

DTL-H2000 Installation and Operation

© 1998 Sony Computer Entertainment Inc.

Publication date: August 1998

Sony Computer Entertainment America
919 E. Hillsdale Blvd., 2nd floor
Foster City, CA 94404

Sony Computer Entertainment Europe
Waverley House
7-12 Noel Street
London W1V 4HH, England

The *DTL-H2000 Installation and Operation* manual is supplied pursuant to and subject to the terms of the Sony Computer Entertainment PlayStation® License and Development Tools Agreements, the Licensed Publisher Agreement and/or the Licensed Developer Agreement.

The *DTL-H2000 Installation and Operation* manual is intended for distribution to and use by only Sony Computer Entertainment licensed Developers and Publishers in accordance with the PlayStation® License and Development Tools Agreements, the Licensed Publisher Agreement and/or the Licensed Developer Agreement.

Unauthorized reproduction, distribution, lending, rental or disclosure to any third party, in whole or in part, of this book is expressly prohibited by law and by the terms of the Sony Computer Entertainment PlayStation® License and Development Tools Agreements, the Licensed Publisher Agreement and/or the Licensed Developer Agreement.

Ownership of the physical property of the book is retained by and reserved by Sony Computer Entertainment. Alteration to or deletion, in whole or in part, of the book, its presentation, or its contents is prohibited.

The information in the *DTL-H2000 Installation and Operation* manual is subject to change without notice. The content of this book is Confidential Information of Sony Computer Entertainment.

PlayStation and PlayStation logos are registered trademarks of Sony Computer Entertainment Inc. All other trademarks are property of their respective owners and/or their licensors.

Table of Contents

List of Figures	iv
List of Tables	iv
About This Manual	v
Changes Since Last Release	v
Related Documentation	v
Developer Reference Series	v
Typographic Conventions	vi
Developer Support	vi
Chapter 1: DTL-H2000 Equipment	
Specifications	1-3
Checklist	1-3
Chapter 2: Installation of Software Tools	
Insert the Programmer's Tools CDROM	2-3
Install the "psx" Tool	2-3
Install the SN Tools	2-3
Install the "psxgraph" Tools (optional)	2-3
Graphic Artist Tools Program Group	2-4
Movie Converter	2-4
Movie Pack	2-4
3D Studio Plug-In	2-5
Add Environment Variables	2-5
Reboot the Computer	2-6
Chapter 3: Hardware Installaton	
Determine a Free Memory Address and a Free IRQ for the Boards	3-3
Edit the autoexec.bat File	3-3
Install the Development Boards	3-3
Reboot the Computer	3-4
Chapter 4: Testing the DTL-H2000	
Verify Ability to Compile	4-3
Run a Program	4-3
Run Other Sample Programs	4-4
Run from the CDROM	4-4
Chapter 5: Miscellany	
Installation of the CD-ROM Emulator Software	5-3
Kanji ROM Specification	5-3
Overview	5-3
Fonts	5-3
Data Format	5-4
Service Function	5-4
Patch for the DTL-H2000	5-4
Sample Program	5-4
cpe2x	5-5
Procedure for Dealing with a Non-Recoverable Error	5-5
Other Items	5-7
Compiler	5-7
If There is no Floating Point Processor on the PC	5-7
Global Allocation	5-7
Debugger	5-7

List of Figures

Figure 5-1: Font Data Format	5-4
------------------------------	-----

List of Tables

Table 5-1: SCE-Stipulated System Errors	5-6
Table 5-2: Error Codes for Internal System Identification	5-6

About This Manual

This manual is the latest release of instructions relating to the PlayStation's® DTL-H2000 Development System as of Run-Time Library release 4.3. The purpose of this manual is to provide installation and operation instructions for the DTL-H2000 Development System.

Changes Since Last Release

There have been no substantial changes in this document since its last release.

Related Documentation

In addition to this document, you can obtain helpful information from the installation sheets, "*PlayStation*" Board (for PC/AT), that come with your hardware.

Developer Reference Series

This manual is part of the *Developer Reference Series*, a series of technical reference volumes covering all aspects of PlayStation development. The complete series is listed below:

Manual	Description
PlayStation Hardware	Describes the PlayStation hardware architecture and overviews its subsystems.
PlayStation Operating System	Describes the PlayStation operating system and related programming fundamentals.
Run-Time Library Overview	Describes the structure and purpose of the run-time libraries provided for PlayStation software development.
Run-Time Library Reference	Defines all available PlayStation run-time library functions, macros and structures.
Inline Programming Reference	Describes in-line programming using DMPSX, GTE inline macro and GTE register information.
SDevTC Development Environment	Describes the SDevTC (formerly "Psy-Q") Development Environment for PlayStation software development.
3D Graphics Tools	Describes how to use the PlayStation 3D Graphics Tools, including the animation and material editors.
Sprite Editor	Describes the Sprite Editor tool for creating sprite data and background picture components.
Sound Artist Tool	Provides installation and operation instructions for the DTL-H800 Sound Artist Board and explains how to use the Sound Artist Tool software.
File Formats	Describes all native PlayStation data formats.
Data Conversion Utilities	Describes all available PlayStation data conversion utilities, including both stand-alone and plug-in programs.
CD Emulator	Provides installation and operation instructions for the CD Emulator subsystem and related software.

CD-ROM Generator	Describes how to use the CD-ROM Generator software to write CD-R discs.
Performance Analyzer User Guide	Provides general instructions for using the Performance Analyzer software.
Performance Analyzer Technical Reference	Describes how to measure software performance and interpret the results using the Performance Analyzer.
DTL-H2000 Installation and Operation	Provides installation and operation instructions for the DTL-H2000 Development System.
DTL-H2500/2700 Installation and Operation	Provides installation and operation instructions for the DTL-H2500/H2700 Development Systems.

Typographic Conventions

Certain Typographic Conventions are used through out this manual to clarify the meaning of the text. The following conventions apply to all narrative text except for structure and function descriptions:

<i>Convention</i>	<i>Meaning</i>
<code>courier</code>	Indicates literal program code.
Bold	Indicates a document, chapter or section title.

The following conventions apply within structure and function descriptions only:

<i>Convention</i>	<i>Meaning</i>
Medium Bold	Denotes structure or function types and names.
<i>Italic</i>	Denotes function arguments and structure members.

Developer Support

Sony Computer Entertainment America (SCEA)

SCEA developer support is available to licensees in North America only. You may obtain developer support or additional copies of this documentation by contacting the following addresses:

Order Information	Developer Support
<i>In North America</i>	<i>In North America</i>
Attn: Developer Tools Coordinator Sony Computer Entertainment America 919 East Hillsdale Blvd., 2nd floor Foster City, CA 94404 Tel: (650) 655-8000	E-mail: DevTech_Support@playstation.sony.com Web: http://www.scea.sony.com/dev Developer Support Hotline: (650) 655-8181 (Call Monday through Friday, 8 a.m. to 5 p.m., PST/PDT)

Sony Computer Entertainment Europe (SCEE)

SCEE developer support is available to licensees in Europe only. You may obtain developer support or additional copies of this documentation by contacting the following addresses:

Order Information	Developer Support
<i>In Europe</i> Attn: Production Coordinator Sony Computer Entertainment Europe Waverley House 7-12 Noel Street London W1V 4HH Tel: +44 (0) 171 447 1600	<i>In Europe</i> E-mail: dev_support@playstation.co.uk Web: https://www-s.playstation.co.uk Developer Support Hotline: +44 (0) 171 447 1680 (Call Monday through Friday, 9 a.m. to 6 p.m., GMT or BST/BDT)

Chapter 1:

DTL-H2000 Equipment

Specifications

The DTL-H2000 is a development environment equipped with all functions necessary for the PlayStation®. It consists of two full size ISA boards for PC compatible machines. It has the following specifications and functions.

CPU-GTE	Same specification as the PlayStation®
Main Memory	8MByte (access can be limited to 2MByte)
Graphics	Same specification as the PlayStation®
Sound	Same specification as the PlayStation®
CD-ROM Subsystem	Equivalent to the PlayStation® (without copy protection)
Controller Terminal	Equivalent to the PlayStation® (connector shape is different)
SIO/PIO Extension	Equivalent to the PlayStation® (connector shape is different)
CD-ROM Drive Terminal	For the DTL-H2010 dedicated CD ROM Drive

Checklist

The complete kit for the DTL-H2000 contains the following items.

- CPU2 Board
- PIO2 Board
- Connecting Cable
- RCA Cable
- Installation Documentation
- Programmer Tools CD (DTL-S2002)
- Technical Reference CD (DTL-S2003)

You should also have a PlayStation® game controller.

If your development environment does **not** have the PlayStation®-dedicated DTL-H2010 CD-ROM drive, make sure that an SPU attachment (“blue dongle”) is attached to the PIO2 Board.

Chapter 2:

Installation of Software Tools

Insert the Programmer's Tools CDROM

Insert the Programmers Tools CD into your CD-ROM drive of your system (not the DTL-H2010).

If you have Windows 95, you can run the Setup program, `setup.bat` in the root directory of the CDROM. Follow all of the instructions. After the computer reboots (to set environment variables), skip to **Add Environmental Variables**.

Otherwise, proceed with the next step, **Install the "psx" Tool**.

Install the "psx" Tool

The directory `[cdrom]:\psx` contains the PlayStation® Development directory, which includes over 100 sample programs with full source code, the include files, and the linking libraries.

- If applicable, back up or delete your previous `c:\psx` directory.
- To be consistent with the automatic installation of the software under Win95, create a parent directory `ps` into which all PlayStation® software will be installed. Copy the `psx` directory, `[cd]:\psx`, from the CD to your local hard drive as `c:\ps\psx`:

```
xcopy /s [cdrom]:\psx c:\ps\psx
```

(or just drag and drop the folder).

- Add the following line to the end of your `c:\autoexec.bat` file.

```
set path=%path%; c:\ps\psx\bin
```

Install the SN Tools

The directory `[cdrom]:\pssn` contains the standard PlayStation® development system, which includes an interactive debugger and the C compiler.

- If applicable, back up or delete your previous `c:\pssn` directory.
- Copy the `pssn` directory, `[cdrom]:\pssn`, from the CD to your local hard drive `c:\ps\pssn`.
- Copy the contents of the `gnu` directory, `d:\gnu`, from the CD to your local hard drive `c:\ps\pssn`:

```
xcopy /s [cdrom]:\gnu\* c:\ps\pssn
```

The GNU license is labeled `gnu.txt`.

- Add the following line to the end of your `c:\autoexec.bat` file.

```
set path=%path%;c:\ps\pssn
```

Install the "psxgraph" Tools (optional)

In this step, we are setting up the "Graphic Artist Tools program" area. It does not contain the entire tool set for the Graphic Artist Tools but only the format conversion tools. Please contact your regional tool coordinator for information on how to obtain the **Graphic Artist Tools CD** (DTL-S220).

The directory `[cdrom]:\psxgraph` contains the tools for converting between standard graphics file formats and the PlayStation® formats.

- If applicable, back up or delete your previous `c:\psxgraph` directory.
- Copy the `psxgraph` directory, `[cdrom]:\psxgraph`, from the CD to your local hard drive `c:\ps\psxgraph`.
- Add the following line to the end of your `c:\autoexec.bat` file.

```
set path=%path%;c:\ps\psxgraph\bin
```
- Copy the all files located in the `system` directory, `[cdrom]:\psxgraph\system`, to the window's system directory, i.e. `c:\windows\system`. These files are used by the Movie Converter.
- If you have Windows 95, skip on to the next step. Otherwise, you create the groups and match the icons yourself, by performing the following steps in Windows 3.1:

Graphic Artist Tools Program Group

Create a Graphic Artist Tools program group in the Windows 3.1 environment as follows.

1. Under the Program Manager "File" pulldown, click the File>New button.
2. Select Program Group and click OK.
3. Fill in the Description with "Graphic Artist Tools". You may leave the "Group File" field blank. A new group will be displayed.
4. You are now ready to add the individual tool icons. Please follow the individual program installation instructions listed below.

Note: For additional details on setting up program icons, please refer to your Windows 3.1 manual.

Movie Converter

With the "Graphic Artist Tools" program group selected, create a program icon for the Movie Converter tool.

1. Under the Program Manager "File" pulldown, click the File>New button.
2. Select Program Item and click OK
3. A Program Item Properties dialog box will pop up. Fill in the Description field with "Movie Converter".
4. Use Browse to identify the name of the executable to be placed in the Command Line field (i.e., `c:\ps\psxgraph\bin\movconv.exe`).
5. Click OK.

Movie Pack

With the "Graphic Artist Tools" program group selected, create a program icon for the Movie Pack tool.

1. Under the Program Manager "File" pulldown, click the File>New button.
2. Select Program Item and click OK
3. A Program Item Properties dialog box will pop up. Fill in the Description field with "Movie Pack".
4. Use Browse to identify the name of the executable to be placed in the Command Line field (i.e., `c:\ps\psxgraph\bin\movpack.exe`).
5. Click OK.

3D Studio Plug-In

When using the 3D Studio plug-in utilities, we highly recommend the following. Please attach the 3DStudio dongle before progressing with a modeling session.

Warning: Do not remove or add dongles while the PC is powered on.

Do not start a 3DStudio plug-in session before doing the following:

1. Remove dexbios (if dexbios is installed)
2. Remove mess1.com (if mess1 is installed)
3. Remove cdbios (if cdbios is installed)

Please read the *.doc and *.txt files in the c:\ps\psxgraph\doc\3ds directory. Specific installation instructions are included in the 3dstod_e.txt file.

Add Environment Variables

Edit your autoexec.bat file to contain the lines listed below.

Note: This example depends on where you have set up your root PSX and PSSN directories. The file paths contain forward slashes, unlike the normal DOS convention which uses backward slashes.

```

REM ===== PSX Development Environment Variables =====
set SN_PATH=c:/ps/pssn
set COMPILER_PATH=c:/ps/pssn
set PSX_PATH=c:/ps/psx/bin
set C_INCLUDE_PATH=c:/ps/psx/include
set C_PLUS_INCLUDE_PATH=c:/ps/psx/include
set LIBRARY_PATH=c:/ps/psx/lib

set GO32=DMPSTACK 1000000

REM ===== GNU C/C++=====
set GO32TMP=c:/tmp
set TMPDIR=c:/TMP

REM If your computer does not have a floating point
REM co-processor then uncomment the following line:
REM set GO32=emu c:/pssn/emu387
REM =====

```

SDevTC users -- Please Note:

The file c:\ps\pssn\SN.INI is referenced by the compiler. This file can be used to contain some of the DOS environment variables. When the environment variables and SN.INI are both defined, SN.INI is given preference.

Due to the way the new SDevTC environment is laid out, it may be necessary to manually make changes to your SN.INI file. SN.INI has been configured to work with the default install directory structure. If you have deviated from the default path, you will need to modify the following lines within the file \ps\pssn\bin\sn.ini to reflect your computer's directory structure:

```

[ccpsx]
LIBRARY_PATH=c:\ps\psx\lib
C_INCLUDE_PATH=c:\ps\psx\include
COMPILER_PATH=c:\ps\pssn\bin
assembler_path=c:\ps\pssn\bin
linker_path=c:\ps\pssn\bin

```

2-6 Installation of Software Tools

Additional Note: To run any of the samples that use a .lnk file, the following lines need to be modified to reflect your library path:

```
[psylink]
library_path=c:\ps\psx\lib
```

As a bug fix, it is necessary to define an environment variable PSYQ_PATH. In ccpsxd version 3.05.0009, an error will be returned if PSYQ_PATH is not defined. However, it is the directory specified in SN_PATH which will actually be referred to.

Example:

```
> set PSYQ_PATH=c:\temp
```

For more information, please refer to the following documents:

```
\pssn\bin\Readme.1st
\pssn\bin\Readme.txt
```

Reboot the Computer

This completes the installation of the software tools. The installation of the DTL-H2000 hardware follows.

Chapter 3:

Hardware Installaton

Determine a Free Memory Address and a Free IRQ for the Boards

By default, the dip-switch/jumper settings of the board are set to

```
IRQ: OFF
Base Port Address: 1340
```

You will have to set the jumpers of the board to an available interrupt and address. Follow the installation instructions entitled "**PlayStation**" Board (for PC/AT) that is packaged with the boards. **The interrupt and address you choose should not be in conflict with other boards in the system.**

There are a number of ways to determine which interrupts and addresses are available. You can use the "MSD" program included in most versions of DOS. Or, if you are running Windows 95, you can see what interrupts are assigned by performing the following:

1. Go the "My Computer" icon. Yours may be named differently, but it looks like a computer:



2. Right click on it and select "Properties".
3. Select the Device Manager tab.
4. Select the Print... button.
5. Choose "All devices and system summary".
6. Print out the document. For available IRQs, read the **IRQ SUMMARY** section. For available I/O port addresses, refer to the **IO PORT SUMMARY** section.

Alternatively, some PC-Compatibles are equipped with a "Setup" routine hidden in the boot sector of the boot-up hard drive accessed during a cold-boot (activated by turning off the computer's power supply and then turning it back on). After the computer runs its memory check, and the cursor moves to the top-right corner of the screen, you can hit a function key (F1 through F10) to get into the "setup" mode. Since computers vary, you may have to try the function keys one at a time. If you have a manual for your computer, read it for more information.

Edit the autoexec.bat File

The `autoexec.bat` file is edited to include the `dexbios` device driver.

Suppose you moved the interrupt jumper on the board from **OFF** to an unused interrupt **11**. Then the `dexbios` line in the `autoexec.bat` file must be modified as follows.

```
c:\ps\pssn\dexbios /a1340 /i11
```

This example assumes that you placed `pssn` directly under the `c:\ps` directory.

In general, the syntax of the line should be as follows:

```
<parent>\ps\pssn\dexbios /a<address> /I<interrupt>
```

Modify your `autoexec.bat` and save your changes.

Install the Development Boards

The two development boards will go into two free 16-bit ISA slots in the PC.

3-4 Hardware Installation

- Turn off the computer before installing the boards.
- Make sure that the boards fit snugly in their sockets.

Reboot the Computer

If you have difficulties during the booting process, you probably have an interrupt or memory conflict. Recheck your work.

Chapter 4:

Testing the DTL-H2000

Verify Ability to Compile

The procedure described here may be done immediately once the software tools have been installed. It isn't necessary to install the DTL-H2000 hardware to verify ability to compile.

To make sure you can compile, **reboot** your machine to register the environment variables. Make sure your paths are set correctly. If they aren't, you may have to increase the environment memory space in your `config.sys` file, using a line like this:

```
shell = command.com /E:1024/p
```

The `/E:1024` sets the environment size to 1024 bytes (valid ranges are from 160 to 32768), and `/p` makes this `command.com` the default command prompt. (See p.342 of *Peter Norton's Complete Guide to DOS 6.22* 6th Edition for further details.)

Once you are certain your paths are set up correctly, you can proceed to compile. At an MS-DOS prompt, type the following two lines:

```
cd c:\ps\psx\sample\graphics\balls
psymake all
```

The sample should compile with no errors, and return a command-line prompt. If you have problems, please recheck your steps. Otherwise please contact us (refer to the section in the front of this manual on Technical Assistance).

Note: If the DTL-H2000 hardware is not yet installed, the program will not run.

Run a Program

Open up a DOS-command window. Alternatively, it may help to run the computer completely in DOS, without Windows 3.1 or Windows 95.

- Type

```
resetps 1
```

This resets the DTL-H2000.

- Type

```
run /w5 c:\ps\pssn\snpatch.cpe
```

This patch fixes a bug in the ROM of the DTL-H2000. Throughout the literature of the PlayStation®, you may see references to "patchw" or "patchx" or "patchj". Ignore them, since "snpatch.cpe" is the current version.

- Type

```
run /w5 main.cpe
```

This loads the file `main.cpe` into the memory of the DTL-H2000 after pausing for a delay of "5", and runs the program.

- Wait for few seconds. What should appear on your video monitor is a blue screen with a bouncing ball. If the program does not execute, type `resetps 1` and repeat the sample program steps. If it fails again, review your setup procedures. Make sure that dexbios is actually running.

NOTE: If you receive "Cannot connect to target" while executing your set commands, add a longer pause between your commands or verify your board settings.

- To exit the sample program, press the rectangular button, "Select", on the pad-controller.

Run Other Sample Programs

Programs can be built by giving the command **PSYMAKE**. The makefile can also be used to run a program as some programs require the preloading of model and texture data before being executed.

For some of the samples you may need to execute **psymake load** to download the necessary data files to the development boards.

The following is a list of file suffixes that may be found in some of the sample directories:

```
.c      C source
.h      C include (header) file
.obj    object file
.sym    symbol file
.cpe    PS-X executable file
.tim    texture data file
.tmd    3D model data file
.lnk    psylink command file

makefile.mak      makefile for building executable
```

All of the samples assume that you placed the `pssn` and `psx` directories directly in the `c:\ps` directory. If you have a different directory structure for the PSX libraries and header files, you will need to modify the `.lnk` files for some programs. The `.lnk` linker command file specifies the file path where the libraries and additional object modules used in the program can be found.

Run from the CDROM

No software drivers need to be installed to run the external CDROM drive DTL-H2010 (the "black box").

Running samples: A sample program has already been compiled on the Programmer Tools CDROM (DTL-S2002) and will run directly from the DTL-H2010. The following represents the flow which you may use to execute a program in the CD-ROM player.

- Insert the **Programmer Tools CDROM** (DTL-S2002) into the DTL-H2010 drive.
- At a DOS-command prompt, type the following:

```
resetps 1
run /w5 c:\ps\pssn\snpatch
run /w5 c:\ps\pssn\selcd
run /w5 c:\ps\pssn\cdexec
```

The `CDMENU.EXE` from the CD-ROM will be started and the menu will appear. The Up/Down key and start button on the PAD can access and execute the sample program. The source code for `CDMENU.EXE` is in `\ps\psx\utility\menu\cdexec`.

Running finished CDRoms: The above procedure can also be used for running commercial CDRoms. On most DTL-H2000s and all DTL-H2500s, you can alternatively run `resetps` with an argument of 0:

```
resetps 0
```

This will reboot the development environment and run from the black box.

Chapter 5:

Miscellany

Installation of the CD-ROM Emulator Software

Read the "readme.txt" that came with your CD-ROM emulator kit, which is a full set of instructions for setting up your emulator card. In addition, note that the cdbios driver contains commands of the following form:

```
cdbios /a<address> /d<dma> /i<interrupt>
```

The address, dma channel, and interrupt number are controlled by the three DIP switches on the PIO2 board. Although the emulator board's actual address is a 4-byte hexadecimal number, the DIP switch positions A15 -A4, three bytes, represent a decimal value. The actual addresses and a table of their equivalents are given below:

Decimal Notation	Hex Notation	Actual Address (in hex)	Remarks
300	0x12C	0x12C0	
308	0x134	0x1340	Default
310	0x136	0x1360	
318	0x13E	0x13E0	
380	0x17C	0x17C0	
388	0x184	0x1840	
390	0x186	0x1860	
398	0x18E	0x18E0	

In this case, take A15-A4 from 0x1340 and match it with 0x134 to get "308". For more information, please refer to the "**CD Emulator**" book on the **Developer Tools** CDRom.

Kanji ROM Specification

Overview

Two bitmap (16 dots X 16 dots) Kanji fonts are stored in the kernel ROM of the PlayStation®.

The addresses of the font patterns in Production (consumer) PlayStations do not always correspond with development systems. The service function described below, Krom2RawAdd, is provided to get the address.

Fonts

Data format 16 dots X 16 dots 2 level bitmap

Character size 15 dots X 15 dots

Content

JIS first standard Kanji characters and non Kanji letters. Non Kanji letters include top space (0x2121).

Access Method

The head address of the font pattern of the one specific character at the start of the ROM can be obtained by giving its shift JIS code to the service function. After that, direct access of all the font patterns is possible.

Data Format

As shown in the drawing below, the byte on the left hand side top of the pattern is the head. The byte on the right hand side top follows it. The bit ordering has the most significant bit on the left hand side.

Figure 5-1. Font Data Format

# 0	# 1
# 2	# 3
...	...
...	...
...	...
# 30	# 31

Service Function

The following function is provided as part of libapi.lib. This function is a system call, and the code, including an address code exchange table, is located in the kernel area (0-0xffff) of RAM.

Krom2RawAdd

The service function that gets the Kanji font pattern address

Format

```
unsigned long Krom2RawAdd(sjiscode)
unsigned short sjiscode;
```

Argument

sjiscode shift JIS code

Explanation

The function obtains the head address of the font pattern which corresponds to the Kanji character designated by the shift JIS code.

Return value

The function returns the head address of the Kanji font pattern.

-1 is returned if there is no font data that corresponds to the designated Kanji character.

Patch for the DTL-H2000

After reset, run snpatch.cpe. This allows the service function and font pattern to be used from the program.

The address of the font pattern in patchx.cpe is different from its address in the PlayStation (0xbfc66000 in the machine, and 0x1fa66000 in patchx.cpe.). Because of this, do not insert the font address directly in any code. Use the service function to provide the address.

Sample Program

The function `_get_font()`

The function `_get_font` transmits the font pattern corresponding to the designated shift JIS code to VRAM, and returns the developed format which can be used as a 16 bit texture pattern.

```
unsigned long
_get( sjis )
unsigned char *sjis;
{
    unsigned short sjiscode;
    sjiscode = *sjis<<8| *(sjis+1);
    return Krom2RawAdd(sjiscode); /* getting kanji font pattern address*/
}
```

```

#define COLOR 0x4210
#define BLACK 0x3000
_get_font(s, data)
char *s;
unsigned short *data;
{
    unsigned short *p, *d, w;
    long i, j;
    if((p=(unsigned short*)_get(s))!=-1) {
        d = data;
        for(i=0; i<15; i++) {
            for(j=7; j>=0; j-)
                *d++=(((*p>>j)&0x01)==0x01)?COLOR:BLACK;
            for(j=15; j>=8; j-)
                *d++=(((*p>>j)&0x01)==0x01)?COLOR:BLACK;
            p++;
        }
    }
    else {
        for(d=data, i=0; i<2*16*16; i++)
            *d++=BLACK;
    }
}
}

```

cpe2x

CPE2X translates a CPE format file created by the PSYLINK linker to a PS-X EXE format file, which is a private execution format. Execution requirements are as follows.

Type of operating platform: PC AT compatible
Operating system: MS-DOS 3.3 or later

Details of the CPE format are not disclosed.

Information about PS-X EXE format details and its execution method are contained in the following document.

Related manual: *DTL-D2140 Library Reference*

The following is an example of its use.

```
C:>CPE2X MAIN.CPE
```

MAIN.EXE is created by this code.

Procedure for Dealing with a Non-Recoverable Error

The system `exit()` is called if an error that cannot be dealt with is detected on the PlayStation®. `SystemError()` is called by an internal call to `exit()`. This is a system call that displays a system error on the monitor. An application may also call `SystemError()` directly.

The first argument of `SystemError()` is the error identification character. For SCE system errors, this will always be an "S". In addition to "S", "E" is available to the application. The second argument of `SystemError()` is the error identification code, consisting of a three digit decimal number. SCE reserves the numbers 7XX, 8XX, and 9XX for the system. The remaining numbers are available for use by the application.

When an SCE-stipulated error occurs, please call `exit()` using the relevant error identification code as the argument.

Table 5-1. SCE-Stipulated System Errors

Letter	Number	Content
E	XXX	Released to the application
S	000-699	Application errors
	701	Error occurrence with malloc
	751	Cannot open file
	752	Cannot read file
	753	Cannot write file
	754	Error occurrence in file operating functions
	801	HwCPU/EvSpTRAP occurrence that cannot be dealt with
	811	CD-ROM order register time-out
	812	CD-ROM order execution time-out
	813	HwCdRom/EvSpACK occurrence that cannot be dealt with
	814	HwCdRom/EvSpCOMP occurrence that cannot be dealt with
	815	HwCdRom/EvSpDR occurrence that cannot be dealt with
	816	HwCdRom/EvSpDE occurrence that cannot be dealt with
	817	HwCdRom/EvSpERROR occurrence that cannot be dealt with
	818	HwCdRom/EvSpUNKNOWN occurrence that cannot be dealt with
	820	SwCARD/EvSpIOE occurrence that cannot be dealt with
	821	SwCARD/EvSpERROR occurrence that cannot be dealt with
	822	SwCARD/EvSpNEW occurrence that cannot be dealt with
	823	SwCARD/EvSpTIMOUT occurrence that cannot be dealt with
	824	SwCARD/EvSpPERROR occurrence that cannot be dealt with
	825	SwCARD/EvSpUNKNOWN occurrence that cannot be dealt with

Table 5-2. Error Codes for Internal System Identification

Letter	Number	Content
B	001	Adjusting conditions for copy protect
	901	Error in boot sequence
	902	CD-ROM drive cannot be initialized
	903	Device trouble at time of opening SYSTEM.CNF
	904	Cannot restructure kernel
	905	Cannot load first execution file
	906	Data structure trouble with first execution file
	907	Trouble during activation of first execution file
	908	Cannot activate first execution file
	909	Shell open during boot
	911	Trouble at time of reading SYSTEM.CNF
	912	Trouble at time of SYSTEM.CNF analysis
	913	Irregularity in default structure data
	921	Bus error related to extension PIO
X	000-015	CPU exceptions
D	011	CD-ROM order register time-out
	012	CD-ROM order execution time-out
	022	HwCdRom/EvSpERROR occurrence that cannot be recovered
	023	HwCdRom/EvSpDE occurrence that cannot be recovered
	031	CdGetStatus order register time-out
	032	CdGetStatus order execution error
	041	CD-ROM motor suspension order register time-out
	042	CD-ROM motor suspension order execution error

Other Items

Compiler

For a quick summary on the compiler, please refer to the `ccpsx.pdf` document included in the compiler document on the **Technical Reference CD**, in the directory `Progcd\gnu\doc\`.

The GNU CC document is also available.

If There is no Floating Point Processor on the PC

If your PC does not have a floating point co-processor, add the following line to its `autoexec.bat` file:

```
set G032=emu c:\ps\psn\emu387
```

Global Allocation

Please refer to the file `GblReg.pdf` included in the `Technical Notes` directory of the **Technical Reference CD**.

Debugger

For a quick tutorial on how to use the debugger, refer to the file `debugdoc.pdf` in the **Technical Reference CD**, in the `\progcd\notes` directory.

