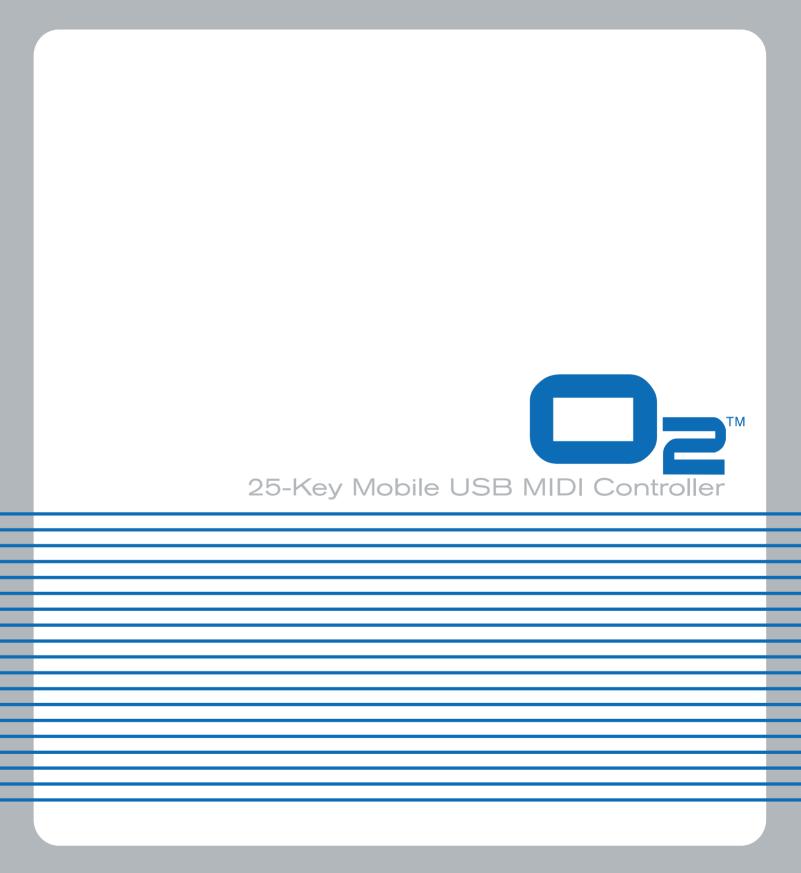# M-AUDIO®

O2™

25-Key Mobile USB MIDI Controller

USER GUIDE

ENGLISH • FRANÇAIS • DEUTSCH • ESPAÑOL • ITALIANO • 日本語

Introduction

Congratulations on your purchase of M-Audio's O$_2$. The O$_2$ follows in the footsteps of the mobile USB MIDI controller that started it all—the Oxygen8. Small enough to fit in a bag along with your laptop, the slim-line M-Audio O$_2$ is perfect for throwing down bass lines, programming drum patterns, triggering effects and tweaking virtual studio parameters—anywhere, anytime.

You get 25 full-size, half-action, touch-sensitive keys, along with eight fully assignable knobs, 8 fully assignable buttons and other real-time control features for performance and programming. One simple USB connection serves as both a MIDI interface and bus-power source. Class compliancy with Windows XP and Mac OS X means that you can get down to business without even installing any drivers.

You can also expand on the functions of the O$_2$ by downloading the Enigma software editor and librarian. For more information, see the Enigma Software Editor section of this manual or visit www.m-audio.com to register and download the free software.

M-Audio O$_2$ Features

Ports:
- MIDI OUT
- USB MIDI OUT/IN

Power:
- USB powered
- DC IN for external PSU

Keyboard:
- 25-note velocity-sensitive keyboard
- 9 velocity curves

Controls:
- 8 programmable rotary dials
- 1 programmable fader
- 8 programmable buttons
- assignable button controls for pitch bend and modulation.
- MIDI-assignable foot switch

MIDI Data from controllers
- MIDI control number
- RPN/NRPN
- Program, Bank LSB, Bank MSB
- pitch bend

- GM/GM2/XG SysEx Messages

MIDI Data from buttons:
- Note on
- Note on/off Toggle
- MIDI CC on/off Toggle
- Program, Bank LSB, Bank MSB presets
- MIDI Machine Control functions
- GM/GM2/XG SysEx Messages
- MIDI CC increment/decrement

"On the fly" features:
- Program and Bank changes
- Snap Shot sends current status for all controllers
- Controller Mute mutes controller output to avoid parameter jumps

Other features:
- memory storage on your computer via SysEx
- free Enigma software to edit and store memories
- 5 memory locations store all settings
- MIDI out from USB interface

What's in the package?

Your M-Audio O$_2$ package should contain the following items:

- O$_2$ keyboard
- Driver CD
- Software Bundle CD
- USB Cable

Power and Connection Via USB

You can power the keyboard via USB or an optional external power supply. Use only one method at a time.

1. Check that the on/off button on the back of the unit is set to "Off."
2. Plug in the USB cable provided with the M-Audio O$_2$ to a free USB port on your computer.
3. Plug in the other end of the USB cable to the USB input on the M-Audio O$_2$.

The single USB cable not only powers the M-Audio O$_2$ but also sends MIDI data to and from your computer system.

You can also use a power adapter (not included) with the following specification: 9V DC output, 250-300mA, center positive.

Verify that you are not powering the M-Audio O$_2$ keyboard via USB, then simply plug in the power supply to the input labelled DC 9V and switch the power on.

Note: Do not leave the adapter plugged in for long periods of time if the unit is not in use.

Windows XP and Mac OS X

If you are using Windows XP or Mac OS X, you may simply switch the power position to "on." Because the M-Audio O₂ keyboard is class compliant, it will work with out any further installation.

M-Audio O₂ Features and Functions

If the installation process has been completed successfully, please read through the following pages for a better understanding of the O₂ and how it works.

Program Mode

This manual refers to "Program Mode." Program Mode defines the state of the M-Audio O₂ when the ADVANCED FUNCTION button is pressed.

In Program Mode, the keyboard of the M-Audio O₂ is set up for selecting functions. The functions are listed above each key on the O₂ keyboard. The second octave of the O₂ keyboard is for numerical data entry while in Program Mode.

The Preset "+" and "-" buttons can be used for increment or decrement changes in assigned value when in Program Mode.

When

If the M-Audio O₂ is in Program Mode, a small dot will appear in the bottom right hand corner of the LED display.

Note that pressing the GLOBAL CHAN button will also engage Program Mode, since the numerical data entry keys are required to enter the new channel assignment. Also, the preset "+" and "-" buttons can be used.

Exit Program Mode by pressing the ADVANCED FUNCTION button when you are finished with programming. The ENTER key must be pressed each time the numerical data entry keys are used to enter a value. Once the ENTER key has been pressed, Program Mode will exit.

Testing the M-Audio O₂ with Your Software

We recommend that you verify that your software application is properly communicating with the M-Audio O₂ keyboard. Most software applications have a MIDI IN indicator. To confirm data is being received, press any key on the keyboard.

If you encounter any issues or the software receives no data, please verify you selected the keyboard's USB driver as the MIDI Input for your software. In addition, please read the troubleshooting section at the back of this manual and please consult the manual that came with your software for proper configuration within the software application.

Recalling Presets

Press the Preset "+" and "-" button to recall one of the preset memories. The LED will display the currently selected preset, preceded by a "p." Press the button again to change the preset to the next one in the series.

The following is a list of the presets contained in the 5 memory locations.

- 01 GM Preset
- 02 Reason Native
- 03 Reason Mixer
- 04 Yamaha XG/Roland JV Preset
- 05 Undefined CC's for MIDI learn*

*Some Applications do not have any default settings and require you to set the MIDI controllers for the application's parameters yourself. This normally involves placing the application in MIDI Learn Mode, clicking on a controller and moving the dial. With such an application, it is recommended that you use controller numbers that tend not to have any function associated with them. Ableton Live is an example of an application that uses the MIDI Learn feature.

Saving and Organizing Presets

You may want to save and reorganize the order of Presets to suit your setup.

Note that the factory presets are stored in ROM within the keyboard and can be restored at any time.

For example, let's move preset 2 ("Reason Native") to location 4 by carrying out the following procedure:

1. Recall preset 2 by pressing the Preset "+" and "-" buttons accordingly.
2. Press the ADVANCED FUNCTION button. The keyboard will enter Program Mode.
3. Press the STORE key on the keyboard.
4. Type in "4" using the numerical data entry keys.
5. Press the ENTER key to confirm.

This will save or store the current setup to preset location 4.

If you want to reset the M-Audio O$_2$ to the factory defaults, hold down the Preset "+" and "-" buttons while switching the keyboard on.

Note: Restoring the Factory presets will erase all setups you have programmed and stored to memory.

You can also organize and store your presets on your computer using the Enigma software. This software is available as a free download at www.m-audio.com. Simply register your M-Audio product and follow the instructions from there.

Sending a Snap Shot

Press the GLOBAL CHAN and MUTE buttons together to send a Snap Shot of the current controller assignments and their values.

Whe

Snap Shot is one way of synchronizing the receiving device with the faders and rotary controllers on your keyboard. The function can also be used as a creative tool, often with interesting and surprising results.

This function can also be used to set up the control parameters at the start of a song. If you set all the

controller values to obtain the desired effect levels in your song, you can then record the Snap Shot to ensure the song will always play back with the correct effect levels. To do this, put your sequencer into record mode and press the Snap Shot buttons.

Muting All Controllers

To Mute all rotary controllers and the fader, press the function button labelled MUTE.

This feature allows you to alter the position of the rotary controllers without affecting the settings of your

software. CTRL MUTE does not affect buttons, the foot switch or the keyboard. As soon as an assignable

button, a function key, or the keyboard is pressed, the controllers are turned back on. While Controller Mute

is engaged, the LED displays "Off"

Use this feature if you are switching between presets with the controllers out of position. You will be able to move the controller to a position relative to the software's controller value, rather than causing the software's controller value to jump.

Setting the Global MIDI Channel

The M-Audio O$_2$ can transmit on any of the standard 16 MIDI channels. If you are using a computer-based system, the software usually controls the routing of MIDI signals.

If you are using a MIDI sound module or connecting to another piece of MIDI equipment, you will need to make sure that both your M-Audio O$_2$ keyboard and the receiving unit are set to the same MIDI channel. The Global MIDI Channel affects the keyboard, Program, and Bank Changes, plus whatever controllers have been set to respond to the global setting.

To set the Global MIDI Channel:

1. Press the GLOBAL CHANNEL button. The keyboard enters Program Mode. The LED will display the currently selected Global Channel, preceded by a "c."
2. Type in the MIDI channel number using the numeric keys or use the preset "+/-" keys.
3. Press the ENTER key to accept the new channel, and exit Program Mode.

Octave

The keyboard can be shifted up or down to give you access to a total of 11 octaves on the M-Audio O$_2$.

1. Press "OCTAVE +" for every octave you want to shift the keyboard up.
2. Press "OCTAVE -" for every octave you want to shift the keyboard down

Transpose

You can transpose the keyboard to change the key of the music you are playing without changing the key you are playing in.

1. Press "TRANSPOSE" (OCTAVE + and OCTAVE – together).
2. Press the OCTAVE + or - key for every semi tone you want to transpose up or down.

You may have learned to play a piece of music in the key of C. To now play it in F you would need to press "TRANSPOSE" followed by 5 presses on the OCTAVE + key or 7 presses on the OCTAVE - button.

Pitch Bend Control

The Pitch Bend is used to bend the notes played on the keyboard up or down. This allows phrases not normally associated with keyboard playing, such as guitar riffs, to be played.

Your sound source determines how far you can bend the note. It is typically set to 2 semitones but can be up to 2 octaves +/-. When you release the control, it will reset back to 0.

The Pitch Bend control on your M-Audio O_2 keyboard is fully MIDI assignable. Please refer to the "Programming and Editing" section of this manual for more information.

Modulation Control

The Modulation control is used for modulation of the sound being played. This type of real-time controller was introduced on electronic keyboards to give the performer the option of adding vibrato to similar to acoustic instruments.

The Modulation control on your M-Audio O_2 keyboard is fully MIDI assignable. Please refer to the "Programming and Editing" section of this manual for more information.

Foot Switch

Any polarity foot switch (not included) can be plugged in to the foot switch input on your M-Audio O_2 keyboard. The keyboard will automatically detect the correct polarity upon powering on. If you want to reverse the polarity, make sure the pedal is pressed when you switch on your keyboard.

The foot switch is normally used for sustaining the sound you are playing without having to keep your hands on the keyboard. This is also the default function on your M-Audio O_2 keyboard.

On the M-Audio O_2, you can program the footswitch to send out MIDI notes that can trigger samples on different MIDI channels, without moving your hands from the keyboard. You can also send Program Changes any other MIDI message that can be sent from the 8 assignable MIDI buttons on your keyboard.

For more detail about how to program the foot switch, please read the "Programming and Editing" section of this manual.

MIDI Out

On the back of the keyboard is the MIDI output port that can connect to an external sound module or MIDI keyboard. By default, all controller data is sent out via the MIDI output as well as the USB out.

To have the MIDI output function like a USB-to-MIDI interface, engage "MIDI Out from USB" Mode by pressing the ADVANCED FUNCTION button and then the key on the keyboard labeled MIDI OUT.

For more information on "MIDI Out from USB" Mode, please read the "Programming and Editing" section of this manual.

Programming and Editing the M-Audio O_2

Introduction to Programming Options

Each of the M-Audio O_2's controllers can send MIDI CC, RPN/NRPN, GM 1&2, and SysEx messages. They can also be assigned to individual MIDI channels.

MIDI CC (continuous controller) numbers are part of the standard MIDI specifications and are typically used to control the real-time changing o

Any of the real-time controllers on the keyboard can be assigned to a MIDI CC number; the 8 assignable buttons and pedal have slightly different options from the Fader or rotary controllers.

The 2 charts show the transmit messages that can be programmed for each of the 8 knobs, the fader, and assignable MIDI buttons.

Please pay extra attention to the differences between programming the faders or knobs and programming the buttons.

The Fader and Rotary

Knobs: MIDI CC	Description	Data 2	Data 3
0-119	Standard MIDI CCs	Max	Min
120-127	Channel Mode Messages	Max	Min
128	Pitch Bend Sensitivity	-	-
129	Channel Fine Tune	-	-
130	Channel Coarse Tune	-	-
131	Channel Pressure	-	-
132	RPN Coarse	RPN LSB	RPN MSB
133	RPN Fine	RPN LSB	RPN MSB
134	NRPN Coarse	NRPN LSB	NRPN MSB
135	NRPN Fine	NRPN LSB	NRPN MSB
136	Master Volume GM*	-	-
137	Master Pan GM*	-	-
138	Master Coarse Tune GM*	-	-
139	Master Fine Tune GM*	-	-
140	Chorus Mod Rate GM2*	-	-
141	Chorus Mod Depth GM2*	-	-
142	Feedback GM2*	-	-
143	Send to Reverb GM2*	-	-
144	Pitch Bend	-	-
255	Controller Off***	-	-

The Buttons and Pedal:

MIDI CC	Description	Data 1	Data 2	Data 3
0-119	Standard MIDI CC's	-	Toggle value 2	Toggle value 1
120-127	Channel Mode Messages	-	Toggle value 2	Toggle value 1
128	Pitch Bend Range	-	Sensitivity value	-
129	Channel Fine Tune	-	Tuning amount	-
130	Channel Coarse Tune	-	Tuning amount	-
131	Channel Pressure	-	Pressure amount	-
132	RPN Coarse	Value	RPN LSB	RPN MSB
133	RPN Fine	Value	RPN LSB	RPN MSB
134	NRPN Coarse	Value	NRPN LSB	NRPN MSB
135	NRPN Fine	Value	NRPN LSB	NRPN MSB
136	Master Volume GM*	-	Volume LSB	Volume MSB
137	Master Pan GM*	-	Pan LSB	Pan MSB
138	Master Coarse Tune GM*	-	Tuning LSB	Tuning MSB
139	Master Fine Tune GM*	-	Tuning LSB	Tuning MSB
140	Chorus Mod rate GM2*	-	Mod rate	-
141	Chorus Mod Depth GM2*	-	Mod depth	-
142	Feedback GM2*	-	Feedback level	-
143	Send to Reverb GM2*	-	Reverb send level	-
144	Pitch Bend	-	Pitch shift LSB	Pitch shift MSB
145	Program/Bank Preset	Program	Bank LSB	Bank MSB
146	MIDI CC (on/off)	MIDI CC	Button press value	Button release value
147	Note (on/off)	Note	Velocity off	Velocity on
148	Note (on/off toggle)	Note	Velocity off	Velocity on
149	MMC Command**	-	Command select.	-
150	Reverb Type GM2 *	-	Type	-
151	Reverb Time GM2 *	-	Time	-
152	Chorus Type GM2*	-	Type	-
153	MIDI CC Decrement	MIDI CC	Start value	End value
154	MIDI CC Increment	MIDI CC	Start value	End value
255	Controller Off***	-	-	-

*General MIDI Sys Ex messages (for details please see page 12 & 13)
**General MIDI 2 Sys Ex messages
*** MMC Sys Ex messages (for details please see page 7 & 13)
****This value cannot be typed in using the numerical data entry keys. Type in 144 and then press the preset + button to set this value.

Basic Programming Operations

To alter the assignment of one of the 0_2's controllers:

1. Press the ADVANCED FUNCTION button.
   The keyboard will enter Program Mode.
2. Press the CTRL ASSIGN key on the keyboard.
3. Type in the new MIDI CC number using the numerical data entry keys.
   You should see the LED display show this number.
4. Press the ENTER key to confirm.

Move any of the rotary controllers to see the numbers in the LED display change and show the controller's current value. The MIDI controller number that is assigned to the dial last turned is shown on the LED. The last turned dial is always the one selected for editing in Program Mode.

As you create custom setups, be sure you store your changes to a memory location before recalling any other setups.

Selecting a Controller for Editing

To assign a MIDI CC to one of the M-Audio O_2's controllers, it needs to be selected for editing.

1. Press the ADVANCED FUNCTION button, then the CTRL SEL key.
   The LED will display the number of the currently selected controller, preceded by a "C," or "F" if the controller is the fader.
2. Type in the number of the controller using the numerical data entry keys, or the preset +/- buttons.
3. Press the ENTER key to confirm.
   or
1. Move a rotary controller/fader.
Simply move the controller, assignable button, or pedal to select it for editing.

Assigning MIDI CCs

After the controller to edit is selected, change the assigned MIDI CC number in the following way:

1. Press the ADVANCED FUNCTION button, then the CTRL ASGN key.
   The LED will indicate the currently assigned MIDI CC number.
2. Type in a new MIDI CC value using the numerical data entry keys, or the preset +/- buttons.
3. Press the ENTER key to confirm.

Assigning an Individual MIDI Channel

1. Select the controller you wish to edit.
2. Press the ADVANCED FUNCTION button, then the CHAN ASGN key.
   The LED will show the current channel assignment of the selected controller, preceded by a "c."
3. Type the MIDI channel number the controller is to send on (0-16) using the numerical data entry keys or the preset +/- buttons.
4. Press the ENTER key to confirm.
If the controller is assigned to channel 0, it will transmit on the Global Channel.

Limiting the Range of the Controls

Normally, the range of a MIDI controller is 0 to 127. It is possible to limit the maximum and minimum in this range.

1. Press the ADVANCED FUNCTION button, followed by the DATA 2 (MIN) key. The LED will display the current Minimum limit of the controller.
2. Type in the Minimum desired value using the numerical data entry keys or the Preset +/- buttons.
3. Press the ENTER key to confirm.
   Program Mode will exit and the controller's CC assignment will be displayed on the LED.
4. Press the ADVANCED FUNCTION button, followed by the DATA 3 (MAX) key.
   The LED will display the current Maximum limit of the controller.
5. Type in the Maximum value using the numerical data entry keys or the Preset +/- buttons.
6. Press the ENTER key to confirm.

It is possible to limit the range of any rotary dial, the fader, or the Pitch bend and modulation controls. Buttons and the pedal can be set to decrement or increment between two limits. To do this:

1. Press the ADVANCED FUNCTION button, followed by the CTRL ASGN key.
2. Enter '153' for decrement or '154' for increment.
3. Press the ENTER key to confirm.
4. Press the ADVANCED FUNCTION button, followed by the DATA 1 key.
5. Enter the value of the MIDI CC you want the button to send out.
6. Press the ENTER key to confirm.
7. Enter the limits as described above.

Setting Toggle Values for the Buttons

The 8 assignable buttons and the pedal can each be assigned to toggle between two values.

This is how:

1. Press the ADVANCED FUNCTION button, followed by the DATA 2 (MIN) key.
2. Type in the Minimum desired toggle number using the numerical data entry keys or the Preset +/- buttons.
3. Press the ENTER key to confirm.
4. Press the ADVANCED FUNCTION button, followed by the DATA 3 (MAX) key.
5. Type in Maximum desired toggle number using the numerical data entry keys or the Preset +/- buttons.
6. Press the ENTER key to confirm.

If you want the button to send the same value every time, type in the same value both times.

The above method will toggle the button each time you press it. It is also possible to set the button to send one value when you press it, and another value when you release it. To do this:

1. Press the ADVANCED FUNCTION button, followed by the DATA 1 key.
2. Type in 146 using the numerical data entry keys.
    This sets the button up for MIDI CC (On/Off) mode, as shown in Appendix B.
3. Press ENTER to confirm.
4. Assign the two toggle values for press (DATA 3) and release (DATA 2) as described above.

Program Changes

Send out a program change message to the sound card, sound module, instrument or other MIDI device that will receive this standard MIDI message. The program change will be sent on the global MIDI channel.

1. Press the ADVANCED FUNCTION button. The keyboard will enter Program Mode.
2. Press the PROGRAM key on the keyboard.
3. Type in the program number you wish to send, using the numerical data entry keys, or the
4. Preset +/- buttons.
5. Press the ENTER key to confirm.

The assignable buttons can be programmed to send out fixed program messages to individual MIDI channels. For further information regarding this method, please refer to the "MIDI Messages Explained" section of this manual

Bank Changes

If the receiving device has more than 128 programs, access the additional banks by sending out Bank Change LSB and MSB messages.

1. Press the ADVANCED FUNCTION button. The keyboard will enter Program Mode.
2. Press the BANK LSB or BANK MSB key on the keyboard.
3. Type in the bank number you wish to send, using the numerical data entry keys, or the Preset +/- buttons.
4. Press the ENTER key to confirm.

Please check the documentation for your receiving device to ensure that it will respond to these messages.

For more information about LSB and MSB, please refer to the "MIDI Messages Explained" section of this manual.

RPN/NRPN, GM 1&2, Sys Ex and Other Messages

The standard MIDI controller numbers range from 0 to 131. The list of MIDI CC's that can be assigned to the controllers of the keyboard has been extended to include RPN/NRPN, MMC, and General MIDI 1&2 Sys Ex messages.

These advanced messages are as easily programmed by entering values 132 to154 when programming MIDI CCs. The charts in Appendix B show which number corresponds to each message.

To program the values required for these advanced messages, press the ADVANCED FUNCTION button to enter Program Mode. After entering Program Mode, press the DATA 1, DATA 2 or DATA 3 button. For more information, please refer to Appendix B.

Assigning MMC Control to a Button

1. Select the button you want to control the MMC message.
2. Press the ADVANCED FUNCTION button, then the CTRL ASGN key.
3. Type in "149" using the numerical data entry keys.
    This is the number that corresponds to the MMC instruction, as per the chart in Appendix B.
4. Press the ADVANCED FUNCTION button, then the CHAN key.
5. Type in "127" using the numerical keypad.
    This ensures that the message is sent to all device ID numbers. For more information about this,
    please read "the About Sys Ex Messages & Device ID" section later in the manual.
6. Press the ADVANCED FUNCTION button, then the DATA 2 key.
7. Enter a number from the chart below to select the MMC message you want:

Number	MMC Command
01	STOP
02	PLAY
03	DEFERRED PLAY
04	FAST FORWARD
05	REWIND
06	RECORD STROBE
07	RECORD EXIT
08	RECORD PAUSE
09	PAUSE
10	EJECT
11	CHASE
12	COMMAND ERROR RESET
13	MMC RESET

Assigning RPN/NRPN to a Fader/Rotary Controller

Note: For a detailed description of RPN/NRPN data, see the "RPN/NRPNs Explained" section later in the manual.

1. Select the controller to assign as described earlier.
2. Press the ADVANCED FUNCTION button, then the CTRL ASGN key.
    While the display is flashing, enter controller 132 for RPN Coarse, 133 for RPN Fine, 134 for NRPN
    Coarse or 135 for NRPN Fine using the numerical data entry keys or Preset +/- buttons.
3. Press Enter to confirm the number entered.
4. Press the ADVANCED FUNCTION button, then the DATA 3 key.
    This assigns the number for the RPN/NRPN MSB.
5. Press the ADVANCED FUNCTION button, then the DATA 2 key.
    This assigns the number for the RPN/NRPN LSB.
6. Finally, set the channel that the message should be sent on.

Many data sheets for synths make use of NRPN messages and will give the MSB and LSB values that

should be entered for DATA 3 and DATA 2 (See Appendix F). Some manuals may only give the hex values, but the M-Audio O$_2$ requires the decimal value be entered. Convert hexadecimal values to decimal values using the windows calculator; select Scientific mode, select Hex, then enter the hexadecimal value needed to convert. Press the Dec button to convert it to a decimal value. Please reference Appendix C for more information.

Assigning a Note to a Button

The following shows the procedure for setting a button to transmit a MIDI Note On message when pressed, and a MIDI Note Off message when released.

1. Press the ADVANCED FUNCTION button, then the CTRL ASGN key.
2. Enter "147" using the numerical data entry keys or the preset +/- buttons.
3. Press the ENTER key to confirm.
   This is the MIDI CC number that corresponds to Note On/Off mode, shown in Appendix B.
4. Press the ADVANCED FUNCTION button, then the DATA 3 key.
5. Enter "100" using the numerical data entry keys or the Preset +/- buttons.
6. Press the ENTER key to confirm.
   When a button is pressed, a Note On message is sent out with a velocity of 100.
7. Press the ADVANCED FUNCTION button, then the DATA 2 key.
8. Enter "0" using the numerical data entry keys or the Preset +/- buttons.
9. Press the ENTER KEY to confirm.
   When a button is released, a Note Off message will be sent out.
10. Press the ADVANCED FUNCTION button, then the DATA 1 key.
11. Enter "64" using the numerical data entry keys or the Preset +/- buttons.
12. Press the ENTER key to confirm.
    These assignments will send out MIDI Note 64 or E4 each time the button is pressed.

The MIDI Note numbers are given in Appendix D.

Note: When you press the button in Note Mode, the LED display will briefly show the note velocity.

About SysEx Messages and Device ID

When transmitting SysEx messages, the individual control channel number does not define a transmit channel, but a Device ID. When the CHAN key is pressed, the "c" is NOT displayed in the LED screen.

Device IDs range between 00–127. In most cases, the Device ID should be set at 127. This means that the SysEx message will be received by all devices.

The Device ID for a SysEx message assigned to a controller cannot be changed using the

DEV ID key. This key is used for varying the global Device ID of the M-Audio O_2.

For more information please reference the "SysEx Messages" and "Device ID" sections later in the manual.

Non-Volatile Memory

The M-Audio O_2 uses non-volatile memory, allowing the memory to save after powering down and restarting. The current controller and channel assignments are stored whether you have stored the setup to a memory location or not. The Program, Bank LSB and Bank MSB data, global channel setting, MIDI Out from USB setting and last used memory preset are also stored.

Memory Dump

Press the ADVANCED FUNCTION, then MEM DUMP key to send out a number of SysEx data packets that represent the 5 memories set up in the M-Audio O_2. This can be used for storing or backing up the contents of the memory presets externally.

It is possible to record the complete Memory Dump to a standard sequencer. Recall the Memory Dump by

playing the MIDI track containing the recorded Memory Dump, making sure that the M-Audio O_2's drivers are selected as output for that particular track.

The current controller assignments are not affected by a Memory Dump, or a memory send to the keyboard. Recall a preset to access the new memory settings after a memory dump has been sent to the keyboard.

Assigning the Device ID

Press the ADVANCED FUNCTION, then DEV ID key to assign a Device ID to the M-Audio O_2. The default Device ID is 127 when a memory dump is performed; that dump can be received by the same keyboard model regardless of the Device ID setting.

If a Device ID is assigned to any number other than 127, the Memory Dump performed will be specific to the

M-Audio O_2, with the same device ID. If the Device ID of the M-Audio O_2 differs from the one recorded with the Memory Dump, the data will be ignored.

The Device ID is a way of differentiating between multiple keyboards.   It is recommended to keep the Device ID setting as 127.

When the DEV ID key is pressed, the LED display represents the assigned Device ID. It is possible to enter a new device ID using the numerical data entry keys, or the Preset +/- buttons. Press the ENTER key to confirm.

For more information on Sys Ex messages and device ID, please reference the "MIDI Messages Explained" section of this manual.

MIDI Out from USB Mode

MIDI Out from USB Mode allows use of the M-Audio O₂ as a USB-to-MIDI interface. When MIDI Out from USB Mode is engaged, data transmitted from the MIDI Out port of the O₂ is received at the USB port. If MIDI Out from USB is active and the M-Audio O₂ is selected as the USB output device in your software, all data from the software is passed to the MIDI Out port of the O₂.

To activate MIDI Out from USB Mode:

1. Press the ADVANCED FUNCTION button.
2. Press the MIDI OUT key.
   The LED display will show "USB," indicating that the MIDI Out port is now set to transmit data from the USB port. Program Mode will automatically cancel.

When MIDI Out from USB Mode is NOT active, the MIDI Out port will mirror the data that is sent via USB from the M-Audio O₂ controller. To disengage MIDI Out from USB Mode:

1. Press the ADVANCED FUNCTION button.
2. Press the MIDI OUT key.
   The LED display will show 'Int'. This indicates that the M-Audio O₂ keyboard is transmitting data from the keys and controllers of the M-Audio O₂.

Resetting to the Factory Default Setting

To reset the M-Audio O₂ back to the factory defaults, switch off the O₂. Then, with the unit off, hold down the Preset +/- buttons and turn the unit on.

Note: Restoring the factory presets will erase all setups you have stored to memory.

MIDI Messages Explained

Program and Bank Changes Explained

The original GM MIDI specification allowed for only 128 voices, numbered from 0-127. It is possible to access a different voice by sending a Program Change.

In order to expand on the GM set of voices, Bank Changes were devised. Each bank contains 128 patches that can be accessed using a Program Change. There are 16,384 available banks that can be accessed by sending a 14-bit Bank Change message. The first 7 bits of this message are sent in a single byte known as the Bank LSB. The last 7 bits are specified by another byte known as the Bank MSB. The BANK LSB is the most commonly used. This allows for 128 Bank Changes, and often there is no need to send a Bank MSB.

Almost all MIDI devices respond to the Program Change, but some that do not conform to the GM set of voices use the Program Change message for other purposes. Many VST instruments have adopted this approach, allowing the use of a Program Change to change the instrument patch. (The FM7 by Native Instruments is an example of this.)

Bank Changes are used more rarely. Bank Changes are useful in manufacturer's extensions to the MIDI specification, such as Roland's GS specification and Yamaha's XG specification. Both of these require the specification of a Bank Change in order to access the extra voices and effects that these specifications provide.

Sending Program, Bank LSB and Bank MSB data is done via the M-Audio O₂. Simply press the ADVANCED FUNCTION button followed by the PROGRAM, DATA LSB or DATA MSB key, then enter the Program or Bank Change desired.

RPN/NRPNs Explained

Non-registered parameter numbers (NRPN's) are device-specific messages that enable the control of synths via MIDI. The MIDI specification defines parameter numbers to allow room for manufacturers to specify their own controllers. The more common of these have been registered by the MIDI Manufacturer's Association and are part of the MIDI specification (hence the term Registered Parameter Numbers – RPN's). (See Appendix F for additional information.)

MIDI controllers 98 and 99 represent the NRPN LSB and MSB respectively, while 100 and 101 represent the RPN LSB and MSB. This can be seen in the MIDI controllers list in Appendix D. To transmit an NRPN/RPN, these two controller messages are sent along with their user-specified values. An additional controller message and value needs to be sent to specify the (coarse or fine) value adjustment. This is specified by controller number 6 (Data Entry) for coarse adjustments or number 38 for fine adjustments.

Devices that receive NRPN messages will list NRPNs in the User Manual. It is essential that the NRPN MSB and LSB messages are sent together. Both will be specified in the device's manual, but oftentimes only in Hexadecimal format. If this is the case, you may refer to Appendix C for help translating the value to Decimal.

The M-Audio O₂ keyboard greatly simplifies the process of transmitting NRPNs. Enter the appropriate NRPN LSB by pressing the LSB/DATA button twice, enter the NRPN MSB by pressing the MSB/DATA button twice, and as the controller is moved, an appropriate NRPN message will be sent out. Assign NRPN Coarse to make big sweeps, or NRPN Fine to make slight adjustments.

SysEx Explained

System Exclusive (SysEx) messages were defined in the MIDI specification to allow individual devices to have individual control via MIDI. The format of SysEx messages allows for virtually any function to be performed via MIDI—so long as the receiving device is able to translate the message and act accordingly. This allows devices to send audio sample memory data, memory dumps, controller settings, and much more. It also allows the controllers of one device to be controlled by another.

It is not possible to program your own specified SysEx message into the M-Audio O_2. However, several useful Sys Ex messages are pre-programmed into the keyboard. They can be accessed by assigning the appropriate MIDI CC to a controller (see Appendix B).

It should be noted that a SysEx message is not transmitted on any specified channel. All SysEx messages contain a Device ID, which is used to single out devices to respond to the SysEx message. All other devices are ignored. If you are using a SysEx message on the M-Audio O_2, the Global Channel is ignored. When you press the CHAN key, instead of entering a channel for the controller, you will enter a Device ID instead. This is indicated by the fact that the LED displays a 3-digit number, not a 2-digit number proceeded by a "c."

Device ID's run from 00 to 127. 127 is the default device number setting on the M-Audio O_2. This setting transmits the SysEx message to all devices.

Although it is not possible to program the controllers of the M-Audio O_2 with your own SysEx messages, there are software applications that can receive a MIDI input signal and transmit a different, user-specified message. You can program your SysEx messages into the translator software, and then translate the incoming data from the keyboard to your SysEx, depending on the controller you are using.

General Trouble-Shooting

Here are answers to common questions you may have, using your M-Audio O_2 keyboard:

Problem 1: My keyboard suddenly stopped working after having performed fine since installation.

Solution 1: Switch off the unit and let it sit for 10 seconds. Then restart your computer and try again. If the problem persists you may have to reinstall drivers for the unit.

Problem 2: I have plugged a sustain pedal into my keyboard, but it works the wrong way around.

Solution 2: The polarity of the sustain pedal is calculated by the keyboard when it is powered up. On power up, the sustain pedal is assumed to be in the OFF position. So if you want the sustain pedal to be off when it is not depressed, make sure the pedal is not depressed when you power up.

Problem 3: When I press a key, there is a delay before I hear any sound.

Solution 3: This delay is known as latency. Latency with MIDI signals is due to the software application you are using. MIDI data is simply control data. The MIDI data is read by your software. The software then completes a large number of complex calculations in order to produce the sound you hear–all this takes time.

We strongly recommend a proper soundcard. Refer to www.m-audio.com for a selection of USB, PCI and FireWire audio cards. If you already have an adequate sound card, try reinstalling the latest drivers for the sound card, or try reducing the buffer sizes of the audio drivers.

Contact M-Audio

If you have any questions, comments or suggestions about this or any M-Audio product, we invite you to contact us by using the following information:

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Warranty Terms & Registration

Warranty Terms

M-Audio warrants products to be free from defects in materials and workmanship, under normal use and provided that the product is owned by the original, registered user. Visit www.m-audio.com/warranty for terms and limitations applying to your specific product.

Warranty Registration

Thank you for registering your new M-Audio product. Doing so immediately both entitles you to full warranty coverage and helps M-Audio develop and manufacture the finest quality products available. Register online at www.m-audio.com/register to receive FREE product updates and for the chance to win FREE M-Audio gear.

Technical Info

Modifications not authorized by the manufacturer may void users authority to operate this device.

Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.

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CE

M-AUDIO® O₂

FCC Tested to comply with FCC standards

FOR HOME OR STUDIO USE

ESD and Fast Transient may cause the unit to temporarily malfunction.
Switch off and on again to restore normal operation.

Appendices

Appendix A - MIDI IMPLEMENTATION CHART

Function		Transmitted	Received	Remarks
Basic :Default		1-16	X	
Channel: Changed		1-16		
:Default		---------		
Mode :Messages		X	X	
:Altered		*********		
Note		0-127	X	
Number: True Voice		*********		
Velocity: Note ON		0	X	
: Note OFF		X		
After : Keys		X	X	
Touch :Ch's		0		
Pitch Bend		0	X	
Control	0-119	0	X	
Change				
	120-127	0	X	
Program		0-127	X	
Change: True Number		*********		
System Exclusive		GM, GM2, MMC	Memory Dump	
Song Position		X		
Common: Song Select		X	X	
System :Clock		X	X	
Exclusive: Commands		X		
Aux :Local ON/OFF		0		
Messages :All Notes OFF		0	X	
:Active Sense		0		
:Reset		0		
Notes:		0 = YES	X=NO	

Appendix B - Assignable MIDI CC's on the M-Audio O₂

B1 - The Fader and rotary Controllers:

MIDI CC	Description	Data Lsb (Press Twice)	Data Msb (Press Twice)
0-119	Standard MIDI CC's	-	-
120-127	Channel Mode Messages	-	-
128	Pitch Bend Sensitivity	-	-
129	Channel Fine Tune	-	-
130	Channel Coarse Tune	-	-
131	Channel Pressure	-	-
132	RPN Coarse	RPN LSB	RPN MSB
133	RPN Fine	RPN LSB	RPN MSB
134	NRPN Coarse	NRPN LSB	NRPN MSB
135	NRPN Fine	NRPN LSB	NRPN MSB
136	Master Volume GM*	Volume LSB	Volume MSB
137	Master Pan GM*	Pan LSB	Pan MSB
138	Master Coarse Tune GM*	Tuning LSB	Tuning MSB
139	Master Fine Tune GM*	Tuning LSB	Tuning MSB
140	Chorus Mod Rate GM2*	Mod rate	-
141	Chorus Mod Depth GM2*	Mod depth	-
142	Feedback GM2*	Feedback level	-
143	Send to Reverb GM2*	Reverb send level	-
144	Pitch Bend	Pitch shift LSB	Pitch shift MSB
255	Controller Off***	-	-

*   Sys Ex messages
**   MMC Sys Ex messages
*** This value cannot be typed in using the numerical keypad. Type in 144 and then press the Preset + button to set this value.

The Buttons and Pedal:

MIDI CC	Description	Program (Press Twice)	Data Lsb (Press Twice)	Data Msb (Press Twice)
0-119	Standard MIDI CC's	-	Toggle value 2	Toggle value 1
120-127	Channel Mode Messages	-	Toggle value 2	Toggle value 1
128	Pitch Bend Range	-	Sensitivity value	-
129	Channel Fine Tune	-	Tuning amount	-
130	Channel Coarse Tune	-	Tuning amount	-
131	Channel Pressure	-	Pressure amount	-
132	RPN Coarse	Value	RPN LSB	RPN MSB
133	RPN Fine	Value	RPN LSB	RPN MSB
134	NRPN Coarse	Value	NRPN LSB	NRPN MSB
135	NRPN Fine	Value	NRPN LSB	NRPN MSB
136	Master Volume GM*	-	Volume LSB	Volume MSB
137	Master Pan GM*	-	Pan LSB	Pan MSB
138	Master Coarse Tune GM*	-	Tuning LSB	Tuning MSB
139	Master Fine Tune GM*	-	Tuning LSB	Tuning MSB
140	Chorus Mod Rate GM2*	-	Mod rate	-
141	Chorus Mod Depth GM2*	-	Mod depth	-
142	Feedback GM2*	-	Feedback level	-
143	Send to Reverb GM2*	-	Reverb send level	-
144	Pitch Bend	-	Pitch shift LSB	Pitch shift MSB
145	Program/Bank Preset	Program	Bank LSB	Bank MSB
146	MIDI CC (on/off)	MIDI CC	Button press value	Button release value
147	Note (on/off)	Note	Velocity off	Velocity on
148	Note (on/off toggle)	Note	Velocity off	Velocity on
149	MMC Command**	-	Command select.	-
150	Reverb Type GM2 *	-	Type	-
151	Reverb Time GM2 *	-	Time	-
152	Chorus Type GM2*	-	Type	-
153	MIDI CC Decrement	MIDI CC	Start value	End value
154	MIDI CC Increment	MIDI CC	Start value	End value
255	Controller Off***	-	-	-

*   Sys Ex messages
**   MMC Sys Ex messages
*** This value cannot be typed in using the numerical keypad. Type in 144 and then press the Preset + button to set this value.

Appendix C - Hexadecimal Conversion Chart

Hexadecimal to Decimal Conversion Chart

Hexadecimal Value	Decimal Value	Hexadecimal Value	Decimal Value	Hexadecimal Value	Decimal Value
0	0	2B	43	56	86
1	1	2C	44	57	87
2	2	2D	45	58	88
3	3	2E	46	59	89
4	4	2F	47	5A	90
5	5	30	48	5B	91
6	6	31	49	5C	92
7	7	32	50	5D	93
8	8	33	51	5E	94
9	9	34	52	5F	95
0A	10	35	53	60	96
0B	11	36	54	61	97
0C	12	37	55	62	98
0D	13	38	56	63	99
0E	14	39	57	64	100
0F	15	3A	58	65	101
10	16	3B	59	66	102
11	17	3C	60	67	103
12	18	3D	61	68	104
13	19	3E	62	69	105
14	20	3F	63	6A	106
15	21	40	64	6B	107
16	22	41	65	6C	108
17	23	42	66	6D	109
18	24	43	67	6E	110
19	25	44	68	6F	111
1A	26	45	69	70	112
1B	27	46	70	71	113
1C	28	47	71	72	114
1D	29	48	72	73	115
1E	30	49	73	74	116
1F	31	4A	74	75	117
20	32	4B	75	76	118
21	33	4C	76	77	119
22	34	4D	77	78	120
23	35	4E	78	79	121
24	36	4F	79	7A	122
25	37	50	80	7B	123
26	38	51	81	7C	124
27	39	52	82	7D	125
28	40	53	83	7E	126
29	41	54	84	7F	127
2A	42	55	85		

Appendix D - Useful MIDI data

General MIDI Instruments

Piano	Bass	Reed	Synth Effects
0 Acoustic Grand Piano	32 Acoustic Bass	64 Soprano Sax	96 SFX Rain
1 Bright Acoustic Piano	33 Fingered Bass	65 Alto Sax	97 SFX Soundtrack
2 Electric grand Piano	34 Electric Picked Bass	66 Tenor Sax	98 SFX Crystal
3 Honky Tonk Piano	35 Fretless Bass	67 Baritone Sax	99 SFX Atmosphere
4 Electric Piano 1	36 Slap Bass 1	68 Oboe	100 SFX Brightness
5 Electric Piano 2	37 Slap Bass 2	69 English Horn	101 SFX Goblins
6 Harpsichord	38 Syn Bass 1	70 Bassoon	102 SFX Echoes
7 Clavinet	39 Syn Bass 2	71 Clarinet	103 SFX Sci-Fi
Chromatic Percussion	**Strings/Orchestra**	**Pipe**	**Ethnic**
8 Celesta	40 Violin	72 Piccolo	104 Sitar
9 Glockenspiel	41 Viola	73 Flute	105 Banjo
10 Music Box	42 Cello	74 Recorder	106 Shamisen
11 Vibraphone	43 Contrabass	75 Pan Flute	107 Koto
12 Marimba	44 Tremolo Strings	76 Bottle Blow	108 Kalimba
13 Xylophone	45 Pizzicato Strings	77 Shakuhachi	109 Bag Pipe
14 Tubular bells	46 Orchestral Harp	78 Whistle	110 Fiddle
15 Dulcimer	47 Timpani	79 Ocarina	111 Shanai
Organ	**Ensemble**	**Synth Lead**	**Percussive**
16 Drawbar Organ	48 String Ensemble 1	80 Syn Square Wave	112 Tinkle Bell
17 Percussive Organ	49 String Ensemble 2	81 Syn Sawtooth Wave	113 Agogo
18 Rock Organ	50 Syn Strings 1	82 Syn Calliope	114 Steel Drums
19 Church Organ	51 Syn Strings 2	83 Syn Chiff	115 Woodblock
20 Reed Organ	52 Choir Aahs	84 Syn Charang	116 Taiko Drum
21 Accordion	53 Voice Oohs	85 Syn Voice	117 Melodic Tom
22 Harmonica	54 Syn Choir	86 Syn Sawtooth Wave	118 Syn Drum
23 Tango Accordion	55 Orchestral Hit	87 Syn Brass & Lead	119 Reverse Cymbal
Guitar	**Brass**	**Synth Pad**	**Sound Effects**
24 Nylon Acoustic	56 Trumpet	88 New Age Syn Pad	120 Guitar Fret Noise
25 Steel Acoustic	57 Trombone	89 Warm Syn Pad	121 Breath Noise
26 Jazz Electric	58 Tuba	90 Polysynth Syn Pad	122 Seashore
27 Clean Electric	59 Muted Trumpet	91 Choir Syn Pad	123 Bird Tweet
28 Muted Electric	60 French Horn	92 Bowed Syn Pad	124 Telephone Ring
29 Overdrive	61 Brass Section	93 Metal Syn Pad	125 Helicopter
30 Distorted	61 Syn Brass 1	94 Halo Syn Pad	126 Applause
31 Harmonics	62 Syn Brass 2	95 Sweep Syn Pad	127 Gun Shot

MIDI Note Numbers

Octave (n)	Note Numbers											
	Cn	C#n	Dn	D#n	En	Fn	F#n	Gn	G#n	An	A#n	Bn
-1	0	1	2	3	4	5	6	7	8	9	10	11
0	12	13	14	15	16	17	18	19	20	21	22	23
1	24	25	26	27	28	29	30	31	32	33	34	35
2	36	37	38	39	40	41	42	43	44	45	46	47
3	48	49	50	51	52	53	54	55	56	57	58	59
4	60	61	62	63	64	65	66	67	68	69	70	71
5	72	73	74	75	76	77	78	79	80	81	82	83
6	84	85	86	87	88	89	90	91	92	93	94	95
7	96	97	98	99	100	101	102	103	104	105	106	107
8	108	109	110	111	112	113	114	115	116	117	118	119
9	120	121	122	123	124	125	126	127				

Appendix E - Standard MIDI Controller numbers (MIDI CC's)

00	Bank Select	46	Controller 46	92	Tremelo Depth
01	Modulation	47	Controller 47	93	Chorus Depth
02	Breath Control	48	Gen Purpose 1 LSB	94	Celeste (De-tune)
03	Controller 3	49	Gen Purpose 2 LSB	95	Phaser Depth
04	Foot Control	50	Gen Purpose 3 LSB	96	Data Increment
05	Porta Time	51	Gen Purpose 4 LSB	97	Data Decrement
06	Data Entry	52	Controller 52	98	Non-Reg Param LSB
07	Channel Volume	53	Controller 53	99	Non-Reg Param MSB
08	Balance	54	Controller 54	100	Reg Param LSB
09	Controller 9	55	Controller 55	101	Reg Param MSB
10	Pan	56	Controller 56	102	Controller 102
11	Expression	57	Controller 57	103	Controller 103
12	Effects Controller 1	58	Controller 58	104	Controller 104
13	Effects Controller 2	59	Controller 59	105	Controller 105
14	Controller 14	60	Controller 60	106	Controller 106
15	Controller 15	61	Controller 61	107	Controller 107
16	Gen Purpose 1	62	Controller 62	108	Controller 108
17	Gen Purpose 2	63	Controller 63	109	Controller 109
18	Gen Purpose 3	64	Sustain Pedal	110	Controller 110
19	Gen Purpose 4	65	Portamento	111	Controller 111
20	Controller 20	66	Sostenuto	112	Controller 112
21	Controller 21	67	Soft Pedal	113	Controller 113
22	Controller 22	68	Legato Pedal	114	Controller 114
23	Controller 23	69	Hold 2	115	Controller 115
24	Controller 24	70	Sound Variation	116	Controller 116
25	Controller 25	71	Resonance	117	Controller 117
26	Controller 26	72	Release Time	118	Controller 118
27	Controller 27	73	Attack Time	119	Controller 119
28	Controller 28	74	Cut-off Frequency		
29	Controller 29	75	Controller 75	**Channel Mode Messages**	
30	Controller 30	76	Controller 76	120	All Sound off
31	Controller 31	77	Controller 77	121	Reset all Controllers
32	Bank Select LSB	78	Controller 78	122	Local Control
33	Modulation LSB	79	Controller 79	123	All Notes Off
34	Breath Control LSB	80	Gen Purpose 5	124	Omni Off
35	Controller 35	81	Gen Purpose 6	125	Omni On
36	Foot Control LSB	82	Gen Purpose 7	126	Mono On (Poly Off)
37	Porta Time LSB	83	Gen Purpose 8	127	Poly On (Mono Off)
38	Data Entry LSB	84	Portamento Control		
39	Channel Volume LSB	85	Controller 85	**Extra RPN Messages**	
40	Balance LSB	86	Controller 86	128	Pitch Bend sensitivity
41	Controller 41	87	Controller 87	129	Fine Tune
42	Pan LSB	88	Controller 88	130	Coarse Tune
43	Expression LSB	89	Controller 89	131	Channel Pressure
44	Controller 44	90	Controller 90		
45	Controller 45	91	Reverb Depth		

Appendix F - Roland GS and Yamaha XG NRPN Support to Roland JV/XP

NRPN	NRPN	Data	Data
MSB	LSB	MSB	LSB
CC99	CC98	CC06	CC38
01	08	00-7F	n/a (-64 - 0 - +63) Vibrato Rate (relative change)
01	09	00-7F	n/a (-64 - 0 - +63) Vibrato Depth (relative change)
01	0A	00-7F	n/a (-64 - 0 - +63) Vibrato Delay (relative change)
01	20	00-7F	n/a (-64 - 0 - +63) Filter Cutoff Freq. (relative change)
01	21	00-7F	n/a (-64 - 0 - +63) Filter Resonance (relative change)
01	63	00-7F	n/a (-64 - 0 - +63) EG (TVF&TVA) Attack Time (relative change)
01	64	00-7F	n/a (-64 - 0 - +63) EG (TVF&TVA) Decay Time (relative change)
01	66	00-7F	n/a (-64 - 0 - +63) EG (TVF&TVA) Release Time (relative change)
*14	00-7F	00-7F	n/a (-64 - 0 - +63) Drum Filter Cutoff Freq. (relative change)
*15	00-7F	00-7F	n/a (-64 - 0 - +63) Drum Filter Resonance (relative change)
*16	00-7F	00-7F	n/a (-64 - 0 - +63) Drum EG Attack Rate (relative change)
*17	00-7F	00-7F	n/a (-64 - 0 - +63) Drum EG Decay Rate (relative change)
18	00-7F	00-7F	n/a (-64 - 0 - +63) Drum Instrument Pitch Coarse (relative change)
*19	00-7F	00-7F	n/a (-64 - 0 - +63) Drum Instrument Pitch Fine (relative change)
1A	00-7F	00-7F	n/a (0 to Max) Drum Instrument Level (absolute change)
1C	00-7F	00-7F	n/a (Random, L>C>R) Drum Instrument Panpot (absolute change)
1D	00-7F	00-7F	n/a (0 to Max) Drum Instrument Reverb Send Level (absolute change)
1E	00-7F	00-7F	n/a (0 to Max) Drum Instrument Chorus Send Level (absolute change)
%1F	00-7F	00-7F	n/a (0 to Max) Drum Instrument Variation Send Level (absolute change)

* added by Yamaha XG; % changed from Delay to Variation by Yamaha XG

Appendix G - General MIDI Reverb and Chorus Types

Reverb Types

0: Small Room

1: Medium Room

2: Large Room

3: Medium Hall

4: Large Hall

8: Plate

Chorus Types

0: Chorus 1

1: Chorus 2

2: Chorus 3

3: Chorus 4

4: FB Chorus

5: Flanger