I-8196F
Motion Control Module
Quick Start Guide
(Version 1.0)



ICP DAS CO., LTD.

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1 I-8196F Introduction

The I-8196F is a 6-axis stepping/pulse-type servo motor control expansion module for the XP-8000 and WP-8000 programmable automation controller (PAC) series provided by ICPDAS.

A digital signal processor (DSP) calculates the commanded move trajectory and manages supervisory control by monitoring the limits and emergency stops to ensure safe operation. I/O control output (e.g. latch, compare, encoder counter etc.) is realized in a Field Programmable Gate Array (FPGA).

The motion controller is suitable for general-purpose motion control applications. In additions to its wide speed range, this intelligent motion controller also has a variety of built-in motion control functions, such as **2- to 6-axis** linear interpolation, **2- and 3-axis** circular interpolation, helical interpolation, T/S-curve acceleration/deceleration, and automatic home search, etc.

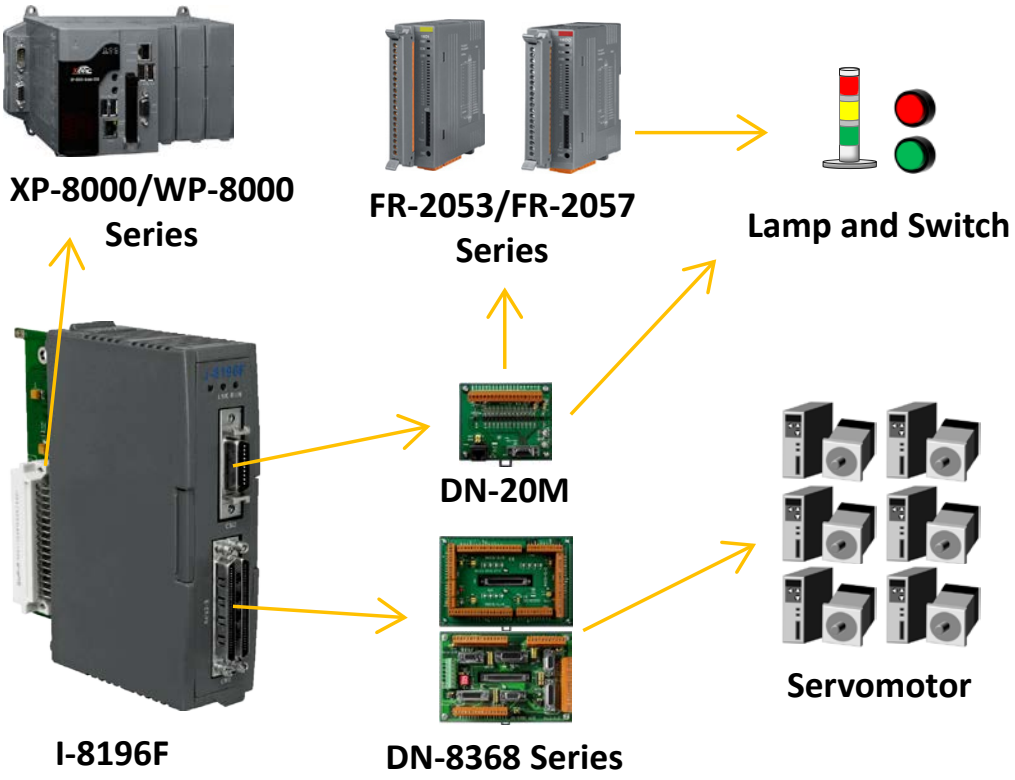


Figure 1: I-8196F application diagram

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1.1 Feature

- Expansion card for ICPDAS programmable automation controller (PAC)
- DSP-based motion control module
- Maximum pulse output frequency: 4 MHz
- Maximum Encoder input frequency: 12 MHz
- Independent 6-axis motion control
- 2- to 6-axis linear/ 2- to 3-axis circular/ helical interpolation function
- Continuous interpolation
- 4-step home mode with auto-searching
- Synchronized start motion
- Programmable T/S-curve acceleration and deceleration
- Software limit protection
- Software FIFO for arbitrary curve motion
- High-speed position latch
- High-speed compare trigger and auto-increment compare mode
- Expandable remote I/O: 128 DI and 128 DO via a two-wire FRnet interface.

1.2 Specifications

Number of Axes	6
Maximum Pulse Output Rate	4 MHz
Command Type	Pulse Command
Pulse Output Mode	CW/CCW, PULSE/DIR, A/B pulse
Linear Interpolation	Any 2- to 6-axis
Circular/Helical Interpolation	Any 2- or 3-axis
Speed Curve Profile	T/S-curve
Mechanical Switch Input	Home, LMT+/-, NHOME, LTC, EMG
Servo I/O Interface	Input: INP, ALM, RDY Output: SVON, ALM_RST, ERC
Ring Counter Mode	32-bit
Position Control Mode	Relative and absolute position
Position Compare Trigger	4 MHz
Encoder Interface	A/B pulse, Up/Down
Encoder Counter	32-bit
Encoder Counting Rate	12 MHz
Digital Input Channels	Local: 12 DI, Expandable: 128 DI
Digital Output Channels	Local: 3 DO, Expandable: 128 DO
I/O Isolation (with DN-8368)	2500 Vrms optical isolation
Connector	68-pin VHDCI Connector and 20-pin SCSI-II
Power Consumption	+24V
Environmental	
Operating Temperature	0 ~ +60 °C
Storage Temperature	-20 ~ +80 °C
Ambient Relative Humidity	5 ~ 90 % RH, non-condensing

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1.3 Dimensions

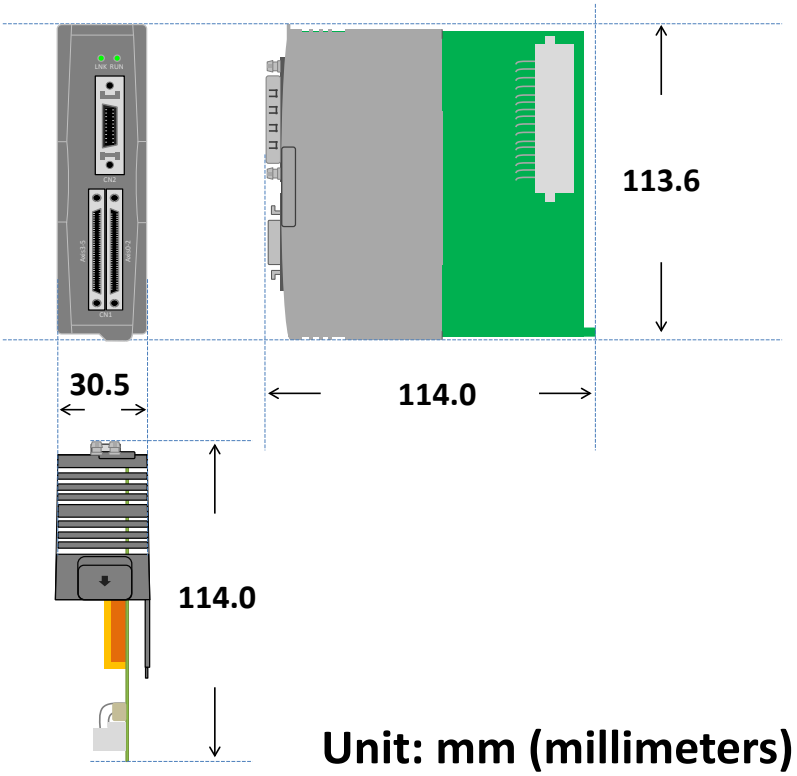


Figure 2: I-8196F housing dimensions

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1.4 Packaging and optional accessories

The package contains the following item:

- I-8196F x 1

Other optional accessories items:

Model No.	Description
DN-8368UB	Photo-isolated Universal Snap-on wiring terminal board
DN-8368GB	Photo-isolated General-purpose wiring terminal board
DN-8368MB	Photo-isolated Snap-on wiring terminal board for Mitsubishi MELSERVO-J2 servo amplifier
DN-20M	General purpose digital input and remote digital I\O (FRnet) extension board
CA-MINI68-15	68-pin VHDCI to SCSI-II Connector Cable, Length 1.5 M
CA-SCSI20-M1 /CA-SCSI20-M3 /CA-SCSI20-M5	20-pin SCSI-II Male connector cable (for Mitsubishi J2 series motor), Length 1 M / 3 M / 5 M.
CA-26-MJ3-15/30/50	26-pin HD D-Sub Male Cable for Mitsubishi Servo Amplifier, 1.5/3/5 M. (for MELSERVO-J3/J4 Series)
CA-26-PA4-15/30/50	26-pin HD D-Sub Male Cable for Panasonic Servo Amplifier, 1.5/3/5 M. (for MINAS A4/A5 Series)
CA-26-YSV-15/30/50	26-pin HD D-Sub Male Cable for Yaskawa Servo Amplifier, 1.5/3/5 M. (for Sigma II/III/V Series)
CA-26-TTA-15/30/50	26-pin HD D-Sub Male Cable for Teco Servo Amplifier, 1.5/3/5 M. (for TSTA-A/A+ Series)
CA-26-DAA2-15/30/50	26-pin HD D-Sub Male Cable for Delta A2 Servo Amplifier, 1.5/3/5 M. (for ASDA-A2 Series)
CA-26-DAB2-15/30/50	26-pin HD D-Sub Male Cable for Delta B2 Servo Amplifier, 1.5/3/5 M. (for ASDA-B2 Series)
CA-26-FFW-15/30/50	26-pin HD D-Sub Male Cable for Fuji Servo Amplifier, 1.5/3/5 M. (for FALDIC-W and ALPHA5 Smart Series)

Table 1: Optional accessories

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2 Hardware Configuration

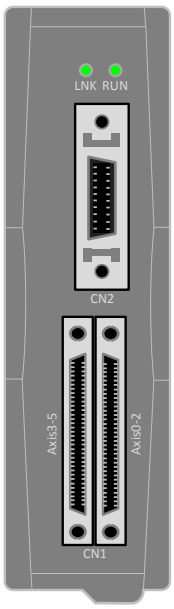


Figure 3: I-8196F device

Name	Description
CN1	Motion control signal port; connect to the DN-8368 series terminal board.
CN2	Universal I / O and Frnet communication ports; connect to the DN-20M terminal board.
LNK(green)	FRnet indicator
RUN(green)	DSP firmware is running

Table 2: Hardware configuration

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2.1 Motion control signal port (CN1)

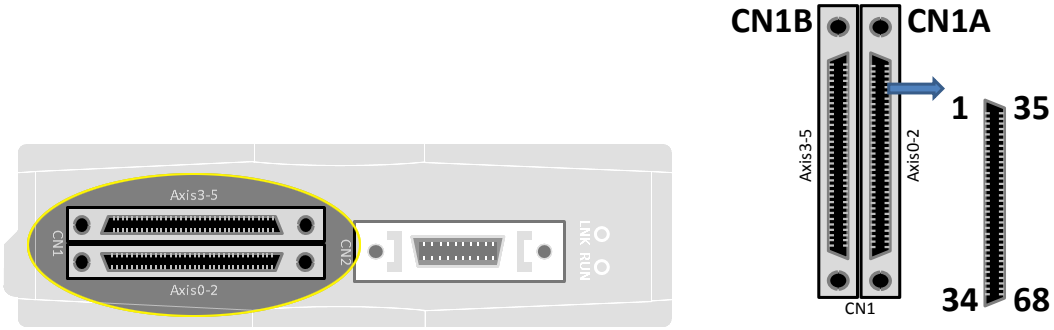


Figure 4: Motion control port CN1

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	57	PEL1	I	Positive End Limit

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			Output				
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 3: Motion control port CN1A pin definition

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

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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

Table 4: Motion control port CN1B pin definition

2.2 General-purpose I / O and FRnet ports (CN2)

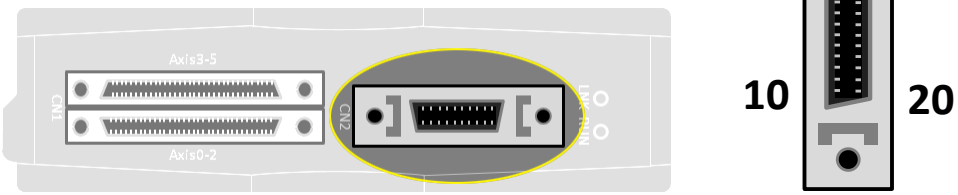


Figure 5: Universal I / O and FRnet communication ports CN2

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 /	I	Generic Digital	15	GDI6 /	I	Generic Digital Input

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	MPG_Axis2		Input or MPG Axis Selection		MPG_Axis1		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	O	Manual Pulse Generator B Phase	19	MPG_A		Manual Pulse Generator A Phase
10	GDO0		Generic Digital Output	20	VCC		5V Digital Power from Bus

Table 5: Universal I / O and FRnet communication port CN2 pin definition

2.3 External terminal board

Only external boards listed in Table 1 are allowed to be connected to the port CN1 and CN2 of the I-8196F. Port CN1 has to be connected to the "DN-8368" series terminal board and CN2 has to be connected to the "DN-20M" terminal board.

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3 Wiring Example

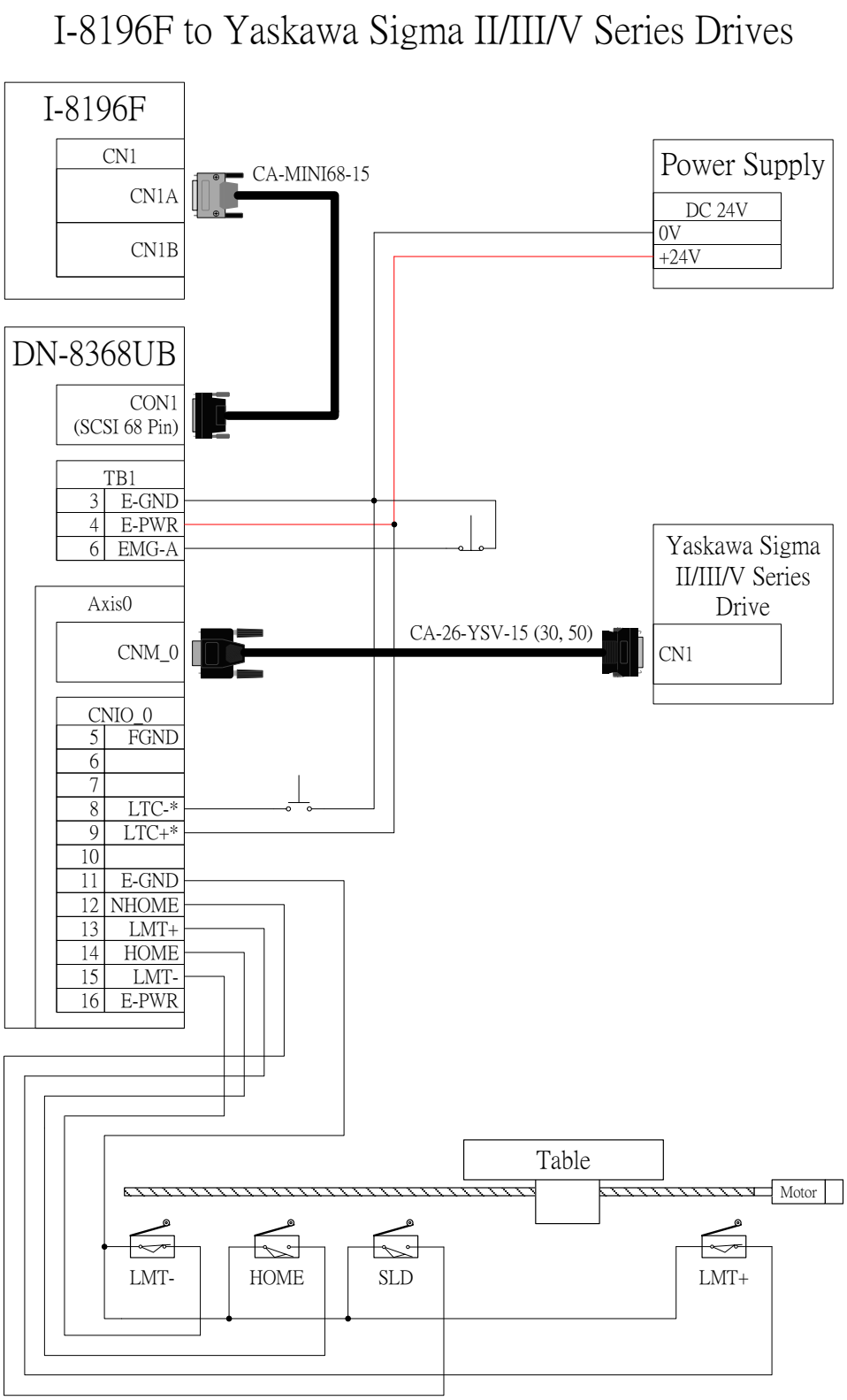
For different servo drive models terminal block and SCSI cables are provided. Therefore the I-8196F can easily be connected to all the common servo motor brands on the market by selecting for the servo motor brands the corresponding terminal block and cable.

Perform the following these installation steps:

1. Plug the I-8196F into the slot of the XP-8000 or WP-8000 programmable automation controller (PAC) series.
2. Connect one or two DN-8368 series terminal board to the CN1 port. Terminal board connected to the CN1A port defines the Axis 0 ~ 2 and the terminal board connected to CN1B is defines the Axis 3 ~ 5.
3. The pin definition of each axis are described in the DN-8368 User's Manual
4. Connect the DN-20M terminal board to the CN2 port if GPIO or FRnet I/O is needed. Refer to the DN-20M instruction manual for the signal pin definitions.

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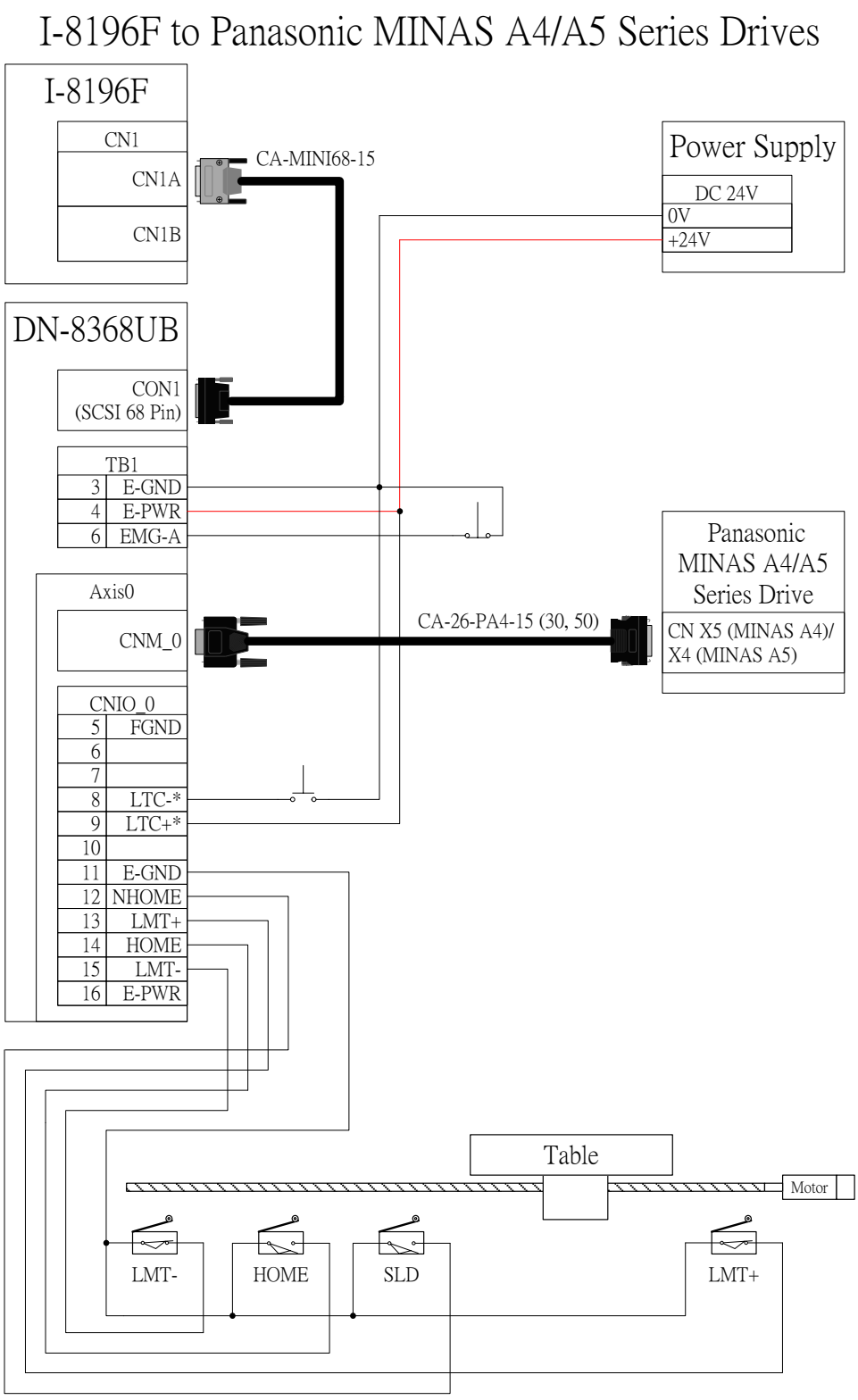
3.1.1 Connecting to Yaskawa Sigma II/III/V Servo Drive



*When using the LTC signal follow the input voltage setting of the DN-8368UB's jumper JP1 ~ JP3

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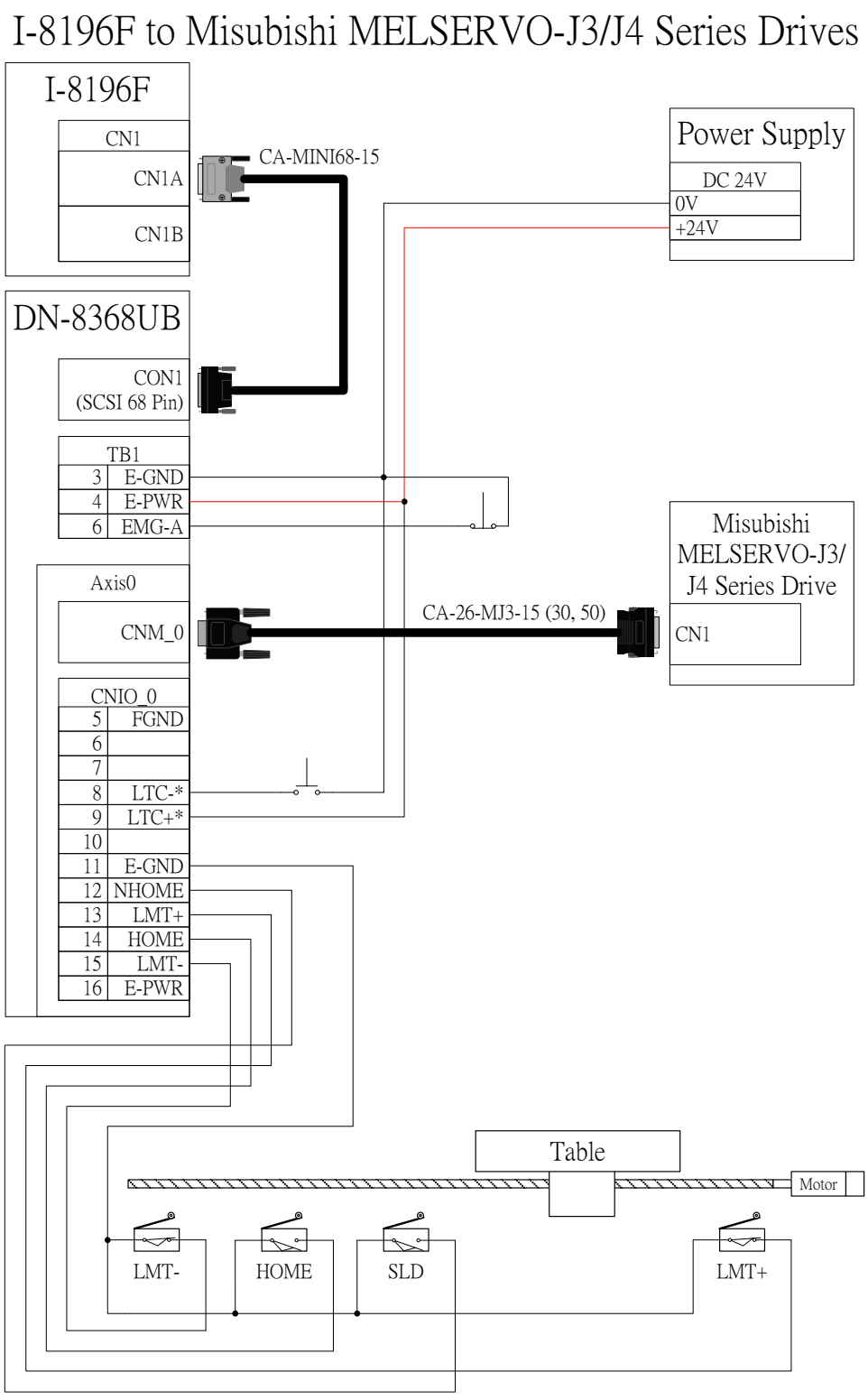
3.1.2 Connecting to Panasonic MINAS A4/A5 Series Servo Drive



*When using the LTC signal follow the input voltage setting of the DN-8368UB's jumper JP1 ~ JP3

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3.1.3 Connecting to Misubishi MELSERVO-J3/J4 Servo Drive



*When using the LTC signal follow the input voltage setting of the DN-8368UB's jumper JP1 ~ JP3.

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4 Software Support

4.1.1 I-8196F Libraries

Libraries and DLL for WinCE 5.0, 6.0 and Windows Embedded WES are provided for the I-8196F. The libraries support Visual C++, C#, VB.Net, LabVIEW.
The i8196F functions and APIs are described in detail in
" I-8196F_Function_Reference_x.x.pdf ". Several simple demonstration programs show the usage of the APIs in an application program.

4.1.2 EzGo Utility

EzGo is a software utility which allows the user to directly execute simple motion commands without writing an application program. This enables the user to get familiar with the motion commands. Furthermore it can be used for monitoring the motion path and the DIO status.

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