PISO-PS600 Getting Started Manual

(Version 1.0)

Hardware & Software & Application
Using PISO-PS600 PCI Motion Control Card

ICP DAS CO., LTD.

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Contents of PISO-PS600

1 INTRODUCTION

1.1 Introduction

The PISO-PS600 is a 6-axis stepping/pulse-type servo motor PCI motion card. Which combines a new generation DSP processor 1600 MIPS running up to 200 MHz, FPGA (Field Programmable Gate Array), I/O to control the position of 6-axis and the maximum output pulse rate up to 4MHz(PPS) for each axis. This card also contains one FRnet port witch allows you to expand additional fast remote digital I/O. The FRnet I/O can added up to 128 DI and 128 DO maximally, and they are update with a period of 0.72 ms automatically.

The motion card support two main position control-loop rules. One is open-loop for servo or stepping motor, another is closed-loop control for stepping motor with encoder feedback. The closed-loop control was included the feed-forward gain control to reduce following error of velocity profile.

The PISO-PS600 can be used on any IPC with stander 3.3V/5V PCI bus, and is suitable for general-purpose motion control applications. It offered a lot of general motion control functions by API functions, such as 2~6 axis linear interpolation, 2/3-axis circular interpolation, T/S-curve velocity profile, various synchronous actions, automatic homing, etc. In addition, The most of motion control functions are execute by DSP. User application program can send the motion command by API to the command buffers that DSP will execute, and can monitor the motion status, FRnet I/O at the same time easily. That's meaning one application system can added on more motion control card that only added a little bit CPU loading.

ICP DAS has also provided a variety of API(relative and absolute) functions and examples to reduce the need for programming by users, making it a highly cost-effective solution for motion builders.

Main Features:

1. 6-axis DSP-based pulse command motion card
2. 32-bit/33MHz universal PCI bus 3.3V/5V
3. 6-axis full closed loop with PI/FF control in position loop
4. Input/Output signals for each axis
   - ◆ 1 channel high speed pulse output (CW, CCW or Pulse/DIR)
   - ◆ 32-bit high speed quadrature encoder interface (A, B, Z)
   - ◆ Positive and negative limit switch input (LMT+, LMT-)
   - ◆ Home switch input (HOME)
   - ◆ Slow down switch input (SLD)
   - ◆ Servo alarm input (ALARM)
   - ◆ Servo in-position input (INP)
   - ◆ Servo ready input (RDY)
   - ◆ High speed position latch input (LTC+/LTC-)
   - ◆ Servo on output (SRV_ON)
   - ◆ Error counter clear output (ERC)
   - ◆ Servo alarm reset output (ALM_RST)
   - ◆ High speed auto incremental compare output (CMP+/CMP-)
5. Dedicated 1 channel emergency stop input (EMG)
6. Support full function manual pulse generator (with 1 A/B phase input, 6 axes-select inputs, 3 magnification inputs, 2 jog inputs and 1 EMG inputs)
7. Additional 1 channel general purpose input and 3 channel general purpose outputs
8. Programmable digital filter for all input signals
9. 1 port FRnet real-time/high-speed serial interface for I/O expansion (128 in/128 out)

Block Diagram:
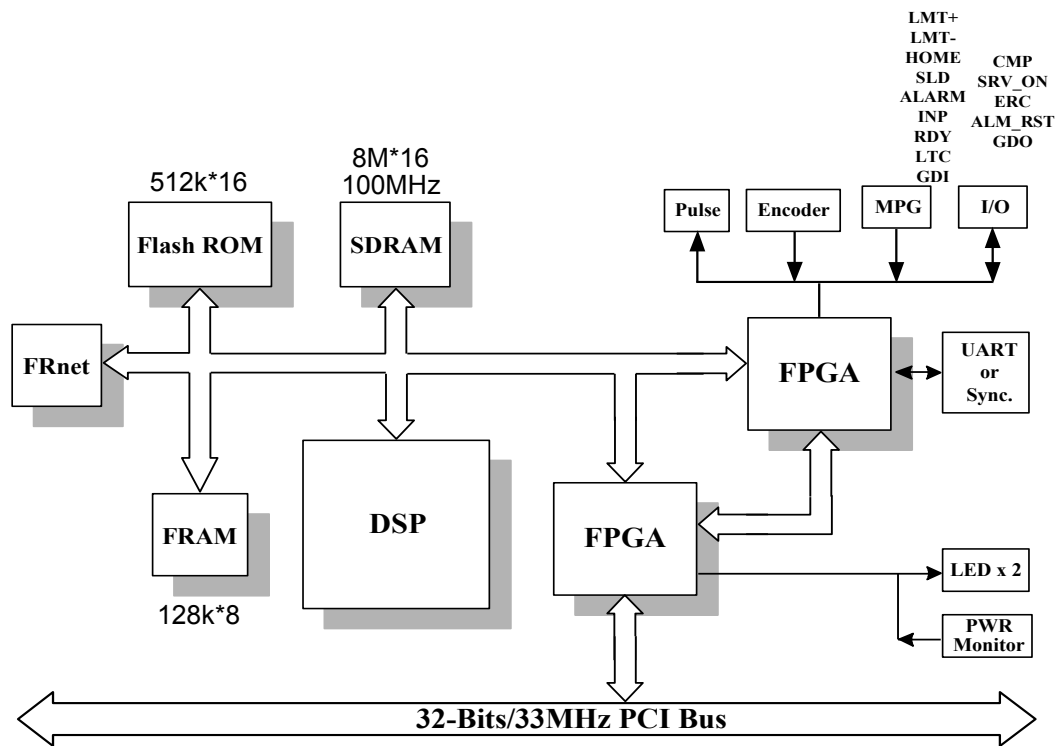
1.2 Hardware Specification

- **(with terminal board connected)**
1. **General Specification:**
- On board high performance floating-point DSP with 200 MHz/1600 MIPS
- On board 128 KB nonvolatile FRAM
- I/O connector: Two 68-pins VHDCI female connectors and one 20-pins SCSI-II female connector
2. **Pulse Output**
- Number of Channels: 6
- Isolation Voltage: 3 kVrms
- Max. Output Pulse Rate: 4 MHz (PPS)
- Programmable OUT/DIR, CW/CCW output modes
- Selectable line drive or open collector output
3. **Encoder Interface**
- Number of Channels: 6
- Isolation Voltage: 3 kVrms
- Max. Count Rate: 12 MHz(Max. 3M pps for A/B phase)
- Programmable OUT/DIR, CW/CCW and EA/EB input modes
- Min. turn on voltage: 3 V max.
4. **Manual Pulse Generator Interface**
- Number of Channels: 1
- Isolation Voltage: 3 kVrms
- Max. Count Rate: 40 Kpps
- Programmable OUT/DIR, CW/CCW and EA/EB input modes
- Selectable 0 to 30 VDC input or 0 to 5 VDC input
5. **Digital Input**
- Number of Channels
- 42-CH dedicated inputs for 6-axis LMT+/LMT-/HOME/SLD/ALARM/INP/ RDY
- 1-CH dedicated input for emergency stop
- 1-CH general purpose digital input
- 6-CH inputs for axes selection in MPG mode
- 3-CH inputs for magnification selection in MPG mode
- 2-CH inputs for jog operation in MPG mode
- 1-CH input for optional emergency stop in MPG mode
- Isolation Voltage: 3 kVrms
- Input Voltage: 0 to 30 VDC
- Logic Low: 3 V max.
- Logic High: 10 V min.
- Input Impedance: 4.7 kΩ, 0.25W
- Input Turn-On Delay: 4 us typ.
- Input Turn-Off Delay: 75 us typ.
6. **High Speed Input**
- Number of Channels: 6-CH inputs for 6-axis LTC
- Isolation Voltage: 3 kVrms
- Input Voltage:
- 0 to 30 VDC
    - Logic Low: 3 V max.

- Logic High: 10 V min.
- 0 to 5 VDC
  - Logic Low: 1.5 V max.
  - Logic High: 3 V min.
- ◆ Input Impedance
  - 0 to 30 VDC: 4.7 kΩ, 0.25W
  - 0 to 5 VDC: 220 Ω, 0.125W
- ◆ Input Turn-On Delay:
  - 0 to 30 VDC: 50 ns typ.
  - 0 to 5 VDC: 50 ns typ.
- ◆ Input Turn-Off Delay:
  - 0 to 30 VDC: 300 ns typ.
  - 0 to 5 VDC: 150 ns typ.

7. Digital Output
- ◆ Number of Channels
  - 18-CH open collector outputs for 6-axis SRV_ON/ERC/ALM_RST
  - 3-CH general purpose open collector digital outputs
- ◆ Isolation Voltage: 3 kVrms
- ◆ Output Current: 20 mA max.
- ◆ Output Turn-On Delay: 7 us typ. @ I_{LOAD}=5 mA
- ◆ Output Turn-Off Delay: 200 us typ. @ I_{LOAD}=5 mA

8. High Speed Output
- ◆ Number of Channels: 6-CH open collector outputs for 6-axis CMP (with 390 Ω pull-up to 5 V)
- ◆ Isolation Voltage: 3 kVrms
- ◆ Output Turn-On Delay: 40 ns typ.
- ◆ Output Turn-Off Delay: 60 ns typ.
- ◆ Maximum compare trigger output rate:
  - 2000 Hz in buffer mode (Arbitrary Spacing)
  - 4 MHz in auto increment mode (Constant Spacing)
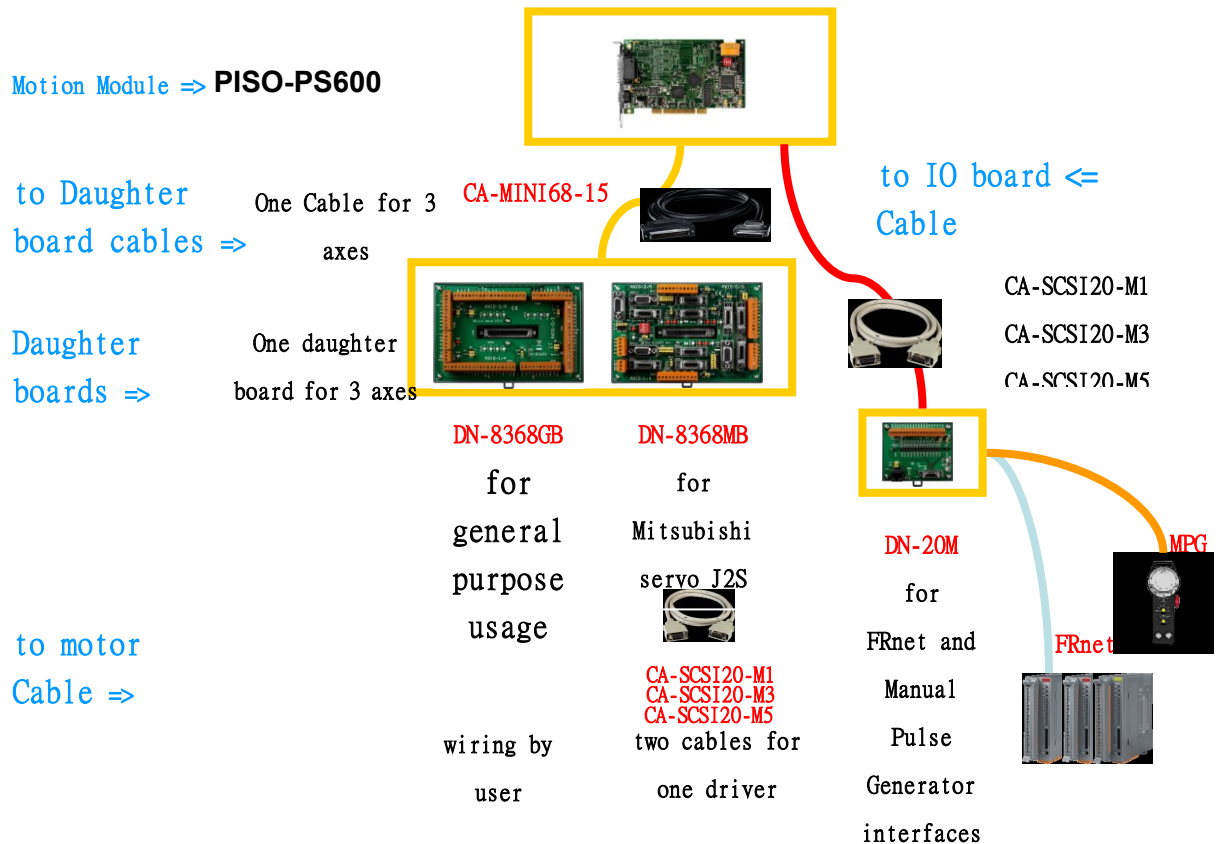- ◆ Compare trigger output pulse width: Programmable (160 ns to 2.6 ms)

9. FRnet Interface
- ◆ 2-Wire wire saving serial interface
- ◆ Max. Expandable I/O: 128 DI and 128 DO
- ◆ Scan Cycle Time: 0.72 ms
- ◆ Max. Distance: 100 M

1.3 Environment

- Operating temperature: 0 to 60 ℃
- Storage temperature: -20 to 80 ℃
- Operating humidity: 10% to 85%, non-condensing
- Storage humidity: 5% to 95%, non-condensing

1.4 Ordering Information

Motion Module ⇒ **PISO-PS600**

to Daughter board cables ⇒   One Cable for 3 axes   CA-MINI68-15

to IO board ⇐ Cable

Daughter boards ⇒   One daughter board for 3 axes

CA-SCSI20-M1
CA-SCSI20-M3
CA-SCSI20-M5

DN-8368GB   DN-8368MB

for general purpose usage   for Mitsubishi servo J2S

DN-20M

for FRnet and Manual Pulse Generator interfaces

MPG

FRnet

to motor Cable ⇒

CA-SCSI20-M1
CA-SCSI20-M3
CA-SCSI20-M5

wiring by user   two cables for one driver

- PISO-PS600   6-axis DSP-Base PCI motion card
- DN-8368GB   Three axis terminal board for general purpose servo motor (*)
- DN-8368MB   Three axis terminal board for Mitsubishi J2S servo motor (*)
- DN-20M   the daughter board is for FRnet connector and Full function Manual-Pulse-Generator
- CA-MINI68-15   68-pin Mini SCSI II to SCSI II Male connector cable 1.5M. (**)
- CA-SCSI20-M1   SCSI II 20-pin & 20-pin Male connector cable 1M, for DN-20M.
- CA-SCSI20-M3   SCSI II 20-pin & 20-pin Male connector cable 3M, for DN-20M.
- CA-SCSI20-M5   SCSI II 20-pin & 20-pin Male connector cable 5M, for DN-20M.
- CA-2P4C-0100   The cable for FRnet modules; Length:100m.

(*) two boards are needed for 4 axis, 5 axis or 6 axis control
(**) two cables are required for 4 axis, 5 axis or 6 axis control

2 HARDWARE INSTALLATION

2.1 Checking Package and Installation

2.1.1 Check Package

PISO-PS600 includes the following item

- PISO-PS600   6-axis DSP-Base PCI motion card

Accessories item

- DN-8368GB   Three axis terminal board for general purpose servo motor (*)
- DN-8368MB   Three axis terminal board for Mitsubishi J2S servo motor (*)
- DN-20M   Terminal board for FRnet and Manual Pulse Generator interfaces.
- CA-MINI68-15   68-pin Mini SCSI II to SCSI II Male connector cable 1.5M. (**)
- CA-SCSI20-M1(3/5)   SCSI II 20-pin Male connector cable 1/3/5M, for DN-20M.
- CA-2P4C-0100   Cable for FRnet modules; Length: 100m.

(*) two boards are needed for 4 axis, 5 axis or 6 axis control

(**) two cables are required for 4 axis, 5 axis or 6 axis control
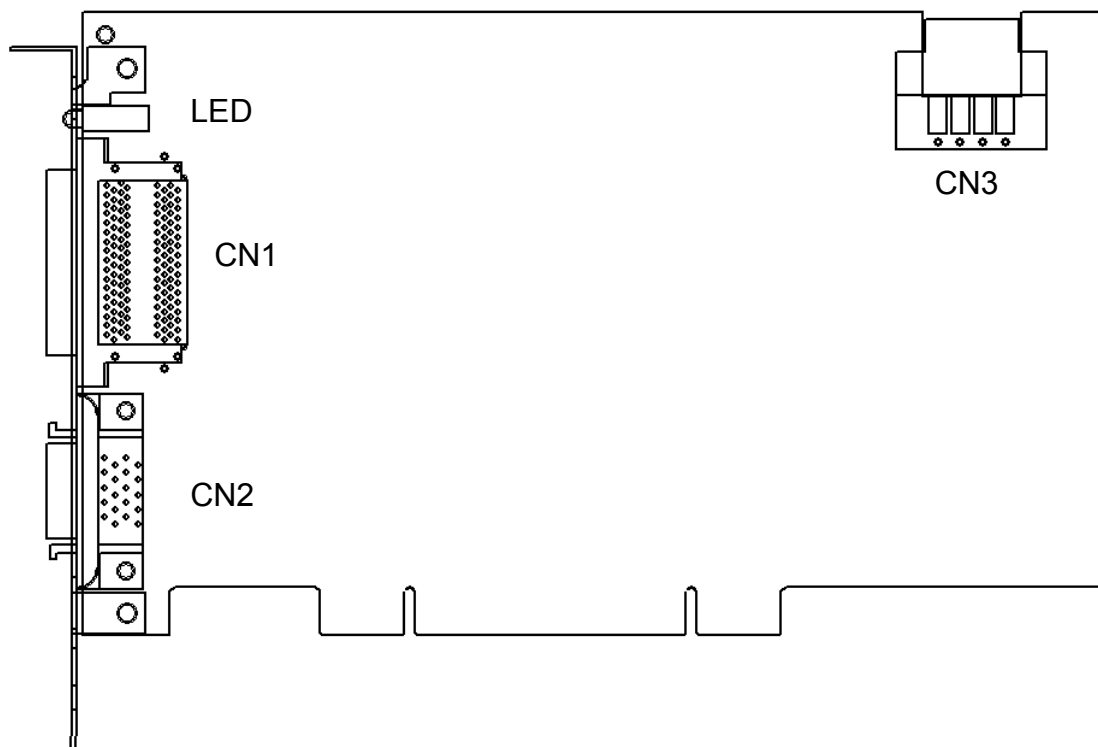
Fig. 2-1 PISO-PS600 Outline Drawing

2.1.2 Installation

■ **Prepare controller**

    1. Choose a personal PC with empty PCI slot.

    2. Turn power off

■ **Motion card Plug-in and wiring**

    1. Switch SW1 to desired position.

    2. Plug in the PISO-PS600 into an empty PCI slot of PC.

    3. Connect the PISO-PS600 with DN-8368xB by a CA-MINI68-15 cable for very DN-8368xB board, as the below figure:

    4. Connect the PISO-PS600 with DN-20M by a CA-SCSI20-M1(3/5) cable, as the below figure:

CA-MINI68-15 for 0,1,2 axis that connector near the PCB

CA-MINI68-15 for 3,4,5 axis that connector far form the PCB

SW1

CA-SCSI20-M1(3,5) for DN-20M
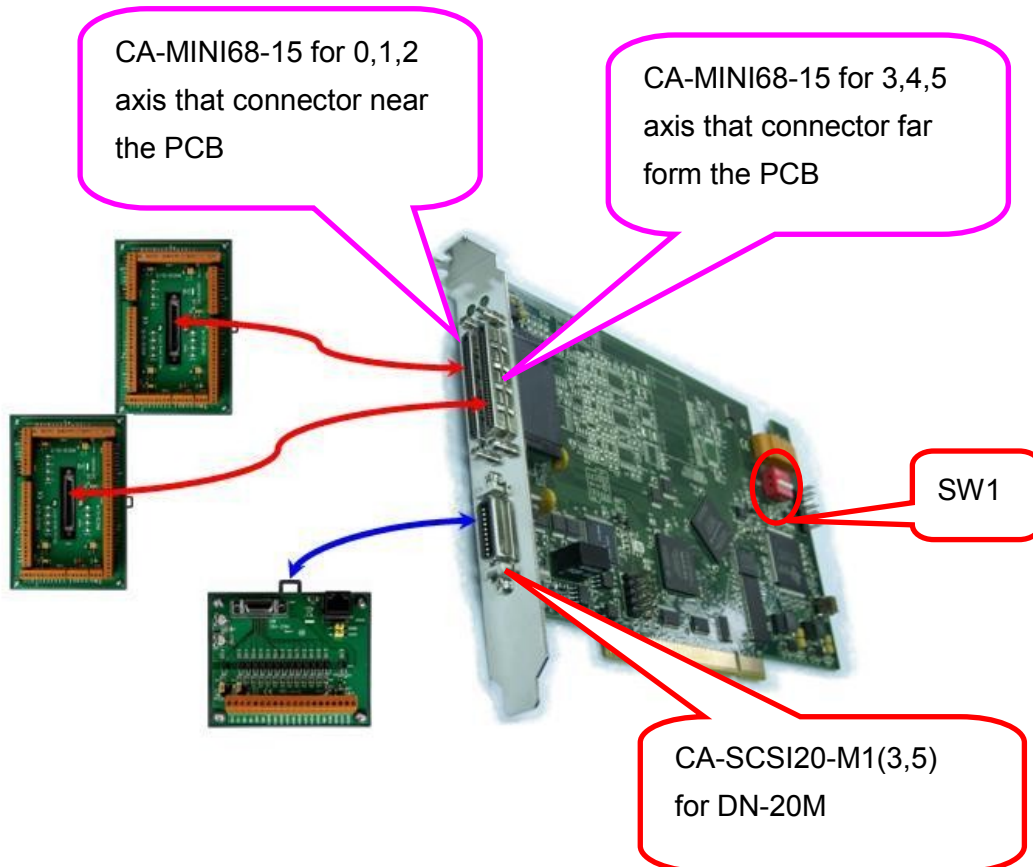
Fig. 2-2 PISO-PS600 Connecting

2.1.3 SW1 Setting

The Card ID of each PISO-PS600 motion card is defined by setting the on-board switch SW1 (1~4) shown in section 2.1.2.   The default setting of the Card ID is 0 by setting SW1(1~4) to be OFF.   If users set 1 and 2 on SW1 to be ON, the Card ID of the motion card is 3.   Up to 16 motion cards in the same system can be supported by setting different Card ID (Card ID = 0~15).

Default setting
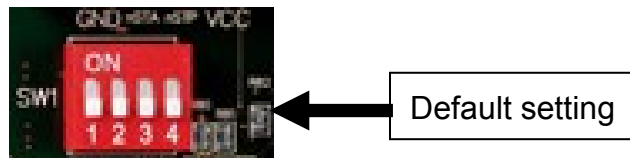
2.2 DN-8368GB Terminal Board

The DN-8368GB is the terminal board for general purpose amplifier usage. It has 3-axis I/O signals.

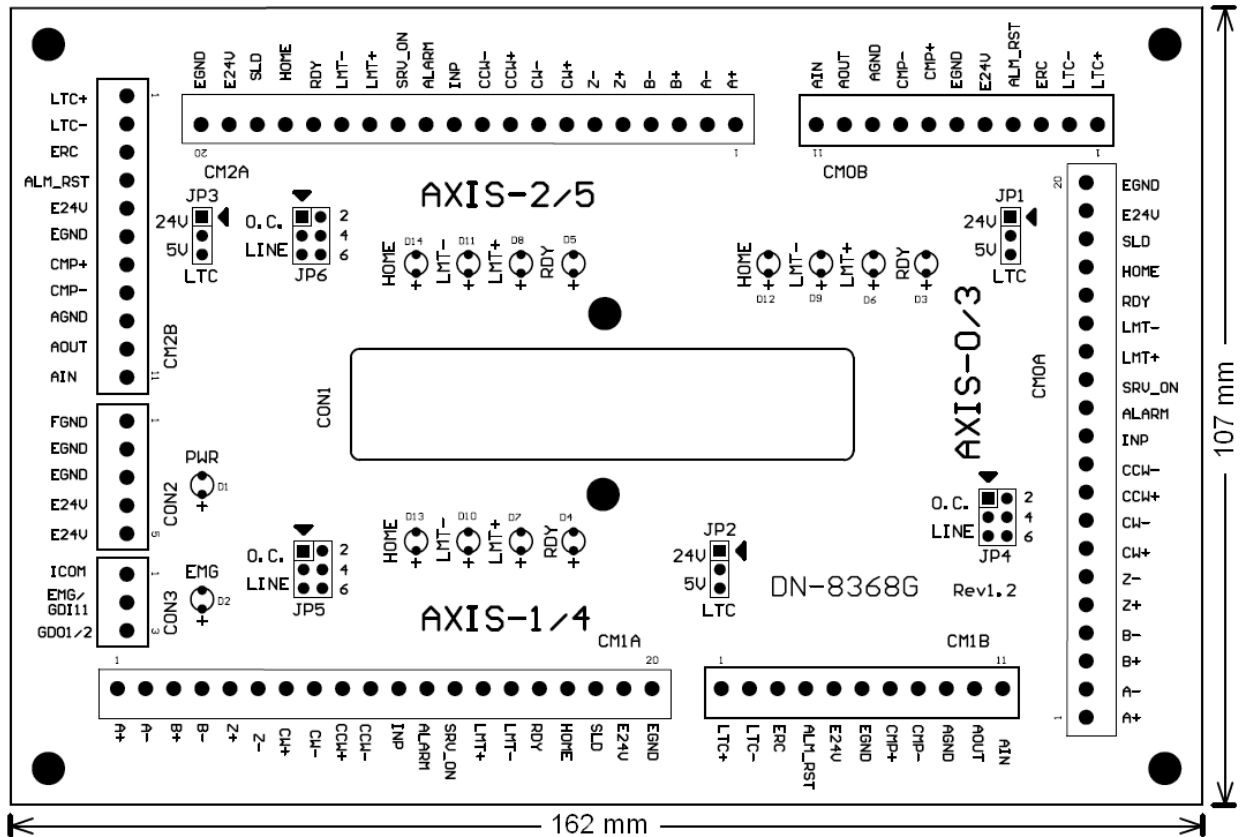## 2.2.1 Board Layout for DN-8368GB

Dimension and Placement

Fig. 2-3 Board layout for the DN-8368GB

2.2.2 Signal Connections for DN-8368GB

Assuring reliable connections is one of the most important tasks when sending or receiving data from your application systems. This chapter will introduce I/O connector (for general purposes) on DN-8368GB, that for specific I/O connector and other signals.

■ CON1

The I/O connector on DN-8368GB is a 68-pin SCSI II connector that enables you to connect sensors and motor drivers to the motion card. Please note: there are two groups of connectors (CN1A/ CN1B) on the main card; therefore, the same signal may have a different name on each sub board. Please refer toTable 2-1, Table 2-2) for your reference.

Table 2-1 CN1A (be close the PCB)

No.	Name	I/O	Function	No.	Name	I/O	Function
1	AOUT0	O	Analog Output	35	AIN0	I	Analog Input
2	AOUT1	O	Analog Output	36	AIN1	I	Analog Input
3	AOUT2	O	Analog Output	37	AIN2	I	Analog Input
4	AGND	-	Analog Ground	38	AGND	-	Analog Ground
5	DGND	-	Digital Ground	39	ERC0	O	Error Counter Clear
6	LTC0	I	Position Latch	40	SVON0	O	Servo On
7	EA0	I	Encoder A-Phase	41	RDY0	I	Servo Ready
8	EB0	I	Encoder B-Phase	42	INP0	I	Servo In-Position
9	EZ0	I	Encoder Z-Phase	43	ALM0	I	Servo Alarm
10	CW0	O	Clockwise pulse	44	SLD0	I	Slow Down
11	CCW0	O	Counter-Clockwise pulse	45	ORG0	I	Origin Signal
12	CMP0	O	Compare Trigger	46	MEL0	I	Minus End Limit
13	EMG	I	Emergency Stop	47	PEL0	I	Positive End Limit
14	ALMRST0	O	Servo Alarm Reset	48	DGND	-	Digital Ground
15	DGND	-	Digital Ground	49	ERC1	O	Error Counter Clear
16	LTC1	I	Position Latch	50	SVON1	O	Servo On
17	EA1	I	Encoder A-Phase	51	RDY1	I	Servo Ready
18	EB1	I	Encoder B-Phase	52	INP1	I	Servo In-Position
19	EZ1	I	Encoder Z-Phase	53	ALM1	I	Servo Alarm
20	CW1	O	Clockwise pulse	54	SLD1	I	Slow Down
21	CCW1	O	Counter-Clockwise pulse	55	ORG1	I	Origin Signal
22	CMP1	O	Compare Trigger	56	MEL1	I	Minus End Limit
23	GDO1	O	Generic Digital Output	57	PEL1	I	Positive End Limit
24	ALMRST1	O	Servo Alarm Reset	58	DGND	-	Digital Ground
25	DGND	-	Digital Ground	59	ERC2	O	Error Counter Clear
26	LTC2	I	Position Latch	60	SVON2	O	Servo On
27	EA2	I	Encoder A-Phase	61	RDY2	I	Servo Ready
28	EB2	I	Encoder B-Phase	62	INP2	I	Servo In-Position
29	EZ2	I	Encoder Z-Phase	63	ALM2	I	Servo Alarm
30	CW2	O	Clockwise pulse	64	SLD2	I	Slow Down
31	CCW2	O	Counter-Clockwise pulse	65	ORG2	I	Origin Signal
32	CMP2	O	Compare Trigger	66	MEL2	I	Minus End Limit
33	DGND	-	Digital Ground	67	PEL2	I	Positive End Limit
34	ALMRST2	O	Servo Alarm Reset	68	VCC	-	5V Digital Power from Bus

Table 2-2 CN1B（be distance from PCB）

No.	Name	I/O	Function	No.	Name	I/O	Function
1	AOUT3	O	Analog Output	35	AIN3	I	Analog Input
2	AOUT4	O	Analog Output	36	AIN4	I	Analog Input
3	AOUT5	O	Analog Output	37	AIN5	I	Analog Input
4	AGND	-	Analog Ground	38	AGND	-	Analog Ground
5	DGND	-	Digital Ground	39	ERC3	O	Error Counter Clear
6	LTC3	I	Position Latch	40	SVON3	O	Servo On
7	EA3	I	Encoder A-Phase	41	RDY3	I	Servo Ready
8	EB3	I	Encoder B-Phase	42	INP3	I	Servo In-Position
9	EZ3	I	Encoder Z-Phase	43	ALM3	I	Servo Alarm
10	CW3	O	Clockwise pulse	44	SLD3	I	Slow Down
11	CCW3	O	Counter-Clockwise pulse	45	ORG3	I	Origin Signal
12	CMP3	O	Compare Trigger	46	MEL3	I	Minus End Limit
13	GDI11	I	Generic Digital Input	47	PEL3	I	Positive End Limit
14	ALMRST3	O	Servo Alarm Reset	48	DGND	-	Digital Ground
15	DGND	-	Digital Ground	49	ERC4	O	Error Counter Clear
16	LTC4	I	Position Latch	50	SVON4	O	Servo On
17	EA4	I	Encoder A-Phase	51	RDY4	I	Servo Ready
18	EB4	I	Encoder B-Phase	52	INP4	I	Servo In-Position
19	EZ4	I	Encoder Z-Phase	53	ALM4	I	Servo Alarm
20	CW4	O	Clockwise pulse	54	SLD4	I	Slow Down
21	CCW4	O	Counter-Clockwise pulse	55	ORG4	I	Origin Signal
22	CMP4	O	Compare Trigger	56	MEL4	I	Minus End Limit
23	GDO2	O	Generic Digital Output	57	PEL4	I	Positive End Limit
24	ALMRST4	O	Servo Alarm Reset	58	DGND	-	Digital Ground
25	DGND	-	Digital Ground	59	ERC5	O	Error Counter Clear
26	LTC5	I	Position Latch	60	SVON5	O	Servo On
27	EA5	I	Encoder A-Phase	61	RDY5	I	Servo Ready
28	EB5	I	Encoder B-Phase	62	INP5	I	Servo In-Position
29	EZ5	I	Encoder Z-Phase	63	ALM5	I	Servo Alarm
30	CW5	O	Clockwise pulse	64	SLD5	I	Slow Down
31	CCW5	O	Counter-Clockwise pulse	65	ORG5	I	Origin Signal
32	CMP5	O	Compare Trigger	66	MEL5	I	Minus End Limit
33	DGND	-	Digital Ground	67	PEL5	I	Positive End Limit
34	ALMRST5	O	Servo Alarm Reset	68	VCC	-	5V Digital Power from Bus

◼ CON2

The connector CON2 is a 5-pin connector for external Power supply (24V input). Table 2-3 shows its I/O connector signal description.

Table 2-3

Pin NO	Pin Define	Function description
1	FGND	Frame ground of DN-8368GB
2	EGND	Ground of the external power
3	EGND	Ground of the external power
4	E24V	External power supply of +24V DC
5	E24V	External power supply of +24V DC

◼ CON3

The connector CON3 is a 3-pin connector for connecting general purpose I/O. There are one digital input and one digital output signal. When the connectors connect to the CN1A of main card (the one closer to the PCB board), the input signal is defined as emergency stop. When the connector connects to the CN1B of main card, the input signal is defined as general purpose input signal. Table 2-4 shows its I/O connector signal description:

Table 2-4

Pin NO	Pin Define	Function description
1	ICOM	Input common, when use with NPN sinking type sensor, connecting to E24V. When use with PNP sourcing type sensor, connecting to EGND.
2	EMG/GDI11	Emergency stop signal (or General purpose input signal)
3	GDO1/GDO2	General purpose output signal

■ CM0A~CM2A

The connector CMxA is a 20-pin connector that enables you to connect the main card to the signals of your motor drivers. The Table 2-5 shows its I/O connector signal description for the 20-pin connector on the DN-8368GB.

Table 2-5

Pin NO	Pin Define	Function description
1	A+	Encoder A-phase(+)
2	A -	Encoder A-phase(-)
3	B+	Encoder B-phase(+)
4	B -	Encoder B-phase(-)
5	Z+	Encoder Z-phase(+)
6	Z-	Encoder B-phase(-)
7	CW+	Positive Direction Pulse(+)
8	CW -	Positive Direction Pulse(-)
9	CCW+	Negative Direction Pulse(+)
10	CCW -	Negative Direction Pulse(-)
11	INP	In-Position signal from the servo motor driver
12	ALARM	Alarm signal from the servo motor driver
13	SRV_ON	Servo ON signal to the servo motor driver
14	LMT+	Positive End Limit signal (PEL) input
15	LMT-	Negative End Limit signal (MEL) input
16	RDY	RDY signal from the servo motor driver
17	HOME	Origin signal (ORG) input
18	SLD	Slow-Down signal input
19	E24V	External Power +24V
20	EGND	External Power Ground

■ CM0B~CM2B

The connector CMxB is an 11-pin connector that enables you to connect the main card to the signals of Digital and Analog input/output. The Table 2-6 shows its I/O connector signal description for the 11-pin connector on the DN-8368GB.

Table 2-6

Pin NO	Pin Define	Function description
1	LTC+	High Speed Position Latch input
2	LTC-	Ground for Position Latch input
3	ERC	Error Counter Clear signal to servo motor driver
4	ALM_RST	Alarm Reset signal to servo motor driver
5	E24V	External power +24V
6	EGND	External Power Ground
7	CMP+	High Speed Compare trigger output
8	CMP-	Ground for Compare trigger output
9	AGND	Ground of analog signal (only for PISO-VS600 and PMDK)
10	AOUT	Analog output signal (only for PISO-VS600 and PMDK)
11	AIN	Analog input signal (only for PISO-VS600 and PMDK)

2.2.3 Jumper Settings

■ **JP1 ~ JP3**

Jumper 1~3(Fig 2-4) controls the input voltage of LTC for 24V (Jumper position is in 1~2) or 5V (Jumper position is in 2~3). The default setting is 5V.
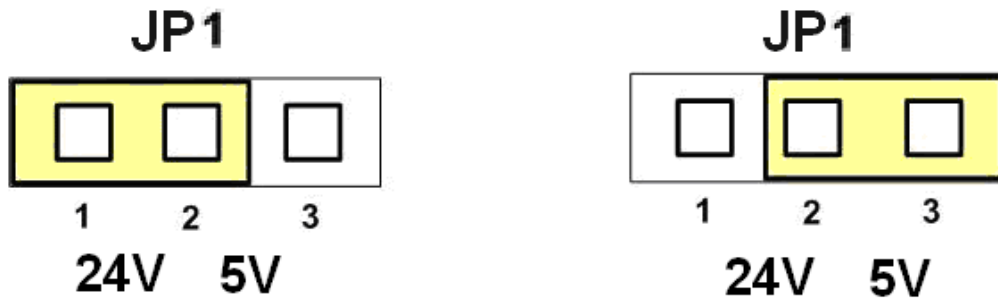
Fig. 2-4 Jumper 1~ Jumper 3 setting

■ **JP4 ~ JP6**

Jumper 4 ~ 6 (Fig 2-5) control the pulse output mode. Two types of the pulse output signal, Differential-Type and Open-Collector Type, can be selected from JP4 ~ JP6. The default setting is Differential-Type.
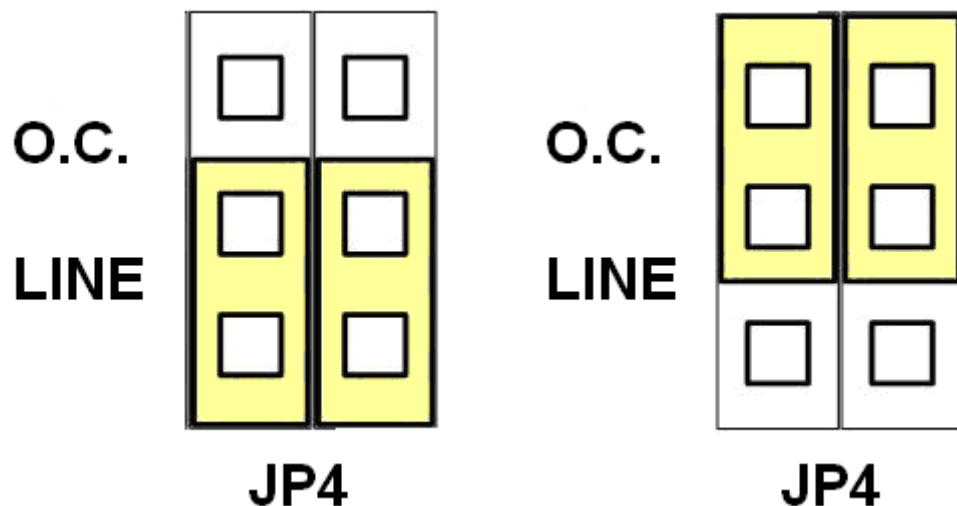
Fig 2-5 Jumper 4~6(Default setting is Differential-Type)

2.2.4 LED Description

LED is used for indicating the special or important DI state, there are two status on the daughter board, one is the machine I/O state (Home, LMT-, LMT+, RDY, etc.), the other is   Power and EMG state. These " LED" indicate the following status:

- HOME: The LED will be turned on when the motion control axis "Home" sensor is ON.

- LMT -: It shows the negative end-limit signal of motion control on the machine. The negative end-limit signal of motion axis is to decide the end point of minus moving. If this signal is on, the LED will be turned on. (This is the case when "Normal Open" mode is set, for "Normal Close" mode, the LED is turned off when signal is on.)

- LMT +: It shows the positive end-limit signal of motion control on the machine. The positive end-limit signal of motion axis is to decide the end point of positive moving. If this signal is on, the LED will be turned on. (This is the case when "Normal Open" mode is set, for "Normal Close" mode, the LED is turned off when signal is on.)

- RDY: It point out whether the servo motor is in the state that can be controlled. The LED will be turned on when the motor can be controlled.

- Power: It shows the power state of DN-8368GB. The LED will be turned on when it is power on.

- EMG: It shows the state of EMG signal. The LED will be turned on when the EMG signal is not triggered.

2.2.5 DN-8368GB Input/Output Connections

a. Pulse Output Signal

There are 3-axis pulse output signals on DN-8368,   For every axis, two pairs of CW and CCW signals are used to send the pulse train.   The CW and CCW signals can also be programmed as PULSE and DIR signals.   Two types of the pulse output signal, Differential-Type and Open-Collector Type, can be selected from JP4~6, those are described in section 2.2.3.   The following wiring diagram is for the pulse output signals of the 3-axis.

◆　　　　**Differential Type (Set Jumper as 3-5, 4-6)**
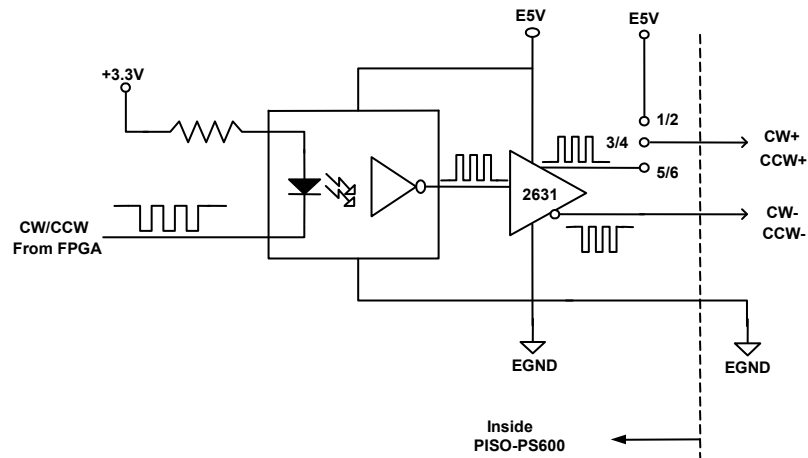
Fig 2-6

◆　　**Open Collector Type (Set Jumper as 1-3, 2-4)**
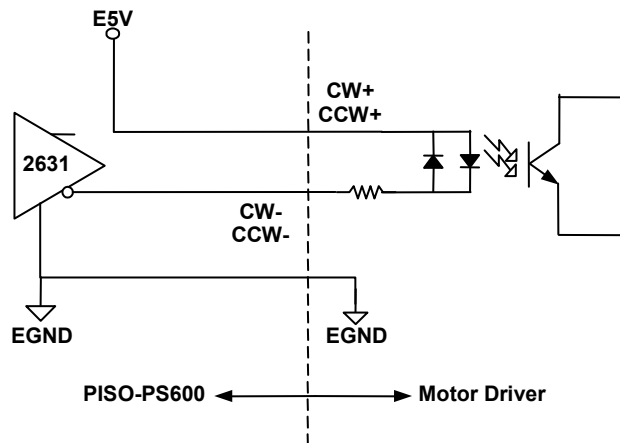
Fig 2-7

b. Encoder and MPG Input Signal
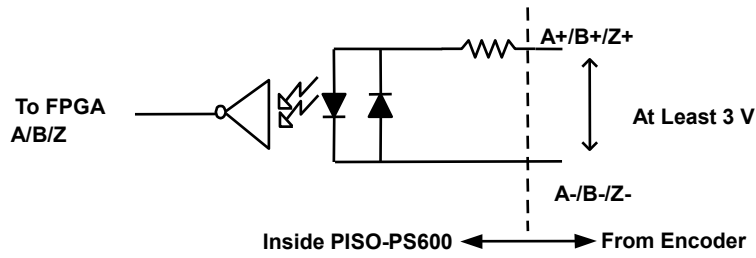
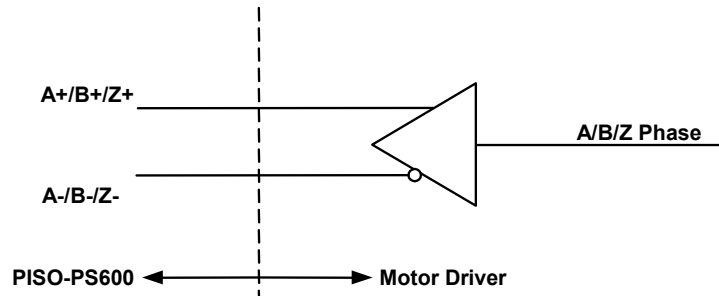**Fig 2-8**

◆ **Connect to a Differential type Encoder or MPG**

Fig 2-9

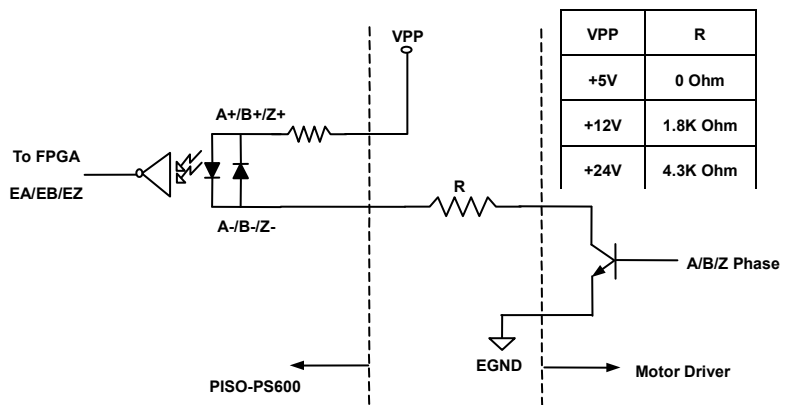◆ **Connect to a Open Collector type Encoder or MPG**

VPP	R
+5V	0 Ohm
+12V	1.8K Ohm
+24V	4.3K Ohm

Fig 2-10

c. Compare Output
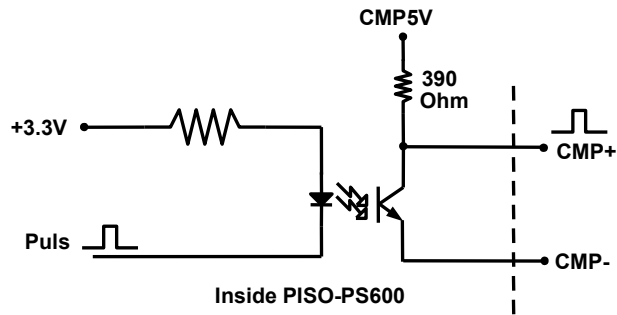
Fig 2-11

d. Digital Input

◆ **NPN Input for NPN Sinking Type Sensor**
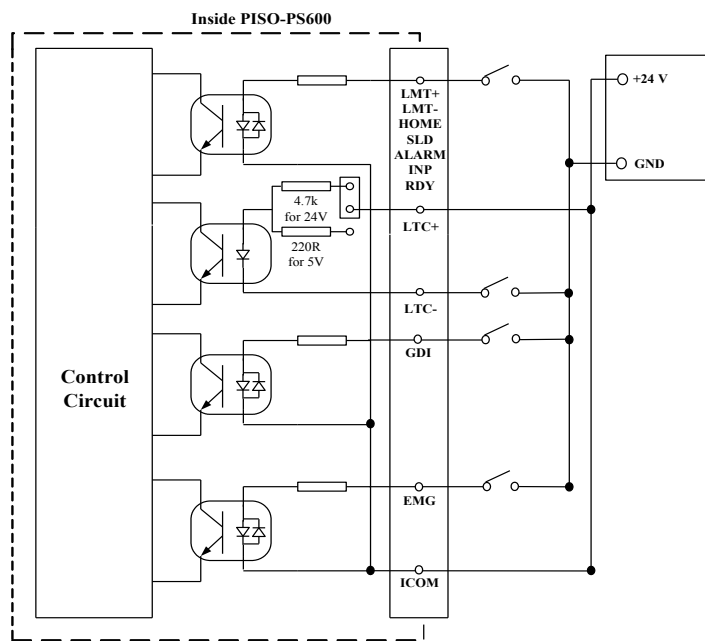
Fig 2-12

◆ **PNP Input for PNP Sourcing Type Sensor**

Inside PISO-PS600

Fig 2-13

e. Digital Output

Inside PISO-PS600

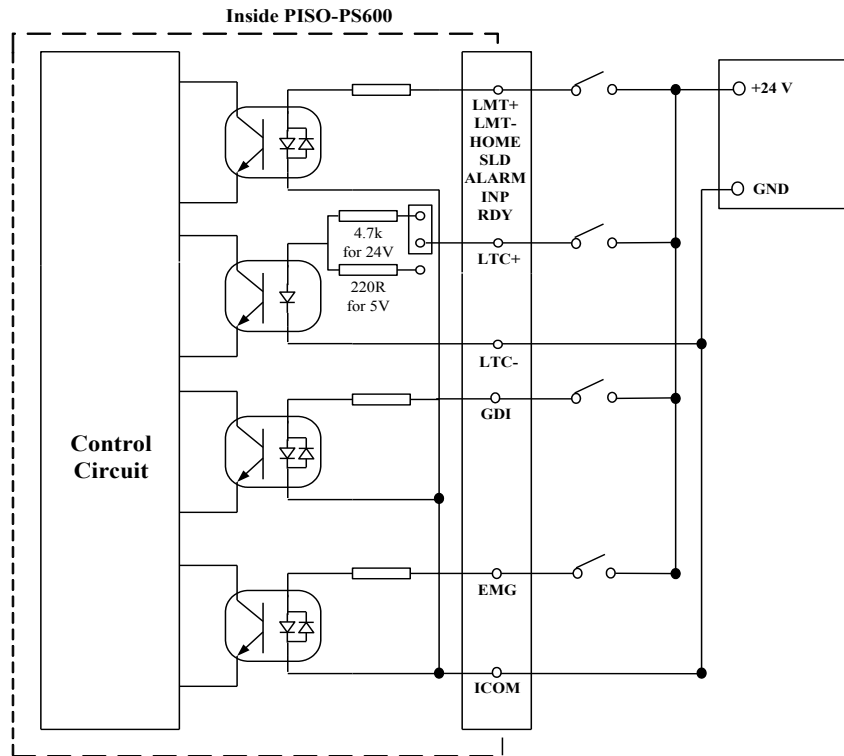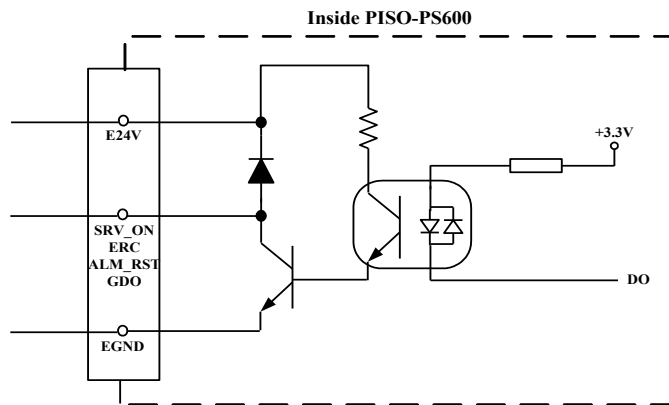**Fig 2-14**

2.2.6 Connection Example for Motor Driver

The following diagram is the connection example between MITSUBISH MR-J2S AC servo driver and the extension board DN-8368GB.
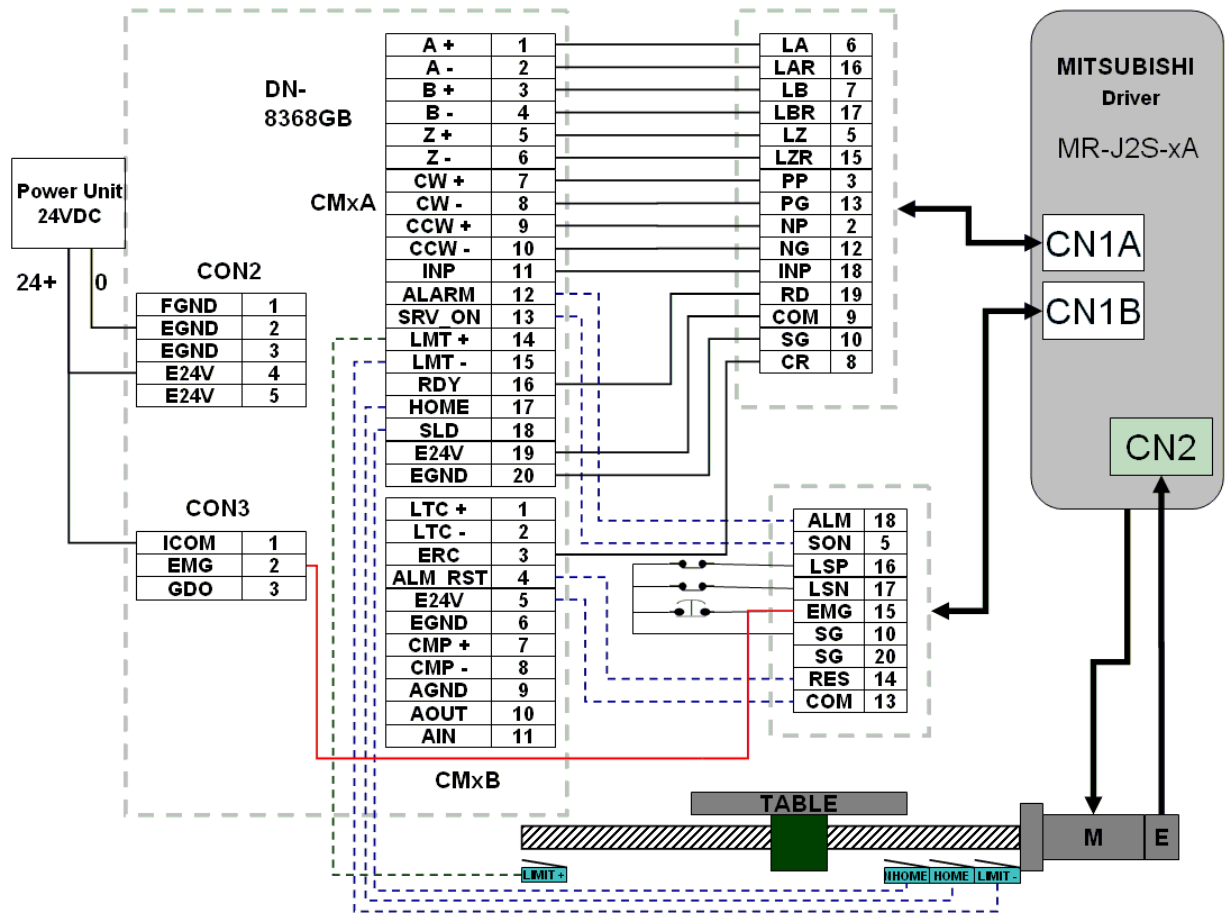

Fig. 2.16 The connection between MR-J2S AC servo driver and DN-8368GB extension board.

2.3 DN-20M Terminal Board

The DN-20M is the daughter board of PISO-PS600, PISO-VS600 and PMDK (Referred to as the main card after in this text) for Manual Pulse Generator (MPG) and FRnet. It connects with main card through one 20-20 SCSI II via CON1 connector.
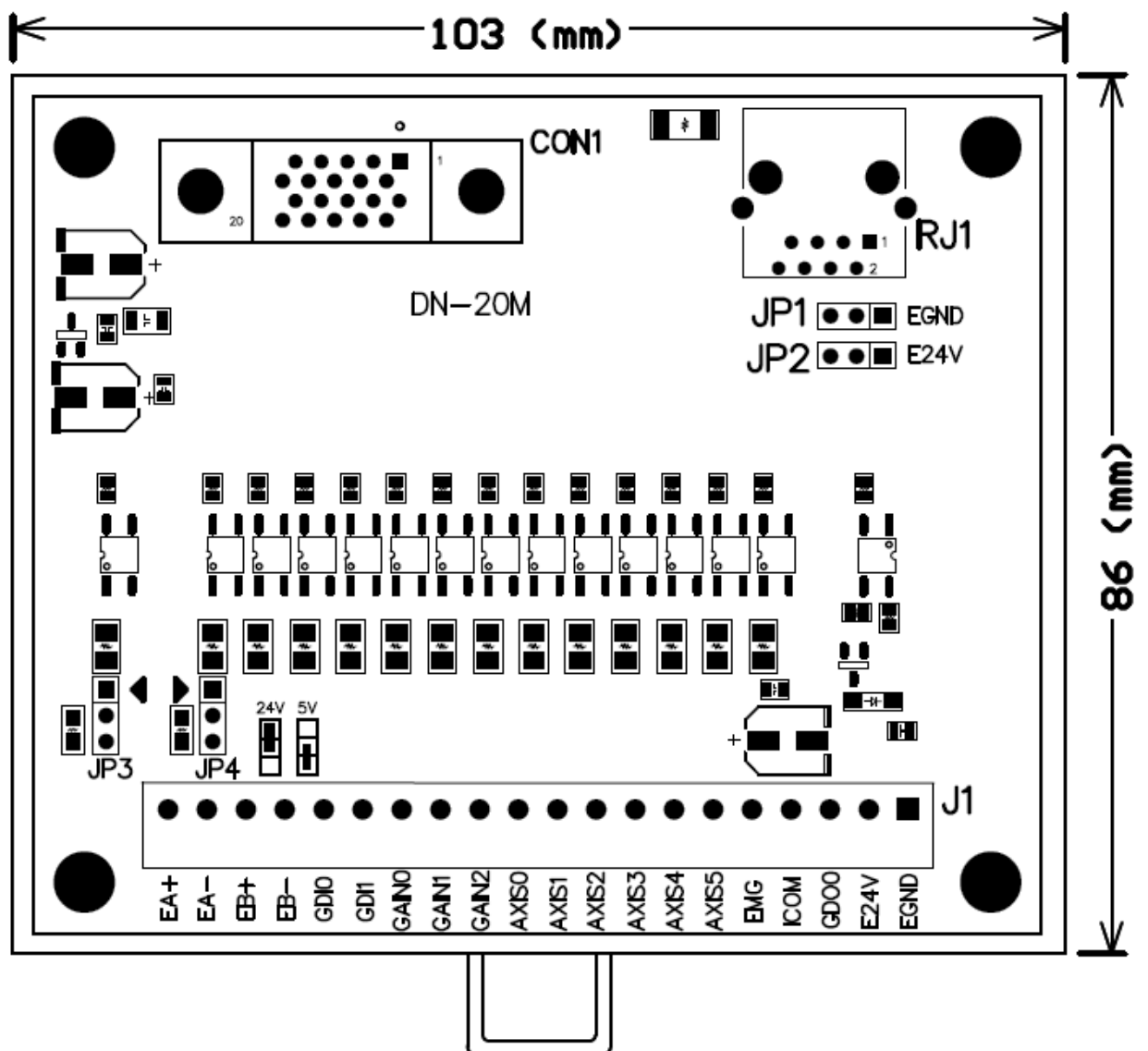
2.3.1 Board Layout for DN-20M

Fig. 2.17   Board layout for the DN-20M

2.3.2 Signal Connections for DN-20M

Assuring reliable connections is one of the most important tasks when sending or receiving data from your application system.

■ **CON1**

The connector CON1 is a 20-pin connector that enables you to connect sensors and motor drivers to the motion card of your Manual-Pulse-Generator and FRnet. The signal definitions are listed in Table 2-7. (For your reference only, this connector is connected with the control board directly; the user may not need to know the signal definition.)

Table 2-7

No.	Name	I/O	Function	No.	Name	I/O	Function
1	FR_A	O	FRnet A Phase	11	DGND	-	Digital Ground
2	FR_B	O	FRnet B Phase	12	MPG_EMG	I	MPG Emergency Stop
3	FR_GND	-	GND of FRnet Signal	13	GDI10 / MPG_Axis5	I	Generic Digital Input or MPG Axis Selection
4	GDI9 / MPG_Axis4	I	Generic Digital Input or MPG Axis Selection	14	GDI8 / MPG_Axis3	I	Generic Digital Input or MPG Axis Selection
5	GDI7 / MPG_Axis2	I	Generic Digital Input or MPG Axis Selection	15	GDI6 / MPG_Axis1	I	Generic Digital Input or MPG Axis Selection
6	GDI5 / MPG_Axis0	I	Generic Digital Input or MPG Axis Selection	16	GDI4 / MPG_Gain2	I	Generic Digital Input or MPG Magnification Selection
7	GDI3 / MPG_Gain1	I	Generic Digital Input or MPG Magnification Selection	17	GDI2 / MPG_Gain0	I	Generic Digital Input or MPG Magnification Selection
8	GDI1	I	Generic Digital Input	18	GDI0	I	Generic Digital Input
9	MPG_B	I	Manual Pulse Generator B Phase	19	MPG_A	I	Manual Pulse Generator A Phase
10	GDO0	O	Generic Digital Output	20	VCC	-	5V Digital Power from Bus

■ RJ1 (The I/O signals of the FRnet)

The connector RJ1 is an 8-pin RJ45 connector that enables you to connect to the signals of FRnet. Fig. 2-17 Pin definition for RJ1 shows the pin assignment for the 8-pin connector on the DN-20M, and the table shows its I/O connector signal description.
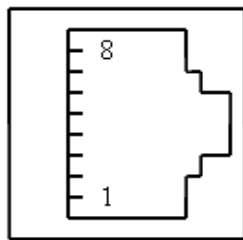
Pin No.	Pin Name	Description
8	E24V or NC	External Power +24V or No connection, selected by JP2
7	E24V or NC	External Power +24V or No connection, selected by JP2
6	FR_B	FRnet port B
5	NC	No connection
4	NC	No connection
3	FR_A	FRnet port A
2	EGND or NC	External Power Ground or No connection, selected by JP1
1	EGND or NC	External Power Ground or No connection, selected by JP1

Fig. 2-18 Pin definition of RJ1

■ **J1**

This Connector is mainly used for connecting the manual-pulse-generator. The Table 2-8 shows its I/O connector signal description for the 20-pin connector of J1:

Table 2-8

Pin NO	Pin Define	Function description
1	EA+	Encoder A-phase(+) signal from the Manual-Pulse-Generator
2	EA -	Encoder A-phase(-) signal from the Manual-Pulse-Generator
3	EB+	Encoder B-phase(+) signal from the Manual-Pulse-Generator
4	EB -	Encoder B-phase(-) signal from the Manual-Pulse-Generator
5	GDI0	General purpose input signal
6	GDI1	General purpose input signal
7	GAIN0	Gain signal from the Manual-Pulse-Generator
8	GAIN1	Gain signal from the Manual-Pulse-Generator
9	GAIN2	Gain signal from the Manual-Pulse-Generator
10	AXIS0	Axis selection signal from the Manual-Pulse-Generator
11	AXIS1	Axis selection signal from the Manual-Pulse-Generator
12	AXIS2	Axis selection signal from the Manual-Pulse-Generator
13	AXIS3	Axis selection signal from the Manual-Pulse-Generator
14	AXIS4	Axis selection signal from the Manual-Pulse-Generator
15	AXIS5	Axis selection signal from the Manual-Pulse-Generator
16	EMG	Emergency Stop signal from the Manual-Pulse-Generator
17	ICOM	Common of all input signals
18	GDO0	General purpose output signal
19	E24V	External Power +24V input
20	EGND	External Power Ground

2.3.3 Jumper Settings

■ JP1 and JP2

Jumper 1 and 2 controls the power usage of RJ1. The following diagram shows the selection condition of the JP1 and JP2.
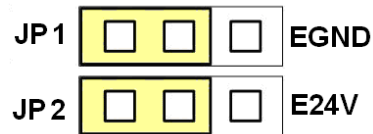

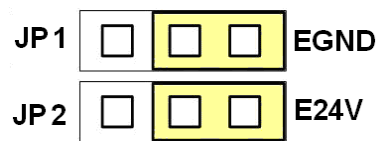**Fig. 2-19 JP1 and JP2 setting (without power on RJ1, Default setting)**

Fig. 2-20 JP1 and JP2 setting (With power on RJ1)

■ JP3, JP4

Jumper 3 and Jumper 4 control the power input signal of Manual-Pulse-generator (MPG) for 24V or 5V, please choose suitable setting according to the MPG that you used. The following diagram shows the selection condition of the JP3 and JP4.
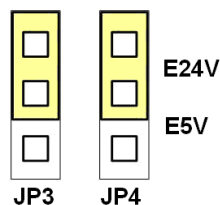

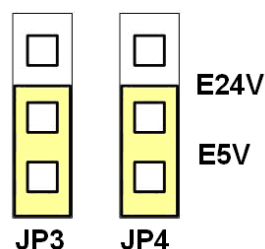**Fig. 2.-21 EA and EB signals setting with 24V (Default setting is 24V)**

Fig. 2-21 EA and EB signals setting with 5 V

2.3.4 Connection Example for MPG

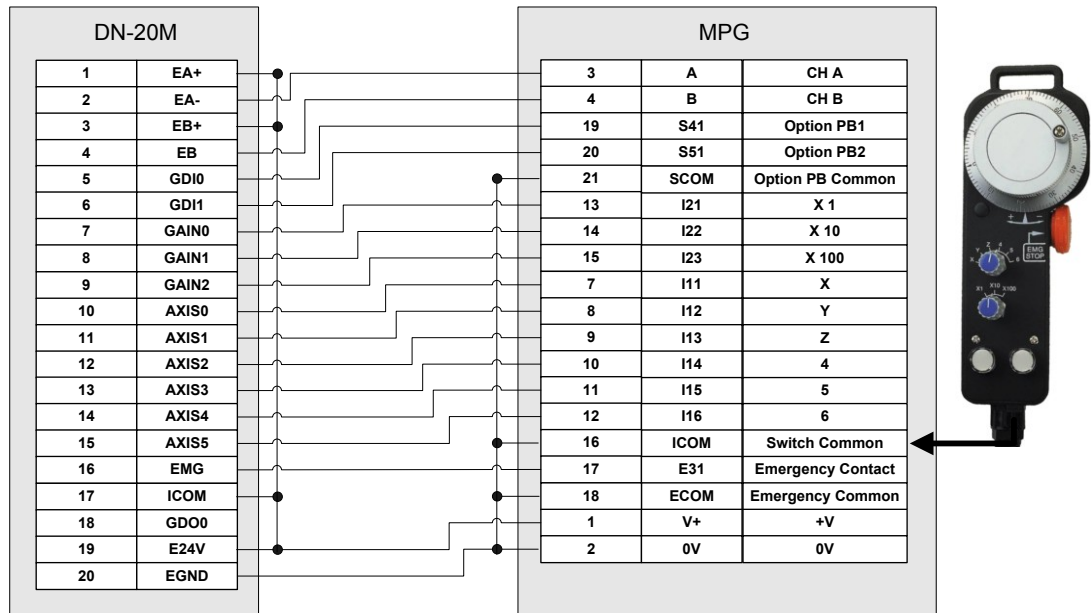The following diagram is the connection example between MPG(**HDW-B**) and the extension board DN-20M.

DN-20M			MPG		
1	EA+		3	A	CH A
2	EA-		4	B	CH B
3	EB+		19	S41	Option PB1
4	EB		20	S51	Option PB2
5	GDI0		21	SCOM	Option PB Common
6	GDI1		13	I21	X 1
7	GAIN0		14	I22	X 10
8	GAIN1		15	I23	X 100
9	GAIN2		7	I11	X
10	AXIS0		8	I12	Y
11	AXIS1		9	I13	Z
12	AXIS2		10	I14	4
13	AXIS3		11	I15	5
14	AXIS4		12	I16	6
15	AXIS5		16	ICOM	Switch Common
16	EMG		17	E31	Emergency Contact
17	ICOM		18	ECOM	Emergency Common
18	GDO0		1	V+	+V
19	E24V		2	0V	0V
20	EGND				

Fig. 2.23 The connection between MPG and DN-20M extension board.

3 SOFTWARE DEVELOPMENT OVERVIEW

3.1 Software Development Overview

The programming following-chart is shown as follows:
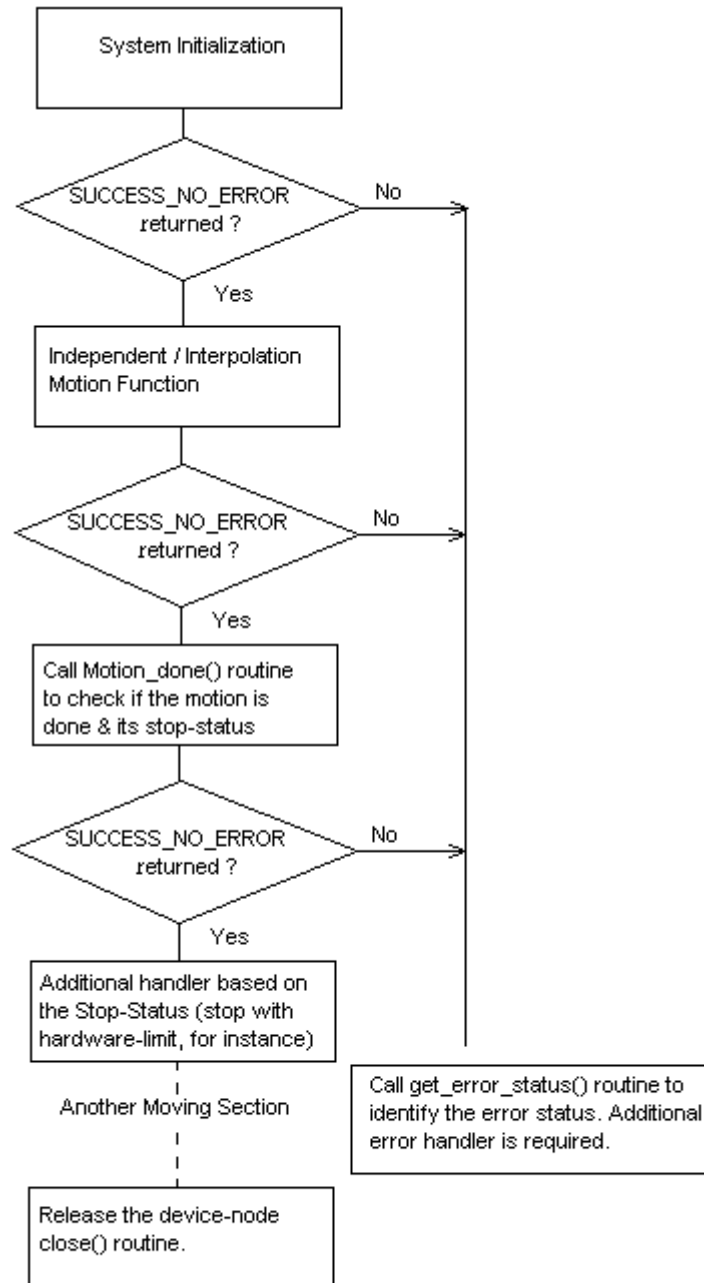
The samples for VC6, VB6, C#(CS) and BCB6 are provided to demonstrate the related functions. Please refer to the samples for detail.

3.2 Safety IO Setting

There are many reasons to stop motion during driving. Some reasons are described in the subsections.

3.2.1 Emergency Stop Signal Input

The EMG input signal in CON3 (at first daughter board that connector is near the PS600 PCB) is able to perform the emergency stop function immediately for all of the 6 axes during driving. The emergency stop function can prevent the critical damage occurrence from the critical accident. If user don't use this Emergency stop signal, please closing between ICOM and EMG at CON3.

3.2.2 Configure the Servo ALARM Signals

When the ALARM signals are occurred from servomotor drivers, users can be notified by these signals and determine what to do. The operating mode (Enable or Disable) and the proper trigger level of these signals can be set by user. Please refer to ps600_set_alarm() function, the section 2.3.4 of *PISO-PS600 Function Reference*.

3.2.3 Configure the Limit Switch Signals(±EL)

To insure the machine in safety, hardware limit switches are placed at the both ends of machine traveling range.   If the machine touch the hardware limit switch sensors, PISO-PS600 will stop immediately.   The operating mode (Enable or Disable) and the proper trigger level of these signals can be set by user.   Please refer to ps600_set_limit () function, the section 2.2.3 of *PISO-PS600 Function Reference*.

3.3 Error Checking

Whenever the critical error is happened to some axis, that axis will stop immediately. And the following motion-function, say ps600_t_move(), will get the runtime error (-301~-315). User could get the detailed error status that terminates the motion by calling ps600_get_error_status(). Please refer to ps600_get_error_status() function, the section 9.11 of *PISO-PS600 Function Reference*.

3.4 Basic Configuration of Motion

The basic motion configuration must be set for necessarily general settings and are described below:

1. Pulse output mode setting: Pulse/Dir、CW/CCW…

    ✓   Relative function: ps600_set_pls_cfg ()

   (Please refer to the section 2.2.1 of *PISO-PS600 Function Reference*)

2. Encoder input setting

    ✓   Relative function: ps600_set_enc_cfg()

   (Please refer to the section 2.2.2 of *PISO-PS600 Function Reference*)

3. DI noise filter setting (If necessary)

    ✓   Relative function: ps600_set_di_filter

   (Please refer to the section 2.3.8 of *PISO-PS600 Function Reference*)

4. Circular motion declaration (Ring counter) (If necessary)

    ✓   Relative function: ps600_set_enc_vring

   (Please refer to the section 7.1 of *PISO-PS600 Function Reference*)

3.5 Manual Pulse Generator Testing

User can use the manual pulse generator function directly to drive motion forward or backward. For further wiring and parameter tuning, user have to check the correction of the DI signals and the moving direction.

The manual pulse generator can be achieved from three driving methods described below:

1. A/B phase Manual Pulse Generator:

   Use the A/B phase manual pulse signals for forward/backward moving.

2. Continuous- pulse driving Manual Pulse Generator:

   User can preset output-pulse frequency.   After setting, user can push the forward (GDI0 at DN-20M) or backward(GDI1 at DN-20M) button to drive fixed velocity for each direction.   If user release the button, the motion will be stop immediately.

3. The target axes can be select by GDI(GDI5 ~ GDI10 Bit ,or BCD) or software parameter.

4. The gain can be controlled by GDI(GDI2 ~ GDI4 Bit ,or BCD) or software parameter.

ALL the above methods and the operation mode (enable or disable) from external pulse input can be chosen and set from the function, ps600_mpg_config(),ps600_set_mpg() (Please refer to the section 7.2,3 of *PISO-PS600 Function Reference*)

3.6 Home Search

PS600 provides the automatic homing function. After proper settings, the homing function can be operated automatically. Four homing steps are provided for setting and are described bellow:

- Near-home sensor searching under high-speed motion.
- Home sensor searching under low-speed motion.
- Servomotor Z-phase searching under low-speed motion.
- Offset movement to the origin of the working area under high-speed motion.

User can select which steps are ignored when setting for the actual operation. It performs automatically that economize the CPU resource and program code reducing. Although there are four home search steps, but user can create more than 10 types of different home search mode by vary with the software functions. It is attributed to the configurable home search direction and perform it or not of each step.

3.6.1 Home Search Configuration

1. Logic level setting for Near home sensor and Home sensor
2. Homing mode setting

   ps600_set_home_cfg () (Please refer to section 3.1 of *PISO-PS600 Function Reference*)

3.6.2 Running the Home Search

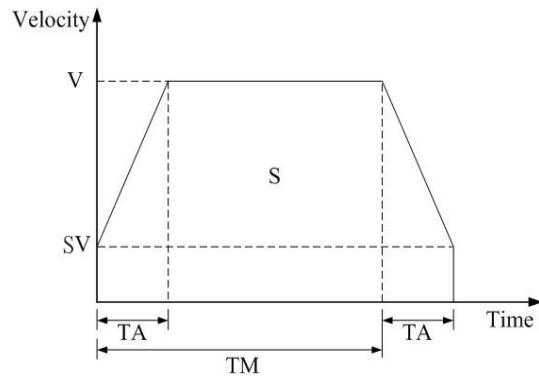1. Start homing with specific speed/acceleration

   ps600_Home _Start () (Please refer to section 3.2 of *PISO-PS600 Function Reference*)
2. Waiting for homing completion

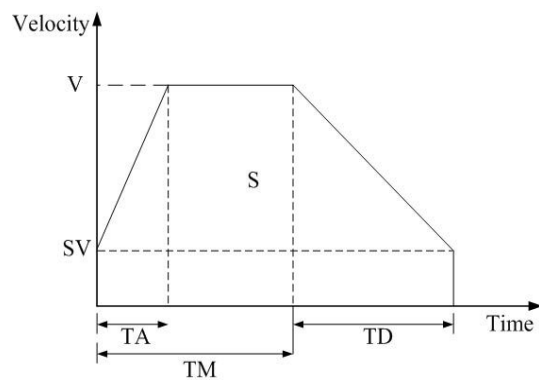   *ps600_motion_done ()* (Please refer to section 9.1 of *PISO-PS600 Function Reference*)

3.7 Basic Motion

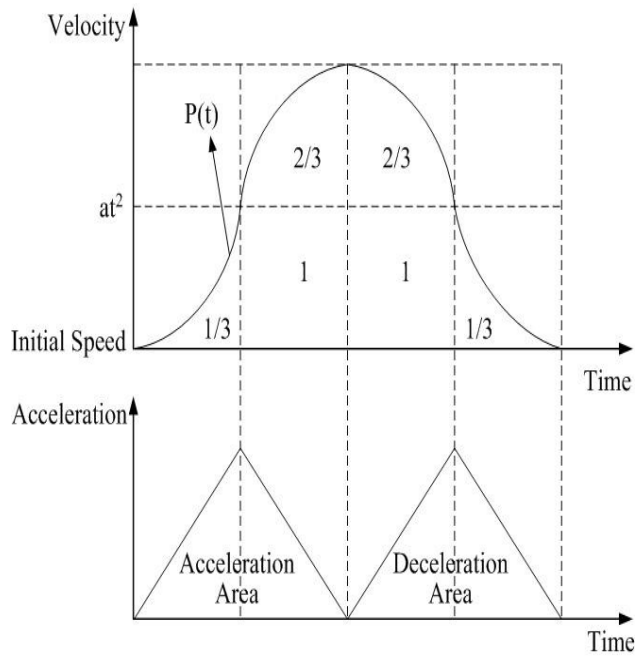## 3.7.1 Speed Profile of the Motion Control
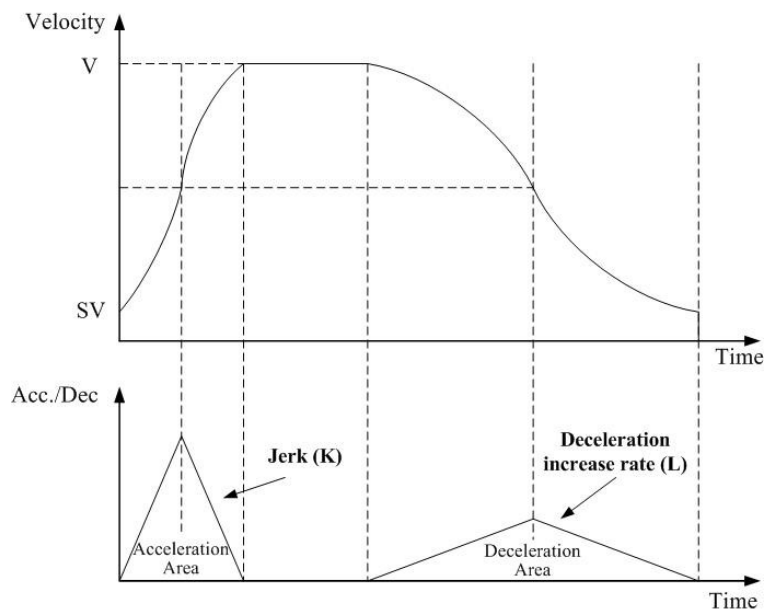

1 Symmetrical T-profile of motion velocity

(If SV is larger than or equal to V, perform constant velocity driving)

2 Asymmetrical T-profile of motion velocity

3 Symmetrical S-curve of motion velocity

4 Asymmetrical S-curve of motion velocity

3.7.2 Basic Motion of Single Axis

1. Fixed-pulse driving output: There are five speed profiles
   - Constant speed (V)
     - ✓ Relative function: ps600_const_move()
   - Symmetrical T-Profile (SV、V、A)
     - ✓ Relative function: ps600_t_move()
   - Symmetrical S-curve (SV、V、K)
     - ✓ Relative function: ps600_s_move()
   - Asymmetrical T-profile (SV、V、A、D)
     - ✓ Relative function: ps600_t_move()
   - Asymmetrical S-curve (SV、V、K、L)
     - ✓ Relative function: ps600_s_move()

   (Please refer to section 4.2 of *PISO-PS600 Function Reference*)

   For the absolute API please refer to section 4.3 of *PISO-PS600 Function Reference*

2. Continuous-pulse driving output: Perform continuous pulse output.
   - ✓ Relative function: ps600_velocity_move()

   (Please refer to section 4.1 of *PISO-PS600 Function Reference*)

3. Waiting for motion done: Waiting for the axis driving accomplished.
   - ✓ Relative function: *ps600_motion_done()*

   (Please refer to section 9.1 of *PISO-PS600 Function Reference*)

3.7.3 Basic Motion of Multi-axis Interpolation

■ Two-axis linear interpolation: Perform two-axis linear interpolation.

✓ Relative function: *ps600_t_line2_move()*, *ps600_s_line2 _move()*

(Please refer to section 5.1.1/5.1.2 of *PISO-PS600 Function Reference*)

For the absolute API please refer to section 5.2.1/5.2.2 of *PISO-PS600 Function Reference*

■ Three-axis linear interpolation: Perform three-axis linear interpolation.

✓ Relative function: *ps600_t_line3_move()*,*ps600_s_line3_move()*

(Please refer to section 5.1.3/5.1.4   of *PISO-PS600 Function Reference*)

For the absolute API please refer to section 5.2.3/5.2.4 of *PISO-PS600 Function Reference*

■ Two-axis ARC interpolation: Perform two-axis ARC interpolation.

✓ Relative function: *ps600_t_arc2_move ()*

(Please refer to section 5.1.6 of *PISO-PS600 Function Reference*)

For the absolute API please refer to section 5.2.6 of *PISO-PS600 Function Reference*

■ The acceleration / deceleration modes of interpolation are: Constant Speed, T-Profile and S-Curve motion.

3.7.4 Motion of Multi-axis Continuous Interpolation

■ Only Constant-Vector-Speed is allowed in Continuous Interpolation motion. The associated axes should be assigned before starting interpolation-motion. The associated-axis of interpolation cannot be changed after starting interpolation.

✓ Relative function: *ps600_conti_interp_config ()*.

(Please refer to section 5.3 of *PISO-PS600 Function Reference*)

■ When the continuous interpolation configuration was completed, call *ps600_conti_interp_start ()* to start the Interpolation.

(Please refer to section 5.4 of *PISO-PS600 Function Reference*)

3.8 Advanced Motion Function

For more advanced motion function please refer to section 7.1~7.6 of *PISO-PS600 Function Reference*)

4 PISO-PS600 PCEzGo

The initial frame of PISO-PS600 PCEzGo is shown in the following figure. Four categories of test function are displayed in the initial frame.

- ✧ Configuration (please refer to section 4.1)
- ✧ Basic Operation (please refer to section 4.2)
- ✧ Interpolation Operation (please refer to section 4.3)
- ✧ FRnet Operation (please refer to section 4.4)

4.1 Configuration Dialog
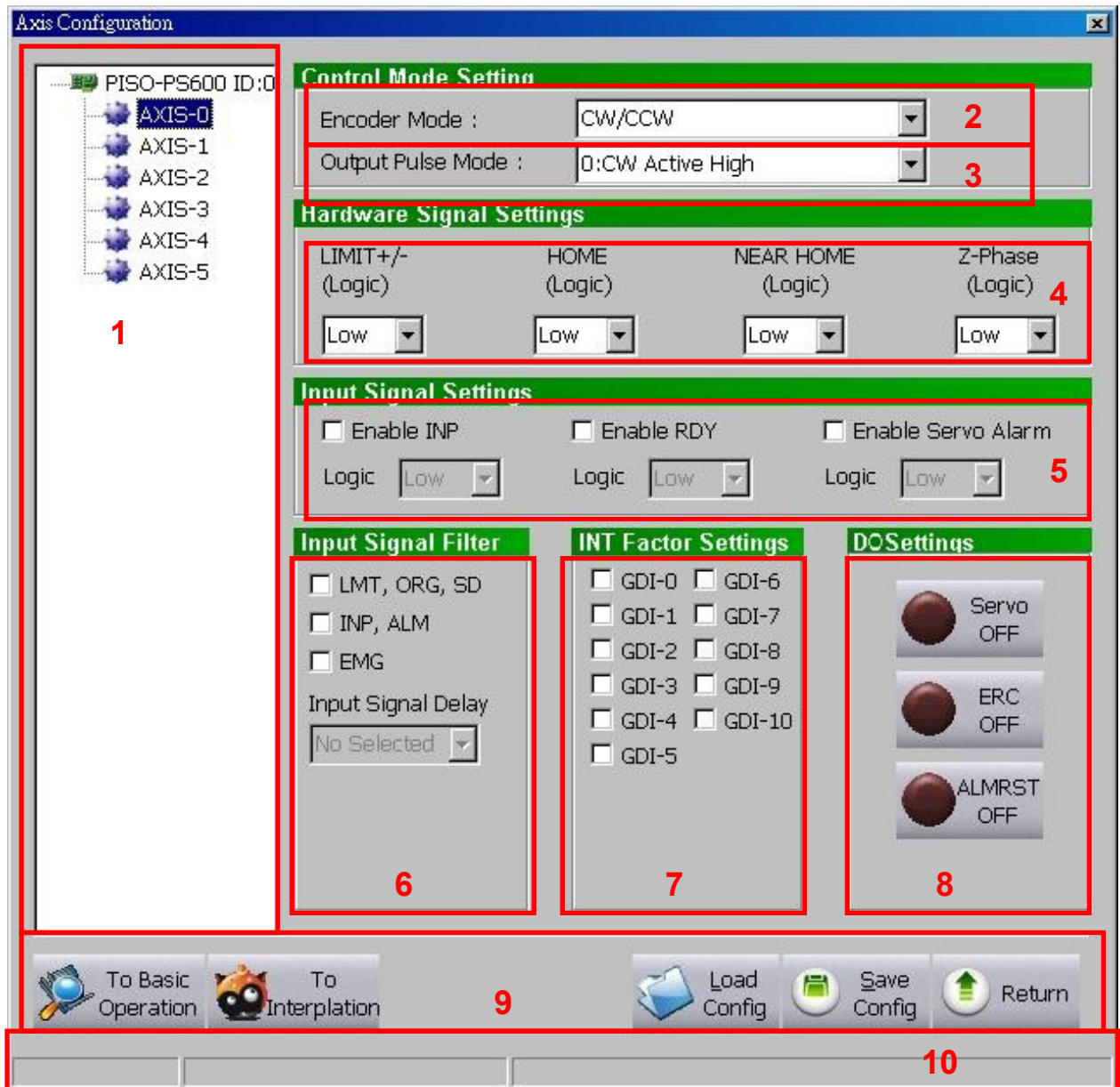
Group Definition & User Guide

1. The tree-structure to show the available axes/cards :
   - Selects the target Axis of the specific motion card .

2. Encoder Mode :
   - Configures the encoder input mode as AB phase or CW/CCW (Up/Down count). Specify the frequency division at AB phase mode.(1/1 AB Phase、1/2 AB Phase、1/4 AB Phase)
   - Relative Function： ps600_set_enc_cfg().

3. Output Pulse Mode :
   - The types of pulse output are classified into 6 modes: 0, 1 is CW/CCW dual channel mode, 2~5 is PULSE/DIR single channel mode.
   - Relative Function：ps600_set_pls_cfg().

4. Hardware Signals Settings：
   - The polarities of the hardware signals are set in this sub-item, including hardware limits(LIMIT+/-), home sensor(HOME), near home sensor(NEAR HOME), servo motor Z-phase signal(INDEX).
   - Relative Function：ps600_set_limit(), ps600_set_home_cfg().

5. Servo Input Signal：
   - Configurable feature enable/disable and logical trigger level of the Servo Alarm signal.
   - Relative Function：ps600_set_alarm(), ps600_set_inp().

6. Input Signals Filter Settings：
   - Setting the delay time of each input signal filter:
     3.84us,30.73us,245.76us

   - Relative Function : ps600_set_di_filter()。

7. INT Factor Settings：
   - Eleven DI(GDI0 ~ GDI10) signal can be interrupt event sources there are provided in PISO-PS600 motion card.
   - Relative Function： ps600_set_int_factor().

8. DO settings On/Off Switch：
   - Relative Function：ps600_servo_on(),ps600_set_erc(),ps600_set_alarm_reset().
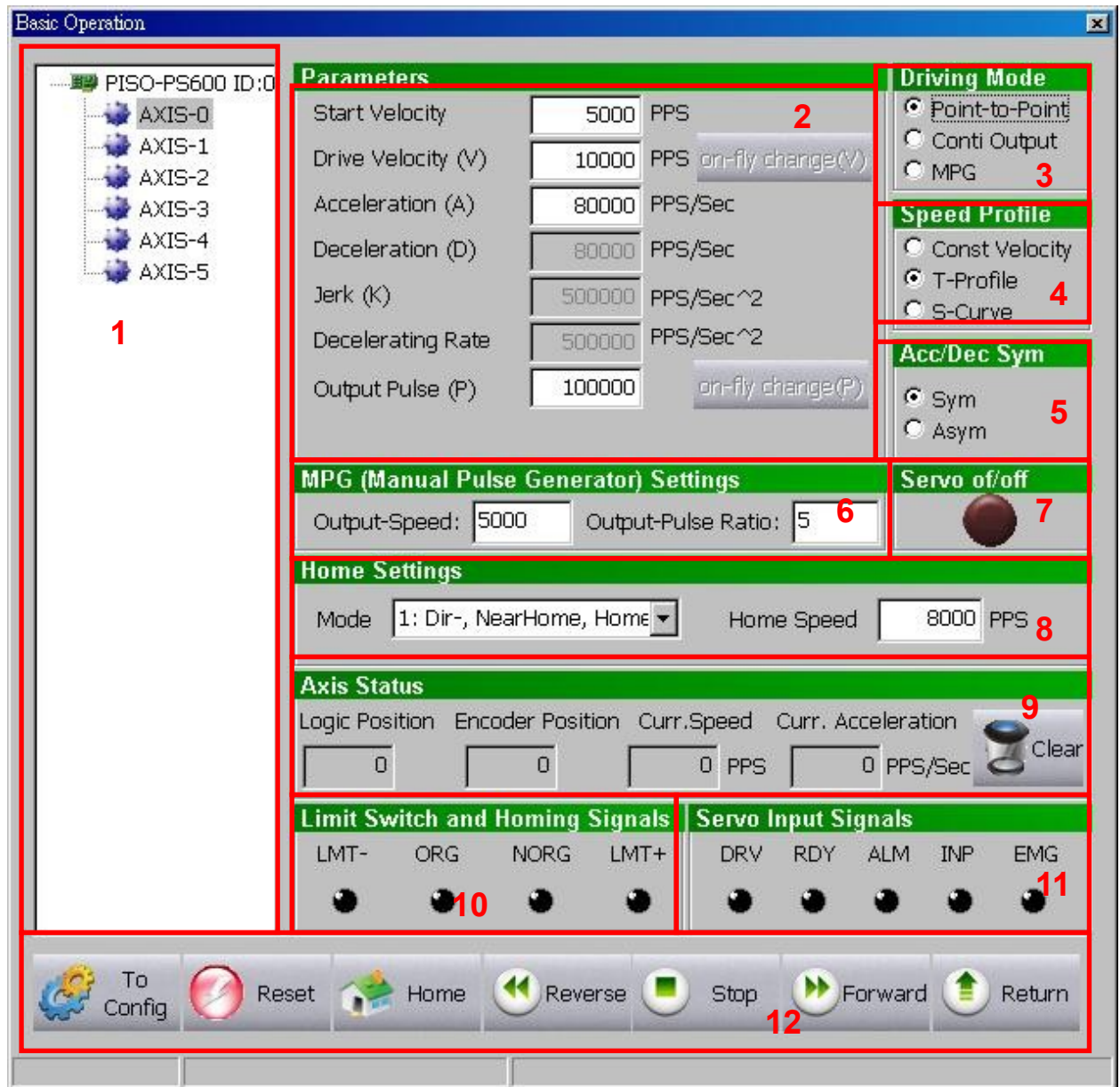
9. Function of Buttons :
   - To BasicOperation: The shortcut to Basic Operation Dialog.
   - To Interpolation: The shortcut to Interpolation Dialog.
   - LoadConfig: Loads the pre-defined configuration.
   - SaveConfig: Saves the configuration of all available PISO-PS600 cards.
   - Return：Returns to initial frame.

10. Status Bar :
   - Displays the Error Status.

4.2 Basic Operation Dialog

Group Definition & User Guide

1. The tree-structure to show the available axes/cards :

   ■ Selects the target Axis of the specific motion card .

2. Parameter Setting :

   ■ The involved parameters are :
   Start Velocity(SV)、Driver Velocity(V)、Acceleration(A) 、Deceleration(D)、Jerk(K)、
   Deceleration Rate(L)、Output Pulse(P).

3. Driving Mode :
   - Point-to-point driving modes.
   - Continuous output driving modes.
   - MPG driving modes.

4. Speed Profile :
   - Const Velocity mode.
   - T-Profile mode.
   - S-Curve mode.

5. Acc/Dec Symmetry Setting :
   - Symmetry Mode.
   - Asymmetry Mode.

6. Manual Pulse Generator Setting :
   - The maximum frequency of MPG and output-pulse ratio are required.

7. Servo On/Off Status
   - Indicates the current Servo status (On or Off).

8. Home Setting
   - Home search mode and home speed setting。
   - Four typical scenarios are introduced to demonstrate the automatic home-searching:
     1: Dir-, NearHome, Home: Search Near-Home sensor in the reverse direction, and Home sensor in the forward direction.
     2: Dir+, NearHome, Home: Search Near-Home sensor in the forward direction, and Home sensor in the reverse direction.
     3: Dir-, NearHome, Home, Index : Search Near-Home sensor in the reverse direction, , Home sensor in the forward direction and Index sensor in the reverse direction.
     4: Dir+, NearHome, Home, Index : Search Near-Home sensor in the forward direction, , Home sensor in the reverse direction and Index sensor in the forward direction.
   - Relative Function： ps600_set_home_cfg().

9. Axis Status :
   - Displays the motion information for each axis, including the logic position counter, encoder position counter, current speed and acceleration.

- Relative Function： ps600_get_cmdcounter()、ps600_get_position()、 ps600_get_speed()、ps600_get_acc().

10. Limit Switch and Homing Signals：
   - Indicates the status of limit switches and home-related sensors.
   - Relative Function： ps600_get_mdi_status().

11. Servo Input Signal：
   - Displays servo Input signal status.

12. Function of Buttons：
   - To Config : The shortcut to Configuration Dialog.
   - Reset : Resets the target card to the initial state.
   - Home : Starts auto-home searching.
   - Reverse : Starts motion in the reverse direction.
   - Stop : Stops Motion.
   - Forward : Starts motion in the forward direction.
   - Return : Returns to initial frame.

4.3 Interpolation Dialog

Group Definition & User Guide

1. The tree-structure to show the available axes/cards :
   - Selects the target motion card.

2. Interpolation Mode Setting :
   - Linear 2D/3D and Circular interpolation.
   - Relative Function : ps600_t_line2_move(), ps600_s_line2_move(), ps600_t_line3_move(), ps600_s_line3_move(), ps600_t_arc2_move(), ps600_abs_t_line2_move(), ps600_abs_s_line2_move(), ps600_abs_t_line3_move(), ps600_abs_s_line3_move(), ps600_abs_t_arc2_move().

3. Acc Mode Setting :
   - Three acceleration modes are supported for interpolation: Constant-Speed, T-Profile and S-Curve acceleration modes.

4. Axis Disposition Setting:
   - Configures the axes that are related to interpolation operation.

5. Parameter Setting :
   - The involved parameters are : Start Velocity(SV), Driver Velocity(V), Acceleration(A), Deceleration(D), Jerk(K)、 Deceleration Rate(L).

6. Arc Mode Setting :
   - Indicates the direction of Circular Interpolation. Clockwise or Counter Clockwise in circular motion.

7. Acc/Dec Symmetry Setting :
   - Symmetry Mode.
   - Asymmetry Mode.

8. Servo On/Off Status :
   - Indicates the current Servo status (On or Off).

9. Finish Points /Center Points Setting : Configures the each Finish-point of the interpolation-related axes; and the Center-Points for circular interpolation.

10. Position Status :
   - Displays the motion information for each axis, including the logic position counter, encoder position counter and current speed.
   - Relative Function : ps600_get_cmdcounter(), ps600_get_position(), ps600_get_speed().

11. Function of Buttons :
   - To Config : The shortcut to Configuration Dialog.
   - Reset : Resets the target card to the initial state.
   - Interpolation Move : Starts Interpolation motion.
   - Stop : Stops Motion.
   - Return : Returns to initial frame.

4.4 FRnet DI/DO Dialog
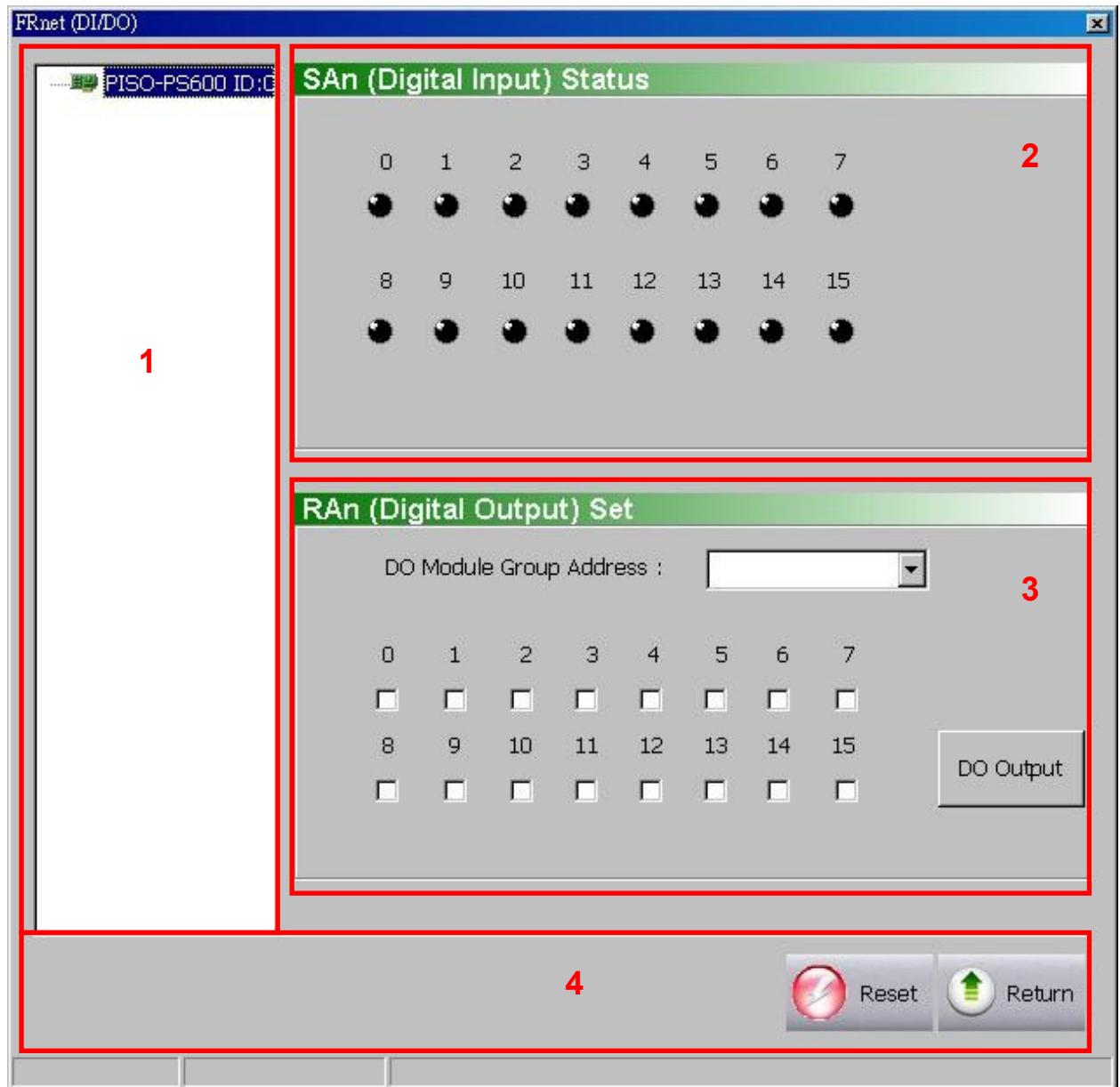
Group Definition & User Guide

1. The tree-structure to show the available FRnet DI modules :
   - Selects the target DI FRnet DI module that is connected to the specific motion card .

2. SAn (Digital Input) Status :
   - Displays the DI status of target FRnet module.
   - Relative Function：ps600_get_FRnet_DI()。

3. RAn (Digital Output) Set :
- Select the Group Address for specific FRnet DO module.
- Sets the Digital Output to the DO module.
- Relative Function：ps600_set_FRnet_DO()。

4. Function of Buttons :
- Reset：Resets the FRnet connection.
- Return：Returns to initial frame.

APPENDIX-A PISO-PS600 Installation

Please execute "setup.exe" from the directory, "/PC_BASE/PCI/PISO_PS600/Win2K_XP/", in CD and click "Next".

Choice the "I accept the agreement" and click "Next".

click "Next".
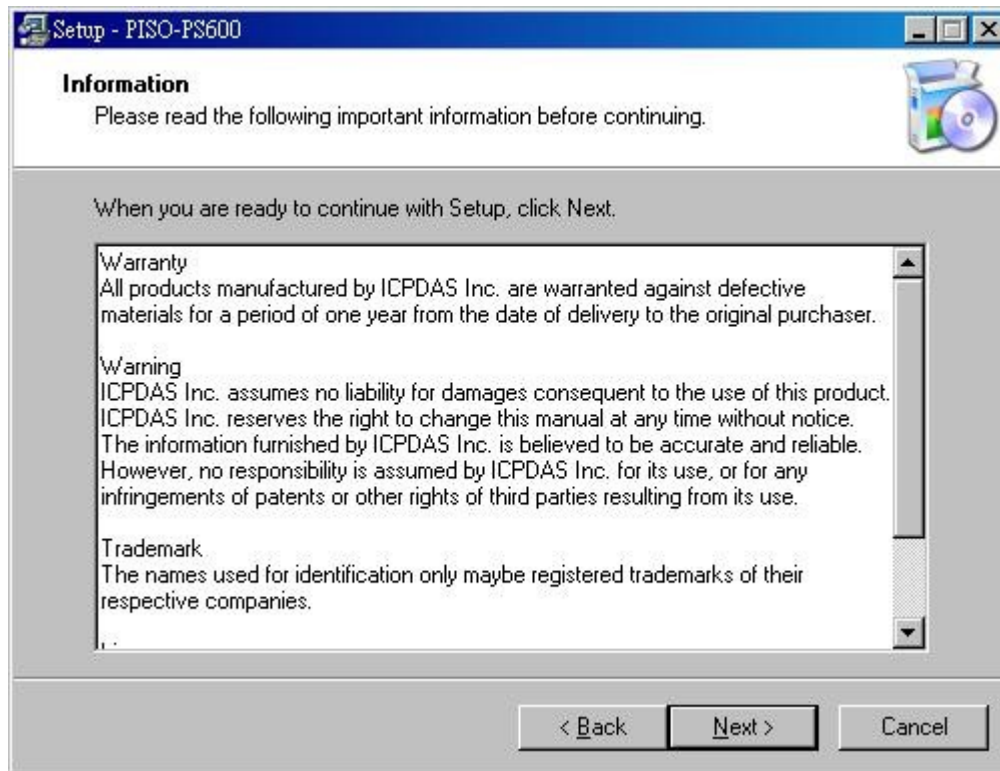
Choice the "Create a desktop icon" and click "Next".
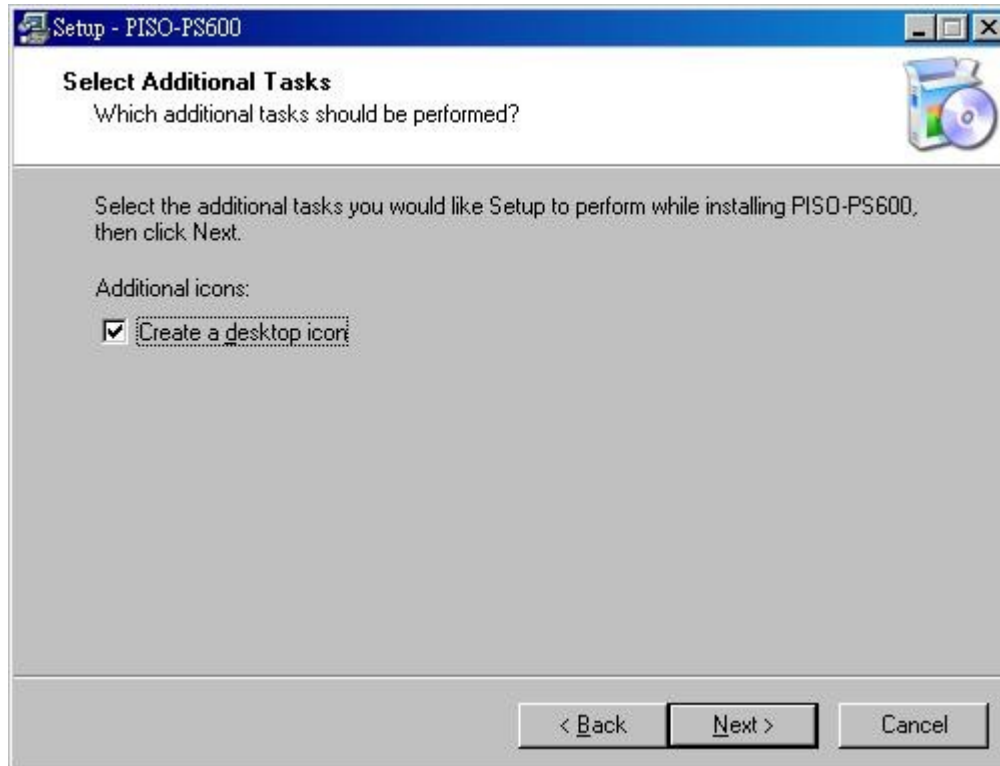
click "Install".
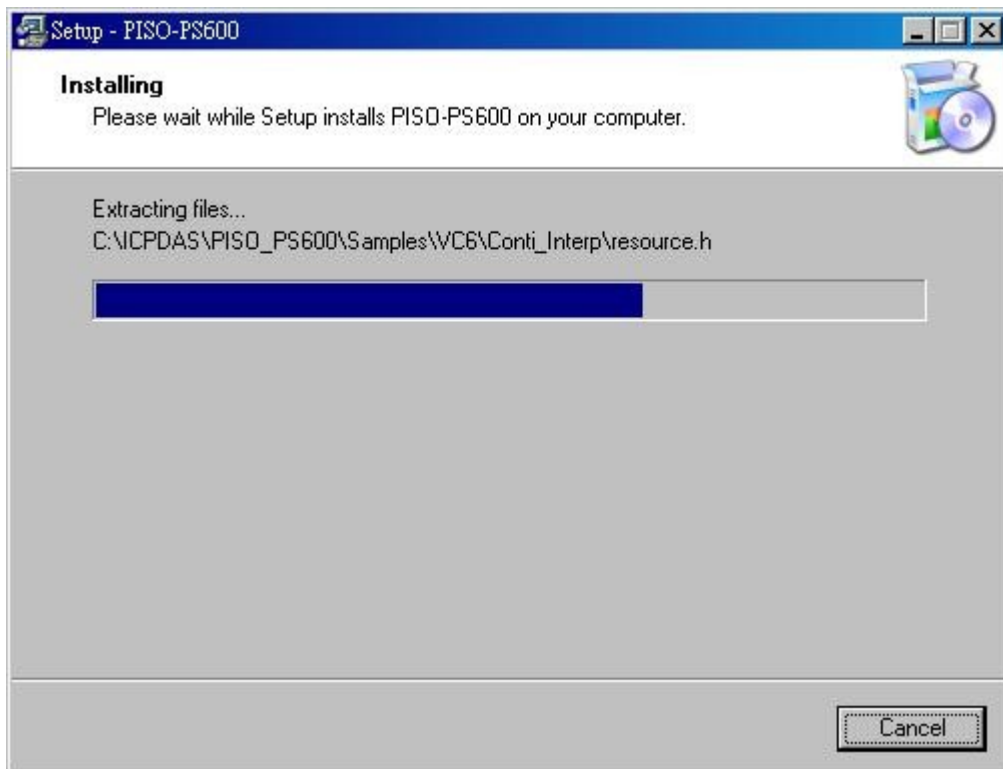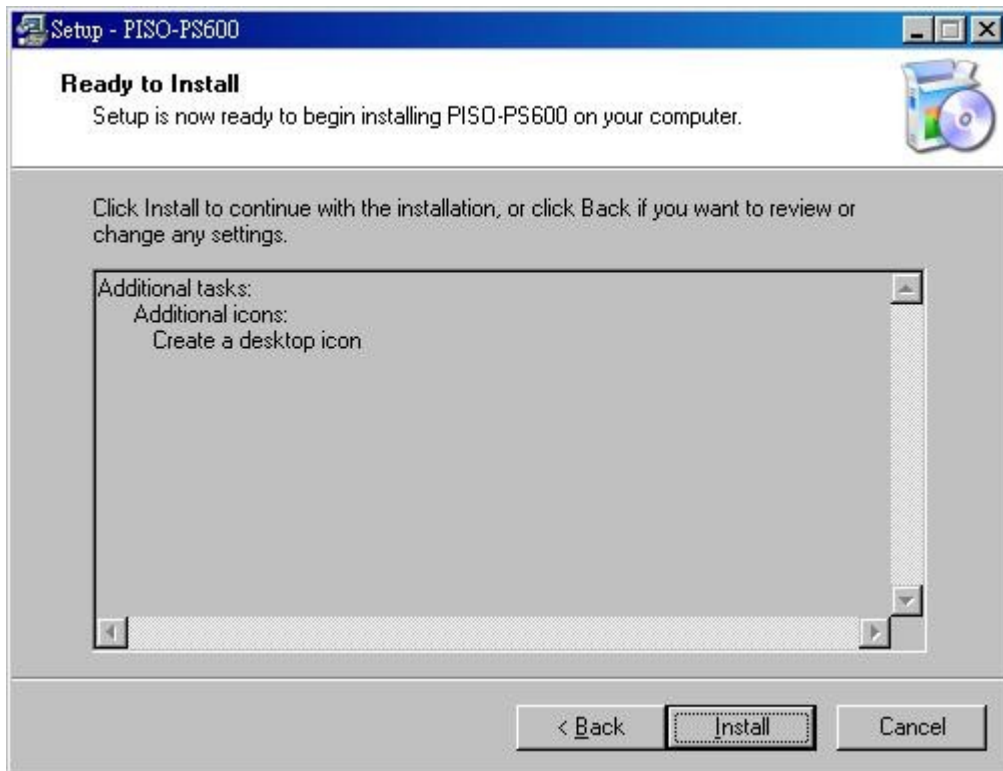
click "Next".
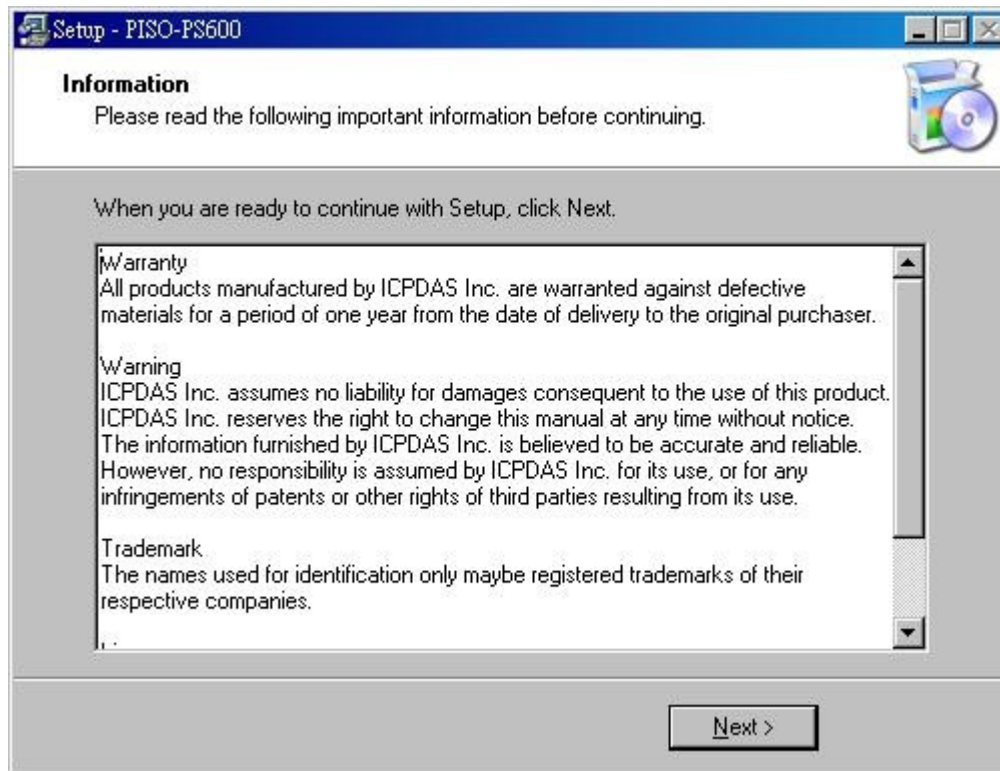
Choice the "Yes,restart the computer now" and click "Finish" button for reboot after installation accomplished.

After installation, the folder/files are distributed as follows:

（Typically, the installed directory is, C:\ICPDAS\PISO_PS600)

$Installed_Directory	\Include		Header Files
	\LIB		Library Files
	\Manuals		All manuals
	\Utility		PCEzGo.exe,CtrlParam.exe
	\Driver	\Win2K	Win 2K drivers and information file
		\WinXP	Win XP drivers and information file
	\Samples	\VC6	Samples for VC 6.0, VB 6.0, BCB 6.0 and C#
		\VB6	
		\BCB6	
		\CS	

APPENDIX-B Others Terminal Boards

B.1 DN-8368MB Daughter Board

The DN-8368MB is a terminal board connecting between Mitsubishi J2S series servo driver (with pulse train input amplifier) and ICP DAS PISO-PS600, PISO-VS600 or PMDK motion controller card. Please do not use it to connect any other servo driver or cards. Moreover, it also includes 3-axis I/O signals. We expect to reduce the wiring between Mitsubishi J2S series servo driver and the motion controller card. This manual describes signals and operation instructions of DN-8368MB; the content is divided into 5 parts. 1. Board layout, 2. I/O Signal connectors, 3. Signal connectors for Mitsubishi J2S series servo amplifier, 4. Jumper and switch setting, 5. LED function describes, etc.

B1.1 Board Layout for DN-8368MB

Dimension and Placement
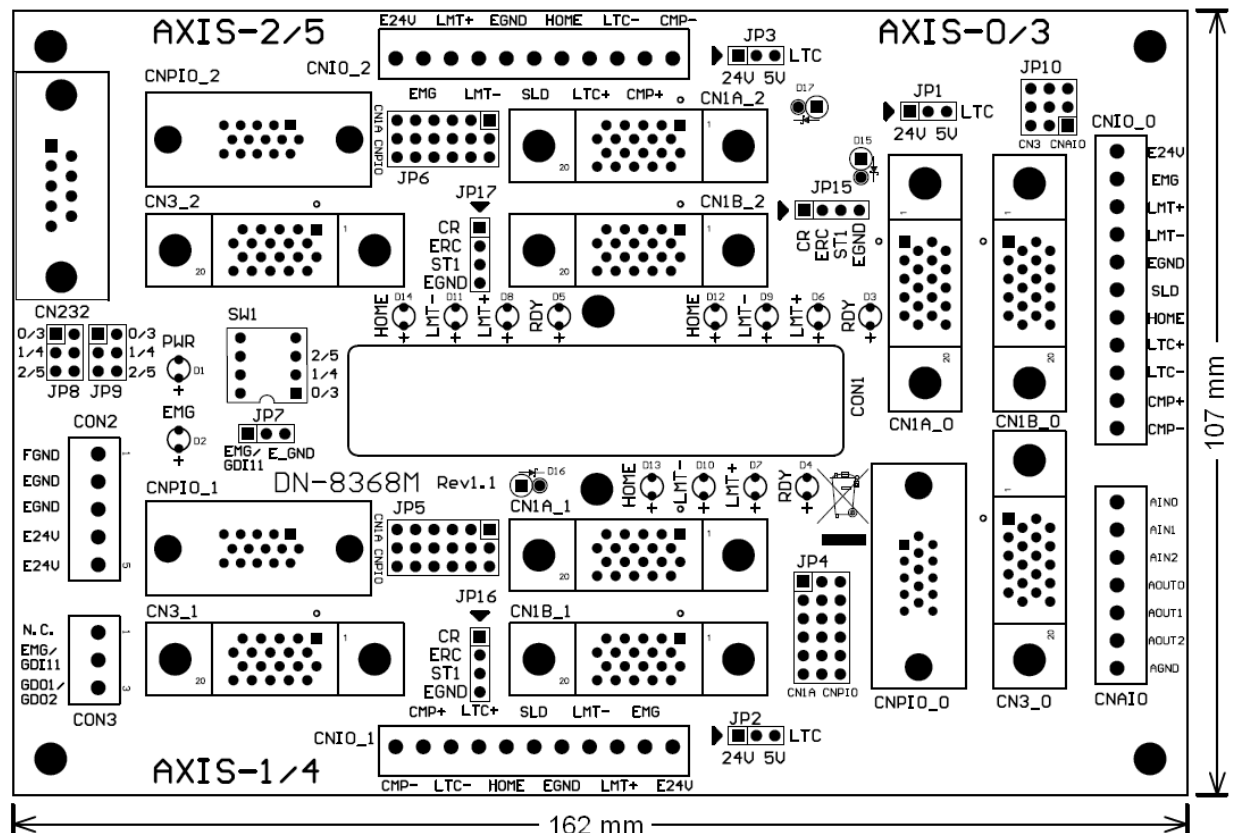
Fig. B1-1 Board layout for the DN-8368MB

B1.2 I/O Signal connector

Assuring reliable connections is one of the most important tasks when sending or receiving data from your application systems. This chapter will introduce I/O connector (for general purposes) on DN-8368MB and machine platform specific I/O connector.   Users can find various signal usage and meanings in this section.

■ CON1

The I/O connector on DN-8368MB is a 68-pin SCSI II connector that enables you to connect to the sensors and motor drivers to the motion card. Please note: there are two groups of connectors (CN1A/ CN1B) on the main card; therefore, the same signal may have a different name on each sub board. Please refer to Table B1-1, Table B1-2 for your reference.

Table B1-1 CN1A（be close the PCB）

No.	Name	I/O	Function	No.	Name	I/O	Function
1	AOUT0	O	Analog Output	35	AIN0	I	Analog Input
2	AOUT1	O	Analog Output	36	AIN1	I	Analog Input
3	AOUT2	O	Analog Output	37	AIN2	I	Analog Input
4	AGND	-	Analog Ground	38	AGND	-	Analog Ground
5	DGND	-	Digital Ground	39	ERC0	O	Error Counter Clear
6	LTC0	I	Position Latch	40	SVON0	O	Servo On
7	EA0	I	Encoder A-Phase	41	RDY0	I	Servo Ready
8	EB0	I	Encoder B-Phase	42	INP0	I	Servo In-Position
9	EZ0	I	Encoder Z-Phase	43	ALM0	I	Servo Alarm
10	CW0	O	Clockwise pulse	44	SLD0	I	Slow Down
11	CCW0	O	Counter-Clockwise pulse	45	ORG0	I	Origin Signal
12	CMP0	O	Compare Trigger	46	MEL0	I	Minus End Limit
13	EMG	I	Emergency Stop	47	PEL0	I	Positive End Limit
14	ALMRST0	O	Servo Alarm Reset	48	DGND	-	Digital Ground
15	DGND	-	Digital Ground	49	ERC1	O	Error Counter Clear
16	LTC1	I	Position Latch	50	SVON1	O	Servo On
17	EA1	I	Encoder A-Phase	51	RDY1	I	Servo Ready
18	EB1	I	Encoder B-Phase	52	INP1	I	Servo In-Position
19	EZ1	I	Encoder Z-Phase	53	ALM1	I	Servo Alarm
20	CW1	O	Clockwise pulse	54	SLD1	I	Slow Down
21	CCW1	O	Counter-Clockwise pulse	55	ORG1	I	Origin Signal
22	CMP1	O	Compare Trigger	56	MEL1	I	Minus End Limit
23	GDO1	O	Generic Digital Output	57	PEL1	I	Positive End Limit
24	ALMRST1	O	Servo Alarm Reset	58	DGND	-	Digital Ground
25	DGND	-	Digital Ground	59	ERC2	O	Error Counter Clear
26	LTC2	I	Position Latch	60	SVON2	O	Servo On
27	EA2	I	Encoder A-Phase	61	RDY2	I	Servo Ready
28	EB2	I	Encoder B-Phase	62	INP2	I	Servo In-Position
29	EZ2	I	Encoder Z-Phase	63	ALM2	I	Servo Alarm
30	CW2	O	Clockwise pulse	64	SLD2	I	Slow Down
31	CCW2	O	Counter-Clockwise pulse	65	ORG2	I	Origin Signal
32	CMP2	O	Compare Trigger	66	MEL2	I	Minus End Limit
33	DGND	-	Digital Ground	67	PEL2	I	Positive End Limit
34	ALMRST2	O	Servo Alarm Reset	68	VCC	-	5V Digital Power from Bus

Table B1-2 CN1B (be distances from PCB）

No.	Name	I/O	Function	No.	Name	I/O	Function
1	AOUT3	O	Analog Output	35	AIN3	I	Analog Input
2	AOUT4	O	Analog Output	36	AIN4	I	Analog Input
3	AOUT5	O	Analog Output	37	AIN5	I	Analog Input
4	AGND	-	Analog Ground	38	AGND	-	Analog Ground
5	DGND	-	Digital Ground	39	ERC3	O	Error Counter Clear
6	LTC3	I	Position Latch	40	SVON3	O	Servo On
7	EA3	I	Encoder A-Phase	41	RDY3	I	Servo Ready
8	EB3	I	Encoder B-Phase	42	INP3	I	Servo In-Position
9	EZ3	I	Encoder Z-Phase	43	ALM3	I	Servo Alarm
10	CW3	O	Clockwise pulse	44	SLD3	I	Slow Down
11	CCW3	O	Counter-Clockwise pulse	45	ORG3	I	Origin Signal
12	CMP3	O	Compare Trigger	46	MEL3	I	Minus End Limit
13	GDI11	I	Generic Digital Input	47	PEL3	I	Positive End Limit
14	ALMRST3	O	Servo Alarm Reset	48	DGND	-	Digital Ground
15	DGND	-	Digital Ground	49	ERC4	O	Error Counter Clear
16	LTC4	I	Position Latch	50	SVON4	O	Servo On
17	EA4	I	Encoder A-Phase	51	RDY4	I	Servo Ready
18	EB4	I	Encoder B-Phase	52	INP4	I	Servo In-Position
19	EZ4	I	Encoder Z-Phase	53	ALM4	I	Servo Alarm
20	CW4	O	Clockwise pulse	54	SLD4	I	Slow Down
21	CCW4	O	Counter-Clockwise pulse	55	ORG4	I	Origin Signal
22	CMP4	O	Compare Trigger	56	MEL4	I	Minus End Limit
23	GDO2	O	Generic Digital Output	57	PEL4	I	Positive End Limit
24	ALMRST4	O	Servo Alarm Reset	58	DGND	-	Digital Ground
25	DGND	-	Digital Ground	59	ERC5	O	Error Counter Clear
26	LTC5	I	Position Latch	60	SVON5	O	Servo On
27	EA5	I	Encoder A-Phase	61	RDY5	I	Servo Ready
28	EB5	I	Encoder B-Phase	62	INP5	I	Servo In-Position
29	EZ5	I	Encoder Z-Phase	63	ALM5	I	Servo Alarm
30	CW5	O	Clockwise pulse	64	SLD5	I	Slow Down
31	CCW5	O	Counter-Clockwise pulse	65	ORG5	I	Origin Signal
32	CMP5	O	Compare Trigger	66	MEL5	I	Minus End Limit
33	DGND	-	Digital Ground	67	PEL5	I	Positive End Limit
34	ALMRST5	O	Servo Alarm Reset	68	VCC	-	5V Digital Power from Bus

■ CON2

The connectors CON2 are a 5-pin connector for external Power supply (24V input). Table B1-3 shows its I/O connector signal description.

Table B1-3

Pin NO	Pin Define	Function description
1	FGND	Frame ground of DN-8368MB
2	EGND	Ground of the external power
3	EGND	Ground of the external power
4	E24V	External power supply of +24V DC
5	E24V	External power supply of +24V DC

■ CON3

The connector CON3 is a 3-pin connector for connecting general purpose I/O. There are one digital input and one digital output signal, when the connectors connect to the CN1A of main card (the one closer to the PCB board), the input signal is defined as emergency stop. When the connectors connect to the CN1B of main card, the input signal is defined as general purpose input signal. Table B1-4 shows its I/O connector signal description:

Table B1-4

Pin NO	Pin Define	Function description
1	N.C	No Connection
2	EMG/GDI11	Emergency stop signal(or General purpose input signal)
3	GDO1/GDO2	General purpose output signal

■ CNAIO (only for PSIO-VS600 and PMDK)

This connector is for analog output and input, there are three analog inputs, 3 analog outputs and one analog ground. The user can utilize this to control the analog signal of PISO-VS600 and PMDK, the detail pin-definition is as below (Table B1-5):

Table B1-5

Pin NO	Pin Define	Function description
1	AGND	Analog ground
2	AOUT2	Analog output
3	AOUT1	Analog output
4	AOUT0	Analog output
5	AIN2	Analog input
6	AIN1	Analog input
7	AIN0	Analog input

■ CNIO_0 ~ CNIO_2

This connector is used for transmitting general machine signal from each axis, such as, Emergency stop, positive end-limit /negative end-limit, Original (HOME), slow down signals, Latch and Compare signals etc to the main card. The detail pin-definition is as below (Table B1-6):

Table B1-6

Pin NO	Pin Define	Function description
1	CMP-	Ground for Compare trigger output
2	CMP+	High Speed Compare trigger output
3	LTC-	Ground for Position Latch input
4	LTC+	High Speed Position Latch input
5	HOME	Origin signal (ORG) input
6	SLD	Slow-Down signal input
7	EGND	External Power Ground
8	LMT-	Negative End Limit signal (MEL) input
9	LMT+	Positive End Limit signal (PEL) input
10	EMG	Emergency stop signal to servo motor driver, direct connect to pin 15 of CN1B
11	E24V	External power, direct connect to pin 4 and pin 5 of CON2

■ CN232

This connector is used for communication between Mitsubishi and computer. Because the servo amplifier of Mitsubishi has a RS-232 serial communication function that can be used to perform servo operation, parameter modification, monitor function, etc. User can set up JP8 and JP9, select the desired axis. The detail pin-definition is as below (Table B1-7)

Table B1-7

Pin NO	Pin Define	Function description
1	N.C	No Connection
2	TXD	Transmitted data output to RS232 of Personal Computer
3	RXD	Received data input from RS232 of Personal Computer
4	N.C	No Connection
5	AGND	Analog Ground
6	N.C	No Connection
7	N.C	No Connection
8	N.C	No Connection
9	N.C	No Connection

■ CNPIO_0 ~ CNPIO_2

This connector usually is used in two ways: first, it can be connected in order to receive external encoder of the linear scale; users can determine to receive encoder source from external linear scale or servo motor by setting JP4 ~ JP6. Another application of CNPIO_0 ~ CNPIO_2 is under the circumstance when not using all Mitsubishi servo motor; stepper or servo motor from manufacturers other than Mitsubishi can be connected together through this connector. The detail pin- definition is as below (Table B1-8):

Table B1-8

Pin NO	Pin Define	Function description
1	CW+	Positive Direction Pulse(+)
2	CCW+	Negative Direction Pulse(+)
3	EGND	External Power Ground
4	A-	Encoder A-phase(-)
5	B-	Encoder B-phase(-)
6	EXT_5V	+5V Power output for external devices
7	CW-	Positive Direction Pulse(-)
8	CCW-	Negative Direction Pulse(-)
9	A+	Encoder A-phase(+)
10	B+	Encoder B-phase(+)
11	Z+	Encoder Z-phase(+)
12	Z-	Encoder Z-phase(-)
13	N.C	No Connection
14	N.C	No connection
15	E24V	External Power, direct connect to pin 4 and pin 5 of CON2

B1.3 I/O connector for servo motor of Mitsubishi

This chapter describes the signals on terminal board DN-8368MB, which is used to connect the main card with Mitsubishi servo motor. The DN-8368MB supports PISO-PS600 (position control mode), PISO-VS600 (Position/Speed control mode) and PMDK (Professional Motion development Kit, with AI/AO).The Mitsubishi servo motor has various control modes, and different modes may have some common signal or require special setting before operation. Detail explanations for signal pins of CN1A, CN1B, and CN3 on Mitsubishi servo driver will be listed in this section.

■ CN1A_0 ~ CN1A_2

There are 20 pins on CN1A. For these pins are pin-to-pin from motion card to Mitsubishi Server driver, the User can just buy cable and connector to connect them directly. Please note, not all pins are used by ICP DAS's motion control card. And some of pins may have different function according to different control mode of the servo driver. Table B1-9 list the detail definition of pins:

Table B1-9

Pin No.	I/O	Position control mode	Speed control mode	Signals in DN-8368MB
	I/O Signals in Servo Drive			Signals in DN-8368MB
1				
2	I	NP		CCW+
3	I	PP		CW+
4				
5	O	LZ	LZ	Z+
6	O	LA	LA	A+
7	O	LB	LB	B+
8	I	CR*	SP1*	Pin 1 of JP15~JP17
9				
10	PWR	SG	SG	EGND
11				
12	I	NG		CCW-
13	I	PG		CW
14				
15	O	LZR	LZR	Z-
16	O	LAR	LAR	A-
17	O	LBR	LBR	B-
18	O	INP	SA	INP
19	O	RD	RD	RDY
20	PWR	SG	SG	EGND

Note: For any pin-define whose symbol is preceded by "*" indicates that by setting Mitsubishi driver parameters (from 43 to 48), it can be set as a different pin-define.

■ CN1B_0 ~ CN1B_2

There are 20 pins on CN1B. Since these pins are pin-to-pin from motion card to Mitsubishi Server driver, the User can just buy cable and connector to connect them directly. Please note, not all pins are used by ICP DAS's motion control card. And some of pins may have different function according to different control mode of servo driver. The detail definitions of pins are as follow:

Table B1-10

	I/O Signals in Servo Drive			Signals in DN-8368MB
Pin No.	I/O	Position control mode	Speed control mode	
1	PWR	LG	LG	AGND
2	I	N.C.	VC	AOUT
3				
4				
5	I	SON*	SON*	SRV_ON
6				
7				
8	I	PC*	ST1*	Pin 3 of JP15~JP17
9				
10	PWR	SG	SG	EGND
11				
12				
13	PWR	COM	COM	E24V
14	I	Reset*	Reset*	ALM_RST
15	I	EMG	EMG	SW1 and Pin 10 of CNIO
16	I	LSP	LSP	EGND
17	I	LSN	LSN	EGND
18	O	ALM	ALM	ALARM
19				
20	PWR	SG	SG	EGND

Note: For any pin-define whose symbol is preceded by "*" indicates that by setting Mitsubishi driver parameters (from 43 to 48), it can be set as a different pin-define.

■ CN3_0 ~ CN3_2

The 3 pins on CN3 of Mitsubishi servo driver work as COM port, allowing the user to read and set configuration from/to servo motor via special software from Mitsubishi. For making things easier, the COM port pins are directed to the CN232 connector of terminal board. By switching JP8~JP9, the users can select which servo motor among these 3 to communicate with. The pins are dentally explained as below:

Table B1-11

Pin No.	I/O	Position control mode	Speed control mode	Signals in DN-8368MB
		I/O Signals in Servo Drive		
1	PWR	LG	LG	AGND
2	O	TXD	TXD	Pin 2 of CN232 (selected by JP8)
3				
4				
5				
6				
7				
8				
9				
10				
11				
12	I	RXD	RXD	Pin 3 of CN232 (selected by JP9)
13	PWR	LG	LG	AGND
14	O	MO2	MO2	AIN
15				
16				
17				
18				
19				
20				

Note1: At speed-control mode, MO2 can be used as feedback signal of PISO-VS600, therefore parameter 17 of Mitsubishi driver must be set to 0000 when user use the PISO-VS600 motion card , so that the Servo-motor speed will be output by MO2 (will be connected directly to PISO-VS600 analog input).

Control mode setting

DN-8368MB could be used with both PISO-PS600 (position control mode) and PISO-VS600 (Speed control mode), please note that the settings in these two modes are different. The following section describes how to set up parameters for Mitsubishi motor and some notes:

- Position Control mode:
  1. The parameter 0 (STY) of J2S servo-driver of Mitsubishi must be set to 0000 (Position control mode).
  2. Please switch the 4-pin jumper (JP15-JP17) to position1-2, so that the CR signal of J2S servo-driver will be controlled by the ERC signal of PISO-PS600 (or PISO-VS600).

- Speed control mode:
  1. The parameter 0 (STY) of J2S servo-driver of Mitsubishi must be set to 0002 (Speed control mode).
  2. Please switch the 4-pin jumper (JP15-JP17) to position 2-3, so that the ST1 signal of J2S servo-driver will be controlled by the ERC signal of PISO-VS600. Or please switch the jumper to position 3-4, that is: the ST1 signal of J2S servo-driver is connected to GND (Disable the ERC function of PISO-VS600).
  3. The parameter 17 (MOD) of J2S servo-driver of Mitsubishi must be set to 0000, so that the output of Servo motor speed will be transmitted via MO2 (It will be directly connected to a PISO-VS 600 analog input.)
  4. The parameter 25 (VCM) of J2S servo-driver of Mitsubishi should be set as an appropriate value (the Rotational speed of the motor when Voltage Command is 10V).
  5. The parameter 29 (VCD) of J2S servo-driver of Mitsubishi should be set as an appropriate value, so that the motor will be absolute stop when Voltage Command is 0V.

Note: When the J2S servo-driver of Mitsubishi is set as speed control mode, I the ST1 signal of J2S servo-driver (CW) (or the ST2 signal of J2S servo-driver (CWW)) must be connected to GND to start the servo motor. The motor speed is depend by the status of SP1~SP3 of J2S servo-driver. If all settings of J2S servo-driver from SP1 to SP3 is turned off, the motor speed will be depend by Voltage command (VC).

B1.4 Jumper and Switch Settings

■ SW1 (EMG SW)

The emergency stop signal for each servo amplifier can be selected from SW1. The number 1, 2, 3 on SW1 are denoted as axis 0/3, 1/4, 2/5, respectively. Fig. B1-2 is the default setting for connecting the EMG signals to Pin#2 of JP7 (The default setting is wired to EGND). The EMG signals from CN1B_0 ~ CN1B_2 will not take effect. If the switch is disconnected as shown in Fig. B1-3, the emergency stop signals can be controlled from EMG signals on CNIO_0 ~ CNIO_3.
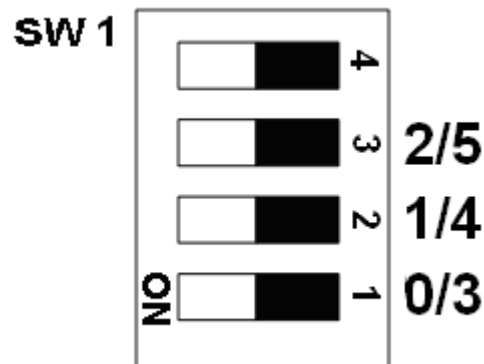
Fig. B1-2   EMG SW setting for normal GND (Default setting)
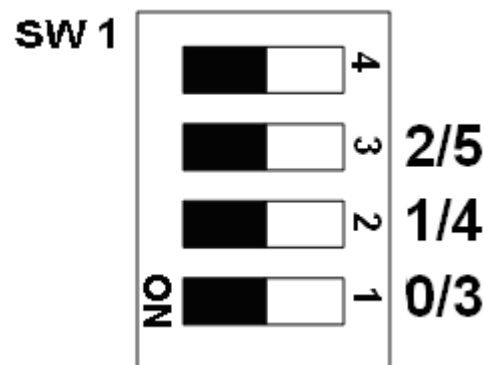
Fig. B1-3 EMG SW setting for user controlled signals.

■ JP1 ~ JP3

Jumper 1~3(Fig B1-4) controls the input voltage of LTC for 24V (Jumper position is in 1~2) or 5V (Jumper position is in 2~3). The default setting is 5V.
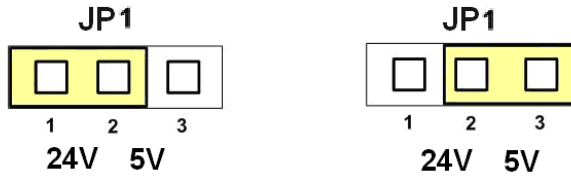
Fig. B1-4 Jumper 1~ Jumper 3 setting

■ JP4 ~ JP6

The encoder signals can be chosen from servo driver encoder or external encoder.   Fig. B1-5 shows that the encoder signals are selected from servo driver encoder (default setting). Fig. B1-6 shows that the encoder signals are selected from external encoder.
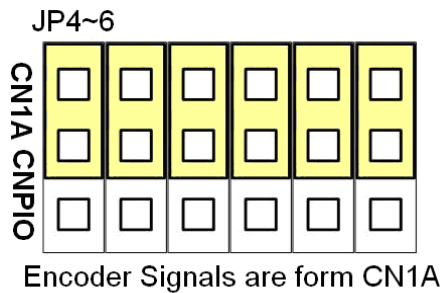
Fig. B1-5 Primary encoder signals setting
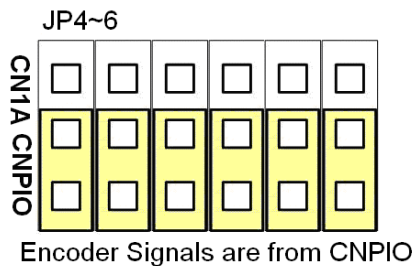
Fig. B1-6 External encoder signals setting

■ JP7

This Jumper is used for setting each axis EMG signal when the SW1 is set to ON, it connects to EGND directly or connects to EMG/GDI11 by user wiring. The detail content is as below (Fig. B1-7 or Fig. B1-8):
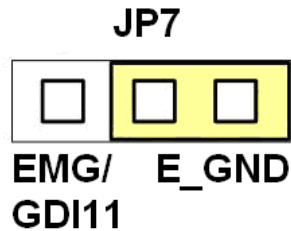
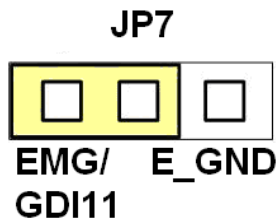**Fig B1-7 The EMG signal is connected to E_GND, directly. (Default setting)**

Fig B1-8 the EMG signal is used by EMG/DI11

■ JP8 ~ JP9

This jumper (JP8 ~ JP9) is used for choosing the RS232 of the computer connect with any axis of DN-8368MB of J2S servo-driver. And they (JP8 and JP9) must be set at the same time. The detail content is as below (Fig. B1-9):
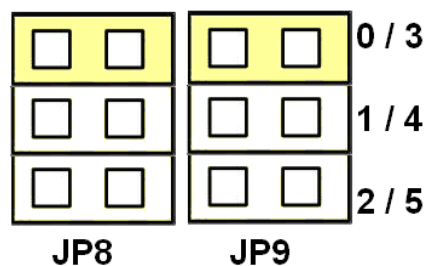
Fig B1-9 with what axis link set up RS232 (Default setting is for 0/3-axis)

■ JP10

User can choose the analog input source from the connector of CNAIO (from pin5 to pin7) of card (or the MO2 of CN3 of J2s servo-driver via the jumper 10 (JP10). The detail content is as below:
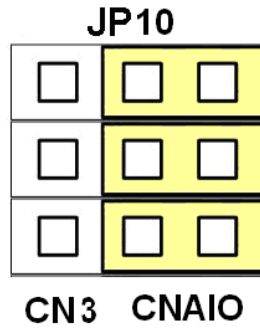
JP10

CN3   CNAIO

Fig B1-10 the analog input of card is connected to the connecter of CNAIO (Pin5 ~ Pin7)

(default setting)

JP10

CN3   CNAIO
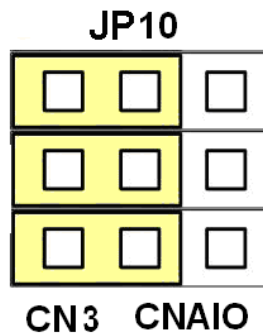
Fig B1-11 the analog input of card is connected to the MO2 signal of J2S servo-driver

■ JP15 ~ JP17

This Jumper (JP15~JP17) can be used for choosing the ERC signal of card use way with

position control or speed control. Please refer to the section (Control Mode Setting), before.
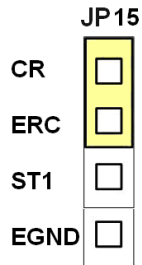
JP15

CR

ERC

ST1

EGND

Fig B1-12 The ERC signal of main card controls the J2S's CR signal. (Default setting)

JP15

CR

ERC

ST1
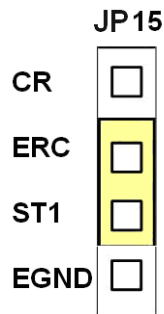
EGND

Fig B1-13 The ERC signal of main card controls the J2S's signal.
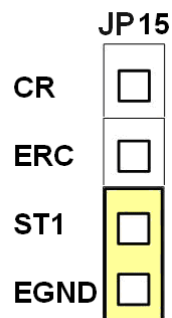
JP15

CR

ERC

ST1

EGND

Fig B1-14 The ST1 signal of J2S connects to EGND, directly.

B1.5 LED Description

LED is used for indicating a specific or emergent DI state, there are two types of LED indicator on the daughter board, one is for showing machine I/O state (Home, LMT-, LMT+, RDY, etc.), the other is for showing Power and EMG state. The detail descriptions are as follows:

- HOME: It shows the original signal of motion control on the machine. The LED will be turned on when the motion control is moved to the original signal.

- LMT -: It shows the minus end-limit signal of motion control on the machine. The minus end-limit signal of motion axis is to decide the end point of minus moving. If this signal is on, the LED will be turned on. (This is the case when "Normal Open" mode is set, for "Normal Close" mode, the LED is turned off when signal is on.)

- LMT +: It shows the plus end-limit signal of motion control on the machine. The plus end-limit signal of motion axis is to decide the end point of plus moving. If this signal is on, the LED will be turned on. (This is the case when "Normal Open" mode is set, for "Normal Close" mode, the LED is turned off when signal is on.)

- RDY: It point out whether the servo motor is in the state ready for operation. The LED will be turned on when the motor is ready

- Power: It shows the power state of DN-8368GB. The LED will be turned on when the power is inputted.

  - EMG: It shows the state of EMG signal. The LED will be turned on when the EMG signal is triggered