BOSS

Dr. Rhythm

DR-880

MIDI IMPLEMENTATION



Revision 1.0

(2005.02.01)

Dr. Rhythm
Model: DR-880

MIDI Implementation

Date: Feb 1, 2005
Version: 1.00

1. Receive Data

■Channel Voice Message

●Note Off

Status	Second	Third
8nH	kkH	vvH
9nH	kkH	00H
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
kk = Note Number:		00H–7FH (0–127)
vv = Velocity:		00H–7FH (0–127)

* Velocity value is not recognized.

●Note On

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

* For drum part, note number of recognized data is as follows;

BANK: DRUM 1		BANK: DRUM 2		BANK: DRUM 3	
Pad #	Note #	Pad #	Note #	Pad #	Note #
Pad 1	36	Pad 1	60	Pad 1	86
Pad 2	35	Pad 2	61	Pad 2	87
Pad 3	38	Pad 3	62	Pad 3	78
Pad 4	40	Pad 4	63	Pad 4	79
Pad 5	42	Pad 5	64	Pad 5	83
Pad 6	37	Pad 6	54	Pad 6	76
Pad 7	39	Pad 7	91	Pad 7	77
Pad 8	56	Pad 8	95	Pad 8	85
Pad 9	44	Pad 9	96	Pad 9	66
Pad 10	46	Pad 10	97	Pad 10	65
Pad 11	50	Pad 11	69	Pad 11	71
Pad 12	48	Pad 12	94	Pad 12	72
Pad 13	45	Pad 13	70	Pad 13	75
Pad 14	41	Pad 14	82	Pad 14	67
Pad 15	52	Pad 15	92	Pad 15	68
Pad 16	49	Pad 16	89	Pad 16	73
Pad 17	57	Pad 17	90	Pad 17	74
Pad 18	55	Pad 18	93	Pad 18	58
Pad 19	53	Pad 19	84	Pad 19	80
Pad 20	51	Pad 20	59	Pad 20	81

●Control Change

❍Bank Select MSB

Status	Second	Third
BnH	00H	mmH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = Upper byte in Bank Number:		00H (preset)
		01H (user)

* This message is used to switch the preset and user of the Kit.

* This message will be received on the MIDI channel for the drum part.

❍Data Entry MSB/LSB

Status	Second	Third
BnH	06H	mmH
BnH	26H	llH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of parameter specified by RPN		
ll = LSB of parameter specified by RPN		

* This message will be received on the MIDI channel for the bass part.

❍Volume

Recognized when Volume receive switch (EDIT:MIDI:SETTING:Rx MIDI Vol) is set to "ON."

Status	Second	Third
BnH	07H	vvH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
vv = Volume:		00H–7FH (0–127)

* This message controls the volume of the part which is received.

❍RPN MSB/LSB

Status	Second	Third
BnH	65H	mmH
BnH	64H	llH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of parameter specified by RPN		
ll = LSB of parameter specified by RPN		

* This message will be received on the MIDI channel for the bass part.

****RPN****

Control Changes include RPN (Registered Parameter Numbers), which are extended parameters whose function is defined in the MIDI specification.
When using RPNs, first the RPN MSB and RPN LSB are transmitted to specify the parameter you wish to control. Then, Data Entry messages are used to set the value of the specified parameter.
Once a parameter has been specified, all further Data Entry messages on that channel are considered to apply to that specified parameter. In order to prevent accidents, when the desired setting has been made for the parameter, it is recommended that RPN be set to Null.

RPN	Data Entry	Description
MSB LSB	MSB LSB	
mm ll	xx yy	
00H 00H	xxH ---	Pitch Bend Sensitivity xx: 00H–0CH (0–12 semitones) yy: ignored Up to 1 octave in semitone steps * The BENDER-RANGE DOWN and BENDER-RANGE UP parameters will also be changed.
7FH 7FH	--- ---	RPN Null xx: ignored yy: ignored No specified parameter is assigned to RPN.

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●Program Change

Status	Second	
CnH	ppH	
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
pp = Program Number:		00H–64H (prog.1–prog.100)

* Receiving a Program Change switches the Kit.

* The first Note On after receiving a Program Change sounds a voice with a new tone. The voices which have been sounded before the Program Change is received does not change.

* This message will be received on the MIDI channel for the drum part.

The correspondence between Program number and Kit is as follows.

Program Number	Kit
prog.1	1
prog.2	2
:	:
prog.100	100
prog.101	ignored
:	:
prog.128	ignored

●Pitch Bend Change

Status	Second	Third
EnH	llH	mmH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm, ll = Pitch Bend Change:		00H, 00H–40H, 00H–7FH, 7FH (-8192–0–+8191)

* This message will be received on the MIDI channel for the bass part.

■System Exclusive Messages

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

F0H:	System Exclusive
ii = ID Number:	41 = Roland
	7E = Universal Non-Realtime Message
	7F = Universal Realtime Message
dd,..., ee = Data:	00H–7FH (0–127)
F7H:	EOX (End Of Exclusive)

●Data Request (RQ1)

Byte	Description
F0H	Status of System Exclusive Message
41H	Manufacturer ID (Roland)
dev	Device ID (10H–1FH)
00H	Model ID #1 (DR-880)
00H	Model ID #2 (DR-880)
02H	Model ID #3 (DR-880)
11H	Command ID (RQ1)
aaH	Address MSB
aaH	Address
aaH	Address
aaH	Address
aaH	Address LSB
ssH	Size MSB
ssH	Size
ssH	Size
ssH	Size
ssH	Size LSB
sum	Checksum
F7H	EOX (End of System Exclusive Message)

* Device ID is the value set by EDIT:MIDI:SETTING:Device ID. Actual Device ID is smaller than the number by 1.

* This message is recognized only when BULK LOAD screen (EDIT:MIDI:BULKLOAD) is displayed.

* Size and checksum are always ignored.

* Regarding address, please refer to “Parameter Address Map” (p. 6).

●Data Set (DT1)

Byte	Description
F0H	Status of System Exclusive Messages
41H	Manufacturer ID (Roland)
dev	Device ID (10H–1FH)
00H	Model ID #1 (DR-880)
00H	Model ID #2 (DR-880)
02H	Model ID #3 (DR-880)
12H	Command ID (DT1)
aaH	Address MSB
aaH	Address
aaH	Address
aaH	Address
aaH	Address LSB
ddH	Data MSB
:	:
ddH	Data LSB
sum	Checksum
F7H	EOX (End of System Exclusive Message)

* Device ID is the value set by EDIT:MIDI:SETTING:Device ID. Actual Device ID is smaller than the number by 1.

* This message is recognized only when BULK LOAD screen (EDIT:MIDI:BULKLOAD) is displayed.

* Checksum is always ignored.

* Regarding address or data, please refer to “Parameter Address Map” (p. 6).

●Universal Non-Realtime System Exclusive Message

○Identity Request

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

Byte	Description
F0H	Status of System Exclusive Message
7EH	ID Number (Universal Non-Realtime Message)
dev	Device ID (10H–1FH, 7FH(Broadcast))
06H	Sub ID#1 (General Information)
01H	Sub ID #2 (Identity Request)
F7H	EOX (End of System Exclusive Message)

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

* Device ID is the value set by EDIT:MIDI:SETTING:Device ID. Actual Device ID is smaller than the number by 1.

* Reply is executed by the unique Device ID when Device ID receives the "Identity Request message" in the Broadcast (7FH).

■System Common Messages

This messages are recognized when the Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at other than INTERNAL.

●Song Position Pointer

Status	Second	Third
F2H	llH	mmH
mm, ll = value:	00H, 00H–7FH, 7FH (0–16383)	

* The DR-880 locates the position in the song.

* This message is recognized only when the DR-880 is in Stop and Song mode.

●Song Select

Status	Second
F3H	ssH
ss = Song Number:	00H–63H (0–99)

* When this message is received in Song mode, it changes the songs.

* This message is recognized only when the DR-880 is in stop and Song mode.

The correspondence between Song number and Song is as follows.

Song Number	Song
0	1
1	2
:	:
99	100

■System Realtime Message

●Timing Clock

Status
F8H

* This message is ignored when the MIDI Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at INTERNAL or REMOTE.

●Start

Status
FAH

* This message is ignored when the MIDI Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at INTERNAL.

●Continue

Status
FBH

* This message is ignored when the MIDI Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at INTERNAL.

●Stop

Status
FCH

* This message is ignored when the MIDI Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at INTERNAL.

●Active Sensing

Status
FEH

* Whenever the DR-880 receives this message, it monitors the interval of the incoming data. If the subsequent message has not arrived within about 500 msec after the previous data, it mutes the sounding voices, then stops monitoring receiving interval.

2. Data Transmission

■Channel Voice Message

●Note Off

Status	Second	Third
9nH	kkH	00H
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
kk = Note Number:		00H–7FH (0–127)

●Note On

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

* This message will be transmitted on the MIDI channel (EDIT:MIDI:SETTING:MIDI Ch.Drum/MIDI Ch.Bass) for each part.

●Control Change

❍Bank Select MSB

Status	Second	Third
BnH	00H	mmH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of the bank number:		00H (preset)
		01H (user)

* This message is transmitted about whether the kit is User or Preset.

* This message will be transmitted on the MIDI channel for the drum part.

❍Data Entry MSB/LSB

Status	Second	Third
BnH	06H	mmH
BnH	26H	llH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of parameter specified by RPN		
ll = LSB of parameter specified by RPN		

* This message will be transmitted on the MIDI channel for the bass part.

❍RPN MSB/LSB

Status	Second	Third
BnH	65H	mmH
BnH	64H	llH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of parameter specified by RPN		
ll = LSB of parameter specified by RPN		

* This message will be transmitted on the MIDI channel for the bass part.

****RPN****

Control Changes include RPN (Registered Parameter Numbers), which are extended parameters whose function is defined in the MIDI specification.
When using RPNs, first the RPN MSB and RPN LSB are transmitted to specify the parameter you wish to control. Then, Data Entry messages are used to set the value of the specified parameter.
Once a parameter has been specified, all further Data Entry messages on that channel are considered to apply to that specified parameter. In order to prevent accidents, when the desired setting has been made for the parameter, it is recommended that RPN be set to Null.

RPN MSB LSB	Data Entry MSB LSB	Description
mm ll	xx yy	
00H 00H	xxH ---	Pitch Bend Sensitivity xx: 00H–0CH (0–12 semitones) yy: ignored Up to 1 octave in semitone steps * The BENDER-RANGE DOWN and BENDER-RANGE UP parameters will also be changed.
7FH 7FH	--- ---	RPN Null xx: ignored yy: ignored No specified parameter is assigned to RPN.

●Program Change

Status	Second	
CnH	ppH	
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
pp = Program Number:		00H–64H (prog.1–prog.100)

* This message will be transmitted on the MIDI channel for the drum part when the Kit is switched.

The correspondence between Kit and Program number is as follows.

Program Number	Kit
prog.1	1
prog.2	2
:	:
prog.100	100

●Pitch Bend Change

Status	Second	Third
EnH	llH	mmH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm, ll = Pitch Bend Change:		00H, 00H–40H, 00H–7FH, 7FH (-8192–0–+8191)

* This message will be transmitted on the MIDI channel for the bass part.

■System Exclusive Messages

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

F0H:	System Exclusive
ii = ID Number:	41 = Roland
	7E = Universal Non-Realtime Message
	7F = Universal Realtime Message
dd,..., ee = Data:	00H–7FH (0–127)
F7H:	EOX (End Of Exclusive)

●Data Set (DT1)

Byte	Description
F0H	Status of System Exclusive Message
41H	Manufacturer ID (Roland)
dev	Device ID (10H–1FH)
00H	Model ID #1ÂiDR-880)
00H	Model ID #2 (DR-880)
02H	Model ID #3 (DR-880)
12H	Command ID (DT1)
aaH	Address MSB
aaH	Address
aaH	Address
aaH	Address
aaH	Address LSB
ddH	Data MSB
:	:
ddH	Data LSB
sum	Checksum
F7H	EOX (End of System Exclusive Message)

* Device ID is the value set by EDIT:MIDI:SETTING:Device ID. Actual Device ID is smaller than the number by 1.

* Data Set message is transmitted when MIDI Bulk dump is performed in MIDI mode.

* Regarding address or data, please refer to “Parameter Address Map” (p. 6)

●Universal Non-Realtime System Exclusive Message

○Identity Reply

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

Byte	Description
F0H	Status of System Exclusive Message
7EH	ID Number (Universal Non-Realtime Message)
dev	Device ID (10H–1FH)
06H	Sub ID #1 (General Information)
02H	Sub ID #2 (Identity Reply)
41H	ID Number (Roland)
02H	Device Family Code (LSB)
02H	Device Family Code (MSB)
00H	Device Family Number Code (LSB)
00H	Device Family Number Code (MSB)
00H	Software Revision Level
06H	Software Revision Level
00H	Software Revision Level (Version LSB)
00H	Software Revision Level (Version MSB)
F7H	EOX (End of System Exclusive Message)

* Device ID is the value set by EDIT:MIDI:SETTING:Device ID. Actual Device ID is smaller than the number by 1.

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

■System Common Message

Not transmitted when Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at MIDI.

●Song Position Pointer

Status	Second	Third
F2H	llH	mmH
mm, ll = Value:		00H, 00H–7FH, 7FH (0–16383)

* This message is transmitted when Song mode is selected, new song is selected in Song mode, or play position is changed in stop state.

●Song Select

Status	Second
F3H	ssH
ss = Song Number:	00H–63H (0–99)

* This message is transmitted when Song mode is selected, or new song is selected in Song mode.

The correspondence between Song and Song number is as follows.

Song	Song Number
1	0
2	1
:	:
100	99

■System Realtime Message

Not transmitted when Sync mode (EDIT:MIDI:SETTING:Sync Mode) is set at MIDI.

●Timing Clock

Status
F8H

●Start

Status
FAH

●Continue

Status
FBH

●Stop

Status
FCH

●Active Sensing

Status
FEH

* This message is transmitted approx. 200 msec interval.

3. Messages Stored during Realtime Recording

■Channel Voice Message

●Note Off

Status	Second	Third
8nH	kkH	vvH
9nH	kkH	00H
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
kk = Note Number:		00H–7FH (0–127)
vv = Velocity:		00H–7FH (0–127)

* The Velocity is always ignored.

●Note On

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

●Control Change

❍Data Entry MSB/LSB

Status	Second	Third
BnH	06H	mmH
BnH	26H	llH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of parameter specified by RPN		
ll = LSB of parameter specified by RPN		

❍RPN MSB/LSB

Status	Second	Third
BnH	65H	mmH
BnH	64H	llH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm = MSB of parameter specified by RPN		
ll = LSB of parameter specified by RPN		

****RPN****

Control Changes include RPN (Registered Parameter Numbers), which are extended parameters whose function is defined in the MIDI specification.
When using RPNs, first the RPN MSB and RPN LSB are transmitted to specify the parameter you wish to control. Then, Data Entry messages are used to set the value of the specified parameter.
Once a parameter has been specified, all further Data Entry messages on that channel are considered to apply to that specified parameter. In order to prevent accidents, when the desired setting has been made for the parameter, it is recommended that RPN be set to Null.

RPN MSB LSB	Data Entry MSB LSB	Description
mm ll	xx yy	
00H 00H	xxH ---	Pitch Bend Sensitivity xx: 00H–0CH (0–12 semitones) yy: ignored Up to 1 octave in semitone steps * The BENDER-RANGE DOWN and BENDER-RANGE UP parameters will also be changed.
7FH 7FH	--- ---	RPN Null xx: ignored yy: ignored No specified parameter is assigned to RPN.

●Pitch Bend Change

Status	Second	Third
EnH	llH	mmH
n = MIDI Channel Number:		0H–FH (ch.1–ch.16)
mm, ll = Pitch Bend Change:		00H, 00H–40H, 00H–7FH, 7FH (-8192–0–+8191)

4. Parameter Address Map

Addresses are shown in every 7-bit hexadecimal.

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

■Parameter base address

With the DR-880, the parameters can be transferred by bulk dump. By bulk address, the plural parameters as one group are received and transmitted.

Start Address (H)	Block
10 00 00 00 00	user songs/patterns
20 00 00 00 00	user kits
30 00 00 00 00	user TSC
40 00 00 00 00	user guitar effects
50 00 00 00 00	system
70 00 00 00 00	bulk start
70 00 00 00 01	bulk end

●User Song/User pattern

This area is the data of the all user songs (001-100) and user patterns (001-500).
If you want to send Data Request to the DR-880 in this area, set the address to 10 00 00 00 00.
The size and checksum are ignored.

Address (H)	Data (H)	Description
10 00 00 00 00	---	user songs/patterns

●User kit

This area is the data of the all user kits (U001-U100).
If you want to send Data Request to the DR-880 in this area, set the address to 20 00 00 00 00.
The size and checksum are ignored.

Address (H)	Data (H)	Description
20 00 00 00 00	---	user kits

●User TSC

This area is the data of the all user TSCs (U01-U20).
If you want to send Data Request to the DR-880 in this area, set the address to 30 00 00 00 00.
The size and checksum are ignored.

Address (H)	Data (H)	Description
30 00 00 00 00	---	user TSC

●User Guitar Effect

This area is the data of the all user guitar effects (U01-U50).
If you want to send Data Request to the DR-880 in this area, set the address to 40 00 00 00 00.
The size and checksum are ignored.

Address (H)	Data (H)	Description
40 00 00 00 00	---	user guitar effects

●System

This area is the data of the all system parameters.
If you want to send Data Request to the DR-880 in this area, set the address to 50 00 00 00 00.
The size and checksum are ignored.

Address (H)	Data (H)	Description
50 00 00 00 00	---	system

●Bulk Start/End

This area is the data of the Bulk start/end.

Address (H)	Data (H)	Description
70 00 00 00 00	00	bulk start
70 00 00 00 01	00	bulk end

5. Supplementary material

●Decimal/Hexadecimal table

(Hexadecimal values are indicated by a following "H")

MIDI uses 7-bit hexadecimal values to indicate data values and the address and size of exclusive messages. The following table shows the correspondence between decimal and hexadecimal numbers.

10	16	10	16	10	16	10	16
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

* Decimal expressions such as used for MIDI channel, Bank Select, and Program Change will be the value 1 greater than the decimal value given in the above table.

* Since each MIDI byte carries 7 significant data bits, each byte can express a maximum of 128 different values. Data for which higher resolution is required must be transmitted using two or more bytes. For example a value indicated as a two-byte value of aa bbH would have a value of aa x 128 + bb.

<Example1>

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

<Example2>

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

❍Examples of actual MIDI messages

<Example1> 99 3E 7F

9nH is the Note On status and "n" is the MIDI channel number. Since 9H = 9, 3EH = 62, and 7FH = 127, this is a Note On message of MIDI CH = 10, Note number 62 and Velocity = 127.

<Example2> C9 49

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

❍Exclusive Messages

Roland exclusive messages (RQ1, DT1) are transmitted with a checksum at the end of the data (before F7) to check that the data was received correctly. The value of the checksum is determined by the address and data (or size) of the exclusive message.

❍How to calculate the checksum

(Hexadecimal values are indicated by a "H")

The checksum consists of a value whose lower 7 bits are 0 when the address, size and checksum itself are added.
The following formula shows how to calculate the checksum when the exclusive message to be transmitted has an address of aa bb cc ddH, and data or size of ee ffH.
aa + bb + cc + dd + ee + ff = total
total / 128 = quotient... remainder
128 - remainder = checksum
Checksum is 0 if the remainder is 0.

●ASCII code table

On the DR-880, the following ASCII code set is used for processing data such as the Song Name, Pattern Name, kit Name, TSC name, and Guitar Effect Name.

Char	Hex.	Char	Hex.	Char	Hex.	Char	Hex.
SP	20H						
A	41H	a	61H	0	30H	:	3AH
B	42H	b	62H	1	31H	;	3BH
C	43H	c	63H	2	32H	<	3CH
D	44H	d	64H	3	33H	=	3DH
E	45H	e	65H	4	34H	>	3EH
F	46H	f	66H	5	35H	?	3FH
G	47H	g	67H	6	36H	@	40H
H	48H	h	68H	7	37H	[	5BH
I	49H	i	69H	8	38H	\	5CH
J	4AH	j	6AH	9	39H	]	5DH
K	4BH	k	6BH	!	21H	^	5EH
L	4CH	l	6CH	"	22H	_	5FH
M	4DH	m	6DH	#	23H	`	60H
N	4EH	n	6EH	$	24H	{	7BH
O	4FH	o	6FH	%	25H	|	7CH
P	50H	p	70H	&	26H	}	7DH
Q	51H	q	71H	'	27H	~	7EH
R	52H	r	72H	(	28H		
S	53H	s	73H	)	29H		
T	54H	t	74H	*	2AH		
U	55H	u	75H	+	2BH		
V	56H	v	76H	,	2CH		
W	57H	w	77H	−	2DH		
X	58H	x	78H	.	2EH		
Y	59H	y	79H	/	2FH		
Z	5AH	z	7AH				

Note: SP indicates "space."

MEMO