

# 『Maple Bus 1.0』 Peripheral Hardware Specifications

## 104 Key Keyboard for US

Revision 1.00

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Revision :

0.50	1999/04/20	First release
0.51	1999/04/21	Deleted key code 137d. Changed device ID. Deleted explanation of sneak current. Changed page layout.
0.60	1999/04/28	Corrected erroneous figure numbering. Filled in items that were pending in 5, "Keyboard Function Information."
1.00	1999/06/07	Corrected Free Device Status

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# 1 The Keyboard

## 1.1 Keyboard Functions

The Keyboard function is an input type man/machine interface serving for input and editing of characters and numerals, and for control of screen operations. This peripheral conforms to the "Maple Bus" Standard Specifications, belonging to function type "FT<sub>6</sub>".

## 1.2 Outline of Operation

### (1) Key scan

Keys are scanned constantly and data on key status is kept up to date in order to enable good response to requests from the host on the status of keys.

### (2) Optimization and conditions

- a) When no keys are pressed, simultaneous depression of up to three keys can be detected.
- b) If three or more keys are being pressed, up to three additional keys can be detected provided that they are combinations that do not result in sneak current. However, if sneak current is produced, an error code results for that key and all subsequent keys pressed.
- c) If a seventh key is pressed while six keys are already being pressed under the conditions given in b) above, an error code results for all further keyboard functions.
- d) If sneak current results when more than three keys are pressed simultaneously, an error code is sent for all further keyboard functions.
- e) If two or more keys are pressed simultaneously while two or more other keys are already being pressed, an error code is sent for all further keyboard functions, even if the combination of keys pressed does not produce a sneak current.

### (3) Restrictions

Key repeat (intermittent output of a key scan code when a key is held down) cannot be set by keyboard function.

When key repeat is required, the repeat rate and initial repeat delay must be set by the host in software.

## 1.3 Keyboard Language, Keyboard Type

The keyboard applicable to these specifications is "US AT 104 Key Keyboard."

## 1.4 Function Outline

The Keyboard function elements are listed below.

- Alphanumeric keys: A~Z,0~9
- Symbol keys: - ^ \ @ [ ] : ; . / \ ! " # \$ % & ' ( ) = ~ | ` { + \* } < > ? \_ , &#x00A0
- Function keys: F1~F12
- Editing keys: Tab, Backspace, Space, CapsLock, Insert, Delete, Home, End, PageUp, PageDown, PrintScreen, ScrollLock, pause, Enter, Esc, , BackSpace
- Cursor keys: ← ↑ → ↓
- Control keys: Ctrl, Alt, Shift
- Special keys: S1,S2,S3
- Numeric keypad: 0~9,NumLock,Enter,.,/,+,-,\*
- Error code: No operation, rollover error, POST Fail, undefined error

## 1.5 Configuration Details

This section gives a detailed description of Keyboard function elements.

(1) Alpha keys, symbol keys: A - Z, - ^ \ @ [ ] : ; . / \ ! " # \$ % & ' ( ) = ~ | ` { + \* } < > ? \_ , &#x00A0

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output. The corresponding letter (A - Z), numeral (0 - 9), or symbol is displayed on the screen. To input the symbol printed in the top left corner of the key (for example ` { + \* } etc.), the Shift key must be held down while pressing the key.

(2) Function keys: F1~F12

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output and a function assigned to the key (such as displaying help) is executed. The method for using these keys differs according to application.

(3) Editing keys: Tab, Backspace, Space, CapsLock, Insert, Delete, Home, End, PageUp, PageDown, PrintScreen, ScrollLock, pause, Enter, Esc, NumLock, BackSpace

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output and a function assigned to the key (such as displaying help) is executed. The method for using these keys differs according to application.

(4) Cursor keys: ← ↑ → ↓

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output and a function assigned to the key (such as displaying help) is executed. The method for using these keys differs according to application.

(5) Control keys: Ctr, Alt, Shift

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output and a function assigned to the key (such as displaying help) is executed. The method for using these keys differs according to application.

(6) Special keys: S1,S2,S3

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output and a function assigned to the key (such as displaying help) is executed. The method for using these keys differs according to application.

(6) Numeric keypad: 0~9,NumLock,Enter,.,/,+,-,\*

These are digital keys that take only two states: pressed/not pressed (ON/OFF). When pressed, the corresponding key scan code is output and a function assigned to the key (such as displaying help) is executed. The method for using these keys differs according to application.

(9) Error code

This function is provided to deal with keyboard errors. It is not associated with a physical key. When seven or more keys are pressed simultaneously or when a sneak current has occurred, an error code is returned to the host.

## 2 Device ID

The device ID corresponds to the Maple Bus 1.0 Standard Specifications. The table below shows the memory image on the host.

### 2.1 US AT 104 Key Keyboard Device ID Configuration

The configuration uses 16 bytes (128 bit).

bit	7	6	5	4	3	2	1	0
1st Data	0	0	0	0	0	0	0	0
2nd Data	0	0	0	0	0	0	0	0
3rd Data	0	0	0	0	0	0	0	0
4th Data	0	1	0	0	0	0	0	0
5th Data	0	0	0	0	0	0	1	1
6th Data	0	0	0	0	0	1	1	0
7th Data	0	0	0	0	0	0	0	0
8th Data	1	0	0	0	0	0	0	0
9th Data	0	0	0	0	0	0	0	0
10th Data	0	0	0	0	0	0	0	0
11th Data	0	0	0	0	0	0	0	0
12th Data	0	0	0	0	0	0	0	0
13th Data	0	0	0	0	0	0	0	0
14th Data	0	0	0	0	0	0	0	0
15th Data	0	0	0	0	0	0	0	0
16th Data	0	0	0	0	0	0	0	0

Fig. 2-1 Device ID

- FT : Peripheral function type  
 FD1 : Function definition block for 1st function  
 FD2 : Function definition block for 2nd function  
 FD3 : Function definition block for 3rd function

(1) FT<sub>0</sub> - FT<sub>31</sub>: Function type

Indicates the function type implemented by the peripheral. There are a total of 32 function types.

(2) FD<sub>31</sub> - FD<sub>0</sub>: Function definition block

These blocks define the various elements that make up a function.

### 3 Data Format

This section describes the Keyboard function data format.

The notation uses the memory image on the host.

#### 3.1 Write Format

The format for writing Keyboard function data is shown below. When the host sends write data with "Set Condition", the keyboard returns a "Device Reply" for normal end or an error code for abnormal end.

bit	7	6	5	4	3	2	1	0
1st Data	LD <sub>7</sub>	LD <sub>6</sub>	LD <sub>5</sub>	LD <sub>4</sub>	LD <sub>3</sub>	LD <sub>2</sub>	LD <sub>1</sub>	LD <sub>0</sub>
2nd Data	0	0	0	0	0	0	0	0
3rd Data	0	0	0	0	0	0	0	0
4th Data	0	0	0	0	0	0	0	0

Fig. 3-1 Write format

Write format description

1st : LD LED setting

2nd : W1 Reserved = 00h

3rd : W2 Reserved = 00h

4th : W3 Reserved = 00h

LED setting

LD	Mapping	Lit	Out
0	Num Lock	1	0
1	Caps Lock	1	0
2	Scroll Lock	1	0
3	Reserved	1	0
4	Reserved	1	0
5	Kana	1	0
6	Power	1	0
7	Shift	1	0

Fig. 3-2 LED information bit

When set to ON (lit), the state is maintained until set to OFF (out).

With keyboard specifications, LD<sub>7</sub>-LD<sub>0</sub> is normally "00h" because all LEDs are unavailable.



### 3.2 Read Format

The format for reading data from the Keyboard function is shown below. When the host sends a "Get Condition", the keyboard returns the "Data Transfer".

The data format size is 8 bytes.

bit	7	6	5	4	3	2	1	0
1st Data	M <sub>7</sub>	M <sub>6</sub>	M <sub>5</sub>	M <sub>4</sub>	M <sub>3</sub>	M <sub>2</sub>	M <sub>1</sub>	M <sub>0</sub>
2nd Data	LD <sub>7</sub>	LD <sub>6</sub>	LD <sub>5</sub>	LD <sub>4</sub>	LD <sub>3</sub>	LD <sub>2</sub>	LD <sub>1</sub>	LD <sub>0</sub>
3rd Data	KC1 <sub>7</sub>	KC1 <sub>6</sub>	KC1 <sub>5</sub>	KC1 <sub>4</sub>	KC1 <sub>3</sub>	KC1 <sub>2</sub>	KC1 <sub>1</sub>	KC1 <sub>0</sub>
4th Data	KC2 <sub>7</sub>	KC2 <sub>6</sub>	KC2 <sub>5</sub>	KC2 <sub>4</sub>	KC2 <sub>3</sub>	KC2 <sub>2</sub>	KC2 <sub>1</sub>	KC2 <sub>0</sub>
5th Data	KC3 <sub>7</sub>	KC3 <sub>6</sub>	KC3 <sub>5</sub>	KC3 <sub>4</sub>	KC3 <sub>3</sub>	KC3 <sub>2</sub>	KC3 <sub>1</sub>	KC3 <sub>0</sub>
6th Data	KC4 <sub>7</sub>	KC4 <sub>6</sub>	KC4 <sub>5</sub>	KC4 <sub>4</sub>	KC4 <sub>3</sub>	KC4 <sub>2</sub>	KC4 <sub>1</sub>	KC4 <sub>0</sub>
7th Data	KC5 <sub>7</sub>	KC5 <sub>6</sub>	KC5 <sub>5</sub>	KC5 <sub>4</sub>	KC5 <sub>3</sub>	KC5 <sub>2</sub>	KC5 <sub>1</sub>	KC5 <sub>0</sub>
8th Data	KC6 <sub>7</sub>	KC6 <sub>6</sub>	KC6 <sub>5</sub>	KC6 <sub>4</sub>	KC6 <sub>3</sub>	KC6 <sub>2</sub>	KC6 <sub>1</sub>	KC6 <sub>0</sub>

Fig. 3-3 Read format

Read format description

- 1st : Change key bit
- 2nd : LED information
- 3rd : Key scan code array #1
- 4th : Key scan code array #2
- 5th : Key scan code array #3
- 6th : Key scan code array #4
- 7th : Key scan code array #5
- 8th : Key scan code array #6

Change key bit

M	Mapping	Down	Up
0	Left Control	1	0
1	Left Shift	1	0
2	Left Alt	1	0
3	S1	1	0
4	Right Control	1	0
5	Right Shift	1	0
6	Right Alt	1	0
7	S2	1	0

Fig. 3-4 Change key bit

Example: [Control] + [Alt]

Normal '00000000' (00h)

Left 「Alt」 Down '00000100' (04h)

Right 「Control」 Down '00010100' (14h)

## LED information

LD	Mapping	Lit	Out	Default
0	Num Lock	1	0	0
1	Caps Lock	1	0	0
2	Scroll Lock	1	0	0
3	Reserved	1	0	0
4	Reserved	1	0	0
5	Kana	1	0	0
6	Power	1	0	0
7	Shift	1	0	0

Fig 3-5 LED information bit

## Key scan code array for simultaneous key depression

When a key on the keyboard is pressed, the key scan code (see "5. Key code") is placed in the array. The array holds up to six key scan codes. When seven or more keys are pressed, a rollover error is generated.

Key input	Change key	Array #1	Array #2	Array #3	Array #4	Array #5	Array #6	Description
No input	00h	00h	00h	00h	00h	00h	00h	
Changed key input Right [Alt] "down"	40h	00h	00h	00h	00h	00h	00h	Changed key only is updated
First key input [A] "down"	40h	04h	00h	00h	00h	00h	00h	Array is left-aligned
Second key input [H] "down"	40h	04h	0Bh	00h	00h	00h	00h	
Third key input [I] "down"	40h	04h	0Bh	0Ch	00h	00h	00h	
Fourth key input [M] "down"	40h	04h	0Bh	0Ch	10h	00h	00h	
Change key input Left [Shift] "down"	42h	04h	0Bh	0Ch	10h	00h	00h	Changed key only is updated
Fifth key input [O] "down"	42h	04h	0Bh	0Ch	10h	12h	00h	
Sixth key input [T] "down"	42h	04h	0Bh	0Ch	10h	12h	17h	
Seventh key input [Q] "down"	42h	01h	01h	01h	01h	01h	01h	Seventh key was pressed. Rollover error generated.
First key input released [A] "up"	42h	0Bh	0Ch	10h	12h	17h	00h	Array is left-aligned
Second key input released [H] + [M] "up"	42h	0Ch	12h	17h	00h	00h	00h	
Changed key input released Right [Alt] "up"	02h	0Ch	12h	17h	00h	00h	00h	Changed key only is updated
First key input released [I] "up"	02h	12h	17h	00h	00h	00h	00h	
First key input released Second key input [O] "up" + [Y] "down"	02h	17h	1Ch	00h	00h	00h	00h	Array is aligned with priority to "up"
First key input released [T] "up"	02h	1Ch	00h	00h	00h	00h	00h	
Changed key input released Left [Shift] "up"	00h	1Ch	00h	00h	00h	00h	00h	Changed key only is updated
First key input released [Y] "up"	00h	00h	00h	00h	00h	00h	00h	No key pressed

Fig. 3-6 Operation example (no sneak current is produced)

## Sneak current phenomenon

Depending on the key position and timing, pressing three or more keys can lead to a condition where the keyboard circuitry cannot respond accurately, producing a false key scan code output. This is called sneak current. When it occurs, the keyboard produces a rollover error.

Key status	Change key	Array #1	Array #2	Array #3	Array #4	Array #5	Array #6	Description
Normal	00h	00h	00h	00h	00h	00h	00h	
Right [Alt] down	40h	00h	00h	00h	00h	00h	00h	Changed key only is updated
[A] down	40h	04h	00h	00h	00h	00h	00h	Array is left-aligned
[Z] down	40h	04h	1Dh	00h	00h	00h	00h	
[P] down	40h	04h	1Dh	01h	01h	01h	01h	Sneak current occurs. Rollover error is generated.

Fig 3-7 Sneak current condition

## 4 Key Scan Codes

キーコード Decimal	Key scan code Hex	Key mapping and usage
0	00h	No operation <sup>6</sup>
1	01h	Rollover error <sup>3</sup>
4	04h	Keyboard [a],[A]
5	05h	Keyboard [b],[B]
6	06h	Keyboard [c],[C]
7	07h	Keyboard [d],[D]
8	08h	Keyboard [e],[E]
9	09h	Keyboard [f],[F]
10	0Ah	Keyboard [g],[G]
11	0Bh	Keyboard [h],[H]
12	0Ch	Keyboard [i],[I]
13	0Dh	Keyboard [j],[J]
14	0Eh	Keyboard [k],[K]
15	0Fh	Keyboard [l],[L]
16	10h	Keyboard [m],[M]
17	11h	Keyboard [n],[N]
18	12h	Keyboard [o],[O]
19	13h	Keyboard [p],[P]
20	14h	Keyboard [q],[Q]
21	15h	Keyboard [r],[R]
22	16h	Keyboard [s],[S]
23	17h	Keyboard [t],[T]
24	18h	Keyboard [u],[U]
25	19h	Keyboard [v],[V]
26	1Ah	Keyboard [w],[W]
27	1Bh	Keyboard [x],[X]
28	1Ch	Keyboard [y],[Y]
29	1Dh	Keyboard [z],[Z]
30	1Eh	Keyboard [1],[!]
31	1Fh	Keyboard [2],[@]
32	20h	Keyboard [3],[#]
33	21h	Keyboard [4],[\$]
34	22h	Keyboard [5],[%]
35	23h	Keyboard [6],[^]
36	24h	Keyboard [7],[&]
37	25h	Keyboard [8],[*]
38	26h	Keyboard [9],[[
39	27h	Keyboard [0],[)]
40	28h	Keyboard [Return](Enter) <sup>2</sup>
41	29h	Keyboard [Esc]
42	2Ah	Keyboard [Delete](Backspace) <sup>6</sup>
43	2Bh	Keyboard [Tab]
44	2Ch	Keyboard [Spacebar]
45	2Dh	Keyboard [-],[_]
46	2Eh	Keyboard [=],[+]
47	2Fh	Keyboard [],[{]
48	30h	Keyboard [],[}]
49	31h	Keyboard [N],[n]
51	33h	Keyboard [;],[']
52	34h	Keyboard [`,`],[~]
53	35h	Keyboard [`,`],[~]

Fig. 4-1 Key scan code (1)

Key scan code	Key scan code	Key mapping and usage
	Hex	
54	36h	Keyboard [,],[<]
55	37h	Keyboard [,],[>]
56	38h	Keyboard [/],[?]
57	39h	Keyboard [Caps Lock] <sup>5</sup>
58	3Ah	Keyboard [F1]
59	3Bh	Keyboard [F2]
60	3Ch	Keyboard [F3]
61	3Dh	Keyboard [F4]
62	3Eh	Keyboard [F5]
63	3Fh	Keyboard [F6]
64	40h	Keyboard [F7]
65	41h	Keyboard [F8]
66	42h	Keyboard [F9]
67	43h	Keyboard [F10]
68	44h	Keyboard [F11]
69	45h	Keyboard [F12]
70	46h	Keyboard [Print Screen] <sup>1</sup>
71	47h	Keyboard [Scroll Lock] <sup>5</sup>
72	48h	Keyboard [Pause] <sup>1</sup>
73	49h	Keyboard [Insert] <sup>1</sup>
74	4Ah	Keyboard [Home] <sup>1</sup>
75	4Bh	Keyboard [Page Up] <sup>1</sup>
76	4Ch	Keyboard [Delete Forward] <sup>1,7</sup>
77	4Dh	Keyboard [End] <sup>1</sup>
78	4Eh	Keyboard [Page Down] <sup>1</sup>
79	4Fh	Keyboard [→] <sup>1</sup>
80	50h	Keyboard [←] <sup>1</sup>
81	51h	Keyboard [↓] <sup>1</sup>
82	52h	Keyboard [↑] <sup>1</sup>
83	53h	Numeric keypad [Num Lock] <sup>5</sup>
84	54h	Numeric keypad [/] <sup>1</sup>
85	55h	Numeric keypad [*]
86	56h	Numeric keypad [-]
87	57h	Numeric keypad [+]
88	58h	Numeric keypad [Enter] <sup>2</sup>
89	59h	Numeric keypad [1],[End]
90	5Ah	Numeric keypad [2],[↓]
91	5Bh	Numeric keypad [3],[Page Down]
92	5Ch	Numeric keypad [4],[←]
93	5Dh	Numeric keypad [5]
94	5Eh	Numeric keypad [6],[→]
95	5Fh	Numeric keypad [7],[Home]
96	60h	Numeric keypad [8],[↑]
97	61h	Numeric keypad [9],[Page Up]
98	62h	Numeric keypad [0],[Insert]
99	63h	Numeric keypad [.] ,[Delete]
101	65h	Keyboard [S3] <sup>4</sup>

Fig. 4-2 Key scan code (2)

Key scan code	Key scan code	キーマッピング, 使用法
	Hex	
*224	E0h	Keyboard Left [Control]
*225	E1h	Keyboard Left [Shift]
*226	E2h	Keyboard Left [Alt]
*227	E3h	Keyboard [S1] <sup>4</sup>
*228	E4h	Keyboard Right [Control]
*229	E5h	Keyboard Right [Shift]
*230	E6h	Keyboard Right [Alt]
*231	E7h	Keyboard [S2] <sup>4</sup>

Fig. 4-3 Key scan code(3)

\* These keys are treated as 2<sup>nd</sup> data Chnage key bits in the read format. The key code is not returned for the 3<sup>rd</sup> to 8<sup>th</sup> data of the read format.

## Notes:

1. Key scan codes do not change also when [Control], [Alt], [Shift], or [Num Lock] is pressed.  
Pressing these keys does not generate an additional key scan code.
2. The keyboard Enter key and the numeric keypad Enter key generate a different key scan code.
3. Reserved for standard keyboard state or keyboard error.  
Available as keyboard array, but does not correspond to physical key being pressed.
4. Special key.
5. Functions as non-fixed key.
6. Moves cursor one position back and erases characters one at a time.
7. Erases characters without moving cursor position.

With keyboards of different language specification, key code allocations of some keys may differ.

For details, refer to "Maple Bus 1.0", Function Specifications FT<sub>6</sub>:Keyboard.

## 5 Keyboard Function Information

This section describes device-specific information (device status). The device status must be stored in such a way that device status data cannot be changed or erased.

### 5.1 Type

#### Fixed Device Status

This refers to 112 bytes of device status information data with a fixed format, comprising required information. Correct connection and operation are only assured if all items are properly recorded.

#### Free Device Status

This refers to a maximum of 908 bytes of device-specific status information that can be allocated freely.

### 5.2 Fixed Device Status

The Fixed Device Status area must include all the items listed below.

#### (1) Device ID

Size : 16 bytes (00000040-02050080-00000000-00000000)  
Description : Specify peripheral device ID.

#### (2) Country specification

Size : 1byte (01h)  
Description : Only available in the North America region.

#### (3) Connection method

Size : 1byte(00h)  
Description : Connects to the expansion device and records the direction of the expansion socket.  
Becomes "00h" when the expansion device is not connected to the keyboard.

#### (4) Model name

Size : 30 bytes  
Description : "Keyboard" in hankaku characters.  
Remaining slots to be padded with spaces (20h).

#### (5) License

Size : 60 bytes  
Description : "Produced By or Under License From SEGA ENTERPRISES, LTD." in hankaku characters. Remaining slots to be padded with spaces (20h).



**(6) Standby current consumption**

Size	: 2 bytes
Description	: Indicates the current consumption of the unit in paused condition (During minimum power consumption), in 0.1 mA units (hexadecimal notation). Contains 01-90Ch since power consumption for the 104 Key Keyboard for US w is 40 mA.

**(7) Maximum current consumption**

Size	: 2Byte
Description	: Indicates the maximum current consumption of the unit, in 0.1 mA units (hexadecimal notation). Contains 01-90Ch since power consumption for the 104 Key Keyboard for US w is 40 mA.

**5.3 Free Device Status**

The Free Device Status area can include information about developers, designers, and programmers or any other information. The host can obtain this information by issuing the "All Device Request" command. If it is to be used by an application, the data ordering sequence must be taken into consideration.

"Version 1.010,1999/04/27,315-6211-AM ,," in hankaku characters.

**6 Remarks**

Contents subject to major or minor changes until release of final (distribution) version (Rev. 1.0).
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