

USB-Interface CPD Board Series

HUSB-CPD434CB

HUSB-CPD434MS

User's Manual

Individual Board Information

Multifunctional High-speed NC Boards with
Circular Interpolation, Linear Interpolation, and Positioning

Tentative Version



Hivertec Inc.

<http://www.hivertec.co.jp/>

This manual fits the board of the following CPD series.

CPD430 series USB bus

HUSB – CPD434CB

HUSB – CPD434CB (D)

HUSB – CPD434MS

HUSB – CPD434CB (D)

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In this manual, safety precautions are classified as either Warnings or Cautions.



Warning

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. .



Caution

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage. .

1. Authorized For



Caution



The product and this manual are designed for those with the following knowledge.

- **A basic knowledge of installing and wiring expansion boards.**
- **A basic knowledge of electronic control devices and personal computers.**

2. Applicable Bus



Warning



The boards (products) described in this manual are applicable to PCI Local Bus Specification Rev. 2.1 (+5 V specifications). Do not use them in any environment where this bus is not operating.

3. Environmental Conditions



Warning

Store and use the board only under the following environmental conditions.

- ◆ Ambient operating temperature: 0 to 50 °C
- ◆ Ambient operating humidity: 20% to 85% (with no condensation)
- ◆ Ambient storage temperature: -15 to 75 °C
- ◆ Ambient storage humidity: 10% to 90% (with no condensation)
- ◆ Atmosphere: No corrosive gas, inflammable gas, oil mist, or dust
- ◆ Altitude: 3,000 m above sea level max.
(Lower upper level of temperature ranges by 2 °C for every 300 m.)

4. Transportation and Installation



Warning



Touch a metal object to discharge static electricity from your body before touching the board. Static electricity may cause board failure.



Do not wrap the board in any wrapping material that easily carries a static charge, such as bubble wrap. Static electricity may cause board failure.



Do not touch the edge connector on the board. Contamination on the edge connector may cause operating errors.



Do not place any heavy object on the board. Heavy object may damage components on the boards, possibly causing board failure.



Set the jumpers on the board before mounting it to the computer. If the jumpers are set with the power supply turned ON, the settings may not be recognized correctly possibly causing operating errors.



Set the board jumpers correctly. Incorrect settings may cause operating errors.



Always turn OFF the power supply to the computer and disconnect the power supply cable before installing the board. Installing the board without removing the power supply cable may cause board failure. Furthermore, the device may exhibit unexpected operation.



When installing the board in the computer, be sure the board is straight to the connector in the computer and press in the board so that the gold-plated edge connector is deeply inserted into the PCI connector. If the board is inserted at an angle or not inserted deeply enough, poor contact may cause operating error or board failure.



When installing the board in the computer, use mounting brackets and mounting screws to secure it firmly. Improper securing of the board may cause operating errors.



Caution












Do not drop the board or handle it roughly. Vibration or shock may cause board failure.






Do not touch the solder surface of the board with your hands. Sharp points on the components may cause injury.



5. Wiring

 Warning	
	Always turn OFF the power supply to the computer and disconnect the power supply cable before wiring connectors to exterior lines or before connecting or disconnecting such connectors. Performing this work without removing the power supply cable may cause board failure. Furthermore, the device may exhibit unexpected operation.
	When wiring connectors to exterior lines, check connector signal tables carefully and wire all lines correctly. Incorrect wiring may cause board failure or burning.
	Always keep external power supply within ratings. Using a power supply that is not within ratings may cause board failure, burning, or operating errors.
	Always keep circuits connected to the I/O circuits within the rated currents and voltages. Using circuits that are not within ratings may cause board failure, burning, or operating errors.
	Use the recommended connectors for external lines. Using any other connector may cause operating errors because of faulty contact.
	Always lock connectors for external lines. A connector that is not locked may come loose, possibly causing operating errors because of faulty contact.
	Do not pull on or place heavy objects on cables for external wiring. The connector may come loose and faulty contact may cause operating errors.
	Separate cables for external wiring as far as possible from AC power cables, motor cables, or other cables that generate excessive noise. Noise may cause operating errors.

6. Trial Operation and Adjustment

 Warning	
	Always debug the program completely before using the board to drive a device. Any error in the program may cause unexpected operation.
	When using sample programs provided with the product to operate a device, always start at low speed and be sure that settings match the mechanical system before attempting operation. Operating with settings that do not match the mechanical system may result in unexpected operation.

7. Disposal

 Warning	
	Abide by all applicable laws and ordinances when disposing of a board.

Manual Configuration

The following manuals are provided with CPD-series Boards.

1. User's Manual : Individual Board Information

This manual provides the following information for individual CPD Boards.

- (1) Hardware information
- (2) Installation procedures for accessory software
- (3) Operating procedures for sample software
- (4) Operating procedures for **the Let's try to move**
- (5) Other specific information for individual Board

2. CPD Board Series User's Manual : Software

This manual describes the following software information for the CPD Board Series.

- (1) Library functions (library function level 1 : VC++, VB, and DOS)
- (2) Driver functions (device driver interface library : VC++, VB, and DOS)

3. CPD Board Series User's Manual : Common Information (this manual)

This manual provides information common to all of the CPD Board Series in tutorial style.

- (1) Basic operating methods for CPD Boards (including samples using library functions)
- (2) Descriptions of CPD Board applications (samples of using library functions as reference required for a broader range of application)
- (3) Descriptions of registers based on the PCL6045
- (4) Other information

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1. Introduction

The USB-Interface CPD Board Series has the following four models of Motion Control boards:

HUSB-CPD434CB	Main board + Connector board.....Standard type
HUSB-CPD434CB(D)	Main board + Connector board + DIN mount
HUSB-CPD434MS	Main board
HUSB-CPD434MS(D)	Main board + DIN mount

This user's manual provides information for each of the above USB-interface Motion Control Boards

Use this manual together with the *CPD Board Series User's Manual: Common Information*, which contains information common to all of the Motion Control Boards in the CPD Board Series.

- HUSB-CPD434 is based on the USB 1.1. specification.
- The CPD Board Series Motion Control board provides, depending on the model, 4-axis positioning 2- to 4-axis interpolation and 2-axis circular interpolation.

1.1. About This Manual

This manual provides the following information.

- Information on functions specific to the HUSB-CPD434
 - 1) Axis combinations
- Hardware Information
 - 1) Port addresses
 - 2) Board settings
 - 3) Connector allocation
 - 4) Servomotor interface and stepping-motor interface
 - 5) Machine interface
- Software Startup Guide
 - 1) Installation of the provided software
 - 2) Explanation of the sample programs
 - 3) Testing operation "Trial Tour"

1.2. Provided Software

The following software is provided with this Board. Refer to this software when reading this manual to facilitate understanding.

[Provided software for CPD430 series] Device Drivers for Windows 98, Windows NT and Windows 2000	
Library Functions (Level 1)	Provides functions necessary for basic operations.
Device Driver (DLL for I/F)	Device driver for complex, high-end applications.
Sample Programs	Sample software showing usage of library functions.
"Trial Tour" for Windows	Enables minimal operations by simply connecting Board to computer. It can also be used to check connections.

2. HUSB-CPD434 Specification

2.1. HUSB-CPD434 Specification

	Item	Specification	Notes	
Basic Specifications	Axis control	(1)Positioning system	1 to 4 axes	
		(2)Linear interpolation system	2 to 4 axes simultaneously	
		(3)Circular interpolation system	2 axes simultaneously	
		(4)Pulsar feed system	1 to 4 axes	
	Command system	Command pulses	Pulse-train output by differential driver	Control LSI: PCL6045 series
		Position command range	-134,217,728 to 134,217,727 pulses	
		Command coordinate	Relative coordinate command	
		Reference range at continuous feed	Unlimited (but not applicable to the position range of the counter)	Available of the cyclic counting for the position every 360deg.
		Position override	Possible only in positioning system	
	Speed Control	Speed range	0.1pps to 6.5Mpps (Multiplication 0.1 to 100)	
Constant control of linear speed		2-axes circular, linear interpolation down by :square root 3-axes linear interpolation down by : cubic root 4-axes linear interpolation down by : cubic root		
Speed override		(1)Constant feed(without acc/dec): available in all cases (2)Limited to the positioning, linear interpolation and continuous feed. allowing it during acc/dec duration.		
Acceleration/ deceleration control (Acc/Dec control)	Automatic Acc/Dec system	(1)Positioning and linear interpolation: Linear acc/dec system, S-curve acc/dec system and the partial S-curve acc/dec system are available. ·Triangular drive peak prevention function available ·Asymmetrically sloped acc/dec possible. (2)For circular interpolation: Automatic acc/dec possible except S-curve		
Function Specifications	Origin-returning control	Origin-returning method	13 returning methods for the sensor's origin,Z-phase origin,ELS shared origin (Each returning is done in a single process by the single command)	
		Origin search	Available	
		Getting out of origin area	Available	
	UP/DOWN counters		Command position counter (Command pulse count: length 28-bit)	4 counter per axis
			Machine position counter (Encoder pulse count: length 28-bit)	
			General-purpose counter (Pulse count: length 28-bit)	
			Error counter for runaway detection (Counter: length 16-bit) (Difference between the values of the encoder and the command.)	
	Comparators (CMP)		CMP1 and CMP2 : Soft-limit use comparing positive and negative limits	5 counter per axis
			CMP3,4 and 5: General-purpose(used for changing speed or starting another axis on comparison of the coordinate)	
	Inputs for encoder or pulsar		Each axis has a common input terminal for the encoder/pulsar input signal.	
	Backlash compensation		Compensated every turn of the direction except the circular interpolation system.	
	Positioning-control-start function (PCS) Idling pulse function		Starts positioning by PCS signal during continuous feed. (Only for positioning system)	
			Function of improving stepping motor acceleration characteristics.	
Vibration suppress at a stop		Function of vibration suppression when the stepping motor stops.		
Machine interface		+/ELS,OLS,DLS, and encoder A,B, and Z-phase per axis. (All with photocoupler isolation)		
Servo interface		Command-pulse output: differential output		
		Input: Servo alarm and in-position per axis (all with photocoupler insulation)		
		Output: Servo reset, servo ON, and servo error counter clear per axis. (all with photocoupler insulation)		
Conditions	Ambient temperature	0 to 50 centigrade (no condensation)		
	Power Supply	MS: DC24V +/- 10% 550mA Max CB: DC5V +/- 5% 1150mA Max		
	Dimensions	With DIN mounting : 161.5 x 111 x 75mm Without DIN mounting : 161.5 x 111 x 40mm		

Table 2. 1-1 HUSB-CPD434 Specifications

2.2. Mechanical Details

(1) Dimensions of Main and Connector Boards (Millimeters)

HUSB-CPD434CB and HUSB-CPD434MS.....Main board
 ACB-CPD434CB.....Connector board

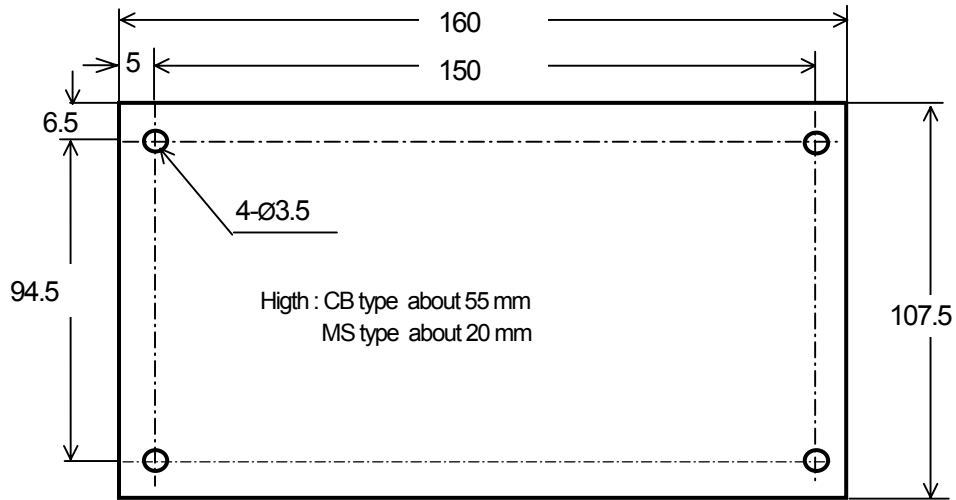


Fig. 2. 2-1 Dimensions of Main and Connector Boards

(2) Dimensions of DIN Rail Mount Base (Millimeters)

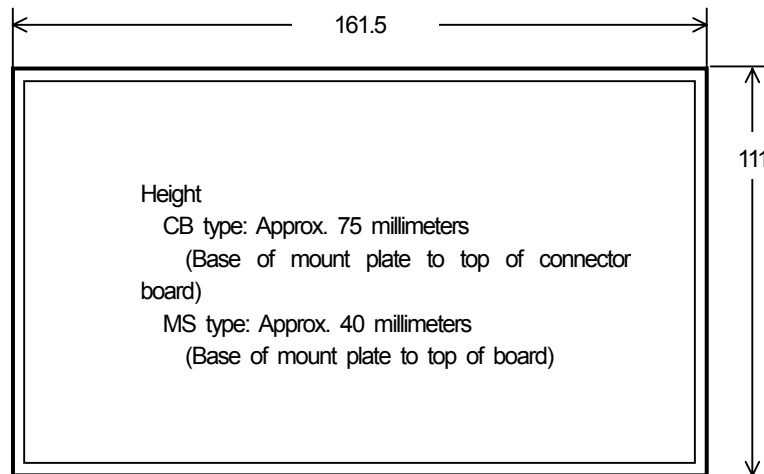


Fig. 2. 2-2 Dimensions of DIN Rail Mount Base

2.3. Combinations of Operations between Axes

The following combinations of control modes (operation combinations) are available between axes. The independent operation includes positioning, zero return, continuous feed, pulse feed and timer (The timer mode is not a movement but it uses one of the axes).

Combination of Axes	HUSB-CPD434	Remarks
Linear Interpolation and Independent Axis	Operation of independent axis is possible during interpolation.	Simultaneous operation is possible but is not required (each operation can start separately).
Circular Interpolation and Independent Axis	Operation of independent axis is possible during circular operation.	
Circular Interpolation and Linear Interpolation	Linear interpolation is possible during circular operation.	

Table 2. 3-1 Combinations of Operation between Axes

2.4. Special Remarks on USB CPD Series

Care must be taken on the following point when configuring a port for USB CPD series boards:

(1) Plugging and unplugging of USB cables.

See Section 2.5 "USB Board Recognition and Communication Time Lag".

2.5. USB Board Recognition and Communication Time Lag

(1) Recognition of USB Boards - Attaching and Detaching

1. Recognition of CPD boards (device):Takes place when starting up application (library for driver I/F).
2. Devices attached after startup:.....Cannot be recognized.
3. Device detached after startup:.....Becomes uncontrollable.
4. USB connection made during operation:....Adversely affects USB communication of the application (causes communication shutdown).
5. Attaching and detaching CPD board (device):....Restart use (communication) after 5 seconds of attaching a device.
Re-attach a device after 5 seconds of detaching a device.

(2) USB Board Communication Time Delay

The HUSB-CPD434 boards takes a little more time than what is specified in [USB 1.1 Specification: Bulk communication]

The time needed for driver communication (time delay) is shown in the below table. Note the time delay slightly varies by the computer being used.

No.	Driver Function	msec	No.	Driver Function	msec
1	cp430_GetDeviceCount()	—	8	cp430_rReg()	10
2	cp430_GetDeviceInfo()	—		cp430_wReg()	6
3	cp430_OpenDevice()	—	9	cp430_rPortB()	4
4	cp430_CloseDevice()	—		cp430_wPortB()	2
5	cp430_rMstsW()	4	10	cp430_rBufDW()	8
6	cp430_rSstsW()	4		cp430_wBufDW()	4
7	cp430_wCmdW()	2			

Note:

1. The time delay shown in the above table is for continuous operation of the driver function. The time needed for individual operation of a function is obtained by deducting 1msec from corresponding numbers.
2. The time delay for functions of level 1 library function is obtained by adding up relevant numbers (in msec) from the above table.

2.6. Setup of Option Ports

The following two items of the option port are set up during initialization.

Note: This part is different from the description in “CPD434 Board Basic Operation (Program Configuration)” in Section 6 “Basic Operation” in the User’s Manual (Common Information). See Section 4.6 “How to Access Boards” for detail.

	Items to Set up	Board Signal Name	Items to Select	Where to Set up
1	ELS Polarity	+/- xELS	N.O. (Detected when coupler current is OFF) N.C. (Detected when coupler current is ON)	Option port ELPOL b3 - b0 : U, . . . , X
2	DLS/PCS Selection	xDLS/xPCS	Used as DLS speed reduction sensor/PCS signal	Option port DLS/PCS

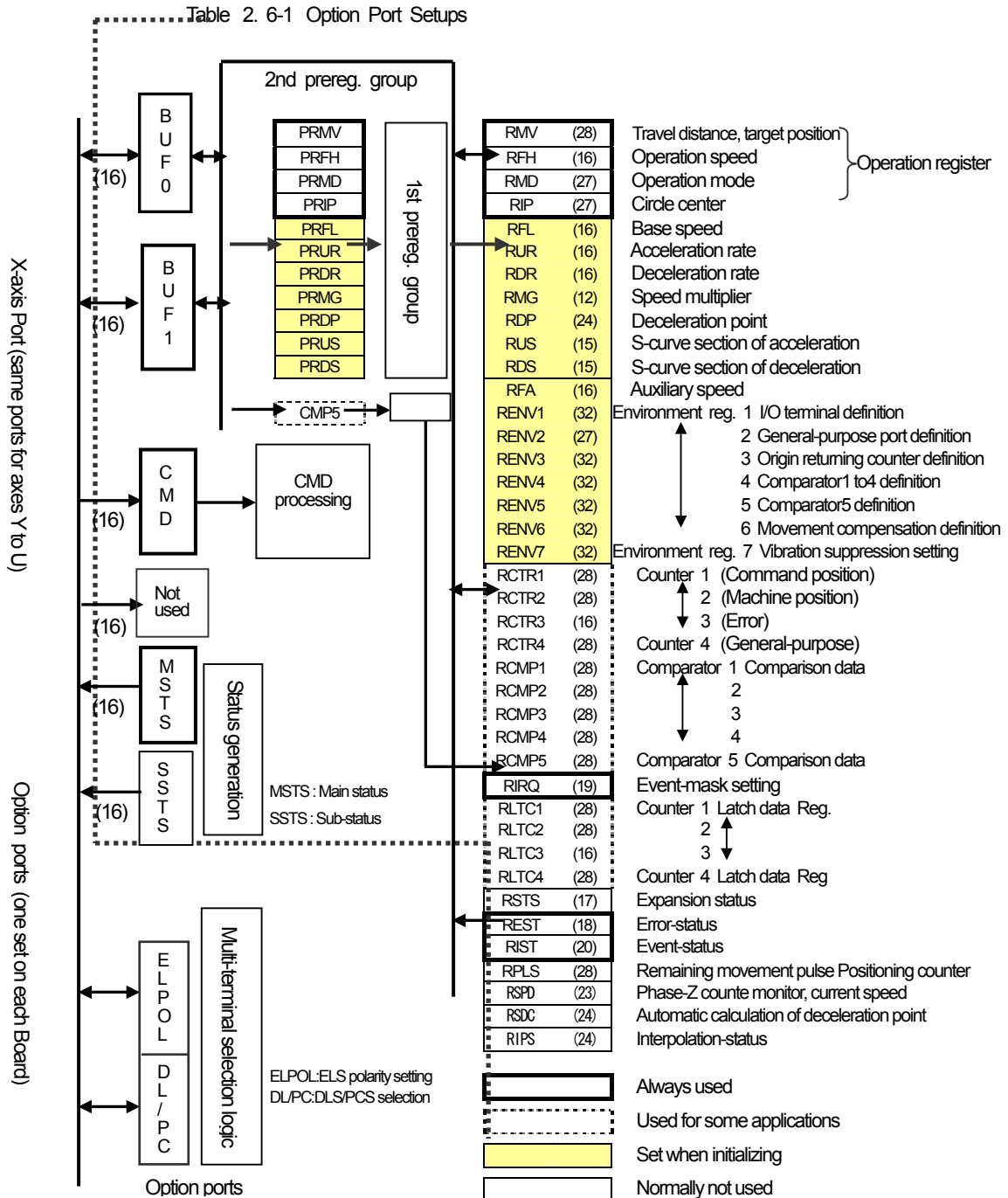


Fig. 2. 6-1 Port and Register Arrangement

3. Hardware

3.1 BlockDiagram

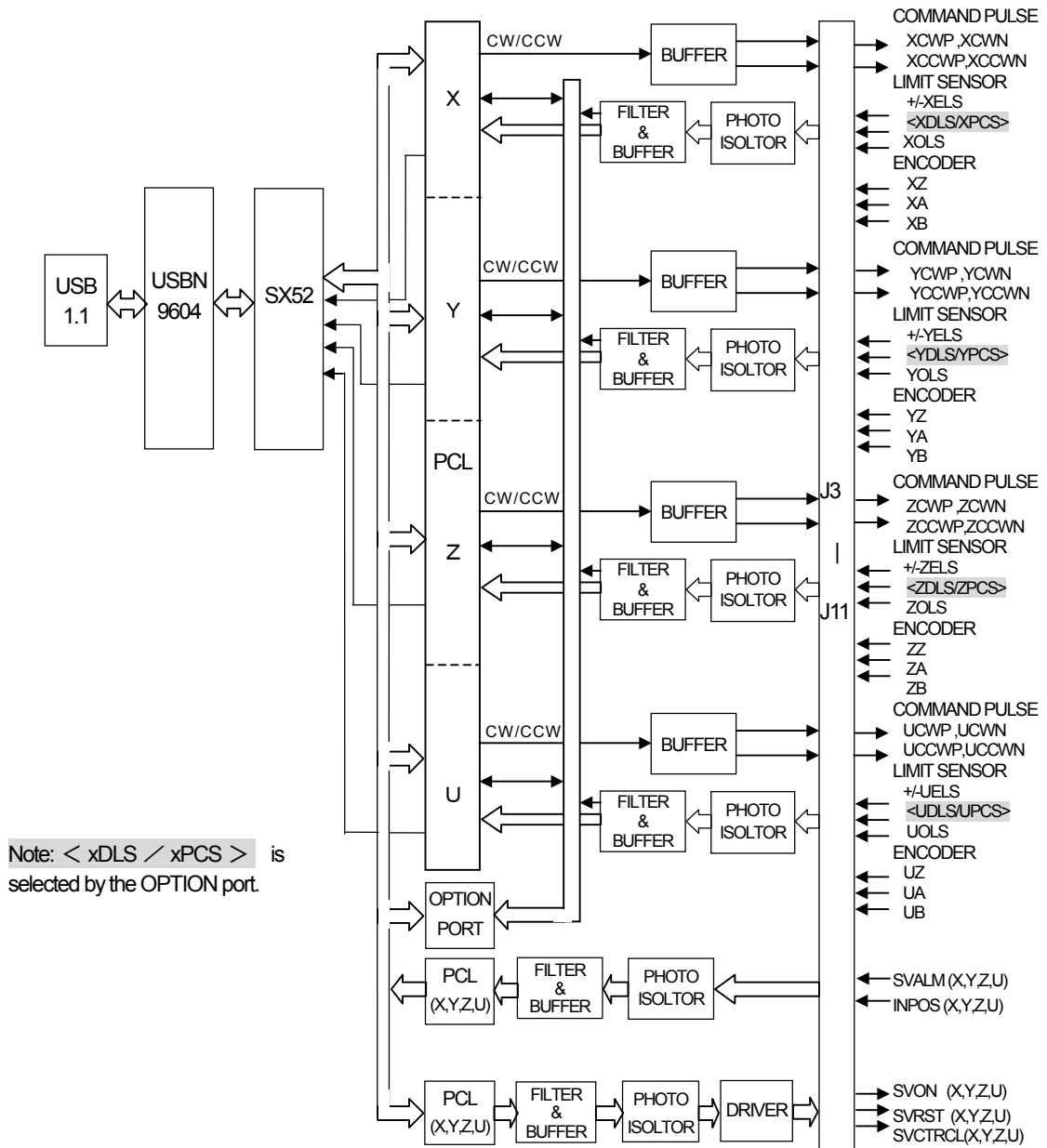


Table 3. 1-1 BLOCK DIAGRAM of HUSB-CPD434

3.2. Port Addresses

3.2.1. Port Addresses

I/O maps are used for all ports. Table 3.2-1 shows the ports of the HUSB-CPD434 board

Note: Knowledge of the following table is not required to use the provided software library (level 1) functions. The following table is required when using the provided software driver functions.

Classification	Address (hex)	Name	Read (INP)	Name	Write (OUT)
PCL 6045 X axis	+ 0	MSTS	Main status (15 to 0) Sub-status, general-purpose I/O port IN	CMD	Command
	+ 2	SSTS		OTP	Not used (reserved)
	+ 4	BUF0		BUF0	I/O buffer OUT (15 to 0)
	+ 6	BUF1		BUF1	I/O buffer OUT (31 to 16)
PCL 6045 Y axis	+ 8	MSTS	Main status (15 to 0) Sub-status, general-purpose I/O port IN	CMD	Command
	+ A	SSTS		OTP	Not used (reserved)
	+ C	BUF0		BUF0	I/O buffer OUT (15 to 0)
	+ E	BUF1		BUF1	I/O buffer OUT (31 to 16)
PCL 6045 Z axis	+10	MSTS	Main status (15 to 0) Sub-status, general-purpose I/O port IN	CMD	Command
	+12	SSTS		OTP	Not used (reserved)
	+14	BUF0		BUF0	I/O buffer OUT (15 to 0)
	+16	BUF1		BUF1	I/O buffer OUT (31 to 16)
PCL 6045 U axis	+18	MSTS	Main status (15 to 0) Sub-status, general-purpose I/O port IN	CMD	Command
	+1A	SSTS		OTP	Not used (reserved)
	+1C	BUF0		BUF0	I/O buffer OUT (15 to 0)
	+1E	BUF1		BUF1	I/O buffer OUT (31 to 16)
Option ports	+80	ELPOL	Status of ELS polarity for each axis	ELPOL	Status of ELS polarity for each axis
	+82	DLS/PCS	Status of DLS/PCS input selection	DLS/PCS	Status of DLS/PCS input selection
	+84	CMP4	STA output when CMP4 condition is established	CMP4	STA output when CMP4 condition is established
	+86	CMP5	STP output when CMP5 condition is established	CMP5	STP output when CMP5 condition is established

Table 3. 2-1 Board Addresses

3.2.2. Option Port

Option ports are provided to each Board. The port functions are described below.

(1) Sets or reads the ELS polarity setting for each axis (ELPOL). When the power is turned ON, the bits are set to 0 (N.C.).

ELS polarity is set during writing. Setup status is confirmed during readout.

N.O.: ELS detected when current to coupler is ON.

N.C.: ELS detected when current to coupler is OFF.

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	UELS	ZELS	YELS	XELS

(2) Sets or reads the DLS/PCS input selection (DLS/PCS). When the power is turned ON, the bits are set to 0 (DLS)

Selects the DLS signal input as PCS signal input for connector J1 (X to U axes).

Selection status of DLS/PCS input signal is confirmed during reading.

Bit n = '0' : DLS signal input

Bit n = '1': PCS input signal

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	UPCS	ZPCS	YPCS	XPCS

- (3) Sets or reads the simultaneous start signal (STA) when the Comparator 4 (CMP4) comparison condition is established. When the power is turned ON, the bits are set to 0 (output disabled).
 Writing sets the output mask of simultaneous start signal (STA) when the Comparator 4 (CMP4) comparison condition is established.
 Reading confirms the output mask status when the Comparator 4 (CMP4) comparison condition is established.
 Bit n = '0' : Output mask
 Bit n = '1': Output enabled

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	U-axis	Z-axis	Y-axis	X-axis

- (4) Sets or reads the simultaneous stop signal (STP) when the Comparator 5 (CMP5) comparison condition is established. When the power is turned ON, the bits are set to 0 (output disabled).
 Writing sets the output mask of simultaneous stop signal (STP) when the Comparator 5 (CMP5) comparison condition is established.
 Reading confirms the output mask status when the Comparator 5 (CMP5) comparison condition is established.
 Bit n = '0' : Output mask
 Bit n = '1' : Output enabled

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	0	U-axis	Z-axis	Y-axis	X-axis

3.3. HUSB-CPD434 Board Types

The following four board types are available:

HUSB-CPS434CB:	Main board + Connector board	Standard type
HUSB-CPD434CB(D)	Main board + Connector board + DIN mount plate	
HUSB-CPD434MS	Main board	
HUSB-CPD434MS(D)	Main board	+ DIN mount plate

3.4. HUSB-CPD434CB Board – Configuration and Wiring

3.4.1. HUSB-CPD434CB(D) Board - Names of Components

- Photo 2.1-1 shows the names of components of the HUSB-CPD434(D) board.

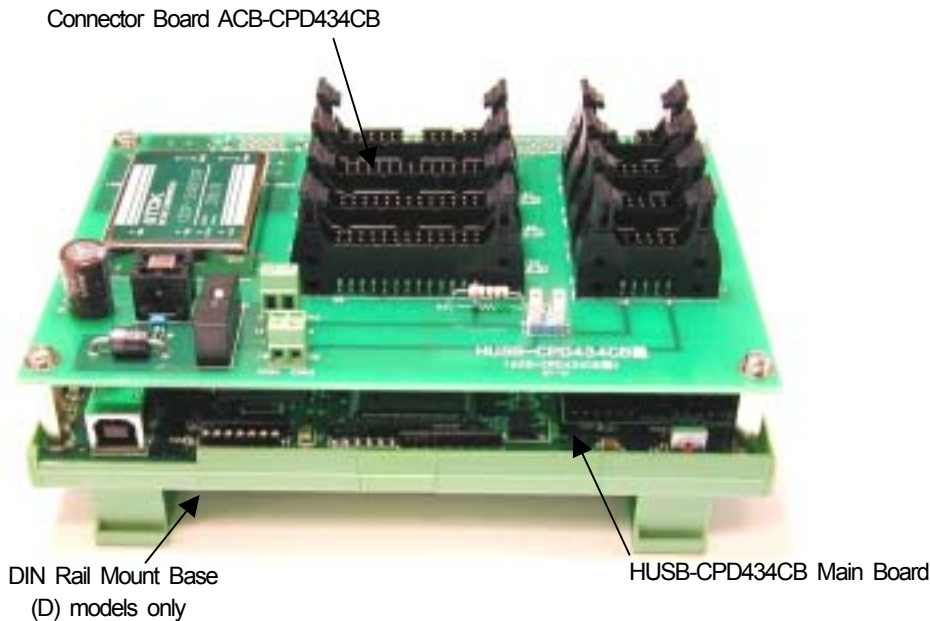


Photo 3. 4-1 HUSB-CPD434CB (D)

3.4.2. Use of HUSB-CPD434 with Open-Collector Input for Encoder Input

The encoder input for the HUSB-CPD434 is factory-set to differential input. To use the board with an open-collector input, remove the Connector Board ACB-CPD434CB and set the encoder input format selection jumpers P1, P2, P3 and P4 (see "Section 3.4.4. (2) Selection of Encoder Input Format")
 After setting, replace the Connector board as shown in Photo 3.4-1 and fasten with the four retaining screws. This is not necessary if the encoder is not used or differential input is used.

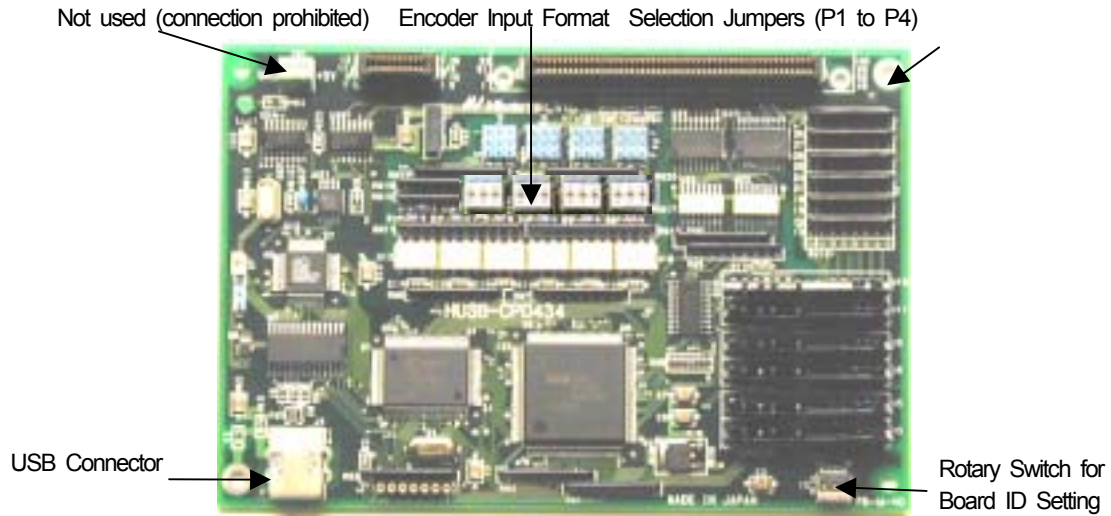
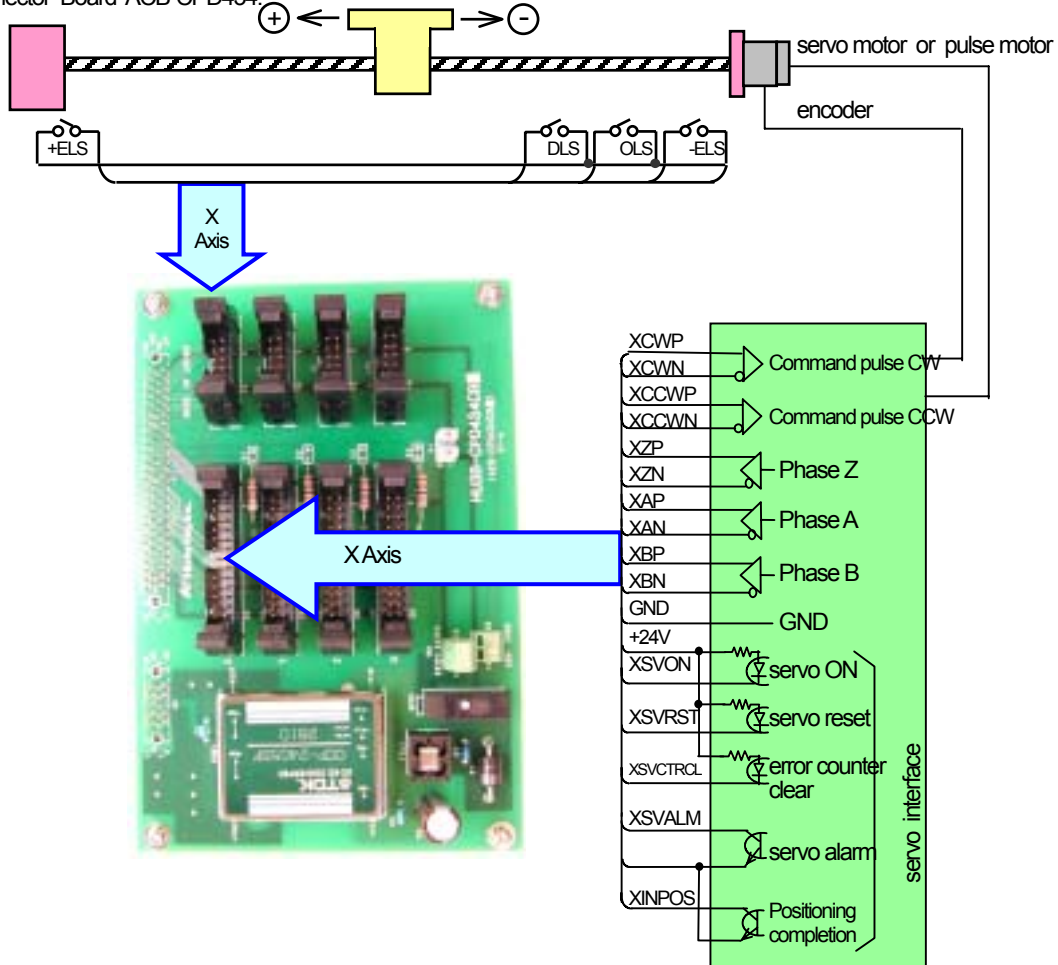


Photo 3. 4-2 HUSB-CPD434CB Main board

3.4.3. Cable Connections

The following figure shows the outline of the connection between the motor driver and machine sensor using the Connector Board ACB-CPD434.





Caution on USB Connector Plugging and Unplugging

Generally, hot-plug is allowed with USB connectors. With motion systems, however, it is NOT recommended to plug or unplug USB connectors while the system is activated.

3.4.4. Settings on HUSB-CPD434CB Main Board

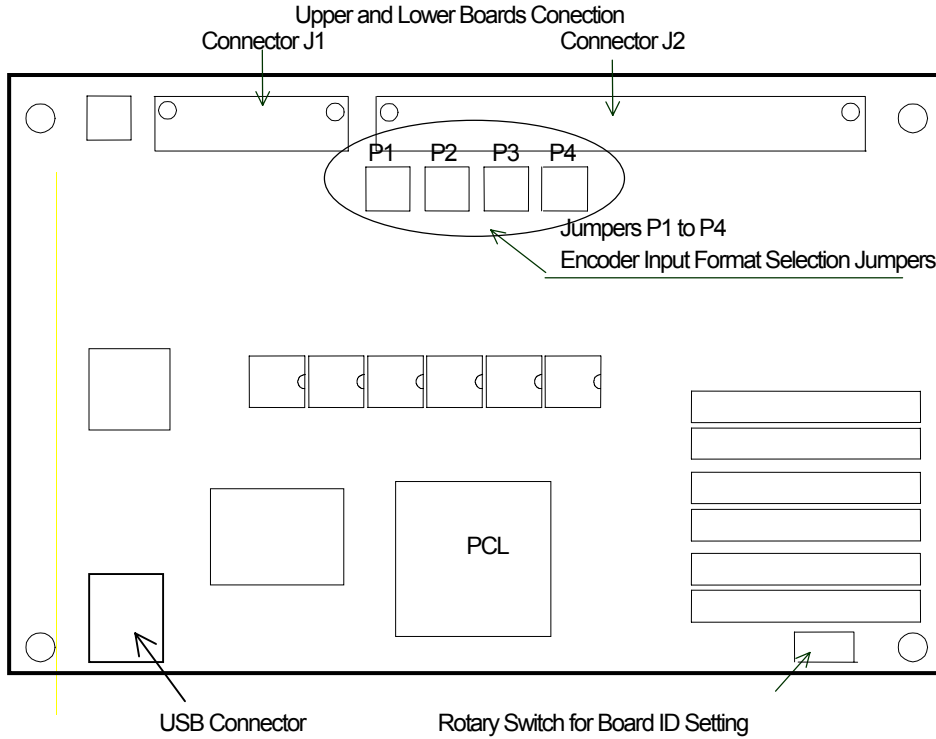


Fig. 3. 4-1 Jumper Pin Locations on the CPD434CB board

(1) Setting Rotary Switch for Board ID

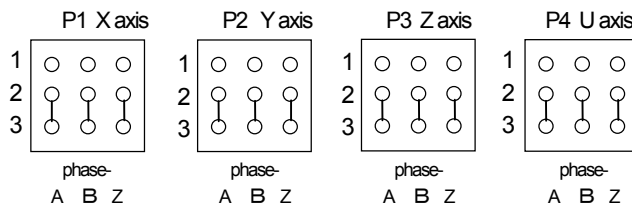
The board ID is the number with which the system identifies a HUSB-CPD434 controller. The arrow points the ID number being set (hexadecimal: 0 to F(15)).



Fig. 3. 4-2 Setting Board ID (factory-set '0')

(2) Selection of Encoder Input Format

The Encoder Input Format is set to the nature of the encoder output – differential or open-collector. (See Table 3.6-3 Encoder Input Circuit Conditions)



2-3 Jumpered: Differential connection (factory set)
 1-2 Jumpered: Open-collector connection

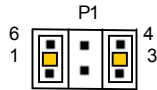
Fig. 3. 4-3 Encoder Input Circuit Format

3.4.5. Handling ACB-CPD434CB Connector Board

The connector board has MIL header connectors to distribute main board signals to relevant axes (J3 to J10). Also, it supplies +5VDC power to the main board through the +24V DC/DC converter. TB1 is the connector for the +24VDC power supply.

(1) TB1 Power Connector and P1 Jumper

- Power required: +24V \pm 10%, 800mA max
Jumper P1 makes the +24VDC coupler insulation power supplies EXPOW1 and EXPOW2 common.
For connection of TB1, see Table 3.4-3 TB1 Power Supply Connector.
- NFB is for protection against excessive current when +24V is reverse connected (1 A).
When an excessive current is detected, a white rod pops out. Press it back into its original position after correcting the fault.



COMMON1 and COMMON2 are common, so are EXTPOW1 and EXTPOW2 (factory set)
Fig. 3. 4-4 P1 Jumper

(2) Cutting Pattern for Pulse Motor Driver +5v Motor-Free (MF) Signal

Most pulse motors output their motor driver MF (motor free) signals (+5V) on the interface. In this case, cut the corresponding printed patterns E1 (X Axis) to E4 (U Axis) to introduce a 3k ohms resistor in the circuit, which allows the use of serve ON/OFF signals from the 24V line.

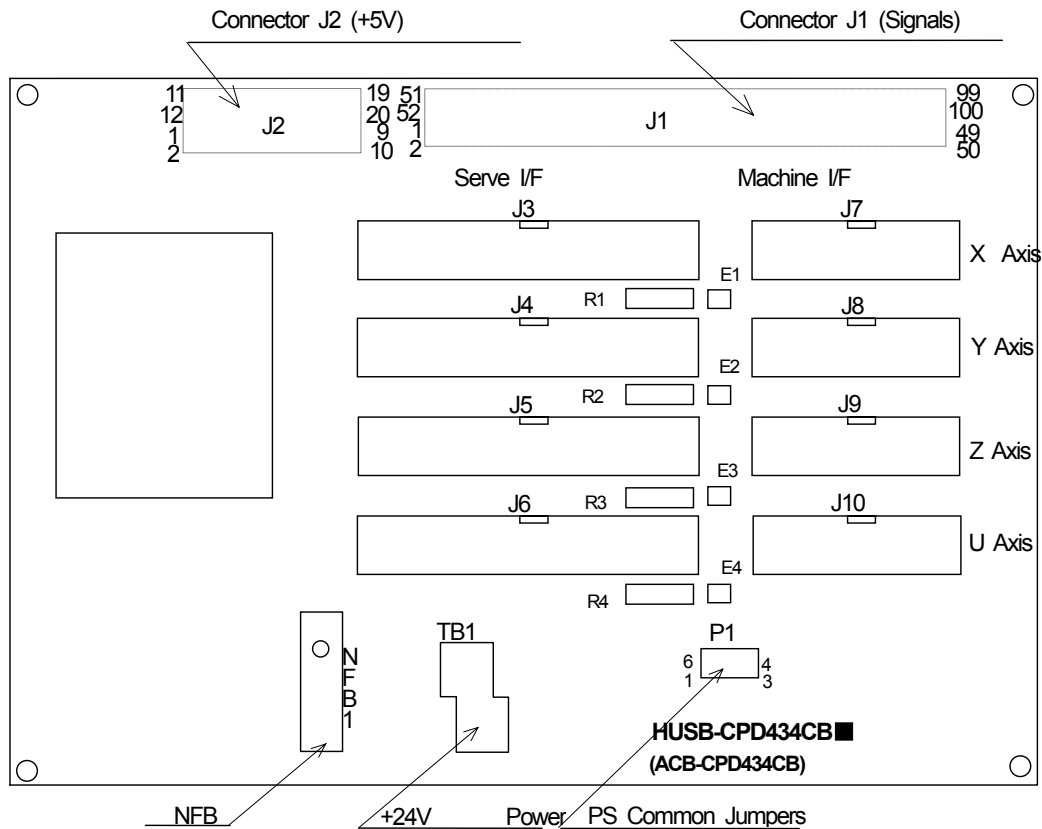


Fig. 3. 4-5 Connector Board ACB-CPD434CB Component Layout

(3) Signals on ACB Board Connectors

Table 3.4-1, below, shows pin allocations of ACB Connector Board connecting to the motor driver.

J3: X Axis, J4: Y Axis, J5: Z Axis, J6: U Axis

Pin	Signal Name		Pin	Signal Name	
1	EXTPOW2	+24V input supplied from TB1	2	EXTPOW2	+24V input supplied from TB1
3	SVALM	Servo alarm input	4	INPOS	Positioning completion input
5	SVON	Servo ON output	6	SVRST	Servo reset output
7	SVCTRCL	Deviation counter clear output	8		
9	COM2	Common GND for +24V	10	COM2	+24V GND common
11	GND	Common GND for +5V	12	GND	+5V GND
13	AP	Encoder A-phase input +	14	AN	Encoder A-phase input -
15	BP	Encoder B-phase input +	16	BN	Encoder B-phase input -
17	ZP	Encoder Z-phase input +	18	ZN	Encoder Z-phase input -
19	GND	Common GND for +5V	20	GND	+5V GND
21	CWP	CW command pulse output +	22	CWN	CW command pulse output -
23	CCWP	CCW command pulse output +	24	CCWN	CCW command pulse output -
25	+5V output	Driver coupler	26	+5V output	Driver coupler

Connector type: 26-pin flat cable connector XG4A-2631 (Omron)

Cable-side connector (reference): XG4M-2630 (for flat cable)

: XG5M-2632-N (for loose wire, crimping terminal)

Table 3. 4-1 J3 to J6 Connector Pin Assignment (connecting to motor driver)

Table 3. 4-2, below, shows the pin assignment for the connectors that connect to machine interface.

J7: X-Axis, J8: Y-Axis, J9: Z-Axis, J10: U-Axis

Pin	Signal Name		Pin	Signal Name	
1	EXTPOW1	+24V input supplied from TB1	2	XTPOW1	+24V input supplied from TB1
3	+ELS	CW-side end-limit input	4	-ELS	CCW-side end-limit input
5	DLS/PCS	Input for DLS/PCS positioning start	6		
7	OLS	Input of origin sensor	8		
9	COM1	Common GND for +24V	10	COM1	Common GND for +24V

Connector type: 10-pin flat cable connector XG4A-1031 (Omron)

Cable-side connector (reference): XG4M-1030 (for flat cable)

XG5M-1032-N (for loose wire, crimping terminal)

Table 3. 4-2 J7 to J10 Connector Pin Assignment (connecting to sensor)

Table 3.4-3, below, shows the terminal layout of the TB1 +24V power supply.

Terminal	Signal Name		Remarks
1A	EXTPOW1	+24V power input	COM1 and COM2 are made common by connecting between 3 and 4 on jumper P1. Likewise, EXTPOW1 and EXTPOW2 are made common by connecting between 1 and 6 on jumper P1
1B	COM1	GND for above	
2A	EXTPOW2	+24V power input	
2B	COM2	GND for above	

Table 3. 4-3 TB1 Power Supply Terminal

(4) HUSB-CPS434CB Board Connector Pin Assignment (reference)

Pin assignment of upper and lower board connectors, J1 and J2, are shown in Table 3. 4-4 and Table 3. 4-5 below.

PIN No.	Signal Name(Function)	PIN No.	Signal Name(Function)
1	+5V power out	51	+5V power out
2	+5V power out	52	+5V power out
3	GND	53	GND
4	GND	54	GND
5	XCWP (diff.positive out: CW pulse/pulse out)	55	ZCWP (diff.positive out: CW pulse/pulse out)
6	XCWN (diff.negative out: CW pulse/pulse out)	56	ZCWN (diff.negative out: CW pulse/pulse out)
7	XCCWP (diff.positive out: CCW pulse/pulse out)	57	ZCCWP (diff.positive out: CCW pulse/pulse out)
8	XCCWN (diff.negative out: CCW pulse/pulse out)	58	ZCCWN (diff.negative out: CCW pulse/pulse out)
9	YCWP (diff.positive out: CW pulse/pulse out)	59	UCWP (diff.positive out: CW pulse/pulse out)
10	YCWN (diff.negative out: CW pulse/pulse out)	60	UCW (diff.negative out: CW pulse/pulse out)
11	YCCWP (diff.positive out: CCW pulse/pulse out)	61	UCCWP (diff.positive out: CCW pulse/pulse out)
12	YCCWN (diff.negative out: CCW pulse/pulse out)	62	UCCWN (diff.negative out: CCW pulse/pulse out)
13	XAP (Encoder A-phase positive input)	63	ZAP (Encoder A-phase positive input)
14	XAN (Encoder A-phase negative input)	64	ZAN (Encoder A-phase negative input)
15	XBP (Encoder B-phase positive input)	65	ZBP (Encoder B-phase positive input)
16	XBN (Encoder B-phase negative input)	66	ZBN (Encoder B-phase negative input)
17	XZP (Encoder Z-phase positive input)	67	ZZP (Encoder Z-phase positive input)
18	XZN (Encoder Z- negative input)	68	ZZN (Encoder Z-phase negative input)
19	YAP (Encoder A-phase positive input)	69	UAP (Encoder A-phase positive input)
20	YAN (Encoder A-phase negative input)	70	UAN (Encoder A-phase negative input)
21	YBP (Encoder B-phase positive input)	71	UBP (Encoder B-phase positive input)
22	YBN (Encoder B-phase negative input)	72	UBN (Encoder B-phase negative input)
23	YZP (Encoder Z-phase positive input)	73	UZP (Encoder Z-phase positive input)
24	YZN (Encoder Z-phase negative input)	74	UZN (Encoder Z-phase negative input)
25	GND	75	GND
26	GND	76	GND
27	XSVALM (Servo alarm input)	77	ZSVALM (Servo alarm input)
28	XINPOS (Positioning completion input)	78	ZINPOS (Positioning completion input)
29	XSVON (Servo ON output)	79	ZSVON (Servo ON output)
30	XSVRST (Servo reset output)	80	ZSVRST (Servo reset output)
31	XSVCTRCL (Error counter clear output)	81	ZSVCTRCL (Error counter clear output)
32	YSVALM (Servo alarm input)	82	USVALM (Servo alarm input)
33	YINPOS (Positioning completion input)	83	UINPOS (Positioning completion input)
34	YSVON (Servo ON output)	84	USVON (Servo ON output)
35	YSVRST (Servo reset output)	85	USVRST (Servo reset output)
36	YSVCTRCL (Error counter clear output)	86	USVCTRCL (Error counter clear output)
37	COMMON2 (Common GND for +24V)	87	COMMON2 (Common GND for +24V)
38	COMMON2 (Common GND for +24V)	88	COMMON2 (Common GND for +24V)
39	EXTPOW2 (+24V power input for isolation supply)	89	EXTPOW2 (+24V power input for isolation supply)
40	EXTPOW2 (+24V power input for isolation supply)	90	EXTPOW2 (+24V power input for isolation supply)
41	+XELS (Input for positive limit sensor)	91	+ZELS (Input for positive limit sensor)
42	-XELS (Input for negative limit sensor)	92	-ZELS (Input for negative limit sensor)
43	XDLS/XPCS (Input for DLS/PCS positioning start)	93	ZDLS/ZPCS (Input for DLS/PCS positioning start)
44	XOLS (Input for origin sensor)	94	ZOLS (Input for origin sensor)
45	+YELS (Input for positive limit sensor)	95	+UELS (Input for positive limit sensor)
46	-YELS (Input for negative limit sensor)	96	-UELS (Input for negative limit sensor)
47	YDLS/YPCS (Input for DLS/PCS positioning start)	97	UDLS/UPCS (Input for DLS/PCS positioning start)
48	YOLS (Input for origin sensor)	98	UOLS (Input for origin sensor)
49	EXTPOW1 (+24V power input for isolation supply)	99	EXTPOW1 (+24V power input for isolation supply)
50	EXTPOW1 (+24V power input for isolation supply)	100	EXTPOW1 (+24V power input for isolation supply)

Table 3. 4-4 CPD434 CB J1 CONNECTOR PIN OUT (for reference)

PIN No.	Signal Name(Function)	PIN No.	Signal Name(Function)
1	+5V power supply	11	+5V power supply
2		12	
3		13	
4	+5V power supply	14	+5V power supply
5		15	
6		16	
7	GND	17	GND
8		18	
9		19	
10	GND	20	GND

Table 3. 4-5 CPD434 CB J2 CONNECTOR PIN OUT (for reference)

3. 5. Settings on HUSB-CPD434MS Board

3.5.1. Names of Components of HUSB-SPD434MS (D)

- Photos 3. 5-1 and 3. 5-2 show the names of main components of HUSB-CPD434MS (D).

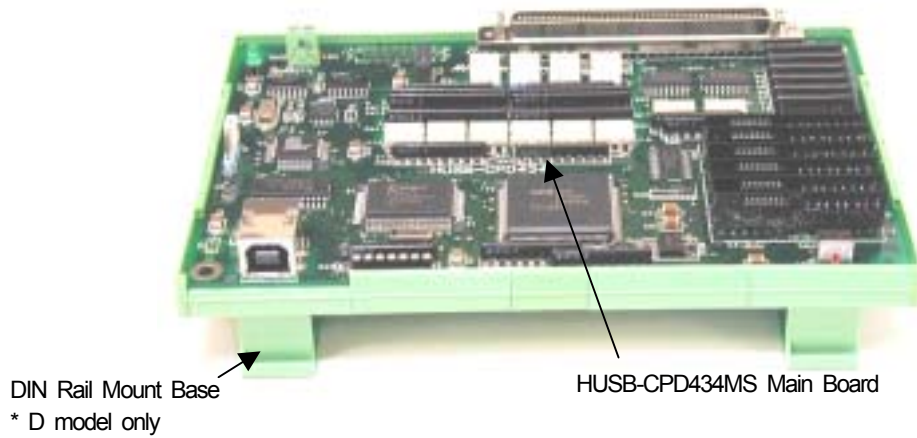


Photo 3. 5-1 HUSB-CPD434MS (D)

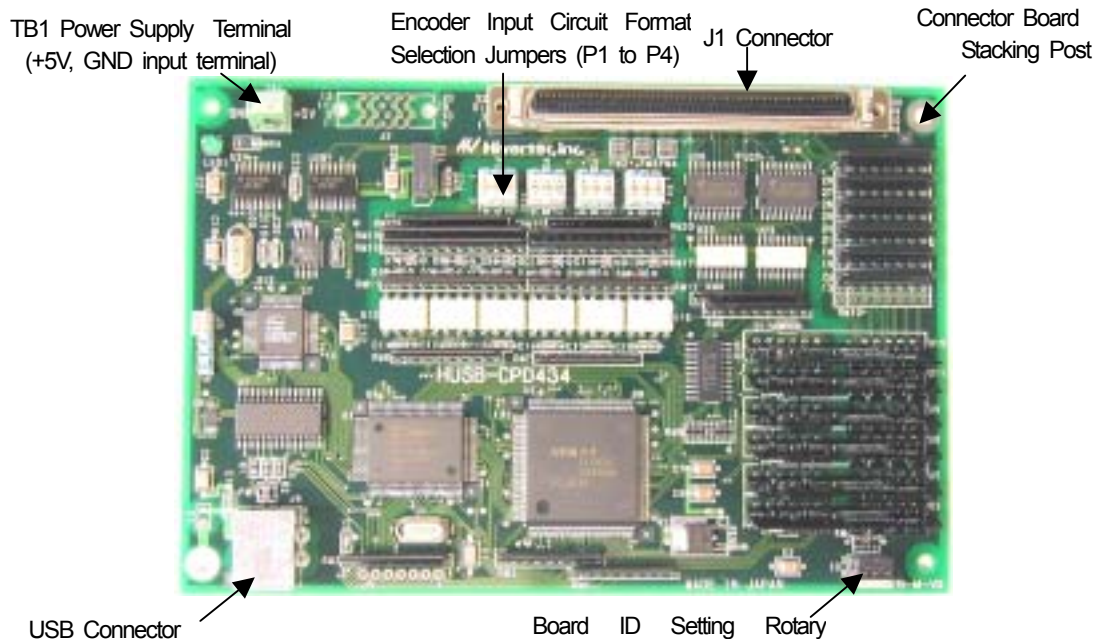


Photo 3. 5-2 HUSB-CPD434MS Main Board



Caution on USB Connector Plugging and Unplugging

Generally, hot-plugging is allowed with USB connectors. With motion systems, however, it is NOT recommended to plug or unplug USB connectors while the system is activated.

3.5.2. Settings on HUSB-CPD434MS Board

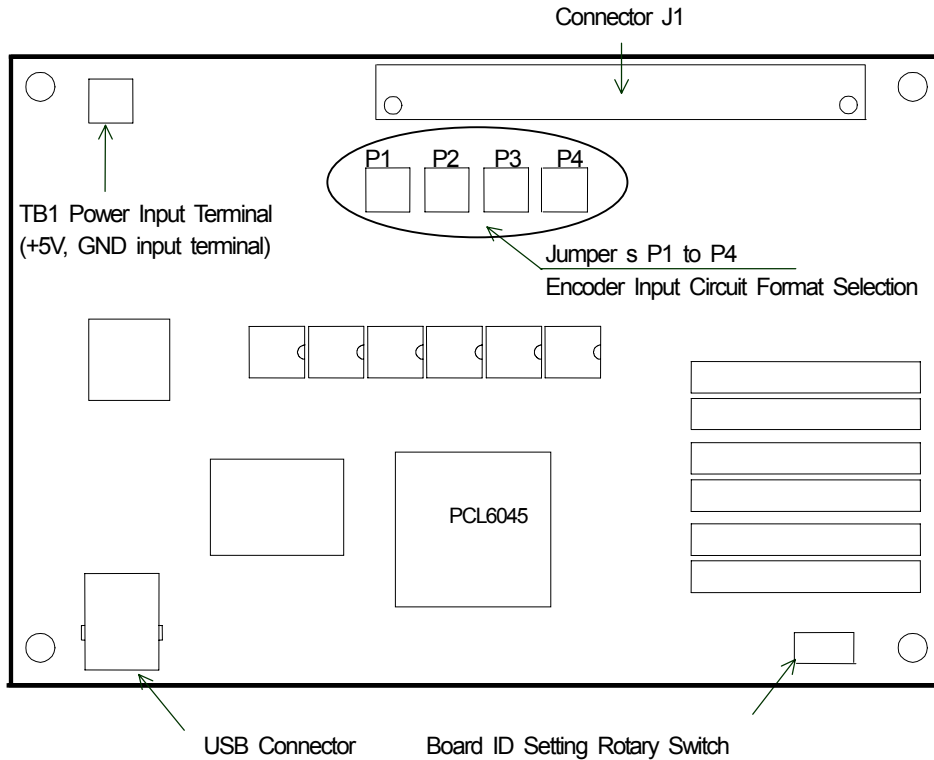


Fig. 3.5-1 Jumper Settings on CPD434MS Board

(1) Setting Rotary Switch for Board ID

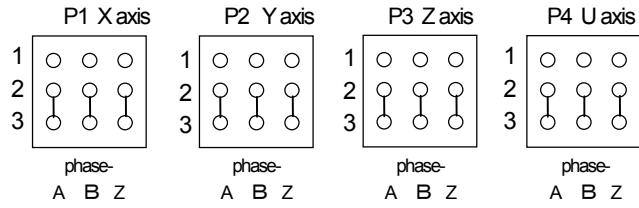
The board ID is the number with which the system identifies a HUSB-CPD434 controller. The arrow points the ID number being set (hexadecimal: 0 to F(15)).



Fig. 3.5-2 Setting Board ID (factory-set '0')

(2) Encoder Input Circuit Format Selection

The Encoder Input Format is set to the nature of the encoder output – differential or open-collector.
 (See Table 3.6-3 Encoder Input Circuit Conditions)



2-3 Jumpered: Differential connection (factory set)

1-2 Jumpered: Open-collector connection

Fig. 3. 5-3 Encoder Input Circuit Format

(3) TB1 Power Supply Input Terminal

Power (+5V) to the HUSB-CPD434MS board is supplied from an external power source via the TB1 terminal.

- Power supply: +5V \pm 5%, 1150mA max.
- TB1 connecting terminals

Terminal	Signal Name		Remarks
1	+5V	+5V supply from externalsource	
2	GND	Common	

Table 3. 5-1 Power Supply Input Terminal

(4) J1 Pin Assignment

PIN No.	Signal Name(Function)	PIN No.	Signal Name(Function)
1	+5V power out	51	+5V power out
2	+5V power out	52	+5V power out
3	GND	53	GND
4	GND	54	GND
5	XCWP (diff.positive out: CW pulse/pulse out)	55	ZCWP (diff.positive out: CW pulse/pulse out)
6	XCWN (diff.negative out: CW pulse/pulse out)	56	ZCWN (diff.negative out: CW pulse/pulse out)
7	XCCWP (diff.positive out: CCW pulse/pulse out)	57	ZCCWP (diff.positive out: CCW pulse/pulse out)
8	XCCWN (diff.negative out: CCW pulse/pulse out)	58	ZCCWN (diff.negative out: CCW pulse/pulse out)
9	YCWP (diff.positive out: CW pulse/pulse out)	59	UCWP (diff.positive out: CW pulse/pulse out)
10	YCWN (diff.negative out: CW pulse/pulse out)	60	UCW (diff.negative out: CW pulse/pulse out)
11	YCCWP (diff.positive out: CCW pulse/pulse out)	61	UCCWP (diff.positive out: CCW pulse/pulse out)
12	YCCWN (diff.negative out: CCW pulse/pulse out)	62	UCCWN (diff.negative out: CCW pulse/pulse out)
13	XAP (Encoder A-phase positive input)	63	ZAP (Encoder A-phase positive input)
14	XAN (Encoder A-phase negative input)	64	ZAN (Encoder A-phase negative input)
15	XBP (Encoder B-phase positive input)	65	ZBP (Encoder B-phase positive input)
16	XBN (Encoder B-phase negative input)	66	ZBN (Encoder B-phase negative input)
17	XZP (Encoder Z-phase positive input)	67	ZZP (Encoder Z-phase positive input)
18	XZN (Encoder Z- negative input)	68	ZZN (Encoder Z-phase negative input)
19	YAP (Encoder A-phase positive input)	69	UAP (Encoder A-phase positive input)
20	YAN (Encoder A-phase negative input)	70	UAN (Encoder A-phase negative input)
21	YBP (Encoder B-phase positive input)	71	UBP (Encoder B-phase positive input)
22	YBN (Encoder B-phase negative input)	72	UBN (Encoder B-phase negative input)
23	YZP (Encoder Z-phase positive input)	73	UZP (Encoder Z-phase positive input)
24	YZN (Encoder Z-phase negative input)	74	UZN (Encoder Z-phase negative input)
25	GND	75	GND
26	GND	76	GND
27	XSVAlM (Servo alarm input)	77	ZSVAlM (Servo alarm input)
28	XINPOS (Positioning completion input)	78	ZINPOS (Positioning completion input)
29	XSVON (Servo ON output)	79	ZSVON (Servo ON output)
30	XSVRST (Servo reset output)	80	ZSVRST (Servo reset output)
31	XSVCTRCL (Error counter clear output)	81	ZSVCTRCL (Error counter clear output)
32	YSVAlM (Servo alarm input)	82	USVAlM (Servo alarm input)
33	YINPOS (Positioning completion input)	83	UINPOS (Positioning completion input)
34	YSVON (Servo ON output)	84	USVON (Servo ON output)
35	YSVRST (Servo reset output)	85	USVRST (Servo reset output)
36	YSVCTRCL (Error counter clear output)	86	USVCTRCL (Error counter clear output)
37	COMMON2 (Common GND for +24V)	87	COMMON2 (Common GND for +24V)
38	COMMON2 (Common GND for +24V)	88	COMMON2 (Common GND for +24V)
39	EXTPOW2 (+24V power input for isolation supply)	89	EXTPOW2 (+24V power input for isolation supply)
40	EXTPOW2 (+24V power input for isolation supply)	90	EXTPOW2 (+24V power input for isolation supply)
41	+XELS (Input for positive limit sensor)	91	+ZELS (Input for positive limit sensor)
42	-XELS (Input for negative limit sensor)	92	-ZELS (Input for negative limit sensor)
43	XDLS/XPCS (Input for DLS/PCS positioning start)	93	ZDLS/ZPCS (Input for DLS/PCS positioning start)
44	XOLS (Input for origin sensor)	94	ZOLS (Input for origin sensor)
45	+YELS (Input for positive limit sensor)	95	+UELS (Input for positive limit sensor)
46	-YELS (Input for negative limit sensor)	96	-UELS (Input for negative limit sensor)
47	YDLS/YPCS (Input for DLS/PCS positioning start)	97	UDLS/UPCS (Input for DLS/PCS positioning start)
48	YOLS (Input for origin sensor)	98	UOLS (Input for origin sensor)
49	EXTPOW1 (+24V power input for isolation supply)	99	EXTPOW1 (+24V power input for isolation supply)
50	EXTPOW1 (+24V power input for isolation supply)	100	EXTPOW1 (+24V power input for isolation supply)

- Connector type Board side 100pin MDR type connector (half pitched)
- Type 102A0 – 52A2JL (SUMITOMO 3M)
- Cable side connector :Plug 101A0-6000EL (Crimp type)
- :Shell 103A0-A200-00 (aluminium die cast)

3.6. Servo and Machine Interface

3.6.1. Command Pulse Output and Driver Connection




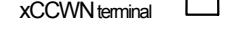
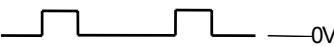

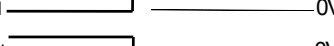
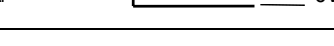
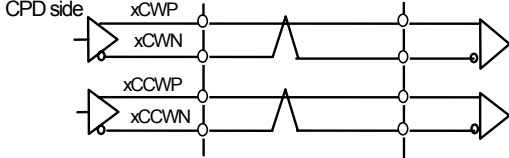
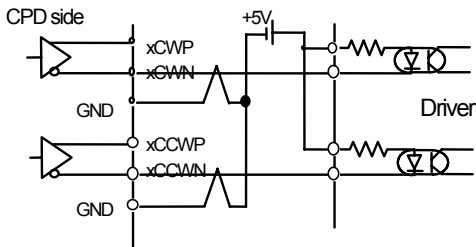
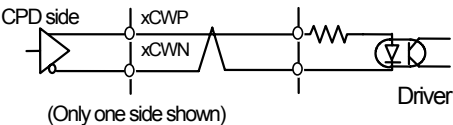
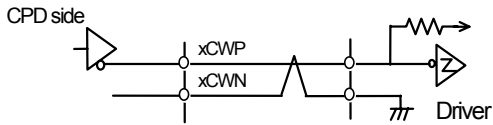
No.	Item	Contents
1	Electrical conditions Output pulse driver pulse width	ential driver (26LS31) mand pulse frequency 50% duty width pulse width of 200 microsecond when the frequency is less 2.4 Kpps
2	Signal format Individual pulse output method (Set in Environment Setting Register 1.)	xCWP terminal  0V xCWN terminal  0V xCCWP terminal  0V xCCWN terminal  0V
	Direction and pulse train method (Set the direction output logic in Environment Setting Register 1.)	Pulse-train output xCWP terminal  0V xCWN terminal  0V Direction output xCCWP terminal  0V xCCWN terminal  0V
3	Connection to motor driver by differential input	
	Connection to motor driver by coupler input	
	For the motor drivers ensuring differential connection to the coupler input	 (Only one side shown)
	Connection to motor driver by TTL input	 (Only one side shown)

Table 3. 6-1 Command Pulse Output Circuits

Note: Caution is required for speeds and cable lengths when the motor driver does not use a differential input. As guidelines, use 500 Kpps with a cable length of 3 m for coupler connections and 250 Kpps with a cable length of 1 m for TTL connections. Always check motor driver reception circuit specifications before application.

3.6.2. Axis Sensors and Servo Interface Input

Table 3. 6-2 shows the input circuit conditions.

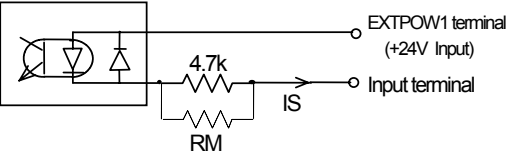
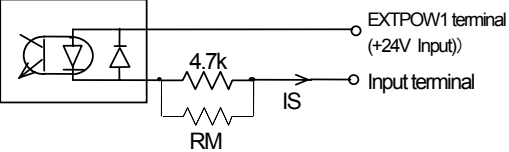
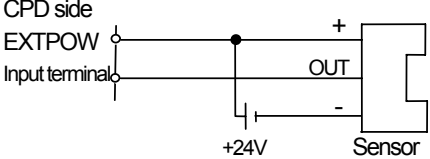
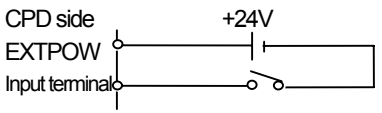
No.	Item	Contents
1	Circuit format 1 Shared by \pm xELS, xDLS, and xOLS.	 <p>Input terminal: $5\text{mA} \leq IS \leq 10\text{mA}$ EXTPOW1: standard 24-V input terminal</p>
2	Circuit format 2 Shared by xINPOS and xSVALM	 <p>Input terminal : $5\text{mA} \leq IS \leq 10\text{mA}$ EXTPOW1 : standard 24-V input terminal</p>
3	Polarity settings Polarity settings for \pm xELS, xDLS, xOLS, xINPOS, and xSVALM;	<p>N. O. (Normal Open) condition: The signal is detected when current to the photocoupler is ON N. C. (Normal Open) condition: The signal is detected when current to the photocoupler is OFF</p> <p>For ELS, set the polarity with the option port. (P.5) For DLS, OLS, INPOS, and SVALM, set the polarity with the RENV1. (See CPD Board Series User's Manual: Common Information for details.)</p>
4	External connections Photoelectric sensor input Limit switch input	 

Table 3. 6-2 Axis Sensor sand Servo Interface Input Conditions

3.6.3. Encoder Input

No.	Item	Contents
1	Encoder input circuit format	
2	Advancement of phase settings for Phase A or Phase B	Set by means of software.
3	Differential connection	
4	Open-collector connection (when using internal +5V power) (Leave the jumper off when supplying +5V from an external power source.)	

Table 3. 6-3 Encoder Input Circuit Conditions

3.6.4. Servo Interface Output Circuit

Table 3. 6-4 shows the output circuit conditions.

No.	Item	Contents
1	Driver circuit format xSVON, xSVRST, xSVCTRCL	<p>Rating load voltage: DC12V—DC24V Allowable load current: Less than 80mA/terminal</p>
2	Output logic level (The polarity cannot be changed.)	The xSVON, xSVRST; or xSVCTRCL is ON when the port output is "1".
3	External connections	

Table 3. 6-4 Serve Interface Output Conditions

4. Software Startup Guide

4.1. Applicable OS's and Drivers

(1) The software works on the following OS's:

WindowsXP Professional	(WinXP hereinafter)
WindowsXP Home Edition	(WinXP hereinafter)
Windows2000 Professional	(Win2k hereinafter)
Windows98 Second Edition	(Win98 hereinafter)

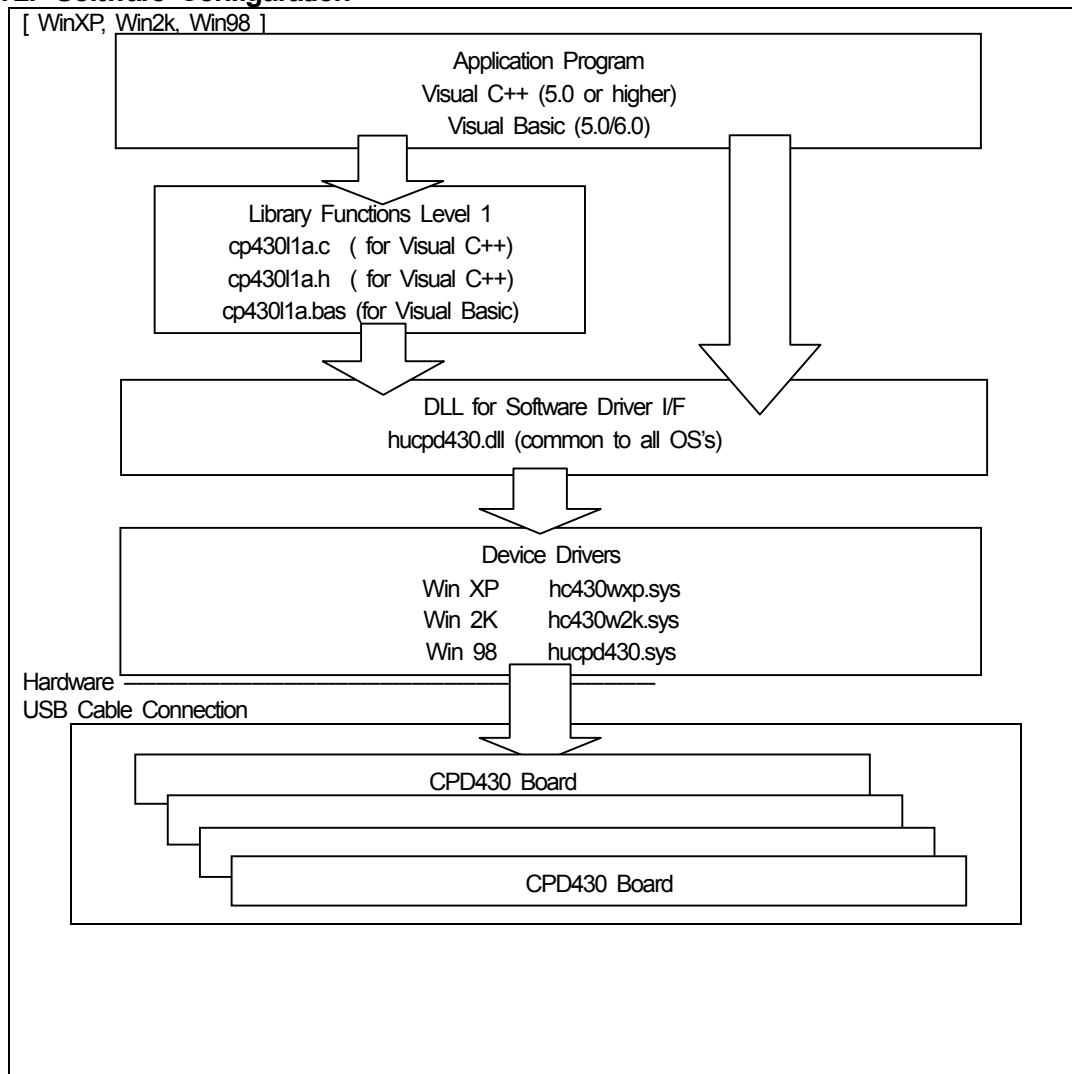
(2) Applicable device drivers:

WinXP:	hc430wpx.sys
Win2k:	hc430w2k.sys
Win98:	hucpd430.sys

(1) The DLL hucpd430.dll is commonly used as the Windows version driver I/F among the above OS's.

Note: The HUSB-CPD434 board is referred to as the CPD430 board in the software-related descriptions.

4.2. Software Configuration



For details of the folder configuration of provided software, see (A:\)¥Readme.txt.

4.3. Installing the Device Drivers

(1) Windows XP Installation

1. Verify that Windows XP is operating and insert the USB connector into an USB connector in the computer with the power supply of CPD board OFF. After that turn ON the power of CPD430 board.
2. The CPD Board will be detected by the system and a window will be displayed automatically to guide you in the installation of the required device driver.
3. Insert the provided floppy disk into the computer's floppy disk drive.
4. Check "Install the software automatically (Recommended)".
5. Select "Hivertec HUSB-CPD430 (WinXP)".

Complete the installation by following the directions in the system dialog boxes. (Refer to Figure 4.3-2)

(2) Windows2K Installation

1. Verify that Windows XP is operating and insert the USB connector into an USB connector in the computer with the power supply of CPD board OFF. After that turn ON the power of CPD430 board.
2. The CPD Board will be detected by the system and a window will be displayed automatically to guide you in the installation of the required device driver.
3. A dialog box will be displayed requesting the installation source directory. Insert the provided floppy disk into the computer's floppy disk drive.
4. ♦ Check the appropriate boxes to select "Specify a location".
5. Select "A::\WIN2K (In this case, the floppy drive is drive A.)".

Complete the installation by following the directions in the system dialog boxes. (Refer to Figure 4.3-3)

(3) Windows 98 Installation

1. Verify that Windows XP is operating and insert the USB connector into an USB connector in the computer with the power supply of CPD board OFF. After that turn ON the power of CPD430 board.
2. The CPD Board will be detected by the system and a window will be displayed automatically to guide you in the installation of the required device driver. (Only the first time)
3. A dialog box will be displayed requesting the installation source directory. Insert the provided floppy disk into the computer's floppy disk drive.
4. ♦ Check the appropriate boxes to select "Specify a location".
5. Select "A::\WIN98 (In this case, the floppy drive is drive A.)".

Complete the installation by following the directions in the system dialog boxes. (Refer to Figure 4.3-4)

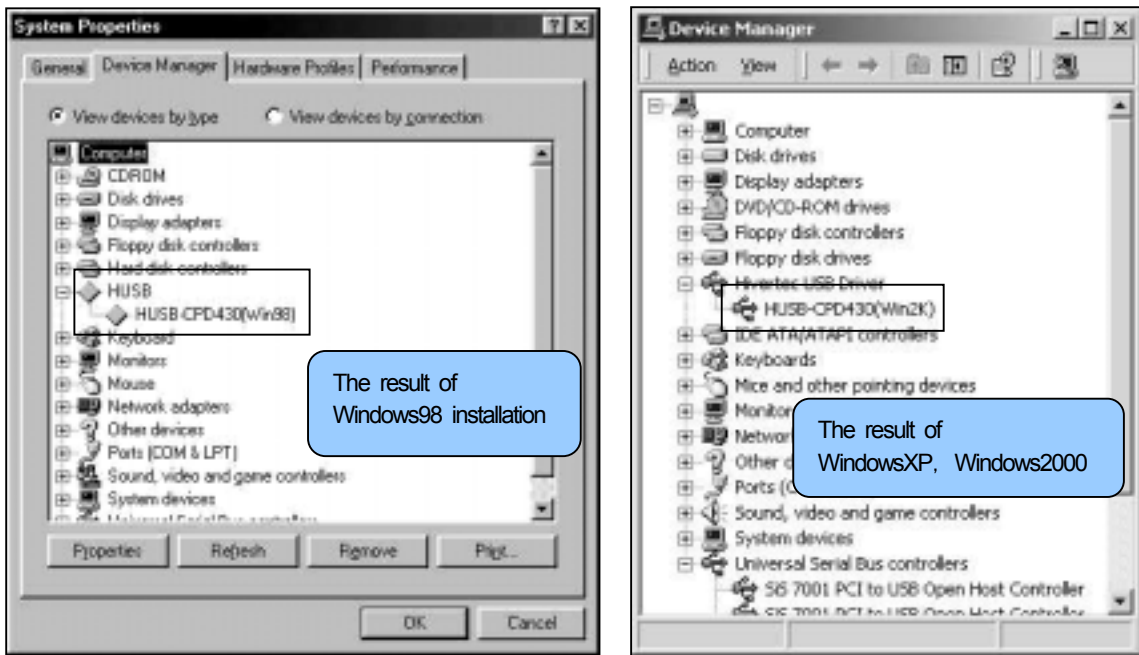


Fig. 4. 3-1 The check screen after device driver installation

Fig. 4. 3-2 WinXP Installations

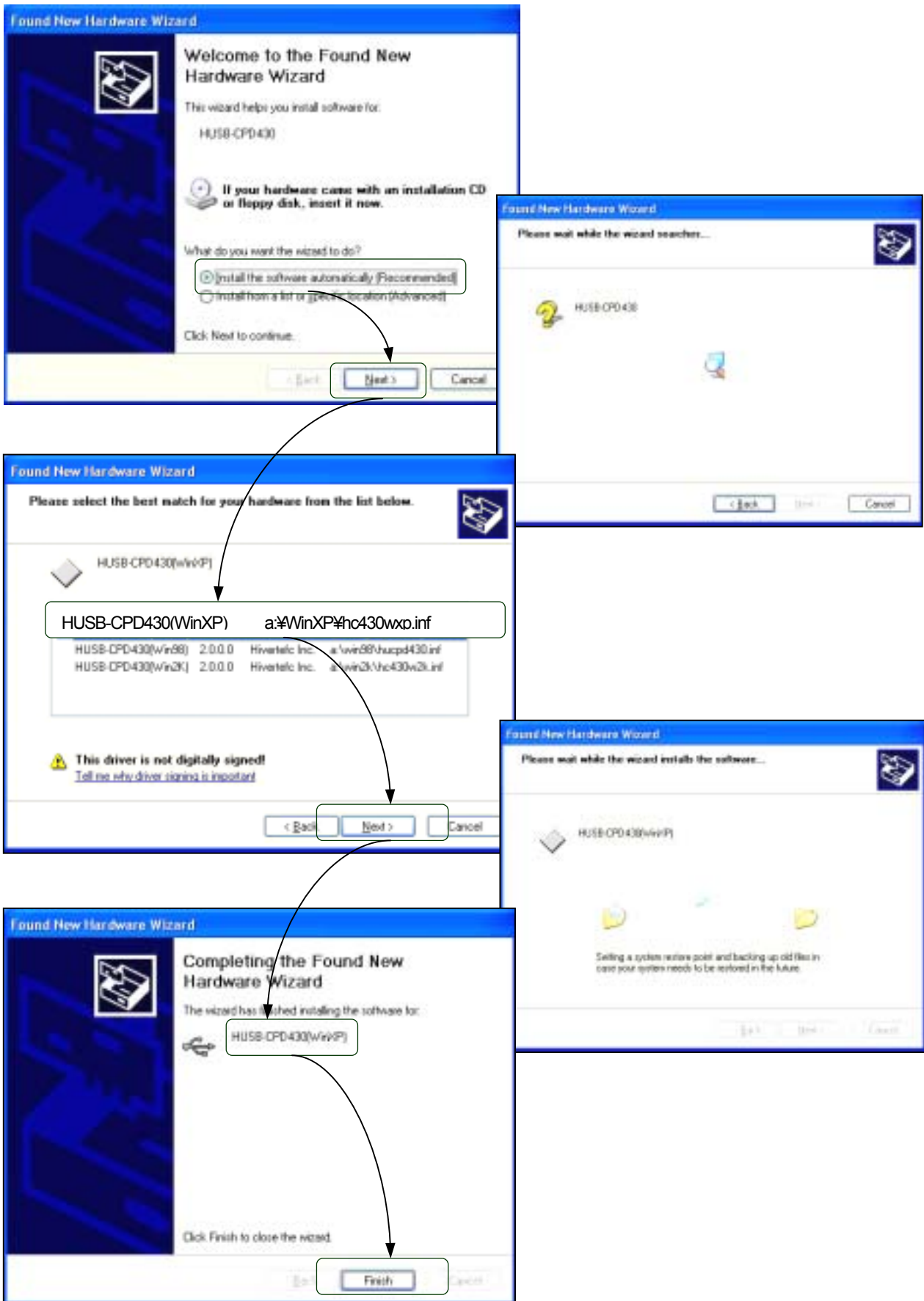


Fig. 4. 3-3 Win2K Installations

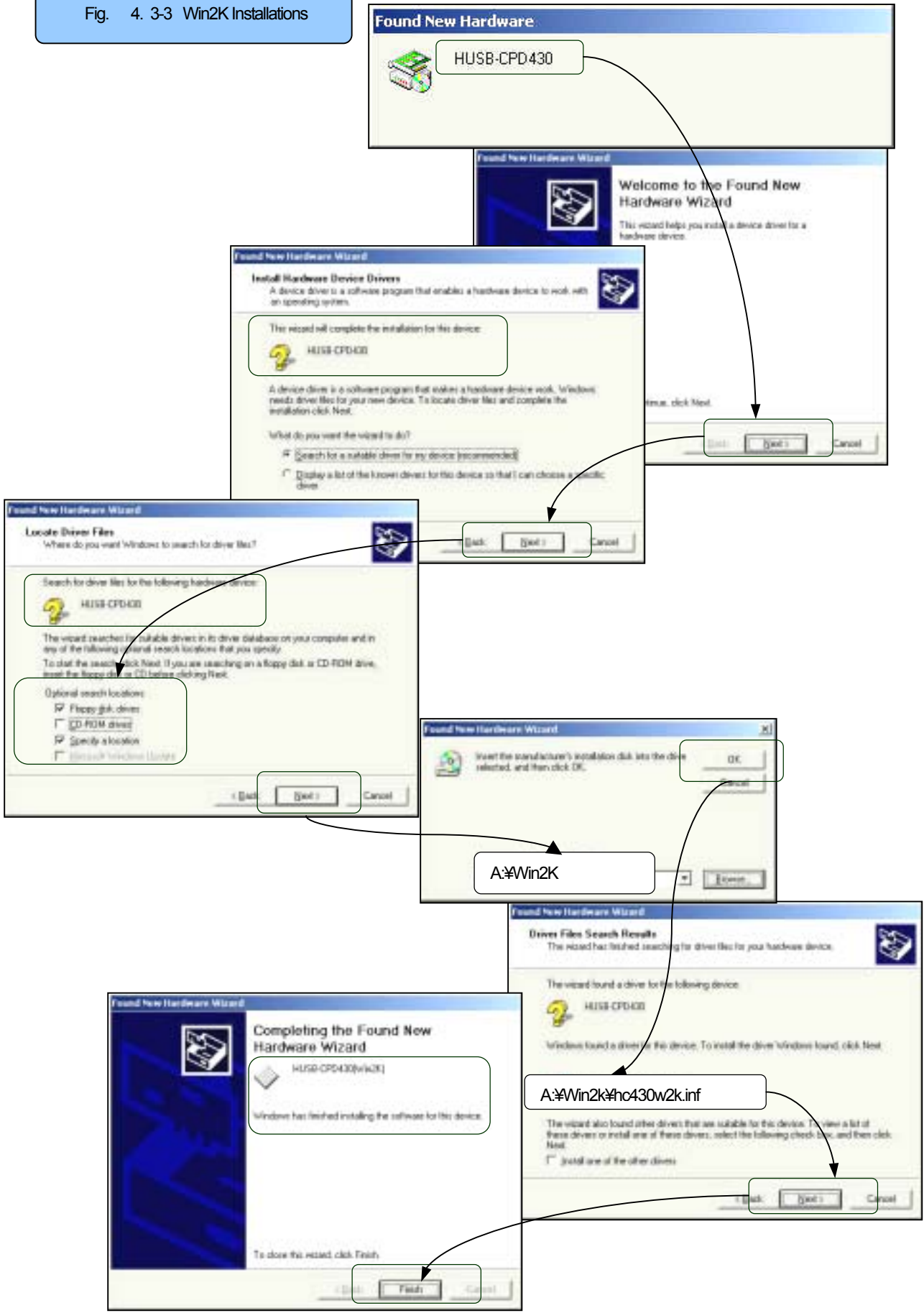
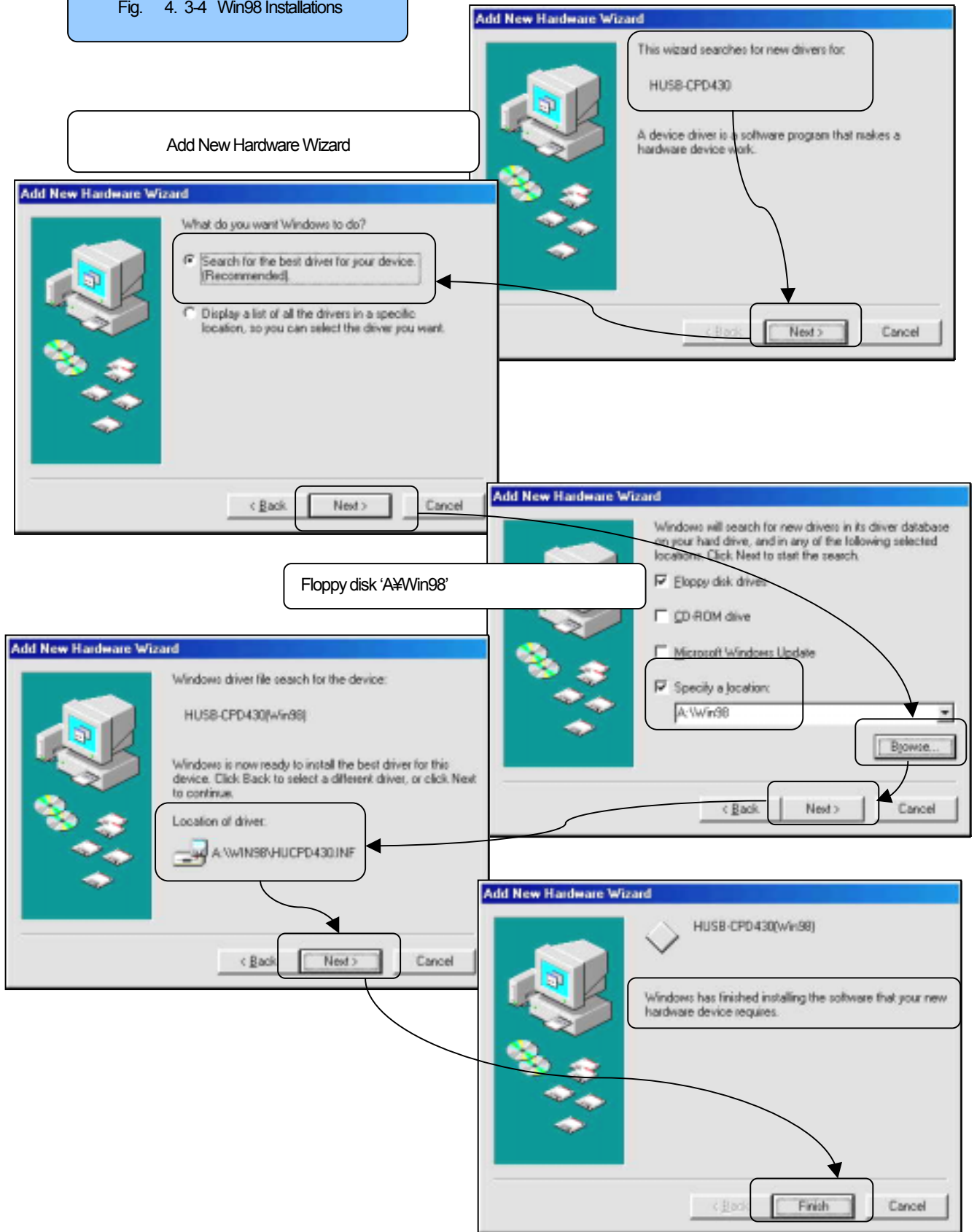


Fig. 4. 3-4 Win98 Installations



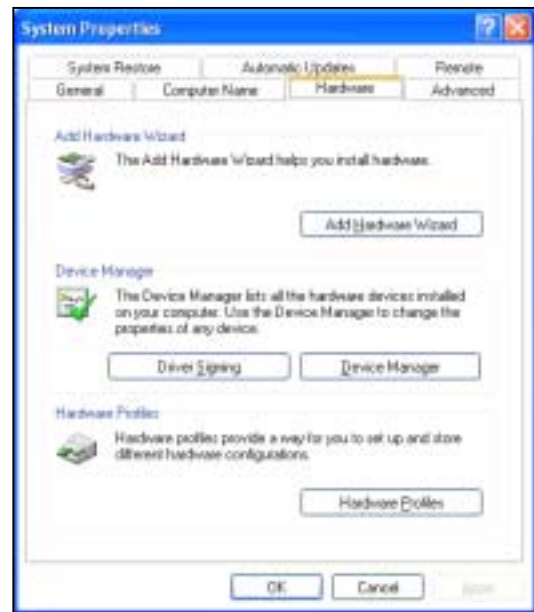
4.4 Update Device driver

When upgrading a driver and a driver I/F library etc., the method in the case of updating the device driver is as follows.

4.4.1 Update driver

When updating, it carries out with CPD430 board connected to the computer.

- (1) WindowsXP Right-click "My Computer" on Start menu and click 'Properties'.
Select the Hardware tab and click the Device Manager.
Click the plus sign (+) next to "Hivertec USB Driver" and locate "HUSB-CPD430".
Right-click the "HUSB-CPD430" and click Update Driver.
Refer to Fig. 4. 4-1 WinXP Update driver for details on subsequent procedures.



(2) Windows2000

Right-click "My Computer" on the desktop and click 'Properties'.



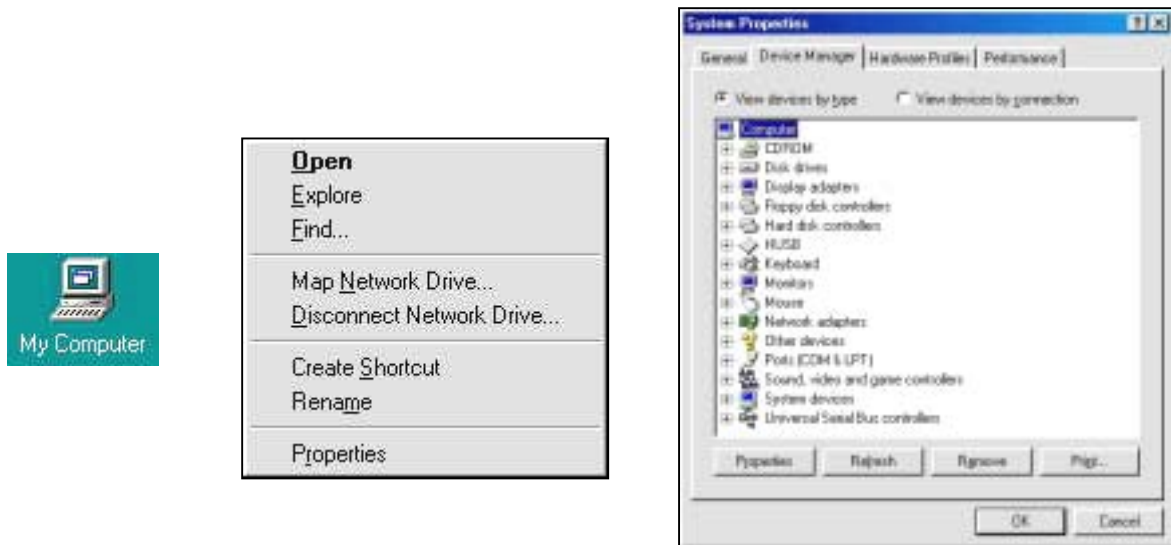
(3) Windows98

Right-click "My Computer" on the desktop and click 'Properties'.

Select the Device Manager tab and click the plus sign (+) next to "Hivertec USB Driver" and locate "HUSB-CPD430".

Right-click the "HUSB-CPD430" and click Update Driver.

Refer to *Fig. 4-4-3 Win98 Update driver* for details on subsequent procedures.



4.4.2 Update driver I/F library

If the Library File is saved in Windows System Directry (C:\Windows\system32 in the case of WindowsXP, C:\Winnt\system32 in the case of Win2K, C:\Windows\system in the case of Win98. (If System Drive is C:)), updates as the above.

If the Library File is copied in Folder, delete the old file whose name is same as updated file and copy the updated file in Folder. (An overwrite copy is also possible.)

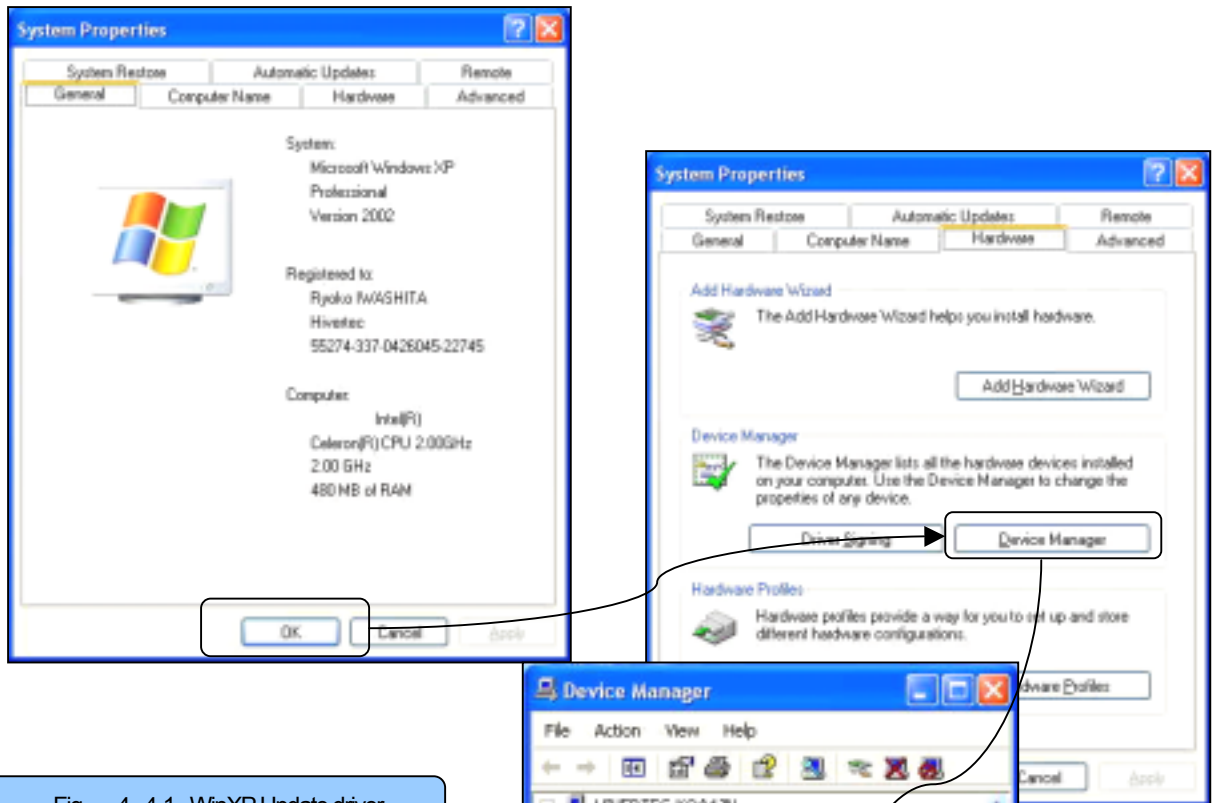
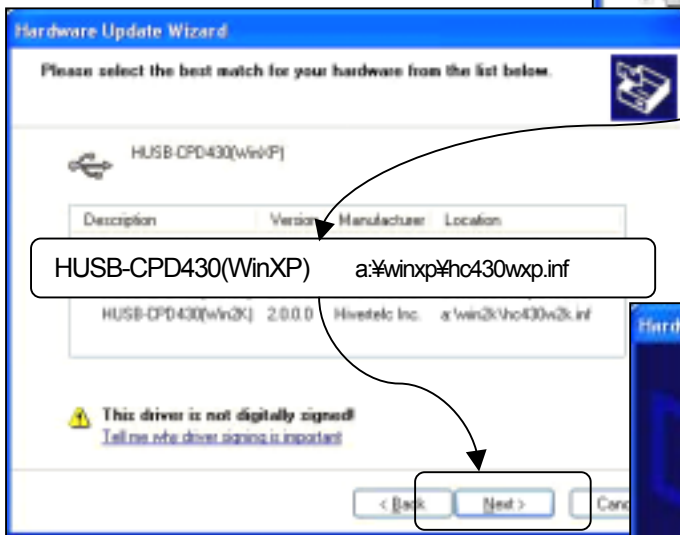
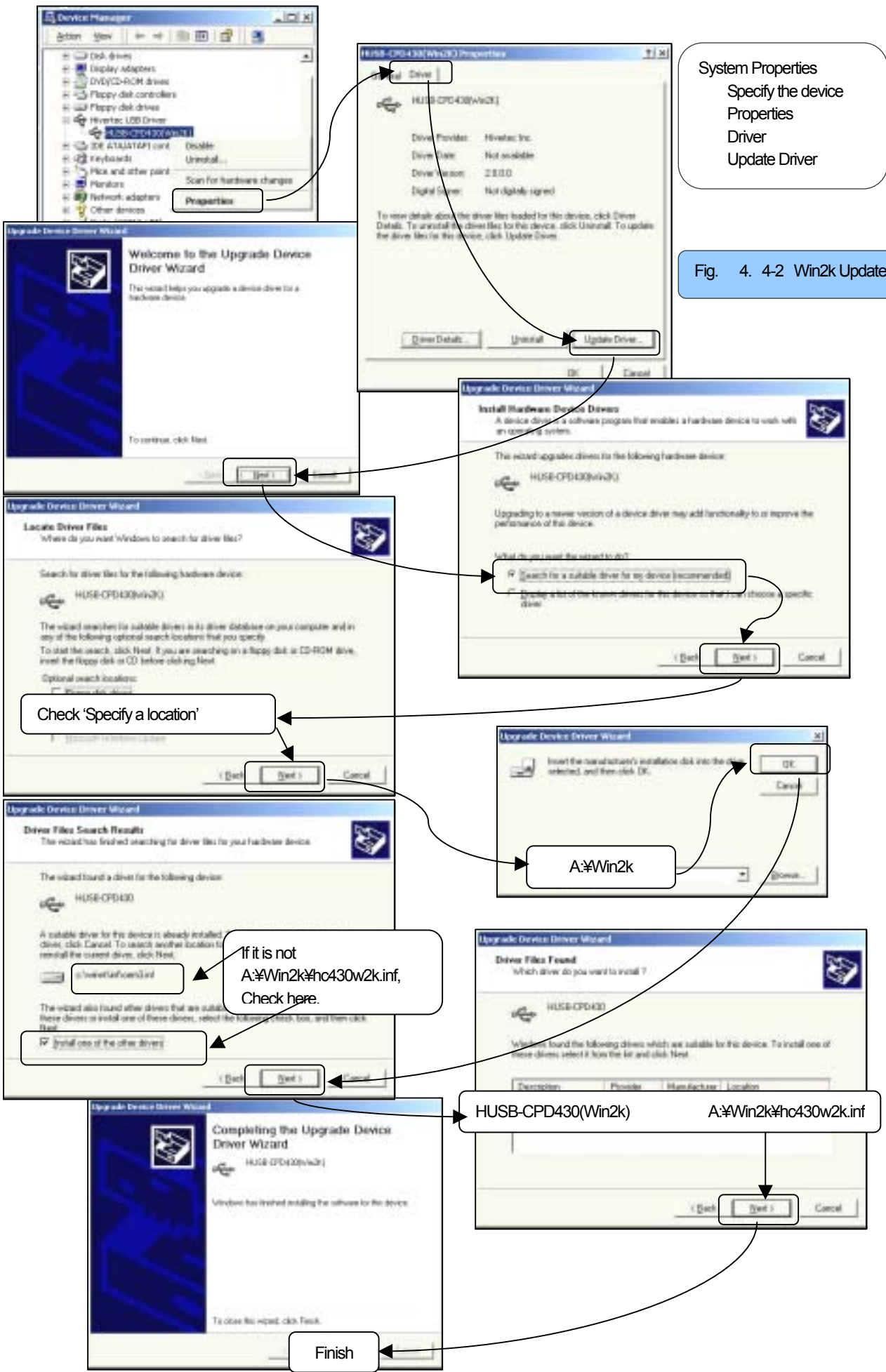


Fig. 4-4-1 WinXP Update driver





System Properties
Specify the device
Properties
Driver
Update Driver

Fig. 4. 4-2 Win2k Update Driver

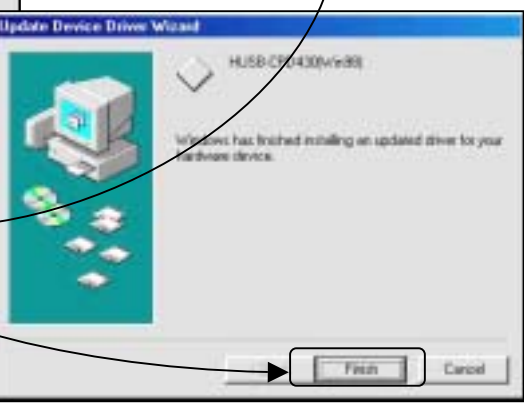
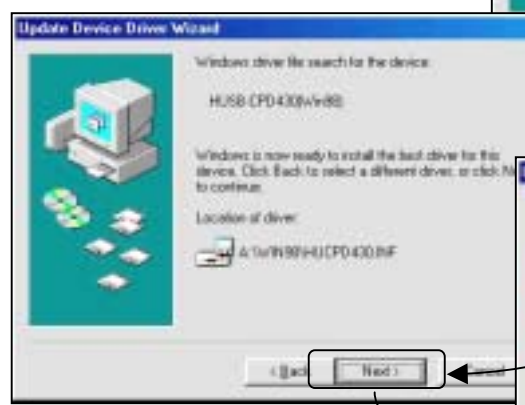
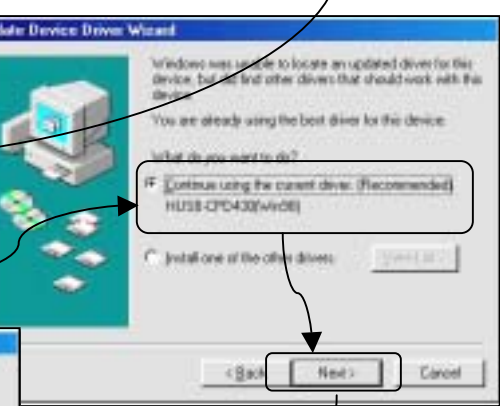
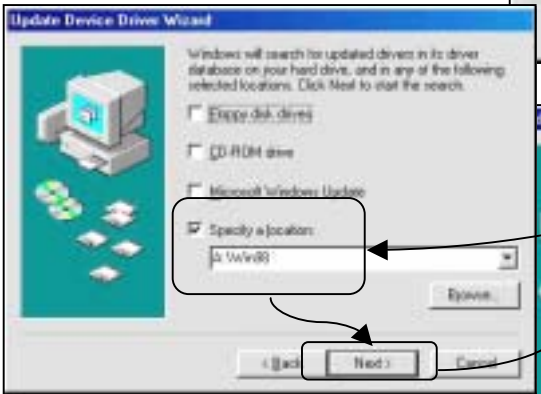
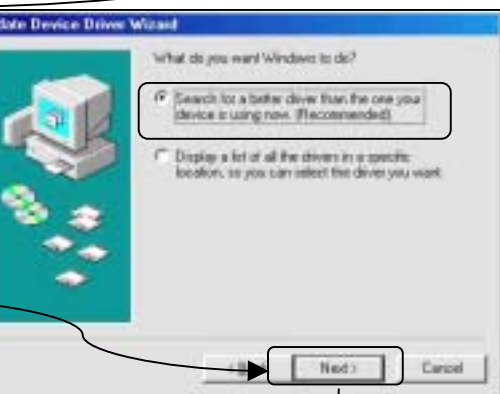
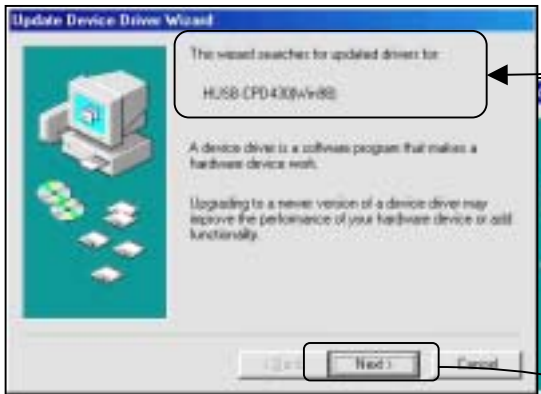
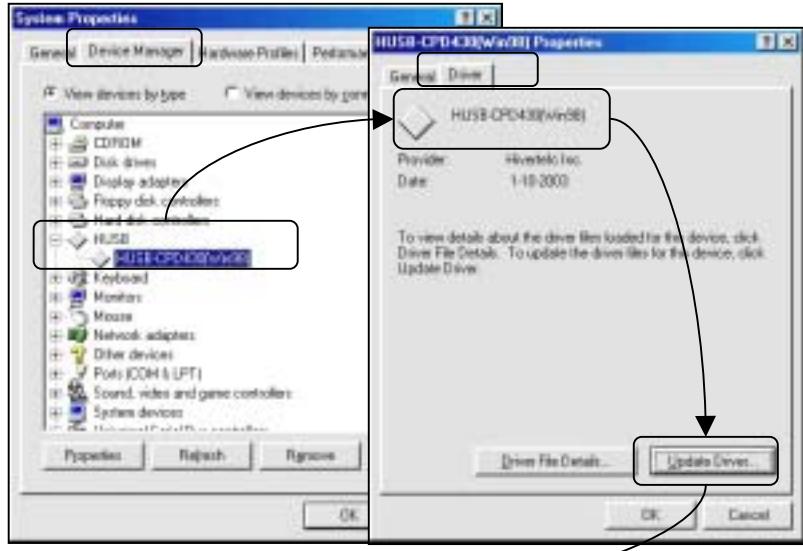
Check 'Specify a location'

If it is not
A:\Win2k\h430w2k.inf,
Check here.

HUSB-CPD430(Win2k) A:\Win2k\h430w2k.inf

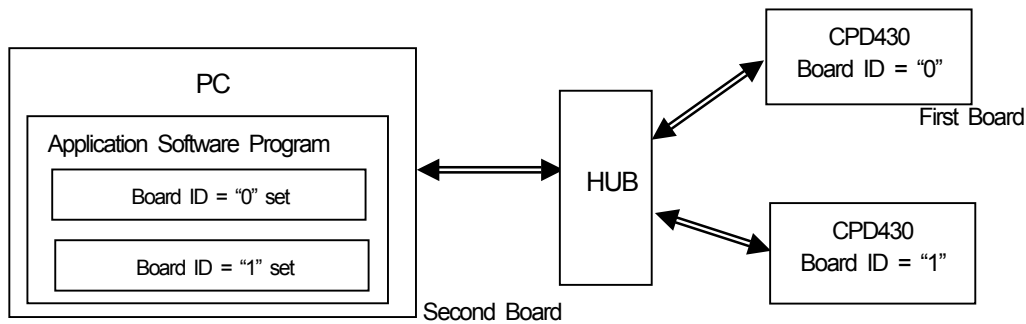
Fig. 4-4-3 Win98 Update Driver

System Properties
Specify the device
Properties
Driver
Update Driver



4.5. To Use Multiple Boards

This section explains how to install more than one CPD430 board in one computer and connect each board to an independent, external device.



(1) Assigning HUSB-CPD 434 Controller

To identify the two or more CPD boards connected to the PC with a USB cable, a unique board ID number is given to each of the installed boards. Fifteen ID numbers between 0 and F (hexadecimal) are available.

(2) Confirming Device ID

Use the floppy disk of the provided software and execute ¥test¥Release¥tpc43400.exe to check the board ID displayed on the monitor screen.

(3) Setting Board ID

To set board ID, see "Setting Rotary Switch for Board ID" in sections 3.4.4.(1) or 3.5.2.(1).

Note: The above two sections are common to all CPD430 series boards.

4.6. Accessing the Boards

To access one of the installed CPD430 boards, first open a particular device and obtain a device handle value used to access the board. To open a device, it is necessary to have information on the hardware resources allocated to the device being opened. The information for identifying a board is called the device information.

(1) Device Information Structure (Data Structure for Board Recognition)

To recognize boards, the following HUSBDEVINF structure is provided:

[Visual C++ : C Language]

```
typedef struct _HUSBDEVINF {
    WORD    BrdID;        // Board ID      (0 to 15)
    WORD    EPcnt;       // Number of end points (> = 2)
    WORD    EPspc[8];    // End point specification (0x81,0x02,0x00,0x00)
    WORD    EPSiz[8];    // Number of bytes of end points (32,32, 0, 0)
    WORD    EPOpt[8];    // End point option (reserved)
    HANDLE  EPhdl[8];    // End point handle (pipe handle)
} HUSBDEVINF, * PHUSBDEVINF;
```

[Visual Basic]

```
Type spc_mat
  dt(0 To 7)    As Integer
End Type
Type hdl_mat
  dt(0 To 7)    As Long
End Type
Public Type HUSBDEVINF
  BrdID        As Integer      ' Board ID      (0 to 15)
  EPcnt        As Integer      ' Number of end points (> = 2)
  EPspc        As spc_mat      ' End point specification (0x81,0x02,0x00,0x00)
  EPsiz        As spc_mat      ' Number of bytes of end points (32, 32, 0, 0)
  EPOpt        As spc_mat      ' End point option (reserved)
  EPhdl        As hdl_mat      ' End point handle (pipe handle)
End Type
```

(2) Board Access Preparatory Procedure and End Processing

[Using driver I/F DLL functions]

1. Obtaining device information for all of the boards installed

Obtaining information of all the CPD430 boards installed in the PC in the "HUSBDEVINF" structure area.

- ◆ cp430_GetDeviceCount() . . . Confirms the number of boards.
- ◆ cp430_GetDeviceInfo() . . . Obtains device information on all the CPD430 boards.

2. Open every device

Transfer the device information of a CPD430 board to the Open Device Function.

The CPD430 board is opened and the Open Device Function returns a device handle value that is needed to access this board.

When two or more boards are used, repeat this procedure on each of the boards.

When any particular board is to be selected, check the device information and board ID value to see if they are correct.

- ◆ cp430_OpenDevice() . . . Process to opens a board

3. Initialize the board signal processing

Using the device handle obtained in the above, the corresponding PDC430 board can be accessed from now on. Before initializing each register, set up the device usage conditions (signal processing method in a board) with the following function. See Section 3.2.2. Option Port for setting instructions.

- ◆ cp430_wPortB() . . . Sets the device usage conditions (signal processing method)

4. Initializing each board and each axis

After the above setting process, initialize all the boards that are to be used.

See the CPD Board Serial User's Manual (Common Version) for setting of each register. With this setting done, pulse output from each axis is available for normal operation.

5. When all the required processing has been done and exit the application, close all of the devices that were opened performing "Device Close Process" on each of the opened devices:

- ◆ cp430_CloseDevice() . . . Close a specified board (for one board)

[Using library functions]

1. Obtain device information for all the boards that are to be used.

Obtaining information of all the CPD430 boards installed in the PC in the "HUSBDEVINF" structure area.

- hpc430_GetDevInfo() . . . Confirms the number of boards and obtains device information of all the boards.

2. Open every device

Transfer the device information of a CPD430 board to the Open Device Function.

The CPD430 board is opened and the Open Device Function returns a device handle value that is needed to access this board.

When two or more boards are used, repeat this procedure on each of the boards.

- ◆ `hcp430_DevOpen()` . . . Opens a board and initializes registers.
Makes initial setting of signal processing method on each board, and initialize each axis.

Using the device handle obtained in the above, the corresponding PDC430 board can be accessed from this point on.

When a device has been successfully opened, setting of device conditions is initialized.

Depending on hardware connecting conditions, any of the boards may require re-setting using the relevant library function.

With this setting done, pulse output from each axis is available for normal operation.

Refer to the CPD Board Series User's Manual [Software] for details on the library functions.

<<< Important Remarks >>>

- ◆ Verify the following points when each axis is connected to a motor and ready for operation.
 - Operational test of the \pm ELS signals (The sensors are operated alone, with the motor stopped.)
 - Status of signal inputs when the servo alarm signals have been connected
 - Input status of the origin signal (OLS or Phase-Z)Proper operation may not be possible if the signals listed above are not being input properly.
- ◆ The following points must be checked if the command pulse output to the motor is not operating properly.
 - Check that the command pulse output setting matches the "servodriver" input.
 - Check whether there is something in the "servodriver" input signal causing the motor to be stopped.

3. When all the required processing has been done and exit the application, close all of the devices that were opened performing "Device Close Process" on each of the opened devices:

- ◆ `cp430_CloseDevice()` . . . Close a specified board (for one board)

***** Exceptions in Device Recognition *****

In case a device is not recognized or the device ID of a CPD board is not found when trying to obtain device information -:

- In the following cases, a device is not recognized as a CPD device (lack of device information).
 - ◆ Even if the vendor ID and product ID match, device information cannot be obtained.
 - ◆ The number of device end points is inadequate. (useless as input or output)
 - ◆ No match of end point specification. (useless as input or output)
- Even if a device clears all the three points above, the driver will process such a device as ID = 99, if
 - ◆ the driver fails to recognize any of the functions the CPD board should have.

In the above cases, unconformity between the device and system is suspected. The manufacturer kindly requests that such a case is brought to the attention of Hyvertec Customer Support Department.

4.7. Sample Programs

Sample programs have been provided to help explain how to use the library (level 1) functions. The following two kinds of programs have been provided and have almost identical displays and operations. The explanation in this section is based on the Visual C++ (5.0) C coding sample program.

1. Visual C++ (5.0) C coding (spc43000.exe)
2. Visual Basic (5.0) (spc43002.exe)

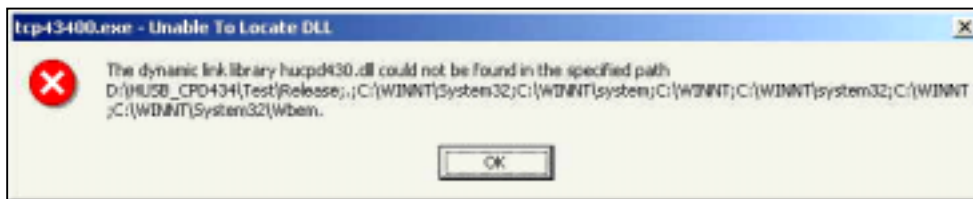
When using the sample program, copy the program to your hard disk.

The sample program can be executed by double-clicking the corresponding executable file (spc43000.exe or spc43002.exe).

Precautions when Executing the Sample Program

1. When using the sample program for Visual C++, version 5.0 (or higher) of Visual C++ must be installed already as the development tool.
2. When using the sample program for Visual Basic, version 5.0 (or higher) of Visual Basic must be installed already as the development tool.
3. When two or more CPD430 Boards are being used, set a unique Board ID on each Board. If the same Board ID is set on more than one Board, the first Board found with that Board ID will operate.
4. The program will not run if one of the following error messages is displayed when you execute the program.

[Error Messages]



* DLL is not installed.
Retry to install it.



- * CPD430 board is not installed, or the system does not recognize it.
- * Device driver is not installed.

* Mismatch between the device and system is suspected.
Contact Hyvertec's Customer Support Department.



4.7.1. Sample Program Operation

There is a source program in the sample program that initializes each axis. Therefore, this source program must be changed if you want to operate the Board with different initialization conditions. The following selection menu will be displayed when the sample program starts properly:

[Select Operation Menu]

Select the desired operation to execute that operation example.

(With the VC++ sample program, the operations are selected with a single-click.
With the VB sample program, the operations are selected with a double-click.)



(1) Opening/Closing Devices

This sample program obtains device information and opens/closes the devices.

In order to access a CPD430 Board, it is necessary to first open the device and obtain the device handle that is required to access the device. The Open Device function initializes each register and the option ports at the same time as it opens the device and obtains the device handle.

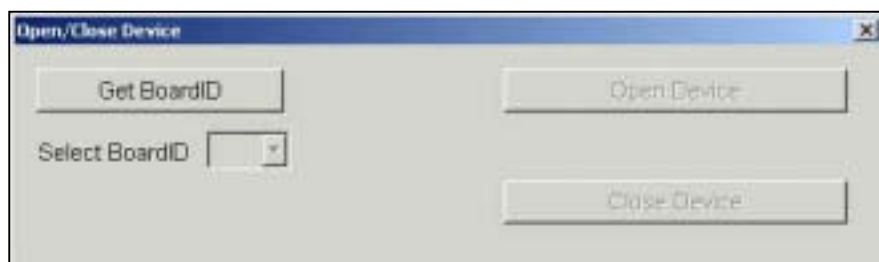
In this sample operation, its Board ID selects the Board, the device information is obtained for the selected Board, and that Board's device is opened.

Also, that Board's device is closed with the Close Device function.

For more details on device information and opening/closing devices, refer to the *CPD Board Series User's Manual: Section 4.6. Accessing Boards*.

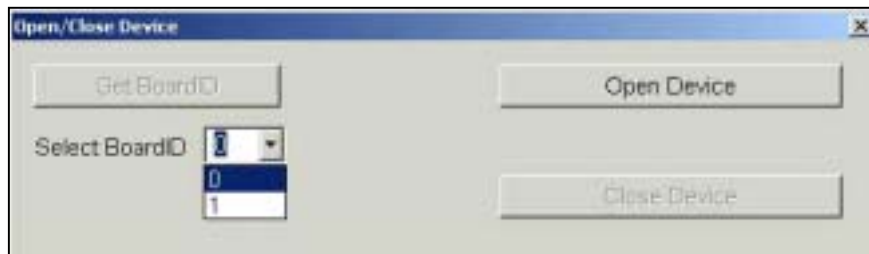
The following windows show how to perform the sample operations.

[Device Open / Close Windows]



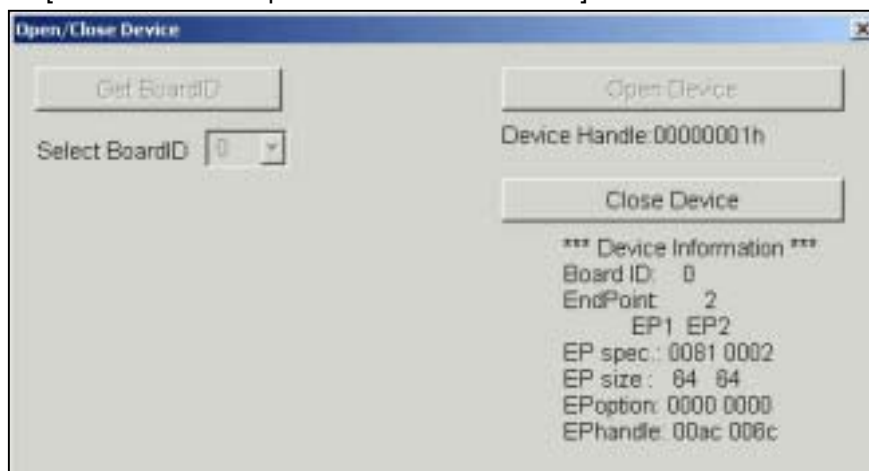
Click "Get Board ID" in the dialog box, and the "Select Board ID" area will display the Board IDs of the Boards that are actually installed in the computer.

[Get Board ID]



Select the desired Board ID and click the "Open Device" Button to open the device.

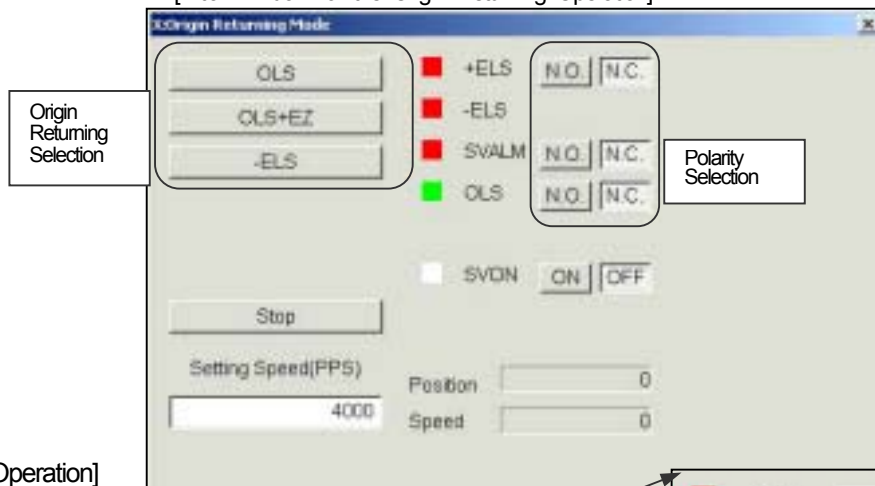
[Window after the Open Device Button is clicked]



Click the "Close Device" Button to close the device and return to the "Select Board ID" Dialog Box.

(2) Origin Returning Operation

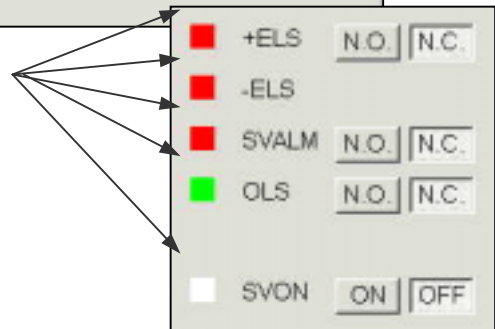
This sample program makes the settings for the origin returning operation and performs the origin returning operation.
 [Initial Window for the Origin Returning Operation]



Preparations for Operation]

1. Polarity Selection

The indicated color will change when there is an input from the sensor.
 The +ELS, -ELS, and SVALM indicators will be red when there is an input and the OLS indicator will be green.
 If the SVON signal is being output, the indicator will be green.
 The input polarity can be switched by clicking the “N.O.” and “N.C.” Buttons.
 The Servo can be turned ON and OFF by clicking the “ON” and “OFF” Buttons.



When a stepping motor driver is being used, the “OFF” Button turns the excitation ON and the “ON” Button turns the excitation OFF.

Note 1. Operation is disabled while +ELS, -ELS, or SVALM is being input. Start operation after checking the status of each sensor. It is assumed that SVON is connected as specified.

Note 2. With a normally open (N.O.) terminal, the signal is ON (detected) when there is a current.
 With a normally closed (N.C.) terminal, there is normally a current flowing and the signal is ON (detected) when there is no current.

2. Setting the Operation Speed

The operation speed can be set in the range of 1 to 65,535 pps. The initial value is 4,000 pps, so change this initial value to the desired speed when necessary.



Also, the base speed is set to 400 pps. If the operation speed is set below 400 pps, the motor will accelerate when the speed drops to 400 pps even if it is supposed to decelerate because the DLS or OLS signal is ON. In this case, change the sample program and set the base speed to the appropriate value.

[Executing the Origin Returning Operation]

Any one of the following origin returning methods can be selected.

“OLS”: Origin returning operation 1(After OLS is detected, Get out of origin, re-enter and end.)

“OLS+EZ”: Origin returning operation 2: OLS ON is detected and encoder phase-Z is detected.

“ ELS”: Origin returning operation 6: Reverse when ELS is detected and end when ELS is exited.

Refer to the *CPD Board Series User's Manual: Software Information* for more details on the origin returning operations.

After completing, the “Preparations for Operation” and specifying one of the origin returning methods, click the “Origin Returning” Button to execute the specified origin returning operation.

Clicking the “Stop” Button stops operation.

The current position display indicates the command pulse count.

The current speed display indicates the pulse speed (pps) currently being output.

Note The OLS signal detection is rising-edge detection, so the OLS signal will not be detected if the signal is already ON when operation starts. In this case, perform continuous feed operation until the OLS signal goes OFF and then execute the origin returning operation.

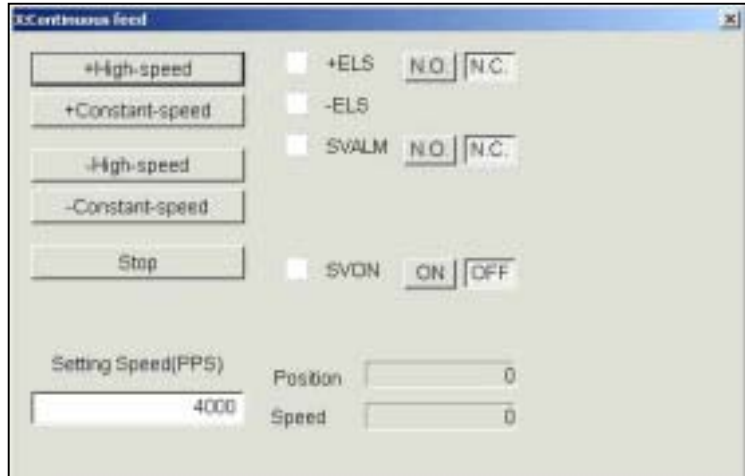
(3) Continuous Feed Operation

This sample program demonstrates the high-speed continuous feed and constant-speed continuous feed operations.

[Continuous Feed Operation Window]

Before starting operation, perform the same preparatory checks (such as checking sensor connections) performed for the origin returning operation.

Click the **“+High-speed”**, **“+Constant-speed”**, **“-High-speed”**, or **“-Constant-speed”** Button to perform the corresponding continuous feed operation. **“Stop”** Button: Click it to stop operation.

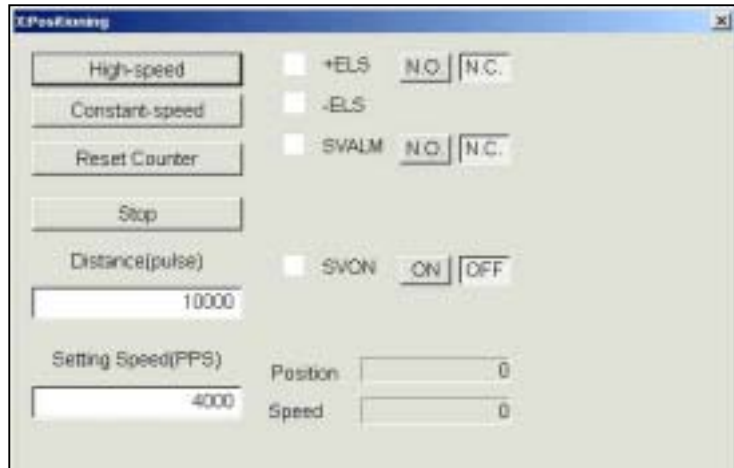


(4) Positioning Operation

This sample program demonstrates the high-speed positioning and constant-speed positioning operations.

[Positioning Operation Window]

Sets the magnitude of movement by the number of pulses (with a + or – symbol)



“Reset Counter” Button: Click it to reset the current position to zero.

“Stop” Button: Click it to stop operation.

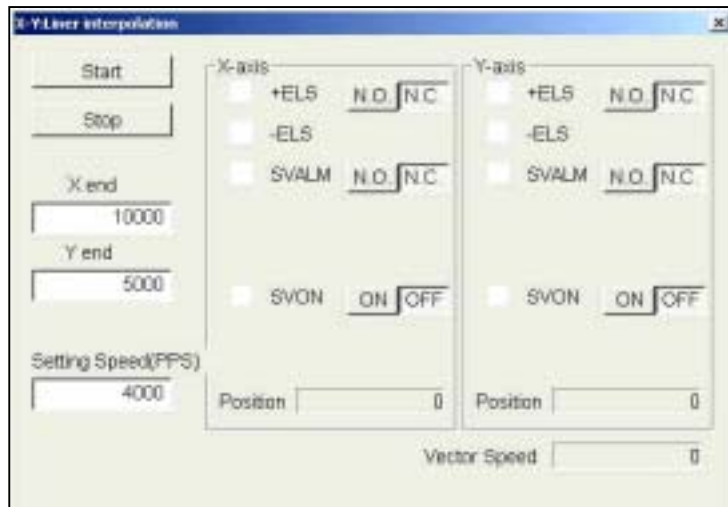
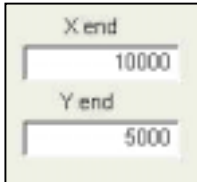
(5) Linear Interpolation Operation

This sample program performs linear interpolation operation at high speed. The combined speed is fixed.

[Linear Interpolation Operation Window]

Before starting operation, perform the same preparatory checks (such as checking sensor connections) performed for the origin returning operation.

Sets the end position for the X- and Y-Axes.



“Start” Button: Click it to perform the linear interpolation operation.

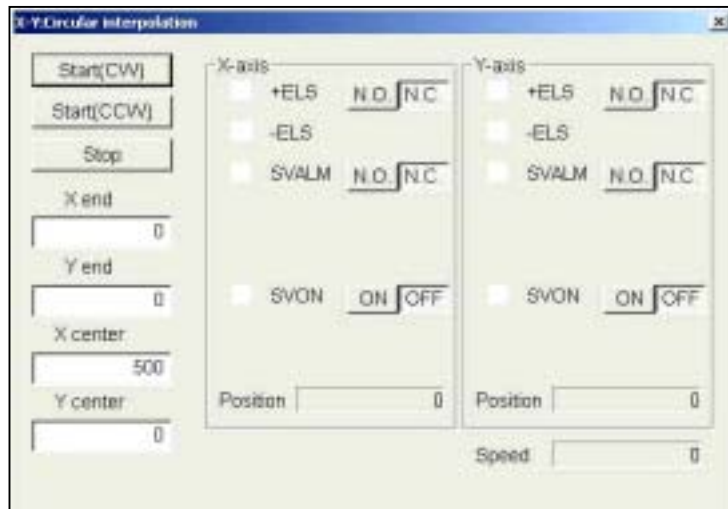
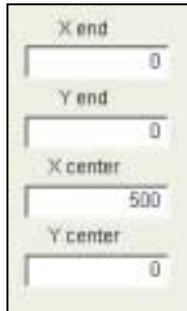
“Stop” Button: Click it to stop operation.

(6) Circular Interpolation Operation

This sample program performs circular interpolation operation at the base speed. (Constant surface speed control with a base speed of 500 pps)

[Circular Interpolation Operation Window]

Before starting operation, perform the same preparatory checks (such as checking sensor connections) performed for the origin returning operation. positions for the X- and Y-axes.

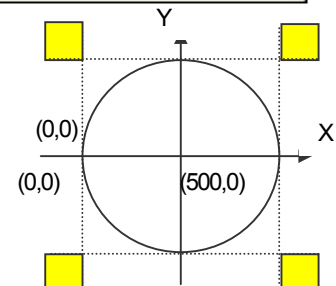


Note: The current point is the starting point, and the end position is at the end coordinate values relative to that starting point.

When the end point value is set to (0,0), a complete circle will be formed.

If the end point coordinates are not on the circle, end point withdrawal will start when the operation reaches either the specified X-axis or Y-axis end position.

If the end position has been set in one of the yellow regions shown in the diagram on the right, the operation will never reach the X-axis or Y-axis end position: operation will not come to a stop.



“Start (CW)” or “Start (CCW)” Button: Click it to perform a circular Interpolation operation.

“Stop” Button: Click it to stop operation.

4.8. "Let's try to move" Program for Windows Systems

The "Let's try to move" program software allows you to check minimal operations on the display by simply connecting Board to computer. Execute the A:\test\Release\tpc4300.exe file on the provided floppy disk. (In this case, the floppy disk drive is drive A.)

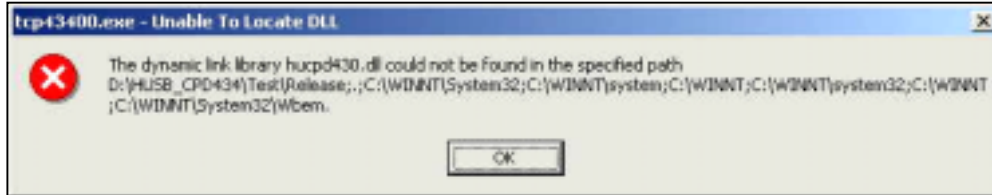
< Caution >

When two or more CPD Boards are being used, set a unique Board ID on each Board. If the same Board ID is set on more than one Board, the first Board found with that Board ID will operate.

For safety reasons, the display will not change with this application while the axis is operating.

The program will not run if one of the following error messages is displayed when you execute the program.

[Error Messages]



* DLL is not installed.
Retry to install it.



* CPD430 board is not installed, or the system does not recognize it.
* Device driver is not installed.

* Mismatch between the device and system is suspected.
Contact Hyvertec's Customer Support Department.



4.8.1. "Let's try to move" Operation Window

The following window will be shown when the "Let's try to move" program is executed. When the program starts, it will operate with the first Board that is found. To operate the "Let's try to move" program with a different Board, select the Setting Window by clicking the "X-U Setting" tab at the top of the Window.



(1) Device Information Display

The information of the device being selected is displayed as shown below.

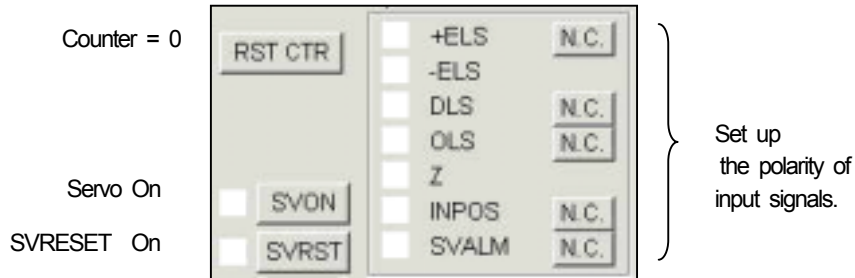
BoardID	: 1h	End Points	: 2
EP1 spec	: 81h	EP2 spec	: 02h
EP1 size	: 64	EP2 size	: 64

- Note: 1. Board ID: The setup value on the board ID rotary switch
 2. Other values: The values displayed above are normal for actual operations.

(2) Display of Each Axis and Operation Commands

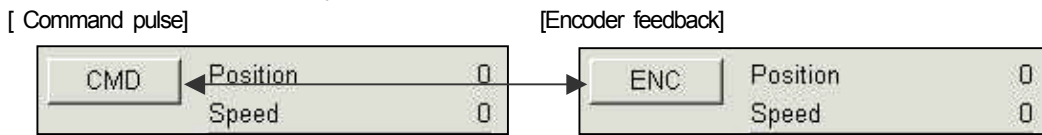
Operation on the board for each axis is identical. In addition, the axis initialization program is uniformly fixed in the source program. Consequently, if the initialization conditions must be changed somehow, a change to the source program is needed.

1. Change of operation conditions of an axis and its status



2. Display of the current position of axes and operation speed

The information on the current position and operation speed of each axis is updated once every 1/10 of a second. For display of the current position, either [command output pulse] or [encoder feedback] may be selected. The current position is indicated by the [number of pulses] and the speed [PPS].



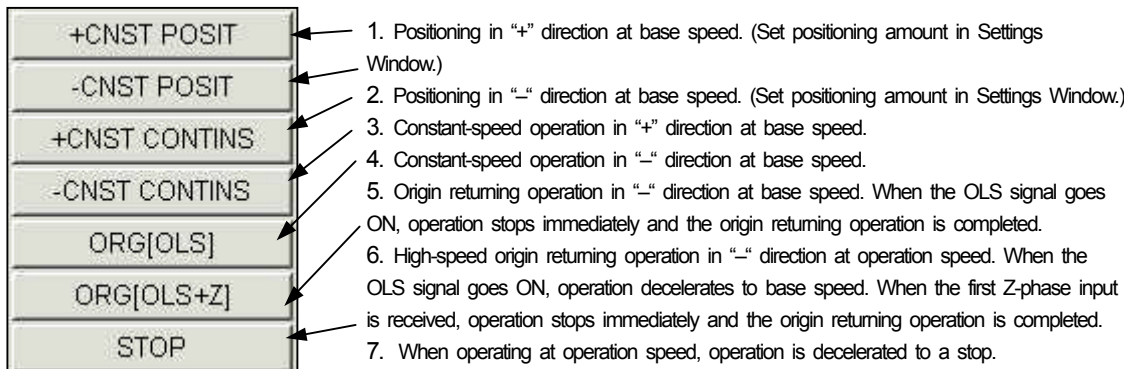
3. Operation start and stop commands to axes

Operations performed on each axis are as follows:

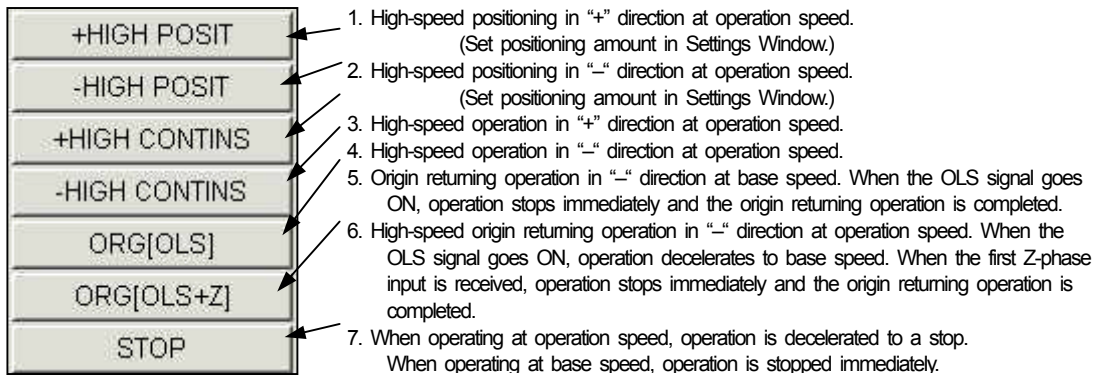
- Constant speed / High-speed positioning
- +Constant speed / High-speed operation
- Origin returning [OLS] operation (Constant speed operation. Returns to origin at an OLS signal)
- Origin returning [OLS+Z] operation (High-speed operation. Returns to origin at an OLS signal plus a first Z-phase input)Stop

Positioning operation and switching between Hi / Lo speeds of continuous operation are set on the control screen. See Section 4.8.2. (2) Changeable Axis Operation Conditions for details.

Setting a [Constant speed operation]



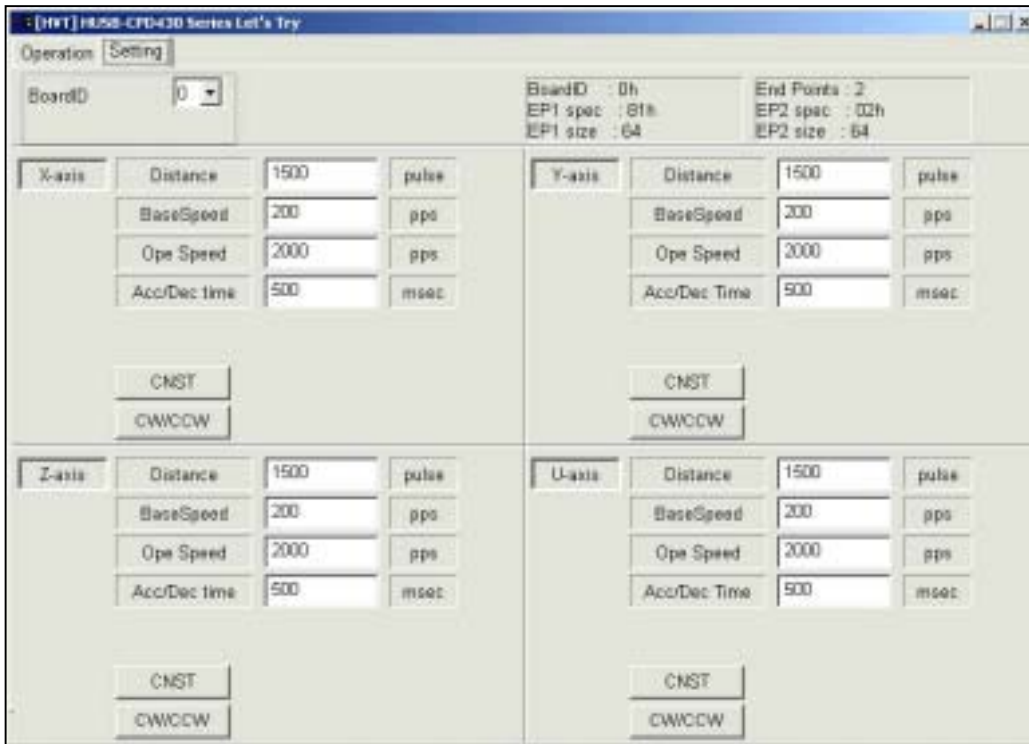
[Setting High-speed Operation]



- Note 1. Acceleration/deceleration operations use linear acceleration/deceleration.
- Note 2. The DLS signal is enabled. If this signal is not being used, set it as an N.O. condition and set it so that it is not input.
- Note 3. The INPOS signal is enabled. If this signal is not being used, set it as an N.C. condition and set it so that it is not normally input.
- Note 4. The OLS signal detection is rising-edge detection, so the OLS signal will not be detected if the signal is already ON when operation starts. In this case, perform continuous feed operation until the OLS signal goes OFF and then execute the origin returning operation.
- Note 5. During operation, if EA/EB error or PA/PB error occur, the "POSIT" button, the "CONTINS" button, and the "ORG" button is enabled.

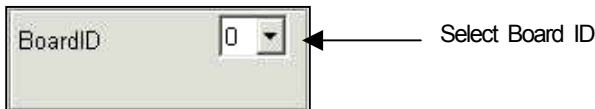
4.8.2. "Let's-Try-to-Move" Settings Window

The following settings window will be displayed when all axes were stopped in the Let's try to move Operation Confirmation Window and the "X-U Setting" tab was clicked at the top of that Window.



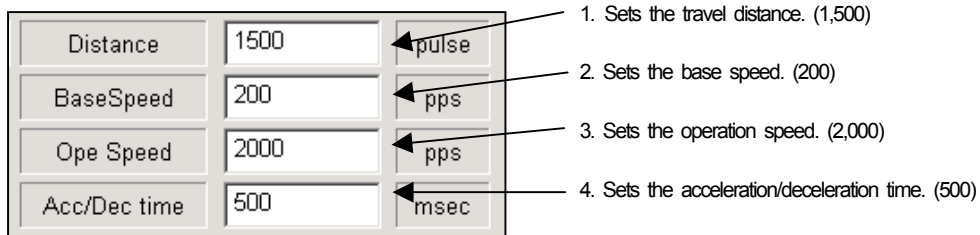
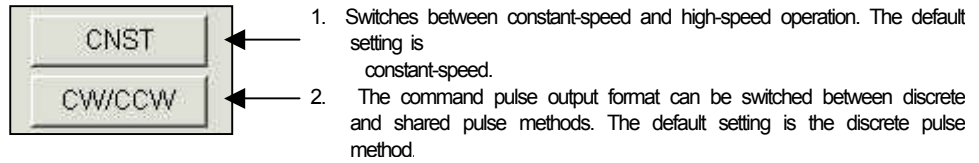
(1) Board Selection and Device Information

When two or more Boards have been installed in the computer, the Board used for the Let's try to move can be specified by selecting its device number or Board ID, as shown below.



(2) Changeable Axis Operating Conditions

The operating conditions can be set individually for each axis that can operate.



Note 1. The setting range for the travel distance is -999,999 to +9,999,999 pulses.

Note 2. The setting ranges for both the base speed and operation speed are 1 to 65,535 pps, although the full setting range may not be usable depending on the combination of settings being used. For the same it may not be possible to use the full setting range of the acceleration/deceleration time depending on the settings made for the operation speed and base speed.

Note 3. If the operation speed is set below the base speed, the motor will accelerate when the speed drops to 400 pps even if it is supposed to decelerate because the Stop command is input, the DLS is ON, or the OLS signal is ON.

Note 4. Error Message

[Display of Error Message]



The window shown on the left will be displayed if an invalid setting has been input. Click **OK** and enter a valid setting.