PC-HELPER

High-Speed Motion Control
Board for PCI
(4 axes)

SMC-4DF-PCI

(8 axes)

SMC-8DF-PCI

User's Guide

CONTEC CO.,LTD.

Check Your Package

Thank you for purchasing the CONTEC product.

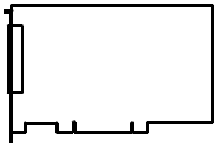
The product consists of the items listed below.

Check, with the following list, that your package is complete. If you discover damaged or missing items, contact your retailer.

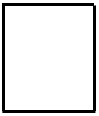
Product Configuration List

- Board (One of the following)
  [SMC-4DF-PCI or SMC-8DF-PCI] …1
- First step guide …1
- CD-ROM *1 [API-PAC(W32)] …1
- Synchronization control cable (10cm) …1
- Warranty Certificate…1
- Serial number label…1

*1 The CD-ROM contains the driver software and User's Guide (this guide)

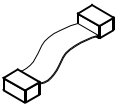


Board



First step guide

CD-ROM
[API-PAC(W32)]



Synchronization control cable

Warranty Certificate

Serial number label

Copyright

Trademarks

Table of Contents

1. Before Using the Product

This chapter provides information you should know before using the product.

About the Board

This product is a PCI board that supports stepping motors and (“pulse string input” types of) servomotors.
SMC-4DF-PCI can perform motor control for up to 4 axes.
SMC-8DF-PCI can perform motor control for up to 8 axes.
Multi-axis independent control and linear/circular interpolation control are performed via a motor driver unit. It can store positioning information for up to 1024 frames per axis and control multiple axes simultaneously. In addition, it can override speed/target positions during operation. Windows driver is bundled with this product.

These various functions make it possible to build complex positioning control systems for variety of uses such as manufacturing devices and test devices.

Features

- Capable of multi-axis independent control and pulse output up to 6.5Mpps
  SMC-4DF-PCI : Control for up to 4 axes and motor control pulse output up to 6.5Mpps are available.
  SMC-8DF-PCI : Control for up to 8 axes and motor control pulse output up to 6.5Mpps are available.
  Command pulse for motor control supports common pulse, independent pulse and 90°C phase difference pulse.
  Limit input 3channels/axis, general-purpose input 7channels/axis, and general-purpose output 3channels/axis are equipped. Also, depending on the software setting, 6 general-purpose inputs can be used as alarm inputs, and general-purpose outputs as deviation counter clear outputs.
- Capable of various control operations such as positioning, linear/circular interpolation, frame continuous operations, synchronization control, and so on
  Various control operations such as positioning, origin returning, linear/circular interpolation, S-curve acceleration/deceleration, frame continuous motion, synchronization control, and so on are available.
  Changing speed/target position during operation is available.
  " PCL6045 series" from Nippon Pulse Motor CO., LTD. is used as the motor control IC.
- Provided with various input/output formats enabling connection to an encoder input circuit as well as pulse output circuit.
  Encoder input circuits can be connected with differential output, TTL level output, and open-collector output. Pulse output circuits can be connected with differential input, opto-coupler and TTL level input.
- Capable of storing positioning information up to 1024 frames for each axis and control without extra CPU load
  The parameters which are necessary for motor operations such as travel distance, travel speed, acceleration/deceleration rate, and so on as 1 frame can be stored up to 1024 frames for each axis. In addition, the control from the ending of 1 frame to the beginning of the next frame is mainly performed by hardware, complex continuous positioning can operate at a high speed. It is possible to repeatedly execute the frame after executing a frame once (loop operation).

- With the multi-boards and axis synchronization control function, capable of aligning the timing for operation start and end
  Synchronization control of multi-axis simultaneous start/stop control, linear interpolation operation is available. Synchronization control of up to 16 boards (128 axes) is possible, when dedicated synchronization control cables are connected.
- Windows compatible driver libraries is attached.
  Using the attached driver library API-PAC(W32) makes it possible to create applications of Windows. In addition, a diagnostic program by which the operations of hardware can be checked is provided.
- Connector shape and pin assignments are compatible with SMC-4DL-PCI, SMC-8DL-PCI
  Since this product is compatible with SMC-4DL-PCI and SMC-8DL-PCI in the connector shape and signal allocation, it can be replaced with them.
- Provided with a terminal strip CCB-SMC2 (option) to which driver units up to 4 pieces can be connected
  A dedicated terminal strip CCB-SMC2 (option) which assigns signals for each axis is provided. Driver units and limit sensors for stepping motors and servo motors can be connected up to 4 pieces.

About Migration From The Existing Products

This product cannot use [API-SMC(98/PC)] (CD-ROM attached) which is the driver software for the existing products SMC-2P(PCI), SMC-4P(PCI), and SMC-3(PC). [API-SMC(98/PC)] (bundled CD-ROM) cannot be used. Please use [API-SMC(WDM)] (bundled CD-ROM) which is the driver software for this product. As a reference material when migrating from the existing products to this product, “Migration guide” which summarizes migration methods and differences about initial settings and API function units is provided. Please use the guide for your reference.
”Migration guide” can be downloaded from the download library of CONTEC’s Web site (http://www.contec.com/download)

Support Software

You should use CONTEC support software according to your purpose and development environment.

Windows version of motion control driver **API-SMC(WDM)**
[Stored on the bundled CD-ROM driver library API-PAC(W32)]

The API-SMC(WDM) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program useful for checking operation is provided.

< Operating environment >

OS	Windows 7, Vista, XP, Server 2008, Server 2003, 2000
Adaptation language	Visual Basic, Visual C++, Visual C#

You can download the updated version from the CONTEC's Web site (http://www.contec.com/apipac/). For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Cable & Connector (Option)

Shielded Cable With Two 100pin Connector
: PCB100PS-0.5 (0.5m)
: PCB100PS-1.5 (1.5m)
: PCB100PS-3 (3m)
: PCB100PS-5 (5m)

Flat Cable with One 100-Pin Connector
: PCA100P-1.5 (1.5m)
: PCA100P-3 (3m)
: PCA100P-5 (5m)

Accessories (Option)

Connection Conversion Board for SMC : CCB-SMC2 *1*2*3
Screw Terminal (M3*100) : EPD-100A *2*3*4

*1 Distributes 100-pin 0.8-mm pitch connector x 1 to: D-SUB 37 connector x 4, D-SUB-9 connector x 4.
*2 A PCB100PS optional cable is required separately.
*3 Cables and accessories are required each connector.
*4 "Spring-up" type terminal is used to prevent terminal screws from falling off.

* Check the CONTEC's Web site for more information on these options.

Customer Support

CONTEC provides the following support services for you to use CONTEC products more efficiently and comfortably.

Web Site

Japanese http://www.contec.co.jp/
English http://www.contec.com/
Chinese http://www.contec.com.cn/

Latest product information

CONTEC provides up-to-date information on products.

CONTEC also provides product manuals and various technical documents in the PDF.

Free download

You can download updated driver software and differential files as well as sample programs available in several languages.

Note! For product information
Contact your retailer if you have any technical question about a CONTEC product or need its price, delivery time, or estimate information.

Limited Three-Years Warranty

CONTEC products are warranted by CONTEC CO., LTD. to be free from defects in material and workmanship for up to three years from the date of purchase by the original purchaser.

Repair will be free of charge only when this device is returned freight prepaid with a copy of the original invoice and a Return Merchandise Authorization to the distributor or the CONTEC group office, from which it was purchased.

This warranty is not applicable for scratches or normal wear, but only for the electronic circuitry and original products. The warranty is not applicable if the device has been tampered with or damaged through abuse, mistreatment, neglect, or unreasonable use, or if the original invoice is not included, in which case repairs will be considered beyond the warranty policy.

How to Obtain Service

For replacement or repair, return the device freight prepaid, with a copy of the original invoice. Please obtain a Return Merchandise Authorization number (RMA) from the CONTEC group office where you purchased before returning any product.

* No product will be accepted by CONTEC group without the RMA number.

Liability

The obligation of the warrantor is solely to repair or replace the product. In no event will the warrantor be liable for any incidental or consequential damages due to such defect or consequences that arise from inexperienced usage, misuse, or malfunction of this device.

Safety Precautions

Understand the following definitions and precautions to use the product safely.

Safety Information

This document provides safety information using the following symbols to prevent accidents resulting in injury or death and the destruction of equipment and resources. Understand the meanings of these labels to operate the equipment safely.

⚠ DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Handling Precautions

⚠ DANGER

Do not use the product where it is exposed to flammable or corrosive gas. Doing so may result in an explosion, fire, electric shock, or failure.

⚠ CAUTION

- There are switches and jumpers on this product that need to be set in advance.
  Be sure to check these before installing this product.
- Only set the switches and jumpers on this product to the specified settings.
  Otherwise, this product may malfunction, overheat, or cause a failure.
- Do not strike or bend this product.
  Otherwise, this product may malfunction, overheat, cause a failure or breakage.
- Do not touch this product's metal plated terminals (edge connector) with your hands.
  Otherwise, this product may malfunction, overheat, or cause a failure.
  If the terminals are touched by someone's hands, clean the terminals with industrial alcohol.
- Do not install or remove this product to or from the extension slot while the computer's power is turned on. And also do not connect this product and external device while the power is turned on.
  Otherwise, this product may malfunction, overheat, or cause a failure.
  Be sure that the personal computer or the I/O extension unit power is turned off.
- Do not connect or remove a cable with or from this product while the computer's power is turned on. And also do not connect this product and external device while the power is turned on.
  Otherwise, this product may malfunction, overheat, or cause a failure.
  Be sure that the personal computer or the I/O extension unit power is turned off.
- When you use this product in a noisy environment or are nervous about noise, attach ferrite cores to the connection cable

- Make sure that your PC or expansion unit can supply ample power to all the products installed. Insufficiently energized products could malfunction, overheat, or cause a failure.
- The specifications of this product are subject to change without notice for enhancement and quality improvement.
  Even when using this product continuously, be sure to read the manual and understand the contents.
- Do not modify this product. CONTEC will bear no responsibility for any problems, etc., resulting from modifying this product.
- Regardless of the foregoing statements, CONTEC is not liable for any damages whatsoever (including damages for loss of business profits) arising out of the use or inability to use this CONTEC product or the information contained herein.
- Regarding “CE EMC Directive Notice”.
  Please connect the Interface Connector with a shielded cable to meet the mentioned standard above.

Environment

Use this product in the following environment. If used in an unauthorized environment, the board may overheat, malfunction, or cause a failure.

Operating temperature

0 - 50ºC

Humidity

10 - 90%RH (No condensation)

Corrosive gases

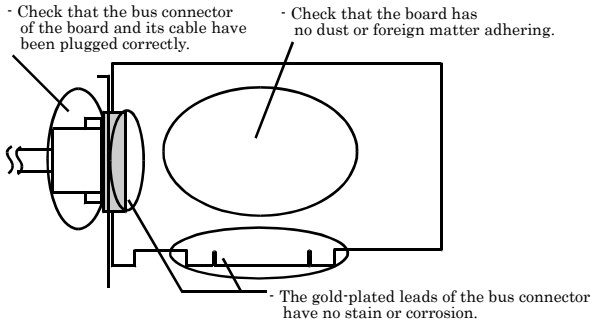
None

Floating dust particles

Not to be excessive

Inspection

Inspect the product periodically as follows to use it safely.



Storage

When storing this product, keep it in its original packing form.

(1) Put this product in the storage bag.

(2) Wrap it in the packing material, then put it in the box.

(3) Store the package at room temperature at a place free from direct sunlight, moisture, shock, vibration, magnetism, and static electricity.

Disposal

When disposing of the product, follow the disposal procedures stipulated under the relevant laws and municipal ordinances.

2. Setup

This chapter explains how to set up this product.

What is Setup?

Setup means a series of steps to take before the product can be used.
Different steps are required for software and hardware.
The setup procedure varies with the OS and applications used.

Using the Board under Windows

Using the Driver library API-PAC(W32)

This section describes the setup procedure to be performed before you can start developing application programs for the board using the bundled CD-ROM “Driver library API-PAC(W32)”.

Taking the following steps sets up the software and hardware. You can use the diagnosis program later to check whether the software and hardware function normally.

Step 1 Installing the Software

Step 2 Setting the Hardware

Step 3 Installing the Hardware

Step 4 Initializing the Software

Step 5 Checking Operations with the Diagnosis Program

If Setup fails to be performed normally, see the “Setup Troubleshooting” section at the end of this chapter.

Using the Board under Window

Using Software Other than the Driver library API-PAC(W32)

For setting up software other than API-PAC(W32), refer to the manual for that software. See also the following parts of this manual as required.

This chapter Step 2 Setting the Hardware

This chapter Step 3 Installing the Hardware

Chapter 3 External Connection

Chapter 6 About Hardware

Using the Board under an OS Other than Windows

For using the board under an OS other than Windows, see the following parts of this manual.

This chapter Step 2 Setting the Hardware

Chapter 3 External Connection

Chapter 6 About Hardware

Step 1 Installing the Software

This section describes how to install the API function libraries.

Before installing the hardware on your PC, install the API driver libraries from the bundled API-PAC(W32) CD-ROM.

The following description assumes the operating system as Windows XP. Although some user interfaces are different depending on the OS used, the basic procedure is the same.

Which Driver to Use

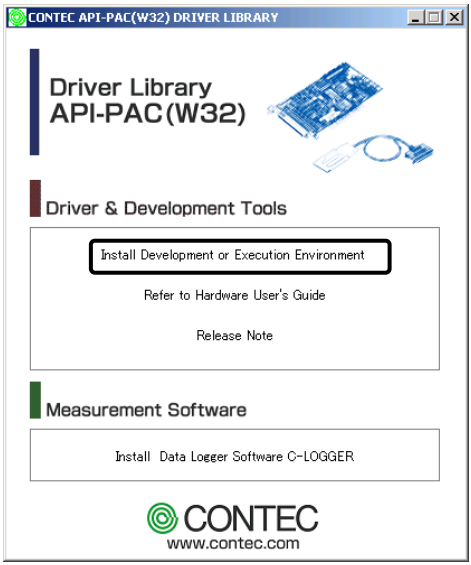
This product supports the advanced motion control driver API-SMC(WDM) only. The motion control driver API-SMC(98/PC) cannot be used.

Starting the Install Program

(1) **Load the CD-ROM [API-PAC(W32)] on your PC.**

(2) **The API-PAC(W32) Installer window appears automatically.**
If the panel does not appear, run (CD-ROM drive letter):\AUTORUN.exe.

(3) **Click on the [Install Development or Execution Environment] button.**



* When using the Windows 7, Vista, driver is automatically installed.

⚠ CAUTION

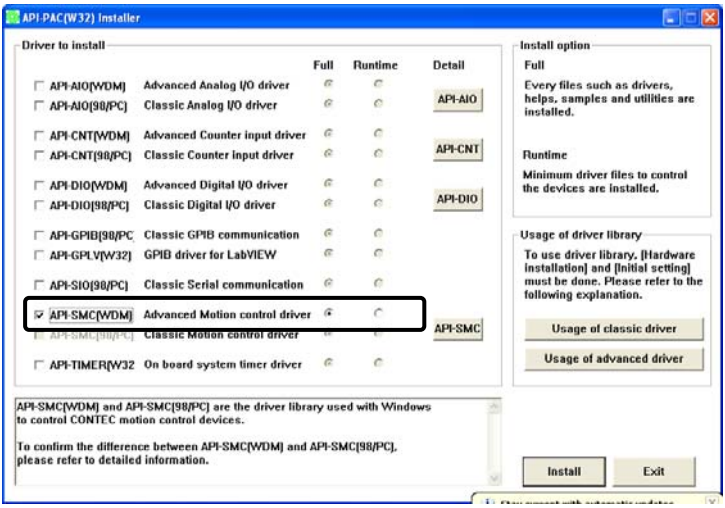
Before installing the software in Windows 7, Server 2008, Vista, XP, Server 2003, 2000, log in as a user with administrator privileges.

Selecting API-SMC(WDM)

(1) **The following dialog box appears to select “Driver to install” and “Install option”, “Usage of driver library”.**

(2) **Select the "Advanced Motion control driver".**

(3) **Click on the [Install] button.**



* Clicking the [API-SMC] button displays detailed information about API-SMC(WDM) and API-SMC(98/PC).

Executing the Installation

(1) Follow the on-screen instructions to proceed to install.

(2) After finishing installing, Readme file is displayed.

You have now finished installing the software.

Step 2 Setting the Hardware

This section describes how to set this product and plug it on your PC.
This product has some switches and jumper to be preset.
Check the on-product switches and jumpers before plugging this product into an expansion slot.
This product can be set up even with the factory defaults untouched. You can change this product settings later.

Parts of this product and Factory Defaults

Figure 2.1. - 2.2. shows the names of major parts on this product.
Note that the switch setting shown below is the factory default.

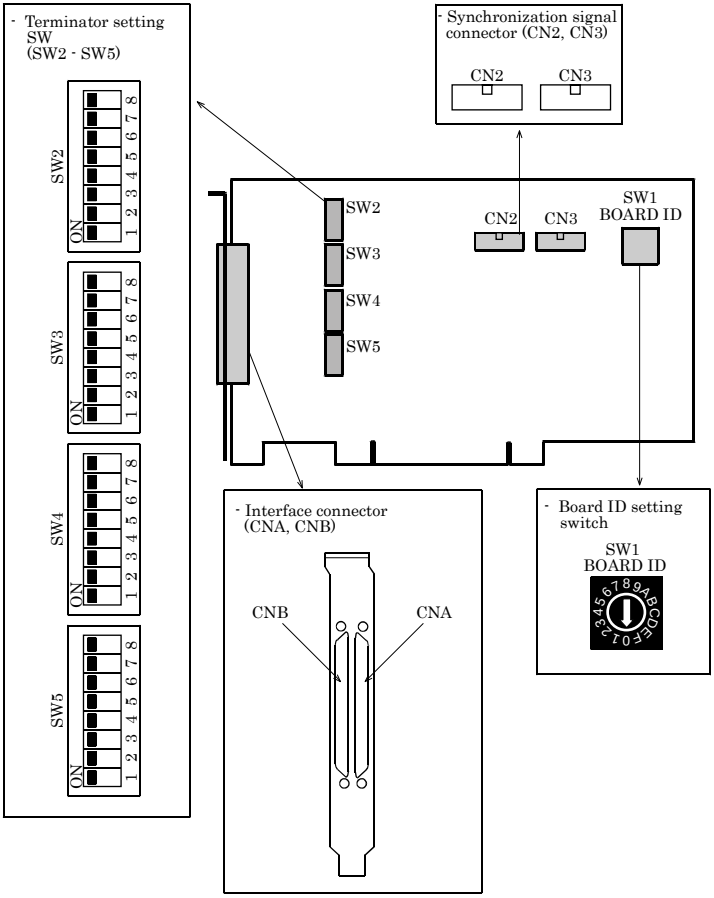


Figure 2.1. Component Locations < SMC-8DF-PCI >

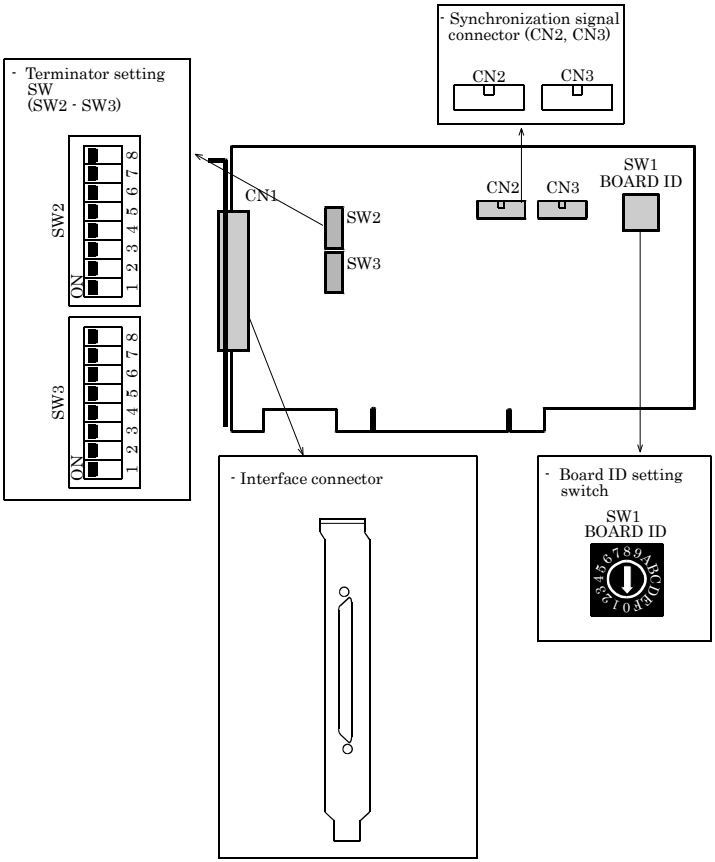


Figure 2.2. Component Locations < SMC-4DF-PCI >

Setting the Board ID

If you install two or more boards on one personal computer, assign a different ID value to each of the boards to distinguish them.

The board IDs can be set from 0 - Fh to identify up to sixteen boards.

If only one board is used, the original factory setting (Board ID = 0) should be used.

Setting Procedure

To set the board ID, use the rotary switch on the board. Turn the SW1 knob to set the board ID as shown below.

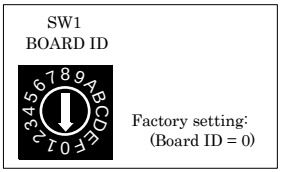


Figure 2.3. Board ID Settings (SW1)

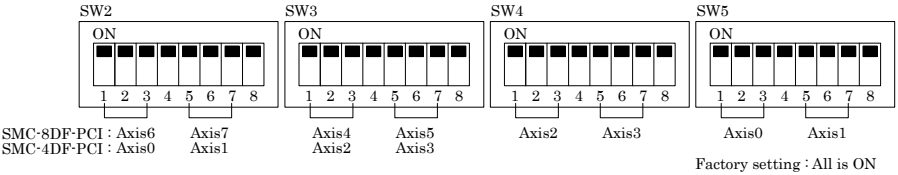
Setting the Terminating Resistor

You can select whether to insert a terminator (terminal resistor) in the differential input section. Select whether to insert the terminator depending on the system to be used.

Setup Method

To select whether to insert the terminator, use the DIP switches (SMC-4DF-PCI : SW2 and SW3, SMC-8DF-PCI : SW2 - SW5) on the board.

Set each SW according to the figure shown below.



Bit	Input signal	Insert the terminal	Not insert the terminal
1	Phase-A	ON	OFF
2	Phase-B	ON	OFF
3	Phase-Z	ON	OFF
4	N.C.	----	----
5	Phase-A	ON	OFF
6	Phase-B	ON	OFF
7	Phase-Z	ON	OFF
8	N.C.	----	----

Figure 2.4. Terminator Setup SW and Settings

Plugging the Board

(1) Before plugging the board, shut down the system, unplug the power code of your PC.

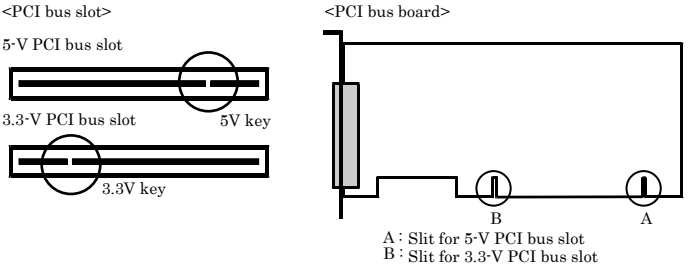
(2) Remove the cover from the PC so that the board can be mounted.

(3) Plug the board into an expansion slot.

(4) Put the cover back into place.

Applicable PCI bus slots

PCI bus slots used in PCs have keys to prevent 5V and 3.3V PCI bus boards from being accidentally plugged into wrong bus slots. This board can be plugged into both of the 5V and 3.3V PCI bus slots.



⚠ CAUTION

- Do not touch the board's metal plated terminals (edge connector) with your hands.
  Otherwise, the board may malfunction, overheat, or cause a failure.
  If the terminals are touched by someone's hands, clean the terminals with industrial alcohol.
- Do not install or remove the board to or from the slot while the computer's power is turned on.
  Otherwise, the board may malfunction, overheat, or cause a failure.
  Doing so could cause trouble. Be sure that the personal computer or the I/O expansion unit power is turned off.
- Make sure that your PC or expansion unit can supply ample power to all the boards installed.
  Insufficiently energized boards could malfunction, overheat, or cause a failure.
- Power supply from the PCI bus slot at +5V is required.

Step 3 Installing the Hardware

For using an expansion board under Windows, you have to let the OS detect the I/O addresses and IRQ to be used by the board. The process is referred to as installing the hardware.

In the case of using two or more boards, make sure you install one by one with the Found New Hardware Wizard.

Turning on the PC

Turn on the power to your PC.

⚠ CAUTION

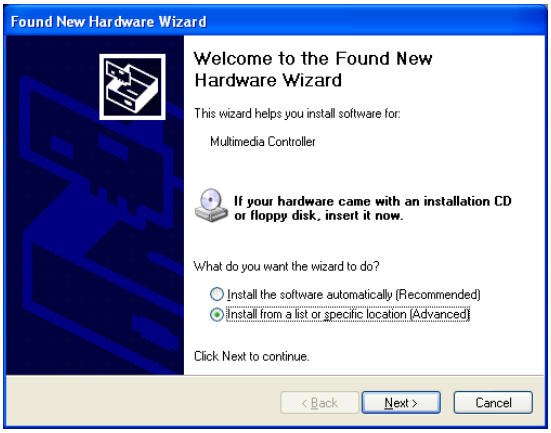
- The board cannot be properly installed unless the resources (I/O addresses and interrupt level) for the board can be allocated. Before attempting to install the board, first determine what PC resources are free to use.
- The resources used by each board do not depend on the location of the slot or the board itself. If you remove two or more boards that have already been installed and then remount one of them on the computer, it is unknown that which one of the sets of resources previously assigned to the two boards is assigned to the remounted board. In this case, you must check the resource settings.

When Using API-SMC(WDM)

(1) The “Found New Hardware Wizard” will be started.

Select “No, not this time” and then click the “Next” button.

(2) When “Multimedia Controller” is displayed, select “Install from a list or specific location[Advanced]” and then specify that folder on the CD-ROM which contains the setup information (INF) file to register the board.

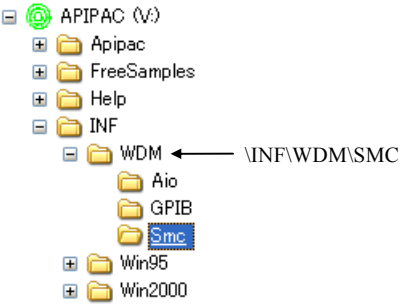


When the model name of hardware is displayed, select “Install the software automatically [Recommended]” and then click on the “Next” button.

Source folder

The setup information (INF) file is contained in the following folder on the bundled CD-ROM.

\INF\WDM\SMC



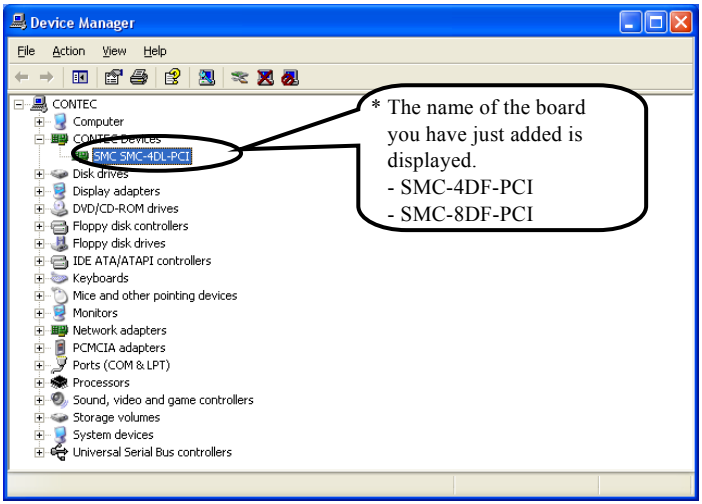
You have now finished installing the hardware.

Step 4 Initializing the Software

The API function library requires the initial setting to recognize the execution environment. It is called the initialization of the API function library.

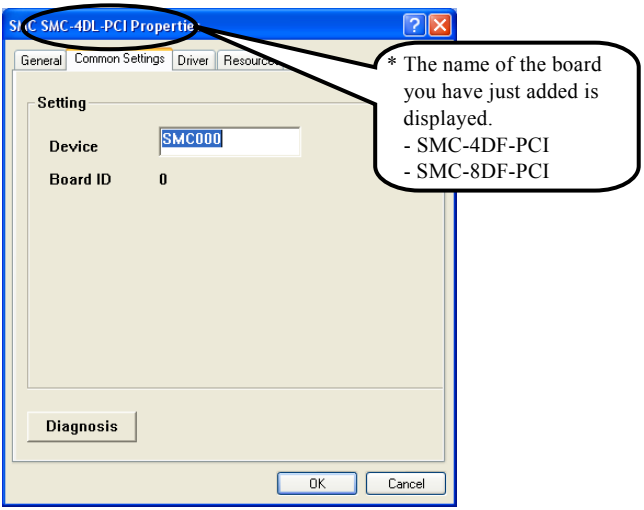
Setting the device name

(1) Run Device Manager. From [My Computer] - [Control Panel], select [System] and then select the [Device Manager] tab.
(You can also open Device Manager by right clicking on My Computer and selecting Properties.)



(2) The installed hardware appears under the CONTEC Devices node. Open the CONTEC Devices node and select the device you want to setup (the device name should appear highlighted). Click [Properties].

(3) The property page for the device opens.
Enter the device name in the common settings tab page and then click [OK].
The device name you set here is used later when programming.



* The initial device name that appears is a default value. You can use this default name if you wish.

* Make sure that you do not use the same name for more than one device.

You have now finished installing the initial setting of Software.

Step 5 Checking Operations with the Diagnosis Program

Use the diagnosis program to check that the board and driver software work normally, thereby you can confirm that they have been set up correctly.

What is the Diagnosis Program?

The diagnosis program diagnoses the states of the board and driver software.
For Quick Check, the program checks the board resources for validity. The resources include the I/O addresses, interrupt level (IRQ), board ID, and sync signal.
For Detail Check, the program checks the connections of the motor control board, driver unit, and limit sensor for validity. The program inputs/outputs signals in interactive mode to check for validity. Check items are Limit Signals Input, Control Signals Input/Output and Pulse Signals Output.

Check method

Perform the input/output test and check the execution environment with the driver unit connected.
The dedicated screw terminal CCB-SMC2 will come in handy when you check the board.
The board should be checked with the factory defaults.
For direct connection to the board, see Chapter 3 “External Connection”.

Connection diagram

The following connection diagrams show connections using the dedicated screw terminal CCB-SMC2.

<Pulse output>

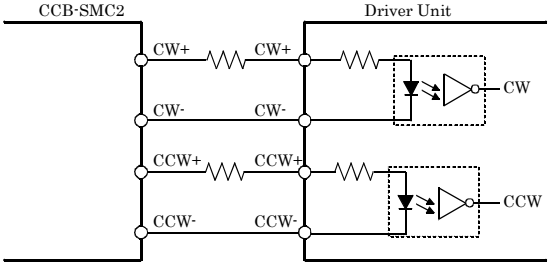


Figure 2.5. Connection diagram ***< 1 / 2 >***

<Limit input>

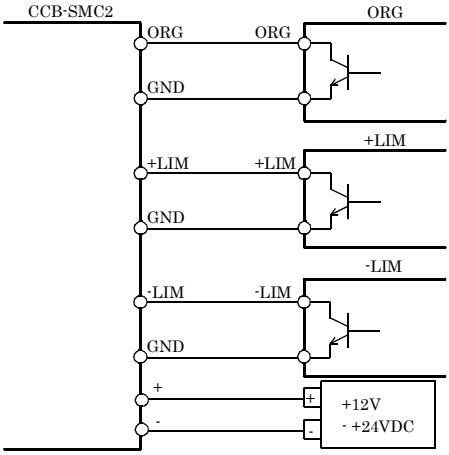
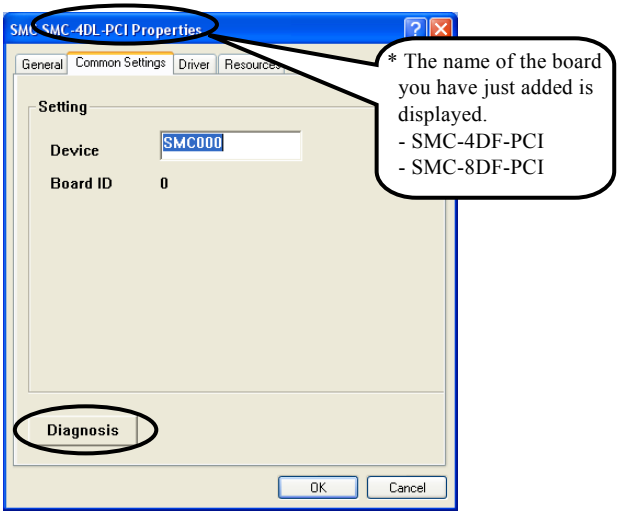


Figure 2.5. Connection diagram ***< 2 / 2 >***

Using the Diagnosis Program

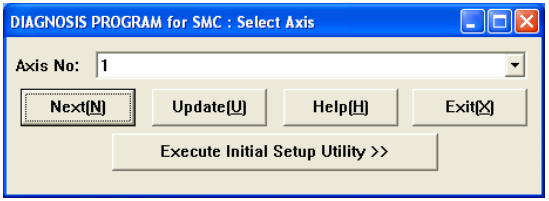
Starting the Diagnosis Program

Click the [Diagnosis] button on the device property page to start the diagnosis program.

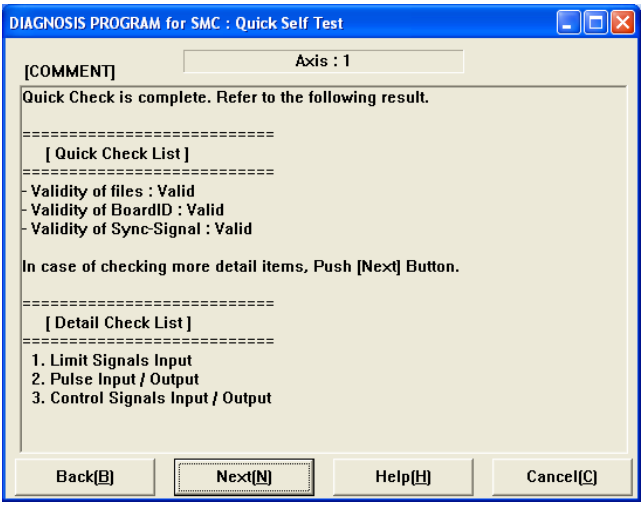


Checking for motor control

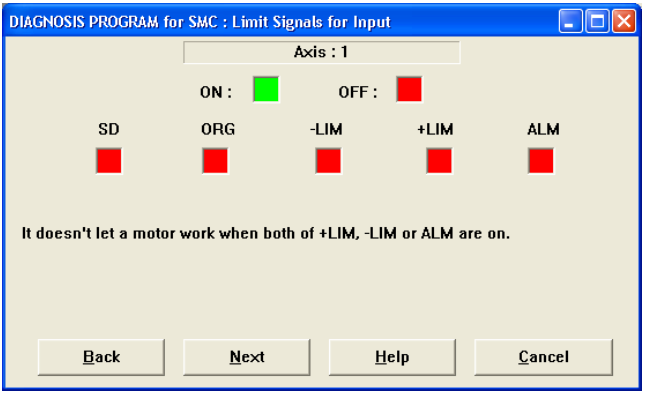
(1) Select the name of the axis you want to diagnose, then click on the [Execute Initial Setup Utility] button to execute Quick Check.



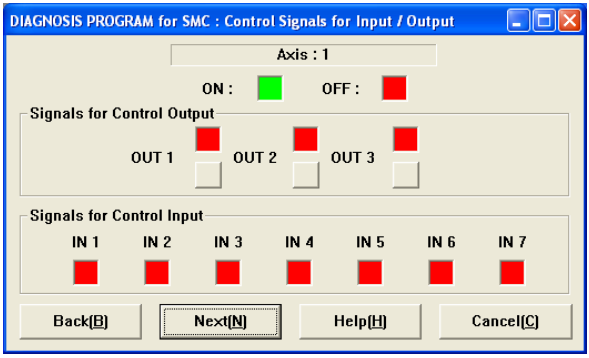
To execute Detail Check, click on the [Next] button. Otherwise, click on the [Back] or [Cancel] button.

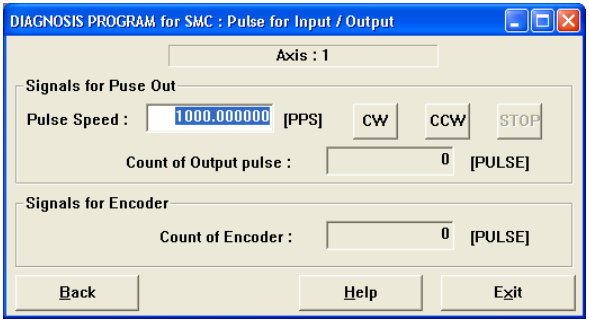


(2) Check/mask each signal.
When the alarm (ALM) is ON or each limit (+LIM, -LIM) is ON, the motor does not operate in that direction. In this case, check the connection of the signal or mask it.



(3) Simple operation is performed.





Setup Troubleshooting

Symptoms and Actions

Data input or output does not operate correctly

- Run the diagnosis program to check that the device is registered and whether any initialization errors have occurred.
- Is there a problem with the device settings, wiring, or similar? Check the I/O setting of motor driver unit and limit sensor for validity.

The diagnostic program works correctly but the application program does not.

The diagnostic program uses the API-TOOL functions. If the diagnostic program works correctly, other applications should work correctly also. If you have a problem, recheck your program taking note of the following points.

- Check the return values of the API functions.
- Refer to the source code for the sample programs.

The OS does not boot correctly or does not detect the device correctly.

Refer to the "Troubleshooting" section of API-SMC(WDM) HELP.

If your problem cannot be resolved

Contact your retailer.

3. External Connection

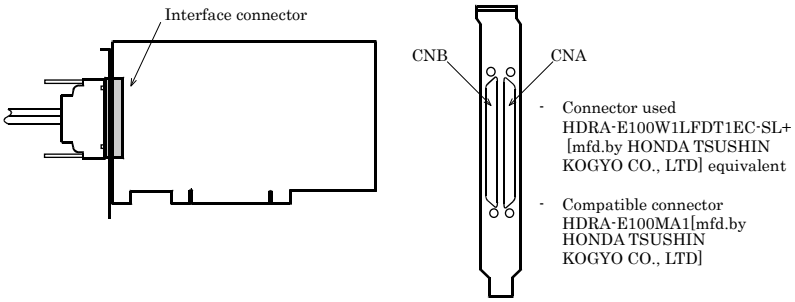
This chapter describes the interface connectors on the board and the external I/O circuits.
Check the information available here when connecting an external device.

How to connect the connectors

Connector shape

< SMC-8DF-PCI >

The on-board interface connector (CNA, CNB) is used when connecting this product and the external devices.

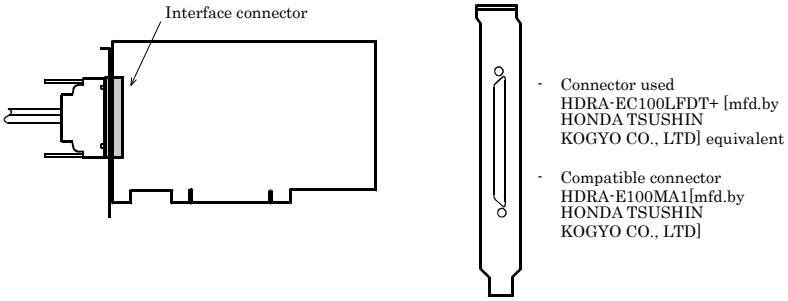


* Please refer to chapter 1 for more information on the supported cable and accessories. Cables and accessories are required each connector.

Figure 3.1. Interface Connector Shape < SMC-8DF-PCI >

< SMC-4DF-PCI >

The on-board interface connector is used when connecting this product and the external devices.



* Please refer to chapter 1 for more information on the supported cable and accessories.

Figure 3.2. Interface Connector Shape < SMC-4DF-PCI >

Connector Pin Assignment

Pin Assignments of Interface Connector (CNA, CNB) < SMC-8DF-PCI >

CNB

axis0 : P-COM	100	50	axis2 : P-COM
axis0 : IN1/ALM	99	49	axis2 : IN1/ALM
axis0 : IN2/INP	98	48	axis2 : IN2/INP
axis0 : IN3/SD	97	47	axis2 : IN3/SD
axis0 : IN4/LTC	96	46	axis2 : IN4/LTC
axis0 : IN5/PCS	95	45	axis2 : IN5/PCS
axis0 : IN6/CLR	94	44	axis2 : IN6/CLR
axis0 : IN7	93	43	axis2 : IN7
axis0 : ORG	92	42	axis2 : ORG
axis0 : +LIM	91	41	axis2 : +LIM
axis0 : -LIM	90	40	axis2 : -LIM
axis1 : P-COM	89	39	axis3 : P-COM
axis1 : IN1/ALM	88	38	axis3 : IN1/ALM
axis1 : IN2/INP	87	37	axis3 : IN2/INP
axis1 : IN3/SD	86	36	axis3 : IN3/SD
axis1 : IN4/LTC	85	35	axis3 : IN4/LTC
axis1 : IN5/PCS	84	34	axis3 : IN5/PCS
axis1 : IN6/CLR	83	33	axis3 : IN6/CLR
axis1 : IN7	82	32	axis3 : IN7
axis1 : ORG	81	31	axis3 : ORG
axis1 : +LIM	80	30	axis3 : +LIM
axis1 : -LIM	79	29	axis3 : -LIM
axis0 : A+	78	28	axis2 : A+
axis0 : A-	77	27	axis2 : A-
axis0 : B+	76	26	axis2 : B+
axis0 : B-	75	25	axis2 : B-
axis0 : Z+	74	24	axis2 : Z+
axis0 : Z-	73	23	axis2 : Z-
axis1 : A+	72	22	axis3 : A+
axis1 : A-	71	21	axis3 : A-
axis1 : B+	70	20	axis3 : B+
axis1 : B-	69	19	axis3 : B-
axis1 : Z+	68	18	axis3 : Z+
axis1 : Z-	67	17	axis3 : Z-
axis0 : OUT3	66	16	axis2 : OUT3
axis0 : OUT2	65	15	axis2 : OUT2
axis0 : OUT1	64	14	axis2 : OUT1
axis0 : DIR+/CCW+	63	13	axis2 : DIR+/CCW+
axis0 : DIR-/CCW-	62	12	axis2 : DIR-/CCW-
axis0 : OUT+/CW+	61	11	axis2 : OUT+/CW+
axis0 : OUT-/CW-	60	10	axis2 : OUT-/CW-
GND	59	9	GND
axis1 : OUT3	58	8	axis3 : OUT3
axis1 : OUT2	57	7	axis3 : OUT2
axis1 : OUT1	56	6	axis3 : OUT1
axis1 : DIR+/CCW+	55	5	axis3 : DIR+/CCW+
axis1 : DIR-/CCW-	54	4	axis3 : DIR-/CCW-
axis1 : OUT+/CW+	53	3	axis3 : OUT+/CW+
axis1 : OUT-/CW-	52	2	axis3 : OUT-/CW-
GND	51	1	GND

* Axis0 - Axis3 of this manual corresponds to Axis No.1 - Axis No.4 in API-SMC(WDM).

P-COM	Plus common	B+	Encoder phase B input+
IN1/ALM	General-purpose input1/Alarm input	B-	Encoder phase B input-
IN2/INP	General-purpose input2/Positionig input	Z+	Encoder phase Z input+
IN3/SD	General-purpose input3/Slow down input	Z-	Encoder phase Z input-
IN4/LTC	General-purpose input4/counter latch input	OUT1	General-purpose output1
IN5/PCS	General-purpose input5/positioning operation start input	OUT2	General-purpose output2
IN6/CLR	General-purpose input6/Counter clear input	OUT3	General-purpose output3
IN7	General-purpose input7	DIR+/CCW+	Direction/CCW output+
ORG	Origin input	DIR-/CCW-	Direction/CCW output-
+LIM	Positive-direction limit	OUT+/CW+	Pulse/CW output+
-LIM	Negative-direction limit	OUT-/CW-	Pulse/CW output-
A+	Encoder phase A input+	GND	Power ground input (common to internal GND)
A-	Encoder phase A input-		

Figure 3.3. Pin Assignments of Interface Connector (CNB) < SMC-8DF-PCI >

CNA

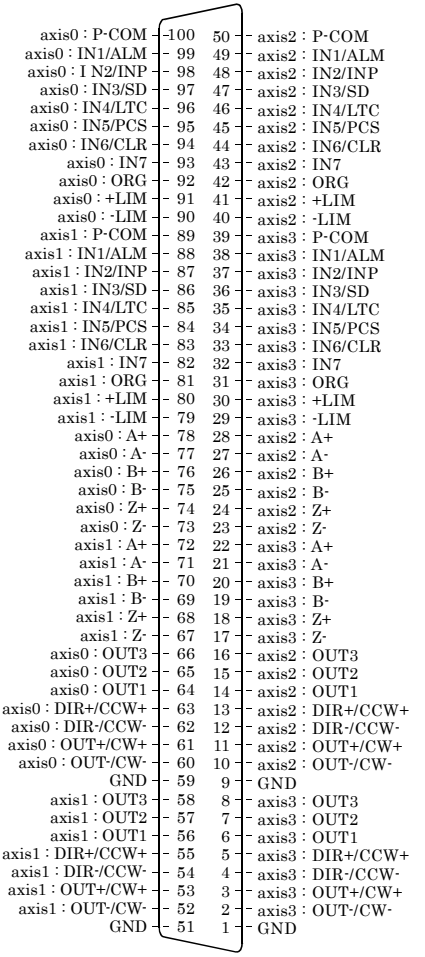
GND	1	51	GND
axis7 : OUT-/CW-	2	52	axis5 : OUT-/CW-
axis7 : OUT+/CW+	3	53	axis5 : OUT+/CW+
axis7 : DIR-/CCW-	4	54	axis5 : DIR-/CCW-
axis7 : DIR+/CCW+	5	55	axis5 : DIR+/CCW+
axis7 : OUT1	6	56	axis5 : OUT1
axis7 : OUT2	7	57	axis5 : OUT2
axis7 : OUT3	8	58	axis5 : OUT3
GND	9	59	GND
axis6 : OUT-/CW-	10	60	axis4 : OUT-/CW-
axis6 : OUT+/CW+	11	61	axis4 : OUT+/CW+
axis6 : DIR-/CCW-	12	62	axis4 : DIR-/CCW-
axis6 : DIR+/CCW+	13	63	axis4 : DIR+/CCW+
axis6 : OUT1	14	64	axis4 : OUT1
axis6 : OUT2	15	65	axis4 : OUT2
axis6 : OUT3	16	66	axis4 : OUT3
axis7 : Z-	17	67	axis5 : Z-
axis7 : Z+	18	68	axis5 : Z+
axis7 : B-	19	69	axis5 : B-
axis7 : B+	20	70	axis5 : B+
axis7 : A-	21	71	axis5 : A-
axis7 : A+	22	72	axis5 : A+
axis6 : Z-	23	73	axis4 : Z-
axis6 : Z+	24	74	axis4 : Z+
axis6 : B-	25	75	axis4 : B-
axis6 : B+	26	76	axis4 : B+
axis6 : A-	27	77	axis4 : A-
axis6 : A+	28	78	axis4 : A+
axis7 : -LIM	29	79	axis5 : -LIM
axis7 : +LIM	30	80	axis5 : +LIM
axis7 : ORG	31	81	axis5 : ORG
axis7 : IN7	32	82	axis5 : IN7
axis7 : IN6/CLR	33	83	axis5 : IN6/CLR
axis7 : IN5/PCS	34	84	axis5 : IN5/PCS
axis7 : IN4/LTC	35	85	axis5 : IN4/LTC
axis7 : IN3/SD	36	86	axis5 : IN3/SD
axis7 : IN2/INP	37	87	axis5 : IN2/INP
axis7 : IN1/ALM	38	88	axis5 : IN1/ALM
axis7 : P-COM	39	89	axis5 : P-COM
axis6 : -LIM	40	90	axis4 : -LIM
axis6 : +LIM	41	91	axis4 : +LIM
axis6 : ORG	42	92	axis4 : ORG
axis6 : IN7	43	93	axis4 : IN7
axis6 : IN6/CLR	44	94	axis4 : IN6/CLR
axis6 : IN5/PCS	45	95	axis4 : IN5/PCS
axis6 : IN4/LTC	46	96	axis4 : IN4/LTC
axis6 : IN3/SD	47	97	axis4 : IN3/SD
axis6 : IN2/INP	48	98	axis4 : IN2/INP
axis6 : IN1/ALM	49	99	axis4 : IN1/ALM
axis6 : P-COM	50	100	axis4 : P-COM

* Axis4 - Axis7 of this manual corresponds to Axis No.5 - Axis No.8 in API-SMC(WDM).

P-COM	Plus common	B+	Encoder phase B input+
IN1/ALM	General-purpose input1/Alarm input	B-	Encoder phase B input-
IN2/INP	General-purpose input2/Positionig input	Z+	Encoder phase Z input+
IN3/SD	General-purpose input3/Slow down input	Z-	Encoder phase Z input-
IN4/LTC	General-purpose input4/counter latch input	OUT1	General-purpose output1
IN5/PCS	General-purpose input5/positioning operation start input	OUT2	General-purpose output2
IN6/CLR	General-purpose input6/Counter clear input	OUT3	General-purpose output3
IN7	General-purpose input7	DIR+/CCW+	Direction/CCW output+
ORG	Origin input	DIR-/CCW-	Direction/CCW output-
+LIM	Positive-direction limit	OUT+/CW+	Pulse/CW output+
-LIM	Negative-direction limit	OUT-/CW-	Pulse/CW output-
A+	Encoder phase A input+	GND	Power ground input (common to internal GND)
A-	Encoder phase A input-		

Figure 3.4. Pin Assignments of Interface Connector (CNA) < SMC-8DF-PCI >

Pin Assignments of Interface Connector < SMC-4DF-PCI >



* Axis0 - Axis3 of this manual corresponds to Axis No.1 - Axis No.4 in API-SMC(WDM).

P-COM	Plus common	B+	Encoder phase B input+
IN1/ALM	General-purpose input1/Alarm input	B-	Encoder phase B input-
IN2/INP	General-purpose input2/Positionig input	Z+	Encoder phase Z input+
IN3/SD	General-purpose input3/Slow down input	Z-	Encoder phase Z input-
IN4/LTC	General-purpose input4/counter latch input	OUT1	General-purpose output1
IN5/PCS	General-purpose input5/positioning operation start input	OUT2	General-purpose output2
IN6/CLR	General-purpose input6/Counter clear input	OUT3	General-purpose output3
IN7	General-purpose input7	DIR+/CCW+	Direction/CCW output+
ORG	Origin input	DIR-/CCW-	Direction/CCW output-
+LIM	Positive-direction limit	OUT+/CW+	Pulse/CW output+
-LIM	Negative-direction limit	OUT-/CW-	Pulse/CW output-
A+	Encoder phase A input+	GND	Power ground input (common to internal GND)
A-	Encoder phase A input-		

Figure 3.5. Pin Assignments of Interface Connector < SMC-4DF-PCI >

Connecting Output Signals

Pulse output circuit (CW, CCW)

The pulse output circuit on this product, which is in the form of a differential line driver (AM26LS31 equivalent) as shown in the following figure, can be connected with differential input, opto-coupler, and TTL level input.

Connection with the differential input

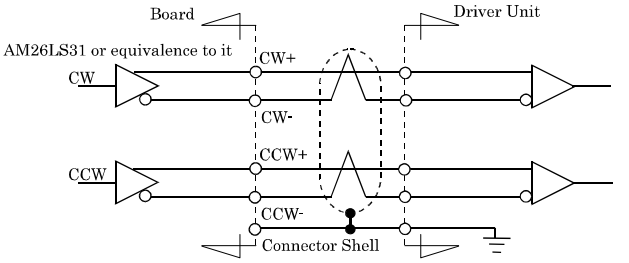


Figure 3.6. Pulse output circuit (Connection with the differential input)

⚠ CAUTION

- Please use the twisted-pair cable that does the shield processing as a noise measures when connecting it with the differential input.

Connection with the opto-coupler input (When the driver unit guarantees the connection with the differential output)

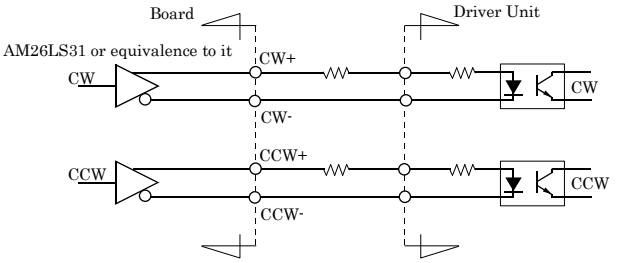


Figure 3.7. Pulse output circuit (connection with the opto-coupler input)

Connection with the opto-coupler input

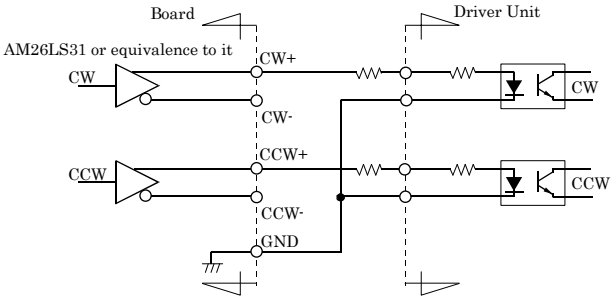


Figure 3.8. Pulse output circuit (connection with the opto-coupler input)

Connection with TTL level input

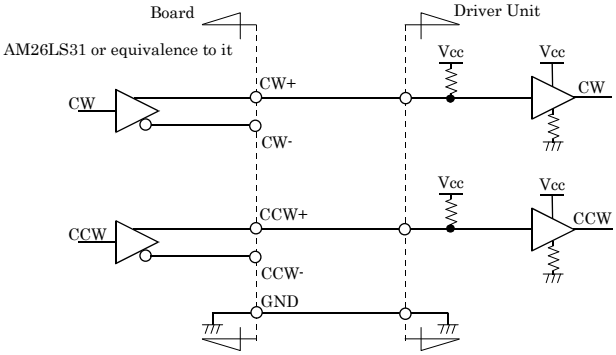


Figure 3.9. Pulse output circuit (connection with the TTL level input)

⚠ CAUTION

- The pulse output part of this product outputs the voltage by 2.5V or more at the High level output, and outputs the voltage of 0.5V or less at the Low level output. When connecting with the photo-coupler input or the TTL level input, please connect it after confirming the specification in the pulse input part of the driver unit operates by the above-mentioned voltage.

  In addition, please insert a current-limiting resistor according to the allowable current and drive current of the connected input circuit.
- To prevent the circuit from malfunctioning due to noise, wire it as far away from other signal lines and noise sources as possible.

Control signal/general-purpose signal output circuit(OUT1 - OUT3, ERC, CP1, CP2)

Output circuit of each output signal on this product is illustrated below. The signal output is an open-collector output. A ground wire must therefore be connected for driving.

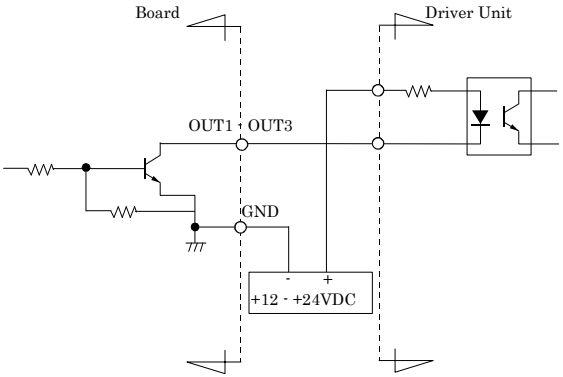


Figure 3.10. Output circuit

Connecting Input Signals

Encoder input circuit

Encoder input circuit on this product is illustrated below. The signal input is a differential input capable of connecting a line driver output, TTL level output and open-collector output.

Connection with the differential output

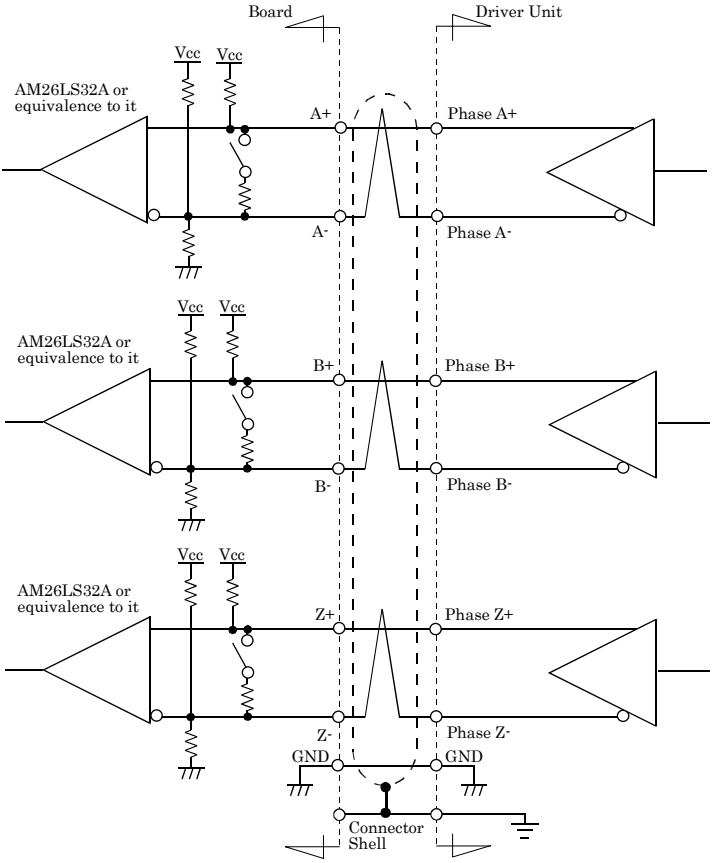


Figure 3.11. Encoder input circuit

⚠ CAUTION

- Please use the twisted-pair cable that does the shield processing as a noise measures when connecting it with the differential output.
- Restrict the use of cables to 10m for the line driver output.

Connection with the TTL level output

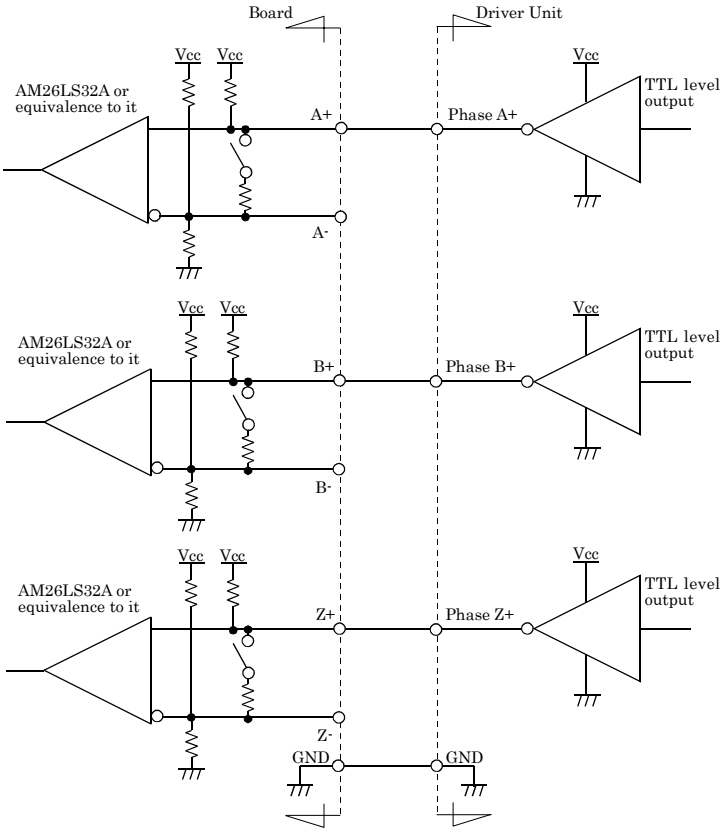


Figure 3.12. Encoder input circuit

⚠ CAUTION

- When connecting TTL level output signals, please do not insert a terminating resistor with reference to "Setting the Terminating Resistor in chapter 2". When inserted with a terminating resistor (factory setting), this product may malfunction, overheat, or causes a failure.
- Restrict the use of cables to 1.5m for the TTL level output.
- To prevent the circuit from malfunctioning due to noise, wire it as far away from other signal lines and noise sources as possible.

Connection with the open-collector output

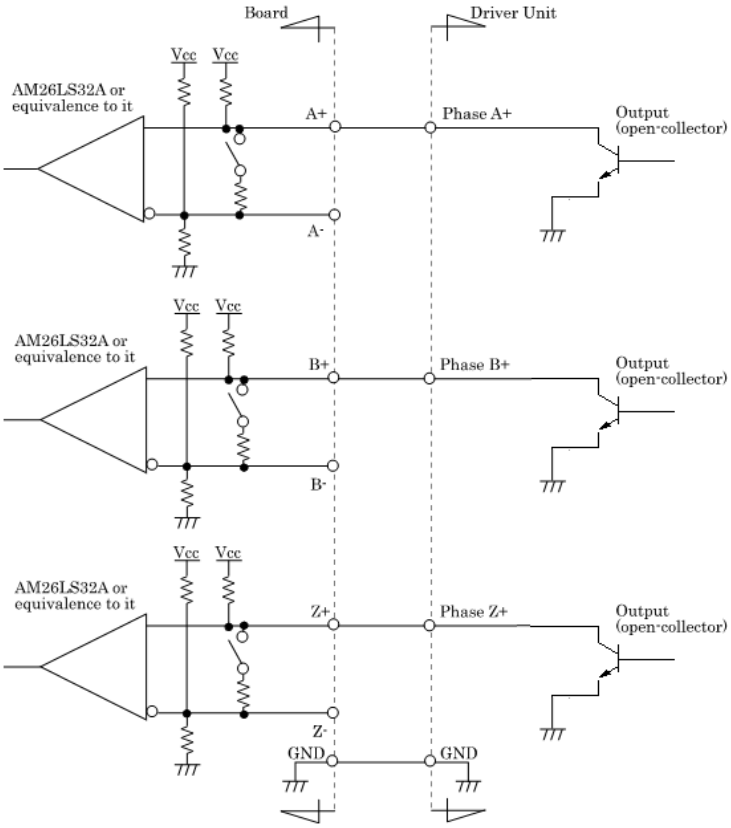


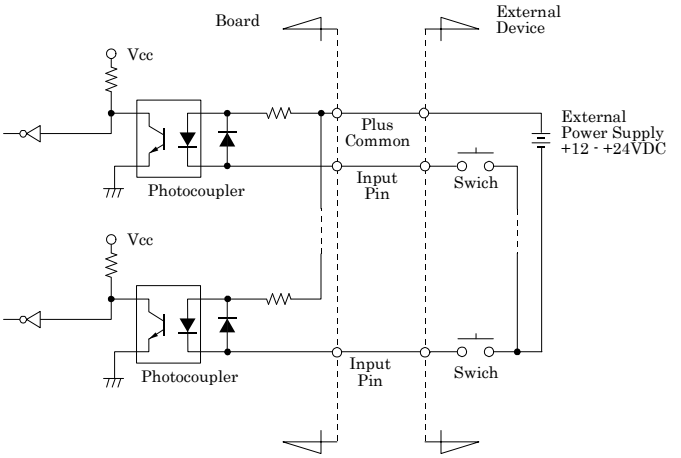
Figure 3.13. Encoder input circuit

⚠ CAUTION

- When connecting open-collector output signals, please do not insert a terminating resistor with reference to "Setting the Terminating Resistor in chapter 2". When inserted with a terminating resistor (factory setting), this product may malfunction, overheat, or causes a failure.
- Restrict the use of cables to 3m for the open-collector output.
- To prevent the circuit from malfunctioning due to noise, wire it as far away from other signal lines and noise sources as possible.

Limit input/general-purpose input/control input circuit(IN1 - IN7, +LIM, -LIM, ORG)

The limit input/general-purpose input/control input circuit on this board is illustrated below.
The signal input is an current drive input by opto-coupler (Corresponding to the current sink output). To drive the limit input/
general-purpose input/control input block, therefore, an external power supply is required at +12 - +24 V.



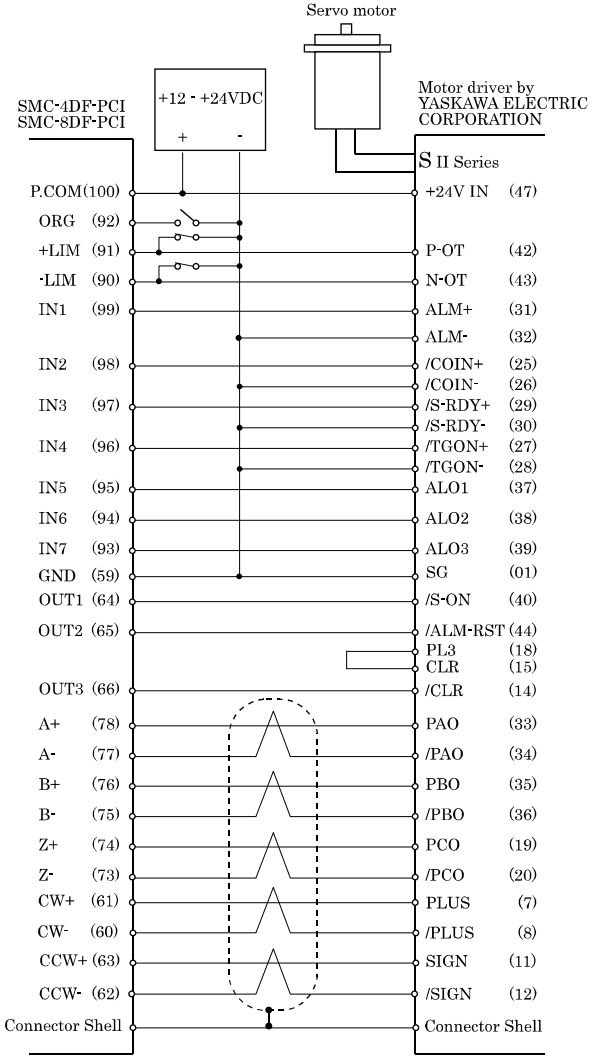
* Input pin is IN1 - IN7, +LIM, -LIM, ORG.

Figure 3.14. Limit input/general-purpose input/control input circuit

Connection Examples

Given below are practical examples of connection of this product that outputs pulses by the independent pulsing method to motor drivers. These examples show the connections through axis0 (Axis No.1 in API-SMC(WDM)).

Example of Connection to driver unit (Σ□ II Series) for Servo motor



*Please connect the Shield Line of cable with the Connector Shell.

Figure 3.15. Example of Connection to driver unit (Σ II Series) for Servo motor

Surge Voltage Countermeasures

When connecting a load that generates surge voltages and inrush currents, such as an induction load (relay coil) or an incandescent light bulb, to the digital output, appropriate protection must be provided in order to prevent damage to the output stage or a malfunction due to noise. The rapid shutoff of a coil, such as a relay, generates a sudden high-voltage pulse. If this voltage exceeds the voltage tolerance level of the output transistor, it can cause the transistor to gradually deteriorate, or even completely damage the transistor. Therefore, when driving an induction load, such as a relay coil, you should always connect a surge-absorbing device. The following illustrates a surge voltage countermeasure that can be employed:

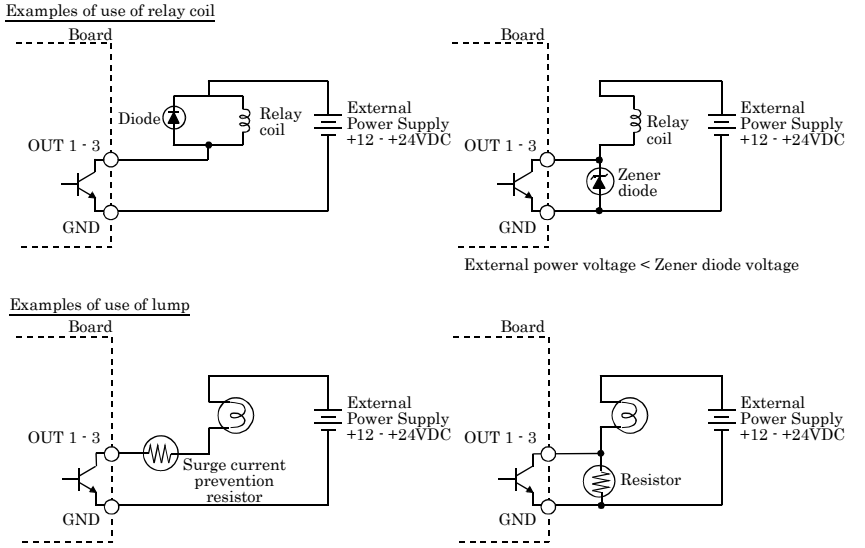


Figure 3.16. Surge Voltage Countermeasure

⚠ CAUTION

In order for a protection circuit to operate effectively, it must be connected within 50 cm of a load and a contact point.

4. Functions

This chapter describes the functions of this product.
You can easily set up and execute each of the functions using the bundled driver library.
For more information on this product, please refer to the “API-SMC HELP” after installing.

About each motor control operation

PTP operation function

This function moves the motor from one point to another (Point To Point motion).
Use the function for simple position control.

JOG operation function

This function moves the motor without specifying the travel distance.
Use the function to manually position the motor.

ORG operation function

This function moves the motor to the origin.

Linear interpolation

This product supports multi-axial linear interpolation. Linear interpolation causes linear motion to the specified position.

Circular interpolation

This product supports any 2-axial circular interpolation. Circular interpolation causes circular motion from the current coordinate to the target coordinate along an arc centered at the center point.

S-curve acceleration/deceleration function

This product has the S-curve acceleration/deceleration function in addition to the linear acceleration/deceleration function. The S-curve acceleration/deceleration function reduces acceleration when starting and stopping accelerating/decelerating the motor, thereby suppressing the vibration generated at the start and end of motion.

Frame (bank) sequence operation function

This product handles the set of parameters which are necessary for motor operations such as travel distance, travel speed, acceleration/deceleration rate, and so on as 1 frame, and can store up to 1024 frames for each axis. It is possible to repeatedly execute the frame after executing a frame once (loop operation). By storing and executing continuous multiple frames in the memory of the board, the following benefits can be got.

- Decrease the CPU load on the PC for complex control
- Shorten the idling time for the operation switchover of each frame
- By combination with synchronization control function, multi-axial continuous interpolation control is available.

Difference in minimum time when possible to the frame (bank) sequence operation by system configuration

When the time of a frame (bank) is short, the frame (bank) sequence operation might not be able to be done normally. Time of a frame (bank) sequence operation that can be normally operated depends on the speed of CPU. Information on PC (CPU and Chip Set), the number of axes for operation, and

time of operation a frame that confirms normal operation are showed in the following table.

Table 4.1. When it inserts in the expansion slot of a personal computer

CPU / Chip Set / Number of operation axes	Time of a frame (bank) sequence (Min.)
Core 2 Duo E6300 / Q965 / 1 axis	200µsec
Core 2 Duo E6300 / Q965 / 4 axes	200µsec
Core 2 Duo E6300 / Q965 / 8 axes	400µsec
Pentium III 800MHz / i815 / 1 axis	400µsec
Pentium III 800MHz / i815 / 4 axes	600µsec
Pentium III 800MHz / i815 / 8 axes	800µsec

Table 4.2. When CONTEC's expansion unit ECH(PCI)BE-H2B, ECH(PCI)BE-H4B, ECH(PCI)BE-F2B, ECH(PCI)BE-F4B and ECH(PCI)BE-H4A are used

CPU / Chip Set / Number of operation axes	Time of a frame (bank) sequence (Min.)
Core 2 Duo E6300 / Q965 / 1 axis	200µsec
Core 2 Duo E6300 / Q965 / 4 axes	200µsec
Core 2 Duo E6300 / Q965 / 8 axes	400µsec
Pentium III 800MHz / i815 / 1 axis	500µsec
Pentium III 800MHz / i815 / 4 axes	600µsec
Pentium III 800MHz / i815 / 8 axes	900µsec

These values may not be satisfied depending on the system configuration including other boards and applications.

Synchronous control function

Synchronization is the function that makes the motors start operation at the identical timing or, if any of the motors is stopped with an alarm (abnormal stop), stops all the relevant axes at once.
The following types of synchronous control are available.

- Multi-axis synchronous start control
- Multi-axis synchronous stop
- Linear interpolation

⚠ CAUTION

The limitations about linear interpolation of SMC-8DF-PCI are as follows :

- Capable of accelerating or decelerating when selecting Max. 4 axes of axis 0 to axis 3 (of axis No.1 to No. 4 in API-SMC(WDM))
- Capable of accelerating or decelerating when selecting Max. 4 axes of axis 4 to axis 7 (of axis No.5 to No. 8 in API-SMC(WDM))
- Capable of constant speed when selecting both Max. 4 axes of axis 0 to axis 3 and Max. 4 axes of axis 4 to axis 7

Synchronous control function between boards

As for this product, the synchronous control of max. 128 axes (The SMC-8DF-PCI : using 16 boards) is possible by the connection to SMC-4DF-PCI or SMC-8DF-PCI by using a dedicated synchronous control cable.

The following types of synchronous control between boards are available.

- Multi-axis synchronous start control
- Multi-axis synchronous stop
- Linear interpolation (constant speed only)

Meanings of signals

Limit input signals

Limits switches are used to detect the position of the carrier in a positioning system using a stepping motor to stop the motor when the carrier has reached the target position (final destination). This product is also provided with the slow-down stop input to slow down the high-speed rotation at acceleration or deceleration. The mounting position of each limit switch is shown below.

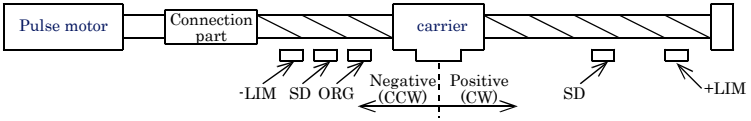


Figure 4.1. The attachment position relation of a limit switch

+LIM (Positive-direction end limit input), -LIM (Negative-direction end limit input)

Place +LIM at the end position when the stepping motor rotates clockwise (CW) and -LIM at the end position when the stepping motor rotates counterclockwise (CCW). When the carrier reaches either position (the limit input is turned on), the motor stops immediately unconditionally. Even when a subsequent operation directive (instruction) for moving in the same direction is issued, the carrier won't move forward beyond the limit position as long as the limit has been applied. The motor restarts operation (rotation) in response to an operation directive for moving in the opposite direction.
The logical direction can be set by software.

SD (deceleration (decelerated stop) input)

SD is a limit input to detect the position at which to start deceleration during high-speed rotation (accelerating/decelerating operation). The carrier operating (moving) at high speed starts deceleration at that position and stops after slowing down to the initial speed. The logical direction can be set by software.

ORG (origin input)

ORG is the switch input to detect the origin to be set as the base point for each operation. The logical direction can be set by software.

Encoder input signal

Phases A, B and Z are available to this product for encoder input. The signals that can be connected are those in the following output forms: the line driver output form, the TTL level output form, and the open-collector output form.
The specifications for the input pulse that can be set are as follows:

- 2-phase Input, Multiply by 1
- 2-phase Input, Multiply by 2
- 2-phase Input, Multiply by 4
- Single-phase Input, Multiply by 1

2-phase Input

Two-phase input is a pulse input consisting of two phases between which there is a phase difference of 90° : Phase A (leading signal) and Phase B (trailing signal). The minimum phase difference between Phase A and Phase B should be set to 0.2µ sec for line driver output connection, to 0.34µ sec for TTL level output connection or to 1µ sec for open-collector output connection.

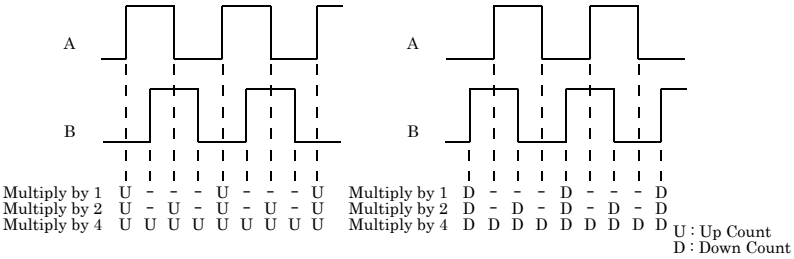


Figure 4.2. Sample Count for Two-phase Input Setting

Single-phase input

In single-phase input, the counter counts up at the rising edge of Phase A (UP) pulse and counts down at the rising edge of Phase B (DOWN) pulse.
A count cannot be performed properly, if Phase A (UP) pulse and Phase B (DOWN) pulse are generated at the same time.

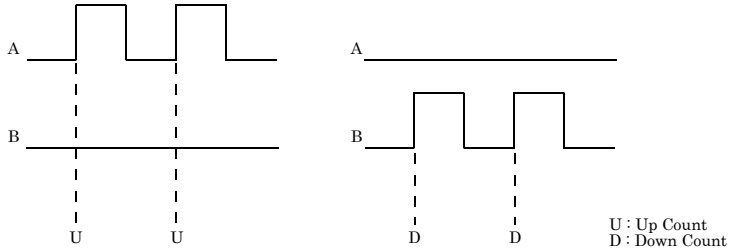


Figure 4.3. Sample Count for Single-phase Input Setting

Pulse output signal

Apart from the independent pulse (CW, CCW), this product can also generate the following pulses : common pulse (pulse output, direction output), 90°C phase-different pulse (leading pulse output, trailing pulse output). This allows you to use (or select) the most suitable one in accordance with the pulse motor drive unit to be used (or connected). As these pulse outputs are line driver outputs, check the specifications of the motor driver unit to be used before connecting them.

⚠ CAUTION

This product cannot directly drive the stepping motor. These pulse output signals must therefore be connected to the motor driver unit prepared for the stepping motor.

CW (Positive-direction pulse output), CCW (Negative-direction pulse output)

CW (forward pulse output) is the pulse output signal to rotate (operate) the stepping motor clockwise (CW). CCW (backward pulse output) rotates the motor counterclockwise. These signals are independent of each other. When a command for rotation is executed, the pulse signal for the specified direction outputs the preset number of operation pulses.

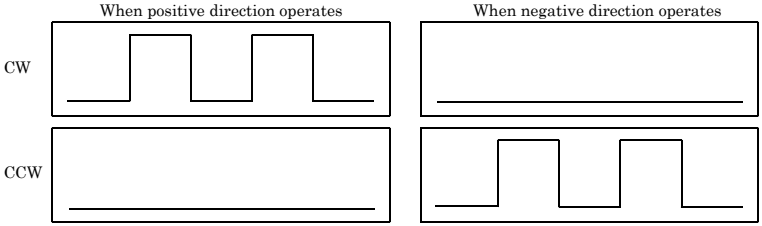


Figure 4.4. Specification for Output Pulse in Independent Pulsing Method

OUT (Pulse output), DIR (Direction output)

OUT (pulse output) is the serial pulse output that carries the above CW and CCW signals on a single line. The CW and CCW directions are indicated by the signal status of DIR (direction output). Note that the DIR signal is valid only when the OUT signal is active.

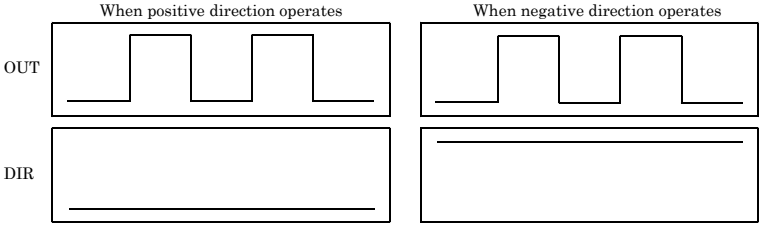


Figure 4.5. Specification for Output Pulse in Common Pulsing Method

OUT (leading pulse output) and DIR (trailing pulse output)

The OUT (leading pulse output) signal and the DIR (trailing pulse output) signal are generated. The motor is operated (rotated) in the positive direction (clockwise), when there is a phase difference of +90° between DIR (trailing pulse output) and OUT (leading pulse output). On the other hand, the motor is operated (rotated) in the negative direction (counterclockwise), when there is a phase difference of -90° between DIR (trailing pulse output) and OUT (leading pulse output).

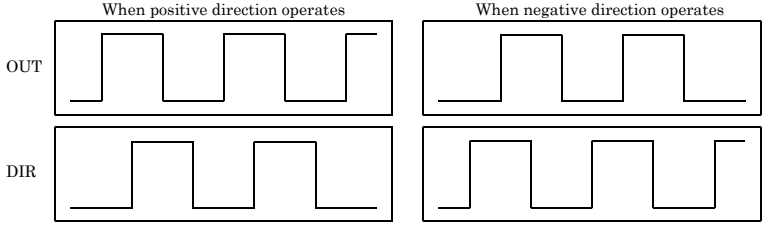


Figure 4.6. Specification for Output Pulse in 90°C phase-different Pulsing Method

General-purpose input signals

This product has general-purpose input signals (IN1 - IN7) in addition to limit input and encoder input signals.

IN1 - IN7 (General-purpose input signals)

IN1 - IN7 (general-purpose input signals) can be used to read data from I/O ports. Since these are independent of motor control, they do not affect pulse output even during motor operation. There are 7 pins for each axis, which are used for input of positioning completion signals or alarm signals from motor driver units as well as for general-purpose input. By software, IN1-IN6 can be switched to serve as alarm input, positioning completion input, deceleration (decelerated stop) input, counter latch, positioning control start input, and counter clear input respectively. The input logic can also be changed by software.

ALM (Alarm input signal)

ALM is the input signal to detect the alarm signal from the motor driver. The input logic can be changed by software.

INP (positioning completion signal)

INP is the signal to detect the positioning completion signal from the motor driver unit. The input logic can be changed by software.

SD (deceleration (decelerated stop) input)

SD is a signal to detect the position at which to start deceleration. The input logic can be changed by software.

LTC (counter latch input)

Signal to latch with the counter value, allowing the counter value to be cleared immediately after latching or an interrupt request to be generated upon latching. The input logic can be changed by software.

PCS (positioning control start input)

Signal for overriding (replacing) the target position, allowing positioning to be performed by the set amount of shifting from the input-ON timing. The input logic can be changed by software.

CLR (counter clear input)

It is a signal to reset a specified counter. Selecting edge input or level input and resetting multiple counters are available. The input logic can be changed by software.

General-purpose output signals

This product has general-purpose output signals (OUT1 - OUT3) in addition to pulse output signal. In addition, output signals can be switched to alarm clear output, driver differential clear output, or comparator output by software.

OUT1 - OUT3 (General-purpose output signals)

OUT1 - OUT3 (general-purpose output signals) can be used to write data to I/O ports. Since these are independent of motor control, they do not affect pulse output even during motor operation.
There are 3 pins for each axis, which are used for the output of level output signals for servo-on and hold-off to the motor driver unit, one-shot pulse signals for various clear signals, and comparator output signals. The output logic can also be changed by software.

ALMCLR (alarm clear output signal), ERC (driver differential clear output)

ALMCLR and ERC are signals to output clear one-shot pulses to the alarm clear and deviation counter clear inputs of the motor driver unit. The width of one-shot pulses (output logic changeable) can be selected from among 12 μsec, 102 μsec, 408 μsec, 1.6 msec, 13 msec, 52 msec, 104 msec.

CP1, CP2 (comparator output)

CP1 and CP2 compare the count value with the set comparator value. Signals will be output when the set criteria are satisfied. The output logic can be changed by software.

P.COM (Plus common)

P.COM is the plus common signal for limit input signals (+LIM, -LIM, SD, ORG) and general-purpose input/output signals (IN1 - IN7, OUT1 - OUT3).

GND (Ground)

GND is the ground line for the general-purpose output signals (OUT1 - OUT3).

Connecting the synchronization control connectors

There are synchronization signal control connectors (CN2, CN3) which enable synchronization operations of multiple pieces of this product. These connectors are used for connecting synchronization signal cables.

Connection method

For synchronous operations of two or more boards, connect them with synchronization signal cables. Use a synchronization signal cable to connect the CN2 of a smaller ID board to the CN3 of the board with a greater board ID number.

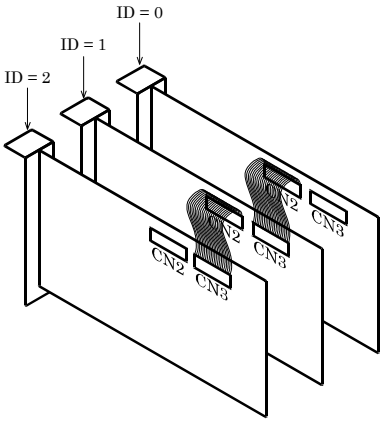


Figure 4.7. Connection method of a cable

Configuration examples for synchronization operations (for SMC-8DF-PCI)

Cable connection		Unconnection	Connection	Connection	Unconnection
Hardware	Synchronization connector number	CN3	CN2	CN3	CN2	CN3	CN2
	Board ID number	First piece (ID = 0)	Second piece (ID = 1)	Third piece (ID = 2)
	Axis number	Axis 0	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 0	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 0	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7
Configuration example 1		Group A (24-axis synchronization operations)																							
Configuration example 2		Group A (12-axis synchronization operations)												Group B (12-axis synchronization operations)											
Configuration example 3		Group A (20-axis synchronization operations)																							Group B (4-axis synchronization operations)

< Description for the above figure >

- Configuration example 1: when all axes (24 axes) working synchronously by using 3 pieces of SMC-8DF-PCI
- Configuration example 2: When divided into 2 groups of 12-axis synchronization operations by using 3 pieces of SMC-8DF-PCI
- Configuration example 3: When divided into 1 group of 20-axis synchronization operations and a group of 4-axis synchronization operations by using 3 pieces of SMC-8DF-PCI

⚠ CAUTION

- Connectors for synchronization signals control of this product (CN2, CN3) are dedicated for SMC-4DF-PCI, SMC-8DF-PCI. Please do not connect this synchronization cable with products other than SMC-4DF-PCI and SMC-8DF-PCI.
- Please make up synchronization groups from axis 0 (Axis No.1 or No. 4 in API-SMC(WDM) (Axis No.5 in API-SMC(WDM))).

Motion control system

System configuration

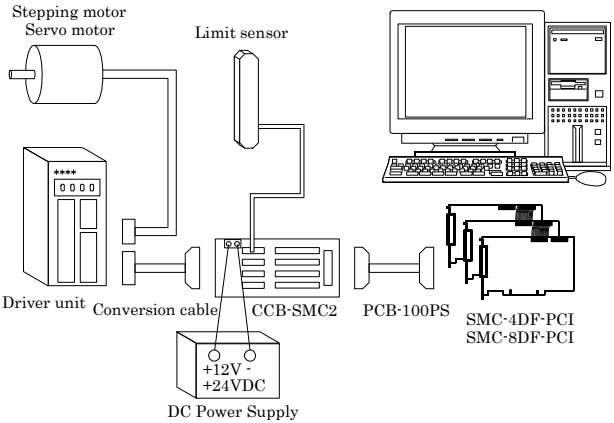


Figure 4.8. System configuration

Table 4.3. Component features

Item	Description
SMC-4DF-PCI SMC-8DF-PCI (Main board)	When installed on the PC, this board generates pulses required for position control.
PCB-100PS (Option)	This cable connects the board to the CCB-SMC2.
CCB-SMC2 (Option)	This screw terminal is used to efficiently connect the devices (the board, driver unit, DC power supply, limit sensor) required for position control. The screw terminal can connect a four-axis motion control system alone.
Conversion cable (User)	The shape of the control connector of each driver unit is largely different depending on the manufacturer and type. A conversion cable must be prepared to connect each driver unit to the CCB-SMC2.
Driver unit (Motor maker)	Motor and driver unit to be subject to motion control. Available in various types by motor capacity, power-supply voltage, and motor shape. Select the ones that best fit your needs.
Stepping motor Servo motor (Motor maker)	
Limit sensor (Switch maker)	This sensor is installed at the forward/backward limit and origin detection positions. When a table is used in the system, the sensor is bundled with the table. For a self-made system, use commercially available switches.
DC Power supply (Power supply maker)	Power supply to the CCB-SMC2. Use a 12 - 24-VDC power supply.

5. About Software

CD-ROM Directory Structure

```
\
|– Autorun.exe          Installer Main Window
| Readmej.html          Version information on each driver (Japanese)
| Readmeu.html          Version information on each driver (English)
   .
   .
|——APIPAC               Driver file for Windows
|    |—AIO
|    |   |—DISK1
|    |   |—DISK2
|    |   |—……
|    |   |—DISKN
|    |—AioWdm
|    |—CNT
|    |—DIO
|    |—……
   .
   .
| —HELP                 HELP file
|    |—Aio
|    |—Cnt
|    |—……
   .
   .
| —INF                  Each INF file for OS
|    |—WDM
|    |—Win2000
|    |—Win95
   .
   .
|—linux                 Driver file for Linux
|    |—cnt
|    |—dio
|    |—……
   .
   .
| —Readme               Readme file for each driver
   .
   .
| —Release              Driver file on each API-TOOL
|    |—API_NT           (For creation of a user-specific install program)
|    |—API_W95
   .
   .
|—UsersGuide            Hardware User's Guide (PDF files)
```

About Software for Windows

The bundled CD-ROM “API Function Library Package API-PAC(W32)” contains the functions that provide the following features:

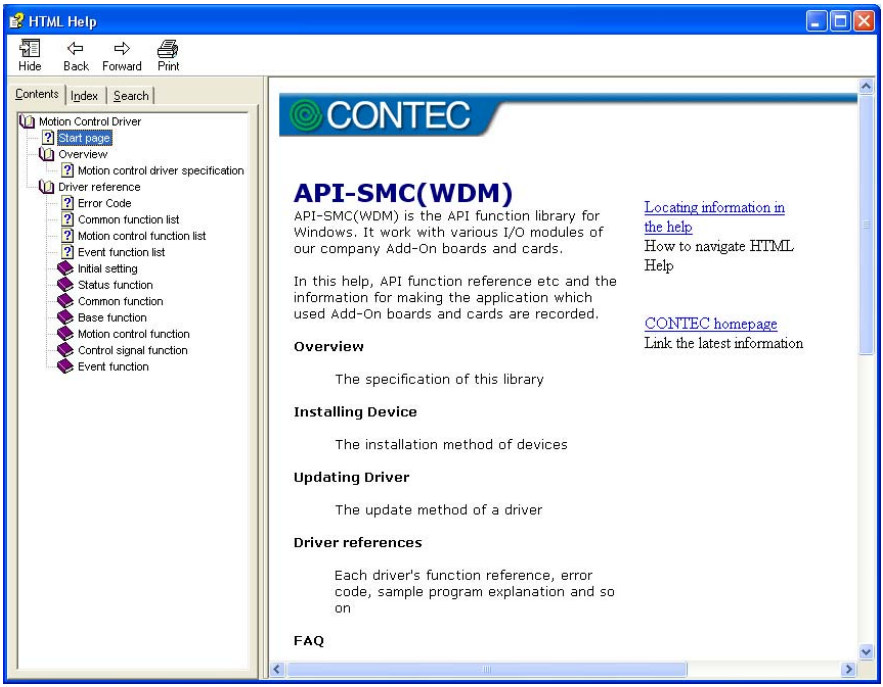
- Function to easily set and control the position of the stepping motor or servomotor
- Function to set and execute basic motor operations such as PTP and JOG operations
- Capable of digital input/output of specified axes

For details, refer to the help file. The help file provides various items of information such as “Function Reference”, “Sample Programs”, and “Q&A”. Use them for program development and troubleshooting.

Accessing the Help File

(1) Click on the [Start] button on the Windows taskbar.

(2) From the Start Menu, select “Programs” – “CONTEC API-PAC(W32)” - “SMC” - “API-SMC-D HELP” to display help information.



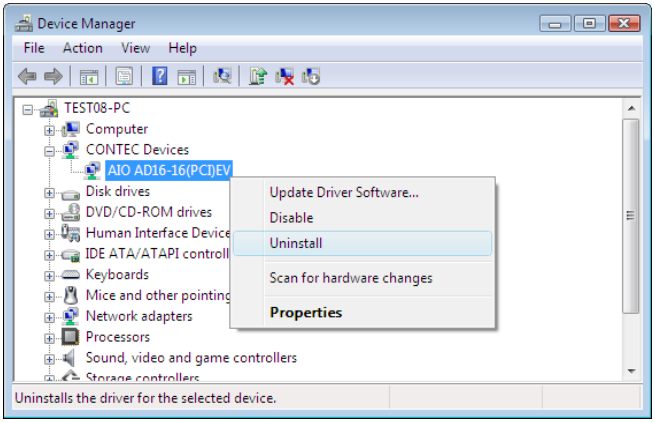
Uninstalling the Driver Libraries

The method used to uninstall API-PAC(W32) differs depending on which OS you are using.
Follow the procedure given below.

Uninstall procedure for Windows 7, Vista and Windows Server 2008

< Uninstalling the device driver >

1. Run Device Manager. From [My Computer] - [Control Panel], select [System] and then select the [Device Manager] tab.
   (You can also open Device Manager by right clicking on My Computer and selecting Properties.)
2. All of the hardware that uses the API-TOOL(WDM) driver is registered under the CONTEC Devices tree.
   Open the device tree, select the hardware to uninstall, and then right-click the hardware.
   From the popup menu, select [Uninstall].

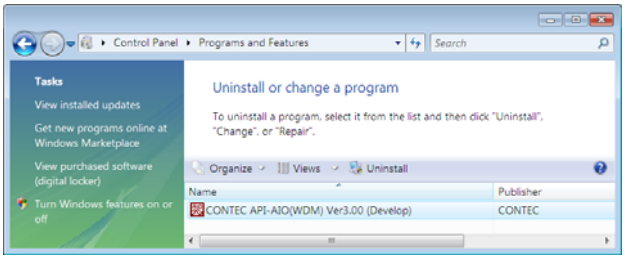


3. A dialog box opens asking you to confirm whether to uninstall. Select the [Delete the driver software for this device] checkbox, and then click [OK].

< Uninstall the development environment >

Use [My Computer] - [Control Panel] - [Programs and Features] to uninstall the development environment.
In case of API-***(WDM), select [CONTEC API-***(WDM) VerX.XX (development environment)] and then click [Uninstall].

In case of API-*** (98/PC), select [CONTEC API-*** (98/PC)xx VerX.XX] and then click [Uninstall].
*　"***" contains the driver category name (AIO, CNT, DIO, SMC, etc.).



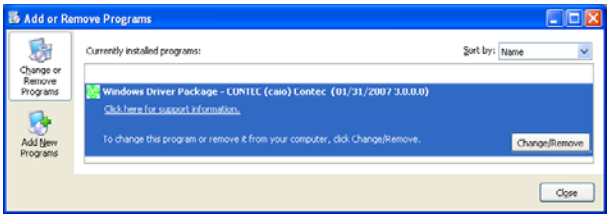
Uninstall procedure for Windows XP and Windows Server 2003

< Uninstall the device driver >

Use [My Computer] - [Control Panel] - [Add and Remove Programs] to uninstall the device driver.
In case of API-***(WDM), select [Windows driver package - CONTEC (****)] and then click [Change/Remove].

In case of API-*** (98/PC), select [CONTEC API-*** (98/PC)xx VerX.XX (development environment)] and then click [Change/Remove].

*　"***" contains the driver category name (caio, ccnt, cdio, csmc, etc.).

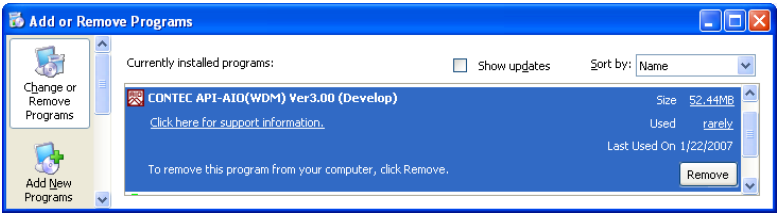


< Uninstall the development environment >

Use [My Computer] - [Control Panel] - [Add and Remove Programs] to uninstall the development environment.
In case of API-***(WDM), select [CONTEC API-***(WDM) VerX.XX (development environment)] and then click [Change/Remove].

In case of API-*** (98/PC), select [CONTEC API-*** (98/PC)xx VerX.XX (development environment)] and then click [Change/Remove].

* "***" contains the driver category name (AIO, CNT, DIO, SMC, etc.).



6. About Hardware

This chapter provides hardware specifications and hardware-related supplementary information.

For detailed technical information

For further detailed technical information (“Technical Reference” including the information such as an I/O map, configuration register, etc.), visit the CONTEC's web site (http://www.contec.com/support/) to call for it.

Hardware specification

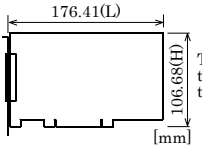
Tables 6.1 - 6.6 list the hardware specifications of the board.

Table 6.1. Common Section

Item	Specification	
	SMC-4DF-PCI	SMC-8DF-PCI
Control target	Stepping motor or servo motor driver unit (pulse train input type)	
Number of axes to control	4axis	8axis
Device used	PCL6045B (Nippon Pulse Motor CO., LTD.) or equivalence to it	
Interrupt	1 ch	
Interrupt factor	When stopping by positive-direction end limit input ON When stopping by negative-direction end limit input ON At the time of stop by alarm input on When stopping by simultaneous stop operation When stopping by deceleration (decelerated stop) input on When occurring the encoder input error The other event (setting by the software)	
The number of sheets that can be used simultaneously	16 sheets	
I/O address	Any 128 ports boundary	
Current consumption (Max.)	5VDC 800mA	5VDC 1600mA
Operating condition	0 - 50°C, 10 - 90% (No condensation)	
PCI bus specification	32-bit, 33MHz, Universal key shapes supported *1	
Dimension (mm)	176.41(L) x 106.68(H)	
Connector used	HDRA-EC100LFDT+ [mfd by HONDA TSUSHIN KOGYO CO., LTD.] or equivalence to it	HDRA-E100W1LFDT1EC-SL+ [mfd by HONDA TSUSHIN KOGYO CO., LTD.] or equivalence to it
Weight	120g	150g

*1 This board requires power supply at +5V from an expansion slot (it does not work on a machine with a +3.3V power supply alone).

Board dimensions



The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Table 6.2. Encoder Input Section

Item	Specification
Encode type	Incremental
Maximum counter value	8000000h - 7FFFFFFh(-134,217,728 - 134,217,727), 28 bit
Input signal type	Single-phase input (UP/DOWN/Z) / Phase input (A/B/Z)
Supported output type	Differential output, TTL level output, open-collector output
Device used	AM26LS32A(T.I) or equivalence to it
Terminal resistor	150Ω (Separatable with SW)
Receiver input sensitivity	±200mV
In-phase input voltage range	±7V
Distance in which signal can be extended	10m (Depending on the time of connecting the differential output, wiring environment and input frequency) 3m (Depending on the time of connecting the open-collector output, wiring environment and input frequency) 1.5m (Depending on the time of connecting the TTL level output, wiring environment and input frequency)
Response frequency (Max.)	5MHz duty (When connecting the differential output, 2-phase Input, Multiply by 4, duty 50%) 3MHz duty (When connecting the TTL level output, 2-phase Input, Multiply by 4, duty 50%) 1MHz duty (When connecting the open-collector output, 2-phase Input, Multiply by 4, duty 50%)

Table 6.3. Limit Input Section

Item	Specification
Signal channel	3channels/axis (original point, Forward limit, reserve limit)
Input signal name	ORG : origin input +LIM : positive direction end limit input -LIM : negative direction end limit input
Input logic	Enables selecting the positive/negative logic by using the Software
Input type	Opto-coupler input (corresponding to current sink output)
Response time (Max.)	200 μsec
Input resistance	4.7kΩ
Input ON current	2.0mA or more
Input OFF current	0.16mA or less
External circuit power supply	12V - 24VDC(±10%)

Table 6.4. General-purpose Input Section

Item	Specification
Signal channel	7channels/axis
Input signal name	IN1/ALM : alarm input, general-purpose input IN2/INP : positioning completion input, general-purpose input IN3/SD : deceleration (decelerated stop) input, general-purpose input IN4/LTC : counter latch input, general-purpose input IN5/PCS : positioning control start input, general-purpose input IN6/CLR : counter clear input, general-purpose input IN7 : general-purpose input
Input logic	Enables selecting the positive/negative logic by using the Software
Input type	Opto-coupler input (corresponding to current sink output)
Response time (Max.)	200 μsec
Input resistance	4.7kΩ
Input ON current	2.0mA or more
Input OFF current	0.16mA or less
External circuit power supply	12V - 24VDC(±10%)

Table 6.5. Pulse Output Section

Item	Specification
Pulse rate	0.1pps - 6.5 Mpps
Output signal name	CW : pulse / CW output CCW : direction / CCW output
Output signal system	2 Pulse types (pulse for positive/negative direction) or the common pulse type (pulse signal/directional signal) 90°C phase difference pulse (lead/lag pulse)
Output form	Un-isolated differential line driver output
Device used	AM26LS31(T.I) or equivalence to it
H level output voltage	2.5V - 5.25V
L level output voltage	0V - 0.5V
Rated output current (Max.)	20mA

Table 6.6. General-purpose Output Section

Item	Specification
Number of signal channel	3channels/axis
Output signal name	OUT1 : general-purpose output OUT2 : general-purpose output OUT3 : general-purpose output (Each output pin can be switched with the following functions) ALMCLR : alarm clear output ERC : driver differential clear output CP1 : comparator1 output CP2 : comparator2 output
Signal specification	Un-isolated open collector output (current sink type) (Enables selecting the positive/negative logic by using the Software)
Response time (Max.)	10μsec (when using the loading on the input side 510Ω, +24VDC)
Rated output current (Max.)	100mA per 1ch, 300mA per 1axis
Rated output withstanding voltage (Max.)	50VDC

Block Diagram

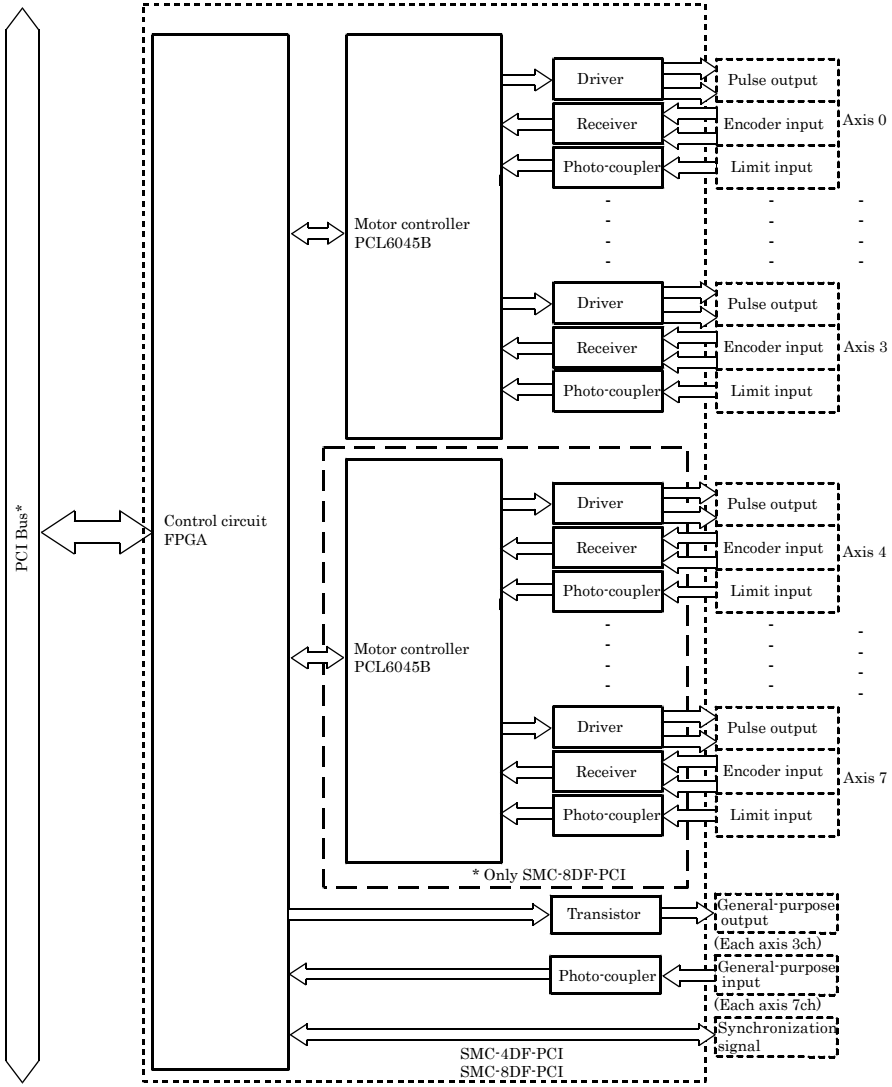


Figure 6.1. Block Diagram

SMC-4DF-PCI
SMC-8DF-PCI
User's Guide

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