

MIDI Implementation

Model: RD-88

Date: Jul. 22, 2020

Version: 1.12

1. Data Reception

■ Channel Voice Messages

● Note Off

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

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

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

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

● Note On

Status	2nd byte	3rd byte
-----	-----	-----
9nH	kkH	vvH

n = MIDI channel number: 0H - FH (ch.1 - ch.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 = Polyphonic Key Pressure: 00H - 7FH (0 - 127)

● Control Change

○ Bank Select (Controller number 0, 32)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	00H	mmH
BnH	20H	11H

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

mm, 11 = Bank number: 00 00H - 7F 7FH (bank.1 - bank.16384)

* Not received when the Rx Bank parameter (SYSTEM: MIDI: MIDI RX) is OFF.

The Scenes corresponding to each Bank Select are as follows.

BANK SELECT	PROGRAM	GROUP	NUMBER
MSB	LSB	NUMBER	
085	000	001 - 128	Scene
085	001	001 - 128	:
085	002	001 - 128	:
085	003	001 - 016	:
			001 - 128
			129 - 256
			257 - 384
			384 - 400

The Tones corresponding to each Bank Select are as follows.

BANK SELECT	PROGRAM	GROUP	NUMBER
MSB	LSB	NUMBER	
090	065	001 - 009	SN PR-A
089	064	001 - 015	SN PR-B
071	071	001 - 038	RD-88
087	092	001 - 128	PR-A
087	093	001 - 111	:
087	064	001 - 128	RR-B
087	065	001 - 128	:
087	066	001 - 128	:
087	067	001 - 075	:
087	068	001 - 128	PR-C
087	069	001 - 128	PR-D
087	070	001 - 128	:
087	071	001 - 128	:
087	072	001 - 128	:
087	073	001 - 128	:
087	074	001 - 128	:
087	075	001 - 128	:
087	076	001 - 128	:
087	077	001 - 085	:
087	078	001 - 128	PR-E
087	079	001 - 128	:
087	080	001 - 128	:
087	081	001 - 128	:
087	082	001 - 128	:
087	083	001 - 128	:
087	084	001 - 128	:
087	085	001 - 128	COMMON
087	086	001 - 128	:
087	087	001 - 128	:
087	088	001 - 128	:
087	089	001 - 128	:
087	090	001 - 128	:
087	091	001 - 069	:
071	007	001 - 128	USER
101	064	001 - 011	EXZ001
			0001 - 0009
			0001 - 0015
			0001 - 0038
			0001 - 0128
			0129 - 0239
			0001 - 0128
			0128 - 0256
			0257 - 0384
			0385 - 0459
			0001 - 0128
			0001 - 0128
			0129 - 0256
			0257 - 0384
			0385 - 0512
			0513 - 0640
			0641 - 0768
			0769 - 0896
			0897 - 1024
			1025 - 1109
			0001 - 0128
			0129 - 0256
			0257 - 0384
			0385 - 0512
			0513 - 0640
			0641 - 0768
			0769 - 0896
			0001 - 0128
			0129 - 0256
			0257 - 0384
			0385 - 0512
			0513 - 0640
			0641 - 0768
			0769 - 0837
			0001 - 0128
			0001 - 0011

○ Modulation (Controller number 1)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	01H	vvH

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

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

○ Breath type (Controller number 2)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	02H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

○ Foot Type (Controller number 4)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	04H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

MIDI Implementation

o Portamento Time (Controller number 5)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	05H	vvH

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

vv = Portamento Time: 00H - 7FH (0 - 127)

* The Porta Time parameter (SCENE EDIT: ZONE SOUND: GENERAL) will change.

o Data Entry (Controller number 6, 38)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	06H	mmH
BnH	26H	11H

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

mm, 11 = the value of the parameter specified by RPN/NRPN

mm = MSB, 11 = LSB

o Volume (Controller number 7)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	07H	vvH

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

vv = Volume: 00H - 7FH (0 - 127)

* The Level parameter (SCENE EDIT: ZONE EDIT: INTERNAL) will change.

o Panpot (Controller number 10)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	0AH	vvH

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

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

* The Pan parameter (SCENE EDIT: ZONE EDIT: INTERNAL) will change.

o Expression (Controller number 11)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	0BH	vvH

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

vv = Expression: 00H - 7FH (0 - 127)

o General Purpose Controller 1 (Controller number 16)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	10H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 2 (Controller number 17)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	11H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 3 (Controller number 18)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	12H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 4 (Controller number 19)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	13H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Hold 1 (Controller number 64)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	40H	vvH

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

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

o Portamento (Controller number 65)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	41H	vvH

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

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

* The Porta Sw parameter (SCENE EDIT: ZONE SOUND: GENERAL) will change.

o Sostenuto (Controller number 66)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	42H	vvH

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

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

o Soft (Controller number 67)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	43H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Legato Foot Switch (Controller number 68)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	44H	vvH

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

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

* The Legato Sw parameter (SCENE EDIT: ZONE SOUND: GENERAL) will change.

o Resonance (Controller number 71)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	47H	vvH

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

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

* The Resonance parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Release Time (Controller number 72)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	48H	vvH

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

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

* The Release parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Attack time (Controller number 73)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	49H	vvH

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

vv = Attack time value (relative change): 00H - 40H - 7FH (-64 - 0 - +63)

* The Attack parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Cutoff (Controller number 74)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	4AH	vvH

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

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

* The Cutoff parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Decay Time (Controller number 75)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	4BH	vvH

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

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

* The Decay parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Vibrato Rate (Controller number 76)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	4CH	vvH

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

vv = Vibrato Rate value (relative change): 00H - 40H - 7FH (-64 - 0 - +63)

* The Vib Rate parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Vibrato Depth (Controller number 77)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	4DH	vvH

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

vv = Vibrato Depth Value (relative change): 00H - 40H - 7FH (-64 - 0 - +63)

* The Vib Depth parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o Vibrato Delay (Controller number 78)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	4EH	vvH

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

vv = Vibrato Delay value (relative change): 00H - 40H - 7FH (-64 - 0 - +63)

* The Vib Delay parameter (SCENE EDIT: ZONE SOUND: MODIFY) will change.

o General Purpose Controller 5 (Controller number 80)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	50H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 6 (Controller number 81)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	51H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

* Not received when the RX PC parameter (SYSTEM: MIDI: MIDI RX) is OFF.

● Channel Pressure

Status	2nd byte
-----	-----
DnH	vvH

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

vv = Channel Pressure: 00H - 7FH (0 - 127)

● Pitch Bend Change

Status	2nd byte	3rd byte
-----	-----	-----
EnH	llH	mmH

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

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

Controller	Reset value
Pitch Bend Change	+/-0 (center)
Polyphonic Key Pressure	0 (off)
Channel Pressure	0 (off)
Modulation	0 (off)
Breath Type	0 (min)
Foot Type	0 (min)
Expression	127 (max)
	However the controller will be at minimum.
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 - ch.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 - ch.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 - ch.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 - ch.16)

mm = mono number: 00H - 10H (0 - 16)

* The same processing will be carried out as when All Notes Off is received.
* The Mono/Poly parameter (SCENE EDIT: ZONE SOUND: GENERAL) will change.

● POLY (Controller number 127)

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

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

* The same processing will be carried out as when All Notes Off is received.
* The Mono/Poly parameter (SCENE EDIT: ZONE SOUND: GENERAL) will change.

■ System Exclusive Message

Status	Data byte	Status
-----	-----	-----
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 System Exclusive messages and the Universal Realtime System Exclusive messages and the Data Request 1 (RQ1) messages and the Data Set 1 (DT1) messages will be set automatically.

● Universal Non-realtime System Exclusive Messages

○ Identity Request Message

Status	Data byte	Status
-----	-----	-----
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)
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 will be transmitted.

● Universal Realtime System Exclusive Messages

○ Master Volume

Status	Data byte	Status
-----	-----	-----
F0H	7FH, 7FH, 04H, 01H, 11H, 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)
11H	Master Volume lower byte
mmH	Master Volume upper byte
F7H	EOX (End Of Exclusive)

* The lower byte (11H) of Master Volume will be handled as 00H.
 * The Master Volume will change.

○ Master Fine Tuning

Status	Data byte	Status
-----	-----	-----
F0H	7FH, 7FH, 04H, 03H, 11H, 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)
11H	Master Fine Tuning LSB
mmH	Master Fine Tuning MSB
F7H	EOX (End Of Exclusive)

mm, 11: 00 00H - 40 00H - 7F 7FH (-100 - 0 - +99.9 [cents])

* The MasterTune parameter (SYSTEM: GENERAL) will change.

○ Master Coarse Tuning

Status	Data byte	Status
-----	-----	-----
F0H	7FH, 7FH, 04H, 04H, 11H, mmH	F7

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)
11H	Master Coarse Tuning LSB
mmH	Master Coarse Tuning MSB
F7H	EOX (End Of Exclusive)

mmH: 28H - 40H - 58H (-24 - 0 - +24 [semitones])

11H: ignored (processed as 00H)

* The MasKeyShift parameter (SYSTEM: GENERAL) will change.

● Global Parameter Control

○ Scale/Octave Tuning Adjust

Status	Data byte	Status
-----	-----	-----
F0H	7EH, 7FH, 08H, 08H, ffH, ggH, hhH, ssH...	F7

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)

appropriate, the requested data is transmitted as a Data Set 1 (DT1) message. If the conditions are not met, nothing is transmitted.

Status	Data byte	Status
-----	-----	-----
F0H	41H, dev, 00H, 00H, 00H, 64H, 11H, aaH, bbH, ccH, ddH, ssH, ttH, uuH, vvH, sum	F7H

Byte	Remarks
----	-----
F0H	Exclusive status
41H	ID number (Roland)
dev	device ID (dev: 10H - 1FH, 7FH)
00H	model ID #1 (RD-88)
00H	model ID #2 (RD-88)
00H	model ID #3 (RD-88)
64H	model ID #4 (RD-88)
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)

● 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 00H 64H.

- * 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 "Parameter Address Map".
- * For the checksum, refer to "How to calculate the checksum".
- * Not received when the Rx Exclusive parameter (SYSTEM:MIDI:MIDI RX) is OFF.

○ 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

o Data Set 1 (DT1)

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

Status	Data byte	Status
-----	-----	-----
F0H	41H, dev, 00H, 00H, 00H, 5BH, 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)	
00H	Model ID #1 (RD-88)	
00H	Model ID #2 (RD-88)	
00H	model ID #3 (RD-88)	
64H	model ID #4 (RD-88)	
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 "Parameter Address Map".
- * 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 "How to calculate the checksum".
- * Not received when the Rx Exclusive parameter (SYSTEM: MIDI: MIDI RX) is OFF.

2. Data Transmission

■ Channel Voice Messages

● Note Off

Status	2nd byte	3rd byte
-----	-----	-----
8nH	kkH	vvH

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

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

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

● Note On

Status	2nd byte	3rd byte
-----	-----	-----
9nH	kkH	vvH

n = MIDI channel number: 0H - FH (ch.1 - ch.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, the RD-88 can transmit any control change message.

o Bank Select (Controller number 0, 32)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	00H	mmH
BnH	20H	11H

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

mm, 11 = Bank number: 00 00H - 7F 7FH (bank.1 - bank.16384)

* These messages are transmitted when Scene or Tone is selected. But not transmitted when Tx PC (SYSTEM:MIDI:MIDI TX) or Tx Bank parameter (SYSTEM:MIDI:MIDI TX) is OFF.

o Modulation (Controller number 1)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	01H	vvH

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

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

o Breath type (Controller number 2)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	02H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Foot Type (Controller number 4)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	04H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Portamento Time (Controller number 5)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	05H	vvH

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

vv = Portamento Time: 00H - 7FH (0 - 127)

o Data Entry (Controller number 6, 38)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	06H	mmH
BnH	26H	11H

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

mm, 11 = the value of the parameter specified by RPN/NRPN

mm = MSB, 11 = LSB

o Volume (Controller number 7)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	07H	vvH

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

vv = Volume: 00H - 7FH (0 - 127)

o Panpot (Controller number 10)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	0AH	vvH

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

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

o Expression (Controller number 11)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	0BH	vvH

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

vv = Expression: 00H - 7FH (0 - 127)

o General Purpose Controller 1 (Controller number 16)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	10H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 2 (Controller number 17)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	11H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 3 (Controller number 18)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	12H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 4 (Controller number 19)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	13H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Hold 1 (Controller number 64)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	40H	vvH

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

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

o Portamento (Controller number 65)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	41H	vvH

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

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

o Sostenuto (Controller number 66)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	42H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Soft (Controller number 67)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	43H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

MIDI Implementation

o Legato Foot Switch (Controller number 68)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	44H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Resonance (Controller number 71)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	47H	vvH

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

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

o Release Time (Controller number 72)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	48H	vvH

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

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

o Attack time (Controller number 73)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	49H	vvH

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

vv = Attack time value (relative change): 00H - 40H - 7FH (-64 - 0 - +63)

o 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 - 40H - 7FH (-64 - 0 - +63)

o General Purpose Controller 5 (Controller number 80)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	50H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 6 (Controller number 81)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	51H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 7 (Controller number 82)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	52H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o General Purpose Controller 8 (Controller number 83)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	53H	vvH

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

vv = Control value: 00H - 7FH (0 - 127)

o Portamento control (Controller number 84)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	54H	kkH

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

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

o General Purpose Effect 1 (Reverb Send Level) (Controller number 91)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	5BH	vvH

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

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

o General Purpose Effect 3 (Chorus Send Level) (Controller number 93)

Status	2nd byte	3rd byte
-----	-----	-----
BnH	5DH	vvH

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

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

o 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 - ch.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	
MSB, LSB	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

* These messages are transmitted when each value is set in SCENE EDIT:ZONE EDIT:EXTERNAL.

* These messages are transmitted when each value is set in SCENE EDIT:ZONE EDIT:EXTERNAL.

o General Controller

Status	2nd byte	3rd byte
-----	-----	-----
BnH	kkH	vvH

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

kk = Controller number: 00H - 77H (0 - 31, 33 - 95)

vv = Control value: 00H - 7FH (0 - 127)

● Program Change

Status	2nd byte
-----	-----
CnH	ppH

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

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

* These messages are transmitted when Scene or Tone is selected. But not transmitted when Tx PC parameter (SYSTEM:MIDI:MIDI TX) is OFF.

● Channel Pressure

Status	2nd byte
-----	-----
DnH	vvH

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

vv = Channel Pressure: 00H - 7FH (0 - 127)

● Pitch Bend Change

Status	2nd byte	3rd byte
-----	-----	-----
EnH	llH	mmH

n = MIDI channel number: 0H - FH (ch.1 - ch.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	mmH

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

mm = mono number: 00H - 10H (0 - 16)

● POLY (Controller number 127)

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

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

■ System Realtime Message

● Active Sensing

Status

FEH

* This message is transmitted at intervals of approximately 250 msec.

■ System Exclusive Message

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

● Universal Non-realtime System Exclusive Messages

o Identity Reply Message

Receiving Identity Request Message, the RD-88 send this message

Status	Data byte	Status
-----	-----	-----
F0H	7EH, dev, 06H, 02H, 41H, 64H, 03H, 00H, 00H, 00H, 01H, 00H, 01H	F7H

Byte	Explanation
----	-----
F0H	Exclusive status
7EH	ID number (Universal Non-realtime Message)
10H	Device ID (dev: 10H - 1FH)
06H	Sub ID#1 (General Information)
02H	Sub ID#2 (Identity Reply)
41H	ID number (Roland)
64H 03H	Device family code
00H 00H	Device family number code
00H 01H 00H 01H	Software revision level
F7H	EOX (End of Exclusive)

• Data Transmission

o Data Set 1 (DT1)

Status	Data byte	Status
-----	-----	-----
F0H	41H, dev, 00H, 00H, 00H, 64H, 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)	
00H	Model ID #1 (RD-88)	
00H	Model ID #2 (RD-88)	
00H	model ID #3 (RD-88)	
64H	model ID #4 (RD-88)	
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 "Parameter Address Map".

* 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.

* "<*>" marked address or parameters are ignored when the RD-88 received them.

RD-88 (ModelID = 00H 00H 00H 64H)

Start	Address	Description
-----	-----	-----
00 00 00 00	| System	[System]
01 00 00 00	| Temporary Scene	[Scene]
02 00 00 00	| Setup	[Setup]
10 00 00 00	| User Scene (001)	[Scene]
10 01 00 00	| User Scene (002)	[Scene]
:	:	:
13 0F 00 00	| User Scene (400)	[Scene]

* [System]

Offset	Address	Description
-----	-----	-----
00 00 00	| System Common	[System Common]
00 01 00	| System Control	[System Control]
00 02 00	| System Chorus	[Chorus]
00 03 00	| System Reverb	[Reverb]
00 04 00	| Master EQ	[EQ]
00 05 00	| Master Comp	[Comp]
00 06 00	| Input Reverb	[Reverb]
00 07 00	| Input EQ	[EQ]

* [Scene]

Offset	Address	Description
-----	-----	-----
00 00 00	| Scene Common	[Scene Common]
00 10 00	| Scene Tone (1)	[Scene Tone]
00 11 00	| Scene Tone (2)	[Scene Tone]
00 12 00	| Scene Tone (3)	[Scene Tone]
00 20 00	| Scene EQ (1)	[Scene EQ]
00 21 00	| Scene EQ (2)	[Scene EQ]
00 22 00	| Scene EQ (3)	[Scene EQ]
00 30 00	| Scene MFX (1)	[MFX]
00 32 00	| Scene MFX (2)	[MFX]
00 34 00	| Scene MFX (3)	[MFX]
00 40 00	| Scene Zone (1)	[Scene Zone]
00 41 00	| Scene Zone (2)	[Scene Zone]
00 42 00	| Scene Zone (3)	[Scene Zone]
00 50 00	| Scene IFX	[MFX]
00 52 00	| Scene Chorus	[Chorus]
00 53 00	| Scene Reverb	[Reverb]
00 54 00	| Scene Sympathetic Resonance	[Sympathetic Resonance]

* [Setup]

Offset	Address	Description
-----	-----	-----
00 00	| 0aaa aaaa | Scene BS MSB (CC# 0)	(0 - 127)
00 01	| 0aaa aaaa | Scene BS LSB (CC# 32)	(0 - 127)
00 02	| 0aaa aaaa | Scene PC (PC)	(0 - 127)
00 00 00 03	| Total Size	

* [System Common]

Offset	Address	Description
#	00 00	0000 aaaa |
	00 01	0000 bbbb |
	00 02	0000 cccc |
	00 03	0000 dddd | Master Tune (24 - 2024)
		-1000 - 1000
	00 04	0aaa aaaa | Master Key Shift (40 - 88)
		-24 - 24
	00 05	000a aaaa | Scene Control Channel (0 - 16)
		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, OFF
	00 06	0000 aaaa | (reserve) <*>
	00 07	0000 000a | Remote Keyboard (0 - 1)
		OFF, ON
	00 08	0000 000a | Control Source Select (0 - 1)
		SYS, SCENE
	00 09	0aaa aaaa | System Control Source(1) (0 - 96)
		OFF, CC01, CC02, CC03, CC04, CC05, CC06, CC07, CC08, CC09, CC10, CC11, CC12, CC13, CC14, CC15, CC16, CC17, CC18, CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, CC33, CC34, CC35, CC36, CC37, CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, CC64, CC65, CC66, CC67, CC68, CC69, CC70, CC71, CC72, CC73, CC74, CC75, CC76, CC77, CC78, CC79, CC80, CC81, CC82, CC83, CC84, CC85, CC86, CC87, CC88, CC89, CC90, CC91, CC92, CC93, CC94, CC95, BEND, AFT
	00 0A	0aaa aaaa | System Control Source(2) (0 - 96)
		OFF, CC01, CC02, CC03, CC04, CC05, CC06, CC07, CC08, CC09, CC10, CC11, CC12, CC13, CC14, CC15, CC16, CC17, CC18, CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, CC33, CC34, CC35, CC36, CC37, CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, CC64, CC65, CC66, CC67, CC68, CC69, CC70, CC71, CC72, CC73, CC74, CC75, CC76, CC77, CC78, CC79, CC80, CC81, CC82, CC83, CC84, CC85, CC86, CC87, CC88, CC89, CC90, CC91, CC92, CC93, CC94, CC95, BEND, AFT
	00 0B	0aaa aaaa | System Control Source(3) (0 - 96)
		OFF, CC01, CC02, CC03, CC04, CC05, CC06, CC07, CC08, CC09, CC10, CC11, CC12, CC13, CC14, CC15, CC16, CC17, CC18, CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, CC33, CC34, CC35, CC36, CC37, CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, CC64, CC65, CC66, CC67, CC68, CC69, CC70, CC71, CC72, CC73, CC74, CC75, CC76, CC77, CC78, CC79, CC80, CC81, CC82, CC83, CC84, CC85, CC86, CC87, CC88, CC89, CC90, CC91, CC92, CC93, CC94, CC95, BEND, AFT
	00 0C	0aaa aaaa | System Control Source(4) (0 - 96)
		OFF, CC01, CC02, CC03, CC04, CC05, CC06, CC07, CC08, CC09, CC10, CC11, CC12, CC13, CC14, CC15, CC16, CC17, CC18, CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, CC33, CC34, CC35, CC36, CC37, CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, CC64, CC65, CC66, CC67, CC68, CC69, CC70, CC71, CC72, CC73, CC74, CC75, CC76, CC77, CC78, CC79, CC80, CC81, CC82, CC83, CC84, CC85, CC86, CC87, CC88, CC89, CC90, CC91, CC92, CC93, CC94, CC95, BEND, AFT
#	00 0D	0000 aaaa |
	00 0E	0000 bbbb | System Tempo (20 - 250)
		20 - 250
	00 0F	0000 000a | Tempo Source (0 - 1)
		SCENE, SYS
	00 10	0000 000a | Receive Program Change (0 - 1)
		OFF, ON
	00 11	0000 000a | Receive Bank Select (0 - 1)
		OFF, ON
	00 12	0000 000a | (reserve) <*>
	00 13	0000 000a | (reserve) <*>
	00 14	0000 000a | (reserve) <*>
	00 15	0000 aaaa | Scale Tune Type (0 - 8)
		CUSTOM, EQUAL, JUST-MAJ, JUST-MIN, PYTHAGORE, KIRNBERGE, MEANTONE, WERCKMEIS, ARABIC
	00 16	0000 aaaa | Scale Tune Key (0 - 11)
		C, C#, D, D#, E, F, F#, G, G#, A, A#, B
	00 17	0aaa aaaa | Scale Tune for C (0 - 127)
		-64 - 63
	00 18	0aaa aaaa | Scale Tune for C# (0 - 127)
		-64 - 63
	00 19	0aaa aaaa | Scale Tune for D (0 - 127)
		-64 - 63
	00 1A	0aaa aaaa | Scale Tune for D# (0 - 127)
		-64 - 63
	00 1B	0aaa aaaa | Scale Tune for E (0 - 127)
		-64 - 63
	00 1C	0aaa aaaa | Scale Tune for F (0 - 127)
		-64 - 63
	00 1D	0aaa aaaa | Scale Tune for F# (0 - 127)
		-64 - 63
	00 1E	0aaa aaaa | Scale Tune for G (0 - 127)
		-64 - 63
	00 1F	0aaa aaaa | Scale Tune for G# (0 - 127)
		-64 - 63

00 20	0aaa aaaa	Scale Tune for A (0 - 127)
		-64 - 63
00 21	0aaa aaaa	Scale Tune for A# (0 - 127)
		-64 - 63
00 22	0aaa aaaa	Scale Tune for B (0 - 127)
		-64 - 63
00 23	0000 000a	Local Switch (0 - 1)
		OFF, ON
00 24	0000 000a	(reserve) <*>
00 00 00 25	Total Size	

* [System Control]

Offset	Address	Description
00 00	0000 000a	Transmit Program Change (0 - 1)
		OFF, ON
00 01	0000 000a	Transmit Bank Select (0 - 1)
		OFF, ON
00 02	0aaa aaaa	Keyboard Velocity (0 - 127)
		REAL, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127
00 03	0000 0aaa	Keyboard Velocity Curve (0 - 4)
		SPR LIGHT, LIGHT, MEDIUM, HEAVY, SPR HEAVY
00 04	0aaa aaaa	Keyboard Velocity Curve Offset (54 - 73)
		-10 - 9
00 05	0aaa aaaa	Keyboard Velocity Delay Sens (1 - 127)
		-63 - 63
00 06	0aaa aaaa	Keyboard Velocity Key Follow (1 - 127)
		-63 - 63
00 07	0000 000a	Keyboard Off Position (0 - 1)
		STANDARD, DEEP
00 08	0aaa aaaa	Wheel(1) Function (0 - 97)
		OFF, MOD: CC01, BRETH: CC02, CC03, FOOT: CC04, PTIME: CC05, DENT: CC06, VOL: CC07, BAL: CC08, CC09, PAN: CC10, EXP: CC11, CC12, CC13, CC14, CC15, GEN-1: CC16, GEN-2: CC17, GEN-3: CC18, GEN-4: CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, OFF: CC32, CC33, CC34, CC35, CC36, CC37, DENT: CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, HOLD1: CC64, PORTA: CC65, SOSTE: CC66, SOFT: CC67, LEGAT: CC68, HOLD2: CC69, CC70, RESO: CC71, RELES: CC72, ATTACK: CC73, CUTOFF: CC74, DECAY: CC75, VRATE: CC76, VDEPTH: CC77, VDLX: CC78, CC79, GEN-5: CC80, GEN-6: CC81, GEN-7: CC82, GEN-8: CC83, PCTRL: CC84, CC85, CC86, CC87, CC88, CC89, CC90, REV: CC91, TREM: CC92, CHO: CC93, CELST: CC94, PHASR: CC95, AFT, BEND DOWN, BEND UP
00 09	0aaa aaaa	Wheel(2) Function (0 - 98)
		OFF, MOD: CC01, BRETH: CC02, CC03, FOOT: CC04, PTIME: CC05, DENT: CC06, VOL: CC07, BAL: CC08, CC09, PAN: CC10, EXP: CC11, CC12, CC13, CC14, CC15, GEN-1: CC16, GEN-2: CC17, GEN-3: CC18, GEN-4: CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, OFF: CC32, CC33, CC34, CC35, CC36, CC37, DENT: CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, HOLD1: CC64, PORTA: CC65, SOSTE: CC66, SOFT: CC67, LEGAT: CC68, HOLD2: CC69, CC70, RESO: CC71, RELES: CC72, ATTACK: CC73, CUTOFF: CC74, DECAY: CC75, VRATE: CC76, VDEPTH: CC77, VDLX: CC78, CC79, GEN-5: CC80, GEN-6: CC81, GEN-7: CC82, GEN-8: CC83, PCTRL: CC84, CC85, CC86, CC87, CC88, CC89, CC90, REV: CC91, TREM: CC92, CHO: CC93, CELST: CC94, PHASR: CC95, AFT, BEND DOWN, BEND UP
00 0A	0aaa aaaa	Assignable Knob(1) Function (0 - 98)
		OFF, MOD: CC01, BRETH: CC02, CC03, FOOT: CC04, PTIME: CC05, DENT: CC06, VOL: CC07, BAL: CC08, CC09, PAN: CC10, EXP: CC11, CC12, CC13, CC14, CC15, GEN-1: CC16, GEN-2: CC17, GEN-3: CC18, GEN-4: CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, OFF: CC32, CC33, CC34, CC35, CC36, CC37, DENT: CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, HOLD1: CC64, PORTA: CC65, SOSTE: CC66, SOFT: CC67, LEGAT: CC68, HOLD2: CC69, CC70, RESO: CC71, RELES: CC72, ATTACK: CC73, CUTOFF: CC74, DECAY: CC75, VRATE: CC76, VDEPTH: CC77, VDLX: CC78, CC79, GEN-5: CC80, GEN-6: CC81, GEN-7: CC82, GEN-8: CC83, PCTRL: CC84, CC85, CC86, CC87, CC88, CC89, CC90, REV: CC91, TREM: CC92, CHO: CC93, CELST: CC94, PHASR: CC95, AFT, BEND DOWN, BEND UP
00 0B	0aaa aaaa	Assignable Knob(2) Function (0 - 98)
		OFF, MOD: CC01, BRETH: CC02, CC03, FOOT: CC04, PTIME: CC05, DENT: CC06, VOL: CC07, BAL: CC08, CC09, PAN: CC10, EXP: CC11, CC12, CC13, CC14, CC15, GEN-1: CC16, GEN-2: CC17, GEN-3: CC18, GEN-4: CC19, CC20, CC21, CC22, CC23, CC24, CC25, CC26, CC27, CC28, CC29, CC30, CC31, OFF: CC32, CC33, CC34, CC35, CC36, CC37, DENT: CC38, CC39, CC40, CC41, CC42, CC43, CC44, CC45, CC46, CC47, CC48, CC49, CC50, CC51, CC52, CC53, CC54, CC55, CC56, CC57, CC58, CC59, CC60, CC61, CC62, CC63, HOLD1: CC64, PORTA: CC65, SOSTE: CC66, SOFT: CC67, LEGAT: CC68, HOLD2: CC69, CC70, RESO: CC71, RELES: CC72, ATTACK: CC73, CUTOFF: CC74, DECAY: CC75, VRATE: CC76, VDEPTH: CC77, VDLX: CC78, CC79, GEN-5: CC80, GEN-6: CC81, GEN-7: CC82, GEN-8: CC83, PCTRL: CC84, CC85, CC86, CC87, CC88, CC89, CC90, REV: CC91, TREM: CC92, CHO: CC93, CELST: CC94, PHASR: CC95, AFT, BEND DOWN, BEND UP

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			-63 - 63				VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP		
00 1B	0000 000a	Keyboard Off Position	(0 - 1)						
			STANDARD, DEEP						
00 1C	0aaa aaaa	Wheel(1) Function	(0 - 97)						
		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,PITCH BEND		00 24	0aaa aaaa	Assignable Knob(5) Function	(0 - 98)		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP
00 1D	0000 000a	Wheel(1) Source	(0 - 1)						
			SCENE, SYS						
00 1E	0aaa aaaa	Wheel(2) Function	(0 - 98)						
		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP		00 25	0aaa aaaa	Assignable Knob(6) Function	(0 - 98)		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP
00 1F	0000 000a	Wheel(2) Source	(0 - 1)						
			SCENE, SYS						
00 20	0aaa aaaa	Assignable Knob(1) Function	(0 - 98)						
		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP		00 26	0aaa aaaa	Assignable Knob(7) Function	(0 - 98)		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP
00 21	0aaa aaaa	Assignable Knob(2) Function	(0 - 98)						
		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP		00 27	0aaa aaaa	Assignable Knob(8) Function	(0 - 98)		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP
00 22	0aaa aaaa	Assignable Knob(3) Function	(0 - 98)						
		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP		00 28	0000 000a	Assignable Knob Source	(0 - 1)		SCENE, SYS
00 23	0aaa aaaa	Assignable Knob(4) Function	(0 - 98)						
		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP		00 29	0aaa aaaa	(reserve) <*>	(0 - 101)		
				00 2A	0aaa aaaa	FC(1) Function	(0 - 101)		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP
				00 2B	0aaa aaaa	FC(2) Function	(0 - 101)		OFF,MOD:CC01,BRETH:CC02,CC03,FOOT:CC04,PTIME:CC05,DENT:CC06,VOL:CC07,BAL:CC08,CC09,PAN:CC10,EXP:CC11,CC12,CC13,CC14,CC15,GEN-1:CC16,GEN-2:CC17,GEN-3:CC18,GEN-4:CC19,C20,CC21,CC22,CC23,CC24,CC25,CC26,CC27,CC28,CC29,CC30,CC31,OFF:CC32,CC33,CC34,CC35,CC36,CC37,DENT:CC38,CC39,CC40,CC41,CC42,CC43,CC44,CC45,CC46,CC47,CC48,CC49,CC50,CC51,CC52,CC53,CC54,CC55,CC56,CC57,CC58,CC59,CC60,CC61,CC62,CC63,HOLD1:CC64,PORTA:CC65,SOSTE:CC66,SOFT:CC67,LEGAT:CC68,HOLD2:CC69,CC70,RESO:CC71,RELES:CC72,ATTAK:CC73,CUTOFF:CC74,DECAY:CC75,VRATE:CC76,VDPATH:CC77,VLDLY:CC78,CC79,GEN-5:CC80,GEN-6:CC81,GEN-7:CC82,GEN-8:CC83,PCTRL:CC84,CC85,CC86,CC87,CC88,CC89,CC90,REV:CC91,TREM:CC92,CHO:CC93,CELST:CC94,PHASR:CC95,AFT,BEND DOWN,BEND UP

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MIDI Implementation

				OFF,0,1,2,3,4,5,6,7,8,9,				104,105,106,107,108,109,110,111,112,113,114,115,
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				116,117,118,119,120,121,122,123,124,125,126,127|
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|		00 3F	0aaa aaaa	External CC 1 Value (0 - 127)
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|	#	00 40	0000 aaaa	
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|		00 41	0000 bbbb	External CC 2 Number (0 - 128)
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|				OFF,0,1,2,3,4,5,6,7,8,9,|
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|
				104,105,106,107,108,109,110,111,112,113,114,115,|				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|
				116,117,118,119,120,121,122,123,124,125,126,127|				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|
#	00 2E	0000 aaaa						58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|
	00 2F	0000 bbbb	External Resonance Offset (CC#71)	(0 - 128)				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|
				OFF,0,1,2,3,4,5,6,7,8,9,|				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				104,105,106,107,108,109,110,111,112,113,114,115,|
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|				116,117,118,119,120,121,122,123,124,125,126,127|
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|		00 42	0aaa aaaa	External CC 2 Value (0 - 127)
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|		00 43	0000 000a	(reserve) <*>
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|				-----
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|		00 00 00 44	Total Size	-----
				104,105,106,107,108,109,110,111,112,113,114,115,|				
				116,117,118,119,120,121,122,123,124,125,126,127|				
#	00 30	0000 aaaa						
	00 31	0000 bbbb	External Attack Time Offset (CC#73)	(0 - 128)				* [Sympathetic Resonance]
				OFF,0,1,2,3,4,5,6,7,8,9,|				-----
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|		Offset		
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|		Address	Description	
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|				-----
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|		00 00	0000 000a	SymReso Switch (0 - 1)
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|				OFF, ON
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|		00 01	0aaa aaaa	SymReso Depth (0 - 127)
				104,105,106,107,108,109,110,111,112,113,114,115,|		00 02	0aaa aaaa	Cabinet Resonance (0 - 127)
				116,117,118,119,120,121,122,123,124,125,126,127|		00 03	00aa aaaa	AtkIn LFF (1 - 32)
#	00 32	0000 aaaa						16,20,|
	00 33	0000 bbbb	External Decay Time Offset (CC#75)	(0 - 128)				25,32,40,50,63,80,100,125,160,200,250,315,400,|
				OFF,0,1,2,3,4,5,6,7,8,9,|				500,630,800,1000,1250,1600,2000,2500,3150,4000,|
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				5000,6300,8000,10000,12500,15000,Bypass [Hz]
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|		00 04	000a aaaa	AtkIn HPF (0 - 31)
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|				Bypass,|
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|				16,20,25,32,40,50,63,80,100,125,160,200,250,315,|
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|				400,500,630,800,1000,1250,1600,2000,2500,3150,|
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|				4000,5000,6300,8000,10000,12500,15000 [Hz]
				104,105,106,107,108,109,110,111,112,113,114,115,|		00 05	000a aaaa	AtkInPkg Freq (1 - 31)
				116,117,118,119,120,121,122,123,124,125,126,127|				16,20,25,32,40,50,63,80,100,125,160,200,250,315,|
#	00 34	0000 aaaa						400,500,630,800,1000,1250,1600,2000,2500,3150,|
	00 35	0000 bbbb	External Release Time Offset (CC#72)	(0 - 128)				4000,5000,6300,8000,10000,12500,15000 [Hz]
				OFF,0,1,2,3,4,5,6,7,8,9,|		00 06	000a aaaa	AtkInPkg Gain (0 - 30)
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				-15 - +15 [dB]
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|		00 07	0000 0aaa	AtkInPkg Q (0 - 4)
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|				0.5,1.0,2.0,4.0,8.0
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|		00 08	0aaa aaaa	(reserve) <*>
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|		00 09	00aa aaaa	(reserve) <*>
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|		00 0A	0aaa aaaa	(reserve) <*>
				104,105,106,107,108,109,110,111,112,113,114,115,|		00 0B	00aa aaaa	Rev HF Damp
				116,117,118,119,120,121,122,123,124,125,126,127|				16,20,|
	00 36	00aa aaaa	External Bend Range (RPN#0)	(0 - 49)				25,32,40,50,63,80,100,125,160,200,250,315,400,|
				OFF,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,|				500,630,800,1000,1250,1600,2000,2500,3150,4000,|
				17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,|				5000,6300,8000,10000,12500,15000,Bypass [Hz]
				33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48|		00 0C	000a aaaa	Rev LF Damp (0 - 31)
#	00 37	0000 aaaa						Bypass,|
	00 38	0000 bbbb	External Modulation Depth (RPN#5)	(0 - 128)				16,20,25,32,40,50,63,80,100,125,160,200,250,315,|
				OFF,0,1,2,3,4,5,6,7,8,9,|				400,500,630,800,1000,1250,1600,2000,2500,3150,|
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				4000,5000,6300,8000,10000,12500,15000 [Hz]
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|		00 0D	0aaa aaaa	(reserve) <*>
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|		00 0E	0aaa aaaa	(reserve) <*>
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|		00 0F	0aaa aaaa	(reserve) <*>
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|		00 10	0aaa aaaa	(reserve) <*>
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|		00 11	0aaa aaaa	(reserve) <*>
				104,105,106,107,108,109,110,111,112,113,114,115,|		00 12	0aaa aaaa	Aliquot Level (0 - 127)
				116,117,118,119,120,121,122,123,124,125,126,127|		00 13	0aaa aaaa	Level (0 - 127)
#	00 39	0000 aaaa						
	00 3A	0000 bbbb	External Chorus Send (CC#93)	(0 - 128)				
				OFF,0,1,2,3,4,5,6,7,8,9,|				
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|				
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|		00 19	0aaa aaaa	(reserve) <*>
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|		00 1A	0aaa aaaa	(reserve) <*>
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|		00 1B	000a aaaa	(reserve) <*>
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|		00 1C	0000 00aa	SymReso Part (0 - 3)
				104,105,106,107,108,109,110,111,112,113,114,115,|				OFF,UPPER1,UPPER2,LOWER
				116,117,118,119,120,121,122,123,124,125,126,127|				-----
#	00 3B	0000 aaaa				00 00 00 1D	Total Size	-----
	00 3C	0000 bbbb	External Reverb Send (CC#91)	(0 - 128)				-----
				OFF,0,1,2,3,4,5,6,7,8,9,|				
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|				
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|				
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|				
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|				
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|				
				104,105,106,107,108,109,110,111,112,113,114,115,|				
				116,117,118,119,120,121,122,123,124,125,126,127|				
#	00 3D	0000 aaaa						
	00 3E	0000 bbbb	External CC 1 Number	(0 - 128)				
				OFF,0,1,2,3,4,5,6,7,8,9,|				
				10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,|				
				26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,|				
				42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,|				
				58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,|				
				74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,|				
				90,91,92,93,94,95,96,97,98,99,100,101,102,103,|				

* [Comp]

Offset	Address	Description
00 00	0000 000a	Switch (0 - 1) OFF, ON
00 01	0aaa aaaa	Low Attack Time (0 - 100) 0.1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100 [ms]
00 02	0aaa aaaa	Low Release Time (0 - 99) 10 - 1000 [ms]
00 03	0aaa aaaa	Low Threshold (4 - 64) -60 - 0 [dB]
00 04	0000 0aaa	Low Ratio (0 - 7) 1:1, 2:1, 3:1, 4:1, 8:1, 16:1, 32:1, INF:1
00 05	000a aaaa	Low Knee (0 - 30) 0 - 30 [dB]
00 06	0aaa aaaa	Low Output Gain (16 - 112) -24.0 - +24.0 [dB]
00 07	0aaa aaaa	Mid Attack Time (0 - 100) 0.1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100 [ms]
00 08	0aaa aaaa	Mid Release Time (0 - 99) 10 - 1000 [ms]
00 09	0aaa aaaa	Mid Threshold (4 - 64) -60 - 0 [dB]
00 0A	0000 0aaa	Mid Ratio (0 - 7) 1:1, 2:1, 3:1, 4:1, 8:1, 16:1, 32:1, INF:1
00 0B	000a aaaa	Mid Knee (0 - 30) 0 - 30 [dB]
00 0C	0aaa aaaa	Mid Output Gain (16 - 112) -24.0 - +24.0 [dB]
00 0D	0aaa aaaa	High Attack Time (0 - 100) 0.1, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100 [ms]
00 0E	0aaa aaaa	High Release Time (0 - 99) 10 - 1000 [ms]
00 0F	0aaa aaaa	High Threshold (4 - 64) -60 - 0 [dB]
00 10	0000 0aaa	High Ratio (0 - 7) 1:1, 2:1, 3:1, 4:1, 8:1, 16:1, 32:1, INF:1
00 11	000a aaaa	High Knee (0 - 30) 0 - 30 [dB]
00 12	0aaa aaaa	High Output Gain (16 - 112) -24.0 - +24.0 [dB]
00 13	000a aaaa	Split Freq Low (0 - 30) 16, 20, 25, 31, 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, 16000 [Hz]
00 14	000a aaaa	Split Freq Hi (0 - 30) 16, 20, 25, 31, 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, 16000 [Hz]
00 00 00 15	Total Size	

* [EQ]

Offset	Address	Description
00 00	0aaa aaaa	EQ Input Gain (40 - 88) -24 - +24 [dB]
00 01	0aaa aaaa	EQ Low Gain (40 - 88) -24 - +24 [dB]
00 02	0aaa aaaa	EQ Mid1 Gain (40 - 88) -24 - +24 [dB]
00 03	0aaa aaaa	EQ Mid2 Gain (40 - 88) -24 - +24 [dB]
00 04	0aaa aaaa	EQ Mid3 Gain (40 - 88) -24 - +24 [dB]
00 05	0aaa aaaa	EQ High Gain (40 - 88) -24 - +24 [dB]
00 06	000a aaaa	EQ Low Frequency (0 - 29) 20, 25, 31, 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, 16000 [Hz]
00 07	000a aaaa	EQ Mid1 Frequency (0 - 29) 20, 25, 31, 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, 16000 [Hz]

00 08	000a aaaa	EQ Mid2 Frequency (0 - 29) 20, 25, 31, 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, 16000 [Hz]
00 09	000a aaaa	EQ Mid3 Frequency (0 - 29) 20, 25, 31, 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, 16000 [Hz]
00 0A	000a aaaa	EQ High Frequency (0 - 29) 20, 25, 31, 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, 16000 [Hz]
00 0B	0000 0aaa	EQ Mid1 Q (0 - 5) 0.5, 1.0, 2.0, 4.0, 8.0, 16.0
00 0C	0000 0aaa	EQ Mid2 Q (0 - 5) 0.5, 1.0, 2.0, 4.0, 8.0, 16.0
00 0D	0000 0aaa	EQ Mid3 Q (0 - 5) 0.5, 1.0, 2.0, 4.0, 8.0, 16.0
00 0E	0000 000a	EQ Switch (0 - 1) OFF, ON

00 00 00 0F Total Size

* [MFX]

Offset	Address	Description
00 00	0aaa aaaa	Type (0 - 90)
00 01	0000 000a	MFX Switch (0 - 1)
00 02	0aaa aaaa	MFX Chorus Send Level (0 - 127)
00 03	0aaa aaaa	MFX Reverb Send Level (0 - 127)
00 04	0aaa aaaa	(reserve) <*>
00 05	0aaa aaaa	(reserve) <*>
00 06	0aaa aaaa	(reserve) <*>
00 07	0aaa aaaa	(reserve) <*>
00 08	0aaa aaaa	(reserve) <*>
00 09	0aaa aaaa	(reserve) <*>
00 0A	0aaa aaaa	(reserve) <*>
00 0B	0aaa aaaa	(reserve) <*>
00 0C	0000 aaaa	(reserve) <*>
00 0D	0000 aaaa	(reserve) <*>
00 0E	0000 aaaa	(reserve) <*>
00 0F	0000 aaaa	(reserve) <*>
00 10	0000 aaaa	
00 11	0000 bbbb	
00 12	0000 cccc	
00 13	0000 dddd	MFX Parameter 1 (12768 - 52768) -20000 - 20000
00 14	0000 aaaa	
00 15	0000 bbbb	
00 16	0000 cccc	
00 17	0000 dddd	MFX Parameter 2 (12768 - 52768) -20000 - 20000
00 18	0000 aaaa	
00 19	0000 bbbb	
00 1A	0000 cccc	
00 1B	0000 dddd	MFX Parameter 3 (12768 - 52768) -20000 - 20000
00 1C	0000 aaaa	
00 1D	0000 bbbb	
00 1E	0000 cccc	
00 1F	0000 dddd	MFX Parameter 4 (12768 - 52768) -20000 - 20000
00 20	0000 aaaa	
00 21	0000 bbbb	
00 22	0000 cccc	
00 23	0000 dddd	MFX Parameter 5 (12768 - 52768) -20000 - 20000
00 24	0000 aaaa	
00 25	0000 bbbb	
00 26	0000 cccc	
00 27	0000 dddd	MFX Parameter 6 (12768 - 52768) -20000 - 20000
00 28	0000 aaaa	
00 29	0000 bbbb	
00 2A	0000 cccc	
00 2B	0000 dddd	MFX Parameter 7 (12768 - 52768) -20000 - 20000
00 2C	0000 aaaa	
00 2D	0000 bbbb	
00 2E	0000 cccc	
00 2F	0000 dddd	MFX Parameter 8 (12768 - 52768) -20000 - 20000
00 30	0000 aaaa	
00 31	0000 bbbb	
00 32	0000 cccc	
00 33	0000 dddd	MFX Parameter 9 (12768 - 52768) -20000 - 20000
00 34	0000 aaaa	
00 35	0000 bbbb	
00 36	0000 cccc	
00 37	0000 dddd	MFX Parameter 10 (12768 - 52768) -20000 - 20000
00 38	0000 aaaa	
00 39	0000 bbbb	

	00 3A	0000 cccc				01 09	0000 hbbb		
	00 3B	0000 dddd	MFX Parameter 11	(12768 - 52768)		01 0A	0000 cccc		
				-20000 - 20000		01 0B	0000 dddd	MFX Parameter 31	(12768 - 52768)
#	00 3C	0000 aaaa							-20000 - 20000
	00 3D	0000 bbbb				#	01 0C	0000 aaaa	
	00 3E	0000 cccc					01 0D	0000 bbbb	
	00 3F	0000 dddd	MFX Parameter 12	(12768 - 52768)			01 0E	0000 cccc	
				-20000 - 20000			01 0F	0000 dddd	MFX Parameter 32
#	00 40	0000 aaaa							(12768 - 52768)
	00 41	0000 bbbb							-20000 - 20000
	00 42	0000 cccc							
	00 43	0000 dddd	MFX Parameter 13	(12768 - 52768)			00 00 01 10	Total Size	
				-20000 - 20000					
#	00 44	0000 aaaa							
	00 45	0000 bbbb							
	00 46	0000 cccc							
	00 47	0000 dddd	MFX Parameter 14	(12768 - 52768)					
				-20000 - 20000					
#	00 48	0000 aaaa							
	00 49	0000 bbbb							
	00 4A	0000 cccc							
	00 4B	0000 dddd	MFX Parameter 15	(12768 - 52768)					
				-20000 - 20000					
#	00 4C	0000 aaaa				#	00 01	0000 0aaa	Switch (0 - 1)
	00 4D	0000 bbbb					00 02	0aaa aaaa	Reverb Type OFF, ON
	00 4E	0000 cccc					00 03	0000 aaaa	Reverb Level (0 - 7)
	00 4F	0000 dddd	MFX Parameter 16	(12768 - 52768)			00 04	0000 bbbb	(0 - 127)
				-20000 - 20000			00 05	0000 cccc	
#	00 50	0000 aaaa					00 06	0000 dddd	Reverb Parameter 1
	00 51	0000 bbbb							(12768 - 52768)
	00 52	0000 cccc				#	00 07	0000 aaaa	-20000 - 20000
	00 53	0000 dddd	MFX Parameter 17	(12768 - 52768)			00 08	0000 bbbb	
				-20000 - 20000			00 09	0000 cccc	
#	00 54	0000 aaaa					00 0A	0000 dddd	Reverb Parameter 2
	00 55	0000 bbbb				#	00 0B	0000 aaaa	(12768 - 52768)
	00 56	0000 cccc					00 0C	0000 bbbb	-20000 - 20000
	00 57	0000 dddd	MFX Parameter 18	(12768 - 52768)			00 0D	0000 cccc	
				-20000 - 20000			00 0E	0000 dddd	Reverb Parameter 3
#	00 58	0000 aaaa					00 0F	0000 aaaa	(12768 - 52768)
	00 59	0000 bbbb				#	00 10	0000 bbbb	-20000 - 20000
	00 5A	0000 cccc					00 11	0000 cccc	
	00 5B	0000 dddd	MFX Parameter 19	(12768 - 52768)			00 12	0000 dddd	Reverb Parameter 4
				-20000 - 20000					(12768 - 52768)
#	00 5C	0000 aaaa				#	00 13	0000 aaaa	-20000 - 20000
	00 5D	0000 bbbb					00 14	0000 bbbb	
	00 5E	0000 cccc					00 15	0000 cccc	
	00 5F	0000 dddd	MFX Parameter 20	(12768 - 52768)			00 16	0000 dddd	Reverb Parameter 5
				-20000 - 20000					(12768 - 52768)
#	00 60	0000 aaaa				#	00 17	0000 aaaa	-20000 - 20000
	00 61	0000 bbbb					00 18	0000 bbbb	
	00 62	0000 cccc					00 19	0000 cccc	
	00 63	0000 dddd	MFX Parameter 21	(12768 - 52768)			00 1A	0000 dddd	Reverb Parameter 6
				-20000 - 20000					(12768 - 52768)
#	00 64	0000 aaaa				#	00 1B	0000 aaaa	-20000 - 20000
	00 65	0000 bbbb					00 1C	0000 bbbb	
	00 66	0000 cccc					00 1D	0000 cccc	
	00 67	0000 dddd	MFX Parameter 22	(12768 - 52768)			00 1E	0000 dddd	Reverb Parameter 7
				-20000 - 20000					(12768 - 52768)
#	00 68	0000 aaaa				#	00 1F	0000 aaaa	-20000 - 20000
	00 69	0000 bbbb					00 20	0000 bbbb	
	00 6A	0000 cccc					00 21	0000 cccc	
	00 6B	0000 dddd	MFX Parameter 23	(12768 - 52768)			00 22	0000 dddd	Reverb Parameter 8
				-20000 - 20000					(12768 - 52768)
#	00 6C	0000 aaaa				#	00 23	0000 aaaa	-20000 - 20000
	00 6D	0000 bbbb					00 24	0000 bbbb	
	00 6E	0000 cccc					00 25	0000 cccc	
	00 6F	0000 dddd	MFX Parameter 24	(12768 - 52768)			00 26	0000 dddd	Reverb Parameter 9
				-20000 - 20000					(12768 - 52768)
#	00 70	0000 aaaa				#	00 27	0000 aaaa	-20000 - 20000
	00 71	0000 bbbb					00 28	0000 bbbb	
	00 72	0000 cccc					00 29	0000 cccc	
	00 73	0000 dddd	MFX Parameter 25	(12768 - 52768)			00 2A	0000 dddd	Reverb Parameter 10
				-20000 - 20000					(12768 - 52768)
#	00 74	0000 aaaa				#	00 2B	0000 aaaa	-20000 - 20000
	00 75	0000 bbbb					00 2C	0000 bbbb	
	00 76	0000 cccc					00 2D	0000 cccc	
	00 77	0000 dddd	MFX Parameter 26	(12768 - 52768)			00 2E	0000 dddd	Reverb Parameter 11
				-20000 - 20000					(12768 - 52768)
#	00 78	0000 aaaa				#	00 2F	0000 aaaa	-20000 - 20000
	00 79	0000 bbbb					00 30	0000 bbbb	
	00 7A	0000 cccc					00 31	0000 cccc	
	00 7B	0000 dddd	MFX Parameter 27	(12768 - 52768)			00 32	0000 dddd	Reverb Parameter 12
				-20000 - 20000					(12768 - 52768)
#	00 7C	0000 aaaa				#	00 33	0000 aaaa	-20000 - 20000
	00 7D	0000 bbbb					00 34	0000 bbbb	
	00 7E	0000 cccc					00 35	0000 cccc	
	00 7F	0000 dddd	MFX Parameter 28	(12768 - 52768)			00 36	0000 dddd	Reverb Parameter 13
				-20000 - 20000					(12768 - 52768)
#	01 00	0000 aaaa				#	00 37	0000 aaaa	-20000 - 20000
	01 01	0000 bbbb					00 38	0000 bbbb	
	01 02	0000 cccc					00 39	0000 cccc	
	01 03	0000 dddd	MFX Parameter 29	(12768 - 52768)			00 3A	0000 dddd	Reverb Parameter 14
				-20000 - 20000					(12768 - 52768)
#	01 04	0000 aaaa				#	00 3B	0000 aaaa	-20000 - 20000
	01 05	0000 bbbb					00 3C	0000 bbbb	
	01 06	0000 cccc					00 3D	0000 cccc	
	01 07	0000 dddd	MFX Parameter 30	(12768 - 52768)			00 3E	0000 dddd	Reverb Parameter 15
				-20000 - 20000					(12768 - 52768)
#	01 08	0000 aaaa				#	00 3F	0000 aaaa	-20000 - 20000

		00 40	0000	bbbb																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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4. Supplementary Material

■ Decimal and Hexadecimal Table

(An "H" is appended to the end of numbers in hexadecimal notation.)

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 greater than the values given in the above table.

* A 7-bit 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-bit 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 "Use nibbled data" is expressed in hexadecimal in 4-bit units. A value expressed as a 2-byte nibble 0a 0bH has the value of a x 16+b.

<Example1> What is the decimal expression of 5AH?

From the preceding table, 5AH = 90

<Example2> 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

<Example3> 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

<Example4> What is the nibbled expression of the decimal value 1258?

16) 1258

16) 78 ...10

16) 4 ...14

0 ... 4

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

■ Examples of Actual MIDI Messages

<Example1> 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.

<Example2> 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.

<Example3> 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 12+80 = 8192) is 0, so this Pitch Bend Value is 28 00H - 40 00H = 40 x 12+80 - (64 x 12+80) = 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.

<Example4> 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 control 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 generators 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 rewound or fast-forwarded, the sequencer may not be able to transmit the correct status, and the sound generator 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 (RQ1, DT1) 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 aabbccddH and the data or size is eeffH.

```
aa + bb + cc + dd + ee + ff = sum
sum / 128 = quotient ... remainder
128 - remainder = checksum
```

<Example> Setting program level to 74 (DT1).

According to the "Parameter Address Map", the start address of Temporary Scene is 01 00 00 00H, the offset address of Scene Common is 00 00 00H, and the address of Scene Level is 00 10H. Therefore the address is;

```
01 00 00 00H
00 00 00H
+) 00 10H
-----
01 00 00 10H
```

Level 74 of the Scene has the value of 4AH. So the system exclusive message should be sent is;

```
F0 41 10 00 00 00 64 12 01 00 00 10 4A ?? F7
(1) (2) (3) (4) (5) address data checksum (6)
(1) Exclusive Status (2) ID (Roland) (3) Device ID (17)
(4) Model ID (RD-88) (5) Command ID (DT1) (6) End of Exclusive
```

Then calculate the checksum.

```
01H + 00H + 00H + 10H + 4AH = 1 + 0 + 0 + 16 + 74 = 91 (sum)
91 (sum) / 128 = 0 (quotient) ... 91 (remainder)
checksum = 128 - 91 (remainder) = 37 = 25H
```

This means that F0 41 10 00 00 00 64 12 01 00 00 10 4A 25 F7 is the message should be sent.

■ ASCII Code Table

Program Name, etc., 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.

5. MIDI Implementation Chart

[Digital Piano]
Model RD-88

MIDI Implementation Chart

Date : Jul. 22, 2020
Version : 1.12

Function...		Transmitted	Recognized	Remarks
Basic Channel	Default	1-16	1-16	Memorized
	Changed	1-16	1-16	
Mode	Default	Mode 3	Mode 3	*2
	Messages Altered	Mono, Poly *****	Mode 3, 4 (M=1)	
Note Number:	True Voice	0-127 *****	0-127 0-127	
Velocity	Note On	o	o	
	Note Off	o	o	
After Touch	Key's	x	o	
	Channel's	o	o	
Pitch Bend		o	o	
Control Change	0,32	o	o	*1 Bank select
	1	o	o	Modulation
	2	o	o	Breath type
	4	o	o	Foot type
	5	o	o	Portamento time
	6,38	o	o	Data entry
	7	o	o	Volume
	10	o	o	Panpot
	11	o	o	Expression
	16	o	o	General purpose controller 1
	17	o	o	General purpose controller 2
	18	o	o	General purpose controller 3
	19	o	o	General purpose controller 4
	64	o	o	Hold 1
	65	o	o	Portamento
	66	o	o	Sostenuto
	67	o	o	Soft
	68	o	o	Legato foot switch
	71	o	o	Resonance
	72	o	o	Release time
	73	o	o	Attack time
	74	o	o	Cutoff
	75	o	o	Decay time
	76	o	o	Vibrate rate
	77	o	o	Vibrate depth
	78	o	o	Vibrate delay
	80	o	o	General purpose controller 5
	81	o	o	General purpose controller 6
	82	o	o	General purpose controller 7
	83	o	o	General purpose controller 8
	84	o	o	Portamento control
	91	o	o (Reverb)	General purpose effects 1
	93	o	o (Chorus)	General purpose effects 3
	1-31,33-95	o	-	General purpose controller
	98,99	x	x	NRPN LSB,MSB
	100,101	o	o	RPN LSB,MSB
Program Change	:True Number	o	o	*1
		*****	0-127	Program No.1-128
System Exclusive		o	o	*3
System Common	:Song Position	x	x	
	:Song Select	x	x	
	:Tune Request	x	x	
System Real Time	:Clock	x	x	
	:Commands	x	x	
Aux Messages	:All Sound Off	x	o	
	:Reset All Controllers	o	o	
	:Local On/Off	x	x	
	:All Notes Off	o	o (123,127)	
	:Active Sensing	x	o	
	:System Reset	x	x	
Notes		*1 o x is selectable. *2 Recognized as M=1 even if M1. *3 Transmitted only when "Transmitted Edit Data" is ON or RQ1 is received.		

Mode 1 : OMNI ON, POLY
Mode 3 : OMNI OFF, POLYMode 2 : OMNI ON, MONO
Mode 4 : OMNI OFF, MONOo : Yes
x : No