

CTK-3500

MIDI Implementation

CASIO COMPUTER CO., LTD.

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Part I

MIDI Message Overview

1 Product Configuration as a MIDI Device

As a MIDI device, this Instrument consists of the Performance Controller Section and Sound Generator Section described below. Each of these sections can send and receive specific MIDI Messages in accordance with its function.

1.1 Performance Controller Section

The Performance Controller Section performs keyboard play and controller operations, and generates performance messages in accordance with auto play, etc. Basically, generated performance messages are sent to external destinations while also being transmitted to the Sound Generator Section. The channel number of the sent channel message is in accordance with the Instrument's instrument part number.

MIDI Output Performance Information The following describes the performance information that is output and is not output as MIDI signals.

- Output performance
 - Keyboard play and controller operations by the musician
 - Auto accompaniment
- Non-output performance
 - Demo Songs
 - Song playback
 - Lesson function
 - Dance Music playback

1.2 Sound Generator Section

The Sound Generator Section mainly performs receive of performance information and sound source setting information. It consists of a common part that does not depend on the channel and a musical instrument part that is independent of each channel.

1.2.1 Sound Generator Common Block

The common block consists of system effects, mixer master control, etc. A number of the parameters of these items can be controlled by universal system exclusive messages.

1.2.2 Instrument Part Block

The instrument part section consists of a total of 32 instrument parts, divided into two groups, named Group A and Group B of 16 instruments each. Each part can perform operations and setting changes using channel messages. Only Group B can be controlled by external channel messages.

As shown in the following table, there is a fixed relationship between channel message receive channel numbers and instrument parts.

Number	Name	Channel	Assigned Function
00	A01	01	Keyboard
01	A02	02	-
02	A03	03	-
03	A04	04	-
04	A05	05	-
05	A06	06	Guide Sound
06	A07	07	Guide Voice
07	A08	08	Metronome
08	A09	09	Auto Accompaniment (Percussion)
09	A10	10	Auto Accompaniment (Drum)
10	A11	11	Auto Accompaniment (Bass)
11	A12	12	Auto Accompaniment (Chord 1)
12	A13	13	Auto Accompaniment (Chord 2)
13	A14	14	Auto Accompaniment (Chord 3)
14	A15	15	Auto Accompaniment (Chord 4)
15	A16	16	Auto Accompaniment (Chord 5)
16	B01	01	MIDI/Auto Performance Functions
17	B02	02	MIDI/Auto Performance Functions
18	B03	03	MIDI/Auto Performance Functions
19	B04	04	MIDI/Auto Performance Functions
20	B05	05	MIDI/Auto Performance Functions
21	B06	06	MIDI/Auto Performance Functions
22	B07	07	MIDI/Auto Performance Functions
23	B08	08	MIDI/Auto Performance Functions
24	B09	09	MIDI/Auto Performance Functions
25	B10	10	MIDI/Auto Performance Functions
26	B11	11	MIDI/Auto Performance Functions
27	B12	12	MIDI/Auto Performance Functions
28	B13	13	MIDI/Auto Performance Functions
29	B14	14	MIDI/Auto Performance Functions
30	B15	15	MIDI/Auto Performance Functions
31	B16	16	MIDI/Auto Performance Functions

2 Timbre Type Specific Operation

The sound source operation performed for a sound generator instrument receive message may depend on the value of the Timbre Type (see “About the Timbre Type” in “10 Program Change”) of each part’s operation mode. For details, see the explanation for each message.

3 Conditions that Disable Message Send and Receive

All MIDI message send and receive is disabled during auto play by the Instrument.

Part II

Channel Message

4 Receive Channel

The channel number of the channel message received by each part is shown in the table under “1.2.2 Instrument Part Block”.

5 Send Channel

Basically, the MIDI channel of the channel message sent when the Instrument is played coincides with the MIDI channel of the part being played. Note, however, that the MIDI channel of the performance information that corresponds to the keyboard main part depends on the Keyboard Channel setting value.

6 Note Off

Message Format: 8nH kkH vvH
9nH kkH 00H(receive only)

n: MIDI Channel Number
kk: Key Number
vv: Velocity(Send:40H, Receive:Ignored)

Send Sent when the keyboard is played and when play is performed using Auto Accompaniment.

Receive Receipt stops a note being sounded by a note on message.

7 Note On

Message Format: 9nH kkH vvH

n: MIDI Channel Number
kk: Key Number
vv: Velocity

Send Sent when the keyboard is played and when play is performed using Auto Accompaniment.

Receive Receipt sounds a note of the corresponding instrument part.

8 Control Change

Message Format: BnH ccH vvH

n: MIDI Channel Number
cc: Control Number
vv: Value

Send Sent when the Instrument's pedal is operated or when Instrument settings are changed.

Receive Receipt changes the pedal and other performance conditions, and Instrument settings.

8.1 Bank Select (00H,20H)

Message Format: BnH 00H mmH (MSB)
BnH 20H 11H (LSB)

n: MIDI Channel Number
mm: MSB Value(Note1)
11: LSB Value(Send:00H, Receive:Ignored)

Note1 : For details about the relationship between the MSB value and the tone, see the Tone List that comes with the Instrument.

Send Sent when a tone is selected.

Receive Receipt causes a change in the tone bank number stored in Instrument memory, but the tone is not actually changed until a Program Change message is received. For details, see "10 Program Change".

8.2 Modulation (01H)

Message Format: BnH 01H vvH

n: MIDI Channel Number
vv: Value

Receive Receipt adds, to the tone being sounded, modulation of a depth specified by the value. In the case of a tone that already has modulation applied, receipt of this message increases the modulation depth. The modulation effect differs according to the tone being used.

8.3 Portamento Time (05H)

Message Format: BnH 05H vvH

n: MIDI Channel Number
vv: Value

Receive Receipt changes the portamento application time.

8.4 Data Entry (06H,26H)

Message Format: BnH 06H mmH (MSB)
BnH 26H 11H (LSB)

n: MIDI Channel Number
mm: MSB Value
11: LSB Value

Send Sent when there is a change to the parameter assigned to RPN. This Instrument does not have a parameter that corresponds to NRPN.

Receive Receipt changes the parameter assigned to RPN. This Instrument does not have a parameter that corresponds to NRPN.

8.5 Volume (07H)

Message Format: BnH 07H vvH

n: MIDI Channel Number
vv: Value

Send Sent when auto accompaniment is used.

Receive Receipt changes the volume of the corresponding part.

8.6 Pan (0AH)

Message Format: BnH 0AH vvH

n: MIDI Channel Number
vv: Value(Note1)

Note1 : For information about the relationship between setting values and send/receive values, see “18.3 Pan Setting Value Table” in “IV Setting Values and Send/Receive Values”.

Send Sent when auto accompaniment is used.

Receive Receipt changes the pan of the corresponding part.

8.7 Expression (0BH)

Message Format: BnH 0BH vvH

n: MIDI Channel Number
vv: Value

Receive Receipt changes the Expression value.

8.8 Hold1 (40H)

Message Format: BnH 40H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Send Sent when a pedal that has a sustain (damper) function is operated.

Receive Receipt performs an operation equivalent to a sustain pedal operation.

Timbre Type Specific Operation This operation differs in accordance with the Timbre Type (see “About the Timbre Type” in “10 Program Change”) setting.

- Timbre Type: Melody
Sustain off/on control is performed in accordance with the value of the received message.
- Timbre Type: Drum
The received message does not affect sound source operation.

8.9 Portamento On/Off (41H)

Message Format: BnH 41H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Receive Receipt changes the portamento on/off setting.

8.10 Sostenuto (42H)

Message Format: BnH 42H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Send Sent when a pedal that has a sostenuto function is operated.

Receive Receipt performs an operation equivalent to a sostenuto pedal operation.

8.11 Soft (43H)

Message Format: BnH 43H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Send Sent when a pedal that has a soft function is operated.

Receive Receipt performs an operation equivalent to a soft pedal operation.

8.12 Filter Resonance (47H)

Message Format: BnH 47H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.2 -64 - 0 - +63 Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Receive Receipt changes the Resonance strength.

8.13 Release Time (48H)

Message Format: BnH 48H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.2 -64 - 0 - +63 Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Receive Receipt makes a relative change in the time it takes for a note to decay to zero after a key is released.

8.14 Attack Time (49H)

Message Format: BnH 49H vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.2 -64 - 0 - +63 Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Receive Receipt makes a relative change in the time it takes for a note to rise to its maximum level.

8.15 Filter Cutoff (4AH)

Message Format: BnH 4AH vvH

n: MIDI Channel Number
vv: Value (Note1)

Note1 : For information about the relationship between setting values and send/receive values, see the “18.2 -64 - 0 - +63 Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Receive Receipt changes the state of applying cutoff filter.

8.16 Portamento Control (54H)

Message Format: BnH 54H vvH

n: MIDI Channel Number
vv: Source Key Number

Receive Receipt of this message first stores the Source Note Number for the next note. When the next Note On is received, the portamento effect is applied to the note using this Source Note Number as the pitch start point and the Note On event key number as the end point. If there already is a note being sounded by Source Note Number at this time, the new note on is not performed and the portamento effect is applied to the pitch of the note being sounded. That is to say that legato play is performed.

8.17 Reverb Send (5BH)

Message Format: BnH 5BH vvH

n: MIDI Channel Number
vv: Value

Send Sent when auto accompaniment is used.

Receive Receipt changes the reverb send of the corresponding part.

8.18 RPN (64H,65H)

Message Format: BnH 64H 11H (LSB)
BnH 65H mmH (MSB)

n: MIDI Channel Number
11: LSB Value
mm: MSB Value

8.18.1 Pitch Bend Sensitivity

Message Format: BnH 64H 00H
BnH 65H 00H
BnH 06H mmH
BnH 26H 11H

n: MIDI Channel Number
mm: MSB Value(00H - 0CH)
11: LSB Value(Send:00H, Receive:Ignored)

Send Sent when Bend Range is changed.

Receive Receipt changes Bend Range.

8.18.2 Fine Tune

Message Format: BnH 64H 01H
 BnH 65H 00H
 BnH 06H mmH
 BnH 26H 11H

n: MIDI Channel Number
mm: MSB Value
ll: LSB Value

Receive Receipt changes the fine tune of the corresponding part.

8.18.3 Coarse Tune

Message Format: BnH 64H 02H
 BnH 65H 00H
 BnH 06H mmH
 BnH 26H 11H

n: MIDI Channel Number
mm: MSB Value
ll: LSB Value

Receive Receipt changes the coarse tune of the corresponding part. Does not affect sound source operation when the Timbre Type (see “About the Timbre Type” in “10 Program Change”) is Drum.

8.18.4 Null

Message Format: BnH 64H 7FH
 BnH 65H 7FH

n: MIDI Channel Number

Send Sent when an RPN message send operation is performed.

Receive Receipt de-selects RPN.

9 Mode Message

9.1 All Sound Off (78H)

Message Format: BnH 78H 00H

n: MIDI Channel Number

Receive Receipt stops all voices that are sounding.

9.2 Reset All Controllers (79H)

Message Format: BnH 79H 00H

n: MIDI Channel Number

Send Sent when MIDI send related settings are changed.

Receive Receipt initializes each performance controller.

9.3 All Notes Off (7BH)

Message Format: BnH 7BH 00H

n: MIDI Channel Number

Send Sent when MIDI send related settings are changed, or when auto play is stopped, etc.

Receive Receipt releases (key release) all voices that are sounding.

9.4 Omni Off (7CH)

Message Format: BnH 7CH 00H

n: MIDI Channel Number

Receive Receipt performs the same operation as when All Notes Off is received.

9.5 Omni On (7DH)

Message Format: BnH 7DH 00H

n: MIDI Channel Number

Receive Receipt performs the same operation as when All Notes Off is received.

9.6 Mono (7EH)

Message Format: BnH 7EH 00H

n: MIDI Channel Number

Receive Receipt performs the same operation as when All Sound Off is received.

9.7 Poly (7FH)

Message Format: BnH 7FH 00H

n: MIDI Channel Number

Receive Receipt performs the same operation as when All Sound Off is received.

10 Program Change

Message Format: CnH ppH

n: MIDI Channel Number
pp: Program Number (Note1)

Note1 : For details about the relationship between the program number and the tone, see the Tone List that comes with the Instrument.

Send Sent when a tone is selected.

Receive Receipt changes the tone of the corresponding part. The selected tone is determined by the program value of this message and the Bank Select message value received prior to this message. Also note that receipt of this message also may change the Timbre Type that corresponds to the selected tone. For more information, see “About the Timbre Type” below.

About the Timbre Type Tones that are selected by each Instrument part have an attribute that depends on the sound source operation type. This attribute is called the “timbre type,” which is one of the types described below.

- Melody

This timbre type optimizes for normal melody tones.

- Drum

This setting optimizes for drum sounds. The damper pedal does not function. The Hold1, Channel Coarse Tune, and Master Coarse Tune messages are ignored if they are received.

11 Channel After Touch

Message Format: DnH vvH

n: MIDI Channel Number
vv: Value

Receive Receipt adds, to the tone being sounded, modulation of a depth specified by the value. In the case of a tone that already has modulation applied, receipt of this message increases the modulation depth. The modulation effect differs according to the tone being used.

12 Pitch Bend

Message Format: EnH llH mmH

n: MIDI Channel Number
ll: Value LSB
mm: Value MSB

Send Sent when the bender is operated.

Receive Receipt changes the pitch of the currently sounding note. The range of the pitch change depends on the Bend Range value setting.

Part III

System Message

13 Timing Clock

Message Format: F8H

Send Sent when auto accompaniment is used.

14 Start

Message Format: FAH

Send Sent when auto accompaniment is used.

15 Stop

Message Format: FCH

Send Sent when auto accompaniment is used.

16 Active Sensing

Message Format: FEH

Receive Once this message is received, the Active Sensing mode is entered. If no MIDI message is received for a specified amount of time, voices being sounded by this Instrument's sound source are released, the controller is reset, and the Active Sensing mode is exited.

17 System Exclusive Message

Message Format: F0H...F7H

The Instrument sends and receives universal system exclusive messages.

17.1 Universal Real Time System Exclusive Message

Message Format: F0H 7FH...F7H

17.1.1 Master Volume

Message Format: F0H 7FH 7FH 04H 01H 11H mmH F7H

11: LSB Value(Send:00H, Receive:Ignored)

mm: MSB Value

Receive Receipt changes the Master Volume.

17.1.2 Master Fine Tuning

Message Format: FOH 7FH 7FH 04H 03H 11H mmH F7H

11: LSB Value(Note1)

mm: MSB Value(Note1)

Note1 : For information about the relationship between setting values and send/receive values, see “18.4 Fine Tune Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Send This message is sent when the tuning setting is changed.

Receive Receipt changes the tuning setting.

17.1.3 Master Coarse Tuning

Message Format: FOH 7FH 7FH 04H 04H 11H mmH F7H

11: LSB Value(Send:00H, Receive:Ignored)

mm: MSB Value

Send Sent when Transpose is changed.

Receive Receipt changes the Transpose parameter. Does not affect sound source operation when the Timbre Type (see “About the Timbre Type” in “10 Program Change”) is Drum.

17.1.4 Reverb Type

Message Format: FOH 7FH 7FH 04H 05H 01H 01H 01H 01H 01H 00H vvH F7H

vv: Value(Note1)

Note1 : For information about the relationship between setting values and send/receive values, see “18.5 Reverb Type Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Send This message is sent when the reverb type is changed. The Instrument treats a hall simulator as a reverb.

Receive Receipt changes the reverb type.

17.1.5 GM System On

Message Format: FOH 7EH 7FH 09H 01H F7H

Receive Receipt puts the sound source into a GM sound source mode.

17.1.6 GM System Off

Message Format: FOH 7EH 7FH 09H 02H F7H

Receive Receipt changes the sound source setting to the Instrument presetting.

Part IV

Setting Values and Send/ Receive Values

18 Setting Value Tables

18.1 Off/On Setting Value Table

Transmit Value	Receive Value	Parameter
00H	00H - 3FH	Off
7FH	40H - 7FH	On

18.2 -64 - 0 - +63 Setting Value Table

Transmit Value	Receive Value	Parameter
00H	00H	-64
:	:	:
40H	40H	0
:	:	:
7FH	7FH	+63

18.3 Pan Setting Value Table

Transmit Value	Receive Value	Parameter
00H	00H	Left
:	:	:
40H	40H	Center
:	:	:
7FH	7FH	Right

18.4 Fine Tune Setting Value Table

Transmit Value	Receive Value	Parameter
(LSB, MSB)	(LSB, MSB) - (LSB, MSB)	
(43H, 00H)	(00H, 00H) - (5FH, 00H)	415.5 Hz
(65H, 00H)	(60H, 00H) - (7FH, 00H)	415.6 Hz
(07H, 01H)	(00H, 01H) - (1FH, 01H)	415.7 Hz
(29H, 01H)	(20H, 01H) - (3FH, 01H)	415.8 Hz
:	:	:
(40H, 3FH)	(30H, 3FH) - (4FH, 3FH)	439.8 Hz
(60H, 3FH)	(50H, 3FH) - (6FH, 3FH)	439.9 Hz
(00H, 40H)	(70H, 3FH) - (1FH, 40H)	440.0 Hz
(20H, 40H)	(20H, 40H) - (3FH, 40H)	440.1 Hz
(40H, 40H)	(40H, 40H) - (5FH, 40H)	440.2 Hz
:	:	:
(54H, 7EH)	(50H, 7EH) - (6FH, 7EH)	465.6 Hz
(73H, 7EH)	(70H, 7EH) - (0FH, 7FH)	465.7 Hz
(11H, 7FH)	(10H, 7FH) - (2FH, 7FH)	465.8 Hz
(30H, 7FH)	(30H, 7FH) - (7FH, 7FH)	465.9 Hz

18.5 Reverb Type Setting Value Table

Transmit Value	Receive Value	Parameter
00H	00H	Off
01H	01H	Reverb 1
02H	02H	Reverb 2
03H	03H	Reverb 3
04H	04H	Reverb 4
05H	05H	Reverb 5
06H	06H	Reverb 6
07H	07H	Reverb 7
08H	08H	Reverb 8
09H	09H	Reverb 9
0AH	0AH	Reverb 10
0BH	0BH	Virtual Hall

Part V

MIDI Implementation Notation

19 Value Notation

19.1 Hexadecimal Notation

MIDI implementation sometimes requires that data be expressed in hexadecimal format. Hexadecimal values are indicated by the letter “H” after the value. The hexadecimal equivalents of decimal values 10 through 15 are expressed as the letters A through F.

The table below shows the hexadecimal equivalents for decimal values 0 through 127, which are often used in MIDI messages.

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
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

19.2 Binary Notation

When a MIDI implementation data value is expressed in binary, the letter “B” (for “binary”) is affixed at the end of the value. The table below shows the binary equivalents for the decimal values 0 through 127, which are often used for settings.

Decimal	Hexadecimal	Binary
0	00H	00000000B
1	01H	00000001B
2	02H	00000010B
3	03H	00000011B
4	04H	00000100B
5	05H	00000101B
6	06H	00000110B
7	07H	00000111B
8	08H	00001000B
9	09H	00001001B
10	0AH	00001010B
11	0BH	00001011B
12	0CH	00001100B
13	0DH	00001101B
14	0EH	00001110B
15	0FH	00001111B
16	10H	00010000B
:	:	
125	7DH	01111101B
126	7EH	01111110B
127	7FH	01111111B

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