LibPSn00b Library Reference

Draft: March 25, 2022

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About This Manual

The purpose of this manual is to describe all available LibPSn00b library functions, macros and structures that have been implement so far throughout the development of this project.

There are some plans to make a *LibPSn00b Library Overview* companion volume that further describes the structure, use and purpose of the libraries of LibPSn00b but is not yet being worked on due to limited available man power of the PSn00bSDK project as of the writing of this document.

Related Documentation

Since an overview volume of the *LibPSn00b Runtime Library* is not yet made, the *Lameguy's PSX Programming Tutorial Series* is the best available substitute document for beginners alike for now. This can be found on the Tools & Resources page of the Lameguy64 website at **http://lameguy64.net/index.php?page=tools**.

The tutorial series covers both the Programmer's Tool/PsyQ SDK and PSn00bSDK and is also essential learning materials to those new to programming for the PSX.

Note: The Lameguy64 website additionally posts updates and current developments regarding PSn00bSDK and the LibPSn00b Runtime Libraries on occasion.

Nocash's PSX specs document may also be of great use, especially if you plan to go low level: **http://problemkaputt.de/psx-spx.htm**

Documentation Credits

Lead writer: Lameguy64

CD-ROM Library

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Overview

The LibPSn00b CD-ROM library provides facilities for using the CD-ROM hardware of the PS1. Unlike the CD-ROM library of the official SDK, the LibPSn00b CD-ROM library is immune to the 30 file and directory limit and is capable of parsing directories containing as many files as the ISO9660 file system can support, unless the records are too large to be loaded into the PS1's memory. However, to maintain compatibility with the PS1 BIOS, the root directory must not exceed the 30 file limit and the entire disc should contain no more than 45 directories total, otherwise the disc will be unbootable to the console.

Whilst the CD-ROM library is not constrained by the 30 file per directory limit, it does not support Joliet CD-ROM extensions to support long file names. However, a library extension is considered for future development.

Library Status

As of July 25, 2020, the state of the LibPSn00b CD-ROM library is as follows:

Feature	Status
CD-ROM Control	Fully Working
CD-ROM Track Query	Fully Working
CD-Audio Playback	Fully Working
CD-XA Audio Playback	Fully Working
Data Reading	Mostly working (see **CdGetSector**)
ISO9660 File System Support	Fully Working
STR Data Streaming	Not yet implemented, but possible with own implementation.
Multi-session Support	Fully Working (not automatic, see **CdLoadSession**)

Structures

CdlATV

CD-ROM attenuation parameters

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Structure

```
typedef struct CdlATV
{
    u_char    val0;         CD to SPU L-to-L volume
    u_char    val1;         CD to SPU L-to-R volume
    u_char    val2;         CD to SPU R-to-R volume
    u_char    val3;         CD to SPU R-to-L volume
} CdlATV;
```

Explanation

This structure specifies parameters for the CD-ROM attenuation. Values must be of range 0 to 127.

The CD-ROM attenuation can be used to set the CD-ROM audio output to mono (0x40, 0x40, 0x40, 0x40) or reversed stereo (0x00, 0x80, 0x00, 0x80). It can also be used to play one of two stereo channels to both speakers.

The CD-ROM attenuation affects CD-DA and CD-XA audio.

See also

CdMix

CdlDIR

CD-ROM directory query context handle

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*Yes*	*R56*	*02/28/2020*

Structure

typedef void* CdlDIR;

Explanation

Used to store a directory context created by **CdOpenDir()**. An open context can then be used with **CdReadDir()** and closed with **CdCloseDir()**.

See Also

CdOpenDir

CdlFILE

File entry structure

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Structure

```
typedef struct CdlFILE
{
    CdlLOC    loc;          CD-ROM position coordinates of file
    u_long    size;         Size of file in bytes
    char      name[16];     File name
} CdlFILE;
```

Explanation

Used to store basic information of a file such as logical block location and size. Currently, **CdSearchFile()** is the only function that uses this struct but it will be used in directory listing functions that may be implemented in the future.

See also

CdSearchFile

CdlFILTER

Structure used to set CD-ROM XA filter

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/19/2019*

Structure

```
typedef struct CdlFILTER
{
    u_char     file;           File number to fetch (usually 1)
    u_char     chan;           Channel number (0 through 7)
    u_short    pad;            Padding
} CdlFILTER;
```

Explanation

This structure is used to specify stream filter parameters for CD-ROM XA audio streaming using the **CdlSetfilter** command. This only affects CD-ROM XA audio streaming.

CD-ROM XA audio is normally comprised of up to 8 or more ADPCM compressed audio streams interleaved into one continuous stream of data. The data stream is normally read at 2x speed but only one of eight XA audio streams can be played at a time. The XA stream to play is specified by the **CdlSetfilter** command and this struct.

The CD-ROM XA filter can be changed during CD-ROM XA audio playback with zero audio interruption. This can be used to achieve dynamic music effects by switching to alternate versions of a theme to fit specific scenes seamlessly.

See also

CdControl

CdlLOC

CD-ROM positional coordinates

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Structure

typedef struct CdlLOC
{

u_char	*minute;*	Minutes (BCD)
u_char	*second;*	Seconds (BCD)
u_char	*sector;*	Sector or frame (BCD)
u_char	*track;*	Track number (not used)

} CdlLOC;

Explanation

This structure is used to specify CD-ROM positional coordinates for **CdlSetloc**, **CdlReadN** and **CdlReadS** CD-ROM commands. Use **CdIntToPos()** to set parameters from a logical sector number.

See also

CdIntToPos CdControl

Functions

CdAutoPauseCallback

Sets a callback function for auto pause

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*Yes*	*R45*	*12/18/2019*

Syntax

long *CdAutoPauseCallback(	
void(func*)())**	Callback function

Explanation

The callback function specified in **func* is executed when an auto pause interrupt occurs when the current CD-ROM mode is set with **CdlModeAP**. Auto pause interrupt occurs when CD Audio playback reaches the end of the audio track. Specifying 0 disables the callback.

This can be used to easily loop CD audio automatically without requiring any intervention in your software loop.

Returns

Pointer to the last callback function set. Zero if no callback was set previously.

See Also

CdControl

CdCloseDir

Closes a directory context created by **CdOpenDir()**.

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*Yes*	*R56*	*02/28/2020*

Syntax

void CdCloseDir(
    CdlDIR **dir***)** Directory context

Explanation

Closes a directory query context created by **CdOpenDir()**.

Behavior is undefined when closing a previously closed directory context.

See also

CdOpenDir

CdControl

Issues a control command to the CD-ROM controller

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*12/12/2019*

Syntax

int CdControl(

u_char	*com*,	Command value
u_char	**param*,	Command parameters
u_char	**result***)**	Pointer of buffer to store result

Description

Sends a CD-ROM command specified by *com* to the CD-ROM controller, waits for an acknowledge interrupt (very fast) then returns. It will also issue parameters from *param* to the CD-ROM controller if the command accepts parameters. Response data from the CD-ROM controller is stored to *result* on commands that produce response data.

Because this function waits for an acknowledge interrupt from the CD-ROM controller, this function should not be used in a callback. Instead, use **CdControlF()**.

Commands that are blocking require the use of **CdSync()** to wait for the command to fully complete.

CD-ROM Control Commands:

Command	Value	Parameter	Blocking	Description
CdlNop	0x01	-	No	Also known as Getstat. Normally used to query the CD-ROM status, which is retrieved using CdStatus().
CdlSetloc	0x02	CdlLOC	No	Sets the seek target location, but does not perform a seek. Actual seeking begins upon issuing CdlSeekL, CdlSeekP, CdlPlay, CdlReadN and CdlReadS commands.
CdlPlay	0x03	u_char	No	Begins CD Audio playback. CD-ROM mode must be set with CdlModeDA and CdlSetMode flags to work properly. CdlModeAP flag enables automatic pause at end of track. Parameter specifies an optional track number to play (Note: some emulators do not support the track parameter).
CdlForward	0x04	-	No	Fast forward (CD Audio only), issue CdlPlay to stop fast forward.
CdlBackward	0x05	-	No	Rewind (CD Audio only), issue CdlPlay to stop rewind.
CdlReadN	0x06	CdlLOC	No	Begin reading data sectors. Used in conjunction with CdReadCallback().
CdlStandby	0x07	-	Yes	Also known as MotorOn, starts CD motor and remains idle.

Command	Value	Parameter	Blocking	Description
CdlStop	0x08	-	Yes	Stops playback and the disc itself.
CdlPause	0x09	-	Yes	Stops playback or data reading, but leaves the disc on standby.
CdlInit	0x0A	-	Yes	Initialize the CD-ROM controller.
CdlMute	0x0B	-	No	Mutes CD audio (both DA and XA).
CdlDemute	0x0C	-	No	Unmutes CD audio (both DA and XA).
CdlSetfilter	0x0D	CdlFILTER	No	Set XA audio filter.
CdlSetmode	0x0E	u_char	No	Set CD-ROM mode.
CdlGetparam	0x0F	-	No	Returns current CD-ROM mode and file/channel filter settings.
CdlGetlocL	0x10	-	No	Returns current logical CD position, mode and XA filter parameters.
CdlGetlocP	0x11	-	No	Returns current physical CD position (using SubQ location data).
CdlSetsession (orig)	0x12	u_char	Yes	Seek to specified session on a multi-session disc.
CdlGetTN	0x13	-	No	Get CD-ROM track count.
CdlGetTD	0x14	u_char	No	Get specified track position.
CdlSeekL	0x15	-	Yes	Logical seek to target position, set by last CdlSetloc command.
CdlSeekP	0x16	-	Yes	Physical seek to target position, set by last CdlSetloc command.
CdlTest (orig)	0x19	varies	Yes	Special test command not disclosed to official developers (see nocash documents for more info).
CdlReadS	0x1B	CdlLOC	No	Begin reading data sectors without pausing for error correction.

CD-ROM Return Values:

Command	0	1	2	3	4	5	6	7
CdlGetparam	stat	mode	0	file	channel	-	-	-
CdlGetlocL	amin	asec	aframe	mode	file	channel	sm	ci
CdlGetlocP	track	index	min	sec	frame	amin	asec	aframe
CdlGetTN	stat	first	last	-	-	-	-	-
CdlGetTD	stat	min	sec	-	-	-	-	-

Note: *Values are in BCD format.*

Returns

1 if the command was issued successfully. Otherwise 0 if a previously issued command has not yet finished processing.

See also

CdSync CdControlF btoi itob

CdControlB

Issues a CD-ROM command to the CD-ROM controller (non-blocking)

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdControlB(

u_char	*com*,	Command value
u_char	**param*,	Command parameters
u_char	**result***)**	Pointer of buffer to store result

Explanation

This function works just like **CdControl()**, but blocks on blocking commands until said blocking command has completed.

Because this function waits for an acknowledge interrupt from the CD-ROM controller, this function should not be used in a callback. Use **CdControlF()** instead.

See also

CdControl CdControlF

CdControlF

Issues a CD-ROM command to the CD-ROM controller (does not block)

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/19/2019*

Syntax

int CdControlF(

u_char	*com*,	Command value
u_char	**param*)	Command parameters

Explanation

This function works more or less the same as **CdControl()** but it does not block even for the acknowledge interrupt from the CD-ROM controller. Since this function is non-blocking it can be used in a callback function.

When using this function in a callback, a maximum of two commands can be issued at once and only the first command can have parameters. This is because the CD-ROM controller can only queue up to two commands and the parameter FIFO is not cleared until the last command is acknowledged. But waiting for acknowledgment in a callback is not possible.

See also

CdControl

CdGetToc

Get CD-ROM TOC information

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdGetToc(
CdlLOC **toc***)** Pointer to an array of **CdlLOC** entries

Explanation

Retrieves the track entries from a CD's table of contents (TOC). The function can return up to 99 track entries, which is the maximum number of audio tracks the CD standard supports.

This function only retrieve the minutes and seconds of an audio track's position as the CD-ROM controller only returns the minutes and seconds of a track, which may result in the end of the previous track being played instead of the intended track to be played. This can be remedied by having a 2 second pregap on each audio track on your disc.

Returns

Number of tracks on the disc, zero on error.

See also

CdControl

CdGetSector

Get data from the CD-ROM sector buffered

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*03/25/2022*

Syntax

int CdGetSector(		
void	**madr,*	Pointer to memory buffer to store sector data
int	*size***)**	Number of 32-bit words to retrieve

Explanation

Reads sector data that is pending in the CD-ROM sector buffer and stores it to **madr*. Uses DMA to transfer the sector data and blocks very briefly until said transfer completes.

This function is intended to be called within a callback routine set using **CdReadyCallback()** to fetch read data sectors from the CD-ROM sector buffer.

Returns

Always 1.

See also

CdReadyCallback

CdMode

Gets the last CD-ROM mode

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdMode(void)

Explanation

Returns the CD-ROM mode last set when issuing a **CdlSetmode** command. The function returns instantly as it merely returns a value stored in an internal variable.

Since the value is simply a copy of what was specified from the last **CdlSetmode** command, the mode value may become inaccurate if **CdlInit** or other commands that affect the CD-ROM mode have been issued previously.

Returns

Last CD-ROM mode value.

CdMix

Set CD-ROM mixer or attenuation

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdMix(
    CdlATV **vol***)** CD-ROM attenuation parameters.

Explanation

Sets the CD-ROM attenuation parameters from a **CdlATV** struct specified by *vol*. The CD-ROM attenuation settings are different from the SPU CD-ROM volume.

Normally used to configure CD and XA audio playback for mono or reverse stereo output, though this was rarely used in practice.

Returns

Always 1.

See also

CdlATV

CdPosToInt

Translates CD-ROM positional coordinates to a logical sector number

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdPosToInt(	
CdlLOC **p***)**	Pointer to a **CdlLOC** struct.

Explanation

Translates the CD-ROM position parameters from a **CdlLOC** struct specified by *p* to a logical sector number. The translation takes the lead-in offset of 150 sectors into account so the logical sector number returned would begin at zero.

Returns

Logical sector number minus the 150 sector lead-in.

CdIntToPos

Translates a logical sector number to CD-ROM positional coordinates

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

CdlLOC *CdIntToPos(

int	*i*,	Logical sector number
CdlLOC	**p*)	Pointer to a **CdlLOC** structure

Explanation

This function translates the logical sector number from *i* to CD-ROM positional coordinates stored to a **CdlLOC** struct specified by *p*. The translation takes the lead-in offset into account so the first logical sector begins at 0 and the result will be offset by 150 sectors.

Returns

Pointer to the specified **CdlLOC** struct plus 150 sectors.

CdInit

Initializes the CD-ROM library

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*12/12/2019*

Syntax

int CdInit(
    int *mode***)** Reserved (may be used in the future)

Description

Initializes the CD-ROM subsystem which includes hooking the required IRQ handler, sets up internal variables of the CD-ROM library and attempts to initialize the CD-ROM controller. The *mode* parameter does nothing but may be used in future updates of this library.

This function must be called after **ResetGraph** and before any other CD-ROM library function that interfaces with the CD-ROM controller. This function may not be called twice as it may cause instability or would just crash.

Returns

Always 1. May change in the future.

CdIsoError

Retrieve CD-ROM ISO9660 parser status

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*Yes*	*R57*	*02/18/2020*

Syntax

int CdIsoError()

Explanation

Returns the status of the file system parser from the last call of a file system related function, such as **CdSearchFile()**, **CdGetVolumeLabel()** and **CdOpenDir()**. Use this function to retrieve the exact error occurred when either of those functions fail.

Returns

CD-ROM ISO9660 parser error code, as listed below.

Value	Description
CdlIsoOkay	File system parser okay.
CdlIsoSeekError	Logical seek error occurred. May occur when attempting to query the file system while an Audio CD is inserted, which does not contain a file system.
CdlIsoReadError	Read error occurred while reading the CD-ROM file system descriptor.
CdlIsoInvalidFs	Disc does not contain a standard ISO9660 file system.
CdlIsoLidOpen	Lid is open when attempting to parse the CD-ROM file system.

CdLoadSession

Locates and parses the specified disc session

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*Yes*	*R66*	*07/18/2020*

Syntax

int CdLoadSession(
    int *session***)**   Session number (1 = first session)

Explanation

Loads a session specified by *session* on a multi-session disc. Uses **CdlSetsession** to seek to the specified disc session, then scans the following 512 sectors for an ISO volume descriptor. If a volume descriptor is found the file system of that session is parsed and files inside the new session can be accessed using regular CD-ROM file and directory querying functions (**CdSearchFile()**, **CdOpenDir()**, **CdReadDir()**, **CdCloseDir()**). No special consideration is required when reading files from a new session.

Loading a session takes 5-10 seconds to complete depending on the distance between the beginning of the disc and the start of the specified session. If the session specified does not exist, the disc will stop and would take 15-20 seconds to restart. The function does not support loading the most recent session of a disc automatically due to limitations of the CD-ROM hardware, so the user must be prompted to specify which session to load and to keep a record of the number of sessions that have been written to the disc.

This function can also be used to update the Table of Contents (TOC) and reparse the file system regardless of the media change status by simply loading the first session. This is most useful for accessing files or audio tracks on a disc that was inserted using the swap trick method (it is recommended to stop the disc using **CdlStop** then restart it with **CdlStandby** after a button prompt for convenience, if you wish to implement this capability). Seeking to sessions other than the first session does not work with the swap trick however, so a chipped or unlockable console is desired for reading multi-session discs.

Notes

When the lid has been opened, the current CD-ROM session is reset to the first session on the disc.

The console may produce an audible click sound when executing this function. This is normal, and the click sound is no different to the click heard on disc spin-up in older models of the console.

Returns

Returns zero on success. On failure due to open lid, bad session number or no volume descriptor found in specified session, returns -1 and return value of **CdIsoError()** is updated.

CdOpenDir

Open a directory on the CD-ROM file system

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*Yes*	*R56*	*02/28/2020*

Syntax

CdlDIR* CdOpenDir(
const char* *path***)** Directory path to open.

Explanation

Opens a directory on the CD-ROM file system to read the contents of a directory.

A path name must use the backslash character (\) as the directory name separator (in C/C++, you must use double backslash as backslash is used to specify special characters in strings such as \n). The path must be absolute and should begin with a backslash character. It should also not be prefixed with a device name (ie. \MYDIR1\MYDIR2 will work but not cdrom:\MYDIR1\MYDIR2).

The file system routines in libpsxcd can query directory paths of up to 128 characters.

The ISO9660 file system routines of libpsxcd does not support long file names as it only supports the original file descriptor format (no Rock Ridge or Joliet extensions) that only supports MS-DOS style 8.3 file names, even though the file system specification supports longer names.

Returns

Pointer of a **CdlDIR** context, NULL if an error occurred.

See also

CdReadDir CdCloseDir

CdRead

Read sectors from the CD-ROM

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*06/07/2021*

Syntax

int CdRead(		
int	*sectors,*	Number of sectors to read
u_long	**buf,*	Pointer to buffer to store sectors read
int	*mode***)**	CD-ROM mode for reading

Explanation

Reads a number sectors specified by *sectors* from the location set by the last **CdlSetloc** command, the read sectors are then stored to a buffer specified by *buf*. *mode* specifies the CD-ROM mode to use for the read operation.

The size of the sector varies depending on the sector read mode specified by *mode*. For standard data sectors it is multiples of 2048 bytes. If **CdlModeSize0** is specified the sector size is 2328 bytes which includes the whole sector minus sync, adress, mode and sub header bytes. **CdlModeSize1** makes the sector size 2340 which is the entire sector minus sync bytes.

Ideally, **CdlModeSpeed** must be specified to read data sectors at double CD-ROM speed.

This function blocks very briefly to issue the necessary commands to start CD-ROM reading. To determine if reading has completed use **CdReadSync** or **CdReadCallback**.

Returns

Always returns 0 even on errors. This may change in future versions.

See also

CdReadSync CdReadCallback

CdReadCallback

Sets a callback function for read completion

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*06/07/2021*

Syntax

u_long CdReadCallback(	
CdlCB *func***)**	Callback function
void (**func***)(int** *status*,	CD-ROM status
u_char **result***)**	Pointer to a result buffer

Explanation

Works much the same as **CdSyncCallback()** but for **CdRead()**. Sets a callback with the specified function *func*. The callback is executed whenever a read operation initiated by **CdRead()** has completed.

status is the CD-ROM status from the command that has completed processing. **result* points to a read result buffer.

See also

CdRead

CdReadDir

Read a directory entry from an open directory context

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R56*	*02/28/2020*

Syntax

int CdReadDir(

CdlDIR	**dir,*	Open directory context (from **CdOpenDir()**)
CdlFILE	**file***)**	Pointer to a **CdlFILE** struct

Explanation

Retrieves a file entry from an open directory context and stores it to a **CdlFILE** struct specified by *file*. Repeated calls of this function retrieves the next directory entry available until there are no more directory entries that follow.

Returns

1 if there are proceeding directory entries that follow, otherwise 0.

See also

CdOpenDir

CdReadSync

Waits for CD-ROM read completion or returns read status

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*12/19/2019*

Syntax

int CdReadSync(		
int	*mode,*	Mode
u_char	**result***)**	Pointer to store most recent CD-ROM status

Explanation

This function works more or less like **CdSync()** but for **CdRead()**. If *mode* is zero the function blocks if **CdRead()** was issued earlier until reading has completed. If mode is non-zero the function completes immediately and returns number of sectors remaining.

A buffer specified by *result* will be set with the most recent CD-ROM status value from the last read issued.

Returns

Number of sectors remaining. If reading is completed, 0 is returned. On error, -1 is returned.

See also

CdRead

CdReadyCallback

Sets a callback function

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*03/25/2022*

Syntax

long CdReadyCallback(	
CdlCB *func***)**	Callback function
void (*func***)(int** *status*,	CD-ROM status
u_char **result***)**	Pointer to a result buffer

Explanation

Sets a callback with the specified function *func*. The callback is executed whenever there's an incoming data sector from the CD-ROM controller during **CdlReadN** or **CdlReadS**. The pending sector data can be retrieved using **CdGetSector()**.

status is the CD-ROM status code from the last CD command that has finished processing. **result* corresponds to the result pointer that was passed by the last **CdControl()/CdControlB()** call.

This callback cannot be used in conjunction with **CdRead()** because it also uses this callback hook for its own internal use. The previously set callback is restored after read completion however.

Returns

Pointer to last callback function set.

See also

CdControl CdControlB CdGetSector

CdSearchFile

Locates a file in the CD-ROM file system

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*12/19/2019*

Syntax

CdlFILE *CdSearchFile(		
CdlFILE	**loc,*	Pointer to a **CdlLOC** struct to store file information
const char	**filename***)**	Path and name of file to locate

Explanation

Searches a file specified by *filename* by path and name in the CD-ROM file system and returns information of the file if found. The file information acquired will be stored to *loc*.

Directories must be separated with backslashes (\) and a leading backslash is optional and paths must reference from the root directory. File version identifier (;1) at the end of the file name is also optional. File and directory names are case insensitive.

The ISO9660 file system routines of libpsxcd does not support long file names as it only supports the original file descriptor format, which is limited to MS-DOS style 8.3 file names.

Upon calling this function for the first time, the ISO descriptor of the disc is read and the whole path table is cached into memory. Next the directory descriptor of the particular directory specified is loaded and cached to locate the file specified. The directory descriptor is kept in memory as long as the consecutive files to be searched are stored in the same directory until a file in another directory is to be searched. On which the directory descriptor is unloaded and a new directory descriptor is read from the disc and cached. Therefore, locating files in the same directory is faster as the relevant directory descriptor is already in memory and no disc reads are issued.

As of Revision 66 of PSn00bSDK, media change is detected by checking the CD-ROM lid open status bit and attempting to acknowledge it with a CdlNop command, to discriminate the status from an open lid or changed disc.

Returns

Pointer to the specified **CdlFILE** struct. Otherwise NULL is returned when the file is not found.

CdStatus

Get the most recent CD-ROM status

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdStatus(void)

Explanation

Returns the CD-ROM status since the last command issued. The status value is updated by most CD-ROM commands.

To get the current CD-ROM status you can issue **CdlNop** commands at regular intervals to update the CD-ROM status this function returns.

Returns

CD-ROM status from last comand issued.

See also

CdControl

CdSync

Wait for blocking command or blocking status

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

int CdSync(

int	*mode*,	Mode
u_char	**result***)**	Pointer to store most recent CD-ROM status

Explanation

If *mode* is zero the function blocks if a blocking command was issued earlier until the command has finished. If mode is non-zero the function returns a command status value.

A buffer specified by *result* will be set with the most recent CD-ROM status value from the last command issued.

Returns

Command status is returned as one of the following definitions:

CdlComplete	Command completed.
CdlNoIntr	No interrupt, command busy.
CdlDiskError	CD-ROM error occurred.

See also

CdControl

CdSyncCallback

Sets a callback function

Library	Header File	Original	Introduced	Documentation Date
libpsxcd	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

u_long CdSyncCallback(	
CdlCB *func***)**	Callback function
void (**func***)(int** *status*,	CD-ROM status
u_char **result***)**	Pointer to a result buffer

Explanation

Sets a callback with the specified function *func*. The callback is executed whenever a blocking command has completed.

status is the CD-ROM status from the command that has completed processing. **result* corresponds to the **result* parameter on **CdControl()/CdControlB()** and returns the pointer to the buffer last set with that function.

Returns

Pointer to last callback function set.

See also

CdControl CdControlB CdSync

Macros

btoi

Translates a BCD format value to decimal

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

btoi(	
*b***)**	BCD format value

Explanation

Translates a specified value in BCD format (ie. 32/0x20 = 20) into a decimal integer, as the CD-ROM controller returns integer values only in BCD format.

itob

Translates a decimal value to BCD

Library	Header File	Original	Introduced	Documentation Date
libpsxcd.a	*psxcd.h*	*No*	*R45*	*12/18/2019*

Syntax

itob(
    ***i*)**   Decimal value

Explanation

Translates a decimal integer into a BCD format value (ie. 20 = 32/0x20), as the CD-ROM controller only accepts values in BCD format.

Geometry Library

Geometry Library

Overview

The Geometry **Transformation** Engine, often referred to as the GTE, is most responsible for providing 3D capabilities to the PS1. This is effectively an all-integer math co-processor connected directly to the CPU, as it is accessed using COP2 and related MIPS instructions to access registers and issue commands to the GTE.

GTE Register Summary

Data Registers

To access these registers, use MIPS opcodes mfc2, mtc2, lwc2 and swc2 or relevant C macros.

Name	Register Number	Format	Description
C2_VXY0	$0		Vector 0 (X, Y, Z)
C2_VZ0	$1		
C2_VXY1	$2		Vector 1 (X, Y, Z)
C2_VZ1	$3		
C2_VXY2	$4		Vector 2 (X, Y, Z)
C2_VZ2	$5		
C2_RGB	$6		24-bit Color + Primitive Code
C2_OTZ	$7		Average Z
C2_IR0	$8		Accumulator (interpolation)
C2_IR1	$9		Accumulator (vector)
C2_IR2	$10		
C2_IR3	$11		
C2_SXY0	$12		Screen XY coordinate FIFO (3 levels)
C2_SXY1	$13		
C2_SXY2	$14		
C2_SXYP	$15		Screen XY projection result
C2_SZ0	$16		Screen Z coordinate FIFO (4 levels)
C2_SZ1	$17		
C2_SZ2	$18		
C2_SZ3	$19		
C2_RGB0	$20		RGB value output FIFO (4 levels)
C2_RGB1	$21		
C2_RGB2	$22		
C2_MAC0	$24		32-bit Accumulator (value)
C2_MAC1	$25		32-bit Accumulator (vector)
C2_MAC2	$26		
C2_MAC3	$27		
C2_IRGB	$28		RGB conversion (48-bit to 15-bit)
C2_ORGB	$29		
C2_LZCS	$30		Count leading zeros/leading ones
C2_LZCR	$31		

Control Registers

To access these registers, use MIPS opcodes cfc2 and ctc2 or relevant C macros.

Name	Register Number	Description
C2_R11R12	$0	16-bit rotation matrix (1,1), (1,2)
C2_R13R21	$1	16-bit rotation matrix (1,3), (2,1)
C2_R22R23	$2	16-bit rotation matrix (2,2), (2,3)
C2_R31R32	$3	16-bit rotation matrix (3,1), (3,2)
C2_R33	$4	16-bit rotation matrix (3,3)
C2_TRX	$5	Translation Vector (X)
C2_TRY	$6	Translation Vector (Y)
C2_TRZ	$7	Translation Vector (Z)
C2_L11L12	$8	16-bit light source matrix (1,1), (1,2)
C2_L13L21	$9	16-bit light source matrix (1,3), (2,1)
C2_L22L23	$10	16-bit light source matrix (2,2), (2,3)
C2_L31L32	$11	16-bit light source matrix (3,1), (3,2)
C2_L33	$12	16-bit light source matrix (3,3)
C2_RBK	$13	Back color (Red)
C2_GBK	$14	Back color (Green)
C2_BBK	$15	Back color (Blue)
C2_LR1LR2	$16	16-bit light color matrix (R1,R2)
C2_LR3LG1	$17	16-bit light color matrix (R3,G1)
C2_LG2LG3	$18	16-bit light color matrix (G2,G3)
C2_LB1LB2	$19	16-bit light color matrix (B1,B2)
C2_LB3	$20	16-bit light color matrix (B3)
C2_RFC	$21	Fog far color (Red)
C2_GFC	$22	Fog far color (Green)
C2_BFC	$23	Fog far color (Blue)
C2_OFX	$24	GTE projection X offset
C2_OFY	$25	GTE projection Y offset
C2_H	$26	Projection plane distance (FOV)
C2_DQA	$27	Depth queuing coefficient
C2_DQB	$28	Depth queuing offset
C2_ZSF3	$29	gte_avsz3() divisor factor
C2_ZSF4	$30	gte_avsz4() divisor factor
C2_FLAG	$31	Calculation flags

Macros (GTE Registers)

gte_ldv0 gte_ldv1 gte_ldv2

Loads a single SVECTOR to individual GTE vector registers (inline assembly macro)

Library	Header File	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/18/2020*

Syntax

gte_ldv0(
v0 **)** Pointer to an **SVECTOR**

gte_ldv1(
v0 **)** Pointer to an **SVECTOR**

gte_ldv2(
v0 **)** Pointer to an **SVECTOR**

Explanation

Loads values from an **SVECTOR** struct to GTE data registers **C2_VXY0-2** and **C2_VZ0-2**.

gte_ldv3

Load three SVECTORs to GTE vector registers at once (inline assembly macro)

Library	Header File	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/18/2020*

Syntax

gte_ldv3(	
r0,	Pointer to first **SVECTOR**
r1,	Pointer to second **SVECTOR**
r2 **)**	Pointer to third **SVECTOR**

Explanation

Loads values from three **SVECTOR** structs to GTE data registers **C2_VXY0** and **C2_VZ0**, **C2_VXY1** and **C2_VZ1**, **C2_VXY2** and **C2_VZ2** at once.

gte_ldrgb

Load a CVECTOR to GTE register C2_RGBC (inline assembly macro)

Library	Header File	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_ldrgb(	
r0 **)**	Pointer to a **CVECTOR** structure

Explanation

Loads a **CVECTOR** value to GTE data register **C2_RGBC**.

The primitive code (the last byte of a **CVECTOR**) is passed to the color FIFO registers when performing lighting compute operations, so it can be stored to the RGBC field of a primitive directly without any additional operation required.

gte_ldopv2

Loads three 32-bit values to GTE registers C2_IR1, C2_IR2 and C2_IR3 (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_ldopv2(

r0,	Pointer to first 32-bit value to load
r1,	Pointer to second 32-bit value to load
r2 **)**	Pointer to third 32-bit value to load

Explanation

Loads three 32-bit values to GTE data registers **C2_IR1**, **C2_IR2** and **C2_IR3**.

gte_SetGeomOffset

Sets the GTE screen offset (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

```
gte_SetGeomOffset(
    r0,             Screen X offset in pixel units
    r1 )            Screen Y offset in pixel units
```

Explanation

Sets the values of the GTE screen offset which is applied to 2D projected coordinates when performing perspective transformation.

The values are set to GTE control registers **C2_OFX** and **C2_OFY**.

gte_SetGeomScreen

Sets the distance of the projection plane (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_SetGeomScreen(

r0 **)**	Projection plane distance

Explanation

Sets the specified value to GTE control register **C2_H** which determines the projection plane distance, otherwise known as the field of view.

gte_SetTransMatrix

Sets the translation portion of a **MATRIX** to the GTE (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_SetTransMatrix(

r0 **)**	Pointer to a **MATRIX**

Explanation

Sets the translation coordinates from a **MATRIX** struct to GTE control registers **C2_TRX**, **C2_TRY** and **C2_TRZ** respectively.

gte_SetRotMatrix

Sets a 3x3 rotation matrix portion from a **MATRIX** to the GTE (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_SetRotMatrix(
r0 **)** Pointer to a **MATRIX**

Explanation

Sets the 3x3 rotation matrix coordinates from a **MATRIX** struct to GTE control registers **C2_R11R12**, **C2_R13R21**, **C2_R22R23**, **C2_R31R32** and **C2_R33**.

gte_SetLightMatrix

Sets a 3x3 lighting matrix from a **MATRIX** to the GTE (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_SetRotMatrix(
r0 **)** Pointer to a **MATRIX**

Explanation

Sets the 3x3 lighting matrix coordinates from a **MATRIX** struct to GTE control registers **C2_L11L12**, **C2_L13L21**, **C2_L22L23**, **C2_L31L32** and **C2_L33**.

The lighting matrix is essentially a triplet of three light direction vectors. L11, L12 and L13 represents the X, Y and Z coordinates of light source 0 for example. Coordinates must be normalized to ensure correct results.

gte_SetColorMatrix

Sets a 3x3 color matrix from a **MATRIX** to the GTE (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_SetColorMatrix(
r0 **)** Pointer to a **MATRIX**

Explanation

Sets the 3x3 color matrix values from a **MATRIX** struct to GTE control registers **C2_LR1LR2**, **C2_LR3LG1**, **C2_LG2LG3**, **C2_LB1LB2** and **C2_LB3**.

The light color matrix is essentially a triplet of three RGB colors for each of the three light sources. LR1, LG1 and LB1 represents the R, G and B color values for light source 0 for example. Values are of range 0 to 4095, higher values will be saturated.

gte_SetBackColor

Sets an RGB color value to the GTE (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_SetBackColor(

r0,	Value for red
r1,	Value for green
r2 **)**	Value for blue

Explanation

Sets the specified RGB value to GTE control registers **C2_RBK**, **C2_GBK** and **C2_BBK**. This specifies the color value to use when a normal faces away from the direction of the light source. This can be considered as the ambient light color.

Macros (GTE Commands)

gte_avsz3

Average screen Z result (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*12/03/2020*

Syntax

gte_avsz3()   5 cycles

Explanation

Averages the values of GTE registers **C2_SZ1**, **C2_SZ2** and **C2_SZ3**, multiplies it by **C2_ZSF3** and divides the result by 0x1000 before storing to **C2_OTZ**. Used to compute the ordering table depth level for a three-vertex primitive.

The following equation is performed when executing this GTE command:

```
MAC0 = ZSF3*(SZ1+SZ2+SZ3)
OTZ  = MAC0/1000h
```

gte_avsz4

Average screen Z result (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*12/03/2020*

Syntax

gte_avsz4()   6 cycles

Explanation

Averages the values of GTE registers **C2_SZ1**, **C2_SZ2, C2_SZ3** and **C2_SZ4**, multiplies it by **C2_ZSF4** and divides the result by 0x1000 before storing to **C2_OTZ**. Used to compute the ordering table depth level for a four-vertex primitive.

The following equation is performed when executing this GTE command:

```
MAC0 = ZSF4*(SZ1+SZ2+SZ3+SZ4)
OTZ  = MAC0/1000h
```

gte_nclip

Normal clipping (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_nclip() **8 cycles**

Explanation

Computes the sign of three screen coordinates (**C2_SXY0-3**) used for backface culling. If the value of **C2_MAC0** is negative, the coordinates are inverted and thus the triangle is back facing.

The following equation is performed when executing this GTE command:

```
MAC0 = SX0*SY1 + SX1*SY2 + SX2*SY0 - SX0*SY2 - SX1*SY0 – SX2*SY1
```

gte_rtps

Rotate, Translate and Perspective Single (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_rtps() **15 cycles**

Explanation

Performs rotation, translation and perspective calculation of a single vertex. Divide overflows are simply saturated allowing for crude Z clipping. Check **C2_FLAG** to determine which overflow error has occurred during calculation.

The following equation is performed when executing this GTE command:

```
IR1 = MAC1 = (TRX*4096 + R11*VX0 + R12*VY0 + R13*VZ0) >> 12
IR2 = MAC2 = (TRY*4096 + R21*VX0 + R22*VY0 + R23*VZ0) >> 12
IR3 = MAC3 = (TRZ*4096 + R31*VX0 + R32*VY0 + R33*VZ0) >> 12
SZ3 = MAC3
MAC0=(((H*131072/SZ3)+1)/2)*IR1+OFX, SX2=MAC0/65536
MAC0=(((H*131072/SZ3)+1)/2)*IR2+OFY, SY2=MAC0/65536
MAC0=(((H*131072/SZ3)+1)/2)*DQA+DQB, IR0=MAC0/4096
```

gte_rtpt

Rotate, Translate and Perspective Triple (inline assembly macro)

Library	Header	Original	Introduced	Documentation Date
-	*inline_c.h*	*No*	*R1*	*09/24/2020*

Syntax

gte_rtps() **23 cycles**

Explanation

Performs rotation, translation and perspective calculation of three vertices at once.

The equation performed is the same as **gte_rtps()** only repeated three times for each vertex. The result of the first vertex is stored in GTE data register **C2_SXY0**, the second vector in **C2_SXY1** then **C2_SXY2**.

Functions

ApplyMatrixLV

Multiply vector by matrix

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

VECTOR *ApplyMatrixLV(	
MATRIX **m,*	Input matrix
VECTOR **v0,*	Input vector
VECTOR **v1***)**	Output vector

Explanation

Multiplies vector *v0* with matrix *m*, result is stored to *v1*. Replaces the current GTE rotation matrix and translation vector with *m*.

Often used to calculate a translation vector in relation to the rotation matrix for first person or vector camera perspectives (see “fpscam” example).

Return Value

Pointer to *v1.*

CompMatrixLV

Composite coordinate matrix transform

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

VECTOR *CompMatrixLV(	
MATRIX **v0,*	Input matrix A
MATRIX **v1,*	Input matrix B
MATRIX **v2***)**	Output matrix

Explanation

Performs vector multiply by matrix with vector addition from *v0* to the translation vector of *v1*. Then, multiples the rotation matrix of *v0* by the rotation matrix of *v1*. The result of both operations is then stored in *v2*. Replaces the current GTE rotation matrix and translation vector with *v0*.

Often used to adjust the matrix (includes rotation and translation) of an object relative to a world matrix, so the object would render relative to the world matrix (ie. the bouncing cube in the “fpscam” example).

Return Value

Pointer to *v2.*

hicos

Get a value of cos (integer, high precision version)

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

int hicos(
int *a*) Angle in degrees (131072 = 360 degrees)

Explanation

Returns the cos value of angle *a*.

Return Value

Cosine value (4096 = 1.0).

hisin

Get a value of sin (integer, high precision version)

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

int hisin(
    int *a***)**   Angle in degrees (131072 = 360 degrees)

Explanation

Returns the sin value of angle *a*.

Return Value

Sine value (4096 = 1.0).

icos

Get a value of cos (integer)

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

int icos(	
int *a***)**	Angle in degrees (4096 = 360 degrees)

Explanation

Returns the cos value of angle *a*.

Uses Taylor series all-integer sine implementation that is both small and fast, does not use a lookup table.

Return Value

Cosine value (4096 = 1.0).

isin

Get a value of sin (integer)

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

int isin(
    int *a***)**   Angle in degrees (4096 = 360 degrees)

Explanation

Returns the sine value of angle *a*.

Uses Taylor series all-integer sine implementation that is both small and fast, does not use a lookup table.

Return Value

Sine value (4096 = 1.0).

PushMatrix

Pushes the current GTE matrix to the matrix stack

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

void PushMatrix(void)

Explanation

Pushes the current GTE rotation matrix and translation vector to the internal matrix stack.

Only one matrix stack level is currently supported.

PopMatrix

Pops the last matrix pushed into the matrix stack back to the GTE

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

void PopMatrix(void)

Explanation

Pops the last inserted matrix in the internal matrix stack back to the GTE.

Only one matrix stack level is currently supported.

RotMatrix

Defines the rotation matrix of a MATRIX

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

MATRIX *RotMatrix(
 SVECTOR **r,* Rotation vector (input)
 MATRIX **m***)** Matrix (output)

Explanation

Defines the rotation matrix of *m* from rotation coordinates of *r*.

The rotation order of each axis of SVECTOR is X,Y,Z as described in the equation below.

$$s1=\sin(vx) \quad s2=\sin(vy) \quad s3=\sin(vz)$$
$$c1=\cos(vx) \quad c2=\cos(vy) \quad c3=\cos(vz)$$

$$mX=\begin{Bmatrix}1.0 & 0 & 0\\ 0 & c1 & -s1\\ 0 & s1 & c1\end{Bmatrix} \quad mY=\begin{Bmatrix}c2 & 0 & s2\\ 0 & 1.0 & 0\\ -s2 & 0 & c2\end{Bmatrix} \quad mZ=\begin{Bmatrix}c3 & -s3 & 0\\ s3 & c3 & 0\\ 0 & 0 & 1.0\end{Bmatrix}$$

$$m=(mX*mY*mZ)$$

Keep in mind that all matrix operations are performed in fixed point integer math with 12-bit fractions, where 4096 equals to a floating point value of 1.0.

Return value

Pointer to *m*.

See also

gte_SetRotMatrix

Square0

Calculates the square of a VECTOR

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

void Square0(	
VECTOR **v0,*	Input vector
VECTOR **v1***)**	Output vector

Explanation

Calculates the square of vector *v0* and stores the result to *v1*.

TransMatrix

Defines the translation vector of a MATRIX

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

MATRIX *TransMatrix(	
MATRIX **m,*	Translation vector (input)
VECTOR **r*)	Matrix (output)

Explanation

Simply sets the translation vector of MATRIX *m*. To perform accumulative translation operations, see **CompMatrixLV**.

Return value

Pointer to *m*.

See also

RotMatrix CompMatrixLV gte_SetTransMatrix

VectorNormalS

Normalizes a VECTOR into SVECTOR format

Library	Header File	Original	Introduced	Documentation Date
libpsxgte.a	*psxgte.h*	*No*	*R1*	*12/03/2020*

Syntax

void VectorNormalS(	
VECTOR **v0,*	Input (raw) 32-bit vector
SVECTOR **v1***)**	Output (normalized) 16-bit vector

Explanation

Normalizes a 32-bit vector into a 16-bit vector with 12-bit fractions (4096 = 1.0, 2048 = 0.5).

Graphics Library

Chapter Contents

Overview

The graphics library provides functions for initializing and controlling the GPU hardware as well as various structures and macros for preparing graphics primitives to be drawn by the GPU. This library does not provide functions for 3D graphics processing, the Geometry Library (psxgte) provides such functions instead.

This library also provides a global ISR handler which other libraries depend on for handling interrupts and is installed to the kernel by ResetGraph(). Even if you don’t plan to do any graphics, it is highly recommended to call ResetGraph() at the beginning of your program.

Library Status

As of September 12, 2020, the state of the LibPSn00b GPU library is as follows:

Feature	Status
GPU Initialization	Fully Working
Interrupt Service Subsystem	Fully Working
Video Standard Select	Fully Working
Primitives	Mostly Implemented
Ordering Tables	Fully Implemented
DMA VRAM Upload/Download	Fully Working
DMA Ordering Table Transfer	Fully Working
DMA Ordering Table Clear	Fully Working
VSync/DrawSync Callbacks	Fully Working

Structures

DISPENV

Display environment structure

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Structure

```
typedef struct _DISPENV {
    RECT     disp;          Display coordinates (framebuffer position and resolution)
    RECT     screen;        Screen coordinates (picture position and size)
    char     isinter;       Interlace flag (0: non-interlace, 1: interlace)
    char     isrgb24;       RGB24 color mode (0: 16-bit color mode, 1: 24-bit color mode)
    short    pad;           Padding
} DISPENV;
```

Explanation

This structure specifies the display attributes to apply to the GPU using PutDispEnv().

The disp element specifies both the offset of the framebuffer area to be displayed (*disp.x, disp.y*) and display resolution. Valid horizontal resolutions (for *disp.w*) are 256, 320, 384, 512 and 640 and vertical resolutions (for *disp.h*) are 240 and 480 for NTSC standard and 256 and 512 for PAL standard. The display resolution also determines the size of the rectangular area on the framebuffer to be displayed. If the display area exceeds the framebuffer area the picture would simply wrap around to the other side of the framebuffer.

Apparently the GPU is capable of outputting 272 vertical lines in PAL standard even if you have the vertical resolution set to 256. This is yet to be investigated further.

The *screen* element specifies the position (*screen.x*, *screen.y*) and size (*screen.w*, *screen.h*) of the picture displayed on the TV screen. A position of (0, 0) is the base position of the picture and if the picture size is set to (0, 0), default size values are used based on the resolution specified by the *disp* element. Specifying values that are lower or greater than the resolution specified by *disp* can be used to achieve custom resolutions but the hardware will not scale the pixels, it merely just crops or extends what is being shown.

The *isinter* flag specifies if the video signal should be interlaced. This flag must be set when using a vertical resolution of 480 or 512 pixel lines, otherwise, only the even lines would be displayed or a strange video collapse effect will occur (the GPU hardware is not capable of 480p output at all). Interlace can be set for 240 and 256 line modes but it introduces unnecessary jitter, though it improves compatibility with some HDTVs and video capture devices that expect an interlace jitter signal. You may consider this as an option if you wish to implement HDTV compatibility options in your project.

The *isrgb24* flag specifies 24-bit true-color mode and expands the display area on the framebuffer by 1.5x horizontally to accommodate the additional bytes needed for RGB24 pixels. This mode cannot be used for real-time graphics as the GPU only renders at 16-bit color, so 24-bit mode is most useful for FMV sequences, or displaying graphic illustrations from MDEC compressed image data (after decompression).

See also

PutDispEnv

DRAWENV

Drawing environment structures

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Structure

typedef struct _DRAWENV {

RECT	*clip;*	Drawing area in framebuffer within (0, 0) – (1023, 511)
short	*ofs[2];*	GPU drawing offset (x, y)
RECT	*tw;*	Initial texture page window coordinates
u_short	*tpage;*	Initial texture page (see getTPage())
u_char	*dtd;*	Dither processing (0: no dithering, 1: dithered)
u_char	*dfe;*	Allow drawing to displayed area (0: don’t draw to display area, 1: draw)
u_char	*isbg;*	Draw area clear on environment set (0: no clear, 1: clear)
u_char	*r0,g0,b0;*	Draw area clear color
DR_ENV	*dr_env;*	Drawing environment buffer (reserved)

} DRAWENV;

Explanation

This structure specifies the drawing attributes to apply to the GPU using PutDrawEnv().

The *clip* element specifies the rectangular area of the framebuffer that graphics primitives will be drawn to. The drawing area can be of any arbitrary size as long as it is within the framebuffer area.

The *ofs[]* element specifies the X,Y coordinates of the GPU offset which is the position where a coordinate of (0,0) will originate from. The coordinates specified are relative to the *clip* area coordinates.

The *tw* element specifies the texture window size and offset of the texture page. Currently that functionality is not yet implemented in PSn00bSDK so this element does nothing.

The *tpage* element specifies the initial texture page value to set to the GPU. A texture page can be easily calculated using getTPage() and the texture page can be changed mid-drawing using the DR_TPAGE packet.

The *dtd* element specifies if dither processing is enabled or not. The dither processing bit is merged with the specified texture page value and could be disabled if a DR_TPAGE primitive was processed without the dither processing bit set.

The *dfe* element specifies if drawing should be blocked if the area is occupied by a display area. This is normally set to zero since most page flipping setups usually draw to an area not visible to the display and is mandatory for hi-res modes as it would allow the GPU to only draw on rows that are not being displayed, allowing for a pseudo double buffered setup. Setting this to non-zero would allow drawing in a display area as well as draw on both fields in hi-res modes which might be useful for static menu screens in hi-res.

The *isbg* element specifies if the drawing area should be cleared when this structure is applied using PutDrawEnv(), recommended for instances where the screen is constantly being updated. The clear color is specified using the *r0,g0,b0* elements.

The *dr_env* element is a reserved element used as a buffer by PutDrawEnv(). The DR_ENV structure can be used as a primitive packet to change the drawing environment mid-drawing for split-screen setups or off-screen render-to-texture tricks for example.

Work in progress

The *tw* element has no effect to the drawing environment as of version 0.09b.

See also

PutDrawEnv

RECT

Defines a rectangular area

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*12/21/2018*

Structure

```
typedef struct _RECT {
    short    x,y;        Top left coordinates of the rectangular area
    short    w,h;        Width and height of the rectangular area
} RECT;
```

Explanation

Used to define a rectangular area in various structures and functions.

TIM_IMAGE

Texture Image parameters

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _TIM_IMAGE {
    u_long    mode;      Image mode (bit 0-3: color depth, bit 4: CLUT flag)
    RECT      *crect;    Pointer to CLUT rectangle coordinates
    u_long    *caddr;    Pointer to CLUT data (or NULL if no CLUT)
    RECT      *prect;    Pointer to pixel data rectangle coordinates
    u_long    *paddr;    Pointer to pixel data
} TIM_IMAGE;
```

Explanation

Used to store texture image parameters from a TIM file with **GetTimInfo**. The *crect, caddr, prect* and *paddr* elements can be referenced directly to access TIM coordinates and data easily.

See also

GetTimInfo

Structures (Primitives)

DR_AREA

Drawing area primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R32*	*01/14/2022*

Structure

```
typedef struct DR_AREA {
    u_long    tag;        Pointer to next primitive + length of packet
    u_long    code[2];    Primitive code
} DR_AREA;
```

Explanation

Changes the current drawing area in similar function to using **DRAWENV** and **SetDefDrawEnv**, but can be inserted as a primitive packet allowing to change the drawing area mid-rendering.

See Also

setDrawArea

DR_MASK

Mask mode primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*Yes*	*R1*	*06/07/2021*

Structure

typedef struct _DR_MASK {		
u_long	*tag;*	Pointer to next primitive + length of packet
u_long	*code[1];*	Drawing mask primitive code
} DR_MASK;		

Explanation

Sets the drawing mask setting of the GPU, a limited implementation of stencil masks.

See also

setDrawMask

DR_OFFSET

Drawing offset primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R32*	*01/14/2022*

Structure

```
typedef struct _DR_OFFSET
{
    u_long    tag;        Pointer to next primitive + length of packet
    u_long    code[1];    Primitive code
} DR_OFFSET;
```

Explanation

Sets the current drawing offset for graphics primitives. Often used in tandem with **DR_AREA** to update the drawing offset.

See Also

setDrawOffset

DR_TPAGE

Texture page primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _DR_TPAGE {
    u_long      tag;          Pointer to next primitive + length of packet
    u_long      code[1];      Texture page primitive code
} DR_TPAGE;
```

Explanation

A texture page primitive, used to change the current Tpage of the GPU mid-drawing.

Used alongside primitives that lack a Tpage field, such as **SPRT**, **SPRT_8 and SPRT_16** primitives, and for setting the blend operator of untextured primitives, such as **TILE**, **TILE_1, TILE_8, TILE_16**, **POLY_F3, POLY_F4**, **POLY_G3, and POLY_G4** primitives, that have been set for semi-transparency.

See also

setDrawTPage setDrawTPageVal

DR_TWIN

Texture window primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R32*	*01/14/2022*

Structure

```
typedef struct _DR_TWIN
{
    u_long      tag;            Pointer to next primitive + length of packet
    u_long      code[2];        Primitive code
} DR_TWIN;
```

Explanation

Sets texture page window parameters. A texture window is used to restrict textured primitives to a small region of a texture page to allow for wrapping textures.

See Also

setTexWindow

LINE_F2, LINE_F3, LINE_F4

2-point, 3-point and 4-point solid colored line primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _LINE_F2 {
    u_long    tag;              Pointer to next primitive + length of this packet
    u_char    r0,g0,b0,code;    RGB color + primitive code
    short     x0,y0;            Screen coordinates 0
    short     x1,y1;            Screen coordinates 1
} LINE_F2;

typedef struct _LINE_F3 {
    u_long    tag;              Pointer to next primitive + length of this packet
    u_char    r0,g0,b0,code;    RGB color + primitive code
    short     x0,y0;            Screen coordinates 0
    short     x1,y1;            Screen coordinates 1
    short     x2,y2;            Screen coordinates 2
    u_long    pad;              Terminator value (usually 0x55555555)
} LINE_F3;

typedef struct _LINE_F4 {
    u_long    tag;              Pointer to next primitive + length of this packet
    u_char    r0,g0,b0,code;    RGB color + primitive code
    short     x0,y0;            Screen coordinates 0
    short     x1,y1;            Screen coordinates 1
    short     x2,y2;            Screen coordinates 2
    short     x3,y3;            Screen coordinates 3
    u_long    pad;              Terminator value (usually 0x55555555)
} LINE_F4;
```

Explanation

LINE_F2 draws a solid colored 2-point line between (*x0*, *y0*) – (*x1*, *y1*) with color specified by (*r0, g0, b0*).

LINE_F3 draws a solid colored 3-point line around (*x0*, *y0*) – (*x1*, *y1*) – (*x2, y2*) with color specified by (*r0, g0, b0*).

LINE_F4 draws a solid colored 4-point line around (*x0*, *y0*) – (*x1, y1*) – (*x2, y2*) – (*x3, y3*) with color specified by (*r0, g0, b0*).

See also

setLineF2 setLineF3 setLineF4

LINE_G2, LINE_G3, LINE_G4

2-point, 3-point and 4-point shaded line primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structures

typedef struct _LINE_G2 {		
u_long	*tag;*	Pointer to next primitive + length of packet
u_char	*r0,g0,b0,code;*	RGB color 0 + primitive code
short	*x0,y0;*	Screen coordinates 0
u_char	*r1,g1,b1,p1;*	RGB color 1 + padding
short	*x1,y1;*	Screen coordinates 0
} LINE_G2;		

typedef struct _LINE_G3 {		
u_long	*tag;*	Pointer to next primitive + length of packet
u_char	*r0,g0,b0,code;*	RGB color 0 + primitive code
short	*x0,y0;*	Screen coordinates 0
u_char	*r1,g1,b1,p1;*	RGB color 1 + padding
short	*x1,y1;*	Screen coordinates 1
u_char	*r2,g2,b2,p2;*	RGB color 2 + padding
short	*x2,y2;*	Screen coordinates 2
u_long	*pad;*	Terminator value (usually 0x55555555)
} LINE_G3;		

typedef struct _LINE_G4 {		
u_long	*tag;*	Pointer to next primitive + length of packet
u_char	*r0,g0,b0,code;*	RGB color 0 + primitive code
short	*x0,y0;*	Screen coordinates 0
u_char	*r1,g1,b1,p1;*	RGB color 1 + padding
short	*x1,y1;*	Screen coordinates 1
u_char	*r2,g2,b2,p2;*	RGB color 2 + padding
short	*x2,y2;*	Screen coordinates 2
u_char	*r3,g3,b3,p3;*	RGB color 3 + padding
short	*x3,y3;*	Screen coordinates 3
u_long	*pad;*	Terminator value (usually 0x55555555)
} LINE_G4;		

Explanation

LINE_F2 draws a solid colored 2-point line between (*x0*, *y0*) – (*x1*, *y1*) with color specified by (*r0, g0, b0*) – (*r1, g1, b1*).

LINE_F3 draws a solid colored 3-point line around (*x0*, *y0*) – (*x1, y1*) – (*x2, y2*) with color specified by (*r0, g0, b0*) – (*r1, g1, b1*) – (*r2, g2, b2*).

LINE_F4 draws a solid colored 4-point line around (*x0*, *y0*) – (*x1, y1*) – (*x2, y2*) – (*x3, y3*) with color specified by (*r0, g0, b0*) – (*r1, g1, b1*) – (*r2, g2, b2*) – (*r3, g3, b3*).

See Also

setLineG2 setLineG3 setLineG4

P_TAG

Generic primitive header

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _P_TAG {
    u_long    addr:24;     Next primitive address
    u_long    len:8;       Primitive length (in words)
    u_char    r,g,b;       Primitive color
    u_char    code;        Primitive code
} P_TAG;
```

Explanation

Normally used in various primitive preparation macros and the **addPrim** macro.

POLY_F3, POLY_F4

3-point and 4-point, untextured, flat shaded polygon primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _POLY_F3 {
    u_long    tag;              Pointer tag to primitive + packet length
    u_char    r0,g0,b0,code;    RGB color + primitive code
    short     x0,y0;            Screen coordinates 0
    short     x1,y1;            Screen coordinates 1
    short     x2,y2;            Screen coordinates 2
} POLY_F3;

typedef struct _POLY_F4 {
    u_long    tag;              Pointer tag to primitive + packet length
    u_char    r0,g0,b0,code;    RGB color + primitive code
    short     x0,y0;            Screen coordinates 0
    short     x1,y1;            Screen coordinates 1
    short     x2,y2;            Screen coordinates 2
    short     x3,y3;            Screen coordinates 3
} POLY_F4;
```

Explanation

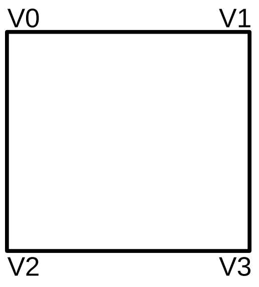
POLY_F3 draws a 3-point flat shaded, untextured polygon to screen coordinates (*x0,y0*) – (*x1,y1*) – (*x2,y2*).

POLY_F4 draws a 4-point flat shaded, untextured polygon to screen coordinates (*x0,y0*) – (*x1,y1) –* (*x2,y2*) – (*x3,y3*).

Elements *r0, g0, b0* specifies the color of the primitive.

Use **setPolyF3** and **setPolyF4** macros respectively to initialize the primitive before adding it to an ordering table.

The following figure describes the vertex order for 4-point polygons:



POLY_FT3, POLY_FT4

3-point and 4-point, textured, flat shaded polygon primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _POLY_FT3 {
    u_long   tag;               Pointer tag to primitive + packet length
    u_char   r0,g0,b0,code;     RGB color + primitive code
    short    x0,y0;             Screen coordinates 0
    u_char   u0,v0;             Texture coordinates 0
    u_short  clut;              Texture CLUT ID
    short    x1,y1;             Screen coordinates 1
    u_char   u1,v1;             Texture coordinates 1
    u_short  tpage;             Texture page
    short    x2,y2;             Screen coordinates 2
    u_char   u2,v2;             Texture coordinates 2
    u_short  pad;               Padding
} POLY_FT3;

typedef struct _POLY_FT4 {
    u_long   tag;               Pointer tag to primitive + packet length
    u_char   r0,g0,b0,code;     RGB color + primitive code
    short    x0,y0;             Screen coordinates 0
    u_char   u0,v0;             Texture coordinates 0
    u_short  clut;              Texture CLUT ID
    short    x1,y1;             Screen coordinates 1
    u_char   u1,v1;             Texture coordinates 1
    u_short  tpage;             Texture page
    short    x2,y2;             Screen coordinates 2
    u_char   u2,v2;             Texture coordinates 2
    u_short  pad0;              Padding
    short    x3,y3;             Screen coordinates 3
    u_char   u3,v3;             Texture coordinates 3
    u_short  pad1;              Padding
} POLY_FT4;
```

Explanation

POLY_FT3 draws a 3-point flat shaded, textured polygon to screen coordinates (*x0,y0*) – (*x1,y1*) – (*x2,y2*).

POLY_FT4 draws a 4-point flat shaded, textured polygon to screen coordinates (*x0,y0*) – (*x1,y1)* – (*x2,y2*) – (*x3,y3*).

Elements (*u0,v0*), (*u1,v1),* (*u2,v2*) and (*u3,v3*) specify the texture coordinates within the texture page specified by *tpage*. Texture CLUT ID is specified by the *clut* element.

Elements *r0, g0, b0* specifies the color of the primitive.

Use **setPolyFT3** and **setPolyFT4** macros respectively to initialize the primitive before adding it to an ordering table.

See **POLY_F3, POLY_F4** for a visual figure of the vertex order for 4-point polygons.

POLY_G3, POLY_G4

3-point and 4-point, untextured, gouraud shaded polygon primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _POLY_G3 {
    u_long   tag;              Pointer tag to primitive + packet length
    u_char   r0,g0,b0,code;    RGB color 0 + code
    short    x0,y0;            Screen coordinates 0
    u_char   r1,g1,b1,pad0;    RGB color 1
    short    x1,y1;            Screen coordinates 1
    u_char   r2,g2,b2,pad1;    RGB color 2
    short    x2,y2;            Screen coordinates 2
} POLY_G3;

typedef struct _POLY_G4 {
    u_long   tag;              Pointer tag to primitive + packet length
    u_char   r0,g0,b0,code;    RGB color 0 + code
    short    x0,y0;            Screen coordinates 0
    u_char   r1,g1,b1,pad0;    RGB color 1 + padding
    short    x1,y1;            Screen coordinates 1
    u_char   r2,g2,b2,pad1;    RGB color 2 + padding
    short    x2,y2;            Screen coordinates 2
    u_char   r3,g3,b3,pad2;    RGB color 3 + padding
    short    x3,y3;            Screen coordinates 3
} POLY_G4;
```

Explanation

POLY_G3 draws a 3-point flat shaded, textured polygon to screen coordinates (*x0,y0*) – (*x1,y1*) – (*x2,y2*).

POLY_G4 draws a 4-point flat shaded, textured polygon to screen coordinates (*x0,y0*) – (*x1,y1) –* (*x2,y2*) – (*x3,y3*).

Elements (*r0,g0,b0*)*,* (*r1,g1,b1*), (*r2,g2,b2*) and (*r3,g3,b3*) specifies the color of the primitive for each point.

Use **setPolyG3** and **setPolyG4** macros respectively to initialize the primitive before adding it to an ordering table.

See **POLY_F3, POLY_F4** for a visual figure of the vertex order for 4-point polygons.

POLY_GT3, POLY_GT4

3-point and 4-point, textured, gouraud shaded polygon primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _POLY_GT3 {
    u_long     tag;                 Pointer tag to primitive + packet length
    u_char     r0,g0,b0,code;       RGB color 0 + code
    short      x0,y0;               Screen coordinates 0
    u_char     u0,v0;               Texture coordinates 0
    u_short    clut;                Texture CLUT ID
    u_char     r1,g1,b1,pad0;       RGB color 1
    short      x1,y1;               Screen coordinates 1
    u_char     u1,v1;               Texture coordinates 1
    u_short    tpage;               Texture page ID
    u_char     r2,g2,b2,pad1;       RGB color 2
    short      x2,y2;               Screen coordinates 2
    u_char     u2,v2;               Texture coordinates 2
    u_short    pad2;                Padding
} POLY_GT3;

typedef struct _POLY_GT4 {
    u_long     tag;                 Pointer tag to primitive + packet length
    u_char     r0,g0,b0,code;       RGB color 0 + code
    short      x0,y0;               Screen coordinates 0
    u_char     u0,v0;               Texture coordinates 0
    u_short    clut;                Texture CLUT ID
    u_char     r1,g1,b1,pad0;       RGB color 1
    short      x1,y1;               Screen coordinates 1
    u_char     u1,v1;               Texture coordinates 1
    u_short    tpage;               Texture page ID
    u_char     r2,g2,b2,pad1;       RGB color 2
    short      x2,y2;               Screen coordinates 2
    u_char     u2,v2;               Texture coordinates 2
    u_short    pad2;                Padding
    u_char     r3,g3,b3,pad3;       RGB color 3
    short      x3,y3;               Screen coordinates 3
    u_char     u3,v3;               Texture coordinates 3
    u_short    pad4;                Padding
} POLY_GT4;
```

Explanation

POLY_GT3 draws a 3-point gouraud shaded, textured polygon to screen coordinates (*x0,y0*) – (*x1,y1*) – (*x2,y2*).

POLY_GT4 draws a 4-point gouraud shaded, textured polygon to screen coordinates (*x0,y0*) – (*x1,y1)* – (*x2,y2*) – (*x3,y3*).

Elements (*u0,v0*), (*u1,v1),* (*u2,v2*) and (*u3,v3*) specify the texture coordinates within the texture page specified by *tpage*. Texture CLUT ID for color-index textures is specified by the *clut* element.

Elements (*r0,g0,b0*)*,* (*r1,g1,b1*), (*r2,g2,b2*) and (*r3,g3,b3*) specifies the color of the primitive for each point.

Use **setPolyGT3** and **setPolyGT4** macros respectively to initialize the primitive before adding it to an ordering table.

See **POLY_F3, POLY_F4** for a visual figure of the vertex order for 4-point polygons.

SPRT

Any-size textured sprite

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _SPRT {
    u_long      tag;                Pointer tag to next primitive packet
    u_char      r0,g0,b0,code;      RGB color of sprite + packet code
    short       x0,y0;              Position of sprite
    u_char      u0,v0;              Sprite texture coordinates within texture page. u0 must be a multiple of 2
    u_short     clut;               Sprite texture CLUT ID (see getClut)
    u_short     w,h;                Sprite size (w must be a multiple of 2)
} SPRT;
```

Explanation

Draws a textured sprite primitive of any defined size, draws faster than POLY_FT4 but lacks the authority for scaling and rotation.

If you use a sprite size greater than 256x256 (or the size of the texture window), the texture will simply repeat.

Because the SPRT primitive has no element to specify a texture page, a DR_TPAGE primitive can be used to work around that limitation. In order for the primitive to be effective, it must be added to the ordering table after the SPRT primitive has been sorted and both primitives must be added to the same element of the ordering table.

Use **setSprt** to initialize the primitive before adding it to the ordering table.

SPRT_8, SPRT_16

Fixed size 8 x 8 or 16 x 16 textured sprite

Library	Header	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _SPRT_8 {
    u_long    tag;             Pointer tag to next primitive packet
    u_char    r0,g0,b0,code;   RGB color of sprite + primitive code
    short     x0,y0;           Position of sprite (top-left coordinates)
    u_char    u0,v0;           Sprite texture coordinates within texture page, u0 must be a multiple of 2
    u_short   clut;            Sprite texture CLUT ID (see getClut)
} SPRT_8;

typedef struct _SPRT_16 {
    u_long    tag;             Pointer tag to next primitive packet
    u_char    r0,g0,b0,code;   RGB color of sprite + primitive code
    short     x0,y0;           Position of sprite (top-left coordinates)
    u_char    u0,v0;           Sprite texture coordinates within texture page, u0 must be a multiple of 2
    u_short   clut;            Sprite texture CLUT ID (see getClut)
} SPRT_16;
```

Explanation

Draws a fixed size 8 x 8 or 16 x 16 pixel textured sprite, supposedly faster than **SPRT**.

Much like **SPRT** it has no texture page element so a DR_TPAGE primitive must be added to the ordering table after the **SPRT** primitive to specify the desired texture page value.

Use **setSprt8** and **setSprt16** respectively to initialize the packet before adding it to an ordering table.

TILE

Any size flat colored sprite

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _TILE {
    u_long   tag;              Pointer tag to next primitive packet
    u_char   r0,g0,b0,code;    RGB color of tile + packet code
    short    x0,y0;            Position of tile (top-left coordinate)
    short    w,h;              Size of tile in pixels
} TILE;
```

Explanation

Draws a flat colored sprite of specified size.

Use **setTile** to initialize the packet before adding it to an ordering table.

TILE_1, TILE_8, TILE_16

Fixed size 1 x 1, 8 x 8 and 16 x 16 colored sprites.

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Structure

```
typedef struct _TILE_1 {
    u_long    tag;              Pointer tag to next primitive packet
    u_char    r0,g0,b0,code;    RGB color of tile + packet code
    short     x0,y0;            Position of tile (top-left coordinates)
} TILE_1;

typedef struct _TILE_8 {
    u_long    tag;              Pointer tag to next primitive packet
    u_char    r0,g0,b0,code;    RGB color of tile + packet code
    short     x0,y0;            Position of tile (top-left coordinates)
} TILE_8;

typedef struct _TILE_16 {
    u_long    tag;              Pointer tag to next primitive packet
    u_char    r0,g0,b0,code;    RGB color of tile + packet code
    short     x0,y0;            Position of tile (top-left coordinates)
} TILE_16;
```

Explanation

Draws a fixed size 1 x 1, 8 x 8 or 16 x 16 flat colored sprite.

Use **setTile1**, **setTile8**, **setTile16** to initialize the packet before adding it to an ordering table.

Functions

AddPrim

Non macro version of **addPrim**

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void AddPrim(	
u_long **ot,*	Pointer to an ordering table element
void **p***)**	Pointer to a primitive packet

Explanation

Links a primitive packet to an ordering table element by setting the value from the specified table element to the primitive packet's tag element (with the size byte retained) and the pointer to the packet is set to the specified table element.

It is recommended to generate primitive packets in a global buffer to ensure that they do not get overwritten when the GPU gets around to processing the primitive (ie. If you allocate the primitive as a local variable in a function, it may have been overwritten when the GPU gets to draw it).

A common misconception among many PS1 homebrew programmers is they sometimes believe only a single primitive packet can be added to each ordering table element. This is false because adding another primitive to an ordering table element that already has a primitive concatenates to the chain, not replace the element.

Therefore, an ordering table length of 4 to 8 elements is usually enough for purely 2D projects. Higher ordering table sizes are recommended for projects featuring 3D visuals.

See also

ClearOTagR DrawOTag

ClearOTagR

Initializes an array to an empty ordering table (reverse order)

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void ClearOTagR(	
u_long **ot,*	Pointer to an array to initialize into a linked list
int *n***)**	Number of array elements

Explanation

Initializes an array of *n* elements specified by **ot* into a linked list to use as an ordering table. An ordering table consists of an array of pointers that point from one entry to the next which primitives may be added to the chain.

This function uses DMA to clear the ordering table. It prepares a reverse order list which starts at the last entry of the array and ends at the first. This is ideal for 3D graphics as higher table entries are drawn first and lower entries are drawn last. Primitives added to one entry first are always drawn last.

To begin processing of an ordering table array initialized by this function, execute DrawOTag(ot+n-1) (draw from last entry of array) since the ordering table is initialized with pointers in reverse order.

When adding an ordering table to another ordering table using addPrims, specify the last element for p0 and the first element for p1 if the ordering table is cleared by this function.

See Also

AddPrim DrawOTag

DrawOTag

Executes an ordering table

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void DrawOTag(	
u_long **ot***)**	Pointer to an ordering table array to draw.

Explanation

Draws out or executes primitives linked to the ordering table array specified by **ot*.

When drawing an ordering table initialized by **ClearOTagR**, you must specify the last array element of the ordering table.

DrawOTag uses DMA to send primitives to the GPU at high speed and may be non-blocking during DMA transfer. Use **DrawSync** to check if the DMA transfer and execution of primitives has completed.

See also

DrawSync ClearOTagR

DrawPrim

Draws a primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R17*	*06/07/2021*

Syntax

void DrawPrim(
    void **pri***)** Pointer to a primitive

Explanation

Draws or execute the primitive specified by *pri*. Uses software I/O to send the primitive to the GPU, so its not recommended for use in drawing a large amount of primitives.

Use only for drawing a few primitives in a very simple single buffered menu for example.

DrawSync

Waits until all GPU drawing or VRAM transfers have completed

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*12/21/2018*

Syntax

int DrawSync(	
int *mode***)**	Function mode

Explanation

Waits until the GPU has finished processing drawing commands or VRAM transfers. If *mode* is non-zero, returns the number of words remaining in a DMA transfer.

Work in progress

This function does not timeout if the GPU locks up due to a bad packet or corrupted ordering table as of version 0.09b.

Returns

Number of words remaining in transfer if *mode* = 1.

DrawSyncCallback

Sets a callback function that is executed on drawing or VRAM transfer completion

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R16*	*07/17/2019*

Syntax

void *DrawSyncCallback(
    void *(*func)()***)**   Pointer to a function

Explanation

Sets a callback function specified by *func* which will be executed on every drawing completion or VRAM transfer. Setting 0 will disable the callback.

Because the callback function is executed inside an interrupt handler, it is necessary to finish any processing as soon as possible. Sub function calls should be kept a minimum as the stack in the ISR is limited.

It is not recommended to issue VRAM or OT transfer operations within the callback function, use it only to set variables for keeping track of drawing and transfer completions.

It is recommended to define any variable manipulated by a callback function as **volatile**, to make sure any code reading the value will always receive changes.

See also

DrawSync

GetTimInfo

Get image parameters of a TIM image file

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*Yes*	*R1*	*02/02/2019*

Syntax

int GetTimInfo(	
unsigned int **tim,*	Pointer to a TIM image file
TIM_IMAGE **timimg***)**	Pointer to a TIM_IMAGE structure

Explanation

Retrieves parameters from a TIM file and stores relevant values to a **TIM_IMAGE** structure.

Return value

0: success, 1: invalid file ID, 2: unsupported TIM version

See also

TIM_IMAGE

GetVideoMode

Gets the current video standard mode

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

int GetVideoMode()

Explanation

Returns the current video standard mode.

Differences

Unlike the official libraries, this function returns the current video mode standard (ie. If this function is called on a PAL machine while in a PAL display mode, it returns 1 or MODE_PAL).

Returns

MODE_NTSC = NTSC

MODE_PAL = PAL

See also

SetVideoMode

LoadImage

Upload image data to VRAM

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void LoadImage(	
RECT **rect,*	Pointer to a RECT specifying VRAM destination coordinates
unsigned int **data***)**	Pointer to source image data

Explanation

Uploads image data from the source address *data* to VRAM. The image size and destination offset in VRAM is specified by *rect* using a RECT object.

LoadImage uses DMA to upload data to VRAM at high speed and may be non-blocking. Use **DrawSync** to check if DMA transfer has completed. Using **DrawSync** when uploading multiple images at once is not necessary as LoadImage will wait for a previous transfer to complete before uploading.

If you want to upload a texture image on every frame in a real time sequence it is best to perform the upload after a **DrawSync** call.

See also

DrawSync GetTimInfo

PutDrawEnv

Applies a DRAWENV structure

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void PutDrawEnv(	
DRAWENV **draw***)**	Pointer to a DRAWENV structure

Explanation

Applies the specified **DRAWENV** structure to the GPU. This function is best called when the GPU is not busy processing any primitives. Use the DrawSync function to wait for the GPU to complete any drawing operations.

Alternatively a DR_ENV struct can be used to change the drawing environment mid-drawing (ie. for split screen rendering).

See also

DRAWENV

PutDispEnv

Applies a DISPENV structure

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void PutDispEnv(	
DISPENV **disp*)	Pointer to a DISPENV structure

Explanation

Applies the specified **DISPENV** struct to the GPU. This function is best called immediately when a V-Blank occurs (using VSync) for updating the screen regularly. Use the VSync function to wait until a V-Blank occurs.

See also

DISPENV VSync

ResetGraph

Resets the graphics subsystem

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void ResetGraph(	
int *mode***)**	Reset mode

Explanation

Resets the GPU and graphics subsystem of libpsxgpu according to *mode*.

On first call, this function will additionally hook the ISR subroutine to the kernel, hooks the internal VSync callback, uninstall the BIOS CD subsystem and exit critical section regardless of *mode*. Because of this, it is highly recommended to call this function at the beginning of your program even if you don’t plan to do any graphics.

The following describes the behavior of the available mode numbers. The exact behavior in the official SDK is not known yet.

Mode	Operation
0	Resets the GPU entirely including video mode (default of 256x240) and sets display mask to 0.
1	Cancels any ongoing DMA transfer and resets the GPU command buffer.
3	Resets the GPU command buffer.

SetDefDispEnv

Sets a display environment with default parameters

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/08/2019*

Syntax

SetDefDispEnv(	
DISPENV **disp,*	Pointer to a **DISPENV** structure
int *x,* **int** *y,*	X, Y framebuffer coordinates to display
int *w,* **int** *h***)**	Display resolution

Explanation

Prepares a **DISPENV** structure with the specified framebuffer and resolution coordinates using default video parameters.

The defaults are the *screen* element of **DISPENV** is set to zeroes, *isinter* is set 0 and *isrgb24* is set 0.

See also

DISPENV PutDispEnv

SetDefDrawEnv

Sets a drawing environment with default parameters

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/08/2019*

Syntax

SetDefDrawEnv(	
DRAWENV **disp,*	Pointer to a **DRAWENV** structure
int *x,* **int** *y,*	X, Y framebuffer coordinates to draw to
int *w,* **int** *h***)**	Draw area size

Explanation

Prepares a **DRAWENV** structure with the specified framebuffer and resolution coordinates using default parameters.

The *ofs[]* elements of **DRAWENV** is set 0 (top-left), *tw* is set 0 (default texture window settings), *tpage* to 0x0a (640, 0), *dtd* to 1 (dithering enabled), *dfe* to 0 (don't draw to displayed area), *isbg* to 0 (no draw area clear) and clear color values set to 0.

See also

DRAWENV PutDrawEnv

SetDispMask

Sets the display mask

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/08/2019*

Syntax

void SetDispMask(	
int *mask***)**	Display mask setting (0: no display, 1: display)

Explanation

Sets the display mask of the GPU. If *mask* is 0, the console will only show a black screen but sync signals are still sent to the television.

This function is useful for hiding garbage shown during video init/setup. **ResetGraph** automatically sets the display mask to 0.

Best called after **VSync** and **PutDispEnv**.

SetVideoMode

Sets the video standard

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2021*

Syntax

void SetVideoMode(
    int *mode***)** Video standard to set

Explanation

Sets the video standard by *mode* (MODE_NTSC for NTSC or MODE_PAL for PAL), normally used to override the current video standard of the console.

Keep in mind that using a video standard other than what is designated on the console itself to color problems or unstable picture without modifications to the hardware. On earlier models the picture will go out and vertical retrace interrupts stop, causing the system to lock up.

StoreImage

Download image data from VRAM

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R21*	*06/07/2021*

Syntax

void StoreImage(	
RECT **rect,*	Pointer to a RECT specifying VRAM source coordinates
u_long **data***)**	Pointer to store downloaded image data

Explanation

Downloads a portion of VRAM from an area specified by *rect,* and stores the downloaded pixel data to a buffer specified by *data*.

StoreImage uses DMA to upload data to VRAM at high speed and could be non-blocking, use **DrawSync** to ensure the DMA transfer has completed.

See also

DrawSync

VSync

Wait for vertical retrace, return hblank count since last call or elapsed vertical blank counter

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/23/2019*

Syntax

void VSync(
  int *mode***)** Mode

Explanation

Waits until a vertical retrace occurs or returns a value using the method specified by *mode*, as defined below.

Mode	Operation
0	Waits until a vertical retrace event occurs.
1	Only return the Hblank count elapsed since last VSync call.
n>1	Waits until n vertical retrace events occur.
n<0	Returns number of vertical retrace events elapsed since the beginning of the program.

VSync() will timeout if the vertical blanking interrupt stops working either due to calling ChangeClearPAD(1), or calling _InitPad() without calling ChangeClearPAD(0) next. The function will attempt to restart vertical blanking interrupts by calling ChangeClearPAD(0) and ChangeClearRCnt(3, 0).

VSync() may also timeout if a large wait value is specified. Use a for-loop that calls VSync(0) instead to get around this limitation.

Return value

Return value varies depending on the value specified by *mode*.

Mode	Return value
>=0	Hblank count elapsed since last VSync call.
<0	Number of vertical retrace events elapsed since the start of your program.

See also

VSyncCallback

VSyncCallback

Sets a specified function to be executed on every V-blank

Library	Header	Original	Introduced	Documentation Date
liblibpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/17/2019*

Syntax

void *VsyncCallback(
    void *(*func)()***)**   Pointer to a callback function

Explanation

Sets a callback function specified by *func* called on every V-blank. Setting 0 will disable the callback.

Because the callback function is executed during a critical section inside an ISR, it is necessary to finish any processing quickly. Sub function calls should also be kept at minimum as the stack in the ISR is limited.

It is recommended to define any variable manipulated by a callback function as **volatile** to make sure that any loop reading the value will always read the variable for changes.

Returns

Pointer to last callback function set.

See also

VSync

Macros

addPrim

Links a primitive packet to an ordering table

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

addPrim(

ot,	Pointer to an ordering table element
*p***)**	Pointer to a primitive packet

Explanation

Links a primitive packet to an ordering table element by setting the value from the specified table element to the primitive packet's tag element (with the size byte retained) and the pointer to the packet is set to the specified table element.

It is recommended to generate primitive packets in a global buffer to ensure that they do not get overwritten when the GPU gets around to processing the primitive (ie. If you allocate the primitive as a local variable in a function, it may have been overwritten when the GPU gets to draw it).

A common misconception among PS1 homebrew programmers is that they sometimes believe that only a single primitive packet can only be added to each ordering table element. This is false as adding another primitive to an ordering table element that already has a primitive added to it will only add to the chain, not replace it so pretty much any number of primitives can be added to a single table element. Therefore, an ordering table length of 4 to 8 elements is usually enough for a 2D game project.

See also

ClearOTagR DrawOTag

addPrims

Links an ordering table to another ordering table

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

addPrims(

ot,	Pointer to an ordering table element
p0,	Pointer to the first element of the ordering table to add
*p1***)**	Pointer to the last element of the ordering table to addition

Explanation

This macro links one ordering table specified by *p0* and *p1* to another ordering table.

The ordering table element that is considered the first element in the chain depends on which function was used to prepare the ordering table. If the ordering table was cleared using ClearOTagR the last element of the array is the first and the first element is the last, if the ordering table is cleared using ClearOTag the first element in the array is the first and the last element is the last.

See also

ClearOTagR

getClut

Calculates and returns a CLUT value

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/17/2019*

Syntax

getClut(
*x, y***)** Framebuffer coordinates to a CLUT

Explanation

Calculates a CLUT value from the specified coordinates. The resulting value is used on textured primitives with a CLUT field. *x* must be a multiple of 16 units, the value will be rounded down to the nearest lower multiple otherwise.

A CLUT is needed only if the texture color depth is 4-bit or 8-bit.

Primitives with a CLUT field include **SPRT**, **SPRT_8, SPRT_16**, **POLY_FT3, POLY_FT4** and **POLY_GT3, POLY_GT4**.

getTPage

Calculates and returns a texture page value

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/16/2019*

Syntax

getTPage(

tp,	Texture color depth (0: 4-bit, 1: 8-bit, 2: 16-bit)
abr,	Blend operator mode (see below)
*x, y***)**	Framebuffer coordinate of texture page

Explanation

Calculates a texture page value using the specified coordinates. The resulting value is used with textured primitives that have a Tpage field or a DR_TPAGE primitive (using **setDrawTPageVal**).

The framebuffer coordinates should be a multiple of 64 for the X axis and a multiple of 256 for the Y axis, the coordinates will be rounded down to the nearest lower multiple otherwise.

The following lists the blend modes for semi-transparent primitives (*abr*):

Mode	Operation
0	B:50% + F:50% (50% alpha)
1	B:100% + F:100% (additive)
2	B:100% - F:100% (subtractive)
3	B:100% - F:25% (subtract 25%)

Primitives that have a Tpage field include **POLY_FT3, POLY_FT4** and **POLY_GT3, POLY_GT4**, use **DR_TPAGE** and **setDrawTPage** or **setDrawTPageVal** for textured primitives without a Tpage field.

Returns

16-bit texture page value.

See also

setDrawTPage setDrawTPageVal

setClut

Sets the CLUT field of a primitive by coordinates

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/17/2019*

Syntax

setClut(

p,	Pointer to a primitive struct with a CLUT field
*x, y***)**	Framebuffer coordinates to a CLUT

Explanation

Sets the CLUT field of a primitive by framebuffer coordinates. *x* must be a multiple of 16 pixels, the value will be rounded down to the nearest lower multiple otherwise.

Primitives with a CLUT field include **SPRT**, **SPRT_8, SPRT_16**, **POLY_FT3, POLY_FT4** and **POLY_GT3, POLY_GT4**.

See also

getClut

setDrawArea

Initializes a **DR_AREA** primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*Yes*	*R32*	*01/14/2022*

Syntax

setDrawArea(

p,	Pointer to a **DR_AREA** primitive
*r***)**	Pointer to a **RECT** structure

Explanation

Initializes a **DR_AREA** primitive *p* and sets the drawing area coordinates of the primitive from *r*. The drawing area coordinates are VRAM absolute and can be used to perform graphics clipping or off-screen rendering mid-drawing (ie. procedural textures).

When changing the drawing area, the drawing offset may also need to be changed with a **DR_OFFSET** packet.

Once the primitive is initialized it can be registered to an ordering table using **addPrim**.

See Also

addPrim

setDrawOffset

Initializes a **DR_OFFSET** primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*Yes*	*R32*	*01/14/2022*

Syntax

setDrawOffset(

p,	Pointer to **DR_OFFSET** primitive
_x,	X coordinate of new drawing offset
*_y***)**	Y coordinate of new drawing offset

Explanation

Initializes a **DR_OFFSET** primitive *p* and sets the drawing offset coordinates from *_x* and *_y*. This sets the home coordinates (0,0) for drawing primitives and the offset itself is VRAM absolute, completely independent from the current drawing area.

For 3D graphics it is generally preferred to use GTE offsets rather than the drawing offset in most situations.

Once the primitive is initialized it can be registered to an ordering table using **addPrim**.

See Also

addPrim

setDrawMask

Prepares a DR_MASK primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*Yes*	*R1*	*07/17/2019*

Syntax

setDrawMask(

p,	Pointer to a **DR_MASK** primitive
sb,	Set mask bit on pixels drawn (0: don’t set, 1: set)
mt**)**	Mask test (0: draw always, 1: don’t draw on masked pixels)

Explanation

Prepares and sets the specified values to a **DR_MASK** primitive. The mask feature allows for limited stencil effects with the GPU.

Setting *sb* to 1 makes primitives set the mask bit on every pixel drawn, the mask bit is stored on the 16th bit of each pixel within the drawing area. The mask is cleared by primitives if *sb* is set 0.

Textured primitives with semi-transparency bits set on either the pixels or CLUT colors of the texture will also set this mask bit regardless of the *sb* setting. Setting *mt* to 1 enables mask test, which prohibits drawing on areas that have the mask bit set in the drawing area.

The mask settings affects all GPU drawing packets as well as GPU VRAM transfer and move operations, it is recommended to issue a **DR_MASK** with *sb:0* and *mt:0* to reset the mask settings after performing mask effects.

setDrawTPage

Prepares a DR_TPAGE primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/16/2019*

Syntax

setDrawTPage(

p,	Pointer to a DR_TPAGE primitive
tp,	Texture color depth (0: 4-bit, 1: 8-bit, 2: 16-bit)
abr,	Blend operator mode (see **getTPage**)
*x, y***)**	Framebuffer coordinate of texture page

Explanation

Prepares and sets the specified values to a DR_TPAGE primitive, used to change the current Tpage of the GPU mid-drawing for primitives that do not have a Tpage field, and/or to set a blending operator for semi-transparent, non-textured primitives.

The framebuffer coordinates should usually be a multiple of 64 for the X axis and a multiple of 256 for the Y axis, the coordinates will be rounded down to the nearest lower value otherwise. Texture color depth has no effect on framebuffer coordinates.

See also

DR_TPAGE

setLineF2

Prepares a LINE_F2 primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R23*	*07/16/2019*

Syntax

setLineF2(

*p***)**	Pointer to a LINE_F2 primitive

Explanation

Prepares a LINE_F2 packet by setting the appropriate packet size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

LINE_F2, LINE_F3, LINE_F4

setLineF3

Prepares a LINE_F3 primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R23*	*07/16/2019*

Syntax

setLineF3(

*p***)**	Pointer to a LINE_F3 primitive

Explanation

Prepares a LINE_F4 packet by setting the appropriate packet size and code values to the primitive, and sets a terminator word at the end of the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

LINE_F2, LINE_F3, LINE_F4

setLineF4

Prepares a LINE_F4 primitives

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setLineF4(

*p***)**	Pointer to a LINE_F4 primitive

Explanation

Prepares a LINE_F4 packet by setting the appropriate packet size and code values to the primitive, and adds a terminator word at the end of the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

LINE_F2, LINE_F3, LINE_F4

setLineG2

Prepares a LINE_G2 primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setLineG2(	
*p***)**	Pointer to a LINE_G2 primitive

Explanation

Prepares a LINE_G2 packet by setting the appropriate size and code values to the primitive, and adds a terminator word at the end of the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

LINE_G2, LINE_G3, LINE_G4

setLineG3

Prepares a LINE_G3 primitive

Library	Header File	Original	Introduced	Documentation Date
libpsxgpu.a	*psxgpu.h*	*No*	*R23*	*06/07/2019*

Syntax

setLineG3(
*p***)** Pointer to a LINE_G3 primitive

Explanation

Prepares a LINE_G3 packet by setting the appropriate size and code values to the primitive, and adds a terminator word at the end of the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

LINE_G2, LINE_G3, LINE_G4

setLineG4

Prepares a LINE_G4 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/16/2019*

Syntax

setLineG4(	
*p***)**	Pointer to a LINE_G4 primitive

Explanation

Prepares a LINE_G4 packet by setting the appropriate size and code values to the primitive, and adds a terminator word at the end of the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

LINE_G2, LINE_G3, LINE_G4

setPolyF3

Prepares a POLY_F3 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyF3(

*p***)**	Pointer to a **POLY_F3** primitive

Explanation

Prepares a **POLY_F3** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

POLY_F3, POLY_F4

setPolyFT3

Prepares a POLY_FT3 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyFT3(
*p***)** Pointer to a **POLY_FT3** packet

Explanation

Prepares a **POLY_FT3** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates, tpage, clut and color) to the primitive and before adding it to an ordering table using addPrim.

See also

POLY_FT3, POLY_FT4

setPolyG3

Prepares a POLY_G3 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyG3(
*p***)** Pointer to a **POLY_G3** packet

Explanation

Prepares a **POLY_G3** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

POLY_G3, POLY_G4

setPolyGT3

Prepares a POLY_GT3 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyGT3(
*p***)** Pointer to a POLY_G3 packet

Explanation

Prepares a POLY_GT3 packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates, tpage, clut and color) to the primitive and before adding it to an ordering table using addPrim.

See also

POLY_GT3, POLY_GT4

setPolyF4

Prepares a POLY_F4 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyF4(

*p***)**	Pointer to a **POLY_F4** packet

Explanation

Prepares a **POLY_F4** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

POLY_F3, POLY_F4

setPolyFT4

Prepares a POLY_FT4 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyFT4(
*p***)** Pointer to a **POLY_FT4** packet

Explanation

Prepares a **POLY_FT4** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates, tpage, clut and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

POLY_FT3, POLY_FT4

setPolyG4

Prepares a POLY_G4 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyG4(

*p***)**	Pointer to a **POLY_G4** packet

Explanation

Prepares a **POLY_G4** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

POLY_G3, POLY_G4

setPolyGT4

Prepares a POLY_GT4 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setPolyGT4(

*p***)**	Pointer to a POLY_GT4 packet

Explanation

Prepares a POLY_GT4 packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates, tpage, clut and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

POLY_GT3, POLY_GT4

setRECT

Sets coordinates to a RECT struct

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/17/2019*

Syntax

setRECT(

v,	Pointer to a RECT struct
_x,	X coordinate to set
_y,	Y coordinate to set
_w,	Width coordinate to set
*_h***)**	Height coordinate to set

Explanation

Sets the x, y, w, and h fields of a RECT specified by *v*, with coordinates specified by *_x, _y,* _w and *_h*. Cleaner looking to use over setting the fields directly.

See also

RECT

setSprt

Prepares a SPRT primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setSprt(
*p***)** Pointer to a **SPRT** packet

Explanation

Prepares a **SPRT** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y, coordinates, clut and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

SPRT

setSprt8

Prepares a SPRT_8 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setSprt8(	
*p***)**	Pointer to a **SPRT_8** packet

Explanation

Prepares a **SPRT_8** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates, clut and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

SPRT_8, SPRT_16

setSprt16

Prepares a SPRT primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setSprt16(
*p***)** Pointer to a **SPRT_16** packet

Explanation

Prepares a **SPRT_16** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates, clut and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

SPRT_8, SPRT_16

setTexWindow

Prepares a DR_TWIN primitive

Library	Header File	Original	Introduced	Date Documented
none	*psxgpu.h*	*No*	*R34*	*10/22/2019*

Syntax

setTexWindow(

p,	Pointer to a **DR_TWIN** structure
*r***)**	Pointer to a **RECT** structure

Explanation

Prepares a DR_TWIN primitive by setting the packet size and packet code based on arguments specified.

The (x, y) coordinates in the RECT structure specifies the offset of the texture window in units of 8 pixels (1 = 8 pixels). The offset adds to the (u,v) coordinates of any textured primitive.

The (w, h) coordinates specifies the texture window constraint in units of 8 pixels (1 = 8 pixels). The constraint limits the range of pixels that can be read, and wraps pixels when texture coordinates exceed the size of the constraint.

setTile

Prepares a TILE primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setTile(

*p***)**	Pointer to a **TILE** packet

Explanation

Prepares a **TILE** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

TILE

setTile1

Prepares a TILE_1 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setTile(
*p***)** Pointer to a **TILE_1** packet

Explanation

Prepares a **TILE_1** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

TILE_1, TILE_8, TILE_16

setTile8

Prepares a TILE_8 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setTile8(
*p***)** Pointer to a **TILE_8** packet

Explanation

Prepares a **TILE_8** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

TILE_1, TILE_8, TILE_16

setTile16

Prepares a TILE_16 primitive

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*06/07/2019*

Syntax

setTile16(
*p***)** Pointer to a **TILE_16** packet

Explanation

Prepares a **TILE_16** packet by setting the appropriate size and code values to the primitive.

Use this macro before setting other values (x,y coordinates and color) to the primitive and before adding it to an ordering table using **addPrim**.

See also

TILE_1, TILE_8, TILE_16

setTPage

Sets the Tpage of a primitive by coordinates

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/17/2019*

Syntax

setTPage(

p,	Pointer to a primitive with a Tpage field
tp,	Texture color depth (0: 4-bit, 1: 8-bit, 2: 16-bit)
abr,	Semi-transparency blend operator (see **getTPage**)
*x, y***)**	Framebuffer coordinates to a texture page

Explanation

Sets the Tpage field of a primitive by coordinates.

Primitives that have a Tpage field include **POLY_FT3, POLY_FT4** and **POLY_GT3, POLY_GT4**.

See also

getTPage

setVector

Sets coordinates to a VECTOR or SVECTOR struct

Library	Header File	Original	Introduced	Date Documented
libpsxgpu.a	*psxgpu.h*	*No*	*R1*	*07/17/2019*

Syntax

setVector(

v,	Pointer to a VECTOR or SVECTOR struct
_x,	X coordinate to set
_y,	Y coordinate to set
*_z***)**	Z coordinate to set

Explanation

Sets the vx, vy and vz fields of a VECTOR or SVECTOR struct specified by *v*, with coordinates specified by *_vx, _vy* and *_vz*. Cleaner looking to use over setting the fields directly.

Miscellaneous Library

Chapter Contents

Overview

The miscellaneous library provides functions mostly to aid in prototyping and testing.

Functions

DMACallback

Sets a callback routine for a DMA interrupt

Library	Header File	Original	Introduced	Date Documented
libpsxetc.a	*psxgpu.h*	*Yes*	*R16*	*07/16/2019*

Syntax

void *DMACallback(	
int *dma*,	DMA channel to set callback
void *(*func)()***)**	Callback function

Explanation

Sets a callback function specified by *func* to a DMA channel specified by *dma*, executed whenever a DMA transfer for the specified channel finishes. Calling this function will automatically install a handler on IRQ3 using **InterruptCallback** to handle DMA interrupts.

This function is not normally exposed to programmers in the official SDK, but is made available in LibPSn00b for low-level prototyping and advanced programmers. Use this function **only** if you know exactly what you're going to do with it.

The following lists the hardware device associated with each DMA channel, channels used by libraries should not be used to avoid conflicts:

Channel	Device
0	MDEC input
1	MDEC output
2	GPU (used by libpsxgpu)
3	CD-ROM (used by libpsxcd)
4	SPU
5	PIO
6	OTC (used by libpsxgpu)

Setting a DMA callback automatically adds an interrupt callback handler on IRQ3 using **InterruptCallback**(). If a callback routine on IRQ3 has been previously set, DMACallback will not set its own handler.

The callback is never an interrupt handler and a callback function must be written as a normal function. Since the callback function is called within an exception handler, the function must return as soon as possible. Recursive function calls must be kept a minimum due to limited stack in the ISR subsystem. DMA interrupt status bits are automatically acknowledged on return so the callback routine does not need to acknowledge it manually.

To uninstall a callback routine, simply specify NULL or 0 for *func*. It will also remove the IRQ enable bit of the corresponding DMA channel. If all DMA callbacks have been removed, the DMA callback handler is removed from the ISR subsystem.

Returns

Pointer to the last installed callback routine.

FntLoad

Upload debug font texture to VRAM

Library	Header File	Original	Introduced	Documentation Date
libpsxetc.a	*psxetc.h*	*No*	*R1*	*09/25/2019*

Syntax

void FntLoad(
  int *x*, **int** *y***)** Framebuffer coordinates to upload font texture

Explanation

Uploads the font texture to VRAM, so debug text drawing functions can be used. This function must be called first before using **FntOpen()**, **FntPrint()** and **FntFlush()**.

The size of the font texture is 32x64 plus a 16 color CLUT immediately below the texture. The X coordinate must be a multiple of 64 and the Y coordinate a multiple of 256.

This function can also close all text streams previously created by **FntOpen()**.

See also

FntOpen

FntOpen

Opens a debug font text stream

Library	Header File	Original	Introduced	Documentation Date
libpsxetc.a	*psxetc.h*	*No*	*R28*	*09/25/2019*

Syntax

int FntOpen(

int *x*, **int** *y*,	X,Y coordinate of text window
int *w*, **int** *h*,	Width and height of text window
int *isbg*,	Draw background (0: none, 1: black, 2: semi-transparent black)
int *n***)**	Number of characters to allocate

Explanation

Opens a text stream window using the debug font uploaded by FntLoad().

The text will only draw inside the area specified by (*x*,*y*)-(*w*,*h*), to allow you to crete multiple text streams at different portions of the screen. The text will wrap if it passes the size of the specified window area. The coordinates are draw area relative and not framebuffer absolute, so you don’t have to adjust it relative to your current draw area coordinates.

Isbg specifies if a solid background should be drawn below the text to improve text readability. Specifying 1 draws a solid black rectangle as the text background, while a value of 2 draws a semi-transparent black rectangle, which not only improves text readability but also allow graphics behind the window to be visible.

n specifies how many characters to allocate for the text stream.

Up to 8 text streams can be created at once. Previously opened streams can be closed and deallocated using **FntLoad**.

Returns

Number of text stream opened, -1 if no more streams can be opened.

See also

FntLoad FntPrint

FntPrint

Print text to specified text stream

Library	Header File	Original	Introduced	Documentation Date
libpsxetc.a	*psxetc.h*	*No*	*R28*	*09/25/2019*

Syntax

int FntPrint(	
int *id*,	Stream number (-1 = use last opened stream)
const char **fmt*,	Format string (same syntax as printf())
… **)**	Text format arguments

Explanation

Prints text to the specified text stream created by **FntOpen**.

This function works much like fprintf(), but text output is directed to the debug font text stream. *Id* specifies which text stream created by **FntOpen** to print the text to, or specify -1 to write the text to the last opened stream.

Because of modern GCC requiring at least one named argument in function names, this function does not have the same syntax as **FntPrint** in the official SDK, and a stream number must be specified at all times.

Use **FntFlush** to draw the text written in the specified text stream.

Returns

Number of characters written.

See also

FntLoad FntOpen FntFlush

FntFlush

Draws a text stream

Library	Header File	Original	Introduced	Documentation Date
libpsxetc.a	*psxetc.h*	*No*	*R28*	*09/25/2019*

Syntax

char *FntFlush(
    int *id***)** Stream number (-1 = use last opened stream)

Explanation

Draws the text window and characters of the specified text stream.

The function waits for drawing to complete, then draws the primitives using DMA transfer and finally waits for it to complete. This helps ensure the text primitives are fully drawn, though it may result to some performance loss.

Returns

Pointer to an internal primitive buffer used to draw the text stream, can be drawn using **DrawOTag**.

See also

FntLoad FntOpen FntPrint

GetInterruptCallback

Returns the address of the callback function of a specified interrupt

Library	Header File	Original	Introduced	Documentation Date
libpsxetc.a	*psxgpu.h*	*Yes*	*R16*	*06/19/2019*

Syntax

void *GetInterruptCallback(
    int *irq***)** Interrupt number

Explanation

Gets the address of the callback function of an interrupt.

Returns

Pointer to the callback function last set.

See also

InterruptCallback

InterruptCallback

Sets a callback routine for an interrupt

Library	Header File	Original	Introduced	Date Documented
libpsxetc.a	*psxgpu.h*	*Yes*	*R15*	*07/16/2019*

Syntax

void *InterruptCallback(	
int *irq*,	Interrupt number to install callback
void *(*func)()***)**	Callback function

Explanation

Sets a callback function specified by *func* to the ISR, which is executed whenever an interrupt specified by *irq* occurs. Only one callback routine can be set per interrupt number at a time.

This is a special low-level function that is not normally used by programmers in the official SDK and is normally only called internally by the libraries. It is exposed in LibPSn00b for better control over the hardware for more advanced programmers. Use this function **only** if you know exactly what you're doing.

The following lists the hardware device associated with each interrupt number:

Interrupt	Device
0	Vsync (used by libpsxgpu)
1	GPU (triggered only by a special GPU packet)
2	CD-ROM (used by libpsxcd)
3	DMA (used by libpsxgpu and libpsxcd)
4	Timer 0
5	Timer 1
6	Timer 2
7	Pad & Memory card
8	Serial (used by libpsxsio)
9	SPU
10	Light-gun & Expansion port

Most hardware devices would only generate an interrupt when enabled by their I/O port registers.

This function should only be called while in critical section. The ISR automatically acknowledges interrupts so the callback routine does not need to acknowledge it (except hardware devices that additionally need to be acknowledged by their I/O registers). Avoid calling too many sub functions in the callback routine as the size of the stack in the ISR is limited.

To uninstall a callback routine, simply specify NULL or 0 for *func*. It will also remove the IRQ mask bit of the corresponding interrupt in I_MASK which disables the interrupt.

Returns

Pointer to the last installed callback routine.

See Also

DMACallback

Serial Input/Output Library

Chapter Contents

Overview

The serial library provides functions to configure and control the serial interface of the PSX. It also provides a custom device intended to replace the default tty device to direct tty output from printf() calls to the serial interface, to be viewed in a serial terminal.

The PSX's serial interface is capable of baud rates of up to 1Mbaud but 230400 baud is the highest data rate that USB serial adapters (such as a CH340) can receive. Achieving reliable communications with high data rates is yet to be studied further.

Library Status

As of September 12, 2020, the state of the LibPSn00b SIO library is as follows:

Feature	Status
Interface Init	Fully working
Data transmit/receive	Fully working
SIO TTY driver	Fully working
Handshake/Flow Control	Fully working
Interrupts	Fully working

Functions

_sio_control

Serial control function

Library	Header File	Original	Introduced	Date Documented
libpsxsio.a	*psxsio.h*	*No*	*R15*	*07/16/2019*

Syntax

int _sio_control(	
int *cmd,*	Command
int *arg,*	Subcommand
int *param***)**	Parameter

Explanation

Multi-purpose serial control function, used to control and retrieve every aspect of the serial interface.

The behavior of this function varies depending on the values specified by *cmd* and *arg.*

The following describes command/argument combinations:

cmd	arg	Function
0	0	Read serial status register.
0	1	Read serial control register.
0	2	Read serial mode register.
0	3	Read serial baud rate.
0	4	Read 1 byte from serial interface (returns byte received).
1	1	Set serial control register.
1	2	Set serial mode (parameters specified by *param*).
1	3	Set serial baud rate (value specified by *param*).
1	4	Write 1 byte to serial interface (byte value specified by *param*).
2	0	Reset serial interface.
2	1	Acknowledge serial interrupt and comms errors.

The following describes serial control options (some values not documented in official SDK):

Bits	Definition	Description
0	CR_TXEN	TX enable.
1	CR_DTR	Output DTR signal.
2	CR_RXEN	RX enable.
3	CR_BRK	Invert TX logic levels.
4	CR_INTRST	Acknowledge IRQ and comms errors.
5	CR_RTS	Output RTS signal.
6	CR_ERRRST	Reset serial hardware.
7		Unknown (always 0).
8-9		Interrupt when RX buffer has n bytes.
	CR_BUFSIZ_1	00: Interrupt on 1 byte.
	CR_BUFSIZ_2	01: Interrupt on 2 bytes.
	CR_BUFSIZ_4	10: Interrupt on 4 bytes.
	CR_BUFSIZ_8	11: Interrupt on 8 bytes.
10	CR_TXIEN	Interrupt on TX ready.
11	CR_RXIEN	Interrupt on RX receive.
12	CR_DSRIEN	Interrupt on DSR signal.
13-15		Unused (always zero).

The following describes serial mode options:

Bits	Definition	Description
0-1	None	Baud rate reload factor (must be 0x2 always).
2-3		Character length.
	MR_CHLEN_5	00: 5 bits per word.
	MR_CHLEN_6	01: 6 bits per word.
	MR_CHLEN_7	10: 7 bits per word.
	MR_CHLEN_8	11: 8 bits per word.
4	MR_PEN	Parity enable.
5	MR_P_EVEN	Odd parity (definition is misleading).
6-7		Stop bit length.
	MR_SB_01	01: 1 stop bit.
	MR_SB_10	10: 1.5 stop bits.
	MR_SB_11	11: 2 stop bits.
8-15		Unused (always zero).

The following describes serial status bits:

Bits	Definition	Description
0	SR_TXRDY	TX ready.
1	SR_RXRDY	Bytes pending in RX buffer.
2	SR_TXU	TX completed.
3	SR_PERROR	Parity error.
4	SR_OE	RX buffer overflow.
5	SE_FE	RX bad stop bit.
6		RX input level.
7	SR_DSR	DSR signal level.
8	SR_CTS	CTS signal level.
9	SR_IRQ	Interrupt request.
10		Unknown (always zero).
11-25		15-bit baud rate timer.

AddSIO

Installs a serial tty device

Library	Header File	Original	Introduced	Date Documented
libpsxsio.a	*psxsio.h*	*No*	*R15*	*06/14/2019*

Syntax

void AddSIO(	
int *baud***)**	Baud rate.

Explanation

Replaces the default BIOS tty device (and Caetla’s tty device) with a serial tty device which redirects all stdout output (such as printf) to serial. The data rate is specified by *baud*, the rest of the parameters are 8 data bits, 1 stop bit, no parity and no hardware handshake by default.

This function can be called at the very beginning of your program (even before **ResetGraph**) to receive every printf message in your program.

DelSIO

Deletes the serial tty device

Library	Header File	Original	Introduced	Date Documented
libpsxsio.a	*psxsio.h*	*No*	*R15*	*06/14/2019*

Syntax

void DelSIO(void)

Explanation

Deletes the serial tty device, not recommended as any further tty output will likely crash the system.

WaitSIO

Waits for serial

Library	Header File	Original	Introduced	Date Documented
libpsxsio.a	*psxsio.h*	*Yes*	*R15*	*06/14/2019*

Syntax

void WaitSIO(void)

Explanation

Waits until a single byte is received from the serial interface, intended to be called immediately after AddSIO and is useful for pausing your program so you can open a terminal program and receive all tty messages.

Sio1Callback

Sets a serial callback routine

Library	Header File	Original	Introduced	Date Documented
libpsxsio.a	*psxsio.h*	*No*	*R15*	*06/14/2019*

Syntax

void *Sio1Callback(	
void (**func***)(void))**	Callback function.

Explanation

Sets a function specified by *func* as a callback routine that is executed whenever the serial interface generates an interrupt enabled by CR_TXIEN, CR_RXIEN or CR_DSRIEN using **_sio_control**(1, 1, <param>). If *func* is zero, the callback is disabled.

It is recommended to read at least 1 byte from the serial interface and call **_sio_control**(2, 1, 0) to acknowledge the serial interrupt at the end of your callback routine.

Since the callback function is executed in the global ISR, sub function calls must be kept at minimum due to limited stack available. The callback function must return as soon as possible to avoid missing any further interrupt requests.

Return value

Address of previously set callback function.

Reference Manual Changelog

March 25, 2022:

- Updated documentation for **CdGetSector()** to correspond with changes implemented to this function since 2021-12-23.
- Corrected description of **CdReadCallback()** function.

January 14, 2022:

- Removed documentation for **SetDrawTPageVal()** function.
- Documented primitives **DR_AREA**, **DR_OFFSET**, **DR_TWIN**
- Documented macros **setDrawArea**, **setDrawOffset**

June 6, 2021:

- Updated psxgpu and psxcd types to account for library changes.

December 3, 2020:

- Documented several important functions of the Geometry Library.

December 2, 2020:

- Moved **InterruptCallback()**, **DMACallback()** and **GetInterruptCallback()** to Miscellaneous Library chapter, as well as corrected the Original status of the aforementioned functions (technically, they aren't original, but the official libraries do not expose it to programmers).

September 18, 2020:

- Document recreated from Revision 60 of document to fix broken formatting spread across entire document.