

MIDI Implementation

Model: RD-2000EX
Date: Jan. 1, 2024
Version: 1.00

1. Receive data

■ Channel Voice Messages

● Note off

Status	2nd byte	3rd byte
8nH	kkH	vvH
9nH	kkH	00H

n = MIDI channel number: 0H–FH (ch.1–16)

kk = note number: 00H–7FH (0–127)

vv = note off velocity: 00H–7FH (0–127)

* Some instruments are not received in Rhythm set.

● Note on

Status	2nd byte	3rd byte
9nH	kkH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

kk = note number: 00H–7FH (0–127)

vv = note on velocity: 01H–7FH (1–127)

● Polyphonic Key Pressure

Status	2nd byte	3rd byte
AnH	kkH	vvH

n = MIDI channel number: 0H–FH (ch.1–ch.16)

kk = note number: 00H–7FH (0–127)

vv = key pressure: 00H–7FH (0–127)

● Control Change

○ Bank Select (Controller number 0, 32)

Status	2nd byte	3rd byte
BnH	00H	mmH
BnH	20H	llH

n = MIDI channel number: 0H–FH (ch.1–16)

mm, ll = Bank number: 00 00H–7F 7FH (bank.1–bank.16384)

○ Modulation (Controller number 1)

Status	2nd byte	3rd byte
BnH	01H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Modulation depth: 00H–7FH (0–127)

○ Portamento Time (Controller number 5)

Status	2nd byte	3rd byte
BnH	05H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Portamento Time: 00H–7FH (0–127)

○ Data Entry (Controller number 6, 38)

Status	2nd byte	3rd byte
BnH	06H	mmH
BnH	26H	llH

n = MIDI channel number: 0H–FH (ch.1–16)

mm, ll = the value of the parameter specified by RPN/NRPN

mm = MSB, ll = LSB

○ Volume (Controller number 7)

Status	2nd byte	3rd byte
BnH	07H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Volume: 00H–7FH (0–127)

○ Panpot (Controller number 10)

Status	2nd byte	3rd byte
BnH	0AH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Panpot: 00H–40H–7FH (Left–Center–Right)

○ Expression (Controller number 11)

Status	2nd byte	3rd byte
BnH	0BH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Expression: 00H–7FH (0–127)

○ Tone Color (Controller number 24)

Status	2nd byte	3rd byte
BnH	18H	vvH

n = MIDI channel number: 0H–3H (ch.1–4)

vv = Control value: 00H–7FH (0–127)

○ Hold 1 (Controller number 64)

Status	2nd byte	3rd byte
BnH	40H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH

○ Portamento (Controller number 65)

Status	2nd byte	3rd byte
BnH	41H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) 0–63 = OFF, 64–127 = ON

○ Sostenuto (Controller number 66)

Status	2nd byte	3rd byte
BnH	42H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) 0–63 = OFF, 64–127 = ON

○ Soft (Controller number 67)

Status	2nd byte	3rd byte
BnH	43H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127)

○ Legato Footswitch (Controller number 68)

Status	2nd byte	3rd byte
BnH	44H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) 0–63 = OFF, 64–127 = ON

○ Resonance (Controller number 71)

Status	2nd byte	3rd byte
BnH	47H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Resonance value (relative change): 00H–7FH (–64–0–+63)

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○ Release Time (Controller number 72)

Status	2nd byte	3rd byte
BnH	48H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Release Time value (relative change): 00H–7FH (-64–0–+63)

○ Attack time (Controller number 73)

Status	2nd byte	3rd byte
BnH	49H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Attack time value (relative change): 00H–7FH (-64–0–+63),

○ Cutoff (Controller number 74)

Status	2nd byte	3rd byte
BnH	4AH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Cutoff value (relative change): 00H–7FH (-64–0–+63)

○ Decay Time (Controller number 75)

Status	2nd byte	3rd byte
BnH	4BH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Decay Time value (relative change): 00H–7FH (-64–0–+63)

○ Vibrato Rate (Controller number 76)

Status	2nd byte	3rd byte
BnH	4CH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Vibrato Rate value (relative change): 00H–7FH (-64–0–+63)

○ Vibrato Depth (Controller number 77)

Status	2nd byte	3rd byte
BnH	4DH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Vibrato Depth Value (relative change): 00H–7FH (-64–0–+63)

○ Vibrato Delay (Controller number 78)

Status	2nd byte	3rd byte
BnH	4EH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Vibrato Delay value (relative change): 00H–7FH (-64–0–+63)

○ Portamento Control (Controller number 84)

Status	2nd byte	3rd byte
BnH	54H	kkH

n = MIDI channel number: 0H–FH (ch.1–16)

kk = source note number: 00H–7FH (0–127)

- * A Note-on received immediately after a Portamento Control message will change continuously in pitch, starting from the pitch of the Source Note Number.
- * If a voice is already sounding for a note number identical to the Source Note Number, this voice will continue sounding (i.e., legato) and will, when the next Note-on is received, smoothly change to the pitch of that Note-on.
- * The rate of the pitch change caused by Portamento Control is determined by the Portamento Time value.

○ High Resolution Velocity Prefix (Controller number 88)

Status	2nd byte	3rd byte
BnH	58H	kkH

n = MIDI channel number: 0H–FH (ch.1–16)

kk = High Resolution Velocity Prefix: 00H–7FH (0–127)

○ Effect 1 (Reverb Send Level) (Controller number 91)

Status	2nd byte	3rd byte
BnH	5BH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Reverb Send Level: 00H–7FH (0–127)

○ Effect 3 (Chorus Send Level) (Controller number 93)

Status	2nd byte	3rd byte
BnH	5DH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Chorus Send Level: 00H–7FH (0–127)

○ RPN MSB/LSB (Controller number 100, 101)

Status	2nd byte	3rd byte
BnH	65H	mmH
BnH	64H	llH

n = MIDI channel number: 0H–FH (ch.1–16)

mm = upper byte (MSB) of parameter number specified by RPN

ll = lower byte (LSB) of parameter number specified by RPN

<<< RPN >>>

Control Changes include RPN (Registered Parameter Numbers), which are extended. When using RPNs, first RPN (Controller numbers 100 and 101; they can be sent in any order) should be sent in order to select the parameter, then Data Entry (Controller numbers 6 and 38) should be sent to set the value. Once RPN messages are received, Data Entry messages that is received at the same MIDI channel after that are recognized as changing toward the value of the RPN messages. In order not to make any mistakes, transmitting RPN Null is recommended after setting parameters you need.

This device receives the following RPNs.

RPN MSB, LSB	Data entry MSB, LSB	Notes
00H, 00H	mmH, llH	Pitch Bend Sensitivity mm: 00H–18H (0–24 semitones) ll: ignored (processed as 00H) Up to 2 octave can be specified in semitone steps.
00H, 01H	mmH, llH	Channel Fine Tuning mm, ll: 20 00H–40 00H–60 00H (-4096 x 100 / 8192–0–+4096 x 100 / 8192 cent)
00H, 02H	mmH, llH	Channel Coarse Tuning mm: 10H–40H–70H (-48–0–+48 semitones) ll: ignored (processed as 00H)
00H, 05H	mmH, llH	Modulation Depth Range mm, ll: 00 00H–06 00H (0–16384 x 600 / 16384 cent)
7FH, 7FH	---, ---	RPN null RPN and NRPN will be set as “unspecified.” Once this setting has been made, subsequent Parameter values that were previously set will not change. mm, ll: ignored

○ Harmonic Bar 1–9 (Controller number 102–110)

Status	2nd byte	3rd byte
BnH	66H–6EH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) Step0–8

○ Percussion Volume (Controller number 112)

Status	2nd byte	3rd byte
BnH	70H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) 0–63 = Normal, 64–127 = Soft

○ Percussion Switch/Decay (Controller number 114)

Status	2nd byte	3rd byte
BnH	72H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) Off, 2nd/Fast, 2nd/Slow, 3rd/Fast, 3rd/Slow

● Program Change

Status	2nd byte
CnH	ppH

n = MIDI channel number: 0H–FH (ch.1–16)

pp = Program number: 00H–7FH (prog.1–prog.128)

● Pitch Bend Change

Status	2nd byte	3rd byte
EnH	llH	mmH

n = MIDI channel number: 0H–FH (ch.1–16)

mm, ll = Pitch Bend value: 00 00H–40 00H–7F 7FH (-8192–0–+8191)

■ Channel Mode Messages

● All Sounds Off (Controller number 120)

Status	2nd byte	3rd byte
BnH	78H	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* When this message is received, all notes currently sounding on the corresponding channel will be turned off.

● Reset All Controllers (Controller number 121)

Status	2nd byte	3rd byte
BnH	79H	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* When this message is received, the following controllers will be set to their reset values.

Controller	Reset value
Pitch Bend Change	±0 (center)
Channel Pressure	0 (off)
Modulation	0 (off)
Breath Type	0 (min)
Expression	127 (max)
Hold 1	0 (off)
Sostenuto	0 (off)
Soft	0 (off)
RPN	unset; previously set data will not change
NRPN	unset; previously set data will not change

● All Notes Off (Controller number 123)

Status	2nd byte	3rd byte
BnH	7BH	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* When All Notes Off is received, all notes on the corresponding channel will be turned off. However, if Hold 1 or Sostenuto is ON, the sound will be continued until these are turned off.

● OMNI OFF (Controller number 124)

Status	2nd byte	3rd byte
BnH	7CH	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* The same processing will be carried out as when All Notes Off is received.

● OMNI ON (Controller number 125)

Status	2nd byte	3rd byte
BnH	7DH	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* The same processing will be carried out as when All Notes Off is received. OMNI ON will not be turned on.

● MONO (Controller number 126)

Status	2nd byte	3rd byte
BnH	7EH	mmH

n = MIDI channel number: 0H–FH (ch.1–16)

mm = mono number: 00H–10H (0–16)

* The same processing will be carried out as when All Notes Off is received.

● POLY (Controller number 127)

Status	2nd byte	3rd byte
BnH	7FH	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* The same processing will be carried out as when All Notes Off is received.

■ System Realtime Message

● Timing Clock

● Active Sensing

Status
FEH

* When Active Sensing is received, the unit will begin monitoring the intervals of all further messages. While monitoring, if the interval between messages exceeds 420 ms, the same processing will be carried out as when All Sounds Off, All Notes Off and Reset All Controllers are received, and message interval monitoring will be halted.

■ System Exclusive Message

Status	2nd byte	3rd byte
F0H	iiH, ddH,,eeH	F7H
F0H:	System Exclusive Message status	
ii = ID number:	an ID number (manufacturer ID) to indicate the manufacturer whose Exclusive message this is. Roland's manufacturer ID is 41H. ID numbers 7EH and 7FH are extensions of the MIDI standard; Universal Non-realtime Messages (7EH) and Universal Realtime Messages (7FH).	
dd,...,ee = data:	00H–7FH (0–127)	
F7H:	EOX (End Of Exclusive)	

Of the System Exclusive messages received by this device, the Universal Non-realtime messages and the Universal Realtime messages and the Data Request (RQ1) messages and the Data Set (DT1) messages will be set automatically.

● Universal Non-realtime System Exclusive Messages

○ Identity Request Message

Status	2nd byte	3rd byte
F0H	7EH, dev, 06H, 01H	F7H
Byte	Explanation	
F0H	Exclusive status	
7EH	ID number (Universal Non-realtime Message)	
dev	Device ID (dev: 10H–1FH, 7FH, the initial value is 10H (17))	
06H	Sub ID#1 (General Information)	
01H	Sub ID#2 (Identity Request)	
F7H	EOX (End Of Exclusive)	

* When this message is received, "Identity Reply Message" (p. 8) will be transmitted.

● Universal Realtime System Exclusive Messages

○ Master Volume

Status	2nd byte	3rd byte
F0H	7FH, 7FH, 04H, 01H, IIH, mmH	F7H
Byte	Explanation	
F0H	Exclusive status	
7FH	ID number (universal realtime message)	
7FH	Device ID (Broadcast)	
04H	Sub ID#1 (Device Control)	
01H	Sub ID#2 (Master Volume)	
IIH	Master Volume lower byte	
mmH	Master Volume upper byte	
F7H	EOX (End Of Exclusive)	

* The lower byte (IIH) of Master Volume will be handled as 00H.

* The Master Volume parameter (EDIT: System: Master Volume) will change.

○ Master Fine Tuning

Status	2nd byte	3rd byte
F0H	7FH, 7FH, 04H, 03H, IIH, mmH	F7H
Byte	Explanation	
F0H	Exclusive status	
7FH	ID number (universal realtime message)	
7FH	Device ID (Broadcast)	
04H	Sub ID#1 (Device Control)	
03H	Sub ID#2 (Master Fine Tuning)	
IIH	Master Fine Tuning LSB	
mmH	Master Fine Tuning MSB	
F7H	EOX (End Of Exclusive)	

mm, II: 00 00H–40 00H–7F 7FH (-100–0–+99.9 [cents])

○ Master Coarse Tuning

Status	2nd byte	3rd byte
F0H	7FH, 7FH, 04H, 04H, IIH, mmH	F7H
Byte	Explanation	
F0H	Exclusive status	
7FH	ID number (universal realtime message)	
7FH	Device ID (Broadcast)	
04H	Sub ID#1 (Device Control)	
04H	Sub ID#2 (Master Coarse Tuning)	
IIH	Master Coarse Tuning LSB	
mmH	Master Coarse Tuning MSB	
F7H	EOX (End Of Exclusive)	
II:	ignored (processed as 00H)	
mm:	28H–40H–58H (-24–0–+24 [semitones])	

● Global Parameter Control

○ Scale/Octave Tuning Adjust

Status	2nd byte	3rd byte
F0H	7EH, 7FH, 08H, 08H, ffH, ggH, hhH, ssH...	F7H
Byte	Explanation	
F0H	Exclusive status	
7EH	ID number (Universal Non-realtime Message)	
7FH	Device ID (Broadcast)	
08H	Sub ID#1 (MIDI Tuning Standard)	
08H	Sub ID#2 (scale/octave tuning 1-byte form)	
ffH	Channel/Option byte 1 bits 0 to 1 = channel 15 to 16 bit 2 to 6 = Undefined	
ggH	Channel byte 2 bits 0 to 6 = channel 8 to 14	
hhH	Channel byte 3 bits 0 to 6 = channel 1 to 7	
ssH	12 byte tuning offset of 12 semitones from C to B 00H = -64 [cents] 40H = 0 [cents] (equal temperament) 7FH = +63 [cents]	
F7H	EOX (End Of Exclusive)	

○ Key-based Instrument Controllers

Status	2nd byte	3rd byte
F0H	7FH, 7FH, 0AH, 01H, 0nH, kkH, nnH, vvH	F7H
Byte	Explanation	
F0H	Exclusive status	
7FH	ID number (universal realtime message)	
7FH	Device ID (Broadcast)	
0AH	Sub ID#1 (Key-Based Instrument Control)	
01H	Sub ID#2 (Controller)	
0nH	MIDI Channel (00–0F)	
kkH	Key Number	
nnH	Control Number	
vvH	Value nn = 07H Level vv = 00H–7FH 0–200% (Relative) nn = 0AH Pan vv = 00H–7FH Left–Right (Absolute)	
:	:	
F7	EOX (End Of Exclusive)	

* This parameter affects drum instruments only.

● Data Transmission

This instrument can use exclusive messages to exchange many varieties of internal settings with other devices.

The model ID of the exclusive messages used by this instrument is 00H 00H 75H.

○ Data Request 1 (RQ1)

This message requests the other device to transmit data. The address and size indicate the type and amount of data that is requested.

When a Data Request message is received, if the device is in a state in which it is able to transmit data, and if the address and size are appropriate, the requested data is transmitted as a Data Set 1 (DT1) message. If the conditions are not met, nothing is transmitted.

Status	2nd byte	3rd byte
F0H	41H, dev, 00H, 00H, 75H, 11H, aaH, bbH, ccH, ddH, ssH, ttH, uuH, vvH, sum	F7H

Byte	Explanation
F0H	Exclusive status
41H	ID number (Roland)
dev	Device ID (dev: 10H–1FH, 7FH)
00H	Model ID #1 (RD-2000EX)
00H	Model ID #2 (RD-2000EX)
75H	model ID #3 (RD-2000EX)
11H	Command ID (RQ1)
aaH	Address MSB
bbH	Address
ccH	Address
ddH	Address LSB
ssH	Size MSB
ttH	Size
uuH	Size
vvH	Size LSB
sum	Checksum
F7H	EOX (End Of Exclusive)

- * The size of data that can be transmitted at one time is fixed for each type of data. And data requests must be made with a fixed starting address and size. Refer to the address and size given in "3. Parameter Address Map" (p. 9).
- * For the checksum, refer to 16 page.

○ Data Set 1 (DT1)

This is the message that actually performs data transmission, and is used when you wish to transmit the data.

Status	2nd byte	3rd byte
F0H	41H, dev, 00H, 00H, 75H, 12H, aaH, bbH, ccH, ddH, eeH, ... ffH, sum	F7H

Byte	Explanation
F0H	Exclusive status
41H	ID number (Roland)
dev	Device ID (dev: 10H–1FH, 7FH, Initial value is 10H)
00H	Model ID #1 (RD-2000EX)
00H	Model ID #2 (RD-2000EX)
75H	Model ID #3 (RD-2000EX)
12H	Command ID (DT1)
aaH	Address MSB: upper byte of the starting address of the data to be sent
bbH	Address: upper middle byte of the starting address of the data to be sent
ccH	Address: lower middle byte of the starting address of the data to be sent
ddH	Address LSB: lower byte of the starting address of the data to be sent.
eeH	Data: the actual data to be sent. Multiple bytes of data are transmitted in order starting from the address.
:	:
ffH	Data
sum	Checksum
F7H	EOX (End Of Exclusive)

- * The amount of data that can be transmitted at one time depends on the type of data, and data will be transmitted from the specified starting address and size. Refer to the address and size given in "3. Parameter Address Map" (p. 9).
- * Data larger than 256 bytes will be divided into packets of 256 bytes or less, and each packet will be sent at an interval of about 20 ms.
- * Regarding the checksum, please refer to p. 16.

2. Data Transmission

■ Channel Voice Messages

● Note off

Status	2nd byte	3rd byte
8nH	kkH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

kk = note number: 00H–7FH (0–127)

vv = note of velocity: 00H–7FH (0–127)

● Note on

Status	2nd byte	3rd byte
9nH	kkH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

kk = note number: 00H–7FH (0–127)

vv = note on velocity: 01H–7FH (1–127)

● Control Change

* By selecting a controller number that corresponds to the setting of parameters of controllers (Pedals, Assign 1-9, Sliders, Wheels), these can transmit any control change message.

○ Bank Select (Controller number 0, 32)

Status	2nd byte	3rd byte
BnH	00H	mmH
BnH	20H	llH

n = MIDI channel number: 0H–FH (ch.1–16)

mm, ll = Bank number: 00 00H–7F 7FH (bank.1–bank.16384)

○ Modulation (Controller number 1)

Status	2nd byte	3rd byte
BnH	01H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Modulation depth: 00H–7FH (0–127)

* These messages are transmitted when Modulation lever is operated.

○ Portamento Time (Controller number 5)

Status	2nd byte	3rd byte
BnH	05H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Portamento Time: 00H–7FH (0–127)

* These messages are transmitted when Portamento Time is set in External Zone.

○ Data Entry (Controller number 6, 38)

Status	2nd byte	3rd byte
BnH	06H	mmH
BnH	26H	llH

n = MIDI channel number: 0H–FH (ch.1–16)

mm, ll = the value of the parameter specified by RPN/NRPN

mm = MSB, ll = LSB

○ Volume (Controller number 7)

Status	2nd byte	3rd byte
BnH	07H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Volume: 00H–7FH (0–127)

* These messages are transmitted when Zone Level Slider is operated in External Zone.

* These messages are transmitted when Volume value is set in External Zone.

○ Panpot (Controller number 10)

Status	2nd byte	3rd byte
BnH	0AH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Panpot: 00H–40H–7FH (Left–Center–Right)

* These messages are transmitted when Pan value is set in External Zone.

○ Expression (Controller number 11)

Status	2nd byte	3rd byte
BnH	0BH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Expression: 00H–7FH (0–127)

○ Tone Color (Controller number 24)

Status	2nd byte	3rd byte
BnH	18H	vvH

n = MIDI channel number: 0H–3H (ch.1–4)

vv = Expression: 00H–7FH (0–127)

○ Hold 1 (Controller number 64)

Status	2nd byte	3rd byte
BnH	40H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127)

* These messages are transmitted when Damper pedal is operated.

○ Portamento (Controller number 65)

Status	2nd byte	3rd byte
BnH	41H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127)

* These messages are transmitted when Portamento Switch is set in External Zone.

○ Sostenuto (Controller number 66)

Status	2nd byte	3rd byte
BnH	42H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127)

○ Soft (Controller number 67)

Status	2nd byte	3rd byte
BnH	43H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127)

○ Legato Footswitch (Controller number 68)

Status	2nd byte	3rd byte
BnH	44H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) 0–63 = OFF, 64–127 = ON

○ Resonance (Controller number 71)

Status	2nd byte	3rd byte
BnH	47H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Resonance value (relative change): 00H–7FH (-64–0–+63)

* These messages are transmitted when Resonance value is set in External Zone.

○ Release Time (Controller number 72)

Status	2nd byte	3rd byte
BnH	48H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Release Time value (relative change): 00H–7FH (-64–0–+63)

* These messages are transmitted when Release Time is set in External Zone.

○ Attack Time (Controller number 73)

Status	2nd byte	3rd byte
BnH	49H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Attack time value (relative change): 00H–7FH (-64–0–+63)

* These messages are transmitted when Attack Time is set in External Zone.

○ Cutoff (Controller number 74)

Status	2nd byte	3rd byte
BnH	4AH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Cutoff value (relative change): 00H–7FH (-64–0–+63)

* These messages are transmitted when Cutoff value is set in External Zone.

○ Decay Time (Controller number 75)

Status	2nd byte	3rd byte
BnH	4BH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Decay Time value (relative change): 00H–40H–7FH (-64–0–+63)

* These messages are transmitted when Decay Time value is set in External Zone.

○ High Resolution Velocity Prefix (Controller number 88)

Status	2nd byte	3rd byte
BnH	58H	kkH

n = MIDI channel number: 0H–FH (ch.1–16)

kk = High Resolution Velocity Prefix: 00H–7FH (0–127)

○ Effect 1 (Reverb Send Level) (Controller number 91)

Status	2nd byte	3rd byte
BnH	5BH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Reverb Send Level: 00H–7FH (0–127)

* These messages are transmitted when Reverb value is set in External Zone.

○ Effect 3 (Chorus Send Level) (Controller number 93)

Status	2nd byte	3rd byte
BnH	5DH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Chorus Send Level: 00H–7FH (0–127)

* These messages are transmitted when Chorus value is set in External Zone.

○ RPN MSB/LSB (Controller number 100, 101)

Status	2nd byte	3rd byte
BnH	65H	mmH
BnH	64H	llH

n = MIDI channel number: 0H–FH (ch.1–16)

mm = upper byte (MSB) of parameter number specified by RPN

ll = lower byte (LSB) of parameter number specified by RPN

<<< RPN >>>

Control Changes include RPN (Registered Parameter Numbers), which are extended. When using RPNs, first RPN (Controller numbers 100 and 101; they can be sent in any order) should be sent in order to select the parameter, then Data Entry (Controller numbers 6 and 38) should be sent to set the value. Once RPN messages are received, Data Entry messages that is received at the same MIDI channel after that are recognized as changing toward the value of the RPN messages. In order not to make any mistakes, transmitting RPN Null is recommended after setting parameters you need.

This device transmits the following RPNs.

RPN	Data entry	Notes
MSB, LSB 00H, 00H	MSB, LSB mmH, llH	Pitch Bend Sensitivity mm: 00H–18H (0–24 semitones) ll: ignored (processed as 00H)
00H, 01H	mmH, llH	Channel Fine Tuning mm, ll: 20 00H–40 00H–60 00H (-4096 x 100 / 8192–0–+4096 x 100 / 8192 cent)
00H, 02H	mmH, llH	Channel Coarse Tuning mm: 10H–40H–70H (-48–0–+48 semitones) ll: ignored (processed as 00H)
00H, 05H	mmH, llH	Modulation Depth Range mm, ll: 00 00H–06 00H (0–16384 x 600 / 16384 cent)
7FH, 7FH	---, ---	RPN null RPN and NRPN will be set as “unspecified.” Once this setting has been made, subsequent

○ Harmonic Bar 1–9 (Controller number 102–110)

Status	2nd byte	3rd byte
BnH	66H–6EH	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) Step0–8

* While the Tone Wheel & Designer Menu screen is displayed, these messages are transmitted when Zone Level sliders is operated.

○ Percussion Volume (Controller number 112)

Status	2nd byte	3rd byte
BnH	70H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) 0–63 = Normal, 64–127 = Soft

* While the Tone Wheel & Designer Menu screen is displayed, these messages are transmitted when Percussion Volume is set.

○ Percussion Switch/Decay (Controller number 114)

Status	2nd byte	3rd byte
BnH	72H	vvH

n = MIDI channel number: 0H–FH (ch.1–16)

vv = Control value: 00H–7FH (0–127) Off, 2nd/Fast, 2nd/Slow, 3rd/Fast, 3rd/Slow

* While the Tone Wheel & Designer Menu screen is displayed, these messages are transmitted when Percussion Switch/Decay is set.

● Program Change

Status	2nd byte
CnH	ppH

n = MIDI channel number: 0H–FH (ch.1–16)

pp = Program number: 00H–7FH (prog.1–prog.128)

* When Rec Mode is ON (EDIT: Utility: Rec Setting: Rec Mode), these messages are transmitted when Tone is selected.

● Pitch Bend Change

Status	2nd byte	3rd byte
EnH	llH	mmH

n = MIDI channel number: 0H–FH (ch.1–16)

mm, ll = Pitch Bend value: 00 00H–40 00H–7F 7FH (-8192–0–+8191)

■ Channel Mode Messages

● MONO (Controller number 126)

Status	2nd byte	3rd byte
BnH	7EH	01H

n = MIDI channel number: 0H–FH (ch.1–16)

* These messages are transmitted when Mono/Poly value is set to MONO in External Zone.

● POLY (Controller number 127)

Status	2nd byte	3rd byte
BnH	7FH	00H

n = MIDI channel number: 0H–FH (ch.1–16)

* These messages are transmitted when Mono/Poly value is set to POLY in External Zone.

■ System Exclusive Messages

Universal Non-realtime System Exclusive Message and Data Set 1 (DT1) are the only System Exclusive messages transmitted by the RD-2000EX.

● Universal Non-realtime System Exclusive Message

○ Identity Reply Message

Receiving Identity Request Message, the RD-2000EX send this message.

Status	2nd byte	3rd byte
F0H	7EH, dev, 06H, 02H, 41H, 75H, 02H, 00H, 01H, 01H, 01H, 00H, 00H	F7H

Byte	Explanation
F0H	Exclusive status
7EH	ID number (Universal Non-realtime Message)
dev	Device ID (use the same as the device ID of Roland)
06H	Sub ID#1 (General Information)
02H	Sub ID#2 (Identity Reply)
41H	ID number (Roland)
75H 02H	Device family code (RD-2000EX)
00H 01H	Device family number code (RD-2000EX)
01H 01H 00H 00H	Software revision level
F7H	EOX (End of Exclusive)

● Data Transmission

○ Data set 1 (DT1)

Status	2nd byte	3rd byte
F0H	41H, dev, 00H, 00H, 75H, 12H, aaH, bbH, ccH, ddH, eeH, ... ffH, sum	F7H

Byte	Explanation
F0H	Exclusive status
41H	ID number (Roland)
dev	Device ID (dev: 00H–1FH, Initial value is 10H)
00H	Model ID #1 (RD-2000EX)
00H	Model ID #2 (RD-2000EX)
75H	Model ID #3 (RD-2000EX)
12H	Command ID (DT1)
aaH	Address MSB: upper byte of the starting address of the data to be sent
bbH	Address: upper middle byte of the starting address of the data to be sent
ccH	Address: lower middle byte of the starting address of the data to be sent
ddH	Address LSB: lower byte of the starting address of the data to be sent.
eeH	Data: the actual data to be sent. Multiple bytes of data are transmitted in order starting from the address.
:	:
ffH	Data
sum	Checksum
F7H	EOX (End Of Exclusive)

* The amount of data that can be transmitted at one time depends on the type of data, and data will be transmitted from the specified starting address and size. Refer to the address and size given in “3. Parameter Address Map” (p. 9).

* Data larger than 256 bytes will be divided into packets of 256 bytes or less, and each packet will be sent at an interval of about 20 ms.

3. Parameter Address Map

* Transmission of “#” marked address is divided to some packets. For example, ABH in hexadecimal notation will be divided to 0AH and 0BH, and is sent/received in this order.

● 1 RD-2000EX (Model ID = 00H 00H 75H)

○ Individual Parameters

* Please don't use a parameter or a address marked <Reserved>.

* The parameters for Program are temporary. If you want to leave the parameters after the RD-2000EX is turned off, execute Program Write.

Start Address	Description
00 00 00 00	System
10 00 00 00	Program (Temporary)

* System

Offset Address	Description
00 00 00	System Common
00 01 00	System Compressor

* Program

00 00 00	Program Common
00 02 00	Program Song/Rhythm
00 04 00	Program Delay
00 06 00	Program Reverb
00 10 00	Program Modulation FX (Zone 1)
00 12 00	Program Tremolo/Amp Simulator (Zone 1)
00 14 00	Program Modulation FX (Zone 2)
00 16 00	Program Tremolo/Amp Simulator (Zone 2)
00 18 00	Program Modulation FX (Zone 3)
00 1A 00	Program Tremolo/Amp Simulator (Zone 3)
00 1C 00	Program Modulation FX (Zone 4)
00 1E 00	Program Tremolo/Amp Simulator (Zone 4)
00 20 00	Program Internal Zone (Zone 1)
00 28 00	Program Internal Zone (Zone 2)
00 30 00	Program Internal Zone (Zone 3)
00 38 00	Program Internal Zone (Zone 4)
00 40 00	Program External Zone (Zone 1)
00 42 00	Program External Zone (Zone 2)
00 44 00	Program External Zone (Zone 3)
00 46 00	Program External Zone (Zone 4)
00 50 00	Program Internal Zone (Zone 5)
00 58 00	Program Internal Zone (Zone 6)
00 60 00	Program Internal Zone (Zone 7)
00 68 00	Program Internal Zone (Zone 8)
00 70 00	Program External Zone (Zone 5)
00 72 00	Program External Zone (Zone 6)
00 74 00	Program External Zone (Zone 7)
00 76 00	Program External Zone (Zone 8)

* System Common

Offset Address	Description
# 00 00	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd Master Tune (24 - 2024) -100.0 - 100.0 [cent]
00 04	000a aaaa Program Control Channel (0 - 16) OFF, 1 - 16
00 05	0000 000a Damper Polarity (0 - 1) STANDARD, REVERSE
00 06	0000 000a FC1 Polarity (0 - 1) STANDARD, REVERSE
00 07	0000 000a FC2 Polarity (0 - 1) STANDARD, REVERSE
00 08	0000 000a EXT Pedal Polarity (0 - 1) STANDARD, REVERSE
00 09	0000 000a EQ Mode (0 - 1) PROGRAM, REMAIN
00 0A	0000 000a Pedal Mode (0 - 1) PROGRAM, REMAIN
00 0C	0000 000a Assign 1-9 Mode (0 - 1) PROGRAM, REMAIN
00 0D	0000 000a Delay Mode (0 - 1) PROGRAM, REMAIN

00 0E	0000 000a	Reverb Mode (0 - 1) PROGRAM, REMAIN
00 0F	0000 000a	Tone/Program Remain (0 - 1) OFF, ON
00 10	0aaa aaaa	Audio Volume (0 - 127)
00 11	0000 000a	Select Button Mode (0 - 1) PROGRAM, REMAIN
00 12	0000 000a	Rhythm Mode (0 - 1) PROGRAM, REMAIN
00 13	0000 000a	Key Touch Mode (0 - 1) TONE/ PROGRAM, REMAIN
00 14	0000 000a	Wheel Mode (0 - 1) PROGRAM, REMAIN
00 15	0000 000a	Control Destination (0 - 1) SELECT, PROGRAM
00 16	0000 000a	Output Mix/Parallel (0 - 1) MIX, PARALLEL
00 17	0000 000a	USB Audio Input Switch (0 - 1) OFF, ON
00 18	0aaa aaaa	USB Audio Input Volume (0 - 127)
00 19	0000 000a	USB Audio Output Switch (0 - 1) OFF, ON
00 1A	0aaa aaaa	USB Audio Output Volume (0 - 127)
00 1B	0000 000a	USB Audio In/Out Select (0 - 1) IN, OUT
00 1C	0000 000a	USB Audio Output Assign (0 - 1) MAIN, SUB
00 1D	0000 000a	USB Memory Player Output Assign (0 - 1) MAIN, SUB
00 1E	0000 000a	Tone Ext Zone Remain (0 - 1) OFF, ON
00 1F	0000 000a	Ext Zone Transmit Control (0 - 1) OFF, ON
00 00 00 20	Total Size	

* System Compressor

Offset Address	Description	
00 00	0000 000a	Compressor Switch (0 - 1) OFF, ON
00 01	0aaa aaaa	Low band Attack time (0 - 100)
00 02	0aaa aaaa	Low band Release time (0 - 100)
00 03	0aaa aaaa	Low band Threshold (4 - 64)
00 04	0000 aaaa	Low band Ratio -60 - 0 [dB] (0 - 13) 1:1.0, 1:1.1, 1:1.2, 1:1.4, 1:1.6, 1:1.8, 1:2.0, 1:2.5, 1:3.2, 1:4.0, 1:5.6, 1:8.0, 1:16, 1:INF
00 05	000a aaaa	Low band Level (0 - 24) 0 - 24 [dB]
00 06	0aaa aaaa	Mid band Attack time (0 - 100)
00 07	0aaa aaaa	Mid band Release time (0 - 100)
00 08	0aaa aaaa	Mid band Threshold (4 - 64)
00 09	0000 aaaa	Mid band Ratio -60 - 0 [dB] (0 - 13) 1:1.0, 1:1.1, 1:1.2, 1:1.4, 1:1.6, 1:1.8, 1:2.0, 1:2.5, 1:3.2, 1:4.0, 1:5.6, 1:8.0, 1:16, 1:INF
00 0A	000a aaaa	Mid band Level (0 - 24) 0 - 24 [dB]
00 0B	0aaa aaaa	High band Attack time (0 - 100)
00 0C	0aaa aaaa	High band Release time (0 - 100)
00 0D	0aaa aaaa	High band Threshold (4 - 64)
00 0E	0000 aaaa	High band Ratio -60 - 0 [dB] (0 - 13) 1:1.0, 1:1.1, 1:1.2, 1:1.4, 1:1.6, 1:1.8, 1:2.0, 1:2.5, 1:3.2, 1:4.0, 1:5.6, 1:8.0, 1:16, 1:INF
00 0F	000a aaaa	High band Level (0 - 24) 0 - 24 [dB]
00 10	0000 aaaa	Split Freq Low (0 - 13) 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800 [Hz]
00 11	0000 aaaa	Split Freq High (0 - 13) 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000, 5000, 6300, 8000 [Hz]
00 00 00 12	Total Size	

* Program Common

Offset Address	Description
00 00	0aaa aaaa Program Name 1 (32 - 127) 32 - 127 [ASCII]

MIDI Implementation

	00 01	0aaa aaaa	Program Name 2	(32 - 127)		00 46	000a aaaa	Key Touch Offset	(54 - 73)
	:			32 - 127 [ASCII]					-10 - +9
	00 0F	0aaa aaaa	Program Name 16	(32 - 127)		00 47	0aaa aaaa	Key Touch Velocity Delay Sens	(1 - 127)
				32 - 127 [ASCII]					-63 - +63
	00 10	0aaa aaaa	Voice Reserve 1	(0 - 64)		00 48	0aaa aaaa	Key Touch Velocity Key Follow Sens	(1 - 127)
	00 11	0aaa aaaa	Voice Reserve 2	(0 - 64)					-63 - +63
	:			0 - 63, FULL		00 49	0000 000a	Key Off Position	(0 - 1)
	00 1F	0aaa aaaa	Voice Reserve 16	(0 - 64)					STANDARD, DEEP
				0 - 63, FULL					
#	00 20	0000 000a 0000 bbbb 0000 cccc	Program Tempo	(5 - 300)					
#	00 23	0000 aaaa 0000 bbbb	FC1 Func	(0 - 152)		00 4A	0000 00aa	Asgn Knob Select	(0 - 2)
			OFF, CCO - CC127,					EQ, DELAY, ASSIGN	
			BEND DOWN, BEND UP, AFTERTOUCH,		00 4B	0000 aaaa 0000 bbbb	A1 Func	(0 - 134)	
			OCTAVE DOWN, OCTAVE UP, EXT START/STOP,					OFF, CCO - CC127,	
			TAP TEMPO, PLAY/STOP, SONG RESET,					AFTERTOUCH,	
			MOD FX SWITCH, MOD FX DEPTH,					MOD FX DEPTH, MOD FX RATE,	
			MOD FX RATE, TREMOLO SWITCH, TREMOLO DEPTH,					TREMOLO DEPTH, TREMOLO RATE,	
			TREMOLO RATE, AMP SIM SWITCH, AMP SIM DRIVE,					AMP SIM DRIVE	
			DELAY SWITCH, ROTARY SPEED, TONE COLOR,		00 4D	0aaa aaaa	A1 Range Min	(0 - 127)	
			PROGRAM DOWN, PROGRAM UP, SCENE DOWN, SCENE UP		00 4E	0aaa aaaa	A1 Range Max	(0 - 127)	
	00 25	0aaa aaaa	FC1 Range Min	(0 - 127)		00 4F	0000 aaaa 0000 bbbb	A2 Func	(0 - 134)
	00 26	0aaa aaaa	FC1 Range Max	(0 - 127)				OFF, CCO - CC127,	
	00 27	0000 aaaa 0000 bbbb	FC2 Func	(0 - 152)				AFTERTOUCH,	
			OFF, CCO - CC127,					MOD FX DEPTH, MOD FX RATE,	
			BEND DOWN, BEND UP, AFTERTOUCH,					TREMOLO DEPTH, TREMOLO RATE,	
			OCTAVE DOWN, OCTAVE UP, EXT START/STOP,					AMP SIM DRIVE	
			TAP TEMPO, PLAY/STOP, SONG RESET,						
			MOD FX RATE, TREMOLO SWITCH, TREMOLO DEPTH,		00 51	0aaa aaaa	A2 Range Min	(0 - 127)	
			TREMOLO RATE, AMP SIM SWITCH, AMP SIM DRIVE,		00 52	0aaa aaaa	A2 Range Max	(0 - 127)	
			DELAY SWITCH, ROTARY SPEED, TONE COLOR,		00 53	0000 aaaa 0000 bbbb	A3 Func	(0 - 134)	
			PROGRAM DOWN, PROGRAM UP, SCENE DOWN, SCENE UP					OFF, CCO - CC127,	
	00 29	0aaa aaaa	FC2 Range Min	(0 - 127)				AFTERTOUCH,	
	00 2A	0aaa aaaa	FC2 Range Max	(0 - 127)				MOD FX DEPTH, MOD FX RATE,	
	00 2B	0000 aaaa 0000 bbbb	EXT Func	(0 - 152)				TREMOLO DEPTH, TREMOLO RATE,	
			OFF, CCO - CC127,					AMP SIM DRIVE	
			BEND DOWN, BEND UP, AFTERTOUCH,						
			OCTAVE DOWN, OCTAVE UP, EXT START/STOP,		00 55	0aaa aaaa	A3 Range Min	(0 - 127)	
			TAP TEMPO, PLAY/STOP, SONG RESET,		00 56	0aaa aaaa	A3 Range Max	(0 - 127)	
			MOD FX RATE, TREMOLO SWITCH, TREMOLO DEPTH,		00 57	0000 aaaa 0000 bbbb	A4 Func	(0 - 134)	
			TREMOLO RATE, AMP SIM SWITCH, AMP SIM DRIVE,					OFF, CCO - CC127,	
			DELAY SWITCH, ROTARY SPEED, TONE COLOR,					AFTERTOUCH,	
			PROGRAM DOWN, PROGRAM UP, SCENE DOWN, SCENE UP					MOD FX DEPTH, MOD FX RATE,	
	00 2D	0aaa aaaa	EXT Range Min	(0 - 127)				TREMOLO DEPTH, TREMOLO RATE,	
	00 2E	0aaa aaaa	EXT Range Max	(0 - 127)				AMP SIM DRIVE	
	00 35	0000 000a	EQ Switch	(0 - 1)					
			OFF, ON						
	00 36	000a aaaa	EQ Input Gain	(0 - 30)					
			-15 - +15[dB]		00 5E	0000 00aa	Tone Color Control Destination	(0 - 3)	
	00 37	000a aaaa	EQ Low Frequency	(0 - 30)				UPPER1, UPPER2, UPPER3, LOWER	
			16,20,25,31,40,50,63,80,100,125,160,		00 5F	0000 00aa	Modulation FX Control Destination	(0 - 3)	
			200,250,315,400,500,630,800,1000,					UPPER1, UPPER2, UPPER3, LOWER	
			1250,1600,2000,2500,3150,4000,5000,		00 60	0000 00aa	Tremolo/Amp Control Destination	(0 - 3)	
			6300,8000,10000,12500,16000 [Hz]					UPPER1, UPPER2, UPPER3, LOWER	
	00 38	0aaa aaaa	EQ Low Gain	(4 - 124)					
			-12.0 - +12.0[dB] (1step = 0.2dB)		00 61	0000 000a	Split Switch (Internal)	(0 - 1)	
	00 39	000a aaaa	EQ Mid Low Frequency	(0 - 30)				OFF, ON	
			16,20,25,31,40,50,63,80,100,125,160,						
			200,250,315,400,500,630,800,1000,		00 63	0000 000a	Sympathetic Resonance Switch	(0 - 1)	
			1250,1600,2000,2500,3150,4000,5000,					OFF,ON	
			6300,8000,10000,12500,16000 [Hz]		00 64	0aaa aaaa	Depth	(0 - 127)	
	00 3A	0aaa aaaa	EQ Mid Low Gain	(4 - 124)		00 65	0aaa aaaa	Damper	(0 - 127)
			-12.0 - +12.0[dB] (1step = 0.2dB)		00 66	00aa aaaa	Pre LPF	(1 - 32)	
	00 3B	0000 0aaa	EQ Mid Low Q	(0 - 4)				16, 20, 25, 32, 40, 50, 63,	
			0.5, 1.0, 2.0, 4.0, 8.0					80, 100, 125, 160, 200, 250,	
	00 3C	000a aaaa	EQ Mid Mid Frequency	(0 - 30)				315, 400, 500, 630, 800, 1000,	
			16,20,25,31,40,50,63,80,100,125,160,					1250, 1600, 2000, 2500, 3150,	
			200,250,315,400,500,630,800,1000,					4000, 5000, 6300, 8000, 10000,	
			1250,1600,2000,2500,3150,4000,5000,					12500, 15000, Bypass [Hz]	
			6300,8000,10000,12500,16000 [Hz]		00 67	000a aaaa	Pre HPF	(0 - 31)	
	00 3D	0aaa aaaa	EQ Mid Mid Gain	(4 - 124)				Bypass,	
			-12.0 - +12.0[dB] (1step = 0.2dB)					16, 20, 25, 32, 40, 50, 63,	
	00 3E	0000 0aaa	EQ Mid Mid Q	(0 - 4)				80, 100, 125, 160, 200, 250,	
			0.5, 1.0, 2.0, 4.0, 8.0					315, 400, 500, 630, 800, 1000,	
	00 3F	000a aaaa	EQ Mid High Frequency	(0 - 30)				1250, 1600, 2000, 2500, 3150,	
			16,20,25,31,40,50,63,80,100,125,160,					4000, 5000, 6300, 8000, 10000,	
			200,250,315,400,500,630,800,1000,					12500, 15000 [Hz]	
			1250,1600,2000,2500,3150,4000,5000,		00 68	000a aaaa	Peaking Freq	(1 - 31)	
			6300,8000,10000,12500,16000 [Hz]					16, 20, 25, 32, 40, 50, 63,	
	00 40	0aaa aaaa	EQ Mid High Gain	(4 - 124)				80, 100, 125, 160, 200, 250,	
			-12.0 - +12.0[dB] (1step = 0.2dB)					315, 400, 500, 630, 800, 1000,	
	00 41	0000 0aaa	EQ Mid High Q	(0 - 4)				1250, 1600, 2000, 2500, 3150,	
			0.5, 1.0, 2.0, 4.0, 8.0					4000, 5000, 6300, 8000, 10000,	
	00 42	000a aaaa	EQ High Frequency	(0 - 30)				12500, 15000 [Hz]	
			16,20,25,31,40,50,63,80,100,125,160,		00 69	000a aaaa	Peaking Gain	(0 - 30)	
			200,250,315,400,500,630,800,1000,					-15 - +15 [dB]	
			1250,1600,2000,2500,3150,4000,5000,		00 6A	0000 0aaa	Peaking Q	(0 - 4)	
			6300,8000,10000,12500,16000 [Hz]					0.5, 1.0, 2.0, 4.0, 8.0	
	00 43	0aaa aaaa	EQ High Gain	(4 - 124)		00 6B	0aaa aaaa	BodyIn Level	(0 - 127)
			-12.0 - +12.0[dB] (1step = 0.2dB)		00 6C	00aa aaaa	BodyIn LPF	(1 - 32)	
								16, 20, 25, 32, 40, 50, 63,	
	00 44	0aaa aaaa	Key Touch Velocity	(0 - 127)				80, 100, 125, 160, 200, 250,	
			REAL, 1 - 127					315, 400, 500, 630, 800, 1000,	
	00 45	0000 0aaa	Key Touch	(1 - 5)				1250, 1600, 2000, 2500, 3150,	
			SUPER LIGHT, LIGHT,					4000, 5000, 6300, 8000, 10000,	
			MEDIUM, HEAVY, SUPER HEAVY					12500, 15000, Bypass [Hz]	
								(0 - 84)	
						00 6D	0aaa aaaa	PreDelay	

#	00 6E	00aa aaaa	HF Damp Freq	0 - 84 [ms] (1 - 32) 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000, 5000, 6300, 8000, 10000, 12500, 15000, Bypass [Hz]	32 - 127 [ASCI]
	00 6F	000a aaaa	LF Damp Freq	(0 - 31) Bypass, 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000, 5000, 6300, 8000, 10000, 12500, 15000 [Hz]	32 - 127 [ASCI]
	00 70	0aaa aaaa	Rev to Comb	(0 - 127)	32 - 127 [ASCI]
	00 71	0aaa aaaa	Comb Decay Time	(1 - 100)	32 - 127 [ASCI]
	00 72	0aaa aaaa	Comb HF Damp	(1 - 100)	32 - 127 [ASCI]
	00 73	0aaa aaaa	Comb Level	(0 - 127)	32 - 127 [ASCI]
	00 74	0aaa aaaa	Rev Level	(0 - 127)	32 - 127 [ASCI]
	00 75	0aaa aaaa	Duplex Scale	(0 - 127)	32 - 127 [ASCI]
	00 76	0aaa aaaa	Level	(0 - 127)	32 - 127 [ASCI]
	00 77	0000 000a	CombA APF	(0 - 1) OFF, ON	32 - 127 [ASCI]
	00 78	0000 000a	CombB APF	(0 - 1) OFF, ON	32 - 127 [ASCI]
	00 79	0000 000a	RevB APF	(0 - 1) OFF, ON	32 - 127 [ASCI]
	00 7A	0aaa aaaa	Damper Offset	(0 - 127)	32 - 127 [ASCI]
	00 7B	0aaa aaaa	Damper Min CombBal	(0 - 100)	32 - 127 [ASCI]
	00 7C	0aaa aaaa	Damper Min Comb Time	(0 - 127)	32 - 127 [ASCI]
	00 7D	0aaa aaaa	Damper Min Rev Time	(0 - 127)	32 - 127 [ASCI]
	00 7E	000a aaaa	Damper Min Pkg	(15 - 30)	32 - 127 [ASCI]
	0 - +15 [dB]				32 - 127 [ASCI]
	# 01 03	0000 aaaa 0000 bbbb	Slider Func	(0 - 129) OFF, CCO - CC127, AFTERTOUCH	32 - 127 [ASCI]
	# 01 05	0000 aaaa 0000 bbbb	A5 Func	(0 - 134) OFF, CCO - CC127, AFTERTOUCH, MOD FX DEPTH, MOD FX RATE, TREMLO DEPTH, TREMOLO RATE, AMP SIM DRIVE	32 - 127 [ASCI]
	01 07	0aaa aaaa	A5 Range Min	(0 - 127)	32 - 127 [ASCI]
	01 08	0aaa aaaa	A5 Range Max	(0 - 127)	32 - 127 [ASCI]
	01 09	0000 aaaa 0000 bbbb	A6 Func	(0 - 134) OFF, CCO - CC127, AFTERTOUCH, MOD FX DEPTH, MOD FX RATE, TREMLO DEPTH, TREMOLO RATE, AMP SIM DRIVE	32 - 127 [ASCI]
	01 0B	0aaa aaaa	A6 Range Min	(0 - 127)	32 - 127 [ASCI]
	01 0C	0aaa aaaa	A6 Range Max	(0 - 127)	32 - 127 [ASCI]
	01 0D	0000 aaaa 0000 bbbb	A7 Func	(0 - 134) OFF, CCO - CC127, AFTERTOUCH, MOD FX DEPTH, MOD FX RATE, TREMLO DEPTH, TREMOLO RATE, AMP SIM DRIVE	32 - 127 [ASCI]
	01 0F	0aaa aaaa	A7 Range Min	(0 - 127)	32 - 127 [ASCI]
	01 10	0aaa aaaa	A7 Range Max	(0 - 127)	32 - 127 [ASCI]
	01 11	0000 aaaa 0000 bbbb	A8 Func	(0 - 134) OFF, CCO - CC127, AFTERTOUCH, MOD FX DEPTH, MOD FX RATE, TREMLO DEPTH, TREMOLO RATE, AMP SIM DRIVE	32 - 127 [ASCI]
	01 13	0aaa aaaa	A8 Range Min	(0 - 127)	32 - 127 [ASCI]
	01 14	0aaa aaaa	A8 Range Max	(0 - 127)	32 - 127 [ASCI]
	01 15	0000 aaaa 0000 bbbb	Wheel1 Func	(0 - 132) OFF, CCO - CC127, AFTERTOUCH, ROTARY SPEED	32 - 127 [ASCI]
	01 17	0000 aaaa 0000 bbbb	Wheel2 Func	(0 - 132) OFF, CCO - CC127, AFTERTOUCH, ROTARY SPEED	32 - 127 [ASCI]
	01 19	0000 000a	Asgn Knob Effect Switch	(0 - 1) OFF, ON	32 - 127 [ASCI]
	01 1C	0aaa aaaa	Memo 1	(32 - 127)	32 - 127 [ASCI]
	01 1D	0aaa aaaa	Memo 2	(32 - 127)	32 - 127 [ASCI]
	01 1E	0aaa aaaa	Memo 3	(32 - 127)	32 - 127 [ASCI]
	01 1F	0aaa aaaa	Memo 4	(32 - 127)	32 - 127 [ASCI]
	01 20	0aaa aaaa	Memo 5	(32 - 127)	32 - 127 [ASCI]
	01 21	0aaa aaaa	Memo 6	(32 - 127)	32 - 127 [ASCI]
	01 22	0aaa aaaa	Memo 7	(32 - 127)	32 - 127 [ASCI]
	01 23	0aaa aaaa	Memo 8	(32 - 127)	32 - 127 [ASCI]
	01 24	0aaa aaaa	Memo 9	(32 - 127)	32 - 127 [ASCI]
	01 25	0aaa aaaa	Memo 10	(32 - 127)	32 - 127 [ASCI]
	01 26	0aaa aaaa	Memo 11	(32 - 127)	32 - 127 [ASCI]
00 00 01 44 Total Size					
* Program Song/Rhythm					
Offset Address Description					
	00 00	0000 000a	Song or Rhythm Switch	(0 - 1) SONG, RHYTHM	
#	00 01	0aaa aaaa	Rhythm Volume	(0 - 127)	
	00 02	0000 aaaa	Rhythm Pattern	(0 - 200)	
	00 04	0000 aaaa	Rhythm Output Assign	(0 - 1) MAIN, SUB	
00 00 00 05 Total Size					
* Program Delay					
Offset Address Description					
	00 00	0000 000a	Switch	(0 - 1) OFF, ON	
	00 01	0000 000a	Off Mode	(0 - 1)	
	00 02	0000 aaaa	Type	IMMEDIATE, REMAIN (1 - 5) DELAY, T-CTRL DELAY, DELAY->TREMLO, 2TAP DELAY, 3TAP DELAY	
	00 03	0aaa aaaa	Level	(0 - 127)	
	00 04	0000 00aa	Output Select	(0 - 2) MAIN, REV, MAIN+REV	
#	00 05	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Delay Parameter 1	(12768 - 52768) -20000 - +20000	
#	00 09	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Delay Parameter 2	(12768 - 52768) -20000 - +20000	

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#	:	00 51	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Delay Parameter 20	(12768 - 52768) -20000 - +20000
00 00 00 55	Total Size				

* Program Reverb

Offset	Address	Description	
00 00	0000 aaaa	Type	(1 - 6) ROOM1, ROOM2, HALL1, HALL2, PLATE, GM2 REVERB
00 01	0aaa aaaa	Level	(0 - 127)
#	00 02	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Reverb Parameter 1
			(12768 - 52768) -20000 - +20000
#	00 06	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Reverb Parameter 2
			(12768 - 52768) -20000 - +20000
#	:	00 4E	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd
			Reverb Parameter 20
			(12768 - 52768) -20000 - +20000
00 00 00 52	Total Size		

* Program Modulation FX, Program Tremolo/Amp Simulator

Offset	Address	Description	
00 00	0000 000a	Switch	(0 - 1) OFF, ON
#	00 01	0000 aaaa 0000 bbbb	Type
			(0 - 255)
00 03	000a aaaa	Control Assign 1	(0 - 16) OFF, 1 - 16
00 04	000a aaaa	Control Assign 2	(0 - 16) OFF, 1 - 16
#	00 07	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Parameter 1
			(12768 - 52768) -20000 - +20000
#	00 08	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Parameter 2
			(12768 - 52768) -20000 - +20000
#	:	01 03	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd
			Parameter 32
			(12768 - 52768) -20000 - +20000
00 00 01 07	Total Size		

* Program Internal Zone

Offset	Address	Description	
00 00	0aaa aaaa	Volume	(0 - 127)
00 01	0aaa aaaa	Pan	(0 - 127) L64 - R63
00 02	0aaa aaaa	Delay Send Level	(0 - 127)
00 03	0aaa aaaa	Reverb Send Level	(0 - 127)
00 04	0aaa aaaa	Resonance Send Level	(0 - 127)
00 05	0000 000a	Routing	(0 - 1) Normal, Inverse
00 06	0aaa aaaa	Keyboard Range Lower	(21 - 108) A0 - UPPER
00 07	0aaa aaaa	Keyboard Range Upper	(21 - 108) LOWER - C8
00 08	0aaa aaaa	Velocity Range Lower	(1 - 127)
00 09	0aaa aaaa	Velocity Range Upper	(1 - 127)
00 0A	0aaa aaaa	Velocity Sensitivity	(1 - 127) -63 - +63
00 0B	0aaa aaaa	Velocity Max	(1 - 127)
00 0C	0aaa aaaa	Zone Transpose	(16 - 112) -48 - +48
00 0D	0aaa aaaa	Coarse Tune	(16 - 112) -48 - +48
00 0E	0aaa aaaa	Fine Tune	(14 - 114) -50 - +50

00 0F	0000 000a	Zone Switch	(0 - 1) OFF, ON
00 10	0000 000a	Damper Control Switch	(0 - 1) OFF, ON
00 11	0000 000a	FC1 Control Switch	(0 - 1) OFF, ON
00 12	0000 000a	FC2 Control Switch	(0 - 1) OFF, ON
00 13	0000 000a	EXT Pedal Control Switch	(0 - 1) OFF, ON
00 14	0000 000a	Modulation Control Switch	(0 - 1) OFF, ON
00 15	0000 000a	Pitch Bend Control Switch	(0 - 1) OFF, ON
00 18	0000 000a	Assign 1 Control Switch	(0 - 1) Disable, Enable
00 19	0000 000a	Assign 2 Control Switch	(0 - 1) Disable, Enable
00 1A	0000 000a	Assign 3 Control Switch	(0 - 1) Disable, Enable
00 1B	0000 000a	Assign 4 Control Switch	(0 - 1) Disable, Enable
00 1C	0000 000a	Assign 5 Control Switch	(0 - 1) Disable, Enable
00 20	0aaa aaaa	Tone Bank Select MSB	(0 - 127)
00 21	0aaa aaaa	Tone Bank Select LSB	(0 - 127)
00 22	0aaa aaaa	Tone Program Change	(0 - 127)
00 23	0aaa aaaa	Tone Category	(0 - 127)
00 24	0aaa aaaa	Tone Color Category	(0 - 63)
00 25	0000 00aa	Mono/Poly	(0 - 2) MONO, POLY, MONO/LEGATO
00 26	000a aaaa	Pitch Bend Range	(0 - 24)
00 27	0000 000a	Portamento Switch	(0 - 1) OFF, ON
#	00 28	0000 aaaa 0000 bbbb	Portamento Time
			(0 - 127)
00 2A	0aaa aaaa	Cutoff Offset	(0 - 127) -64 - +63
00 2B	0aaa aaaa	Resonance Offset	(0 - 127) -64 - +63
00 2C	0aaa aaaa	Attack Time Offset	(0 - 127) -64 - +63
00 2D	0aaa aaaa	Decay Time Offset	(0 - 127) -64 - +63
00 2E	0aaa aaaa	Release Time Offset	(0 - 127) -64 - +63
00 2F	0aaa aaaa	Vibrato Rate Offset	(0 - 127) -64 - +63
00 30	0aaa aaaa	Vibrato Depth Offset	(0 - 127) -64 - +63
00 31	0aaa aaaa	Vibrato Delay Offset	(0 - 127) -64 - +63
00 32	0000 00aa	Nuance	(0 - 2) TYPE1, TYPE2, TYPE3
00 33	0000 0aaa	Hammer Noise	(62 - 66) -2 - 2
00 34	0aaa aaaa	Damper Noise	(0 - 127)
00 35	0aaa aaaa	String Resonance	(0 - 127)
00 36	0aaa aaaa	Key Off Resonance	(0 - 127)
00 37	0aaa aaaa	Sound Lift	(0 - 127)
00 38	0aaa aaaa	Mechanical Key On Noise	(0 - 127)
00 39	0aaa aaaa	Mechanical Key Off Noise	(0 - 127)
00 3A	0aaa aaaa	Hum Noise	(0 - 127)
00 3B	0000 00aa	Individual Note Voicing Tuning Type	(0 - 2) OFF, PRST, USER
#	00 3C	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Individual Note Voicing Tuning 1
			(12 - 1012) -50.0 - +50.0
#	00 40	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd	Individual Note Voicing Tuning 2
			(12 - 1012) -50.0 - +50.0
#	:	04 38	0000 aaaa 0000 bbbb 0000 cccc 0000 dddd
			Individual Note Voicing Tuning 128
			(12 - 1012) -50.0 - +50.0
04 3C	0000 000a	Individual Note Voicing Level Type	(0 - 1) OFF, USER
04 3D	0aaa aaaa	Individual Note Voicing Level 1	(14 - 64) -50 - +0
04 3E	0aaa aaaa	Individual Note Voicing Level 2	(14 - 64) -50 - +0
:	05 3C	0aaa aaaa	Individual Note Voicing Level 128
			(14 - 64) -50 - +0
05 3D	0000 000a	Individual Note Voicing Character Type	(0 - 1) OFF, USER
05 3E	0000 aaaa	Individual Note Voicing Character 1	(59 - 69) -5 - +5
05 3F	0000 aaaa	Individual Note Voicing Character 2	(59 - 69) -5 - +5
:	06 3D	0000 aaaa	Individual Note Voicing Character 128
			(59 - 69) -5 - +5

06 3E	0000 aaaa	Character	(59 - 69) -5 - +5		00 0A	0000 000a	Modulation Control Switch	OFF, ON (0 - 1)
06 3F	0aaa aaaa	Tone Color	(0 - 127)		00 0B	0000 000a	Pitch Bend Control Switch	OFF, ON (0 - 1)
06 40	00aa aaaa	Harmonic Bar 16'	(48 - 88) -16 - 24		00 0E	0000 000a	Assign 1 Control Switch	OFF, ON (0 - 1)
06 41	00aa aaaa	Harmonic Bar 5-1/3'	(48 - 88) -16 - 24		00 0F	0000 000a	Assign 2 Control Switch	Disable, Enable (0 - 1)
06 42	00aa aaaa	Harmonic Bar 8'	(48 - 88) -16 - 24		00 10	0000 000a	Assign 3 Control Switch	Disable, Enable (0 - 1)
06 43	00aa aaaa	Harmonic Bar 4'	(48 - 88) -16 - 24		00 11	0000 000a	Assign 4 Control Switch	Disable, Enable (0 - 1)
06 44	00aa aaaa	Harmonic Bar 2-2/3'	(48 - 88) -16 - 24		00 12	0000 000a	Assign 5 Control Switch	Disable, Enable (0 - 1)
06 45	00aa aaaa	Harmonic Bar 2'	(48 - 88) -16 - 24		00 13	0000 00aa	MIDI OUT Port	Disable, Enable (0 - 3) ALL, OUT1, OUT2, USB
06 46	00aa aaaa	Harmonic Bar 1-3/5'	(48 - 88) -16 - 24		00 14	0000 aaaa	MIDI Tx Channel	(0 - 15) 1 - 16
06 47	00aa aaaa	Harmonic Bar 1-1/3'	(48 - 88) -16 - 24		00 15	0000 000a	Bank Select MSB Switch	(0 - 1) OFF, ON
06 48	00aa aaaa	Harmonic Bar 1'	(48 - 88) -16 - 24		00 16	0aaa aaaa	Bank Select MSB (CC0)	(0 - 127)
06 49	0aaa aaaa	<Reserved>			00 17	0000 000a	Bank Select LSB Switch	(0 - 1) OFF, ON
06 4A	0000 000a	<Reserved>			00 18	0aaa aaaa	Bank Select LSB (CC32)	(0 - 127)
06 4B	0000 000a	Percussion Soft	(0 - 1) NORM, SOFT		00 19	0000 000a	Program Change Switch	(0 - 1) OFF, ON
06 4C	0000 aaaa	<Reserved>			00 1A	0aaa aaaa	Program Change	(0 - 127)
06 4D	0000 aaaa	<Reserved>			00 1B	0000 000a	Volume Switch	(0 - 1) OFF, ON
06 4E	0000 000a	Percussion Slow	(0 - 1) SLOW, FAST		00 1C	0aaa aaaa	Volume (CC7)	(0 - 127)
06 4F	0aaa aaaa	<Reserved>			00 1D	0000 000a	Pan Switch	(0 - 1) OFF, ON
06 50	0aaa aaaa	<Reserved>			00 1E	0aaa aaaa	Pan (CC10)	(0 - 127) L64 - R63
06 51	0000 00aa	Percussion Harmonic	(0 - 2) OFF, 2ND, 3RD		00 1F	0000 000a	Coarse Tune Switch	(0 - 1) OFF, ON
06 5F	0000 000a	Assign 6 Control Switch	(0 - 1) Disable, Enable		00 20	0aaa aaaa	Coarse Tune	(16 - 112) -48 - +48
06 60	0000 000a	Assign 7 Control Switch	(0 - 1) Disable, Enable		00 21	0000 000a	Fine Tune Switch	(0 - 1) OFF, ON
06 61	0000 000a	Assign 8 Control Switch	(0 - 1) Disable, Enable		00 22	0aaa aaaa	Fine Tune	(14 - 114) -50 - +50
06 62	0000 000a	Assign 9 Control Switch	(0 - 1) Disable, Enable		00 23	0000 000a	Mono/Poly Switch	(0 - 1) OFF, ON
06 63	0000 000a	Wheel1 Control Switch	(0 - 1) OFF, ON		00 24	0000 00aa	Mono (CC126) / Poly (CC127)	(0 - 1) M, P
06 64	0000 000a	Wheel2 Control Switch	(0 - 1) OFF, ON		00 25	0000 000a	Portamento Switch	(0 - 1) OFF, ON
06 65	0000 aaaa	Output Assign	(0 - 1) MAIN, SUB		00 26	0000 000a	Portamento Switch (CC65)	(0 - 1) OFF, ON
06 66	0aaa aaaa	Instruments Number	(0 - 19)		00 27	0000 000a	Portamento Time Switch	(0 - 1) OFF, ON
06 67	0000 00aa	Lid	(0 - 6)		00 28	0aaa aaaa	Portamento Time (CC5)	(0 - 127)
06 68	0000 aaaa	String Resonance	(0 - 10)		00 29	0000 000a	Cutoff Switch	(0 - 1) OFF, ON
06 69	0000 aaaa	Damper Resonance	(0 - 10)		00 2A	0aaa aaaa	Cutoff Offset (CC74)	(0 - 127) -64 - +63
06 6A	0000 00aa	Hammer Noise	(62 - 66) -2 - +2		00 2B	0000 000a	Resonance Switch	(0 - 1) OFF, ON
06 6B	0000 aaaa	Duplex Scale	(0 - 10)		00 2C	0aaa aaaa	Resonance Offset (CC71)	(0 - 127) -64 - +63
06 6C	0000 aaaa	Key Off Resonance	(0 - 10)		00 2D	0000 000a	Attack Time Switch	(0 - 1) OFF, ON
06 6D	0000 aaaa	Cabinet Resonance	(0 - 10)		00 2E	0aaa aaaa	Attack Time Offset (CC73)	(0 - 127) -64 - +63
06 6E	0000 00aa	Sound Board Resonator	(0 - 4)		00 2F	0000 000a	Decay Time Switch	(0 - 1) OFF, ON
06 6F	0000 aaaa	Damper Noise	(0 - 10)		00 30	0aaa aaaa	Decay Time Offset (CC75)	(0 - 127) -64 - +63
06 70	0000 aaaa	Key Off Noise	(0 - 10) OFF, 1 - 10		00 31	0000 000a	Release Time Switch	(0 - 1) OFF, ON
06 74	0000 00aa	Micro Tune Type	(0 - 2) OFF, PRST, USER		00 32	0aaa aaaa	Release Time Offset (CC72)	(0 - 127) -64 - +63
06 75	0000 00aa	Micro Amp Type	(0 - 2) OFF, PRST, USER		00 33	0000 000a	Pitch Bend Range Switch	(0 - 1) OFF, ON
06 76	0000 00aa	Micro Shift Type	(0 - 2) OFF, PRST, USER		00 34	00aa aaaa	Pitch Bend Range	(0 - 48)
06 77	0aaa aaaa	Tone Level	(0 - 127)		00 35	0000 000a	Modulation Depth Switch	(0 - 1) OFF, ON
06 78	0000 00aa	Tone Wheel Type	(0 - 2) ORIGINAL, VINTAGE1, VINTAGE2		00 36	0aaa aaaa	Modulation Depth	(0 - 127)
00 00 06 79	Total Size				00 37	0000 000a	Delay Send Level Switch	(0 - 1) OFF, ON
					00 38	0aaa aaaa	Delay Send Level (CC93)	(0 - 127)
					00 39	0000 000a	Reverb Send Level Switch	(0 - 1) OFF, ON
					00 3A	0aaa aaaa	Reverb Send Level (CC91)	(0 - 127)
					00 3B	0000 000a	User Control Change 1 Switch	(0 - 1) OFF, ON
					00 3C	0aaa aaaa	User Control Change 1 Number	(0 - 127)

* Program External Zone			
Offset	Address	Description	
00 00	0aaa aaaa	Keyboard Range Lower	(21 - 108) A0 - UPPER
00 01	0aaa aaaa	Keyboard Range Upper	(21 - 108) LOWER - C8
00 02	0aaa aaaa	Velocity Range Lower	(1 - 127)
00 03	0aaa aaaa	Velocity Range Upper	(1 - 127)
00 04	0aaa aaaa	Zone Transpose	(16 - 112) -48 - +48
00 05	0000 000a	Zone Switch	(0 - 1) OFF, ON
00 06	0000 000a	Damper Control Switch	(0 - 1) OFF, ON
00 07	0000 000a	FC1 Control Switch	(0 - 1) OFF, ON
00 08	0000 000a	FC2 Control Switch	(0 - 1) OFF, ON
00 09	0000 000a	EXT Pedal Control Switch	(0 - 1)

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00 3D	0aaa aaaa	User Control Change 1 Value	(0 - 127)
00 3E	0000 000a	User Control Change 2 Switch	(0 - 1) OFF, ON
00 3F	0aaa aaaa	User Control Change 2 Number	(0 - 127)
00 40	0aaa aaaa	User Control Change 2 Value	(0 - 127)
00 46	0000 000a	Assign 6 Control Switch	(0 - 1) Disable, Enable
00 47	0000 000a	Assign 7 Control Switch	(0 - 1) Disable, Enable
00 48	0000 000a	Assign 8 Control Switch	(0 - 1) Disable, Enable
00 49	0000 000a	Assign 9 Control Switch	(0 - 1) Disable, Enable
00 4A	0000 000a	Wheel1 Control Switch	(0 - 1) OFF, ON
00 4B	0000 000a	Wheel2 Control Switch	(0 - 1) OFF, ON
00 00 00 4C	Total Size		

4. Supplementary Material

Decimal and Hexadecimal Table

In MIDI documentation, data values and addresses/sizes of exclusive messages etc. are expressed as hexadecimal values for each 7 bits.

The following table shows how these correspond to decimal numbers.

D	H	D	H	D	H	D	H
0	00H	32	20H	64	40H	96	60H
1	01H	33	21H	65	41H	97	61H
2	02H	34	22H	66	42H	98	62H
3	03H	35	23H	67	43H	99	63H
4	04H	36	24H	68	44H	100	64H
5	05H	37	25H	69	45H	101	65H
6	06H	38	26H	70	46H	102	66H
7	07H	39	27H	71	47H	103	67H
8	08H	40	28H	72	48H	104	68H
9	09H	41	29H	73	49H	105	69H
10	0AH	42	2AH	74	4AH	106	6AH
11	0BH	43	2BH	75	4BH	107	6BH
12	0CH	44	2CH	76	4CH	108	6CH
13	0DH	45	2DH	77	4DH	109	6DH
14	0EH	46	2EH	78	4EH	110	6EH
15	0FH	47	2FH	79	4FH	111	6FH
16	10H	48	30H	80	50H	112	70H
17	11H	49	31H	81	51H	113	71H
18	12H	50	32H	82	52H	114	72H
19	13H	51	33H	83	53H	115	73H
20	14H	52	34H	84	54H	116	74H
21	15H	53	35H	85	55H	117	75H
22	16H	54	36H	86	56H	118	76H
23	17H	55	37H	87	57H	119	77H
24	18H	56	38H	88	58H	120	78H
25	19H	57	39H	89	59H	121	79H
26	1AH	58	3AH	90	5AH	122	7AH
27	1BH	59	3BH	91	5BH	123	7BH
28	1CH	60	3CH	92	5CH	124	7CH
29	1DH	61	3DH	93	5DH	125	7DH
30	1EH	62	3EH	94	5EH	126	7EH
31	1FH	63	3FH	95	5FH	127	7FH

D: decimal

H: hexadecimal

* Decimal values such as MIDI channel, bank select, and program change are listed as one (1) greater than the values given in the above table.

* A 7-bits byte can express data in the range of 128 steps. For data where greater precision is required, we must use two or more bytes. For example, two hexadecimal numbers aa bbH expressing two 7-bits bytes would indicate a value of aa x 128 + bb.

* In the case of values which have a ± sign, 00H = -64, 40H = ±0, and 7FH = +63, so that the decimal expression would be 64 less than the value given in the above chart. In the case of two types, 00 00H = -8192, 40 00H = ±0, and 7F 7FH = +8191. For example if aa bbH were expressed as decimal, this would be aa bbH - 40 00H = aa x 128 + bb - 64 x 128.

* Data marked “nibbled” is expressed in hexadecimal in 4-bits units. A value expressed as a 2-byte nibble 0a 0bH has the value of a x 16 + b.

<Example 1>

What is the decimal expression of 5AH?

>From the preceding table, 5AH = 90

<Example 2>

What is the decimal expression of the value 12 34H given as hexadecimal for each 7 bits?

>From the preceding table, since 12H = 18 and 34H = 52

18 x 128 + 52 = 2356

<Example 3>

What is the decimal expression of the nibbled value 0A 03 09 0D?

>From the preceding table, since 0AH = 10, 03H = 3, 09H = 9, 0DH = 13

((10 x 16 + 3) x 16 + 9) x 16 + 13 = 41885

<Example 4>

What is the nibbled expression of the decimal value 1258?

```

16) 1258
   78... 10
   4... 14
   0... 4

```

Since from the preceding table, 0 = 00H, 4 = 04H, 14 = 0EH, 10 = 0AH, the answer is 00 04 0E 0AH.

Examples of Actual MIDI Messages

<Example 1> 92 3E 5F

9n is the Note-on status, and n is the MIDI channel number. Since 2H = 2, 3EH = 62, and 5FH = 95, this is a Note-on message with MIDI CH = 3, note number 62 (note name is D4), and velocity 95.

<Example 2> CE 49

CnH is the Program Change status, and n is the MIDI channel number. Since EH = 14 and 49H = 73, this is a Program Change message with MIDI CH = 15, program number 74 (Flute in GS).

<Example 3> EA 00 28

EnH is the Pitch Bend Change status, and n is the MIDI channel number. The 2nd byte (00H = 0) is the LSB and the 3rd byte (28H = 40) is the MSB, but Pitch Bend Value is a signed number in which 40 00H (= 64 x 128 + 0 = 8192) is 0, so this Pitch Bend Value is 28 00H - 40 00H = 40 x 128 + 0 - (64 x 128 + 0) = 5120 - 8192 = -3072

If the Pitch Bend Sensitivity is set to 2 semitones, -8192 (00 00H) will cause the pitch to change 200 cents, so in this case -200 x (-3072) / (-8192) = -75 cents of Pitch Bend is being applied to MIDI channel 11.

<Example 4> B3 64 00 65 00 06 0C 26 00 64 7F 65 7F

BnH is the Control Change status, and n is the MIDI channel number. For Control Changes, the 2nd byte is the controller number, and the 3rd byte is the value. In a case in which two or more messages consecutive messages have the same status, MIDI has a provision called “running status” which allows the status byte of the second and following messages to be omitted. Thus, the above messages have the following meaning.

```

B3 64 00  MIDI ch.4, lower byte of RPN parameter number: 00H
(B3) 65 00  (MIDI ch.4) upper byte of RPN parameter number: 00H
(B3) 06 0C  (MIDI ch.4) upper byte of parameter value: 0CH
(B3) 26 00  (MIDI ch.4) lower byte of parameter value: 00H
(B3) 64 7F  (MIDI ch.4) lower byte of RPN parameter number: 7FH
(B3) 65 7F  (MIDI ch.4) upper byte of RPN parameter number: 7FH

```

In other words, the above messages specify a value of 0C 00H for RPN parameter number 00 00H on MIDI channel 4, and then set the RPN parameter number to 7F 7FH.

RPN parameter number 00 00H is Pitch Bend Sensitivity, and the MSB of the value indicates semitone units, so a value of 0CH = 12 sets the maximum pitch bend range to +/- 12 semitones (1 octave). (On GS sound sources the LSB of Pitch Bend Sensitivity is ignored, but the LSB should be transmitted anyway (with a value of 0) so that operation will be correct on any device.)

Once the parameter number has been specified for RPN or NRPN, all Data Entry messages transmitted on that same channel will be valid, so after the desired value has been transmitted, it is a good idea to set the parameter number to 7F 7FH to prevent accidents. This is the reason for the (B3) 64 7F (B3) 65 7F at the end.

It is not desirable for performance data (such as Standard MIDI File data) to contain many events with running status as given in <Example 4>. This is because if playback is halted during the song and then reword or fast-forwarded, the sequencer may not be able to transmit the correct status, and the sound source will then misinterpret the data. Take care to give each event its own status.

It is also necessary that the RPN or NRPN parameter number setting and the value setting be done in the proper order. On some sequencers, events occurring in the same (or consecutive) clock may be transmitted in an order different than the order in which they were received. For this reason it is a good idea to slightly skew the time of each event (about 1 tick for TPQN = 96, and about 5 ticks for TPQN = 480).

* TPQN: Ticks Per Quarter Note

● Example of an Exclusive Message and Calculating a Checksum

Roland Exclusive messages are transmitted with a checksum at the end (before F7) to make sure that the message was correctly received. The value of the checksum is determined by the address and data (or size) of the transmitted exclusive message.

○ How to Calculate the Checksum (Hexadecimal Numbers are Indicated by 'H')

The checksum is a value derived by adding the address, size and checksum itself and inverting the lower 7 bits.

Here's an example of how the checksum is calculated. We will assume that in the exclusive message we are transmitting, the address is aa bb ccH and the data or size is dd ee ffH.

aa + bb + cc + dd + ee + ff = sum
sum / 128 = quotient ... remainder
128 - remainder = checksum
(However, the checksum will be 0 if the remainder is 0.)

<Example1> Setting DELAY TYPE to DELAY → TREMOLO (DT1)

According to the "3. Parameter Address Map" (p. 9), the start address of Temporary Program is 10 00 00 00H, the offset address of DELAY at Program is 04 00H, and the address of DELAY TYPE is 00 02H. Therefore the address of DELAY TYPE of Setup is;

```

10 00 00 00H-
  04 00H
+) 00 02H
-----
10 00 04 02H
    
```

DELAY → TREMOLO has the value of 03H.

So the system exclusive message should be sent is;

F0	41	10	00 00 75	12	10 00 04 02	03	??	F7
(1)	(2)	(3)	(4)	(5)	Address	size	Checksum	(6)

(1) Exclusive Status	(2) ID (Roland)	(3) Device ID (17)
(4) Model ID (RD-2000EX)	(5) Command ID (DT1)	(6) End of Exclusive

Then calculate the checksum.

10H + 00H + 04H + 02H + 03H = 16 + 0 + 4 + 2 + 3 = 25 (sum)
25 (sum) ÷ 128 = 0 (quotient) ... 25 (remainder)
checksum = 128 - 25 (remainder) = 103 = 67H

This means that F0 41 10 00 00 75 12 10 00 04 02 03 67 F7 is the message should be sent.

<Example2> Getting Program Common data of the Temporary Program (RQ1)

According to the "3. Parameter Address Map" (p. 9), the start address of Temporary Program is assigned as following:

10 00 00 00H Program Common

And the data size of Program Common is 00 00 01 44H.

Therefore the system exclusive message should be sent is;

F0	41	10	00 00 75	10 00 00 00	00 00 01 44	??	F7
(1)	(2)	(3)	(4)	(5)	size	checksum	(6)

(1) Exclusive Status	(2) ID (Roland)	(3) Device ID (17)
(4) Model ID (RD-2000EX)	(5) Command ID (RQ1)	(6) End of Exclusive

Calculating the checksum as shown in <Example 1>, we get a message of F0 41 10 00 00 75 10 00 00 00 00 00 01 44 2B F7 to be transmitted.

■ ASCII Code Table

Program Name of MIDI data are described the ASCII code in the table below.

D	H	Char	D	H	Char	D	H	Char
32	20H	SP	64	40H	@	96	60H	`
33	21H	!	65	41H	A	97	61H	a
34	22H	"	66	42H	B	98	62H	b
35	23H	#	67	43H	C	99	63H	c
36	24H	\$	68	44H	D	100	64H	d
37	25H	%	69	45H	E	101	65H	e
38	26H	&	70	46H	F	102	66H	f
39	27H	`	71	47H	G	103	67H	g
40	28H	(	72	48H	H	104	68H	h
41	29H	)	73	49H	I	105	69H	i
42	2AH	*	74	4AH	J	106	6AH	j
43	2BH	+	75	4BH	K	107	6BH	k
44	2CH	,	76	4CH	L	108	6CH	l
45	2DH	-	77	4DH	M	109	6DH	m
46	2EH	.	78	4EH	N	110	6EH	n
47	2FH	/	79	4FH	O	111	6FH	o
48	30H	0	80	50H	P	112	70H	p
49	31H	1	81	51H	Q	113	71H	q
50	32H	2	82	52H	R	114	72H	r
51	33H	3	83	53H	S	115	73H	s
52	34H	4	84	54H	T	116	74H	t
53	35H	5	85	55H	U	117	75H	u
54	36H	6	86	56H	V	118	76H	v
55	37H	7	87	57H	W	119	77H	w
56	38H	8	88	58H	X	120	78H	x
57	39H	9	89	59H	Y	121	79H	y
58	3AH	:	90	5AH	Z	122	7AH	z
59	3BH	;	91	5BH	[	123	7BH	{
60	3CH	<	92	5CH	\	124	7CH	
61	3DH	=	93	5DH	]	125	7DH	}
62	3EH	>	94	5EH	^			
63	3FH	?	95	5FH	_			

D: decimal

H: hexadecimal

* "SP" is space.

MIDI Implementation Chart

Function...		Transmitted		Recognized	Remarks
Basic Channel	Default Changed	1–16 1–16		1–16 1–16	Memorized
Mode	Default Messages Altered	Mode 3 Mono, Poly *****		Mode 3 Mode 3, 4 (M = 1)	*1
Note Number :	True Voice	0–127 *****		0–127 0–127	
Velocity	Note On Note Off	O O 8n V = 0–127		O O	
After Touch	Key's Channel's	X O *2		O O	
Pitch Bend		O		O	
Control Change	0, 32	O	*2, *3	O	Bank select
	1	O	*2, *3	O	Modulation
	2	O	*2, *3	O	Breath type
	4	O	*2, *3	O	Foot type
	5	O	*2, *3	O	Portamento time
	6, 38	O	*2, *3	O	Data entry
	7	O	*2, *3	O	Volume
	8	O	*2, *3	O	Balance
	10	O	*2, *3	O	Panpot
	11	O	*2, *3	O	Expression
	16	O	*2, *3	X	General purpose controller 1
	17	O	*2, *3	X	General purpose controller 2
	18	O	*2, *3	X	General purpose controller 3
	19	O	*2, *3	X	General purpose controller 4
	64	O	*2, *3	O	Hold 1
	65	O	*2, *3	O	Portamento
	66	O	*2, *3	O	Sostenuto
	67	O	*2, *3	O	Soft
	68	O	*2, *3	O	Legato footswitch
	69	O	*2, *3	O	Hold 2
	70	O	*2, *3	O	Sound variation
	71	O	*2, *3	O	Resonance
	72	O	*2, *3	O	Release time
	73	O	*2, *3	O	Attack Time
	74	O	*2, *3	O	Cutoff
	75	O	*2, *3	O	Decay time
	76	O	*2, *3	O	Vibrato rate
	77	O	*2, *3	O	Vibrato depth
	78	O	*2, *3	O	Vibrato delay
	80	O	*2, *3	X	General purpose controller 5
	81	O	*2, *3	X	General purpose controller 6
	82	O	*2, *3	X	General purpose controller 7
	83	O	*2, *3	X	General purpose controller 8
	84	O	*2, *3	O	Portamento control
	88	O	*2, *3	O	High Resolution Velocity Prefix
	91	O	*2, *3	O	General purpose effects 1
	92	O	*2, *3	O	Tremolo
	93	O	*2, *3	O	General purpose effects 3
	94	O	*2, *3	O	Celeste
	95	O	*2, *3	O	Phaser
	98, 99	O	*2, *3	X	NRPN LSB, MSB
	100, 101	O	*2, *3	O	RPN LSB, MSB
	102–110	O	*4	O	Harmonic Bar 1–9
	112	O	*4	O	Percussion Volume
	114	O	*4	O	Percussion Switch/Decay
	0–127	O	*2, *3	X	
Program Change : True Number		O *****		O 0–127	Program No. 1–128
System Exclusive		O		O	
System Common : Song Position : Song Select : Tune Request		X X X		X X X	
System Real Time : Clock : Commands		O O		X X	
Aux Messages : All Sound Off : Reset All Controllers : Local On/Off : All Notes Off : Active Sensing : System Reset		O O X O O X		*2, *3 *2, *3 *2, *3 X	O (120, 126, 127) O X O (123–127) O X
Notes		*1 Recognized as M ≠ 1 even if M = 1. *2 Transmitted if assigned to pedals, wheels, knobs, sliders. *3 Transmitted if assigned to UserCC *4 Transmitted while the Tone Wheel & Designer Menu screen is displayed.			