1. TRANSMITTED DATA

■Channel Voice Message

●Note Off

Status	Second	Third
9nH	kkH	00H

n = MIDI Channel Number: 0H - FH (ch.1 - ch.16)
kk = Note Number: 17H - 57H (23 - 87)

* Not transmitted in case that MIDI Channel value is "OFF" for each part.

●Note On

Status	Second	Third
9nH	kkH	vvH

n = MIDI Channel Number: 0H - FH (ch.1 - ch.16)
kk = Note Number: 17H - 57H (23 - 87)
vv = Velocity: 01H - 7FH (1 - 127)

* Not transmitted in case that MIDI Channel value is "OFF" for each part.
* For drum part, note number of transmitted data is as follows:

DRUM A

Pad number	Note number
Pad 1	49 (31H) (C#3)
Pad 2	57 (39H) (A3)
Pad 3	53 (35H) (F3)
Pad 4	51 (33H) (D#3)
Pad 5	50 (32H) (D3)
Pad 6	48 (30H) (C3)
Pad 7	45 (2DH) (A2)
Pad 8	41 (29H) (F2)
Pad 9	37 (25H) (C#2)
Pad 10	39 (27H) (D#2)
Pad 11	56 (38H) (G#3)
Pad 12	44 (2CH) (G#2)
Pad 13	36 (24H) (C2)
Pad 14	38 (26H) (D2)
Pad 15	42 (2AH) (F#2)
Pad 16	46 (2EH) (A#2)

DRUM B

Pad number	Note number
Pad 1	69 (45H) (A4)
Pad 2	75 (4BH) (D#5)
Pad 3	70 (46H) (A#4)
Pad 4	58 (3AH) (A#3)
Pad 5	67 (43H) (G4)
Pad 6	68 (44H) (G#4)
Pad 7	73 (49H) (C#5)
Pad 8	74 (4AH) (D5)
Pad 9	60 (3CH) (C4)
Pad 10	61 (3DH) (C#4)
Pad 11	66 (42H) (F#4)
Pad 12	65 (41H) (F4)
Pad 13	54 (36H) (F#3)
Pad 14	62 (3EH) (D4)
Pad 15	63 (3FH) (D#4)
Pad 16	64 (40H) (E4)

* For bass part, the range of note number is 17H - 57H (23 - 87, B0 - D#6).

●Program Change

Status	Second
CnH	ppH

n = MIDI Channel Number: 0H - FH (ch.1 - ch.16)
pp = Program Number: 00H - 7FH (prog.1 - prog.128)

* MIDI Channel Number is same as drum part channel.
* Not transmitted in case that drum part channel is "OFF".
* In Song Play mode or Pattern Play mode, when pattern changes in play, Program Change message is transmitted and includes program number same as the drum kit number of the pattern.

■System Common Message

Not transmitted in case that Sync Mode value is "MIDI".

●Song Position Pointer

Status	Second	Third
F2H	llH	mmH

mm, ll = Value: 00 00H - 7F 7FH (0 - 16383)

* Transmitted when start measure is selected under stop state of performances in Song Play mode.

●Song select

Status	Second
F3H	ssH

ss = Song Number: 00H - 63H (1 - 100)

* Transmitted when song is selected in Song Play mode.

■System Realtime Message

●Timing Clock

Status
F8H

* Transmission regards Sync Mode setting as follows:

Sync Mode: AUTO
Starting by receiving Start message (FAH) or Continue message (FBH), DR-670 transmits Timing Clock messages (F8H) while performances play.

Sync Mode: INT
Transmitted in any conditions of performances.

Sync Mode: MIDI
Not transmitted.

●Start

Status
FAH

* Not transmitted in case that Sync Mode value is "MIDI."

●Continue

Status
FBH

* Not transmitted in case that Sync Mode value is "MIDI."

●Stop

Status
FCH

* Not transmitted in case that Sync Mode value is "MIDI."

●Active Sensing

Status
FEH

* Transmitted at approximately 200 msec intervals. It is possible to find out MIDI line trouble by checking arrival Active Sensing message for the device connected with MIDI OUT.

■System Exclusive Message

Status	Data Bytes	Status
F0H	iiH, ddH,..., eeH	F7H

F0H: Status of System Exclusive Message
ii = ID Number: 41 = Roland
    7E = Universal Non-Real-time Message
dd,..., ee = data: 00H - 7FH (0 - 127)
F7H: EOX (End of Exclusive)

* DR-670 transmits Exclusive messages including songs, user patterns, user drum kits, and setting data in Utilty mode, MIDI mode, and DPP Assign mode. (Bulk dump)

2. RECOGNIZED RECEIVE DATA

■Channel Voice Message

●Note Off

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

n = MIDI Channel Number:	0H - FH (ch.1 - ch.16)
kk = Note Number:	17H - 57H (23 - 87)
vv = Velocity:	00H - 7FH (0 - 127)

* Velocity value is not recognized.
* Not recognized in case that MIDI Channel value is "OFF" for each part.

●Note On

Status	Second	Third
9nH	kkH	vvH

n = MIDI Channel Number:	0H - FH (ch.1 - ch.16)
kk = Note Number:	17H - 57H (23 - 87)
vv = Velocity:	01H - 7FH (1 - 127)

* Not recognized in case that MIDI Channel value is "OFF" for each part.
* For drum part, note number of recognized data is as follows:

DRUM A

Pad number	Note number
Pad 1	49 (31H) (C#3)
Pad 2	57 (39H) (A3)
Pad 3	53 (35H) (F3)
Pad 4	51 (33H) (D#3)
Pad 5	50 (32H) (D3)
Pad 6	48 (30H) (C3)
Pad 7	45 (2DH) (A2)
Pad 8	41 (29H) (F2)
Pad 9	37 (25H) (C#2)
Pad 10	39 (27H) (D#2)
Pad 11	56 (38H) (G#3)
Pad 12	44 (2CH) (G#2)
Pad 13	36 (24H) (C2)
Pad 14	38 (26H) (D2)
Pad 15	42 (2AH) (F#2)
Pad 16	46 (2EH) (A#2)

DRUM B

Pad number	Note number
Pad 1	69 (45H) (A4)
Pad 2	75 (4BH) (D#5)
Pad 3	70 (46H) (A#4)
Pad 4	58 (3AH) (A#3)
Pad 5	67 (43H) (G4)
Pad 6	68 (44H) (G#4)
Pad 7	73 (49H) (C#5)
Pad 8	74 (4AH) (D5)
Pad 9	60 (3CH) (C4)
Pad 10	61 (3DH) (C#4)
Pad 11	66 (42H) (F#4)
Pad 12	65 (41H) (F4)
Pad 13	54 (36H) (F#3)
Pad 14	62 (3EH) (D4)
Pad 15	63 (3FH) (D#4)
Pad 16	64 (40H) (E4)

* For bass part, the range of note number is 17H - 57H (23 - 87, B0 - D#6).

●Program Change

Status	Second
CnH	ppH

n = MIDI Channel Number:	0H - FH (ch.1 - ch.16)
pp = Program Number:	00H - 7FH (prog.1 - prog.128)

* MIDI Channel Number is same as drum part channel.
* Not recognized in case that drum part channel is "OFF."
* Recognizing Program Change message, DR-670 switches Drum Kit of the same number as Program Number. Consequently, bass tone changes as the Drum kit including.
* After recognizing a Program Change message, new voices will sound as a switch, but sounding voices will not change then.

■System Common Message

Not recognized in case that Sync Mode value is "INT".

●Song Position Pointer

Status	Second	Third
F2H	llH	mmH

mm, ll = Value:	00 00H - 7F 7FH (0 - 16383)

* Recognized under stop state of performances in Song Play mode or Pattern Play mode, and located the start position to play as a Value.

●Song Select

Status	Second
F3H	ssH

ss = Song Number:	00H - 63H (1 - 100)

* Recognized under stop state of performances in Song Play Mode, and switched song to play.

■System Realtime Message

●Timing Clock

Status
F8H

* Recognition regards Sync Mode setting as follows:

  Sync Mode: AUTO
  Starting by receiving Start message (FAH) or Continue message (FBH), performances are synchronized to Timing Clock message (F8H).

  Sync Mode: INT
  Not recognized.

  Sync Mode: MIDI
  Recognized in any conditions of performances.

●Start

Status
FAH

* Not recognized in case that Sync Mode value is "INT."

●Continue

Status
FBH

* Not recognized in case that Sync Mode value is "INT."

●Stop

Status
FCH

* Not recognized in case that Sync Mode value is "INT."

●Active Sensing

Status
FEH

* Once receiving Active Sensing message, DR-670 begins checking intervals of receiving messages. If an interval is over 500 msec, DR-670 will stop sounding tones temporarily and not check intervals after this.

■System Exclusive Message

Status	Data Bytes	Status
F0H	iiH, ddH,..., eeH	F7H

F0H:	Status of System Exclusive Message
ii = ID Number:	41 = Roland
	7E = Universal Non-Real-time Message
dd,..., ee = data:	00H - 7FH (0 - 127)
F7H:	EOX (End of Exclusive)

* Bulk-dumped data by own or other DR-670 can be recognized as Exclusive messages. (Bulk load)

3. Messages stored in patterns

■Channel Voice Message

●Note Off

Status	Second	Third
9nH	kkH	00H

n = MIDI Channel Number: 0H - FH (ch.1 - ch.16)
kk = Note Number: 23H - 4BH (35 - 75)

●Note On

Status	Second	Third
9nH	kkH	vvH

n = MIDI Channel Number: 0H - FH (ch.1 - ch.16)
kk = Note Number: 23H - 4BH (35 - 75)
vv = Velocity: 01H - 7FH (1 - 127)

* For drum part, note number of stored data is as follows:

DRUM A

Pad number	Note number
Pad 1	49 (31H) (C#3)
Pad 2	57 (39H) (A3)
Pad 3	53 (35H) (F3)
Pad 4	51 (33H) (D#3)
Pad 5	50 (32H) (D3)
Pad 6	48 (30H) (C3)
Pad 7	45 (2DH) (A2)
Pad 8	41 (29H) (F2)
Pad 9	37 (25H) (C#2)
Pad 10	39 (27H) (D#2)
Pad 11	56 (38H) (G#3)
Pad 12	44 (2CH) (G#2)
Pad 13	36 (24H) (C2)
Pad 14	38 (26H) (D2)
Pad 15	42 (2AH) (F#2)
Pad 16	46 (2EH) (A#2)

DRUM B

Pad number	Note number
Pad 1	69 (45H) (A4)
Pad 2	75 (4BH) (D#5)
Pad 3	70 (46H) (A#4)
Pad 4	58 (3AH) (A#3)
Pad 5	67 (43H) (G4)
Pad 6	68 (44H) (G#4)
Pad 7	73 (49H) (C#5)
Pad 8	74 (4AH) (D5)
Pad 9	60 (3CH) (C4)
Pad 10	61 (3DH) (C#4)
Pad 11	66 (42H) (F#4)
Pad 12	65 (41H) (F4)
Pad 13	54 (36H) (F#3)
Pad 14	62 (3EH) (D4)
Pad 15	63 (3FH) (D#4)
Pad 16	64 (40H) (E4)

* For bass part, the range of note number is 23H - 48H (35 - 75, B1 - D#5).

4. Exclusive Communications

■General

DR-670 can do one-way communications to send and receive parameters for songs, user patterns, user drum kits, and other memorized setting data.
Model ID included in the exclusive message should be 00H 41H. The device ID code should be "DEV ID" value in MIDI mode, that is System Exclusive Device ID. Note that the actual value that set in device ID field is smaller by one than the value set as "DEV ID" in MIDI mode.

●Universal Non-Realtime System Exclusive Message

○Identity Request

Status	Data Bytes	Status
F0H	7EH, dev, 06H, 01H	F7H

Byte	Description
F0H	Exclusive Status
7EH	ID Number (Universal Non-Real-time Message)
dev	Device ID (10H - 1FH, 7FH (17 - 32, 128))
06H	Sub ID#1 (General Information)
01H	Sub ID#2 (Identity Request)
F7H	EOX (End of Exclusive)

* Device ID (dev) value is "DEV ID" in Midi mode or 7FH (Broadcast).

* When Identity Request is received, Identity Reply message will be transmitted.

○Identity Reply

Status	Data Bytes	Status
F0H	7EH, dev, 06H, 02H,	F7H
	41H, 41H, 01H, 00H, 00H,	
	00H, 02H, 00H, 00H,	

Byte	Description
F0H	Exclusive Status
7EH	ID Number (Universal Non-Real-time Message)
dev	Device ID (10H - 1FH (17 - 32))
06H	Sub ID#1 (General Information)
02H	Sub ID#2 (Identity Reply)
41H	Manufacturer ID (Roland)
41H, 01H	Device Family Code
00H, 00H	Device Family Number Code
00H, 02H, 00H, 00H	Software Revision Level
F7H	EOX (End of Exclusive)

* Transmitted Identity Reply message by the unique device ID when the device has received the Identity Request message in the Broadcast(Device ID: 7FH).

●Data Transmission

○Request data RQ1   11H

Byte	Description
F0H	Exclusive status
41H	Manufacturer ID (Roland)
dev	Device ID (10H - 1FH)
00H	Model ID (DR-670) MSB
41H	Model ID (DR-670) LSB
11H	Command ID (RQ1)
aaH	Address MSB
bbH	Address
ccH	Address
ddH	Address
eeH	Address LSB
ssH	Size MSB
ttH	Size
uuH	Size
vvH	Size
wwH	Size LSB
sum	Checksum
F7H	EOX (End of Exclusive)

○Data set   DT1   12H

Byte	Description
F0H	Exclusive status
41H	Manufacturer ID (Roland)
dev	Device ID (10H - 1FH)
00H	Model ID (DR-670) MSB
41H	Model ID (DR-670) LSB
12H	Command ID (DT1)
aaH	Address MSB
bbH	Address
ccH	Address
ddH	Address
eeH	Address LSB
ffH	Data
:	:
ggH	Data
sum	Checksum
F7H	EOX (End of Exclusive)

■Transmission

DR-670 transmits Exclusive message when executing MIDI Bulk dump at "TX BULK" screen in MIDI mode.

■Receive

DR-670 receives Exclusive message only at "RX BULK" screen in MIDI mode.

5. Parameter Address Map

Address value shows in 7-bit hexadecimal.

```
+----------+-----------+-----------+-----------+-----------+-----------+
| Address  |    MSB    |           |           |           |    LSB    |
+----------+-----------+-----------+-----------+-----------+-----------+
| Binary   | 0aaa aaaa | 0bbb bbbb | 0ccc cccc | 0ddd dddd | 0eee eeee |
| 7 bit hex.|    AA    |    BB     |    CC     |    DD     |    EE     |
+----------+-----------+-----------+-----------+-----------+-----------+
```

■Parameter Address

Start Address	Description
10 00 00 00 00	Song data (1 - 100)
20 00 00 00 00	User Pattern data (201 - 400)
30 00 00 00 00	User Drum Kit data (65 - 128)
40 00 00 00 00	Utility mode, MIDI mode and DPP assign settings data
70 00 00 00 00	Bulk transmission control commands

* Address values in messages of data request should be as above. Request size values are free.

6. Supplementary material

●Decimal/Hexadecimal table ("H" follows hexadecimal value)

MIDI uses 7-bit hexadecimal values to indicate data values and the address and size of exclusive messages. The following table shows the correspondence between decimal and hexadecimal 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 expressions such as used for MIDI channel, Program Change, and Device ID will be the value 1 greater than the decimal value given in the above table.
* Since each MIDI byte carries seven significant data bits, each byte can express a maximum of 128 different values. Data for which higher resolution is required must be transmitted using two or more bytes. For example data indicated as a two-byte value of aa bbH would have a value of aa x 128 + bb.

<Example1>

What is the decimal equivalent of 5AH?
From the above table, 5AH = 90.

<Example2>

What is the decimal equivalent of the 7-bit hexadecimal values 12 34H?
From the above table, 12H = 18 and 34H = 52
Thus, 18 x 128 + 52 = 2356

○**Examples of actual MIDI messages**

<Example> C9 49

CnH is the Program Change status and n is the MIDI channel number. Since 9H = 9 and 49H = 73, it is a Program Change message for MIDI CH = 10 and Program number = 74.

○**Examples of exclusive messages and calculating the checksum**

Roland exclusive messages (RQ1, DT1) are transmitted with a checksum at the end of the data (before F7H) to check that the data was received correctly. The value of the checksum is determined by the address and data (or size) of the exclusive message.

○**How to calculate the checksum**

The checksum consists of a value whose lower seven bits are zero when the address, size and checksum itself are added.
The following formula shows how to calculate the checksum when the exclusive message to be transmitted has an address for aa bb cc ddH, and data or size for ee ffH.

aa + bb + cc + dd + ee + ff = total
total ∕ 128 = quotient ... remainder
128 - remainder = checksum

Checksum is zero if the remainder is zero.

<Example> Request to transfer the drum kits data

See the Parameter Address Map address : 30 00 00 00 00H
size : can be any values (now using 00 00 00 00 00H)

```
F0  41  10  00 41  11   30 00 00 00 00   00 00 00 00 00   ??         F7
(1) (2) (3) (4)    (5)   address         size            checksum   (6)
```

(1) Exclusive status
(2) ID number (Roland)
(3) Device ID (17)
(4) Model ID (DR-670)
(5) Command ID (RQ1)
(6) End of Exclusive

Next, we calculate the checksum.

30H + 00H + 00H + 00H + 00H + 00H + 00H + 00H + 00H + 00H = 48 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 = 48 (sum)

48 (total) ∕ 128 = 0 (quotient) ... 48 (remainder)
checksum = 128 - 48 (remainder) = 80 = 50H

This means that the message transmitted will be
F0 41 10 00 41 11 30 00 00 00 00 00 00 00 00 00 50 F7.