

8 ABOUT MIDI

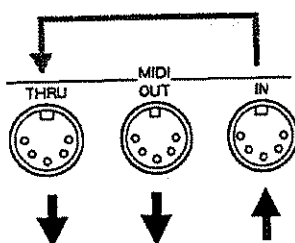
MIDI stands for Musical Instrument Digital Interface, and is a world - wide standard for exchanging musical data between instruments to play notes, select sounds, etc. Devices which are MIDI compatible can exchange musical data, regardless of the manufacturer and model of the device. Musical data such as notes being played or pedals being pressed are handled by MIDI as "MIDI messages".

1. How MIDI messages are transmitted and received

First, we will explain how MIDI messages are transmitted and received.

MIDI connectors

MIDI data is transmitted and received using the following three types of connectors. Depending on your needs, connect MIDI cables to these connectors.



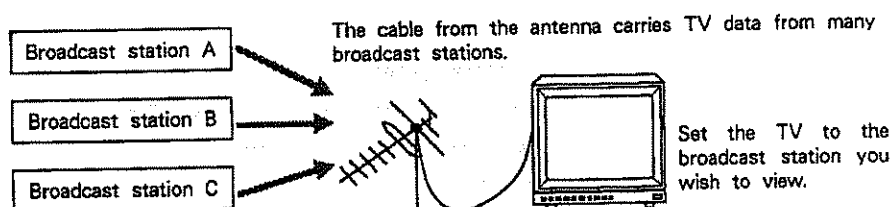
- MIDI IN: Receive MIDI messages from another MIDI device.
- MIDI OUT: Transmit MIDI messages from this device.
- MIDI THRU: Re - transmit (without modifying) the messages received at MIDI IN.

* MIDI THRU connectors can be used to connect several MIDI devices, but in practice, you should consider four or five as the limit. If more devices than this are connected, MIDI messages may become garbled and unreadable.

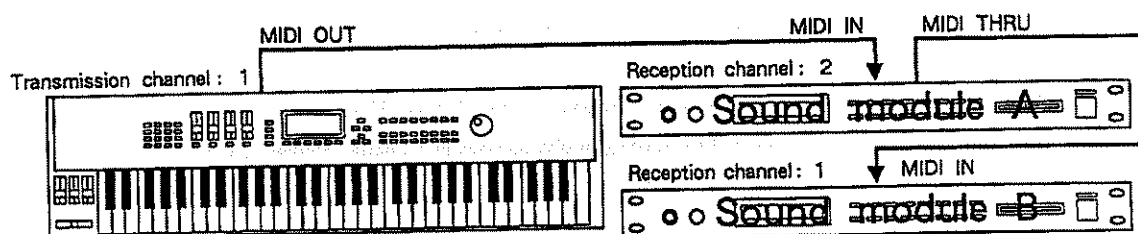
MIDI channels

MIDI uses "channels" to independently transmit messages to two or more MIDI devices using a single MIDI cable.

You may think of MIDI channels as being like the channels of a TV. By selecting channels on a TV receiver, you can receive a variety of different stations. When the transmitting channel matches the receiving channel, the data of that channel is received.



MIDI uses sixteen channels, numbered 1 — 16. MIDI messages will be received by an instrument whose reception channel matches the transmission channel of the transmitting device. If MIDI channels are set as shown in the following diagram, sound module B will sound when the keyboard is played.



2. MIDI messages used by the D-70

In order to transmit many different types of musical information, MIDI uses various types of message. MIDI messages can be divided into messages that are handled independently by each channel (Channel messages), and messages that are handled regardless of the channel (System messages).

■ Messages handled by each channel (Channel messages)

These messages are used to transmit musical performance gestures. Normally, most musical control can be accomplished using only these messages. The settings of each MIDI sound source will determine the effect caused by each type of MIDI message.

● Note messages

These messages transmit keyboard data. Note messages include the following data.

Note number	the key position
Note on	a note has been played
Note off	a note has been released
Velocity	the speed (velocity) at which the note was played

*The note number indicates the key position over a range of 0 — 127, where a note number of 60 indicates middle C (C4).

● Pitch Bender messages

These messages transmit changes in pitch.

● Aftertouch messages

Aftertouch is divided into two types; Channel Aftertouch and Polyphonic Aftertouch. Channel Aftertouch applies to an entire MIDI channel. Regardless of the key you press down strongly, all notes will be affected in the same way.

Polyphonic Aftertouch controls each note independently. Even within the same MIDI channel, pressing down strongly on a specific note will affect only the sound of that note. The D-70 transmits and receives only Channel Aftertouch.

The Aftertouch settings of a device will determine how Aftertouch messages are transmitted and received.

● Program Change messages

Program Change messages select sounds using a Program Number of 1 — 128. The D-70 can receive Program Change messages to select Performances and Patches. Program Change messages received on the System Setup Control channel will select Performances. Program Change messages received on the channel of a Part will select Patches for that Part. For details see P.49.

● Control Change data

These messages allow you to control Vibrato, Hold, Volume, Pan, etc, for more musically expressive playing. Each function is distinguished by a Control Number. The functions that can be controlled will depend on each MIDI device.

■ Messages handled regardless of the channel (System messages)

System messages include Exclusive messages, messages for synchronization, and messages to keep a MIDI system running correctly. Of these, the D-70 uses mainly Exclusive messages.

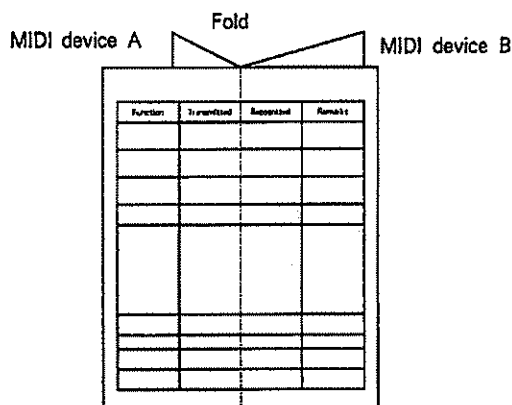
- **Exclusive messages** Exclusive messages are used to transmit data that is unique to each device, such as sound data. In general, these messages allow data to be transferred between devices of the same model made by the same manufacturer. Exclusive messages allow you to transmit sound data (instead of Program Change messages) to a sequencer to be recorded, or transmit sound data to another D-70. When transferring exclusive data between two devices, the Unit Numbers (☞ P.137) of the two MIDI devices must be set to match.

● The MIDI Implementation Chart

Although MIDI allows many devices to communicate with each other, this does not mean that each device will be able to transmit and receive all types of data.

For example, if you wish to transmit Aftertouch messages from a keyboard to control some aspect of the sound, there will be no result unless the MIDI sound module receiving the Aftertouch messages is able to actually respond to Aftertouch messages. In such cases, only the data which is common to both devices can be meaningfully transmitted.

As a quick reference of its MIDI capabilities, the operating manual of each device includes a "MIDI Implementation Chart" (☞ P.211). By comparing the MIDI Implementation Charts of two devices, you can determine the types of MIDI message they will be able to exchange. Since the chart is always a standard size, you can fold together the charts of the transmitting and receiving devices for convenient comparison.



*For details of MIDI message handling, refer to "Roland Exclusive Messages" (☞ P.198) and "MIDI Implementation" (☞ P.202).

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
FOH	Exclusive status
41H	Manufacturer ID (Roland)
DEV	Device ID
MDL	Model ID
CMD	Command ID
[BODY]	Main data
F7H	End of exclusive

MIDI status: FOH, F7H

An exclusive message must be flanked by a pair of status codes, starting with a Manufacturer-ID immediately after FOH (MIDI version 1.0).

Manufacturer-ID: 41H

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

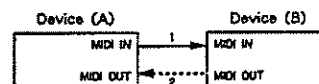
Address mapping is a technique for transferring messages conforming to the data format given in Section 1. It assigns a series of memory-resident records -- waveform and tone data, switch status, and parameters, for example -- to specific locations in a machine-dependent address space, thereby allowing 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 Section 3 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

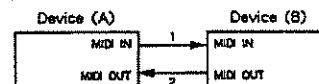


Connection at point 2 is essential for "Request data" procedures. (See Section 3.)

Handshake-transfer procedure (See Section 4 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



Connection at points 1 and 2 is essential.

Notes on the above two procedures

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

3. One-way Transfer Procedure

This procedure sends out data all the way until it stops and is used 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 20 milliseconds 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
FOH	Exclusive status
41H	Manufacturer 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

*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 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 the least significant 7 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 of one or more data as well as a series of data formatted in an address - dependent order.

The MIDI standards inhibit non - real time messages from interrupting an exclusive one. This fact is inconvenient for the devices that support a "soft-through" mechanism. To maintain compatibility with such devices, Roland has limited the DT1 to 255 bytes so that an excessively long message is sent out in separate segments.

Byte	Description
F0H	Exclusive
41H	Manufacturer ID (Roland)
DEV	Device ID
MDL	Model ID
12H	Command ID
aaH	Address MSB
...	...
ddH	LSB
...	...
sum	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.

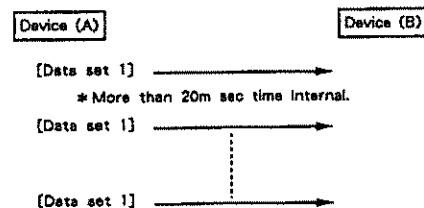
*Some models are subject to limitations in data format used for a single transaction. Requested data, for example, may have a limit in length or must be divided into predetermined address fields before it is exchanged across the interface.

*The number of bytes comprising address data varies from one Model - ID to another.

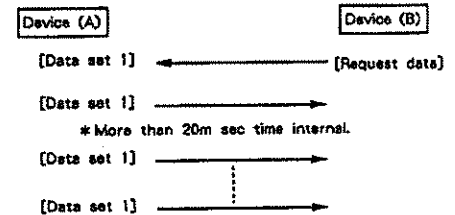
*The error checking process uses a checksum that provides a bit pattern where the least significant 7 bits are zero when values for an address, size, and that checksum are summed.

Example of Message Transactions

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



- Device 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.



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	Manufacturer ID (Roland)
DEV	Device ID
MDL	Model ID
40H	Command ID
aaH	Address MSB
...	...
ssH	LSB
...	...
ssH	Size MSB
...	...
sum	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 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 the least significant 7 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 (RUC)" message.

Byte	Description
F0H	Exclusive status
41H	Manufacturer 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 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 the least significant 7 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 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 DAT to 256 bytes so that an excessively long message is sent out in separate segments.

Byte	Description
F0H	Exclusive status
41H	Manufacturer 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 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 the least significant 7 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	Manufacturer 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	Manufacturer 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 (RUC)" 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 RUC message.

Byte	Description
F0H	Exclusive status
41H	Manufacturer 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 :

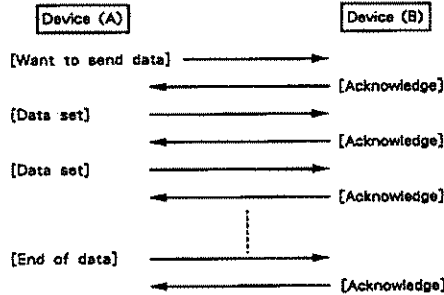
- a WSD or RQD message has specified an illegal data address or size.
- the device is not ready for communication.
- an illegal number of addresses or data has been detected.
- data transfer has been terminated by an operator.
- a communications error has occurred.

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.

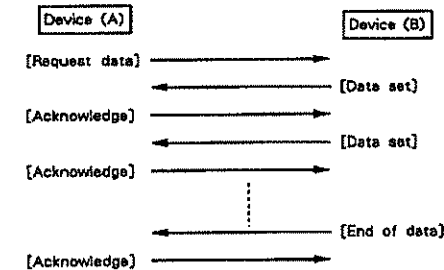
Byte	Description
FOH	Exclusive status
41H	Manufacturer ID (Roland)
DEV	Device ID
MDL	Model ID
4FH	Command ID
F7H	End of exclusive

Example of Message Transactions

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

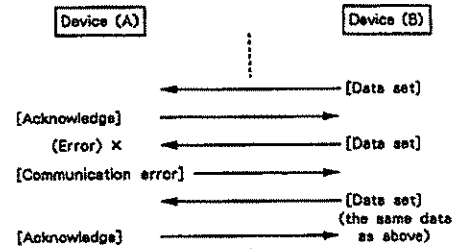


● Device (A) requests and receives data from device (B).

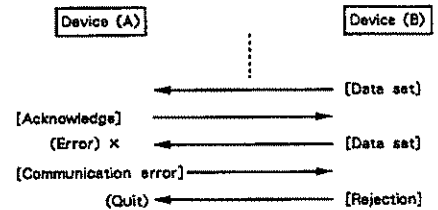


● Error occurs while device (A) is receiving data from device (B).

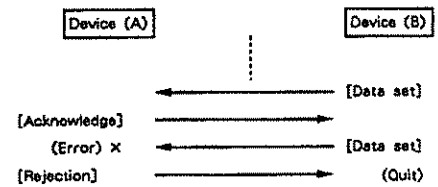
1) Data transfer from device (A) to device (B).



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



3) Device (A) immediately quits data transfer.



1. TRANSMITTED DATA

The D-70 transmits data on Performance/MIDI OUT/Tx channels each of which is assigned 4 sections and on System/Control channels. Each of these channels must be independent of the remainder.

The Performance/MIDI OUT/Tx channels are used to transmit keyboard data to control an external sound source, simulating a master keyboard. System/Control channels are used to simulate operations of play mode through external device such as sequencer. The D-70 will transmit on these channels only during play mode.

Note Event

Note event is transmitted on MIDI channels set Performance/MIDI OUT/Tx channels.

* The channel on which data is to be transmitted depends on the key mode and velocity mode of Performance/MIDI OUT. Transpose and velocity curve change are possible before transmission.

Note event is also transmitted on MIDI channel assigned System/Control channel.

* Simple key information is transmitted on this channel: information can be processed as necessary after reception.

Note off

Status	Second	Third	
8nH	kkH	vvH	
n = MIDI channel number	: 0H - FH (0 - 15)	0 = ch.1 15 = ch.16	
kk = Note number	: 00H - 7FH (0 - 127)		
vv = Velocity	: 01H - 7FH (1 - 127)		

Note on

Status	Second	Third	
9nH	kkH	vvH	
n = MIDI channel number	: 0H - FH (0 - 15)	0 = ch.1 15 = ch.16	
kk = Note number	: 00H - 7FH (0 - 127)		
vv = Velocity	: 01H - 7FH (1 - 127)		

Control change

Transmitted on MIDI channels set to Performance/MIDI OUT/Tx Ch.

* Most of all controllers can be set to any one of function numbers (0 - 95) of control change. Volume (No.7) is memorized.

Function settable controller	Fixed function controller
Bender	Hold Pedal (64 Hold1)
Aftertouch	
Modulation	
Cl/EXP Pedal	
Pedal switch	

Control change is transmitted on channels set to System/Control channel.

* Function of controllers and control changes are permanently defined.

Controller	Control change
Modulation	1 (Modulation)
Brightness	2 (Breath)
EXP Pedal / Cl	6 (Data Entry)
Tone Palette Slider-1	16 (General Purpose 1)
Tone Palette Slider-2	17 () 2)
Tone Palette Slider-3	18 () 3)
Tone Palette Slider-4	19 () 4)
Hold Pedal	64 (Hold1)
Portamento button	65 (Portamento)
Pedal switch	66 (General Purpose 5)
Tone palette button	81 () 6)
Play button	82 () 7)
Tone/Tone Select button	83 () 8)

Status	Second	Third	
BnH	ccH	vvH	
n = MIDI channel number	: 0H - FH (0 - 15)	0 = ch.1 15 = ch.16	
cc = control number	: 00H - 5FH (0 - 95)		
vv = control value	: 00H - 7FH (0 - 127)		

Program Change

The following data are transmitted on MIDI channels set to Performance/MIDI OUT/Tx Ch.

- * The number set to a particular section when performance is selected.
- * The program number being edited in a particular section.

The following data are transmitted on MIDI channels set to System/MIDI Tx Ch.

- * Performance number when performance is selected.

Status	Second	
CnH	ppH	
n = MIDI channel number	: 0H - FH (0 - 15)	0 = ch.1 15 = ch.16
pp = Program number	: 00H - 7FH (0 - 127)	

Channel Aftertouch

Transmitted on MIDI channels set to Performance/MIDI OUT/Tx Ch.

- * Most of the channels can be set for transmitting channel aftertouch.

Settable controllers
Bender
Aftertouch
Modulation
Cl/EXP Pedal
Pedal switch

Transmitted on MIDI channel set to System/Control channel.

- * Transmits aftertouch information of the keyboard as it is.

Status	Second	
DnH	vvH	
n = MIDI channel number	: 0H - FH (0 - 15)	0 = ch.1 15 = ch.16
vv = Value	: 00H - 7FH (0 - 127)	

Pitch Bend Change

Transmitted on MIDI channel set to Performance/MIDI OUT/Tx Ch.

- * Most of the channels can be set for transmitting channel aftertouch.

Settable controllers
Bender
Aftertouch
Modulation
Cl/EXP Pedal
Pedal switch

Transmitted on MIDI channel set to System/Control channel.

- * Transmits the value of bender lever as it is.

Status	Second	Third	
EnH	lH	mmH	
n = MIDI channel number	: 0H - FH (0 - 15)	0 = ch.1 15 = ch.16	
l = Value lower 7 bits	: 00H - 7FH (-64 - +63) / 8192		
mm = Value upper 7 bits	: 00H - 7FH (-64 - +63) * 64 / 8192		

Exclusive

The D-70 can transmit and receive various parameters through exclusive message. For details, refer to Sections, Roland Exclusive Messages and 3. Exclusive Communications.

Status	
FOH	System exclusive
F7H	EOX (End of Exclusive)

Active Sensing

The D-70 transmits this message to allow the device (s) it connecting to check MIDI connection and the like for continuity. Sends this message when no event has occurred 250 ms after the previous event.

Status
FEH

2. RECOGNIZED RECEIVE DATA

The D-70 is in receive status except during ROM play mode. Receives MIDI information through 6 MIDI Performance/PART SET/RX channels set to part 1 to rhythm part, and through the MIDI channel set to System/Control channel. A Performance/PART SET/RX Ch can be assigned more than one part channel but only one MIDI channel can be set to System/Control channel. Data received through Performance/PART SET/RX Ch are used to enable the particular function to control internal sound source for reproducing multi-timbre. Data received on System/Control channel are to reproduce play patterns stored in the sequencer and the like during play mode.

Note Event

Receives this message on a MIDI channel set to Performance/PART SET/RX Ch.

* When received, each part is sounded.

Receives on a MIDI channel assigned System/Control Ch.

* The parts set to Performance/KB PART will sound as if they are directly driven from a keyboard.

Note off

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

n = MIDI channel number : 0H - FH (0 - 15) 0 = ch.1 15 = ch.16
 kk = Note number : 00H - 7FH (0 - 127)
 vv = Velocity : 00H - 7FH (0 - 127)

9n kk 00 is translated as 8n kk 40.

Note on

Status	Second	Third
8nH	kkH	vvH

n = MIDI channel number : 0H - FH (0 - 15) 0 = ch.1 15 = ch.16
 kk = Note number : 00H - 7FH (0 - 127)
 vv = Velocity : 01H - 7FH (1 - 127)

Control change

Receives this message on MIDI channel set to Performance/PART SET/RX Ch.

* Can recognize the following control change numbers.

Control Change	Function
1 (Modulation)	Assignable (Pitch, TVF, TVA, LFO, etc.)
5 (Portamento time)	Portamento time (Mono code only)
7 (Volume)	Part volume
10 (Panpot)	Panpot
64 (Hold1)	Hold or Sostenuto
65 (Portamento)	Portamento switch (Mono code only)

Receives this message also on MIDI channel set to System/Control Ch.

* The value in a control change message acts as if the corresponding control on the panel is set to this value.

Control Change	Corresponding control on the panel
1 (Modulation)	Modulation
2 (Breath)	Brightness
6 (Data Entry)	CI/EXP Pedal
16 (General Purpose 1)	Tone Palette Slider-1
17 ()	Tone Palette Slider-2
18 ()	Tone Palette Slider-3
19 ()	Tone Palette Slider-4
64 (Hold1)	Hold Pedal
65 (Portamento)	Portamento button
80 (General Purpose 5)	Pedal switch
81 ()	Tone palette button
82 ()	Play button
83 ()	Tone/Zone select button

Status	Second	Third
BnH	ccH	vvH

n = MIDI channel number : 0H - FH (0 - 15) 0 = ch.1 15 = ch.16
 cc = control number : 00H - 53H (0 - 83)
 vv = control value : 00H - 7FH (0 - 127)

Program Change

Receives this message on MIDI channel set to Performance/PART SET/RX Ch.

* Changes patch of each part.
 * 0 - 127 are interpreted as A11 - B88, respectively. Internal/card are set to the currently selected performance.

Receives this message on MIDI channel set to System/Control channel.

* Changes performance.
 * 0 - 63 are interpreted as Internal 11 - 88, and 84 - 127 as card 11 - 88 respectively.

Status	Second
CnH	ppH

n = MIDI channel number : 0H - FH (0 - 15) 0 = ch.1 15 = ch.16
 pp = Program number : 00H - 7FH (0 - 127)

Channel Aftertouch

Receives this message on MIDI channel set to Performance/PART SET/RX Ch.

* Can be used to set functions.

Receives this message on MIDI channel set to System/Control Ch.

* Simulates aftertouch on a keyboard.

Status	Second
DnH	vvH

n = MIDI channel number : 0H - FH (0 - 15) 0 = ch.1 15 = ch.16
 vv = Value : 00H - 7FH (0 - 127)

Pitch Bend Change

Receives on MIDI channel set to Performance/PART SET/RX Ch.

* Can be used to set functions.

Receives this message on MIDI channel set to System/Control Ch.

* Simulates bender lever.

Status	Second	Third
EnH	iiH	mmH

n = MIDI channel number : 0H - FH (0 - 15) 0 = ch.1 15 = ch.16
 ii = Value lower 7 bits : 00H - 7FH (- 64 - + 63) / 8192
 mm = Value upper 7 bits : 00H - 7FH (- 64 - + 63) * 64 / 8192

Exclusive

The D-70 can transmit and receive various parameters through exclusive message. For details, refer to Sections, Roland Exclusive Messages and 3. Exclusive Communications.

Status	System exclusive
FOH	EOX (End of Exclusive)
F7H	

Active sensing

Having received this message, the D-70 expects to receive information of any status or data every 500 ms (max.). If the D-70 fails to sense message, it assumes the MIDI bus is disconnected for some reason. Then it mutes all notes that have been turned on by MIDI and returns to normal operation. After that it will not check interval of messages.

Status
FEH

3. EXCLUSIVE COMMUNICATIONS

The D-70 can transmit and receive various parameters through exclusive message in either way described in Section, Roland Exclusive Messages. The following data can be transferred in both ways.

■ Device ID

The actual value of a Device ID is smaller by one than that set to System/Unit #.

■ Model ID

The model ID of D-70 is 39H.

■ Representation of Address/size

Address is used to define a specific location of data. One address consists of 3 MIDI bytes (21 bits): each byte is separated from an adjacent one by a ":".

e.g. 00:00:00.

Address ranges from 00:00:00 to 7F:7F:7F, equivalent of 000000 to 1FFFFFF in normal hexadecimal notation.

Address size also has 3 MIDI bytes and is expressed in the same way as address.

■ Transmitted Data

The D-70 will transmit exclusive message as follows:

1) Data transfer mode

* Transmits data selected by panel operation.

2) On receiving Request data (RQ1, RQD)

* Sends parameters reside in the locations corresponding to addresses included in the received RQ1 or RQD (see Data Format for Exclusive Message In Section, Roland Exclusive Messages).

■ Recognized Receive Data

The D-70 is ready to receive exclusive message except the following occasions.

* During ROM play mode

* While System/Exclusive Rx is off

■ Type of Messages

● One-way transfer

1) Data request (RQ1)

* When the received request data contains valid addresses and address size 1 or more, the D-70 sends Data set 1 (DT1) message which contains the requested parameter.

* The D-70 does not send this message but external device such as sequencer can use.

Byte	Description
FOH	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H-1FH (unit # 1)
39H	Model ID
11H	Command ID (RQ1)
aaH	Address MSB
aaH	Address
aaH	Address LSB
ssH	Size MSB
ssH	Size
ssH	Size LSB
sum	Checksum
F7H	EOX (End of exclusive)

2) Data set (DT1)

* When the received address is valid, the D-70 loads incoming data into the memory location starting with that address.

* The D-70 sends this message when:

- it has received a Request data (RQ1) and to transfer the size of parameters defined by the RQ1.
- one-way bulk dump is operated in data transfer mode.

Byte	Description
FOH	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H-1FH (unit # 1)
39H	Model ID
12H	Command ID (DT1)
aaH	Address MSB
aaH	Address
aaH	Address LSB
ddH	Data (the number of data allowed to send)
:	
sum	Checksum
F7H	EOX (End of exclusive)

● Handshaking Communications

1) Messages used

1-1) Want to send data (WSD)

This is sent first by the transmitting device.

Byte	Description
FOH	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H-1FH (unit # 1)
39H	Model ID
40H	Command ID (WSD)
aaH	Address MSB
aaH	Address
aaH	Address LSB
ssH	Size MSB
ssH	Size
ssH	Size LSB
sum	Checksum
F7H	EOX (End of exclusive)

1-2) Request data (RQD)

This sent first by receiving device.

Byte	Description
FOH	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H-1FH (unit # 1)
39H	Model ID
41H	Command ID (RQD)
aaH	Address MSB
aaH	Address
aaH	Address LSB
ssH	Size MSB
ssH	Size
ssH	Size LSB
sum	Checksum
F7H	EOX (End of exclusive)

1-3) Data set (DAT)

Actual data block

Byte	Description
FOH	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H-1FH (unit # 1)
39H	Model ID
42H	Command ID (DAT)
aaH	Address MSB
aaH	Address
aaH	Address LSB
ddH	Data (number of data allowed to send)
:	
sum	Checksum
F7H	EOX (End of exclusive)

1-4) Acknowledge (ACK)

A response to the sender to indicate acknowledgement of receipt of a request.

Byte	Description
FOH	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H-1FH (unit # 1)
39H	Model ID
43H	Command ID (ACK)
F7H	EOX (End of exclusive)

1 - 5) End of data (EOD)

Sent to the other party to signal end of communication.

Byte	Description
F0H	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H - 1FH (unit # 1)
39H	Model ID
45H	Command ID (EOD)
F7H	EOX (End of exclusive)

1 - 6) Communication error (ERR)

Sent to the other party to warn occurrence of an error.

Byte	Description
F0H	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H - 1FH (unit # 1)
39H	Model ID
4EH	Command ID (ERR)
F7H	EOX (End of exclusive)

1 - 7) Rejection (RJC)

Sent to refuse the operation required by the other party.

Byte	Description
F0H	System exclusive status
41H	Manufacturer (Roland) ID
DEV	Device ID 00H - 1FH (unit # 1)
39H	Model ID
4FH	Command ID (RJC)
F7H	EOX (End of exclusive)

2) Transfer protocol

* There are three starting methods in handshaking communications.

- When bulk dump is selected in data transfer mode on the D-70, it sends a Want to send data to become the sender.
- By receiving a Want to send data message from an external D-70 or computer. In this case the local D-70 is the receiver.
- By receiving a Request data message from an external device such as computer with the D-70 being the sender.

* The D-70 will not transmit a Data request to become a receiver by itself.

* Below outlines the transfer protocol.

2 - 1) To start communication by the transmitting device (as in the cases A) and B) above.)

Transmitting device	Receiving device
1 : [Want to send data] Starts transfer.	----
2a :	<---- [Rejection] Refuses reception if engaged in sound reproduction.
Ends transfer upon receiving the Rejection.	
2b :	<---- [Acknowledge] If not sounding, sends ACK and waits for data block to be sent.
3 : Data set Sends data.	----> When address is valid, stores the receive data.
4a :	<---- [Acknowledge] Sends upon storing the data.
Transmits the next data set upon receiving the Acknowledge.	
4b :	<---- [Communication error] Sends if not correctly received the data and with failed storing.
Repeat the same data when receiving the communication error.	

(Repeats steps 3 and 4, if necessary.)

5 : [End data] No data follows.	---->
6 :	<---- [[Acknowledge] Verifies data end before finishing communication.
Completes transfer upon receiving Acknowledge.	

2 - 2) To start communication by the receiving device (in the cases C) above.)

Transmitting device (D-70)	Receiving device (external device)
1 :	<---- [Request data] Starts transfer.
2 : [Rejection] Refuses transmission if engaged in sounding.	----> Stops transfer upon receiving the Rejection.
3 : [Data set] Sends data if free from reproduction, and the address is valid.	External device receives the data and processes to its own program.
4a :	<---- [Acknowledge] Sends when data has been correctly received.
Proceeds to the next data set upon receiving the Acknowledge.	
4b :	<---- [Communication error] Failed to receive data correctly.
Sends the previous data again upon receiving the Communication error (repeats as necessary).	
5 : [End data] No following data prepared.	---->
6 :	<---- [Acknowledge] Verifies data end before finishing communication.
Completes transfer upon receiving Acknowledge.	

Parameter Address

All the data transferred through exclusive message must be accompanied by the address to identify itself as being for what parameter it represents. An address is represented by the basic address and the offset (amount of shifts). Some parameters have more than one offset. The addresses to be defined by a data set and request data messages must fall in the range specified below.

Names (Tx channel, Performance, Patch and Tone) must be expressed in ASCII code. Codes 0 - 31 are translated into 32 (space) at receiving device.

General table

* The table lists the layout of all of the parameters: any parameter should be found anywhere in the table. Actual address is obtained by adding offset (listed later) to the address in this table.

General table

Address	Size	Contents and remarks	Offset
00:00:00	00:00:08	Internal memory : System setup	Table-1
00:00:08	00:01:20	: Tx channel name	Table-2
00:01:28	00:00:05	Temporary : User set	Table-3
00:01:2D	00:01:71	: Performance	Table-4
00:03:1E	00:00:57	: Part 1 : Patch	Table-5
00:03:75	00:00:57	: Part 2 : Patch	Table-5
00:04:4C	00:00:57	: Part 3 : Patch	Table-5
00:05:23	00:00:57	: Part 4 : Patch	Table-5
00:05:7A	00:00:57	: Part 5 : Patch	Table-5
00:06:51	00:00:3E	: Part 1 : Section 1 : Tone	Table-6
00:07:07	00:00:3E	: Part 1 : Section 2 : Tone	Table-6
00:07:4D	00:00:3E	: Part 1 : Section 3 : Tone	Table-6
00:08:0B	00:00:3E	: Part 1 : Section 4 : Tone	Table-6
00:08:49	00:00:3E	: Part 2 : Section 1 : Tone	Table-6
00:09:07	00:00:3E	: Part 2 : Section 2 : Tone	Table-6
00:09:45	00:00:3E	: Part 2 : Section 3 : Tone	Table-6
00:0A:03	00:00:3E	: Part 2 : Section 4 : Tone	Table-6
00:0A:41	00:00:3E	: Part 3 : Section 1 : Tone	Table-6
00:0A:7F	00:00:3E	: Part 3 : Section 2 : Tone	Table-6
00:0B:3D	00:00:3E	: Part 3 : Section 3 : Tone	Table-6
00:0B:7B	00:00:3E	: Part 3 : Section 4 : Tone	Table-6
00:0C:39	00:00:3E	: Part 4 : Section 1 : Tone	Table-6
00:0C:77	00:00:3E	: Part 4 : Section 2 : Tone	Table-6
00:0D:35	00:00:3E	: Part 4 : Section 3 : Tone	Table-6
00:0D:73	00:00:3E	: Part 4 : Section 4 : Tone	Table-6
00:0E:31	00:00:3E	: Part 5 : Section 1 : Tone	Table-6
00:0E:6F	00:00:3E	: Part 5 : Section 2 : Tone	Table-6
00:0F:2D	00:00:3E	: Part 5 : Section 3 : Tone	Table-6
00:0F:6B	00:00:3E	: Part 5 : Section 4 : Tone	Table-6
00:10:29	00:14:66	Internal : Rhythm setup	Table-7
00:25:0F	00:00:32	(80:05) : User set	Table-3
00:25:41	00:78:40	(81:71) : Performance	Table-4
01:1E:01	00:57:00	(80:57) : Patch	Table-5
01:75:01	00:3E:00	(80:3E) : Tone	Table-6
02:33:01	00:14:66	Card : Rhythm setup	Table-7
02:47:67	00:00:32	(80:05) : User set	Table-3
02:48:19	00:78:40	(81:71) : Performance	Table-4
03:40:69	00:57:00	(80:57) : Patch	Table-5
04:17:59	00:3E:00	(80:3E) : Tone	Table-6
04:55:59	00:02:40	Auxiliary : LCD normal character	Table-8
04:58:19	00:00:50	: LCD big character	Table-9
04:58:69	00:00:01	: User set write request	Table-1
04:58:6A	00:00:01	: Performance write request	Table-1
04:58:6B	00:00:05	: Patch write request	Table-1
04:58:70	00:00:14	: Tone write request	Table-1
04:59:04	00:00:01	: Write result	Table-1

Table 1 System setup

* System setup is to be directly written into the internal memory.

* Exclusive message related parameter when written will be made effective with the next message, if included.

Table - 1. System Setup

Address	Data	Contents and remarks
00:00:00	0 - 127	Master tune (-64 - +63)
00:00:01	0 - 16	Control Channel (1 - 16, Off)
00:00:02	0 - 31	Unit number (1 - 32)
00:00:03	0 - 1	Exclusive MX SW (Off, On)
00:00:04	0 - 1	Hold Pedal Function (Hold, Sostenuto)
00:00:05	0 - 2	Pedal Switch Function (Map, Per. up, Per. down)
00:00:06	0 - 1	MIDI OUT Link mode (Off, On)
00:00:07	0 - 1	Local Switch (Off, On)
00:00:08	(000008H)	Total size

Table 2 Transmission channel name

* To be written directly into the internal memory.

* A channel name must consist of ten characters.

Table - 2. TX Channel Name

Address	Data	Contents and remarks
00:00:00	32 - 127	Channel 1 name (ASCII 10character)
00:00:0A	32 - 127	Channel 2 name (ASCII 10character)
00:00:14	32 - 127	Channel 3 name (ASCII 10character)
00:00:1E	32 - 127	Channel 4 name (ASCII 10character)
00:00:28	32 - 127	Channel 5 name (ASCII 10character)
00:00:32	32 - 127	Channel 6 name (ASCII 10character)
00:00:3C	32 - 127	Channel 7 name (ASCII 10character)
00:00:46	32 - 127	Channel 8 name (ASCII 10character)
00:00:50	32 - 127	Channel 9 name (ASCII 10character)
00:00:5A	32 - 127	Channel 10 name (ASCII 10character)
00:00:64	32 - 127	Channel 11 name (ASCII 10character)
00:00:6E	32 - 127	Channel 12 name (ASCII 10character)
00:00:78	32 - 127	Channel 13 name (ASCII 10character)
00:01:02	32 - 127	Channel 14 name (ASCII 10character)
00:01:0C	32 - 127	Channel 15 name (ASCII 10character)
00:01:16	32 - 127	Channel 16 name (ASCII 10character)
00:01:20	(0000A0H)	Total size

Table 3 User set

Number of user sets prepared: Temporary (1 set), Internal (10 sets) and Card (10 sets)

Table - 3. User Set

Address	Data	Contents and remarks
00:00:00	0 - 127	F.1 Performance (1-11 - C-88)
00:00:01	0 - 127	F.2 Performance (1-11 - C-88)
00:00:02	0 - 127	F.3 Performance (1-11 - C-88)
00:00:03	0 - 127	F.4 Performance (1-11 - C-88)
00:00:04	0 - 127	F.5 Performance (1-11 - C-88)
00:00:05	(000005H)	Total size

● Table 4 Performance

* Number of performance sets prepared: Temporary (1 set), internal (64) and Card (64)
 * For part setting and MIDI OUT section parameters, refer to Table - 41 and 42, respectively.

Table - 4. Performance

Address	Data	Contents and remarks
00:00:00	32 - 127	Performance name (ASCII 10character)
00:00:0A	0 - 6	Keyboard Part (1 - 5, R, Off)
00:00:0B	0 - 6	CI/EXP Pedal - 1 Function (TVF, TVA, LFO pitch, LFO TVF, LFO TVA, Pitch, Porta. time)
00:00:0C	0 - 3	Destination (Off, Low, Up, Both)
00:00:0D	0 - 127	Value (0 - 127)
00:00:0E	0 - 6	CI/EXP Pedal - 2 Function (TVF - Porta. time)
00:00:0F	0 - 3	Destination (Off, Low, Up, Both)
00:00:10	0 - 127	Value (0 - 127)
00:00:11	0 - 3	Pedal switch - 1 Function (Oct up, Oct down, Effector)
00:00:12	0 - 3	Destination (Off, Low, Up, Both)
00:00:13	0 - 3	Pedal switch - 2 Function (Modu - Effector)
00:00:14	0 - 3	Destination (Off, Low, Up, Both)
00:00:15	-----	Part-1 setting <<See Table-41>>
00:00:32	-----	Part-2 setting <<See Table-41>>
00:00:4F	-----	Part-3 setting <<See Table-41>>
00:00:6C	-----	Part-4 setting <<See Table-41>>
00:01:09	-----	Part-5 setting <<See Table-41>>
00:01:26	0 - 15	Part-Rhythm RX Channel (1 - 16, Off)
00:01:27	0 - 127	Output Level (0 - 127)
00:01:28	0 - 127	Zone Lower (C-1 - G9)
00:01:29	0 - 127	Zone Upper (C-1 - G9)
00:01:2A	0 - 1	Assign Priority (Off, On)
00:01:2B	0 - 1	Effect (Off, On)
00:01:2C	0 - 1	MIDI Volume RX SW (Off, On)
00:01:2D	0 - 7	Reverb Type (Room 1 - 3, Hall 1 - 2, Gate, Delay, Cross Delay)
00:01:2E	0 - 31	Delay Time (0 - 31)
00:01:2F	0 - 31	Level (0 - 31)
00:01:30	0 - 31	Feedback (0 - 31)
00:01:31	0 - 4	Chorus Type (Chorus 1 - 2, PB-Chorus, Flanger, Short Delay)
00:01:32	0 - 1	Output Mode (Pre reverb, Post reverb)
00:01:33	0 - 31	Level (0 - 31)
00:01:34	0 - 31	Delay Time (0 - 31)
00:01:35	0 - 31	Rate (0 - 31)
00:01:36	0 - 31	Depth (0 - 31)
00:01:37	0 - 62	Feedback (-31 - +31)
00:01:38	0 - 3	MIDI OUT Velo. Curve (1 - 4)
00:01:39	0 - 127	Velo. Sens (0 - 127)
00:01:3A	0 - 2	Key Mode (Layer, Split, Zone)
00:01:3B	0 - 127	Split Point (C-1 - G9)
00:01:3C	0 - 0	Bender-1 Function (Pitch Bend)
00:01:3D	0 - 3	Destination (Off, Low, Up, Both)
00:01:3E	0 - 96	Bender-2 Function (C.chg 0-95, A.T.)
00:01:3F	0 - 3	Destination (Off, Low, Up, Both)
00:01:40	0 - 96	A.T. - 1 Function (C.chg 0-95, A.T., Bend up, Bend down)
00:01:41	0 - 3	Destination (Off, Low, Up, Both)
00:01:42	0 - 96	A.T. - 2 Function (C.chg 0 - Bend down)
00:01:43	0 - 3	Destination (Off, Low, Up, Both)
00:01:44	0 - 96	Modulation - 1 Function (C.chg 0 - Bend down)
00:01:45	0 - 3	Destination (Off, Low, Up, Both)
00:01:46	0 - 96	Modulation - 2 Function (C.chg 0 - Bend down)
00:01:47	0 - 3	Destination (Off, Low, Up, Both)
00:01:48	0 - 96	CI/EXP Pedal - 1 Function (C.chg 0 - Bend down)
00:01:49	0 - 3	Destination (Off, Low, Up, Both)
00:01:4A	0 - 96	CI/EXP Pedal - 2 Function (C.chg 0 - Bend down)
00:01:4B	0 - 3	Destination (Off, Low, Up, Both)
00:01:4C	0 - 95	Pedal SW - 1 Function (C.chg 0 - 95)
00:01:4D	0 - 3	Destination (Off, Low, Up, Both)
00:01:4E	0 - 95	Pedal SW - 2 Function (C.chg 0 - 95)
00:01:4F	0 - 3	Destination (Off, Low, Up, Both)
00:01:50	0 - 3	Bold Pedal Destination (Off, Low, Up, Both)
00:01:51	0 - 2	MIDI OUT Lower Velocity mode (Normal, SW, Mix)
00:01:52	0 - 127	Threshold sens (0 - 127)
00:01:53	0 - 2	MIDI OUT Upper Velocity mode (Normal, SW, Mix)
00:01:54	0 - 127	Threshold sens (0 - 127)
00:01:55	-----	MIDI OUT Section-1 <<see Table-42>>
00:01:5C	-----	MIDI OUT Section-2 <<see Table-42>>
00:01:63	-----	MIDI OUT Section-3 <<see Table-42>>
00:01:EA	-----	MIDI OUT Section-4 <<see Table-42>>
00:01:71	(0000FH)	Total size

Table - 41. Performance part setting

Address	Data	Contents and remarks
00:00:00	0 - 15	RX Channel (1 - 16, Off)
00:00:01	0 - 127	Patch Select (All - B88)
00:00:02	0 - 127	Output Level (0 - 127)
00:00:03	0 - 127	Zone Lower Limit (C-1 - G9)
00:00:04	0 - 127	Zone Upper Limit (C-1 - G9)
00:00:05	0 - 1	Assign Priority (Off, On)
00:00:06	0 - 1	Effect (Off, On)
00:00:07	0 - 127	Analog Feel (0 - 127)
00:00:08	0 - 1	MIDI Program RX SW (Off, On)
00:00:09	0 - 1	MIDI Volume RX SW (Off, On)
00:00:0A	0 - 3	Bender - 1 Destination (Off, Low, Up, Both)
00:00:0B	0 - 12	Up depth (0 - +12)
00:00:0C	0 - 48	Down depth (-48 - 0)
00:00:0D	0 - 4	Bender - 2 Function (TVF, TVA, LFO pitch, LFO TVF, LFO TVA)
00:00:0E	0 - 3	Destination (Off, Low, Up, Both)
00:00:0F	0 - 127	Value (0 - 127)
00:00:10	0 - 5	A.Touch - 1 Function (TVF, TVA, LFO pitch, LFO TVA, LFO TVA, Pitch)
00:00:11	0 - 3	Destination (Off, Low, Up, Both)
00:00:12	0 - 127	Value (0 - 127)
00:00:13	0 - 5	A.Touch - 2 Function (TVF - Pitch)
00:00:14	0 - 3	Destination (Off, Low, Up, Both)
00:00:15	0 - 127	Value (0 - 127)
00:00:16	0 - 5	Modulation - 1 Function (TVF - Pitch)
00:00:17	0 - 3	Destination (Off, Low, Up, Both)
00:00:18	0 - 127	Value (0 - 127)
00:00:19	0 - 5	Modulation - 2 Function (TVF - Pitch)
00:00:1A	0 - 3	Destination (Off, Low, Up, Both)
00:00:1B	0 - 127	Value (0 - 127)
00:00:1C	0 - 3	Hold 1 Destination (Off, Low, Up, Both)
00:00:1D	(00001DH)	Total size

Table - 42. Performance MIDI OUT section

Address	Data	Contents and remarks
00:00:00	0 - 15	MIDI TX Channel (1 - 16)
00:00:01	0 - 127	MIDI Volume (0 - 127)
00:00:02	0 - 127	Program Change Number (1 - 128)
00:00:03	0 - 48	Transpose (-24 - +24)
00:00:04	0 - 127	Zone Lower Limit (C-1 - G9)
00:00:05	0 - 127	Zone Upper Limit (C-1 - G9)
00:00:06	0 - 1	MIDI OUT switch (Off, On)
00:00:07	(000007H)	Total size

● Table 5 Patch

* Number of patches prepared: Temporary (length worth of 6 parts), Internal (128) and Card (128).

Table - 5. Patch

Address	Data	Contents and remarks
00:00:00	32 - 127	Patch name (ASCII 10character)
00:00:0A	0 - 127	Level (0 - 127)
00:00:0B	0 - 3	Velocity Curve (1 - 4)
00:00:0C	0 - 127	Velocity Sens (0 - 127)
00:00:0D	0 - 2	Key Mode (Layer, Split, Zone)
00:00:0E	0 - 127	Split Point (0-1 - 09)
00:00:0F	-----	Lower parameters <<see Table-51>>
00:00:10	-----	Upper parameters <<see Table-51>>
00:00:23	-----	Section 1 parameters <<see Table-52>>
00:00:30	-----	Section 2 parameters <<see Table-52>>
00:00:3D	-----	Section 3 parameters <<see Table-52>>
00:00:4A	-----	Section 4 parameters <<see Table-52>>
00:00:57 (000057H)		Total size

Table - 51. Patch Lower/Upper parameters

Address	Data	Contents and remarks
00:00:00	0 - 2	Velocity Mode (Normal, SW, Mix)
00:00:01	0 - 127	Threshold Sens (0 - 127)
00:00:02	0 - 1	Key Assign (Poly, Solo)
00:00:03	0 - 1	Solo Legato (Off, On)
00:00:04	0 - 1	Portamento switch (Off, On)
00:00:05	0 - 1	Portamento mode (Normal, Auto)
00:00:06	0 - 127	Portamento Time (0 - 127)
00:00:07	0 - 1	MIDI Pan RX SW (Off, On)
00:00:08	0 - 0	<< Reserved >>
00:00:09	0 - 1	MIDI Portamento RX SW (Off, On)
00:00:0A (00000AH)		Total size

Table - 52. Patch Section parameters

Address	Data	Contents and remarks
00:00:00	0 - 127	Tone Select (all - b8)
00:00:01	0 - 127	Level (0 - 127)
00:00:02	0 - 48	Key Shift (-24 - +24)
00:00:03	0 - 127	Fine Tune (-64 - +63)
00:00:04	0 - 127	Cutoff (-64 - +63)
00:00:05	0 - 127	Resonance (-64 - +63)
00:00:06	0 - 127	Attack Time (-64 - +63)
00:00:07	0 - 127	Release Time (-64 - +63)
00:00:08	0 - 3	Output Assign (Dry, Reverb, Chorus, Direct)
00:00:09	0 - 14	Pan (7> - <7)
00:00:0A	0 - 1	Tone switch (Off, On)
00:00:0B	0 - 127	Zone Lower Limit (C-1 - G9)
00:00:0C	0 - 127	Upper Limit (C-1 - G9)
00:00:0D (00000DH)		Total size

● Table 6 Tone

* Number of tones prepared: Temporary (5 part x 4 section), Internal (128) and Card (128).

Table - 6. Tone

Address	Data	Contents and remarks
00:00:00	32 - 127	Tone name (ASCII 10character)
00:00:0A	0 - 65	Original Tone Media (U1 - U32, D1 - D32, (1 - 13)
00:00:0B	0 - 127	Number (1 - 128)
00:00:0C	0 - 1	DLN switch (Off, On)
00:00:0D	0 - 1	mode (Off, On)
00:00:0E	0 - 127	start address (0 - 127)
00:00:0F	0 - 127	loop length (1 - 128)
00:00:10	0 - 96	Pitch Coarse (-48 - +48)
00:00:11	0 - 127	Fine (-64 - +63)
00:00:12	0 - 15	Pitch Key Follow (-100% - +200%)
00:00:13	0 - 15	Pitch ENV Time KF (-100% - +150%)
00:00:14	0 - 127	A Time (0 - 127)
00:00:15	0 - 34	A depth (-12 - +12)
00:00:16	0 - 127	R Time (0 - 127)
00:00:17	0 - 34	R depth (-12 - +12)
00:00:18	0 - 3	TVP Mode (LFF, BPF, HPF, Bypass)
00:00:19	0 - 127	Cutoff (0 - 127)
00:00:1A	0 - 127	Resonance (0 - 127)
00:00:1B	0 - 3	Velocity Curve (1 - 4)
00:00:1C	0 - 15	Cutoff Key Follow (-100% - +100%)
00:00:1D	0 - 127	ENV Depth (-64 - +63)
00:00:1E	0 - 127	ENV Depth Velo. (0 - 127)
00:00:1F	0 - 15	ENV Time KF (-100% - +150%)
00:00:20	0 - 127	ENV Time Vel. (0 - 127)
00:00:21	0 - 127	ENV Time rel Vel. (0 - 127)
00:00:22	0 - 127	ENV Attack Time (0 - 127)
00:00:23	0 - 127	ENV Attack Level (0 - 127)
00:00:24	0 - 127	ENV Decay 1 Time (0 - 127)
00:00:25	0 - 127	ENV Decay BP (0 - 127)
00:00:26	0 - 127	ENV Decay 2 Time (0 - 127)
00:00:27	0 - 127	ENV Sustain Level (0 - 127)
00:00:28	0 - 127	ENV Release Time (0 - 127)
00:00:29	0 - 127	TVA Level (0 - 127)
00:00:2A	0 - 3	Velocity Curve (1 - 4)
00:00:2B	0 - 127	Velocity Sens (0 - 127)
00:00:2C	0 - 15	ENV Time KF (-100% - +150%)
00:00:2D	0 - 127	ENV Time On Vel. (0 - 127)
00:00:2E	0 - 127	ENV Time Rel Vel. (0 - 127)
00:00:2F	0 - 127	ENV Attack Time (0 - 127)
00:00:30	0 - 127	ENV Attack Level (0 - 127)
00:00:31	0 - 127	ENV Decay 1 Time (0 - 127)
00:00:32	0 - 127	ENV Decay BP (0 - 127)
00:00:33	0 - 127	ENV Decay 2 Time (0 - 127)
00:00:34	0 - 127	ENV Sustain Level (0 - 127)
00:00:35	0 - 127	ENV Release Time (0 - 127)
00:00:36	0 - 4	LFO Waveform (Triangle, Sine, Square, Saw, Random)
00:00:37	0 - 127	Rate (0 - 127)
00:00:38	0 - 15	Delay Time (0 - 15)
00:00:39	0 - 15	Rise Time (0 - 15)
00:00:3A	0 - 4	Offset (-100% - +100%)
00:00:3B	0 - 127	Pitch Mod Depth (-64 - +63)
00:00:3C	0 - 127	TVP Mod Depth (-64 - +63)
00:00:3D	0 - 127	TVA Mod Depth (-64 - +63)
00:00:3E (00003EH)		Total size

● Table 7 Rhythm setup

- * Can be directly written into either internal memory or card.
- * First determine the address of a key and then refer to parameter for that key.

Table - 7. Rhythm Setup

Address	Data	Contents and remarks
00:00:00	0 - 52	Rhythm Shift (-28 ~ +24)
00:00:01	0 - 0	<< Reserved >>
00:00:02	-----	Key E1 data <<see Table-71>>
00:00:25	-----	Key F1 data <<see Table-71>>
00:00:48	-----	Key F#1 data <<see Table-71>>
00:00:6B	-----	Key G1 data <<see Table-71>>
:	:	: (G#1 .. F7)
00:14:20	-----	Key F#7 data <<see Table-71>>
00:14:43	-----	Key G7 data <<see Table-71>>
00:14:56 (000A66H)		Total size

Table - 71. Rhythm Setup Key parameters

Address	Data	Contents and remarks
00:00:00	0 - 66	Original Tone Media (B1 - U32, D1 - D32, I1 - I32)
00:00:01	0 - 127	Number (0 - 127)
00:00:02	0 - 127	Source Key (Off, C#-1 ~ 0B)
00:00:03	0 - 76	Mute (E-1 ~ G7, Off)
00:00:04	0 - 0	<< Reserved >>
00:00:05	0 - 14	Pan (7> ~ <7)
00:00:06	0 - 3	Output Assign (Dry, Reverb, Chorus, Direct)
00:00:07	0 - 1	Envelope Mode (Sustain, No sustain)
00:00:08	0 - 24	Pitch Coarse (-12 ~ +12)
00:00:09	0 - 127	Fine (-64 ~ +63)
00:00:0A	0 - 127	Pitch ENV A Time (0 - 127)
00:00:0B	0 - 34	A Depth (-12 ~ +12)
00:00:0C	0 - 3	TVF Mode (LPF, BPF, HPF, Bypass)
00:00:0D	0 - 127	Cutoff (0 - 127)
00:00:0E	0 - 127	Resonance (0 - 127)
00:00:0F	0 - 3	Velocity Curve (1 - 4)
00:00:10	0 - 127	ENV Depth (-64 ~ +63)
00:00:11	0 - 127	ENV Depth Velo. (0 - 127)
00:00:12	0 - 127	ENV Attack Time (0 - 127)
00:00:13	0 - 127	ENV Attack Level (0 - 127)
00:00:14	0 - 127	ENV Decay 1 Time (0 - 127)
00:00:15	0 - 127	ENV Decay BP (0 - 127)
00:00:16	0 - 127	ENV Decay 2 Time (0 - 127)
00:00:17	0 - 127	ENV Sustain Level (0 - 127)
00:00:18	0 - 127	ENV Release Time (0 - 127)
00:00:19	0 - 127	TVA Level (0 - 127)
00:00:1A	0 - 3	Velocity Curve (1 - 4)
00:00:1B	0 - 127	Velocity Sens (0 - 127)
00:00:1C	0 - 127	ENV Attack Time (0 - 127)
00:00:1D	0 - 127	ENV Attack Level (0 - 127)
00:00:1E	0 - 127	ENV Decay 1 Time (0 - 127)
00:00:1F	0 - 127	ENV Decay BP (0 - 127)
00:00:20	0 - 127	ENV Decay 2 Time (0 - 127)
00:00:21	0 - 127	ENV Sustain Level (0 - 127)
00:00:22	0 - 127	ENV Release Time (0 - 127)
00:00:23 (000623H)		Total size

● Table 8 Full size character for displaying on LCD

- * ASCII code data written into these address are displayed on the LCD as ASCII characters.
- * Accessing to these addresses for data reading will obtain the ASCII codes being displayed on the LCD.
- * Display area is composed of 8 lines x 40 characters.

Table - 8. LCD normal character

Address	Data	Contents and remarks
00:00:00	32 - 127	Top line, left most column (ASCII)
00:00:01	32 - 127	Top line, column 2 (ASCII)
:	:	:
00:02:3F	32 - 127	Bottom line, column 40 (ASCII)
00:02:40 (000140H)		Total size

● Table 9 Double size character for displaying on LCD

- * ASCII code data written into these address locations are displayed on the LCD as ASCII characters having twice dimensions of ordinary counterparts in height and width.
- * Display area is composed of 4 lines x 20 characters.
- * These addresses cannot be accessed for the purpose of reading.

Table - 9. LCD big character

Address	Data	Contents and remarks
00:00:00	32 - 127	Top line, left most column (ASCII)
00:00:01	32 - 127	Top line, column 2 (ASCII)
:	:	:
00:00:4F	32 - 127	Bottom line, column 20 (ASCII)
00:00:50 (000050H)		Total size

● Table 10 User set write request

- * The data written into this address location causes the user set in the temporary area to be transferred and stored into the destination specified by the data.

Table - 10. User set write request

Address	Data	Contents and remarks
00:00:00	0 - 19	Write memory address (1-1 ~ 1-10, C-1 ~ C-10)
00:00:01 (000001H)		Total size

● Table 11 Performance write request

- * The data written into this address location causes the performance in the temporary area to be transferred and stored into the destination memory location specified by the data.
- * A message is returned to indicate the result of writing operation.
- * The address cannot be accessed for the purpose of reading.

Table - 11. Performance write request

Address	Data	Contents and remarks
00:00:00	0 - 127	Write memory address (1-11 ~ 1-88, C-11 ~ C-88)
00:00:01 (000001H)		Total size

● Table 12 Patch write request

- * The data written into this address location causes the patch in the temporary area to be transferred and stored into the destination memory location specified by the data. The destination is either internal or card.
- * A message is returned to indicate the result of writing operation.
- * The address cannot be accessed for the purpose of reading.

Table - 12. Patch write request

Address	Data	Contents and remarks
00:00:00	0 - 127	Part-1 temporary write address (A-11 ~ B-88)
00:00:01	0 - 127	Part-2 temporary write address (A-11 ~ B-88)
00:00:02	0 - 127	Part-3 temporary write address (A-11 ~ B-88)
00:00:03	0 - 127	Part-4 temporary write address (A-11 ~ B-88)
00:00:04	0 - 127	Part-5 temporary write address (A-11 ~ B-88)
00:00:05 (000005H)		Total size

●Table 13 Tone write request

* The data written into this address location causes the tone in the temporary area to be transferred and stored into the destination memory location specified by the data. The destination is either internal or card.

* A message is returned to indicate the result of writing operation.

* The address cannot be accessed for the purpose of reading.

Table - 13. Tone write request

address	Data	Contents and remarks
00:00:00	0 - 127	Part-1 Section-1 write address (a-11 - b-88)
00:00:01	0 - 127	Section-2 write address (a-11 - b-88)
00:00:02	0 - 127	Section-3 write address (a-11 - b-88)
00:00:03	0 - 127	Section-4 write address (a-11 - b-88)
00:00:04	0 - 127	Part-2 Section-1 write address (a-11 - b-88)
00:00:05	0 - 127	Section-2 write address (a-11 - b-88)
00:00:06	0 - 127	Section-3 write address (a-11 - b-88)
00:00:07	0 - 127	Section-4 write address (a-11 - b-88)
00:00:08	0 - 127	Part-3 Section-1 write address (a-11 - b-88)
00:00:09	0 - 127	Section-2 write address (a-11 - b-88)
00:00:0A	0 - 127	Section-3 write address (a-11 - b-88)
00:00:0B	0 - 127	Section-4 write address (a-11 - b-88)
00:00:0C	0 - 127	Part-4 Section-1 write address (a-11 - b-88)
00:00:0D	0 - 127	Section-2 write address (a-11 - b-88)
00:00:0E	0 - 127	Section-3 write address (a-11 - b-88)
00:00:0F	0 - 127	Section-4 write address (a-11 - b-88)
00:00:10	0 - 127	Part-5 Section-1 write address (a-11 - b-88)
00:00:11	0 - 127	Section-2 write address (a-11 - b-88)
00:00:12	0 - 127	Section-3 write address (a-11 - b-88)
00:00:13	0 - 127	Section-4 write address (a-11 - b-88)
00:00:14 (000014H)		Total size

●Table 14 Write result

* Contains the result of write request which has been written upon request for the result of data write into a particular location, specified in tables 10 to 13.

* Write and read operation in these locations are inhibited.

Table - 14. Write result

Address	Date	Contents and remarks
00:00:00	0 - 127	Result code
		0 = Complete, 1 = Protected, 2 = No card, 3 = Illegal card, 4 = Write error, 5 - 126 = Reserved, 127 = Another error)
00:00:01	(000001H)	Total size

4. PANNIC

When this function is activated, the D-70 tries to recover sound failure (in most of cases sound cannot be turned off) occurring at the remotedevice connected via MIDI.

Pressing the soft button Panic (PLAY and EDIT) causes the D-70 to transmit the following over all 16 MIDI channels. n represents channel.

Note off for all note numbers	8n kk 7F
Bender = 0	En 00 40
Channel pressure = 0	Dn 00
Control change 1 = 0 (Modulation = 0)	En 01 00
64 = 0 (Hold1 = off)	En 40 00
7 = 127 (Volume = 127)	En 07 7F

The total message length is 6368 bytes (128 keys x 3 bytes + 14 per channel). To prevent overflow from occurring at the receiver's buffer, data are sent at a half the MIDI transfer rate which will take approx. 4 seconds to complete the transmission.

The the D-70 stops active sensing and pauses one second before returning back to normal operating status.

MIDI Implementation Chart

Function ***		Transmitted	Recognized	Remarks
Basic Channel	Default Changed	1 - 16 1 - 16	1 - 16 1 - 16	Nonvolatile
Mode	Default Messages Altered	Mode 3 × *****	Mode 3, 4 ×	Set by panel operation Memorized
Note Number	True Voice	0 - 127 *****	0 - 127 0 - 127	
Velocity	Note On Note Off	○ v = 1 - 127 ○ v = 1 - 127	○ v = 1 - 127 ○ v = 1 - 127	
After Touch	Key's Ch's	× * 1	× * 1	
Pitch Bender		* 1	* 1 (- 48—+ 12)	Res : 8 bits
Control Change	0 - 95 1 5 7 10 64 65 1, 2, 6 16 - 19 64, 65 80 - 83	* 1 ○ ○ ○ ○	 * 1 * 1 * 1 * 1 * 1 * 1 ○ ○ ○ ○	Modulation Portamento Time Volume Pan Hold Portamento SW Control Channel
Prog Change	True #	* 1 0 - 127 *****	* 1 0 - 127 0 - 127	
System Exclusive		○	* 1	
System Common	Song Pos Song Sel Tune	× × ×	× × ×	
System Real Time	Clock Commands	× ×	× ×	
Aux Message	Local ON/OFF All Notes OFF Active Sense Reset	× × ○ ×	× × ○ ×	
Notes		* 1 Can be set to ○ or × manually and memorized.		

Mode 1 : OMNI ON, POLY
Mode 3 : OMNI OFF, POLY

Mode 2 : OMNI ON, MONO
Mode 4 : OMNI OFF, MONO

○ : Yes
× : No

■ How to read a MIDI Implementation Chart

- : MIDI data that can be transmitted or received
x: MIDI data that cannot be transmitted or received

● Basic Channel

The MIDI channel for transmitting (receiving) MIDI data can be specified over this range. The MIDI channel setting is remembered even when the power is turned off.

● Mode

Most recent synthesizers use mode 3 (omni off, poly).

Reception: Data is received only on the specified channels, and played polyphonically.

Transmission: All musical data is transmitted on the specified MIDI channel.

* "Mode" refers to MIDI Mode messages.

● Note Number

This is the range of note numbers that can be transmitted (received. Note number 60 is middle C (C4))

● Velocity

This is the range over which velocity can be transmitted (received) by Note On and Note Off messages.

● Aftertouch

Key's: polyphonic aftertouch

Ch's: channel aftertouch

● Pitch Bender

The D - 70 is able to transmit and receive Pitch Bender messages.

● Control Change

This indicates the control numbers that can be transmitted (received), and what they will control. For details, refer to the MIDI implementation.

● Program Change

The program change numbers in the chart indicate the actual data. (This is one less than the Pitch and Tone program numbers.)

● Exclusive

Exclusive message reception can be turned on/off by the exclusive switch (setup).

● Common, Realtime

These MIDI messages are used to synchronize sequencers and rhythm machines. The D - 70 does not use these messages.

● Other

These messages are mainly used to keep a MIDI system running correctly. Active sensing transmission can be turned on/off.