
# Communications Protocol for Akai APC40 Controller

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## *Introduction*

The Akai APC40 Controller is a device that provides a control surface interface to Ableton Live software. This controller can alternately be used for controlling other software applications as well. The means of communication will be by MIDI messages over USB.

## *Scope*

This document describes the format of messages between the APC40 and the PC/Mac Host.

## *Glossary*

**Outbound**: The term “outbound” is used to describe messages sent from the PC Host to the device, i.e. from the viewpoint of the PC Host.

**Inbound**: The term “inbound” is used to describe messages sent from the device to the PC Host, i.e. from the viewpoint of the PC Host.

## *General Format of MIDI System Exclusive message*

The System Exclusive messages exchanged between the PC Host and the device will be of the following format:

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0xF0 | MIDI System exclusive message start |
| 2 | 0x47 | Manufacturers ID Byte |
| 3 | <DeviceID> | System Exclusive Device ID |
| 4 | 0x73 | Product model ID |
| 5 | <Message ID> | Message type identifier |
| 6 | <DataLengthMS> | Number of data bytes to follow (most significant) |
| 7 | <DataLengthLS> | Number of data bytes to follow (least significant) |
| 8 | n data bytes | Data field – n bytes long |
| n+8 | 0xF7 | MIDI System exclusive message terminator |

The Manufacturer's identity field will contain the one-byte code allocated to Akai Professional, which is 0x47

The System Exclusive Device ID is typically used to select between multiple devices connected to the same PC Host. In our application, we only expect one APC40 to be connected at any one time and so a value of 0x7F (broadcast) should be used (and it is unlikely that the APC40 will pay any regard to this field).

The Product model ID is intended to select between different Akai Professional devices that are connected to the PC Host to ensure that the message is only received by APC40 devices.

The Message type identifier identifies the type of the message. This field will determine the size of the data field and how the data field bytes should be interpreted.

There will be a number of data bytes in the message. Different message types are likely to have a different data field lengths/formats.

### *Communications from PC Host to device - "Outbound" messages*

## "Universal" MIDI messages

### *Device Enquiry*

APC40 supports the standard MMC Device Enquiry message. These System Exclusive messages are part of the Midi Machine Control Standard and do not follow the general format for APC40 System Exclusive messages.

*Format of Device Inquiry Request message from Host to Device*

| ***byte number*** | ***value*** | ***Description*** |
|---|---|---|
| 1 | 0xF0 | MIDI System exclusive message start |
| 2 | 0x7E | Non-Realtime Message |
| 3 | 0x00 | Channel to inquire. (Set to 0 for this protocol.) |
| 4 | 0x06 | Inquiry Message |
| 5 | 0x01 | Inquiry Request |
| 6 | 0xF7 | MIDI System exclusive message terminator |

The APC40 Controller will respond to a Device Inquiry Request message with the following message:

*Format of response from APC40 to Device Inquiry message*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0xF0 | MIDI System exclusive message start |
| 2 | 0x7E | Non-Realtime Message |
| 3 | <MIDI Channel> | Common MIDI channel setting |
| 4 | 0x06 | Inquiry Message |
| 5 | 0x02 | Inquiry Response |
| 6 | 0x47 | Manufacturers ID Byte |
| 7 | 0x73 | Product model ID |
| 8 | 0x00 | Number of data bytes to follow (most significant) |
| 9 | 0x19 | Number of data bytes to follow (least significant) |
| 10 | <Version1> | Software version major most significant |
| 11 | <Version2> | Software version major least significant |
| 12 | <Version3> | Software version minor most significant |
| 13 | <Version4> | Software version minor least significant |
| 14 | <DeviceID> | System Exclusive Device ID |
| 15 | <Serial1> | Serial Number first digit |
| 16 | <Serial2> | Serial Number second digit |
| 17 | <Serial3> | Serial Number third digit |
| 18 | <Serial4> | Serial Number fourth digit |
| 19 | <Manufacturing1> | Manufacturing Data byte 1 |
| 20 | <Manufacturing2> | Manufacturing Data byte 2 |
| 21 | <Manufacturing3 | Manufacturing Data byte 3 |
| 22 | <Manufacturing4> | Manufacturing Data byte 4 |
| 23 | <Manufacturing5> | Manufacturing Data byte 5 |
| 24 | <Manufacturing6> | Manufacturing Data byte 6 |
| 25 | <Manufacturing7> | Manufacturing Data byte 7 |
| 26 | <Manufacturing8> | Manufacturing Data byte 8 |

| *byte number* | *value* | *description* |
|---|---|---|
| 27 | <Manufacturing9> | Manufacturing Data byte 9 |
| 28 | <Manufacturing10> | Manufacturing Data byte 10 |
| 29 | <Manufacturing11> | Manufacturing Data byte 11 |
| 30 | <Manufacturing12> | Manufacturing Data byte 12 |
| 31 | <Manufacturing13> | Manufacturing Data byte 13 |
| 32 | <Manufacturing14> | Manufacturing Data byte 14 |
| 33 | <Manufacturing15> | Manufacturing Data byte 15 |
| 34 | <Manufacturing16> | Manufacturing Data byte 16 |
| 35 | 0xF7 | MIDI System exclusive message terminator |

# Outbound APC40 Sysex Message Types

There will be three types of message from the PC host to the device.

## *Outbound Message Type 0: Introduction*

This message is sent before any other device-specific message (i.e. other than Device Enquiry). It instructs the APC40 to perform the necessary initialization and informs the firmware of the version number of the application in order that changes in the application can be catered for in the APC40 firmware.

There are three modes that are accepted. The unit defaults to Mode 0 on startup.

| **Mode** | **Identifier** | **Name** |
|---|---|---|
| 0 | 0x40 | Generic Mode |
| 1 | 0x41 | Ableton Live Mode |
| 2 | 0x42 | Alternate Ableton Live Mode |

Notes Regarding Generic Mode (Mode 0):

-[CLIP LAUNCH] buttons are momentary and should light the green LED when ON

-[CLIP STOP] buttons are momentary and should light its LED when ON

-[ACTIVATOR], [SOLO], [RECORD ARM] are toggle buttons and should light its LED when ON

-[TRACK SELECTION] buttons (1-8 + MASTER) are radio style and only one of the 9 buttons are ON at a time. When ON its LED should light. These buttons will NOT send out MIDI in generic mode for its state. These buttons dictate which one of nine banks the DEVICE CONTROL knobs and DEVICE CONTROL switches belong to. These knobs and switches will output on a different MIDI channel

based on the current Track Selection (track 1 = MIDI channel 0, track 8 = MIDI channel 7, MASTER = MIDI channel 8). Upon pressing one of the Track Selection buttons, the current position of the 8 Device Control knobs will be sent.

-[CLIP/TRACK (1)], [DEVICE ON/OFF (2)], [← (3)], [→ (4)] will be toggle style and will light its LED when ON

-[DETAIL VIEW (5)], [REC QUANTIZATION (6)], [MIDI OVERDUB (7)], [METRONOME (8)] will be momentary style and will light its LED when ON

-[SCENE LAUNCH] and [STOP ALL CLIPS] buttons are momentary buttons and will light its LED when ON

-TRACK CONTROL buttons are toggle buttons and will light its LED when ON

-TRACK CONTROL KNOBS and buttons are NOT banked in any way

-[PLAY], [STOP], [RECORD], [UP], [DOWN], [LEFT], [RIGHT], [SHIFT], [NUDGE+], [NUDGE-], [TAP TEMPO] are momentary buttons

-LED rings are all set to SINGLE style

Notes Regarding Ableton Live Mode (Mode 1):

- All buttons are momentary buttons
- Device control knobs and buttons are not banked within the APC40
- LED Rings around the knobs are controlled by the APC40 but can be updated by the Host
- All other LEDs are controlled by the Host

Notes Regarding Alternate Ableton Live Mode (Mode 2):

- All buttons are momentary buttons
- Device control knobs and buttons are not banked within the APC40
- All LEDs are controlled by the Host

## *Format of Type 0 outbound message*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0xF0 | MIDI System exclusive message start |
| 2 | 0x47 | Manufacturers ID Byte |
| 3 | <DeviceID> | System Exclusive Device ID |
| 4 | 0x73 | Product model ID |
| 5 | 0x60 | Message type identifier |
| 6 | 0x00 | Number of data bytes to follow (most significant) |

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 7 | 0x04 | Number of data bytes to follow (least significant) |
| 8 | 0x40 or 0x41 or 0x42 | Application/Configuration identifier |
| 9 | <Version High> | PC application Software version major |
| 10 | <Version Low> | PC application Software version minor |
| 11 | <Bugfix Level> | PC Application Software bug-fix level |
| 12 | 0xF7 | MIDI System exclusive message terminator |

## *Outbound Message Type 1: LEDs.*

This message is used to control the states of the LEDs. A note-on message will cause the specified LED to switch on. A note-off message will cause the specified LED to switch off. The field normally associated with note number will be used to specify the LED. The field normally associated with velocity will indicate the LED display type. The field normally associated with MIDI Channel will indicate the Track for certain LEDs. A Note On message with a velocity of zero is equivalent to a Note Off message, however it is preferred that an actual Note Off message is used.

### *Format of Type 1 outbound Midi note-on messages*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0x9<chan> | MIDI Note-on. The 4-bit <chan> value will be used for the track strips |
| 2 | <ControlID> | identifier for LED object (“note number”) |
| 3 | state | control value (This value will describe the state or color of the LED: OFF/ON/blinking, etc) |

### *Format of Type 1 outbound Midi note-off messages*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0x8<chan> | MIDI Note-off. The 4-bit <chan> value will be used for the track strips |
| 2 | <ControlID> | identifier for LED object (“note number”) |
| 3 | (unused) | control value (ignored) |

### *Assignment of Note number messages to LEDs. Note 0x30 to 0x39 use MIDI Channel 0*

*to 7 to indicate Tracks 1-8. All other note values ignore the MIDI Channel.*

| ***note number*** | ***MIDI Channel*** | ***corresponding LED*** | ***Velocity*** |
|---|---|---|---|
| 0x30 (C_3) | 0-7 = Track 1-8 | RECORD ARM | 0=off, 1-127=on |
| 0x31 (C#3) | 0-7 = Track 1-8 | SOLO | 0=off, 1-127=on |
| 0x32 (D_3) | 0-7 = Track 1-8 | ACTIVATOR | 0=off, 1-127=on |
| 0x33 (D#3) | 0-7 = Track 1-8 | TRACK SELECTION | 0=off, 1-127=on |
| 0x34 (E_3) | 0-7 = Track 1-8 | CLIP STOP | 0=off, 1=on, 2=blink, 3-127=on |
| 0x35 (F_3) | 0-7 = Track 1-8 | CLIP LAUNCH 1 | 0=off, 1=green, 2=green blink, 3=red, 4=red blink, 5=yellow, 6=yellow blink, 7-127=green |
| 0x36 (F#3) | 0-7 = Track 1-8 | CLIP LAUNCH 2 | 0=off, 1=green, 2=green blink, 3=red, 4=red blink, 5=yellow, 6=yellow blink, 7-127=green |
| 0x37 (G_3) | 0-7 = Track 1-8 | CLIP LAUNCH 3 | 0=off, 1=green, 2=green blink, 3=red, 4=red blink, 5=yellow, 6=yellow blink, 7-127=green |
| 0x38 (G#3) | 0-7 = Track 1-8 | CLIP LAUNCH 4 | 0=off, 1=green, 2=green blink, 3=red, 4=red blink, 5=yellow, 6=yellow blink, 7-127=green |
| 0x39 (A_3) | 0-7 = Track 1-8 | CLIP LAUNCH 5 | 0=off, 1=green, 2=green blink, 3=red, 4=red blink, 5=yellow, 6=yellow blink, 7-127=green |
| 0x3A (A#3) | 0-8 = Track 1-8, MASTER (mode 0 only) | CLIP/TRACK (1) | 0=off, 1-127=on |
| 0x3B (B_3) | 0-8 = Track 1-8, MASTER (mode 0 only) | DEVICE ON/OFF (2) | 0=off, 1-127=on |
| 0x3C (C_4) | 0-8 = Track 1-8, MASTER (mode 0 only) | ← (3) | 0=off, 1-127=on |
| 0x3D (C#4) | 0-8 = Track 1-8, MASTER (mode 0 only) | ➔ (4) | 0=off, 1-127=on |
| 0x3E (D_4) | 0-8 = Track 1-8, MASTER (mode 0 only) | DETAIL VIEW (5) | 0=off, 1-127=on |
| 0x3F (D#4) | 0-8 = Track 1-8, MASTER (mode 0 only) | REC QUANT (6) | 0=off, 1-127=on |
| 0x40 (E_4) | 0-8 = Track 1-8, MASTER (mode 0 only) | MIDI OVERDUB (7) | 0=off, 1-127=on |
| 0x41 (F_4) | 0-8 = Track 1-8, MASTER (mode 0 only) | METRONOME (8) | 0=off, 1-127=on |
| | | | |

| ***note number*** | ***MIDI Channel*** | ***corresponding LED*** | ***Velocity*** |
|---|---|---|---|
| 0x50 (G#5) | | MASTER | 0=off, 1-127=on |
| | | | |
| 0x52 (A#5) | | SCENE LAUNCH 1 | 0=off, 1=on, 2=blink, 3-127=on |
| 0x53 (B_5) | | SCENE LAUNCH 2 | 0=off, 1=on, 2=blink, 3-127=on |
| 0x54 (C_6) | | SCENE LAUNCH 3 | 0=off, 1=on, 2=blink, 3-127=on |
| 0x55 (C#7) | | SCENE LAUNCH 4 | 0=off, 1=on, 2=blink, 3-127=on |
| 0x56 (D_7) | | SCENE LAUNCH 5 | 0=off, 1=on, 2=blink, 3-127=on |
| 0x57 (D#7) | | PAN | 0=off, 1-127=on |
| 0x58 (E_7) | | SEND A | 0=off, 1-127=on |
| 0x59 (F_7) | | SEND B | 0=off, 1-127=on |
| 0x5A (F#_7) | | SEND C | 0=off, 1-127=on |

## *Outbound Message Type 2: Controller Value Update messages*

Controls that report an absolute value for their position for inbound messages can have their controller value updated via a Controller Value Update message. This will be done using a MIDI controller message. The field normally associated with controller number will be used to specify the Control ID. The field normally associated with controller value will be used to update the value of a controller on the APC40.

### *MIDI Controller message*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0xB<chan> | MIDI Controller. The 4-bit <chan> value will be used for the track strips |
| 2 | <ControlID> | identifier for control surface object |
| 3 | data | control value |

### *Assignment of controller numbers to absolute controllers*

| ***control*** | ***MIDI Channel*** | ***control ID*** | ***notes*** |
|---|---|---|---|
| Track Level | 0-7 = Tracks 1-8 | 0x07 | |

| *control* | *MIDI Channel* | *control ID* | *notes* |
|---|---|---|---|
| Master Level | | 0x0E | |
| Crossfader | | 0x0F | |
| DEVICE Knob 1 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x10 | |
| DEVICE Knob 2 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x11 | |
| DEVICE Knob 3 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x12 | |
| DEVICE Knob 4 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x13 | |
| DEVICE Knob 5 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x14 | |
| DEVICE Knob 6 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x15 | |
| DEVICE Knob 7 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x16 | |
| DEVICE Knob 8 | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x17 | |
| DEVICE Knob 1 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x18 | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 2 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x19 | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 3 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x1A | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 4 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x1B | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 5 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x1C | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 6 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x1D | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 7 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x1E | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| DEVICE Knob 8 LED Ring Type | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x1F | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |

| *control* | *MIDI Channel* | *control ID* | *notes* |
|---|---|---|---|
| TRACK Knob 1 | | 0x30 | |
| TRACK Knob 2 | | 0x31 | |
| TRACK Knob 3 | | 0x32 | |
| TRACK Knob 4 | | 0x33 | |
| TRACK Knob 5 | | 0x34 | |
| TRACK Knob 6 | | 0x35 | |
| TRACK Knob 7 | | 0x36 | |
| TRACK Knob 8 | | 0x37 | |
| TRACK Knob 1 LED Ring Type | | 0x38 | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 2 LED Ring Type | | 0x39 | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 3 LED Ring Type | | 0x3A | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 4 LED Ring Type | | 0x3B | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 5 LED Ring Type | | 0x3C | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 6 LED Ring Type | | 0x3D | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 7 LED Ring Type | | 0x3E | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |
| TRACK Knob 8 LED Ring Type | | 0x3F | 0=off, 1=Single, 2=Volume Style, 3=Pan Style, 4-127=Single |

## *Interpretation of LED Ring Types*

The LED rings will display its controller value with the LEDs based on the LED Ring Types. This LED Ring Type can be set by the Host by sending an appropriate controller value message. The “Min” and “Max” columns below will state the range of the controller value that will match the LED states as shown in the “Display” column. The “LED STATES” column below will show the state of each of the 15 LEDs going from left to right. A “0” indicates that the LED within the LED ring is OFF. A “1” indicates that the LED within the LED ring in ON.

A. SINGLE

| MIN | MAX | LED STATES |
|---|---|---|
| 0 | 3 | 100000000000000 |
| 4 | 8 | 110000000000000 |
| 9 | 12 | 010000000000000 |
| 13 | 17 | 011000000000000 |
| 18 | 21 | 001000000000000 |
| 22 | 25 | 001100000000000 |
| 26 | 30 | 000100000000000 |
| 31 | 34 | 000110000000000 |
| 35 | 38 | 000010000000000 |
| 39 | 43 | 000011000000000 |
| 44 | 47 | 000001000000000 |
| 48 | 52 | 000001100000000 |
| 53 | 56 | 000000100000000 |
| 57 | 60 | 000000110000000 |
| 61 | 65 | 000000010000000 |
| 66 | 69 | 000000011000000 |
| 70 | 73 | 000000001000000 |
| 74 | 78 | 000000001100000 |
| 79 | 82 | 000000000100000 |
| 83 | 87 | 000000000110000 |
| 88 | 91 | 000000000010000 |
| 92 | 95 | 000000000011000 |
| 96 | 100 | 000000000001000 |
| 101 | 104 | 000000000001100 |
| 105 | 108 | 000000000000100 |
| 109 | 113 | 000000000000110 |
| 114 | 117 | 000000000000010 |
| 118 | 122 | 000000000000011 |
| 123 | 127 | 000000000000001 |

B. VOLUME STYLE

| MIN | MAX | LED STATES |
|---|---|---|
| 0 | 0 | 000000000000000 |
| 1 | 9 | 100000000000000 |
| 10 | 18 | 110000000000000 |
| 19 | 27 | 111000000000000 |
| 28 | 36 | 111100000000000 |
| 37 | 45 | 111110000000000 |
| 46 | 54 | 111111000000000 |
| 55 | 63 | 111111100000000 |
| 64 | 71 | 111111110000000 |
| 72 | 80 | 111111111000000 |
| 81 | 89 | 111111111100000 |
| 90 | 98 | 111111111110000 |
| 99 | 107 | 111111111111000 |
| 108 | 116 | 111111111111100 |
| 117 | 126 | 111111111111110 |
| 127 | 127 | 111111111111111 |

C. PAN STYLE

| MIN | MAX | LED STATES |
|---|---|---|
| 0 | 8 | 111111110000000 |
| 9 | 17 | 011111110000000 |
| 18 | 26 | 001111110000000 |
| 27 | 35 | 000111110000000 |
| 36 | 44 | 000011110000000 |
| 45 | 53 | 000001110000000 |
| 54 | 62 | 000000110000000 |

| MIN | MAX | LED STATES |
|---|---|---|
| 63 | 64 | 0000000010000000 |
| 65 | 73 | 0000000011000000 |
| 74 | 82 | 0000000011100000 |
| 83 | 91 | 0000000011110000 |
| 92 | 100 | 0000000011111000 |
| 101 | 109 | 0000000011111100 |
| 110 | 118 | 0000000011111110 |
| 119 | 127 | 0000000011111111 |

### *Communications from device to PC Host - "Inbound" messages*

These messages will be used to report control surface events from the device to the PC Host and as a response to requests from the PC host.

## Inbound Standard MIDI Message types

These messages will use standard MIDI messages.

Each message type will contain a Control Identifier field which will identify the control surface object to which the message pertains.

Each message type will contain a data field which may contain information about either the new value of the control surface object or how it has changed since the last report.

### *Type NOTE1: Note-on/Note-off messages*

Some devices (such as buttons) have two states and the transitions between these states will be reported using MIDI note-on (when the button is depressed) and note-off (when the button is released). The field normally associated with note number will be used to specify the Control ID.

*Midi note-on messages*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0x9<chan> | MIDI Note-on. The 4-bit <chan> value will be used for the track strips. |
| 2 | <ControlID> | identifier for control surface object ("note number") |
| 3 | 0x7F | control value (non-zero) |

*Midi note-off messages*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0x8<chan> | MIDI Note-off. The 4-bit <chan> value will be used for the track strips |
| 2 | <ControlID> | identifier for control surface object (“note number”) |
| 3 | 0x7F | control value (ignored) |

Assignment of note numbers to buttons. Note 0x30 to 0x49 use MIDI Channel 0 to 7 to indicate Tracks 1-8. All other note values ignore the MIDI Channel. In Mode 1 or Mode 2, all buttons act as momentary buttons.

| ***control*** | ***MIDI Channel*** | ***note number*** | ***Mode 0 Button Type*** |
|---|---|---|---|
| RECORD ARM | 0-7 = Track 1-8 | 0x30 (C_3) | Toggle |
| SOLO | 0-7 = Track 1-8 | 0x31 (C#3) | Toggle |
| ACTIVATOR | 0-7 = Track 1-8 | 0x32 (D_3) | Toggle |
| TRACK SELECTION | 0-7 = Track 1-8 | 0x33 (D#3) | N/A |
| CLIP STOP | 0-7 = Track 1-8 | 0x34 (E_3) | Momentary |
| CLIP LAUNCH 1 | 0-7 = Track 1-8 | 0x35 (F_3) | Momentary |
| CLIP LAUNCH 2 | 0-7 = Track 1-8 | 0x36 (F#3) | Momentary |
| CLIP LAUNCH 3 | 0-7 = Track 1-8 | 0x37 (G_3) | Momentary |
| CLIP LAUNCH 4 | 0-7 = Track 1-8 | 0x38 (G#3) | Momentary |
| CLIP LAUNCH 5 | 0-7 = Track 1-8 | 0x39 (A_3) | Momentary |
| CLIP/TRACK (1) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x3A (A#3) | Toggle |
| DEVICE ON/OFF (2) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x3B (B_3) | Toggle |
| ← (3) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x3C (C_4) | Toggle |
| ➔ (4) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x3D (C#4) | Toggle |
| DETAIL VIEW (5) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x3E (D_4) | Momentary |
| REC QUANT (6) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x3F (D#4) | Momentary |

| *control* | *MIDI Channel* | *note number* | *Mode 0 Button Type* |
|---|---|---|---|
| MIDI OVERDUB (7) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x40 (E_4) | Momentary |
| METRONOME (8) | 0-8 = Tracks 1-8, Master (for mode 0 only) | 0x41 (F_4) | Momentary |
| | | | |
| MASTER | | 0x50 (G#5) | N/A |
| STOP ALL CLIPS | | 0x51 (A_5) | Momentary |
| SCENE LAUNCH 1 | | 0x52 (A#5) | Momentary |
| SCENE LAUNCH 2 | | 0x53 (B_5) | Momentary |
| SCENE LAUNCH 3 | | 0x54 (C_6) | Momentary |
| SCENE LAUNCH 4 | | 0x55 (C#6) | Momentary |
| SCENE LAUNCH 5 | | 0x56 (D_6) | Momentary |
| PAN | | 0x57 (D#6) | Toggle |
| SEND A | | 0x58 (E_6) | Toggle |
| SEND B | | 0x59 (F_6) | Toggle |
| SEND C | | 0x5A (F#6) | Toggle |
| PLAY | | 0x5B (G_6) | Momentary |
| STOP | | 0x5C (G#6) | Momentary |
| RECORD | | 0x5D (A_6) | Momentary |
| UP | | 0x5E (A#6) | Momentary |
| DOWN | | 0x5F (B_6) | Momentary |
| RIGHT | | 0x60 (C_7) | Momentary |
| LEFT | | 0x61 (C#7) | Momentary |
| SHIFT | | 0x62 (D_7) | Momentary |
| TAP TEMPO | | 0x63 (D#7) | Momentary |
| NUDGE + | | 0x64 (E_7) | Momentary |
| NUDGE - | | 0x65 (F_7) | Momentary |

## *Type CC1: Absolute Controller messages*

Most controls will report an absolute value for their position. This will be done using a MIDI controller message. The field normally associated with controller number will be used to specify the Control ID. The field normally associated with controller value will be used to report the absolute control value.

### *MIDI Controller message*

| ***byte number*** | ***value*** | ***description*** |
|---|---|---|
| 1 | 0xB<chan> | MIDI Controller. The 4-bit <chan> value will be used for the track. |
| 2 | <ControlID> | identifier for control surface object |
| 3 | data | control value |

### *Assignment of controller numbers to absolute controllers*

| ***control*** | ***MIDI Channel*** | ***control ID*** | ***notes*** |
|---|---|---|---|
| Track Level | 0-7 = Tracks 1-8 | 0x07 | |
| Master Level | | 0x0E | |
| Crossfader | | 0x0F | |
| DEVICE Knob 1 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x10 | |
| DEVICE Knob 2 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x11 | |
| DEVICE Knob 3 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x12 | |
| DEVICE Knob 4 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x13 | |
| DEVICE Knob 5 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x14 | |
| DEVICE Knob 6 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x15 | |
| DEVICE Knob 7 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x16 | |
| DEVICE Knob 8 | 0-8 = Tracks 1-8, Master (for Mode 0 only) | 0x17 | |
| | | | |

| *control* | *MIDI Channel* | *control ID* | *notes* |
|---|---|---|---|
| TRACK Knob1 | | 0x30 | |
| TRACK Knob 2 | | 0x31 | |
| TRACK Knob 3 | | 0x32 | |
| TRACK Knob 4 | | 0x33 | |
| TRACK Knob 5 | | 0x34 | |
| TRACK Knob 6 | | 0x35 | |
| TRACK Knob 7 | | 0x36 | |
| TRACK Knob 8 | | 0x37 | |
| Footswitch 1 | | 0x40 | Value of 0x7F when depressed and a value of 0x00 when released |
| Footswitch 2 | | 0x43 | Value of 0x7F when depressed and a value of 0x00 when released |

## *Type CC2: Relative Controller messages*

Some controls will report a relative change in their value. This will be done using a MIDI controller message. The field normally associated with controller number will be used to specify the Control ID. The field normally associated with controller value will be used to report the change in the control value.

### *MIDI Controller message*

| *byte number* | *value* | *description* |
|---|---|---|
| 1 | 0xB<chan> | MIDI Controller. The 4-bit <chan> value will be used for the track strips |
| 2 | <ControlID> | identifier for control surface object |
| 3 | data | control change |

### *Interpretation of MIDI Controller values for Relative Controllers*

The value in the data field will indicate a relative change; values 01 to 63 describe a positive change and values 127 down to 64 describe a negative change.

| *data value sent* | *interpretation* |
|---|---|
| 0x00 | No change occured. Control is stationary. |

| *data value sent* | *interpretation* |
|---|---|
| 0x01 | The controller incremented its value by 1 since the last report |
| 0x02 | The controller incremented its value by 2 since the last report |
| ... | ... |
| 0x3f | The controller incremented its value by 63 since the last report |
| 0x40 | The controller decremented its value by 64 since the last report |
| 0x41 | The controller decremented its value by 63 since the last report |
| ... | ... |
| 0x7e | The controller decremented its value by 2 since the last report |
| 0x7f | The controller decremented its value by 1 since the last report |

*Assignment of controller numbers to relative controllers*

| *control* | *control ID* | *notes* |
|---|---|---|
| CUE LEVEL | 0x2F | |

## *Document History*

| *Date* | | *Author* |
|---|---|---|
| May 1, 2009 | First Draft based on APC40 document | Alex Souppa |