LAUNCHKEY

MK2 Programmers Reference guide

Version 1.01
Written by Danny Nugent

Contents

About This Guide

The Launchkey MK2 is a class compliant MIDI device that communicates using MIDI over USB. Using the right MIDI messages it is possible to have control over various parameters of your keyboard, from lighting LEDs to selecting which mode it operates in. This guide will provide all the information needed to start creating unique software for your Launchkey MK2.

Number systems and MIDI conventions

This guide will express MIDI data in three ways. The first will be a shortened description of the message. For example C3 would be used to represent the note number 60 or CC 1 would represent control change 1.

MIDI messages will also be expressed as plain MIDI bytes in both hexadecimal and decimal. Hex numbers will be represented with a lower case "h". The decimal equivalent will be given in brackets after the hex numbers.

For example : B0h, 01h, 7Fh << Hexadecimal
(176, 1, 127). << Decimal equivalent

MIDI Port Communication

The Launchkey has 2 MIDI ports, MIDI (port 1) and InControl (port 2). Unless otherwise stated, all computer to Launchkey MIDI communication mentioned in this guide should be sent on the InControl Port.

For Max MSP users

This guide also has an accompanying series of tutorial patches for Cycling 74's Max MSP software. These will provide a good starting point for anyone using Max or Max for Live but are in no way a complete guide to using your Launchkey in this environment. If you don't own a copy of Max you can download a runtime version from www.cycling74.com. Max for Live users will already have a runtime copy installed on their computer.

Basic and Extended Mode

The Launchkey has two key modes useful for programming, Basic and Extended mode. In its standard use Basic mode acts as a generic MIDI controller while Extended mode handles all communication with Ableton Live for the Launchkey's InControl functions. The Launchkey will behave slightly different in each mode which this guide will go into more detail later on.

One of the key differences between the modes is which MIDI port they send data out of. The Launchkey has two MIDI ports, Launchkey MIDI and LaunchKey InControl. When in Basic mode the keyboard will send data out of the MIDI port. In Extended mode (InControl mode) data will be sent out of the InControl port. The keys and pitch/mod wheels do not respond to mode changes and will always send data out of the MIDI port.

Changing Mode

When you connect your Launchkey it will default to Basic mode. To enter extended mode send the following MIDI message to the Launchkey.

Extended Mode Online Message: *MIDI Channel 16, Note C-1, Velocity 127*
9Fh, 0Ch, 7Fh (159, 12, 127)

When the keyboard enters Extended mode the InControl buttons should light up.

To switch back to basic mode send the following message.

Extended Mode Offline Message: *MIDI Channel 16, Note C-1, Velocity 0*
9Fh, 0Ch, 00h (159, 12, 0)

InControl LEDs should switch off now.

The Launchkey will confirm that it has received a online/offline message by sending the same message back to the computer on the InControl port.

For examples, see "Switching Modes.maxpat "

InControl Buttons

In Extended mode it is possible to switch sections of the Launchkey between InControl mode and Basic mode function. This can be done by using the InControl buttons on the device or sending the following messages;

Section	Basic to InControl Message	InControl to Basic Message
Sliders (49/61 key only)	MIDI channel 16, D-1, velocity 127 9Fh, 0Eh, 7Fh (159, 14, 127)	MIDI channel 16, D-1, velocity 0 9Fh, 0Eh, 00h (159, 14, 0)
Pots	MIDI channel 16, C#-1, velocity 127 9Fh, 0Dh, 7Fh (159, 13, 127)	MIDI channel 16, C#-1, velocity 0 9Fh, 0Dh, 00h (159, 13, 0)
Drum Pads	MIDI channel 16, D#-1, velocity 127 9Fh, 0Fh, 7Fh (159, 15, 127)	MIDI channel 16, D#-1, velocity 127 9Fh, 0Fh, 00h (159, 15, 0)

These messages will also be sent back to the computer on the InControl port to confirm the mode switch.

InControl Status Inquiry

It is possible to query the LED state of InControl buttons and the mute/solo button. This a useful way of working out what sections are in InControl mode

LED Status Inquiry Message: MIDI Channel 16, Note B-1, Velocity 0
9Fh, 0Bh, 00h (159, 11, 0)

The keyboard should then reply with the following message on the InControl port.

LED Status Reply Message: MIDI Channel 16, Note B-1, Velocity (0-15)
9Fh, 0Bh, Velocity (00h - 0Fh)
159, 11, Velocity (0-15)

The first four bits of the velocity byte contains the information of the LEDs status. The value for an off LED will be 0 and a value of 1 for an on LED. The meaning of each bit is as follows;

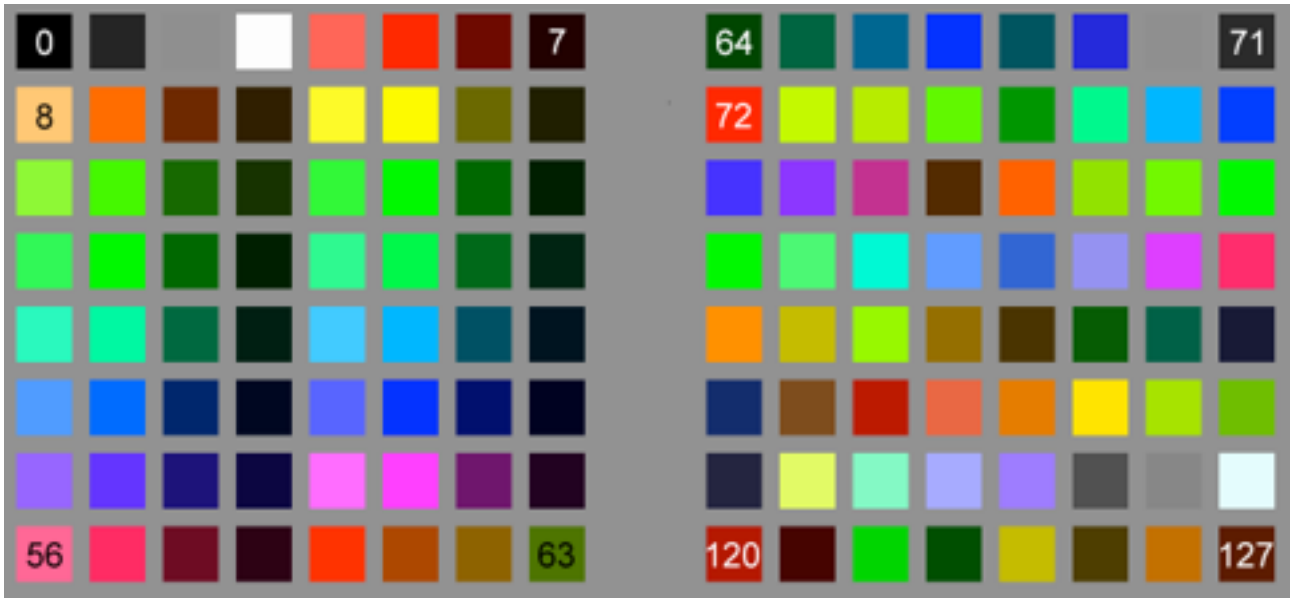
Bit	Meaning
3	Drum-pads InControl Button LED status
2	Pots InControl Button LED status
1	Sliders InControl Button LED status (49/61 key only)
0	Mute/Solo Button LED status (49/61 key only)

For examples, see "Switching Modes.maxpat "

LED Lighting

The drum pads on the Launchkey MK2 have RGB LEDs underneath them. It is possible to control these LEDS by sending MIDI notes and CCs.

Colour Lookup Table



Above is the look up table used for colour selection. Each of the colours has a unique number. The second data byte of these messages determines the colour (velocity or controller value). For example a MIDI note with a velocity of 64 would light the relevant pad green while a CC with a controller value of 3 would light its respective pad white. To switch a LED off the second data byte needs to be 0.

Lighting Pads in Basic Mode

If the keyboard is in Basic Mode or if the InControl button for the pad section is off the following messages can be used to light the pads. All communication is on channel 16 on the InControl port.

Example A: Lighting bottom left drum pad

To light the bottom left drum-pad the following message would be sent

Example LED on message: *MIDI Channel 16, C1, Colour/Velocity (1-127)*
9Fh, 24h, Colour/Velocity (01h - 7Fh)
(159, 36, Colour/Velocity (1- 127))

To turn the same LED off

Example LED off message: *MIDI Channel 16, C1, 0*
9Fh, 24h, 00h
(159, 36, 0)

Example B: Lighting top right round button

To light the top right round pad the following message should be sent

Example LED on message: *MIDI Channel 16, CC 104, Colour/CC value (1-127)*
BFh, 68h, Colour/ Value (01h -7Fh)
(191, 104, Colour/Value (1-127))

To turn the same LED off

Example LED on message: *MIDI Channel 16, CC 104, CC Value 0*
BFh, 68h, 00h
(191, 104, 0)

For more examples see "Colours Basic Mode.maxpat"

Lighting Pads in Extended (InControl) mode

If the keyboard is in Extended mode the following messages can be used to light the pads. All communication is on MIDI channel 16 through the InControl port. It is important to remember that lighting the pads in Extended mode will conflict with any messages sent from Ableton Live.

Example A: Lighting bottom left drum pad

To light the bottom left drum-pad in extended mode the following message would be sent

Example LED on message: *MIDI Channel 16, E7, Velocity/Colour (1-127)*
9Fh, 70h, Velocity/Colour (01h - 7Fh)
(159, 112, Velocity/Colour (1- 127))

To turn the same LED off

Example LED off message: *MIDI Channel 16, E7, 0*
9Fh, 70h, 00h
(159, 112, 0)

Example B: Lighting top right round pad

To light the top right round pad in extended mode the following message should be sent

Example LED on message: *MIDI Channel 16, G#6, Velocity (1-127)*
BFh, 68h, Velocity/Colour (01h -7Fh)
(191, 104, Velocity/Colour (1-127))

To turn the same LED off

Example LED on message: *MIDI Channel 16, G#6, Velocity 0*
BFh, 68h, 00h
(191, 104, 0)

For more examples see "Colours Extended Mode.maxpat"

Flashing LEDs

The RGB LEDs can also be set to a flashing state. Flashing will occur between the current colour (colour A) and a newly selected colour as part of the flashing message (colour B). Flashing syncs to a MIDI clock signal sent on the InControl port with each colour lasting half a beat. If no MIDI clock is being sent to the Launchkey the default tempo is 120 BPM or the last MIDI received MIDI clock value . Colours will flash with 100% lit colour B then 100% lit colour A.

Flashing follows the same message structure as lighting, the only difference is that the message will be sent on MIDI channel 2 rather than 16. As with lighting different MIDI note/ CC numbers are used to refer to the pads depending on if the launchkey is in basic or extended mode. Please see the lighting section for the specific pad values.

Flashing can be stopped by sending a lighting message, on or off, to the same pad on MIDI channel 16.

Example A: Setting the top left drum pad flashing On/Off in Basic mode

To have the pad flash on and off on the beat, the LED first needs to be off. Then the following message should be sent.

Example LED flash message: MIDI channel 2, E1, Velocity/Colour B (1-127)
91h, 28h, Velocity/ Colour B (00h - 7Fh)
(145, 40, Velocity/ Colour B (0-127))

To stop the pad flashing by turning it off

Example LED off message: MIDI Channel 16, E1, Velocity 0
9Fh, 28h, 00h
(159, 40, 0)

Example B: Setting the bottom right round pad flashing between white and blue in extended mode

To have the pad flash white on the on beat and blue on the off beat, the pad first needs to be lit up blue.

Example LED on message: MIDI Channel 16, C8, Velocity 45
9Fh, 78h, 2Dh
(159, 120, 45)

Then the flashing white message will be sent

Example flashing LED message: MIDI Channel 2, C8, Velocity 3
91h, 78h, 03h
(145, 120, 3)

To stop the LED from flashing by setting the LED to light constantly white:

Example LED on message: MIDI Channel 16, C8, Velocity 3
9Fh, 78h, 03h
(159, 120, 3)

For more examples, see both "Colours Basic Mode.maxpat" and "Colours Extended Mode.maxpat"

Pulsing LEDs

In addition to flashing, LEDs can be set to a pulsing state. Pulsing uses one colour and increases / decreases the brightness to create a pulsing effect. As with flashing, pulsing is synced to a MIDI clock and a full pulsing cycle takes 2 beats to complete (see diagram below).

Pulsing follows the same message structure as lighting LEDs except the messages will be sent on channel 3 instead of 16. Once again the note/CC numbers used to refer to a pad are dependent on if you are in extended or basic mode.

To stop an LED from pulsing a lighting off message should be sent to the same pad on channel 16.

Example A: Setting the bottom right round pad pulsing in Basic mode

To set the bottom round pad pulsing in Basic mode the following message should be sent

Example Pulsing Message:	*MIDI Channel 3, CC 105, Value/Colour (1-127)* *B2h, 69h, Value/Colour (01h -7Fh)* *(178, 105, Value/Colour (1-127))*

To stop the same pad pulsing a lighting message needs to be sent

Example Lighting off Message:	*MIDI Channel 16, CC 105, Value 0* *BFh, 69h, 00h* *(191, 105, 0)*

Example B: Setting the 4th drum-pad in the top row pulsing in Extended mode

To set the 4th drum-pad in the top row pulsing the following message should be sent

Example Pulsing Message:	*MIDI Channel 3, D#6, Velocity/Colour (1-127)* *92h, 63h, Velocity/Colour (01h-7Fh)* *(146, 99, Velocity/Colour (1-127))*

To stop the same pad pulsing by lighting it red

Example Lighting message *MIDI Channel 16, D#6, Velocity 5*
9Fh, 63h, 05h
(159, 99, 5)

For more examples, see both "Colours Basic Mode.maxpat" and "Colours Extended Mode.maxpat"

Resetting the Drum Pad LEDs

When the drum pads are reset all of the LEDs will turn off. This happens automatically when switching between Basic and InControl mode. To force this to happen the following messages can be used.

Reset Drum Pad LEDs Message : *MIDI Channel 16, CC 0, Value 0*
BFh, 00h, 00h
(191, 0, 0)

Lighting the Mute/Solo button (49/61 key only)

The button under the 9th slider also contains a red LED which also can be controlled via MIDI message. The LED will automatically switch off when returning to basic mode. This LED does not support flashing or pulsing.

To switch the LED on use the following message

Turn on Mute/Solo LED Message: *MIDI Channel 16, CC 59, Value 127*
BFh, 3Bh, 7Fh
(191, 59, 127)

To switch the LED off use the following message

Turn on Mute/Solo LED Message: *MIDI Channel 16, CC 59, Value 0*
BFh, 3Bh, 00h
(191, 59, 0)

For examples, see "Switching Modes.maxpat"

Additional Messages

Universal device Inquiry

The Launchkey responds to the MIDI 1.0 specification's device inquiry message. The following sysex message will generate a response. This can be sent to any of the Launchkey MIDI ports.

Device Inquiry Message: *F0h, 7Eh, 7Fh, 06h, 01h, F7h.*
(240, 126, 127, 6, 1, 247

The Launchkey will respond with the following message.

Device Reply:

F0h, 7Eh, 00h, 06h, 02h, 00h, 20h, 29h, 7Ah, 00h, FM1,FM2, R1, R2, R3, R4, F7h
(240, 126, 0, 6, 2, 0, 32, 41,FC1, FC2, FM1,FM2, R1, R2, R3, R4, 247)

The message can be deciphered as follows:

- The 00h 20h 29h (0, 32, 41) is the registered MIDI Manufacture ID for "Novation EMS".
- The 7Ah 00h refers to the Launchkey MK2 product ID.
- FM1 and FM2 are the "device family member code". FM2 is always 00h. FM1 changes for key size
    - Launchkey 25 MK2 : FM1 = 00h
    - Launchkey 49 MK2: FM1 = 01h
    - Launchkey 61 MK2: FM1 = 02h

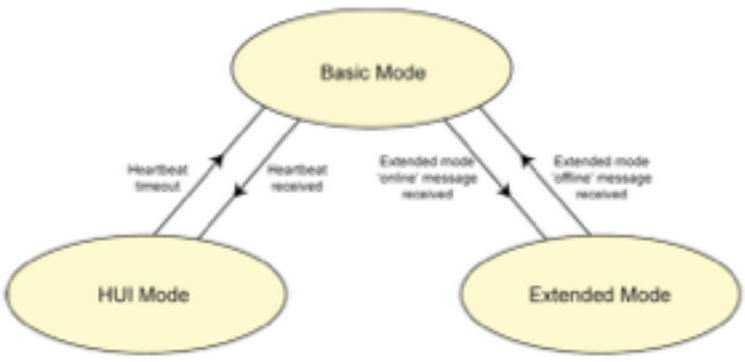
- R1, R2, R3,and R4 refers to the currently installed firmware number where;
    - R1 = Thousands (00h-09h)
    - R2 = Hundreds (00h -09h)
    - R3 = Tens (00h- 09h)
    - R4 = Units (00h -09h)

For example: if the firmware revision is 162, then R1 = 00h, R2 = 01h, R3 = 06h, R4 = 02h ("0162").

A note on HUI mode

The Launchkey also has a third mode HUI. HUI is a MIDI mapping protocol developed jointly by Mackie and Digidesign and is widely supported in many DAWs. When the Launchkey is in HUI mode all communication from the pots, sliders and buttons will output from the InControl port. As with Extended mode sections of controls can switch between HUI and basic mode by using the InControl buttons. When entering HUI the InControl buttons for Pots and Sliders sections will light up.

HUI mode can only be activated when the Launchkey is in Basic mode. Once in HUI it will ignore any extended mode messages. HUI cannot be activated from Extended mode (see diagram below)



State Diagram showing Modes of Keyboard Operation and Transitions

To set the Launchkey to HUI it first must receive the HUI heartbeat message on the inControl Port. In normal use the DAW would send this message.

HUI Heartbeat Message: *MIDI Channel 1, C-1, Velocity 0*
90h, 00h, 00h,
(144, 0, 0,)

The Launchkey will reply to the heart beat with the following message

HUI Heartbeat Reply: *MIDI Channel 1, C-1, Velocity 127*
90h, 00h, 7F
(144, 0, 127)

The heartbeat message is sent regularly from the computer to check if the keyboard is still connected. Every time the launchkey replies to the heartbeat a 5 second countdown timer starts. If this timer reaches zero Launchkey will exit HUI mode and revert to Basic mode

MIDI Reference Table - From Launchkey to Device

Control	Message Type	Message number	Range
Pot 1	CC	15h (21)	00h - 7Fh (0 -127)
Pot 2	CC	16h (22)	00h - 7Fh (0 -127)
Pot 3	CC	17h (23)	00h - 7Fh (0 -127)
Pot 4	CC	18h (24)	00h - 7Fh (0 -127)
Pot 5	CC	19h (25)	00h - 7Fh (0 -127)
Pot 6	CC	1Ah (26)	00h - 7Fh (0 -127)
Pot 7	CC	1Bh (27)	00h - 7Fh (0 -127)
Pot 8	CC	1Ch (28)	00h - 7Fh (0 -127)
Slider 1 (49/61 key)	CC	29h (41)	00h - 7Fh (0 -127)
Slider 2 (49/61 key)	CC	2Ah (42)	00h - 7Fh (0 -127)
Slider 3 (49/61 key)	CC	2Bh (43)	00h - 7Fh (0 -127)
Slider 4 (49/61 key)	CC	2Ch (44)	00h - 7Fh (0 -127)
Slider 5 (49/61 key)	CC	2Dh (45)	00h - 7Fh (0 -127)
Slider 6 (49/61 key)	CC	2Eh (46)	00h - 7Fh (0 -127)
Slider 7 (49/61 key)	CC	2Fh (47)	00h - 7Fh (0 -127)
Slider 8 (49/61 key)	CC	30h (48)	00h - 7Fh (0 -127)
Slider 9/Master	CC	07h (7)	00h - 7Fh (0 -127)
Pad 1 Basic/Extended	Note	28h (40)/ 60h (96)	00h - 7Fh (0 -127)
Pad 2 Basic/Extended	Note	29h (41) / 61h (97)	00h - 7Fh (0 -127)
Pad 3 Basic/Extended	Note	2Ah (42) / 62h (98)	00h - 7Fh (0 -127)
Pad 4 Basic/Extended	Note	2Bh (43) / 63h (99)	00h - 7Fh (0 -127)
Pad 5 Basic/Extended	Note	30h (48) / 64h (100)	00h - 7Fh (0 -127)
Pad 6 Basic/Extended	Note	31h (49) / 65h (101)	00h - 7Fh (0 -127)
Pad 7 Basic/Extended	Note	32h (50) / 66h (102)	00h - 7Fh (0 -127)
Pad 8 Basic/Extended	Note	33h (51) / 67h (103)	00h - 7Fh (0 -127)
Pad 9 Basic/Extended	Note	24h (36) / 70h (112)	00h - 7Fh (0 -127)
Pad 10 Basic/Extended	Note	25h (37) / 71h (113)	00h - 7Fh (0 -127)

Control	Message Type	Message number	Range
Pad 11 Basic/Extended	Note	26h (38) / 72h (114)	00h - 7Fh (0 -127)
Pad 12 Basic/Extended	Note	27h (39) / 73h (115)	00h - 7Fh (0 -127)
Pad 13 Basic/Extended	Note	2Ch (44) / 74h (116)	00h - 7Fh (0 -127)
Pad 14 Basic/Extended	Note	2Dh (45) / 75h (117)	00h - 7Fh (0 -127)
Pad 15 Basic/Extended	Note	2Eh (46) / 76h (118)	00h - 7Fh (0 -127)
Pad 16 Basic/Extended	Note	2Fh (47) / 77h (119)	00h - 7Fh (0 -127)
Upper Round Pad Basic/Extended	CC/Note	68h (104) / 68h (104)	00h / 7Fh (0 -127)
Lower Round Pad Basic/Extended	CC/Note	69h (105) / 78h (120)	00h / 7Fh (0 -127)
Button 1 (49/61 key)	CC	33h (51)	00h / 7Fh (0 / 127)
Button 2 (49/61 key)	CC	34h (52)	00h / 7Fh (0 / 127)
Button 3 (49/61 key)	CC	35h (53)	00h / 7Fh (0 / 127)
Button 4 (49/61 key)	CC	36h (54)	00h / 7Fh (0 / 127)
Button 5 (49/61 key)	CC	37h (55)	00h / 7Fh (0 / 127)
Button 6 (49/61 key)	CC	38h (56)	00h / 7Fh (0 / 127)
Button 7 (49/61 key)	CC	39h (57)	00h / 7Fh (0 / 127)
Button 8 (49/61 key)	CC	3Ah (58)	00h / 7Fh (0 / 127)
Button 9 (49/61 key)	CC	3Bh (59)	00h / 7Fh (0 / 127)
Track Left Button	CC	67h (103)	00h / 7Fh (0 / 127)
Track Right Button	CC	66h (102)	00h / 7Fh (0 / 127)
Rewind button	CC	70h (112)	00h / 7Fh (0 / 127)
Fast Forward Button	CC	71h (113)	00h / 7Fh (0 / 127)
Stop Button	CC	72h (114)	00h / 7Fh (0 / 127)
Play Button	CC	73h (115)	00h / 7Fh (0 / 127)
Loop Button	CC	74h (116)	00h / 7Fh (0 / 127)
Record button	CC	75h (117)	00h / 7Fh (0 / 127)

MIDI Reference Table - From Device to Launchkey

Function	Port/ channel	Message Type	Message Number	Value / Range
Set to Extended mode	InControl Ch 16	Note	0Ch (12)	7Fh (127)
Turn Extended mode off	InControl Ch 16	Note	0Ch (12)	00h (0)
Square pad lighting Basic mode	InControl Ch 16	Note	24h - 33h (36 - 51)	00h - 7Fh (0 -127)
Round pad lighting Basic mode	InControl Ch 16	CC	68h / 69h (104 / 105)	00h - 7Fh (0 -127)
Square pad lighting Extended mode	InControl Ch 16	Note	60h - 67h / 70h -77h (96 - 103 / 112 -119)	00h - 7Fh (0 -127)
Round pad lighting Extended mode	InControl Ch 16	Note	68h / 78h (104/ 120)	00h - 7Fh (0 -127)
Square pad flashing Basic mode	InControl Ch 2	Note	24h - 33h (36 - 51)	00h - 7Fh (0 -127)
Round pad flashing basic mode	InControl Ch 2	CC	68h / 69h (104 / 105)	00h - 7Fh (0 -127)
Square pad flashing Extended mode	InControl Ch 2	Note	60h - 67h / 70h -77h (96 - 103 / 112 -119)	00h - 7Fh (0 -127)
Round pad flashing Extended mode	InControl Ch 2	Note	68h / 78h (104/ 120)	00h - 7Fh (0 -127)
Square pad pulsing Basic mode	InControl Ch 3	Note	24h - 33h (36 - 51)	00h - 7Fh (0 -127)
Round pad pulsing Basic mode	InControl Ch 3	CC	68h / 69h (104 / 105)	00h - 7Fh (0 -127)
Square pad pulsing Extended mode	InControl Ch 3	Note	60h - 67h / 70h -77h (96 - 103 / 112 -119)	00h - 7Fh (0 -127)
Round pad Pulsing Extended mode	InControl Ch 3	Note	68h / 78h (104/ 120)	00h - 7Fh (0 -127)
Reset drum pad LEDS	InControl Ch 16	CC	00h (0)	00h (0)

Function	Port/ channel	Message Type	Message Number	Value / Range
Lighting 9th button (49 /61 key)	InControl Ch 16	CC	3Bh (59)	00h / 7Fh (0 /127)
Pot section InControl On/Off	InControl Ch 16	Note	0Dh (13)	00h / 7Fh (0 /127)
Slider Section InControl On/Off	InControl Ch 16	Note	0Eh (14)	00h / 7Fh (0 /127)
Drum Pad section InControl On/Off	InControl Ch 16	Note	0Fh (15)	00h / 7Fh (0 /127)
LED status Inquiry	InControl Ch 16	Note	0Bh (11)	00h (0)