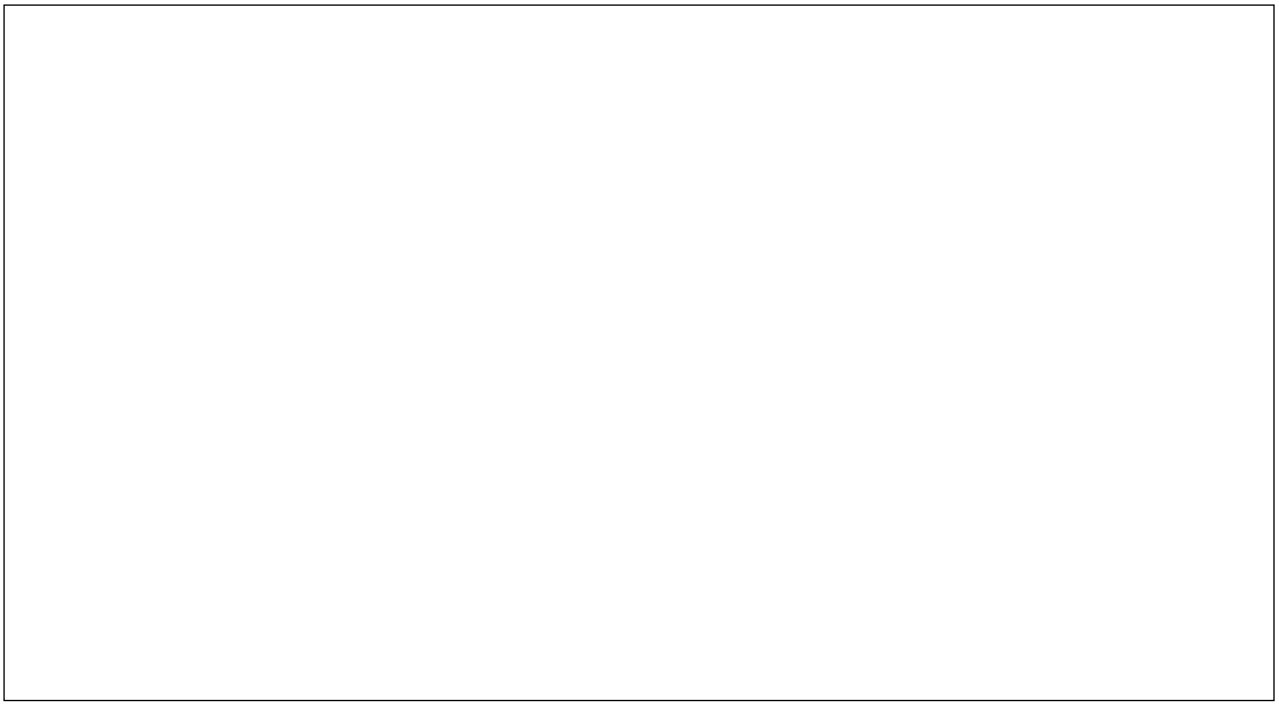
The CBX-D5 in a MIDI recording system

The following diagram shows how the CBX-D5 can be integrated into a MIDI sequencer based music production system.



4 Controls & Connections

Front panel



① POWER switch

Used to turn the power on and off. Press once to switch on, press again to switch off.

② SOURCE indicators

Indicates the input selected for recording: AES/EBU, Y2, CD/DAT, or ANALOG. The source input selection is made by the controlling software.

③ REC FREQ indicators

Indicates the selected sampling frequency for recording: 48kHz, 44.1kHz, 32kHz, and 22.05kHz (analog inputs only). The sampling frequency selection is made by the controlling software.

④ PB FREQ indicators

Indicates the sampling frequency of the digital audio data that is being output by the CBX-D5: 48kHz, or 44.1kHz. The playback sampling frequency setting is made by the controlling software.

When the CBX-D5 is used with an external word clock, the digital outputs will operate at the same frequency as the external word clock and that frequency will not be indicated by the “PB FREQ” indicators.

⑤ INPUT LEVEL meters

Two 12-segment LED bargraphs indicate the level of the incoming digital audio when the input source is set to AES/EBU, CD/DAT, or Y2 (not affected by the level controls), or the level of the analog input signals when the input source is set to ANALOG (controlled by the "ANALOG IN" level controls).

> **NOTE:** Unlike peak meters on analog equipment that light up approximately 3 ~ 6dB before signal clipping, CLIP LEDs on digital equipment light up when the signal has actually clipped. Digital audio signal clipping normally produces unpleasant distortion, pops, and clicks, so care must be taken when setting the recording level for analog input signals. See "Recording" on page 20 for more details.

⑥ OUTPUT LEVEL meters

Four 12-segment LED bargraphs that indicate the output level of channels 1 ~ 4. The "CLIP" LED indicates an output level of +17dBm.

> **NOTE:** Just like the input level meters, lighting an output level meter's "CLIP" LED should be avoided to prevent signal distortion. This situation may occur when two or more CBX-D5 audio channels are mixed, or if excessive EQ is applied. The CBX-D5 does not have any output level controls, the output level is set by the controlling software.

⑦ ANALOG IN LEVEL control

Independent level controls for analog input channels 1 and 2. As well as independent level control, these controls can also be used to balance the left and right channels of a stereo source connected to the analog inputs.

> **NOTE:** These controls have no effect on the AES/EBU, CD/DAT, and Y2 digital inputs and outputs.

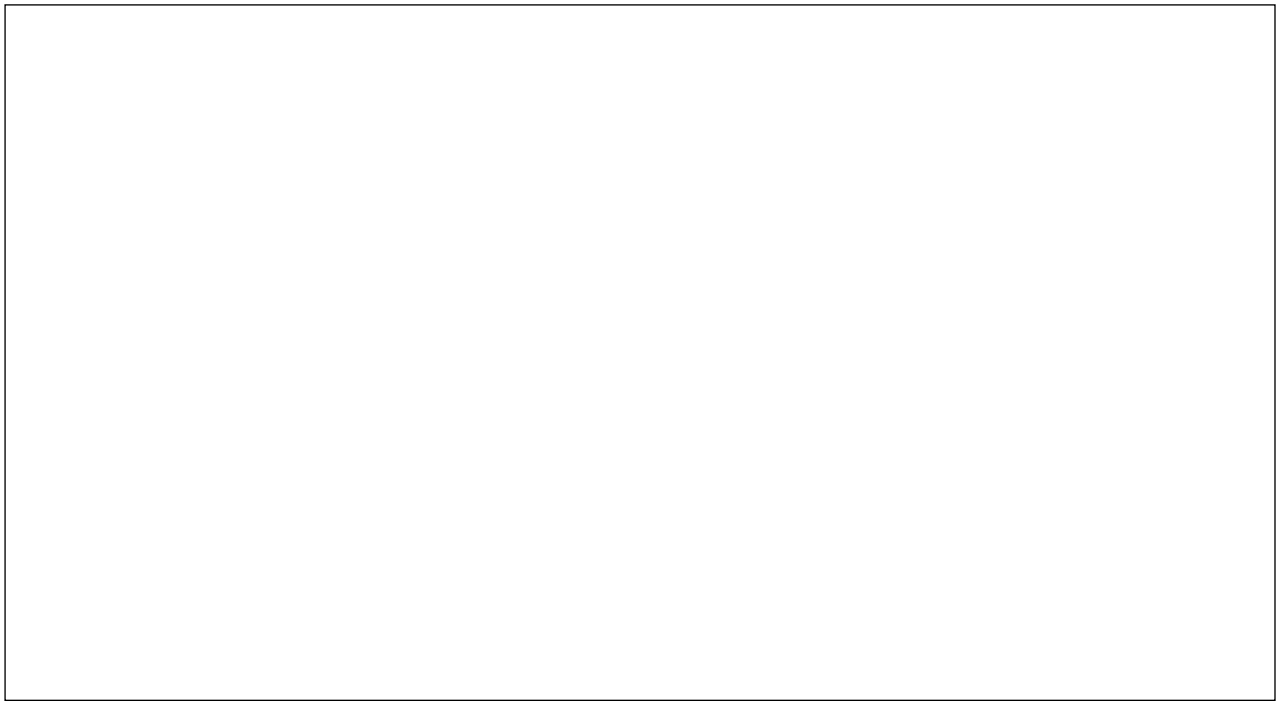
⑧ PHONES VOL

Adjusts the volume level of the headphones.

⑨ PHONES connection

A stereo 6.35 mm (1/4 inch) phone jack used for connecting a pair of stereo headphones. All four CBX-D5 audio channels can be monitored – channels 1 and 3 appear in the left speaker and channels 2 and 4 in the right.

Rear panel



The explanations below are only brief introductions to the CBX-D5's rear panel connections. For full details about the inputs and outputs, see "Inputs & Outputs Explained" on page 26.

① ANALOG IN 1&2

A pair of female XLR 3-31 type connectors used for inputting analog audio signals. These are balanced inputs with a nominal input level of +4dBm and a maximum input level of +22dBm. These could be connected to the outputs of a mixer, synthesizer, drum machine, etc. Microphones, guitars, and equipment with an output level less than –20dBm must first be connected to a preamplifier, then to the CBX-D5.

NOTE:	When the Analog inputs are used unbalanced, the maximum input level is reduced to +16dBm.

② ANALOG OUT 1 ~ 4

Four male XLR 3-32 type connectors used for outputting channels 1 ~ 4 as analog audio signals. These are balanced outputs with a nominal output level of 0dBm and a maximum output level of +17dBm. These could be connected to the inputs of a mixer, amplifier, tape recorder, or DAT recorder.

③ AES/EBU IN 1/2

A female XLR 3-31 type connector for inputting AES/EBU format digital audio. Only one input connection is required for channels 1 and 2 because the AES/EBU format carries two signals in one connection. These could be used when recording digital audio data from professional digital audio equipment such as another hard disk recorder, a digital mixer, digital recorder, or digital VTR.

④ AES/EBU OUT 1/2 & 3/4

Two male XLR 3-32 type connectors for outputting AES/EBU format digital audio. Channels 1 and 2 are output via “OUT 1/2”, and channels 3 and 4 via “OUT 3/4”. These could be used to transfer digital audio data from the CBX-D5 to professional digital audio equipment.

⑤ CD/DAT IN 1/2

A Phono/RCA jack for inputting CD/DAT format digital audio. Channels 1 and 2 are carried in the same connection. This connection could be connected to the digital output of a CD player or DAT recorder and allows digital audio recording without multiple D/A, A/D audio data conversions. Some MIDI samplers are fitted with this type of connection. In this case your sound samples could be recorded directly to your CBX-D5 system.

⑥ CD/DAT OUT 1/2

A Phono/RCA jack for outputting CD/DAT format digital audio. Channels 1 and 2 are carried in the same connection. This could be connected to the digital input of a DAT recorder or DCC recorder, and allows digital audio recording without multiple D/A, A/D audio data conversions.

> **NOTE:** It is widely known that the weakest links in a digital audio system are the A/D and D/A converters. For once the audio has been converted into a digital form, it is immune from all the problems usually associated with analog equipment such as distortions and noise. Although the effects of multiple conversions will be hard to spot, even for the best trained ears, it makes sense that once converted, we try and keep the audio in a digital form by using these digital I/O connections wherever possible.

⑦ Y2 IN 1/2

An 8-pin DIN socket for inputting Y2 Yamaha format digital audio. As with the AES/EBU and CD/DAT formats, two audio channels are carried in the same connection. This could be connected to one of Yamaha’s digital audio products such as a DMR8 Digital Mixer/Recorder, DMC1000 Digital Mixing Console, DRU8 Digital Recorder, SPX1000 Effect Processor, or the DMP series of Digital Mixers.

⑧ Y2 OUT 1/2

An 8-pin DIN socket for outputting Y2 Yamaha format digital audio. This could be used to transfer digital audio data from the CBX-D5 to one of the Yamaha professional digital audio products listed above. You might not own one of these products yourself, but you may need to transfer some of your audio data to a recording studio that does.

⑨ WORD CLK IN/OUT

Two BNC type connectors for inputting and outputting word clock signals. A common word clock signal is used to synchronize data processing circuits when a number of digital audio devices are connected together. For a full description of how and when to use these connections, see “WORD CLK IN/OUT” on page 28.

⑩ MIDI IN

The CBX-D5 receives MIDI control data from the computer via this connection. To prevent the CBX-D5's control data being delayed by other MIDI devices, the CBX-D5 should be the first device connected to your computer. Other MIDI devices should then be connected to the CBX-D5's MIDI THRU connection.

If your computer's MIDI interface has two or three MIDI outputs, dedicate one for use with the CBX-D5.

> **NOTE:** Although not usually a problem on a small MIDI system, when more than three MIDI devices are daisy chained together using MIDI IN and THRU connections, MIDI data can sometimes be delayed, especially if you transmit a lot of continuous controller data such as pitch bend or modulation wheel. If MIDI delays do become a problem, use a MIDI THRU Box to distribute the MIDI signal to each MIDI device.

⑪ MIDI OUT

When the CBX-D5 is being used as a MIDI interface, that is, a direct connection to a computer via the To Host connection, MIDI data from the computer is output to other MIDI devices from this connection. Also used for MIDI bulk dump.

> **NOTE:** The operation of the MIDI IN and MIDI OUT connections varies depending on the position of the CBX-D5's Host select switch. See "TO HOST connection" on page 30 for full details.

⑫ MIDI THRU

MIDI data appearing at the MIDI IN connection is buffered, then output from this connection. In other words, all MIDI data appearing at the MIDI IN connector is output to the MIDI THRU connector unaffected by the CBX-D5.

⑬ TO HOST connector

An 8-pin mini DIN connector that allows direct connection to a computer that is running CBX-D5 supporting software. This can be used when your computer does not have a MIDI interface, i.e., MIDI input and output connections. See "TO HOST connection" on page 30 for more details.

⑭ TO HOST select switch

This switch setting depends on the type of computer connected to the "TO HOST" connector. See "TO HOST connection" on page 30 for full details.

⑮ SCSI connectors

Two 50-way Amphenol type connectors used to connect the CBX-D5 into the SCSI daisy chain.

⑯ SCSI ID selector

A thumb wheel type switch used to set the SCSI ID number of the CBX-D5. See "SCSI ID setting" on page 16 for more details.

⑰ Power inlet

A 3-pin power inlet socket. Connect the supplied power cable to this socket, then plug the other end of the cable into an AC receptacle of the correct type.

5 Connecting Hard Disk Drives

Before connecting a hard disk drive, read through this chapter to familiarize yourself with SCSI and how a SCSI daisy chain should be setup.

What type of hard disk?

If you don't already have a hard disk or are thinking of buying a larger one, see the supplied card for a listing of recommended disk drives.

Hard disk size

The following table shows approximate available recording times for various sizes of hard disk. Available recording times are shown for all of the CBX-D5's sampling frequencies, and as you can see, with a higher sampling frequency – less time is available. This is because using a high sampling frequency produces much more digital data, which means a bigger sound file. See "Sampling frequency (REC FREQ)" on page 20 for more details about selecting a sampling frequency.

Hard disk / Max. Sound File Size	Stereo Recording (minutes)				Mono Recording (minutes)			
	22.05 kHz	32 kHz	44.1 kHz	48 kHz	22.05 kHz	32 kHz	44.1 kHz	48 kHz
2000MB (2GB)	380	260	190	174	760	760	380	348
1000MB (1GB)	190	130	95	87	380	380	190	174
660MB	124	85	62	57	248	248	124	114
330MB	62	42	31	28	124	124	62	56
200MB	40	25	20	17	80	50	40	34
100MB	20	13	10	8	40	26	20	16
40MB	8	5	4	3.30	16	10	8	7
20MB	4	3	2	1.42	8	6	4	3.24
10MB	2	1.18	1	51 secs	4	2.36	2	1.42
5MB	1	38 secs	30 secs	26 secs	2	1.16	1	52 secs
1MB	12 secs	7 secs	6 secs	5 secs	24 secs	24 secs	12 secs	10 secs

Although it is doubtful that you will ever buy a hard disk smaller than 40MB for use with the CBX-D5, the values below 40MB will be useful for checking the remaining record time that is available on a hard disk that already contains some sound files.

Choosing a hard disk

If you plan to buy a hard disk that is not listed on the supplied card, the following specifications should be checked first.

Specification	Check	Notes
Is it compatible with your computer?		Maybe it is advertised as compatible, or your dealer recommends it.
Does it have two SCSI connectors?		You need two to continue the SCSI daisy chain.
Are the SCSI connectors 25-pin D-SUB, or 50-way Amphenol?		Macintosh computers are fitted with a 25-pin D-SUB connector, while most other SCSI devices have a 50-way Amphenol connector.
Are the SCSI cables supplied?		If not, you will need to purchase them separately.
Can the SCSI ID be set from 0 ~ 7? (for Macintosh you only need 0 ~ 6)		If not, it might clash with another device's ID, in which case you may have to rearrange the ID numbers of some other SCSI devices in the chain.
Does it have internal or external termination?		External terminators are normally connected to the rear of the SCSI device. If the device has an internal terminator, make sure it can be switched off so that any device can be positioned at the end of the SCSI daisy chain.
Access Time?		Measured in milliseconds, this is an indication of how fast data from different areas of the disk can be retrieved. The maximum we recommend is 30ms. An access time slower than this may affect the performance of the CBX-D5.
Data Transfer Rate?		Usually measured in Megabits per second (Mbit/s), this shows how fast data can be written to and read from the hard disk. The minimum we recommend is 16Mbits/s. A transfer rate less than this may affect the performance of the CBX-D5.

SCSI

For an general introduction to SCSI, see "SCSI" on page 3.

Setting up a SCSI daisy chain requires a little more than just making connections. SCSI devices require ID numbers and the daisy chain must be terminated correctly. These are explained in the following three sections, "SCSI cables", "SCSI ID setting", and "SCSI termination".

When using a SCSI daisy chain, the following points should be borne in mind.

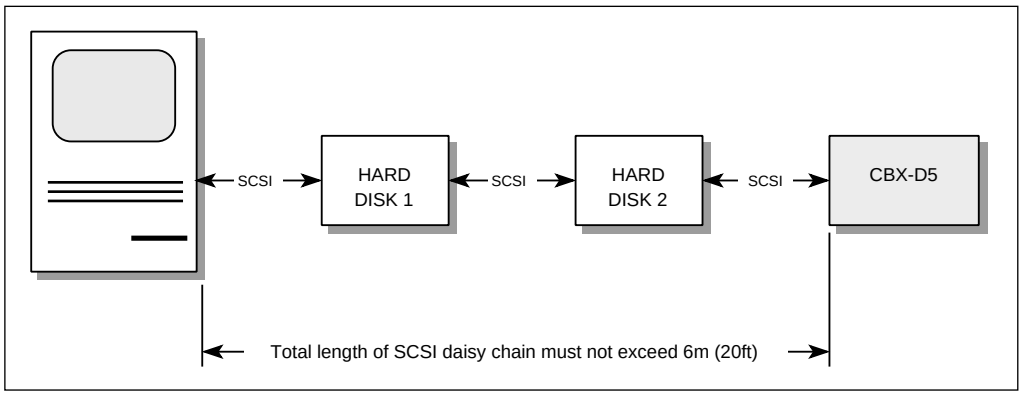
- Allocate each device its own SCSI ID number.
- Terminate the SCSI bus correctly.
- Use quality cables and keep the length down.
- Use the little wire clips (or screws) on a SCSI connector to fasten the cable plugs securely.
- All devices connected in the daisy chain must be switched on to use the system.
- Never switch off, or disconnect a device once the system has been switched on.

NOTE: Switch off all your equipment before making any SCSI connections.

SCSI cables

Most SCSI devices are supplied with a SCSI cable, but if you need to buy one, make sure that it is designed for SCSI usage and that the connecters on either end of the cable are correct for your application.

Cable length is an important issue, but it's not the length of each individual SCSI cable, it's the total length of the SCSI daisy chain that must not exceed 6m (20ft).



Computer connection

Apple Macintosh

Apple Macintosh computers use a 25-pin D-SUB connector for the SCSI port, so use a 25-pin D-SUB to 50-way Amphenol type SCSI cable, usually supplied with an external Macintosh hard disk drive.

Atari ST/STE

For Atari ST/STE computers, a Steinberg SCSI adaptor is required. This should be connected to the Atari ST/STE's "HARD DISK" port (DMA) using a 19-pin DSUB to 19-pin DSUB cable. An external hard disk drive can then be connected to the SCSI adaptor's SCSI connector using a 50-way to 25-pin SCSI cable.

NOTE:	Some Atari ST/STE hard disk drives already contain a SCSI adaptor, however, they cannot be used as a substitute for the Steinberg adaptor.

Although it is possible to use just one external hard disk, it is highly recommended, for the sake of data integrity, that you use at least two external hard disks: one disk for your computer software and data such as Cubase Audio, MIDI song files, etc., and the other disk purely for recording CBX-D5 sound files.

Atari TT

The Atari TT has a SCSI connection built-in, so a SCSI hard disk drive can be connected directly.

Atari TT computers are fitted with an internal hard disk as standard. The internal disk should be used for your computer software and data such as Cubase Audio, MIDI song files, etc., and an external hard disk should be used purely for recording CBX-D5 sound files. An external hard disk must be used with an Atari TT, because it supplies the termination power that is required by the SCSI bus.

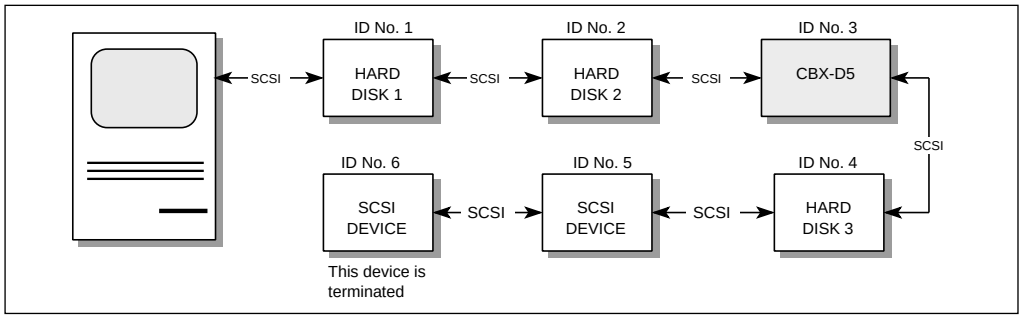
IBM PC/AT compatible

For an IBM PC/AT compatible computer, a SCSI adaptor card is required. This should be installed into one of the computer's internal expansion slots.

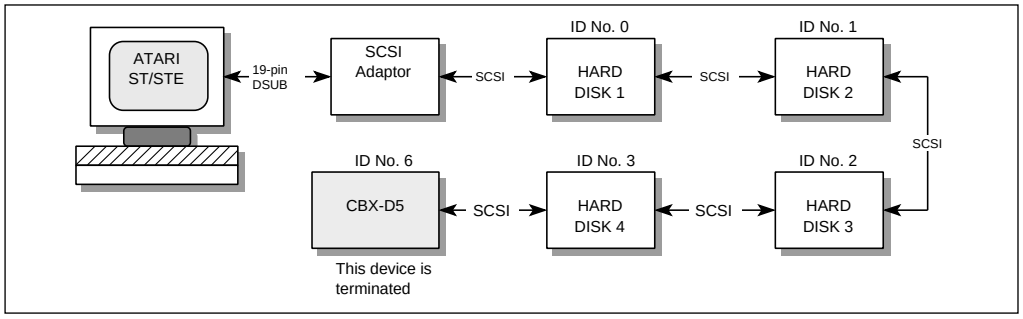
SCSI ID setting

The SCSI bus is a parallel type connection, and data on the bus is available to all devices. However, communication will usually be between two devices only, so each device is allocated an ID number, like an address number. In this way, only the device with the ID number that is specified in the data will actually read and respond to the data.

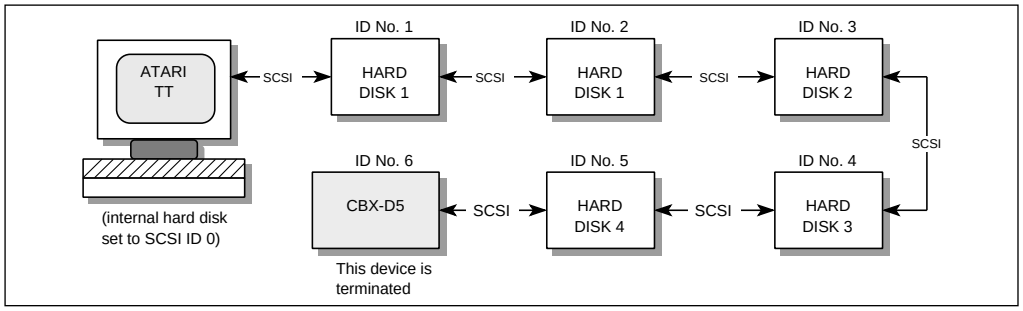
If two devices share the same ID number, the system will probably crash, so make sure that each device has its own ID number. SCSI devices usually have a DIP switch or, like the CBX-D5, a thumb wheel switch for ID setting. Refer to the instructions supplied with your particular SCSI device.



The Apple Macintosh example above shows six devices connected in a SCSI daisy chain (seven including the computer). Each device has its own ID number. Note that the last device in the chain is terminated. On a Apple Macintosh computer, SCSI ID 7 is reserved for use by the computer, and ID 0 for the internal hard disk. **Do not** use either of these IDs for any other SCSI device.



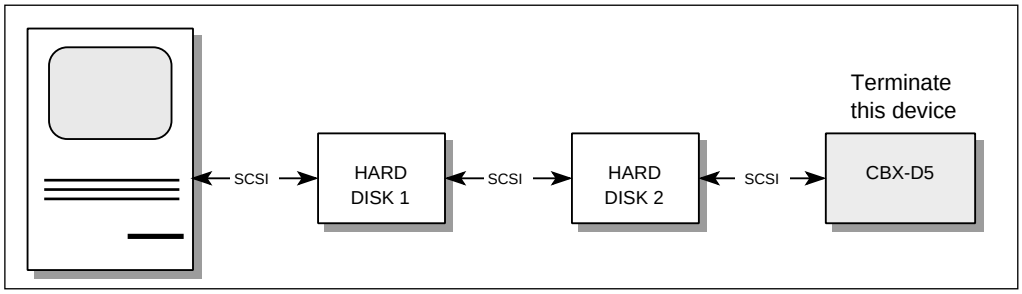
In the Atari ST/STE system shown above, five SCSI devices are connected in a daisy chain. Hard disks **must** be set with continuous SCSI IDs starting from 0 (0, 1, 2, 3…). However, the CBX-D5 can be set to SCSI ID 5 or 6. **Do not** set any device to SCSI ID 7.



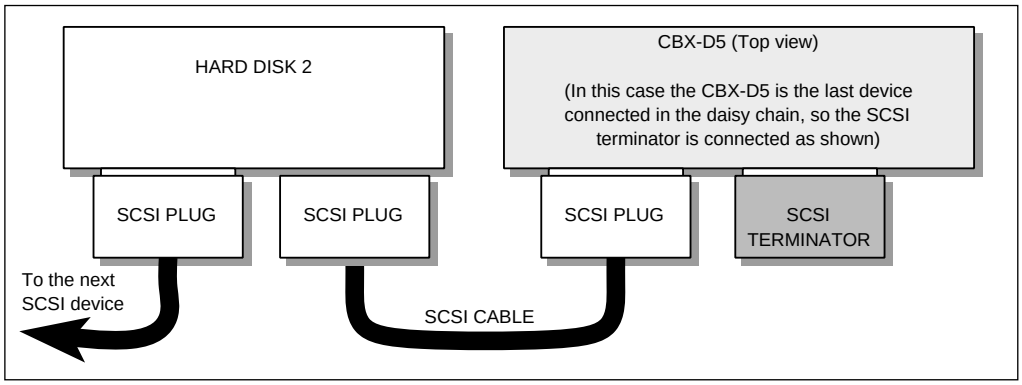
In the Atari TT system shown above, six SCSI devices are connected in a daisy chain. Hard disks **must** be set with continuous SCSI IDs starting from 1 (1, 2, 3, 4…). However, the CBX-D5 can be set to SCSI ID 5 or 6. **Do not** set any device to SCSI ID 7.

SCSI termination

Unlike audio signals, digital signals only have two values: high and low (+5V and 0V). When no data is being transmitted, it is important that SCSI bus lines are kept in the high state (+5V), so that when data is transmitted there is a clear distinction between high and low pulses and the data is transferred without error. To achieve this, a device known as a SCSI terminator is connected in the SCSI daisy chain. A terminator is usually fitted to the last device in the chain.



Some SCSI devices have a terminator built-in. In this case that device should be connected at the end of the daisy chain. Other devices, like the CBX-D5, are supplied with an in-line type terminator and this can be connected as shown below.



NOTE: If the SCSI daisy chain is not terminated correctly, numerous problems including data corruption, system crashes, and intermittent glitches can occur. If you have just set up your SCSI daisy chain or have added a new SCSI device to it and it is not working as it should, check that the SCSI daisy chain is terminated correctly. If the problem persists, try connecting the SCSI devices in a different order.

6 Working with Hard Disks

After connecting your hard disk, setting the SCSI ID, and installing the SCSI terminator, you will need to format the hard disk before it can be used. If you have already powered up your system you will notice that there isn't a disk icon representing the new disk drive on the desktop. This is because your computer could not mount the hard disk during boot-up, due to it not being formatted.

Formatting

Most SCSI hard disks are supplied with their own disk formatting software, so please refer to the hard disk's Manual, and format the disk as specified.

Before disk formatting begins you will probably be asked to supply the SCSI ID of the hard disk and maybe the required interleave value. The SCSI ID will be the number that you set on that hard disk using its SCSI ID DIP switch or thumb wheel switch. If you have to specify an interleave value, check the hard disk's Manual. Also see the "Adding SCSI disk drives" section of your computer manual.

When the disk has been formatted correctly and any supplied hard disk driver software has been installed, a disk icon should appear on your computer's desktop.

Sound file management

By double clicking on the disk's icon you will be able to access sound files stored on the disk. Sound files can be copied, deleted, size checked, etc., using the same menu commands that you would use for your other computer files.

Sound file backup

Because the CBX-D5's sound files can be managed just like your other computer files, sound files can be backed up in much the same way using data compression and backup utilities. However, due to the relatively large size of sound files, floppy disks are not the most effective backup media. Removable hard disks and magneto optical disks are well suited to this task and commonly available sizes include 44MB, 88MB, 128MB, and 650MB.

Another backup option is to digitally transfer your sound files to a DAT recorder. Then, if you want them again in the future, just record them back to the CBX-D5.

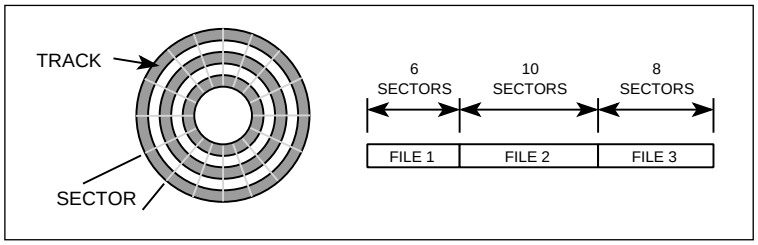
Computer utilities

There are many computer utilities and desk accessories available for managing files and hard disks such as a "file squashers", "auto savers", "hard disk size doublers", etc. If you choose to use a utility to work along side the CBX-D5, **YOU DO SO AT YOUR OWN RISK** and no responsibility can be claimed for lost data, system crashes, and hardware damage.

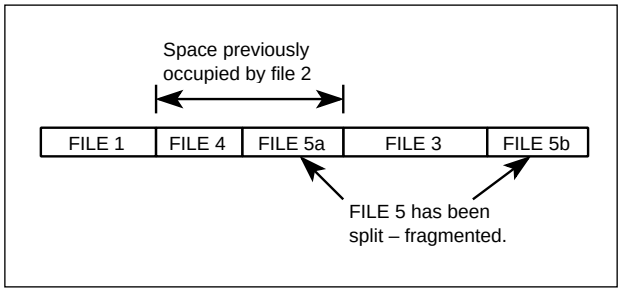
The CBX-D5 is designed to work with the software described in the *System Setup Guide*, why risk losing your valuable audio data by using a "super disk space doubler", or "real-time data compressor"?

Hard disk fragmentation

Hard disks record data into pre-formatted concentric tracks on a number of magnetic disks that are mounted around a common spindle. Tracks are further divided into sectors, and each sector can store 512bytes of data. On a newly formatted disk, files are recorded into a continuous series of sectors as shown below.



As files are deleted and new files saved, files may be split (fragmented) over different areas of the disk, losing the continuity of sectors. In this case, reading one file may cause the disk drive to read sectors from many different parts of the disk, thus slowing down the overall data read rate and making the disk drive work harder.



Disk defragmentation is quite important for hard disk audio recording, as it is better to record data into a continuous series of empty hard disk sectors. If recording starts in an empty sector, but then subsequent sectors in the series are used by another file, because there is so much data being recorded, the disk drive does not have time to find, then move to another area on the disk, so recording may stop.

This is not a problem with a completely empty disk, but if a sound file is deleted, the next recording might start in the deleted space, and recording might stop because there is not enough continuous empty sectors available. This will be more noticeable on a smaller hard disk where you have to keep deleting unwanted sound files to make way for new recordings.

The answer is to use a good hard disk defragmentation utility when a sound file has been deleted. By defragmenting the disk, all sound files will be moved up to the front end of the disk, leaving the available disk space as a series of continuous sectors at the end of the disk.

Hard disk partitioning

Because the CBX-D5 can read and write to any hard disk drive connected in the SCSI chain, it is able to use individual partitions of a hard disk drive that has been partitioned. However, the CBX-D5 cannot record across hard disks or partitions, so the available recording time will be limited to the size of the partition.

NOTE:	The time available for **all recordings** is not limited by the size of a hard disk partition, it is the time available for **one continuous recording**, or one take that is limited.

7 Recording

Sampling frequency (REC FREQ)

The CBX-D5 can record at any one of four sampling frequencies: 48kHz, 44.1kHz, 32kHz (as specified by the AES), or 22.05kHz (analog input only). These sampling frequencies are commonly used for digital audio, and each has its own specific applications.

The sampling frequency is set by the controlling software and the CBX-D5's front panel REC FREQ indicators show the selected frequency. The selected REC FREQ also determines the clock rate for all internal processing, i.e., DSP, digital mixer, DEQ, etc., except for the output Fs converters, whose clock rate is determined by the PB FREQ.

NOTE:	When using the digital inputs, you should set the CBX-D5's REC FREQ to match the digital input signal's sampling frequency. It is not essential, but we recommend it.

48kHz

At 48kHz an audio bandwidth of about 22kHz is possible. Consumer DAT and DCC recorders can record at 48kHz only. Professional equipment also supports this frequency.

44.1kHz

With this sampling frequency an audio bandwidth of about 20kHz is possible. This frequency is used for all prerecorded CDs, DATs (if there are any), and DCC cassettes. Although a higher audio bandwidth is possible using 48kHz, 44.1kHz is considered to be good enough for most applications, and most professional digital audio engineers use this sampling frequency.

32kHz

At this sampling frequency an audio bandwidth of about 15kHz is possible. This frequency is widely used for broadcast applications where a 15kHz audio bandwidth, roughly that of FM radio, is acceptable. Many DSB (Direct Satellite Broadcasting) transmissions use this frequency, although, some may also use 48kHz.

22.05kHz

At this frequency an audio bandwidth of about 10kHz is available. This frequency is widely used in multimedia applications. It might not seem very useful for your audio applications, but if you are limited by hard disk space or the audio material you are recording already has a limited bandwidth it may be useful.

Which sampling frequency?

Since the CBX-D5 contains a sampling frequency converter, digital audio can be output at a different sampling frequency to that which was used during recording. However, playing back a sound file at a higher sampling frequency will not improve the audio quality, as the audio frequency bandwidth of a sound file is determined by the record sampling frequency, not the playback frequency.

This leaves you with two deciding factors for choosing a sampling frequency. Firstly, what audio bandwidth (audio quality) do you want to use, and secondly, how much free disk space is available? See "Hard disk size" on page 13 for a listing of recording times that are available at each sampling frequency for a given size of hard disk (free disk space).

Varispeed

With some tape based digital recorders it is possible to vary the speed of playback and recording. When varispeed is used the sampling frequency of the digital audio is changed. Since the CBX-D5 can playback digital audio at a sampling frequency different to that used for recording, varispeed digital audio can be recorded.

Digital input levels

Digital input signals entering the CBX-D5 cannot be level adjusted. This is the same for most digital audio equipment, the idea being that once the level has been set during the original A/D conversion it should not need readjustment. It also simplifies the interfacing of digital audio signals between equipment.

The level of the audio signal output via the CBX-D5's digital outputs, however, can be level adjusted, and this is set by the controlling software.

Setting the analog input level

The recording level for analog input signals can be set using the CBX-D5's ANALOG IN LEVEL controls. These controls allows independent level setting for channels 1 and 2 and they can also be used to balance the left and right channels of a stereo source connected to the analog inputs. The maximum analog input level is +22dBm.

These controls should be used in conjunction with the input level meters, which are described below.

Input level meters

Unlike analog tape recorders, digital audio recorders are very unforgiving when it comes to excessive signal levels. Digital audio signal clipping normally produces unpleasant distortion, pops, and clicks, and unless you have some very sophisticated editing equipment it is impossible to remove it after the event. So great care must be taken when setting the recording level.

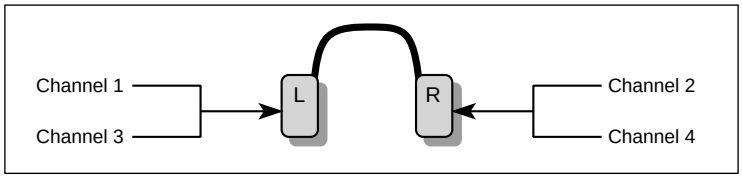
With a digital audio recorder such as the CBX-D5, noise and hiss produced by setting the recording level too low is not a problem. However, setting the recording level too low will reduce the effective dynamic range of the recording and with a dynamic range of 96dB* available it makes sense to use as much of it as possible.

Basically, the recording level should set so that the loudest signals light the –3, –6, –9 LEDs, but never light the CLIP LEDs. When recording with microphones, where sudden signal increases are possible, it may be worth having a "dry run" before you hit the record button. A compressor is a useful tool when recording vocals and acoustic instruments.

Headphone monitoring

During recording and playback, the four audio channels can be monitored using a pair of stereo headphones. Headphones should be connected to the PHONES jack on the front panel. The volume can be adjusted using the PHONES VOLUME control.

As you can see from the diagram below, channels 1 and 3 appear in the left speaker and channels 2 and 4 in the right speaker.



* 96dB is the dynamic range available with a 16-bit digital system (6dB per bit).

Digital audio data containing SCMS

SCMS (Serial Copy Management System) is a protection system designed to stop illegal digital copying of audio material. When a SCMS DAT recorder (most consumer DAT recorders) receives a digital input signal with the copy protect flag set to “protect”, it cannot enter record mode, making digital tape duplication impossible.

NOTE:	SCMS does not affect recordings made using analog connections, and it is only second generation digital copying (copy of a copy) that is prohibited.

If a digital signal that contains SCMS is input to the CBX-D5 it will not prevent the CBX-D5 from recording. The digital audio will be recorded in a sound file without SCMS.

When digital audio data containing SCMS is input into the CBX-D5, and the output format (set from the host computer) is set to *Professional*, output from the digital output jacks may be muted. When the output format is set to *Consumer* however, the digital and analog outputs will be unaffected.
It is possible to record a copyrighted musical composition, edit it and replay it with the CBX-D5. However, the user will be held responsible for its use.

Digital audio data with emphasis

For some recordings, *emphasis* is applied to a digital audio signal. During playback, this emphasis is automatically detected by the replay device and de-emphasis applied. You may have seen the word EMPHASIS appear on a CD player or DAT recorder when a prerecorded disc or tape with emphasis was played back.

The CBX-D5 **has no emphasis functions**, so if a digital signal that has been emphasized is input to the CBX-D5 it will not automatically be de-emphasized and the CBX-D5 will record the signal with the emphasis. During playback, a slight boosting of frequencies above 3.5kHz will be noticeable.

20-bit digital audio

Some CD players are now 20-bit and there is a small but growing selection of 20-bit CD recordings available. Some 20-bit recorders are already being used for professional applications including Yamaha’s DMR8 and DRU8 recorders, which have always offered 20-bit recording.

If a 20-bit digital signal is input to the CBX-D5, it will be converted to a 16-bit signal before recording. For the technically minded, 4-bits, starting from the LSB (Least Significant Bit) will be chopped off.

8 Playback

Playback frequency (PB FREQ)

During playback, sound files are read from disk, processed in the CBX-D5, then output. The CBX-D5 can read sound files that were recorded at sampling frequencies between 11.025kHz and 48kHz. Once inside the CBX-D5, the data is processed at the currently set REC FREQ. Then it is output to the digital outputs at a rate determined by the PB FREQ, and to the analog outputs after analog to digital conversion.

The CBX-D5 can output digital audio at one of two sampling frequencies: 44.1kHz and 48kHz. The playback frequency is set by the controlling software and the CBX-D5's PB FREQ indicators show the selection.

NOTE:	When the CBX-D5 is used with an external word clock, the digital outputs will operate at the same frequency as the external word clock and that frequency will not be indicated by the "PB FREQ" indicators.

The choice of playback frequency will usually be determined by the sampling frequency of the device to which the digital audio is being sent, i.e., a DAT recorder, DCC recorder, digital mixer, etc. There is nothing to be gained by playing a 44.1kHz recorded sound file at 48kHz, and little to be lost by playing a 48kHz recorded sound file at 44.1kHz.

Output level meters

The four output level meters show the output level of each channel. The output level of each channel can be controlled by the controlling software. The maximum output level is +18dBm. So an analog output signal of about +18dBm will light the CLIP LED.

Sound file playback compatibility

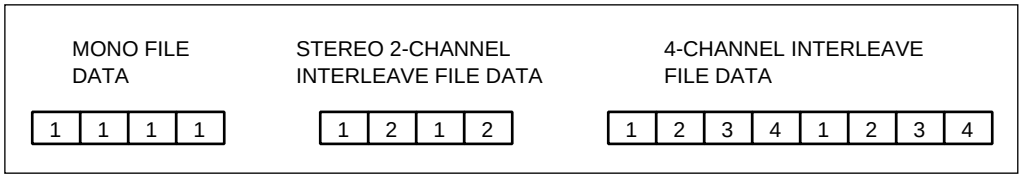
As well as its own sound files, the CBX-D5 can also playback the following sound file formats. These sound file formats are often used with the Apple Macintosh computer.

Sound Designer

Sound Designer II (mono and stereo)

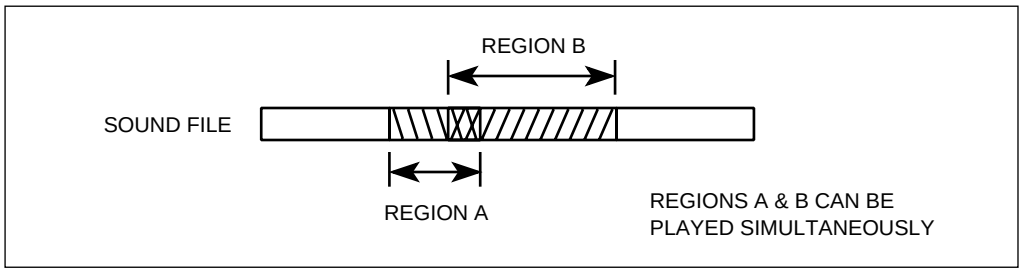
Audio IFF (Interchange File Format)

The CBX-D5 can record and playback mono and stereo 2-channel interleave files. 4-channel interleave files can be played back only.



Sound file regions

Your controlling software may allow you to select a section of a sound file so that it can effectively be handled as an independent piece of sound data. Using different channels, the CBX-D5 can playback two overlapping sections from the same sound file simultaneously.



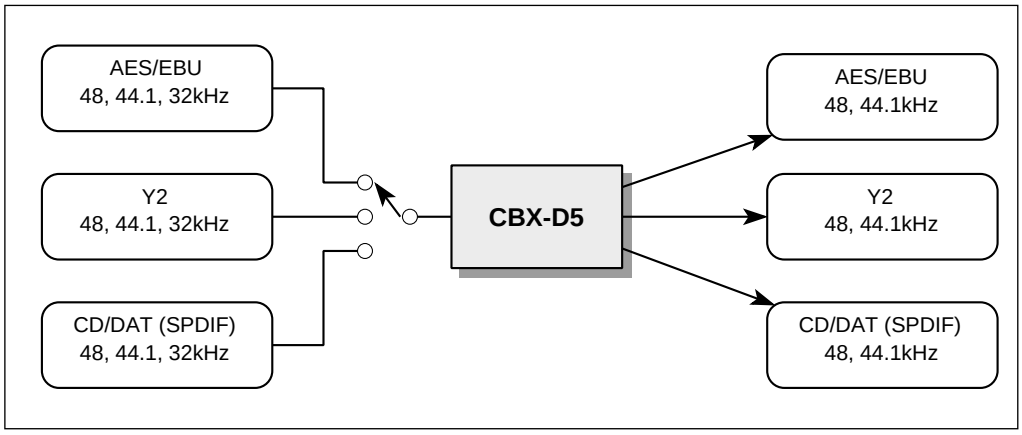
9 Converting the Sampling Frequency & Digital Audio Format in Real Time

When transferring digital audio data between equipment, it is sometimes necessary to convert from one digital audio format to another, say from CD/DAT to AES/EBU, or Y2 to CD/DAT. The CBX-D5 allows you to convert the digital audio format between CD/DAT, AES/EBU, and Y2 in real time.

Real time means that you don't actually have to record the digital audio, you just input it to the CBX-D5, the CBX-D5 converts it, then outputs it for record monitoring.

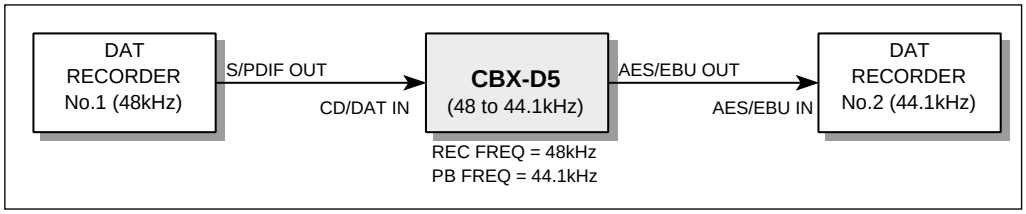
As well as the digital audio format, the CBX-D5 also allows you to convert from one sampling frequency to another, say from 44.1kHz to 48kHz or vice versa. Sampling frequency conversion is useful if you have some DAT tapes, maybe masters, recorded at 48kHz and you want to transfer them directly to a CD disc recorder that will only accept digital audio data at 44.1kHz.

Digital input and output source, record and playback sampling frequency settings are all made via the controlling software, so you will need to refer to your *Software Manuals*. The diagram below shows the conversion possibilities.



NOTE: In this configuration, SCMS and emphasis information will pass through the CBX-D5 and will be output unchanged.

In the system shown below, 48kHz data from DAT recorder No. 1 is fed to the CBX-D5 using the CD/DAT connections. The CBX-D5 converts the sampling frequency to 44.1kHz, then outputs the data to DAT recorder No. 2 via the AES/EBU connections.



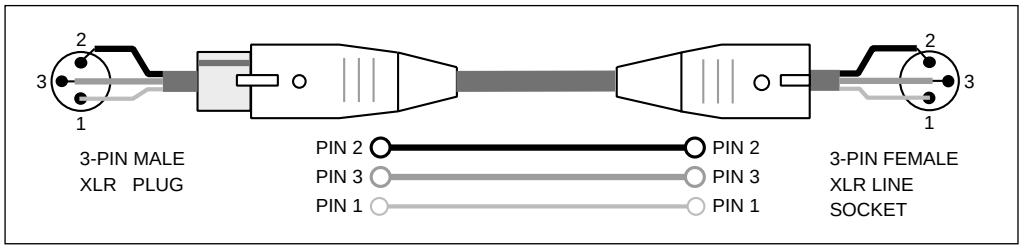
10 Inputs & Outputs Explained

ANALOG IN

A pair of female XLR 3-31 type connectors used for inputting analog audio signals. These are balanced inputs with a nominal input level of +4dBm and a maximum input level of +22dBm. These inputs are intended for use with balanced line level signals, i.e., from a mixer, synthesizer, drum machine, etc. Microphones, guitars, and equipment with an output level less than –20dBm must first be connected to a preamplifier, then to the CBX-D5.

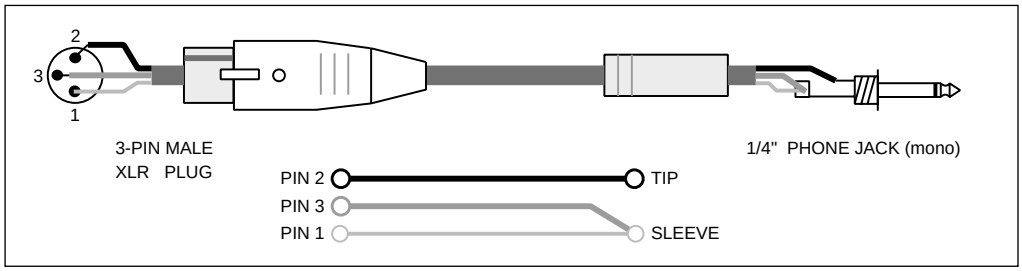
The illustration below shows how an XLR to XLR type cable is wired.

XLR to XLR cable



XLR to phone jack cable

Although balanced, these inputs can be used with unbalanced signals. The diagram below shows how a balanced XLR to unbalanced phone jack connecting cable should be wired.



ANALOG OUT

Four male XLR 3-32 type connectors used for outputting channels 1 ~ 4 as analog audio. These are balanced outputs with a nominal output level of 0dBm and a maximum output level of +17dBm. These could be connected to the inputs of a mixer, amplifier, tape recorder, DAT recorder, etc.

Cable wiring is the same as the “XLR to XLR cable” shown above. Connection to unbalanced inputs is also possible by using an XLR to phone jack cable like the one shown above. Note, however, that a 3-pin female XLR line socket would be used, not a 3-pin male XLR plug as shown in the illustration.

NOTE:	You may buy your XLR connecting cables or you may decide to make your own, either way always use good quality connectors and cable.

AES/EBU IN 1/2

A female XLR 3-31 type connector for inputting AES/EBU format digital audio. This is a balanced type connection and two channels, 1 and 2, are carried in the same connection. This connection could be used when recording digital audio data from another hard disk recorder, a digital mixer, DAT recorder, or digital VTR. The AES/EBU format is used mainly on professional digital audio equipment.

Although an XLR to XLR type connecting cable is required, the recommended cable impedance is different to that of typical audio XLR type connecting cables. You may find that typical audio XLR type cables work successfully, but **to eliminate any risk of data corruption it is best to use a cable that is specifically made for use with the AES/EBU format.** The recommended cable impedance for AES/EBU is 110Ω.

AES/EBU OUT 1/2, 3/4

Two male XLR 3-32 type connectors for outputting AES/EBU format digital audio. Channels 1 and 2 are output via OUT 1/2, and channels 3 and 4 through OUT 3/4. These connections could be used to transfer digital audio data from the CBX-D5 to professional digital audio equipment.

Here again, it is best to use a cable that is specifically made for use with the AES/EBU format. Follow the same recommendations given above for the AES/EBU IN connection.

CD/DAT IN

A Phono/RCA jack for inputting CD/DAT format digital audio. Two channels, 1 and 2 (left, right), are carried in the same connection. This connection could be connected to the digital output of a CD player or DAT recorder and allows digital audio recording without multiple D/A, A/D audio data conversions. Some MIDI samplers are fitted with this type of connection. In this case, sound samples could be transferred digitally between a sampler and the CBX-D5. The CD/DAT format is found mainly on consumer type digital audio equipment, although, most professional digital audio equipment supports it, too.

Phono/RCA type cables and connectors are commonly used for hi-fi equipment, however, **there are connecting cables designed specifically for use with the CD/DAT format and wherever possible they should be used.**

CD/DAT OUT

A Phono/RCA jack for outputting CD/DAT format digital audio. Two channels, 1 and 2 (left/right), are carried in the same connection. This could be connected to the digital input of a DAT recorder or DCC recorder, and it allows digital audio recording without multiple D/A, A/D audio data conversions.

Like the CD/DAT IN connection, it's best to use cables specifically made for the job.

NOTE:	You might have heard or read that AES/EBU type connections can be connected directly to CD/DAT connections and vice versa. In some cases this may work, but it is not recommended. To ensure data integrity, connect AES/EBU outputs to AES/EBU inputs, and CD/DAT inputs to CD/DAT outputs.

Y2 IN

An 8-pin DIN socket for inputting Y2 Yamaha format digital audio. Two channels, 1 and 2 (left/right), are carried in the same connection. This could be connected to one of Yamaha's digital audio products including the DMR8 Digital Mixer/Recorder, DMC1000 Digital Mixing Console, DRU8 Digital Recorder, SPX1000 Effect Processor, and the DMP series of Digital Mixers.

Special cables are available for use with this format. See your Yamaha dealer for details.

Y2 OUT

An 8-pin DIN socket for outputting Y2 Yamaha format digital audio. Two channels, 1 and 2 (left/right), are carried in the same connection. This could be used to transfer digital audio data from the CBX-D5 to one of the Yamaha professional digital audio products listed above.

Again, use the cables specifically recommended for use with the Y2 format.

WORD CLK IN/OUT

NOTE: If all your audio connections are analog, no word clock connections are required.

As we explained on page 4, when a number of digital audio devices are connected together and data is digitally transferred between them, it is essential that the data processing circuits of all devices are synchronized. To achieve this, one device operates as a word clock master and all other devices operate as word clock slaves.

If you connect only two digital audio devices, say the CBX-D5 to a DAT recorder, word clock setup is quite straight forward and no external word clock connections will be required. This is because the AES/EBU, CD/DAT, and Y2 formats carry word clock information within the digital audio data. However, when three or more devices are connected in a digital system, word clock connections will be required.

NOTE: Although we have said that a word clock connection is not required when only two devices are used, some devices may require a BNC word clock connection as well as the digital audio connection. Making a separate connection using the CBX-D5's BNC connectors may also improve data transfer and eliminate any chance of data errors.

The CBX-D5 can operate as either word clock master, using its own internal clock, or as a slave sourcing its word clock from one of the digital inputs or from the WORD CLK IN connection. This setting is made via the controlling software. The CBX-D5's word clock output signal is always at the same frequency as the digital outputs.

NOTE: Because the CBX-D5 can convert the sampling frequency of incoming digital audio signals, the word clock output signal will not necessarily match the recording sampling frequency.

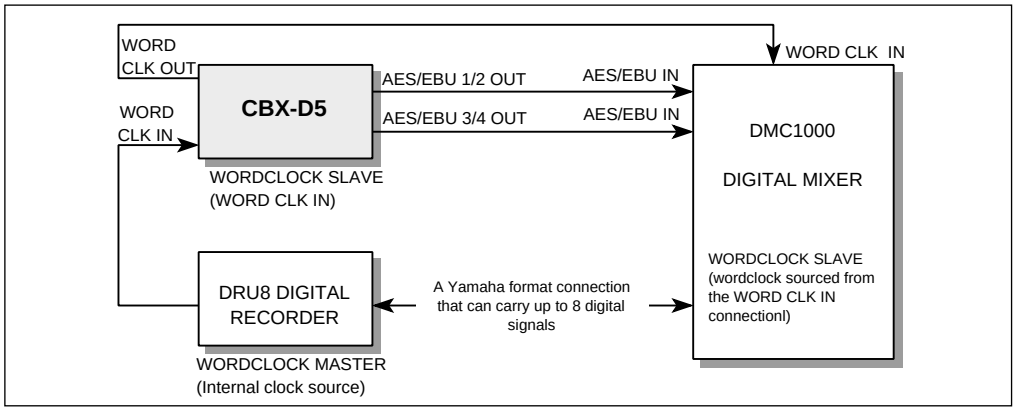
The following table shows how the WORD CLK IN/OUT connections work with each word clock source. Word clock connections use coaxial BNC to BNC type cables.

WORD CLOCK SOURCE	CBX-D5 WORD CLK OUT	CBX-D5 WORD CLK IN
AES/EBU Input	Outputs a word clock signal at the internal clock rate (REC FREQ).	N/C
CD/DAT Input	Outputs a word clock signal at the internal clock rate (REC FREQ).	N/C
Y2 Input	Outputs a word clock signal at the internal clock rate (REC FREQ).	N/C
Internal Clock	Outputs a word clock signal at the internal clock rate (REC FREQ).	N/C
WORD CLK IN	Outputs a word clock signal at the same rate as the word clock at the WORD CLK IN.	Receives the external word clock

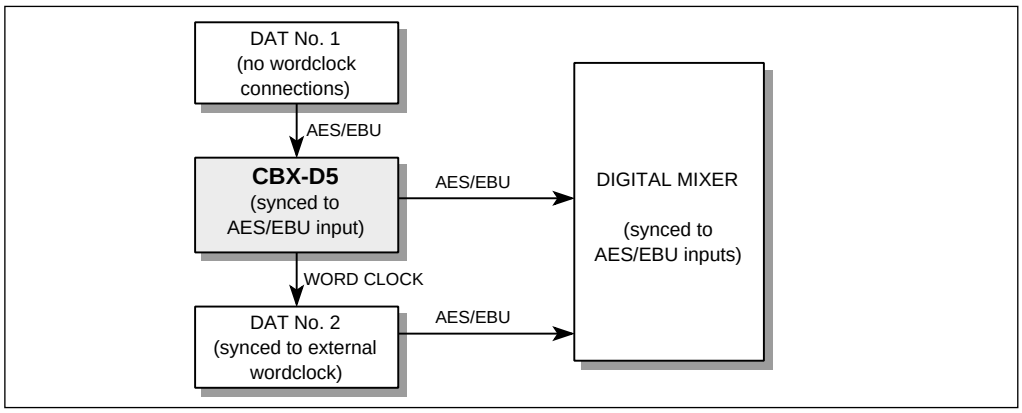
If, for some reason the external word clock source should become disconnected or the CBX-D5 cannot synchronize to it, the CBX-D5 will automatically switch to internal clock.

When the digital output signal is synced to an external word clock, the exact sampling frequency cannot be guaranteed. So the sampling frequency specified in the digital output's channel status bits may be different to the actual output sampling frequency.

In the following example, data from the four CBX-D5 channels are being transferred to a digital mixer, which is also connected to a Yamaha DRU8 8-Track Digital Recorder. The DRU8 is word clock master supplying both the CBX-D5 and the DMC1000 Digital Mixer. In this system, the external word clock connections are essential.



In this example, audio data from two DAT recorders is being mixed via a digital mixer. DAT No. 1 does not have any word clock connections, so the digital audio is fed to the CBX-D5 first, then to the digital mixer. The CBX-D5 generates a word clock signal based on the data from DAT No. 1 and feeds this signal to DAT No. 2, which syncs to the external wordclock. The digital mixer derives its word clock from the AES/EBU inputs.



11 TO HOST connection

As well as the standard MIDI IN, OUT, and THRU connections, the CBX-D5 also has a "TO HOST" connection. This allows direct connection to computers that do not have a built-in or external MIDI interface.

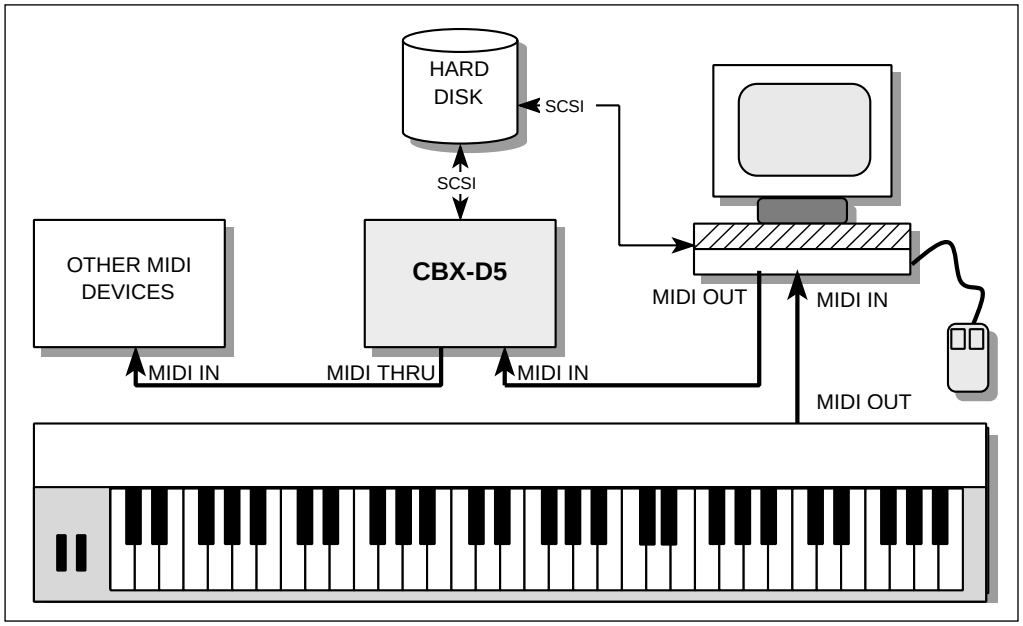
The CBX-D5 has four interface modes for connecting to a controlling computer: MIDI, Mac, PC-1, and PC-2. These interface modes are explained below.

MIDI

This mode is for use with a computer that has a MIDI interface. That is, a computer with a built-in MIDI interface, such as the Atari ST, STE, and TT range of computers, an Apple Macintosh computer with an external MIDI interface unit, or a PC-9801 or IBM PC/AT compatible type computer fitted with a MIDI interface. Most MIDI music software can be used with this type of connection.

The "HOST SELECT" switch should be set to MIDI.

The connecting MIDI cable should be of the type described in the "TO HOST computer connecting cables" on page 33.



The table below explains how the MIDI signals are handled in MIDI mode.

Connection		Function
TO HOST	RECEIVE	No function.
	SEND	No function.
MIDI IN		MIDI data is input and processed.
MIDI OUT		System Exclusive data is output.
MIDI THRU		Data appearing at the MIDI IN port is fed directly to the MIDI THRU port.

NOTE: Depending on the application software used, it is possible that the HOST function on the CBX-D5 (the function that allows you to make a MIDI connection to a host computer without a MIDI interface) may not work.

Mac

This mode is for use with an Apple Macintosh computer that is not connected to an external MIDI interface unit. The CBX-D5 can be connected directly to one of the Apple Mac's serial (RS-422) ports.

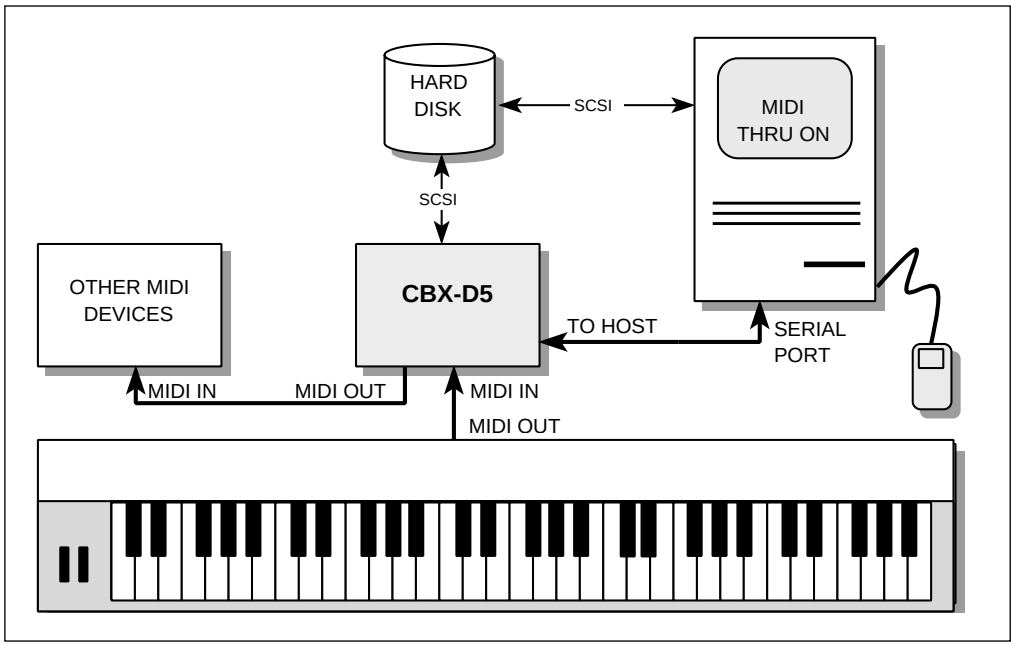
1) Connect the CBX-D5's "TO HOST" connector to one of the Apple Mac's serial ports using the "Mac" connecting cable shown on page 33.

2) Set the CBX-D5's "HOST SELECT" switch to **Mac**.

3) Switch on the Apple Mac and the CBX-D5.

4) Start the Apple Mac music software.

Your music software will probably require you to specify the type of MIDI interface you are using. You should specify "Standard MIDI interface". If it has a "MIDI Time Piece option", turn it off. If your software also requires you to specify the data rate, select 1MHz.



The table below explains how MIDI signals are handled in "Mac" mode. MIDI data is carried to and from the computer via the "TO HOST" connection.

Connection		Function	Details
TO HOST	RECEIVE	MIDI data is input, processed, then fed to the MIDI OUT port.	Synchronized. Data format: 8 bit, 1 stop bit, no parity. 1MHz clock from CBX-D5 to serial ports' HSKi data pin.
	SEND	MIDI data received at the MIDI IN port is output.	When the CBX-D5 is transmitting its Bulk Dump data to the host computer, data from the MIDI IN port is not sent to the host computer. Any MIDI data received while a Bulk Dump is in progress will be ignored.
MIDI IN		MIDI data received is output to the TO HOST SEND.	The CBX-D5 does not respond to the MIDI data appearing at the MIDI IN port, but to the MIDI data from TO HOST RECEIVE.
MIDI OUT		MIDI data received at the TO HOST RECEIVE is output.	
MIDI THRU		MIDI data appearing at the MIDI IN port is fed directly to the MIDI THRU.	

PC-1

This mode is for use with an NEC PC-9801 type computer. The PC-9801 is a very popular computer in Japan. The specifications are the same as those for “PC-2” mode except for the baud rate. See “CBX-D5 Specifications” on page 37.

PC-2

This mode is for use with an IBM PC/AT compatible, PS/1, or PS/2 type computer that does not have a MIDI interface card installed. The CBX-D5 can be connected directly to the computers serial (RS-232C) port.

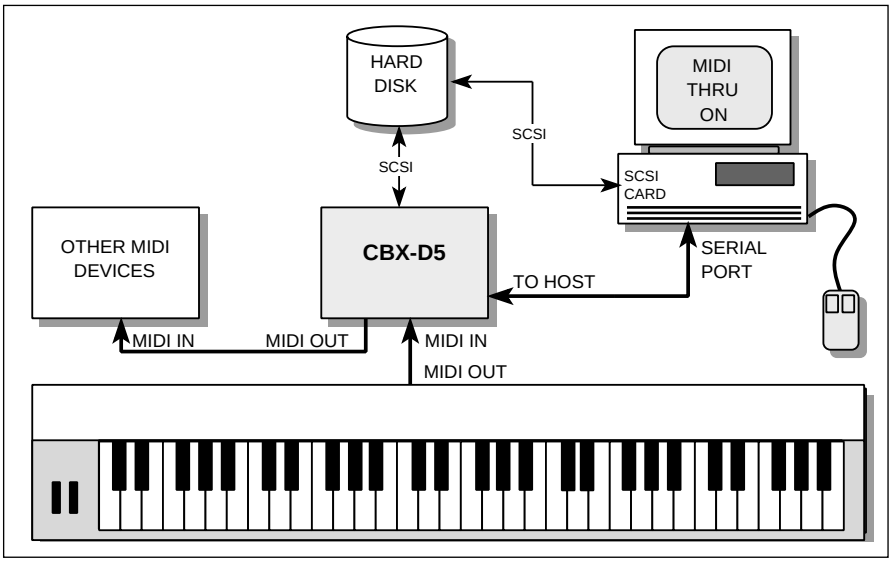
The music software used must be able support the CBX-D5’s “TO HOST” connection. Please consult your Yamaha dealer for more details. If your software does not support the “TO HOST” connection, the CBX-D5 can still be connected to this type of computer by installing a MIDI interface card in the computer or by using an external MIDI interface.

1) Connect the CBX-D5’s “TO HOST” connector to one of the computer’s serial ports using the “PC-2” connecting cable shown on page 33.

2) Set the CBX-D5’s “HOST SELECT” switch to **PC-2**.

3) Switch on the computer and the CBX-D5.

4) Start the computer music software.



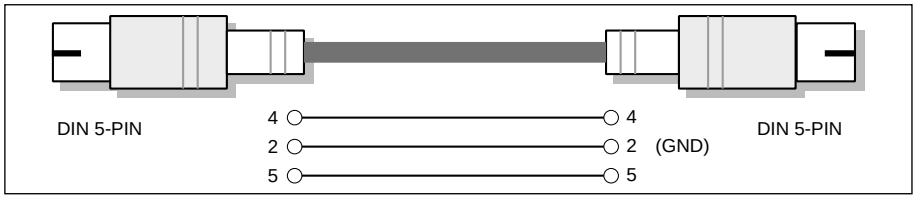
The table below explains how the MIDI signals are handled in PC-2 mode. MIDI data is carried to and from the computer via the “TO HOST” connection.

Connection		Function	Details
TO HOST	RECEIVE	MIDI data is input, processed, then fed to the MIDI OUT port.	Synchronized. Data format: 8 bit, 1 stop bit, no parity.
	SEND	MIDI data received at the MIDI IN port is output.	When the CBX-D5 is transmitting its Bulk Dump data to the host computer, data from the MIDI IN port is not sent to the host computer. Any MIDI data received while a Bulk Dump is in progress will be ignored.
MIDI IN		MIDI data received is output to the TO HOST SEND.	The CBX-D5 does not respond to the MIDI data appearing at the MIDI IN port, but to the MIDI data from TO HOST RECEIVE.
MIDI OUT		MIDI data received at the TO HOST RECEIVE is output.	
MIDI THRU		MIDI data appearing at the MIDI IN port is fed directly to the MIDI THRU.	

TO HOST computer connecting cables

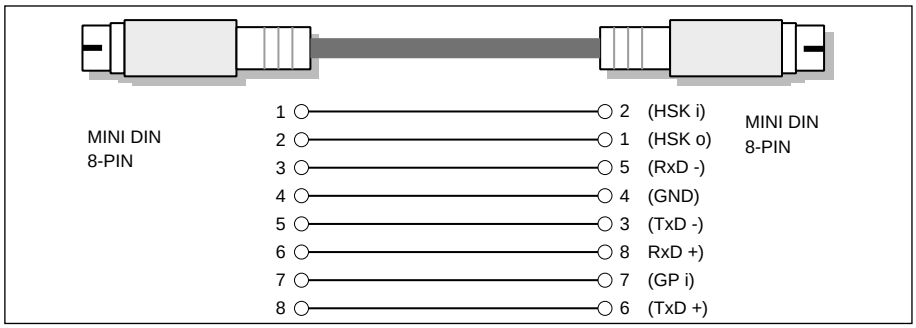
MIDI

Standard MIDI cable. Maximum length 15 meters.



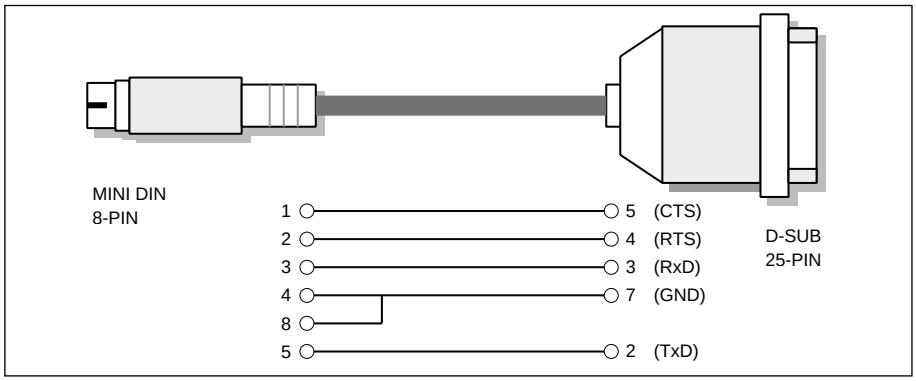
Mac

Apple Macintosh Peripheral cable “M0197”). Maximum length 2 meters.



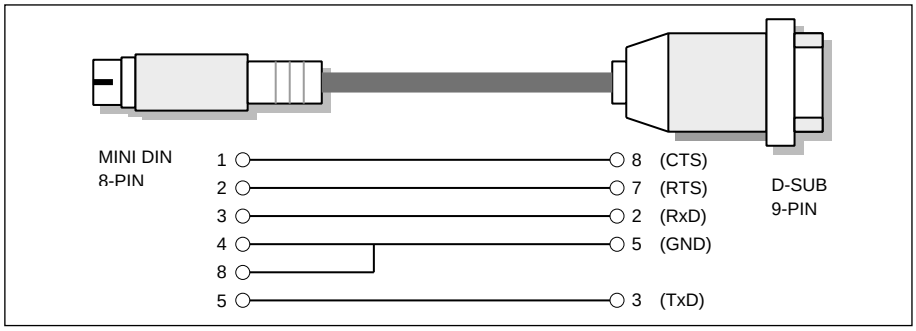
PC-1

8-pin MINI DIN to D-SUB 25-pin cable. If your PC-1 type computer has a 9-pin serial port, use the PC-2 type cable. Maximum length 1.8 meters.



PC-2

8-pin MINI DIN to D-SUB 9-pin cable. Maximum length 1.8 meters.



12 Glossary

A/D Converter: (Analog to Digital converter) A device used to convert analog audio signals into PCM (Pulse Code Modulated) digital audio. The CBX-D5 uses 16-bit linear Δ Σ modulation A/D converters.

Access time: Measured in milliseconds, this is an indication of how fast data from different areas of a hard disk can be accessed.

AES/EBU: A digital interface format established by the AES (Audio Engineering Society) and EBU (European Broadcasting Union) that is used to transfer digital audio data between professional digital audio equipment. Two channels of digital audio (left & right) are carried in one connection, usually an XLR type connection.

Audio IFF: (Audio Interchange File Format) A type of sound file that is used by various Apple Macintosh based digital audio devices. It is recommended by Apple Computer, Inc.

Byte: A digital "word" containing 8 bits. A CBX-D5 digital audio word contains 16 bits.

CD/DAT: See S/PDIF.

Cubase Audio: An integrated MIDI sequencer, digital audio recording and editing program that can be used to control the CBX-D5 via an Atari ST/STE or TT computer.

D/A converter: (Digital to Analog converter) The opposite of an A/D converter, this device is used to convert PCM digital audio data into an analog audio signal. The CBX-D5 uses 18-bit 8-times oversampling D/A converters.

Delta Sigma coding (Δ Σ)**:** A digital audio coding format that greatly improves a digital audio system's performance by using a very high sampling frequency and a 1-bit resolution.

DEQ: (Digital Equalizer) An IC (Integrated Circuit) designed specifically for equalizing digital audio data. The CBX-D5's DEQ IC is made by Yamaha.

Destructive editing: Editing an original recording that cannot be recovered if you make a bad edit. For example, razor blade editing a tape.

Digital Performer: An integrated MIDI sequencer, digital audio recording and editing program that can be used to control the CBX-D5 via an Apple Macintosh computer.

DMA: (Direct Memory Access) The ability to transfer data to and from a system's RAM without involving the CPU. The Atari ST/STE computer has a DMA port.

DMA to SCSI Controller II: A hardware device made by Steinberg that allows the connection of SCSI devices to the DMA port of an Atari ST or STE.

DSP: (Digital Signal Processor) An IC (Integrated Circuit) designed specifically for digital audio data processing. The CBX-D5 uses the same Yamaha DSP IC as those used in the SPX900 Multi-effect Processor and the DMR8 Digital Mixer/Recorder.

Emphasis: Before A/D conversion a 6dB/octave boost starting at 3.5kHz is applied to the audio signal. During D/A conversion the emphasis is automatically detected by the replay device and de-emphasis is applied.

Fragmentation: When a file is split into sections and stored in different areas of a hard disk, i.e., in an uncontinuous series of sectors.

Host connection: Used to connect the CBX-D5 to a computer that does not have a MIDI interface. Connection is made directly to one of the computer's serial ports.

Mark of the Unicorn Digital Performer: A program that integrates MIDI sequencing, digital audio recording and editing and can be used to control the CBX-D5 via an Apple Macintosh computer.

MIDI: (Musical Instrument Digital Interface) MIDI allows electronic musical instruments to communicate with each other.

MTC: (MIDI Timecode) The transmission of SMPTE timecode via MIDI.

Nondestructive editing: As opposed to editing analog tape, which is a once only – get it right first time or else procedure, hard disk recording allows nondestructive editing. This means when you edit, you don't actually edit the sound file, you edit information that tells the CBX-D5 how to play the sound file. So if you make an accidental cut or split, all is not lost because you still have the original sound file.

Nyquist frequency: The audio frequency at which very sharp low pass filtering is applied to an analog signal before A/D conversion. The nyquist theorem states that the sampling frequency of a digital audio system must be at least twice that of the highest audio frequency, otherwise severe distortion called aliasing will occur.

Oversampling: A technique used to improve the noise and distortion performance of a digital audio system by increasing the effective sampling frequency so that the nyquist frequency is set much higher than the highest audio frequency.

PCM: (Pulse code modulation) The type of coding used to represent analog audio as a series of pulses. The amplitude of each pulse is stored as a binary word. The CBX-D5 uses 16-bit binary words.

Region: A section of a sound file that can be handled as an independent piece of sound data, but is in fact identified using start and end pointers to a region of a sound file

RS-232C: A serial communication protocol used on PC compatible and Atari ST/STE computers, usually a 9- or 25-pin D-SUB type connector.

RS-422: A balanced serial communication protocol used on Macintosh computers, usually an 8-pin mini DIN connector.

Sampling frequency: The number of times per second that sample measurements of an analog audio signal are taken during A/D conversion. Typical sampling frequencies are 32kHz, 44.1kHz, and 48kHz.

SCMS: (Serial Copy Management System) A protection code designed to stop illegal digital copying of audio material. When a consumer type DAT recorder receives a digital input signal that contains SCMS, it cannot enter record mode, so digital copying is impossible.

Serial port: A computer connection that can receive and transmit computer data serially (RS-232C or RS-422).

SCSI: (Small Computer Systems Interface) Pronounced Scuzzy, it is a connection format used for connecting peripheral devices such as hard disks, printers, scanners, etc., to a computer. Up to eight SCSI devices can be connected together in a daisy chain, with the controlling computer connected at the end of the chain. See "SCSI" on page 3.

SCSI ID: The identifying address number allocated to each device in a SCSI daisy chain. IDs from 0 to 7 are available. See "SCSI ID setting" on page 16.

SCSI terminator: A device connected at the end of a SCSI daisy chain to stabilize the SCSI bus. See "SCSI termination" on page 17.

SMPTE timecode: A bi-phase code used to synchronize audio and video equipment by communicating hours, minutes, seconds, and frame information.

Sound file: A type of computer file that contains digital audio data.

Soundbite: A term used by Mark of the Unicorn's Digital Performer software to describe a section of a sound file that can be handled as an independent piece of sound data, but is in fact identified using start and end pointers to a region of a sound file.

Sound Designer files: A type of sound file that is used by various Apple Macintosh and Digi Design digital audio devices. There are two types of file: I & II.

S/PDIF: (Sony/Philips Digital Interface Format) A digital interface format established by Sony and Philips that is used to transfer digital audio data between consumer type digital audio equipment such as CD players, consumer DAT recorders, and the new DCC recorders. Two channels of digital audio (left & right) are carried in one connection, usually a phono/RCA jack type connection. On the CBX-D5 this format is referred to as CD/DAT.

Steinberg Cubase Audio: A program that integrates MIDI sequencing, digital audio recording, and editing and can be used to control the CBX-D5 via an Atari ST/STE or TT type computer.

Time slip: The ability to move individual segments of audio data relative to time.

Transfer rate: Usually measured in Megabits per second (Mbit/s), this shows how fast data can be written to and read from a hard disk.

Word clock: A clock signal that is used to synchronize the data processing circuits of all devices connected in a digital audio system. See "Word clock" on page 4.

Y2: A digital interface format developed by Yamaha that is used to transfer digital audio data between Yamaha's professional digital audio equipment. Two channels of digital audio (left & right) are carried in one connection, usually an 8-pin DIN type connection. See "Y2 format" on page 3.

Further reading

For those users who would like to know more about the fascinating world of digital audio here are a few suggested books:

1) "*Tapeless Sound Recording*", Francis Rumsey, Focal Press (Butterworth Group), 1990. A good introduction to tapeless recording including its advantages over tape, digital audio basics, digital interfaces, synchronization, and computer storage media.
2) "*Principles of Digital Audio*", Ken C. Pohlmann, Howard W.Sams & Co, 1989. Covering all aspects of digital audio, this book is ideal for the newcomer who wants to know the basics – plus a bit more.
3) "*The Art of digital Audio*", John Watkinson, Focal Press (Butterworth Group), 1990. An essential read for digital audio professionals – but only for the serious!

Any books related to the following subjects may also be of interest: digital audio, hard disk recording, compact disc, DAT, MIDI, computer music.

13 Recording setup table

Recording Project	
Date	
Notes	

Sound files

Sound File No.	Sound File name	Sound File Contents	Sampling Frequency	Input Source	Length (Time)	File Size (MB)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

14 CBX-D5 Specifications

Data format		16-bit PCM
Number of channels		4-channel system: 2-channel simultaneous record, 4-channel playback (combination of playback and record available)
Sampling frequency	**Sound File Recording**	22.05kHz, 32kHz, 44.1kHz, 48kHz
	Sound File Playback	11.025 ~ 48kHz
	Digital in	32kHz, 44.1kHz, 48kHz
	Digital out	44.1kHz, 48kHz, external word clock
	For digital I/O, internal sampling frequency conversion is available	
File format		Mono, 2-channel interleave, 4-channel interleave
A/D converter		16-bit linear ΔΣ modulation
D/A converter		18-bit with 8-times oversampling digital filter
DEQ (equalizer)		4-channels of multi-band parametric equalization
DSP (effector)		82 reverb & modulation type effects
Digital mixer		4-input, 4-bus, 2-send, 4-return
Connectors	**ANALOG IN 1,2**	XLR-3-31 type x2, +22dB (max)
	ANALOG OUT 1,2,3,4	XLR-3-32 type x4, +17dB (max)
	AES/EBU IN 1/2	XLR-3-31 type x1
	AES/EBU OUT 1/2, 3/4	XLR-3-32 type x2
	CD/DAT IN/ OUT 1/2	Phono/RCA jack x2
	Y2 IN/OUT 1/2	8-pin DIN x2
	WORD CLK IN/OUT	BNC x2
	MIDI IN, OUT, THRU	5-pin DIN x3
	TO HOST	8-pin mini DIN x1
	MIDI baud rate	31, 250 bps (bits per second)
	Mac baud rate	31, 250 bps (1MHz clock)
	PC1 baud rate	31, 250 bps
	PC2 baud rate	38,400 bps
	SCSI	50-way Amphenol x2 (ANSI X3.131-1986)
	Headphones	6.35mm (1/4") stereo phone jack x1
Controls	**ANALOG IN**	Independent control for channel 1 & 2
	PHONES VOLUME	
	Host select	Mac, PC1, PC2, MIDI
	SCSI ID switch	0 ~ 7
	Power switch	on/off
Indicators	**Record source**	AES/EBU, CD/DAT, Y2, ANALOG
	Record Freq	48k, 44.1k, 32k, 22.05k (22.05k analog inputs only)
	Playback Digital Out Freq	48k, 44.1k
	Input level	12-segment LED level meters x 2 (channels 1 & 2)
	Output level	12-segment LED level meters x 4 (channels 1,2,3,4)
Power requirements	**U.S. model**	120V AC, 60Hz
	General model	220-240V AC 50Hz
Power consumption	**U.S. model**	35W
	General model	35W
Dimensions	**(W x H x D)**	310 x 113.6 x 378.2 mm (12.2˝ x 4.5˝ x 14.9˝)
Weight		7.5 kg (16.5 lbs)
A list of supplied accessories is given on page 2.		

0dB = 0.775V rms

Specifications subject to change without notice.

Index

Appendix

Preset Effects

	Effect Name	Category
0	Orchestra Hall	S:Rev Hall
1	Concert Hall	
2	Warm Hall	
3	Vocal Hall	
4	Vocal Large Hall	
5	Vocal Small Hall	
6	Large Room	S:Rev Room
7	Bright Small Room	
8	Backing Vocal Tight Room	
9	Smooth Room	
10	Small Vocal Room	
11	Slap Room	
12	Vocal Stage	S:Rev Stage
13	Vocal Club	
14	Female Vocal Club	
15	Sax Stage	
16	Vocal Plate	S:Rev Plate
17	Percussion Plate	
18	Big Plate	
19	Distant Plate	
20	Stone Room	S:Rev White Room
21	Cathedral	
22	Dark Church	S:Rev Tunnel
23	Tunnel	
24	Cavern	S:Rev Canyon
25	Soft Caynon	
26	Alhambra Guitar	S:Rev Basement
27	Small Cellar	
28	Drum Room	
29	Bathroom Vocals	
30	Early Ref Vocal	S:Early Ref.
31	Early Ref Special Effect	
32	Early Ref Hall	
33	Early Ref Slap Plate	
34	Early Ref Spring Vocal	
35	Early Ref Reverse Vocal	
36	Gate Reverb	S:Gate Reverb
37	Reverse Gate	S:Reverse Gate
38	Delay L,R	S:Delay L,R
39	Vocal Multi Delay	S:Delay L,C,R
40	Stereo Echo	S:Stereo Echo
41	Subtle Pitch Change	S:Pitch Change
42	Wide Guitar	
43	Multi Pitch Delay	
44	Aural Exciter®	S:Aural Exciter®
45	Rotary Speaker	S:Rotary Speaker
46	Ring Modulator	S:Ring Modulator

	Effect Name	Category
47	Stadium	C:Echo->Rev
48	Delay L,R->Rev	C:Delay L,R->Rev
49	Flange->Rev	C:Flange->Rev
50	Gtr Cho Reverb	C:Chorus->Rev
51	Sympho->Rev	C:Sympho->Rev
52	Phaser->Rev	C:Phaser->Rev
53	Aural Exc®->Rev	C:Aural Exc®->Rev
54	Dist->Rev	C:Dist->Rev
55	Dist->Dly L,R	C:Dist->Dly L,R
56	Dist->Echo	C:Dist->Echo
57	High Cut Reverb	C:EQ->Rev
58	EQ Mid Reverb	
59	Sparkling Reverb	
60	Mid Delay	C:EQ->Dly L,R
61	Deep Echo	C:EQ->Echo
62	EQ->Flange	C:EQ->Flange
63	Bass Chorus	C:EQ->Chorus
64	Elec Guitar EQ/Sympho	C:EQ->Symphonic
65	Warm Phase	C:EQ->Phaser
66	St.Flange->Dly LR	C:St.Flange->Dly LR
67	St.Chorus->Dly LR	C:St.Chorus->Dly LR
68	Symph->Dly LR	C:Symph->Dly LR
69	St.Phasing->Dly LR	C:St.Phasing->Dly LR
70	Hall & Plate	D:Hall & Plate
71	Echo & Rev	D:Echo & Rev
72	Delay & Rev	D:Delay & Rev
73	Flange & Chorus	D:Flange & Chorus
74	Flange & Sympho	D:Flange & Sympho
75	Sympho & Chorus	D:Sympho & Chorus
76	Flange & Rev	D:Flange & Rev
77	Chorus & Rev	D:Chorus & Rev
78	Sympho & Rev	D:Sympho & Rev
79	Flange & Dly LR	D:Flange & Dly LR
80	Chorus & Dly LR	D:Chorus & Dly LR
81	Sympho & Dly LR	D:Sympho & Dly LR

The letter at the beginning of the "Category" indicates the Effect Mode.

S:Single
C:Cascade
D:Dual

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DSP/DEQ/DMIX Block Diagram

Preset effects parameter values

No.	Effect Name	Parameter Number													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
0	Orchestra Hall	19	8	10	319	199	4	60	8	6	20	0			
1	Concert Hall	23	8	10	639	479	4	75	8	6	20	0			
2	Warm Hall	17	1	10	149	299	4	80	9	3	17	0			
3	Vocal Hall	21	1	10	99	239	3	75	8	7	20	6			
4	Vocal Large Hall	34	4	8	239	319	2	55	8	6	18	0			
5	Vocal Small Hall	19	2	7	119	239	4	64	8	6	18	6			
6	Large Room	11	6	9	159	999	4	52	6	7	24	0			
7	Bright Small Room	9	7	6	199	249	4	64	6	9	24	12			
8	Backing Vocal Tight Room	9	5	8	319	499	4	86	8	8	22	0			
9	Smooth Room	5	2	6	319	239	4	72	7	6	20	0			
10	Small Vocal Room	9	3	5	159	249	4	60	8	8	17	0			
11	Slap Room	3	3	8	332	399	3	40	9	4	18	19			
12	Vocal Stage	13	5	10	479	319	4	72	10	6	22	7			
13	Vocal Club	15	3	9	319	179	4	40	9	6	16	0			
14	Female Vocal Club	13	3	8	319	199	4	70	10	5	22	10			
15	Sax Stage	13	6	8	79	0	4	65	8	6	24	0			
16	Vocal Plate	15	5	10	479	199	4	72	8	8	22	0			
17	Percussion Plate	11	7	5	639	319	4	64	6	9	23	13			
18	Big Plate	33	3	7	101	304	4	33	8	4	16	0			
19	Distant Plate	17	3	10	99	913	4	25	8	9	25	0			
20	Stone Room	9	5	4	99	29	15	11	30	7	20	99	4	60	0
21	Cathedral	33	7	10	639	98	99	93	4	0	20	299	4	30	2
22	Dark Church	19	3	10	299	84	58	73	20	0	17	199	4	40	0
23	Tunnel	31	4	2	299	68	9	103	4	0	22	299	4	10	2
24	Cavern	25	5	10	639	40	60	66	10	0	24	399	4	70	2
25	Soft Caynon	24	4	10	1109	74	55	41	20	21	10	399	4	70	2
26	Alhambra Guitar	21	8	10	79	72	79	103	4	0	23	499	4	70	1
27	Small Cellar	9	3	5	79	22	18	38	26	0	22	199	4	70	1
28	Drum Room	17	4	9	79	18	29	38	28	3	24	199	4	70	1
29	Bathroom Vocals	5	8	3	79	32	15	31	6	6	22	99	4	70	1
30	Early Ref Vocal	2	14	10	10	379	9	2499	111	0	13				
31	Early Ref Special Effect	3	159	10	10	639	18	7999	100	0	23				
32	Early Ref Hall	1	27	8	8	199	1	459	108	0	22				
33	Early Ref Slap Plate	4	15	10	10	299	6	2399	105	7	23				
34	Early Ref Spring Vocal	5	15	6	8	239	13	239	123	0	22				
35	Early Ref Reverse Vocal	3	27	10	10	1999	18	3999	119	0	23				
36	Gate Reverb	0	21	5	10	49	12	199	99	0	16				
37	Reverse Gate	1	21	10	10	399	18	3999	109	0	24				
38	Delay L,R	9999	9999		9999	9999	109	4	3	0	22				
39	Vocal Multi Delay	8999	13499	4499	6749	8999	124	8	8	0	24				
40	Stereo Echo	4998	4998	124	4999	4999	124	9	9	0	24				
41	Subtle Pitch Change	24	108	179	108	100	24	88	319	100	100				
42	Wide Guitar	24	111	299	99	24	89	399	100						
43	Multi Pitch Delay	24	92	359	24	106	3999	24	112	7999					
44	Aural Exciter®	0	80	75	579										
45	Rotary Speaker	74	48	40	49	1	8	7							
46	Ring Modulator	20	28	100	96	5	8								
47	Stadium	3199	119	1599	119	43	1	45	70	0	15				
48	Delay L,R->Rev	474	6399	107	9	11	8	78	75	0	22				
49	Flange->Rev	13	90	11	75	17	7	399	20	0	24				
50	Gtr Cho Reverb	16	56	40		20	2	148	15	0	15				
51	Sympho->Rev	13	45	13			6	499	20	0	22				

No.	Effect Name	Parameter Number													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
52	Phaser->Rev	24	100	32		9	3	239	24	0	18				
53	Aural Exc®->Rev	1	62	72	9	0	10	219	20	24	15				
54	Dist->Rev	66	6	9	7	9	1	359	40	0	19				
55	Dist->Dly L,R	75	3	0	9	9030	3008	129	40	0	21				
56	Dist->Echo	80	3	11	8	2999	3199	84	50	0	20				
57	High Cut Reverb	9	8	9	4	11	3	35	796	40	40	3	10	4	
58	EQ Mid Reverb	15	9	8	8	8	12	6	265	70	40	3	10	6	
59	Sparkling Reverb	11	4	14	7	13	9	14	421	26	35	3	8	9	
60	Mid Delay	14	8	5	8	9	11	2806	5628	100	40				
61	Deep Echo	10	12	6	6	7	6	4799	4999	67	29				
62	EQ->Flange	11	8	7	5	7	7	11	35	72	100				
63	Bass Chorus	10	9	8	6	8	7	28	50	30	100				
64	Elec Guitar EQ/Sympho	7	8	10	10	3	9	14	69		100				
65	Warm Phase	11	9	8	3	8	9	28	100	45	100				
66	St.Flange->Dly LR	8	86	11	80	4149	4299	4149	4299	123	100				
67	St.Chorus->Dly LR	17	70	60		4149	4299	4149	4299	126	40				
68	Symph->Dly LR	15	80			3405	4299	4299	4149	122	40				
69	St.Phasing->Dly LR	11	100	45		3718	2081	7999	3988	119	40				
70	Hall & Plate	29	2	7	663	15	9	7	8	897	17				
71	Echo & Rev	3199	2999	74	19	2	10	299	78	3	15				
72	Delay & Rev	4799	4949	79	30	6	7	599	40	24	15				
73	Flange & Chorus	6	68	18	80		18	75	45						
74	Flange & Sympho	16	45	40	85		19	75							
75	Sympho & Chorus	19	75				18	75	45						
76	Flange & Rev	7	70	13	90	15	3	7	249	6	16				
77	Chorus & Rev	27	80	55		30	2	6	449	0	20				
78	Sympho & Rev	32	70			10	2	10	726	22	25				
79	Flange & Dly LR	15	50	27	80	3749	1559	3530	7079	133	24				
80	Chorus & Dly LR	29	60	50		4149	4299	4149	4299	113	24				
81	Sympho & Dly LR	29	80			2499	3749	4999	5099	133	25				

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Data-Value Assign Table

Table 1 Rev Time

Data	Value (sec)	Data	Value (sec)
0	0.3	40	4.3
1	0.4	41	4.4
2	0.5	42	4.5
3	0.6	43	4.6
4	0.7	44	4.7
5	0.8	45	4.8
6	0.9	46	4.9
7	1.0	47	5.0
8	1.1	48	5.5
9	1.2	49	6.0
10	1.3	50	6.5
11	1.4	51	7.0
12	1.5	52	7.5
13	1.6	53	8.0
14	1.7	54	8.5
15	1.8	55	9.0
16	1.9	56	9.5
17	2.0	57	10.0
18	2.1	58	11.0
19	2.2	59	12.0
20	2.3	60	13.0
21	2.4	61	14.0
22	2.5	62	15.0
23	2.6	63	16.0
24	2.7	64	17.0
25	2.8	65	18.0
26	2.9	66	19.0
27	3.0	67	20.0
28	3.1	68	25.0
29	3.2	69	30.0
30	3.3		
31	3.4		
32	3.5		
33	3.6		
34	3.7		
35	3.8		
36	3.9		
37	4.0		
38	4.1		
39	4.2		

Table 2 LPF

Data	Value (KHz)
0	1.0
1	1.1
2	1.2
3	1.4
4	1.6
5	1.8
6	2.0
7	2.2
8	2.5
9	2.8
10	3.2
11	3.6
12	4.0
13	4.5
14	5.0
15	5.6
16	6.3
17	7.0
18	8.0
19	9.0
20	10.0
21	11.0
22	12.0
23	14.0
24	16.0
25	Thru

Table 3 HPF1

Data	Value (Hz)
0	Thru
1	32
2	35
3	40
4	45
5	50
6	56
7	63
8	70
9	80
10	90
11	100
12	110
13	125
14	140
15	160
16	180
17	200
18	220
19	250
20	280
21	315
22	355
23	400
24	450
25	500
26	560
27	630
28	700
29	800
30	900
31	1000

Data-Value Assign Table

Table 4 HPF2

Data	Value (Hz)
0	500
1	630
2	800
3	1000
4	1200
5	1600
6	2000
7	2500
8	3200
9	4000
10	5000
11	6300
12	8000
13	10000
14	12000
15	16000

Table 5 Low Shelving

Data	Value (Hz)
0	32
1	40
2	50
3	63
4	80
5	100
6	125
7	160
8	200
9	250
10	315
11	400
12	500
13	630
14	800
15	1000
16	1200
17	1600
18	2000

Table 6 Mid Presence

Data	Value (Hz)
0	315
1	400
2	500
3	630
4	800
5	900
6	1000
7	1200
8	1600
9	2000
10	2500
11	3200
12	4000
13	5000
14	6300

Table 7 High Shelving

Data	Value (Hz)
0	500
1	630
2	800
3	1000
4	1200
5	1600
6	2000
7	2500
8	3200
9	4000
10	5000
11	6300
12	8000
13	10000
14	12000
15	16000

Data-Value Assign Table

Table 8 Length

Data	Value (m)	Data	Value (m)	Data	Value (m)
0	0.5	40	11.2	80	22.7
1	0.8	41	11.5	81	23.0
2	1.0	42	11.8	82	23.3
3	1.3	43	12.1	83	23.6
4	1.5	44	12.3	84	23.9
5	1.8	45	12.6	85	24.2
6	2.0	46	12.9	86	24.5
7	2.3	47	13.1	87	24.9
8	2.6	48	13.4	88	25.2
9	2.8	49	13.7	89	25.5
10	3.1	50	14.0	90	25.8
11	3.6	51	14.2	91	26.1
12	3.9	52	14.5	92	26.5
13	4.1	53	14.8	93	26.8
14	4.4	54	15.1	94	27.1
15	4.6	55	15.4	95	27.5
16	4.9	56	15.6	96	27.8
17	5.2	57	15.9	97	28.1
18	5.4	58	16.2	98	28.5
19	5.7	59	16.5	99	28.8
20	5.9	60	16.8	100	29.2
21	6.2	61	17.1	101	29.5
22	6.5	62	17.3	102	29.9
23	6.7	63	17.6	103	30.2
24	7.0	64	17.9		
25	7.2	65	18.2		
26	7.5	66	18.5		
27	7.8	67	18.8		
28	8.0	68	19.1		
29	8.3	69	19.4		
30	8.6	70	19.7		
31	8.8	71	20.0		
32	9.1	72	20.2		
33	9.4	73	20.5		
34	9.6	74	20.8		
35	9.9	75	21.1		
36	10.2	76	21.4		
37	10.4	77	21.7		
38	10.7	78	22.0		
39	11.0	79	22.4		

Table 9 Trans Time

Data	Value (ms)	Data	Value (ms)
0	2	40	3100
1	3	41	3600
2	4	42	4400
3	5	43	5400
4	6	44	6200
5	7	45	7200
6	8	46	8700
7	11	47	11000
8	12	48	12500
9	14	49	14500
10	17	50	17500
11	21	51	22000
12	24		
13	28		
14	34		
15	43		
16	49		
17	57		
18	68		
19	85		
20	97		
21	114		
22	137		
23	170		
24	195		
25	230		
26	280		
27	340		
28	390		
29	450		
30	550		
31	680		
32	780		
33	910		
34	1100		
35	1400		
36	1600		
37	1800		
38	2200		
39	2700		

Effect parameters

Type	0:Orchestra Hall ~ 19:Distant Plate					
	(Reverb Type)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Reverb Time	sec	0.3	30.0	Table #1	69
2	High	-	0.1	1.0	0.1	9
3	Diffusion	-	0	10	1	10
4	Initial Delay	ms	0.1	200.0	0.1	1999
5	Reverb Delay	ms	0.1	200.0	0.1	1999
6	Density	-	0	4	1	4
7	ER/Rev Balance	%	0	100	1	100
8	Low Gain	dB	-12	12	2	12
9	High Gain	dB	-12	12	2	12
10	LPF	KHz	1	Thru	Table #2	25
11	HPF	Hz	Thru	1000	Table #3	31

Type	20:Stone Room ~ 29:Bathroom Vocal								
	(Room Simulation Type)								
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.		Local Table 1	
1	Reverb Time	sec	0.3	30.0	Table #1	69		Data	Value
2	High	-	0.1	1.0	0.1	9			
3	Diffusion	-	0	10	1	10		0	Front
4	Initial Delay	ms	0.1	200.0	0.1	1999		1	Center
5	Width	m	0.5	30.2	Table #8	103		2	Rear
6	Height	m	0.5	30.2	Table #8	103			
7	Depth	m	0.5	30.2	Table #8	103			
8	Wall Vary	-	0	30	1	30			
9	HPF	Hz	Thru	1000	Table #3	31			
10	LPF	KHz	1	Thru	Table #2	25			
11	Reverb Delay	ms	0.1	200.0	0.1	1999			
12	Density	-	0	4	1	4			
13	ER/Rev Balance	%	0	100	1	100			
14	Listening Position	-	Front	Rear	LocalTab 1	2			

Type	30:Early Ref Vocal ~ 35:Early Ref Reverse Vocal								
	(Early Reflection Type)								
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.		Local Table 1	
1	Type	sec	S-Hall	Spring	LocalTab 1	5		Data	Value
2	Room Size	-	0.1	20.0	0.1	199			
3	Liveness	-	0	10	1	10		0	S-Hall
4	Diffusion	-	0	10	1	10		1	L-Hall
5	Initial Delay	ms	0.1	400.0	0.1	3999		2	Random
6	ER Number	-	1	19	1	18		3	Reverse
7	Feedback Delay	ms	0.1	800.0	0.1	7999		4	Plate
8	Feedback Gain	%	-99	99	1	198		5	Spring
9	HPF	Hz	Thru	1000	Table #3	31			
10	LPF	KHz	1	Thru	Table #2	25			

Type	36:Gate Reverb ~ 37:Reverse Gate								
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.		Local Table 1	
1	Type	sec	Type-A	Type-B	LocalTab 1	1		Data	Value
2	Room Size	-	0.1	20.0	0.1	199			
3	Liveness	-	0	10	1	10		0	Type-A
4	Diffusion	-	0	10	1	10		1	Type-B
5	Initial Delay	ms	0.1	400.0	0.1	3999			
6	ER Number	-	1	19	1	18			
7	Feedback Delay	ms	0.1	800.0	0.1	7999			
8	Feedback Gain	%	-99	99	1	198			
9	HPF	Hz	Thru	1000	Table #3	31			
10	LPF	KHz	1	Thru	Table #2	25			

Type	38:Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Lch Delay Time	ms	0.1	1360.0	0.1	13599
2	Rch Delay Time	ms	0.1	1360.0	0.1	13599
3						
4	FB1 Delay Time	ms	0.1	1360.0	0.1	13599
5	FB2 Delay Time	ms	0.1	1360.0	0.1	13599
6	FB Gain	%	-99	99	1	198
7	FB1 High Control	-	0.1	1.0	0.1	9
8	FB2 High Control	-	0.1	1.0	0.1	9
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	39:Vocal Multi Delay					
	(Delay L,C,R)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Lch Delay Time	ms	0.1	1360.0	0.1	13599
2	Rch Delay Time	ms	0.1	1360.0	0.1	13599
3	Center Delay Time	ms	0.1	1360.0	0.1	13599
4	FB1 Delay Time	ms	0.1	1360.0	0.1	13599
5	FB2 Delay Time	ms	0.1	1360.0	0.1	13599
6	FB Gain	%	-99	99	1	198
7	FB1 High Control	-	0.1	1.0	0.1	9
8	FB2 High Control	-	0.1	1.0	0.1	9
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	40:Stereo Echo					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Lch Init Delay Time	ms	0.1	680.0	0.1	6799
2	Lch FB Delay Time	ms	0.1	680.0	0.1	6799
3	Lch FB Gain	%	-99	99	1	198
4	Rch Init Delay Time	ms	0.1	680.0	0.1	6799
5	Rch FB Delay Time	ms	0.1	680.0	0.1	6799
6	Rch FB Gain	%	-99	99	1	198
7	Lch FB High Control	-	0.1	1.0	0.1	9
8	Rch FB High Control	-	0.1	1.0	0.1	9
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	41:Subtle Pitch Change					
	(Pitch Change 1)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	1 Pitch	-	-24	24	1	48
2	1 Fine	cent	-100	100	1	200
3	1 Delay	ms	0.1	650.0	0.1	6499
4	1 FB Gain	%	-99	99	1	198
5	1 Level	%	0	100	1	100
6	2 Pitch	-	-24	24	1	48
7	2 Fine	cent	-100	100.0	1	200
8	2 Delay	ms	0.1	650.0	0.1	6499
9	2 FB Gain	%	-99	99	1	198
10	2 Level	%	0	100	1	100

Type	42:Wide Guitar					
	(Pitch Change2)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	L Pitch	-	-24	24	1	48
2	L Fine	cent	-100	100	1	200
3	L Delay	ms	0.1	650.0	0.1	6499
4	L FB Gain	%	-99	99	1	198
5	R Pitch	-	-24	24	1	48
6	R Fine	cent	-100	100.0	1	200
7	R Delay	ms	0.1	650.0	0.1	6499
8	R FB Gain	%	-99	99	1	198
9						
10						

Type	43:Multi Pitch Delay					
	(Pitch Change3)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	1 Pitch	-	-24	24	1	48
2	1 Fine	cent	-100	100	1	200
3	1 Delay	ms	0.1	1300.0	0.1	12999
4	2 Pitch	-	-24	24	1	48
5	2 Fine	cent	-100	100	1	200
6	2 Delay	ms	0.1	1300.0	0.1	12999
7	3 Pitch	-	-24	24.0	1	48
8	3 Fine	cent	-100	100	1	200
9	3 Delay	ms	0.1	1300.0	0.1	12999
10						

Type	44:Aural Exciter® *					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	HPF	Hz	500	16000	Table #4	15
2	Enhance	%	0	100	1	100
3	Mix Level	%	0	100	1	100
4	Delay Time	ms	0.1	650.0	0.1	6499
5						
6						
7						
8						
9						
10						

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Type	45:Rotary Speaker								
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.		Local Table1	
1	Middle Speed	Hz	0.05	40.00	0.05	799		Data	Value
2	Depth	%	0	100	1	100			
3	Transition Time	ms	2	22000	Table #9	51		0	Low
4	L/M/H Speed Diff	Hz	0.05	5.80	0.05	115		1	Middle
5	Switch L/M/H	-	Low	High	LocalTab1	2		2	High
6	Low Gain	dB	-12	12	2	12			
7	High Gain	dB	-12	12	2	12			
8									
9									
10									

Type	46:Ring Modulator					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Wave PM Depth	%	0	100	1	100
2	Wave PM Freq	Hz	0.05	40	0.05	799
3	Wave AM Depth	%	0	100	1	100
4	Wave AM Freq	Hz	0.05	40	0.05	799
5	Low Gain	dB	-12	12	2	12
6	High Gain	dB	-12	12	2	12
7						
8						
9						
10						

Type	47:Stadium					
	(Echo->Reverb)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Echo Lch Delay	ms	0.1	320.0	0.1	3199
2	Echo Lch FB Gain	%	-99	99.0	1	198
3	Echo Rch Delay	ms	0.1	320	0.1	3199
4	Echo Rch FB Gain	%	-99	99.0	1	198
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	ER/Rev Balance	%	0	100	1	100
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	48: Delay L,R -> Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Dly Lch Delay	ms	0.1	640.0	0.1	6399
2	Dly Rch Delay	ms	0.1	640.0	0.1	6399
3	Dly Lch FB Gain	%	-99	99	1	198
4	Dly Rch FB Gain	%	-99	99	1	198
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	ER/Rev Balance	%	0	100	1	100
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	49: Flange -> Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3	Modulation Delay	%	0.1	100.0	0.1	999
4	Modulation FB Gain	%	0	99	1	99
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Initial Delay	ms	0.1	200	0.1	1999
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	50: Guitar Chorus Reverb					
	(Chorus->Rev)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Chorus Mod Freq	Hz	0.05	40.00	0.05	799
2	Chorus PM Depth	%	0	100	1	100
3	Chorus AM Depth	%	0	100.0	1	100
4						
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Initial Delay	ms	0.1	200	0.1	1999
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	51: Sympho -> Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3						
4						
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Initial Delay	ms	0.1	200	0.1	1999
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	52: Phaser -> Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3	Modulation Delay	%	0.1	5.0	0.1	49
4						
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Initial Delay	ms	0.1	200	0.1	1999
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	53:Aural Exciter®*->Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	HPF	Hz	500	16000	Table #4	15
2	Enhance	%	0	100	1	100
3	Mix Level	%	0	100	1	100
4	Reverb Time	sec	0.3	30.0	Table #1	69
5	High	-	0.1	1.0	0.1	9
6	Diffusion	-	0	10	1	10
7	Initial Delay	ms	0.1	200.0	0.1	1999
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

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Type	54: Distortion -> Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Distortion Level	%	0	100	1	100
2	Middle Freq	Hz	315	6300	Table #6	14
3	Middle Gain	dB	-12	12	2	12
4	Treble Gain	dB	-12	12	2	12
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1.0	0.1	9
7	Rev Initial Delay	ms	0.1	200	0.1	1999
8	Rev Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	55: Distortion->Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Distortion Level	%	0	100	1	100
2	Middle Freq	Hz	315	6300	Table #6	14
3	Middle Gain	dB	-12	12	2	12
4	Treble Gain	dB	-12	12	2	12
5	Dly Lch Delay	ms	0.1	1360.0	0.1	13599
6	Dly Rch Delay	ms	0.1	1360.0	0.1	13599
7	Dly FB Gain	%	-99	99	1	198
8	Delay Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	56: Distortion->Echo					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Distortion Level	%	0	100	1	100
2	Middle Freq	Hz	315	6300	Table #6	14
3	Middle Gain	dB	-12	12	2	12
4	Treble Gain	dB	-12	12	2	12
5	Echo Lch Delay	ms	0.1	680.0	0.1	6799
6	Echo Rch Delay	ms	0.1	680.0	0.1	6799
7	Echo FB Gain	%	-99	99	1	198
8	Echo Mix Level	%	0	100	1	100
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	57: HighCut Reverb ~ 59: Sparkling Reverb					
	(EQ->Rev)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Reverb Time	sec	0.3	30	Table #1	69
8	Initial Delay	ms	0.1	200.0	0.1	1999
9	ER/Rev Balance	%	0	100	1	100
10	Rev Mix Level	%	0	100	1	100
11	Density	-	0	3	1	3
12	Diffusion	-	0	10	1	10
13	High	-	0.1	1.0	0.1	9

Type	60: Mid Delay					
	(EQ->Delay L,R)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Dly Lch Delay	ms	0.1	1360.0	0.1	13599
8	Dly Rch Delay	ms	0.1	1360.0	0.1	13599
9	Dly FB Gain	%	-99	99	1	198
10	Delay Mix Level	%	0	100	1	100

Type	61: Deep Echo					
	(EQ->Echo)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Echo Lch Delay	ms	0.1	680.0	0.1	6799
8	Echo Rch Delay	ms	0.1	680.0	0.1	6799
9	Echo FB Gain	%	-99	99	1	198
10	Echo Mix Level	%	0	100	1	100

Type	62: EQ->Flange					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Modulation Freq	Hz	0.05	40.0	0.05	799
8	Modulation Depth	%	0	100	1	100
9	Modulation FB Gain	%	0	99	1	99
10	Flange Mix Level	%	0	100	1	100

Type	63: Bass Chorus					
	(EQ->Chorus)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Chorus Mod Freq	Hz	0.05	40.0	0.05	799
8	Chorus PM Depth	%	0	100	1	100
9	Chorus AM Depth	%	0	100	1	100
10	Chorus Mix Level	%	0	100	1	100

Type	64: Elec Guitar EQ/Sympho					
	(EQ->Sympho)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Modulation Freq	Hz	0.05	40.0	0.05	799
8	Modulation Depth	%	0	100	1	100
9						
10	Sympho Mix Level	%	0	100	1	100

Type	65: Warm Phase					
	(EQ->Phaser)					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Low Freq	Hz	32	2000	Table #5	18
2	Low Gain	dB	-12	12	2	12
3	Mid Freq	Hz	315	6300	Table #6	14
4	Mid Gain	dB	-12	12	2	12
5	High Freq	Hz	500	16000	Table #7	15
6	High Gain	dB	-12	12	2	12
7	Modulation Freq	Hz	0.05	40.0	0.05	799
8	Modulation Depth	%	0	100	1	100
9	Modulation Delay	ms	0.1	5.0	0.1	49
10	Phaser Mix Level	%	0	100	1	100

Type	66: Flange -> Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3	Modulation Delay	%	0.1	100.0	0.1	999
4	Modulation FB Gain	%	0	99	1	99
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	Delay Mix Level	%	0	100	1	100

Type	67: St.Chorus -> Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Chorus Mod Freq	Hz	0.05	40.00	0.05	799
2	Chorus PM Depth	%	0	100	1	100
3	Chorus AM Depth	%	0	100.0	1	100
4						
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	Delay Mix Level	%	0	100	1	100

Type	68: Sympho -> Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3						
4						
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	Delay Mix Level	%	0	100	1	100

Type	69: Phaser -> Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3	Modulation Delay	%	0.1	5.0	0.1	49
4						
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	Delay Mix Level	%	0	100	1	100

Type	70: Hall & Plate					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Hall Reverb Time	sec	0.3	30.0	Table #1	69
2	Hall High	-	0.1	1.0	0.1	9
3	Hall Diffusion	-	0	10	1	10
4	Hall Initial Delay	ms	0.1	200.0	0.1	1999
5	Hall LPF	KHz	1	Thru	Table #2	25
6	Plate Reverb Time	sec	0.3	30	Table #1	69
7	Plate High	-	0.1	1	0.1	9
8	Plate Diffusion	-	0	10	1	10
9	Plate Initial Delay	ms	0.1	200	0.1	1999
10	Plate LPF	KHz	1	Thru	Table #2	25

Type	71: Echo & Reverb					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Echo Lch Delay	ms	0.1	320.0	0.1	3199
2	Echo Rch Delay	ms	0.1	320.0	0.1	3199
3	Echo FB Gain	%	-99	99	1	198
4	Reverb Time	sec	0.3	30.0	Table #1	69
5	Rev High	-	0.1	1.0	0.1	9
6	Rev Diffusion	-	0	10	1	10
7	Rev Initial Delay	ms	0.1	200.0	0.1	1999
8	Rev ER/Rev Balance	%	0	100	1	100
9	Rev HPF	Hz	Thru	1000	Table #3	31
10	Rev LPF	KHz	1	Thru	Table #2	25

Type	72: Delay & Reverb					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Delay Lch Delay	ms	0.1	640.0	0.1	6399
2	Delay Rch Delay	ms	0.1	640.0	0.1	6399
3	Delay FB Gain	%	-99	99	1	198
4	Reverb Time	sec	0.3	30.0	Table #1	69
5	Rev High	-	0.1	1.0	0.1	9
6	Rev Diffusion	-	0	10	1	10
7	Rev Initial Delay	ms	0.1	200.0	0.1	1999
8	Rev ER/Rev Balance	%	0	100	1	100
9	Rev HPF	Hz	Thru	1000	Table #3	31
10	Rev LPF	KHz	1	Thru	Table #2	25

Type	73: Flange & Chorus					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Flange Mod Freq	Hz	0.05	40.0	0.05	799
2	Flange Mod Depth	%	0	100.0	1	100
3	Flange Mod Delay	%	0.1	100	0.1	999
4	Flange Mod FB Gain	%	0	99.0	1	99
5						
6	Chorus Mod Freq	Hz	0.05	40	0.05	799
7	Chorus PM Depth	%	0	100.0	1	100
8	Chorus AM Depth	%	0	100	1	100
9						
10						

Type	74: Flange & Sympho					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Flange Mod Freq	Hz	0.05	40.0	0.05	799
2	Flange Mod Depth	%	0	100.0	1	100
3	Flange Mod Delay	%	0.1	100	0.1	999
4	Flange Mod FB Gain	%	0	99.0	1	99
5						
6	Sympho Mod Freq	Hz	0.05	40	0.05	799
7	Sympho Mod Depth	%	0	100.0	1	100
8						
9						
10						

Type	75:Sympho & Chorus					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Sympho Mod Freq	Hz	0.05	40.0	0.05	799
2	Sympho Mod Depth	%	0	100.0	1	100
3						
4						
5						
6	Chorus Mod Freq	Hz	0.05	40	0.05	799
7	Chorus PM Depth	%	0	100.0	1	100
8	Chorus AM Depth	%	0	100	1	100
9						
10						

Type	76: Flange & Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Flange Mod Freq	Hz	0.05	40.0	0.05	799
2	Flange Mod Depth	%	0	100.0	1	100
3	Flange Mod Delay	%	0.1	100	0.1	999
4	Flange Mod FB Gain	%	0	99.0	1	99
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Diffusion	-	0	10	1	10
8	Rev Initial Delay	ms	0.1	200	0.1	1999
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	77: Chorus & Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Chorus Mod Freq	Hz	0.05	40.0	0.05	799
2	Chorus PM Depth	%	0	100.0	1	100
3	Chorus AM Depth	%	0	100	1	100
4						
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Diffusion	-	0	10	1	10
8	Rev Initial Delay	ms	0.1	200	0.1	1999
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	78: Sympho & Rev					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.0	0.05	799
2	Modulation Depth	%	0	100.0	1	100
3						
4						
5	Reverb Time	sec	0.3	30.0	Table #1	69
6	Reverb High	-	0.1	1	0.1	9
7	Rev Diffusion	-	0	10	1	10
8	Rev Initial Delay	ms	0.1	200	0.1	1999
9	HPF	Hz	Thru	1000	Table #3	31
10	LPF	KHz	1	Thru	Table #2	25

Type	79: Flange & Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3	Modulation Delay	%	0.1	100.0	0.1	999
4	Modulation FB Gain	%	0	99	1	99
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	LPF	KHz	1	Thru	Table #2	25

Type	80: Chorus & Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Chorus Mod Freq	Hz	0.05	40.00	0.05	799
2	Chorus PM Depth	%	0	100	1	100
3	Chorus AM Depth	%	0	100.0	1	100
4						
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	LPF	KHz	1	Thru	Table #2	25

Type	81: Sympho & Delay L,R					
No.	Parameter Name	Unit	Minimum	Maximum	Step/Table	Max.Int.
1	Modulation Freq	Hz	0.05	40.00	0.05	799
2	Modulation Depth	%	0	100	1	100
3						
4						
5	Delay Lch Delay	ms	0.1	800.0	0.1	7999
6	Delay Rch Delay	ms	0.1	800.0	0.1	7999
7	Delay FB1 Delay	ms	0.1	800.0	0.1	7999
8	Delay FB2 Delay	ms	0.1	800.0	0.1	7999
9	Delay FB Gain	%	-99	99	1	198
10	LPF	KHz	1	Thru	Table #2	25

MIDI Parameter

Common parameter

System

parameter name	value
Rec Source	*1
Rec Frequency	*2
Play Back Frequency	*3
Trigger Rec Mode on/off	*4
Trigger Rec Level	*5
Sync Mode Select	*6
MIDI Sync on/off	*4
Channel Status bit0 (out)	*13
Channel Status Sampling Freq	*14

Effect Return Sel/Level

parameter name	value
Effect Return 1 Select 1	*7
Effect Return 1 Select 2	*7
Effect Return 2 Select 1	*7
Effect Return 2 Select 2	*7
Effect Return 3 Select 1	*7
Effect Return 3 Select 2	*7
Effect Return 4 Select 1	*7
Effect Return 4 Select 2	*7
Effect Return 1 Level 1	0~127
Effect Return 1 Level 2	0~127
Effect Return 2 Level 1	0~127
Effect Return 2 Level 2	0~127
Effect Return 3 Level 1	0~127
Effect Return 3 Level 2	0~127
Effect Return 4 Level 1	0~127
Effect Return 4 Level 2	0~127

DEQ

parameter name	value
Mode	*8

DSP2

parameter name	value
Type	0~81
Parameter 1	0~? (word)
Parameter 2	0~? (word)
:	:
:	:
Parameter 30	0~? (word)

Channel parameter

System (ch 0,1 only)

parameter name	value
Rec Monitor on/off	*4

Volume, Effect Send

parameter name	value
Channel Volume	0~127
Bus 1 Select	*7
Bus 2 Select	*7
Bus 3 Select	*7
Bus 4 Select	*7
Bus 1 Volume	0~127
Bus 2 Volume	0~127
Bus 3 Volume	0~127
Bus 4 Volume	0~127
Effect Send 1 Level	0~127
Effect Send 2 Level	0~127

DEQ

parameter name	value
IIR1 Parameter	**
IIR2 Parameter	**
IIR3 Parameter	**
IIR4 Parameter	**

**** IIR n parameter (n=1~4)**

parameter name	value
Type	*9
Frequency	*10
Gain	*11
Q	*12

*1

value	source
0	AES/EBU
1	Y2
2	CD/DAT
3	ANALOG

*2

value	Freq (KHz)
0	48
1	44.4
2	32
3	22.05

*3 Sync mode Select = internal

value	Freq (KHz)
0	48
1	44.1

*4

value	on/off
0	off
1	on

*5

value	Level (dB)
0	–9
1	–15
2	–18
3	–24
4	–30
5	–36
6	–42
7	–48
8	–∞

*6

value	Mode
0	internal
1	external
2	AES/EBU
3	Y2
4	CD/DAT

*7

value	Select
0	OUT1
1	OUT2
2	OUT3
3	OUT4
4	mute

*8

value	Mode
0	Reserved
1	Thru
2	PEQ

Software Thru
4IIR/4Ch

*9

value	Type	Freq	Gain	Q
0	Through	0	0	0
1	Lo1	1	0	0
2	Lo2	1	0	1
3	Hi1	1	0	0
4	Hi2	1	0	1
5	LoSh	1	1	0
6	HISh	1	1	0
7	Presence	1	1	1
8	BandE1	1	0	1
9	BandPass	1	0	1

0:invalid
1:valid

*10

value	Freq (Hz)
0	18
1	20
2	22
3	25
4	28
5	32
6	36
7	40
8	45
9	50
10	56
11	63
12	70
13	80
14	90
15	100
16	110
17	125
18	140
19	160
20	180
21	200
22	220
23	250
24	280
25	315
26	355
27	400
28	450
29	500
30	560
31	630
32	700
33	800
34	900
35	1000
36	1100
37	1200
38	1400
39	1600
40	1800
41	2000
42	2200
43	2500
44	2800
45	3200
46	3600
47	4000
48	4500
49	5000
50	5600
51	6300
52	7000
53	8000
54	9000
55	10000
56	11000
57	12000
58	14000
59	16000
60	18000

When RecFreq=32kHz,
values 59 & 60 are 15000Hz

*11

value	Gain (dB)
0	–15
:	:
30	15

*12

value	Q
0	0.1
:	:
49	5.0

*13

value	bit0
0	consumer
1	professional

*14 Sync mode Select =
Channel status sampling
Freq. other than internal

value	Freq (KHz)
0	48
1	44.1
2	32

MIDI Parameter Map

Common parameter

Common Parameter (base address=h'2000)	System	Rec Source	0	Parameter 6 MSB	50
		Rec Frequency	1	Parameter 6 LSB	51
		Play Back Frequency	2	Parameter 7 MSB	52
Channel 0 Parameter (base address=h'0)		Trigger Rec Mode on/off	3	Parameter 7 LSB	53
		Trigger Rec Level	4	Parameter 8 MSB	54
		Sync Mode Select	5	Parameter 8 LSB	55
Channel 1 Parameter (base address=h'0)		MIDI Sync on/off	6	Parameter 9 MSB	56
		Channel Status bit0	7	Parameter 9 LSB	57
		Channel Status Sampling Freq	8	Parameter 10 MSB	58
Channel 2 Parameter (base address=h'0)		Reserved	9	Parameter 10 LSB	59
		Reserved	10	Parameter 11 MSB	60
		Reserved	11	Parameter 11 LSB	61
Channel 3 Parameter (base address=h'0)	Efct Rtn	Effect Return 1 Select 1	12	Parameter 12 MSB	62
		Effect Return 1 Select 2	13	Parameter 12 LSB	63
		Effect Return 2 Select 1	14	Parameter 13 MSB	64
		Effect Return 2 Select 2	15	Parameter 13 LSB	65
		Effect Return 3 Select 1	16	Parameter 14 MSB	66
		Effect Return 3 Select 2	17	Parameter 14 LSB	67
		Effect Return 4 Select 1	18	Parameter 15 MSB	68
		Effect Return 4 Select 2	19	Parameter 15 LSB	69
		Effect Return 1 Level 1	20	Parameter 16 MSB	70
		Effect Return 1 Level 2	21	Parameter 16 LSB	71
		Effect Return 2 Level 1	22	Parameter 17 MSB	72
		Effect Return 2 Level 2	23	Parameter 17 LSB	73
		Effect Return 3 Level 1	24	Parameter 18 MSB	74
		Effect Return 3 Level 2	25	Parameter 18 LSB	75
		Effect Return 4 Level 1	26	Parameter 19 MSB	76
		Effect Return 4 Level 2	27	Parameter 19 LSB	77
		Reserved	28	Parameter 20 MSB	78
		Reserved	29	Parameter 20 LSB	79
		Reserved	30	Parameter 21 MSB	80
		Reserved	31	Parameter 21 LSB	81
	DEQ	Mode	32	Parameter 22 MSB	82
		Reserved	33	Parameter 22 LSB	83
		Reserved	34	Parameter 23 MSB	84
		Reserved	35	Parameter 23 LSB	85
		Reserved	36	Parameter 24 MSB	86
		Reserved	37	Parameter 24 LSB	87
	DSP2	Reserved	38	Parameter 25 MSB	88
		Type	39	Parameter 25 LSB	89
		Parameter 1 MSB	40	Parameter 26 MSB	90
		Parameter 1 LSB	41	Parameter 26 LSB	91
		Parameter 2 MSB	42	Parameter 27 MSB	92
		Parameter 2 LSB	43	Parameter 27 LSB	93
		Parameter 3 MSB	44	Parameter 28 MSB	94
		Parameter 3 LSB	45	Parameter 28 LSB	95
		Parameter 4 MSB	46	Parameter 29 MSB	96
		Parameter 4 LSB	47	Parameter 29 LSB	97
		Parameter 5 MSB	48	Parameter 30 MSB	98
		Parameter 5 LSB	49	Parameter 30 LSB	99

Channel N parameter

System	Rec Monitor on/off	0	Valid only for ch 0, 1
	Reserved	1	
	Reserved	2	
	Reserved	3	
	Reserved	4	
	Reserved	5	
Vol,Efct Snd	Channel Volume	6	
	Reserve	7	
	Bus 1 Select	8	
	Bus 2 Select	9	
	Bus 3 Select	10	
	Bus 4 Select	11	
	Bus 1 Volume	12	
	Bus 2 Volume	13	
	Bus 3 Volume	14	
	Bus 4 Volume	15	
	Effect Send 1 Level	16	
	Effect Send 2 Level	17	
	Reserved	18	
	Reserved	19	
	Reserved	20	
	Reserved	21	
	Reserved	22	
	Reserved	23	
DEQ	Reserved	24	
	Reserved	25	
	Reserved	26	
	Reserved	27	
	Reserved	28	
	Reserved	29	
	IIR 1 Parameter *	30	
		37	
	IIR 2 Parameter *	38	
		45	
	IIR 3 Parameter *	46	
		53	
	IIR 4 Parameter *	54	
		61	
	Reserved	62	
	:		
	Reserved	69	

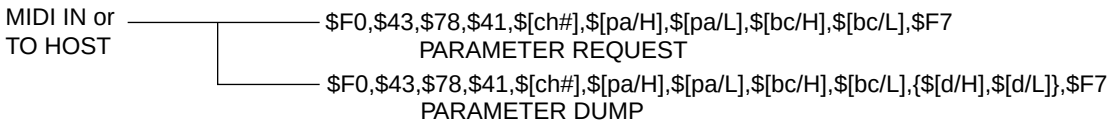
* IIR n Parameter

Type	0
Frequency	1
Gain	2
Q	3
Reserved	4
Reserved	5
Reserved	6
Reserved	7

MIDI Data Format

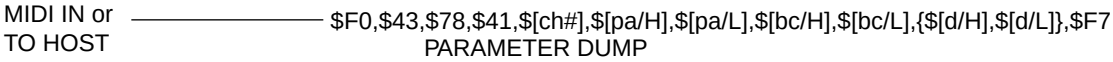
1. Block Diagram of MIDI Reception/Transmission

<MIDI Reception Conditions>



* If the Host Selector switch is set to anything other than “MIDI”, the MIDI data are echoed back to HOST IN → MIDI OUT and MIDI IN → HOST OUT, respectively.

<MIDI Transmission Conditions>



* If the Host Selector switch is set to anything other than “MIDI”, the MIDI data are echoed back to HOST IN → MIDI OUT and MIDI IN → HOST OUT, respectively.

2. Channel Messages

Channel messages are not transmitted or received.
If the Host Selector switch is set to anything other than “MIDI”, the MIDI data are echoed back to HOST IN → MIDI OUT and MIDI IN → HOST OUT, respectively.

3. System Messages

The CBX-D5 handles System Exclusive messages like those below.
Digital Track Message (Note 1)

(Note 1) The Digital Track Message (hereafter referred to as DT) is comprised of the Yamaha System Exclusive ID and a Digital Track Command, and is a System Exclusive message.

The Digital Track Messages used with this equipment are formatted as shown below.

General format for the Digital Track Message

11110000	F0		
01000011	43		YAMAHA System Exclusive ID
01111000	78		YAMAHA System Exclusive Sub ID
	<ab>	*1	DT command
	data bytes	*2	
11110111	F7		

*1 <ab>

DT status (MS 3 bits)	Sub status (LS 4 bits)
0-2: Reserved	
3: DT status of encapsulated MIDI command	Sub status equals to MIDI status code
4: DT status of device specific messages	Substatus=0 → parameter dump Substatus=1 → parameter request
5 - 7: Reserved	

(See Table 1 for DT command formats.)

*2 data bytes

The format and length vary depending on the DT status byte.
The first byte of the DT message is the channel number (It is usually from 0 to 3).

Several DT commands may be contained in one DT message.
The EOX (F7) command is used at the end of the DT message.
From a standpoint of error correction, we recommend inserting breaks in DT messages at 100 ms intervals.

DT command format (Table 1)

1: Encapsulated MIDI command (for details, see Table 2)

Status	3
Substatus	MIDI status byte
Databyte[0]	channel
Databyte[1...]	MIDI data bytes

2: Device specific messages

2.1 parameter dump

Status	4
Substatus	0
Databyte[0]	channel
Databyte[1 - 2]	parameter address
Databyte[3 - 4]	byte count
Databyte[5...]	data

CAUTION: When recording to a hard disk, one unit is used for multi-channel recording/playback. For this reason, parameters are separated into Common and Channel parameters. The parameter addresses used are as follows:

Channel parameter base address = h'0

Common parameter base address = h'2000

Parameter Dump Format (Appendix 2.1)

11110000	F0	
01000011	43	YAMAHA system exclusive ID
01111000	78	YAMAHA system exclusive sub ID
01000000	40	parameter dump status
0ccccccc	nn	channel number
0mmmmmmm	mm	parameter address Most significant 7bits [pa/H]
0l l l l l l l	l l	parameter address Least significant 7bits [pa/L]

parameter address = 0×80 *[pa/H] + [pa/L]
0x0000-0xx1FFF: channel parameter 0x0000-0x1FFF
0x2000-0xx3FFF: common parameter 0x0000-0x1FFF

0mmmmmmm*	mm	byte count Most significant 7bits [bc/H]
0l l l l l l l	l l	byte count Least significant 7bits [bc/L]

byte count = 0×80 *[bc/H] + [bc/L]

0ddddddd	data
⋮	⋮
0ddddddd	data
11110111	F7

2.2 parameter dump

Status	4
Substatus	1
Databyte[0]	channel
Databyte[1 - 2]	parameter address
Databyte[3 - 4]	byte count

Parameter Request Format (Appendix 2.2)

11110000	F0	
01000011	43	YAMAHA system exclusive ID
01111000	78	YAMAHA system exclusive sub ID
01000001	41	parameter request status
0ccccccc	nn	channel number
0mmmmmmm	mm	parameter address Most significant 7bits [pa/H]
0l l l l l l l	l l	parameter address Least significant 7bits [pa/L]

parameter address = 0×80 *[pa/H] + [pa/L]
0x0000-0xx1FFF: channel parameter 0x0000-0x1FFF
0x2000-0xx3FFF: common parameter 0x0000-0x1FFF

0mmmmmmm	mm	byte count Most significant 7bits [bc/H]
0l l l l l l l	l l	byte count Least significant 7bits [bc/L]

byte count = 0×80 *[bc/H] + [bc/L]

0ddddddd	data
⋮	⋮
0ddddddd	data
11110111	F7

Encapsulated MIDI command (Table 2)

Control changes (Assignable)

00000110	06	data entry for RPN
00000111	07	channel volume
00001011	0B	channel expression
00010000	10	
01100000	60	data increment for RPN
01100001	61	data decrement for RPN
01111000	78	All sound off

No control numbers other than these may be used.
Also, control values are not stored in the memory.

RPN

00000000	00	Pitch bend range

Pitch bend

Channel mode message

01111001	79	reset all controllers

MIDI Implementation chart