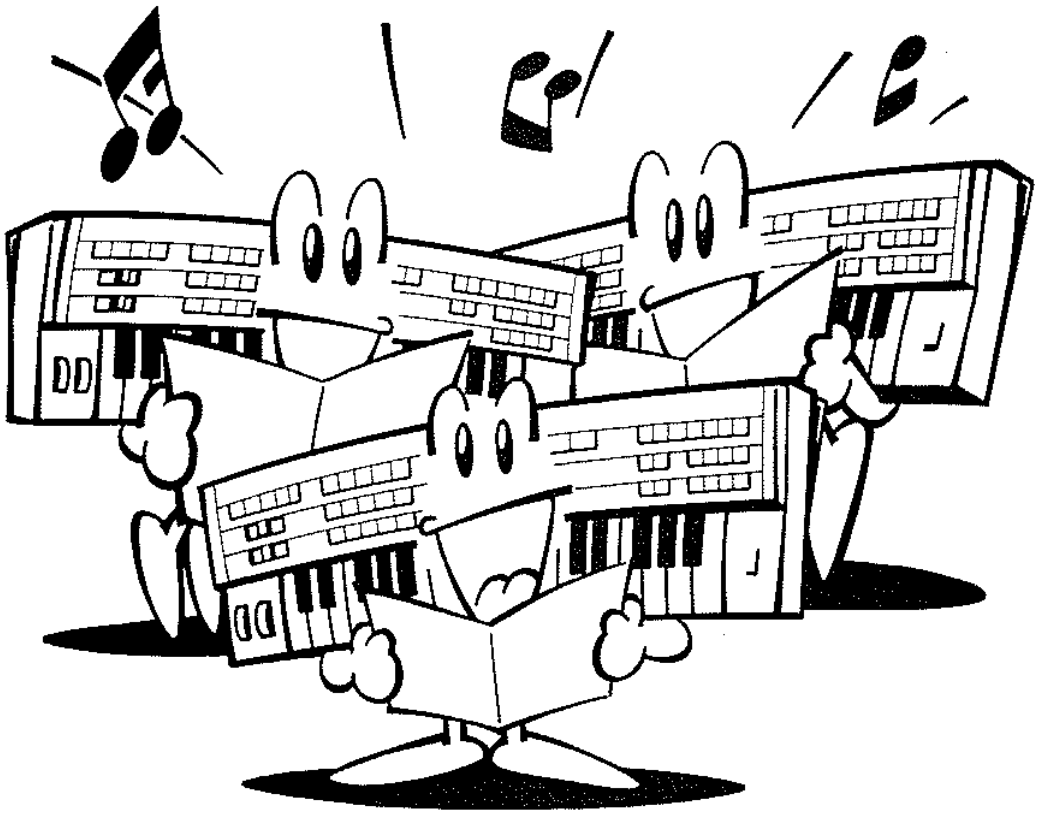
GUIDEBOOK FOR MIDI

NOV.1985



CASIO

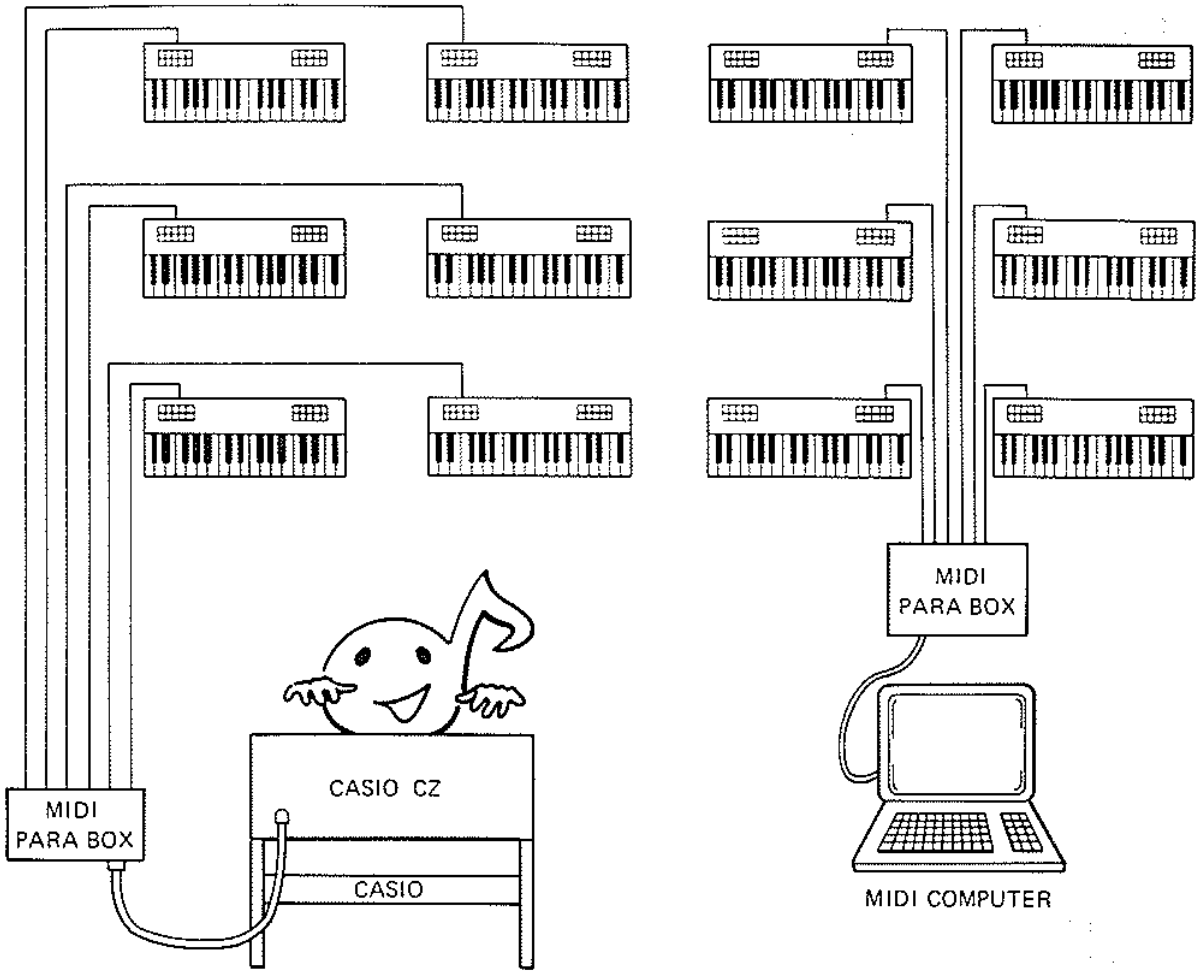
I MIDI FORMAT

1. WHAT IS MIDI?

The MIDI (Musical Instrument Digital Interface) is an international standard for external control of electronic musical instruments.
In other words, musical instruments, rhythm machines, sequencers, etc. are equipped with standardized input and output terminals and the music information which the instruments send and receive via these terminals is made compatible by a certain formating.
This standard enables a musical instrument to connect, synchronize, and sequence (memorize) to other models and even to other brands.

1-1. What is MIDI Capable of Doing?

Connections can be made among keyboards, rhythm machines, sequencers, and MIDI interface equipped computers.



1-2. What Data is Delivered Via MIDI?

(1) Key velocity : striking speed of keys

(2) After touch : key pressure

(3) Note data : pitch and duration

(4) Pitch bend data

(5) Program change

(6) Channel assignment : each keyboard must have a channel number that specifies which keyboard should be played.

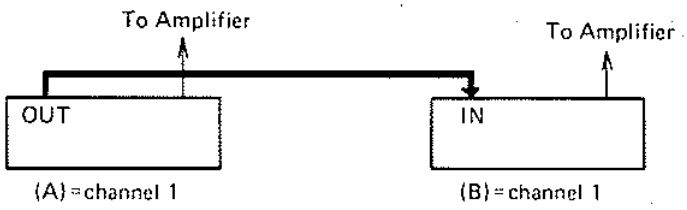
(7) Clock signal for synchronization

(8) Start/Stop signal

(9) Exclusive message : Each brands' unique commands or data.

2. EXAMPLES OF MIDI CONNECTION

2-1. Remote Play

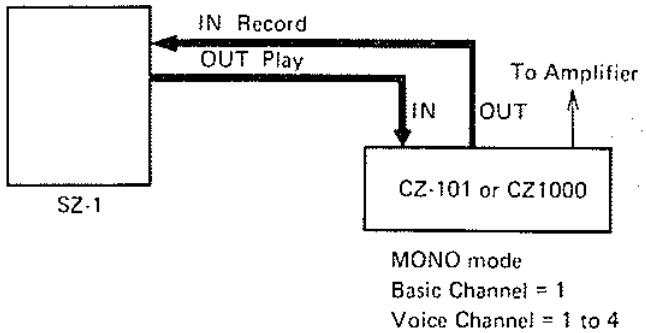


Music played on keyboard (A) is also performed on keyboard (B).

* The same basic channel should be set on both keyboards.

2-2. Play Utilizing Digital Sequencer SZ-1.

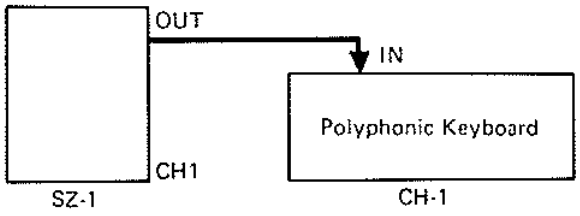
(1) Monophonic 4-note orchestral performance.



Together with a sequencer having minimum of four tracks such as Casio SZ-1, CZ-101 or CZ-1000 synthesizers can play four monophonic tones simultaneously.

* CZ-101 or CZ-1000 should be set in MONO mode, Basic channel 1, and voice channels 1 to 4.
  Recorded musics in tracks 1 to 4 correspond to voice channels 1 to 4 of CZ-101 or CZ-1000.

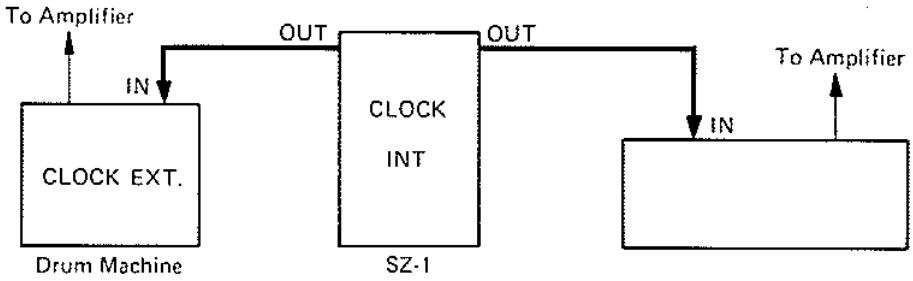
(2) Polyphonic playback



The keyboard plays a polyphonic music recorded in one of the sequencer tracks.

* The sequencer and the keyboard should have the same channel number.

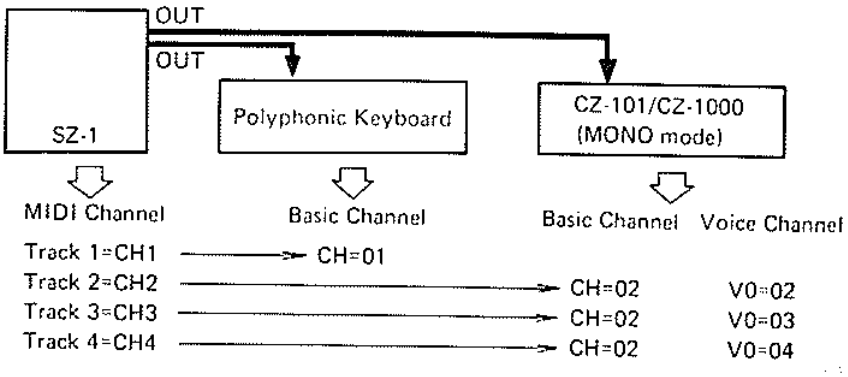
(3) Synchronous playback with a drum machine.



This connection adds a drum machine to connection diagram (1) or (2). Drums start/stop and tempo can be synchronized with keyboard playback.

* In this configulation, the SZ-1 is the master.
  For synchronization, the clock switch of the SZ-1 must be set to INT and the drum machine clock to EXT.

(4) Synchronized playback of a single polyphonic track and three monophonic tracks.

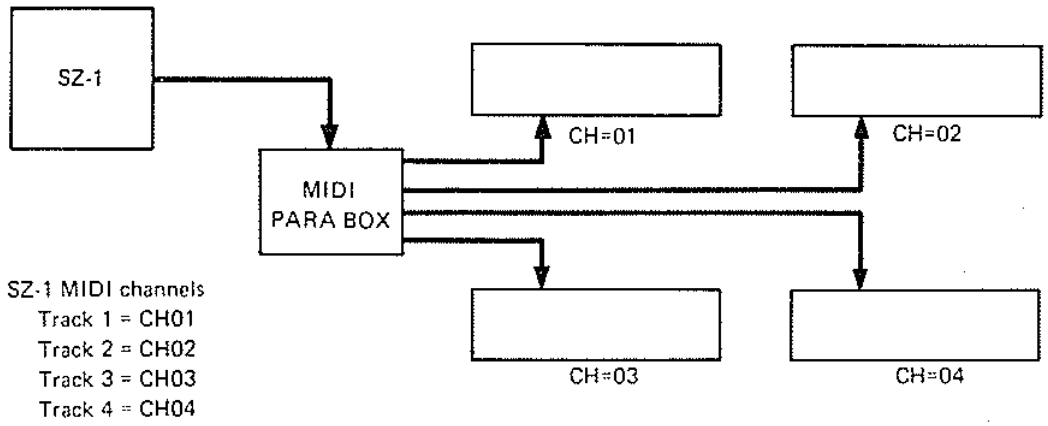


In this configulation, polyphonic music is recorded on sequencer's track 1. In the tracks 2 to 4, monophonic musics in different tones are recorded.

Keyboard A must be set to the POLY mode and basic channel 01.
Keyboard B should be set to the MONO mode, basic channel 02 and voice channels 02 to 04.

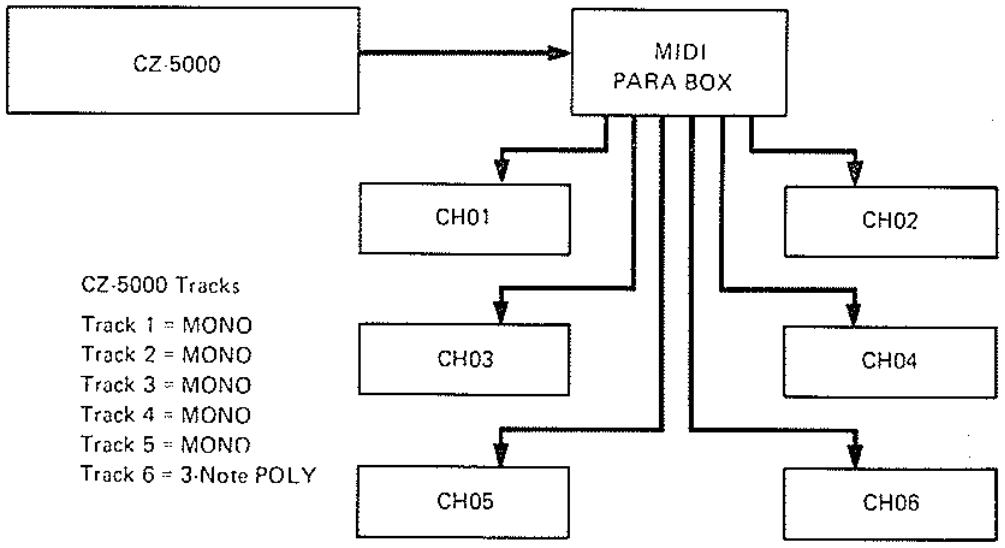
For playback, polyphonic music is executed from keyboard A while three different monophonic tones are played in keyboard B.

(5) Synchronized playback of 4 polyphonic tracks.



Polyphonic voices recorded in each track are played in the keyboard of corresponding channel.

2-3. Using the CZ-5000's Internal Sequencer



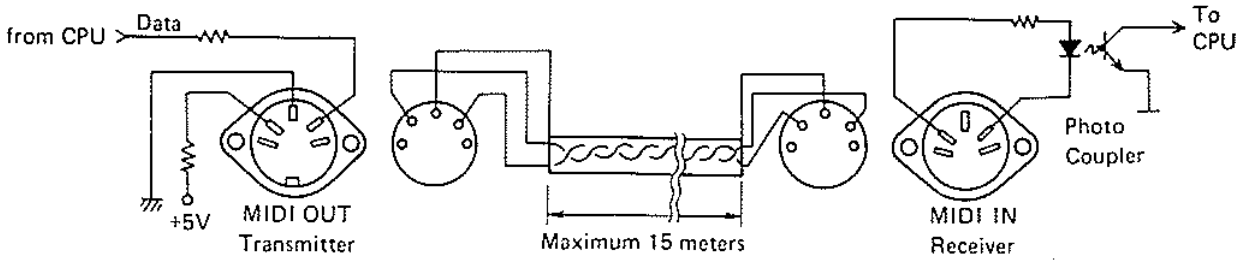
Recorded voices in tracks 1 to 6 are played in the keyboard of the basic channels 01 to 06 respectively.

Note: Only 8 voices can be recorded in CZ-5000 sequencer.

3. MIDI CIRCUITS

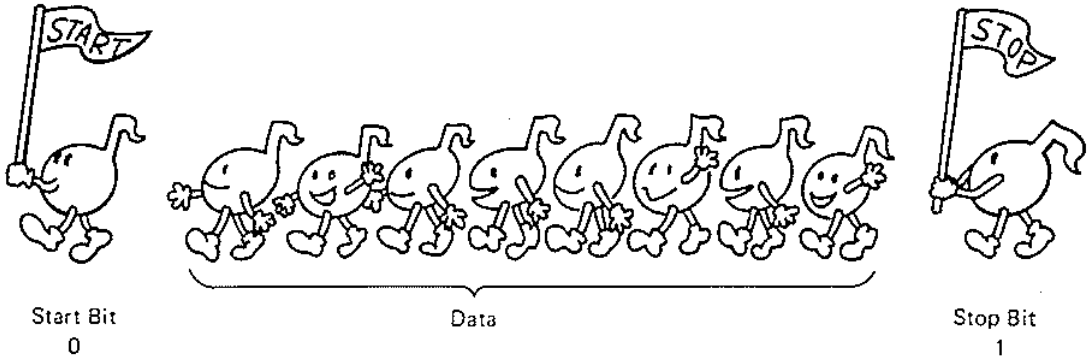
The following figure shows the MIDI connection.

Data from the transmitter's CPU is sent to the receiver's CPU through the MIDI cable at the rate of 31.25K baud (31,250 bits per second).
In the receiver, the photo coupler transforms the "H" or "L" level of the data into the light energy, and then to the voltage level again to insulate against electric noises.



4. MIDI FORMAT

On data item is composed of 8 bits (1 byte) plus the start bit (always "0" = "L") and the stop bit (always "1" = "H").

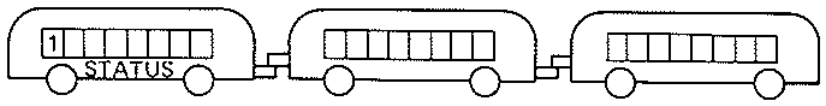


In the following explanations, the start and the stop bits are omitted.

4-1. Channel Voice Message

Channel voice messages carry data which control the voices (tones) and channel number.

One message is composed of 2 or 3 bytes (plus two bits for the start and the stop bits in each byte).

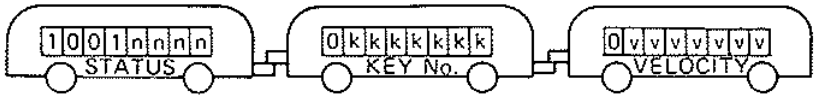


The first byte is called "status byte" as it indicates what data the message carries.
The first bit of the status byte is always 1.
The followings explain the functions of some important messages.

(1) Note ON event

First (Status) Byte	Second Byte	Third Byte
1001nnnn	0kkkkkkk	0vvvvvvv

This message is made of three bytes and carries key number (a pitch to be sounded) and velocity (hitting speed) information.



Status byte 1001nnnn

The first four bit of the status byte 1001 indicates that a pitch should be sounded.
The lower half of the byte determines the channel number as shown below.

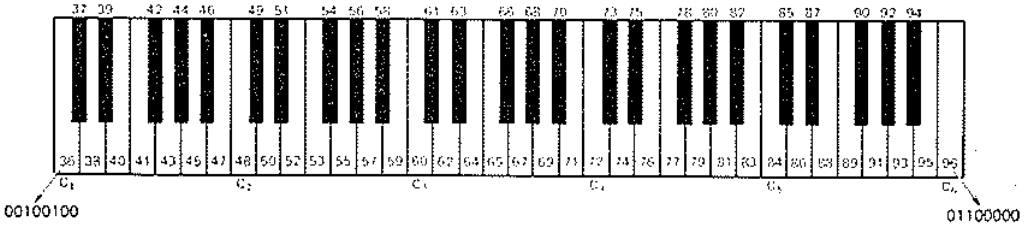
n n n n	Channel No.
0 0 0 0	1
0 0 0 1	2
0 0 1 0	3
0 0 1 1	4
0 1 0 0	5
0 1 0 1	6
0 1 1 0	7
0 1 1 1	8
1 0 0 0	9
1 0 0 1	10
1 0 1 0	11
1 0 1 1	12
1 1 0 0	13
1 1 0 1	14
1 1 1 0	15
1 1 1 1	16

2nd byte 0kkkkkkk

The second byte of the Note ON event message carries a key number data.
Upon receipt of this data, corresponding key of designated channel keyboard sounds.
In order to discriminate from the status byte, the first bit of the succeeding bytes should be 0.
The following figure indicates the relation between the key and 0kkkkkkk, where the numbers of the keys are the decimal number of 0kkkkkkk.

i.e.,

Weight		64	32	16	8	4	2	1
	0	k	k	k	k	k	k	k

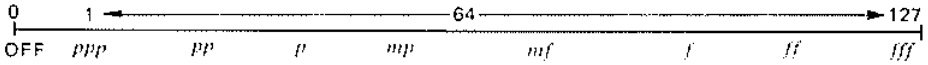


3rd byte 0vvvvvvv

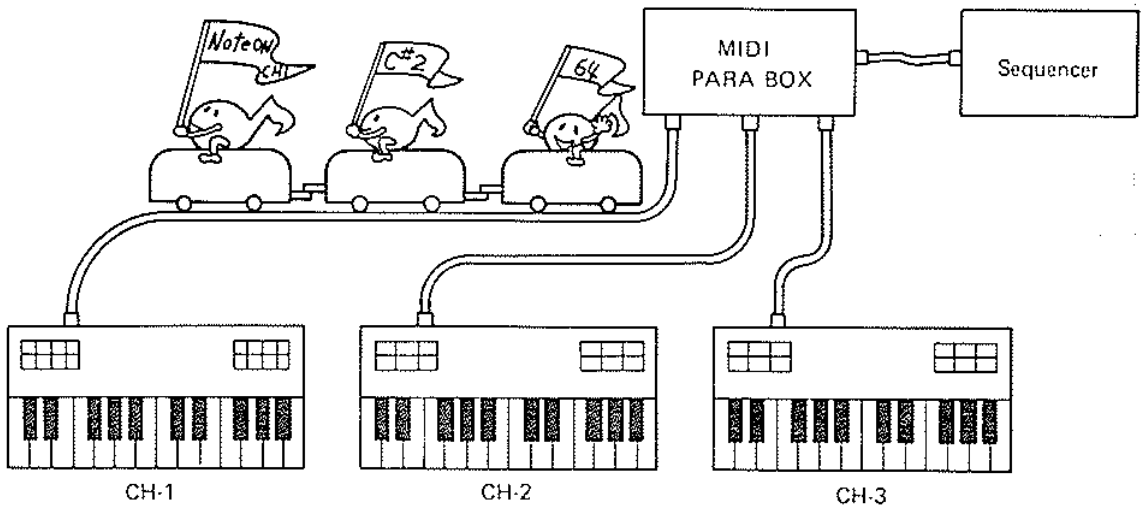
The third byte of the message indicates the key velocity.
The following figure indicates the relation between the loudness and 0vvvvvvv.

Weakest
00000001

Loudest
01111111



For keyboard having no velocity feature such as CZ-101, CZ-1000 and CZ-5000, velocity data is always transmitted and recognized as 64.



Note: 1. When two or more same messages are transmitted, the status bytes from the second message can be omitted.

e.g. To sound C2 and E2 on channel 1

10010001	00110000	01000000	00110100	01000000
Channel Note ON	C2	Velocity 64	E2	Velocity 64

2. Velocity 0 is used as "Note Off".

(2) Control change 1011nnnn 0ccccccc 0vvvvvvv

nnnn : Channel number
ccccccc : Control number
vvvvvvv : Control value

The message conveys the information of switches and VRs of the control panel.

2nd byte 0ccccccc

ccccccc indicates a switch or a VR in the control panel.

3rd byte 0vvvvvvv

vvvvvvv describes the status of the switch or value of the VR.

The following table lists the control change messages of models CZ-101/1000/5000 and CT-6000.

CZ-101/1000

ccccccc	Decimal Number	Switch or VR	vvvvvvv	Status	Transmit	Receive
0000001	1	VIBRATO ON/OFF	0000000	OFF	○	○
			1111111	ON	○	○
0000101	5	PORTAMENTO TIME	0000000 ≀ 1100011	00 ≀ 99	X	○
0000110	6	MASTER TUNE	0000000 ≀ 1111111	0 ≀ 127	X	○
1000001	65	PORTAMENTO ON/OFF	0000000	OFF	○	○
			1111111	ON		

* Transmit and Receive: ○ possible, X impossible

i.e. CZ-101 is able to receive PORTAMENTO TIME data but cannot send it.

For sending VIBRATO ON data to channel 2, the message carries:

1011 0010 00000001 01111111

Control Change | Channel 2 | VIBRATO switch | ON

CZ-5000

ccccccc	Decimal Number	Switch or VR	vvvvvvv	Status	Transmit	Receive
0000001	1	MODULATION Wheel	≀		○	○
0000101	5	PORTAMENTO TIME	0000000 ≀ 1100011	00 ≀ 99	×	○
0000110	6	MASTER TUNE	0000000 ≀ 1111111	0 ≀ 127	×	○
1000000	64	SUSTAIN Pedal	0000000	OFF	○	○
			1111111	ON		
1000001	65	PORTAMENTO ON/OFF	0000000	OFF	○	○
			1111111	ON		

CT-6000

ccccccc	Decimal Number	Switch or VR	vvvvvvv	Status	Transmit	Receive
1000000	64	SUSTAIN Pedal	0000000	OFF	○	○
			1111111	ON		

(4) Program change 1100nnnn 0ppppppp

nnnn : Channel number

ppppppp : Program (tone) number

This message is composed of two bytes and sent when a tone is changed to another. The following table indicates the program numbers of the Casio synthesizers.

CZ-101/1000

ppppppp	Decimal Number	Tone Number	Transmit	Receive
0000000 ≀ 0001111	0 ≀ 15	PRESET TONE 1 ≀ PRESET TONE 16	○	○
0100000 ≀ 0101111	32 ≀ 47	INTERNAL No. 1 ≀ INTERNAL No. 16		
1000000 ≀ 1001111	64 ≀ 79	Cartridge No. 1 ≀ Cartridge No. 16		

CZ-5000

ppppppp	Decimal Number	Tone Number	Transmit	Receive
0000000 〜 0011111	0 〜 31	PRESET A-1 (BRASS ENSEMBLE 1) 〜 PRESET D-8 (TYPHOON SOUND)	○	○
0100000 〜 0111111	32 〜 63	MEMORY BANK A-1 〜 MEMORY BANK D-8	○	○

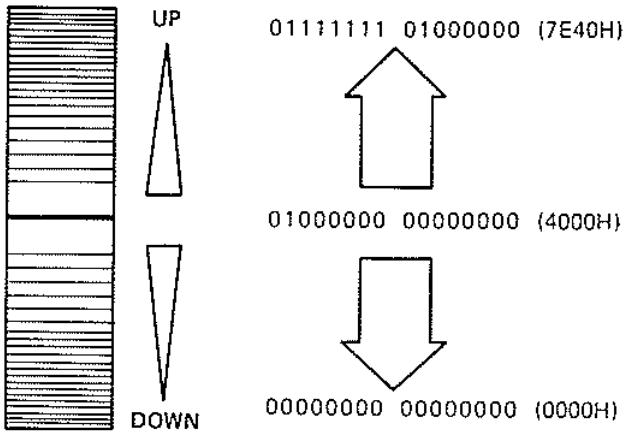
CT-6000 cannot transmit or receive the program change messages.

If a keyboard receives a larger program number than described above, it selects the largest program number.
i.e., if a CZ-5000 receives program change message of Cartridge No. 1 from a CZ-101, the CZ-5000 sets MEMORY BANK D-8.

(5) Pitch Bender Change 1110nnnn 0vvvvvvv 0vvvvvvv

Informations of a pitch bender wheel's position is transmitted by two bytes (14 bits as the first bit of the value bytes are fixed as 0).
The central value – the normal position of the wheel- should be 01000000 00000000.

The lower 6 bits are not used (fixed as 0) in Casio synthesizers as shown below.



(6) Channel Pressure 1101nnnn 0vvvvvvv
(After-Touch)
vvvvvvv : Pressure value

This message conveys the after-touch (key pressure) data of the whole channel.
The following table shows the pressure value of CT-6000

	Transmit	Recognize
Minimum Pressure	00000000	00000000
≀	≀	≀
Maximum Pressure	01111100	01111111

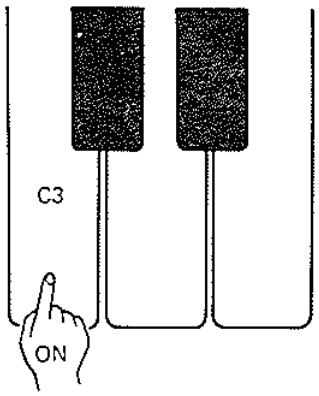
(7) Polyphonic Key Pressure 1010nnnn 0kkkkkkk 0vvvvvvv
(After-Touch)
0kkkkkkk : Key No.
0vvvvvvv : Pressure value

For the keyboards having after-touch key pressure detection feature on each key, the message carries the pressure data for each key.

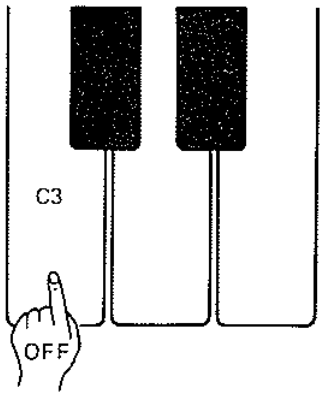
(8) Note OFF Event 1000nnnn 0kkkkkkk 0vvvvvvv
kkkkkkk : Key No.
vvvvvvv : Key velocity

This message informs releasing key and the releasing speed. However, since the releasing velocity is not important and it wastes transmitting time, most keyboards do not utilize the message.
Instead of this message, Note ON Event (velocity 0) is mostly used.

i.e., when hitting and releasing key C3 of channel 01 keyboard.



10010000 00111100 01000000
Note ON, Channel 1, Key No.60 = C3, Velocity = 64



( ) 00111100 00000000
The status can be omitted if it is the same message. Key No.60 = C3, Velocity 0 = Key OFF

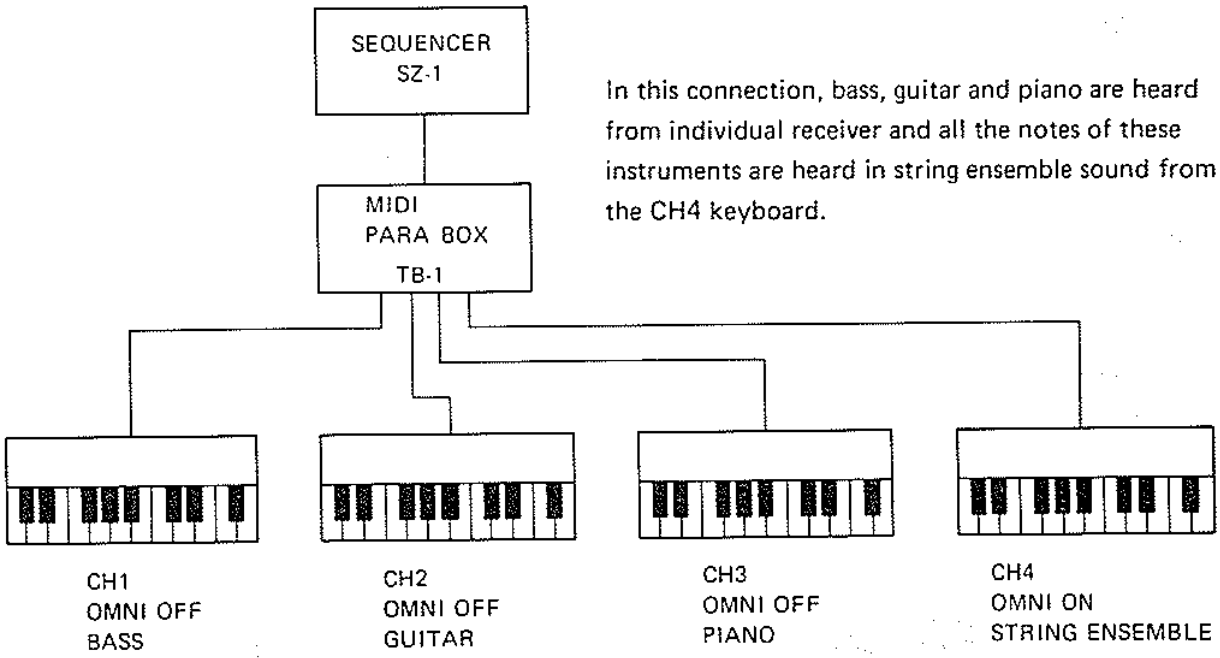
4-2. Channel Mode Messages

The channel mode messages are transmitted by the same status as the control change message 1011, and the discrimination is made whether the second byte is in between 01111010 (7AH) and 01111111 (7FH).

One of the important feature in the channel mode message is OMNI which determines a receiver whether it accepts only the assigned channel data or all the voice data.

OMNI ON . . . . . If a receiver is set on OMNI ON, it accepts all the sounds whatever the assigned channel number is.

OMNI OFF . . . . A receiver set on OMNI OFF accepts only the assigned channel data.



With combinations of OMNI ON/OFF and Polyphonic/Monophonic, for a receiver assigned to basic channel "N", the four possible modes arising from the two mode messages are;

	OMNI ON	OMNI OFF
POLY ON	Mode 1	Mode 3
POLY OFF	Mode 2	Mode 4

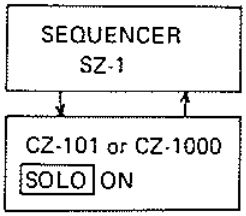
Mode 1 . . . . . OMNI ON POLY ON
Voice messages are received from all Voice Channels and assigned to voices polyphonically.

Mode 2 ..... Voice messages are received from all Voice Channels, and control only one voice, monophonically.

Mode 3 ..... Voice messages are received in Voice Channel N only, and are assigned to voices polyphonically.

Mode 4 ..... Voice messages are received in Voice Channels N through N+M−1, and assigned monophonically to voices 1 through M, respectively.
The number of voices M is specified by the third byte of the Mono Mode Message.

Track 1 . . . SYNTH. BASS
Track 2 . . . VIOLINE
Track 3 . . . PERCUSSION
Track 4 . . . SYNTH. STRINGS



CZ-101 or CZ-1000 is set on Mode 4 when SOLO button is pushed. Under this condition, monophonic 4 voices recorded in each track of the sequencer is playbacked simultaneously from the CZ-101 or CZ-1000.

Basic Channel = 1
Voice Channel 1 : SYNTH. BASS.
Voice Channel 2 : VIOLIN
Voice Channel 3 : PERCUSSION
Voice Channel 4 : SYNTH. STRINGS

Channel Mode Messages have the following formats:

(1) OMNI ON	1011nnnn	01111101	00000000	
	(Bn H)	(7DH)	(00H)	
	nnnn : Basic channel			
(2) OMNI OFF	1011nnnn	01111100	00000000	
	(Bn H)	(7CH)	(00H)	
(3) POLY ON	1011nnnn	01111111	00000000	
	(Bn H)	(7FH)	(00H)	
(4) MONO ON	1011nnnn	01111110	00000000	①
	(Bn H)	(7EH)	(00H)	
			0vvvvvvv	②

① When the third byte is 00H, the keyboard produces only a single monophonic voice.

② vvvvvvv : Number of Voice Channel
The keyboard is able to produce several monophonic voices simultaneously.
i.e., when the third byte is 00000100, then the keyboard can play four different monophonic voices simultaneously.

Other than the above modes, Channel Mode Message includes the local control and all note off messages.

(5) Local Control Off 1011mmmm 01111010 00000000
(Bn H) (7AH) (00H)

On this mode, a receiver cannot accept data from the keyboard but only MIDI data.

(6) Local Control On 1011nnnn 01111010 01111111
(Bn H) (7AH) (7FH)

On this message, a receiver is able to produce sounds either from the keyboard and MIDI data.

(7) All Note Off 1011nnnn 01111011 00000000
(Bn H) (7BH) (00H)

Upon receipt of this message, the keyboard stops producing sounds.

Model	Channel Mode	Transmitted	Recognized	Remarks
CT-6000	Default*	Mode 1 (Mode 3)	Mode 1 (Mode 3)	
	Messages	X	X	
	Local ON/OFF	X	○	
	All Notes OFF	X	X	
CZ-101 CZ-1000	Default	Mode 3	Mode 3	OMNI ON/OFF ignored
	Messages	X	POLY, MONO Mode 1 → 3 Mode 2 → 4	
	Local ON/OFF	X	○	
	All Notes OFF	X	X	
CZ-5000	Default	Mode 3	Mode 3	Changing to Mode 4 is possible from the control panel switch
	Messages	X	X	
	Local ON/OFF	X	○	
	All Notes OFF	X	X	
SZ-1	Default	Mode 3		
	Message	X	X	
	Local ON/OFF	X	X	
	All Notes OFF	X	X	

* Default: Status at Power-ON

4-3. System Common Message

(1) Song Position Pointer..... 11110010 0ℓℓℓℓℓℓℓ
(F0H) 0hhhhhhh

ℓℓℓℓℓℓℓ : Least significant
hhhhhhh : Most significant

As soon as a music starts, a register built in a MIDI apparatus starts counting from 0 and counts up the MIDI beat (1 beat = 6 MIDI clocks*). When the music is stopped, the resister stops counting and stores the number in it.
If the music is continue – started, the register starts counting from the stored number.
A certain number can be preset in the register by this message.

* Refer to page 16 for "MIDI clock".

(2) Song Select 11110011 0sssssss
(F3H)

sssssss : Song number

For a sequencer or a keyboard which is able to record several songs, the message designates a song number or a sequence number.

(3) Tune Request..... 11110110
(F6H)

The message tunes an analog synthesizer's oscillator automatically.

(4) EOX 11110111
(End of System Exclusive) (F7H)

This message indicates the end of a System Exclusive Message.

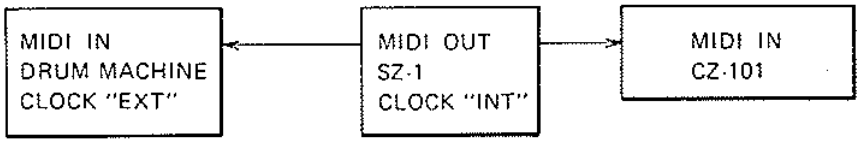
Model	System Common	Transmitted	Recognized	Remarks
CT-6000	Song Position	X	X	
	Song Select	X	X	
	Tune Request	X	X	
CZ-101 CZ-1000	Song Position	X	X	
	Song Select	X	X	
	Tune Request	X	X	
CZ-5000	Song Position	X	X	
	Song Select	X	X	
	Tune Request	X	X	
SZ-1	Song Position	X	X	
	Song Select	X	X	
	Tune Request	X	X	

4-4. System Real Time Message

System Real Time Messages synchronize the MIDI apparatuses which utilize the timing between drum machine and sequencer.

(1) MIDI Timing Clock 11111000 (F8H)

On the connection shown below, a song recorded in a SZ-1 is played on a CZ-101 and a rhythm machine, and as the song and the rhythm should be synchronized, the SZ-1 sends this code (F8H) 24 times per a quarter note (♩).



The clock selection switches on the SZ-1 and the drum machine should be on "INT" and "EXT" respectively.

(2) Start ..... 11111010 (FAH)

When the sequence start button (PLAY button on SZ-1) on a transmitter is pushed, this message is sent to receiver(s).
In SZ-1, this message is transmitted to receiver when the number in the song pointer is 0 and PLAY button is pushed.

(3) Continue ..... 11111011 (FBH)

When a sequencer is stopped at the middle of a song, the song position pointer in the sequencer also stops counting.
If the sequencer receives this message after then, the song position pointer counts up again from the stopped number.

(4) Stop ..... 11111100 (FCH)

When a MIDI apparatus receives this message, the song position pointer stops counting and holds the stopped number.

(5) Active Sensing ..... 11111110 (FEH)

The message is used for MIDI connection;
When a receiver recognizes this message, it expects to receive a message within 300ms.
If the receiver do not get any message within 300ms, it then shuts the voice off.

(6) System Reset ..... 11111111 (FFH)

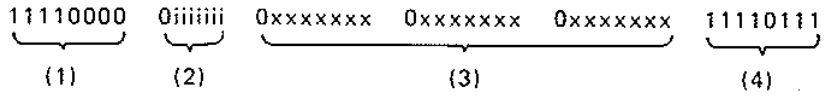
Once a receiver accepts this message, it initializes itself to the Power-ON status.

Model	System Real Time	Transmitted	Recognized	Remarks
CT-6000	Clock	○	○	
	Commands*	○	○	
CZ-101 CZ-1000	Clock	X	X	
	Commands	X	X	
CZ-5000	Clock	○	○	
	Commands	○	○	
SZ-1	Clock	○ Clock "INT"	○ Clock "EXT"	
	Commands	○ Clock "INT"	○ Clock "EXT"	

*Commands: Other messages than "MIDI Timing Clock"

4-5. System Exclusive Messages

Other than the above explained messages, manufacturers' unique messages can be transmitted from a MIDI interfaced personal computer.
The following shows the format of System Exclusive Messages.



(1) Status ..... 11110000 (FOH)

(2) Manufacturers' Identification Number ... 0iiiiiii

When a system exclusive message is transmitted, it must identify the manufacturer's registered code number.

The followings show the identification number of each manufacturer.

Casio	01000100	(44H)
Sequential Circuits, Inc.	00000001	(01H)
Big Briar	00000010	(02H)
Octave/Plateau	00000011	(03H)
Moog Music	00000100	(04H)
Passport Designs	00000101	(05H)
Lexicon	00000110	(06H)
Kurzweil Music System	00000111	(07H)
CBS Musical Instruments	00001000	(08H)
Steinway & Sons	00001001	(09H)
Oberheim Electronics	00010000	(10H)
Bon Tempi	00100000	(20H)
S.I.E.L.	00100001	(21H)
Kawai	01000000	(40H)
Roland	01000001	(41H)
Korg	01000010	(42H)
Yamaha	01000011	(43H)

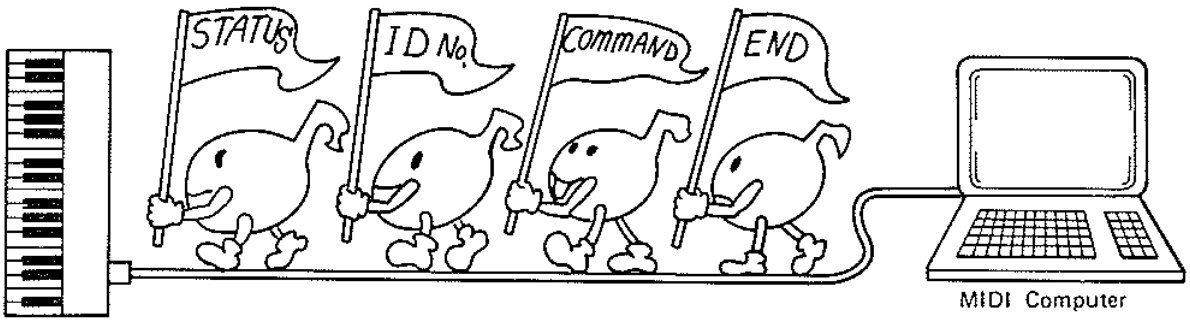
(3) Command 0xxxxxxx 0xxxxxxx 0xxxxxxx

xxxxxxx and number of bytes can be determined by the manufacturers, however, the first bit of any byte must be 0.

For Casio's System Exclusive Messages, refer to the next section.

(4) End of System Exclusive 11110111 (F7H)

A receiver recognizes the end of a System Exclusive Message when it receives other statuses (except System Real Time Messages) or this code.



II. CASIO'S SYSTEM EXCLUSIVE MESSAGE

Note: In this section, all the message codes are shown in hexadecimal notation unless otherwise noticed.

e.g.

11110000	01000100	00000000	01111010
F 0	4 4	0 0	7 A

1. CZ-101, CZ-1000

1-1. Messages

(1) Send Request 1

When a CZ-101/1000 receives a Send Request 1 message from a personal computer, PARAMETER data for one tone of the designated Basic Channel are transmitted from the CZ-101/1000 to the personal computer by the following procedures.

	Computer ⟶ CZ-101/1000	CZ-101/1000 ⟶ Computer
1	F0 44 00 00 7N 10 d_1d_2	
2		F0 44 00 00 7N 30
3	7N 31	
4		Tone Data F7
5	F7	

N : Basic Channel

d_1d_2 : Memory Bank

PRESET TONE No. 1 ~ 16 ..... 00 ~ 0F or 10 ~ 1F
INTERNAL 1 ~ 16 ..... 20 ~ 2F or 30 ~ 3F
CARTRIDGE 1 ~ 16 ..... 40 ~ 4F or 50 ~ 5F
Sound Area* 60

*Sound Area: The voice which the CZ-101/1000 is able to sound at the moment.

Tone Data: PARAMETER data. Refer to page 22.

(2) Receive Request

A personal computer transmits a PARAMETER data for one tone to a CZ-101/1000 by the following procedures.

	Computer ⟶ CZ-101/1000	CZ-101/1000 ⟶ Computer
1	F0 44 00 00 7N 20 $d_1 d_2$	
2		F0 44 00 00 7N 30
3	Tone Data F7	
4		F7

N: Basic Channel

$d_1 d_2$: Memory Bank

(3) Bend Range

The BEND RANGE of the CZ-101/1000 is varied according to the Bend Range message from the personal computer.

	Computer ⟶ CZ-101
1	F0 44 00 00 7N 40 $d_1 d_2$ F7

N : Basic Channel

$d_1 d_2$: BEND RANGE 0 ~ 12 ····· 00 ~ 0C

(4) Key Transpose

The KEY TRANSPOSE of the CZ-101/1000 is varied according to the Key Transpose message from the personal computer.

	Computer ⟶ CZ-101/1000
1	F0 44 00 00 7N 41 $d_1 d_2$ F7

N : Basic Channel

$d_1 d_2$: Key transpose data

Key	G	A	A#	B	B#	C	C#	D	E	E#	F	F#
$d_1 d_2$	45	44	43	42	41	00	01	02	03	04	05	06

(5) Tone Mix

TONE MIX ON/OFF and the mixing level are set in the CZ-101/1000 by the following message from the personal computer.

	Computer ⟶ CZ-101/1000
1	F0 | 44 | 00 | 00 | 7N | 42 | $d_1 d_2$ | F7

N : Basic Channel
d_1 : TONE MIX ON/OFF
d_1 = 4 · · · ON
d_1 = 0 · · · OFF

d_2 : Mixing level
d_2 = 1 · · · LEVEL 1
d_2 = 9 · · · LEVEL 9

(6) Send Request 2

When a CZ-101/1000 receives a Send Request 2 message from a personal computer, PROGRAMMER and EFFECT data are transmitted from the keyboard to the personal computer.

	Computer ⟶ CZ-101/1000	CZ-101/1000 ⟶ Computer
1	F0 | 44 | 00 | 00 | 7N | 19 | $d_1 d_2$	
2		F0 | 44 | 00 | 00 | 7M | 30
3	7N | 31	
4		$d_3 d_4$ | $d_5 d_6$ | F7
5	F7	

$d_1 d_2$: Dummy data. Should be within 00 ~ F7
N : Basic Channel
$d_3 d_4$: Memory Bank
PRESET TONE 1 ~ 16 ..... 00 ~ 0F
INTERNAL 1 ~ 16 ..... 20 ~ 2F
CARTRIDGE 1 ~ 16 ..... 40 ~ 4F

$d_5 d_6$: VIBRATO/PORTAMENT

$d_5 d_6$	VIBRATO	PORTAMENT
00	OFF	OFF
10	ON	OFF
20	OFF	ON
30	ON	ON

M : Voice Channel

When the keyboard is set to MODE 4 (OMNI OFF, MONO), the four Voice Channels are transmitted repeating the above procedures 1 ~ 5 four times. At this time, M should be N, N+1, N+2 and N+3. If the CZ-101/1000 is set to MODE 1, MODE 2 or MODE 3, the above procedures are performed once with M=V.

1-2. Tone Data

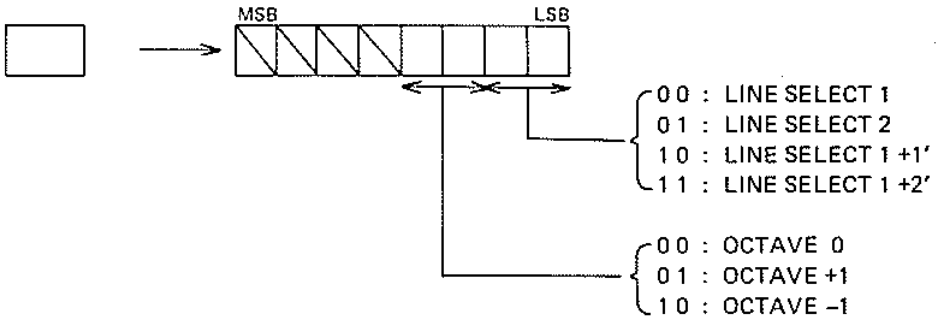
In Send Request 1 and Receive Request messages, Tone Data is transmitted between the personal computer and a CZ-101/1000 in the following order.

In the following table, one square indicates 8-bit data, however, in the actual data transmissions, it is divided in two (4-bit each) and 0 (0000 in binary code) is added on each 4-bit data.

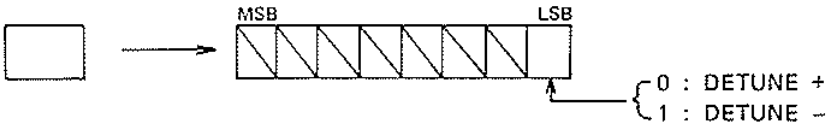
e.g., data $\boxed{d_1 d_2}$ is actually transmitted as $\boxed{0d_1}$ $\boxed{0d_2}$.

Sending Order	Symbol	Contents of Data	Data Format
1	PFLAG	LINE SELECT, OCTAVE	
2	PDS	DETUNE +/–	
3	PDL, PDH	DETUNE data	
4	PVK	VIBRATO WAVE	
5	PVDLD, PVDLV	VIBRATO DELAY TIME	
6	PVSD, PVSV	VIBRATO RATE	
7	PVDD, PVDV	VIBRATO DEPTH	
8	MFW	DCO1 WAVEFORM	
9	MAMD, MAMV	DCA1 KEY FOLLOW	
10	MWMD, MWMV	DCW1 KEY FOLLOW	
11	PMAL	END step of DCA1 ENVELOPE	
12	PMA	DCA1 ENVELOPE RATE & LEVEL	
13	PMWL	END step of DCW1 ENVELOPE	
14	PMW	DCW1 ENVELOPE RATE & LEVEL	
15	PMPL	END step of DCO1 ENVELOPE	
16	PMP	DCO1 ENVELOPE RATE & LEVEL	
17	SFW	DCO2 WAVEFORM	
18	SAMD, SAMV	DCA2 KEY FOLLOW	
19	SWMD, SWMV	DCW2 KEY FOLLOW	
20	PSAL	END step of DCA2 ENVELOPE	
21	PSA	DCA2 ENVELOPE RATE & LEVEL	
22	PSWL	END step of DCW2 ENVELOPE	
23	PSW	DCW2 ENVELOPE RATE & LEVEL	
24	PSPL	END step of DCO2 ENVELOPE	
25	PSP	DCO2 ENVELOPE RATE & LEVEL	

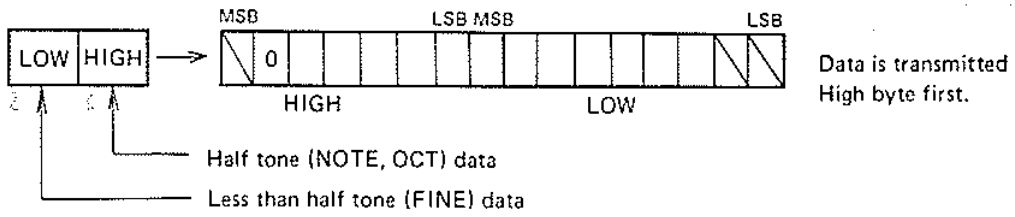
(1) PFLAG ---------- LINE SELECT and OCTAVE data



(2) PDS ---------- DETUNE + or –



(3) PDETL, PDETH ---------- DETUNE data



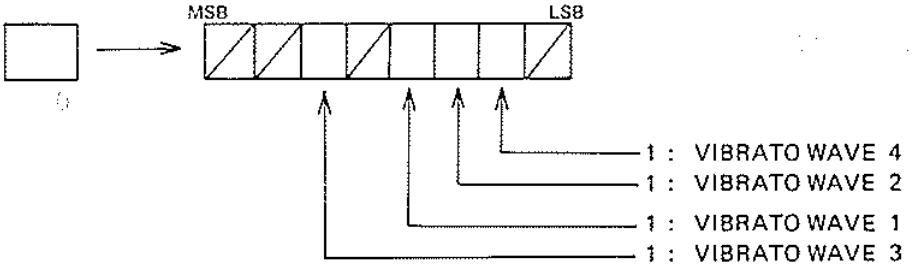
The FINE data 0 ~ 60 is assigned to 00 ~ 3F (HEX.) as follows.

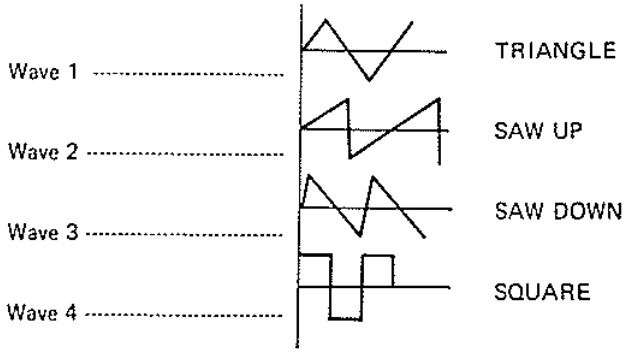
FINE Data	MIDI Transmission Data	HEX.
0	0 0 0 0 0 0 0 0	00
≀	≀	≀
15	0 0 0 0 1 1 1 1	0F
16	0 0 0 1 0 0 0 1	11
≀	≀	≀
30	0 0 0 1 1 1 1 1	1F
31	0 0 1 0 0 0 0 1	21
≀	≀	≀
45	0 0 1 0 1 1 1 1	2F
46	0 0 1 1 0 0 0 1	31
≀	≀	≀
60	0 0 1 1 1 1 1 1	3F

The CZ-101/1000 is able to detune up to three octaves and eleven notes (47 half tones). This half tone data is transmitted as follows:

OCT	NOTE	MIDI Transmission Data	HEX.
0	0 ≀ 11	0 0 0 0 0 0 0 0 ≀ 0 0 0 0 1 0 1 1	00 ≀ 0B
1	0 ≀ 11	0 0 0 0 1 1 0 0 ≀ 0 0 0 1 0 1 1 1	0C ≀ 17
2	0 ≀ 11	0 0 0 1 1 0 0 0 ≀ 0 0 1 0 0 0 1 1	18 ≀ 23
3	0 ≀ 11	0 0 1 0 0 1 0 0 ≀ 0 0 1 0 1 1 1 1	24 ≀ 2F

(4) PVK ····· VIBRATO WAVE





(5) PVDLD, PVDLV ..... VIBRATO DELAY TIME data

VIBRATO DELAY TIME data is transmitted in three bytes.

DELAY TIME	PVDLD, PVDLV (HEX)	DELAY TIME	PVDLV, PVDLV (HEX)	DELAY TIME	PVDLD, PVDLV (HEX)	DELAY TIME	PVDLD, PVDLV (HEX)
0	00 00 00	25	19 00 19	50	32 00 4B	75	4B 00 0F
1	01 00 01	26	1A 00 1A	51	33 00 4F	76	4C 00 E7
2	02 00 02	27	1B 00 1B	52	34 00 53	77	4D 00 EF
3	03 00 03	28	1C 00 1C	53	35 00 57	78	4E 00 F7
4	04 00 04	29	1D 00 1D	54	36 00 5B	79	4F 00 FF
5	05 00 05	30	1E 00 1E	55	37 00 5F	80	50 01 0F
6	06 00 06	31	1F 00 1F	56	38 00 63	81	51 01 1F
7	07 00 07	32	20 00 21	57	39 00 67	82	52 01 2F
8	08 00 08	33	21 00 23	58	3A 00 6B	83	53 01 3F
9	09 00 09	34	22 00 25	59	3B 00 6F	84	54 01 4F
10	0A 00 0A	35	23 00 27	60	3C 00 73	85	55 01 5F
11	0B 00 0B	36	24 00 29	61	3D 00 77	86	56 01 6F
12	0C 00 0C	37	25 00 2B	62	3E 00 7B	87	57 01 7F
13	0D 00 0D	38	26 00 2D	63	3F 00 7F	88	58 01 8F
14	0E 00 0E	39	27 00 2F	64	40 00 87	89	59 01 9F
15	0F 00 0F	40	28 00 31	65	41 00 8F	90	5A 01 AF
16	10 00 10	41	29 00 33	66	42 00 97	91	5B 01 BF
17	11 00 11	42	2A 00 35	67	43 00 9F	92	5C 01 CF
18	12 00 12	43	2B 00 37	68	44 00 A7	93	5D 01 DF
19	13 00 13	44	2C 00 39	69	45 00 AF	94	5E 01 EF
20	14 00 14	45	2D 00 3B	70	46 00 B7	95	5F 01 FF
21	15 00 15	46	2E 00 3D	71	47 00 BF	96	60 02 1F
22	16 00 16	47	2F 00 3F	72	48 00 C7	97	61 02 3F
23	17 00 17	48	30 00 43	73	49 00 CF	98	62 02 5F
24	18 00 18	49	31 00 47	74	4A 00 D7	99	63 02 7F

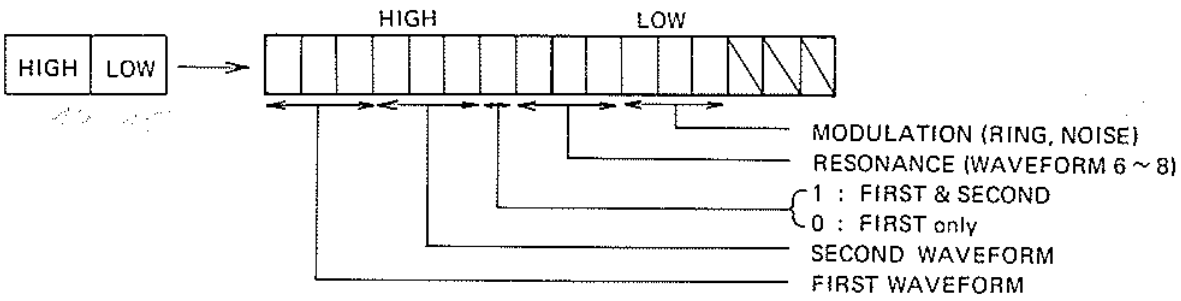
(6) PVSD, PVSV ---------- VIBRATO RATE data

RATE	PVSD, PVSV (HEX)	RATE	PVSD, PVSV (HEX)	RATE	PVSD, PVSV (HEX)	RATE	PVSD, PVSV (HEX)
0	0 0 0 0 2 0	25	1 9 0 3 4 0	50	3 2 0 9 E 0	75	4 8 1 C E 0
1	0 1 0 0 4 0	26	1 A 0 3 6 0	51	3 3 0 A 6 0	76	4 C 1 D E 0
2	0 2 0 0 6 0	27	1 B 0 3 8 0	52	3 4 0 A E 0	77	4 D 1 E E 0
3	0 3 0 0 8 0	28	1 C 0 3 A 0	53	3 5 0 B 6 0	78	4 E 1 F E 0
4	0 4 0 0 A 0	29	1 D 0 3 C 0	54	3 6 0 B E 0	79	4 F 2 0 E 0
5	0 5 0 0 C 0	30	1 E 0 3 E 0	55	3 7 0 C 6 0	80	5 0 2 3 E 0
6	0 6 0 0 E 0	31	1 F 0 4 0 0	56	3 8 0 C E 0	81	5 1 2 5 E 0
7	0 7 0 1 0 0	32	2 0 0 4 6 0	57	3 9 0 D 6 0	82	5 2 2 7 E 0
8	0 8 0 1 2 0	33	2 1 0 4 A 0	58	3 A 0 D E 0	83	5 3 2 9 E 0
9	0 9 0 1 4 0	34	2 2 0 4 E 0	59	3 B 0 E 6 0	84	5 4 2 B E 0
10	0 A 0 1 6 0	35	2 3 0 5 2 0	60	3 C 0 E E 0	85	5 5 2 D E 0
11	0 B 0 1 8 0	36	2 4 0 5 6 0	61	3 D 0 F 6 0	86	5 6 2 F E 0
12	0 C 0 1 A 0	37	2 5 0 5 A 0	62	3 E 0 F E 0	87	5 7 3 1 E 0
13	0 D 0 1 C 0	38	2 6 0 5 E 0	63	3 F 1 0 6 0	88	5 8 3 3 E 0
14	0 E 0 1 E 0	39	2 7 0 6 2 0	64	4 0 1 1 E 0	89	5 9 3 5 E 0
15	0 F 0 2 0 0	40	2 8 0 6 6 0	65	4 1 1 2 E 0	90	5 A 3 7 E 0
16	1 0 0 2 2 0	41	2 9 0 6 A 0	66	4 2 1 3 E 0	91	5 B 3 9 E 0
17	1 1 0 2 4 0	42	2 A 0 6 E 0	67	4 3 1 4 E 0	92	5 C 3 B E 0
18	1 2 0 2 6 0	43	2 B 0 7 2 0	68	4 4 1 5 E 0	93	5 D 3 D E 0
19	1 3 0 2 8 0	44	2 C 0 7 6 0	69	4 5 1 6 E 0	94	5 E 3 F E 0
20	1 4 0 2 A 0	45	2 D 0 7 A 0	70	4 6 1 7 E 0	95	5 F 4 1 E 0
21	1 5 0 2 C 0	46	2 E 0 7 E 0	71	4 7 1 8 E 0	96	6 0 4 7 E 0
22	1 6 0 2 E 0	47	2 F 0 8 2 0	72	4 8 1 9 E 0	97	6 1 4 B E 0
23	1 7 0 3 0 0	48	3 0 0 8 E 0	73	4 9 1 A E 0	98	6 2 4 F E 0
24	1 8 0 3 2 0	49	3 1 0 9 6 0	74	4 A 1 B E 0	99	6 3 5 3 E 0

(7) PVDD, PVDV ..... VIBRATO DEPTH data

DEPTH	PVDD, PVDV (HEX)	DEPTH	PVDD, PVDV (HEX)	DEPTH	PVDD, PVDV (HEX)	DEPTH	PVDD, PVDV (HEX)
0	00 00 01	25	19 00 1A	50	32 00 4F	75	4B 00 E7
1	01 00 02	26	1A 00 1B	51	33 00 53	76	4C 00 EF
2	02 00 03	27	1B 00 1C	52	34 00 57	77	4D 00 F7
3	03 00 04	28	1C 00 1D	53	35 00 5B	78	4E 00 FF
4	04 00 05	29	1D 00 1E	54	36 00 5F	79	4F 01 07
5	05 00 06	30	1E 00 1F	55	37 00 63	80	50 01 1F
6	06 00 07	31	1F 00 20	56	38 00 67	81	51 01 2F
7	07 00 08	32	20 00 23	57	39 00 6B	82	52 01 3F
8	08 00 09	33	21 00 25	58	3A 00 6F	83	53 01 4F
9	09 00 0A	34	22 00 27	59	3B 00 73	84	54 01 5F
10	0A 00 0B	35	23 00 29	60	3C 00 77	85	55 01 6F
11	0B 00 0C	36	24 00 2B	61	3D 00 7B	86	56 01 7F
12	0C 00 0D	37	25 00 2D	62	3E 00 7F	87	57 01 8F
13	0D 00 0E	38	26 00 2F	63	3F 00 83	88	58 01 9F
14	0E 00 0F	39	27 00 31	64	40 00 8F	89	59 01 AF
15	0F 00 10	40	28 00 33	65	41 00 97	90	5A 01 BF
16	10 00 11	41	29 00 35	66	42 00 9F	91	5B 01 CF
17	11 00 12	42	2A 00 37	67	43 00 A7	92	5C 01 DF
18	12 00 13	43	2B 00 39	68	44 00 AF	93	5D 01 EF
19	13 00 14	44	2C 00 3B	69	45 00 B7	94	5E 01 FF
20	14 00 15	45	2D 00 3D	70	46 00 BF	95	5F 02 0F
21	15 00 16	46	2E 00 3F	71	47 00 C7	96	60 02 3F
22	16 00 17	47	2F 00 41	72	48 00 CF	97	61 02 5F
23	17 00 18	48	30 00 47	73	49 00 D7	98	62 02 7F
24	18 00 19	49	31 00 4B	74	4A 00 DF	99	63 03 00

(8) MFW ..... DC01 WAVEFORM & MODULATION



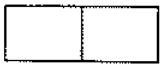
Data is transmitted High byte first.

WAVEFORM, MODULATION	MIDI Data													
FIRST = 1	0	0	0					0	0	0				
FIRST = 2	0	0	1					0	0	0				
FIRST = 3	0	1	0					0	0	0				
FIRST = 4	1	0	0					0	0	0				
FIRST = 5	1	0	1					0	0	0				
FIRST = 6	1	1	0					0	0	1				
FIRST = 7	1	1	0					0	1	0				
FIRST = 8	1	1	0					0	1	1				
SECOND = 1				0	0	0	1	0	0	0				
SECOND = 2				0	0	1	1	0	0	0				
SECOND = 3				0	1	0	1	0	0	0				
SECOND = 4				1	0	0	1	0	0	0				
SECOND = 5				1	0	1	1	0	0	0				
SECOND = 6				1	1	0	1	0	0	1				
SECOND = 7				1	1	0	1	0	1	0				
SECOND = 8				1	1	0	1	0	1	1				
MODULATION OFF											0	0	0	
RING ON											1	0	0	
NOISE ON											0	1	1	

(9) MAMD, MAMV ..... DCA1 KEY FOLLOW

DCA1 KEY FOLLOW	MAMD, MAMV
0	00 00
1	01 08
2	02 11
3	03 1A
4	04 24
5	05 2F
6	06 3A
7	07 45
8	08 52
9	09 5F

(10) MWMD, MWMV ..... DCW 1 KEY FOLLOW



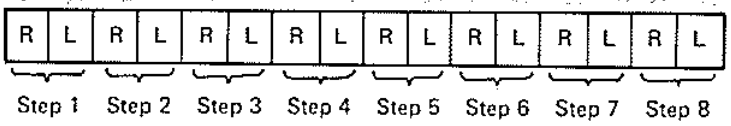
DCW1 KEY FOLLOW	MWMD, MWMV
0	00 00
1	01 1F
2	02 2C
3	03 39
4	04 46
5	05 53
6	06 60
7	07 6E
8	08 92
9	09 FF

(11) PMAL ---------- DCA1 ENVELOPE END step

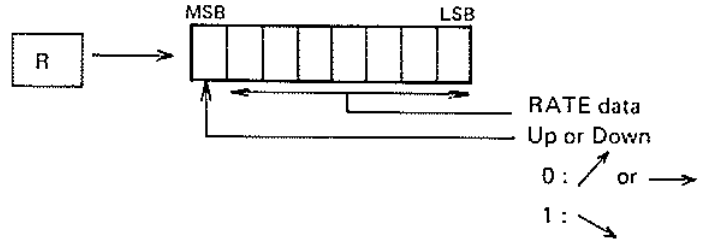
DCA1 ENVELOPE END Step	PMAL
1	00
2	01
3	02
4	03
5	04
6	05
7	06
8	07

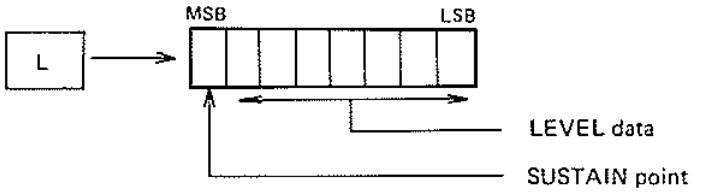
PMAL indicates the end of the ENVELOPE.

(12) PMA ---------- DCA1 ENVELOPE RATE and LEVEL



R : RATE
L : LEVEL





1 : SUSTAIN point
0 : Not SUSTAIN point

DCA1 ENVELOPE Data Table

RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)
0	0 0	25	1 E	50	3 C	75	5 A	0	0 0	25	3 5	50	4 E	75	6 7
1	0 1	26	1 F	51	3 D	76	5 B	1	1 D	26	3 6	51	4 F	76	6 8
2	0 2	27	2 0	52	3 E	77	5 C	2	1 E	27	3 7	52	5 0	77	6 9
3	0 3	28	2 1	53	3 F	78	5 D	3	1 F	28	3 8	53	5 1	78	6 A
4	0 4	29	2 2	54	4 0	79	5 E	4	2 0	29	3 9	54	5 2	79	6 B
5	0 6	30	2 4	55	4 2	80	6 0	5	2 1	30	3 A	55	5 3	80	6 C
6	0 7	31	2 5	56	4 3	81	6 1	6	2 2	31	3 B	56	5 4	81	6 D
7	0 8	32	2 6	57	4 4	82	6 2	7	2 3	32	3 C	57	5 5	82	6 E
8	0 9	33	2 7	58	4 5	83	6 3	8	2 4	33	3 D	58	5 6	83	6 F
9	0 A	34	2 8	59	4 6	84	6 4	9	2 5	34	3 E	59	5 7	84	7 0
10	0 C	35	2 A	60	4 8	85	6 6	10	2 6	35	3 F	60	5 8	85	7 1
11	0 D	36	2 B	61	4 9	86	6 7	11	2 7	36	4 0	61	5 9	86	7 2
12	0 E	37	2 C	62	4 A	87	6 8	12	2 8	37	4 1	62	5 A	87	7 3
13	0 F	38	2 D	63	4 B	88	6 9	13	2 9	38	4 2	63	5 B	88	7 4
14	1 0	39	2 E	64	4 C	89	6 A	14	2 A	39	4 3	64	5 C	89	7 5
15	1 2	40	3 0	65	4 E	90	6 C	15	2 B	40	4 4	65	5 D	90	7 6
16	1 3	41	3 1	66	4 F	91	6 D	16	2 C	41	4 5	66	5 E	91	7 7
17	1 4	42	3 2	67	5 0	92	6 E	17	2 D	42	4 6	67	5 F	92	7 8
18	1 5	43	3 3	68	5 1	93	6 F	18	2 E	43	4 7	68	6 0	93	7 9
19	1 6	44	3 4	69	5 2	94	7 0	19	2 F	44	4 8	69	6 1	94	7 A
20	1 8	45	3 6	70	5 4	95	7 2	20	3 0	45	4 9	70	6 2	95	7 B
21	1 9	46	3 7	71	5 5	96	7 3	21	3 1	46	4 A	71	6 3	96	7 C
22	1 A	47	3 8	72	5 6	97	7 4	22	3 2	47	4 B	72	6 4	97	7 D
23	1 B	48	3 9	73	5 7	98	7 5	23	3 9	48	4 C	73	6 5	98	7 E
24	1 C	49	3 A	74	5 8	99	7 7	24	3 4	49	4 D	74	6 6	99	7 F

Conversion calculations

Conversion from RATE data (α) to MIDI data (β).

$$\beta = 119_{10} \times \alpha \div 99_{10}$$

Conversion from MIDI data (β) to RATE data (α).

When $\beta = 0$, $\alpha = 0$.

When $\beta = 77_H$, $\alpha = 99_{10}$

Otherwise:

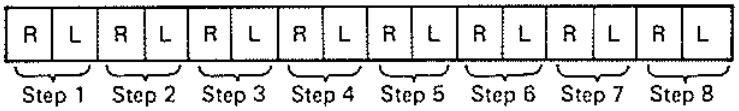
$$\alpha = 99_{10} \times \beta \div 119_{10} + 1$$

(13) PMWL ---------- DCW1 ENVELOPE END step

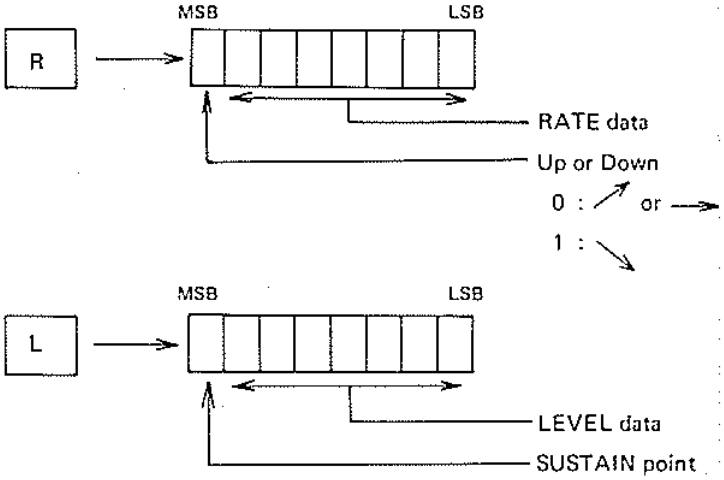
DCW1 ENVELOPE END Step	PMWL
1	00
2	01
3	02
4	03
5	04
6	05
7	06
8	07

PMWL indicates the end of the ENVELOPE.

(14) PMW ---------- DCW1 ENVELOPE RATE and LEVEL



R : RATE
L : LEVEL



1 : SUSTAIN point
0 : Not SUSTAIN point

DCW1 ENVELOPE Data Table

RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)
0	0 8	25	2 6	50	4 4	75	6 2	0	0 0	25	2 0	50	4 0	75	6 0
1	0 9	26	2 7	51	4 5	76	6 3	1	0 1	26	2 1	51	4 1	76	6 1
2	0 A	27	2 8	52	4 6	77	6 4	2	0 2	27	2 2	52	4 2	77	6 2
3	0 B	28	2 9	53	4 7	78	6 5	3	0 3	28	2 3	53	4 3	78	6 4
4	0 C	29	2 A	54	4 8	79	6 6	4	0 5	29	2 5	54	4 5	79	6 5
5	0 E	30	2 C	55	4 A	80	6 8	5	0 6	30	2 6	55	4 6	80	6 6
6	0 F	31	2 D	56	4 B	81	6 9	6	0 7	31	2 7	56	4 7	81	6 7
7	1 0	32	2 E	57	4 C	82	6 A	7	0 8	32	2 9	57	4 9	82	6 9
8	1 1	33	2 F	58	4 D	83	6 B	8	0 A	33	2 A	58	4 A	83	6 A
9	1 2	34	3 0	59	4 E	84	6 C	9	0 B	34	2 B	59	4 B	84	6 B
10	1 4	35	3 2	60	5 0	85	6 E	10	0 C	35	2 C	60	4 C	85	6 D
11	1 5	36	3 3	61	5 1	86	6 F	11	0 E	36	2 E	61	4 E	86	6 E
12	1 6	37	3 4	62	5 2	87	7 0	12	0 F	37	2 F	62	4 F	87	6 F
13	1 7	38	3 5	63	5 3	88	7 1	13	1 0	38	3 0	63	5 0	88	7 0
14	1 8	39	3 6	64	5 4	89	7 2	14	1 1	39	3 2	64	5 2	89	7 2
15	1 A	40	3 8	65	5 6	90	7 4	15	1 3	40	3 3	65	5 3	90	7 3
16	1 B	41	3 9	66	5 7	91	7 5	16	1 4	41	3 4	66	5 4	91	7 4
17	1 C	42	3 A	67	5 8	92	7 6	17	1 5	42	3 5	67	5 5	92	7 6
18	1 D	43	3 B	68	5 9	93	7 7	18	1 7	43	3 7	68	5 7	93	7 7
19	1 E	44	3 C	69	5 A	94	7 8	19	1 8	44	3 8	69	5 8	94	7 8
20	2 0	45	3 E	70	5 C	95	7 A	20	1 9	45	3 9	70	5 9	95	7 9
21	2 1	46	3 F	71	5 D	96	7 B	21	1 A	46	3 B	71	5 B	96	7 B
22	2 2	47	4 0	72	5 E	97	7 C	22	1 C	47	3 C	72	5 C	97	7 C
23	2 3	48	4 1	73	5 F	98	7 D	23	1 D	48	3 D	73	5 D	98	7 D
24	2 4	49	4 2	74	6 0	99	7 F	24	1 E	49	3 E	74	5 E	99	7 F

Conversion Calculation

Conversion from RATE data (α) to MIDI data (β).

$\beta = 119_{10} \times \alpha \div 99_{10} + 8$

Conversion from MIDI data (β) to RATE data (α).

when $\beta' = 0$, $\alpha = 0$

when $\beta' = 77_H$, $\alpha = 99_{10}$

otherwise:

$\alpha = 99_{10} \times \beta' \div 119_{10} + 1$

whereas $\beta' = \beta - 8$

Conversion from LEVEL data (α) to MIDI data (β).

$\beta = 127_{10} \times \alpha \div 99_{10}$

Conversion from MIDI data (β) to LEVEL data (α).

when $\beta = 0$, $\alpha = 0$

when $\beta = 7F_H$, $\alpha = 99_{10}$

otherwise:

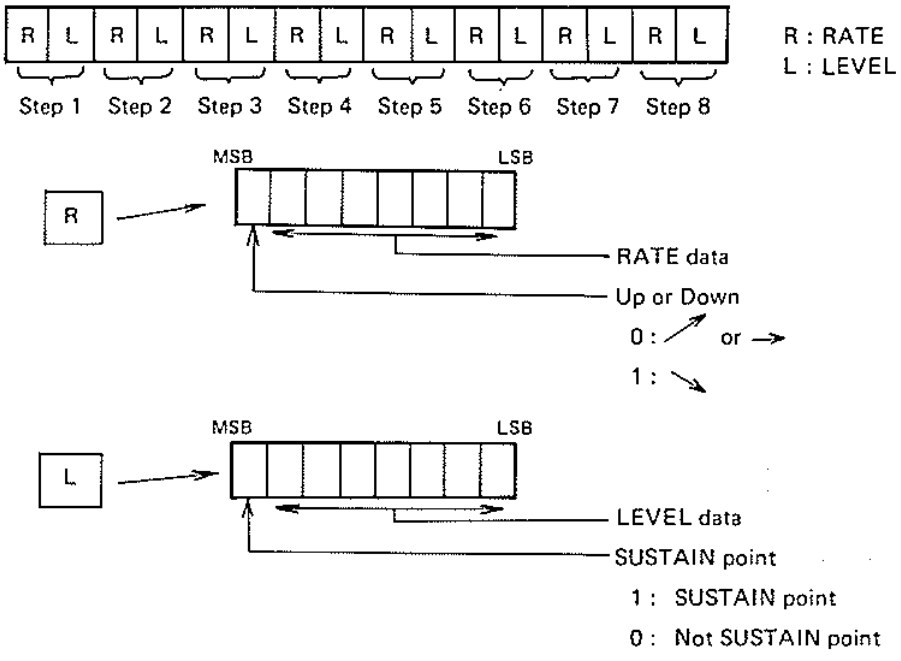
$\alpha = 99_{10} \times \beta \div 127_{10} + 1$

(15) PMPL ---------- DCO1 ENVELOPE END step

DCO1 ENVELOPE END Step	PMOL
1	00
2	01
3	02
4	03
5	04
6	05
7	06
8	07

PMPL indicates the end of the ENVELOPE.

(16) PMP ---------- DCO1 ENVELOPE RATE and LEVEL



DCO1 ENVELOPE Data Table

RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	RATE	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)	LEVEL	MIDI DATA (HEX)
0	0 0	25	2 0	50	4 0	75	6 0	0	0 0	25	1 9	50	3 2	75	4 F
1	0 1	26	2 1	51	4 1	76	6 1	1	0 1	26	1 A	51	3 3	76	5 0
2	0 2	27	2 2	52	4 2	77	6 2	2	0 2	27	1 B	52	3 4	77	5 1
3	0 3	28	2 3	53	4 2	78	6 4	3	0 3	28	1 C	53	3 5	*78	5 2
4	0 5	29	2 5	54	4 5	79	6 5	4	0 4	29	1 D	54	3 6	79	5 3
5	0 6	30	2 6	55	4 6	80	6 6	5	0 5	30	1 E	55	3 7	80	5 4
6	0 7	31	2 7	56	4 7	81	6 7	6	0 6	31	1 F	56	3 8	81	5 5
7	0 8	32	2 9	57	4 9	82	6 9	7	0 7	32	2 0	57	3 9	82	5 6
8	0 A	33	2 A	58	4 A	83	6 A	8	0 8	33	2 1	58	3 A	83	5 7
9	0 B	34	2 B	59	4 B	84	6 B	9	0 9	34	2 2	59	3 B	*84	5 8
10	0 C	35	2 C	60	4 C	85	6 D	10	0 A	35	2 3	60	3 C	85	5 9
11	0 E	36	2 E	61	4 E	86	6 E	11	0 B	36	2 4	61	3 D	86	5 A
12	0 F	37	2 F	62	4 F	87	6 F	12	0 C	37	2 5	62	3 E	87	5 B
13	1 0	38	3 0	63	5 0	88	7 0	13	0 D	38	2 6	63	3 F	88	5 C
14	1 1	39	3 2	64	5 2	89	7 2	14	0 E	39	2 7	64	4 4	89	5 D
15	1 3	40	3 3	65	5 3	90	7 3	15	0 F	40	2 8	65	4 5	*90	5 E
16	1 4	41	3 4	66	5 4	91	7 4	16	1 0	41	2 9	*66	4 6	91	5 F
17	1 5	42	3 5	67	5 5	92	7 6	17	1 1	42	2 A	67	4 7	92	6 0
18	1 7	43	3 7	68	5 7	93	7 7	18	1 2	43	2 B	68	4 8	93	6 1
19	1 8	44	3 8	69	5 8	94	7 8	19	1 3	44	2 C	69	4 9	94	6 2
20	1 9	45	3 9	70	5 9	95	7 9	20	1 4	45	2 D	70	4 A	95	6 3
21	1 A	46	3 B	71	5 B	96	7 B	21	1 5	46	2 E	71	4 B	*96	6 4
22	1 C	47	3 C	72	5 C	97	7 C	22	1 6	47	2 F	*72	4 C	97	6 5
23	1 D	48	3 D	73	5 D	98	7 D	23	1 7	48	3 0	73	4 D	98	6 6
24	1 E	49	3 E	74	5 E	99	7 F	24	1 8	49	3 1	74	4 E	99	6 7

Conversion Calculation

Conversion from RATE data (α) to MIDI data (β).

$\beta = 127_{10} \times \alpha \div 99_{10}$

Conversion from MIDI data (β) to RATE data (α).

when $\beta = 0$, $\alpha = 0$

when $\beta = 7F$, $\alpha = 99$

otherwise:

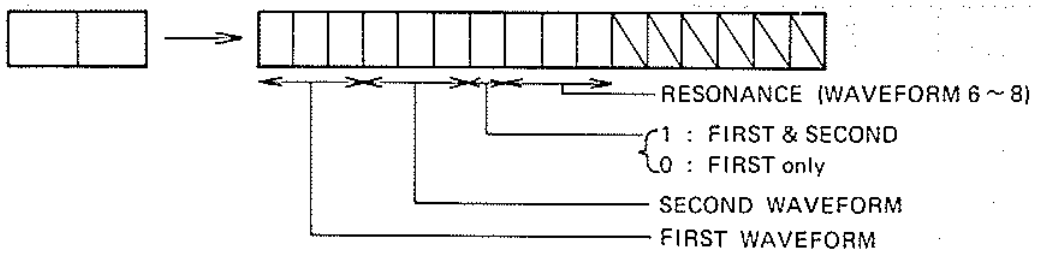
$\alpha = 99_{10} \times \beta \div 127_{10} + 1$

Relation between LEVEL and MIDI data

LEVEL data	MIDI data	
	Decimal	Hex.
0	0	00
≀	≀	≀
63	63	3F
64	68	44
≀	≀	≀
99	103	67

The LEVELs marked with * are octave(s) higher than the pitch at LEVEL 0. i.e., the pitch is increased by one octave each according to values "66 + 6n".

(17) SFW ---------- DCO2 WAVEFORM



WAVEFORM data format is the same as that for MFW.

The formats for the following data for DCA2, DCW2 and DCO2 are the same as those of DCA1, DCW1 and DCO1.

(18) SAMD, SAMV ---------- DCA2 KEY FOLLOW

(19) SWMD, SWMV ---------- DCW2 KEY FOLLOW

(20) PSAL ---------- DCA2 ENVELOPE END step

(21) PSA ---------- DCA2 ENVELOPE RATE and LEVEL

(22) PSWL ---------- DCW2 ENVELOPE END step

(23) PSW ---------- DCW2 ENVELOPE RATE and LEVEL

(24) PSPL ---------- DCO2 ENVELOPE END step

(25) PSP ---------- DCO2 ENVELOPE RATE and LEVEL

2. CZ-5000

(1) Send Request 1

Same as CZ-101/1000 except . . .

$d_1 d_2$: Memory Bank

PRESET A-1 ~ A-8 ..... 00 ~ 07
PRESET B-1 ~ B-8 ..... 08 ~ 0F
PRESET C-1 ~ C-8 ..... 10 ~ 17
PRESET D-1 ~ D-8 ..... 18 ~ 1F

MEMORY BANK A-1 ~ A-8 ..... 20 ~ 27
MEMORY BANK B-1 ~ B-8 ..... 28 ~ 2F
MEMORY BANK C-1 ~ C-8 ..... 30 ~ 37
MEMORY BANK D-1 ~ D-8 ..... 38 ~ 3F
Sound Area 60

(2) Receive Request 1

Same as CZ-101/1000 except . . .

$d_1 d_2$: Memory Bank

MEMORY BANK A-1 ~ A-8 ..... 20 ~ 27
MEMORY BANK B-1 ~ B-8 ..... 28 ~ 2F
MEMORY BANK C-1 ~ C-8 ..... 30 ~ 37
MEMORY BANK D-1 ~ D-8 ..... 38 ~ 3F
Sound Area 60

(3) Bend Range

Same as CZ-101/1000

(4) KEY TRANSPOSE

Same as CZ-101/1000

(5) GLIDE NOTE

Receiving a data from a personal computer, GLIDE NOTE is set to the designated CZ-5000.

	Computer ⟶ CZ-5000							
1	F0	44	00	00	7N	43	$d_1 d_2$	F7

N : Basic Channel

$d_1 d_2$: GLIDE NOTE

+1 ~ +24 ..... 01 ~ 18
−1 ~ −24 ..... 41 ~ 58
0 00

(6) GLIDE TIME

Receiving a data from a personal computer, GLIDE TIME is set to the designated CZ-5000.

	Computer ⟶ CZ-5000							
1	F0	44	00	00	7N	44	d_1d_2	F7

N : Basic Channel

d_1d_2 : GLIDE TIME
0 ~ 99 ..... 00 ~ 63

(7) MODULATION DEPTH

Receiving a data from a personal computer, MODULATION DEPTH is set to the designated CZ-5000.

	Computer ⟶ CZ-5000							
1	F0	44	00	00	7N	45	d_1d_2	F7

N : Basic Channel

d_1d_2 : MODULATION DEPTH
0 ~ 99 ..... 00 ~ 63

(8) Volume LEVEL

Receiving a data from a personal computer, volume level is set to the designated track.
Also, a CZ-5000 transmits the volume level data of each track to another CZ-5000 when it is operated:

- Playback or recording of the sequencer.
- Volume level is varied by the Track-checking.
- Playback or recording is stopped by RESET button.

	Computer or CZ-5000 ⟶ CZ-5000							
1	F0	44	00	00	7N	d_1d_2	d_3d_4	F7

d_1d_2 : LEVEL
1 ~ 15 ..... 01 ~ 0F

d_3d_4 : Track No. when a CZ-5000 transmits LEVEL data to another CZ-5000
Track No. 1 ~ 8 ..... 00 ~ 07
Basic Channel when a CZ-5000 receives LEVEL data from a personal computer.
Basic Channel 1 ~ 8 ..... 00 ~ 07

*When the CZ-5000 is MONO mode, d_3d_4 become the Voice Channel.

N : Does not matter as the Basic Channel and the Voice Channel are designated by d_3d_4.

(9) GLIDE ON/OFF

Receiving a data from a personal computer, GLIDE ON/OFF status is set on a CZ-5000. Also a CZ-5000 transmits the data to another CZ-5000 when;

Song recorded in the sequencer section is playbacked.
A song is recorded in the sequencer.
Recording or playback is stopped by the RESET button.
GLIDE button is pushed.

	Computer or CZ 5000 ⟶ CZ-5000
1	F0 44 00 00 7N 47 d_1 d_2 F7

d_1 : GLIDE ON/OFF data
0 ..... GLIDE OFF
4 ..... GLIDE ON

d_2 : Keyboard Channel when a CZ-5000 transmits GLIDE ON/OFF data.
KBCH 1 ~ 16 ..... 0 ~ F

Track No. when a CZ-5000 transmits GLIDE ON/OFF data of the tracks.
Track No. 1 ~ 8 ..... 0 ~ 7

Basic Channel when a CZ-5000 receives GLIDE ON/OFF data from a personal computer or another CZ-5000.
Basic Channel 1 ~ 16 ..... 0 ~ F

N : Does not matter.

(10) Send Request 2

Receiving Send Request 2 message from a personal computer, a CZ-5000 transmits the sequencer data to the computer by the following procedures.

	Computer ⟶ CZ-5000	CZ-5000 ⟶ Computer
1	F0 44 00 00 7N 14 61	
2		F0 44 00 00 7N 30
3	7N 31	
4		Sequencer data 7N 32
5	7N 31	
6		Sequencer data 7N 32
		256 Bytes
ℓ-2	7N 31	
ℓ-1		Sequencer data F7
ℓ	F7	

* The number of the procedure ℓ differs according to the length of the recorded song.
N : Basic Channel

(11) Receive Request 2

A personal computer transmits sequencer data to a CZ-5000 by the following procedures.

	Computer ⟶ CZ-5000	CZ-5000 ⟶ Computer
1	F0 44 00 00 7N 24 61	
2		F0 44 00 00 7N 30
3	256 bytes Sequencer data 7N 32	
4		7N 30
5	256 bytes Sequencer data 7N 32	
6		7N 30
ℓ-1	256 bytes Sequencer data F7	
ℓ		F7

* The number of the procedure differs according to the length of the recorded song.

N : Basic Channel
Basic Channel 1 ~ 16 ····· 0 ~ F