
Haptic Motor Driver API

Revision History

Rev.	Date	Written by	Remarks
1.0	2010-02-01	Lars	Draft copy
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Overview

This document describes the Application Programming Interface (API) of the Haptic Motor Driver (ISA1200).

Terminology

ISA1200 – This is a chip that supports two types of vibration motor (AC/DC). Different settings are possible using the I2C-Bus, and it can adjust the strength of vibration (strong/mild) with the PWM. (For more information, refer to the datasheet and go to <http://www.imagis.co.kr>)

I2C – This is a serial computer type developed by Philips. It is a communication method that is adopted to connect low-speed peripheral devices such as a motherboard, embedded system, mobile phone, etc.

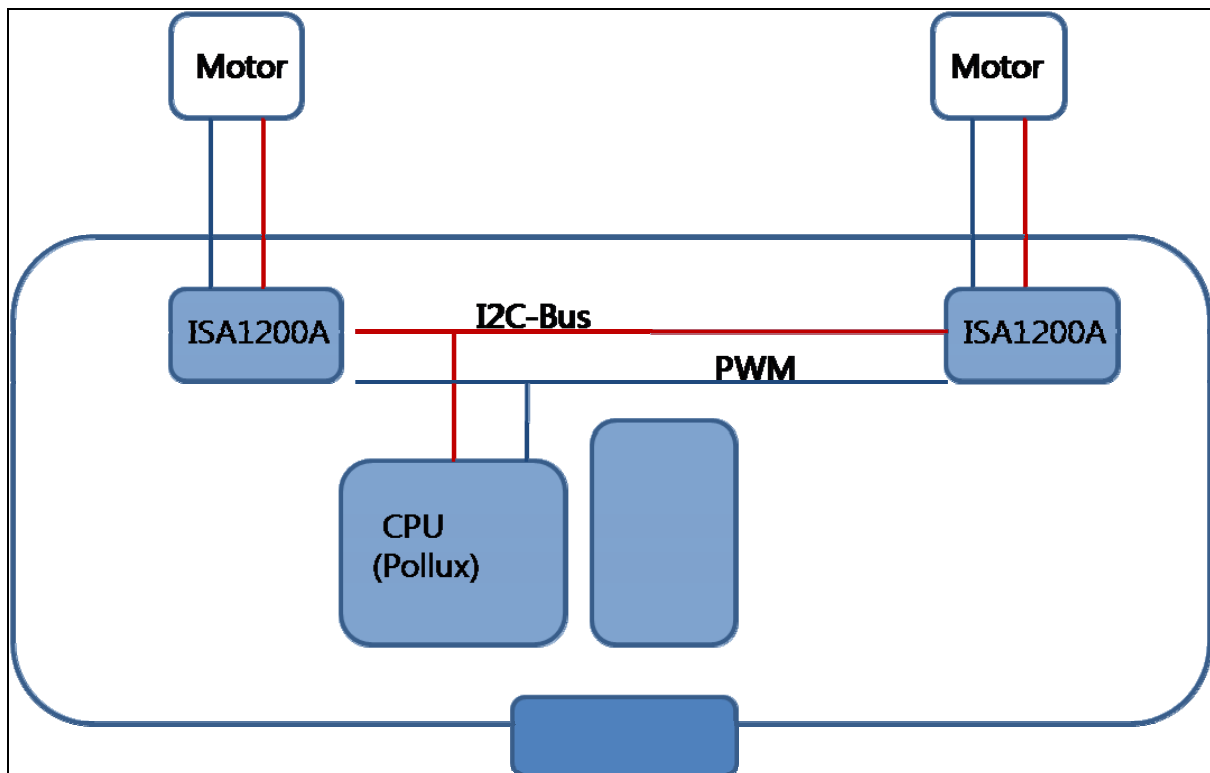
PWM (pulse width modulation) – This is a method of pulse modulation that changes the width of pulse for modulation.

Hardware

This chapter summarizes the hardware connection of the CPU, ISA1200 and motor in CAANOO. Additionally, this chapter describes basic hardware knowledge that is considered necessary when using a device driver in application programs.

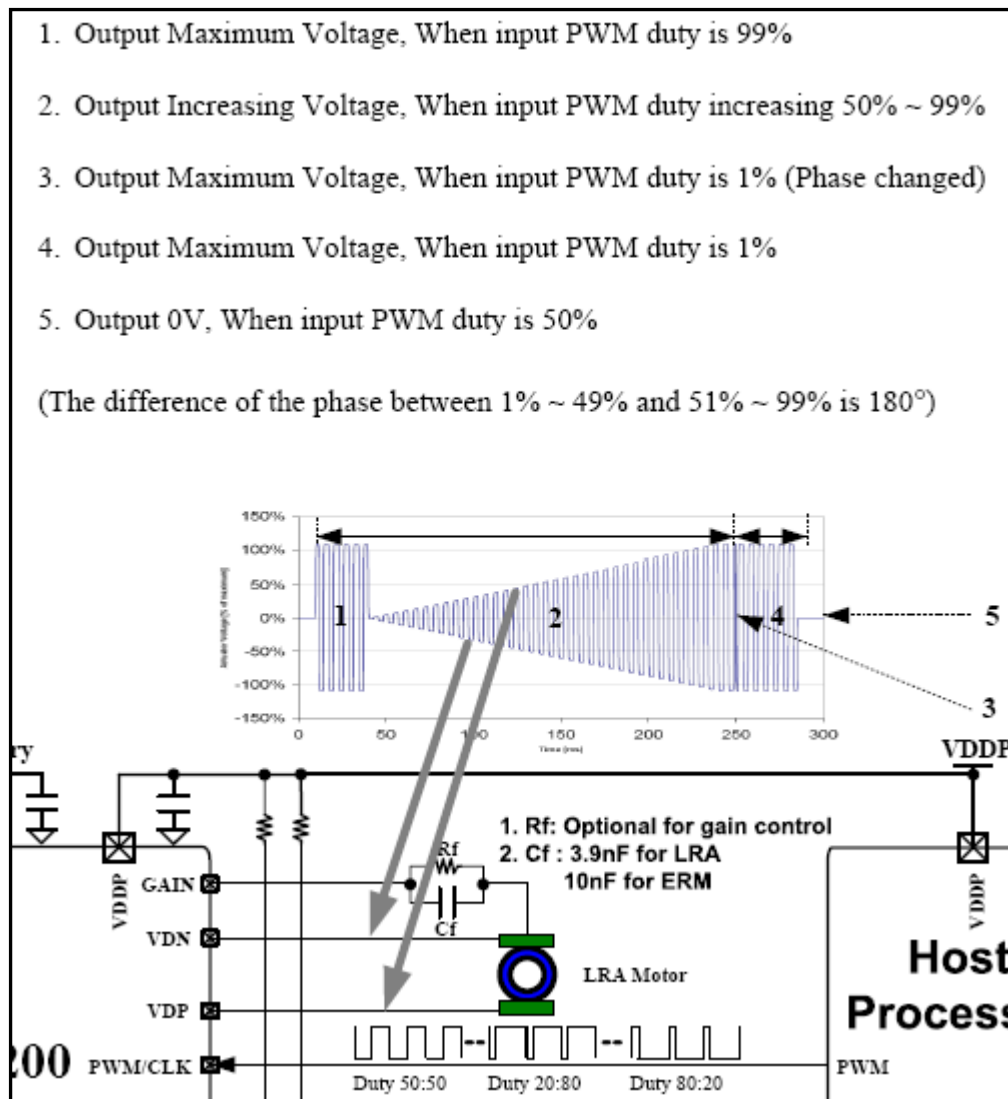
Hardware Connection

In CAANOO, the connected state of the CPU (pollux) and ISA1200 are as follows:



The above picture shows that respective settings can be set individually (e.g., chip on, off, or strong/mild setting for vibration) for the ISA1200A and ISA1200B by using the I2C-Bus. It can be designed so that the user feels identical forms of vibration by using the PWM signals.

PWM Signal and Strength of Vibration



PWM and the strength of vibration can be displayed as pictured above. The strength of vibration is at a maximum¹ when PWM duty is at either 1% or 99%, but is minimum when PWM duty is at 50%.

¹ The only difference of PWM duty at 1% or 99% is that the rotational direction of the motor is reversed.

Software - API

This chapter describes methods to control the haptic motor when applications and the haptic motor device driver share data with each other.

Communication Method between Application and ISA1200 Device Driver

In terms of hardware, ISA1200 is installed with 2 motors in CAANOO and can control them both. As they share a single PWM, they create uniform patterns of vibration effect. However, strength of vibration in the left and right motors may vary. It is designed to use a single device driver file ("/dev/isa1200"). An application controls the motors and also two chips that are connected with only the device driver file and ioctl().

Device Driver API – simple_isa1200if.h

This section describes ioctl command and the main structures of the file "simple_isa1200if.h" which offers API for communicating with a device driver.

vibration_act_t

```
#define VIB_STRENGTH_MIN    (-126)

#define VIB_STRENGTH_MAX    (126)

struct _vibration_act {
    short time_line;          //millisecond base...
    short vib_strength;
}__attribute__((packed));

typedef struct _vibration_act vibration_act_t;

#define MAX_VIB_ACTION_NR (120)
```

```
struct _pattern_data {
    int act_number;                                //include finish sequence...
    vibration_act_t vib_act_array[MAX_VIB_ACTION_NR];
};

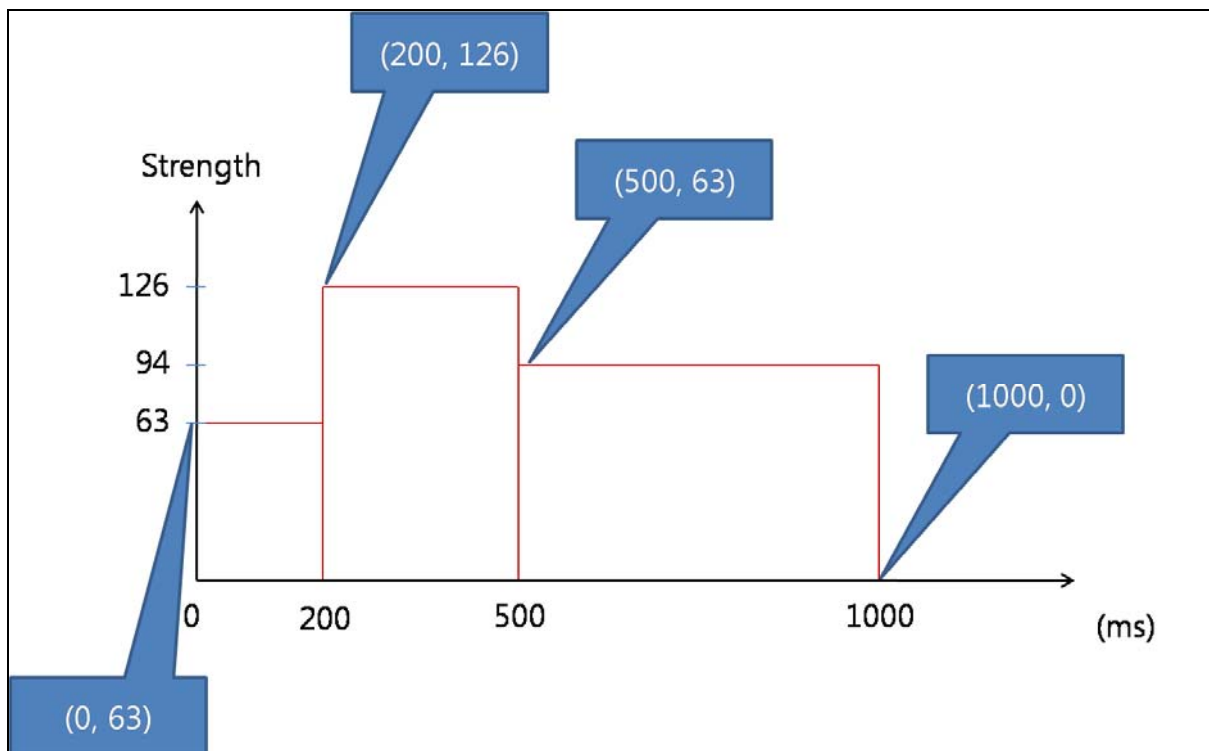
typedef struct _pattern_data pattern_data_t;
```

VIB_STRENGTH_MIN, VIB_STRENGTH_MAX

This defines the minimum value (1%) and maximum value (99%) of the duty of PWM that the CPU sends to ISA1200.2

vibration_act_t, pattern_data_t

The following image displays vibration patterns.



² Refer to the Appendix to discover why this value hovers between -126 and 126.

As displayed above, the strength of vibration starts from 63 at its initial phase (0 ms). At about 200 ms, the vibration reaches the maximum point for about 300 ms but stops at the point of 1000 ms. This can be expressed in four vibration_act_t structures. The ordered pairs of the value of each structure (time_line, vib_strength) are as follows:

(0, 63), (200, 126), (500, 63), (1000, 0)

Substitute four vibration_act_t structures in the vib_act_array[] field of pattern_data_t. Enter the number of vibration_act_t structures in the act_number. Use the ioctl() to deliver it to the device_driver. Then, the haptic device driver creates vibration patterns that match the pattern_data_t.

IOCTL Commands

IOCTL_MOTOR_DRV_ENABLE IOCTL_MOTOR_DRV_DISABLE	It was originally planned for switching a motor on/off, but it now exists as the command for backward compatibility or for using the function if necessary.
IOCTL_FFLUSH_JOB IOCTL_JOB_STATUS IOCTL_PLAY_PATTERN	Command related to vibration patterns.
IOCTL_INDIVIDUAL_MODE IOCTL_ISA1200A_ENABLE IOCTL_ISA1200B_ENABLE	Command for testing vibrations on the left and right for initial mass production.
IOCTL_GET_VIB_LEVEL IOCTL_SET_VIB_LEVEL	Adjustment of Vibration Levels

Appendix A - Pattern Data

The pattern file (FadeIn_Strong_Short.txt) provided with the haptic motor driver (ISA1200) is as follows:

```

*****
;
;*                               *
;                               *
;*                               IVD_Recorder Output                               *
;*                               *
;*                               *
;*                               Date: 2009/06/08   Start Time: 10:08                               *
;*                               *
;*                               *
*****

; IVD_RECORDER_MODES:

;       - nMaximumPlayTimeMs: 10000 ms
;       - bFastMode: 1
;       - bRecordAllOutputvalue: 0
;       - szRecorderOutputFileName: IVD_Recorder.txt
;       - szDeviceParametersFileName: C:\WINDOWS\system32\VTMDP_LH2300_NewLRA.c
*****

126
100      -126
120      0
150      126
250      -126
265      0

```

The filename without the extension is the effect name. The major part of the file content is the ordered pair structures of two numbers. The structure of respective ordered pairs is in the form of: time line and strength. The time line is measured in milliseconds starting from "0". Meanwhile, the strength varies from -126 to 126. Strength indicates the intensity of motor vibration. A lower number has gentler vibration strength. The slightest degree of vibration is indicated by "0".