PCI-1243U

4-Axis Stepping Motor Control Card

User Manual

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Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

1. PCI-1243U card
2. Companion CD-ROM (DLL driver included)
3. User Manual

Contents

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CHAPTER 1

General Information

If you have just purchased the PCI-1243U, or just need to brush up on its features or specifications, you would want to read this chapter.

Sections include:

- Introduction
- Features
- Applications
- Specifications
- Block Diagram

Chapter 1 General Information

1.1 Introduction

PCI-1243U is a high-speed four-axis stepping motor control card that simplifies stepping motor control, giving you added performance from your stepping motors.

Four-Axis Control

PCI-1243U has one single-chip pulse generator on-board, which enables the simultaneous and independent control of three axes. PCI-1243U provides digital pulse and directional control (+ and -) for each stepping motor axis.

User-Friendly Interface

PCI-1243U has been designed to act as a user-friendly solution for your stepping motor control applications. Programming the PCI-1243U is very easy. Windows DLL drivers and a utility are provided, and they contain all the command functions needed for total control of your stepping motors.

Digital I/O

PCI-1243U features 8 isolated digital inputs and 8 isolated digital outputs for general I/O use (on/off control etc.).

Isolation Protection

The PCI-1243U's PULSE and DIRECTION outputs and five limits input switches are isolated from the PC side.

1.2 Features

- One on-board pulse generator that enables simultaneous independent control of four stepping motors
- Two operating modes - two-pulse (+ and - direction pulse) or one-pulse (pulse-direction) mode
- Programmable step rate from 1 to 400k pps (pulses per second).
- Programmable initial speed, final speed and time duration. Automatic trapezoidal acceleration/deceleration tamping is performed

16 I/O TTL Compatible Channels

- All inputs/outputs are optically isolated, providing 5000Vrms isolation protection
- Command Interpreter provided that eases learning the PCI-1243U command set

1.3 Applications

- Precise X-Y-Z position control
- Precise rotation control
- Robotics and assembly equipment
- Other stepping-motor applications

1.4 Specifications

- Number of axes: Three independent axes (individually programmable)
- Operating modes: Two-pulse mode (+ or – direction) or one-pulse (pulse-direction) mode
- Steps per command: ±16777215 steps
- Step Rate: 1 - 400 kpps
- Acceleration/deceleration ramping: User programmable start, run and ramping rates.
- Output polarity: Positive/negative going pulse (programmable)
- Output Sink Protection: 1.1 A / all channels
- Output Type: Open Collector, 150 mA/ch, Vmax = 30 V DC
- Limit *5 / EMG *1 / All Isolated / Ref DOC
- Limit switch input voltage: external +12V to +24V
- Limit: ORG/+-SD/+-EL:NC,NO Control By Register
- EMG/Tri-Start: Isolated : NC, NO Control By Jumper

1.4.1 Digital Input / Output

- Input channels: 8 Isolated DI
- Output channels: 8 Isolated open-collector DO
- Input voltage range: DC+12V ~ +24V
- Output capability: Open Collector, 150 mA/ch, Vmax = 30 V DC

1.4.2 General

- Power Consumption:
  Normal: 340 mA/ 5 V
  Max: 500 mA / 5 V
- Connector: 62-pin D-type connector
- Board Dimensions: 183.5 x 99.06 mm
- Operating Temperature: 0 ~70° C

1.5 Block Diagram

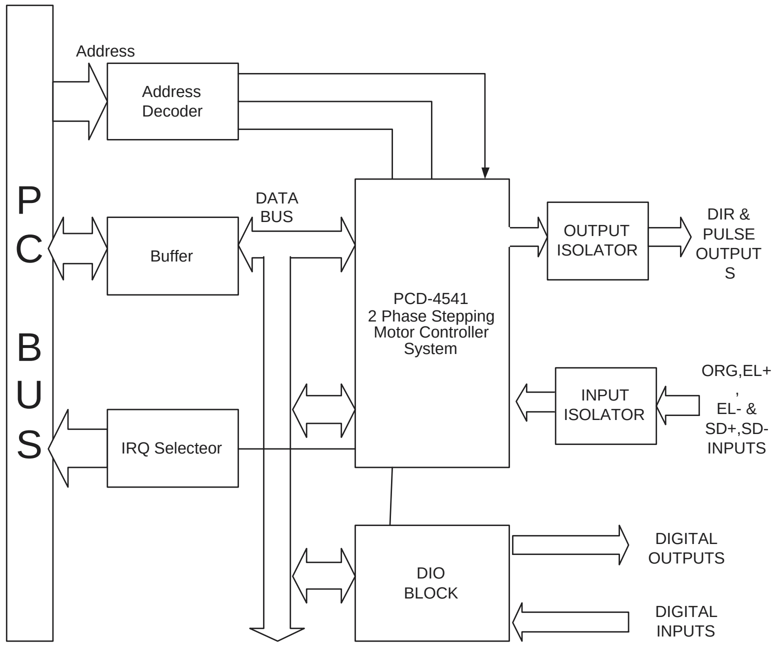


Figure 1.1: PCI-1243U 4-Axis Stepping Motor Control Card

CHAPTER 2

Installation

If you have not yet configured and/or installed your PCI-1243U, or need to change the configuration this chapter will give you the information you require.

Sections include:

- Hardware Installation
- Pin Assignments
- Limit Switch Configuration
- Jumper Settings
- BoardID

Chapter 2 Installation

2.1 Hardware Installation

After you have set the jumpers and BoardID switch, you will be ready to install the card in your PC's chassis. The following section will assist you in installing PCI-1243U.

Warning! *Disconnect power from your PC whenever you install or remove the PCI-1243U or its cables.*

2.1.1 Installing the Card in your Computer:

1. Turn off the computer and all peripheral devices (such as printers and monitors).
2. Disconnect the power cord and any other cables from the back of the computer. Turn the chassis so that the back of the unit faces you.
3. Remove the chassis cover (see your computer users guide if necessary).
4. Locate the expansion slots at the rear of the unit and choose an unused slot.
5. Remove the screw that secures the expansion slot cover to the chassis. Save the screw to secure PCI-1243U.
6. Carefully grasp the upper edge of the PCI-1243U card. Align the hole in the retaining bracket with the hole on top of the expansion slot, and align the gold striped edge connector with the expansion slot socket. Press the board firmly into the socket.
7. Replace the screw in the expansion slot retaining bracket.
8. Replace the chassis cover.
9. Connect the D-62 male connector to the PCI-1243U's 62-pin female connector. Connect the connector to your stepping motor driver according to the specifications outlined in Section 2.2.
10. Connect the cables you removed in step 2. Turn on the computer. Hardware installation is now complete.

2.2 Pin Assignments

This section assists with connecting the PCI-1243U's 62-pin connector to a variety of stepping motor drivers.

The following diagrams shows PCI-1243U's pin connector assignments, and offer some examples of input/output circuit connections from the card to the driver. You should select the example that best supports your application needs and the capabilities of your stepping motor driver.

Note: *Output circuit diagrams of the stepping motor can be found in Appendix B*

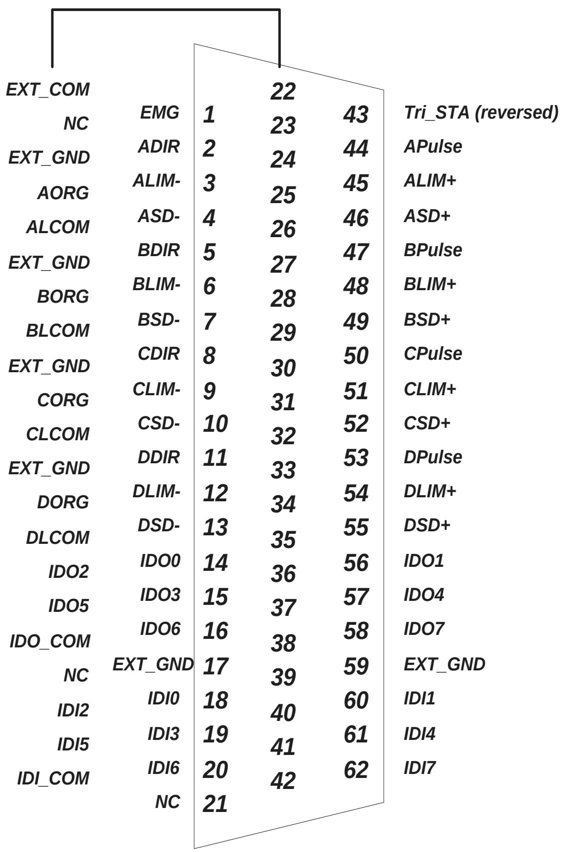


Figure 2.1: PCI-1243U Pin Assignment

Driving Pins for Each Axis	
DIR/-dir	Direction signal output (in direction mode) or (-) direction pulse output (in pulse mode)
Pulse/+dir	Pulse signal output (in direction mode) or (+) direction pulse output (in pulse mode)
Emergency Stop Pins	
EMG	Emergency Stop input
Tri_STA	Input channel for motion start external trigger signal. The hardware trigger start function is reserved for future usage.
EXT_COM	Isolated inputs common point for EMG and Tri_STA channel
Limit Switch Pins	
Lim+	(+) Direction limit switch input
Lim-	(-) Direction limit switch input
SD+	(+) Direction slowdown limit switch input
SD-	(-) Direction slowdown limit switch input
ORG	Original (home) point limit switch input
LCOM	Limit switch common point for each channel
Isolated Digital Input Pins	
IDIx	Isolated Digital Input channels, x= 0~7
IDI_COM	Common ground for IDI channels
Isolated Digital Output Pins	
IDOx	Isolated Digital Output channels, x=0~7
IDO_COM	Common point for IDO channels
EXT_GND	Ground pin for IDO channels

2.2.1 Input / Output Circuit Connections

The figure below illustrates an example of PCI-1243U output connections to the stepping motor driver.

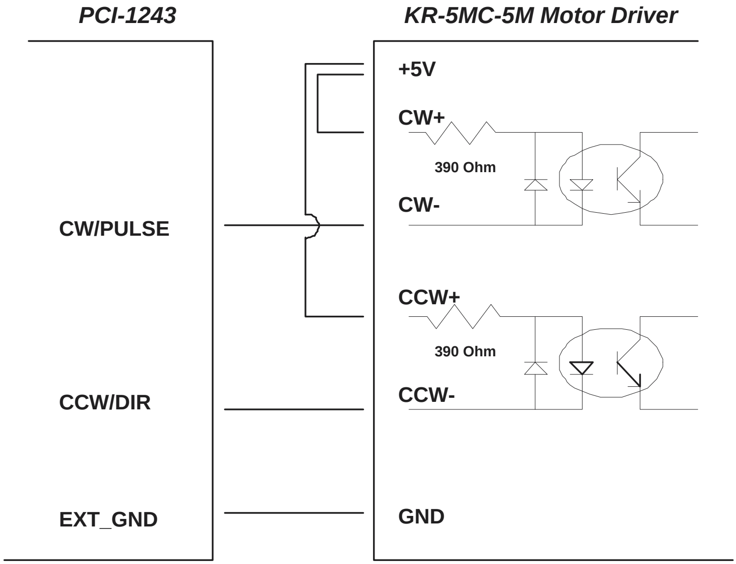


Figure 2.2: Output Connections Example

The following figure illustrates the connection of the pulse output pin to the external device.

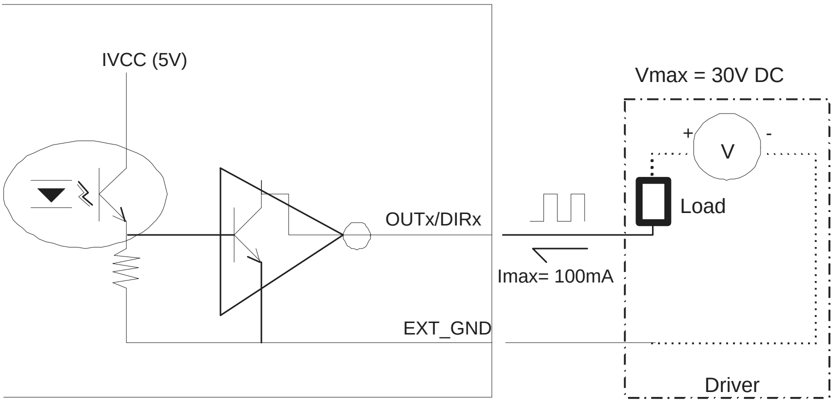


Figure 2.3: Pulse Output Test Configuration (Open Collector Type)

PCI-1243U provides 8 isolated DI channels and 8 isolated DO channels. With general purpose I/O points, users can control and monitor peripheral sensors in their applications. The following figures illustrate how the I/O points are connected.

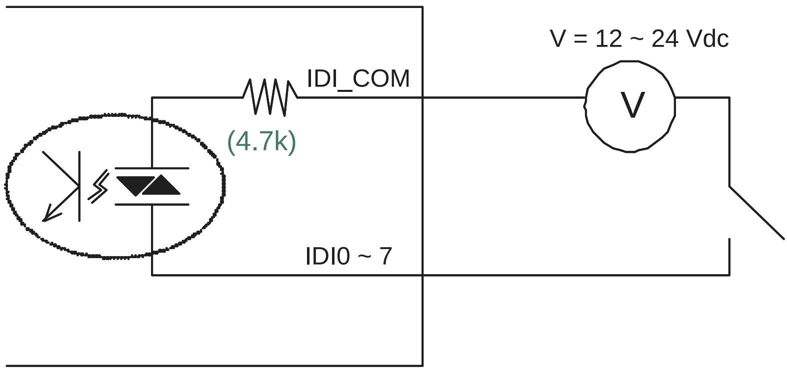


Figure 2.4: Isolated Digital Input Wiring Configuration

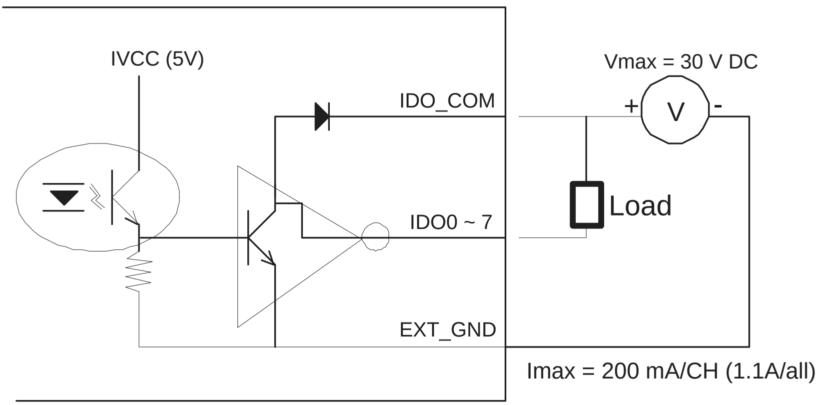


Figure 2.5: Isolated Digital Output Wiring Configuration

2.3 Limit Switch Configuration)

PCI-1243U features 5 limit switches for additional control of output.

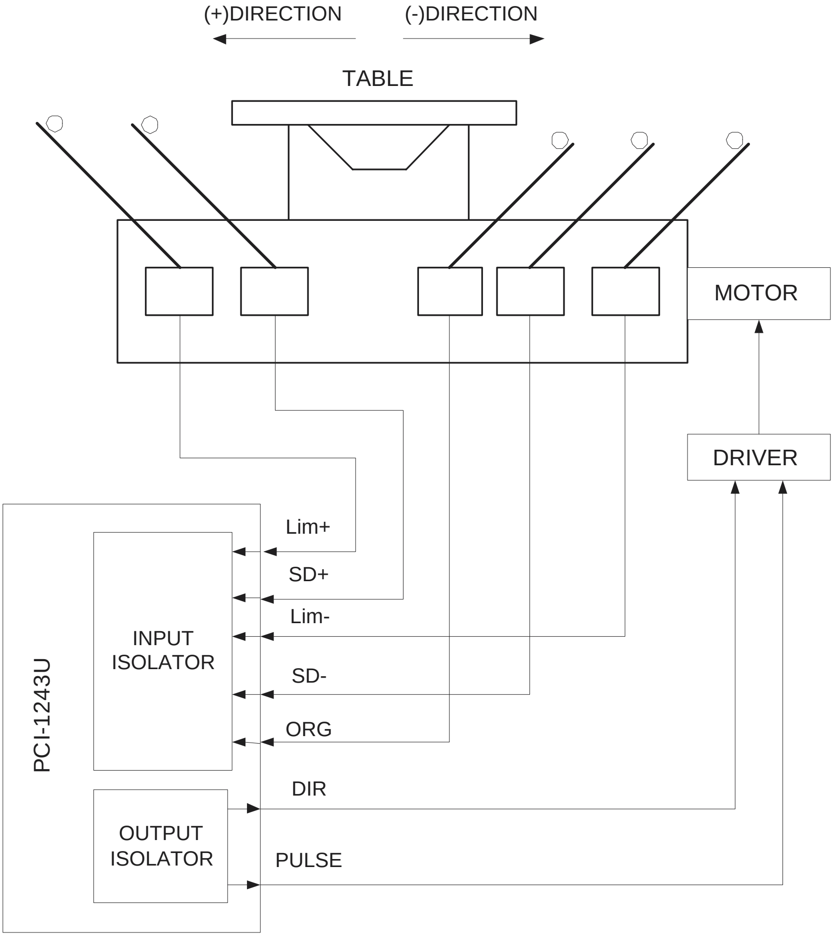
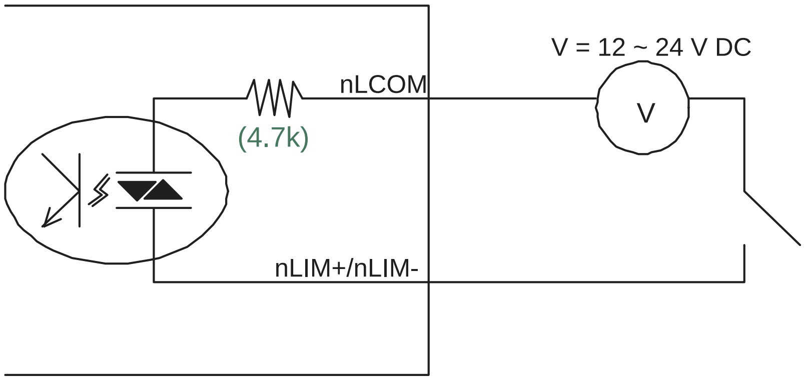


Figure 2.6: Limit Switches

2.3.1 Lim+/ Lim-

These are the End Limit signal inputs. If there is a signal in the same direction as the pulse output (in direction or pulse mode) that becomes active, the pulse output stops immediately.

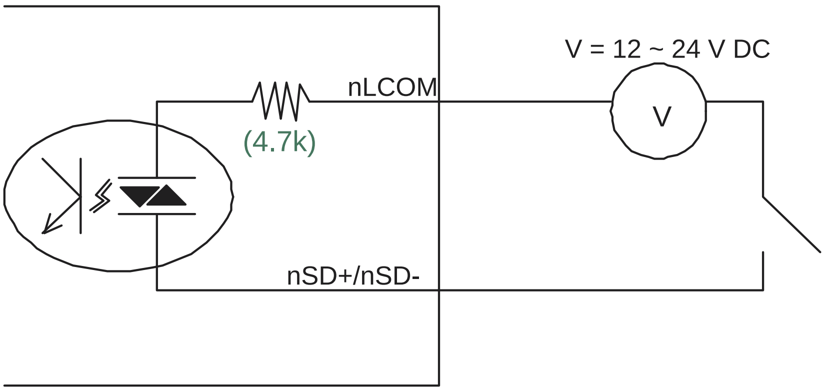


nLCOM = ALCOM / BLCOM / CLCOM / DLCOM

Figure 2.7: Lim Switch Test Configuration

2.3.2 SD+/SD-

These are the Slow-Down signal inputs, which are in operation in the SD-enable mode (refer to the control select modes). If there is a signal in the same direction as the pulse output (in direction or pulse mode) that becomes active during high-speed start, the frequency ramps down. When the signal becomes inactive, the frequency ramps up again.



nLCOM = ALCOM / BLCOM / CLCOM / DLCOM

Figure 2.8: SD Switch Test Configuration

2.3.3 ORG

This is the Origin point input. If this signal becomes active during origin return (refer to the control select modes), pulse output stops immediately.

Although PCI-1243U caters for five limit switches on each axis, not all of them have to be operated in one application. Refer to following figure for an example of the usage of limit switches.

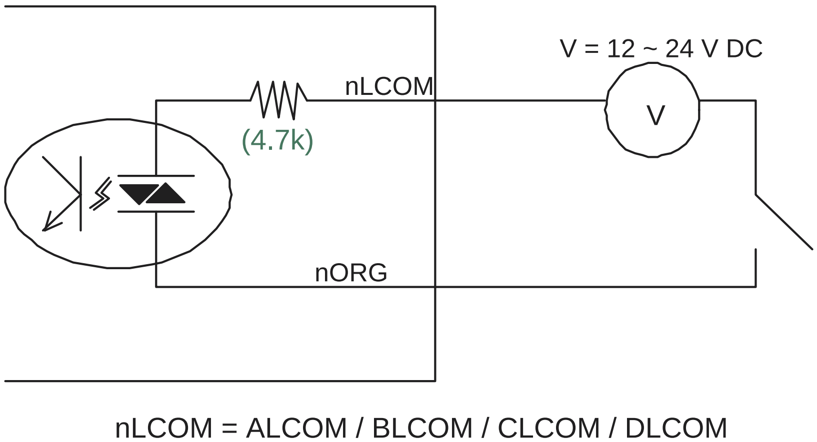
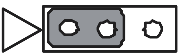
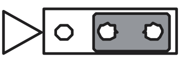


Figure 2.9: ORG Switch Test Configuration

2.4 Jumper Settings

JP1 has a convenient design that enables storage of motion register configurations into CPLD, so the configurations can be kept even when the PC power is off. The factory default is in “Normal” position (1-2 pin shorted), which means the register setting will disappear after a power reset. You can move JP1 to the “Keep” position (2-3 pin shorted) to store configurations.

Table 2.1: JP1 Settings

	Normal (reset register) (default).
	Keep (store configurations)

JP11 and JP12 set the polarity for Emergency stop and Tri_STA pin respectively. When the jumper is set to pin 2 and 3 (factory default), the input channel is in 'normally open'. When the jumper is set to pin 1 and 2, the input channel is 'normally closed'.

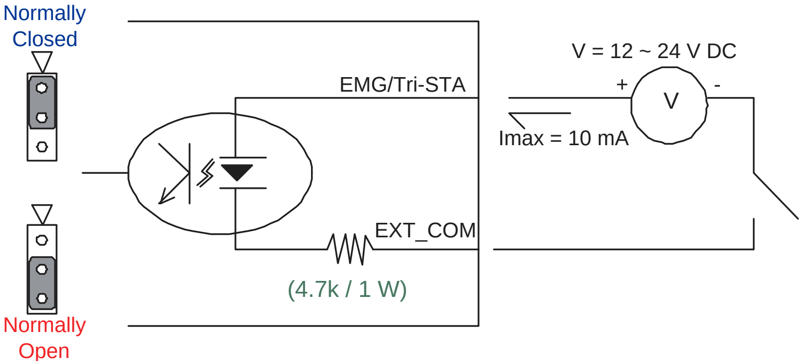


Figure 2.10: EMG / Tri_STA Test Configuration

Note: The factory default is Normally Open.

2.5 Setting the BoardID Switch (SW1)

You can use the BoardID command (0x10) to get the board's unique identifier. PCI-1243U has a built-in BoardID DIP switch (SW1), which is used to define each card's unique identifier. You can determine the identifier in the register as shown in Table 2.2. When there are multiple cards on the same chassis, this BoardID setting is useful for identifying each card's device number. We set the PCI-1243U's BoardID switch to 0 at the factory. If you need to adjust this setting, please see below..

Table 2.2: BoardID Setting (SW1)

BoardID (DEC)	Switch Position			
	ID3	ID2	ID1	ID0
0*	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON
3	ON	ON	OFF	OFF
4	ON	OFF	ON	ON
5	ON	OFF	ON	OFF
6	ON	OFF	OFF	ON
7	ON	OFF	OFF	OFF
8	OFF	ON	ON	ON
9	OFF	ON	ON	OFF
10	OFF	ON	OFF	ON
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON
13	OFF	OFF	ON	OFF
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF
* : Default				

2.5.1 BoardID Register

You can determine the BoardID setting in the register as shown below.

Table 2.3: BoardID register of PCI-1243U

Base+(0x10)	3	2	1	0
Abbreviation	ID3	ID2	ID1	ID0

Note: *ID0: The least significant bit (LSB) of BoardID*
ID3: The most significant bit (MSB) of BoardID

2.6 Software Driver Installation

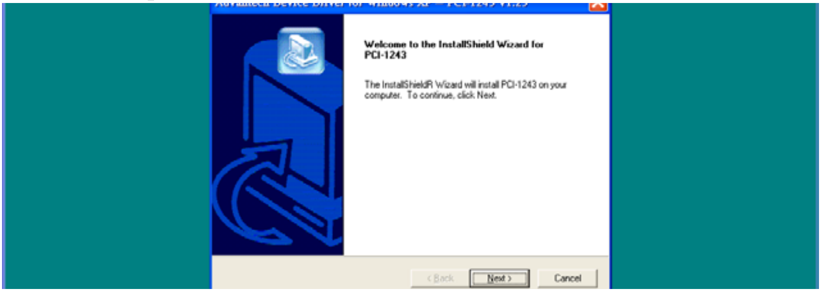
We recommend installing the driver before you install the PCI-1243U card into your system. This will guarantee a smooth installation process.

The 32-bit DLL driver Setup program for the card is included on the companion CD-ROM that is shipped with your DAS card package. Please follow the steps below to install the driver software:

1. Insert the companion CD-ROM into your CD-ROM drive.
2. The setup program will be launched automatically if you have the autoplay function enabled on your system.

Note: If the autoplay function is not enabled on your computer, use Windows Explorer or Windows Run command to execute SETUP.EXE on the companion CD-ROM.

3. Start the PCI-1243U DLL drivers installation by selecting "Installation" => "Individual Driver" => "PCI Series" => "PCI-1243U".
   When the Setup Program is launched, you will see the following Setup Screen.



4. Follow the installation instructions step by step to complete your DLL driver setup.
5. Set up the PCI-1243U Motion Utility by referring to chapter 3.
   For further information on driver-related issues, an online version of Software Manual is available by accessing the following path: "Start" => "Program Files" => "Advantech Automation" => "Motion Manager" => "Motion Manager".
   Example source codes can be found under the corresponding installation folder such as the default installation path:
   \Program Files\Advantech\AMCL\Examples\PCI-1243

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CHAPTER 3

Motion Utility

This chapter introduces the Advantech Motion Manager utility.

Sections include:

- Introduction
- Configuration
- Motion Operations

Chapter 3 Motion Utility

3.1 Introduction

The Advantech Motion Manager Utility is designed for easy installation, configuration, and diagnostics on PCI-1243U. In this utility, you can set mechanical parameters, electrical parameters, and home modes in the parameter table. Some basic motion functions can also be operated in the utility, such as point-to-point, continuous movement, and home.

You can also figure the digital input points status easily in the utility. Furthermore, the motion speed profile display function is also implemented in this software package.

In the following section, all the functions will be introduced one by one.

3.1.1 Main Page

You can launch the utility from “Start” => “Program Files” => “Advantech Automation” => “Motion Manager” => “Motion Manager”.

Once the utility is initialed, it will scan the system and list the existing PCI-1243U cards on the system with their BoardID number. If there is no PCI-1243U card detected by the utility, please double check if the card is properly plugged into the system.

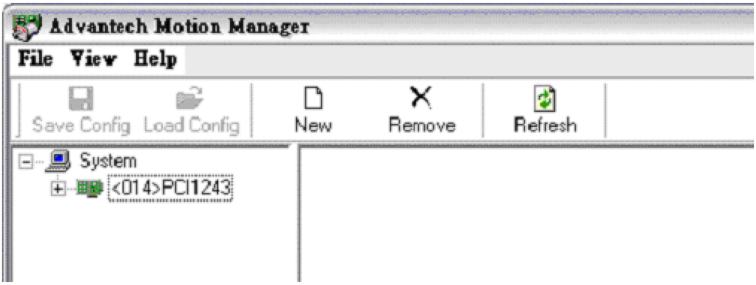


Figure 3.1: Displaying Available PCI-1243U Cards on the System

For each PCI-1243U card in the system, there are three main software pages:

- Inspection (Information)
- Configuration (Config)
- Operation (Run)

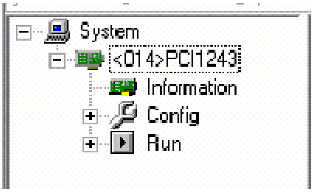


Figure 3.2: Accessing the PCI-1243U Card

In the "Information" page, all DLL driver versions are listed so that you can easily check if the current driver in the system is up-to-date.

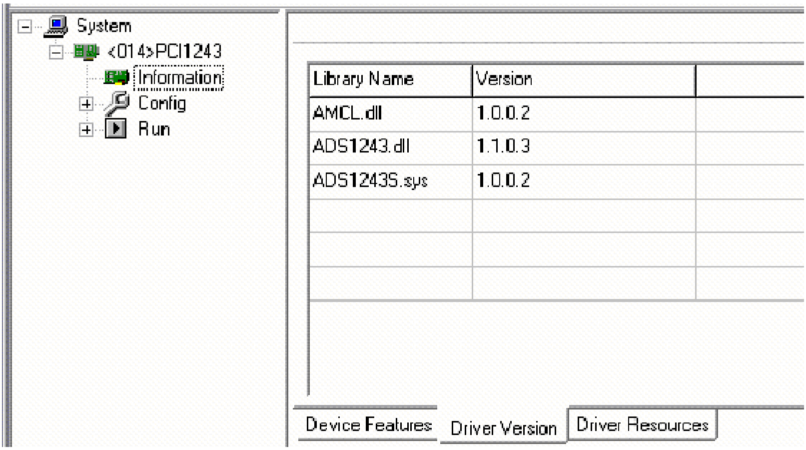


Figure 3.3: Information Page

Note *You may download the driver from Advantech's web site if necessary:*

http://www.advantech.com.tw/support/

3.2 Configuration

In the “Configuration” page you can set all the parameters used by PCI-1243U, including mechanical, motion I/O and home parameters. You input the basic mechanical parameters in the first page. This includes parameters such as maximum RPM of motor, number of pulses per revolution, and the gear ratio of the gear box, if there is one. Then, based on this mechanical information, the software driver can automatically calculate the unit transformation, so that the user can enjoy the convenience of inputting commands with Pulse, mm or inch.

PCI-1243U also supports four different types of Home functions, with related settings that are configurable from this page.

3.2.1 Machine Configuration Page

POLogic: There are two possible logic modes for the pulse output of PCI-1243U.

Setting Positive Logic means the pulse output channel will normally be in low status, and the output pulse will start from a rising edge. While the logic mode is set to Negative Logic, the pulse output channels will normally be high. The choice depends on the type of motor driver.

Pulse Mode: The output of PCI-1243U can be set as CW/CCW mode or Pulse/Direction mode in this column.

Max Speed (rpm): You need to input the maximum rotation speed of the motor here. The unit is rpm (revolutions per minute).

PPR (pulse/rev): Property of stepping motor, PPR (pulses per revolution) means the number of pulses that are required to turn the motor one revolution. With the parameters of maximum speed and PPR, the software driver can calculate the maximum pulse output rate.

Pitch (mm/rev): The property of ball-screws. If ball-screws were used in the moving table, it is necessary to input the parameter here to use physical units like mm and inch, in the command set.

Gear Ratio: The property of the gear box. If a gear box was used in the moving table, then it is necessary to input a parameter here to use physical units like mm and inch, in the command set.

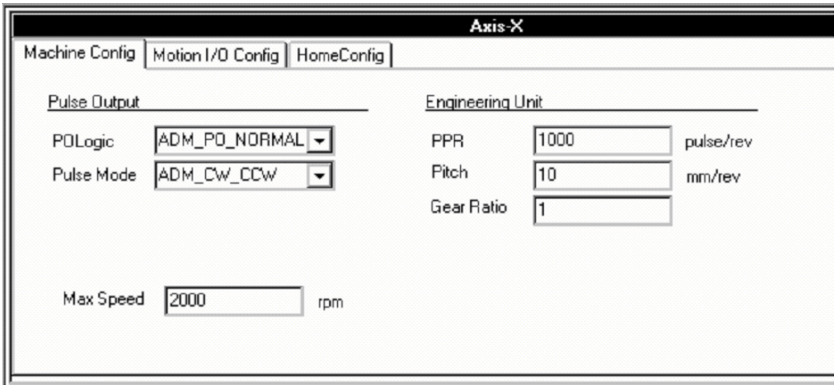


Figure 3.4: Machine Configuration Page

3.2.2 Motion I/O Configuration Page

HWLimtMode_P: The hardware limitation switch mode in positive direction. It can be "Normal Open" or "Normal Close".

HWLimtMode_N: The hardware limitation switch mode in negative direction. It can be "Normal Open" or "Normal Close".

SD_P: The "Slow-Down" switch can be enabled by checking the dialog box above. And Users can set the hardware slow-down switch mode in positive direction as "Normal Open" or "Normal Close" in this column.

SD_N: The hardware slow-down switch mode in negative direction. It can be "Normal Open" or "Normal Close".

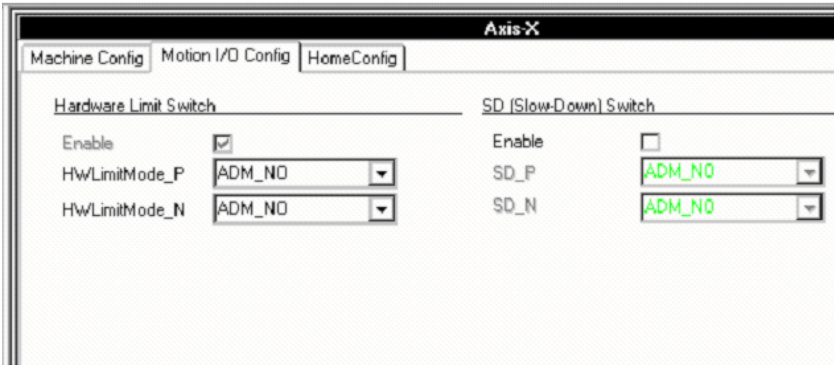


Figure 3.5: Motion I/O Configuration

3.2.3 Home Configuration Page

Home Mode: PCI-1243U supports four different Home modes, they are mode0, 1, 6, and 9. Choose the most suitable mode to get better homing accuracy. Please refer to Appendix C for detailed information on each Home mode.

Direction: This defines the initial direction when the homing movement starts. As long as the direction is defined, the motor will move in the specific direction. It will stop when it reaches the ORG sensor, or return if the limit switch was reached first.

ORG Mode: The hardware ORG sensor switch mode in original point. It can be “Normal Open” or “Normal Close”.

Reset Mode: While the setting is “Reset Counter”, the counter value will be reset after homing is accomplished. If the “Do not reset counter” mode was chosen, the counter value will stay as it was, even when the homing process is finished.

SV: The start up speed while homing.

DV: The final drive speed while homing.

Acc. Time: The time period for acceleration from “SV” to “DV”.

Offset: The additional offset distance after reaching the original point.

Unit: The unit of above commands can be pulse, mm or inch.

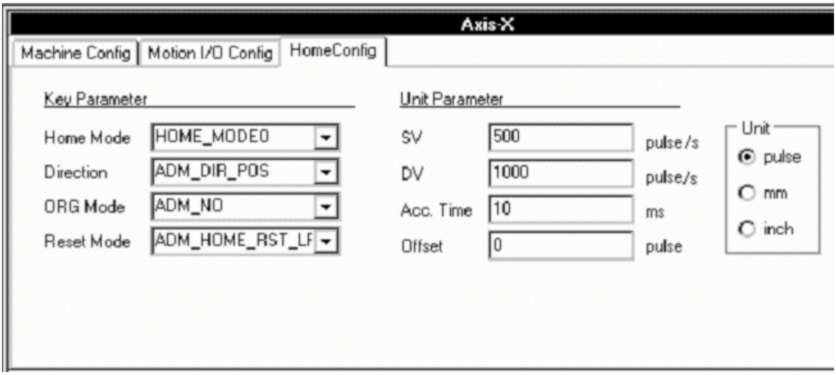


Figure 3.6: Home Configuration

Apply, Save and Load the parameters:

After finishing the configuration for each axis, the parameters can be applied to the PCI-1243U card by using “Apply to Axis” as shown in the following diagram.

You can also press the “New” button to create a virtual PCI-1243U, and simulate the parameters.

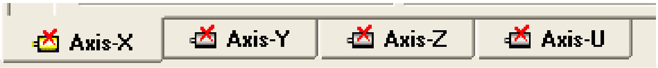
The parameters can be saved into a file and loaded from a file. This makes it possible to send the configuration file to a remote site by e-mail, so several sites can easily have the same configuration.

Figure 3.7: Save and Load Configuration Files

3.3 Motion Operations

3.3.1 Testing Motion Movement

The motion utility provides operational functions as well as configuration functions. You can test motion movement without writing any software program. However, please do apply the parameters you set for the axes in the configuration pages. Since the default parameters are all "0", if you did not press the "Apply to Axis" button, operation of the axes is not possible and there will be a red cross on the tab as shown below.



3.3.2 Point to Point Movement

Acc/Dec Mode: PCI-1243U supports Trapezoid and S-curve acceleration/deceleration modes. The mode can be set in the column.

AccTime_L: Acceleration time period allowed in Trapezoid acceleration mode.

DecTime_L: Deceleration time period allowed in Trapezoid deceleration mode.

AccTime_S: Acceleration time period allowed in S-curve acceleration mode.

DecTime_S: Deceleration time period allowed in S-curve deceleration mode.

SV: Start-up velocity of the movement

DV: Final driving velocity of the movement

Unit: The unit of above commands can be pulse, mm or inch.

Distance: The distance you want to move in the point to point movement.

PtP ABS: In a Point to Point movement, the 'Distance' mentioned above is calculated on the basis of an absolute coordinate system. That means the distance is from the original starting point.

PtP INC: In Point to Point movement, the 'Distance' mentioned above is calculated on the basis of a relative coordinate system. That means the distance is from the current location.

CW: In continuous movement, press the CW button to make the motor turn clockwise.

CCW: In continuous movement, press the CCW button to make the motor turn counterclockwise.

Stop_S: Once this button is pressed, the motor will decelerate to SV then stop.

Stop_M: When the button is pressed the motor will stop immediately.

Change DV: This is an advanced function of PCI-1243U that can change speed on the fly. DV can be changed directly without decelerating to initial speed.

Hold: The movement can be paused by pressing the "Hold" button.

Conti.: When movement is paused by the "Hold" command, you can resume movement by pressing the "Conti." button.

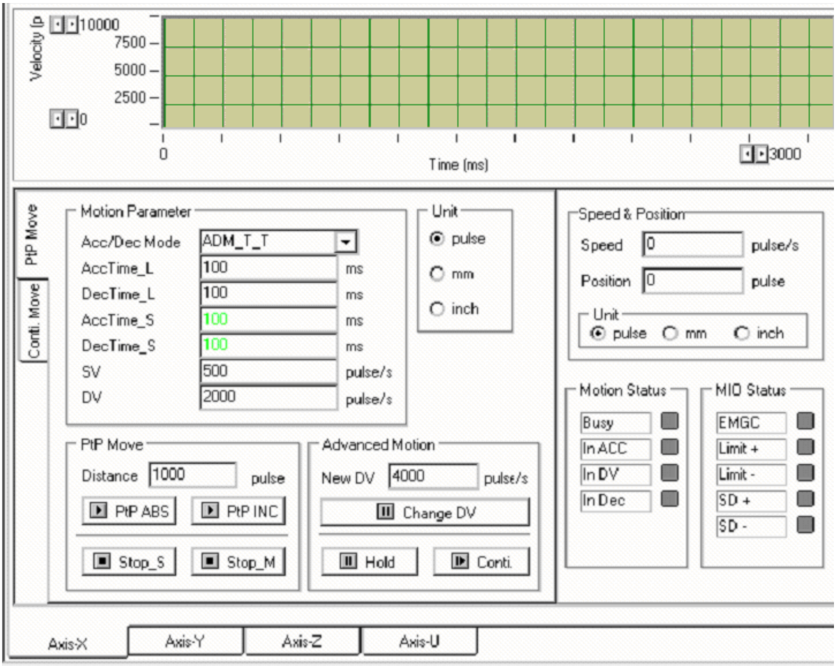


Figure 3.8: Point to Point Movement

3.3.3 Home Function

Home Mode: PCI-1243U supports four different Home modes, they are mode0, 1, 6, and 9. Users can choose the best fit mode to get the proper homing accuracy. Please refer to Appendix C for the detail definition of each Home mode, and 3.2.3 for parameter information.

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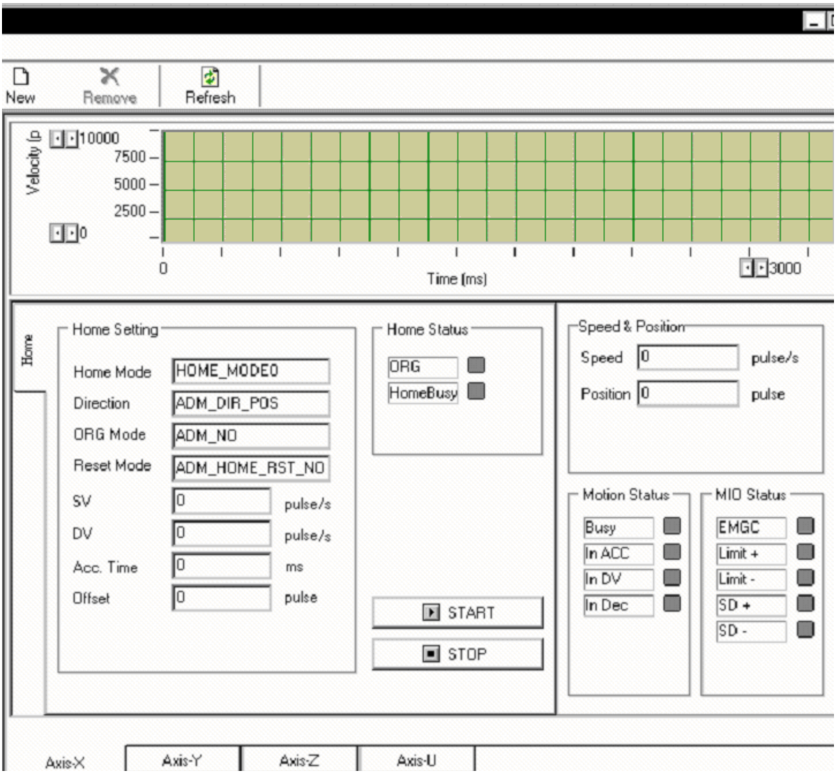


Figure 3.9: Home Function

3.3.4 Digital I/O Operation

DO Mask State: PCI-1243U provides a mask option for each digital output bit. If the mask bit is not set, the output command will not affect the output status of the specific bit.

DO State: Checking the box under the bit number can issue the status change command to the specific bit.

DI State: In this column it shows the status of digital input bits, and you can change the polling time interval.

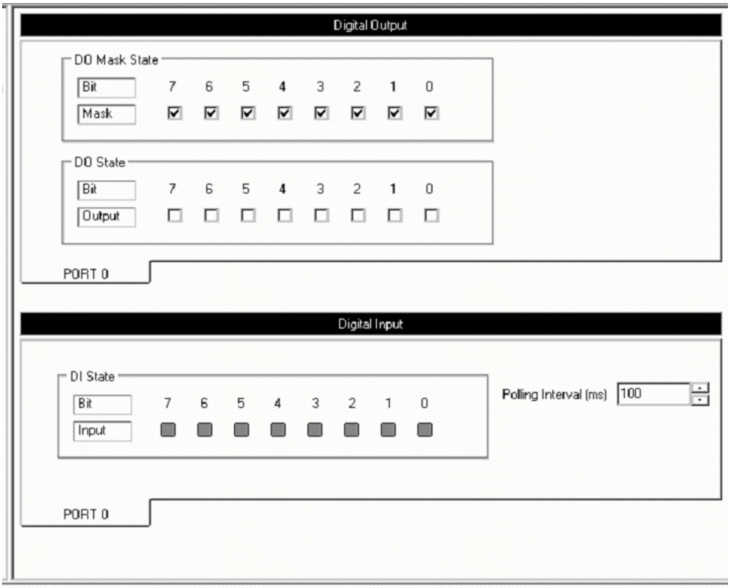


Figure 3.10: Digital I/O Operation

2

CHAPTER 4

Register Programming

This chapter describes the PCI-1243U's hardware registers. It also contains typical operational procedures that will assist you in program design. This chapter is a good place to start getting to know and use the capabilities of the PCI-1243U to best suit your application.

Sections include:

- PCI-1243U Registers
- Programming PCI-1243U
- Command Modes
- Status Registers
- General I/O Registers
- Motion Status Register
- Typical Operational Procedures

Chapter 4 Register Programming

4.1 Motion Control Registers

Several motion control registers are used to control PCI-1243U. These registers are used to store commands, speed, mode, number of pulses and more. The following sections describe these registers in detail.

4.1.1 R0: Preset Pulse Counter (24 bits)

PCI-1243U has an internal preset countdown counter. By entering a number of pulses, this preset counter will begin counting down from that point.

The preset counter decrements by one for each pulse output in the continuous, zero return and preset operations. However, if the preset counter operation mode is inhibited by the output mode command, the preset counter will not count down.

The counter value (number of remaining pulses) can be read while in operation or while stopped. To read the value, first select R0. The register select timing latches the data into a 24-bit read buffer.

In preset operation, PCI-1243U places a number of positioning pulses in this register, and then starts the operation. Once the operation has started, the counter value is decremented with each pulse that is output. When the number of pulses that have been output is equal to the value originally entered in the preset counter, the value in the counter will be zero and PCI-1243U will stop operation.

The allowable range is 0 to 16,777,215 (FFFFFF HEX).

If you enter 0 in the preset counter and write the start command, PCI-1243U will not use the preset operation. When INT output is enabled, PCI-1243U will output an INT signal.

If you stop the preset operation using the stop command or an external signal, the number of remaining pulses will be saved in the preset counter. By entering a new start command, PCI-1243U will continue to output all of the remaining pulses.

After the preset number of pulses has been output, the value in the preset counter will be 0.

If you want to restart the operation using the same number of pulses, you will have to put the value in R0 again.

4.1.2 R1: FL Speed Register (13 bits)

This register is used to set the FL (initial/low) speed. To operate in high speed mode, PCI-1243U will start with the FL speed and then accelerate to the FH (final/high) speed. If a deceleration-stop command is entered during high-speed operation, PCI-1243U will decelerate. When the speed drops to FL speed, the operation will stop.

If the FL speed is set to 0, the motor may not actually stop. Make sure to set the FL speed to a number greater than 1.

The allowable range is 1 to 8,191 (1FFF HEX).

The relationship between the value entered and the output pulse speed varies with the value placed in R4 (Please refer to 4.1.5).

4.1.3 R2: FH Speed Register (13 bits)

This register is used to set the FH (final/high) speed.

The allowable range is 1 to 8,191 (1FFF HEX).

The relationship between the value entered and the output pulse speed varies with the value placed in R4 (Please refer to 4.1.5).

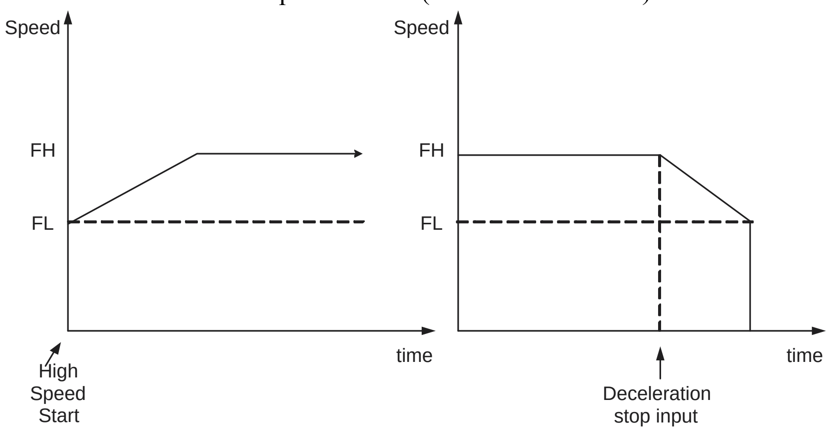


Figure 4.1: R4's Effect on Output Pulse Speed

4.1.4 R3: Accel/decel Rate Register (10 bits)

This register is used to select the acceleration (ramping up) and deceleration (ramping down) characteristics.

If PCI-1243U executes a high-speed mode start, the motor starts at the FL speed entered in R1, and accelerates to the FH speed entered in R2.

The motor decelerates to FL speed when a “SD” (slow down) signal is received, the ramping down point is reached, or a deceleration command is received. Specify the acceleration and deceleration characteristics for these operating patterns using the accel/decel rate setting register. The acceleration rate of the linear accel/decel is equal to the maximum acceleration rate of the S-curve acceleration/deceleration pattern.

If the reference clock period is (TCLK) [sec], T_{SUD} (the time required for the ramping-up / ramping-down) is:

T_{SUD} = [(R2)-(R1)] x (R3) x (TCLK) x Multiplier [sec]

Alternatively, if the ramping-up/ramping-down time is known, R3 can be calculated as: R3 = T_{SUD} / {[(R2)-(R1)] x (TCLK) x Multiplier}

Note *Multiplier = 1 while in Linear Accel/Decel mode*

Multiplier = 2 while in S-curve Accel/Decel mode

The range for R3 is 002 (hex) to 3FF (hex) (2 to 1023 in decimal).

Note *For PCI-1243U, TCLK = 233.ns*

The allowable range is: 2 to 1,023 (3FF HEX).

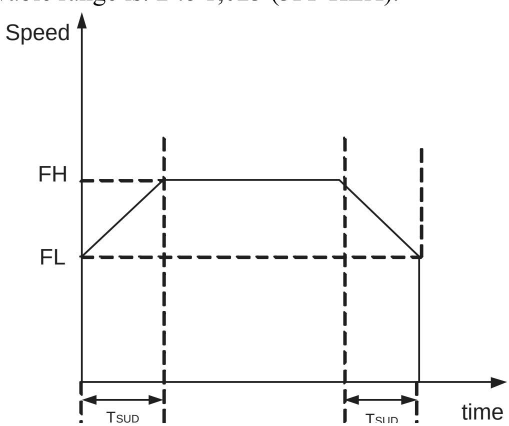


Figure 4.2: R3’s Effect

4.1.5 R4: Multiplier Register (10 bits)

The speed setting registers R1 and R2 can have values from 1 to 8,191. The relationship between the values entered and the output pulse speed can be set using this multiplier register.

When a set value on the speed register is Rf (where Rf is a value set at R1 and R2), the frequency outputted at the PULSE OUTPUT terminal FPOUT is

F_{POUT} = {(Reference clock freq. [Hz] x (Rf)) / (8192 x (R4)}

= (Rf) x {(Reference clock freq.) / [8192 x (R4)]}

When (reference clock)/ [8192 x (R4)]= 1 ... 1x mode

When (reference clock)/ [8192 x (R4)]= 2 ... 2x mode

For PCI-1243U, the reference clock frequency is 4.9152 [MHz], Therefore:

(R4)= 600 (=258 hex) 1x mode

(R4)= 300 (=12C hex) 2x mode

The setting range is 002 (hex) to 3FF (hex), which corresponds to 2 to 1023 in decimal notation. The smaller the setting value, the higher the output frequency.

4.1.6 R5: Ramping-Down Point Register (16 bits)

While in preset, high-speed operation, PCI-1243U compares the value in this register, R5, to the value in the preset counter. When the value in R5 is larger than the preset counter value, the PCI-1243U will start to decelerate.

If the value placed in R5 is smaller than the preset counter value and the PCI-1243U is programmed for preset, high-speed operation, the motor will operate at FL speed and not accelerate.

The FL speed, FH speed, and the accel/decel rate determine the ramping-down point.

Please note that in PCI-1243U, the R5 value is calculated by the user. The system will not define the R5 value automatically.

Entering inappropriate values may stop the output of pulses during deceleration, or cause PCI-1243U to operate longer at the FL speed after deceleration.

The allowable range is 0 to 65,535 (FFFF HEX) of pulses remaining at which to start deceleration.

Calculating the Ramping-Down Point

R5 set value [pulses] = {[(R2 set value)2 - (R1 set value)2] x (R3 set value) x Multiplier} / [(R4 set value) x 8192]

The value for R5 has to be calculated and written in the register.

Note *Multiplier = 1 while in Linear Accel/Decel mode*
Multiplier = 2 while in S-curve Accel/Decel mode

When determining the ramping-down point, the FL frequency, the FH frequency and the deceleration rate have to be taken into account. If an improper value is set, pulse output may be terminated halfway during ramping-down (Figure 4.3. A) or may continue after ramping-down, causing longer FL speed operation (Figure 4.3. C).

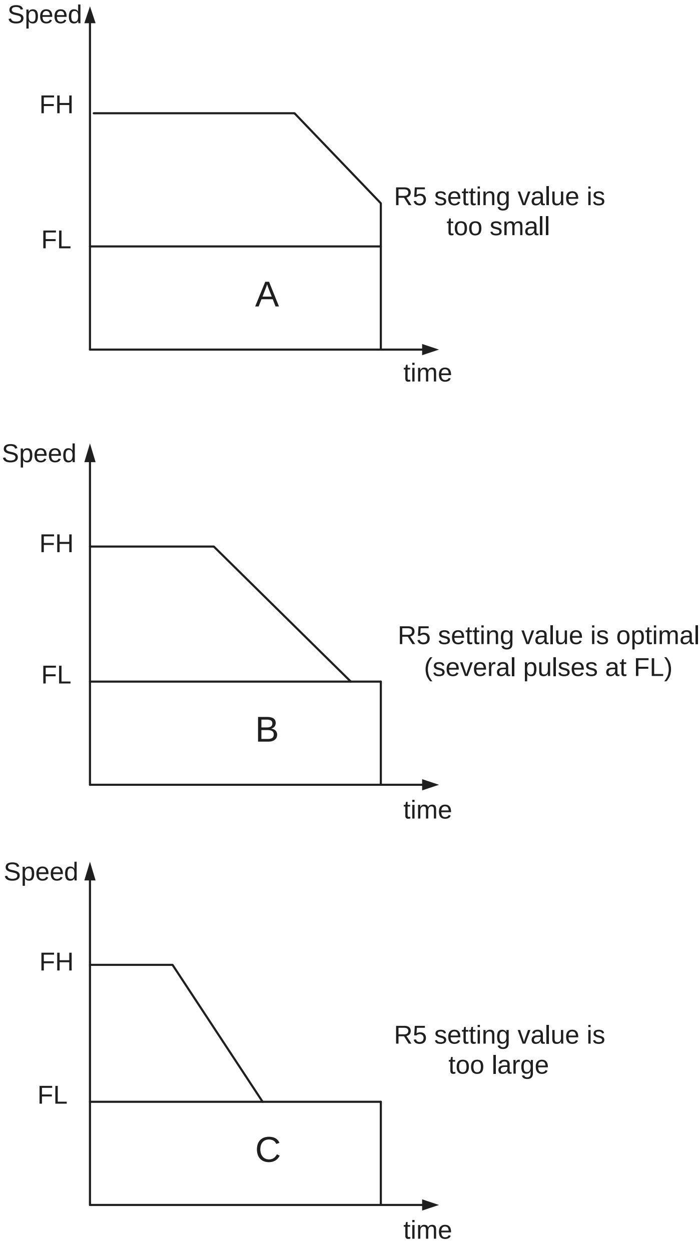


Figure 4.3: Setting the Ideal Ramping-Down Point

A ramping-down point is set based on the number of pulses output during ramping-down. Therefore the area marked by oblique lines in the chart below is the number of pulses to be calculated. FL and FH are the output pulse frequencies.

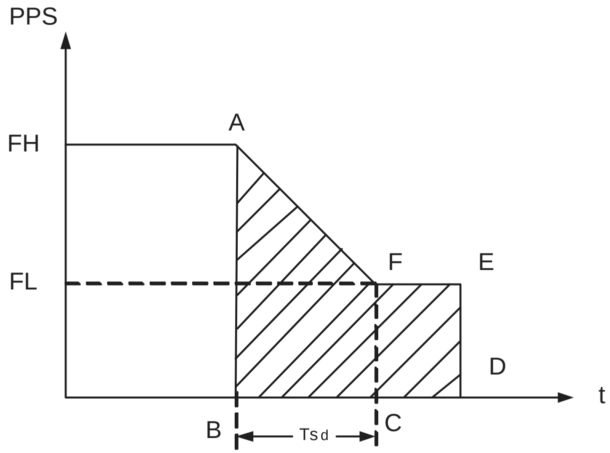


Figure 4.4: Pulse Calculation

T_{SD} [sec], the time required for the deceleration is:

T_{SD} = [(R2)-(R1)] x (R3) x Multiplier / (CLOCK) (1)

where CLOCK = 4.9152 MHz

Note *Multiplier = 1 while in Linear Accel/Decel mode*

Multiplier = 2 while in S-curve Accel/Decel mode

The relationship between the set value on speed register (Rf) and output frequency (F [PPS]) is

F = (Rf) x (CLOCK)/ [8192 x (R4)] (2)

Therefore, FL output frequency FL [PPS] and FH output frequency FH [PPS] are

FL = (R1) x (CLOCK)/ [8192 x (R4)] (3)

FH = (R2) x (CLOCK)/ [8192 x (R4)] (4)

P_{SD}, the number of pulses during T, [sec] is represented by the area of the trapezoid A-B-C-F

P_{SD} = {[(FL) + (FH)]* Ted}/ 2(5)

Substitute equations (1), (3) and (4) into equation (5)

P_{SD} = {[(R2)^2 – (R1)^2] x (R3) x Multiplier} / [2 x 8192 x (R4)]

When output 5 pulses at FL speed after the completion of the ramping-down, the set value of the ramping-down point register (R5) is

R5 = P_{SD} + 5

R5 = {[(R2)^2 – (R1)^2] x (R3) x Multiplier} / [16384 x (R4)] + 5

Note *Multiplier = 1 while in Linear Accel/Decel mode*

Multiplier = 2 while in S-curve Accel/Decel mode

4.1.7 R6: Idling Pulse Register (3-bit)

To operate in high speed mode, the motor is accelerated quickly after starting. Therefore, the speed calculated from the output pulse frequency will be higher than the FL speed that is set. If FL is set to a value lower than the self-start frequency, the motor will not start.

Therefore, in order to be able to start from near the self-start frequency, the acceleration using the FL speed can be started from 1 to 7 pulses after the start command. The pulses that the start is delayed by are referred to as idling pulses.

The allowable range is 0 to 7. This is effective in high-speed operation. Setting this register to 0 will provide a normal start.

4.1.8 R7: Environmental Data Register (1-bit)

The allowable range is 0 or 1

0CW/CCW pulse type

1Pulse/DIR type

4.2 Programming PCI-1243U

PCI-1243U stores a selected command in a buffer. This command remains there until a new command is received. The only command that can be RESET, is the 'starting mode' command.

4.2.1 I/O Control Register Map:

The following table depicts the PCI-1243U's register I/O address map.

Axis	Offset Address	R/W	Definition
X (0)	0x00	Write	Command Buffer
		Read	Status0
	0x01	Write	Data Register (LowerBit7 To Bit0)
		Read	Internal Data (Lower)
	0x02	Write	Data Register (MiddleBit15 To Bit8)
		Read	Internal Data (Middle)
	0x03	Write	Data Register (UpperBit23 To Bit16)
		Read	Internal Data (Upper)
Y (1)	0x04	Write	Command Buffer
		Read	Status0
	0x05	Write	Data Register (LowerBit7 To Bit0)
		Read	Internal Data (Lower)
	0x06	Write	Data Register (MiddleBit15 To Bit8)
		Read	Internal Data (Middle)
	0x07	Write	Data Register (UpperBit23 To Bit16)
		Read	Internal Data (Upper)

Z (2)	**0x08**	Write	Command Buffer
		Read	Status0
	0x09	Write	Data Register (LowerBit7 To Bit0)
		Read	Internal Data (Lower)
	0x0A	Write	Data Register (MiddleBit15 To Bit8)
		Read	Internal Data (Middle)
	0x0B	Write	Data Register (UpperBit23 To Bit16)
		Read	Internal Data (Upper)
U (3)	**0x0C**	Write	Command Buffer
		Read	Status0
	0x0D	Write	Data Register (LowerBit7 To Bit0)
		Read	Internal Data (Lower)
	0x0E	Write	Data Register (MiddleBit15 To Bit8)
		Read	Internal Data (Middle)
	0x0F	Write	Data Register (UpperBit23 To Bit16)
		Read	Internal Data (Upper)
	0x10	Write	NA
		Read	Board ID (Version Code)
	0x11	Write	IDO Port (D7~ D0)
		Read	Read Back IDO Setting
	0x12	Write	NA
		Read	IDI Port (D7 ~ D0)
	0x13	Write	IDI Control REG
		Read	IDI Control REG
	0x14	Write	IRQ Control REG_L
		Read	IRQ Status_L(Reset Status)
	0x15	Write	IRQ Control REG_H
		Read	IRQ Status_H (Reset Status)
	0x16	Write	X
		Read	IRQ Status_L
	0x17	Write	X
		Read	IRQ Status_H

	0x18	Write	Counter Data REG_L
		Read	Counter Data REG_L
	0x19	Write	Counter Data REG_H
		Read	Counter Data REG_H
	0x1A	Write	Counter Control REG
		Read	Counter Control REG
	0x1B	Write	Load Counter Data
		Read	X
	0x1C	Write	STA_Mode
		Read	STA_Mode Status
	0x1D	Write	SW STA Trigger
		Read	NA
	0x1E	Write	Reset PCD4541 Command
		Read	NA
	0x1F	Write	NA
		Read	NA
	0x20	Write	X-Axis Limit Switch Control Register
		Read	X-Axis Limit Switch Control Status
	0x21	Write	Y-Axis Limit Switch Control Register
		Read	Y-Axis Limit Switch Control Status
	0x22	Write	Z-Axis Limit Switch Control Register
		Read	Z-Axis Limit Switch Control Status
	0x23	Write	U-Axis Limit Switch Control Register
		Read	U-Axis Limit Switch Control Status
	0x24	Write	NA
		Read	Limit switch status

For each motion axis, four register addresses are used. One command buffer and three data buffers.

Command Buffers: WR0, WR4, WR8 and WR12

Each of the three channels has a command buffer which enables individual programming. Channel l's command buffer is BASE + 0, Channel 2's is BASE + 4, Channel 3's is BASE + 8 and Channel 4's is BASE + 12. A command can be written to any of the three buffers, and the appropriate channel will respond to the command.

Low Data Buffers: WR1, WR5, WR9 and WR13

Low data-buffer for each channel is found at BASE + 1, BASE + 5, BASE + 9 and BASE + 13, for channel 1, channel 2, channel 3 and channel 4 respectively. During writing (output), these buffers contain data bits 0-7 of the respective channels.

Middle Data Buffers: WR2, WR6, WR10 and WR14

Middle data-buffer for each channel is found at BASE +2, BASE +6, BASE +10 and BASE +14, for channel 1, channel 2, channel 3 and channel 4 respectively. When writing (output), these buffers contain data bits 8-15 of the respective channels.

High Data Buffers: WR3, WR4, WR11 and WR15

High data-buffer for each channel is found at BASE +3, BASE +7, BASE +11 and BASE +15, for channel 1, channel 2, channel 3 and channel 4 respectively. When writing (output), these buffers contain data bits 16 -23 of the respective channels.

4.2.2 Command Buffer Register Format

The command buffer register format is as follows:

Register format							
D7	D6	D5	D4	D3	D2	D1	D0
C1	C0						
Mode		Command					

Selection Modes

The two high-order bits of the command buffer specifies the command that will be executed. The remaining six bits contain command parameters. The command modes available are as follows:

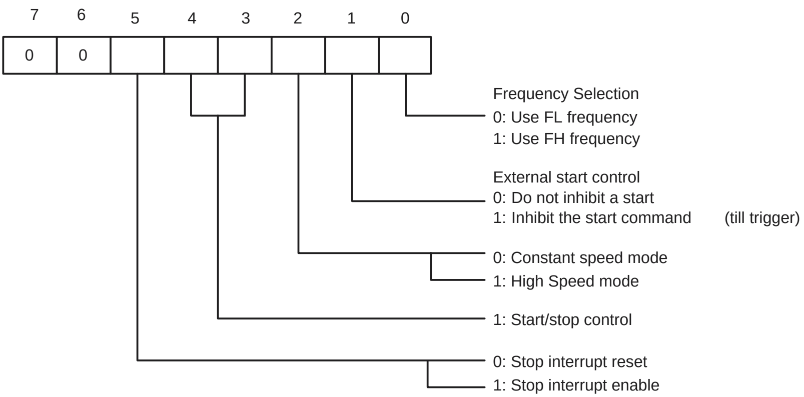
Selection modes		
C1	C0	
0	0	Start-Stop Command selection
0	1	Operation Mode Select command
1	0	Register Select command
1	1	Output Mode select command

Please refer to section 4.3 for details on each command mode.

4.3 Command Modes

The following sections describe all the available commands and their parameters in detail.

4.3.1 Start-Stop Commands



0	0	*	1	0	0	0	0

Constant speed operation with the FL register. Operates at the speed set for the FL register.

0	0	*	1	0	0	0	1

Constant speed operation with the FH register. Operates at the speed set for the FH register.

0	0	*	1	0	1	0	1

High speed mode operation with the FH register. Frequency ramps up halfway from the rate of FL to that of FH. During high-speed start this command lets the frequency ramp up/down to the rate of the FH speed.

0	0	*	1	0	1	0	0

Dual rate operation (ramping down). Frequency ramps down to the level of the FL.

* 0 (no output of INT signal at stop)

1 (output of INT signal at stop)

0	0	*	1	1	1	0	0

Decelerating stop (reset command is required after stop). Frequency ramps down to the rate of the FL, then stops.

0	0	0	0	1	0	0	0

Reset command. This stops pulse generation under any condition. If you start with the start-command, be sure to reset with the reset command before the next start. This gives INT signal and the start command has to be reset. Contents in registers R0 through R7 are not changed.

* 0 (no output of INT signal at stop)

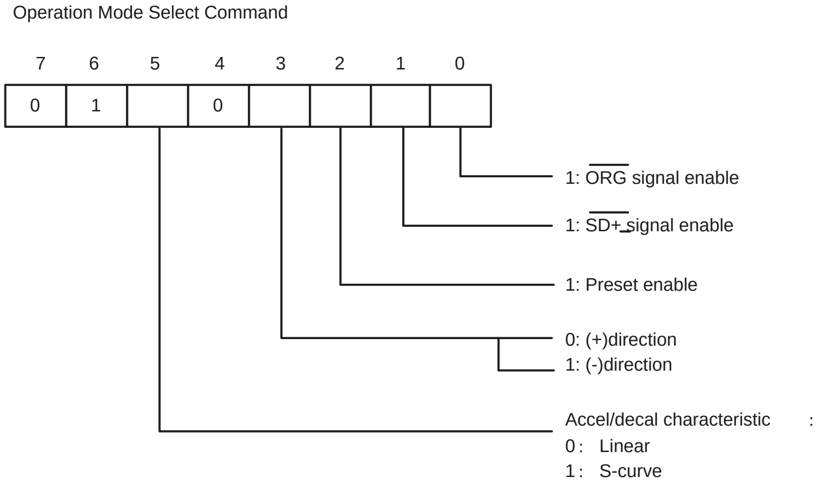
1 (output of INT signal at stop)

0	0	0	0	0	0	1	0

1: The start command is set to standby. It will wait for the external start trigger to start motion.

0: Software start command will start motion immideately.

4.3.2 Operation Mode Select Command



0	1	0	0	*	0	0	0

Manual mode. Operation initiated in the start mode continues until the stop command is transferred.

0	1	0	0	*	0	0	1

Origin return mode. Operation initiated in the start mode continues until the mechanical origin signal or stop command comes.

0	1	0	0	*	1	0	0

Preset mode. Operation initiated in the start mode, stops when the quantity set for register R0 is reached.

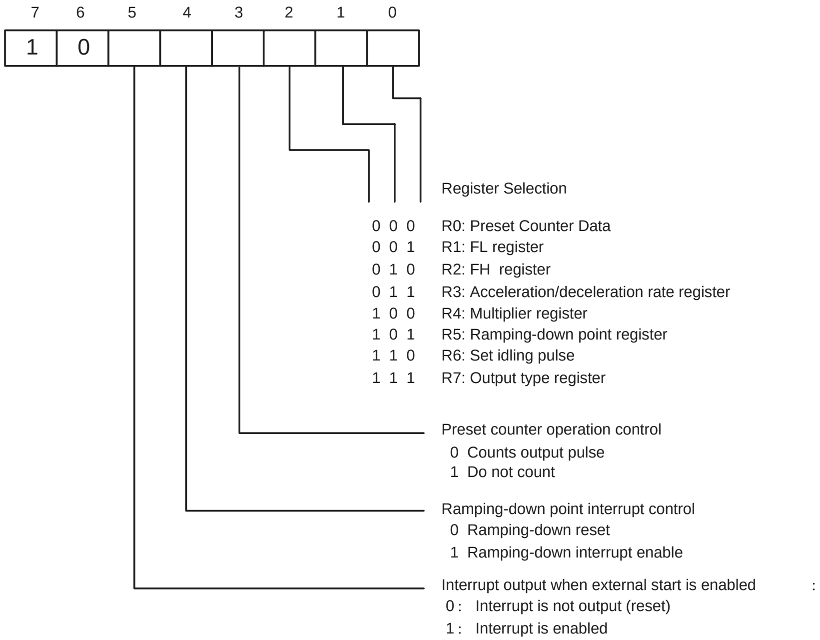
Operation in the high speed start mode ramps down when the remaining quantity of the counter is less than the quantity set for register R5.

0 (+) direction 1 (-) direction

0	1	*	0	0	0	0	0

PCI-1243U supports two acceleration/deceleration modes. You can choose linear accel/decal mode by setting bit5 as ‘0’. On the other hand, if bit6 is set to ‘1’, then the acdel/decal profile will be S-curve.

4.3.3 Register Select Command



Register select code: Selecting an access register with last 3 bits.

Preset Counter Operation Control:

When this bit is 1, the preset counter will stop counting. When this bit is 0, the preset counter will decrement by one for each pulse output.

Ramping-down Point Interrupt Control:

This bit controls whether or not the INT signal is output when the ramping-down point is reached. When this bit is 1 and the preset counter value becomes smaller than the ramping-down point setting in R5, it will output an INT signal. To reset the INT signal, set this bit to 0. If you want to mask this operation, leave this bit set to 0. The INT terminal output is the result of an logical OR of this signal with the interrupt signal when stopped. To determine which source has caused the INT signal to be output, check Status0.

Interrupt Control:

Enable the interrupt by setting bit0 as ‘1’.

When interrupt is activated it is necessary to read this specified bit0 to reset the interrupt.

Kinds of registers and data bits

Description		Bits	R/W	Setting Range
R0	Preset counter data	24	R/W	0 to 16,777,215 (FFFFFF)
R1	FL register	13	W(R)	1 to 8,191 (1FFF)
R2	FH register	13	W(R)	1 to 8, 191 (1FFF)
R3	Acceleration/deceleration rate register	10	W(R)	2 to 1, 023 (3FF)
R4	Multiplier register	10	W(R)	2 to 1, 023 (3FF)
R5	Set ramping-down point	16	W(R)	0 to 65, 535 (FFFF)
R6	Set idling pulse	3	W(R)	0 to 7
R7	Output type register	1	W(R)	0 to (1)

Note1 *: * R/W: Read/Write register*

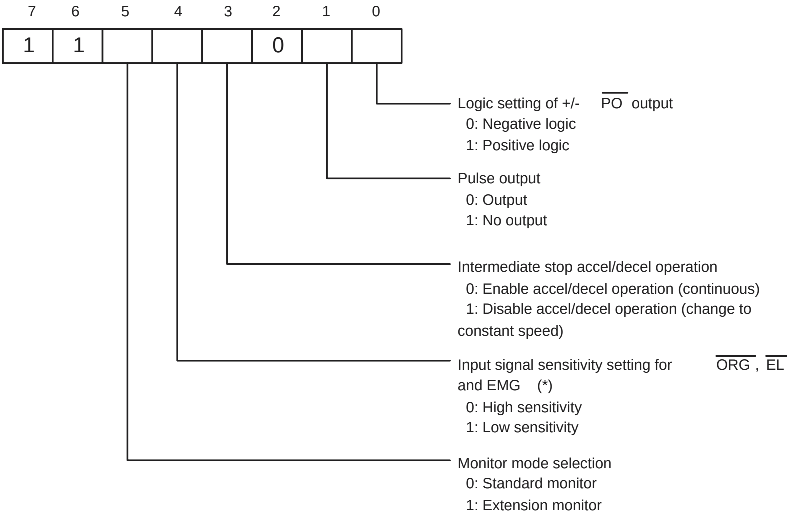
W(R): Write only register. However, it can be read using the extension monitor setting.

Note2 *R7 is allowed to be 0 or 1.*

R7 = 0, CW/CCW output type

R7= 1, Pulse/Direction output type

4.3.4 Output Mode Select Command



If bit3 is set, operations will not accel/decal unless this bit was cleared.

Sensitivity setting:

Low: the input signal will be ignored when pulse width < 800 ns

High: the input signal will be recognized when pulse width < 800 ns

PULSE / DIRECTION logic control

PULSE / +dir and DIR/-dir output logic be changed as follows

4.4 Status Registers

You can set the standard monitor or extension monitor by "Output mode select command"

- Status0 does not have any restrictions on reading. Since Status1, Status2, and Status3 share their addresses with the lower data byte of the preset counter, there is a restriction on reading from them.

To read Status1, Status2, or Status3, first select the R7 register (or a register other than R0 in the normal monitor mode). Then you can read Status1 from the lower data byte, Status2 from the middle data byte, and Status3 from the upper data byte.

- Status0 to 3 are latched while reading. The data bus will not change while in the read cycle.

- After operation has stopped, if the start mode command is read with the extension monitor, the start control mode bit will be 0.

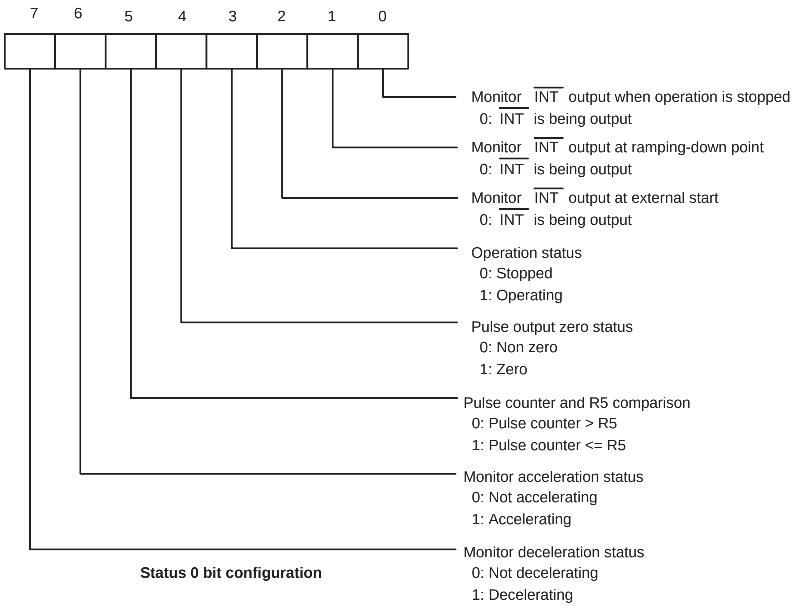
- When reading using the register select command, the register selection is limited to R3 only.

Mode	**Address\ Register**	**RD0, RD4, RD8, RD12**	**RD1, RD5, RD9, RD13**	**RD2, RD6, RD10, RD14**	**RD3, RD7, RD11, RD15**
Standard Monitor	R0	Status0	R0 lower byte	R0 middle byte	R0 upper byte
	R1 to R7	Status0	Status1	0	0
Extension Monitor	R0	Status0	R0 lower byte	R0 middle byte	R0 upper byte
	R1	Status0	R1 lower byte	R1 upper byte	Start mode command
	R2	Status0	R2 lower byte	R2 upper byte	Control mode command
	R3	Status0	R3 lower byte	R3 upper byte	Register select command
	R4	Status0	R4 lower byte	R4 upper byte	Output mode command
	R5	Status0	R5 lower byte	R5 upper byte	R7 data
	R6	Status0	R6 data	Speed lower byte	Speed upper byte
	R7	Status0	Status1	Status2	Status3

The definitions of Status registers are as following:

4.4.1 Status0: Channel Status Buffers (RD0, RD4, RD8 and RD13)

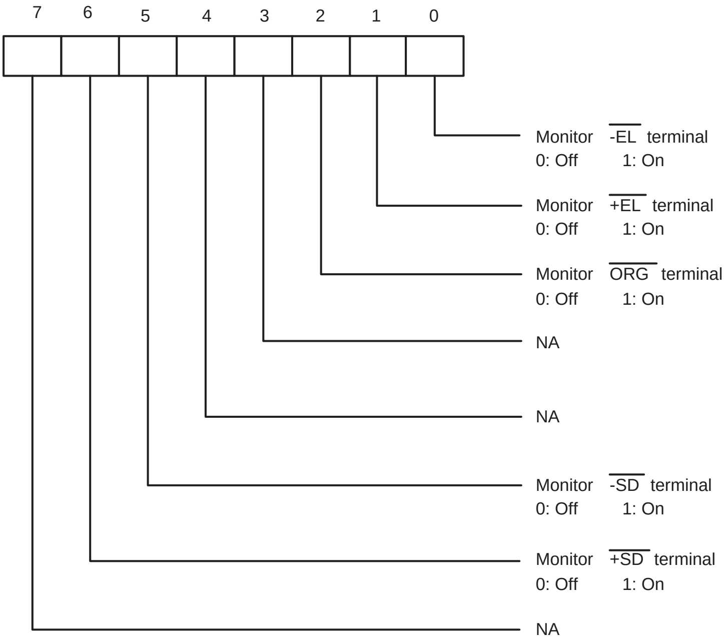
There is a status buffer for each channel (status 0). These buffers are found at BASE +0, BASE +4, BASE +8 and BASE +13 for channel 1, channel 2, channel 3 and channel 4 respectively. These buffers enable you to read the internal status of each channel, and also get certain information on input signals or conditions.



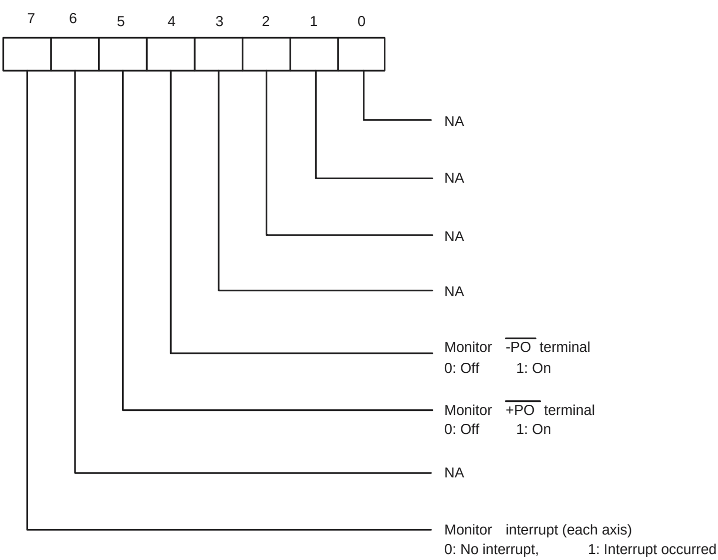
Status 0 bit configuration

4.4.2 Extension Monitor

When the Extension Monitor was selected, you can check the value of each register R0 ~ R7 by assigning the register with "register selection command", and then read the specific address respectively. Also, Status1, Status2 and Status3 can be read in the extension monitor mode. On the following page are the definitions of each status register.



Status 1 bit configuration



For the value of Status3, it should be “0100-0000”. It represents the PCD4541 chipset.

4.5 General I/O Registers

Register from Base+10h to Base+1Bh are for general I/O, following are the definitions of each register.

4.5.1 Base+10h: Read Board ID

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	-	-	-	-	-	-	-	-
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	-	-	-	-	ID3	ID2	ID1	ID0

This Register Is Read Board ID (D3~D0)

The Operation Steps are as the following

Step 1: outportb (base+0x10, 0x00)

Step 2: BoardID = inportb (base+0x10)

4.5.2 Base+11h: Read/Write IDO Port

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	IDO7	IDO6	IDO5	IDO4	IDO3	IDO2	IDO1	IDO0
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	IDO7	IDO6	IDO5	IDO4	IDO3	IDO2	IDO1	IDO0

This Register Is Read/Write IDO Output (D7~D0)

4.5.3 Base+12h: Read/Write IDI Port

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	-	-	-	-	-	-	-	-
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	IDI7	IDI6	IDI5	IDI4	IDI3	IDI2	IDI1	IDI0

This Register Read IDI Port (D7~D0)

4.5.4 Base+13h: R/W IDI Port Trigger Control Register

Write	D7	D6	D5	D4	D3	D2	D1	D0
	IDI_Ctl7	IDI_Ctl6	IDI_Ctl5	IDI_Ctl4	IDI_Ctl3	IDI_Ctl2	IDI_Ctl1	IDI_Ctl0
Read	D7	D6	D5	D4	D3	D2	D1	D0
	IDI_Ctl7	IDI_Ctl6	IDI_Ctl5	IDI_Ctl4	IDI_Ctl3	IDI_Ctl2	IDI_Ctl1	IDI_Ctl0

IDI_Ctl7 ~ IDI_Ctl0: Isolated Digital Input channel interrupt Edge Trigger Control

0: IDIx (x = 7 ~ 0): Falling Edge Trigger

1: IDIx (x = 7 ~ 0): Rising Edge Trigger

4.5.5 Base+14h: IRQ Control/Enable Register Low Byte

Write	D7	D6	D5	D4	D3	D2	D1	D0
	INT_IDI7	INT_IDI6	INT_IDI5	INT_IDI4	INT_IDI3	INT_IDI2	INT_IDI1	INT_IDI0
Read	D7	D6	D5	D4	D3	D2	D1	D0
	INT_IDI7	INT_IDI6	INT_IDI5	INT_IDI4	INT_IDI3	INT_IDI2	INT_IDI1	INT_IDI0

INT_IDI7~ INT_IDI0:

0: Disable IDIx INT (x = 7 ~ 0)

1: Enable IDIx INT (x = 7 ~ 0)

4.5.6 Base+15h: IRQ Control/Enable Register High Byte

Write	D7	D6	D5	D4	D3	D2	D1	D0
	INT_All	-	-	-	-	-	INT_Motion	INT_Timer
Read	D7	D6	D5	D4	D3	D2	D1	D0
	INT_All	-	-	-	-	-	INT_Motion	INT_Timer

INT_All:

0: Disable INT of all channels

1: Enable INT of all channels

INT_Motion, INT_Timer:

0: Disable INT for Motion or Timer functions

1: Enable INT for Motion or Timer functions

4.5.7 Base+16h: IRQ Status Low Byte

Write	D7	D6	D5	D4	D3	D2	D1	D0
	Clear interrupt flag							
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	IDI_Sta7	IDI_Sta6	IDI_Sta5	IDI_Sta4	IDI_Sta3	IDI_Sta2	IDI_Sta1	IDI_Sta0

IDI_Sta7~ IDI_Sta0: IDIx (x = 7 ~ 0) INT Status

0: In-Active

1: Active

Note: This flag will be cleared while writing to the register

4.5.8 Base+17h: IRQ Status High Byte

Write	D7	D6	D5	D4	D3	D2	D1	D0
	Clear interrupt flag							
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	Sta_All	-	-	-	-	-	Sta_Motion	Sta_Timer

Sta_All: INT Status

0: Inactive

1: Active

Sta_Motion, Sta_Timer:

0: INT is inactive for Motion or Timer functions

1: INT is active for Motion or Timer functions

Note *This flag will be cleared while writing to the register*

4.5.9 Timer Function Specification

Clock Base : 1 MHz On Board OSC

Timer Tick Base: 10 Clock Base (100 kHz)

Timer Tick Width: 10 µs

4.5.10 Base+18h: Counter Data Register Low byte

Write	D7	D6	D5	D4	D3	D2	D1	D0
	Counter DATA (Low Byte)							
Read	D7	D6	D5	D4	D3	D2	D1	D0
	Counter DATA (Low Byte)							

4.5.11 Base+19h: Counter Data Register High Byte

Write	D7	D6	D5	D4	D3	D2	D1	D0
	Counter DATA (High Byte)							
Read	D7	D6	D5	D4	D3	D2	D1	D0
	Counter DATA (High Byte)							

4.5.12 Base+1Ah: Counter Gate Control Register

Write	D7	D6	D5	D4	D3	D2	D1	D0
	-	-	-	-	-	-	-	CNT_EN
Read	D7	D6	D5	D4	D3	D2	D1	D0
	-	-	-	-	-	-	-	CNT_EN

CNT_EN: Counter Gate Control status

0: Disable

1: Enable

4.5.13 Base+1Bh: Counter Load Trigger

Write	D7	D6	D5	D4	D3	D2	D1	D0
	Load counter setting value into chip							
Read	D7	D6	D5	D4	D3	D2	D1	D0
	X							

4.6 Motion Status Register

4.6.1 Base+1Ch: STA Motion Start Trigger Source Control Register (Axes Dependant)

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA				U-Axes	Z-Axes	Y-Axes	X-Axes
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	0	0	0	0	U-Axes	Z-Axes	Y-Axes	X-Axes

With the STA function, you can start all axes synchronously. The trigger source can be either external or from software.

D3~D0: X-, Y-, Z-, and U-Axis STA Source

0: External Control 1: Software Control

4.6.2 Base+1Dh: STA Software Source Trigger

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA							
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA							

Writing to Base+1D to start the synchronous motion.

4.6.3 Base+1Eh: Software Reset PCD4541

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA							RST
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA							RST

D0: 1: Reset PCD4541 Chip

0: Active PCD4541 Chip

Note: For the Reset Process, the time Interval must > 100 us.

Outportb (Base+0x1E, 0x01);

/* wait 100us */

Outportb (Base+0x1E, 0x00);

4.6.4 Base+20h: X-Axis Limit Switch Control Reg./Status

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA		NA	SD-	SD+	LMT-	LMT+	ORG
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	0	0	0	SD-	SD+	LMT-	LMT+	ORG

D0 ~ D4:

1: Normal Close Input

0: Normal Open Input

4.6.5 Base+21h: Y-Axis Limit Switch Control Reg./Status

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA		NA	SD-	SD+	LMT-	LMT+	ORG
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	0	0	0	SD-	SD+	LMT-	LMT+	ORG

D0 ~ D4:

1: Normal Close Input

0: Normal Open Input

4.6.6 Base+22h: Z-Axis Limit Switch Control Reg./ Status

Write	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	NA		NA	SD-	SD+	LMT-	LMT+	ORG
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	0	0	0	SD-	SD+	LMT-	LMT+	ORG

D0 ~ D4:

1: Normal Close Input

0: Normal Open Input

4.6.7 Base+23h: U-Axis Limit Switch Control Reg./Status

Write	D7	D6	D5	D4	D3	D2	D1	D0
	NA		NA	SD-	SD+	LMT-	LMT+	ORG
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	0	0	0	SD-	SD+	LMT-	LMT+	ORG

D0 ~ D4:

1: Normal Close Input

0: Normal Open Input

4.6.8 Base+24h: +/- Limit Switch Status

Write	D7	D6	D5	D4	D3	D2	D1	D0
	NA							
Read	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
	ULMT+	ULMT-	ZLMT+	ZLMT-	YLMT+	YLMT-	XLMT+	XLMT-

D0 ~ D7:

1: Limit Switch Active

0: Limit Switch In-Active

4.6.9 Example of reading Status Register

In this section, we will demonstrate how to get the emergency stop limit switch status by reading the Status Register.

Step1:

Setting the "Output Mode Select Command" and you can choose the .Monitor mode. as Standard monitor or Extension monitor. In Standard monitor mode user can get Status0 ~ 1, and in Extension monitor mode Status0 ~ 3 can be read. Since the status of emergency stop limit switch is defined in Status1, so both Standard and Extension monitor mode is workable. In this case, we set the monitor mode as "Extension".

outportb(base+(CH*4+CommandBufferIndex),DATA);

//CH : Axes 0 ~ 2

//CommandBufferIndex = 0

//DATA is just setting The [Output Mode Command] Monitor Mode Selection Bit5

//DATA = (CurrentAxesOutputModeCommandValue & (~FORCE_EXTENSION_MODE)) | (FORCE_EXTENSION_MODE)

Step2:

Select R7 Register. (If you want to read another status such as R0, R1, or Current Speed.., then you must select another Register such as R0, R1, and R6. Please refer to the Table in section 4.6)

outportb(base+(CH*4+CommandBufferIndex,DATA);

//DATA is just setting The [Register Select Command] As R7

//DATA = (CurrentAxesRegisterSelectCommandValue & (~0x07)) | (FORCE_SELECT_R7)

Step3:

Read the Status1 register. For X-Axes (RD0, RD1, RD2, RD3), Y-Axes (RD4 ~ RD7), Z-Axes (RD8 ~ RD11) Please refer to the Table in section 4.6

Status0 Of n-Axes = inportb(base+(CH*4+0))

Status1 Of n-Axes = inportb(base+(CH*4+1))

Status2 Of n-Axes = inportb(base+(CH*4+2))

Status3 Of n-Axes = inportb(base+(CH*4+3))

Step4:

Get the EL+/EL status

For

EL- = Status1.BIT0

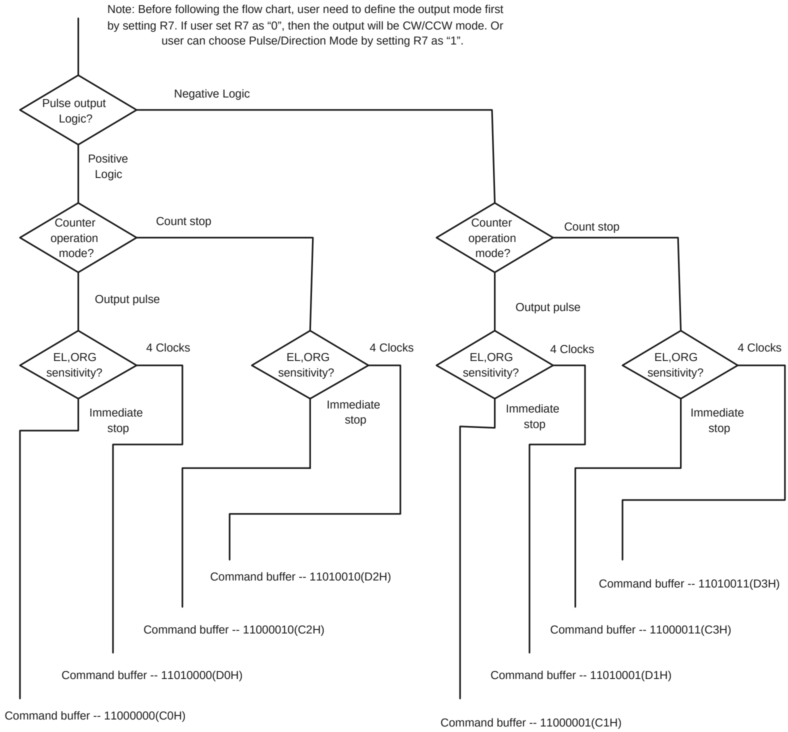
EL+ = Status1.BIT1

EL- Of n-Axes = ((Status1 Of n-Axes) & 0x01)>>0

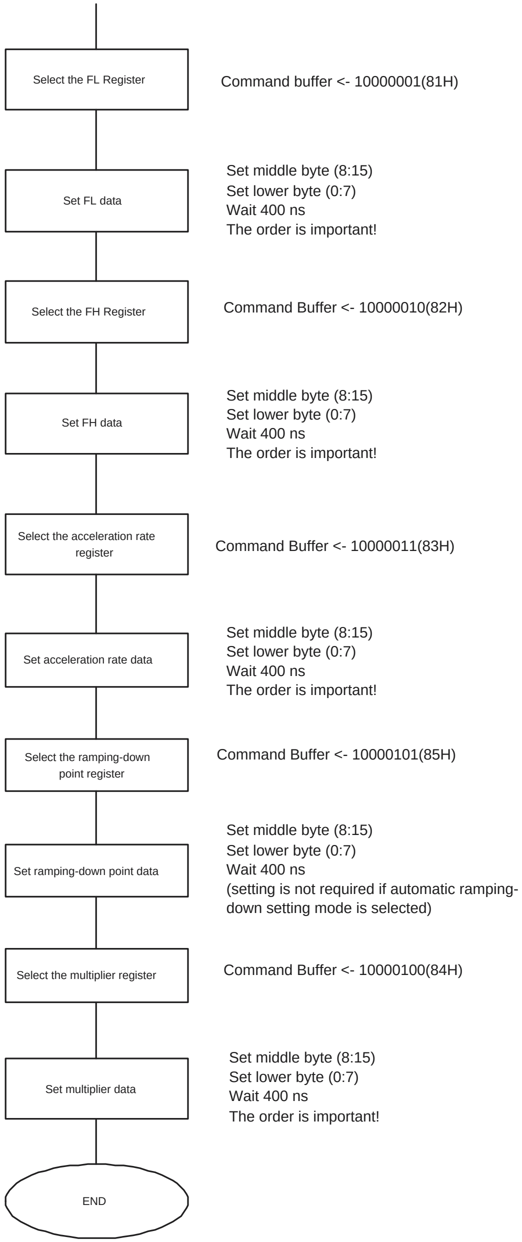
EL+ Of n-Axes = ((Status1 Of n-Axes) & 0x02)>>1

4.7 Typical Operational Procedures

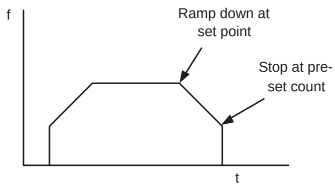
4.7.1 Initialization

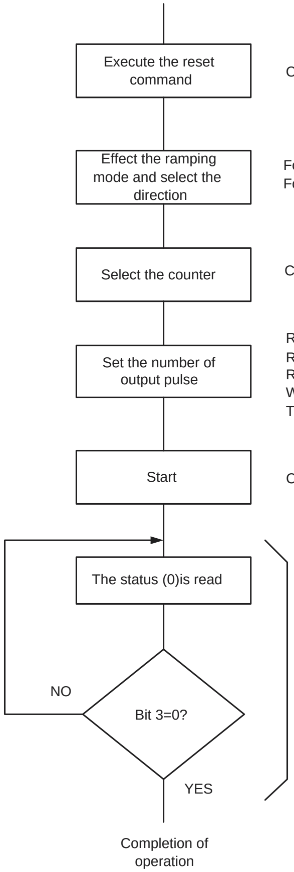


4.7.2 Setting Speed Data



4.7.3 Constant Speed Preset Model





Command buffer <- 00001000(08H)

For(+)direction: command buffer <- 01000100(44H)
For(-)direction: command buffer <- 01001100(4CH)

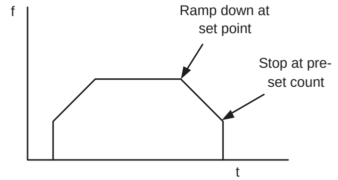
Command Buffer <- 10000000(80H)

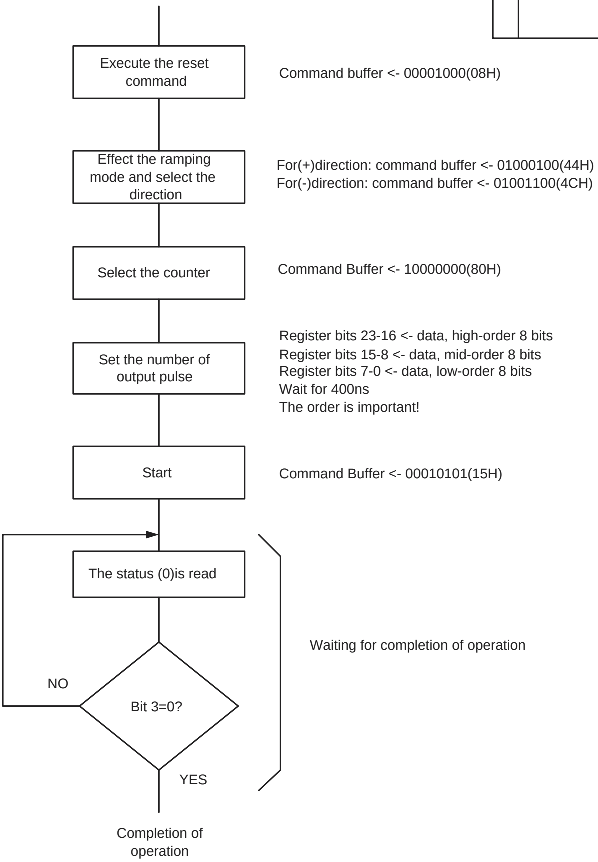
Register bits 23-16 <- data, high-order 8 bits
Register bits 15-8 <- data, mid-order 8 bits
Register bits 7-0 <- data, low-order 8 bits
Wait for 400ns
The order is important!

Command Buffer <- 00010101(15H)

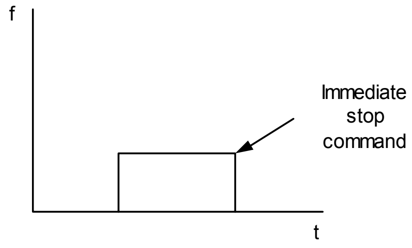
Waiting for completion of operation

4.7.4 High Speed Preset Model





4.7.5 Constant Speed Continuous Mode



Execute the reset command — Command buffer <- 00001000(08H)

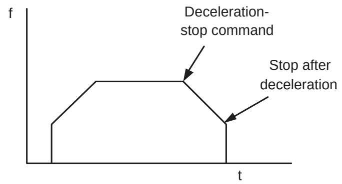
Effect the manual mode and set the direction — For(+)direction: command buffer <- 01000000(40H)
For(-)direction: command buffer <- 01001000(48H)

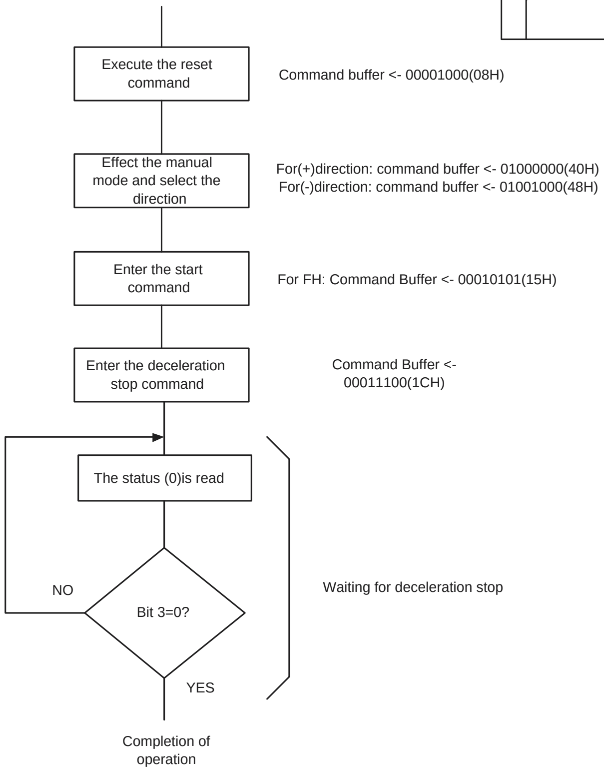
Enter the start command — For FL: Command Buffer <- 00010000(10H)
For FH: Command Buffer <- 00010001(11H)

Enter the immediate stop command — Command buffer <-00001000(08H) (reset command)

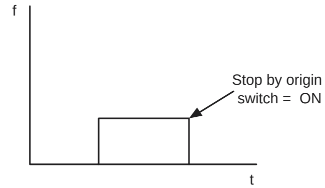
Completion of operation

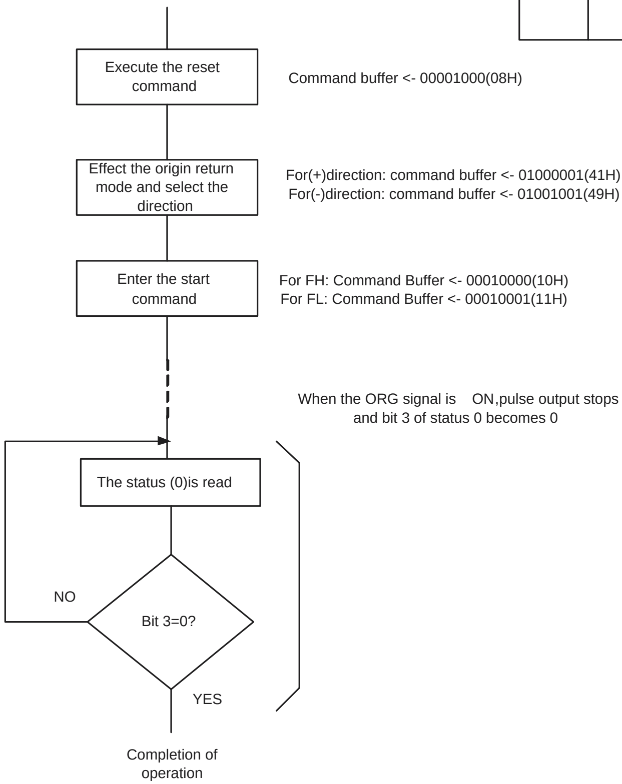
4.7.6 High Speed Continuous Mode



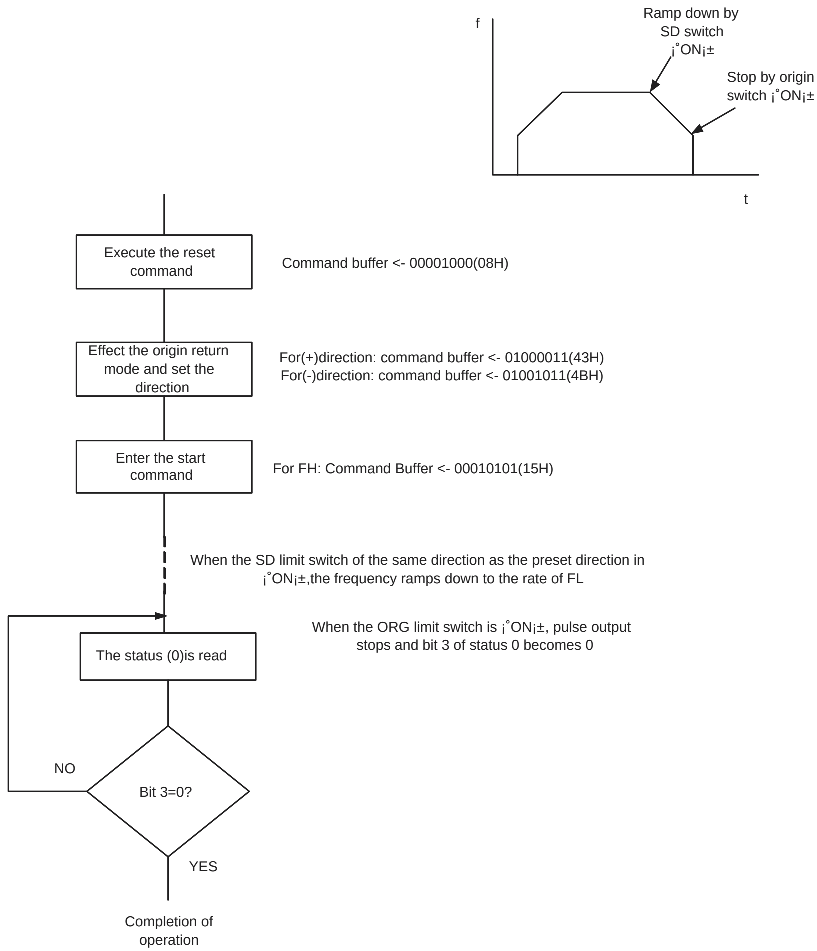


4.7.7 Constant Speed Origin Return Model





4.7.8 High Speed Origin Return Model



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APPENDIX

A

Diagrams

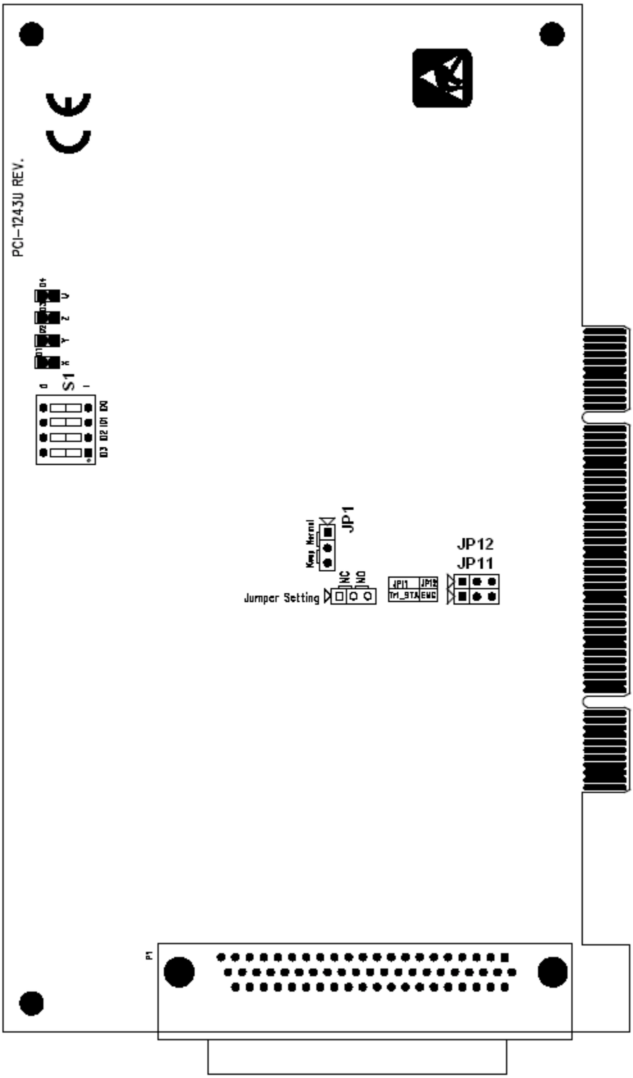
This chapter provides diagrams for some of the major functions of PCI-1243U.

Sections include:

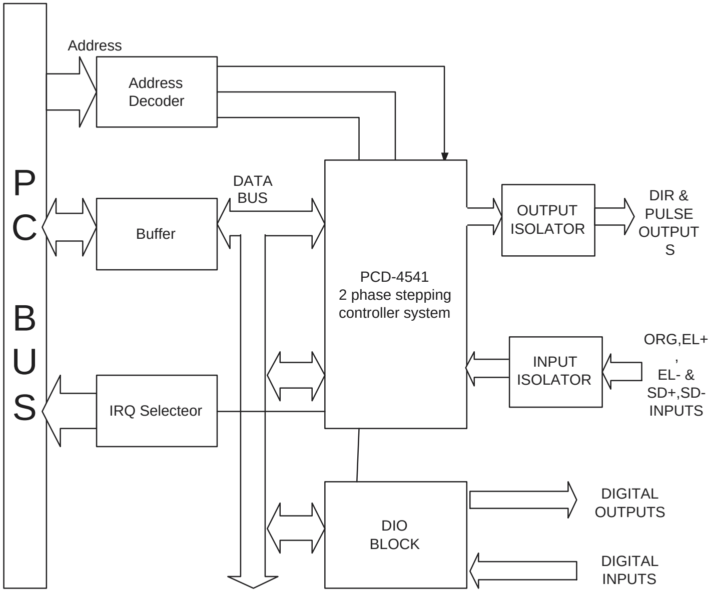
- Jumper and Switch Layout
- PCI-1243U Block Diagram
- Output Circuit Diagram

Appendix A Diagrams

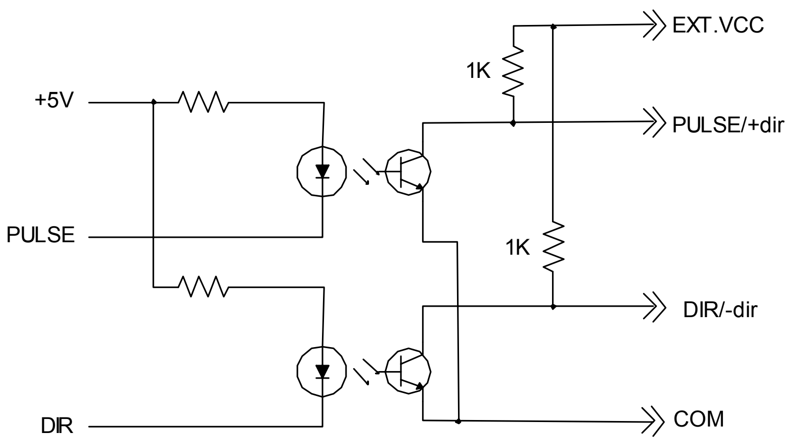
A.1 Jumper and Switch Layout



A.2 PCI-1243U Block Diagram



A.3 Output Circuit Diagram



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APPENDIX B

Simple Stepping Motor Driver

This chapter provides extra diagrams related to the simple stepping motor driver.

Appendix B Simple St. Motor Driver

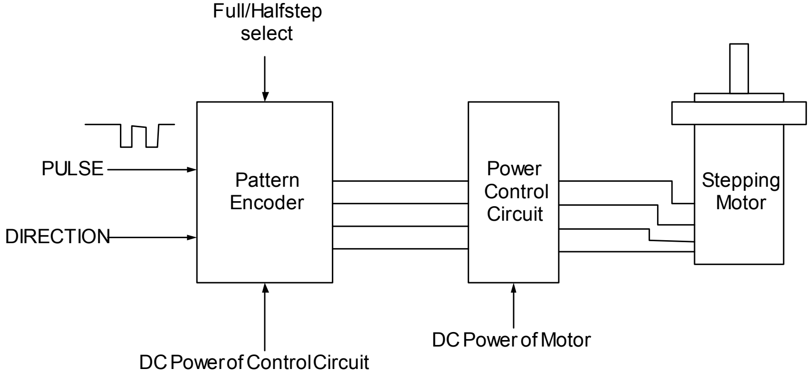


Figure B.1: Simple Stepping Motor Driver Block Diagram

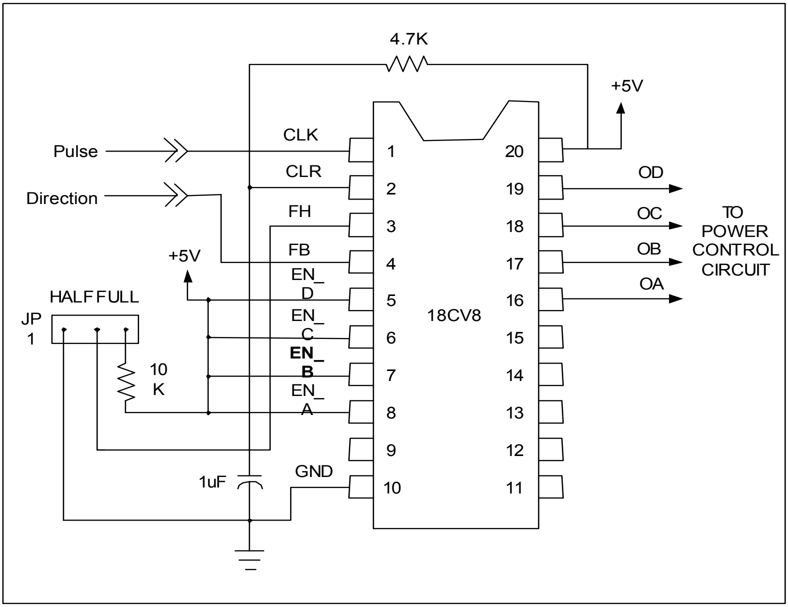
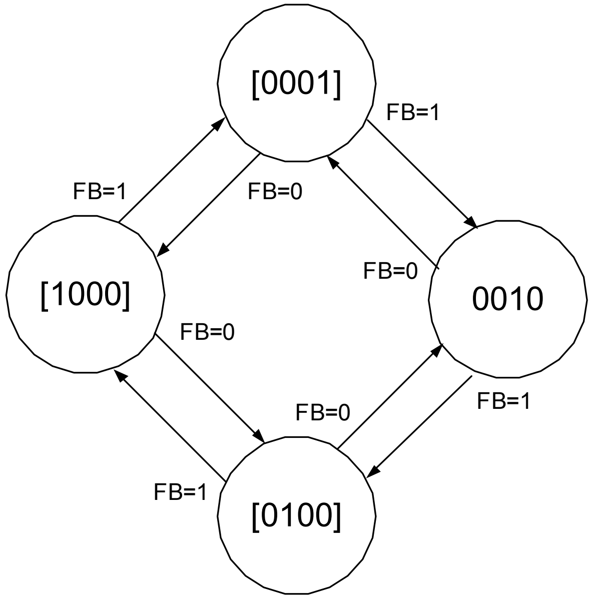


Figure B.2: Pattern Encoder Connection



OutputPattern=[ODOCOBOA]
FH= 1 in all states

Figure B.3: JP1 at Full Step Control

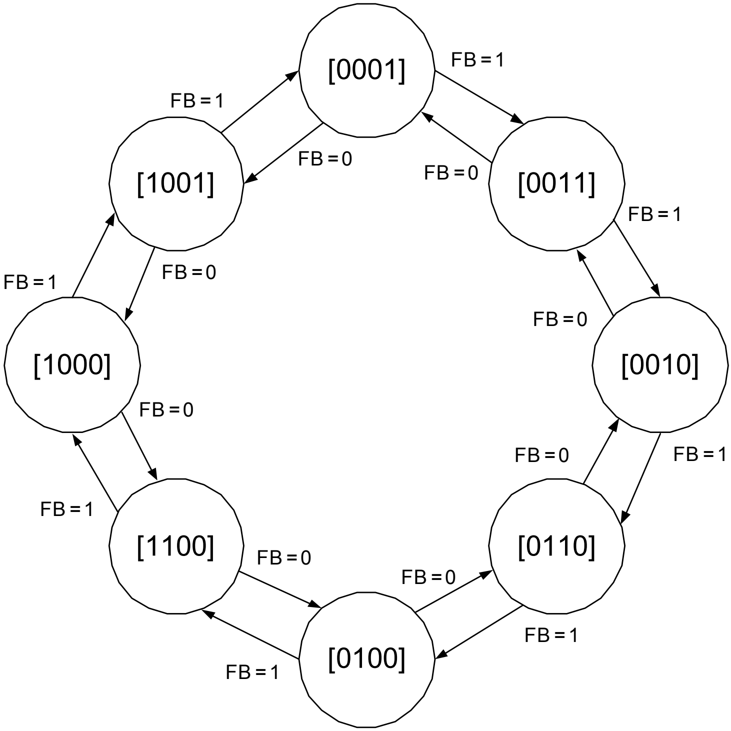


Figure B.4: JP1 at Half Step Control

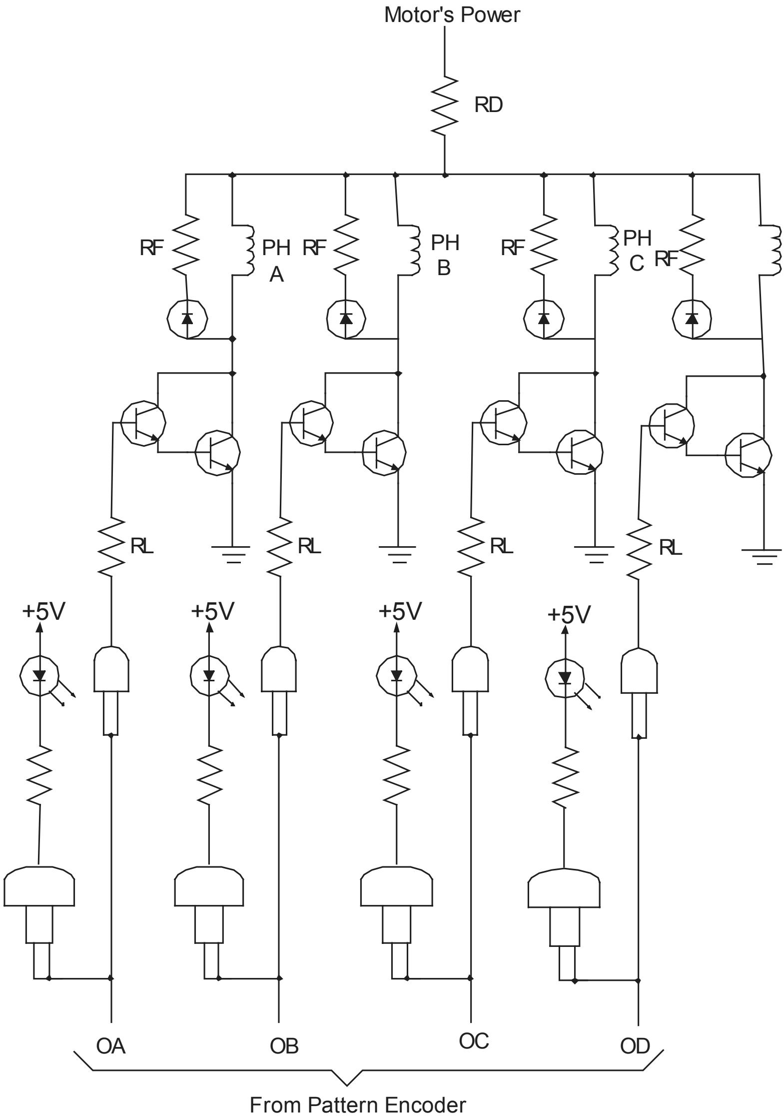


Figure B.5: 4-Phase Stepping Motor Power Control Circuit

APPENDIX

C

Home Function

An accurate home position is fundamental for every precision machine. In order to manage the various requirements for the home position, PCI-1243U provides a total of 4 home modes.

This chapter gives users an overview of each home mode and its characteristics. After reading this chapter, it should be easier to choose the most suitable home mode for your application.

Appendix C Home Function

C.1 How to Read the Home Velocity Profile

Since the homing process is quite complex, PCI-1243U provides a 'Home Pattern Graph' for each mode to give users a clear concept about how the home function proceeds.

In the Home velocity profile, there are three types of sensor inputs that can be found, and they are all high-active. "HOME" represents the status of the home sensor, and the raising edge means the home sensor was triggered. "LMT" means limit switch, and the raising edge means the limit switch was activated. "ECZ" represents the index signal of the encoder.

The pattern in each case shows the velocity profile of the motor. It starts from a solid dot, and the arrow represents the direction of movement, which then ends up at a hollow dot. There are only two movement speeds that can be defined in the homing process. One is the start up speed FL, and the other is the maximum speed FH. For velocity, the slants means speed up or slow down.

C.2 Home Mode0

In Home mode0, the motor will start up at low speed FL, and accelerate to high speed FH towards the home sensor. Once the home sensor is reached, the motor will decelerate. And then stop when the speed is down to FL.

If the home sensor was active at start up, or the limit switch was met first, the motor will go in the opposite direction when reaching the limit switch. Then it will keep moving until it crosses the home sensor, and finally search the home signal again.

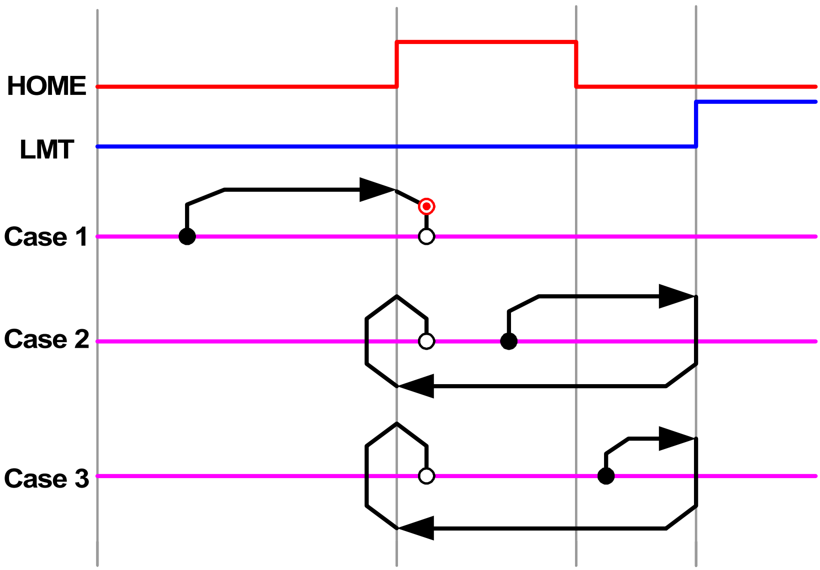


Figure C.1: Velocity Profile of Home Mode0

C.3 Home Mode1

In Home Mode1, the motor will start up at speed FL, and accelerate to speed FH towards the home sensor. Once the home sensor is reached, the motor will decelerate. The main difference with mode0 is that in this mode, the motor will go back and approach the home again with low speed FL. This makes the stop point even closer to the raising edge of the home sensor.

If the home sensor was active at start up, or the limit switch was met first, the motor will go in the opposite direction when reaching the limit switch. Then it will keep moving until it crosses the home sensor, and finally search the home signal again.

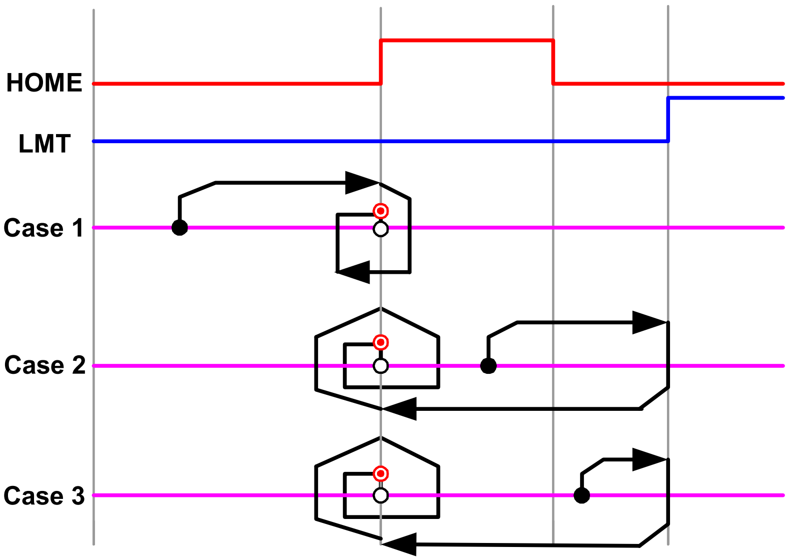


Figure C.2: Velocity Profile of Home Mode1

C.4 Home Mode6

In Home mode6, the motor will start up at low speed FL, and accelerate to high speed FH towards the limit switch. Once the limit switch is reached, the motor will stop immediately.

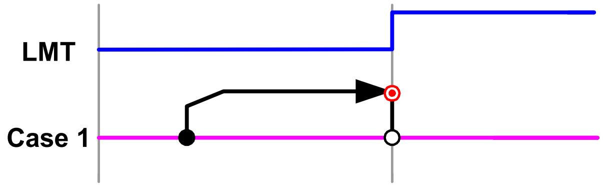


Figure C.3: Velocity Profile of Home Mode6

C.5 Home Mode9

In Home mode9, the motor will start up at speed FL, and accelerate to speed FH towards the home sensor. Once the home sensor is reached, the motor will decelerate and go backward at speed FL. Once the motor leave the triggered area of home sensor, it will stop immediately.

If the home sensor was active at start up, or the limit switch was met first, the motor will go in the opposite direction when reaching the limit switch. Then it will keep moving until it crosses the home sensor, and finally search the home signal again.

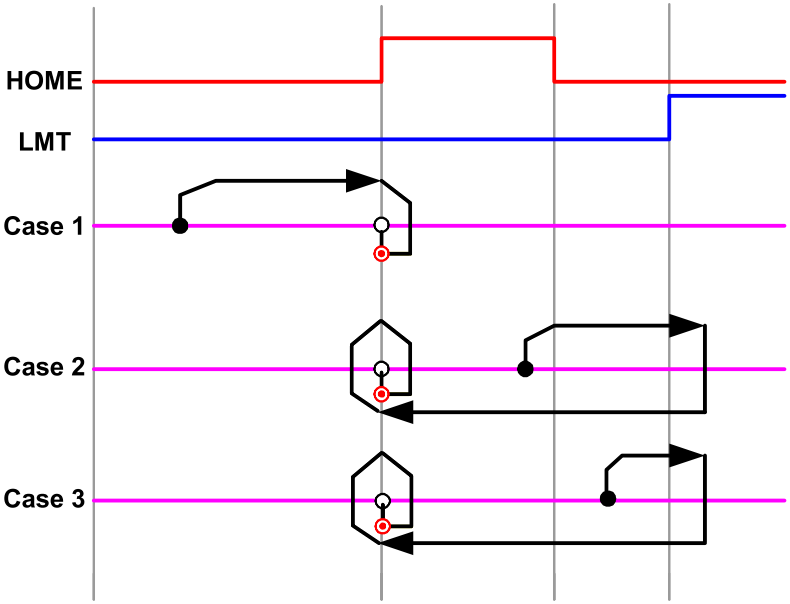


Figure C.4: Velocity Profile of Home Mode9