# MODEL AM-16/B

# AUDIO CROSSPOINT SWITCHER

## OWNER'S MANUAL

REVISION 2.01

360 Systems

PROFESSIONAL DIGITAL AUDIO

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# INTRODUCTION

**OBTAINING THE AM-16/B MAINTENANCE MANUAL**

Fill out the warranty card in the front of this manual and return it to 360 Systems as soon as possible. On receiving it, we will send you the maintenance manual, which includes schematics and repair tips. Registration of your unit also entitles you to free repairs during the first year, and will let us contact you in the event new software or support materials become available.

**CAUTION**

**VERIFY THAT THE VOLTAGE MARKING ON THE REAR PANEL IS SUITABLE FOR THE MAINS POWER AVAILABLE IN YOUR AREA OR COUNTRY.**

**DO NOT REMOVE OR DEFEAT THE GROUNDING PIN ON THE AC POWER CORD. A SERIOUS SHOCK HAZARD CAN RESULT FROM FAILING TO MAKE CONNECTION TO A PROPERLY GROUNDED ELECTRICAL OUTLET.**

**DO NOT USE THIS PRODUCT OUT OF DOORS, IN RAIN, OR IN DAMP OR WET ENVIRONMENTS.**

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# AM-16 SERIES SYSTEM

The AM-16 Audio Crosspoint Switcher contains a large feature set of useful tools designed to assist the broadcaster, sound contractor and recording engineer. This manual explores its technical capabilities, and describes a number of ways it can be used to solve specific problems. Because so many features are provided, the reader will find it useful to refer to the Table of Contents when searching for a particular topic.

The AM-16 Series is an expandable audio switching matrix built of two primary components-- the AM-16/B Master Crosspoint Switcher, and an optional companion piece, the AM-16/E Expander Module. These two basic blocks can be associated with each other in a variety of ways. An exceptionally versatile remote control capability makes it easy to control the switchers, using off-the-shelf controllers, or sophisticated custom interfaces.

## 0.10 THE AM-16/B MASTER CROSSPOINT SWITCHER

All the components required for a basic 16 x 16 system are contained in the AM-16/B master unit. It provides electronically balanced inputs and outputs, and incorpor-ates a new generation of CMOS crosspoint switches having exceptionally good audio performance. Audio switching is managed by a micro-computer system providing instantaneous response, non-volatile storage of routing programs, and intelligent interfacing with remote controllers. Large numeric displays provide an easy view of program status, while backlit legends assist the user in operating the front panel controls.

The master unit may be operated as a 16 x 16 monaural switcher, or as an 8 x 8 stereo unit. In stereo, audio channels are managed as pairs, and are indicated as 1 through 8 on the displays. Larger systems may be constructed by using several master units in parallel, to provide an expanded number of inputs or outputs.

## 0.20 THE AM-16/E EXPANDER MODULE

Basic systems may be enlarged with the addition of one or more Expander modules. They contain audio circuits identical to the master unit, and use commands from the master's micro-computer to control their audio. A single expander module, together with one master, will make a 16 x 16 stereo switcher, while one master and three expanders will provide a 16 x 16 matrix, four channels deep, as used in the new "D2" format VTRs.

Expander Modules connect to the master unit by a single flat cable and are self-powered. They require no controls, and are designed for use only with the AM-16/B master. A maximum of three expanders may be connected to a single master.

## 0.30 REMOTE CONTROL CAPABILITIES

The master unit may be controlled locally from its front panel, or remotely through MIDI or an EIA-422/485 port. Apart from the basic tasks that may be directly executed through single commands, many "software hooks" have been incorporated so that specialized functions may be written into custom software. Basic remote commands include:

Program recall
Increment chain step
Decrement chain step
Bulk data upload
Bulk data download
Bypass On/Off

Software hooks are described in detail in Appendix F. The AM-16/B can receive commands through MIDI or the EIA-422/485 port, but not both. A user-installed jumper selects a port, as described in section 1.42.

### 0.31 EIA-422/485 REMOTE CONTROL

A nine-pin "D" connector is provided for communication by the EIA-422 or EIA-485 electrical standards. Each has the advantage of operation to at least 1,000 feet (305 meters).

Section 2.41 describes selection of MIDI or EIA-485 communication modes from the front panel.

EIA-422 is a receive-only port on the AM-16/B. It is possible to connect a number of switchers to a single 422 cable in a multi-drop configuration, with each listening on its own channel. It may be convenient to think of 422 as a uni-directional link.

EIA-485 is electrically similar to 422, but it is bi-directional. Many transmitters and receivers may be attached to a single twisted pair cable in a simple multi-drop installation. In use, each box "tests" the cable to see if it is busy before using it.

An important feature of the AM-16 Series is that if any of the devices connected to a 485 line is turned off, it releases the line. This greatly enhances the reliability of larger systems. Similarly, any device can be unplugged from the 485 line without interfering with the integrity of the remote control line.

### 0.32 MIDI REMOTE CONTROL

MIDI uses two connectors-- one for transmit and one for receive. It is ideal for short cable runs (less than 50 feet); and because of its popularity in the music industry, several inexpensive remote control units are available. A wide range of IBM, Apple and Atari software is also available for remote control.

MIDI cables may not be "Y" connected, or used in multi-drop configurations. They may be easily split by connecting them to what is known as a "Thru-Box",

which actively drives each of its outputs. Details regarding the Midi specification can be found in Appendix E.

### 0.33 USING MIDI AND EIA-422/485 AT THE SAME TIME

When the 422/485 port is used, the AM-16/B is not listening on the MIDI input port. However, MIDI program maps (see section 2.30) and bulk data transfers may still be transmitted through the MIDI output port. This way, outboard audio gear accepting MIDI program commands can be controlled by the switcher, which in turn is controlled by a 422/485 transmitter.

# Chapter
# INSTALLING THE AM-16/B

### 1.10 A.C.

Connect the power cable to a grounded outlet. Versions of this product are produced for use with different voltages. Be certain the voltage marking on the rear panel is suitable for the area in which it is to be used.

### 1.11 POWER SWITCH

The A.C. power switch is located on the left side of the front panel. It shows a blue area when in the "on" position. One or more of the displays will also illuminate when power is applied.

### 1.12 FUSE

The A.C. fuse is located on the rear panel of the AM-16/B. Replace it only with the same type and rating. For 120 volts, use a 1-amp, 3AG slow-blow. For 230 volts, use 1/2-amp, 3 AG slow-blow.

### 1.20 AUDIO CONNECTOR WIRING

Fifty-six pin ELCO Type 8016 connectors are used for audio inputs and outputs. Mating plugs are provided, with loose terminals. These bifurcated terminals are gold plated, and provide excellent reliability and resistance to oxidation. They may be installed in the plug shell while the AM-16/B is connected and operating, and may be easily removed with an appropriate ELCO tool. See Appendix D.

The pinout for the ELCO connectors appears in Appendix D. It is also silk-screened on the rear panel of the AM-16/B. For reference, pin locations are also provided. Both inputs and outputs use an identical pinout, with the exception of channel 11, which has the + and - connections reversed on the output connector. Note that this discrepancy is not reflected in the rear panel silk screen.

The mating plugs provided with the AM-16/B include cable strain reliefs. A variety of other connector parts are available from ELCO distributors. See Appendix D for a listing of optional part numbers and sources.

### 1.21 AUDIO INPUT CONNECTIONS

Audio inputs are electronically balanced with respect to ground. Each input is identical, and has an impedance of 40.2 k ohms. For balanced applications, connect to the + and - terminals, and use the ground terminal for the shield.

Single-ended (unbalanced) connections may be made between ground and either the + or - terminal. The user therefore has the option of making the overall signal path inverting if desired. It is a good idea to connect the unused input to the ground terminal for the same channel.

NOTE: When wiring an input, use only the ground terminal for that particular channel. Do not share grounds with other channels.

### 1.22 AUDIO OUTPUT CONNECTIONS

Audio outputs are electronically balanced with respect to ground and have a source impedance of 100 ohms. For balanced applications, connect to the + and - terminals and use the ground only for the shield.

Single-ended (unbalanced) connections may be made to either the + or - terminal, and ground. The user has the option of making the polarity of a signal path inverting by selecting the minus (-) output. Do not ground the unused output.

### 1.23 BALANCED VS SINGLE-ENDED GAIN STRUCTURE

The gain of the AM-16/B depends on the type of connection made to it. A gain of unity might be obtained with a balanced input connected to the + and - input terminals, and a balanced output measured between the + and - output terminals. The same input voltage applied between ground and a single input terminal will produce a differential output voltage 6 dB less. Similarly, a given input voltage applied in a balanced connection will produce an output voltage 6 dB less, if measured between ground and either output terminal. If both input and output are unbalanced, the total reduction will be 12 dB.

### 1.24 REAR PANEL INPUT GAIN ADJUSTMENTS

Level trims on the rear panel adjust the input gain of each channel; they do not alter the output amplifier gain. The trims may be used to produce standardized output levels from different level audio sources. An adjustment range of -6 dB to +4 dB is available.

### 1.25 FRONT PANEL AUDIO JACKS

In addition to the rear panel connectors, input and output channels 8 and 16 (stereo pair #8 in the stereo mode) are available on the front panel as single-ended 1/4" jacks. These convenience jacks are for studio situations where outboard equipment or test signals are to be inserted. Plugging a jack into the front panel input connectors will disconnect signals presented to channels 8 or 16 on the rear panel inputs.

An additional 12 dB of gain is provided on the front panel input jacks. This is to facilitate connection of consumer gear or -10 dB semi-pro equipment.

The output jacks are at the same level as the rear panel connector, and do not interrupt the rear panel output.

### 1.30 THE EIA-422/485 PORT

A 9-pin female "D" connector located on the rear panel serves as an EIA-422 receive-only port, or as an EIA-485 bi-directional port. See section 1.42, 2.41 and Appendix F for additional data on using the ports. The following connector pinout is used:

Pin 1 Ground
Pin 2
Pin 3 Signal (+)
Pin 4
Pin 5
Pin 6
Pin 7
Pin 8 Signal (-)
Pin 9

### 1.31 MIDI INPUT PORT

Use a standard 5-pin MIDI cable to connect the MIDI IN of the AM-16/B to the MIDI OUTPUT of a MIDI equipped computer or MIDI program number transmitter. Any device capable of sending program numbers via MIDI may be used to control the AM-16/B, i.e. keyboards, foot controllers, etc.

### 1.32 MIDI OUTPUT PORT

A cable may be connected from the MIDI OUT connector of the AM-16/B to send program change information to other MIDI-based audio equipment. It may be desirable to use a "Thru-Box" or a Midi Patcher to split the MIDI output into the separate parallel paths for all the outboard equipment. Alternately, the MIDI cable may be "daisy-chained" through outboard gear equipped with “Thru” jacks.

The MIDI IN and MIDI OUT connectors may also be used to upload and download the contents of the AM-16/B's memory to a computer or to another AM-16/B. See section 2.90 for further information on these features.

### 1.33 INTERFACE PORT TO AM-16/E EXPANDER MODULES

A 15-pin female "D" connector on the rear panel provides all signals needed to control additional AM-16/E Expander Modules. A maximum of three expanders may be added, and a special interface cable must be ordered to connect the expanders to the AM-16/B. When ordering this cable, specify whether one, two or three AM-16/E expanders are to be connected.

### 1.40 CONFIGURING INTERNAL JUMPER OPTIONS

> ***CAUTION: Before changing the jumpers, turn the power off and unplug the unit. Ground yourself to the chassis to discharge static electricity on your fingers before touching anything inside the box.***

Several push-on jumpers inside the AM-16/B select user options. The jumpers may be removed with the fingers and replaced in the desired position by pressing them onto a pair of square pins until seated.

### 1.41 MONAURAL/STEREO SELECT

Jumper JP1 (located on the front panel printed circuit card) selects whether the AM-16/B operates as a 16 x 16 monaural switcher, or whether programs are paired together for stereo, as an 8 x 8 unit. Place the jumper between the center pin and the appropriate outer pin. Each is clearly labeled STEREO or MONAURAL. Stereo pairs are arranged as:

| | |
|---|---|
| 1 and 9 | 5 and 13 |
| 2 and 10 | 6 and 14 |
| 3 and 11 | 7 and 15 |
| 4 and 12 | 8 and 16 |

This arrangement is also the way channels are paired for stereo on the front panel scribble strip.

### 1.42 EIA-422/485 OR MIDI SELECT

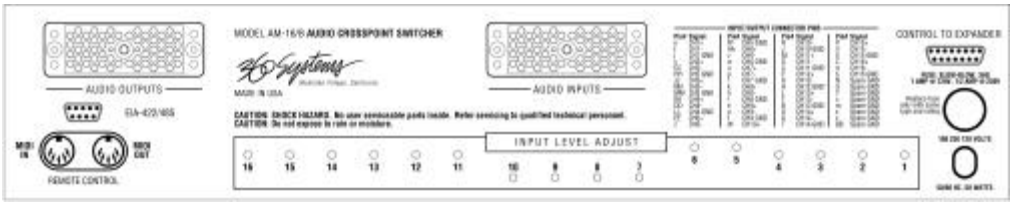
The AM-16/B can receive remote control commands through either the 9-pin EIA-422/485 connector or through the MIDI IN port. It is necessary to select one or the other with jumper JMP1, located on the right rear corner of the large circuit card. This is set at the factory for EIA-422/485 for use with the AM-16R Remote.

Place the jumper between the center pin and the appropriate outer pin. One is marked "MIDI", and the other is marked "485".

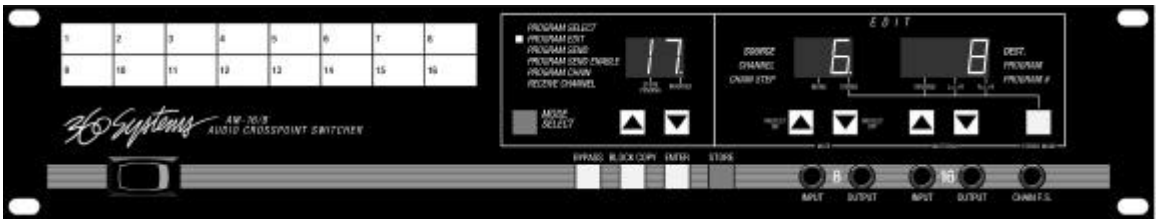
Be certain to select the "normal" (MIDI) or "485" communications mode as described in section 2.41.

### 1.43 EIA-422/485 TERMINATION JUMPER

When using long lines to send data via EIA-485 to the switcher, improved wave shape can be achieved by resistively terminating the line. A 150-ohm termination can be placed across the line by installing JMP2, located at the right rear corner of the large circuit card. As shipped, the jumper is installed on only one of the pins; remove it, and place it across both pins.




AM-16B REAR PANEL



## Chapter Two
# USING THE AM-16/B AUDIO SWITCHER

### 2.00 ABOUT THE OPERATING MODES

This overview begins with the most commonly used features, and then reviews the more seldom-used aspects. You will find it helpful to put the AM-16/B in front of you while reading about its operation, or refer to Figure 1.

The AM-16/B has six operating modes, selected by the blue MODE SELECT button. One of these may be selected at a time, and is indicated by an LED. A helpful feature of the device is that other legends and displays appear only as necessary to clarify the task at hand.

### 2.01 THE EDIT BUFFER

As a convenience to the user, the AM-16/B allows all editing to be done in a temporary memory space called the Edit Buffer. Information placed in the Edit Buffer can be altered, deleted and reviewed without fear of damaging "real information" in the main memory. When a final decision has been reached, the contents of the Edit Buffer are loaded into main memory with the STORE function. (Section 2.23)

### 2.10 PROGRAM SELECT MODE

The PROGRAM SELECT mode allows stored audio routing programs (together with their associated PROGRAM SEND information) to be recalled from memory. See section 2.30 for more on auxiliary PROGRAM SEND capabilities. Stored programs are recalled as *program numbers*, and appear on the left numeric display. One hundred program locations (00 through 99) are provided for storage of routing programs. Program 100 is "bypass", and program numbers 101 through 127 select program chains 1 through 27. (See Section 2.50 Program Chain Mode.)

## 2.11 SELECTING STORED PROGRAMS

To select a program, press the MODE SELECT button until the PROGRAM SELECT LED comes on. Use the up/down arrows under the left display to change the program number. When the desired program number is arrived at, press ENTER. The MODIFIED LED will extinguish, and the new program will be active.

In PROGRAM SELECT mode, the MODIFIED LED indicates that the displayed program *is not* the currently active one-- that is, the one being heard. To make it active, simply press ENTER. This two-step scheme allows one to move from a program to another without hearing all the intermediate possibilities.

Similarly, if it is not known which program is active, scroll through all of them (which happens very quickly) and note the program number displayed at the time the MODIFIED LED goes out; this is the current program.

## 2.12 REMOTE PROGRAM SELECTION

Programs can also be recalled through remote program change commands without touching the front panel buttons. To receive them, set the AM-16/B to the channel number on which the programs are to be transmitted. (See section 2.60) When a program number is received, the switcher retrieves the program from memory and configures itself accordingly. Incoming program commands are ignored if the receive channel is set to "OF" (off).

## 2.20 PROGRAM EDIT MODE

The PROGRAM EDIT mode is used to create one or more simultaneous source-destination connections within the switcher. Any of the sixteen sources may be assigned to one or more destinations. In practice, each destination is assigned to a single source, one at a time; the entire set can then stored in memory as a program number which can be recalled later.

Constructing a set of audio paths is a two-step process. The source-destination assignments are assembled in an "edit buffer", in which they are created, auditioned, and modified, without actually changing the contents of the crosspoint switches or program memory. They are then written to the crosspoint switches as a second step. Once all of the audio paths are programmed, the entire set can then be written to a program memory.

## 2.21 CONSTRUCTING AUDIO PATHS

First, select the program number to be edited, as described in Section 2.11. Then press the MODE SELECT button until the PROGRAM EDIT LED lights. The left display window indicates the program number being edited.

The right display indicates the DESTINATION to which an input will be assigned. Select a destination *first*, using the arrow buttons under that display.

The center display indicates the SOURCE to be assigned to that destination. Use the arrow buttons under the center display to select the source. *Selection of a source must be done after the destination has been selected*. (It is helpful to think of the Destinations as the locations of data, and the Sources as the data in those locations. When you want to scan through the audio paths to see how each is programmed, you step through the Destinations.) So far, the selected program has only been modified in the Edit Buffer, and is neither being heard or stored into memory.

Press ENTER to hear the new selection. The MODIFIED LED will light, indicating that the signal paths just programmed are a modification of the selected program. The new program may be stored as described below, or abandoned by pressing either of the left display arrow buttons.

If no source is to be connected to a destination, the source display can select the symbol "--" which indicates a mute. A shortcut to reaching the "--" symbol is to press both arrow buttons under the center display at the same time.

When a number of simultaneous audio paths are to be programmed at once, it is faster to do it as follows:

Select 1st destination
Select 1st source
Select 2nd destination
Select 2nd source
Select last destination
Select last source
Press ENTER (MODIFIED LED comes on) or STORE
Perform STORE operation

It is always possible to make additional modifications to a program. Simply select an additional destination, a source to go with it, and press ENTER to audition it.

Note that it isn't necessary to audition new audio paths with the ENTER button; if there is no question about their being correct, press the STORE command to write them to memory at once.

### 2.22 MULTIPLE INPUT ASSIGNMENTS

An input can drive as many as sixteen outputs at once; each line is individually buffered so there is no increase in loading on any input.

Audio "mults" can be created by assigning a single input to many outputs at once. For example, Input #1 can be assigned to Outputs #1, 2 and 3:

| INPUT NUMBER | OUTPUT NUMBER |
|---|---|
| 1 | 1 |
| 1 | 2 |
| 1 | 3 |

## 2.23 STORING EDITED PATHS AS A PROGRAM NUMBER

The entire set of sixteen audio paths can now be stored in memory. Pressing the STORE button *once* will place the switcher in the PROGRAM SELECT mode. Notice that the STORE PENDING LED is illuminated. This means that a STORE operation *can happen* if STORE is pressed again. It has not yet happened, but during the STORE PENDING interval, a new program number may be selected as a location for the edited work. Use the arrow buttons under the left window to select the new program number. Press STORE again, and the STORE PENDING LED will go out. The new set of paths is now stored as a program, with a numeric identity.

## 2.24 THE STORE-PENDING TIMER

In the "Store Pending" mode, the AM-16/B's computer is waiting to see if a program number is selected and finally stored. Four seconds are allowed to complete the operation. If at the end of that interval the STORE button has not been pressed a second time, the store-pending mode will be exited. This "watch-dog" prevents accidental damage to valuable programs that might occur if the switcher was left armed.

## 2.25 MEMORY PROTECT

Memory protection is provided to prevent accidental erasure of valuable programs in the switcher. It is a "global" function; that is, all programs are simultaneously protected. It is also stored in non-volatile RAM, so that when power is turned off, the protect function is remembered.

To set memory protect, enter the PROGRAM SELECT mode. Press the "up" arrow button under the center display; the legend "Pr on" will appear. Memory protect is now active.

To turn memory protect off, press the "down" arrow button under the center display; the legend "Pr OFF" will appear. Memory protect is now disabled.

Should you attempt to store a program while memory protect is on, it <u>will not</u> over-write the existing one, and will instead display "Pr on". To store, turn

memory protect off, and resume the store operation. Memory protect also affects remote control STORE commands. **Note that Memory Protect must be Off in order to use the unit with an AM-16R Remote Control.**

It is a good idea to use the "System Exclusive" data transfer capability to create external backup copies of memory. This way, no matter what the cause of damaged memory, it can be recovered. See Section 2.90.

## 2.26 COPYING PROGRAMS

It is often convenient to copy programs from their original memory location to one or more new ones. Many programs will be similar to each other, and the easiest way to create variations is by editing the original-- but under a new program number.

NOTE: Programs may have *identical audio connections*, but posses *different* auxiliary Program Send information. See Section 2.30.

To copy a single program, go to the PROGRAM SELECT mode and select a program number. Press STORE once, and using the arrow buttons under the program display, select a new number in which to place the program copy.

Press STORE again to write to memory.

## 2.27 THE BLOCK COPY FEATURE/MAKING MULTIPLE COPIES

To make multiple copies of a single program, enter the PROGRAM SELECT mode, select a program number and press ENTER. Press BLOCK COPY. Notice that the center display and right display appear. Use the arrow buttons under the right display to select the *upper limit first*. Next, use the arrow buttons under the center display to select the lower limit. The switcher will not allow an improper range to be selected. Press STORE twice to copy to the new block of memory.

## 2.28 USING BYPASS AS AN EDIT/COMPARE FUNCTION

Because the bypass program is instantly available from the front panel, it can be used to compare the audio effect of two different programs. To do this, load the BYPASS program with one selection, select any other program and alternately turn BYPASS on and off, noting the difference.

## 2.30 PROGRAM SEND MODE

Each of the 100 stored programs carries with it a set of eight program change commands, which are transmitted from the MIDI output port each time a new master program number is selected. Each program change command within the set of eight consists of a channel number and a program number; all may be different. The channel number and program number together can "map" the information to the desired destination, to select programs on equipment such as digital reverbs and effects units that have MIDI capability.

The auxiliary MIDI program sends are separate and unrelated to the audio functions. Their use is entirely optional.

MIDI program changes are transmitted through the EIA-485 port as well as from the MIDI OUT connector. They may be converted from EIA-485 back into MIDI at a distant location, to provide long-distance MIDI control.

## 2.31 CREATING MIDI PROGRAM MAPS

A set of auxiliary program changes will be associated with a particular program number, so that when that program is selected, the auxiliary programs are transmitted. Enter the PROGRAM SELECT mode, and select the program number you wish to create a program map for.

Then select PROGRAM SEND mode. Eight program changes can be created for a single program. They can be in any order, as all will be transmitted in a single burst. The left display indicates which of the eight is currently being assembled.

NOTE: The left display is not a program or a channel; it is simply a reference to identify which of the eight program changes is currently under construction. Begin with number "1".

Use the arrow buttons under the center CHANNEL display to select a channel number, 1 through 16, to match the MIDI receiving device, or "off" (displayed as "OF") if no transmission is desired.

Next select a MIDI program number to be transmitted, using the right arrow buttons. Any number from 0 through 127 may be used. This number corresponds to a program number for the receiving device on that MIDI channel. This completes one of the eight auxiliary program changes. During programming, each program number is immediately transmitted as it is selected. This means that the change can be "previewed" on the receiving device.

Change the left display to MIDI program two, and again select a MIDI channel number and program number for it. Repeat this for all eight MIDI programs in the set. If less than eight are needed, program the unused ones with "off" for the MIDI send channel. The completed set is now to be stored with a

particular PROGRAM SELECT number within the switcher. If this number was selected earlier, it may now be stored as described in the following Section 2.32.

### 2.32 STORING MIDI PROGRAM MAPS

Press STORE *once*. The PROGRAM SELECT mode will be entered, and the STORE PENDING LED will light. The left display shows the patch number being stored to. Press STORE again. The set of auxiliary programs are now stored as the program number shown, and the STORE PENDING LED turns off.

If the left display *does not* show the desired program number, use the arrow buttons to select a new number. As before, press STORE a second time to write to the new program number.

> ***CAUTION: Storing to a new number will also replace any* audio path *information for that number with the information associated with the newly created MIDI program map.***

As with storing audio paths, four seconds are allowed to make a selection before the switcher will exit the store-pending mode. Should this happen, you may again press STORE *once* to re-enter the mode. A final selection can now be made and entered by pressing STORE again.

> ***CAUTION: In the event two different programs are transmitted on the same channel, the second (or last) affects the receiving device.***

### 2.33 EDITING MIDI PROGRAM MAPS

Midi program maps are edited simply by recalling the program number of interest, entering the PROGRAM SEND mode, and modifying the MIDI channel and program number data. The old data will be recalled and displayed to assist you in the modifications. Repeat the programming steps under 2.31, and STORE the modified information to the same program number.

## 2.40 PROGRAM SEND ENABLE MODE

At times the MIDI program send information may not be wanted at the equipment it was intended for. For example, a digital reverb under MIDI control will always select the program commanded by the AM-16/B, while you may have need for something different.

Turning PROGRAM SEND ENABLE off will suppress transmission of all program change commands without deleting them from memory. Use the MODE SELECT button to enter the PROGRAM SEND ENABLE mode. Toggle the up/down arrows under the left display, to select "OF" (off), or "on". The right display will show "nor" for normal, if it hasn't been changed. The last state is stored in non-volatile memory and is retained when power is turned off. It is also "global"; that is, it affects all programs.

## 2.41 SELECTING EIA-485 TRANSMISSION

If remote control data is to be received via EIA-422 (which is listen-only) instead of by EIA-485 (which is talk-listen) it is important that the 485 transmit protocols be disabled; otherwise, the AM-16/B may attempt communication on the line when a remote control device is also trying to use it. It may be convenient to think of MIDI and 422 as the same thing in terms of how the software manages the remote ports.

When PROGRAM SEND ENABLE is "on", the transmit capability of the 485 port may be enabled by pressing the "up" arrow under the right display; it will then read "485". Transmission of MIDI patch maps will continue, as long as PROGRAM SEND ENABLE is in the "on" state.

Once 485 is selected, PROGRAM SEND ENABLE may be turned "off" without leaving the 485 mode by pressing the "down" arrow under the left display.

## 2.50 PROGRAM CHAIN MODE

Program chains are strings of programs tied into a loop. The advantage of chains is that they exist in a useful sequence, presenting an easy way to switch between two or more programs that may not be consecutively numbered.

The AM-16/B has 27 chains, each containing a maximum of 32 steps. (A step represents an individual program number "link" in the chain.) Chains may be recalled with front panel controls, or through the remote control ports. They are assigned Program Numbers 101 through 127.

Once a chain has been recalled, it may be incremented using either the front panel controls, remote control commands or a momentary footswitch.

### 2.51 SELECTING A STORED CHAIN

Chains are selected from the front panel by entering the PROGRAM CHAIN mode, selecting a chain number from 1 to 27 with the left arrow buttons, and pressing ENTER to initiate step one. The middle arrow buttons may be used to increment or decrement the chain. ENTER may be pressed at any time to return to step one.

The left display shows which chain number is selected. The center display shows the current CHAIN STEP. The right display shows the PROGRAM # active for that particular chain step.

Chains 1-27 may be accessed when the switcher receives program change numbers 101-127. Remote control commands can also be used to increment and decrement chain steps. MIDI controller #96 will increment, and controller #97 will decrement. Refer to Appendix E and F for more information regarding MIDI implementation.

### 2.52 PROGRAMMING A CHAIN

Use the MODE SELECT button to enter the PROGRAM CHAIN mode. Select any chain number from 1 to 27, and press ENTER. Notice that the center display is labeled CHAIN STEP, and the right display is labeled PROGRAM #.

The middle display will show CHAIN STEP "1". The right display will show the PROGRAM # for this step. Use the arrow buttons under the right display to select a program number for CHAIN STEP #1. Any number between 0 and 99 may be chosen, as well as the bypass patch "bP".

Use the arrow buttons under the CHAIN STEP display to move to CHAIN STEP #2. Again, use the up/down arrows under the right-hand display to select a PROGRAM # for this step.

Repeat this process to create a chain of up to 32 steps. At the end, simultaneously depress *both* arrow buttons under the PROGRAM # display. The word "End" will appear in the display, and the chain length will be set to the number of steps already programmed.

When advancing through a chain, the last entry will wrap around to the first one when "End" is reached. In chains using all 32 steps it is not necessary to enter "End". Step 1 will always follow step 32.

### 2.53 STORING A CHAIN

Press STORE *once* to enter the store-pending mode; if the chain number appearing in the left display is suitable, press STORE again to write the chain to memory. If not suitable, use the arrow buttons under the left display to select another number between 1 and 27. Press STORE a second time to write the contents to memory. As with other modes, a STORE decision must be made within four (4) seconds or the switcher will exit from the store-pending mode.

### 2.54 EDITING A CHAIN

Editing a chain is the same as creating one from scratch, except that old material is edited to become new material. The "End" marker may also be placed differently.

First select a chain while in PROGRAM CHAIN mode. The chain will not become active until ENTER is pressed. Until that time, the chain can be edited by changing the program numbers associated with each step. The MODIFIED LED will be on, indicating a "recall-pending" mode. If changes are to be dumped, press ENTER and the original program will again be established. If the program is to be saved, press STORE *once* to enter the STORE-PENDING mode.

If the chain number displayed is suitable, press STORE again to save the edited chain. If desired, use the left arrow buttons to select a different chain number, and then press STORE to save to the new location.

### 2.55 SPECIAL CHAIN CHARACTERS

Aside from the numbers 0 through 99, the characters "bP" will be found in place of program #100. Program 100 is the special BYPASS mode, and may be treated as any other program. See section 2.80 for additional information on BYPASS.

The character "--" means that the previous program selection will be duplicated if this character is entered. It may be helpful to insert "--" at times if you think you will want to insert additional steps into the center of the chain later on. Similarly, a step can be deleted by replacing a program number with "--". "End" also occupies one of the 32 steps within the chain. To enter "--" in a chain, press both right arrows simultaneously.

### 2.56 CHAIN FOOTSWITCH JACK

A momentary contact footswitch can be plugged into the front panel jack. By placing the switcher in the PROGRAM CHAIN mode, the chain will advance by one step each time the footswitch is depressed. As a convenience, the first step of the chain will not become active until the first time the switch is pressed.

This way, the user can move from one chain selection to another without hearing all the intermediate programs.

It does not matter whether the footswitch is of the "normally open" or "normally closed" variety. On power up, the switcher looks to see whether the contact is open or closed, and accepts the opposite as the "active" command. Remember, the footswitch will not function until the switcher is placed in the PROGRAM CHAIN mode.

### 2.57 SELECTING CHAIN STEPS THROUGH MIDI

It is possible to move forward or backward through the chain steps via MIDI. Refer to Appendix E for detailed information on the MIDI implementation.

MIDI controller #96 increments, and emulates the footswitch.
MIDI controller #97 decrements the chain step number.

### 2.60 RECEIVE CHANNEL MODE

The AM-16/B receives remote control data on MIDI channels 1-16, and in Omni mode, which is all channels simultaneously. It can also be turned off and ignore all incoming channel data. When a new channel number is selected, it will be stored in non-volatile memory. Therefore, each time the AM-16/B is turned on, the last selected RECEIVE CHANNEL will be active. The receive channel setting is global, and applies to all programs.

**Receive Channel Mode should be OFF for use with the AM-16R Remote Control, and Unit Address should usually be between 0 and 3 when used with a single Remote.**

System data (bulk data transfers) are always received, regardless of whether a receive channel has been selected. The number in the right hand display is the Unit Address Number. This Adress applies to System data transfers, as well as use with the AM-16R Remote Control. The number set here determines which Level on the remote controls the AM-16B.

### 2.61 PROGRAMMING THE RECEIVE CHANNEL

Use the MODE SELECT button to enter the RECEIVE CHANNEL mode. The center display will illuminate, with the legend CHANNEL. The currently assigned channel will be shown. Aside from 1-16, the character "o" indicates Omni mode (receives on all channels), while "OF" means off-- that is, not receiving on any channel.

The Unit Address number ranges from 0 to 127.

A new channel number or Unit Address is automatically remembered when it is selected; it is not necessary to store it.

## 2.70 THE MONAURAL MODE

The AM-16/B is shipped from the factory set for 16 x 16 monaural operation. The MONAURAL LED on the display indicates this mode. Note that when operated in the monaural mode, the stereo mode switch described below is not active. Monaural operation is obtained by changing an internal jumper; see section 1.41 for further information.

## 2.71 STEREO MODES

The Stereo Mode is selected by an internal jumper as outlined in Section 1.41. When operating the AM-16/B in stereo, the PROGRAM EDIT mode offers a number of special stereo options to correct stereo signal placement problems. For example, source material may have reversed channels, or signal be present on only one channel.

Use the STEREO MODE button to step through the options; each mode is indicated by an LED on the front panel. Stereo reverse simply exchanges the left and right channels. Left = L+R sends the left input to the left and right outputs; the right input is ignored. Right = L+R sends the right input to the left and right outputs; the left input is ignored.

The special stereo modes are selected as part of an edited program. They are stored along with other characteristics, and apply only to a particular program number. The special stereo modes are inoperative when the switcher is jumpered for monaural use.

## 2.80 THE BYPASS MODE

The Bypass mode gives immediate access to a stored program to configure the switcher to a standardized set of audio paths. The user may store anything in the bypass program. For example, all inputs and outputs might be connected in a straight-through configuration, or all signal paths might be muted or routed in some special way to create a "default" setup.

## 2.81 SELECTING BYPASS

The BYPASS program may be activated from the front panel with the momentary BYPASS button. The "BYPASS LED" appears when active. It may also be selected from the PROGRAM SELECT mode as Program 100, and when selected in this manner is always displayed as "bP". The BYPASS program may be quickly retrieved by using the down-arrow to locate it just below program 00.

Through the remote control ports, BYPASS is also selected as program 100. It may also be remotely selected via MIDI controller #95, which emulates the front panel button.

### 2.82 PROGRAMMING BYPASS

To edit bypass, select "bP" (between program 99 and 00). Press ENTER and edit the program as you would any other. (See Section 2.20) Bypass cannot be retrieved for editing purposes through the BYPASS button. Editing in bypass mode (bypass switch on but another program location selected) will allow programs to be recalled, edited and stored without changing the state of the Crosspoint switches. You can store the current state of the switches into the “bP” memory, press the Bypass switch, and then perform normal programming without fear of disturbing the existing patches.

### 2.90 TRANSFERRING RAM DATA VIA MIDI SYSTEM EXCLUSIVE

The contents of the non-volatile RAM in the AM-16/B can be transferred back and forth to a computer equipped for MIDI System Exclusive data transfers. This way, an infinite number of stored patches are available to the user, or to multiple users.

A number of inexpensive MIDI data-filer programs are available for use on many computers.

### 2.91 SYS-EX TRANSFERS TO THE AM-16/B

To perform a system exclusive data transfer, set up the computer, and bring up a system exclusive data transfer program. Connect a MIDI cable between the MIDI OUTPUT of the computer and the MIDI IN of the AM-16/B. The switcher will recognize system exclusive data as soon as it appears, and load it into the RAM. No keystrokes are required, and it does not matter what operating mode the unit is in for the transfer to begin. On completion, the switcher will automatically return to PROGRAM SELECT mode. It will then recall Program 0, set the crosspoint switches accordingly, and send MIDI program maps.

### 2.92 SYS-EX TRANSFERS FROM THE AM-16/B

To transfer data from the switcher to a suitably equipped computer, connect a MIDI cable from the MIDI OUT of the switcher to the MIDI INPUT of the computer. Set up the computer's system exclusive program to receive data.

Place the switcher in the RECEIVE CHANNEL mode, and press ENTER. Data will immediately be transferred, and the display will read "UP" during the transfer. The switcher's buttons will not respond to commands until the data transfer is complete, which takes two to three seconds. Sending or receiving system-exclusive data does not affect audio during transmission. However, on completion of a download to the AM-16/B, program #00 of the new set will immediately be called.

# APPENDIX A
## INITIALIZATION

The AM-16/B is shipped from the factory with all of its audio paths, MIDI program maps and chains initialized to the following configuration:

| | |
|---|---|
| Bypass | All outputs muted ("--"). |
| Program "0" | Each input routed to a like numbered output. |
| All other programs 1-99 | All outputs muted ("--"). |
| All MIDI program maps | MIDI channel = off |
| Program number | 0 |
| All program chains | Program number "--" (null) |

Should you wish to clear all programs to this default setting, you may do so by applying power while holding down the STORE button.

> ***CAUTION: This will erase all previously stored information in the switcher.***

# APPENDIX B
## SOFTWARE REVISION NUMBER

From time to time different versions of software may be produced for the AM-16/B. These may incorporate customer suggestions, or they may support special-purpose applications for the product. Software is installed as a plug-in "chip" inside the unit.

To determine which revision is present in a particular AM-16/B, turn the power off. Hold down the ENTER button, and turn the power on again. The display will show the revision number. Owner's manuals may be revised occasionally, and will also carry revision numbers to indicate their suitability for a particular unit.

The current revision number is 2.00.

# APPENDIX C
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| MATRIX SIZE | 16 x 16 master switcher, expandable w/ 16 x 16 expansion units. Configurable to mono, stereo or multi-channel systems. |
| STORED PGMS | 100 programs stored in non-volatile memory. Programs may control individual switches or operate as salvos. |
| BANDWIDTH | DC to 50 kHz (-3 dB) |
| DISTORTION | Less than .008%, THD + N, DC to 20 kHz @ +22 dBv |
| SIGNAL/NOISE | 105 dB unweighted referred to maximum output. |
| NOISE FLOOR | 78 dBu (96 microvolts) |
| CROSSTALK | Any channel to any other: 99 dB @ 1 kHz; 83 dB @ 20 kHz |
| CONNECTORS | 56-pin ELCO 8016 with gold plated pins. Mates provided. |
| FRONT PANEL JACKS | Input and output 8 and 16 duplicated single ended on front panel with 12 dB additional gain. Connection to front input jack interrupts Corresponding rear panel input. |
| INPUT | Electronically balanced with R.F. suppression. |
| INPUT Z | 40k ohms |
| INPUT GAIN | Nominally 0 dB; adjustable over 10 dB range. |
| MAXIMUM INPUT | +27 dBu |
| COMMON MODE | Rejection better than 55 dB (typical), DC to 20 kHz |
| OUTPUT | Phase corrected differential outputs, short circuit proof |
| OUTPUT Z | 100 ohms |
| MAX. OUTPUT | +27 dBu differential; +22 dBu single ended |
| STABILITY | Optimum output stage compensation with decoupling of load reactances gives excellent square wave response and stability. |
| REMOTE CONTROL | Full control through EIA-422/485 or MIDI |
| DATA CABLE RUN | Maximum length with EIA-422/485: 1,000 ft. Maximum length with MIDI: 50 ft. |
| DATA TRANSFER | Upload/download capability of stored data via front panel or remote terminal. |
| MIDI MAPPING | Eight MIDI commands on any eight MIDI channel numbers are transmitted with each selected program. Front panel Enable/disable. Data also transmitted on EIA-422/485. |
| MAP MEMORY | Mapped MIDI commands stored in non-volatile memory. |
| POWER | 97-130 volts or 200-245 volts AC, 50/60 Hz, 30 watts |
| POWER SUPPLY | Redundant power supply regulators for all supply rails. |
| DIMENSIONS | 3.5" x 19" x 8" (88.5 x 482 x 203 mm) (height x width x depth), including mated connectors. |
| WEIGHT | 10 lbs (5.45 kg) net. |
| MECHANICAL | Constructed of 18 ga steel, semi-gloss baked powder paint. Front panel black anodized aluminum with Lexan® overlay. |
| MATERIALS & STANDARDS | Printed circuit cards: epoxy glass (FR-4) have 94-VO flame retardant rating. Power transformer approval to U.L. and CSA standards. AC components U.L. recognized. |
| COUNTRY OF MFG. | Made in U.S.A. |

# APPENDIX D
## CONNECTOR COMPONENTS & WIRING

The AM-16/E is shipped with the following mating connectors:

2 pcs. ELCO 56 ckt. plug, P/N 00-8016-056-000-701
100 pcs. ELCO solder terminal, P/N 60-8017-0513-000-339
2 pcs. ELCO cable clamp, P/N 30-8026-9601-00-000

The user may wish to procure other ELCO connector elements to better meet his specific requirements. ELCO produces a wide variety of terminals and connector shells. Some of the more useful ones are described below:

Wire crimp tail terminal, P/N 60-8017-0313
Cover, die cast alum w/ large cable clamp P/N 30-8016-9828
Cover, die cast alum w/ ex. large cable clamp P/N 30-8016-9842
Terminal removal tool, P/N 06-1877-04
Contact crimping tool (for crimp terminal only) P/N 06-7852-01

Product catalogs and sales outlets may be obtained directly from AVX Corporation at:

Tel: (480) 539-1496
Fax: (480) 539-1501
www.avxcorp.com

## INPUT CONNECTOR PINOUT (J1)

| Pin # | Signal |
|---|---|
| n | CH 1 + |
| t | CH 1 - |
| j | CH 1 GND |
| y | CH 2 + |
| CC | CH 2 - |
| HH | CH 2 GND |
| JJ | CH 3 + |
| NN | CH 3 - |
| MM | CH 3 GND |
| KK | CH 4 + |
| DD | CH 4 - |
| LL | CH 4 GND |
| EE | CH 5 + |
| z | CH 5 - |
| FF | CH 5 GND |
| AA | CH 6 + |
| v | CH 6 - |
| w | CH 6 GND |
| u | CH 7 + |
| p | CH 7 - |
| r | CH 7 GND |
| k | CH 8 + |
| h | CH 8 - |
| l | CH 8 GND |
| e | CH 9 + |
| a | CH 9 - |
| f | CH 9 GND |
| W | CH 10 + |
| R | CH 10 - |
| J | CH 10 GND |
| S | CH 11 + |
| M | CH 11 - |
| C | CH 11 GND |
| E | CH 12 + |
| A | CH 12 - |
| H | CH 12 GND |
| L | CH 13 + |
| F | CH 13 - |
| B | CH 13 GND |
| D | CH 14 + |
| K | CH 14 - |
| T | CH 14 GND |
| P | CH 15 + |
| V | CH 15 - |
| X | CH 15 GND |
| Z | CH 16 + |
| d | CH 16 - |
| b | CH 16 GND |

NOTE: Pins N,U,Y,c,m, and s are spare ground pins, and may be used for shield termination. Pins x, and BB are always left bank.

## OUTPUT CONNECTOR PINOUT (J2)

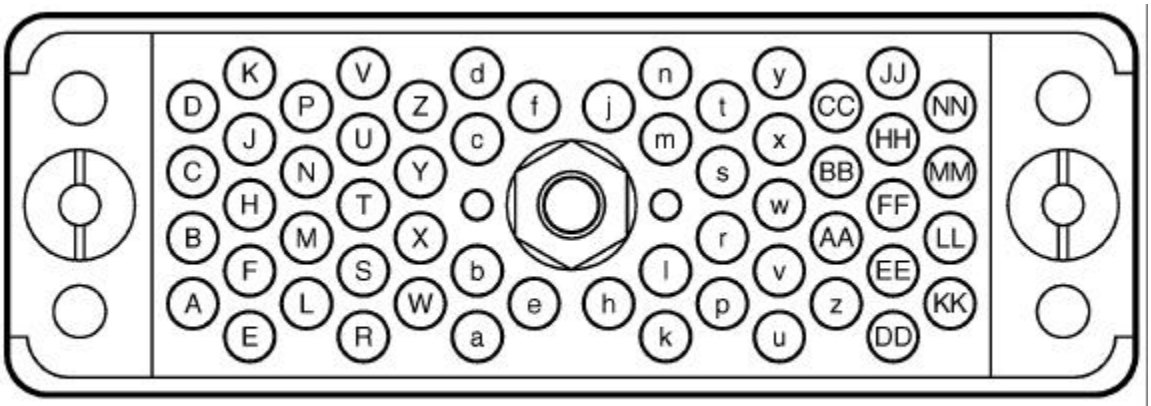
| Pin # | Signal Name |
|---|---|
| n | CH 1 + |
| t | CH 1 - |
| j | CH 1 GND |
| y | CH2 + |
| CC | CH2 - |
| HH | CH 2 GND |
| JJ | CH 3 + |
| NN | CH 3 - |
| MM | CH 3 GND |
| KK | CH 4 + |
| DD | CH 4 - |
| LL | CH 4 GND |
| EE | CH 5 + |
| z | CH 5 - |
| FF | CH 5 GND |
| AA | CH 6 + |
| v | CH 6 - |
| w | CH 6 GND |
| u | CH 7 + |
| p | CH 7 - |
| r | CH 7 GND |
| k | CH 8 + |
| h | CH 8 - |
| l | CH 8 GND |
| e | CH 9 + |
| a | CH 9 - |
| f | CH 9 GND |
| W | CH 10 + |
| R | CH 10 - |
| J | CH 10 GND |
| **M*** | **CH 11 +** |
| **S*** | **CH 11 -** |
| C | CH 11 GND |
| E | CH 12 + |
| A | CH 12 - |
| H | CH 12 GND |
| L | CH 13 + |
| F | CH 13 - |
| B | CH 13 GND |
| D | CH 14 + |
| K | CH 14 - |
| T | CH 14 GND |
| P | CH 15 + |
| V | CH 15 - |
| X | CH 15 GND |
| Z | CH 16 + |
| d | CH 16 - |
| b | CH 16 GND |

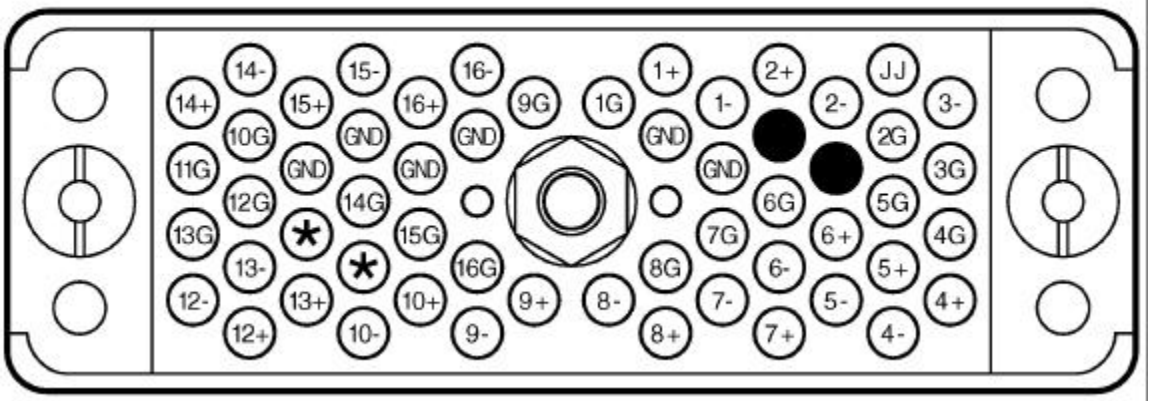
* Pins M, and S are reversed from input connector pinout assignments.

## INPUT/OUTPUT CONNECTOR PIN DIAGRAMS

DIAGRAM BY PIN #

TOP




BOTTOM

DIAGRAM BY SIGNAL NAME

**VIEWED FROM SOLDER SIDE OF CONNECTOR**

* Note that pins M and S are 11- and 11+ respectively on the Input connector. Pins M and S are 11+ and 11- respectively on the Output connector. (See chart on the previous page.) Pins N, U, Y, c, m, s, are spare grounds and may be used for shield termination. Pins x, BB, are to be left blank.

# APPENDIX E
## AM-16/B MIDI SPECIFICATION

The AM-16/B uses remote control protocols based on MIDI. These have the advantage of being widely used and understood, and are easy to develop specialized programs for. The MIDI baud rate is 31.25k Baud. See Appendix H for information on operation of the switcher at 38.4k baud. Note that the protocol is the same at 38.4k baud, but that this rate is not compatible with MIDI or the AM16-R.

Those planning complex control schemes for the AM-16/B may find it helpful to obtain complete information on MIDI from the Midi Manufacturers Association. There are ordering instructions on their website at www.midi.org.

# APPENDIX F
## REMOTE CONTROL: AM-16/B COMMUNICATION SPECIFICATION

**********
**Received Data - Channel Messages**
**********

Program Change
(Change current program)
status = 1100nnnn nnnn = 0 to 0Fh (Channel 1 to 16)
0ppppppp ppppppp = 0 to 127
[0 to 99 = Patch No. 0 to 99
100 = Bypass Program
101 to 127 = Chain 1 to Chain 27]

Chain Increment
(Increment current chain step)
status = 1011nnnn nnnn = 0 to 0Fh (Channel 1 to 16)
0ccccccc c = Data increment, Controller No. 96 (60h)
0vvvvvvv v = 127

Chain Decrement
(Decrement current chain step)
status = 1011nnnn nnnn = 0 to 0Fh (Channel 1 to 16)
0ccccccc c = Data decrement, Controller No. 97 (61h)
0vvvvvvv v = 127

Bypass On/Off
(Turn Bypass On/Off, emulates front panel button)
status = 1011nnnn nnnn = 0 to 0Fh (Channel 1 to 16)
0ccccccc c = Controller No. 95 (59h)
0vvvvvvv v = 0 = OFF
0vvvvvvv v = 127 = ON

nnnn = 0 to 0Fh (Channel 1 to 16)

**********
**Transmitted Data - Channel Messages**
**********

Program Change
(Change an external device's program)
status = 1100nnnn
0ppppppp p = 0 to 127
nnnn = 0 to 0Fh (Channel 1 to 16)

**********
**Received Data - System Messages**
**********

**Request All Programs**
F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
00h Command byte, 00h = Request All Programs
F7h End of System Message
Returns: All Programs, command #01h

**Receive All Programs**
F0h System Exclusive Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
01h Command byte, 01h = Receive All Patches
data 4096 bytes of Patch and Chain data
F7h End of System Message

**Edit Buffer Request**
F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
02h Command byte, 02h = Request Edit Buffer
F7h End of System Message

**Receive Edit Buffer**
F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
03h Command byte, 03h = Receive Edit Buffer
data 64 bytes of Edit Buffer data
F7h End of System Message

### Remote Store Edit Buffer to Program #nn Request

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
04h Command byte, 04h = Request Remote Store
nn nn = 0 to 127 (Patch or Chain Number)
[0 to 99 = Program No. 0 to 99
100 = Bypass Program
101 to 127 = Chain 1 to Chain 27]
F7h End of System Message
Returns: ACK/NAK

### Request System Global Data

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
05h Command byte, 05h = Request System Global Data
F7h End of System Message
Returns: System Global Data, command #06h

### Receive System Global Data

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
06h Command byte, 06h = Request System Global Data
data byte 0 = Current Mode (read only)
[0 = Program Select, 1 = Program Edit, 2 = Program Send
3 = Program Send Enable, 4 = Program Chain, 5 = Receive Channel]
data byte1 = Current Program Number (read only)
[0 thru 99 = Program 0 thru 99, 100 = Bypass]
data byte2 = Current Chain Number (read only)
--Valid only when chain active--
[00h thru 1Ah: 00h = Chain #1, 1Ah = Chain #27]
data byte3 = Current Chain Step Number (read only)
--Valid only when chain active--
[00h thru 1Fh: 00h = Step #1, 1Fh = Step #32]
data byte4 = Current Receive Channel (read/write)
[00h = Receive on All
01h thru 10h = Ch. 1 thru 16
11h = OFF]
data byte5 = 0 0 0 0 0 S P M
[M = Mapping ON/OFF, 1 = ON, 0 = OFF (read/write)]
[P = Protect ON/OFF, 1 = ON, 0 = OFF (read/write)]
[S = Stereo/Mono Operation, 1 = Stereo, 0 = Mono (read only)]
F7h End of System Message

### Request Program #nn

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
07h Command byte, 07h = Request Program #nn
nn nn = 0 to 127 (Program or Chain Number)
[0 to 99 = Program No. 0 to 99
100 = Bypass Program
101 to 127 = Chain 1 to Chain 27]
F7h End of System Message
Returns: Program #nn, command #08h

**Receive and Store Program #nn**
(Stores Directly to Program RAM, Current Machine status unaffected)
F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
08h Command byte, 08h = Receive Program #nn
nn nn = 0 to 127 (Patch or Chain Number)
[ 0 to 99 = Program No. 0 to 99
100 = Bypass Program
101 to 127 = Chain 1 to Chain 27 ]
data 32 bytes of Program or Chain data
F7h End of System Message
Returns: ACK/NAK

**Receive Crosspoint Update**
(Update crosspoint hardware & Edit Buffer)
F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
09h Command byte, 09h = Transmitting Crosspoint Update
dest 00 thru 0Fh, [ 00h = Dest #1, 0Fh = Dest #16 ]
source 00 thru 10h, [00h = OFF, 01h = source #1, 10h = source #16 ]
F7h End of System Message
Returns: ACK/NAK

**Receive All Crosspoint Update**

(Update crosspoint hardware & Edit Buffer)

F0h System Exclusive Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
0Ah Command byte, 0Ah = Transmitting Crosspoint Update
data 16 Bytes of Crosspoint Data
byte 0 = source for Dest. #1 00h thru 10h
: [00h = OFF
: 01h = source #1
: 10h = source #16]
byte 15 = source for Dest. #16
F7h End of System Message
Returns: ACK/NAK

**Receive ACK/NAK**

(Handshake for any protected request/transfer)

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
0Bh Command byte, 0Bh = ACK/NAK
nn nn = 0 ACK, Request/Transfer Ok
nn = 7Eh NAK, Data Error
nn = 7Fh NAK, Memory Protect is On
F7h End of System Message

**********
**Transmitted Data - System Messages**
**********

**Transmitting All Patches**

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
01h Command byte, 01h = Transmitting All Programs
data 4096 bytes of data
F7h End of System Message

## Transmitting Edit Buffer

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
03h Command byte, 03h = Transmitting Edit Buffer
data 64 bytes of Edit Buffer data
F7h End of System Message

## Transmitting System Global Data

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh (Set in Receive Channel Mode in far right display)
06h Command byte, 06h = Transmitting System Global Data
data byte 0 = Current Mode (read only)
[0 = Program Select, 1 = Program Edit, 2 = Program Send
3 = Program Send Enable, 4 = Program Chain, 5 = Receive Channel]
data byte1 = Current Program Number (read only)
[0 thru 99 = Program 0 thru 99
100 = Bypass]
data byte2 = Current Chain Number (read only)
--Valid only when chain active--
[00h thru 1Ah: 00h = Chain #1, 1Ah = Chain #27]
data byte3 = Current Chain Step Number (read only)
--Valid only when chain active--
[00h thru 1Fh: 00h = Step #1, 1Fh = Step #32]
data byte4 = Current Receive Channel (read/write)
[00h = Receive on All
01h thru 10h = Ch. 1 thru 16
11h = OFF]
data byte5 = 0 0 0 0 0 S P M
[M = Mapping ON/OFF, 1 = ON, 0 = OFF (read/write)
P = Protect ON/OFF, 1 = ON, 0 = OFF (read/write)
S = Stereo/Mono Operation, 1 = Stereo, 0 = Mono (read only) ]
F7h End of System Message

## Transmitting Program #nn Data

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh
08h Command byte, 08h = Transmitting Program #nn Data
nn nn = 0 to 127 (Program or Chain Number)
[0 to 99 = Program No. 0 to 99, 100 = Bypass Program, 101 to 127 = Chain 1 to Chain 27]
data 32 bytes of Program or Chain Data
F7h End of System Message

**Transmitting ACK/NAK**

(Handshake for any protected request/transfer)

F0h System Message
00h
00h
1Ch 360 Systems ID
04h Device number, 04h = AM16/B (rev 2.00 and greater)
addr addr = Device Address, 00h thru 7Fh
0Bh Command byte, 0Bh = ACK/NAK
nn nn = 0 ACK, Request/Transfer Ok
nn = 7Eh NAK, Data Error
nn = 7Fh NAK, Memory Protect is On
F7h End of System Message

**********

**System Command Byte Summary**

**********

| --Received Data-- | --Transmitted Data-- |
|---|---|
| 00h = Request All Programs | (Transmitted by requesting unit) |
| 01h = Receive All Programs | 01h = Transmitting All Programs |
| 02h = Request Edit Buffer | (Transmitted by requesting unit) |
| 03h = Receive Edit Buffer | 03h = Transmitting Edit Buffer |
| 04h = Request Remote Store | 04h = Request Remote Store |
| 05h = Request System Global Data | (Transmitted by requesting unit) |
| 06h = Receive System Global Data | 06h = Transmitting System Global Data |
| 07h = Request Program #nn | (Transmitted by requesting unit) |
| 08h = Receive Program #nn | 08h = Transmitting Program #nn Data |
| 09h = Receive Crosspoint Update | 09h = Transmit Crosspoint Update |
| 0Ah = Receive All Crosspoint Update | 0Ah = Transmit All Crosspoint Update |
| 0Bh = Receive ACK/NAK | 0Bh = Transmitting ACK/NAK |

# APPENDIX G
## AM-16/B DATA STRUCTURES

**********
**Edit Buffer Data Structure (64 Bytes)**
**********

Byte 00 thru Byte 15 are Current Source/Dest Assignments (16 Bytes)

There is one byte per destination structured as follows:

Source = 0 M M S S S S S

where SSSSS = input (0 - 16) 0 = OFF
1 = Source #1
: :
: :
16 = Source #16

MM = stereo mode: 00 = normal
[01 = reversed
10 = L = L + R (Left input feeds both outputs)
11 = R = L + R (Right input feeds both outputs) ]

Destination Data Structure Ordered as Follows:
Byte 00: Destination #1, Source, structured as above
:
:
Byte 15: Destination #16, Source

NOTE: In Stereo operation only the first 8 bytes are used. The left side of the pair (1 thru 8) and the mode bits determine the right side of the pair (9 thru 16). Although bytes 8 thru 15 are not used they must be sent. It is suggested sending bytes 8 thru 15 equal 0.

Byte 16 thru Byte 31 are Current Program Sends (16 Bytes)

There are two bytes per step structured as follows:

BYTE 0 : 0 0 0 C C C C C CCCC = MIDI channel number,
0 = Off
1 = Ch#1
: :
: :
16 = Ch#16

BYTE 1 : 0 P P P P P P P PPPPPPP = MIDI program number.

0 = Program #0
: :
: :
127 = Program #127

Program Send Data Structure Ordered as Follows:
Byte 16: Step #1, Channel = BYTE 0, structured as above
Byte 17: Step #1, Program = BYTE 1, structured as above
:
:
Byte 30: Step #8, Channel = BYTE 0
Byte 31: Step #8, Program = BYTE 1

Byte 32 thru Byte 63 are Current Chain (32 Bytes)

There is one byte per step structured as follows:
BYTE : 0 P P P P P P P PPPPPPP = Program Number
where: 0 = Program #0
: = :
: = :
99 = Program #99
100 = Bypass
101 = End of Chain
127 = Off

Chain Data Structure Ordered as Follows:
Byte 32: Step #1, Program Number, structured as above
:
:
Byte 63: Step #32 Program Number

**********

**All Dump Data Structure (32 Bytes per Program and Chain, Total 4096 Bytes)**

**********

Program and Chain Data ordered as in Edit Buffer. (as follows):

Program #00 : Byte 0 thru 31
Program #01 : Byte 32 thru 63
:
:
Program #99 : Byte 3168 thru 3199
Bypass : Byte 3200 thru 3231

Chain #01 : Byte 3232 thru 3263
:
:
Chain #27 : Byte 4064 thru 4095

# APPENDIX H
## OPERATION AT 38.4k BAUD

The AM-16/B operates at 31.25k baud because that rate is used by all MIDI equipment. MIDI interfaces are available on a number of computers, including the ATARI 1000. MIDI ports may be added to IBM-compatible computers with the ROLAND MPU-1PC or MPU-401 MIDI adapters.

When basic remote program selection is all that is required, a number of desk top MIDI controllers exist, such as the Lexicon MRC-1.

EIA-422 and -485 ports often operate at non-MIDI baud rates. The AM-16/B may be ordered with an option that provides a 38.4k baud rate and EIA-422 and -485 ports only. This model does not support MIDI send, receive, or program mapping due to the non-standard baud rate. It also will not work with the AM-16R Remote Control.