

CT-S100

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
- Non-output performance
 - Demo Songs
 - Song playback
 - Auto accompaniment

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.

| Part Number | Part Name | Channel | Assigned Function |
|-------------|-----------|---------|---------------------------------|
| 00 | A01 | 01 | Keyboard |
| 01 | A02 | 02 | - |
| 02 | A03 | 03 | Tone Selection Sound |
| 03 | A04 | 04 | - |
| 04 | A05 | 05 | - |
| 05 | A06 | 06 | - |
| 06 | A07 | 07 | Operation Tone |
| 07 | A08 | 08 | Metronome/Pre-count |
| 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

The main conditions when MIDI message send and receive are disabled by the Instrument are those described below.

- While the instrument is accessing flash memory.

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 MIDI Out 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)

Transmit Sent when the keyboard is played. The key number changes in accordance with on the MIDI Out Octave Shift function. The velocity changes in accordance with on the MIDI Out Velocity function.

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

Transmit Sent when the keyboard is played. The key number changes in accordance with on the MIDI Out Octave Shift function. The velocity changes in accordance with on the MIDI Out Velocity function.

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

For details about messages, see each section of this manual that covers them.

8.1 Bank Select (00H,20H)

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

n: MIDI Channel Number
mm: MSB Value(Note1)
ll: 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.

Transmit 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

Transmit Sent when there is a change to the parameter assigned to RPN.

Receive Receipt changes the parameter assigned to RPN.

8.5 Volume (07H)

Message Format: BnH 07H vvH

n: MIDI Channel Number
vv: Value

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 “15.3 Pan Setting Value Table” in “IV Setting Values and Send/Receive Values”.

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 of the corresponding part.

8.8 Damper Pedal (Sustain) (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 “15.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

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 “15.1 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 “15.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

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 “15.1 Off/On Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

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

Receive Receipt changes the filter resonance intensity.

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 “15.2 -64 - 0 - +63 Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Transmit Sent when Sustain function of the instrument is operated.

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 “15.2 -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 “15.2 -64 - 0 - +63 Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Receive Receipt changes the filter cut-off frequency.

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 Level (5BH)

Message Format: BnH 5BH vvH

n: MIDI Channel Number
vv: Value

Receive Receipt changes the reverb send of the corresponding part.

8.18 RPN (Registered Parameter Number) LSB/MSB (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)

Receive Receipt changes Bend Range of the corresponding part.

8.18.2 Channel Fine Tuning

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

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

Receive Receipt changes the fine tune of the corresponding part.

8.18.3 Channel Coarse Tuning

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 RPN Null

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

n: MIDI Channel Number

Transmit 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

Transmit Sent when MIDI send related settings are changed.

Receive Receipt stops all voices that are sounding.

9.2 Reset All Controllers (79H)

Message Format: BnH 79H 00H

n: MIDI Channel Number

Transmit 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

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

9.4 Omni Mode Off (All Notes 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 Mode On (All Notes Off) (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 Mode On (Poly Mode Off) (All Notes Off) (7EH)

Message Format: BnH 7EH 00H

n: MIDI Channel Number

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

9.7 Poly Mode On (Mono Mode Off) (All Notes Off) (7FH)

Message Format: BnH 7FH 00H

n: MIDI Channel Number

Receive Receipt performs the same operation as when All Notes 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.

Transmit 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 Damper Pedal (Sustain), Channel Coarse Tune, and Master Coarse Tune messages are ignored if they are received.

11 Channel Pressure (Aftertouch)

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 Change

Message Format: EnH llH mmH

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

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

Part III

System Message

13 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.

14 System Exclusive Message

Message Format: FOH...F7H

The Instrument sends and receives universal system exclusive messages.

14.1 Universal Real Time System Exclusive Message

Message Format: FOH 7FH...F7H

14.1.1 Master Volume

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

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

mm: MSB Value

Receive Receipt changes the Master Volume.

14.1.2 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 "15.4 Fine Tune Setting Value Table" in "IV Setting Values and Send/Receive Values" of this document.

Transmit This message is sent when the Tuning setting is changed.

Receive Receipt changes the Tuning setting.

14.1.3 Master Coarse Tuning

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

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

mm: MSB Value

Transmit 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.

14.1.4 Reverb Type

Message Format: F0H 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 “15.5 Reverb Type Setting Value Table” in “IV Setting Values and Send/Receive Values” of this document.

Transmit Sent when Reverb Type is changed.

Receive Receipt changes the Reverb Type.

14.1.5 GM System On

Message Format: F0H 7EH 7FH 09H 01H F7H

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

14.1.6 GM System Off

Message Format: F0H 7EH 7FH 09H 02H F7H

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

14.1.7 GM2 System On

Message Format: F0H 7EH 7FH 09H 03H F7H

Receive Though the Instrument does not support GM2, receipt of the GM2 System On message has the same result as receipt of the GM System On message.

Part IV

Setting Values and Send/ Receive Values

15 Setting Value Tables

15.1 Off/On Setting Value Table

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

15.2 -64 - 0 - +63 Setting Value Table

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

15.3 Pan Setting Value Table

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

15.4 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 |

15.5 Reverb Type Setting Value Table

| Transmit Value | Receive Value | Parameter |
|----------------|---------------|-----------|
| 00H | 00H | Off |
| 01H | 01H | Room 1 |
| - | 02H | Room 2 |
| - | 03H | Room 3 |
| - | 04H | Room 4 |
| 05H | 05H | Hall 1 |
| 06H | 06H | Hall 2 |
| - | 07H | Hall 3 |
| - | 08H | Hall 4 |
| 09H | 09H | Stadium 1 |
| - | 0AH | Stadium 2 |

Part V

MIDI Implementation Notation

16 Value Notation

16.1 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 |

16.2 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 | 0000000B |
| 1 | 01H | 0000001B |
| 2 | 02H | 0000010B |
| 3 | 03H | 0000011B |
| 4 | 04H | 0000100B |
| 5 | 05H | 0000101B |
| 6 | 06H | 0000110B |
| 7 | 07H | 0000111B |
| 8 | 08H | 0001000B |
| 9 | 09H | 0001001B |
| 10 | 0AH | 0001010B |
| 11 | 0BH | 0001011B |
| 12 | 0CH | 0001100B |
| 13 | 0DH | 0001101B |
| 14 | 0EH | 0001110B |
| 15 | 0FH | 0001111B |
| 16 | 10H | 00010000B |
| : | : | |
| 125 | 7DH | 01111101B |
| 126 | 7EH | 01111110B |
| 127 | 7FH | 01111111B |

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