MIDI Implementation

RolandPiano
600/700/800

Roland

Roland Exclusive Messages

1. Data Format for Exclusive Messages

Roland's MIDI implementation uses the following data format for all exclusive messages (type IV) :

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
CMD	Command ID
[BODY]	Maindata
F7H	End of exclusive

MIDI status : F0H, F7H

An exclusive message must be flanked by a pair of status codes, starting with a Manufactures-ID immediately after F0H (MIDI version1.0).

Manufactures-ID : 41H

The Manufactures-ID identifies the manufacturer of a MIDI instrument that triggeres an exclusive message. Value 41H represents Roland's Manufactures-ID.

Device-ID : DEV

The Device-ID contains a unique value that identifies the individual device in the multiple implementation of MIDI instruments. It is usually set to 00H - 0FH, a value smaller by one than that of a basic channel, but value 00H - 1FH may be used for a device with multiple basic channels.

Model-ID : MDL

The Model-ID contains a value that uniquely identifies one model from another. Different models, however, may share an identical Model-ID if they handle similar data.

The Model-ID format may contain 00H in one or more places to provide an extended data field. The following are examples of valid Model-IDs, each representing a unique model :

```
01H
02H
03H
00H, 01H
00H, 02H
00H, 00H, 01H
```

Command-ID : CMD

The Command-ID indicates the function of an exclusive message. The Command-ID format may contain 00H in one or more places to provide an extended data field. The following are examples of valid Command-IDs, each representing a unique function :

```
01H
02H
03H
00H, 01H
00H, 02H
00H, 00H, 01H
```

Main data : BODY

This field contains a message to be exchanged across an interface. The exact data size and contents will vary with the Model-ID and Command-ID.

2. Address-mapped Data Transfer

Address mapping is a technique for transferring messages conforming to the data format given in Section 1. It assigns a series of memory-resident records--waveform and tone data, switch status, and parameters, for example--to specific locations in a machine-dependent address space, thereby allowing access to data residing at the address a message specifies.

Address-mapped data transfer is therefore independent of models and data categories. This technique allows use of two different transfer procedures : one-way transfer and handshake transfer.

One-way transfer procedure (See Section3 for details.)

This procedure is suited for the transfer of a small amount of data. It sends out an exclusive message completely independent of a receiving device status.

Connection Diagram
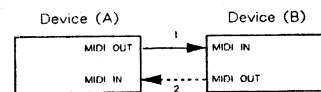
Connectionat point2 is essential for "Request data" procedures. (See Section3.)

Handshake-transfer procedure (See Section4 for details.)

This procedure initiates a predetermined transfer sequence (handshaking) across the interface before data transfer takes place. Handshaking ensures that reliability and transfer speed are high enough to handle a large amount of data.

Connection Diagram
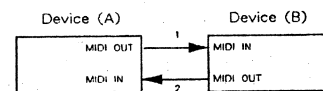
Connectionat points1 and 2 is essential.

* There are separate Command-IDs for different transfer procedures.
* DevicesA and B cannot exchange data unless they use the same transfer procedure, share identical Device-ID and Model ID, andare ready for communication.

3. One-way Transfer Procedure

This procedure sends out data all the way until it stops when the messages are so short that answerbacks need not be checked.
For long messages, however, the receiving device must acquire each message in time with the transfer sequence, which inserts intervals of at least 20milliseconds in between.

Types of Messages

Message	Command ID
Request data 1	RQ1 (11H)
Data set 1	DT1 (12H)

Request data # 1 : RQ1 (11H)

This message is sent out when there is a need to acquire data from a device at the other end of the interface. It contains data for the address and size that specify designation and length, respectively, of data required.
On receiving an RQ1 message, the remote device checks its memory for the data address and size that satisfy the request.

If it finds them and is ready for communication, the device will transmit a "Data set#1 (DT1)" message, which contains the requested data. Otherwise, the device will send out nothing.

Byte	Description	
F0H	Exclusive status	
41H	Manufactures ID (Roland)	
DEV	Device ID	
MDL	Model ID	
11H	Command ID	
aaH	Address MSB	
⋮	⋮	
		LSB
ssH	Size	MSB
⋮		⋮
		LSB
sum	Check sum	
F7H	End of exclusive	

2

*The size of the requested data does not indicate the number of bytes that will make up a DT1 message, but represents the address fields where the requested data resides.
*Some models and data are subject to limitations in data format used for a single transaction. Requested data, for example, may have a limit in length or must be divided into predetermined address fields before it is exchanged across the interface.
*The same number of bytes comprises address and size data, which, however, vary with the Model-ID.
*The error checking process uses a checksum that provides a bit pattern where lower seven bits are zero when values for an address, size, and that checksum are summed.

Data set # 1 : DT1 (12H)

This message corresponds to the actual data transfer process. Because every byte in the data is assigned a unique address, a DT1 message can convey the starting address (es) of one or more data as well as a series of data formatted in an address- dependent order.
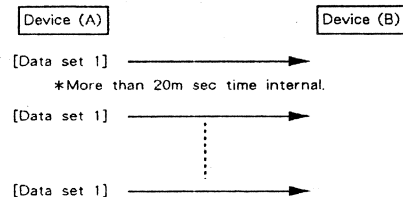
Although the MIDI standards inhibit non-real time messages from interrupting an exclusive one, some devices support a "soft- through" mechanism for such interrupts. To maintain compatibility with such devices, Roland has limited the DT1 to 256 bytes so that an excessively long message is sent out in separate segments.

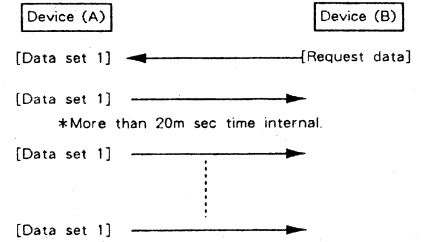| Byte	Description
F0H	Exclusive
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
12H	Command ID
aaH	Address MSB
⋮	⋮
	LSB
ddH	Data
⋮	⋮
⋮	⋮
sum	Check sum
F7H	End of exclusive

*A DT1 message is capable of providing only the valid data among those specified by an RQ1 message.
*Some models and data are subject to limitations in data format used for a single transaction. Requested data, for example, may have a limit in length or must be divided into predetermined address fields before it is exchanged across the interface.
*The number of bytes comprising address data varies from one Model-ID to another.
*The error checking process uses a checksum that provides a bit pattern where lower seven bits are zero when values for an address, size, and that checksum are summed.

Example of Message Transactions

● Device A sending data to Device B
Transfer of a DT1 message is all that takes place.

```
  Device (A)                          Device (B)

[Data set 1] ──────────────────►
       *More than 20m sec time internal.
[Data set 1] ──────────────────►
                         ┊
                         ┊
[Data set 1] ──────────────────►
```

● Device B requesting data from Device A
Device B sends an RQ1 message to Device A. Checking the message, Device A sends a DT1 message back to Device B.

```
  Device (A)                          Device (B)

[Data set 1] ◄──────────────[Request data]

[Data set 1] ──────────────────►
       *More than 20m sec time internal.
[Data set 1] ──────────────────►
                         ┊
                         ┊
[Data set 1] ──────────────────►
```

4. Handshake- Transfer Procedure

Handshaking is an interactive process where two devices exchange error checking signals before a message transaction takes place, thereby increasing data reliability. Unlike one-way transfer that inserts a pause between message transactions, handshake transfer allows much speedier transactions because data transfer starts once the receiving device returns a ready signal.

When it comes to handling large amounts of data--sampler waveforms and synthesizer tones over the entire range, for example--across a MIDI interface, handshaking transfer is more efficient than one-way transfer.

Types of Messages

Message	Command ID
Want to send data	WSD (40H)
Request data	RQD (41H)
Data set	DAT (42H)
Acknowledge	ACK (43H)
End of data	EOD (45H)
Communication error	ERR (4EH)
Rejection	RJC (4FH)

Want to send data : WSD (40H)

This message is sent out when data must be sent to a device at the other end of the interface. It contains data for the address and size that specify designation and length, respectively, of the data to be sent.

On receiving a WSD message, the remote device checks its memory for the specified data address and size which will satisfy the request. If it finds them and is ready for communication, the device will return an "Acknowledge (ACK)" message.
Otherwise, it will return a "Rejection (RJC)" message.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
40H	Command ID
aaH	Address MSB
⋮	⋮
	LSB
ssH	Size MSB
⋮	⋮
	LSB
sum	Check sum
F7H	End of exclusive

*The size of the data to be sent does not indicate the number of bytes that make up a "Data set (DAT)" message, but represents the address fields where the data should reside.
*Some models and data are subject to limitations in data format used for a single transaction. Requested data, for example, may have a limit in length or must be divided into predetermined address fields before it is exchanged across the interface.
*The same number of bytes comprises address and size data, which, however, vary with the Model-ID.
*The error checking process uses a checksum that provides a bit pattern where lower seven bits are zero when values for an address, size, and that checksum are summed.

Request data : RQD (41H)

This message is sent out when there is a need to acquire data from a device at the other end of the interface. It contains data for the address and size that specify designation and length, respectively, of data required.

On receiving an RQD message, the remote device checks its memory for the data address and size which satisfy the request. If it finds them and is ready for communication, the device will transmit a "Data set (DAT)" message, which contains the requested data. Otherwise, it will return a "Rejection (RJC)" message.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
41H	Command ID
aaH	Address MSB
⋮	⋮
	LSB
ssH	Size MSB
⋮	⋮
	LSB
sum	Check sum
F7H	End of exclusive

*The size of the requested data does not indicate the number of bytes that make up a "Data set (DAT)" message, but represents the address fields where the requested data resides.
*Some models and data are subject to limitations in data format used for a single transaction. Requested data, for example, may have a limit in length or must be divided into predetermined address fields before it is exchanged across the interface.
*The same number of bytes comprises address and size data, which, however, vary with the Model-ID.
*The error checking process uses a checksum that provides a bit pattern where lower seven bits are zero when values for an address, size, and that checksum are summed.

Data set : DAT (42H)

This message corresponds to the actual data transfer process. Because every byte in the data is assigned a unique address, the message can convey the starting address (es) of one or more data as well as a series of data formatted in an address-dependent order.

Although the MIDI standards inhibit non-real time messages from interrupting an exclusive one, some devices support a "soft-through" mechanism for such interrupts. To maintaincompatibility with such devices, Roland has limited the DAT to 256bytes so that an excessively long message is sent out in separate segments.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
42H	Command ID
aaH	Address MSB
⋮	⋮
	LSB
ddH	Data
⋮	⋮
sum	Check sum
F7H	End of exclusive

*A DAT message is capable of providing only the valid data among those specified by an RQD or WSD message.
*Some models and data are subject to limitations in data format used for a single transaction. Requested data, for example, may have a limit in length or must be divided into predetermined address fields before it is exchanged across the interface.
*The number of bytes comprising address data varies from one model ID to another.
*The error checking process uses a checksum that provides a bit pattern where lower seven bits are zero when values for an address, size, and that checksum are summed.

Acknowledge : ACK (43H)

This message is sent out when no error was detected on reception of a WSD, DAT, "End of data (EOD)", or some other message and a requested setup or action is complete. Unless it receives an ACK message, the device at the other end will not proceed to the next operation.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
43H	Command ID
F7H	End of exclusive

End of data : EOD (45H)

This message is sent out to inform a remote device of the end of a message. Communication, however, will not come to an end unless the remote device returns an ACK message even though an EOD message was transmitted.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
45H	Command ID
F7H	End of exclusive

Communications error : ERR (4EH)

This message warns the remote device of a communications fault encountered during message transmission due, for example, to a checksum error. An ERR message may be replaced with a "Rejection (RJC)" one, which terminates the current message transaction in midstream.

When it receives an ERR message, the sending device may either attempt to send out the last message a second time or terminate communication by sending out an RJC message.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
4EH	Command ID
F7H	End of exclusive

Rejection : RJC (4FH)

This message is sent out when there is a need to terminate communication by overriding the current message. An RJC message will be triggered when :

a WSD or RQD message has specified an illegal data address or size, or the device is not ready for communication.

an illegal number of addresses or data has been detected.

data transfer has been terminated by an operator.

a communications error has occurred.

An ERR message may be sent out by a device on either side of the interface. Communication must be terminated immediately when either side triggers an ERR message.

Byte	Description
F0H	Exclusive status
41H	Manufactures ID (Roland)
DEV	Device ID
MDL	Model ID
4FH	Command ID
F7H	End of exclusive

Example of Message Transactions

● Data transfer from device (A) to device (B).
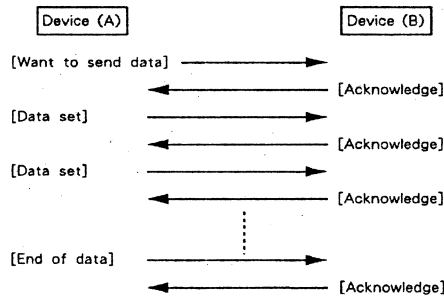
● Device (A) requests and receives data from device (B).
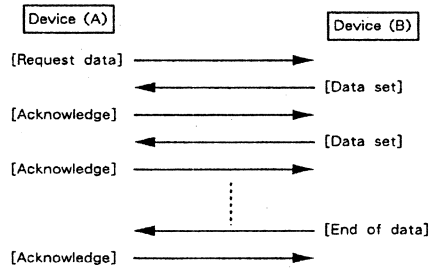
● Error occurs while device (A) is receiving data from device (B).

1) Data transfer from device (A) to device (B).

2) Device (B) rejects the data re-transmitted, and completes data transfer.

3) Device (A) immediately completes data transfer.

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1. TRANSMITTED DATA

■ Note event

Note off

Status	Second	Third
9nH	kkH	00H

kk = Note number 16H−6CH (22−108) ／HP−600, 700
OFH−71H (15−113) ／HP−800
n = MIDI Channel 0H−FH (1−16)

Note on

Status	Second	Third
9nH	kkH	vvH

vv = Velocity 01H−7FH (1−127)

The range may be changed by transposition.
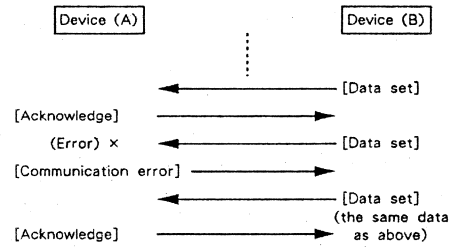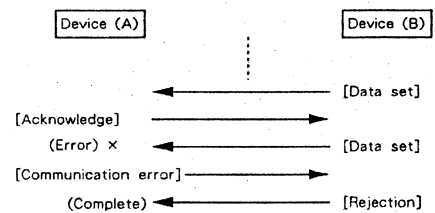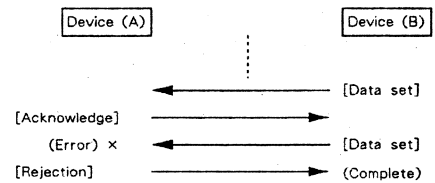
When the power is first applied, the default transposition is set at 0.
The following chart shows the relation of the key position and transposed value. (While the TRANSPOSE switch is held down.)

HP−600／700

Key	Transposed value (semi tones)	Transmitted note range
Power−on	0	28−103
F#5	−6	22−97
G5	−5	23−98
G#5	−4	24−99
A5	−3	25−100
A#5	−2	26−101
B5	−1	27−102
C6	0	28−103
C#6	+1	29−104
D6	+2	30−105
D#6	+3	31−106
E6	+4	32−107
F6	+5	33−108

HP−800

Key	Transposed value (semi tones)	Transmitted note range
Power−on	0	21−108
F#6	−6	15−102
G6	−5	16−103
G#6	−4	17−104
A6	−3	18−105
A#6	−2	19−106
B6	−1	20−107
C7	0	21−108
C#7	+1	22−109
D7	+2	23−110
D#7	+3	24−111
E7	+4	25−112
F7	+5	26−113

■ Control change

Hold−1

Status	Second	Third
BnH	40H	vvH

vv = 7FH : On
vv = 00H : Off

Sostenuto

Status	Second	Third
BnH	42H	vvH

vv = 7FH : On
vv = 00H : Off

If the power has been applied while the SOFT pedal is held down, the SOFT pedal will be changed to the SOSTENUTO pedal.

Soft

Status	Second	Third
BnH	43H	vvH

vv = 7FH : SoftOn
vv = 00H : SoftOff

Chorus

Status	Second	Third
BnH	5DH	vvH

vv = 7FH : Chorus 2 ON
vv = 40H : Chorus 1 ON
vv = 00H : Chorus OFF

When the CHORUS 1／2 switch is pressed while the TRANSPOSE−MIDI switch is held down, chorus 1／2 ON or OFF message is sent.

Also, if the power has been applied while the TRANSPOSE／MIDI switch is held down, chorus 1／2 ON or OFF message can be sent by only pressing the CHORUS 1／2 switch, and memorized chorus 1／2 ON or OFF message is sent by pressing one of the Tone Selectorbuttons.

■ Program change

Status	Second
CnH	ppH

pp = Program Change (0−127)

If the power has been applied while the TRANSPOSE／MIDI switch is held down, the PROGRAM CHANGE message can be sent by only pressing the following switches.

Switch	Prog#
PIANO1	0
PIANO2	1
HARPSICHORD	3
VIBRAPHONE	5
E.PIANO	6

The following table shows the GROUP, BANK and NUMBER values related with key position which is set while the TRANSPOSE／MIDI switch is held down.

HP−600／700 Key	Related value	HP−800 Key	Related value
A 4	GROUP A	A 3	GROUP A
B 4	GROUP B	B 3	GROUP B
F# 3	BANK 1	F# 2	BANK 1
G# 3	BANK 2	G# 2	BANK 2
A# 3	BANK 3	A# 2	BANK 3
C# 4	BANK 4	C# 3	BANK 4
D# 4	BANK 5	D# 3	BANK 5
F# 4	BANK 6	F# 3	BANK 6
G# 4	BANK 7	G# 3	BANK 7
A# 4	BANK 8	A# 3	BANK 8
F 3	NUMBER 1	F 2	NUMBER 1
G 3	NUMBER 2	G 2	NUMBER 2
A 3	NUMBER 3	A 2	NUMBER 3
B 3	NUMBER 4	B 2	NUMBER 4
C 4	NUMBER 5	C 3	NUMBER 5
D 4	NUMBER 6	D 3	NUMBER 6
E 4	NUMBER 7	E 3	NUMBER 7
F 4	NUMBER 8	F 3	NUMBER 8

When one of the above−mentioned keys is pressed while the TRANSPOSE／MIDI switch is held down, a PROGRAM CHANGE message will be transmitted.
The transmitted program change numbers are related to the GROUP, BANK and NUMBER values as follows.

GROUP A BANK	NUMBER 1	2	3	4	5	6	7	8
1	0	1	2	3	4	5	6	7
2	8	9	10	11	12	13	14	15
3	16	17	18	19	20	21	22	23
4	24	25	26	27	28	29	30	31
5	32	33	34	35	36	37	38	39
6	40	41	42	43	44	45	46	47
7	48	49	50	51	52	53	54	55
8	56	57	58	59	60	61	62	63

GROUP B BANK	NUMBER 1	2	3	4	5	6	7	8
1	64	65	66	67	68	69	70	71
2	72	73	74	75	76	77	78	79
3	80	81	82	83	84	85	86	87
4	88	89	90	91	92	93	94	95
5	96	97	98	99	100	101	102	103
6	104	105	106	107	108	109	110	111
7	112	113	114	115	116	117	118	119
8	120	121	122	123	124	125	126	127

■ Mode message

Status	Second	Third
BnH	mmH	00H

mm = 7BH : ALL NOTE OFF ＊1
mm = 7CH : OMNI OFF ＊2
mm = 7FH : POLY ON ＊2

＊1 When all keys on the keyboard are released, the ALL NOTES OFF (BnH, 7BH,00H) is sent.
＊2 When power is first applied or Basic Channel is changed, OMNI OFF and POLY ON are sent in the Basic Channel.

■ Active sensing

Status
FEH

2. RECOGNIZED RECEIVE DATA

■Note event

Note off

Status	Second	Third
8nH	kkH	vvH
9nH	kkH	00H

kk=Note number : 00H–7FH (0–127)
vv=Velocity : ignored
n=MIDI Channel : 0H–FH (1–16)

Note on

Status	Second	Third
9nH	kkH	vvH

vv=Velocity : 01H–7FH (1–127)

Note numbers outside of the range 15–108 (HP–600) or 15–113 (HP–700/800) are transposed to the nearest octave inside this range.
The transpose function does not affect the recognized NOTE numbers.

■Control change

Hold–1

Status	Second	Third
BnH	40H	vvH

vv=00H–3FH : Off
vv=40H–7FH : On

Sostenuto

Status	Second	Third
BnH	42H	vvH

vv=00H–3FH : Off
vv=40H–7FH : On

Soft

Status	Second	Third
BnH	43H	vvH

vv=00H–3FH : Off
vv=40H–7FH : On

Chorus

Status	Second	Third
BnH	5DH	vvH

vv=00H–29H : Off
vv=2AH–54H : Chorus 1 ON
vv=55H–7FH : Chorus 2 ON

If the power has been applied while the PIANO 1 switch is held down, this message is ignored.

■Program change

Status	Second
CnH	ppH

pp=Program Change (0–7)

If the power has been applied while the PIANO 1 switch is held down, this message is ignored.

Received Program Change messages are assigned as follows.
The program numbers 8–127 are ignored.

Prog #	Voice
0	PIANO1
1	PIANO2
2	PIANO2
3	HARPSICHORD
4	PIANO2
5	VIBRAPHONE
6	E.PIANO
7	E.PIANO

■Mode message

All note off

Status	Second	Third
BnH	7BH	00H

When the ALL NOTES OFF is recognized, all the notes which have been turned ON only by MIDI IN note ON messages are turned OFF. However, if the damper ON message has been recognized, these ON notes will be not turned OFF until the Damper OFF message is received.

OMNI OFF

Status	Second	Third
BnH	7CH	00H

OMNI ON

Status	Second	Third
BnH	7DH	00H

MONO

Status	Second	Third
BnH	7EH	0mH

POLY

Status	Second	Third
BnH	7FH	00H

These Mode Messages (2nd byte=123–127) are also recognized as ALL NOTES OFF.

Mode Messages are recognized as follows :

	POLY ON (127)	MONO ON (126) mmmm=1	MONO ON (126) mmmm≠1
OMNI OFF (124)	OMNI=OFF POLY	OMNI=OFF POLY	OMNI=ON POLY
OMNI ON (125)	OMNI=ON POLY	OMNI=ON POLY	OMNI=ON POLY

■Exclusive

Status
F0H : System Exclusive
F7H : EOX (End of Exclusive)

Refer to Section 4.

■Active sensing

Status
FEH : Active Sensing

3. BASIC CHANNEL SETTING

When the power is first applied, the Basic Channel is normally set to 1, and the receiver is set to MODE 3 (OMNI OFF, POLY ON).

However, the Basic Channel may be changed when the following key on the keyboard is pressed while the TRANSPOSE/MIDI switch is held down.
The receiver will be set to the MODE 3 (OMNI OFF, POLY ON).

When the highest key (G7 : HP–600/700, C8 : HP–800) on the keyboard is pressed while the TRANSPOSE/MIDI switch is held down. The Basic Channel will be set to 1, and the receiver is set to the MODE 1 (OMNI ON, POLY ON).

HP–600/700

Key	Basic Channel	OMNI
Power–on	1	OFF
E1	1	OFF
F1	2	OFF
F#1	3	OFF
G1	4	OFF
G#1	5	OFF
A1	6	OFF
A#1	7	OFF
B1	8	OFF
C2	9	OFF
C#2	10	OFF
D2	11	OFF
D#2	12	OFF
E2	13	OFF
F2	14	OFF
F#2	15	OFF
G2	16	OFF
G7	1	ON

HP–800

Key	Basic Channel	OMNI
Power–on	1	OFF
A0	1	OFF
A#0	2	OFF
B0	3	OFF
C1	4	OFF
C#1	5	OFF
D1	6	OFF
D#1	7	OFF
E1	8	OFF
F1	9	OFF
F#1	10	OFF
G1	11	OFF
G#1	12	OFF
A1	13	OFF
A#1	14	OFF
B1	15	OFF
C2	16	OFF
C8	1	ON

4. MULTI TIMBRE MODE

If the power has been applied while the PIANO 2 switch is held down, or the System Exclusive Message (Multi Timbre ON) has been received, the HP-600/700 /800 turns to MULTI TIMBRE MODE.
Also, if the power is applied again while no switchs or any except PIANO 2 are held down, or the System Exclusuve message (Multi Timbre OFF) has been received, the HP-600/700/800 returns from this mode.
The Exclusive Messages are following.

Multi Timbre ON

F0H	Status of System Exclusive
41H	Roland ID
00H	Device ID
1AH	Model ID
12H	Command ID (dataset)
00H	Address (msb)
00H	(lsb) = multi timbre
vvH	Data vv = 01H - 7FH
ssH	Sum ss : 00H + 00H + vvH + ssH = 0
F7H	EOX End of Exclusive

Multi Timbre OFF

F0H	Status of System Exclusive
41H	Roland ID
00H	Device ID
1AH	Model ID
12H	Command ID (dataset)
00H	Address (msb)
00H	(lsb) = multitimbre
00H	Data
00H	Sum
F7H	EOX End of Exclusive

Data 00H is recognized as return from Multi Timbre.
Data 01H - 7FH is recognized as turn to Multi Timbre.

Transmit and receive channels are followig

Tone	Channel
PIANO 2	1
HARPSICHORD	11
VIBRAPHONE	12
E.PIANO	13

Chorus

Receive chorus 1/2 ON or OFF messages in channel 1,11,12 and 13. The last ON /OF message received has priority.
Transmit chorus 1/2 ON or OFF messages in channel fixed upon each Tone.
When the CHORUS 1/2 switch is pressed while the TRANSPOSE/MIDI switch is held down, chorus 1/2 ON or OFF message is sent.

Pedals

Damper Pedal, Soft Pedal and Sostenuto Pedal can be recognized individually as manual and MIDI message.

Program Change, Mode Message

NOT transmitted and CAN NOT be recognized Program Change.
CAN NOT be recognized Mode Messages, always in Mode 3 (omni off poly).

Basic Channel

Basic Channel CAN NOT be changed.

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