



RP-16 Instruction Manual

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Introduction

Thank you for purchasing the RP-16 Midi Show Recorder and Player. The RP-16 is part of our BB-200 series of 1/4 rack space, Midi based controllers. It can record and play back up to 16 separate Midi sequences or shows. The RP-16 can record full bandwidth Midi data so you can play virtually any Midi sequence or show into the unit, and it will faithfully record the information. In fact, your Midi sequence can not only contain all the "regular" Midi commands, but can even contain Midi Time Code (the digital Midi version of SMPTE time code) and act as the Master unit in shows requiring synchronized audio, video, or other elements.

Recording is done in real time by simply playing the Midi file into the unit and requires no software or EPROM burners. Playback can be started from either an opto-isolated input or Midi Sequence Select. Shows can be played back individually, sequentially, or in looping mode by simply setting the various DIP switches on the front of the unit. Rear panel connections for the 16 Show inputs, as well as a Stop input and a Playing tally output, are contained on a standard DB25 connector. All shows are stored on affordable, non-volatile SmartMedia cards, which can be easily changed to provide totally new shows and upgrades within seconds.

SETUP

The RP-16 is very simple to setup. No software or special program is required. The front panel DIP switches provide all the basic functions. With these switches, you can set the Record or Play Mode, select different shows, and start and stop shows. For those new to Midi, a short tutorial follows:

Midi Tutorial:

Every Midi cable can carry multiple types of Midi commands. These commands are broken up further into 16 separate Midi channels, each channel having access to all of the same Midi commands. For example, you can have a Note On command on channel 1 and another Note On command on channel 2 on the same cable, and they won't interfere with each other.

Most Midi commands have a maximum resolution of 7 bits, or 128 discreet values. Most commands have 128 "values," which have 128 variations each. The commands that we are concerned with typically are Note On/Off and Controller commands.

Note On/Off:

We use Midi Note On/Off commands to control digital On/Off outputs in our BB-200 series units. Each Note command has 3 values that are transmitted with it; Midi Channel (1-16), Note number (0-127), and Velocity (0-127). To activate a particular digital output on a BB-200 unit such as our DO-16 or AO-16 with digital option, you must transmit the Note On or Off command on the proper Midi channel, with the proper Note number, and the proper Velocity (velocities greater than 0 are on, 0 is off). Each BB-200 can be assigned to any 1 of the 16 Midi channels via the front panel DIP switches. The number that each output responds to is set with the Offset DIP switches. Whatever offset the unit is set to, the first output will respond to that number, and the next 15 outputs will respond to consecutively higher numbers. For example, with an offset of "0" and a Midi Channel setting of "1" (default setting), the first output will respond to Note On/Off commands on Midi channel 1, note number "0", the next output will respond to Ch 1, number 1, etc.

Controllers:

Midi Continuous Controllers are used to activate the 16 analog outputs on our AO-16 when it is in controller mode. Each Controller message has 3 parts to it; Midi Channel (1-16), Controller Number (0-127), and Value (0-127). Each output on the AO-16 can thus be set to any voltage between 0 and 10 volts with a resolution of 128 steps. For example, the

first output of a unit with a Midi Channel setting of 2 and an offset of 16 would respond to Midi Controller messages on Ch2, Controller number 16. A value of “0” in this message would set the voltage to 0 volts, a value of 64 would set the voltage to 5 volts, and a value of 127 would set the voltage to 10 volts.

Pitchbend:

A special case in the Midi command set is Pitchbend. Each Midi channel has only 1 pitchbend command. Thus we can have a maximum of 16 Pitchbend commands on a single Midi cable, each on one of the 16 Midi channels. The advantage of Pitchbend commands is that they are a high resolution command. They have 128 X 128 or 16384 discreet steps that they can set an output to instead of only 128 discreet steps that can be achieved with a controller command. When the AO-16 is set to Pitchbend Mode, it ignores the Midi channel and Offset settings and reassigns each of the 16 analog outputs to a Pitchbend command on the 16 Midi channels. Even though each Pitchbend command has a resolution of 16384 steps, the Maximum resolution of the AO-16 is 4096 (12 bit) steps. This is quite sufficient for almost any application. The unit automatically “rounds down” the higher resolution Pitchbend command to the nearest 12 bit value and sets the output voltage accordingly. This mode is preferable to the Controller mode, as it gives you more control over the voltage and a smoother output. [Please note: Most Midi devices do not generate high resolution Pitchbend. Although they do generate Pitchbend, they typically only send 128 discreet values and simply skip all the in between values. Most sequencers though, will record the higher resolution commands if you can generate them. Contact MediaMation for more information about our high resolution Pitchbend generators and other options.]

REAR PANEL CONNECTORS

Power Options

NOTE: The RP-16 can receive its power from 2 different methods. **It is important that you only use one of these methods at a time.**

Rear Panel Power Jack:

This jack will supply power to RP-16’s internal electronics directly.. It requires any supply of AC or DC between 9 and 24 volts in order to function properly. Polarity (+ and - of the supply) does not matter as the unit has a full bridge rectifier inside.

Midi In or Out/Thru Phantom Power:

Although a Midi jack has 5 connections, only 3 are used for the actual Midi signal. It is a fairly common practice to use the other 2 connections to provide “phantom power” to other devices. Our BB-200 units take advantage of this. On the RP-16, you can receive or transmit power via the rear panel Midi Out jack (not available on the Midi In jack). A jumper (JMP8) on the circuit board near the jacks inside the unit determines whether the unused pins of the Midi jack are connected to the RP-16 power circuit or not. Typically, you can power several BB-200 units from a single source using this method. If you are receiving or sending power from the Midi Out jack, put jumper JMP8 in the enable position.

Notes:

Remember, if you are using the Power In jack to supply power to the RP-16, you can then transmit that power to other BB-200 units via the Midi Out jack, but make sure that none of them is

also trying to transmit power back to your unit. By removing the jumper, or placing it in the Disable position, you are isolating the RP-16 power circuit, and you *must* use the Power In jack to supply power to the unit.

Also, check your Midi cables before you use Phantom Power. Many Midi cables are only “3 wire” type and have no connections to the 2 unused pins. In order to utilize the Phantom Power option, you must use Midi cables with all 5 pins wired through.

Midi In Jack

The Midi In jack receives Midi information from your Midi source. This can be a sequencer, a control console such as the PC-1600, or any other Midi source. This input jack follows the full Midi specification and is opto-isolated.

Midi Out/Thru

The Midi Out/Thru jack re-transmits any Midi data that is received in the Midi In jack to send to other units in the Midi chain. This “Thru” function is only active when the unit is in the idle state (not playing or recording.) During recording, this function is totally disabled. During playback, the resulting data will interfere with the Midi data that the RP-16 is generating and thus, is not reliable. This jack provides an exact reflection of the Midi data that is received at the Midi In jack. A unique feature of all of the BB-200 units is that any data coming out of the Midi Out/Thru jack is totally processed and re-generated. This means that there is no signal degradation at all, and the Midi signal emanating from this jack is brand new “fresh” data. As such, there is a small timing delay (less than 1 millisecond,) but as many BB-200 units as you wish may be daisy chained without having to worry about the typical signal limitations of only 3-5 devices on a Midi chain that most Midi devices have. For example, 25 BB-200 series units may be daisy chained together, and the last unit in the chain will have just as solid and undistorted a data signal as the first unit in the chain. In fact, an incoming Midi signal that has some distortion on it is actually re-transmitted out the Midi Thru jack as a new, undistorted signal in better shape than when it arrived.

DB-25 I/O Connector

This connector carries all the input pins to your external buttons or other interfaces. It is a standard DB-25 connector socket. Mating connectors are readily available at most electronic, computer, or Radio Shack stores. Please see accompanying diagram for the specific signals at each pin on this connector.

FRONT PANEL INDICATORS

DIP Switches

These are used to set the Mode (Record, Play, Loop , etc.), and select and start shows manually. Please refer to the accompanying diagrams for the different settings.

Power LED

This LED will illuminate whenever the unit is powered up.

Midi LED

This LED is used to indicate incoming Midi messages received at the Midi In jack. Whenever a Midi message is received, this LED will blink.

Sequence Indicator LEDs

These LEDs indicate the currently selected sequence and its status. When the LED is blinking slowly (about 2 per second,) that indicates the sequence is selected but not playing and the unit is in Idle mode. When the LED blinks rapidly, that indicates that the selected sequence is in Record Ready mode and will start recording as soon as data is sent to it. When the LED is on steady, that indicates the selected sequence is Playing or Recording.

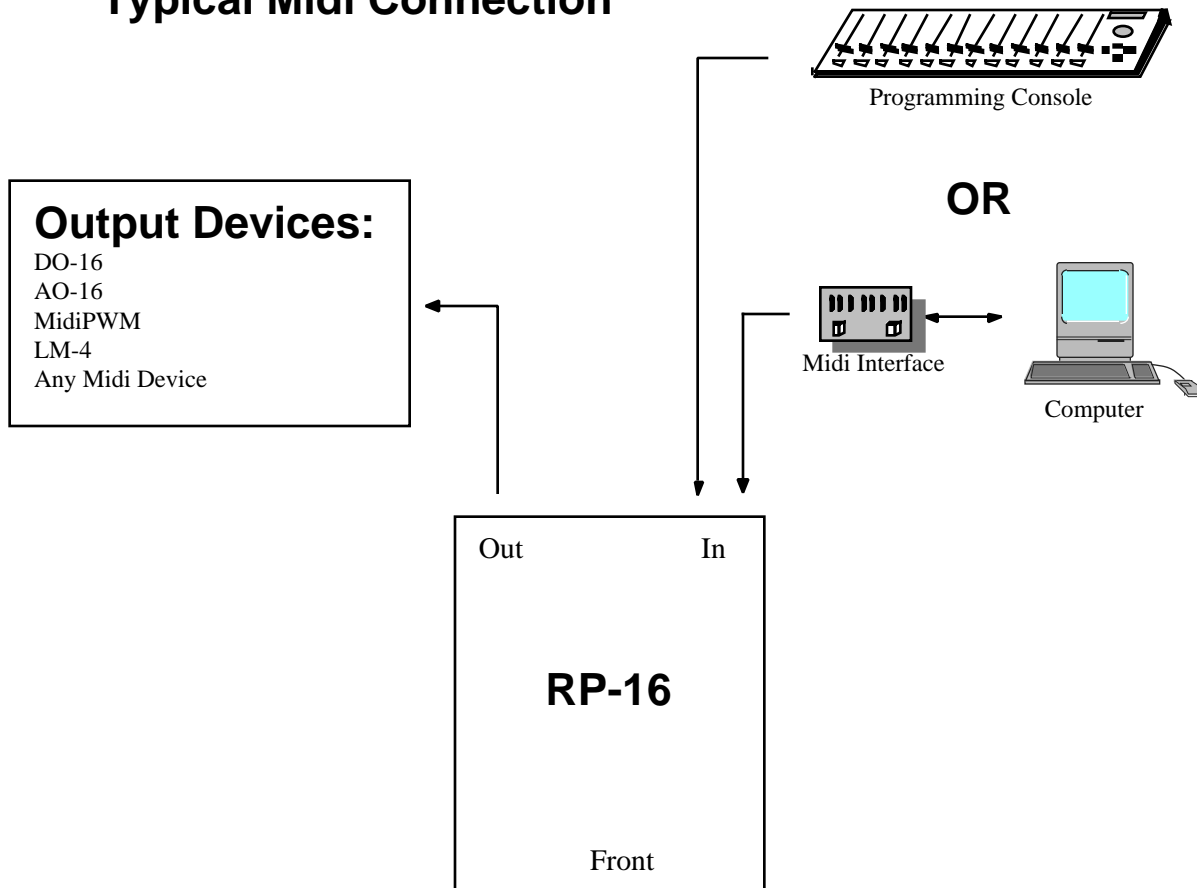
CONNECTING YOUR RP-16

The RP-16 has all of the connectors on the rear panel, and all of the indicators and DipSwitches on the front. This makes it easy to mount and wire the unit without creating an “octopus” of cables. An optional rack mount adapter allows up to 4 BB-200 units to be mounted in a single rack space. There is also an optional mounting plate that provides “wings” so the unit may be mounted to any flat surface.

Midi Wiring

Typically, the RP-16 will be in circuit as you program. When your sequence is ready to load into the unit, put the unit into record and play the sequence into the RP-16. Once all the sequences have been stored into the memory card of the RP-16, your sequencer or programming console may be removed and you are ready to play shows. Below is a typical wiring diagram for the Midi connections.

Typical Midi Connection



Wiring the DB25 Connector

The DB25 connector on the rear of the unit allows you to connect external buttons, controllers, or other interfaces to the RP-16 to control its functions. There are 16 inputs to choose which of the 16 shows to play, one input to Stop playback, and one input to move to the next sequence or continue a sequence that was stopped midway (see the DipSwitch settings to choose which function this input will do). There are also 2 output pins; a Play Indicator and a current regulated voltage to be used to trigger the inputs.

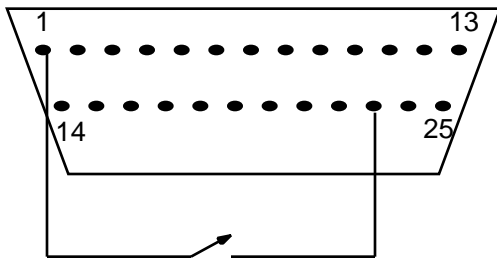
Input Pins

The inputs on the RP-16 are all fully Opto-Isolated. This means that signals sent into the pin don't go to the internal circuitry, but rather are applied to an LED that uses light to trigger the internal circuitry. This protects the internal circuitry from static and other stray voltages that might damage the unit. However, since the inputs are isolated, you must supply an external voltage and a current regulating resistor in order to light the LED. Sometimes, this is not convenient. For this reason, pin 23 on the DB25 has a current regulated voltage output that you can use to trigger the inputs. Using this connection reduces the isolating protection though and should not be used in conditions with lots of static, lighting, unstable AC Power, or critical applications. Refer to the diagram below.

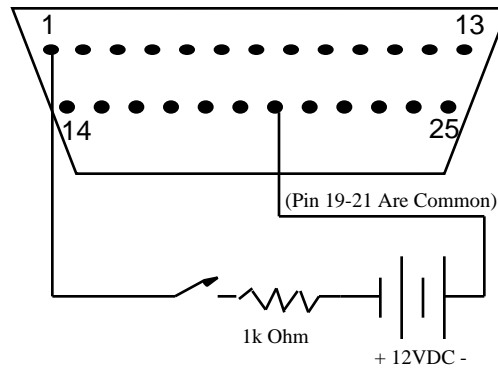
Play Indicator

The Play Indicator output is an opto-isolated, open collector output that pulses rapidly when any sequence is playing. This output can source up to 50ma of DC voltage. You can use it to drive an LED to indicate that a show is playing, a relay to turn on higher power lights or trigger other devices, or connect it to various pins on the RP-16 itself to disable them. A typical usage is to disable the RP-16's ability to start another sequence until the current sequence is finished. Since this output is a "pull to ground" connection, simply wiring it to any of the input pins will short that pin and disable that pin whenever a sequence is playing. If you are using the power from pin #23 to drive your inputs, you can simply connect the Play Indicator pin to pin 23, and you will not be able to trigger any sequences until the current sequence is complete. See the diagram below for more details.

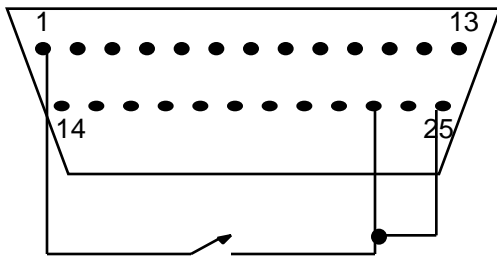
Using the Internal Power to trigger Sequence #1



Using an External Voltage to trigger Sequence #1



Using the Play Indicator to inhibit when using internal Power to trigger Sequence #1



SETUP

The RP-16 stores its data on a standard 2 MB SmartMedia card. Cards sold by MediaMation Inc. are pre-formatted before shipping. If you are adding a new card to your system, you will need format it if it is brand new, or run a quick setup command if it has been previously formatted. This formatting process sets up the card for use with the RP-16 and also stores information about any bad memory blocks that may be present on the card in a header inside the card's memory. These procedures take a simple Midi System Exclusive command to initiate. This command can be sent from any Midi sequencer or programmable controller.

Formatting a new SmartMedia Card

When using a brand new SmartMedia card, you must format the card. To do this, follow these steps:

1. Disconnect power from the RP-16.
2. Insert the new SmartMedia card.
3. Connect a Midi cable from your sequencer or controller to the Midi In jack on the back of the RP-16.
4. Connect power to the RP-16.
5. Send the following System Exclusive command to the unit by typing it into your sequencer or controller, or by playing back the Standard Midi File labeled FORMAT.MID contained on the included utility disk. The command is:

" F0 77 7F 10 00 F7 "

The front panel LEDs on the unit will chase back and forth to indicate the card is being formatted. When they finish, the unit is ready to go.

Setting up a previously formatted SmartMedia card

When using a previously formatted SmartMedia card, you must setup the RP-16 for that particular card. To do this, follow these steps:

1. Disconnect power from the RP-16.
2. Insert the formatted SmartMedia card.
3. Connect a Midi cable from your sequencer or controller to the Midi In jack on the back of the RP-16.
4. Connect power to the RP-16.
5. Send the following System Exclusive command to the unit by typing it into your sequencer or controller, or by playing back the Standard Midi File labeled SETUP.MID contained on the included utility disk. The command is:

" F0 77 7F 13 F7 "

The front panel LED's on the unit will chase back and forth to indicate the card is being formatted. When they finish, you are ready to go

Checking available Free Space

Unless you are certain that you have not filled up your SmartMedia cards memory, you will want to check the available Free Space left on your card. To do this, simply send the following Midi System Exclusive command:

" F0 77 7F 1A F7 "

One of the 16 front panel LED's will then begin blinking 10 times to indicate the approximate amount of free space remaining on your SmartMedia card. The following table tells you what each LED means. A Midi sequence requires a minimum of 1 block of memory space (each Block of memory is 4k bytes in size).

LED Number	Blocks Free	Percentage
1 (Leftmost LED)	32 or less	6%
2	64	12%
3	96	18%
4	128	25%
5	160	31%
6	192	37%
7	224	43%
8	256	50%
9	288	56%
10	320	62%
11	352	68%
12	384	75%
13	416	81%
14	448	87%
15	480	93%
16	Up to 512	Up to 100%

RECORDING

Once you have formatted or setup your SmartMedia card, you are ready to record your show or sequence into the RP-16. This is done by selecting which of the available 16 shows you want to record your sequence into, putting the RP-16 into Record mode, and playing your sequence into the unit.

Step 1 – Selecting the sequence #

First, you must decide which of the 16 sequences you will record onto. The 16 LED's on the front of the unit indicate the currently selected sequence. The LED should be blinking slowly. There are three ways to select or change which sequence is the current sequence:

1 Selecting the sequence via the front or rear “Next” switch.

You can choose which of the 16 sequences you will use by cycling through each sequence by toggling either the front panel Next switch (DipSwitch #6) or by activating the Next pin (pin #17) on the rear panel DB25 connector. Each time you toggle the switch or activate the rear panel pin, the unit will change the active sequence to the next higher sequence. The light for that sequence will begin to blink. When you reach sequence 16, the next cycle will return you to sequence 1 and start again. This is the typical method for selecting the sequence to record on as it does not matter if the sequence is empty or not.

2 Selecting the sequence via Midi

You can choose which of the 16 sequences you will use by sending a Midi Sequence Select command. Simply send the proper Sequence select number and the unit will switch to that sequence. NOTE: If the sequence has a show stored in it already, this will cause the show to begin playing. Only use this method for empty sequences. Many sequencers do not send this command easily, so this is not typically used to select the sequence for recording.

3 Selecting the sequence via the rear connector terminals

You can choose which of the 16 sequences you will use by triggering one of the 16 sequence select pins located on the DB25 connector on the rear of the unit. Simply activate the proper input and the unit will switch to that sequence. NOTE: If the sequence has a show stored in it already, this will cause the show to begin playing. Only use this method for empty sequences. *See the section for wiring the rear panel connector for more information.*

Step 2 – Put the unit into record mode

When the proper sequence is selected, you now put the unit into record mode by pushing the front panel DipSwitch #2 down. The selected sequence LED will now begin to blink rapidly.

Step 3 – Record your sequence

As soon as the LED is blinking rapidly, you are ready to record. The RP-16 will record any Midi Data it receives with the exception of Midi Start, Stop, and Beat Clock commands. All other commands will be recorded in real time as they come in. As soon as the RP-16 starts to record, the LED will go on solid and stop blinking. **NOTE: The Midi Thru function is disabled during the record process. This will typically make you output devices stop responding during this process. This is normal as the unit is too busy at this point to bother with this function.**

There are 3 different ways to start the record process:

1 Send a Midi Start Command

The best way to start the record process is to send a Midi Start command. Most sequencers will generate this command if you activate the “transmit sync” or “generate Midi Beat Clocks” feature (this is different than MTC or Midi Time Code). This is the preferred method of starting the record process as it allows you to leave as much blank space before the first Midi Data as you need, and the record process will stop when you stop your sequencer as it will generate the Stop command.

Example- To activate this feature in Performer or Digital Performer, go the BASIC menu and select TRANSMIT SYNC. A window will appear with several options. Select the Midi port or interface that the RP-16 is connected to in the pull down menu. Next select GENERATE MIDI CLOCK. Close the window and you are ready to go. From now on, each time you start your sequence from the beginning, it will generate the Start command. When you stop it, it will generate the Stop command. *It is a good idea to only turn this function on when ready to record. Turn it off during normal programming and playback modes.*

Send Midi Data

When the RP-16 is in record ready mode, it will begin recording as soon as it receives ANY Midi Data. Simply start playing your sequence and the unit will start to record. You will need to manually stop the record process by either switching DipSwitch # 2 off, Toggling the Play/Stop DipSwitch (#5) down and back up, or activating the rear DB25 Stop pin (#18)

Using the START DipSwitch

When the RP-16 is in record ready mode, it will begin recording as soon as you activate the Start DipSwitch (#5) on the front panel. The unit will begin recording as soon as you push this switch down. You will need to manually stop the record process by either switching DipSwitch # 2 off, Toggling the Play/Stop DipSwitch (#5) back up, or activating the rear DB25 Stop pin (#18)

Playback

Once you have recorded at least 1 sequence into the RP-16, you are ready to playback your sequences. The RP-16 will only play 1 sequence at a time. If another sequence is currently playing and you trigger a new sequence, that sequence will stop playing and the new one will begin. Just like recording, there are 3 ways to start the playback process.

1 Send a Midi Start or Sequence Select Command

Most sequencers will generate this command if you activate the “transmit sync” or “generate Midi Beat Clocks” feature (this is different than MTC or Midi Time Code). When the Rp-16 receives a Start command, it will begin to playback the current sequence. When it receives a Sequence Select command, it will switch to whichever sequence number the Sequence Select is, and begin playback. See example above in RECORDING to turn on and off this function in Performer. Most other sequencers will have similar instructions to turn on the generate Start/Stop and Sequence Select feature.

Activate one of the 16 select pins on the DB25

Applying the proper signal to any one of the 16 Sequence Select pins (pins 1-16) will start that sequence playing.

Using the START DipSwitch

When the RP-16 is in Idle mode, it will begin playing as soon as you activate the Start DipSwitch (#5) on the front panel. Toggling the Play/Stop DipSwitch (#5) back up, or activating the rear DB25 Stop pin (#18) will stop the playback

Loop Setting

The playback mode of the RP-16 can be set with the front panel DipSwitches. If the Start DipSwitch (#5) is on or Down when the unit is powered up, playback will begin immediately.

SW7	SW8	Description
OFF	OFF	One Sequence play
OFF	ON	One Sequence play with loop
ON	OFF	Sequential Sequence play
ON	ON	Sequential Sequence play with loop

Connector PIN assignment (DB-25M)

Pin 1	Sequence 1	Pin 14	Sequence 14
Pin 2	Sequence 2	Pin 15	Sequence 15
Pin 3	Sequence 3	Pin 16	Sequence 16
Pin 4	Sequence 4	Pin 17	Next Sequence Select
Pin 5	Sequence 5	Pin 18	Stop
Pin 6	Sequence 6	Pin 19	Common
Pin 7	Sequence 7	Pin 20	Common
Pin 8	Sequence 8	Pin 21	Common
Pin 9	Sequence 9	Pin 22	Common
Pin 10	Sequence 10	Pin 23	+ Power for Inputs
Pin 11	Sequence 11	Pin 24	Common
Pin 12	Sequence 12	Pin 25	Play Indicator
Pin 13	Sequence 13		

Advanced Commands

The following System Exclusive commands give you access to the advanced features of the RP-16

MIDI Control command (System Exclusive message)

Format SmartMedia

F0 77 7F 10 00 F7

Erase Sequence

F0 77 7F 11 aa bb cc dd...F7 *aa, bb, cc...Sequence Number up to 16*

Erase all Sequences

Erase all of Sequence (1 to 16)

F0 77 7F 12 F7

Setup for SmartMedia
F0 77 7F 13 F7

Free space
F0 77 7F 1A F7 (*)

Next Sequence select (SW6)

This switch changes Sequence to next. SW ON ---> OFF

Recording Mode (SW2, SW5)

Both switches must be on when you want to select recording mode.

Format SmartMedia Command

SmartMedia might contain a few blocks. When you use the new SmartMedia card with RP-16, you must run this command. This process checks for/the bad blocks in a card and stores this information in a header.

Setup for SmartMedia Command

Formatted SmartMedia for RP-16 has blocked information. When you change a card, you must run this command.

Free space Command

This command show you how much memory space is available in a card. The minimum block size on a SmartMedia is 4 Kbytes. Even if a Sequence has only a few Midi commands, it takes 4 Kbytes.

(*)Most of the left LEDs blink	32 blocks free	1 block = 4 Kbytes
2nd left LED blinks	64 blocks free	
2nd right LED blinks	448 blocks free	
Most right LEDs blink	480 blocks free	

In recording mode, MIDI Thru will not work.

Recording Error Sequence # LED blinks

Format Error #4 LED lights up

Erase Error #15 LED lights up

Worst Case 501 Block x 3840 bytes = 1923840

Best Case 511 Block x 3840 bytes = 1962240

Worst Case 458 sec = 7.6 min. 549668 Events

Best Case 458 sec = 7.6 min. 560840 Events