MPX 1 V1.10

MIDI Implementation Details

Lexicon

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MIDI Implementation Details

ASCII text versions of this document , the MPX 1 Control Tree and MPX 1 Parameter Descriptions are available on CompuServe under section seven of the MIDI B forum. To access these documents:

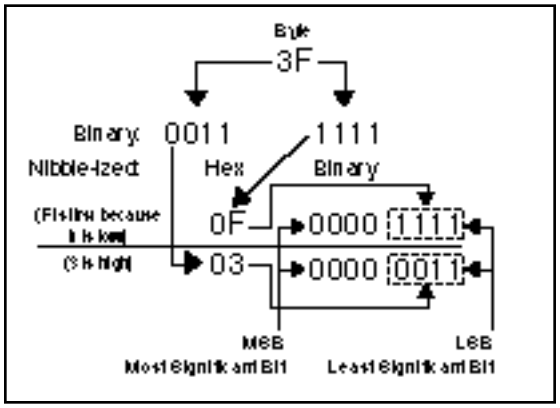
- Enter CompuServe, type GO MIDIBVEN
- Select "section seven: Lexicon"
- Enter the Lexicon library

Overview

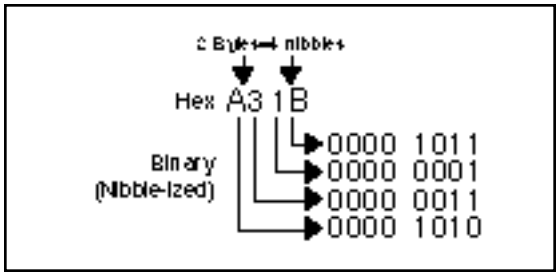
This document defines the System Exclusive (SysEx) MIDI implementation used in the Lexicon MPX 1, and assumes familiarity with the functions and operations of the MPX 1. This document covers both V1.00 and V1.10 software, which was released to support the MPX R1 MIDI Remote Controller.

Data Formatting

With the exception of message headers (first 5 bytes) and “end of SysEx” messages (the last byte in the message), all data is transmitted in a nibble-ized format, i.e. each byte of data is transmitted as a pair of bytes, with 4 bits of data in each byte.



As in all other cases in the MPX 1, the less-significant portion of the byte is transmitted first. 16-bit "words" (2 bytes) are sent low nibble of the low byte, followed by high nibble of the low byte, low nibble of the high byte, then high nibble of the high byte.



Message Tables

Throughout this document, SysEx messages are shown as Message Tables to provide a consistent method of describing the contents of each message class. The tables are organized into rows of related groups of bytes and columns containing the attributes of each field. For example, the System Configuration message table is defined as follows:

Transmit only

Byte #	Byte Value	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	00	System Configuration	
6-7	0n	Major Version (1 byte)	The number that appears to the left of the decimal point on the power up display. Example: V**1**.00
8-9	0n	Minor Version (1 byte)	

The first column indicates the Byte # of a particular field.

The second column indicates the byte value. This value is generally presented in hex, but may also appear in binary. In some cases the value is a fixed number (for example: Lexicon ID) while others may vary. Values that can change are represented using a combination of numbers and letters. Binary numbers, for instance, are represented using a lower case “b” for each variable bit in the value (for example: Device ID: 0bbb bbbb). The “b”s can represent 1s or 0s. Hex numbers which can use different numbers in the lower nibble are represented by a lower case “n” which can represent any hex number between 0 and F.

Although only a single “0n” is indicated in the Value column for certain fields, these fields will often consist of multiple bytes (each of which uses the format: 0n). This is due to nibble-ization, and to the fact that a single field can describe a group of more than 1 byte (strings, for example). In these cases, the Description column will generally indicate the number of bytes of un-nibble-ized data contained in the field.

System Control

All external control is performed using parameters. These parameters are broken down into a two dimensional inverted tree not unlike the directory structure of a computer disk. Each controllable parameter in the system (as well as the system itself) is assigned a specific Control Address that defines its position in the tree. Each System Control Address is defined by a series of Control Levels. The size (number of control levels) of a given parameter's Control Address varies depending on its position. The following diagram shows a portion of the MPX 1 tree with one full branch. (Letters are used to define System Control levels.)

The parameter which defines the product itself sits at the top of the tree with, essentially, a null control address (no control levels).

```
Control levels ->
       A      B      C      D      E      F      G      H      I
       |      |      |      |      |      |      |      |      |
MPX 1
       0 - Program
              0 - Pitch
                     0 - Detune (M)
                            0 - Mix
                                   0-100%
                            1 - Level
                            2 - Tune
                            ...
              1 - Chorus
                     0 - Chorus Algorithm
                            0 - Mix
                            1 - Level
              2 - EQ
              ...
       1 - System
              0 - Audio Config
              1 - Setup
              . . .
```

The address of "Program" is A:0, while the address of Detune is A:**0**, B:**0**, C:**0**. Detune's "Level" is A:**0**, B:**0**, C:**0**, D:**1** and Detune's "Tune" is A:**0**, B:**0**, C:**0**, D:**2**. The address of the Chorus Algorithm's "Level" is A:**0**, B:**1**, C:**0**, D:**1** while "Audio Config" would be at A:**1**, B:**0**. The number of control levels increases as you move to the right in the tree. Each control address in the system that contains a parameter is refered to as a "node".

Note that the Control Address is used to identify a specific parameter — including the MPX 1 itself. The "parameter" which defines the MPX 1 is at the top of the tree with a null Control Address (no control levels).

Parameter Types

MPX 1 system software contains an indexed list of parameter types representing each unique parameter in the system. The parameter type defines all attributes of the parameter (name, number of bytes, etc.) *except* its position in the tree which is defined by its Control Address. Several parameters can be defined as the same parameter type. For example, each Mix parameter in each algorithm in the MPX 1 is the same parameter type, but has a different Control Address. Conversely, all System Control Addresses which are accessible have a single parameter type assigned to them.

Messages

Using Control Addresses and Parameter Types, several SysEx messages have been defined to allow an external system to learn to control and interface with another MPX 1. Five core messages are typically used:

Request
System Configuration
Parameter Description
Parameter Type
Data Transfer

These five messages make up a basic toolkit for communicating with the MPX 1. Each message type is given an identifying number.

Request

The Request message consitutes an external request made to an MPX 1 to respond with one of the other message types. The Request consists of the identifying number of the message you want returned and, any specific information the system requires to respond properly.

System Configuration Message

This message provides basic information about the target system such as software revision, date of release and number of parameter types supported by the particular system.

Parameter Description Message

Each parameter type in the MPX 1 has a “description” that provides information about the parameter such as its legal values. A controlling system typically “requests” the System Configuration Message to find out how many parameter types the system supports, then requests the Parameter Description for each parameter. A local database of parameter descriptions in the controlling system is used to build the control tree and to edit parameters.

Parameter Type Message

After a database of parameter descriptions has been built of all parameter types, the controlling system needs to find out what the control tree for the MPX 1 looks like and what parameter type is used at each “node” of the tree. To do this, the controlling system “requests” the Parameter Type for a specific Control Address.

Data Transfer Message

After the parameter type at a given control address is known, the Data Transfer Message is used to send parameter change values to the MPX 1 or to “request” the current value. The Parameter Description tells you the name and legal values of the parameter.

“Learning” the MPX 1

In order for a controlling system to control or interface with the MPX 1, it needs information such as the Manufacturer ID, the Product ID and the Device ID of the system. The Manufacturer ID and the Product ID can be acquired using the Non Real-Time System Exclusive General Information Device Inquiry. The Device ID can be obtained from the system’s user interface or by using “all devices” (127).

Building a “Parameter Description” Database

Building a control tree and editing parameters requires information about parameter types. The external control system requests the “System Configuration Message” to tell it how many “types” the system supports, then requests a description of each parameter. As each parameter description comes in, the control system builds a database with them. Refer to the Parameter Description (04 hex) for additional information about the elements of this database.

Building the Control Tree

Once the controlling system knows the number of parameters types the system supports, it needs to know the position of each in the control tree. The Parameter Type message is used to find the location in the tree of any parameter type. When you want to find out what parameter type is at a particular control address, you “request” the Parameter Type Message using the Control Address as arguments to the Request message. The request for a typical Control Address is shown below. Note that the “Num Control Levels” and the actual Control Address (eg - “Level A value”) fields are 16-bit values in a nibble-ized form with the least significant nibble coming first.

request

——header——	class	Num Control levels	Level A value	Level B value
F0 06 09 00 **06**	0**3** 0**0**	0**2** 0**0** 0**0** 0**0**	0**0** 0**0** 0**0** 0**0**	0**1** 0**0** 0**0** 0**0** F7

“06” is the message class for the request (un-nibble-ized), “03” is the message class you are requesting (Parameter Type Message), “2” is the number of control levels in the Control Address, “0” is the value of level ‘A’ of the Control Address and “1” is the value of level ‘B’ of the Control Address (or A:0, B:1). This would be “Chorus” in the following tree fragment:

```
Control levels ->
       A      B      C      D      E      F      G      H      I
       |      |      |      |      |      |      |      |      |
MPX 1
       0 - Program
              0 - Pitch
                     0 - Detune (M)
                            0 - Mix
                                   0-100%
                            1 - Level
                            2 - Tune
                            ...
              1 - Chorus
                     0 - Chorus Algorithm
                            0 - Mix
                            1 - Level
                     2 - EQ
              ...
       1 - System
              0 - Audio Config
              1 - Setup
              ...
```

The top of the control tree is a sort of “null” Control Address which doesn’t contain any control levels. It is requested as follows:

request

——header——	class	Num Control levels
F0 06 09 00 06	03 00	00 00 00 00 F7

The message indicates 0 control levels but the MPX 1 responds with the parameter type at the top of the tree. The parameter types are represented as numbers in the Parameter Type Message which comes back from the MPX 1. This number (0x0155) is then used as an index into the database of parameter descriptions created earlier. Building the control tree always starts by requesting the parameter type at the top of the tree.

Once you have access to the description of the parameter at the top of the control tree, the description contents is used to build the tree below it. Each of the descriptions contains a “min” value and a “max” value. For parameters such as “Mix” that can be edited, these are the maximum mix value (100) and the minimum mix value (0) to which the parameter can be set. When the parameter type is not an editable parameter, the min and max represent the tree branches below it. A parameter is considered editable if the “Control Level” flag in the parameter description Control Flags field is NOT set (see Parameter Description (04 hex). For these parameter types the min value is always 0 and the max value is always the number of branches below it, minus 1. The min and max values represent the minimum and maximum branch (level value) that can be accessed below it. In the case of the top level parameter, the max value is the largest level ‘A’ Control Address value allowed.

When the controlling system knows how many level ‘A’ parameters are allowed, it can work with those branches. In the MPX 1, it the max value under the top level parameter type is 1. This means that level “A” can be 0 or 1. The controller would then request the parameter “type” at control address A:0 (A = 0) as follows:

request

——header——	class	Num Control levels	level A
F0 06 09 00 06	03 00	01 00 00 00	0**0** 00 00 00 F7

The MPX 1 would send back the parameter type at that Control Address (0x0153, the “Program” parameter). In the MPX 1, this parameter has a max value of 19. This means that control addresses A:0 B:0 through A:0 B:19 are legal so you can request parameter types for these addresses. In the next request you would go one level deeper:

request

——header——	class	Num Control levels	level A	level B
F0 06 09 00 06	03 00	02 00 00 00	0**0** 00 00 00	0**0** 00 00 00 F7

The MPX 1 system would send back the parameter type at *that* control address (0x014D, the “Pitch” parameter). In the MPX 1, this parameter has a max value of 10. This means that control addresses A:0 B:0 C:0 through A:0 B:0 C:10 are legal so you can request parameter types for these addresses.

This continues deeper and deeper into the control levels (letters) until you reach an actual editable parameter. At this point you have reached the end of the branch so you go to the next value of that level. In the MPX 1, the entire first branch looks like this:

```
       Control level
       A      B      C      D      E      F      G      H      I
       |      |      |      |      |      |      |      |      |
MPX 1
       0 - Program
              0 - Pitch
                     0 - no effect
                            0 - Mix
```

When you hit the “Mix” parameter, you are at the end of the branch so you would go to the next address under “no effect” which is “Level”.

```
        Control level
        A       B       C       D       E       F       G       H       I
        |       |       |       |       |       |       |       |       |
MPX 1
        0 - Program
                0 - Pitch
                        0 - no effect
                                0 - Mix
                                1 - Level
```

The “no effect” parameter has a maximum value of 1 so you would back up to the next value of “Pitch” which is “Detune (M)” (A:0, B:0, C:1).

```
        Control level
        A       B       C       D       E       F       G       H       I
        |       |       |       |       |       |       |       |       |
MPX 1
        0 - Program
                0 - Pitch
                        0 - no effect
                        1 - Detune (M)
```

The description shows a maximum value of 3, meaning that control addresses A:0 B:0 C:1 D:0 through A:0 B:0 C:1 D:2 are legal. This procedure continues until you hit the bottom of the tree.

In each parameter’s description, there is a field called “control flags”. This is a bit-mapped value that, among other things, tells you if a parameter is a “branch” or an editable parameter. If the control flag is set to 1, there are more parameters beneath it. If the bit is set to 0, the parameter is editable and there are no parameters beneath it.

Note that all of the numbers in these requests except the message class must be 16-bit values so they must each be sent as 4 nibble-ized bytes.

Using the information

In many ways, the implementation of MPX 1 SysEx will differ depending on the system in which it is implemented. A personal computer, for instance, can present more information at one time to the user than a hand held remote control. The personal computer also has a much larger memory capacity (for holding onto databases, etc.) than the remote. On the other hand, a program running on a personal computer may not want to tie up memory with information about connected equipment or provide more than a simple interface to the box. All of these issues effect how a particular program will use LUSP to control a system.

Please note that these are hypothetical implementations only.

An MRC-type of Controller

A simple implementation on a system like the Lexicon MRC would not have enough internal memory to hold much information about the connected system at any given time so it would have to request information of the system as needed.

The MRC only has 4 faders so only 4 parameters could be accessed at any given time. The faders and their associated buttons would either allow you to navigate through the control tree or actually change a parameter value. The MACH button on the MRC could be designated as an <Esc> key to back you up towards the top of the tree while the faders and buttons drop you down into the tree (fader selects the branch, button drops you down in).

For example, for the MPX 1, part of the tree looks like this:

```
System Control level
A       B       C       D       E       F       G       H       I
|       |       |       |       |       |       |       |       |
0 - Program
        0 - Pitch
                0 - Detune (M)
                        0 - Mix
                        1 - Level
                        2 - Tune
                        3 - P Dly
                1 - Detune (S)
                        ...
                2 - Detune (D)
                        ...
                3 - Shift (M)
                        ...
        1 - Chorus
                ...
        2 - EQ
                ...
        3 - Modulation
                ...
        4 - Reverb
                ...
        5 - Delay
                ...
```

Initially, the MRC display would simply show the name of the connected product which it retrieves by requesting the Parameter Type at the top of the tree. Once the Parameter Type is known, a request is sent for a description of the parameter which would include the name of the parameter (in this case “MPX 1”, the top level parameter). The description also includes a minimum and maximum value for the parameter which would be used to select branches to drop down into.

This currently has a maximum value of 1 so requests are made for the Parameter Types at System Control Addresses 0 and 1. Requests are sent for descriptions of the two Parameter Types. The name strings in the returning messages are used to display the choices, one over each fader: “Program” and “System”.

When a labeled fader is moved, the MRC isends a Parameter Data Message to the connected system followed by a request for the Parameter Display Message for the parameter. This produces a formatted, text version of the current parameter value. Pressing the button drops you to the next level. In this example, let’s assume we’ve selected the “Program” branch. In the above diagram “Program” has 6 items under it: Pitch, Chorus, EQ, Modulation, Reverb and Delay. Moving the “Program” fader we would see “Pitch”, “Chorus”, “EQ”, “Modulation”, “Reverb” or “Delay” displayed. The strings would be acquired by setting the “Program” parameter value and requesting a Parameter Display message.

If the “Program” button is pressed, the system requests the Parameter types of the first four branches under “Program”: “Pitch”, “Chorus”, “EQ” and “Modulation”. The names from each description are displayed over the four faders. Pressing the MRC’s PAGE button would get the next four items if available, eventually wrapping back around to the first four. As the faders are moved, the Parameter Data Message is sent and Parameter Display message is requested to display the selection.

The previous process is repeated until the “Branch” bit of the “Control Flags” of a parameter description is encountered set for 0. (Parameters with that bit set to 0 actually change the operation of the system and signal the end of a branch. The previous parameters only provide navigation through the tree.)

A Glass Interface Controller

A glass interface (personal computer, etc.) could take a slightly different approach. With a graphic display capability and memory (both program and data) to spare, a glass interface can provide more direct and visually stimulating access to the MPX 1. The glass interface has the option of deriving the tree structure from the MPX 1 during an initialization phase or of learning the tree structure once then hard (or semi-hard) coding the Control Addresses to the glass interface elements. The tree structure could still be learned via MIDI but it would only be used to build a road map into the tree.

Because all aspects of the interface use a common SysEx message (Parameter Data Message), the glass interface programmer can concentrate on presentation and organization of the information instead of merely accessing it. Communication traffic could be reduced by doing a one-time build of a parameter description database.

As a side note, the user interface software in the MPX 1 uses both hard and soft coded Control Addresses to edit parameters within the box itself.

Device Inquiry

The MPX 1 supports Non-Real Time System Exclusive General Information “Device Inquiry” as defined in the “MIDI 1.0 Detailed Specification 4.2”. When the MPX 1 receives the following message: F0 7E <channel> 06 01 F7 (where <channel> is the device ID of the connected MPX 1), the MPX 1 will respond with the following message:

0xF0, 0xFE	<channel>	Universal System Exclusive Non-real time header
0x06		General Information (sub-ID#1)
0x02		Identity Reply (sub-ID#1)
0x06		Lexicon’s System Exclusive ID code
0x00, 0x00		Device Family Code
0x09, 0x00		Device Family Member Code (MPX1)
0x0n		Major Software Version number
0x0n		Minor Software Version number
0x0n		Software Development Phase
0x00		unused
0xF7		EOX

Message Classes

MPX 1 System Exclusive uses message types defined as Message Classes. The Message Class identifier appears just after the standard SysEx header (Start of SysEx: F0, Company ID, Product ID, Device ID) and defines how the remaining data should be interpreted. The following message classes have been defined for the MPX 1:

# Hex	Description
00	System Configuration Message
01	Parameter Data
02	Parameter Display
03	Parameter Type
04	Parameter Description
05	Parameter Label
06	Requests
12	Handshake
16	Database Dump
18	Effect Parameters
19	All Effect Parameters
1A	Program Stats
1B	Program Dump
1C	Compact (Preset) Program Dump

00 System Configuration Message

The System Configuration Message provides a method for extracting information about the software in the system from the box via SysEx. As such, this message can only be requested from the system and will be ignored if sent to the system.

Transmit only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**00**	System Configuration	
6-7	0n	Major Version (1 byte)	The number that appears to the left of the decimal point on the power up display. Example: V**1**.00
8-9	0n	Minor Version (1 byte)	The number that appears to the right of the decimal point on power up display. Example: V1.**00**
10-25	0n	8-character Time string (8 bytes)	Time of the code build in ASCII format: xx:yy:zz xx = Hour yy = Minute zz = Second Example: 17:51:03
26-47	0n	11-character Date string (11 bytes)	Date of the code build in ASCII format: xxx:yy:zzzz xxx = Month yy = Day zzzz = Year Example: May 10 1996
48-51	0x01C0	#of parameter types (2 bytes)	Total number of parameter types in the MPX 1.
52-55	0x0164	“Bottom” parameter # (2 bytes)	Last system control parameter in a branch before an editable parameter.
56-59	0x0005	#of Control Levels used (2 bytes)	Maximum number of control levels used by the system
60	F7	End of Sysex	

Number of Parameter Types
The Number of Parameter Types message specifies the number of parameter types in the MPX 1. An editor program can use this to request Parameter Description (04 hex) dumps of all the parameters in the system.

Bottom Parameters
A Bottom parameter is the last control level on a given branch and indicates that there is only one lower level — the one which contains the real, adjustable parameters. With the exception of Effect control levels, all other parameters are used only to navigate the user interface. (Effect control levels can be sent values to change the currently running algorithm.)

Rather than identifying Bottom parameters, a controlling system can simply monitor the Control Level flag in the Parameter Description to identify the end of a branch (bit/flag cleared).

The remaining information can be used by the controlling system to detect software updates and to ascertain the ROM version.

There are no arguments to the System Configuration Request. The Request message is as follows (assuming the Device ID is 0):

```
                                                Req
——header——      Class        ——unused———
F0 06 09 00 06   00 00    00 00 00 00 00 00  F7
          |
  Device ID (0-126)
```

01 Parameter Data Message

This message allows all types of parameter data to be passed to and from the system. Typically this message class is used to change parameter values in a system remotely (automation, etc) and to dump data in and out of the box. The word “parameter” should be interpreted loosely here as MPX 1 parameters can be actual dumps as well as traditional parameters such as mix, reverb time, etc.

Transmit + Receive only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127 transmit, 0-126 receive
5	**01**	Message class	Parameter data
6-9	0n	Number of bytes (2 bytes)	Number of bytes in the parameter and its option, if available. This is a 16-bit field so up to 64K bytes is supported.
10-x	0n	Parameter data	Actual parameter data and, if available, option data. Option data always appears after the parameter data. Use the number of bytes field of the parameter and the option description to differntiate the parameter from the option.
—	0n	# of control levels (2 bytes)	Number of control levels are used in the parameter address. This is a 16-bit field so the address can have up to 64k digits (control levels). (MPX 1 max is 5.)
—	0n	Control level 0 (**A)** (2 bytes)	This is the first control level. It defines the level 0 (**A)** control address of the parameter. The control level addresses are 16 bit fields so the control addresses can be 64k deep. Note that letters are used to differentiate levels and their values.
—	0n	Control level 1 (**B)** (2 bytes)	same as previous
—	0n	Control level 2 (**C)** (2 bytes)	same as previous
—	0n	— up to Control level 65535	same as previous
	F7	End of Sysex	

Note that the “data” includes any Option data associated with the parameter. For example a 16-bit parameter with an 8-bit option would contain 3 bytes of data. The Parameter Type of both the parameter and its option must be used to correctly interpret the “data” in this message.

Control Levels are used in the request message for this packet as follows:

0n	**Number of Control Levels**	(lo nib)	(Nibble 1 of argument)
0n	Number of Control Levels	(lo mid nib)	(Nibble 2 of argument)
0n	Number of Control Levels	(hi mid nib)	(Nibble 3 of argument)
0n	Number of Control Levels	(hi nib)	(Nibble 4 of argument)
0n	**Control Level 0 (A)**	(lo nib)	(Nibble 5 of argument)
0n	Control Level A	(lo mid nib)	(Nibble 6 of argument)
0n	Control Level A	(hi mid nib)	(Nibble 7 of argument)
0n	Control Level A	(hi nib)	(Nibble 8 of argument)
0n	**Control Level 1 (B)**	(lo nib)	(Nibble 9 of argument)
0n	Control Level	(lo mid nib)	(Nibble 10 of argument)
0n	Control Level	(hi mid nib)	(Nibble 11 of argument)
0n	Control Level B	(hi nib)	(Nibble 12 of argument)

To request Program - EQ - 1 Band (M) - Gain (control address A:**0**, B:**2**, C:**1**, D:**2**) on a system with the Device ID set for 0, send:

——header——	request class	Num Control levels
F0 06 09 00 06	0**1** 00	0**4** 00 00 00

Level A (Program)	Level B (EQ)	Level C (1 Band (M))	Level D Gain)	
0**0** 00 00 00	0**2** 00 00 00	0**1** 00 00 00	0**2** 00 00 00	F7

A typical return message is as follows:

——header——	Number of data bytes	data	Number of Control levels
F0 06 09 00 01	01 00 00 00	00 00	04 00 00 00

Level A	Level B	Level C	Level D	
0**0** 00 00 00	0**2** 00 00 00	0**1** 00 00 00	0**2** 00 00 00	F7

To request a display dump (control address A:**1**, B:**8**, C:**1**) on a system with the Device ID set for 0, send:

——header——	request class	Num Control levels	Level A (System)
F0 06 09 00 06	0**1** 00	0**3** 00 00 00	0**1** 00 00 00

Level B (Panel)	Level C (Display)	
0**8** 00 00 00	0**1** 00 00 00	F7

A typical return message is as follows:

——header——	Number of data bytes	data—>
F0 06 09 00 01	00 02 00 00	00 02 02 05 06 07 02 06 00 00

data—>

0D 04 09 06 08 07 00 02 00 02 00 02 0C 04 05 06 06 07
05 06 0C 06 0C 03 0E 03 00 02 00 02 00 02 00 02 00 02
00 02 00 02 05 02 00 02 00 02 00 02 00 03 04 06 02 04

# control lvls	Level A	Level B	Level C	
03 00 00 00	01 00 00 00	08 00 00 00	01 00 00 00	F7

02 Parameter Display Message

This message allows you to display parameter values based on what they actually do instead of the numbers that represent them in the stored data structures. This is particularly useful for system parameters which generally have text strings stored in the internal ROM to describe the values.

Transmit only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**02**	Parameter Display	Message class
6-9	0n	# of characters (2 bytes)	Number of characterss (bytes) in the string
10-x	0n	String characters	“Number of characters” of nibble-ized ASCII characters
—	0n	# of control levels (2 bytes)	Number of control levels are used in the parameter address. This is a 16-bit field so the address can have up to 64k digits (control levels)
—	0n	Control level 0 (**A)** (2 bytes)	This is the first control level. It defines the level 0 (**A)** control address of the parameter. The control level addresses are 16-bit fields so the control addresses can be 64k deep. Letters are used to differentiate levels and their values.
—	0n	Control level 1 (**B)** (2 bytes)	same as previous
—	0n	Control level 2 (**C)** (2 bytes)	same as previous
—	0n	— up to Control level 65535	same as previous
	F7	End of Sysex	

Control Levels are used in the request message for this packet as follows:

0n	**Number of Control Levels**	(lo nib)	(Nibble 1 of argument)
0n	Number of Control Levels	lo mid nib)	(Nibble 2 of argument)
0n	Number of Control Levels	(hi mid nib)	(Nibble 3 of argument)
0n	Number of Control Levels	(hi nib)	(Nibble 4 of argument)
0n	**Control Level 0 (A)**	(lo nib)	(Nibble 5 of argument)
0n	Control Level A	(lo mid nib)	(Nibble 6 of argument)
0n	Control Level A	(hi mid nib)	(Nibble 7 of argument)
0n	Control Level A	(hi nib)	(Nibble 8 of argument)
0n	**Control Level 1 (B)**	(lo nib)	(Nibble 9 of argument)
0n	Control Level B	(lo mid nib)	(Nibble 10 of argument)
0n	Control Level B	(hi mid nib)	(Nibble 11 of argument)
0n	Control Level B	(hi nib)	(Nibble 12 of argument)

To request Program - EQ - 1 Band (M) - Gain (control address A:0, B:2, C:1, D:2) on a system with the Device ID set for 0, send:

——header——	request class	Num Control levels	Level A (Program)
F0 06 09 00 06	0**2** 00	04 00 00 00	00 00 00 00

Level B (EQ)	Level C (1 Band (M))	Level D (Gain)	
02 00 00 00	01 00 00 00	02 00 00 00	F7

The number of characters varies with Parameter Type, the arguments and the actual value of the parameter.

03 Parameter Type Message

This message is transmitted from the system in response to a request for Parameter Type at a specific Control Address. This allows external equipment to build a control tree of the system by requesting the parameter at an address, checking its description to identify it as a Control Level or an adjustable parameter. (Control Levels indicate at least one lower level.)

Transmit only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**03**	Message Class	Parameter Type
6-9	0n	Parameter Type (2 bytes)	0x0000-0x01BF (see list)
10	F7	End of Sysex	

Control Levels are used in the request message for this packet as follows:

0n	**Number of Control Levels**	(lo nib)	(Nibble 1 of argument)
0n	Number of Control Levels	(lo mid nib)	(Nibble 2 of argument)
0n	Number of Control Levels	(hi mid nib)	(Nibble 3 of argument)
0n	Number of Control Levels	(hi nib)	(Nibble 4 of argument)
0n	**Control Level A**	(lo nib)	(Nibble 5 of argument)
0n	Control Level A	(lo mid nib)	(Nibble 6 of argument)
0n	Control Level A	(hi mid nib)	(Nibble 7 of argument)
0n	Control Level A	(hi nib)	(Nibble 8 of argument)
0n	**Control Level B**	(lo nib)	(Nibble 9 of argument)
0n	Control Level B	(lo mid nib)	(Nibble 10 of argument)
0n	Control Level B	(hi mid nib)	(Nibble 11 of argument)
0n	Control Level B	(hi nib)	(Nibble 12 of argument)

To request the Parameter Type number for Program - EQ - 1 Band (M) - Gain) on a system with the Device ID set for 0, send:

——header——	request class	Num Control levels	Level A (Program)
F0 06 09 00 06	0**3** 00	04 00 00 00	00 00 00 00

Level B (EQ)	Level C (1 Band (M))	Level D (Gain)	
02 00 00 00	01 00 00 00	02 00 00 00	F7

04 Parameter Description

Each parameter type used by the system is assigned a unique identifying number, much like menus and dialog boxes are assigned IDs in Windows and Macintosh software. As these numbers represent the attributes of a parameter, each can be used for several parameters. An example of this is the audio Mix parameter type used in all MPX 1 algorithms. The Mix parameter itself is different for each algorithm, but as each uses the same parameter type, only one parameter description is necessary.

Typically, this message is requested once for each legal parameter type creating a database of all parameter descriptions to build a control tree.

Transmit only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**04**	Message Class	**Parameter description**
6-9	0n	Parameter Type (2 bytes)	max 65536 types
10-11	0n	# of Characters in Name (1 byte)	max 255 characters
12 - n			
	0n	Name of parameter (# of characters nibbled)	ASCII (as some LCDs use 0-7 for custom characters. 0, should not be interpreted as the end of the string)
	0n	# of bytes (2 bytes)	Size of the parameter (max 65535 bytes)
	0n	Control Flags (1 byte)	Hex Binary 00 0000 0000=No flags set 01 0000 0001=Automation 02 0000 0010=Patchable 03 0000 0011=Automation & Patchable 04 0000 0100=Control Level 08 0000 1000=Bottom Control Level
	0n	Option Parameter Type (2 bytes)	Uses standard Parameter Type numbers. Note that a value of 0xFFFF indicates no options are used.
	0n	**Number of units/limits** (1 byte)	max 255 units/limits
	0n	1st **Min**imum Value (2 bytes)	
	0n	1st **Max**imum Value (2 bytes)	
	0n	1st **Display units** (2 bytes)	see below
	0n	2nd Minimum Value (2 bytes)	
	0n	2nd Maximum Value (2 bytes)	
	0n	2nd Display units (2 bytes)	
	0n	nth Minimum Value (2 bytes)	
	0n	nth Maximum Value (2 bytes)	
	0n	nth Display units (2 bytes)	
	F7	End of Sysex	

Parameter Type Number (Bytes 6-x)

This is the ID of this parameter type. Each actual parameter in the system is assigned a Parameter Type Number to describe its operation.

Number of Parameter Name Characters (Bytes 10-11)

This identifies both the number of characters in the name and the point at which the Parameter Name field ends and the Number of bytes field begins. Not all parameter names are of the same size; audio parameters tend to have 5-character names, while most others have 11 characters.

Parameter Name (Bytes 12-x)
This is the actual text string used to describe the parameter. Note that this string is NOT null terminated but will often be padded with spaces (ASCII 20 hex). In most cases, these are the strings that appear on the front panel display. Parameter types with the same names often have other attributes that are different.

Number of Bytes
This is the size of the parameter in bytes. Most parameters are 1 or 2 bytes. Parameters that are bigger include the "Program" name, the "Setup" name and other "dump" parameters. Though not reflected in this number, the data bytes for parameter Options are included in data messages for parameters which have options. When dealing with Parameter Data messages, the Parameter Description for the option parameter must be referenced to correctly interpret the data (number of bytes in the option Parameter Type, min/max value, etc.).

Note that some Option parameter types (Rate units, Drate units, etc.) actually have 0 bytes. In these parameters, the "data" is actually contained in the MSB of the root parameter's data. Refer to the Unique Parameters section for additional information.

Control flags
The control flags are used to define several attributes that are either on or off (0=NO, 1=YES). The following bits have been defined for the MPX 1:

Bit	Mask	Description
0	0x01	Patchable
1	0x02	Automation (transmitted when automation is turned on)
2	0x04	Control level
3	0x08	Bottom Control Level (the last control level before an editable parameter)

Options Parameter Type
This defines the Parameter Type Number (ID) of the parameter's option if it exists. Options are essentially extensions of the parameter itself. Though they have their own types, they are accessed through the parameters. (See the Parameter Data Message.) Often the option data value must be evaluated *before* a parameter value can be correctly interpreted ("Delay" units, for instance). A value of 0xFFFF indicates that no option parameter is used.

Number of Units/Limits
Some MPX 1 parameters can operate in different "unit" types. An example of this is Delay Tme, which can be set in milliseconds, a ratio of beats per measure relative to the current tempo, feet, meters or tapped in milliseconds. The system only has a fixed amount of actual delay memory and the steps of each of these represents different amounts of time so the limits for each are different. This field defines how many unit types are available for this parameter. This value will also tell you how many mins, maxs, and display units are included in this packet.

If the Number of Units/Limits is more than 1, the Option is used to determine which unit type is used and what they are called. Use the String version of the Option to get a text description of the current Unit.

Minimum Value
This is the minimum allowable value for this parameter type. Note that the values are expressed as signed words that must be *cast* to signed or unsigned bytes if the parameter is a single byte parameter. Also note that the min and max values are only meaningful for 1 and 2 byte parameters. Typically, the min and max fields are defaulted to 0x0000 and 0xFFFF respectively for "dumps".

Maximum Value
This is the maximum allowable value for this parameter type.

Display Units Type
This field specifies a specific display type for this parameter type. Like parameter types, display types define a display technique that can be used for more than one parameter type.

Requesting the Parameter Description
A parameter description is requested by specifying the parameter type. For example, to request parameter 125 hex on a system with the Device ID set for 0, the following message would be sent:

request header	parameter class	parameter number
F0 06 09 00 06	0**4** 00	05 02 01 00 F7

Note that all 4 nibbles of the parameter must be sent padded with 0s if needed.

05 Parameter Label Message

This message allows you to get a string describing the parameter at a given control level. This message was included to simplify navigation of the control tree when the controlling system has limited memory available. The string returned is the same as the “name” field of the parameter description message.

Transmit only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**05**	Parameter Label	Message class
6-9	0n	# of characters	Number of characters (bytes) in the string
10-x	0n	Parameter Label String	This is the actual string (nibble-ized) so it is the “Number of characters” x 2 long
—	0n	# of control levels (2 bytes)	Number of control levels used in the parameter address. This is a 16-bit field so the address can have up to 64k digits (control levels)
—	0n	Control level 0 (**A)** (2 bytes)	This is the first control level. It defines the level 0 (**A)** control address of the parameter. The control level addresses are 16-bit fields so the control addresses can be 64k deep. Letters are used to differentiate levels and their values.
—	0n	Control level 1 (**B)** (2 bytes)	same as previous
—	0n	Control level 2 (**C)** (2 bytes)	same as previous
—	0n	— up to Control level 65535	same as previous
	F7	End of Sysex	

Control Levels are used in the request message for this packet as follows:

0n	**Number of Control Levels**	(lo nib)	(Nibble 1 of argument)
0n	Number of Control Levels	(lo mid nib)	(Nibble 2 of argument)
0n	Number of Control Levels	(hi mid nib)	(Nibble 3 of argument)
0n	Number of Control Levels	(hi nib)	(Nibble 4 of argument)
0n	**Control Level 0 (A)**	(lo nib)	(Nibble 5 of argument)
0n	Control Level A	(lo mid nib)	(Nibble 6 of argument)
0n	Control Level A	(hi mid nib)	(Nibble 7 of argument)
0n	Control Level A	(hi nib)	(Nibble 8 of argument)
0n	**Control Level 1 (B)**	(lo nib)	(Nibble 9 of argument)
0n	Control Level B	(lo mid nib)	(Nibble 10 of argument)
0n	Control Level B	(hi mid nib)	(Nibble 11 of argument)
0n	Control Level B	(hi nib)	(Nibble 12 of argument)

To request Program - EQ - 1 Band (M) - “1-Band (M)” (control address A:0, B:2, C:1) on a system with the Device ID set for 0, send:

request ——header——	class	Num Control levels	Level A (Program)
F0 06 09 00 06	0**5** 00	03 00 00 00	00 00 00 00

Level B (EQ)	Level C (1 Band (M))
02 00 00 00	01 00 00 00 F7

06 Requests

The Request message class allows external systems to interrogate the MPX 1. The system responds to Requests by outputting a SysEx message with the same message class as the Request Class type which identifies the request.

Receive Only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**06**	Message Class	**Requests**
6-7	0n	Request Class (1 byte)	
8-9	0n	argument **1** (1 byte)	Message requests require arguments
10-11	0n	argument **2** (1 byte)	
xx	0n	argument **n** (1 byte)	no theoretical limit to number of arguments
xx	F7	End of Sysex	

Note that the Request Class of the request is the Message Class of the response. The arguments vary depending on the Request Class. Refer to the specific Message Class sections for information about the arguments to those requests.

Quick reference for all Requests
id = Device ID (0-126)

Message requests start with Header **F0 06 09 ID 06** and end with **F7**

Message	Request Class	argument bytes 1	2	3	4	5	6	7	8	9	10	11	12
Configuration	00 00												
Param data	01 00	# levels		level A		level B		level C		level D		level E	
Param display	02 00	# levels		level A		level B		level C		level D		level E	
Param type	03 00	# levels		level A		level B		level C		level D		level E	
Param description	04 00	param type (#)											
Param label	05 00	# levels		level A		level B		level C		level D		level E	
Handshake	12 00	command											
Memory Tool	10 00	# bytes		address (lo)		address (hi)							
Effect Params	18 00	Effect type		Algorithm #									

12 Handshaking

This message provides a mechanism for synchronizing certain aspects of one system to another. The most significant use of this is during bulk dumps to a system where the transmitting unit (an external editor, another MPX 1, etc.) could conceivably send the data too fast for the receiving system to process it. In these cases the receiving system transmits a BUSY handshake message while it internally processes the last dump. When it is ready to receive more data it transmits a READY handshake message. This allows data to be transmitted at the fastest possible rate without corrupting the data (buffer overflows, etc...).

Transmit + Receive

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**12**	Message Class	**Handshake Message Class**
6-7	0n	Handshake Command (1 byte)	
8	F7	End of Sysex	

The following handshake commands have been defined:

HANDSHAKE_NOP	0
HANDSHAKE_ARE_YOU_THERE	1
HANDSHAKE_IM_ALIVE	2
HANDSHAKE_BUSY	3
HANDSHAKE_READY	4
HANDSHAKE_ERROR	5
NUM_HANDSHAKES	6

This message can also be used to determine if a system is connected by sending the HANDSHAKE_ARE_YOU_THERE message to the system as follows:

——header——
F0 06 09 00 **12 01** F7

16 DataBase Dump

This message class allows “Source and Effect Type” database dumps to bew transmitted and. The database is used by the system to provide special sorting capabilities of programs. When an MPX 1 program is created, the operator has the option of classifying the program by “Source type” and “Effect type”. This data is stored as a table of 250 3-byte elements; one for each program in the system. The three bytes are bitmapped to define which group the program is included in. The first and second bytes define the “Effect type” while the third byte defines the “Source type”. Each bit is defined as follows:

Source	hex) (1 byte)	binary	Effect	hex (2 bytes)	binary
Live PA	01	0000 0001	Pitch	0001	0000 0000 0000 0001
Vocal	02	0000 0010	Chorus	0002	0000 0000 0000 0010
Guitar	04	0000 0100	EQ	0004	0000 0000 0000 0100
Keyboard	08	0000 1000	Mod	0008	0000 0000 0000 1000
Acoustic	10	0001 0000	Delay	0010	0000 0000 0001 0000
Drums	20	0010 0000	Ambient	0020	0000 0000 0010 0000
Tempo	40	0100 0000	Chamber	0040	0000 0000 0100 0000
SoundFX	80	1000 0000	Gate	0080	0000 0000 1000 0000
			Hall	0100	0000 0001 0000 0000
			Inverse	0200	0000 0010 0000 0000
			Plate	0400	0000 0100 0000 0000
			Dual	0800	0000 1000 0000 0000

Transmit & Receive

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**16**	Message Class	Database
6-7	0n	Program 1 Effect Type (2 byte)	see chart
8-11	0n	Program 1 Source Type (1 byte)	see chart
12-13	0n	Program 2 Effect Type (2 byte)	see chart
14-17	0n	Program 2 Source Type (1 byte)	see chart
		Repeat two bytes for effect and one byte for source to program 250	
1506	F7	End of Sysex	

There are no arguments to the request for the database.

The request message is as follows:

——header—— class unused
F0 06 09 00 06 **06 01** 00 00 00 00 00 00 F7

18 Report Effect Parameters

This message allows external equipment to determine what parameter numbers are associated with a given effect or controller type and algorithm number. Any MPX 1 effect can have a maximum of 30 parameters, so space is set aside in the message packet for that number of parameters but the actual number of parameters is passed as the first byte.

Transmit Only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**18**	Message Class	Report Effect Parameters
6-7	0n	Effect/Controller Type (1 byte)	see the list below
8-9	0n	Effect/Controller Number (1 byte)	
10-31	0n	Effect/Controller Name (11 bytes)	ASCII characters space filled 20h
32-33	0n	# of Parameters (1 byte)	1-30
34-153	0n	30 Parameters	
		(60 bytes/30 two byte words)	Space is always left for 30 params even if less are used. Refer to parameter description.
154	F7	End of Sysex	

Typically, a request for this information is followed by a request for a description of each of the parameters using the Parameter Description message.

The effect type and algorithm number are the only two parameters used in the request message for this packet:

0n	Effect Type	(lo nib)	(Nibble 1 of argument)
0n	Effect Type	(hi nib)	(Nibble 2 of argument)
0n	Algorithm #	(lo nib)	(Nibble 3 of argument)
0n	Algorithm #	(hi nib)	(Nibble 4 of argument)
0n	unused		(Nibble 5 of argument)
0n	unused		(Nibble 6 of argument)

Effect Types are defined as follows:

0	Pitch
1	Chorus
2	EQ
3	Mod
4	Reverb
5	Delay
6	Knob
7	LFO 1
8	LFO 2
9	MIDI Arpeggiator
10	ADSR 1
11	ADSR 2
12	Random Number Generator
13	A-B Generator
14	Sample and Hold
15	Envelope Generator 1
16	Envelope Generator 2

Note that, although 6-16 (Knob-Envelope Generator 2) are really not effects, they are handled by the system as such. From an MIDI editor's perspective, the only difference between these Effects Types and the audio effects is that these only have a single algorithm: 1. As such, they always have the same parameters.

For example, to request the Chorus algorithm 4:

	request	effect algorithm		
——header——	class	type	number	unused
F0 06 09 00 06	**08 01**	01 00	04 00	00 00 F7

Note that, if the Effect Type is 6- 16, the Algorithm Number field is a “don’t care” and can contain any value.

19 Report All Effect Parameters

This message identifies the parameter numbers associated with the active program. Any MPX 1 Effect can contain 6 effects, each with a maximum of 30 parameters, so space is set aside in the message packet for that number of parameters for each effect but the actual number of parameters is passed as previous parameters.

Receive only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	19	All Parameter numbers	
6-9	0n	Program number	0-249, 0xFFFF = active program
10-31	0n	Pitch effect name (11 bytes)	ASCII name
32-33	0n	# of Pitch parameters (1 byte)	0-29
34-37	0n	First Pitch parameter (2 bytes)	Parameter numbers. See Parameter Description appendix
38-153	0n	Pitch parameters 2-30	
154-175	0n	Chorus effect name (11 bytes)	
176-177	0n	# of Chorus parameters (1 byte)	
178-181	0n	First Chorus parameter (2 bytes)	
182-297	0n	Chorus parameters 2-30	
298-319	0n	EQ effect name (11 bytes)	
320-321	0n	# of EQ parameters (1 byte)	
322-325	0n	First EQ parameter (2 bytes)	
326-441	0n	EQ parameters 2-30	
442-463	0n	Mod effect name (11 bytes)	
464-465	0n	# of Mod parameters	
466-469	0n	First Mod parameter (2 bytes)	
470-585	0n	Mod parameters 2-30	
586-607	0n	Reverb effect name (11 bytes)	
608-609	0n	# of Reverb parameters	
610-613	0n	First Reverb parameter (2 bytes)	
614-729	0n	Reverb parameters 2-30	
730-751	0n	Delay effect name (11 bytes)	
752-753	0n	# of Delay parameters	
754-757	0n	First Delay parameter (2 bytes)	
758-873	0n	Delay parameters 2-30	
874	F7	End of Sysex	

There is one parameter used in the request message for this packet, program number.

Example: Request Program 1

	request	request	
——header——		class	unused
F0 06 09 00 06		**09 01**	**00 00 00 00** 00 00 F7

Example: Request Active program

	request	request	
——header——		class	unused
F0 06 09 00 06		**09 01**	**0F 0F 0F 0F** 00 00 F7

1A Program Information

This message provides basic information about the MPX 1 programs.

Receive only

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**1A**	Program information	
6-9	0n	Program Number (2 bytes)	0-249
10-33	0n	Name 12 characters (12 bytes)	ASCII space
34-35	0n	Pitch effect number (1 byte)	0-10
36-37	0n	Chorus effect number (1 byte)	0-11
38-39	0n	EQ effect number (1 byte)	0-18
40-41	0n	Mod effect number (1 byte)	0-8
42-43	0n	Reverb effect number (1 byte)	0-5
44-45	0n	Delay effect number (1 byte)	0-8
46	F7	End of Sysex	

The program number is the only parameter used in the request message for this packet:

0n	Program Number	(lo nib)	(Nibble 1 of argument)
0n	Program Number	(lo mid nib)	(Nibble 2 of argument)
0n	Program Number	(hi mid nib)	(Nibble 3 of argument)
0n	Program Number	(hi nib)	(Nibble 4 of argument)
0n	unused		(Nibble 5 of argument)
0n	unused		(Nibble 6 of argument)

To request the stats on program number **8**, send:

	request	Program	
——header——	class	number	unused
F0 06 09 00 06	**0A 01**	**08** 00 00 00	00 00 F7

1B Program Dump

This message allows any program to be copied into or out of the system. In the MPX 1, programs 0-199

are presets and 200-249 are user registers (programs). The active program (the one currently running in the system), is identified as program number 0xFFFF. Note that when an MPX 1 receives this message it transmits a BUSY handshake message while it internally processes the received program. When the system is ready for more data, it transmits a READY handshake message.

Transmit & Receive

Byte #	Value HEX	Description	Notes
1	F0	Sysex ID (Start)	
2	06	Lexicon ID	
3	09	MPX 1 ID	
4	0bbb bbbb	Device ID	0-127
5	**1B**	Program	
6-9	0n	Program number (2 byte)	Program Number 0-249 for programs 1-250 or FFFFh for current active loaded program
10-73	0n	Pitch effect data (32 bytes)	Stored parameter values in the order they are indexed in effect, including options. See detail
74-137	0n	Chorus effect data (32 bytes)	“
138-201	0n	EQ effect data (32 bytes)	“
202-265	0n	Modulation data (32 bytes)	“
266-329	0n	Reverb data (32 bytes)	“
330-393	0n	Delay data (32 bytes)	“
394-399	0n	Sort flags (3 bytes)	First two bytes make up a word for Effect Type; last byte is for Source Type
400-479	0n	Audio Routing (40 bytes)	5 bytes for each block: input, pitch, chorus, eq, mod,delay, reverb and output. The bytes are Effect type, Upper input connection, Lower input connection, Routing and Patch type. See detail
480,481	0n	Pitch Algorithm number	0-10
482,483	0n	Chorus Algorithm number	0-11
484,485	0n	EQ Algorithm number	0-18
486,487	0n	Modulation Algorithm number	0-8
488,489	0n	Reverb Algorithm number	0-5
490,491	0n	Delay Algorithm number	0-8
492-515	0n	Program name (12 bytes)	12-character name (space filled.)
516-517	0n	Effect Status (1 bytes)	Determines bypassed state of each effect. With bit set, effect is active; with bit not set, effect is bypassed. 0000 0001=Pitch On 0000 0010=Chorus On 0000 0100=EQ On 0000 1000=Modulation On 0001 0000=Reverb On 0010 0000=Delay On
518-557	0n	Soft values (20 bytes)	10 soft row parameters 2 bytes each. The first byte is Effect or Controller type and the second is the index into effect or controller. See detail
558-561	0n	Tempo (2 bytes)	41-400 BPM
562-563	0n	Tempo Source (1 byte)	0=Internal 1=MIDI
564-565	0n	Beat Value (1 byte)	0=Eighth note 1=Dotted Eighth note 2=Quarter note 3=Dotted Quarter note 4=Half note 5=Dotted half note 6=Whole note
566-567	0n	Tap Source (1 byte)	See detail appendix of values for controllers
568-569	0n	Tap Average (1 byte)	1-8 beats average
570-571	0n	Tap Source Level (1 byte)	0-127

572-573	0n	Meter (1 byte)	0=Inputs 1=Outputs 2=Pitch In Level 3=Pitch Out Level 4=Pitch In&Out Level 5=Chorus In Level 6=Chorus Out Level 7=Chorus In&Out Level 8=EQ In Level 9=EQ Out Level 10=EQ In&Out Level 11=Mod In Level 12=Mod Out Level 13=Mod In&Out Level 14=Delay In Level 15=Delay Out Level 16=Delay In&Out Level 17=Reverb In Level 18=Reverb Out Level 19=Reverb In&Out Level 20=LFO 1 & 2 21=Envelopes 1 & 2 22=Foot pedal 23=ADSR 1 & 2 24=Simulation
574-575	0n	Host Level (1 byte)	A0=OFF A1=-95dB A2 to FD=-94 to -3dB FE=-2dB FF=-1dB 00=0dB
576-577	0n	Host Mix (1 byte)	0-64h 0-100%
578-697	0n	Patch data (60 byte)	5 patches 12 bytes each bytes/Item 1/Source controller number 1/Source Min value 1/Source Mid value 1/Source Max value 1/Dest effect controller type 1/ Dest effect controller index 2/Destination Min 2/Destination Mid 2/Destination Max See detail
698-721	0n	Knob data (12 byte)	The packet is organized as follows: byte 1=Value byte 2=Minimum byte 3=Maximum bytes 4-12=Name of the controller
722-737	0n	LFO 1 data (8 byte)	
738-753	0n	LFO 2 data (8 byte)	
754-763	0n	Arpeggiator data (5 bytes)	
764-781	0n	ADSR 1 data (9 bytes)	
782-799	0n	ADSR 2 data (9 bytes)	
800-807	0n	Random generator data (4 bytes)	
808-817	0n	AB data (5 bytes)	
818-827	0n	Sample hold (5 bytes)	
828-835	0n	Envelope gen 1 (4 bytes)	
836-843	0n	Envelope gen 2 (4 bytes)	
844	F7	End of Sysex	

Parameter Data (Bytes 10-393)

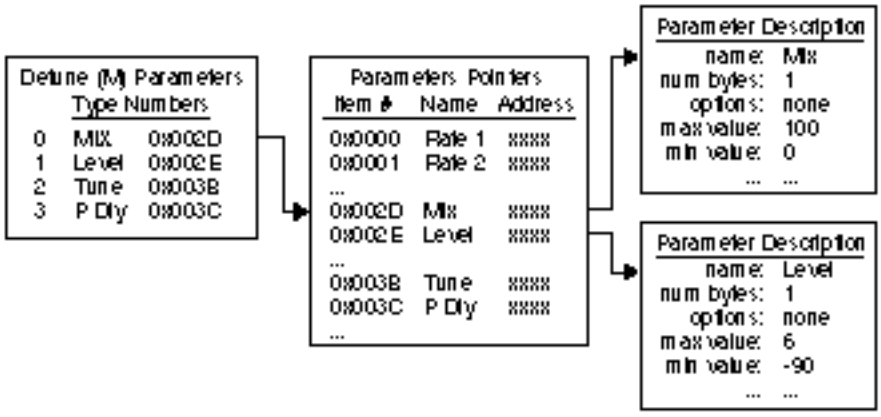
The MPX 1 can assign algorithms with different parameters to a single effect block. For example, the Pitch effect can be a detuner with 4 parameters, or a dual pitch shifter with 5 parameter. In addition, the third and fourth parameters for the detuner are 1-byte parameters while the third and fourth parameters for the pitch shifter are 2-byte parameters. In both cases, the actual data is stored in the same 32 byte section of the dump called “pitch effect data”. A table of Parameter Type numbers with a table of pointers to the data structures is used to get information about any parameter whose Parameter Type number is known.

Parameter Type numbers	table of pointers to structures
#define NOTE_PARAM 0x002C	&Note_param,
#define MIX_PARAM 0x002D	&Mix_param,
#define LEVEL_PARAM 0x002E	&Level_param,

For each algorithm in the system (a total of 61), there is a table containing the Parameter Types used by the algorithm. For example:

Detune (M) Parameter Types
0x002D - Mix
0x002E - Level
0x003B - Tune
0x003D - P Dly

To edit a parameter, a pointer is initialized to the beginning of the 32-byte effect data block. This 32-byte data block is treated as an array of bytes. In order to access the target parameter the offset into this 32-byte array must be calculated. This is done by determining the number of bytes used by each of the parameters *preceding* the parameter you want to edit. This is accomplished by walking through each of the parameter types, in the algorithm’s Parameter Type table and using the Parameter Type number to access the parameter data structure to determine the number of bytes used. The pointer to the 32-byte effect data block is then incremented by the number of bytes used by this parameter. When the process is complete the pointer is left pointing at the target parameter’s data.



For example, in the “Detune (M)” effect, “Tune” is the third parameter. After a pointer is initialized to the beginning of the pitch “32 byte parameter data” array, it must be incremented past the first and second parameters’ data to get to the “Tune” data.

pitch parameter data:
0x64 - Mix
0x00 - Level
0x0A - Tune
0x01 - Tune Option
0x00 - P Dly
0x00 - unused

The routine sets up a second pointer to the array of Parameter Type for the Detune (M) algorithm and accesses the structure for the first parameter, Mix.

Detune (M) Parameter Types
- **0x002D - Mix**
- 0x002E - Level
- 0x003B - Tune
- 0x003D - P Dly

The Mix structure shows that it is a one byte parameter so the data pointer is incremented once.

pitch parameter data:
- 0x64 - Mix
- **0x00 - Level**
- 0x0A - Tune
- 0x01 - Tune Option
- 0x00 - P Dly
- 0x00 - unused

The Parameter Type pointer is incremented to get the Parameter Type of the second parameter.

Detune (M) Parameters Types
- 0x002D - Mix
- **0x002E - Level**
- 0x003B - Tune
- 0x003D - P Dly

The second parameter's structure is accessed and reveals that it is the one byte parameter "Level". The data pointer is incremented again and now points to the "Tune" parameter data.

pitch parameter data:
- 0x64 - Mix
- 0x00 - Level
- **0x0A - Tune**
- 0x01 - Tune Option
- 0x00 - P Dly
- 0x00 - unused

Detune (M) Parameters "Types"
- 0x002D - Mix
- 0x002E - Level
- **0x003B - Tune**
- 0x003D - P Dly

As the operating system for the MPX 1 displays a maximum of two parameters at once, two such pointers are set up.

There are two ways an off-line system can build a Parameter Types list for a given effect's algorithm. One approach is to request the Report Effect Parameters (18 hex) message which returns this list directly. A more generic method of generating a list of Parameter Types for a given algorithm is to use the Parameter Type (03 hex) message. The request for this message class takes the control address for a parameter and returns the Parameter Type at that address. For example, "pitch" is at control address 0-0. The pitch algorithm Detune (M) is at address 0-0-1. Detune (M) parameters are at addresses 0-0-1-0 through 0-0-1-3. The Detune (M) parameter itself will tell you how many parameters *it* has from which you can request the Parameter Type message for each parameter to build a local list with.

Once the Parameter Type number is known, the number of bytes used by the parameter can be derived from the Parameter Description. There are two basic approaches to dealing with Parameter Descriptions. One is to request the Parameter Description (04 hex) each time you have a Parameter Type number and you need to know something about the parameter. The other approach is to build a database of parameter descriptions locally and reference it whenever you need to find out something about a parameter. If disk space and/or RAM space is available, the latter approach is preferable as it makes acquisition of Parameter Descriptions a one time effort.

It is important to remember that the MPX 1 allows parameters to have “option” values. “Delay Units” for example, determines the units in which delay time is adjusted (milliseconds, feet, meters, etc...). As “Delays” are stored in their “Unit” values, it is essential to read the options unit value before operating on the actual delay setting. Because of this close association of options to their attached parameters, option data ALWAYS immediately follows the parameter data to which it is associated. In this example, this means that the 2-byte “delay” parameter becomes a 3-byte parameter.

Continuing the previous example, to access the “P Dly” parameter, you must get past the “Tune” parameter *and* it’s option parameter value. You will note that, although “Tune” is a 1-byte parameter, its description structure reveals that it has an option: “Optimize”.

pitch parameter data:
- 0x64 - Mix
- 0x00 - Level
- 0x0A - Tune
- **0x01 - Tune Option**
- 0x00 - P Dly
- 0x00 - unused

The option parameter itself is identified by a Parameter Type number which we use to access the structure describing it. The “Optimize” Parameter Description indicates that it is a 1 byte parameter so we increment the pointer one last time to get to the “P Dly” parameter data.

pitch parameter data:
- 0x64 - Mix
- 0x00 - Level
- 0x0A - Tune
- 0x01 - Tune Option
- **0x00 - P Dly**
- 0x00 - unused

Note that not all option parameters are 1-byte. Some have 0 bytes. These are embedded onto the MSB of the parameter itself.

Other values which may appear in the parameter data packet should be ignored.

LFOs through Envelopes (Bytes 722-843)

The data for the LFOs, Arpeggiator, ADSRs, Random number generator, AB, Sample and Hold and the Envelope Generators are organized in a similar fashion to the effect parameter data. The only difference being that there are not multiple algorithms. The parameters for all of these items are always the same. Otherwise, these parameters are accessed exactly as the effect parameters, including options.

Sort Flags (Bytes 394-399, Parameter Type: 0x0115 in V1.00; 0x0116 in V1.10)

Sort Flags consist of “effect types” (2 bytes) and “input types” (1 byte) (in that order).These define which to which sorting groups (database) the program will be assigned.

The bit assignments for Effect types are:

PITCH	0x0001
CHORUS	0x0002
EQ	0x0004
MOD	0x0008
DELAY	0x0010
AMBIENT	0x0020
CHAMBER	0x0040
GATE	0x0080
HALL	0x0100
INVERSE	0x0200
PLATE	0x0400
DUAL	0x0800

The bit assignments for Input types are:

LIVE_PA	0x01
VOCAL	0x02
GUITAR	0x04
KEYBOARD	0x08
ACOUSTIC	0x10
DRUMS	0x20
TEMPO	0x40
SOUND_FX	0x80

Audio Routing (Bytes 400-479)

Audio Routing data defines how the audio data moves in and around the system for the current program. The audio routing is broken up into 8 blocks; one for each effect type, one for the input and one for the output. The effects blocks represent the signal flow into, through and out of the box (left to right on the Map and Order screens of the system). Each block consists of the following 5 one byte fields:

0 - Effect Type (Parameter Type 0x0146 in V1.00; 0x0147 in V1.10)
1 - Upper Input Connection (Parameter Type 0x0143 in V1.00; 0x0144 in V1.10)
2 - Lower Input Connection (Parameter Type 0x0144 in V1.00; 0x0145 in V1.10)
3 - Routing (Parameter Type 0x0145 in V1.00; 0x0146 in V1.10)
4 - Path Type

These descriptions can be used for range limits, etc..

The Effect Type will always be one of the following:

0 - Pitch
1 - Chorus
2 - EQ
3 - Modulator
4 - Reverb
5 - Delay
6 - Input
7 - Output

As the blocks represent signal flow through the box, the Effect Type of the first block will always be “Input” and the Effect Type”of the last block will always be “Output”. Aside from that, the effects can be in any order with the condition that all of the effects types must always be used, and no single effect type can be used twice.

Upper Input Connection and Lower Input Connection describe the way that the audio signal is fed to the respective inputs to the effect block. The following connection types are available:

0 - Stereo to Stereo
1 - Left to Left
2 - Right to Right
3 - Left to Left and Right (mono)
4 - Right to Left and Right (mono)

If the block does not use the lower path, the input connection will be ignored but will become active if needed.

Note that the input block “Upper” and “Lower” connections are place markers and are not actually used by the system.

The Routing field defines how the particular block deals with the upper and lower audio paths. The following type of Routing have been defined:

0 - Upper
1 - Lower
2 - Parallel
3 - Merge
4 - Split

Upper and Lower routings place the effect block in the upper or lower signal path ONLY. Parallel routing makes the effect take its input from both the upper and lower paths, then outputs to both the upper and lower paths. Merge routing takes its input from both the upper and lower paths, but outputs only on the upper path. Split routing takes its input from the upper path and outputs on both the upper and lower paths.

Path Type defines whether a given effect block is on a single or double path. Some Routings imply the Path Type, but others, such as “Upper”, do not. The following Path Types have been defined:

0 - Single Path
1 - Double Path

Example

Value	Description
0x06	Effect type: **Input** block
0x00	Upper input connector: *not used*
0x00	Lower input connector: *not used*
0x04	Routing: Split
0x01	Patch type: Double path
0x02	Effect type: **EQ** block
0x03	Upper input connector: Left to Left and Right (mono)
0x00	Lower input connector: Stereo to Stereo
0x00	Routing: Upper
0x01	Patch type: Double path
0x03	Effect type: **Modulator** block
0x00	Upper input connector: Stereo to Stereo
0x04	Lower input connector: Right to Left and Right (mono)
0x01	Routing: Lower
0x01	Patch type: Double path
0x00	Effect type: **Pitch** block
0x00	Upper input connector: Stereo to Stereo
0x00	Lower input connector: Stereo to Stereo
0x00	Routing: Upper
0x01	Patch type: Double path
0x01	Effect type: **Chorus** block
0x00	Upper input connector: Stereo to Stereo
0x00	Lower input connector: Stereo to Stereo
0x03	Routing: Merge
0x01	Patch type: Double path
0x05	Effect type: **Delay** block
0x00	Upper input connector: Stereo to Stereo
0x00	Lower input connector: Stereo to Stereo
0x00	Routing: Upper
0x00	Patch type: Single path
0x04	Effect type: **Reverb** block
0x00	Upper input connector: Stereo to Stereo
0x00	Lower input connector: Stereo to Stereo
0x00	Routing: Upper
0x00	Patch type: Single path
0x07	Effect type: **Output** block
0x00	Upper input connector: Stereo to Stereo
0x00	Lower input connector: Stereo to Stereo
0x00	Routing: Upper
0x00	Patch type: Single path

Rules

In addition to the basic range limits that should be placed on the values of each field of the Audio Routing blocks, there are some rules which should be followed when making changes such as avoiding illegal configurations (audio path is broken, etc.), avoiding redundant paths (parallel followed by a parallel, etc.) and avoiding confusing configurations. The following guidelines are provided for editing Audio Routing blocks.

The default signal path between the stereo inputs and outputs is a single path—six effects blocks connected in series. The routing options allow the user to split this path in two, creating upper and lower paths. Once the path has been split, it can be merged back into a single path again. It is even possible to split and merge the path more than once.

In order to minimize redundant configurations and to keep the user from making unusable routing maps (blocks with nothing connected to the inputs, etc.), the number of options available is conditional, depending on how blocks in front (on the input side) of the selected block are configured. There are five possible options.

Upper — The inputs and outputs of an upper block are on the upper path. This is the only option available for a single path.

Lower — The inputs and outputs of a lower block are on the lower path. Blocks can only be assigned to the lower path if the path has been previously split.

Split — The inputs of a split block are on the upper path. The outputs are assigned to both the upper and lower path. (The lower path output signal is an exact copy of the upper path signal.) A split block can only be used in a single path. It turns a single path into a double path.

Parallel — Parallel blocks have two pairs of stereo inputs. One pair is assigned to the upper path, the other to the lower path. The outputs are assigned to both the upper and lower path. (The lower path output signal is an exact copy of the upper path signal.) Parallel blocks can only be used in a double path, following either an upper or lower block.

Merge — Merge blocks have two pairs of stereo inputs. One pair is assigned to the upper path, the other to the lower path. The outputs are assigned to only the upper path. A merge block can only be used in a double path. It changes a double path into a single path.

NOTES:

1. For every split, there must be a merge. (Think of them as open and close parenthesis marks.)
2. The input block must either be upper or split. (The user gets to choose)
3. The output block will be automatically set to upper or merge. (This is determined by the state of the path prior to the output block. If it has been split, then the output block is automatically set to merge. If it is single, the output block is upper.
4. As stated previously, it is possible to create configurations in which the path is split and merged more than once.
5. Merge and parallel blocks imply more processing overhead, since they require mixing of two pairs of signals. Given the number of blocks, the maximum number of merge /parallel blocks possible is 2 in V1.10 (3 in V1.00).

SELECTED BLOCK IS ON A SINGLE PATH

configurations selectable with KNOB

preceding block	upper	lower	split	parallel	merge
upper	•		•		
merge	•		•		

SELECTED BLOCK IS ON A DOUBLE PATH
configurations selectable with KNOB

preceding block	upper	lower	split	parallel	merge
upper	•	•		•	•
lower	•	•		•	•
split	•	•			
parallel	•	•			

NOTES:
1. A block is on a single path unless it is in between a split and merge. (There can be as many as six blocks between a split and merge.)
2. Split changes a single path into a double path. Merge changes a double path back into a single path.
3. If a split is inserted into a single path and there is no merge between it and the output block, the output block is automatically set to merge.
4. If a split is inserted in front of a previously exisiting split, and there is no merge in between them, the previously existing split is changed to upper.
5. If a merge is inserted into a double path and there is no split between it and the output block, then all following blocks are set to upper. If there is a split between the merge and the output block, then all blocks between the merge and the split are set to upper.
6. When the routing configuration of a block is changed, its input and output connections should be reset to the default value, stereo.

Algorithm numbers (Bytes 480-491)

Algorithm numbers is a list of the current algorithms assigned to each of the six effects blocks in the system. The algorithm numbers appear in the following order:

Index	Effect	Range	Parameter Type	
			V1.00	V1.10
0	Pitch	0-10	0x014D	0x014E
1	Chorus	0-11	0x014E	0x014F
2	EQ	0-18	0x014F	0x0150
3	Modulator	0-8	0x0150	0x0151
4	Reverb	0-5	0x0151	0x0152
5	Delay	0-8	0x0152	0x0153

A zero (0) in all cases represents “no effect” algorithm assigned. The “no effect” algorithm actually contains a “Mix” and “Level” parameter though they are ignored by the system.

When changing the algorithm number of an effect, remember that the parameter values for the old algorithm may not be compatible with the new algorithm. In much the same way you would reference the Parameter Type numbers for a given algorithm when interpreting the 32 bit parameter effect data, you should check the values of all parameters against the limits in the Parameter Description. If a particular parameter has an out-of-range value when it is loaded into the MPX 1, the system will fix the value but the edit indicator will always come on when the program is loaded.

Note that programs are recognized as “cleared” by the system if the pitch algorithm number is 0xFF.

Program name (Bytes 492-515, Parameter Type 0x010B in V1.00; 0x010C in V1.10)

These 12 bytes represent the name that is associated with the stored program. The name does NOT need to be null (0) terminated but must instead be padded with spaces (0x20).

Effect Status (Bytes 516-517, Parameter Type 0x0113 in V1.00; 0x0114 in V1.10)
This one byte determines the “bypassed/not-bypassed” state of each of the effects blocks. Each of the first six bits is assigned to an effect block with a 0 indicating “bypassed” and a 1 indicating “not-bypassed” (or active). The following masks are defined in the system software to toggle these bits:

PITCH_ON	0x01
CHORUS_ON	0x02
EQ_ON	0x04
MOD_ON	0x08
REVERB_ON	0x10
DELAY_ON	0x20

Knob Data (Bytes 698-721)
The “Knob” (also referred to as the custom controller) allows the operator to rename a parameter and place it in “Soft Row”. “Value” represents the value of the custom controller you want to store and the value you want the controller to initialize to. The minimum and maximum values are 8-bit values but should be limited to 0-127 as all other controllers.

With Knob you can assign a 9-character name that will appear on the display as well as minimum and a maximum value to which the controller can be adjusted. As with the program name, the Knob name does NOT need to be null terminated but should be padded with spaces (0x20).

Patch System Data (Bytes 578-697)
This group of bytes defines the patch assignments made for the current program. Each patch consists of 12 bytes which function as follows:

Offset	Description	# Bytes	Parameter Type	
			V1.00	V1.10
0	Source controller number	1	0x013A	0x013B
1	Source minimum value	1	0x013B	0x013C
2	Source mid value	1	0x013C	0x013D
3	Source maximum value	1	0x013D	0x013E
4	Destination effect/controller type	1	0x013E	0x013F
5	Destination parameter index	1	0x013F	0x0140
6,7	Destination minimum value	2	0x0140	0x0141
8,9	Destination mid value	2	0x0141	0x0142
10,11	Destination maximum value	2	0x0142	0x0143

Source controller number is the number from Appendix A: Controller Numbers. A value of 0xFF indicates that the controller is unassigned.

Source minimum value defines what the system considers the minimum value for a given controller. When the controller hits this value the system will drive the destination parameter to its defined minimum value.

Source mid value defines what the system considers the mid value for a given controller. When the controller hits this value the system will drive the destination parameter to the destination’s defined mid value. A value of 0xFF indicates that the mid field is not used.
This implies linear response to controller values between the min and max values.

Source maximum value defines what the system considers the maximum value for a given controller. When the controller hits this value the system will drive the destination parameter to its defined maximum value. All controllers have a range of 0-127.

Destination effect/controller type is the effect or controller that will be acted upon by the patch. The value in this field must be one of the following numbers:

0 Pitch
1 Chorus
2 EQ
3 Mod
4 Reverb
5 Delay
6 Knob
7 LFO1
8 LFO2
9 Arpeggiator*
10 ADR1
11 ADR2
12 Randomizer
13 AB Controller
14 Sample and Hold
15 Envelope1 Generator
16 Envelope2 Generator
17 System Parameters

*Although this controller appears in the list, none of its parameters can be patched.

A value of 0xFF indicates that the destination is unassigned.

Destination parameter number is the parameter number for specified effect or controller number that will be acted upon by the current patch. This number is an index into the parameters for the effect or controller, NOT the Parameter Type number. The Mix parameter for all effects, for instance, is parameter number 0. Level is ALWAYS parameter number 1. With the exception of System Parameters, these indeces directly map the last number of the LUSP control address for each parameter. For System Parameters, 0=Host Mix and 1=Host Level. A value of 0xFF indicates that the destination is unassigned.

Destination minimum value is the minimum value that the patch will drive the parameter. The range of this parameter depends on the type of parameter being patched. The value here will always be a value between the minimum and the maximum values allowed for the parameter.

Destination mid value is the middle value of the destination that the patch will drive the parameter to when the mid source value is applied to the patch.

Destination maximum value is the maximum value of the destination that the patch will drive the parameter to when the maximum source value is applied to the patch.

The min and max allowable destination values for a given parameter are listed in each parameter description. See Parameter Description (04 hex)..

Soft Values (Bytes 518-557)

Soft Values define the assignments for the 10 “Soft Row” parameters as follows:

Byte#	Descriptions	# Bytes	Parameter Type	
			V1.00	V1.10
1,2	effect/controller type #1	1	0x0138	0x0139
3,4	parameter index #1	1	0x0139	0x0140
5,6	effect/controller type #2	1	0x0138	0x0139
7,8	parameter index #2	1	0x0139	0x0140
9,10	effect/controller type #3	1	0x0138	0x0139
11,12	parameter index #3	1	0x0139	0x0140
13,14	effect/controller type #4	1	0x0138	0x0139
15,16	parameter index #4	1	0x0139	0x0140
17,18	effect/controller type #5	1	0x0138	0x0139
19,20	parameter index #5	1	0x0139	0x0140
21,22	effect/controller type #6	1	0x0138	0x0139
23,24	parameter index #6	1	0x0139	0x0140
25,26	effect/controller type #7	1	0x0138	0x0139
27,28	parameter index #7	1	0x0139	0x0140
29,30	effect/controller type #8	1	0x0138	0x0139
31,32	parameter index #8	1	0x0139	0x0140
33,34	effect/controller type #9	1	0x0138	0x0139
35,36	parameter index #9	1	0x0139	0x0140
37,38	effect/controller type #10	1	0x0138	0x0139
39,40	parameter index #10	1	0x0139	0x0140

The effect/controller type is one of the following:

0	Pitch
1	Chorus
2	EQ
3	Mod
4	Reverb
5	Delay
6	Knob
7	LFO 1
8	LFO 2
9	Arpeggiator
10	ADR 1
11	ADR 2
12	Randomizer
13	AB Controller
14	Sample and Hold
15	Envelope 1 Generator
16	Envelope 2 Generator
0xFF	unassigned

The parameter index is the parameter number for the defined effect or controller number that you want to place in the Soft Values Edit. This number is an index into the parameters for the effect or controller NOT the Parameter Type number. The Mix parameter for all effects, for instance, is parameter number 0. Level is ALWAYS parameter number 1. These indeces directly map to the last number of the control address for each parameter.

Tempo (Bytes 558-561, “Rate” Parameter Type 0x010C in V1.00; 0x010D in V1.10)

Tempo is an unsigned word (16-bit value) that specifies the current system tempo in beats per minute (BPM) when the program is loaded. Note that, internally, the system measures tempo down to the sample level but it averages to the nearest BPM when the program is stored. The tempo range supported by the system is 41-400 BPM.

Tempo Source (Bytes 562-563, Parameter Type 0x010D in V1.00; 0x010E in V1.10)
This parameter defines whether the tempo is derived from the internal value (stored or tapped in) or from a MIDI clock. Legal values are as follows:

0 - internal tempo source
1 - MIDI tempo source

Beat Value (Bytes 564-565, Parameter Type 0x010E in V1.00; 0x010F in V1.10)
Beat Value defines how the system will interpret each tap it receives. The following values have been defined for this field:

0	Eighth note
1	Dotted Eighth note
2	Quarter note
3	Dotted Quarter note
4	Half note
5	Dotted Half note
6	Whole note

Tap Source (Bytes 566-567, Parameter Type 0x010F in V1.00; 0x0110 in V1.10)
Tap Source is the number of a controller that will drive the MPX 1 tap function, calculating the tempo in real-time. Controllers that can be used as Tap Sources are limited to those listed in Appendix A: Controller Numbers beginning with Footswitch Pulse 1 (tip). All sources preceding this on the list are considered illegal.

Tap Average (Bytes 568-569, Parameter Type 0x0110 in V1.00; 0x0111 in V1.10)
This field defines how many taps the system averages when it calculates the tempo based on taps. Legal values are 1-8.

Tap Source Level (Bytes 570-571, Parameter Type 0x0111 in V1.00; 0x0112 in V1.10)
This field defines the threshold which a control source must cross to be interpreted as a tap.

Meter (Bytes 572-573, Parameter Type 0x00F8)
This field defines the signal that drives the MPX 1 display meters. The following sources are available:

0	Inputs
1	Outputs
2	Pitch Input
3	Pitch Output
4	Pitch in (left headroom) and Pitch Output (right headroom)
5	Chorus Input
6	Chorus Output
7	Chorus in (left headroom) and Chorus Output (right headroom)
8	EQ Input
9	EQ Output
10	EQ in (left headroom) and EQ Output (right headroom)
11	Modulation Input
12	Modulation Output
13	Modulation in (left headroom) and Modulation Output (right headroom)
14	Delay Input
15	Delay Output
16	Delay in (left headroom) and Delay Output (right headroom)
17	Reverb Input
18	Reverb Output
19	Reverb in (left headroom) and Reverb Output (right headroom)
20	LFOs (left=LFO 1, right=LFO 2)
21	Envelopes (left=Envelope 1, right=Envelope 2)
22	Footpedal
23	ADRs (left=ADR1, right=ADR2)

Host Level (Bytes 574-575, Parameter Type 0x0148 in V1.00; 0x0149 in V1.10)
This sets the MPX 1 Host Level parameter when the program is loaded. Legal values are -96 to 0.

Host Mix (Bytes 576-577, Parameter Type 0x0147 in V1.00; 0x0148 in V1.10)
This sets the MPX 1 Host Mix parameter when the program is loaded. Legal values are from 0 to 100.

Requesting a Program Dump

The request for this packet takes the program number as an argument as follows:

0n	Program Number	(lo nibble)	(Nibble 1 of argument)
0n	Program Number	(lo mid nibble)	(Nibble 2 of argument)
0n	Program Number	(hi mid nibble)	(Nibble 3 of argument)
0n	Program Number	(hi nibble)	(Nibble 4 of argument)
0n	unused		(Nibble 5 of argument)
0n	unused		(Nibble 6 of argument)

For example, to request program number 8 the following message would be sent:

request				
——header——	Class	-prog num—	unused	
F0 06 09 00 06	0B 01	08 00 00 00	00 00	F7

Compact Program (1C hex)

This message is for Lexicon development use only.

Parameters

There are some parameters in the MPX 1 control tree that require a bit more information to be dealt with cleanly. The following sections provide additional information about all of these “parameters”. Note that the Parameter Type number of the parameter is listed at the beginning of each section.

Unique Parameters

MIDI Speed (Type 0x00F2 at control address A - 0x0001, B - 0x0002, C - 0x000A)
Only the values in the following table should be used for the MIDI Speed parameter, other values may produce random results:

Fast	0x01
Medium Fast	0x02
Medium Slow	0x04
Slow	0x40

Also see midi_output_rate under Setup Dumps.

Panel Button Message (Type 0x011D in V1.00; 0x011E in V1.10)
This parameter is implemented in such a way that the messages sent to the MPX 1 are treated as if they were sent from the keyboard drivers in the system. The keyboard drivers in MPX 1 always send a PRESS message when a button is pressed followed by a RELEASE message when the button is released to the operating system. If a button is held for more than 2 seconds, a HOLD message is sent to the operating system. A RELEASE message always follows a HOLD message. In general, MIDI data coming into the box should follow the same conventions for consistent operation. The system will NOT interpret a PRESS that is not followed by a RELEASE as a HOLD. In most cases, HOLD is used to gain access to a sub menu. If the HOLD followed by release convention cannot be emulated by Windows, for instance, a separate screen button could be used to trigger the HOLD message.

With the exception of TAP, most operations respond to the RELEASE version of the buttons. It is perfectly legal to send the RELEASE versions only. The LEFT/RIGHT button press combination and TIP/RING footswitch press are the only such button types recognized by the system. The system will NOT recognize two individual button PRESSes (without releases) as the combination. The combination messages MUST be used.

Button	Press (Hex)	Hold (Hex)	Release (Hex)
Pitch	00	16	2C
Chorus	01	17	2D
EQ	02	18	2E
Program	03	19	2F
Mod	04	1A	30
Delay	05	1B	31
Reverb	06	1C	32
Edit	07	1D	33
Mix	08	1E	34
Patch	09	1F	35
Bypass	0A	20	36
System	0B	21	37
Tap	0C	22	38
Left <	0D	23	39
Value	0E	24	3A
Store	0F	25	3B
A/B	10	26	3C
Right >	11	27	3D
Options	12	28	3E
Foot Switch Tip	13	29	3F
Foot Switch Ring	14	2A	40
Left and Right <>	15	2B	41

Direction	Value (Hex)
Encoder CW	42
Encoder CCW	43

New in V1.10	Value (Hex)
Tap	0x44
Toggle A/B	0x45

For example, to emulate the release of the Program button (2F), you would send the following message:

——header—— num bytes button
F0 06 09 00 01 01 00 00 00 0F 02 03 00 00 00 01 00 00 00
08 00 00 00 00 00 00 00 F7

Rate (Types 0x0000-0x0010)

The Rate parameter is different from most other parameters for two reasons. First, it can represent rate as a frequency or as a ratio applied to the current system wide tempo. Second, it uses the MSB (most significant bit) to define its mode/units.

Frequency When representing a frequency, the value of Rate is in units of hundredths of a hertz (100=1Hz). The maximum frequency is 50Hz or 5000.

Ratio When representing a ratio, the value of Rate is broken up into two fields: a numerator and a denominator (n:d). The numerator is stored in the high byte while the denominator is in the low byte. Either value can be between 1 and 24. The system uses these values as a fraction which gets multiplied by the current tempo to derive the actual rate (in hundredths of Hz).

Units/MSB For Rate parameters, the MSB of the value is used to determine what units are being used. If set for 1, the Ratio units are used. If set for 0, the Frequency units are used. This means that, instead of looking at the options data first to determine what unit is being used (as elsewhere in the system), you must look at the MSB of the rate value itself to determine the units.

Dumps

The MPX 1 SysEx protocol allows different kinds of data to be moved in and out of the MPX 1 using a single message class. Other products have unique message classes defined for moving structures and tables in and out of the system, but the MPX 1 has folded most of these into Parameter Data messages which librarian programs can use to find dumps then move them in and out of the box without knowing much of anything about system or the contents of the data. The following sections provide detailed information about all of the Dump parameters in the MPX 1. Editor and/or controller programs can use this information to perform off-line editing of these dumps.

All LEDs Dump (Type 0x012F in V1.00; 0x0130 in V1.10)

This dump contains the current contents of the LED buffer in the MPX 1 that controls the states of the front panel LEDs. The actual front panel LEDs are represented as individual bits in the dump. The following table outlines the assignments of the bytes/bits in the dump:

Transmit & Receive

Byte #	Description	Bit Assignments	On State
1	Left Headroom	bit 0 = Left Headroom -24dB LED	1
		bit 1 = Left Headroom -18dB LED	1
		bit 2 = Left Headroom -12dB LED	1
		bit 3 = Left Headroom -6dB LED	1
		bit 4 = Left Headroom 0dB LED	1
		bit 5 = Left Headroom Clip (red) LED	1
		bit 6 = unused	
		bit 7 = unused	
2	Column 1	bit 0 = Scan bit 0 (0) (see note below)	
		bit 1 = Scan bit 1 (0)	
		bit 2 = Scan bit 2 (0)	
		bit 3 = Pitch LED	0
		bit 4 = Chorus LED	0
		bit 5 = EQ LED	0
		bit 6 = Program LED	0
		bit 7 = unused	
3	Right Headroom	bit 0 = Right Headroom -24dB LED	1
		bit 1 = Right Headroom -18dB LED	1
		bit 2 = Right Headroom -12dB LED	1
		bit 3 = Right Headroom -6dB LED	1
		bit 4 = Right Headroom 0dB LED	1
		bit 5 = Right Headroom Clip (red) LED	1
		bit 6 = unused	
		bit 7 = unused	
4	Column 2	bit 0 = Scan bit 0 (1)	
		bit 1 = Scan bit 1 (0)	
		bit 2 = Scan bit 2 (0)	
		bit 3 = Modulation LED	0
		bit 4 = Delay LED	0
		bit 5 = Reverb LED	0
		bit 6 = Edit LED	0
		bit 7 = unused	
5	7 Segment Display 1 (left)	bit 0 = segment a	1
		bit 1 = segment b	1
		bit 2 = segment c	1
		bit 3 = segment d	1
		bit 4 = segment e	1
		bit 5 = segment f	1
		bit 6 = segment g	1
		bit 7 = decimal point (Digital In)	1

6	Column 3	bit 0 = Scan bit 0 (0)	
		bit 1 = Scan bit 1 (1)	
		bit 2 = Scan bit 2 (0)	
		bit 3 = Mix LED	0
		bit 4 = Patch LED	0
		bit 5 = Bypass LED	0
		bit 6 = System LED	0
		bit 7 = unused	
7	7 Segment Display 2 (middle)	bit 0 = segment a	1
		bit 1 = segment b	1
		bit 2 = segment c	1
		bit 3 = segment d	1
		bit 4 = segment e	1
		bit 5 = segment f	1
		bit 6 = segment g	1
		bit 7 = decimal point (Clock)	1
8	Column 4	bit 0 = Scan bit 0 (1)	
		bit 1 = Scan bit 1 (1)	
		bit 2 = Scan bit 2 (0)	
		bit 3 = Tempo LED	0
		bit 4 = 'A' LED	0
		bit 5 = Value LED	0
		bit 6 = Store LED	0
		bit 7 = unused	
9	7 Segment Display 3 (right)	bit 0 = segment a	1
		bit 1 = segment b	1
		bit 2 = segment c	1
		bit 3 = segment d	1
		bit 4 = segment e	1
		bit 5 = segment f	1
		bit 6 = segment g	1
		bit 7 = decimal point (MIDI)	1
10	Column 5	bit 0 = Scan bit 0 (0)	
		bit 1 = Scan bit 1 (0)	
		bit 2 = Scan bit 2 (1)	
		bit 3 = MIDI LED	0
		bit 4 = 'B' LED	0
		bit 5 = Options LED	0
		bit 6 = unused	
		bit 7 = unused	

1 represents an LED being turned ON. 0 represents the LED turned OFF for the headrooms and 7 segment displays. For the "Columns" the states are reversed: 0=ON, 1=OFF. When sending the data to the system, "unused" bits can be treated as "don't care" (they are stripped off).

Note that the first 3 bits of the "Columns" contain scan information used by the system to drive a hardware multiplexer which provides scanning for both the LEDs and the keyboard. When sending this dump to the system, the states of these bits MUST be as shown in the table above ("Scan bit 0 (x)").

Remember, when sending LED information, that the system software is often updating certain LED states in real-time (blinking LEDs, etc.). When this happens the values you send will be overwritten by the system's values.

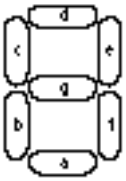
If you are using this feature, it is recommended that you first request the current state of the LEDs and save it locally so that you can restore the LEDs to their proper state after you are done.

The following constants are defined in the system software to drive the headrooms:

```
/* Headroom Defs */
NO SIGNAL LEDS      0x00    /* 0000 0000 */
24DB LEDS           0x01    /* 0000 0001 */
18DB LEDS           0x03    /* 0000 0011 */
12DB LEDS           0x07    /* 0000 0111 */
6DB LEDS            0x0f    /* 0000 1111 */
0DB LEDS            0x1f    /* 0001 1111 */
CLIP LEDS           0x3f    /* 0011 1111 */
```

The 7 segment displays are represented with each bit assigned to a segment. The following diagram shows where each segment appears on the display:

7 Segment Displays
d0 = segment a
d1 = segment b
d2 = segment c
d3 = segment d
d4 = segment e
d5 = segment f
d6 = segment g
d7 = Decimal Point



The number images are defined in the system software as follows:

```
                            /* pgfe dcba */
0 IMAGE             0x3f    /* 0011 1111 */
1 IMAGE             0x30    /* 0011 0000 */
2 IMAGE             0x5b    /* 0101 1011 */
3 IMAGE             0x79    /* 0111 1001 */
4 IMAGE             0x74    /* 0111 0100 */
5 IMAGE             0x6d    /* 0110 1101 */
6 IMAGE             0x6f    /* 0110 1111 */
7 IMAGE             0x38    /* 0011 1000 */
8 IMAGE             0x7f    /* 0111 1111 */
9 IMAGE             0x7c    /* 0111 1100 */
P IMAGE             0x5e    /* 0101 1110 */
```

Display Dump (Type 0x011E in V1.00; 0x011F in V1.10)

The display dump allows the current contents of the display to be extracted or messages to be placed on the display of a connected MPX 1. The dump contains 32 characters; one for each segment of the LCD (top left to bottom right). All ASCII characters can be used along with the numbers 0-7 which access the 8 custom characters supported by the display. Because of this, NULL terminated strings should not be used. The NULL will be interpreted as the first custom character.

When “requested”, the current contents of the display buffer is transmitted. Note that several displays use custom characters, particularly the “parameter edited” character (which uses custom character 0). This can be a problem for ‘C’ language functions which look for null terminated strings. Always parse the strings and deal with the custom characters appropriately.

Custom Character Bitmap Dumps (Type 0x0130 in V1.00; 0x0131 in V1.10)

This dump allows you to send bit-mapped custom characters to the LCD. A total of 8 custom characters can be used as any other (ASCII) character when writing to the display. Normally, characters are written to the display by sending the ASCII number representing the character to the display. Custom characters are displayed by sending the numbers 0-7 for the custom characters 0-7 respectively, to the display. The use of the number 0 should be noted for its implications in the ‘C’ programming language.

Developers can use this dump to generate their own characters for a start-up screen when their system connects with an MPX 1.

Each custom character is 5 pixels wide by 7 pixels high with one additional row of pixels on the bottom for the underline. When loading custom characters, the data is transferred as 8 bytes of data, each representing one row of the character starting from the top. Each bit of the byte corresponds to one pixel with 1 turning the pixel on and 0 turning it off. Because each character is only 5 pixels wide, the top 3 bits are not used. As a result, all characters will either have a 1 or a 0 in the high nibble. For example, the letter 'T' would be represented as follows:

0x1f, 0x04, 0x04, 0x04, 0x04, 0x04, 0x04, 0x00

row	binary	hex
0 -	0001 1111	0x1f
1 -	0000 0100	0x04
2 -	0000 0100	0x04
3 -	0000 0100	0x04
4 -	0000 0100	0x04
5 -	0000 0100	0x04
6 -	0000 0100	0x04
under	0000 0000	0x00

You would use the custom characters by sending a display dump message using the custom character numbers in the places where you want the custom characters to appear on the display.

Note that the dump always contains all 8 custom characters for a total of 64 data bytes.

Setup Dumps (Type 0x0128 in V1.00; 0x0129 in V1.10)

The system supports 5 stored setups and an active setup. The system is immediately reconfigured for new active setups once they are received.

The setup data structure is defined as follows (dump bytes are in this order):

Byte #	Description	# Bytes	Parameter Type	
			V1.00	V1.10
1,2	MIDI Receive Channel	1	0x00F1	
3-6	MIDI Transmit Speed	2	0x00F2	
7,8	MIDI SysEx Receive	1	0x00F3	
9,10	MIDI SysEx On/Off	1	0x0126	0x0127
11,12	MIDI Transmit	1	0x00F4	
13-16	Pgm# Offset	2	0x00F5	
17,18	MIDI Automation	1	0x00F6	
19,20	MIDI Clock Send On/Off	1	0x00F7	
21,22	Program Sort Mode	1	0x00F9	
23,24	Modes Contrast	1	0x00FA	
25,26	Automation Xmit ID	1	0x00FB	
27,28	MIDI Pgm Change On/Off	1	0x00FC	
29,30	MIDI Ctl Smooth	1	0x0117	0x0118
31,32	Modes Bypass	1	0x00FE	
33,34	Modes MemProtect On/Off	1	0x00FF	
35,36	Store Prompt On/Off	1	0x0118	0x0119
37,38	patch_update_mode	1	not used	
39,40	Modes Sleep	1	0x0101	
41,42	Modes Mix	1	0x0102	
43,44	Modes Pgm Load	1	0x00FD	
45,46	Pgm+	1	0x0104	
47,48	Pgm-	1	0x0105	
49,50	Audio Input/clck	1	0x0106	
51,52	Audio Output	1	0x0107	
53,54	Audio Dig In Lvl	1	0x0108	
55,56	Audio ChanStatus	1	0x0109	
57,58	Audio Soft Sat	1	0x010A	
59,60	pedal_max	1	-	
61,62	pedal_delta	1	-	
63,64	Modes Tempo	1	0x0119	0x011A
65,66	Audio Input Mode	1	0x011A	0x011B
67,68	Modes Pgm Load	1	0x0100	
69-86	setup_name	9		
87,88	Global Bypass Level	1		0x010B

MIDI Receive Channel (midi_in_channel)
This is the MIDI channel on which the system recognizes incoming data. Legal values are 0-15 for the standard midi channels, 16 for MIDI off and 17 for Omni mode.

MIDI Transmit Speed (midi_output_rate)
This sets the rate at which midi data is output from the system. Only the values in the following table should be used in this field:

Fast	- 0x01
Medium Fast	- 0x02
Medium Slow	- 0x04
Slow	- 0x40

MIDI SysEx Receive (midi_device_id)
This is the device ID used in all outgoing SysEx dump messages and incoming messages. Legal values are 0-126.

MIDI SysEx On/Off (sysex_on_off)
This enables (1) or disables reception of SysEx data by the system.

MIDI Transmit (midi_out_channel)
This is the MIDI channel on which the system outputs MIDI data. Legal values are 0-15 for the standard midi channels and 16 for MIDI off.

Pgm# Offset (program_change_offset)
This 2 byte value sets the “Pgm# Offset” on the system which allows incoming standard program change messages to be offset from the first program. Normally a program change value of 0 loads program 1.

MIDI Automation (midi_automation_mode)
This determines if the MIDI automation in the system is on (1) or off (0).

MIDI Clock Send On/Off (midi_clock_mode)
This determines if MIDI clock is (1) or is not (0) to be transmitted from the system (MIDI out).

Program Sort Mode (sort_mode)
This sets the current program sort mode in the system. The following values have been defined:

SORT_BY_NAME	0
SORT_BY_NUMBER	1
SORT_BY_INPUT	2
SORT_BY_FX_TYPE	3
SORT_BY_INP_AND_FX	4
SORT_BY_MIDI_MAPS	5
SORT_BY_MIDI_CHAINS	6
SORT_BY_TOP_10	7

Modes Contrast (cur_contrast)
This sets the contrast level of the system’s LCD. Legal values are 0-15.

Automation Xmit ID (automation_device_id)
This sets the device ID of the outgoing SysEx data generated by the system’s automation. Legal values are 0-126 or 127 for all targets. (this is an option of the MIDI Automation On/Off)

MIDI Pgm Change On/Off (program_change_mode)
This enables (1) or disables (0) program changes via standard MIDI program change messages.

MIDI Ctl Smooth (cont_smooth)
This sets the amount of interpolation that is performed on the incoming MIDI controller data. 0 = no interpolation, 100 = full interpolation.

Modes Bypass (bypass_mode)
This sets how the audio is routed through the system when system bypass is turned on. The following values have been defined:

NORMAL_BYPASS	0
ALL_MUTE_BYPASS	1
INPUT_MUTE_BYPASS	2

Modes MemProtect On/Off (memory_protect_mode)
This turns the system's program memory protect mode is turned on (1) or off (0).

Store Prompt On/Off (auto_store_mode)
This sets the auto store mode to on (1) or off (0). (this is an option of Modes MemProtect)

patch_update_mode
This is not implemented.

Modes Sleep (sleep_mode)
This sets the current sleep mode from the following:

NO_SLEEP_MODE	0
HELP_SLEEP_MODE	1
ENGLISH_PROMO_SLEEP_MODE	2
FRENCH_PROMO_SLEEP_MODE	3
GERMAN_PROMO_SLEEP_MODE	4
TALIAN_PROMO_SLEEP_MODE	5
SPANISH_PROMO_SLEEP_MODE	6

Modes Mix (mix_mode)
This sets the current mix mode: 0 = global, 1 = program

Modes Pgm Load (program_load_mode)
This defines how the system will route the audio through the system during a program load. Bypass = 0 or all mute = 1.

Pgm+ (pgm_inc_controller)
Pgm- (pgm_dec_controller
These define the controllers used to increment and decrement the current program. Refer to the list of controllers in Appendix A: Controller Indeces for legal values.

Audio Input/clck (clock_source)
This is really the input/clock source. It sets the audio input to the system as either analog or digital as well as the sample clock source. The following values have been defined:

ANALOG_INTERNAL_MODE	0
ANALOG_EXTERNAL_MODE	1
DIGITAL_EXTERNAL_MODE	2

Audio Output (output_type)
This sets the current audio output from the system to either analog (0) or digital (1).

Audio Dig In Lvl (dig_in_level)
This sets the level of the digital audio coming into the system when enabled. The legal range for values is +6 to -90 which directly translates into the level.

Audio ChanStatus (chan_stat_mode)
This defines whether the system generates channel status (1) or passes it through from the digital audio feeding the system (0) (pass thru). Note that the pass thru mode should only be used if digital audio is the audio source or the system is using digital audio as the sync source (Analog/External).

Audio Soft Sat (soft_saturation_mode)
This turns the soft saturation circuits on (1) or off (0).

pedal_max
pedal_delta
These are internally generated calibrations of the connected foot pedal. pedal_max is related to the minimum pedal voltage after calibration. It decreases from 0xFF as the pedal minimum voltage increases. (The reason it's backwards, and the reason it's called "max", is that the pedal ADC is basically a down counter).

pedal_delta is proportional to the range of the pedal voltage after calibration (the max voltage - the min voltage). In other words, pedal_max is the offset term and pedal_delta is the scaling term.

Modes Tempo (tempo_mode)
This determines whether the current tempo is global (0) or program specific (1).

Audio Input Mode (input_mode)
This sets the configuration of the audio input signal. The following choices have been defined:

STEREO_INPUT_MODE	0
LEFT_MONO_INPUT_MODE	1
RIGHT_MONO_INPUT_MODE	2

Modes Pgm Load (autoload_mode)
This sets the auto load mode to Manual (0) or auto-load (1).

setup_name
This is an array containing the ASCII name string for the setup. This can be a maximum of 9 characters and should NOT be null terminated (NULL is a custom character for the LCD). Unused characters should be spaces (0x20).

global_bypass_level
This sets the level of the dry audio when the unit is placed in Bypass or when programs are being loaded.

Global Patches Dump (Type 0x012D in V1.00; 0x012E in V1.10)

This message class allows you to send Global Patches dumps to, or receive them from an MPX 1. There are 10 global patches in the system, each with a one byte source and destination. The sources are the controllers from Appendix A: Controller Indeces beginning with "Pedal" (0x18) and ending at "TSw" (0xA2). A value of 0xFF is used if the patch is unassigned ("None" displayed). The destinations are as follows:

0	none
1	host Mix
2	Ptch Mix
3	Chrs Mix
4	EQ Mix
5	Mod Mix
6	Dly Mix
7	Rvb Mix
8	host Lvl
9	Ptch Lvl
10	Chrs Lvl
11	EQ Lvl
12	Mod Lvl
13	Dly Lvl
14	Rvb Lvl

The dumps are formatted as two 10-byte arrays; the first 10 are for the sources (1-10) and the second 10 bytes are the destinations (1-10).

```
typedef struct
{
        BYTE global_patch_sources[10];
        BYTE global_patch_destinations[10];
}GLOBAL_PATCHES;
```

Bypass Controllers Dump (Type 0x012C in V1.00; 0x012D in V1.10)

This dump allows you to send "Bypass Controllers" assignments to, or receive them from the system. The bypass controllers allow the operator to define a particular controller to toggle the effects and system bypass on and off. The 7 bypass controllers are assigned as follows:

0 - Host Bypass
1 - Pitch Bypass
2 - Chorus Bypass
3 - Modulation Bypass
4 - EQ Bypass
5 - Reverb Bypass
6 - Delay Bypass

The dump consists of seven 1-byte controller sources that can be patched to these destinations. The sources are the controllers from Appendix A; Controller Indeces beginning with "Tog1" (0x19) and ending at "CC119" (0x96). A value of 0xFF is used if the controller is unassigned ("None" displayed).

Remap Controllers Dump (Type 0x012B in V1.00; 0x012C in V1.10)

This dump allows you to send "Remap Controllers table" assignments to, or receive them from the system. The remap controllers table is used by the system to define the MIDI controller number which will be used to transmit the control source if it is used in a patch and has a non-0xff value in this table. The value 0xff designates "not assigned". The system supports 163 controller sources (listed in Appendix A) which each have an associated remap value in the remap table. The table in the Appendix identifies the assignment of each byte of this dump sequentially.

Current Choices Dump (Type 0x0125 in V1.00; 0x0126 in V1.10)

This message allows you to get the current settings of all menu choices in the system. Typically, this dump is used to initialize the state (bypass, running program, etc..) of the system. In the system software, the current choices are stored in a data structure of the following type:

Byte #	Description	# Bytes
1,2	program_bank	1
3,4	current_effect_edit_parameter	1
5,6	cur_alg_select	1
7,8	cur_internal_cont_param_num	1
9,10	cur_internal_cont	1
11,12	compare_mode	1
13,14	dbase_edit_cur_choice	1
15,16	soft_val_play_cur_choice	1
17,18	soft_val_cur_choice	1
19,20	soft_val_edit_cur_choice	1
21,22	current_map_block	1
23,24	cur_routing_item	1
25,26	cur_map_screen	1
27,28	order_cur_choice	1
29,30	mix_cur_choice	1
31,32	patch_cur_choice	1
33,34	audio_cur_choice	1
35,36	audio_options_cur_choice	1
37,38	midi_cur_choice	1
39,40	chains_cur_choice	1
41,42	store_cur_choice	1
43,44	cur_edit_page	1
45-48	*cur_edit_page_name_ptr	2
49,50	cur_edit_param_index	1
51,52	cur_num_edit_params	1
53,54	cur_system_page	1
55-58	*cur_system_page_name_ptr	2
59,60	cur_system_param_index	1
61,62	cur_num_system_params	1
63-66	selected_program_num	2
67-70	running_program_num	2
71,72	operating_mode	1
73,74	button_encoder_mode	1
75,76	system_init_mode	1
77,78	cur_setup_num	1
79,80	cur_setup_choice	1
81,82	cur_utility_choice	1
83,84	bypass_state	1
85,86	cur_bypass_patch_num	1
87,88	cur_tools_param_num	1
89,90	cur_tools_tool	1
91,92	cur_global_patch_num	1
93,94	cur_global_patch_menu_choice	1
95,96	cur_ui_dump_type	1
97,98	cur_cont_remap_choice	1
99,100	cur_patch_param	1
101,102	patch_knob_mode	1
103,104	cur_auto_store_choice	1
105,106	cur_tempo_choice	1
107,108	cur_tempo_source_error_choice	1
109,110	cur_midi_map_choice	1
111,112	cur_invalid_data_choice	1
113,114	cur_verify_choice	1
115,116	cur_verify_store_choice	1
117,118	cur_prog_sel_choice	1
119,120	cur_sleep_choice	1
121-124	*cur_menu_ptr	2
125-128	*mix_prev_menu_ptr	2
129-132	*patch_prev_menu_ptr	2
133-136	*autostore_prev_menu_ptr	2
137-140	*verify_prev_menu_ptr	2
141-144	*store_prev_menu_ptr	2

program_bank
This is the program bank that is set when controller 32 (Bank Select) is sent to the box. This is used to offset incoming standard program change messages by 0, 100 and 200 when set to 0, 1, and 2 respectively.

current_effect_edit_parameter
This contains the parameter number of the effect edit menu. Note that this is really only significant when in the EDIT mode with effect parameters visible because of an “effect_matrix” that contains the current positions in each effect’s menu. “current_effect_edit_parameter” is only the currently displayed version. The “effect_matrix” is not accessible via MIDI.

cur_alg_select
This contains the current value of the effect (algorithm) select menu. When displayed, this translates into the algorithm number for the selected effect.

cur_internal_cont_param_num
cur_internal_cont
not used

compare_mode
This contains the current “compare mode” for the system (1 = on, 0 = off).

dbase_edit_cur_choice
This contains the current choice for the “Database” menu.

soft_val_play_cur_choice
This contains the current choice for the “Soft Row” menu when accessed via the Program mode.

soft_val_cur_choice
This contains the current choice for the “Soft Row” menu when accessed via the Edit mode.

soft_val_edit_cur_choice
This contains the current choice for the “Soft Row Edit” menu when accessed via the Program mode.

current_map_block
This contains the current effect block being edited in the “Audio Routing” menu. Note that block number 0 is ALWAYS the input and block number 8 is always the output.

cur_routing_item
This contains the current effect *block* being edited in the “Audio Routing” menu OPTION. Again, block number 0 is ALWAYS the input and block number 8 is always the output.

cur_map_screen
not used

order_cur_choice
This contains the current effect block being moved in the “Effect Order” menu.

mix_cur_choice
This contains the current active position in “Mix” menu. (range: 0-13)

patch_cur_choice
This contains the current patch number being edited in the patch menu (range:0-4)

audio_cur_choice
This contains the current “Audio” menu item. (range:0-5)

audio_options_cur_choice
This contains the current “Audio” menu OPTION item. (range:0-2)

midi_cur_choice
This contains the current “MIDI” menu item. (range:0-10)

chains_cur_choice
This contains the current “Chains” menu item. (range:0-2)

store_cur_choice
This contains the current “Store” menu item. A value of 0 allows the encoder to select a program number while the 1-12 allow the encoder to edit the programs name.

cur_edit_page
This is the current “Edit” menu item (Compare, Meter Assign, etc...) (range: 0-18)

cur_edit_page_name_ptr
This is an internal pointer to a name string for the cur_edit_page.

cur_edit_param_index
This is a more global version of the “current choices” for menus under “Edit”. In some menus, this actually replaces the “current choice” variable. The range varies depending on which menu is active.

cur_num_edit_params
This is global “Edit” mode count of the max value for the active menu.

cur_system_page
This is the current “System” menu item (Audio, Mode, etc...) (range: 0-9)

cur_system_page_name_ptr
This is an internal pointer to a name string for the cur_system_page.

cur_system_param_index
This is a more global version of the “current choices” for menus under “System”. In some menus, this actually replaces the “current choice” variable. The range varies depending on which menu is active.

cur_num_system_params
This is global “System” mode count of the max value for the active menu.

selected_program_num
This is the “Selected” but not necessarily loaded program number.

running_program_num
This is the number of the currently running program.

operating_mode
This contains the current operating mode. The modes are defined as follows:

PROGRAM_MODE 0
EDIT_MODE 1
SYSTEM_MODE 2

button_encoder_mode
This confirms the operation of the encoder and the <> buttons. (0=normal, 1=swapped).

system_init_mode
This is the current choice for the “System: Initialize” menu. (range: 0-6)

cur_setup_num
This is the current “Setup” that is active. (range:0-4)

cur_setup_choice
This is the current choice for the “System: Mode” (formerly “Setup”) menu. (range: 0-9)

cur_utility_choice
not used

bypass_state
This is the current bypass state of the box. 1=Bypass ON, 0=Bypass OFF

cur_bypass_patch_num
This is current choice of the bypass patch menu (Option under “System:Mode Bypass”). (range: 0-6)

cur_tools_param_num
This is the current choice for the “System” “Initialize”, “Clear Programs” and “Copy Programs” menus. The range of this varies depending on which menu is active.

cur_tools_tool
This defines whether “initialize”(0), “Clear Programs”(1) or “Copy Programs”(2) menus is selected.

cur_global_patch_num
This contains the current “Global Patch” number that is being edited. (range: 0-9)

cur_global_patch_menu_choice
This contains the current choice for the “Global Patches” menu. (range: 0-2)

cur_ui_dump_type
This contains the currently selected MIDI dump type. (range 0-21)

cur_cont_remap_choice
This contains the currently selected “Controller Remap” choice (which controllers transmit value is being edited). (range:0-)

cur_patch_param
This is the current parameter for the patching system. The range of this is 0-5 if a destination is defined otherwise the value is limited to 0-2.

patch_knob_mode
not used

cur_auto_store_choice
This is handler variable used by the system’s “Auto Store” function.

cur_tempo_choice
This contains the current choice for the “Edit:Tempo” menu. (range: 0-3)

cur_tempo_source_error_choice
This is a handler variable used by the Tempo subsystem when client to external MIDI clock and an out of range clock is detected.

cur_midi_map_choice
This contains the current choice for the “MIDI Maps” menu. (range: 0-2)

cur_invalid_data_choice
This is a handler variable used by the system in monitoring the incoming digital audio.

cur_verify_choice
cur_verify_store_choice
These are handler variables for two of the “Verify” requesters.

cur_prog_sel_choice
not used

cur_sleep_choice
not used

cur_menu_ptr
mix_prev_menu_ptr
patch_prev_menu_ptr
autostore_prev_menu_ptr
verify_prev_menu_ptr
store_prev_menu_ptr
are internal pointers to menus that the system must return to when it enters one of these menus.

Patches Dump (Type 0x0129 in V1.00; 0x012A in V1.10)

This dump allows you to get the patch data for all of the patches in the active program or send it to the system.

There are 5 patches transmitted in this message which are each organized as follows:

Byte #	Description	# Bytes
1,2	Source Controller number	1
3,4	Source Minimum value	1
5,6	Source Middle value	1
7,8	Source Maximum Value	1
9,10	Destination Effect/Parameter type	1
11,12	Destination Parameter index	1
13-16	Destination Minimum value	2
17-20	Destination Middle value	2
21-24	Destination Maximum value	2

See also Program Dump.

Soft Row Dump (Type 0x012A in V1.00; 0x012B in V1.10)

This message allows you to get a dump of all the Soft value (soft row) data in the active program or send it to the system.

There are 10 Soft Row parameters which are stored in each program and are transferred with this packet, each containing the following:

Effect/Parameter type (1 byte)
Parameter index (1 byte)

See also Program Dump.

Units

While most parameters in the MPX 1 use a single form of measurement, there are some that can be measured in 2 or more unit types. The LFO's Rate parameter, for instance, can be adjusted in Hz or in a ratio of the cycles per second. Another example is the delay time parameters which can be set for milliseconds, a ratio of the number of echoes per beat, in meters or in feet.

When a parameter can be set using different units, the Parameter Description will include additional minimum and maximum values as well as display units for these unit types. The currently selected units"are defined in two ways — both of which are "options" to the parameter. The most straightforward method uses a single byte option parameter which contains the currently selected units. In this case, the actual data is transmitted with the parameter data as an additional byte (the Parameter Data message packet for a one byte parameter with a units option would be sent with two bytes — the actual parameter data and the option data). In this case, the second byte (the option data) would be read first to determine the unit type. This is the method used for delay parameters.

The other method, typically used for Rate parameters, uses the MSB of the parameter data itself to determine the units to use. In these cases the MSB is stripped off the parameter before it is used (for display etc). In these cases, the "number of bytes" field in the Parameter Description for the option parameter is 0.

Though the MSB method is used on all Rate parameters, the separate byte method is preferred.

Note that, while the Delay "Time" parameter can be set for "echos:beat" much like the Rate parameters have "cycles:beat", the option value which defines the mode is a separate byte. The Rate parameters use the MSB of the parameter value itself.

Appendix A: Controller Indeces

Host List of Controllers

The following table lists all internal (Ctls) and MIDI controllers.

	Number	Display	Description
Ctls :	0x00	Off	always 0
	0x01	On	always 1
	0x02	Knob	adjust knob
	0x03	Puls1	lfo1
	0x04	Tri1	lfo1
	0x05	Sine1	lfo1
	0x06	Cos1	lfo1
	0x07	Puls2	lfo2
	0x08	Tri2	lfo2
	0x09	Sine2	lfo2
	0x0A	Cos2	lfo2
	0x0B	Rand	random generator
	0x0C	Arp	arpeggiator
	0x0D	ADR1	envelope generator
	0x0E	ADR2	envelope generator
	0x0F	S/H	sample and hold
	0x10	Env1	envelope follower 1
	0x11	Env2	envelope follower 2
	0x12	Mtr1	meter 1 follower
	0x13	Mtr2	meter 2 follower
	0x14	A/B	continuous range 0 = a, 127 - B
	0x15	ATrg	pulse whenever A/B changes from B to A
	0x16	BTrg	pulse whenever A/B changes from A to B
	0x17	ABTrg	pulse whenever A/B changes
	0x18	Pedal	foot pedal
	0x19	Tog1	latched output of foot switch 1
	0x1A	Tog2	latched output of foot switch 2
	0x1B	Tog3	latched output of foot switch 3
	0X1C	Sw1	momentary output of foot switch 1
	0x1D	Sw2	momentary output of foot switch 2
	0x1E	Sw3	momentary output of foot switch 3
MIDI:	0x1F	—	MIDI controller 0 (bank select) (not selectable in the system)
	0x20	CC1	MIDI controller 1
	0x21	CC2	MIDI controller 2
	...		
	0x3F	—	MIDI controller 32 (bank select) (not selectable in the system)
	...		
	0x96	CC119	MIDI controller 119
	0x97	Bend	pitch bend
	0x98	Touch	after touch
	0x99	Vel	note on velocity
	0x9A	Last•	last note (“•”is place holder for a note special character)
	0x9B	Low•	low note
	0x9C	High•	high note
	0x9D	Tempo	MIDI/internal tempo (40-400BPM is converted to source range of 0=127)
	0x9E	Cmnds	Start, Stop, Continue converted to switch; start/continue = 127, stop = 0
	0x9F	Gate	on as long as at least one MIDI note is on
	0xA0	Trig	pulse whenever a new MIDI note on is detected
	0xA1	LGate	on only when more than one MIDI note is on
	0xA2	TSw	toggled on and off by after touch

Global Patch controllers

Uses the numbers from the list above except the items before “Pedal” are excluded.

0x18	Pedal	foot pedal
...		
0xA2	TSw	toggled on and off by after touch

Bypass controllers

Uses the numbers from the list above except the items before “Tog 1” and after MIDI controller 119 are excluded.

0x19	Tog1	latched output of foot switch 1
..		
0x96	CC119	MIDI controller 119

Appendix B: Display Units

Note: Many of these also have a “long”, more verbose version not listed here

Unit#	Name	Description
0x00	Mix Disp Units	Display in decimal followed by ‘%’
0x01	No Disp Units	Display in decimal
0x02	Waveform Disp Units	Use the “waveform_strings”
0x03	Percentage Disp Units	Display in decimal followed by ‘%’
0x04	On Off Disp Units	Use the “on_off_strings”
0x05	Log Lin Disp Units	Use the “log_lin_strings”
0x06	Note Disp Units	Use the “note_strings”
0x07	“None” Decimal Disp Units	Display “None” for 0, otherwise in decimal
0x08	Tempo Ratio Disp Units	Display high and low bytes as separate decimal numbers seperated by a ‘:’. Strip off the MSB of the high byte.
0x09	Hz Disp Units	Display in decimal followed by “Hz”
0x0a	Q Disp Units	Display in decimal 1/10ths units optionally followed by ‘Q’ (eg. 10 would be “1.0 Q”)
0x0b	Envelope Disp Units	Use the “envelope_mode_strings”
0x0c	Velocity Disp Units	Use the “velocity_mode_strings”
0x0d	Modulation Disp Units	Use the “modulation_mode_strings”
0x0e	Degree Disp Units	Display in decimal (optional degree symbol)
0x0f	Ms Or Time Sig Disp Units	Display high and low bytes as separate decimal numbers seperated by a ‘:’. Strip off the MSB of the high byte.
0x10	Load Mode Disp Units	Use the “load_mode_strings”
0x11	Lfo Mode Disp Units	Use the “lfo_mode_strings”
0x12	Adsr Mode Disp Units	Use the “adsr_mode_strings”
0x13	Rate Units Disp Units	If MSB is 1, display “cycles:beat” otherwise display “Hz”.
0x14	Time Units Disp Units	Use the “time_unit_strings” using the option data as an index.
0x15	Fb Insert Disp Units	Use the “fb_insert_point_strings” using the option data as an index.
0x16	Tap Mode Disp Units	Use the “tap_mode_strings”
0x17	Rate Disp Units	Display in decimal 1/100ths units with optional “Hz” (eg. 100 would be “1.00 Hz”)
0x18	Midi Channel Disp Units	For values 0-15, display as decimal number plus 1. For value of 16, display “Off” For value of 17, display “Omni”
0x19	Midi Out Rate Disp Units	Use the “midi_out_rate_strings”
0x1a	Meter Disp Units	Use the “meter_strings”
0x1b	Sort Mode Disp Units	Use the “sort_mode_strings”
0x1c	Bypass Mode Disp Units	Use the “bypass_mode_strings”
0x1d	Mem Protect Disp Units	Use the “mem_protect_mode_strings”
0x1e	Patch Update Mode Disp units	Use the “patch_update_mode_strings”
0x1f	Sleep Mode Disp Units	Use the “sleep_mode_strings”
0x20	Mix Mode Disp Units	Use the “mix_mode_strings”
0x21	Program Load Disp Units	Use the “program_load_strings”
0x22	Clock Source Disp Units	Use the “clock_source_strings”
0x23	Audio Output Disp Units	Use the “audio_output_mode_strings”
0x24	Chan Stat Disp Units	Use the “chan_stat_mode_strings”
0x25	Alphanumeric Disp Units	Display the data as an ASCII string
0x26	Bpm Disp Units	Display in decimal followed by BPM
0x27	Tempo Source Disp Units	Use the “tempo_source_strings”
0x28	Cont Source Disp Units	For values 0 and FFFF, display “None”. For values 1-30 use the “internal_cont_strings”. For values 31-150, display “CC” followed by the value minus 31. For values >151, use “midi_control_strings” with value minus 151 for index.
0x29	Min Off Cont Source Disp Units	Same as previous except display “None” for the “min_value”
0x2a	Num Beats Disp Units	Display in decimal followed by “Beats”
0x2b	Options No Disp Units	Display in decimal using option data
0x2c	Ab Mode Disp Units	Use the “ab_mode_strings”
0x2d	Global Patch Dest Disp Units	Use the “global_patch_dest_strings”
0x2e	MIDI Dump Disp Units	Use the “midi_dump_strings”
0x2f	Eq Mode Disp Units	Use the “eq_mode_strings”
0x30	Name Disp Units	Display data as an ASCII string
0x31	Wah Type Disp Units	Use the “wah_type_strings” using the option data as an index
0x32	Input Mode Disp Units	Use the “input_mode_strings”
0x33	Arp Mode Disp Units	Use the “arpeggiator_mode_strings”
0x34	Env Source Disp Units	Use the “encelope_source_strings”
0x35	Size Disp Units	Divide the value by 2 and add 4. If LSB of value is 1, add “.5” else add “.0”. Optionally add “M” or “Meters”.
0x36	Treb Disp Units	Use “reverb_freq_strings”
0x37	Bassrt Disp Units	Display ‘X’ followed by “bass_rt_strings”

0x38	Crossover Disp Units	Use “reverb_freq_strings” offsetting the parameter value by 12. If value = 48 use “Flat”.
0x39	Midrt Disp Units	If reverb algorithm is 1 or 5 use the “chamber_decay_strings”, if 2 then use “hall_decay_strings”, if 3 use “plate_decay_strings”
0x3a	Percent50 Disp Units	Multiply value by 2 and display in decimal followed by ‘%’.
0x3b	Msec Disp Units	Display in decimal (optionally follow with “ms”)
0x3c	Spread Disp Units	Display in decimal. Note that if “Link” is turned on, the value is scaled
0x3d	Shape Disp Units	Display in decimal
0x3e	Slope Disp Units	If the value is < 16, a minus sign is displayed followed by 16 minus the value in decimal. Otherwise, a plus sign is displayed followed by the value minus 16 in decimal
0x3f	Dplevel Disp Units	If the value is 0, “Off” is displayed. If the value is the “max_value”, “Full” is displayed. Otherwise, a minus sign is displayed, the value is multiplied by 2 and used as an offset into the “levelog_db” table, where the first display value is derived. The value is incremented then used again for an index into the table for the second character. Finally, the letters “dB” are tacked onto the end.
0x40	Duration Disp Units	140 is added to the value multiplied by 5 (140+(value*5)) and displayed as decimal with “ms” tacked onto the end.
0x41	Cromatics Note Disp Units	The value has 12 subtracted from it until is less than 11 with the octave incremented each time. The resulting “octave” number is displayed in hex followed by the note using whats left of the value as an index into “cromatic_note_strings”.
0x42	AmbRtHc Disp Units	Use “ambience_RT_HC_strings”
0x43	Word No Disp Units	Display as a decimal word (2 bytes)
0x44	Dump Disp Units	Display “Dump”
0x45	Feet Disp Units	Display in decimal (optionally add “Feet”)
0x46	Meters Disp Units	Display in decimal (optionally add “Meters”)
0x47	Phase Disp Units	Use “phase_strings”
0x48	Pdly Disp Units	Display in decimal (optionally add “ms”)
0x49	Optimize Disp Units	Display in decimal using option data (optinally add “ms”)
0x4a	Arp Velocity Source Disp Units	If value is < 128, display as a decimal number otherwise subtract 127 and use 0x28 Controller Source Display Units.
0x4b	Control Level Disp Units	Display the parameters name
0x80	Level Disp Units	If value = “min_value”, display “Off” otherwise display a signed decimal number followed by “dB”.
0x81	Pitch Disp Units	Display as signed decimal number in 100ths (100 = “1.00”)
0x82	Bipolar Percentage Disp Units	Display as signed decimal number followed by “%”.
0x83	Bipolar No Disp Units	Display as signed decimal number
0x84	Pan Disp Units	If value = 0, display ‘C’ or “Center”. If value is negative (MSB = 1), display (FF - value) + 1 in decimal followed by ‘L’ or “Left”. If the value is positive, display the value in decimal followed by ‘R’ or “Right”.
0x85	Bipolar Word Disp Units	Display in decimal word (2 bytes)
0x86	FF “None” No Disp Units	If the value is FF, display “None” otherwise, display “CC” followed by the value in decimal.
0x87	Bipolar Degrees Disp Units	Display in signed decimal (optionally add the degree symbol or the word “degrees”)
0x88	Bal Disp Units	Display in signed decimal.
0x89	Tone Level Disp Units	Display in signed decimal followed by “dB”.

Appendix C: Glossary of Terms

data structure	This is term used in the “C” programming language to describe a group of associated bytes (bytes with something in common, belonging to a group).
-	This is used in the “C” programming language to define constants
typedef	This is used in the “C” programming language to define custom data “types”
/* */	This is used in the “C” programming language to denote comments
0x	This is used in the “C” programming language to identify hex numbers

Appendix D: Known Bugs

As of this writing, the following bugs have been identifiec in the SysEx implementation of the MPX 1 V1.00:

The description for Parameter Number 0x014A (used at control address' A:1, B:11, C:0, D:0, address A:1, B:11, C:1, D:0 and address A:1, B:11, C:2, D:0.) reports it's size as 0 bytes when in fact it contains 542 bytes.

A branch of the control tree at address A:1 B:2 C:0 ends with "type" 0x015B which is a control level not an editable parameter as it should.

Parameters for algorithms that are not loaded can be edited using the parameter data message (eg. Detune (M) loaded and Shift (M) parameters are edited). This can be fatal so it should be avoided.

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