"Maple Bus 1.0" Peripheral Hardware Specifications

VMS

Revision 1.00

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Revision history

0.50	1998/04/03	Draft version
0.80	1998/04/07	Initial release
0.81	1998/05/10	Changed key name (Suspend button → SLEEP button)
1.00	1999/03/12	Fixed Device Status items • Revised product name • Revised Standby current consumption • Revised maximum current consumption

Contents

1 VMS Function

1.1 VMS Definition

The VMS (Visual Memory System) comprises the following three services.

(1) Memory for storing data files with game contents and VMS programs, allowing data to be freely read and written, according to the Maple Bus 1.0 Standard Specifications FT_1: Storage Functions.

(2) Built-in reflective type monochrome liquid-crystal display (LCD) showing information for the user. Video data shown on the LCD must be managed according to the Maple Bus 1.0 Standard Specification FT_2: B/W LCD.

(3) Time data counter and time keeping capability.
Also provided are an alarm function and buttons used for time setting.
Time data counter capability for time keeping, according to Maple Bus 1.0 Standard Specifications FT_3: Timer Function.

1.2 Outline

VMS consists of the following elements.

- À Flash memory (128 Kbytes)
- Á Reflective type monochrome liquid-crystal display (LCD)
- Â Digital direction keys (UP, DOWN, LEFT, RIGHT)
- Ã Digital buttons (A, B, MODE, SLEEP)
- Ä Clock function
- Å Connector (14-pin)

1.3 Configuration Details

This section describes details of the VMS configuration elements listed above.

À Flash memory (128 K bytes)
Memory area which serves to store data files with game contents and other information, and VMS programs. The total area consists of 256 block with 512 bytes each. The area available for data (programs) is 200 blocks.
Block no. 0 - 127 is the program area.
Programs are stored sequentially, starting from block number 0.(0, 1, 2, ...127).

Block no.128 - 200 is the data area.
The data area is filled in reverse sequential order, starting with block 200. (200, 199, 198, etc.)
If no program is stored in the program area, this area can also be used for data.

Á Reflective type monochrome liquid-crystal display (LCD)
Serves for showing game program screens as well as game content data, time data and other information. The LCD specifications are as follows.

1.	Number of LCD dots:	Vertical 32 dots x horizontal 48 dots with icon display capacity (4 icons)
2.	Gray-scale:	2 states (normally white)
3.	Contrast adjustment:	None
4.	Backlight:	None

Â Digital direction keys (UP, DOWN, LEFT, RIGHT)
Digital keys which take two values for the pressed or released state (=ON/OFF). UP and DOWN、LEFT and RIGHT are arranged symmetrically, with the UP and DOWN axis (X axis) at a right angle to the LEFT and RIGHT axis (Y axis). Button state values are detected as "0" for depressed and "1" for released. Input data may not be generated for 3 or more keys simultaneously.

Ã Digital buttons (A, B, MODE, SLEEP)
Digital keys which take two values for the pressed or released state (=ON/OFF). The buttons can be arranged freely. When several buttons are pressed simultaneously, the data for all buttons must be detected. Button state values are detected as "0" for depressed and "1" for released.

Ä Clock function
Serves for time counting. While power is being supplied, the time data must be continuously updated and stored. It must also be possible to freely change (input) time data, and to call up the time data. An alarm function is also included. Time data are changed with the setting buttons (UP, DOWN, LEFT, RIGHT, A, B).

Å Connector (14-pin)
Serves for connecting the VMS to the new generation game machine, and to other VMS units. The connector is divided into two sections, a male connector with 7 pins and a female connector with 7 pins.

2 VMS Operation

This section explains operation of the VMS units.
The VMS comprises the following six functions.

À Data transfer function
Á File operation function
Â LCD display function
Ã Icon display function
Ä Key scan function
Å Time function

2.1 Data Transfer Function

VMS can perform data transfer in two configurations.

À Data transfer between VMS and new generation game machine (preliminary)
The VMS can be connected to the new generation game machine (preliminary) for data exchange in both directions. To enable this, the VMS must conform to the Maple Bus 1.0 Standard Specifications.
The VMS can store data received from the new generation game machine (game content data files, VMS programs, etc.) The number of data that can be stored depends on the amount of installed memory, and the data size. For details regarding the communication format, please refer to the VMS user's manual and to the documentation of the various function types.

Á Data transfer between VMS units
Two VMS units can be connected to each other, for data transfer. Communication uses a full-duplex synchronous serial data communication protocol. For details regarding the communication protocol, please refer to the VMS user's manual.

2.2 File Operation Function

VMS allows the user to perform various operations on data files with game content data and VMS program files. This includes file name display, erasing files, and copying files between VMS units.

À File name display
The LCD that is an integral part of the VMS unit can be used to show the names of data files with game content data and VMS program files. This function is available when the VMS unit is operating in standalone mode (not connected to the new generation game machine).

Á File erase
Data files with game content data and VMS program files stored in the VMS unit can be erased by the user. This function is available when the VMS unit is operating in standalone mode (not connected to the new generation game machine).

Â File copy among VMS units
Data files with game content data and VMS program files stored in a VMS unit can be copied to another unit, using the data transfer function.

2.3 LCD Display Function

The LCD matrix screen on the VMS unit can show any kind of image. Video data may either be sent from the host or generated by a game program running on the VMS itself. The VMS must be able to correctly display all of these types of video data. Conversely, this means that the video data must be generated so that they match the LCD specifications, as listed in section 1.3. Fig. 2.1 shows the contents of the LCD screen.

2.4 Icon Display Function

The LCD matrix screen on the VMS unit also incorporates a space for four different icons which are shown outside of the regular display area. These icons indicate various operation states of the VMS unit. The icons are as listed below.

À	File operation	Appears when a file operation is carried out.
Á	Game program	Appears when a game program is running
Â	Clock	Appears when clock data are shown
Ã	Memory access	Appears when memory data are being accessed

The VMS automatically determines the current operation state and displays the respective icon. Fig. 2.1 shows the icon display content.

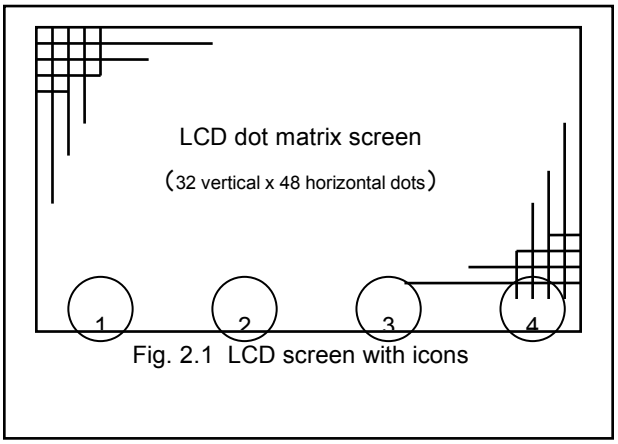

Fig. 2.1 LCD screen with icons

ICONS：

1. File operation icon
2. Game program icon
3. Clock icon
4. Memory access icon

2.5 Key Scan Function

The VMS unit has four digital direction keys. When operating in stand alone mode, that is while not connected to the new generation game machine (preliminary), the ON/OFF state of the digital direction keys and digital buttons must be constantly monitored. Any change in the ON/OFF status of a button must be immediately reflected in the program running on the VMS unit.

2.6 Time Data Get Function

Time data must be updated automatically every second for as long as power is supplied. When the VMS is connected to the new generation game machine (preliminary) and new time data are being sent from the game machine, these data must be used to update the VMS time data. If the user changes the time setting during standalone operation, the VMS unit must also use the new data.
Leap year compensation must be carried out automatically.
It is not necessary to continuously display the time on the LCD.

3 Device ID

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

3.1 VMS Device ID Configuration

The configuration uses 16 bytes (128 bit).

Bit	7	6	5	4	3	2	1	0	Data content
1st Data	0	0	0	0	0	0	0	0	FT
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	1	1	1	0	
5th Data	0	1	1	1	1	1	1	0	FD1
6th Data	0	1	1	1	1	1	1	0	
7th Data	0	0	1	1	1	1	1	1	
8th Data	0	1	0	0	0	0	0	0	
9th Data	0	0	0	0	0	0	0	0	FD2
10th Data	0	0	0	0	0	1	0	1	
11th Data	0	0	0	1	0	0	0	0	
12th Data	0	0	0	0	0	0	0	0	
13th Data	0	0	0	0	0	0	0	0	FD3
14th Data	0	0	0	0	1	1	1	1	
15th Data	0	1	0	0	0	0	0	1	
16th Data	0	0	0	0	0	0	0	0	

Fig. 3.1 Device ID

1st - 4th data:	VMS unit function type (FT)
5th - 8th data:	Function definition block (FD1) for 1st function
9th - 12th data:	Function definition block (FD2) for 2nd function
13th - 16th data:	Function definition block (FD3) for 3rd function

À FT: Function type
Indicates the function type implemented by the VMS unit.
The following functions are available:
FT_1: Storage function
FT_2: B/W LCD function
FT_3: Timer function

Á FD1 - FD3: Function definition blocks

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

FD1: Defines the timer function elements.
FD2: Defines the B/W LCD function elements.
FD3: Defines the storage function elements.

The standard content for these function definitions is shown below.

Note: Identically named items in the function definitions may have different values.
These definitions are defined for each function and are entirely independent of each other.
The data handled by the functions are separate.

À Timer function definitions

- Time units that can be read — year, month, day, hour, minute, second
- Time units that can be written to the function — year, month, day, hour, minute, second
- Buttons used for time setting — UP, DOWN, LEFT, RIGHT key; A, B button
- Alarm — 1 alarm function

(For details on each item, please see Function Type Specifications FT_3: Timer Function.)

Á B/W LCD function definitions

- Number of LCDs — 1
- Transfer data size for one LCD screen — 192 bytes
- Access count for writing 1 block of data — 1 (1 access: 192 bytes)
- LCD data horizontal/vertical orientation — horizontal 1
- When screen data are ’0’, is corresponding dot black or white? — White

(For details on each item, please see Function Type Specifications FT_2: B/W LCD Function.)

Â Storage function definition

- Number of partitions — 1
- Data size of 1 block — 512 bytes
- Access count for writing 1 block of data — 1 (1 access: 512 bytes)
- Access count for writing 1 block of data — 4 (1 access: 128 bytes)
- Data storage media are removable? — No (fixed media)
- CRC performed for each data block? — Not required

(For details on each item, please see Function Type Specifications FT_1: Storage Function.)

4 Data Format

This section describes the VMS data format.
The notation uses the memory image on the host.

4.1 Read Format

The following two formats are available when reading data from the VMS unit.

À File data read format
Á Time data read format

4.1.1 File Data Read Format

This format is used when reading file data from the VMS unit. (File data are data other than LCD image data and time data, consisting usually of game content files or VMS program files.)
The data format size is 512 bytes. A block of data specified by the host (512 bytes) is read.
For information on blocks, see Function Type Specification FT_1: Storage Function.

Data address	Data
+0000h	Data at start address of specified block
+0001h	Data at start address of specified block + 001h
+0002h	Data at start address of specified block + 002h
+0003h	Data at start address of specified block + 003h
+0004h	Data at start address of specified block + 004h
: : :	: : :
+01FEh	Data at start address of specified block +1 FEh
+01FFh	Data at start address of specified block +1 FFh

Fig. 4.1 File data read format

4.1.2 Time Data Read Format

This format is used when reading time data from the VMS unit.
The data format size is 8 bytes.

Data address	Data	Setting sample	Description
+0000h	Year		Year setting value
+0001h			
+0002h	Month		Month setting value
+0003h	Day		Day setting value
+0004h	Time		Hour setting value
+0005h	Minute		Minute setting value
+0006h	Second		Second setting value
+0007h	Fixed value	00h	

Fig. 4.2 Time data read format

Time data description

Year setting value: 2-byte data indicating the year (hexadecimal)
Lower-order byte is stored in +0000h, upper-order byte in +0001h
Month setting value: 1-byte data indicating the month (hexadecimal)
Day setting value: 1-byte data indicating the day (hexadecimal)
Hour setting value: 1-byte data indicating the hour (hexadecimal)
Minute setting value: 1-byte data indicating the minute (hexadecimal)
Second setting value: 1-byte data indicating the second (hexadecimal)

4.2 Write Format

This section describes the format for writing data to the VMS unit.
There are three write formats, depending on the type of data that are being written.

4.2.1 File Data Write Format

This format is used when writing file data to the VMS unit. Because the flash memory of the VMS is managed in blocks of 512 bytes each, data read is also managed in blocks.
When writing data to the VMS, the maximum data size that can be sent at one time is 128 bytes. To write one block of data, it is therefore necessary to divide the data for one block into four 128- bytes segments.

Data send count	Data address	Data
1	+0000h	Data at start address of specified block
	:	:
	+007Fh	Data at start address of specified block + 07Fh
2	+0000h	Data at start address of specified block + 080h
	:	:
	+007Fh	Data at start address of specified block + 0FFh
3	+0000h	Data at start address of specified block + 100h
	:	:
	+007Fh	Data at start address of specified block + 17Fh
4	+0000h	Data at start address of specified block + 180h
	:	:
	+007Fh	Data at start address of specified block + 1FFh

Fig. 4.3 File data write format

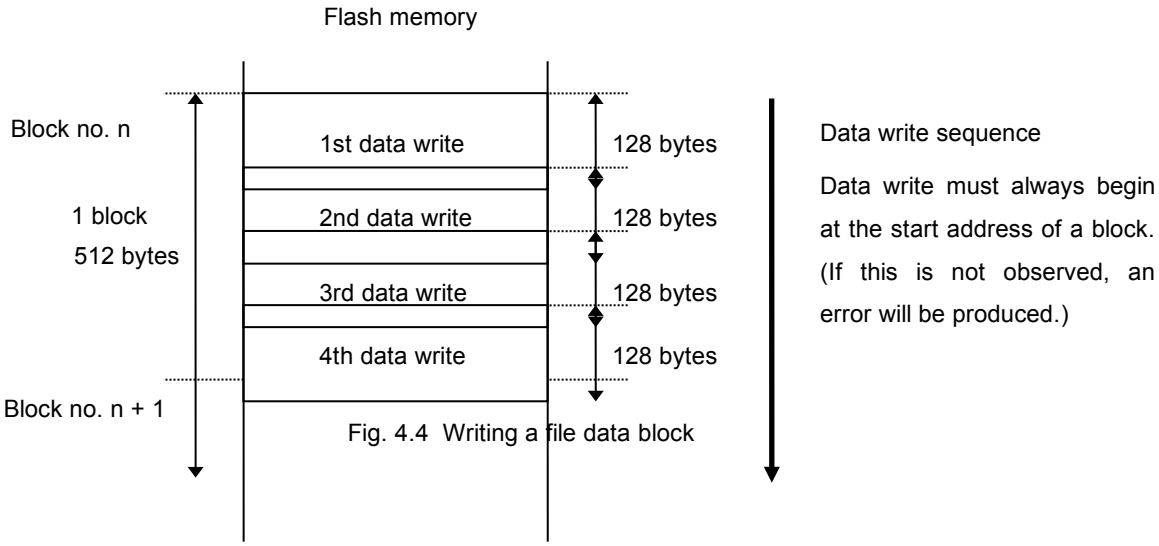

Fig. 4.4 Writing a file data block

4.2.2 LCD Image Data Write Format

This format is used when writing LCD image data to the VMS unit.
The data size for LCD image data is 192 bytes, which corresponds to one LCD matrix screen excluding icon
data. (Icon display cannot be specified.)

Fig. 4.4 shows the write format for LCD image data.
Fig. 4.5 shows the relationship between LCD image data and write data.

Data address	Data
+000h	Image data (Fig. 4.6: +000h)
+001h	Image data (Fig. 4.6: +001h)
+002h	Image data (Fig. 4.6: +002h)
+003h	Image data (Fig. 4.6: +003h)
+004h	Image data (Fig. 4.6: +004h)
+005h	Image data (Fig. 4.6: +005h)
+006h	Image data (Fig. 4.6: +006h)
:	:
:	:
:	:
+0BEh	Image data (Fig. 4.6: +0BEh)
+0BFh	Image data (Fig. 4.6: +0BFh)

Fig. 4.5 LCD image data write format

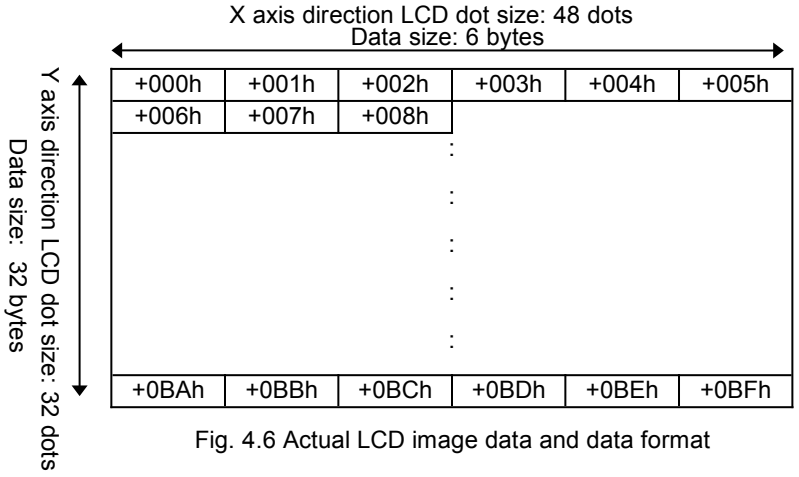

Fig. 4.6 Actual LCD image data and data format

4.2.3 Time Data Write Format

This format is used when writing time image data to the VMS unit.
The data size for time image data is 8 bytes.

Data address	Data	Setting example	Description
+0000h	Year		Year setting value
+0001h			
+0002h	Month		Month setting value
+0003h	Day		Day setting value
+0004h	Hour		Hour setting value
+0005h	Minute		Minute setting value
+0006h	Second		Second setting value
+0007h	Fixed value	00h	

Fig. 4.7 Time data write format

Time data description

Year setting value: 2-byte data indicating the year (hexadecimal)
Lower-order byte is stored in +0000h, upper-order byte in +0001h
Month setting value: 1-byte data indicating the month (hexadecimal)
Day setting value: 1-byte data indicating the day (hexadecimal)
Hour setting value: 1-byte data indicating the hour (hexadecimal)
Minute setting value: 1-byte data indicating the minute (hexadecimal)
Second setting value: 1-byte data indicating the second (hexadecimal)

5 VMS Information

This section describes device-specific information (device status). Device status data are stored as is and cannot be modified or erased.

5.1 Type

Fixed Device Status
This refers to 112 bytes of device status information with a fixed format, comprising required VMS specification settings. Correct connection and operation of the VMS unit are only assured if all items are properly recorded.

Free Device Status
This refers to a maximum of 912 bytes of device status information that can be allocated freely.

5.2 Fixed Device Status

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

À Device ID
Size: 16 bytes (00-00-00-0E-7E-7E-3F-40-00-05-10-00-00-0F-41-00)
Description: Specifies the device ID of the VMS unit.
(For information about the device ID, see section 3.)

Á Country specification
Size: 1 byte (02h)
Description: Japan specification

Â Model name
Size: 31 bytes
Description: ASCII string "VISUAL MEMORY"
To be padded with spaces (20h).

Ã License
Size: 60 bytes
Description: "Produced By or Under License From SEGA ENTERPRISES,LTD."
To be padded with spaces (20h).

Ä Standby current consumption
Size: 2 bytes
Description: Indicates the current consumption of the unit in paused condition, in 0.1 mA units (hexadecimal notation) Because this is 10 mA for VMS, the item is denoted as 00-64 h.

- Maximum current consumption
  - Size: 2 bytes
  - Description: Indicates the maximum current consumption of the unit, in 0.1 mA units (hexadecimal notation) Because this is 13 mA for VMS, the item is denoted as 00-82 h.

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.

6 Remarks

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