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DVP-ES3 **Series Operation Manual**

DVP-ES3 **Series**
Operation Manual

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DVP-ES3 Series Operation Manual

Revision History

Version	Revision	Date
1st	The first version was published.	2019/09/05

DVP-ES3 Series Operation Manual

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Chapter 10 CANopen Funciton and Operation

Chapter 11 CPU Module Operating Principles

Chapter 12 Troubleshooting

Appendix D Maintenance and Inspection

1

Chapter 1 Product Introduction

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1

1.1 Overview

This manual introduces the DVP-ES3 Series PLC functions, devices, module tables, troubleshooting, and so forth.

1.1.1 Related Manuals

The related manuals for DVP-ES3 Series programmable logic controllers are listed below.

- DVP-ES3 Series Programming Manual
  This introduces programming for the DVP-ES3 Series programmable logic controllers, basic instructions, and applied instructions.
  For DVP-ES2 Series PLC, refer to DVP-ES2-/EX2-SS2/SA2/SX2/SE & TP Operation Manual – Programming.
- ISPSoft User Manual
  This introduces the use of the ISPSoft software, programming language (Ladder, SFC, FBD, and ST), POUs, and tasks.
  DVP-ES3 Series PLC can only use ISPSoft for programming, NOT WPLSoft.
- DVP-ES3 Series Operation Manual
  This introduces electrical specifications, dimensions, CPU functions, devices, module tables, troubleshooting, and so forth.

1.1.2 Models Descriptions

Classification	Model Name	Description
DVP-ES3 Series CPU module	DVP32ES311T	24 VDC powered CPU module NPN output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 32 I/Os (16DI+16DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP32ES300T	100-220 VAC powered CPU module NPN output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 32 I/Os (16DI+16DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP32ES300R	100-220 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 32 I/Os (16DI+16DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP48ES300T	100-220 VAC powered CPU module NPN output, 1x Ethernet port, 2x RS-485 ports, 1x USB

Classification	Model Name	Description
		port, 1x Micro SD interface, supporting 48 I/Os (24DI+24DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP48ES300R	100-220 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 48 I/Os (24DI+24DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP64ES300T	100-220 VAC powered CPU module NPN output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 64 I/Os (32DI+32DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP64ES300R	100-220 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 64 I/Os (32DI+32DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP80ES300T	100-220 VAC powered CPU module NPN output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 80 I/Os (40DI+40DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP80ES300R	100-220 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 80 I/Os (40DI+40DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
Digital input/output module	DVP08XM211N	8 inputs 24VDC 5mA
	DVP08XP211R	４ inputs 24VDC 5mA

Classification	Model Name	Description
		4 Relay outputs 250VAC Below 30VDC 2A/output, 5A/COM
	DVP08XP211T	4 inputs 24VDC 5mA 4 NPN (sinking) outputs 5 – 30VDC 0.5A/output, 4A/COM
	DVP08XN211R	8 Relay outputs 250VAC Below 30VDC 2A/output, 5A/COM
	DVP08XN211T	8 NPN (sinking) outputs 5 – 30VDC 0.5A/output, 4A/COM
	DVP16XM211N	16 inputs 24VDC 5mA
	DVP16XP211R	8 inputs 24VDC 5mA 8 Relay outputs 250VAC Below 30VDC 2A/output, 5A/COM
	DVP16XP211T	8 inputs 24VDC 5mA 8 NPN (sinking) outputs 5 – 30VDC

Classification	Model Name	Description
		0.5A/output, 4A/COM
	DVP16XN211R	16 Relay outputs 250VAC Below 30VDC 2A/output, 5A/COM
	DVP16XN211T	16 NPN (sinking) outputs 5 – 30VDC 0.5A/output, 4A/COM
	DVP24XP200R	16 inputs 24VDC 5mA 8 Relay outputs 250VAC Below 30VDC 2A/output, 5A/COM
	DVP24XP200T	16 inputs 24VDC 5mA 8 NPN (sinking) outputs 5 – 30VDC 0.5A/output, 4A/COM
	DVP24XN200R	24 Relay outputs 250VAC Below 30VDC 2A/output, 5A/COM
	DVP24XN200T	24 NPN (sinking) outputs 5 – 30VDC 0.5A/output, 4A/COM
	DVP32XP200R	16 inputs 24VDC 5mA 8 Relay outputs

Classification	Model Name	Description
		250VAC Below 30VDC 2A/output, 5A/COM
	DVP32XP200T	16 inputs 24VDC 5mA 16 NPN (sinking) outputs 5 – 30VDC 0.5A/output, 4A/COM
Analog input/output module	DVP04AD-E2	4-channel analog input Hardware resolution 14 bits: -5V ~ +5V, -10V ~ +10V, -20mA ~ +20mA Hardware resolution 13 bits: 0/4 ~ 20mA Conversion time: 400 µs/channel
	DVP02DA-E2	2-channel analog input Hardware resolution 14 bits: -10V ~ +10V, -20mA ~ +20mA Conversion time: 400 µs/channel
	DVP04DA-E2	4-channel analog input module Hardware resolution 14 bits: -10V ~ +10V, -20mA ~ +20mA Conversion time: 400 µs/channel
	DVP06XA-E2	4-channel analog input Hardware resolution 14 bits: -5V ~ +5V, -10V ~ +10V, -20mA ~ +20mA Hardware resolution 13 bits: 0/4 ~ 20mA Conversion time: 400 µs/channel 2-channel analog output Hardware resolution 14 bits: -10V ~ +10V, -20mA ~ +20mA Conversion time: 400 µs/channel
Temperature measurement module	DVP04PT-E2	4-channel, 2-wire/3-wire RTD Sensor type: Pt100 / Pt1000 / Ni100 / Ni1000 / 0-300Ω / 0-3000Ω Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 200 ms/channel

Classification	Model Name	Description
		PID controller
	DVP06PT-E2	6-channel, 2-wire/3-wire RTD Sensor type: Pt100 / Pt1000 / Ni100 / Ni1000 / Cu50 / Cu100 / 0-300Ω / 0-3000Ω / JPt100 / LG-Ni1000 Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 200 ms/channel PID controller
	DVP04TC-E2	4-channel thermocouple Sensor type: J, K, R, S, T, E, N and -80 to +80 mV Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 200 ms/channel PID controller
External terminal module	DVPAEXT01-E2	For DVP-ES2/ES3 Series PLC

1.2 Overview

An DVP-ES3 Series CPU module is an advanced controller with built-in 4 high speed counters for inputs, up to 4-axis (pulse), and can optionally work with a total of 8-axis (CANopen) position outputs. It provides a strong network function for users, and users can create connection among devices on the network through software. An DVP-ES3 Series CPU module also provides structured programming. Users can assign programs to different tasks, and write a program which is frequently executed in a function block. Besides, users can choose different programming languages ladder diagrams (LD), structured texts (ST), sequential function charts (SFC), and continuous function chart (CFC) dealt with by IEC 61131-3 according to their needs when writing programs. They can create the DVP-ES3 Series hardware configuration by means of hardware configuration software. They can also restore or back up a system rapidly through the built-in SD interface in an DVP-ES3 Series series CPU module. This manual introduces the basic operation of an DVP-ES3 Series system, and help users familiarize themselves with the DVP-ES3 Series system.

1.3 Characteristics

Characteristics of the DVP-ES3 Series CPU module:

(1) High efficiency

- The DVP-ES3 Series CPU module uses a 32-bit high-speed processor. The module executes basic instructions at 25 ns each and moving instructions at 150 ns each. The module executes instructions at a speed of 40k steps/ms (40% of the instructions are basic instructions, and 60% of the instructions are applied instructions).

- The CPU of the DVP-ES3 Series uses the Soc architecture, built with 4 high speed counters. The maximum frequency is 200 kHz for each counter; four-axis (8 points) high speed position output at 200 kHz.

(2) Supporting more inputs and outputs

- The DVP-ES3 Series CPU module supports up to 256 digital I/Os (inputs + outputs) or 8 analog I/O modules.

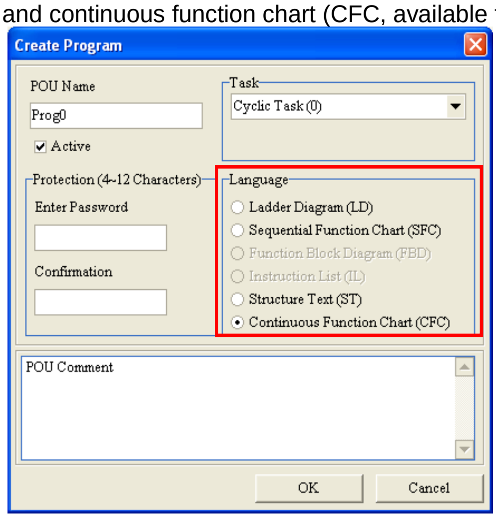
(3) Larger program capacity and memory

- The AS300 Series advanced CPU modules have 64k steps of program capacity. 60000 general registers (30000 for specific use and 30000 for programming editing), and 64k words of memory (that can be used for storing parameters).

(4) Supporting IEC 61131-3

- The DVP-ES3 Series CPU module supports IEC 61131-3.

- Supported programming languages are ladder diagrams (LD), sequential function chart (SFC), structured text (ST), and continuous function chart (CFC, available for ISPSoft V3.01 or later)

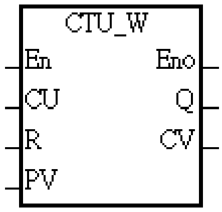


- You can select a programming language according to your preference. Programming languages support one another so that programs written by different users are compatible.

(5) Strong function block

- Both standard IEC61131-3 function blocks and convenient functions blocks provided by Delta Electronics, Inc. are supported. You can use function blocks for frequently used programs for greater structure and convenience.

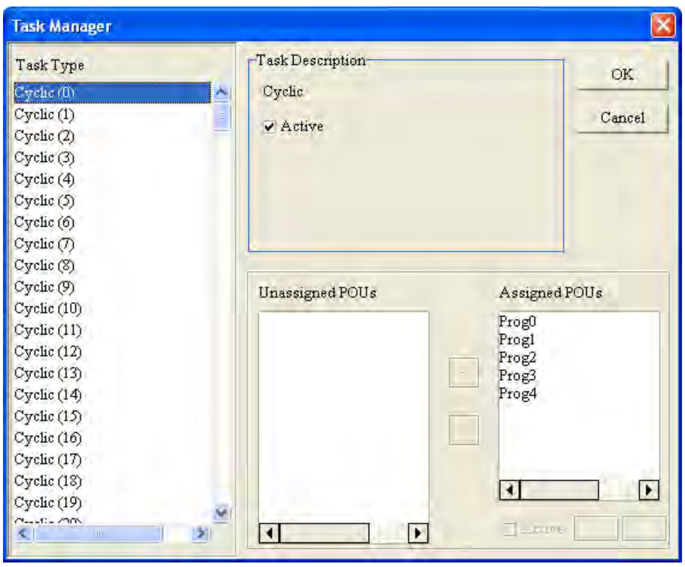
- The symbol for a function block in a ladder diagram is similar to an integrated circuit (IC) in a circuit diagram. Because the ladder diagram is based on the traditional circuit diagram, the operation of a function block is similar to the function of an integrated circuit. You only need to send the signal to the corresponding input of the function block. You do not need to consider the processing procedure inside the function block.



- A function block is a program element equipped with the operation function. It is similar to a subroutine, and is a type of POU (Program Organization Unit). It cannot operate by itself, and must be called through the main program POU. The function defined by the function block is executed after being called with the related parameters. The final result can be sent to the device or variable in the superior POU after the function block completes.

- You can set passwords in ISPSoft to provide function block security. The program inside a function block cannot be read, and business patents cannot be compromised.

(6) Task



- You can assign 283 tasks at most to a program. Among these tasks, 32 are cyclic, 32 are I/O interrupts, 4 are timer interrupts, two are communication interrupts, one is an external 24 V low-voltage interrupt, and 212 are user-defined tasks.

- You can enable and disable a task when running a program by using the TKON and TKOFF instructions.

(7) Increasing hardware configuration efficiency through a USB cable and ISPSoft

- The DVP-ES3 Series CPU module provides a standard USB 2.0 interface. USB 2.0 increases the data transfer rate and decreases the time it takes to download the program, monitor the program, and configure the hardware. You do not need to buy a special communication cable for the CPU module. You can use a general USB cable to connect to the DVP-ES3 Series CPU module.

(8) Serial control interface with multiple functions

- DVP-ES3 Series CPU modules provide two RS-485 serial control interfaces, COM1 and COM2, which can be set as a either master or slave.

- Built-in CAN communication port is for Delta Special Driver and CANopen DS301 communication mode.

(9) High-speed Ethernet communication interface

- DVP-ES3 Series CPU modules are equipped with a 10/100 M Ethernet communication interface and support email, web, Modbust TCP, Ethernet/IP Adapter and socket services.

(10) Memory card

- The memory card has the following functions.

  System backup: user program, CPU parameters, module table, and the device setting values

  System recovery: user program, CPU parameters, module table, and device setting values

  Parameter storage: device value

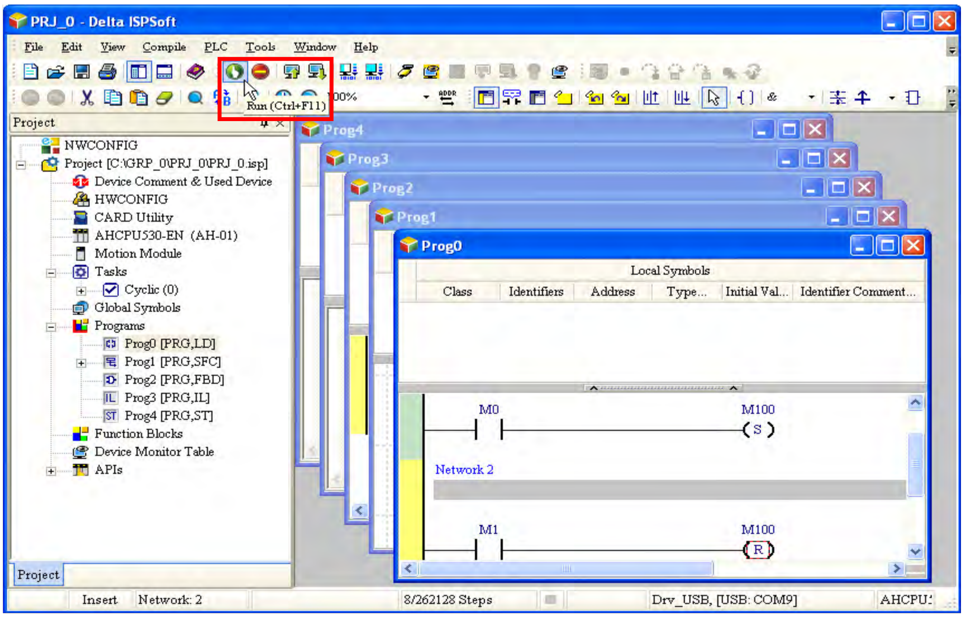
  Log storage: system error log and system status log

(11) Supporting on-line debugging mode

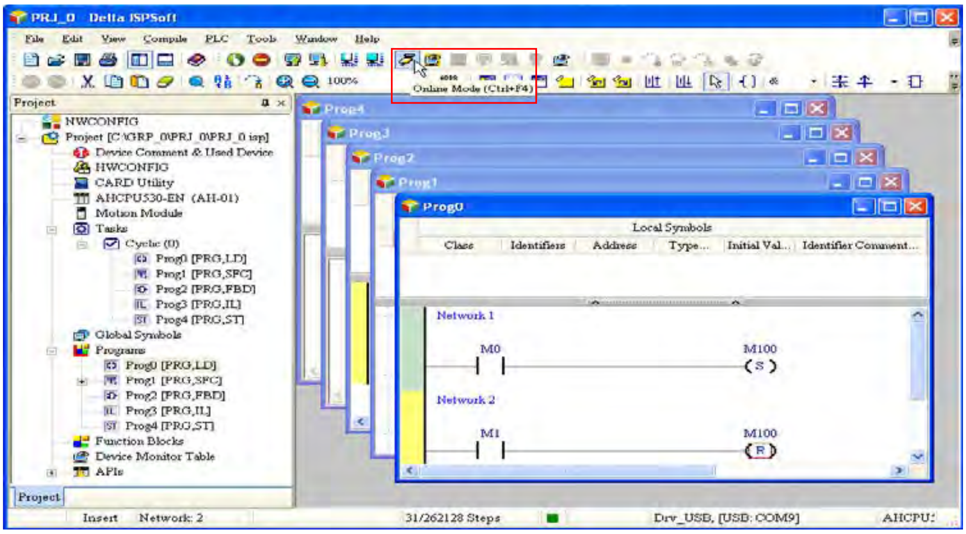
- You can use the on-line debugging mode in the DVP-ES3 Series CPU module after a single instruction step completes, or after a breakpoint is specified, to find bugs in the program.

- The CPU module must be running to enter the debugging mode. After enabling the on-line monitoring function, click . The debugging screen varies from programming language to programming language, but the same operation applies to these programming languages. For the DVP-ES3 Series PLC, structured text (ST) does not support debugging mode, and sequential function charts (SFC) supports debugging mode during the action and the transition.

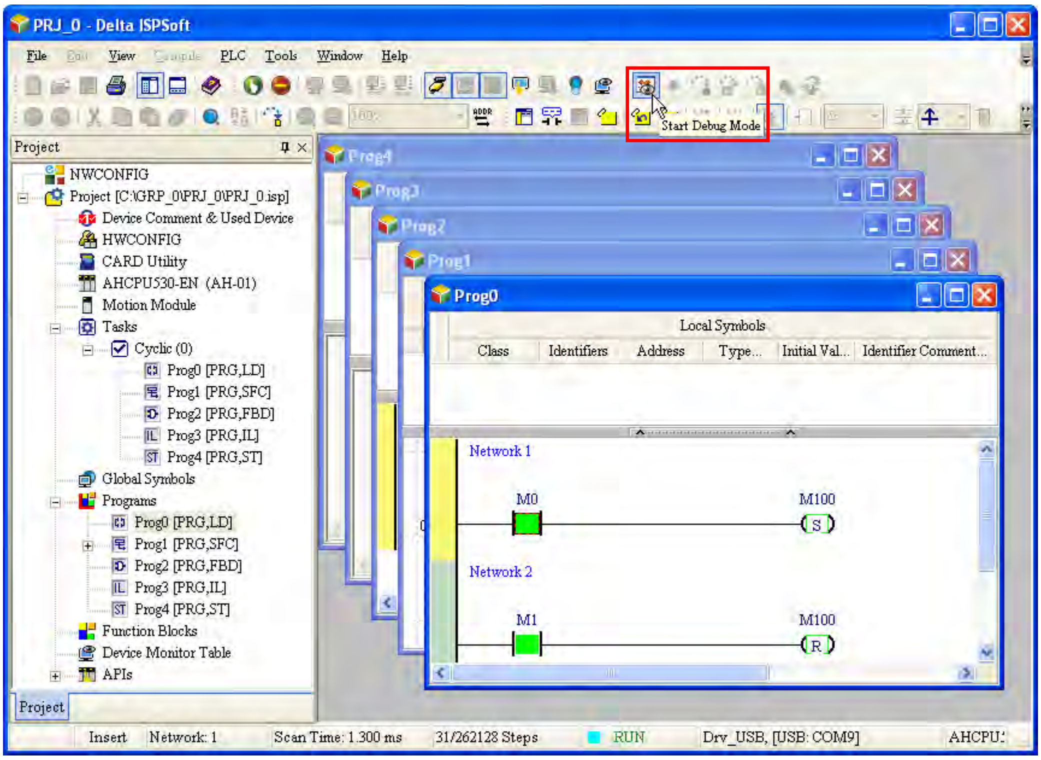
Step 1: Set the PLC to RUN



Step 2: Enter online mode



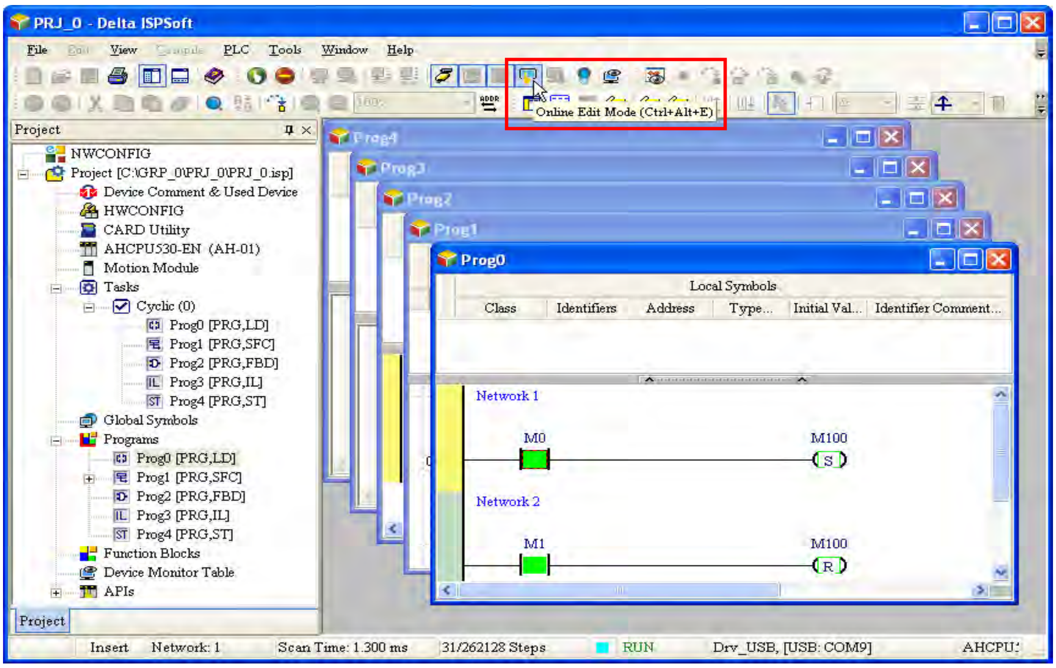
Step 3: Enter debugging mode



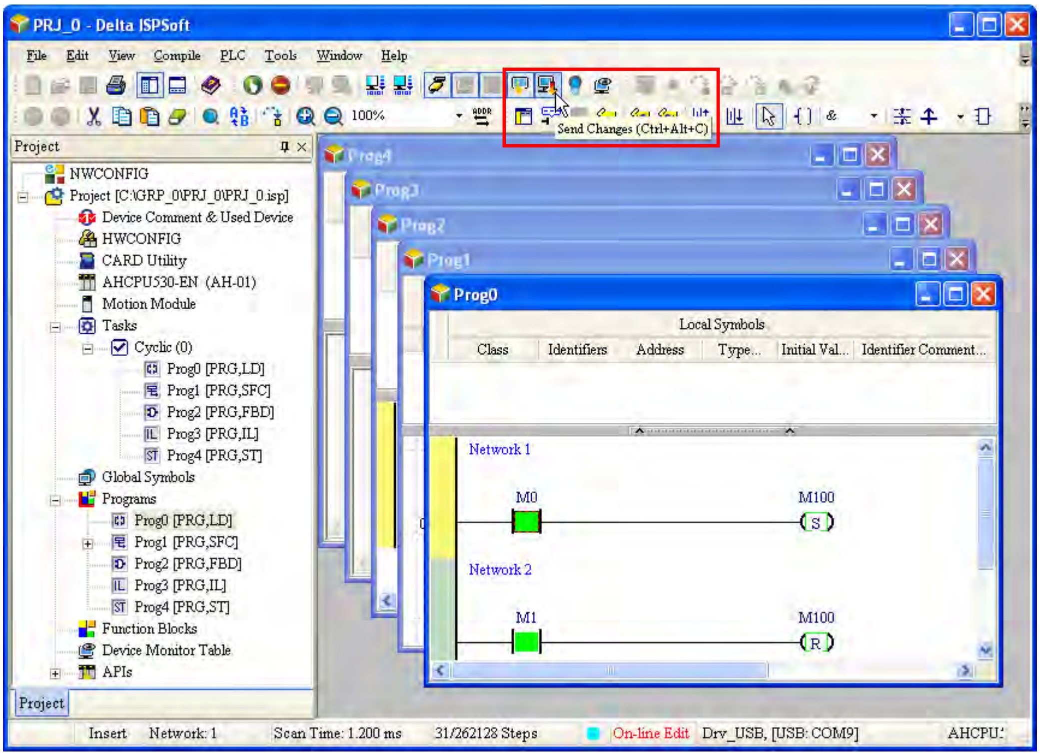
(12) On-line editing mode

- You can use the on-line editing mode when the system is running to update the program without affecting the system operation.

- When the system is in the on-line monitoring mode, enter the on-line editing mode by clicking .



- After the program is modified and compiled, you can update the program in the CPU module by clicking  to download it to the CPU.



MEMO

2

Chapter 2 Specifications and System Configuration

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2.1 General Specifications

Item	Specifications
Operating temperature	-0 to 55°C
Storage temperature	-40 to 70°C
Operating humidity	5–95% No condensation
Storage humidity	5–95% No condensation
Work environment	No corrosive gas exists.
Installation location	In a control box
Pollution degree	2
Ingress protection (IP ratings)	IP20
EMC (electromagnetic compatibility)	Refer to Appendis C for more information.
Vibration resistance	Tested with: 5 Hz ≦ f ≦ 8.4 Hz, constant amplitude 3.5 mm; 8.4 Hz ≦ f ≦ 150 Hz, constant acceleration 1g Duration of oscillation: 10 sweep cycles per axis on each direction of the three mutually perpendicular axes International Standard IEC 61131-2 & IEC 60068-2-6 (TEST Fc)
Shock resistance	Tested with: Half-sine wave: Strength of shock 15 g peak value, 11 ms duration; Shock direction: The shocks in each in direction per axis, on three mutually perpendicular axes (total of 18 shocks) International Standard IEC 61131-2 & IEC 60068-2-27 (TEST Ea)
Safety	Conforms to IEC 61131-2, UL 61010-2-201
Ambient air temperature-barometric pressure-altitude	Operating: 1080 ~ 795hPa (-1000 ~ 2000 m) Storage:1080 ~ 660hPa (-1000 ~ 3500 m)

2.2 CPU Module Specifications

2.2.1 Functional specifications

Item	DVP32ES311T, DVPxxES300T, DVPxxES300R	Remark
Execution	The program is executed cyclically.	
Input/Output control	Regenerated inputs/outputs Direct inputs/outputs	The inputs and outputs can be controlled through the direct inputs (DX) and direct outputs (DY).
Programming language	IEC 61131-3	
	Ladder diagrams, continuous function charts, structured text, and sequential function charts	
Instruction execution speed	40K steps/ms	
Number of instructions	Over 600 instructions	
Constant scan cycle (ms)	1-32000 (The scan cycle can be increased by one millisecond.)	Setting the parameter
Program capacity (step)	64K steps (128K bytes)	
Installation	DIN rails or screws	
Installation of a module	No backplane installation; only module after module	
Maximum number of modules which can be installed	Up to 8 modules for AIO modules and cannot exceed 256 IO points	
Number of tasks	283 tasks (32 cyclic tasks; 16 I/O interrupts; four timed interrupts, etc.)	Refer to ISPSoft Manual for more information.
Number of inputs/outputs	256	Number of inputs/outputs accessible to an actual input/output module
Input relays [X]	256 (X0 ~ X377)	Octal format
Output relays [Y]	256 (Y0 ~ Y377)	Octal format
Internal relays [M]	8192 (M0–M8191)	
Timers [T]	512 (T0–T511)	
Counters [C]	512 (C0–C511)	
32-bit counter [HC]	256 (HC0–HC255)	
Data register [D]	30000 (D0–D29999)	
Data register [W]	30000 (W0–W29999)	
Stepping relay [S]	2048 (S0–S2047)	
Index register [E]	10 (E0–E9)	
Special auxiliary relay [SM]	4096 (SM0–SM4095)	
Special data register [SR]	2048 (SR0–SR2047)	
Serial communication port	2x RS-485	
Ethernet port	10/100 M	Refer to the section

Item	DVP32ES311T, DVPxxES300T, DVPxxES300R	Remark
	Supporting Modbus TCP and Ethernet/IP Adapter protocols	9.3 for more details on Ethernet specificaitons
USB port	Mini B type USB	
Storage interface	SD Card (Micro SD); maximum storage: 32G	
Real-time clock	Years, months, days, hours, minutes, seconds and weeks	Active about one week, storing in an electric double layer capacitor
CANopen DS301 (Master)	Maximum node: 64; maximum bytes: 2000	Built-in CAN communication port
CANopen DS301 (Slave)	Maximum PDO: 8; maximum bytes: 8	

2.2.2 Electrical specifications

Model / Item	DVP32ES311T
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)
Weight (g)	390 g

- **Electrical specifications for the inputs on digital input/output module. The signals passing through the inputs are 24 VDC signals.**

<table>
<tr><th colspan="2">Model / Item</th><th>DVP32ES311T
DVP32ES300T
DVP32ES300R</th><th>DVP48ES300T
DVP48ES300R</th><th>DVP64ES300T
DVP64ES300R</th><th>DVP80ES300T
DVP80ES300R</th></tr>
<tr><td colspan="2">Number of inputs</td><td>16 (X0 ~ X17)</td><td>24 (X0 ~ X27)</td><td>32 (X0 ~ X37)</td><td>40 (X0 ~ X47)</td></tr>
<tr><td colspan="2">Connector type</td><td colspan="4">Removable terminal blocks</td></tr>
<tr><td colspan="2">Input type</td><td colspan="4">Digital input</td></tr>
<tr><td colspan="2">Input form</td><td colspan="4">Direct current (sinking or sourcing)</td></tr>
<tr><td colspan="2">Input voltage/ current</td><td colspan="4">X0 ~ X7: 24VDC, 5.8mA
X10 ~ X47: 24VDC, 4mA</td></tr>
<tr><td rowspan="2">Action level</td><td>OFF→ON</td><td colspan="4">>15 VDC</td></tr>
<tr><td>ON→OFF</td><td colspan="4"><5 VDC</td></tr>
<tr><td rowspan="2">Response time</td><td>OFF→ON</td><td colspan="4">X0 ~ X7: 1.5μs
X10 ~ X17: 15μs
X20 ~ X47: 10ms</td></tr>
<tr><td>ON→OFF</td><td colspan="4">X0 ~X7: 1.5μs
X10 ~ X17: 15μs
X20 ~ X47: 10ms</td></tr>
<tr><td colspan="2">Maximum input frequency</td><td colspan="4">X0 ~ X7: 200kHz
X10 ~ X17: 20kHz
X20 ~ X47: 50Hz</td></tr>
<tr><td colspan="2">Input impedance</td><td colspan="4">X0 ~ X7: 3.9kΩ
X10 ~ X47: 5.6kΩ</td></tr>
</table>

Item \ Model	DVP32ES311T DVP32ES300T DVP32ES300R	DVP48ES300T DVP48ES300R	DVP64ES300T DVP64ES300R	DVP80ES300T DVP80ES300R
Input signal	Voltage input Sinking: The inputs are NPN transistors whose collectors are open collectors. Sourcing: The inputs are PNP transistors whose collectors are open collectors.			
Electrical isolation	Optocoupler			
Input display	When the optocoupler is driven, the input LED indicator is ON.			

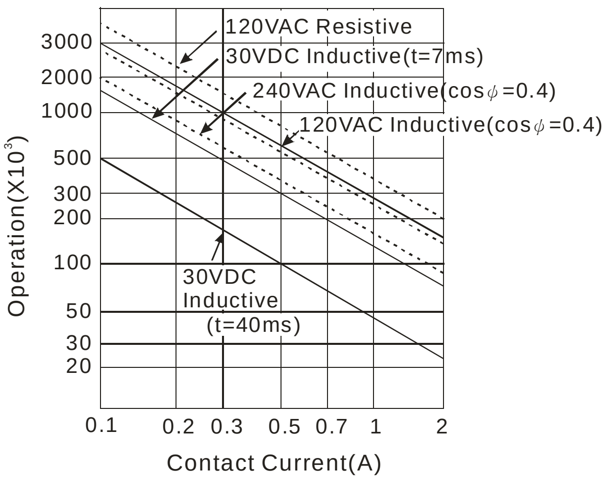
- **Electrical specifications for the outputs on DVP-ES3 Series.**

Item \ Model	DVP-ES3 Series	32ES300R	48ES300R	64ES300R	80ES300R	32ES311T	32ES300T	48ES300T	64ES300T	80ES300T
Number of outputs		16	24	32	40	16	16	24	32	40
Connector type		Removable terminal blocks								
Output form		Relay				Transistor-T (sinking)				
Voltage		10 ~ 250 VAC, 5 ~ 30VDC				5 ~ 30VDC				
Leakage current		0uA				<10uA				
Maximum load	**Resistance**	2A/output, 5A/COM				0.5A/output, 2A/COM*2				
	Inductance	Life cycle curve*3				12W (24VDC)				
	Bulb	20WDC/100WAC				2W (24VDC)				
Switching frequency*1		≦1Hz				Y0 ~ Y7: 200kHz Y10 ~ Y47 ≦1kHz				
Maximum Response time	**OFF→ON**	Approximately 10ms				Y0 ~ Y7: 1.5μs Y10 ~ Y47: 100μs				
	ON→OFF					Y0 ~ Y7: 1.5μs Y10 ~ Y47: 100μs				

*1: The scan cycle affects the frequency.

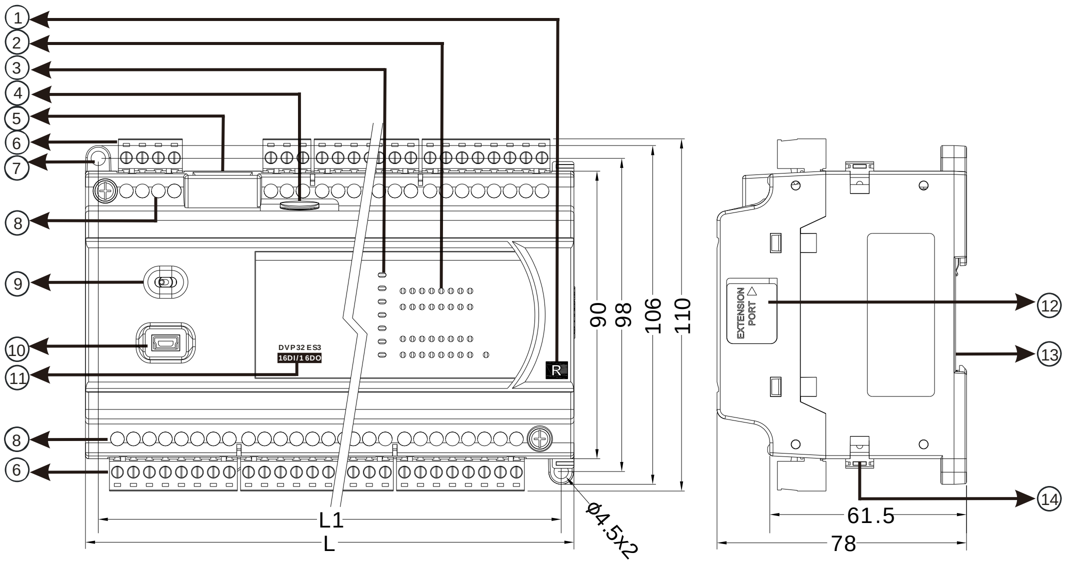
*2: UP, ZP should include external aid power 24VDC (-15% ~ +20%) and the rated comsumption is around 1mA/point.

*3: The life cycle curve is shown below.



2.2.3 CPU Module Profiles

- **DVP32ES300R / DVP32ES300T / DVP32ES311T / DVP48ES300R / DVP48ES300T / DVP64ES300R / DVP64ES300T / DVP80ES300R / DVP80ES300T**



Unit: mm

- **Diameter chart**

DVP	32ES311T	32ES300R/T	48ES300R/T	64ES300R/T	80ES300R/T
L	165 mm	165 mm	216 mm	267 mm	310 mm
L1	157 mm	157 mm	208 mm	259 mm	302 mm

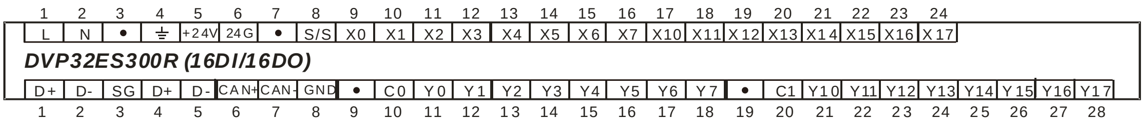
- **LED indocaor descriptions**

Number	Name	Description
1	Output type	R: Relay output T: Transistor output
2	Input/Output LED	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.
3	Power LED	Indicates the power status of the CPU module
	Run LED	Operating status of the module ON: the program is running. OFF: the program is stopped. Blinking: the program detects an error
	Error LED	Error status of the module Blinking slowly (1 second ON, 3 seconds OFF): warning Blinking (0.5 seconds ON, 0.5 seconds OFF): error occurs Blinking rapidly (0.2 seconds ON, 0.2 seconds OFF) ON: scanning timeout OFF: the module is normal.
	USB LED COM1 LED COM2 LED	Indicates the communication status OFF: no communication Blinking: communication
	LINK/ACT LED	ON: communication port is connected Blinking: packet sending/receiving OFF: communication port is not connected

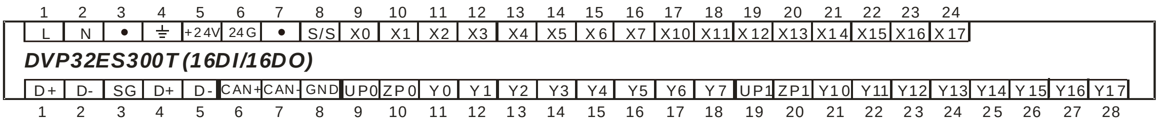
Number	Name	Description
4	SD card slot	Provides an interface for SD card storing
5	RJ45 communication port	Provides an interface for RJ45 communication
6	Removable terminal blocks	Connects the module and the wiring module
7	Mounting hole	Secures the module on the set
8	Terminal number	Terminal number
9	RUN/STOP	RUN: executes the program STOP: stops the program
10	USB port	Mini USB communication port
11	Model name	Shows the model name of the CPU module.
12	External module connection port	Connects the modules
13	DIN rail slot (35 mm)	For the DIN rail
14	I/O module securing clip	Secures the modules

2.2.4 CPU Module Input/Output Terminals

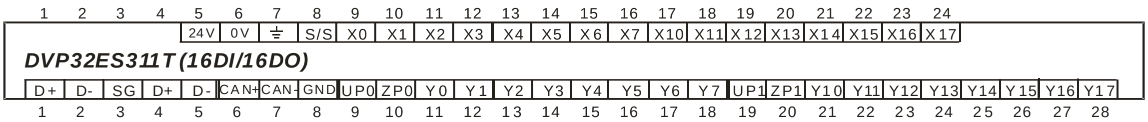
- **DVP32ES300R**



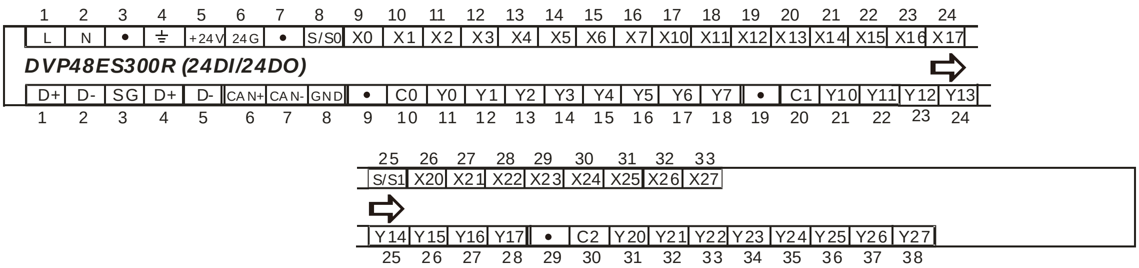
- **DVP32ES300T**



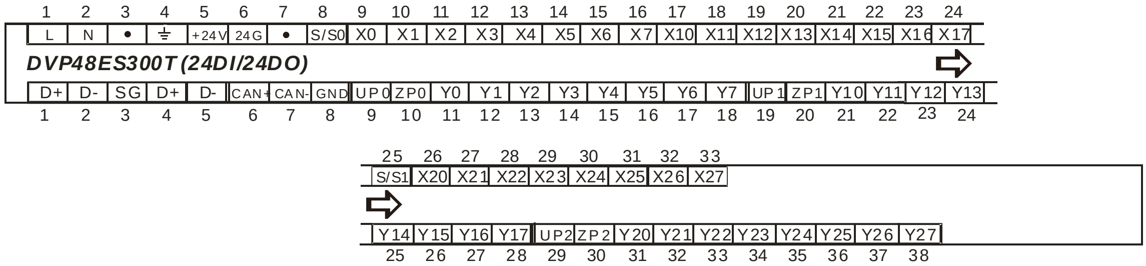
- **DVP32ES311T**



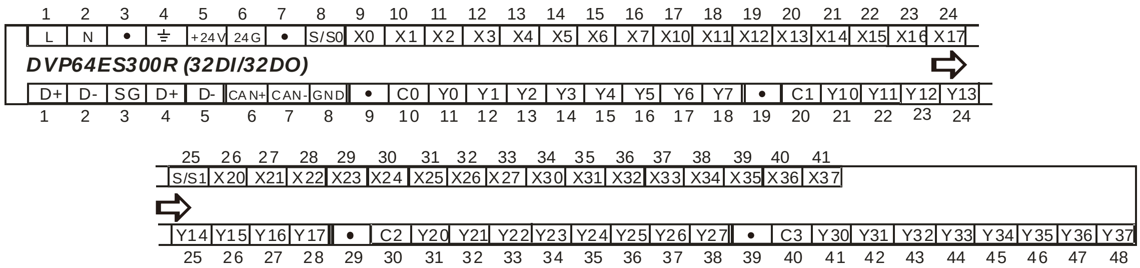
- **DVP48ES300R**



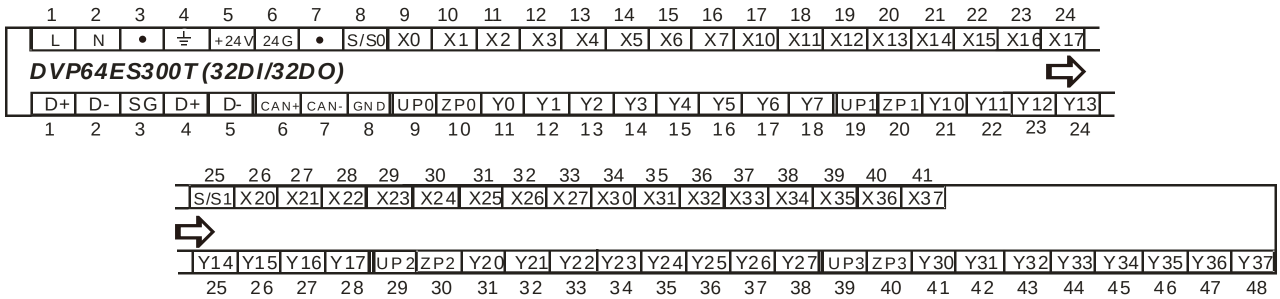
- **DVP48ES300T**



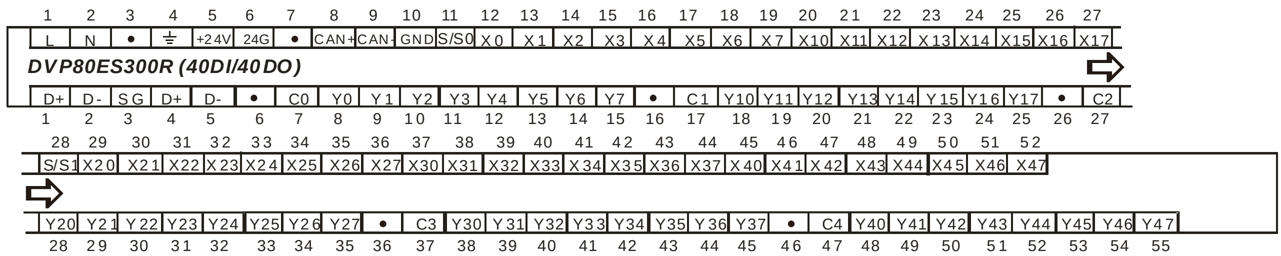
- **DVP64ES300R**



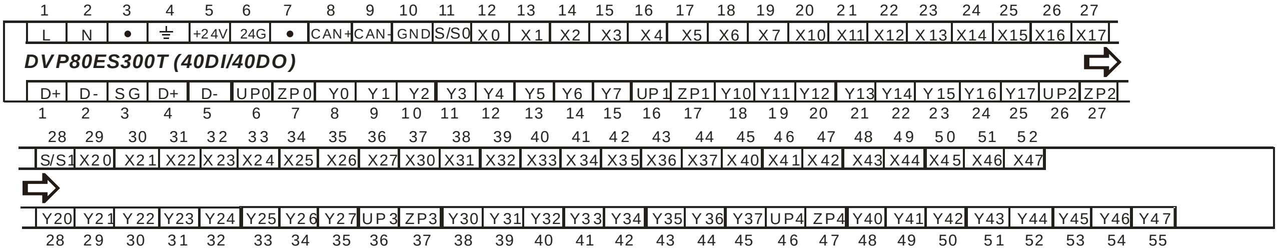
- **DVP64ES300T**



- **DVP80ES300R**



- **DVP80ES300T**



2.3 Digital Input/Output Module Specifications

2.3.1 General Specifications

Model (DVP) / Item	08XM 211N	08XN 211R	08XN 211T	08XP 211R	08XP 211T	16XM 211N	16XP 211T	16XN 211T	16XP 211R	16XN 211R
Power supply	Provided by CPU module								24VDC	
Weight	105 g	135 g	109 g	120 g	107 g	148 g	149 g	143 g	179 g	209 g

Model (DVP) / Item	24XN 200R	24XN 200T	24XP 200R	24XP 200T	32XP 200R	32XP 200T
Power supply	100VAC ~ 240VAC					
Weight	390	310	300	260	340	280

- **Electrical specifications for the inputs on digital input/output modules**
  (The signals passing through the inputs are 24 VDC signals.)

Model (DVP) / Item		08XM 211N	08XP 211R	08XP 211T	16XM 211N	16XP 211R	16XP 211T	24XP 200R	24XP 200T	32XP 200R	32XP 200T
Number of inputs		8	4	4	16	8	8	16	16	16	16
Connector type		Removable terminal block									
Input type		Digital input									
Input form		Direct current (sinking or sourcing)									
Input voltage		24VDC, 5mA									
Action level	**OFF→ON**	>15VDC									
	ON→OFF	<5VDC									
Response time	**OFF→ON**	10ms±10%									
	ON→OFF	15ms±10%									
Input impedance		4.7kΩ									
Input signal		Voltage input Sinking: The inputs are NPN transistors whose collectors are open collectors. Sourcing: The inputs are PNP transistors whose collectors are open collectors.									
Electrical isolation		Optocoupler									
Input display		When the optocoupler is driven, the input LED indicator is ON.									

- **Electrical specifications for the outputs on a digital input/output module**

Model (DVP) / Item		08XP 211R	08XN 211R	16XP 211R	16XN 211R	24XP 200R	24XN 200R	32XP 200R	08XP 211T	08XN 211T	16XP 211T	16XN 211T	24XP 200T	24XN 200T	32XP 200T
Number of outputs		4	8	8	16	8	24	16	4	8	8	16	8	24	16
Connector type		Removable terminal block													
Output type		Relay-R							Transistor-T (sinking)						
Voltage		below 250 VAC, 30VDC							5 ~ 30VDC						
Leakage current		0uA							<10uA						
Max. load	**Resis-tance**	2A/output, 5A/COM*3							0.5A/output, 4A/COM*2						
	Induc-tance	Life cycle curve*4							12W (24VDC)						
	Bulb	20WDC/100WAC							2W（24VDC）						

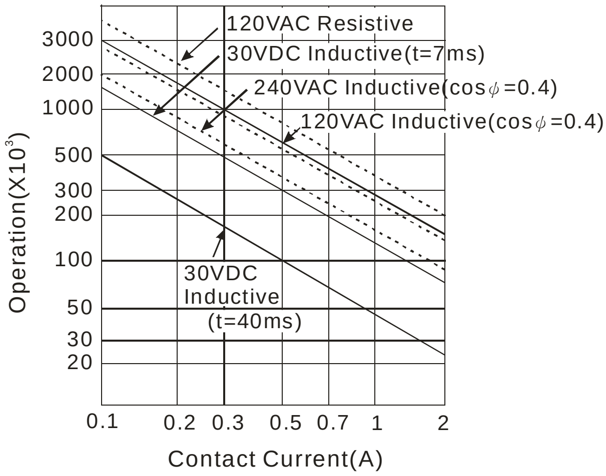
Model (DVP) / Item		08XP 211R	08XN 211R	16XP 211R	16XN 211R	24XP 200R	24XN 200R	32XP 200R	08XP 211T	08XN 211T	16XP 211T	16XN 211T	24XP 200T	24XN 200T	32XP 200T
Switching frequency*1		≦1Hz							≦1kHz						
Response time	**OFF→ON**	Approximately 10ms							50μs						
	ON→OFF								200μs						

*1: The scan cycle affects the frequency.

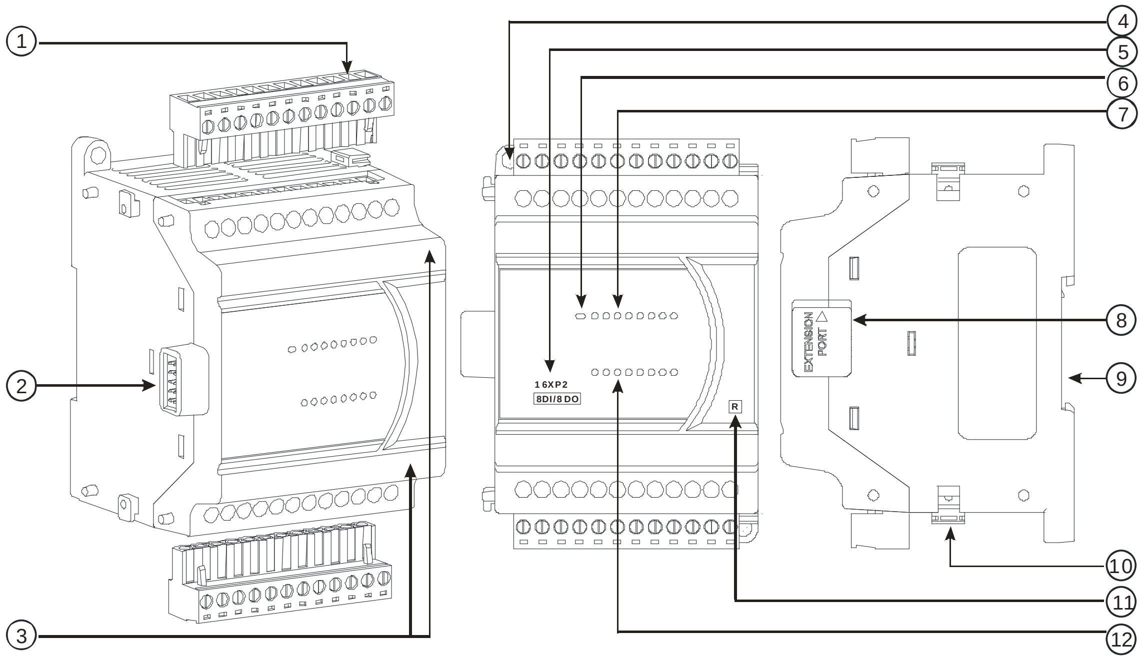
*2: UP, ZP should include external aid power 24VDC (-15% ~ +20%) and the rated comsumption is around 1mA/point.

*3: DVP16XN211R and DVP16XP211R should include external aid power 24VDC (-15% ~ +20%) and the rated comsumption is around 5mA/point.

*4. The life cycle curve is shown below.



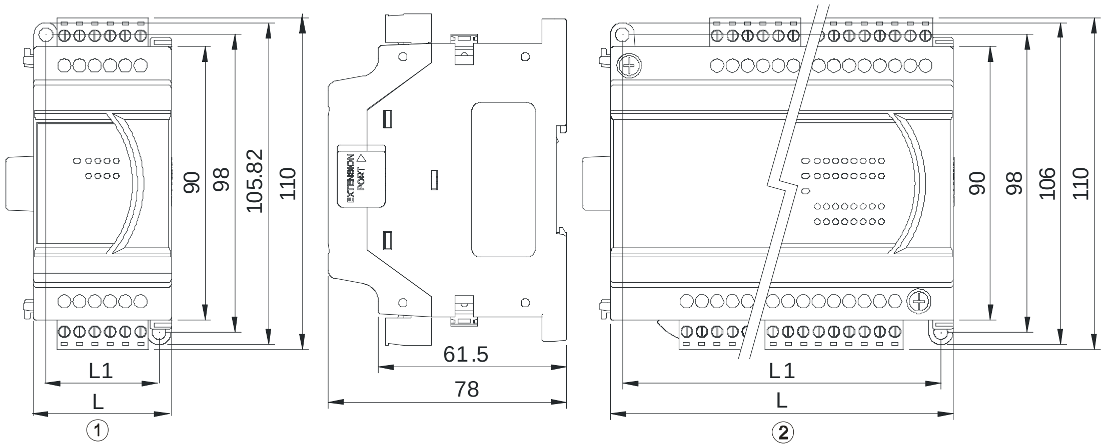
2.3.2 Digital Input/Output Module Profiles



Unit: mm

Number	Name	Description
1	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
2	External module connection port	Connects the modules
3	Terminal number	Terminal number
4	Mounting hole	Secures the module on the set
5	Model name	Model name of the module
6	Power LED	Indicates the power status of the CPU module
7	Input/output LED indicator	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.
8	External module connection port	Connects the modules
9	DIN rail slot (35 mm)	For the DIN rail
10	I/O module securing clip	Secures the modules
11	Output type	R: Relay output T: Transistor output
12	Input/Output LED	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.

2.3.3 Digital Input/Output Module Terminals



Unit: mm

- **Diameter chart**

DVP	08XM2 11N	08XP2 11R/T	08XN2 11R/T	16XM2 11N	16XP2 11R/T	16XN2 11R/T	24XP2 00R/T	24XN2 00R/T	32XP2 00R/T
Refer to	①			②			②		
L	45			70			145		
L1	37			62			137		

2.3.4 Digital Input/Output Module Terminals

- **DVP08XM211N**

1	2	3	4	5	6
S/S	X0	X1	X2	X3	NC
DVP08XM2 (8DI)					
NC	X4	X5	X6	X7	NC
1	2	3	4	5	6

- **DVP08XN211R/T**

1	2	3	4	5	6
C0	Y0	Y1	Y2	Y3	NC
DVP08XN2-R (8DO)					
C1	Y4	Y5	Y6	Y7	NC
1	2	3	4	5	6

1	2	3	4	5	6
NC	NC	Y0	Y1	Y2	Y3
DVP08XN2-T (8DO)					
UP	ZP	Y4	Y5	Y6	Y7
1	2	3	4	5	6

- **DVP08XP211R/T**

DVP08XP2-R (4DI/4DO)

	1	2	3	4	5	6
Upper	S/S	X0	X1	X2	X3	NC
Lower	C0	Y0	Y1	Y2	Y3	NC

DVP08XP2-T (4DI/4DO)

	1	2	3	4	5	6
Upper	S/S	X0	X1	X2	X3	NC
Lower	UP	ZP	Y0	Y1	Y2	Y3

- **DVP16XM211N**

DVP16XM2 (16DI)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	S/S	X0	X1	X2	X3	X4	X5	X6	X7	NC		
Lower	S/S	X10	X11	X12	X13	X14	X15	X16	X17	NC	NC	NC

- **DVP16XN211R/T**

DVP16XN2-R (16DO)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	C0	Y0	Y1	Y2	Y3	C1	Y4	Y5	Y6	Y7		
Lower	24V	0V	⏚	C2	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

DVP16XN2-T (16DO)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7		
Lower	UP1	ZP1	⏚	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	NC

- **DVP16XP211R/T**

DVP16XP2-R (8DI/8DO)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	S/S	X0	X1	X2	X3	X4	X5	X6	X7	NC		
Lower	24V	0V	⏚	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7

DVP16XP2-T (8DI/8DO)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	S/S	X0	X1	X2	X3	X4	X5	X6	X7	NC		
Lower	UP	ZP	⏚	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	NC

● **DVP24XP200R/T**

DVP24XP2-R (16DI/8DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17

+24V	24G	NC	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
1	2	3	4	5	6	7	8	9	10	11	12

DVP24XP2-T (16DI/8DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17

+24V	24G	UP	ZP	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
1	2	3	4	5	6	7	8	9	10	11	12

● **DVP24XN200R/T**

DVP24XN2-R (24DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	C0	Y0	Y1	Y2	Y3	C1	Y4	Y5	Y6	Y7	C4	Y20	Y21	Y22	Y23	NC	NC

+24V	24G	NC	NC	C2	Y10	Y11	Y12	Y13	C3	Y14	Y15	Y16	Y17	C5	Y24	Y25	Y26	Y27	NC	NC
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

DVP24XN2-T (24DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP2	ZP2	Y20	Y21	Y22	Y23	NC

+24V	24G	NC	NC	UP1	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	UP3	ZP3	Y24	Y25	Y26	Y27	NC
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

● **DVP32XP200R/T**

DVP32XP2-R (16DI/16DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17

+24V	24G	NC	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	C1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

DVP32XP2-T (16DI/16DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17

+24V	24G	UP	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

2.4 Analog Input/Output Module Specifications

2.4.1 General Specifications

- **DVP04AD-E2**

Electrical specifications

Module name	DVP04AD-E2
Number of inputs	Four
Analog-to-digital conversion	Voltage input/Current input
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block (distance to the terminal is 5 mm)
Conversion time	400 μs /channel
Weight	204 g

Things to note when connecting the module to a CPU PLC module:

1. Up to 8 modules can be connected to a CPU PLC module.
2. The connected module is numbered automatically from 0 (nearest to the CPU PLC module) to 7 (furthest away from the CPU PLC module).
3. The connected modules do NOT take up any digital I/O points.

Functional specifications

Analog/digital module	Voltage input		Current input		
Analog input channel	4 channels				
Rated input range	±10V	±5V	±20 mA	0 ~ 20 mA	4 ~ 20 mA
Digital conversion range	±32,000	±32,000	±32,000	0 ~ 32,000	0 ~ 32,000
Hardware input limit*1	±10.12V	±5.06V	±20.24 mA	-0.24~20.24 mA	3.81~20.19 mA
Digital conversion limit*2	±32,384	±32,384	±32,384	-384 ~+32,384	-384 ~+32,384
Hardware resolution	14-bit	14-bit	14-bit	13-bit	13-bit
Input impedance	≧1M Ω		250 Ω		
Absolute input range*3	±15 V		±32 mA		
Digital data format	16-bit two's complement number				
Average function	Yes, CR#8 ~ CR#11, setting range: K1 ~ K100				
Self-diagnosis function	Detecting if exceeding upper and lower limts or channel disconnection				
Overall Accuracy	25° C/77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C/-32° F to 131° F: The allowed error range is ±1% of full scale.				
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC				

*1: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2: If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit and a conversion limit error appears. For example in the voltage input mode (-10 V to +10 V), when the input signal is 10.15 V, exceeding the hardware upper limit, it also exceeds the conversion upper limit. The module uses the upper limit value (32387) as the input signal and a conversion limit error appears.

2

*3: If an input signal exceeds the absolute range, it might damage the channel.

- **DVP02DA-E2/DVP04DA-E2**

Electrical specifications

Module name	**DVP02DA-E2**	**DVP04DA-E2**
Number of outputs	Two	Four
Analog-to-digital conversion	Voltage output/Current output	
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)	
Connector type	Removable terminal block (distance to the terminal is 5 mm)	
Conversion time	400 μs /channel	
Short cicuit protection*1	Yes	
Weight	194 g	207 g

*1: The module is with short circuit protection, but if the duration of a short circuit is too long, it can cause circuit damage. Current output can be open circuit.

Things to note when connecting the module to a CPU PLC module:

1. Up to 8 modules can be connected to a CPU PLC module.
2. The connected module is numbered automatically from 0 (nearest to the CPU PLC module) to 7 (furthest away from the CPU PLC module).
3. The connected modules do NOT take up any digital I/O points.

Functional specifications

Digital/analog module	**Voltage output**	**Current output**	
Rated output range	-10 V ~ 10V	0 ~ 20 mA	4 mA ~ 20 mA
Digital conversion range	-32,000 ~ +32,000	0 ~ +32,000	0 ~ +32,000
Digital conversion limit	-32,768 ~ +32,767	0 ~ +32,767	-6,400 ~ +32,767
Hardware resolution	14-bit	14-bit	14-bit
Maximum output current	5 mA	-	
Load impedance	1K Ω ~ 2M Ω	0 ~ 500 Ω	
Output impedance	0.5 Ω or lower		
Overall Accuracy	25° C/77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C/-32° F to 131° F: The allowed error range is ±1% of full scale.		
Digital data format	16-bit two's complement number		

Digital/analog module	Voltage output	Current output
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC	

- **DVP06XA-E2**

Electrical specifications

Module name	DVP06XA-E2
Number of inputs/outputs	Inputs: four; Outputs: two
Analog-to-digital conversion	Voltage input/Current input; Voltage output/Current output;
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block (distance to the terminal is 5 mm)
Conversion time	400 μs /channel
Weight	213 g

Things to note when connecting the module to a CPU PLC module:

1. Up to 8 modules can be connected to a CPU PLC module.
2. The connected module is numbered automatically from 0 (nearest to the CPU PLC module) to 7 (furthest away from the CPU PLC module).
3. The connected modules do NOT take up any digital I/O points.

A/D Functional specifications

	Voltage input		Current input		
Analog input channel	4 channels				
Rated input range	±10V	±5V	±20 mA	0 ~ 20 mA	4 ~ 20 mA
Digital conversion range	±32,000	±32,000	±32,000	0 ~ 32,000	0 ~ 32,000
Hardware input limit*1	±10.12V	±5.06V	±20.24 mA	-0.24~20.24 mA	3.81 ~ 20.19 mA
Digital conversion limit*2	±32,384	±32,384	±32,384	-384 ~+32,384	-384 ~ +32,384
Hardware resolution	14-bit	14-bit	14-bit	13-bit	13-bit
Input impedance	≧1M Ω		250 Ω		
Absolute input range*3	±15 V		±32 mA		
Digital data format	16-bit two’s complement number				
Average function	Yes, CR#8 ~ CR#11, setting range: K1 ~ K100				
Self-diagnosis function	Detecting if exceeding upper and lower limts or channel disconnection				
Overall Accuracy	25° C/77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C/-32° F to 131° F: The allowed error range is ±1% of full scale.				

	Voltage input	Current input
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC	

*1: If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2: If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit and a conversion limit error appears. For example in the voltage input mode (-10 V to +10 V), when the input signal is 10.15 V, exceeding the hardware upper limit, it also exceeds the conversion upper limit. The module uses the upper limit value (32387) as the input signal and a conversion limit error appears.

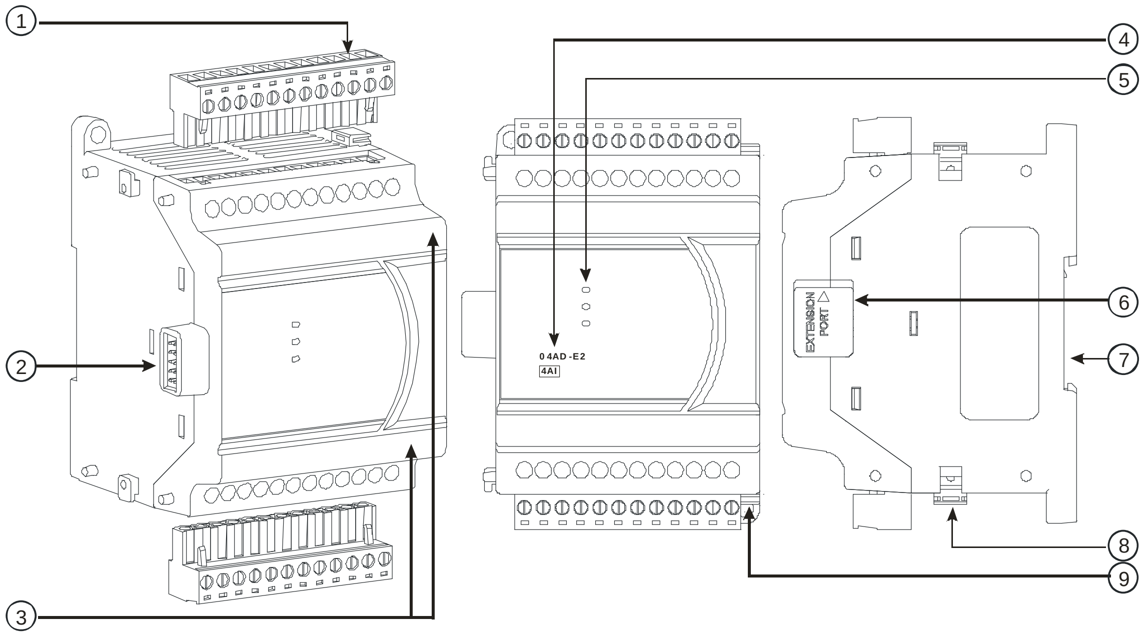
*3: If an input signal exceeds the absolute range, it might damage the channel.

D/A Functional specifications

	Voltage output	Current output	
Analog output channel	2 channels		
Rated output range	-10V ~ 10V	0 ~ 20 mA	4 mA ~ 20 mA
Digital conversion range	-32,000 ~ +32,000	0 ~ +32,000	0 ~ +32,000
Digital conversion limit	-32,768 ~ +32,767	0 ~ +32,767	-6,400 ~ +32,767
Hardware resolution	14-bit	14-bit	14-bit
Maximum output current	5 mA	-	
Load impedance	1K Ω ~ 2M Ω	0 ~ 500 Ω	
Output impedance	0.5 Ω or lower		
Short cicuit protection*1	Yes		
Overall Accuracy	25° C/77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C/-32° F to 131° F: The allowed error range is ±1% of full scale.		
Digital data format	16-bit two’s complement number		
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC		

*1: The module is with short circuit protection, but if the duration of a short circuit is too long, it can cause circuit damage. Current output can be open circuit.

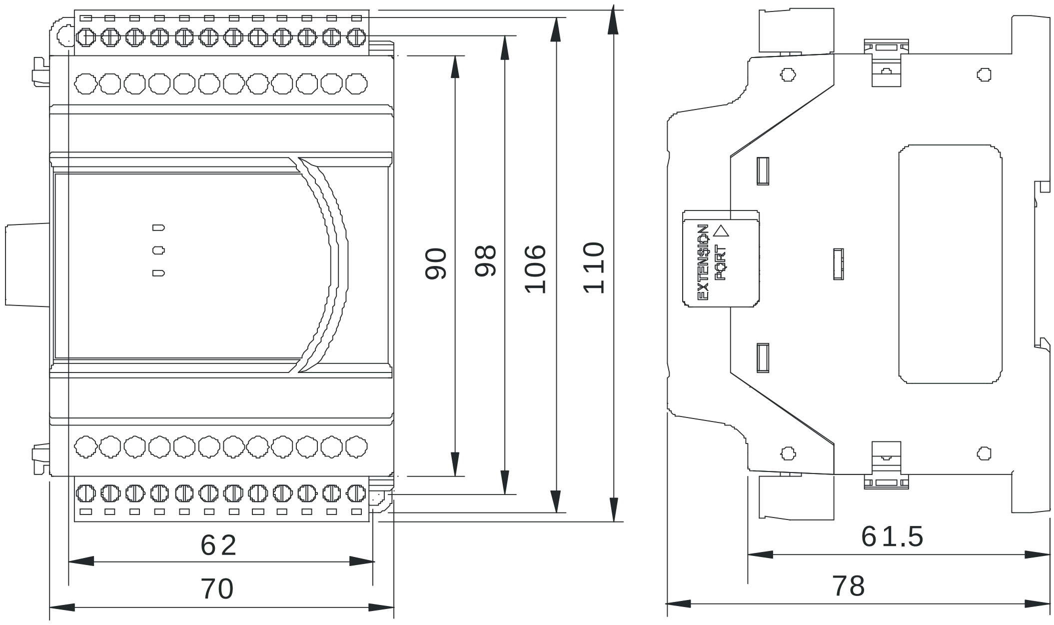
2.4.2 Analog Input/Output Module Profiles



Unit: mm

Number	Name	Description
1	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
2	External module connection port	Connects the modules
3	Terminal number	Terminal number
4	Model name	Model name of the module
5	POWER LED indicator	Indicates the status of the power supply ON: the power is on OFF: no power
	ERROR LED indicator	Error status of the module ON: a serious error occurs in the module. OFF: the module is normal. Blinking: a minor error occurs in the module.
	Analog to digital conversion indicator	Indicates the analog to digital conversion status Blinking: conversion is taking place OFF: stop conversion
6	External module connection port	Connects the modules
7	DIN rail slot (35 mm)	For the DIN rail
8	I/O module securing clip	Secures the modules
9	Mounting hole	Secures the module on the set

2.4.3 Analog Input / Output Terminals



Unit: mm

2.4.4 Analog Input / Output Module Terminals

- **DVP04AD-E2**

DVP04AD-E2 (4AI)

1	2	3	4	5	6	7	8	9	10	11	12
V1+	I1+	VI1-	FE	V2+	I2+	VI2-	FE	V3+	I3+	VI3-	FE

1	2	3	4	5	6	7	8
24V	0V	⏚	FE	V4+	I4+	VI4-	FE

- **DVP02DA-E2**

DVP02DA-E2 (2AO)

1	2	3	4	5	6	7	8	9	10	11	12
24V	0V	⏚	FE	FE	FE	VO1	IO1	AG	VO2	IO2	AG

- **DVP04DA-E2**

DVP04DA-E2 (4AO)

1	2	3	4	5	6	7	8	9	10	11	12
VO1	IO1	AG	FE	VO2	IO2	AG	FE	VO3	IO3	AG	FE

1	2	3	4	5	6	7	8
24V	0V	⏚	FE	VO4	IO4	AG	FE

- **DVP06XA-E2**

DVP06XA-E2 (4AI/2AO)

1	2	3	4	5	6	7	8	9	10	11	12
V1+	I1+	VI1-	V2+	I2+	VI2-	V3+	I3+	VI3-	V4+	I4+	VI4-

1	2	3	4	5	6	7	8	9	10	11	12
24V	0V	⏚	FE	FE	FE	VO1	IO1	AG	VO2	IO2	AG

2.5 Temperature Measurement Modules Specifications

2.5.1 General Specifications

- **DVP04PT-E2/DVP06PT-E2**

Electrical specifications

Model Name	DVP04PT-E2	DVP06PT-E2
Number of inputs	Four	Six
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)	
Connector type	Removable terminal block (distance to the terminal is 5 mm)	
Conversion time	200 ms /channel	
Weight	207 g	176 g

Things to note when connecting the module to a CPU PLC module:

1. Up to 8 modules can be connected to a CPU PLC module.
2. The connected module is numbered automatically from 0 (nearest to the CPU PLC module) to 7 (furthest away from the CPU PLC module).
3. The connected modules do NOT take up any digital I/O points.

Functional specifications

	Centigrade (°C)	Fahrenheit (°F)	Input impedance
Digital data format	16-bit two's complement number		
Overall accuracy	25°C/77°F: The error is ±0.3% of the input within the range. 0 to +55°C / 32 to 131°F: The error is ±0.6% of the input within the range.		
Applicable sensor	04PT: 3-Wire Pt100 (DIN 43760-1980 JIS C1604-1989, 100Ω 3850 PPM/°C); Pt1000 (DIN EN60751, 1 kΩ 3850 PPM/°C), Ni100/Ni1000 (DIN 43760); input impedence: 0 ~ 300Ω / 0 ~ 3000Ω 06PT: 3-Wire Pt100 (DIN 43760-1980 JIS C1604-1989, 100Ω 3850 PPM/°C); Pt1000 (DIN EN60751, 1 kΩ 3850 PPM/°C), Ni100/Ni1000 (DIN 43760), Cu50, Cu100, JPt100 (JIS C1604-1989), LG-Ni1000; input impedence: 0 ~ 300Ω / 0 ~ 3000Ω		
Rated input range	Pt100: -180°C to +800°C Ni100: -80°C to +170°C Pt1000: -180°C to +800°C Ni1000: -80°C to +170°C JPt100: -180°C to +500°C LG-Ni1000: -50°C to +180°C Cu50: -50°C to +150°C Cu100: -50°C to +150°C	Pt100: -292°F to +1,472°F Ni100: -112°F to +338°F Pt1000: -292°F to +1,472°F Ni1000: -112°F to +338°F JPt100: -292°F to +932°F LG-Ni1000: -58°F to +356°F Cu50: -58°F to +302°F Cu100: -58°F to +302°F	0–300 Ω 0–3000 Ω
Analog-to-digital conversion	Pt100: K-1,800 ~ K8,000 Ni100: K-800 ~ K1,700 Pt1000: K-1,800 ~ K8,000 Ni1000: K-800 ~ K1,700 JPt100: K-1,800 ~ K5,000 Cu50: K-500 ~ K1,500 Cu100: K-500 ~ K1,500 LG-Ni1000: K-500 ~ K1,800	Pt100: K-2,920 ~ K14,720 Ni100: K-1,120 ~ K3,380 Pt1000: K-2,920 ~ K14,720 Ni1000: K-1,120 ~ K3,380 JPt100: K-2,920 ~ K9,320 Cu50: K-580 ~ K3,020 Cu100: K-580 ~ K3,020 LG-Ni1000: K-580 ~ K3,560	K0 ~ K3,000 K0 ~ K30,000
Hardware resolution	16-bit (0.1°C)	16-bit (0.1°F)	16-bit (0.1 Ω)

Average function	Setting range: K1 ~ K100
Self-diagnosis function	Detecting if exceeding upper and lower limts or channel disconnection
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, and the analog channels are isolated from one another by optocouplers. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC

2

- **DVP04TC-E2**

Electrical specifications

Number of inputs	Four
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block (distance to the terminal is 5 mm)
Conversion time	200 ms /channel
Weight	205 g

Things to note when connecting the module to a CPU PLC module:

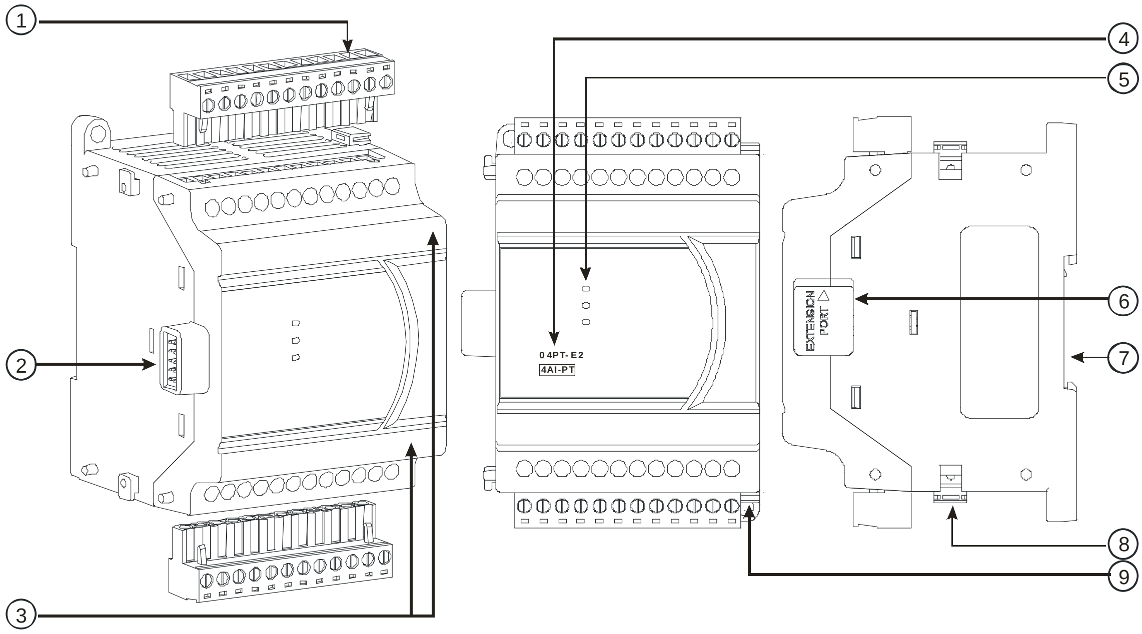
1. Up to 8 modules can be connected to a CPU PLC module.
2. The connected module is numbered automatically from 0 (nearest to the CPU PLC module) to 7 (furthest away from the CPU PLC module).
3. The connected modules do NOT take up any digital I/O points.

Functional specifications

	Centigrade (°C)	**Fahrenheit (°F)**	**Input impedance**
Analog input channel	Four		
Digital data format	16-bit two’s complement number		
Overall accuracy	25°C/77°F: The error is ±0.3% of the input within the range. 0 to +55°C / 32 to 131°F: The error is ±0.6% of the input within the range.		
Applicable sensor	J-type, K-type, R-type, S-type, T-type, E-type, N-type thermocouple; input impedance: ±80mV		
Rated input range	J-type：-100°C ~1,150°C K-type：-100°C ~ 1,350°C R-type：0°C ~ 1,750°C S-type：0°C ~ 1,750°C T-type：-150°C ~ 390°C E-type：-150°C ~ 980°C N-type：-150°C ~ 1,280°C	J-type：-148°F ~ 2,102°F K-type：-148°F ~ 2,462°F R-type：32°F ~ 3,182°F S-type：32°F ~ 3,182°F T-type：-238°F ~734°F E-type：-238°F ~ 1,796°F N-type：-238°F ~2,336°F	±80mV
Analog-to-digital conversion	J-type：K-1,000 ~ K11,500 K- type：K-1,000 ~ K13,500 R-type：K0 ~ K17,500	J-type：K-1,480 ~ K21,020 K-type：K-1,480 ~ K24,620 R-type：K320 ~ K31,820	±8,000

	S-type：K0 ~ K17,500 T-type：K-1,500 ~ K3,900 E-type：K-1,500 ~ K9,800 N-type：K-1,500 ~ K12,800	S-type：K320 ~ K31,820 T-type：K-2,380 ~ K7,340 E-type：K-2,380 ~ K17,960 N-type：K-2,380 ~ K23,360	
Hardware resolution	16-bit (0.1°C)	16-bit (0.1°F)	16-bit (0.01 mV)
Average function	Yes, CR#8 ~ CR#11, setting range: K1 ~ K100		
Self-diagnosis function	Detecting if exceeding upper and lower limts or channel disconnection		
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, and the analog channels are isolated from one another by optocouplers. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC Isolation between analog channels: 120 VAC		

2.5.2 Temperature Measurement Module Profiles

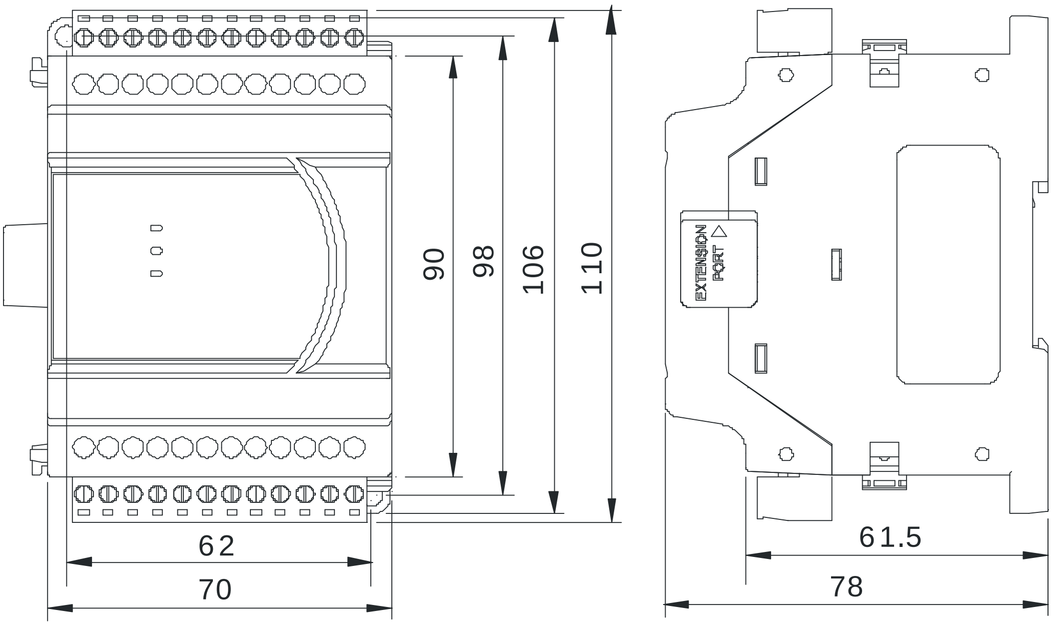


Unit: mm

Number	Name	Description
1	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
2	External module connection port	Connects the modules
3	Terminal number	Terminal number
4	Model name	Model name of the module
5	POWER LED indicator	Indicates the status of the power supply ON: the power is on OFF: no power

Number	Name	Description
	ERROR LED indicator	Error status of the module ON: a serious error occurs in the module. OFF: the module is normal. Blinking: a minor error occurs in the module.
	Analog to digital conversion indicator	Indicates the analog to digital conversion status Blinking: conversion is taking place OFF: stop conversion
6	External module connection port	Connects the modules
7	DIN rail slot (35 mm)	For the DIN rail
8	I/O module securing clip	Secures the modules
9	Mounting hole	Secures the module on the set

2.5.3 Temperature Measurement Module Dimensions



Unit: mm

2.5.4 Temperature Mesurement Module Terminals

- **DVP04PT-E2**

DVP04PT-E2 (4AI)

1	2	3	4	5	6	7	8	9	10	11	12
O1+	I1+	I1-	FE	O2+	I2+	I2-	FE	O3+	I3+	I3-	FE

1	2	3	4	5	6	7	8
24V	0V	⏚	FE	O4+	I4+	I4-	FE

- **DVP06PT-E2**

DVP06PT-E2 (6AI)

1	2	3	4	5	6	7	8	9	10	11	12
O1+	I1+	I1-	O2+	I2+	I2-	O3+	I3+	I3-	O4+	I4+	I4-

1	2	3	4	5	6	7	8	9	10	11	12
24V	0V	⏚	FE	FE	FE	O5+	I5+	I5-	O6+	I6+	I6-

- **DVP04TC-E2**

DVP04TC-E2 (4AI)

1	2	3	4	5	6	7	8	9	10	11	12
I1+	I1-	FE	I2+	I2-	FE	I3+	I3-	FE	I4+	I4-	FE

1	2	3	4	5	6	7	8
24V	0V	⏚	FE	FE	FE	FE	FE

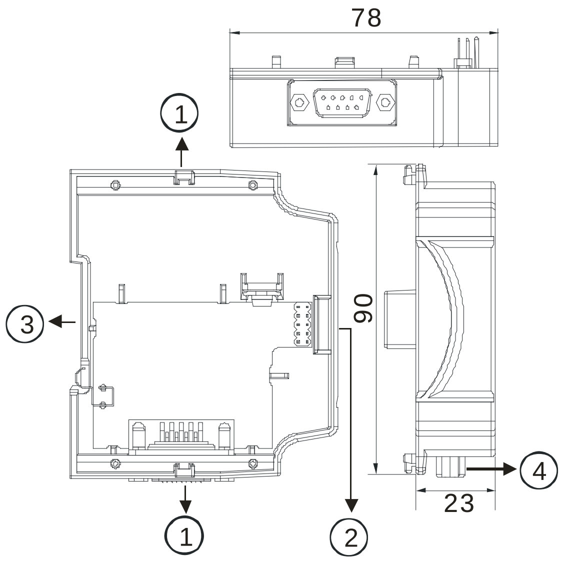
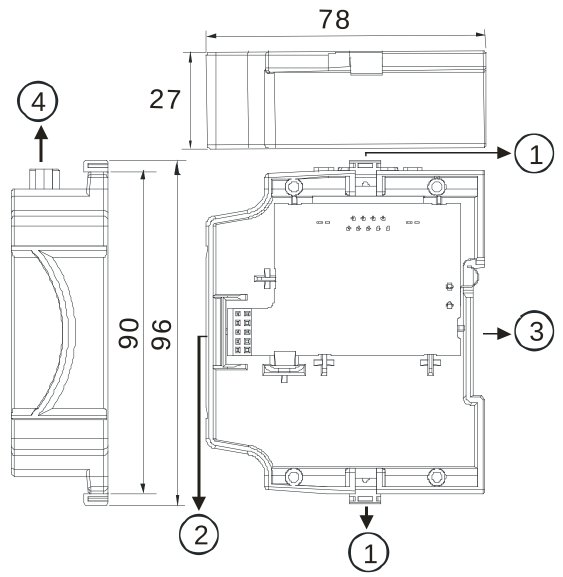
2.6 Extension Cable Interface Module Specifications

2.6.1 General Specifications

DVPAEXT01-E2 (DVPAEXT1R-E2 + DVPAEXT1L-E2) is an extension cable interface module. The extension distance is 0.7 meters. DVPAEXT01-E2 is only applicable to the connection between DVP-ES2/EX2 series CPU and the DI/DO or AI/AO extension modules, and the installation does not count as any digital extension point or analog module.

Item \ Model	DVPAEXT01-E2	
	DVPAEXT1R-E2	**DVPAEXT1L-E2**
Weight	50 g	55 g

2.6.2 Extension Cable Interface Module Profiles

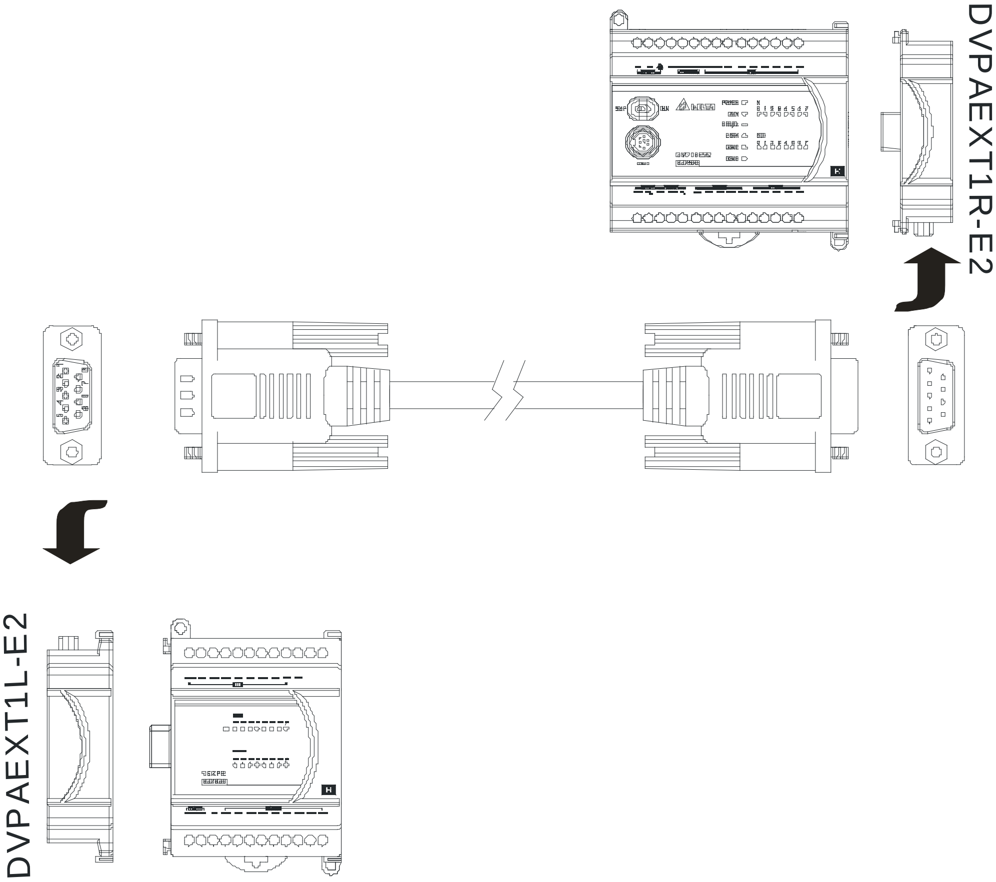
DVPAEXT1R-E2 (right side, previous one)	DVPAEXT1L-E2 (left side, latter one)
	

Number	Name	Description
1	I/O module securing clip	Secures the modules
2	External module connection port	Connects the modules
3	DIN rail slot (35 mm)	For the DIN rail
4	Extension cable port	Connects the extension cable

2.6.3 Installation and Wiring

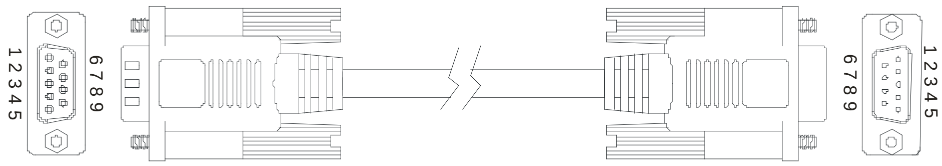
- **Use DVPAEXT01-E2 (DVPAEXT1R-E2 + DVPAEXT1L-E2) to extend the connections**

Since the installation space is limited, you can use DVPAEXT01-E2 (DVPAEXT1R-E2 + DVPAEXT1L-E2) to extend the communication signal and the connection between DVP-ES2/EX2 series CPU and the DI/DO or AI/AO extension modules.



- **Pin Definition**

Use the enclosed cable to connect DVPAEXT1R-E2 and DVPAEXT1L-E2.



3

Chapter 3 Installing Software

Table of Contents

Before developing an DVP-ES3 Series system, install ISPSoft and COMMGR. ISPSoft is a software platform for integrating the hardware, network configuration, and program development for a system. COMMGR functions as middleware between a computer and devices. It functions as a communication management interface between ISPSoft and DVP-ES3 Series hardware.

3.1 Installing and Uninstalling ISPSoft

- System requirements

<table>
<tr><th>Item</th><th colspan="2">System requirement</th></tr>
<tr><td>Operating system</td><td colspan="2">Windows XP / 7 / 8 / 10</td></tr>
<tr><td>CPU</td><td colspan="2">Pentium 1.5 G or above</td></tr>
<tr><td>Memory</td><td colspan="2">256 MB or above (512 MB or above is recommended.)</td></tr>
<tr><td>Hard disk drive</td><td colspan="2">Capacity : 1000 MB or above</td></tr>
<tr><td>CD-ROM drive</td><td colspan="2">This is optional for installing ISPSoft.</td></tr>
<tr><td>Monitor</td><td colspan="2">Resolution: 800×600 or above
(suggested setting: 1024x768/96 dpi)</td></tr>
<tr><td>Keyboard/Mouse</td><td colspan="2">A general keyboard/mouse or devices compatible with Windows</td></tr>
<tr><td>Printer</td><td colspan="2">A printer with a driver for Windows. This is needed to print projects.</td></tr>
<tr><td>RS-232 port</td><td>For connecting to a PLC</td><td rowspan="3">One of them is used, but a PLC that is connected must have a corresponding port. (*1)</td></tr>
<tr><td>USB port</td><td>For connecting to a PLC</td></tr>
<tr><td>Ethernet port</td><td>For connecting to a PLC</td></tr>
<tr><td>Communication software</td><td colspan="2">COMMGR, a communication manager, must be installed. (*2)</td></tr>
<tr><td>Supported Models</td><td colspan="2">AH500 series PLCs/DVP series PLCs (exclusive of DVP-PM series PLCs)/ AS series, AC motor drives: VFD with PLC built-in series, and Text panel HMI with PLC built-in series.</td></tr>
</table>

*1. ISPSoft supports several ways to connect a computer to a PLC. Make sure the port and the mode supported by the PLC are correct before you connect a computer to the PLC.

*2. Refer to section 3.2 for more information about COMMGR.

*3. The functions and specifications mentioned above are only applicable to ISPSoft version 3.00 or above. The older versions are not equipped with complete functions.

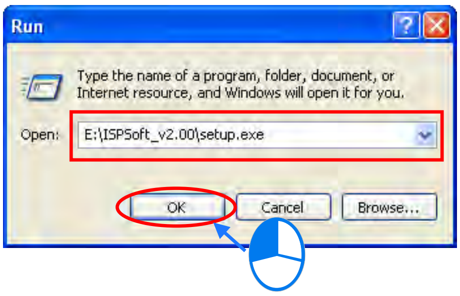
3.1.1 Installing ISPSoft

When the previous version of ISPSoft is detected in a computer, that version is advised to be uninstalled first before the latest ISPSoft can be installed.

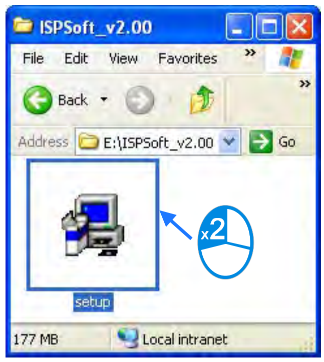
(1) Start a computer and enter the operating system. You have to log in to the system as a system administrator before installing ISPSoft.

(2) Put an ISPSoft CD in the CD-ROM drive, or download the installation program from the official Delta website http://www.deltaww.com/ to download ISPSoft. (The installation programs need to be decompressed if downloaded from the internet.)

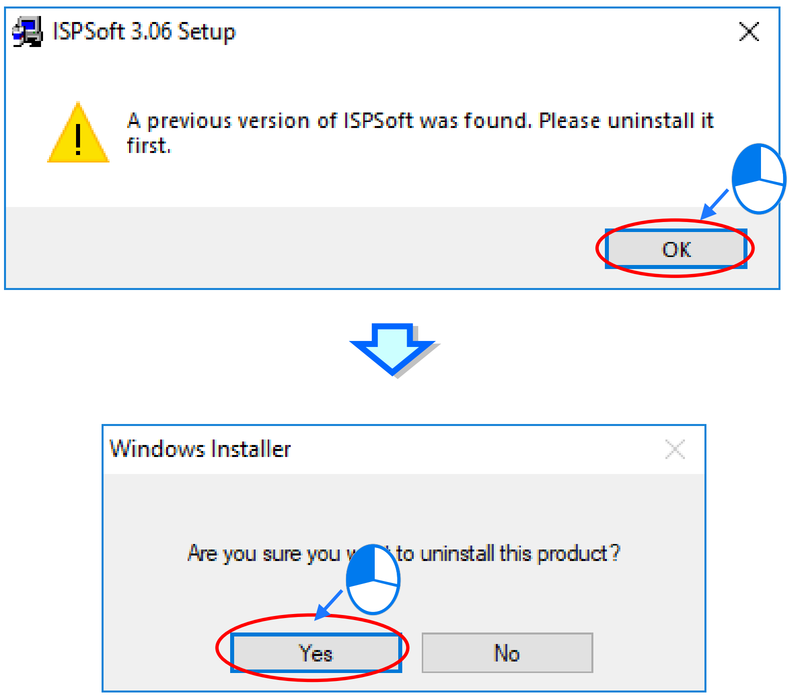
(3) Click **Start**, and **Run…** to open the **Run** window. Specify the path denoting the executable file which is used to install COMMGR in the **Open** box, and then click **OK**. Alternatively, you can double-click the ISPSoft setup icon to execute the installation program.



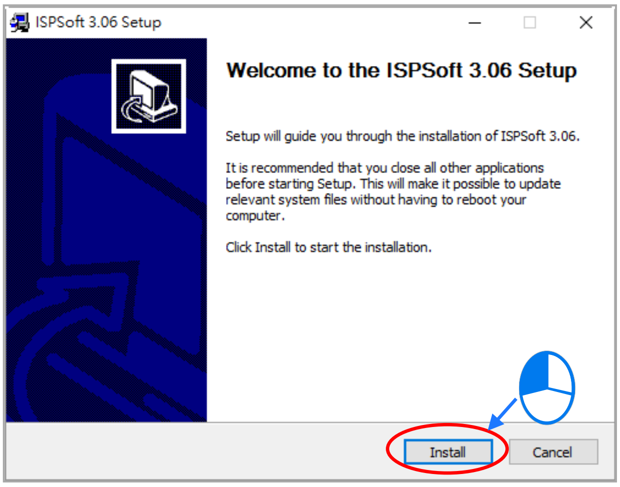
OR



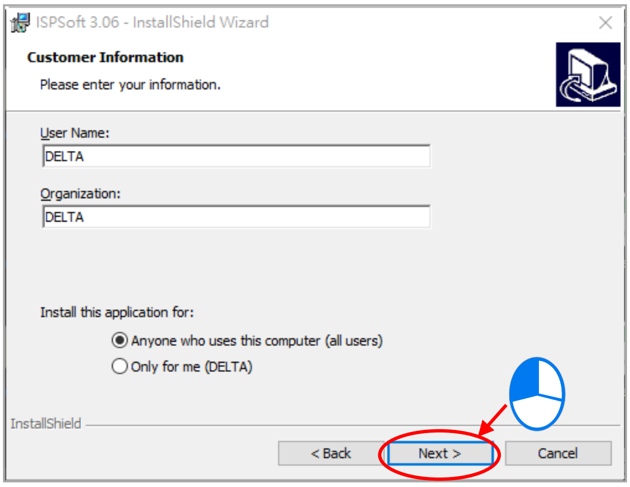
(4) When a previous version of the ISPSoft is found, click **OK** and then **Yes** to uninstall that version shown in the pop-up windows (see below).



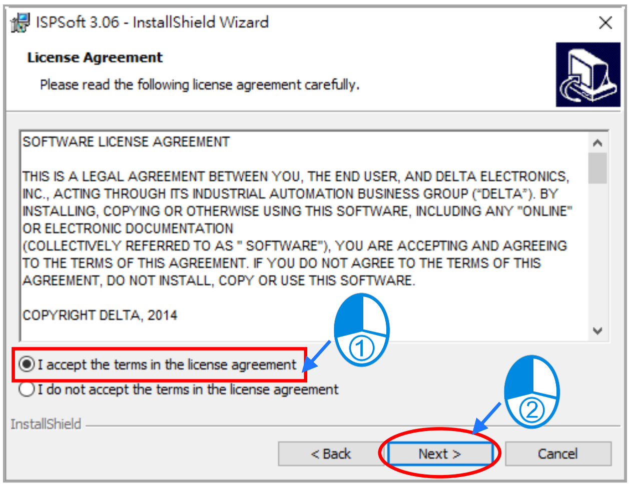
(5) Click **Install** once Shield Wizard window appears.



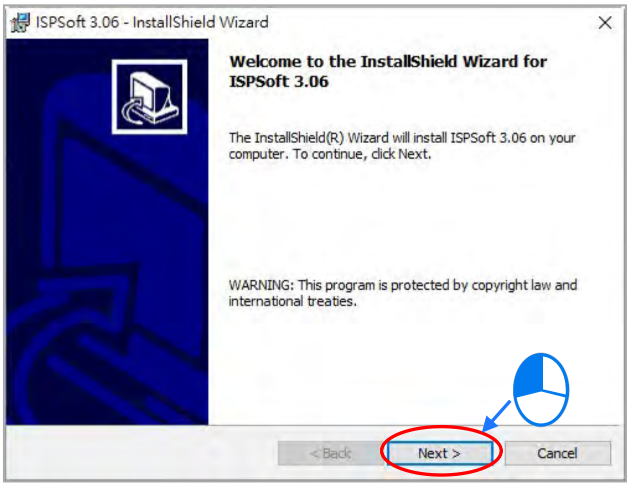
(6) Type related information in the **User Name** box and the **Organization** box, and then click **Next**.



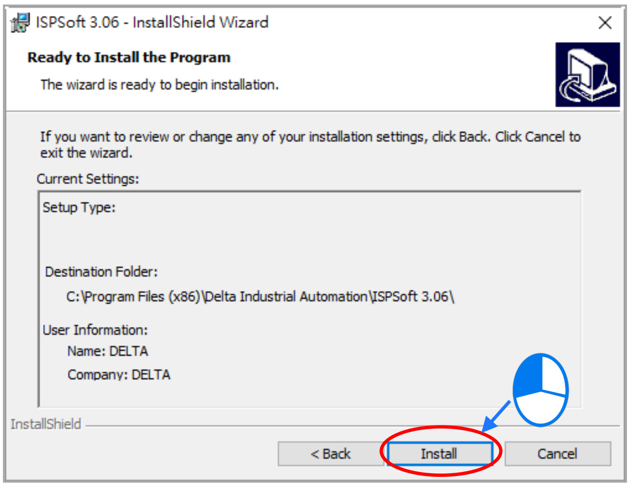
(7) Choose **I accept the terms in the license agreement**. Click **Next** to proceed to the next step.



(8) Then, click **Next** for the next step.

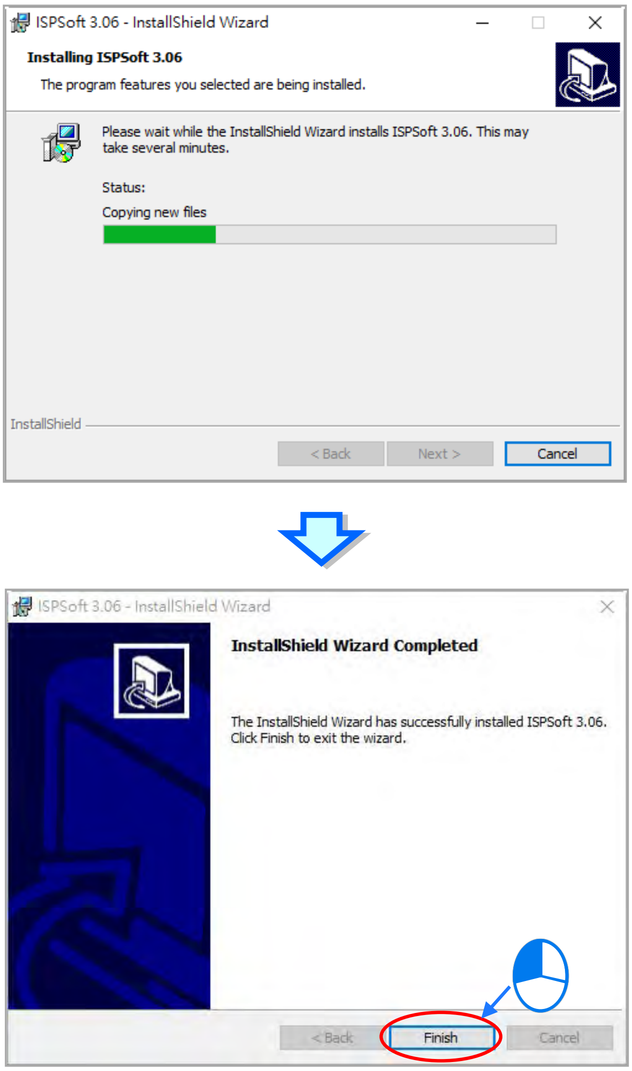


(9) Check the installation information, and then click **Install**.

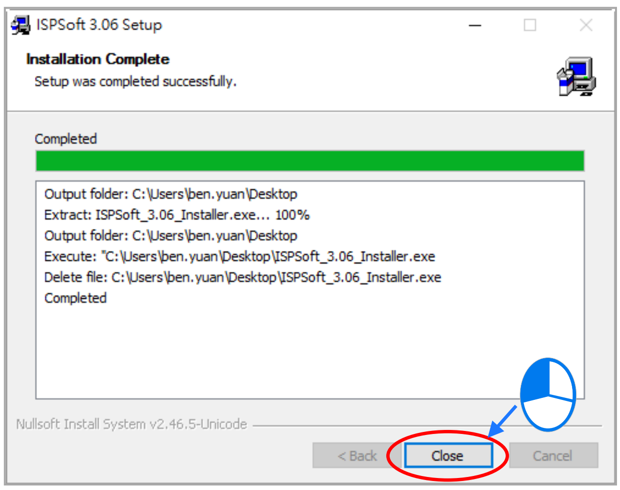


3

(10) After installation is complete, click **Finish** to continue the next step.



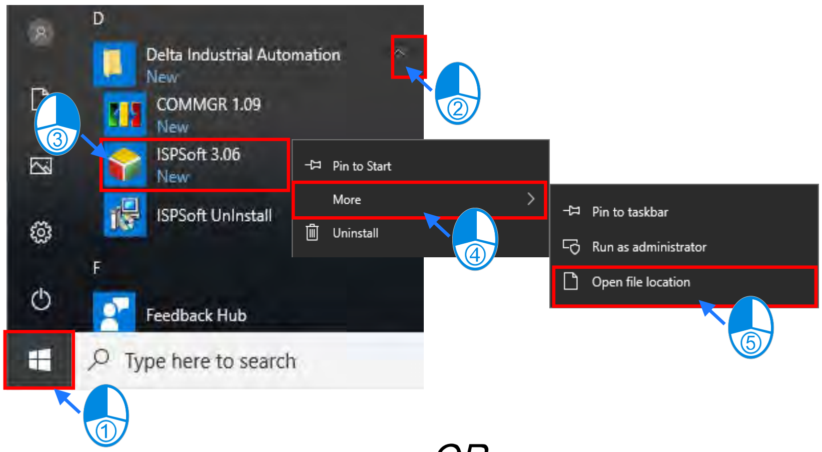
(11) When installation is complete, shortcuts to the software is created on the desktop and Start menu. Click **Close** to exit the setup.



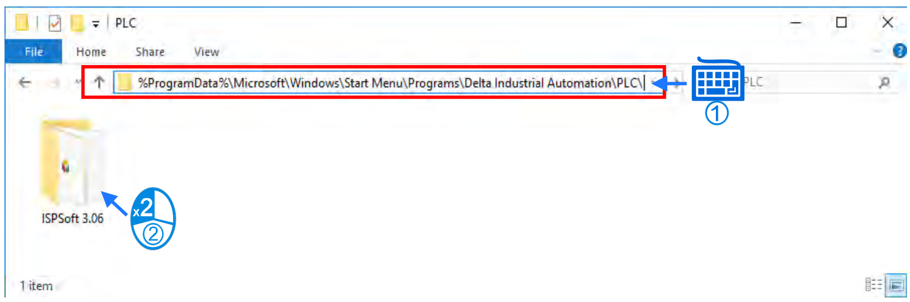
3.1.2 Uninstalling ISPSoft

(1) Generally, you can click **ISPSoft Uninstall** or choose **Programs** under **Control Panel** to remove the ISPSoft; when **ISPSoft Uninstall** is not found, there are two methods to uninstall the software:

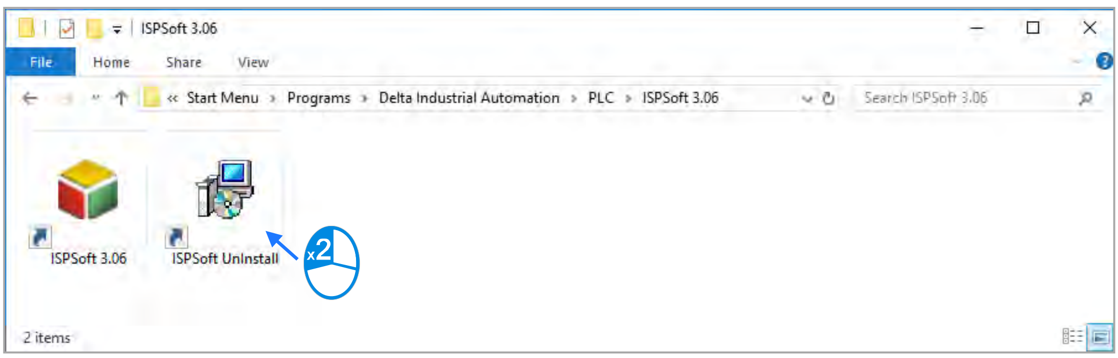
- Method 1: Choose **ISPSoft x.xx** from the Windows list, click **More** then select **Open file location.**
- Method 2: Place **%ProgramData%\Microsoft\Windows\Start Menu\Programs\Delta Industrial Automation\PLC** in the address box and press **Enter**. Then, double click ISPSoft x.xx file.



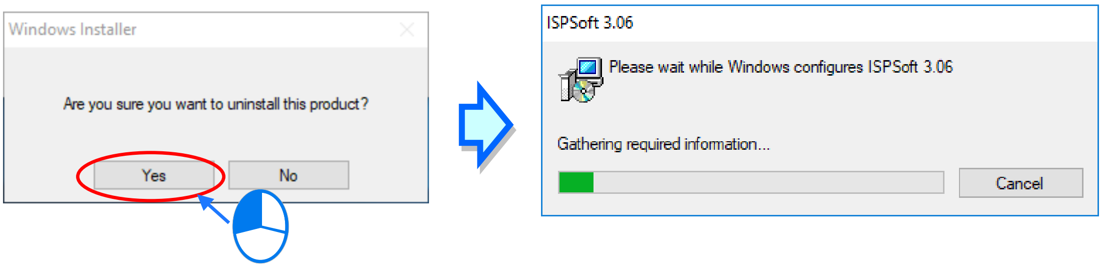
OR



(2) Remove the software by double-clicking the **ISPSoft UnInstall**.



(3) To uninstall ISPSoft, click **Yes** shown in the pop-up window. The window will automatically close once the software is removed.



3.2 Installing and Uninstalling COMMGR

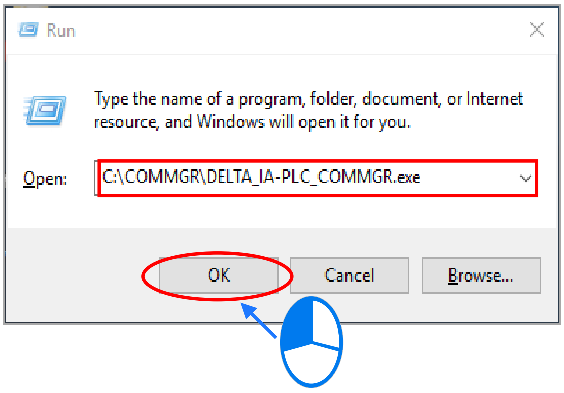
3.2.1 Installing COMMGR

COMMGR is a software independent of ISPSoft. It must be installed separately. When the previous version of COMMGR is detected in a computer, that version is advised to be uninstalled first before the latest COMMGR can be installed.

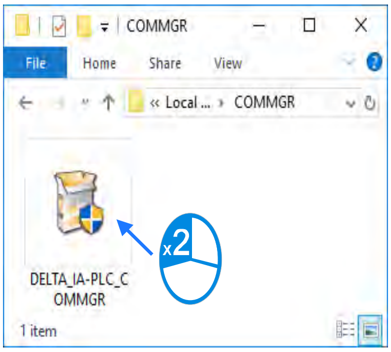
(1) Start a computer and enter the operating system. You have to log in to the system as a system administrator before installing COMMGR.

(2) Put a COMMGR CD in the CD-ROM drive, or download the installation program from the official Delta website http://www.deltaww.com/. (The installation programs need to be decompressed if downloaded from the internet.)

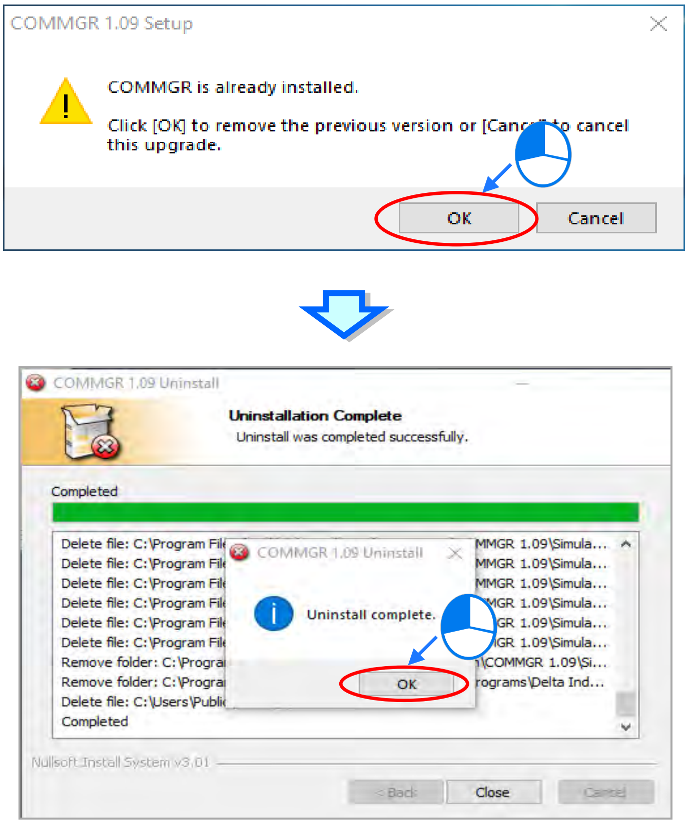
(3) Click **Start**, and then click **Run…** to open the **Run** window. Specify the path denoting the executable file which is used to install COMMGR in the **Open** box, and then click **OK**. Alternatively, you can double-click the Delta COMMGR setup icon to execute the installation program.



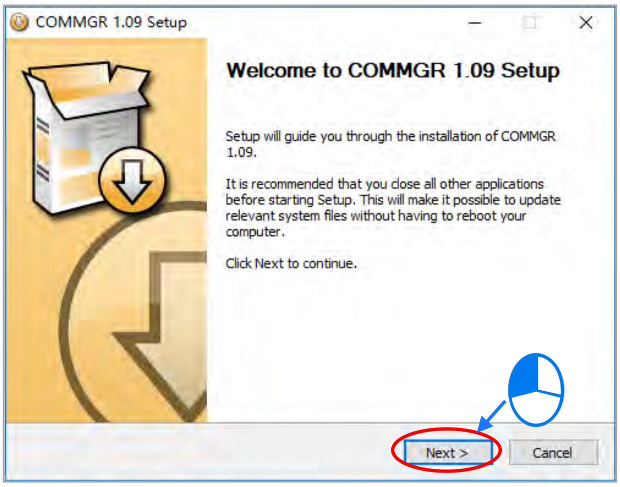
OR



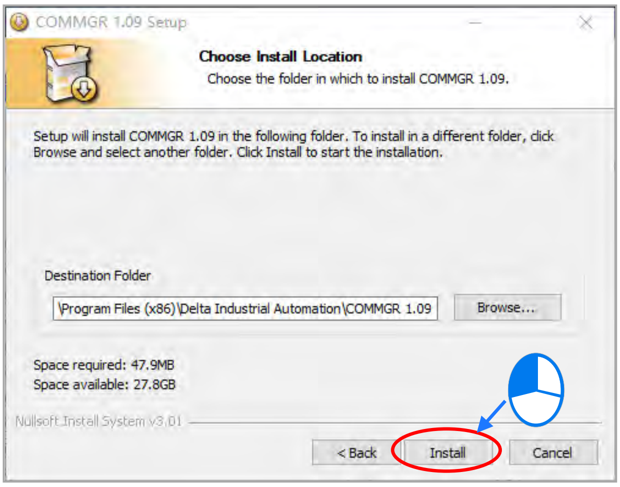
(4) When the previous version of COMMGR is installed, click **OK** to remove that version shown in the pop-up window (see below) and when uninstall is complete, click **OK** again.



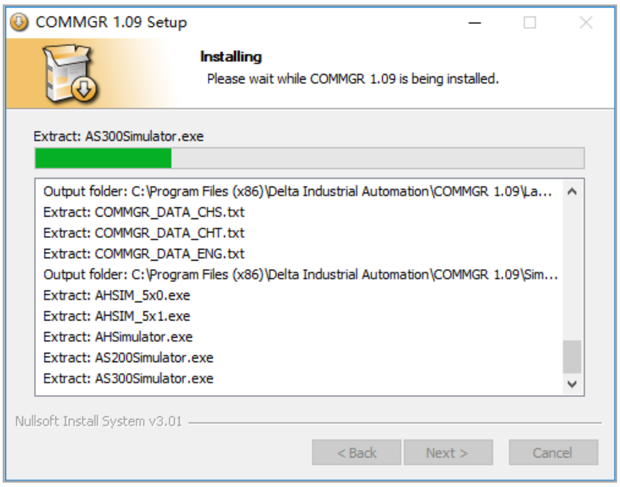
(5) Click **Next** after the Setup window appears.

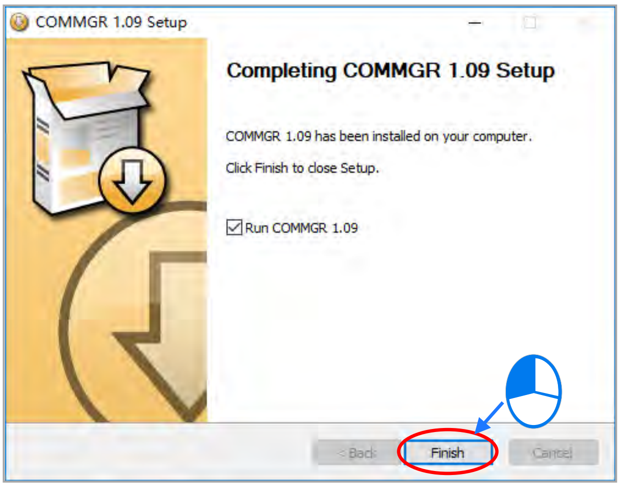


(6) Use default setup in the destination folder. Click **Install** to start the installation.



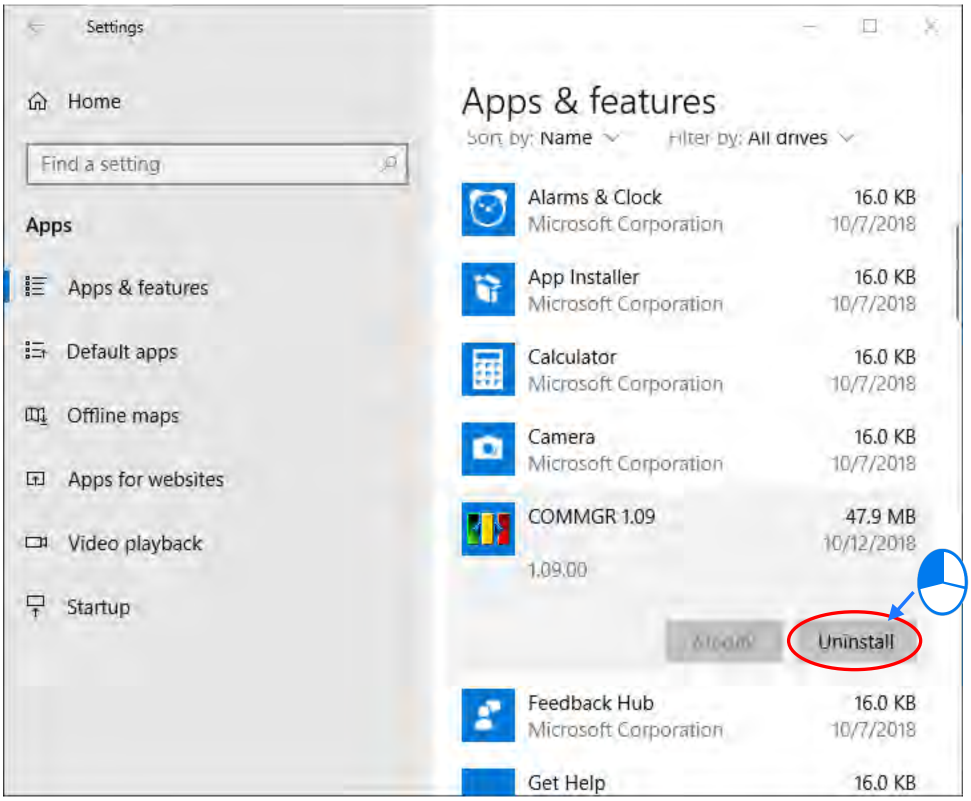
(7) When the installation is complete, the shortcut for COMMGR is created on the Start menu, click **Finish** to close the setup.



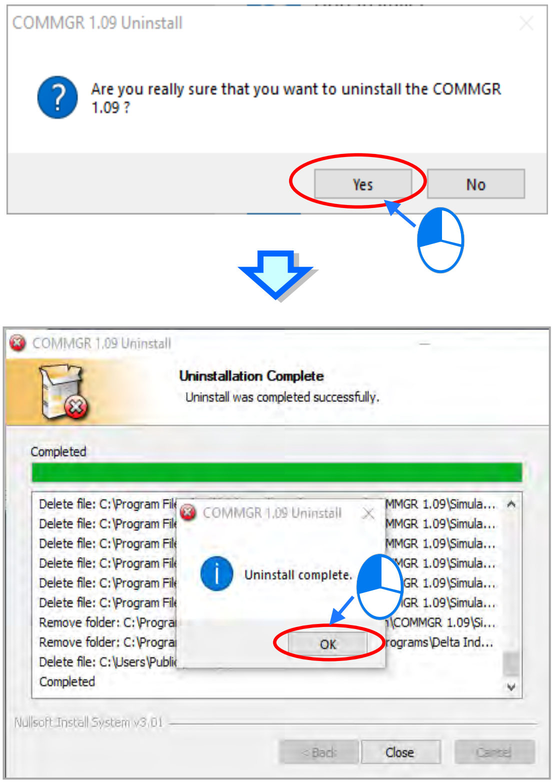


3.2.2 Uninstalling COMMGR

(1) Enter the settings of **Apps & features** in Windows, select **COMMGR x.xx** and click **Uninstall**.



(2) Click **Yes** and then **OK** to complete COMMGR uninstallation.



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Chapter 4 Installing Hardware

Table of Contents

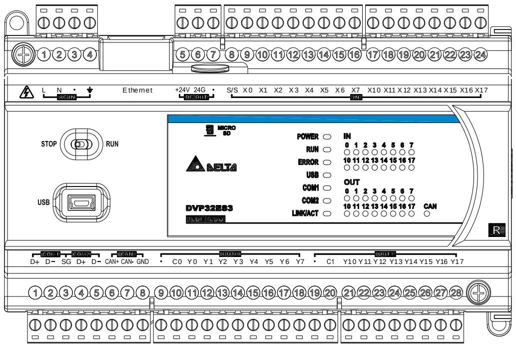
4.1 DVP-ES3 Hardware Framework

4.1.1 DVP-ES3 Hardware Component

The DVP-ES3 series programmable logic controller is a small programmable logic control (PLC). The execution speed and memory capacity are increased. Use of function blocks is also supported. In order to meet your more advanced application requirements, the DVP-ES3 series programmable logic controllers provide more flexible system extension frameworks. Under such system frameworks, you do not need to use several CPU modules to control the system because there are too many I/O points or the equipment is too far away. This retains system completeness, and you can be more efficient in developing projects.

The minimum framework requirement for the DVP-ES3 series system is only one CPU module.

DVP-ES3 CPU module (the example below uses AC power supply model)



The following lists the limits for setting up a common framework of the DVP-ES3 PLC system. Exceeding the first two limits causes the PLC to send an error message.

Limit 1: The maximum number of digital I/O points is 256. The built-in digital I/O points of the CPU module are included. If DI points are 200, you can have less than 56 DO points.

Limit 2: You can connect up to 8 modules (AD, DA, XA, PT, TC or PU) to the PLC.

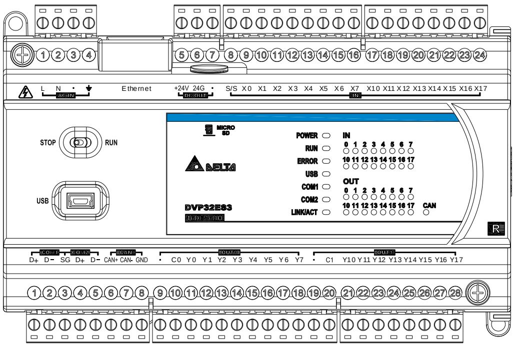
Limit 3: The maximum power consumption of CPU module and extension module should be within the range of what a CPU module or a power module can supply. Refer to section 4.5.4 for the maximum power consumption of modules.

4.1.2 Necessary Components

A completeDVP-ES3 Series system consists of the following two necessary components.

- **CPU module**

  A CPU module is the nucleus of a complete DVP Series system. It is responsible for controlling and managing the whole system. Delta Electronics, Inc. provides businesses with several types of CPU modules. You can select a CPU module according to your needs.



- **Communication cable**

  Several communication interfaces are included in a CPU module, and many types of network modules are available. You can select a suitable communication cable according to the actual situation.

  The following table lists information about communication interfaces and main applications.

Interface	Connector	Application
Communication port	Five-pin removable terminal block	Computer/HMI communication/Industrial control network (2x RS-485)
Ethernet	RJ45	Computer/HMI communication/Remote control/Data exchange/Industrial control network
USB	Mini USB	Computer communication

4.1.3 Optional Components

- **Extension modules**

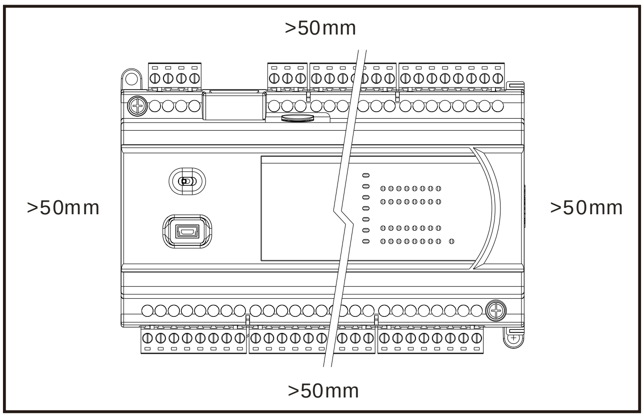
  Apart from the standard communication ports on a CPU module, the CPU module is equipped with I/O functions. Refer to section 1.1.2 for a selection of extension modules. You can select a suitable extension module according to your needs.

4.2 Notes on Installation

- Before a module is installed, please make sure of the size of the module. To ensure sufficient installation space, you must take into account the size of the communication cable connector and the room which needs to be reserved.
- Make sure that the work environment conforms to the specifications for the products. It is necessary to take into account basic temperature/humidity control and dust/corrosion prevention.
- Electromagnetic interference can result in system malfunction. Therefore, you must design the EMC carefully. Please refer to Appendix C in this manual for more information on EMC standards.
- If components such as screws and washers are specified in the manual, use components conforming to the specifications.
- If a cable is connected to a communication port, make sure the cable connector is properly joined to the port on the module.

4.3 Installation

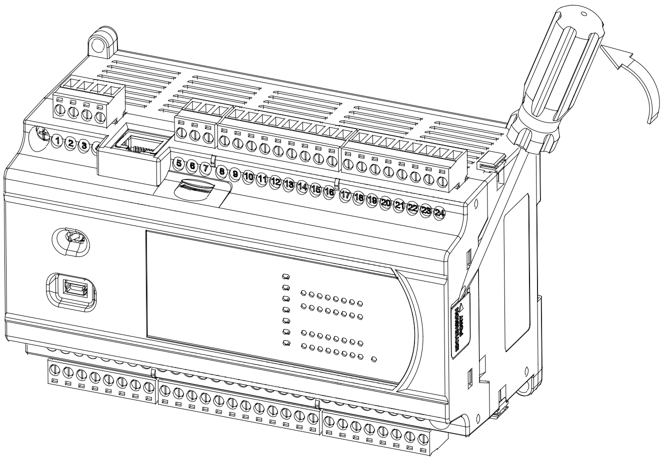
A PLC has to be installed in a closed control box. In order to ensure that the PLC radiates heat normally, the space between the PLC and the control box must be larger than 50 millimeters.



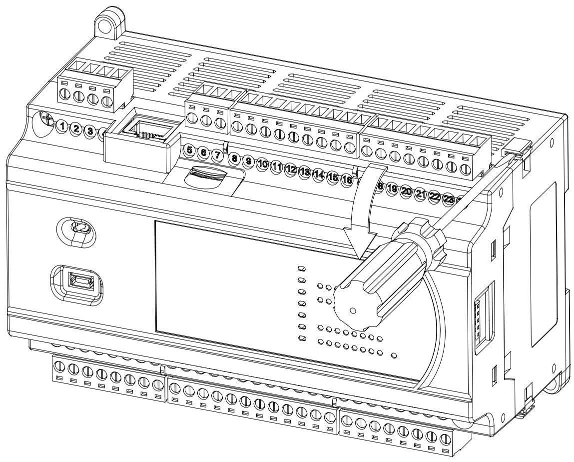
- Keep the PLC away from high-voltage equipment, high-voltage wires, and high-voltage motors.
- In order to prevent the PLC from overheating, do not install the PLC vertically on the bottom or top of the control box.
- Install the PLC horizontally in the control box, as shown above.
- If you intend to increase the number of modules, you must leave some space for installing the modules in the control box.

4.3.1 Linking the CPU module and a module

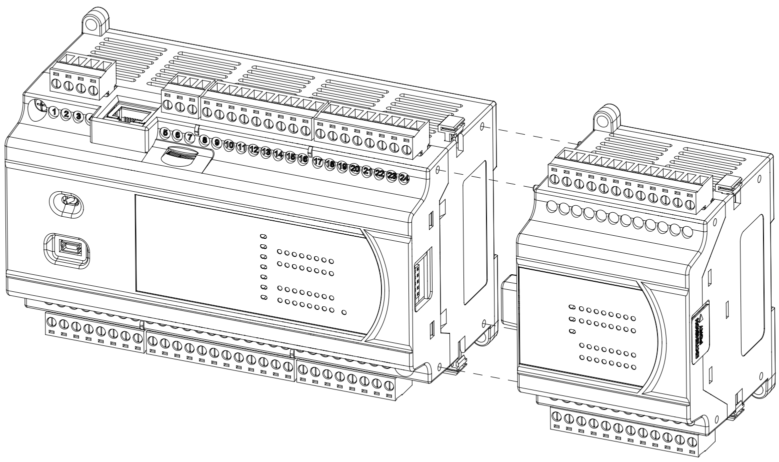
Step 1: Use a flat head screwdriver to open the side cover on the CPU module for linking a module.

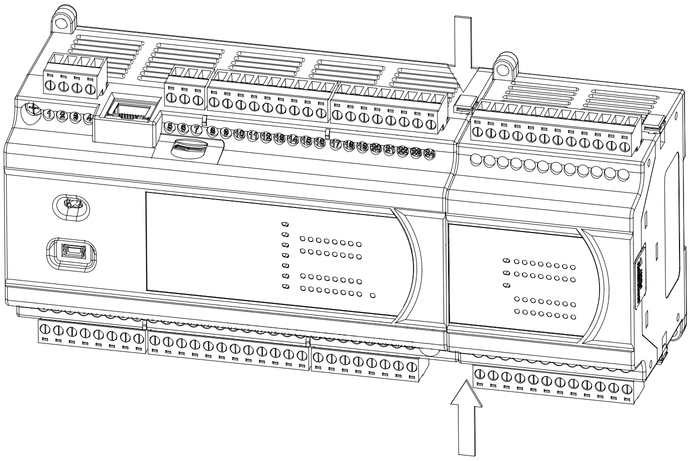


Step 2: Use a flat head screwdriver to release the I/O module securing clip.



Step 3: Connect the CPU module and the module with the I/O connecting ports.



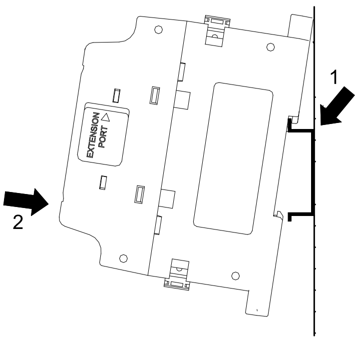
Step 4: Push the two I/O module securing clips towards the directions as the arrows below shown to hook the modules together.


4.3.2 Installation on the Set

Method 1 – Direct installation: Use M4 screws on the mounting hole to fasten the module.

Method 2 – Installation with a DIN rail

- Install the module on a DIN rail.
    1. Link the module onto the DIN rail as the number 1 arrow indicated.
    2. Push the module into the DIN rail as the number 2 arrow indicated, until you hear a click.
    3. Make sure they are hooked together and the installation is done.
- Remove the module from a DIN rail
    1. Use a flat head screwdriver to unlink the module from the DIN rail.
    2. Pull the module away from the DIN rail.



4.4 Wiring

- **Warnings**

WARNING

- Before installing or wiring a module, you must verify that the external power supply is turned off. If the power supply is not turned off, you may get an electric shock, or the product may be damaged.
- After you complete installing or wiring the module, make sure that a terminal block cover is installed on the module before turning on the power supply or operating the module. If the terminal block cover is not installed properly, you may get an electric shock, or the module may not operate normally.
- Be sure to connect the terminals FG and LG ⏚/⏚ with protective grounding conductors. Otherwise, you may get an electric shock, or the module may not operate normally.
- To ensure that a PLC is wired correctly, you must check the rated voltage of the product and the arrangement of the terminals. If the PLC is connected to a power supply that does not conform to the rated voltage, or the product is not wired correctly, a fire may occur, or the product may be damaged.
- The external connections should be crimped, press-welded by specific tools, or soldered correctly. Improper connections may result in a short circuit, fire, or malfunction.
- Tighten the terminal screws to the specified torque. If the terminal screws are loose, a short circuit, fire, or faulty operation may occur. Tightening the terminal screws too far may cause damage to the terminal screws or the module, resulting in a short circuit or malfunction.
- Make sure there are no foreign substances such as iron filings or wiring debris inside the module. Foreign substances may result in a fire, damage, or malfunction.

- **Things to note while wiring an I/O module**

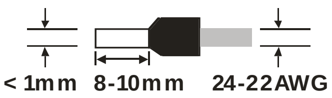
(1) Terminal definitions

◆ Two-/three-wire (passive sensor): the sensor and the system share the same power circuit.

◆ Four-wire (active sensor): the sensor uses an independent power supply and should not share the same power circuit with the system.

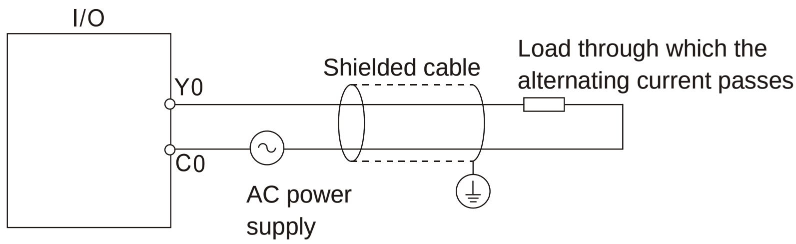
(2) Terminals with insulation sleeves cannot be used as a terminal block. It is recommended that the terminals be covered with insulation tubes.

(3) Use single-wire cables or two-wire cables with a diameter of 24 AWG to 22 AWG (2mm) and with less than 1mm pin-type terminals. Only use copper conducting wires with a temperature rating of 60/75°C.



(4) Keep the input cables, output cables, and power cable separate from one another.

(5) If the main circuit and the power cable cannot be separated from each other, use a shielded cable, and ground it at the side of the I/O module. In some cases, the shielded cable can be grounded at the opposite side.



(6) If you wire a module through conduit, you must ground the conduit correctly.

(7) Keep 24 VDC input cables separate from 110 VAC input cables and 220 VDC input cables.

(8) If the wiring length is more than 200 meters (686.67 inches), leakage current can result from parasitic capacitance, and the system will not function properly.

- **Things to note while grounding**

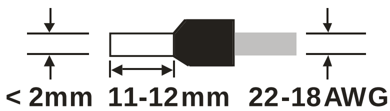
1. Use correct and independent method to grounding.

2. Use single-wire cables or two-wire cables in a diameter of 22 AWG to 18 AWG and with less than 2 mm pin-typed terminals.

3. Make the grounding point close to the PLC and make sure ground the surge protector and the PLC system.

Notes:

(1) Use 110 V/220 V power cable and the 24 VDC power cable with a diameter of 22-18AWG and with less than 2 mm pin-type terminals. Be sure to twist the power cables at the terminal screws. To prevent a short circuit from loose screws, you must use solderless terminals with insulation sleeves.



(2) If cables are connected to the terminals LG and FG, you must ground the cables. Do not connect LG and FG to any devices. If LG and FG are not grounded, the PLC will be susceptible to noise. Since LG carries electric potential, you will get an electric shock if you touch the metal parts.

4.5 Connecting Power Cables

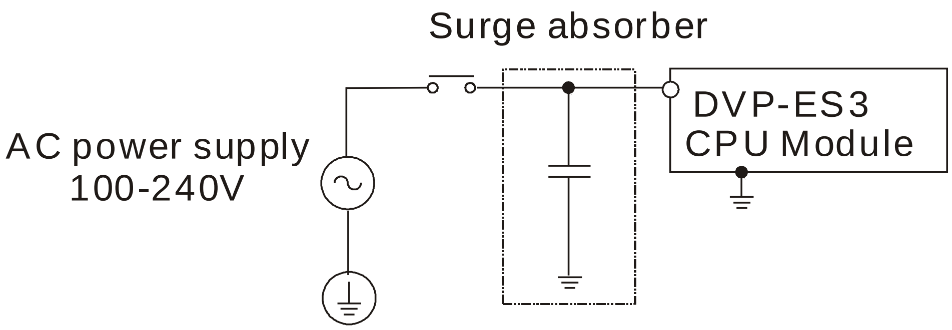
4.5.1 Precautions

- **Connecting AC power cables**

(1) The cables carrying the 110 VAC, 220 VAC, and 24 VDC should be single or two-wire cables.

(2) Do not bundle 110 VAC cable, 220 VAC cable, 24 VDC cable, the (high-voltage high-current) main circuit, and the I/O signal cable together. The distance between adjacent cables should be more than 100 millimeters (3.94 inches).

(3) To prevent electrical surge from lightning, install a surge protector as shown below.



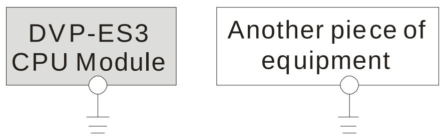
Points for attention:

1. Ground the surge protector and the PLC system.

2. Select the surge protector with a working voltage that is not less than the maximum allowable input voltage.

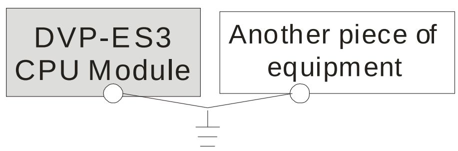
4.5.2 Ground

- The diameter of the ground should not be less than the diameters of the cables connected to the terminals L and N.
- If using multiple pieces of equipment, use a single-point ground.



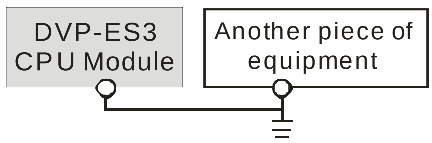
The single-point ground is better.

- If you cannot use a single-point ground, use a common-point ground.



The common-point ground is permitted.

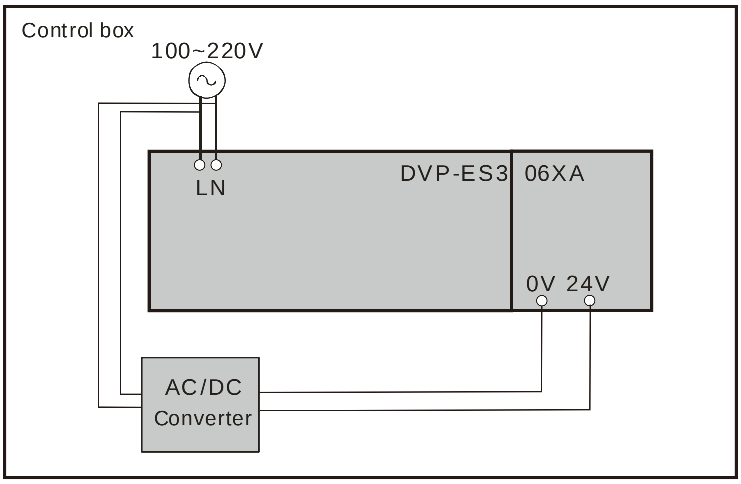
- Do not connect equipment ground wires together as shown on the right.



The equipment can not be grounded in this way.

4.5.3 Wiring Power Supply

- **Connecting an AC power cable**



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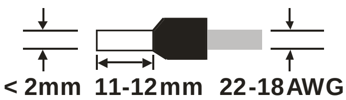
The power input of DVP-ES3 is the AC input.

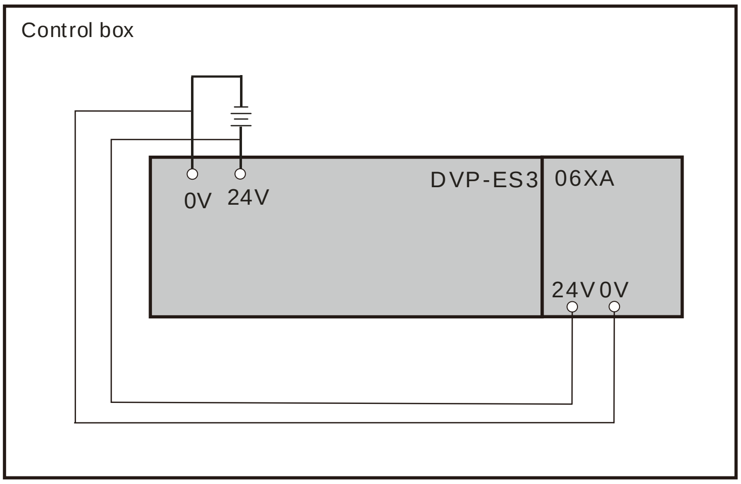
- The alternating-current input voltage is between 100 VAC–240 VAC. Connect the power supply to the terminals L and N. If you connect the 110 VAC or the 220 VAC power supply to the input terminals +24V and 24G, you will damage the PLC.

- If a power outage lasts for less than 10 milliseconds, the PLC keeps running without being affected. If the power outage lasts longer, or if the voltage of the power supply decreases, the PLC stops running, and there is no output. When the power supply returns to normal, the PLC resumes operating. Note that there are latched auxiliary relays and registers in the PLC when you write the program.

- Use single-wire cables or two-wire cables in a diameter of 22 AWG to 18 AWG and with less than 2 mm pin-typed terminals. Only use copper conducting wires with a temperature rating of 60/75°C.



- **Connecting an DC power cable**



Note: Use appropriate power supply according to your device choice.

4.5.4 Power Consumption

Classification	Model name	Internal power consumption (mA)	Internal power consumption (W)	External power consumption (W)
CPU module	DVP32ES311T	137	3.3	N/A
Digital I/O module	DVP08XM211N	10	0.24	N/A
	DVP08XP211R	30	0.72	N/A
	DVP08XP211T	12	0.29	0.12
	DVP08XN211R	55	1.32	N/A
	DVP08XN211T	12	0.29	0.24
	DVP16XM211N	14	0.34	N/A
	DVP16XP211R	14	0.34	1
	DVP16XP211T	14	0.34	0.36
	DVP16XN211R	14	0.34	1.9
	DVP16XN211T	16	0.38	0.72
	DVP24XP200R	12	0.29	N/A
	DVP24XP200T	14	0.34	0.36
	DVP24XN200R	14	0.34	N/A
	DVP24XN200T	18	0.43	0.72

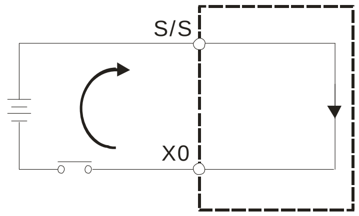
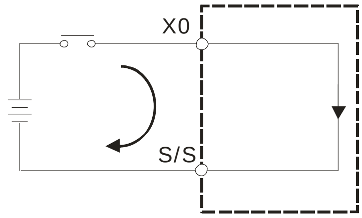
Classification	Model name	Internal power consumption (mA)	Internal power consumption (W)	External power consumption (W)
	DVP32XP200R	14	0.34	N/A
	DVP32XP200T	16	0.38	0.72
Analog I/O module	DVP04AD-E2	15	0.36	1
	DVP02DA-E2	15	0.36	1.5
	DVP04DA-E2	15	0.36	3
	DVP06XA-E2	16.7	0.4	2.5
Temperature measurement module	DVP04PT-E2	15	0.36	1.5
	DVP06PT-E2	16.7	0.4	1.5
	DVP04TC-E2	15	0.36	1.2

4.6 Wiring CPU Modules

4.6.1 Wiring Digital Input Terminals

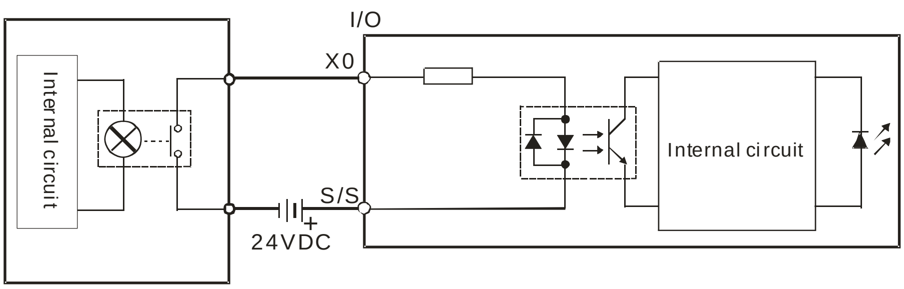
4.6.1.1 Direct Current Power Supply (24 VDC)

When the digital input signal is DC input, there are two DC input types, Sinking and Sourcing. See the definition below.

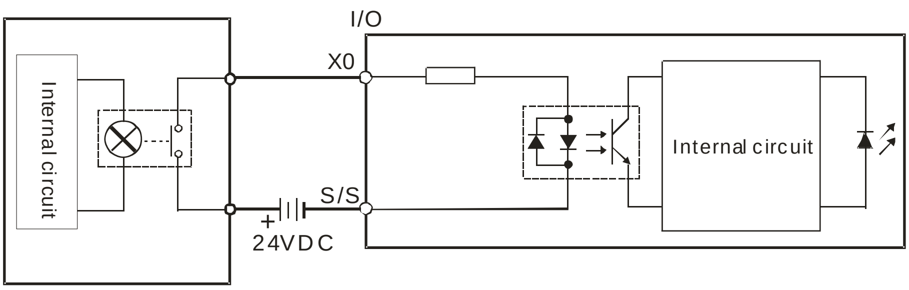
● Sinking Sink = The current flows into the common terminal S/S.  	● Sourcing Source = The current flows from the common terminal S/S. 

4.6.1.2 Relay Types

- **Sinking**

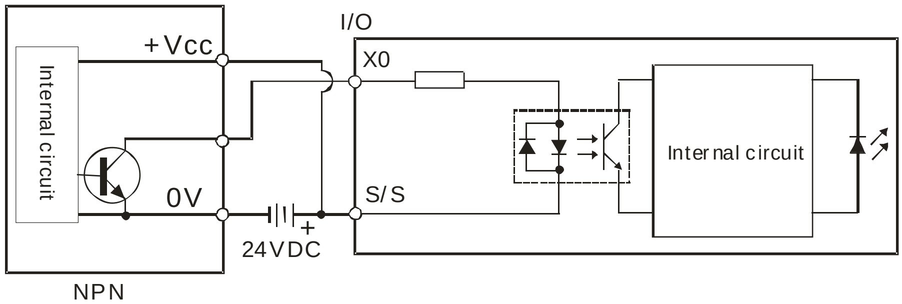


- **Sourcing**

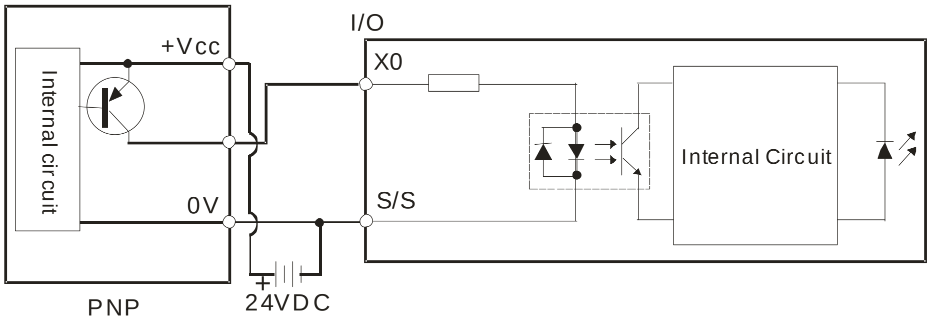


4.6.1.3 Open-collector Input Types

- **Sinking (NPN input type)**



- **Souring (PNP input type)**

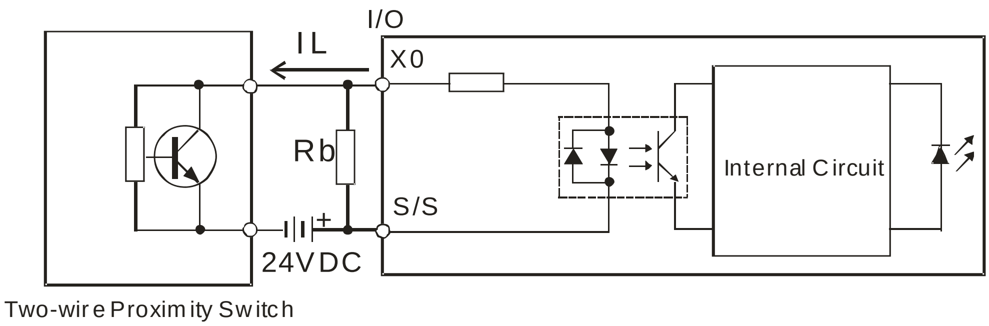


4.6.1.4 Two-wire Proximity Switch

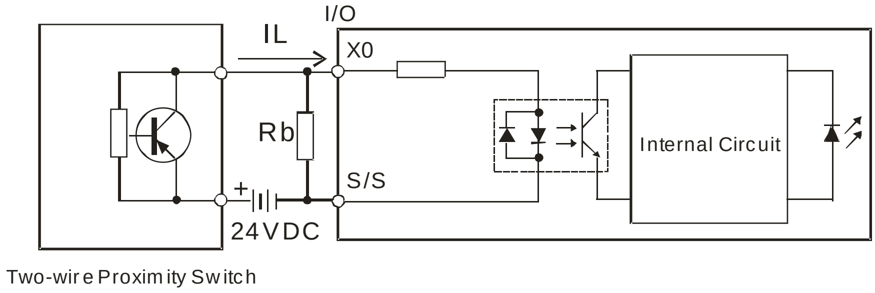
Use the two-wire proximity switch whose leakage current IL is less than 1.5 mA when the switch is OFF. If the leakage current is larger than 1.5 mA, connect the divider resistance Rb using the formula below.

$$Rb \leq \frac{6}{IL - 1.5} \quad (k\Omega)$$

- **Sinking**



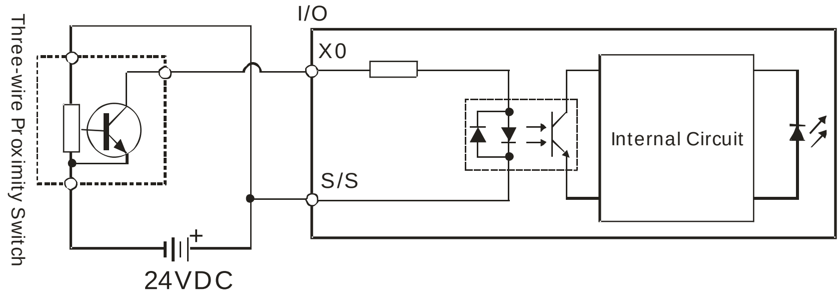
- **Souring**



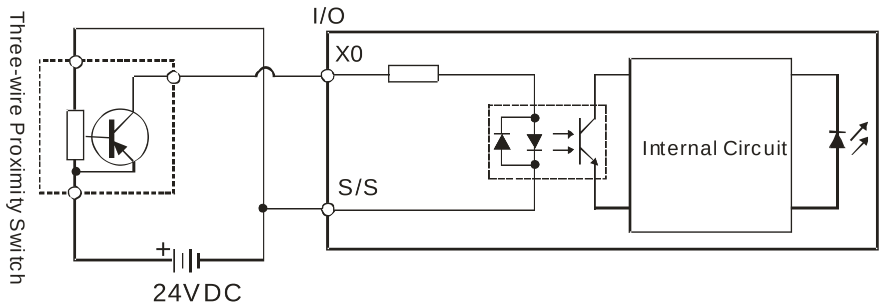
4.6.1.5 Three-wire Proximity Switch

4

- **Sinking**

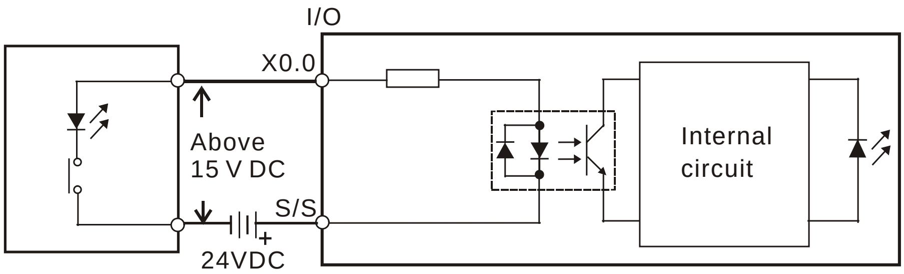


- **Souring**



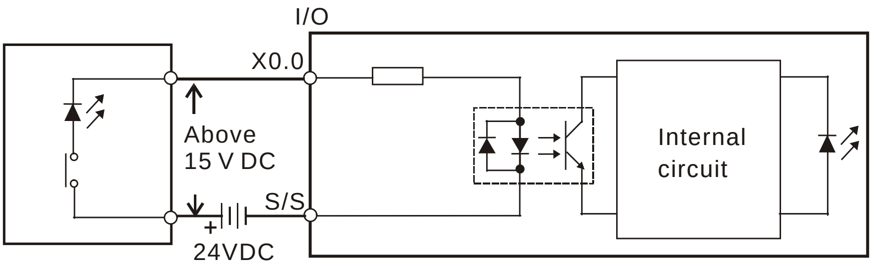
4.6.1.6 Optoelectronic Switch

- **Sinking**



Optoelectronic switch

- **Souring**



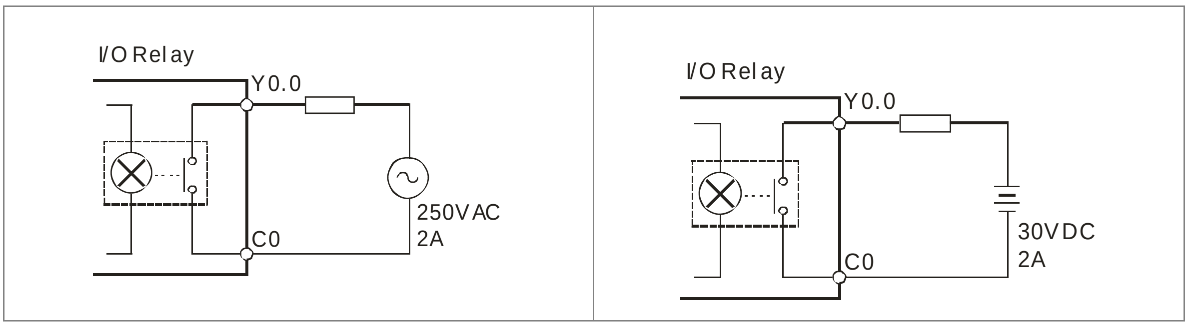
Optoelectronic switch

4.6.2 Wiring Digital Output Terminals

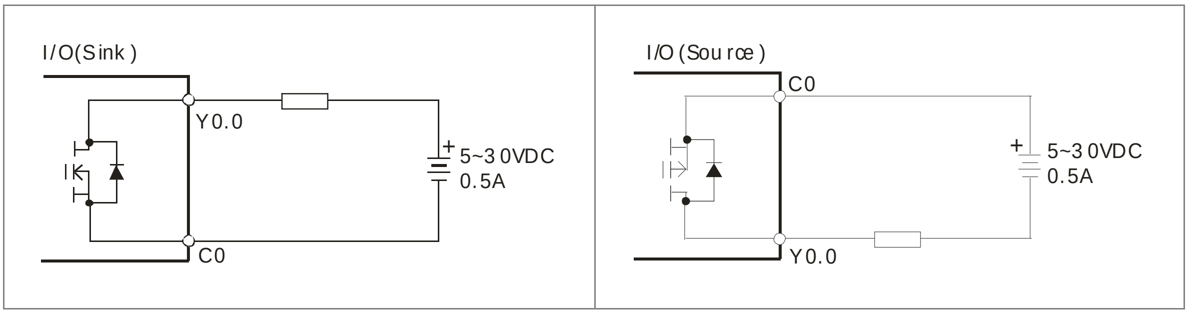
4.6.2.1 Output Circuits

There are two types of output units. They are relay outputs and transistor outputs.

1. Relay output



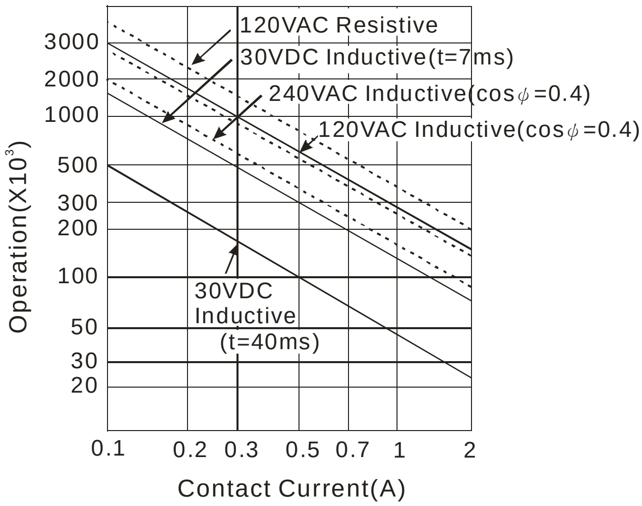
2. Transistor output



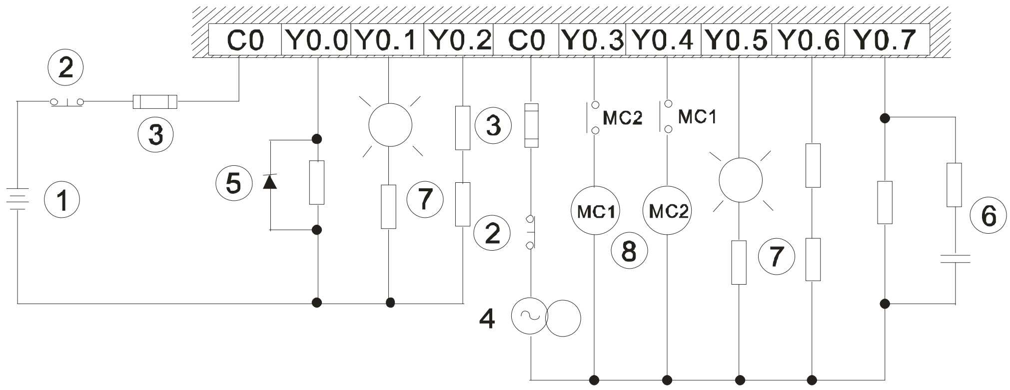
4.6.2.2 Relay Output Circuit

4

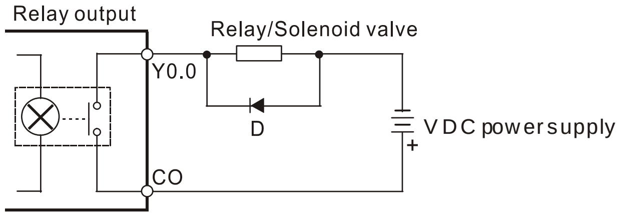
Relay terminals have no polarity. They can be used with alternating current that passes through a load, or with direct current that passes through a load. The maximum current that can pass through every relay terminal is 2 A, and refer to each product specification for the maximum current that can pass through every common terminal. The lifetime of a relay terminal varies with the working voltage, the load type (the power factor cosψ), and the current passing through the terminal. The relation is shown in the life cycle curve below.



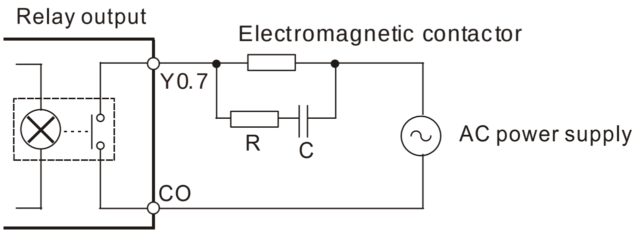
- Relay output circuit



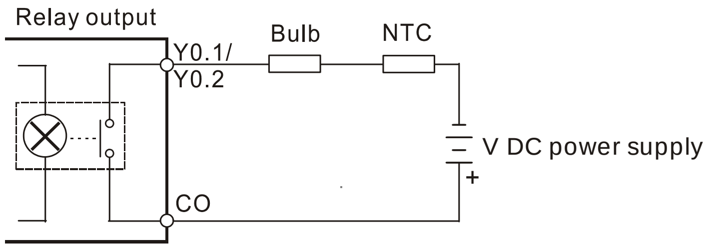
<table>
<tr><td>①</td><td>Direct-current power supply</td></tr>
<tr><td>②</td><td>Emergency stop using an external switch.</td></tr>
<tr><td>③</td><td>Fuse: to protect the output circuit, a fuse having a breaking capacity between 5 A to 10 A is connected to the common terminal.</td></tr>
<tr><td>④</td><td>Alternating-current power supply</td></tr>
<tr><td>⑤</td><td>A relay or a solenoid valve is used as a DC load. A diode is connected in parallel to absorb the surge voltage that occurs when the load is OFF.



D: 1N4001 diode</td></tr>
<tr><td>⑥</td><td>An electromagnetic contactor is used as an AC load. A resistor and a capacitor are connected in parallel to absorb the surge voltage that occurs when the load is OFF.

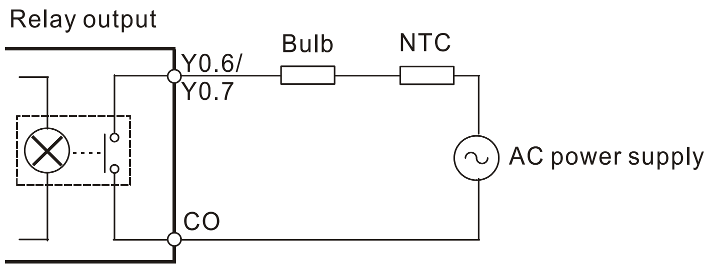


R: 100~120 Ω
C: 0.1~0.24 uF</td></tr>
<tr><td>⑦</td><td>A bulb (incandescent lamp) is used as a DC load. A thermistor is connected in series to absorb the surge current that occurs when the load is ON.



NTC:10 Ω

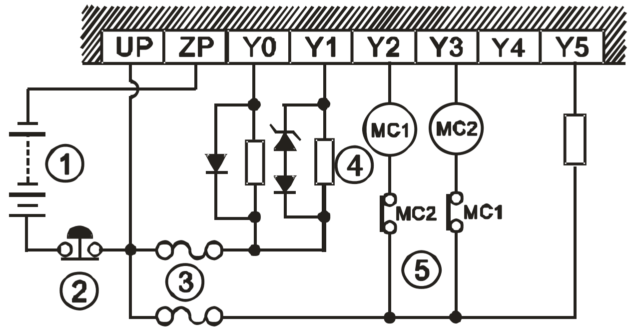
A bulb (neon lamp) is used as an AC load. A thermistor is connected in series to absorb the surge current that occurs when the load is ON.

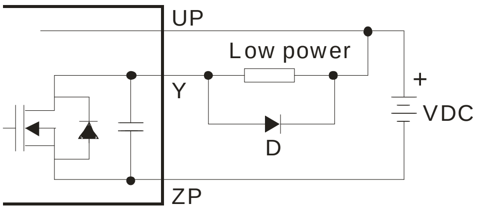


NTC: 10 Ω</td></tr>
<tr><td>⑧</td><td>Mutually exclusive output: For example, Y0.3 controls the clockwise rotation of the motor, and Y0.4 controls the counterclockwise rotation of the motor. This interlock circuit and the program in the PLC ensure that there are protective measures if an abnormal condition occurs.</td></tr>
</table>

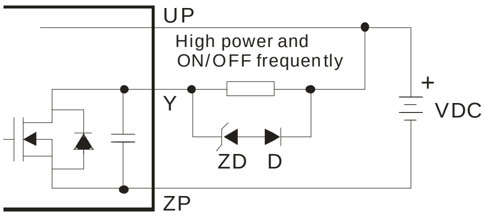
4

4.6.2.3 Transistor Output Circuit (NPN)





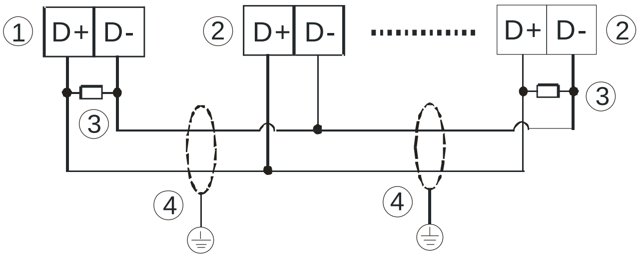
D: 1N4001 Diode or its equivalent



D: 1N4001 Diode or its equivalent
ZD: 9V Zener, 5W

①	Direct-current power supply
②	Emergency stop
③	Fuse
④	The output terminals of a transistor module are open-collector output terminals. If Y0.0/Y0.1 is a pulse train output terminal of a transistor module, the output current passing through its output pull-up resistor must be greater than 0.1 A to ensure that the transistor module operates normally. 1. A diode is connected in parallel to absorb the surge voltage: used in low-power situations (refer to Figure 1). 2. A diode and Zener are connected in parallel to absorb the surge voltage: used in high-power and power-on/off frequently situations (refer to Figure 2).
⑤	Mutually exclusive output: For example, Y2 controls the clockwise rotation of the motor, and Y3 controls the counterclockwise rotation of the motor. This interlock circuit and the program in the PLC ensure that there are protective measures if an abnormal condition occurs.

4.6.3 Wiring RS-485 Terminals

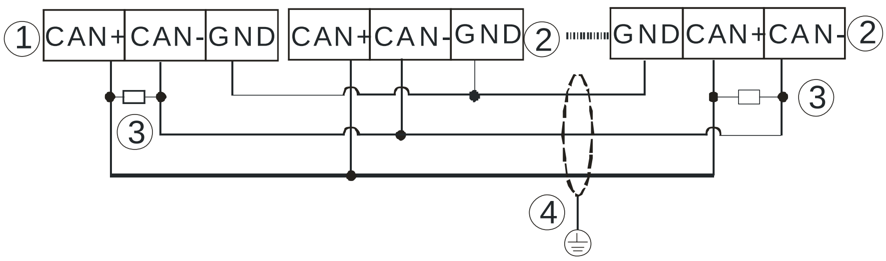


①	Master	②	Slave	③	Terminal resistor	④	Shielded cable

Note:

1. It is suggested to use 120Ω terminal resistors on the master and the last slave.
2. Use two-wire shielded cables in a diameter of 20 AWG to ensure a quality communication.

4.6.4 Wiring CANopen Terminals



①	Master	②	Slave	③	Terminal resistor	④	Shielded cable

Note:

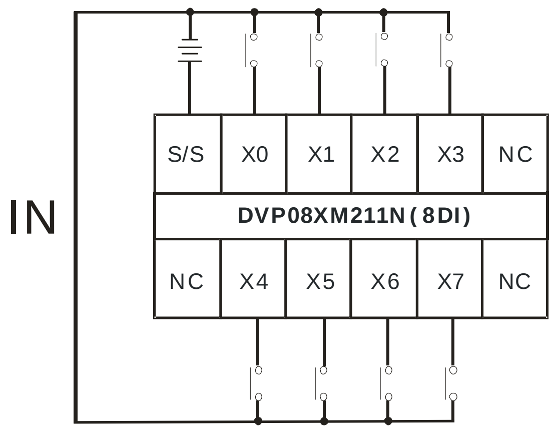
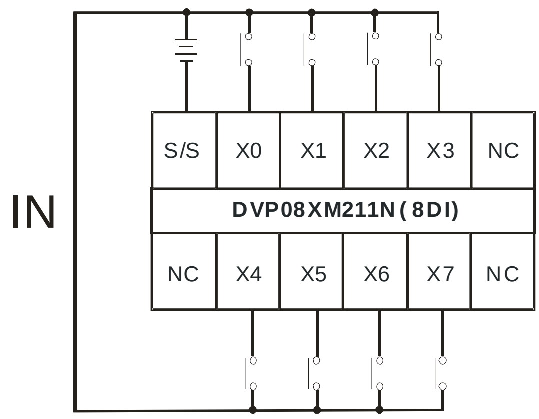
1. It is recommended to use Daisy Chain for connection and be sure to use 120Ω terminal resistor in the beginning and the end of the terminal arrangement.
2. GND is the grounding signal for CANopen network.

4.7 Wiring Digital Input / Output Modules

This section illustrates how to wire digital input/output modules. The wiring diagrams below also illustrate how the power supplies are connected to S/S, and COM. If you need more information about wiring of digital input/output terminals, refer to Section 4.6.1 and 4.6.2 in this manual.

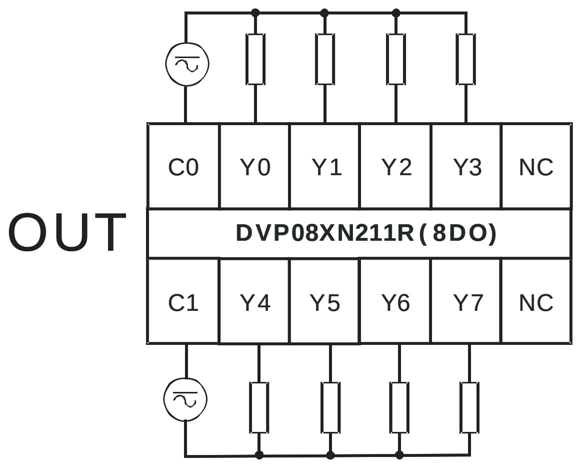
4.7.1 Wiring DVP08XM211N

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA

Sinking	Sourcing
	

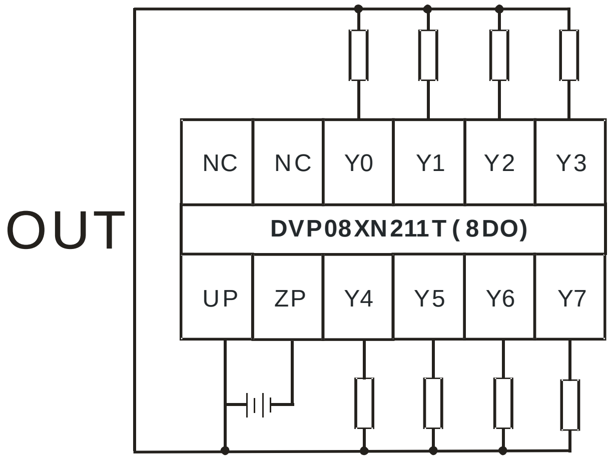
4.7.2 Wiring DVP08XN211R

Output form	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM



4.7.3 Wiring DVP08XN211T

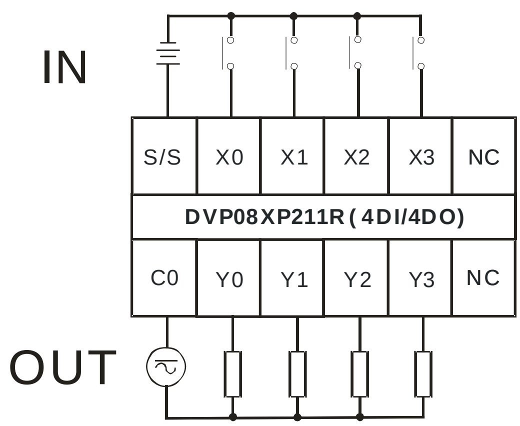
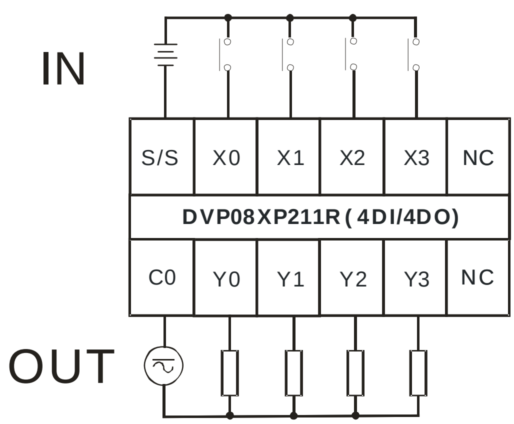
Output form	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM



Note: You need to add external power supply 24 VDC (-15% ~ +20%) for UP and ZP; power consumption is up to 10 mA.

4.7.4 Wiring DVP08XP211R

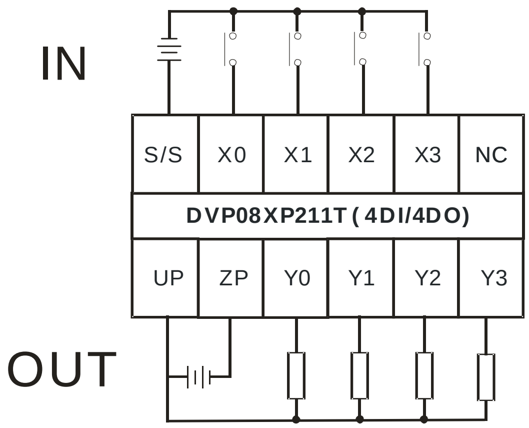
Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM

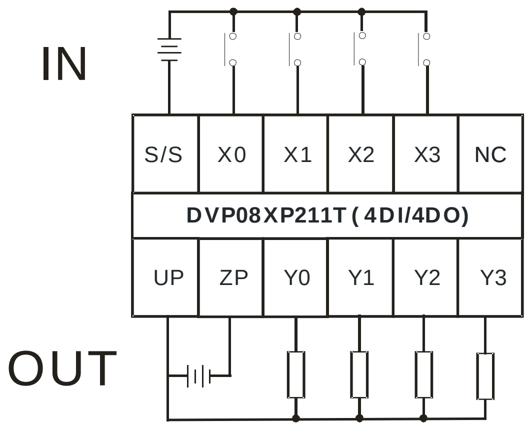
Sinking input and relay output	**Sourcing input and relay output**
	

4.7.5 Wiring DVP08XP211T

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM

Sinking input and output	Sourcing input and sinking output

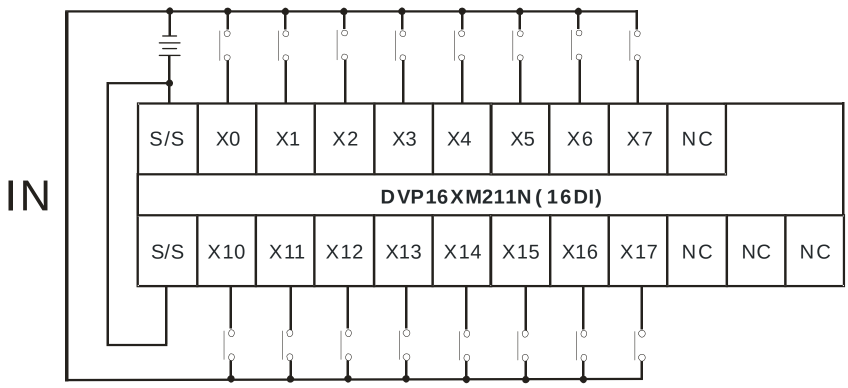
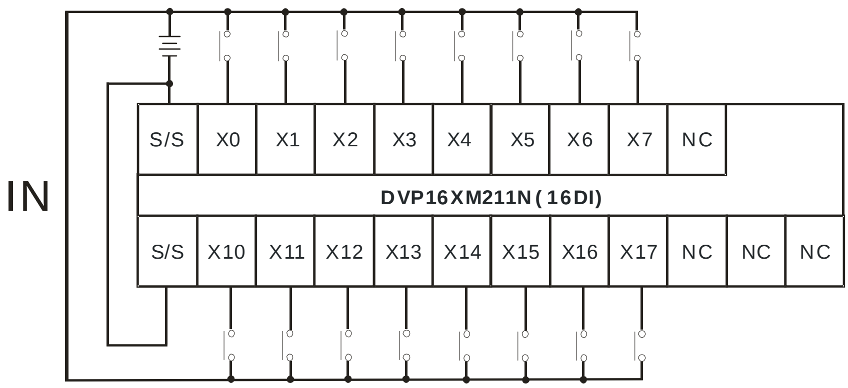




Note: You need to add external power supply 24 VDC (-15% ~ +20%) for UP and ZP; power consumption is up to 5 mA.

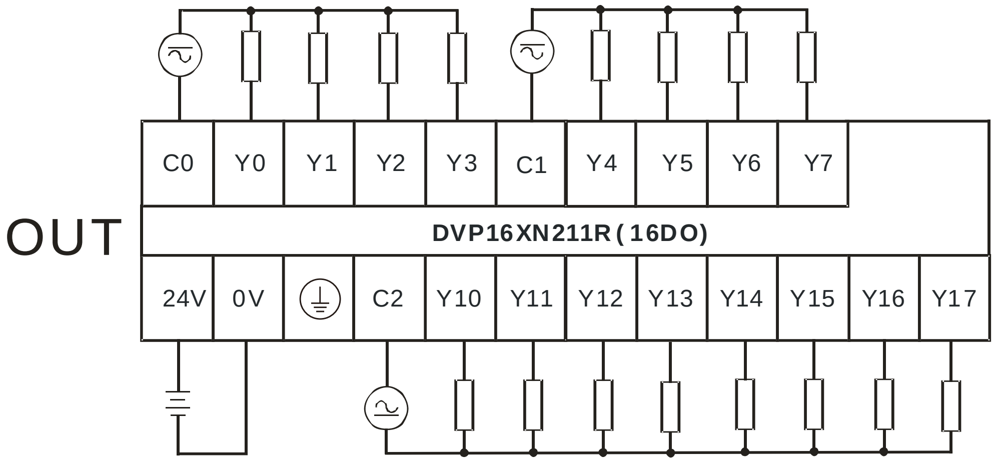
4.7.6 Wiring DVP16XM211N

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA

Sinking input	
Sourcing input	

4.7.7 Wiring DVP16XN211R

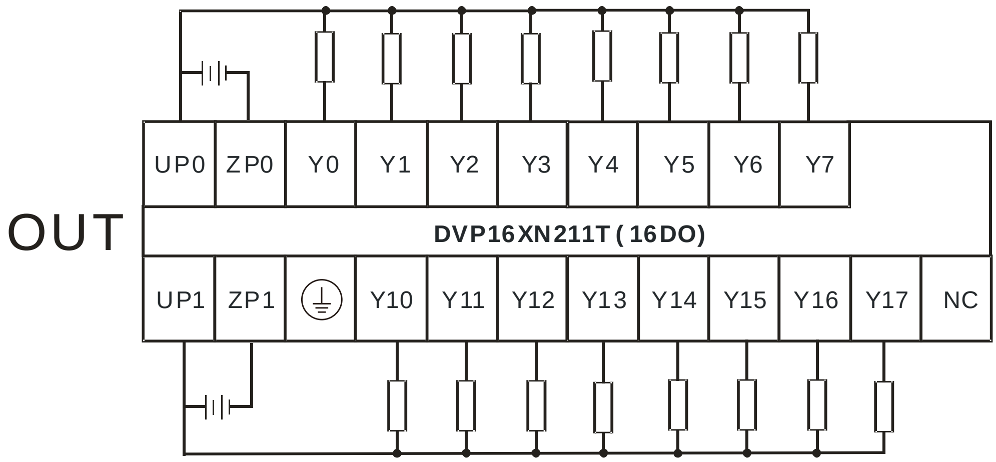
Output type	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM



Note: Connect the terminal ⏚ to ground.

4.7.8 Wiring DVP16XN211T

Output type	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM



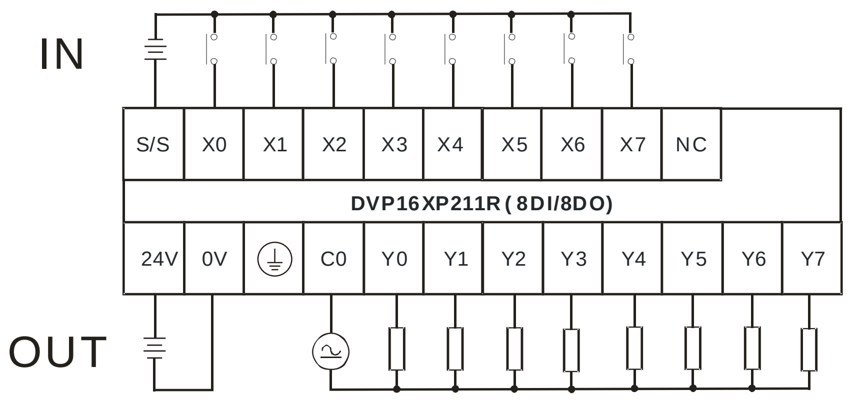
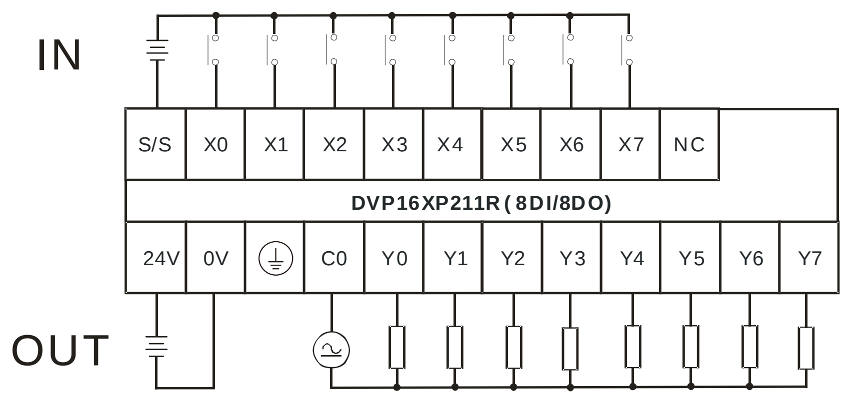
Note:

1. You need to add external power supply 24 VDC (-15% ~ +20%) for UP0, ZP0 and UP1, ZP1; power consumption is up to 30 mA.

2. Connect the terminal ⏚ to ground.

4.7.9 Wiring DVP16XP211R

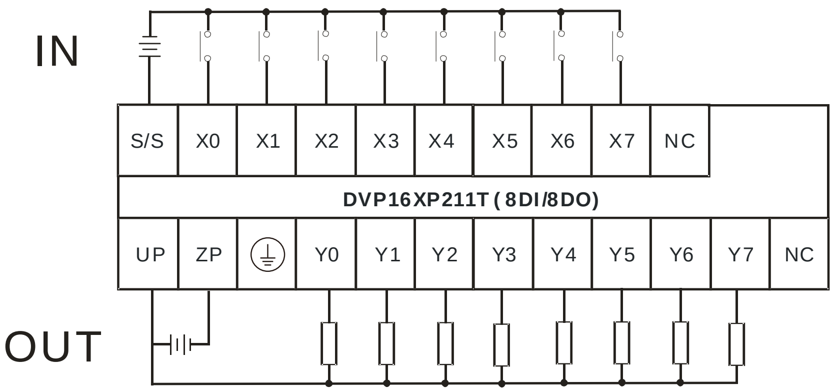
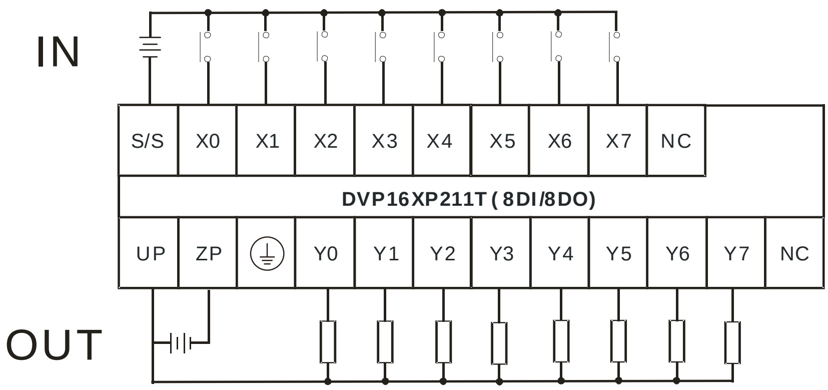
Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM

<table>
<tr><td>Sinking input and relay output</td><td>
</td></tr>
<tr><td>Sourcing input and relay output</td><td>
</td></tr>
</table>

Note: Connect the terminal ⏚ to ground.

4.7.10 Wiring DVP16XP211T

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM

Sinking input and output	
Sourcing input and sinking output	

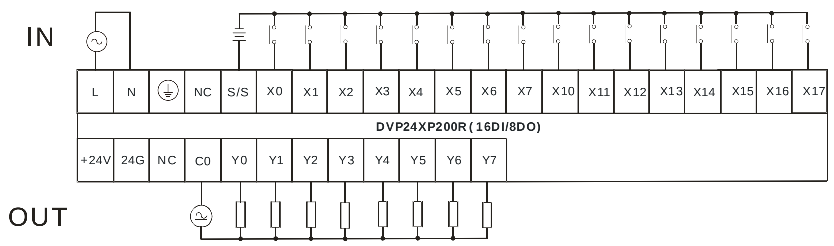
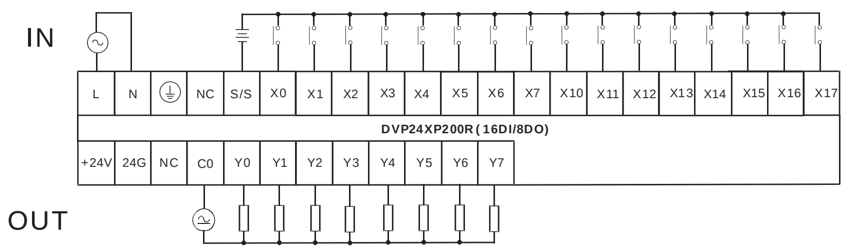
Note:

1. You need to add external power supply 24 VDC (-15% ~ +20%) for UP and ZP; power consumption is up to 15 mA.

2. Connect the terminal ⏚ to ground.

4.7.11 Wiring DVP24XP200R

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM

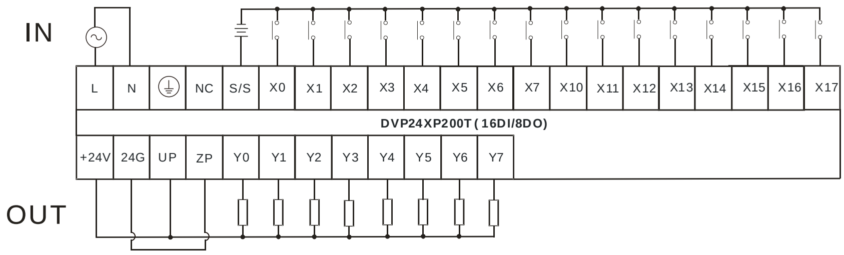
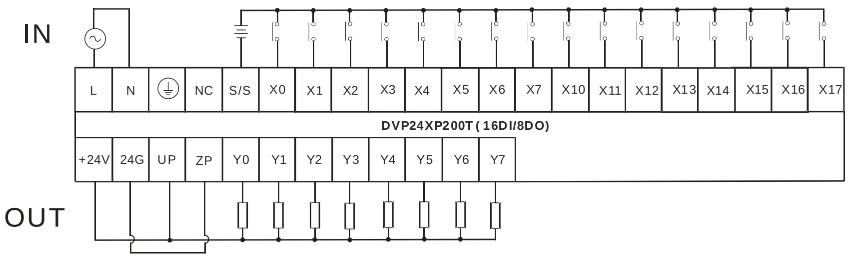
Sinking input and relay output	
Sourcing input and relay output	

Note:

1. The module is built-in with a +24 V power supply for I/Os to use.
2. Connect the terminal ⏚ to ground.

4.7.12 Wiring DVP24XP200T

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM

Sinking input and output	
Sourcing input and sinking output	

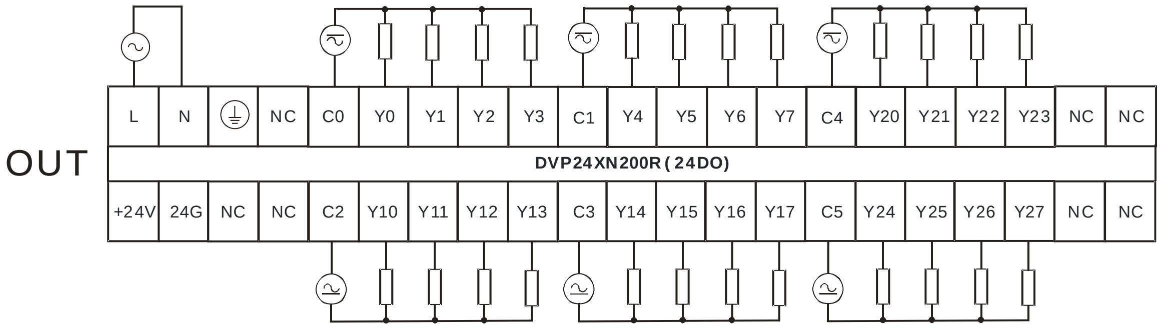
Note:

1. You need to add external power supply 24 VDC (-15% ~ +20%) for UP and ZP; power consumption is up to 15 mA.

2. Connect the terminal to ground.

4.7.13 Wiring DVP24XN200R

Output type	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM



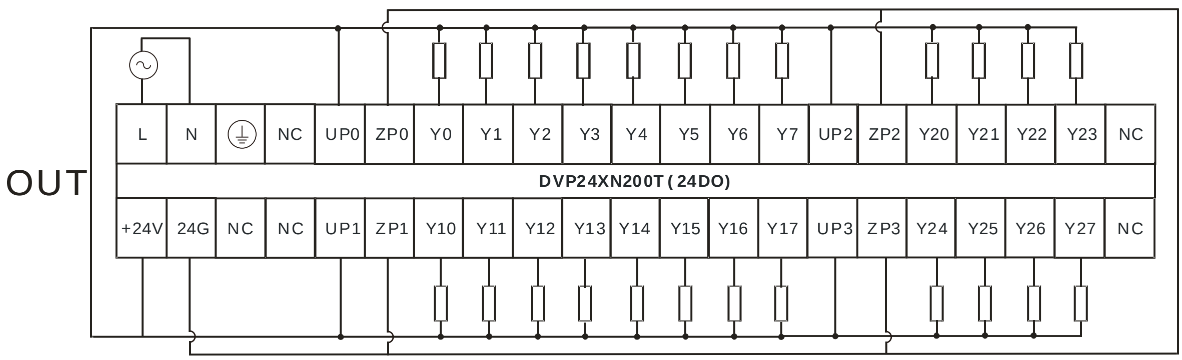
Note:

1. The module is built-in with a +24 V power supply for I/Os to use.

2. Connect the terminal ⏚ to ground.

4.7.14 Wiring DVP24XN200T

Output type	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM



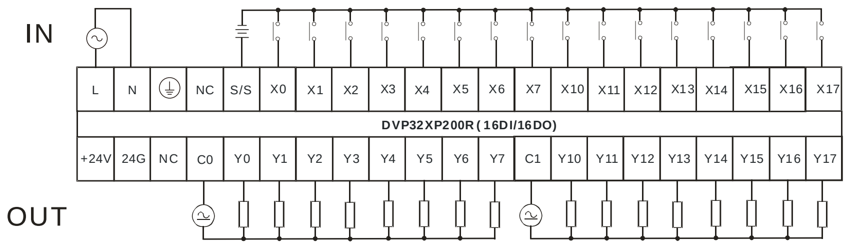
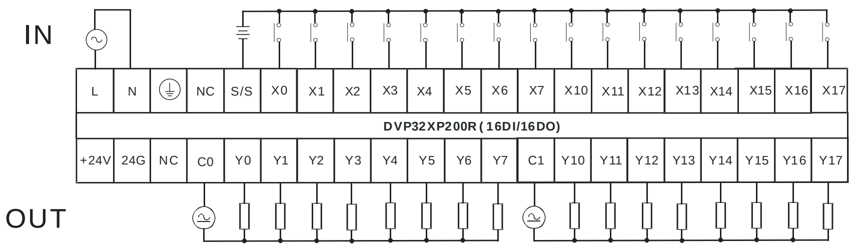
Note:

1. You need to add external power supply 24 VDC (-15% ~ +20%) for UP0, UP1, UP2, UP3 and ZP0, ZP1, ZP2, ZP3; power consumption is up to 30 mA.

2. Connect the terminal ⏚ to ground.

4.7.15 Wiring DVP32XP200R

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Relay
Voltage specifications	250 VAC, below 30 VDC, 2A/output, 5A/COM

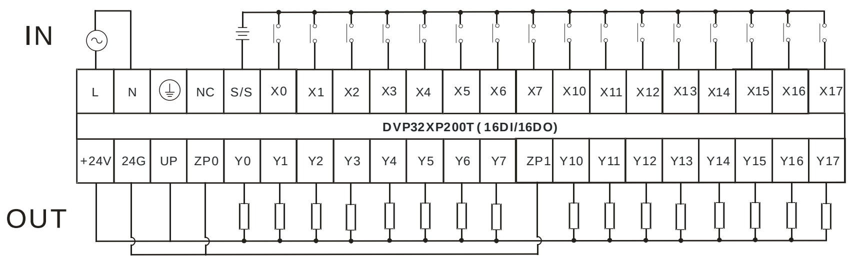
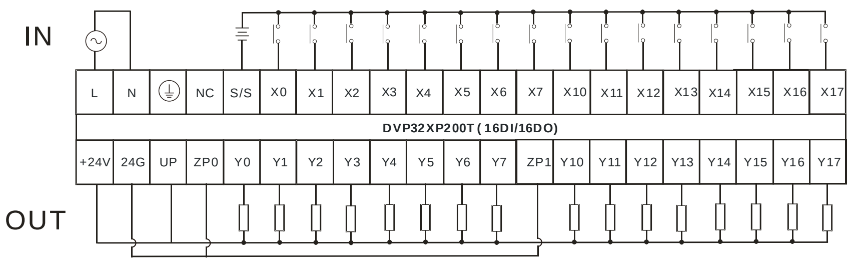
Sinking input and relay output	
Sourcing input and relay output	

Note:

1. The module is built-in with a +24 V power supply for I/Os to use.
2. Connect the terminal ⏚ to ground.

4.7.16 Wiring DVP32XP200T

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.5A/output, 4A/COM

Sinking input and output	
Sourcing input and sinking output	

Note:

1. You need to add external power supply 24 VDC (-15% ~ +20%) for UP, ZP0 and ZP1; power consumption is up to 30 mA.

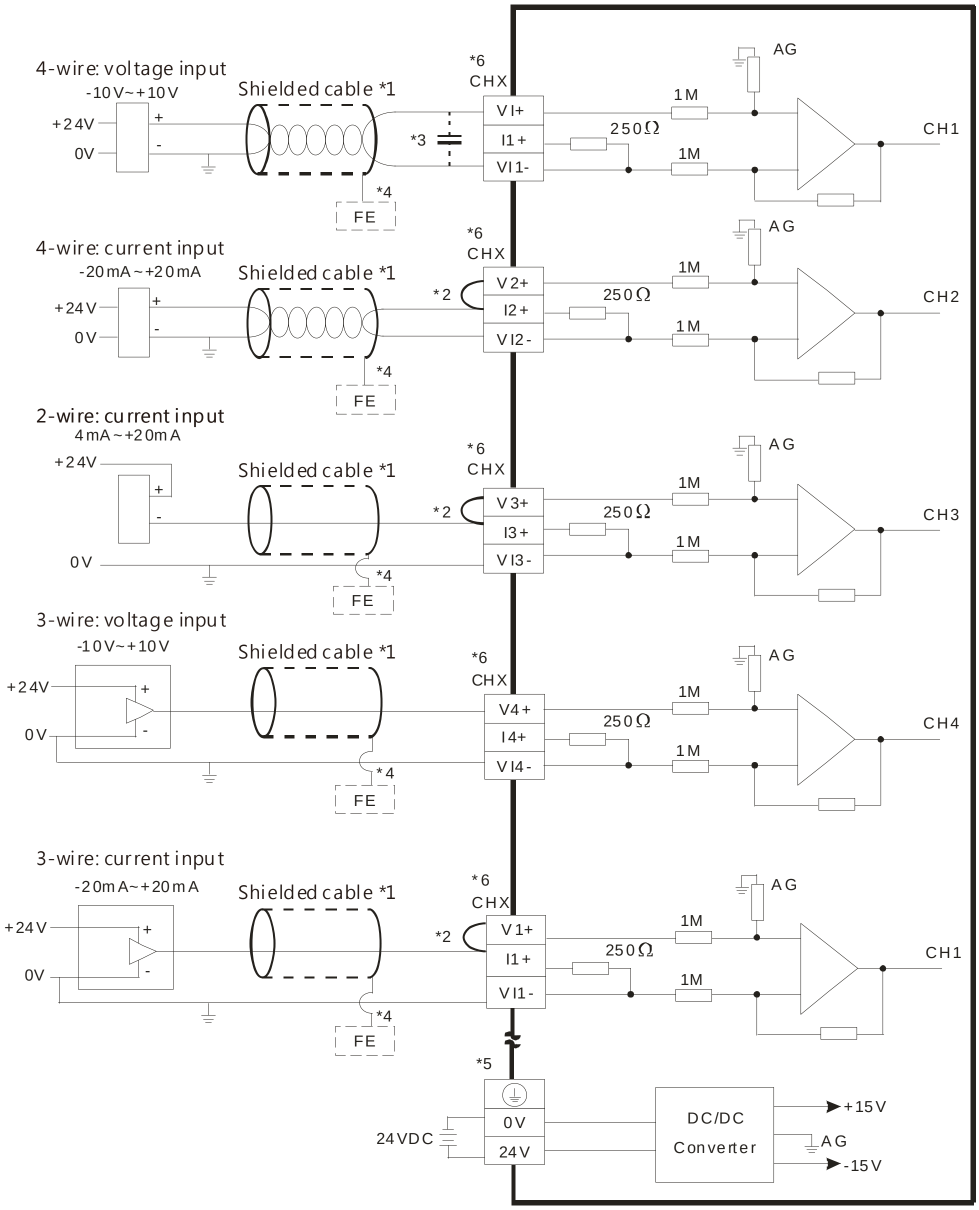
2. Connect the terminal ⏚ to ground.

4.8 Wiring Analog Input / Output Modules

Definitions of the terminals

- Two/three-wire (passive sensor): the sensor and the system share the same power circuit.
- Four-wire (active sensor): the sensor uses an independent power supply and should not share the same power circuit with the system.
- Note: use cables with the same length (less than 200 m) and use terminal resistors of less than 100 ohm.

4.8.1 Wiring DVP04AD-E2



*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If the module is connected to a current signal, the terminals Vn and In+ (n=1–4) must be short-circuited.

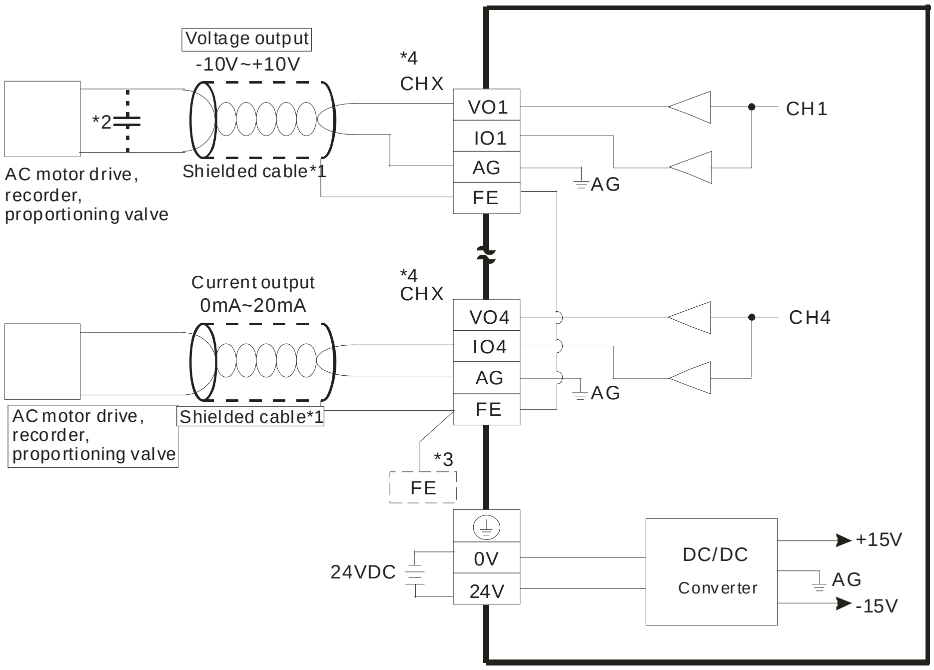
*3. If noise in the input voltage results in noise interference in the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF with a working voltage of 25 V.

*4. Connect FE of the shielded cable to ground.

*5. Connect the terminal ⏚ to ground.

*6. Every channel can work with the wiring shown above.

4.8.2 Wiring DVP02DA-E2 / DVP04DA-E2



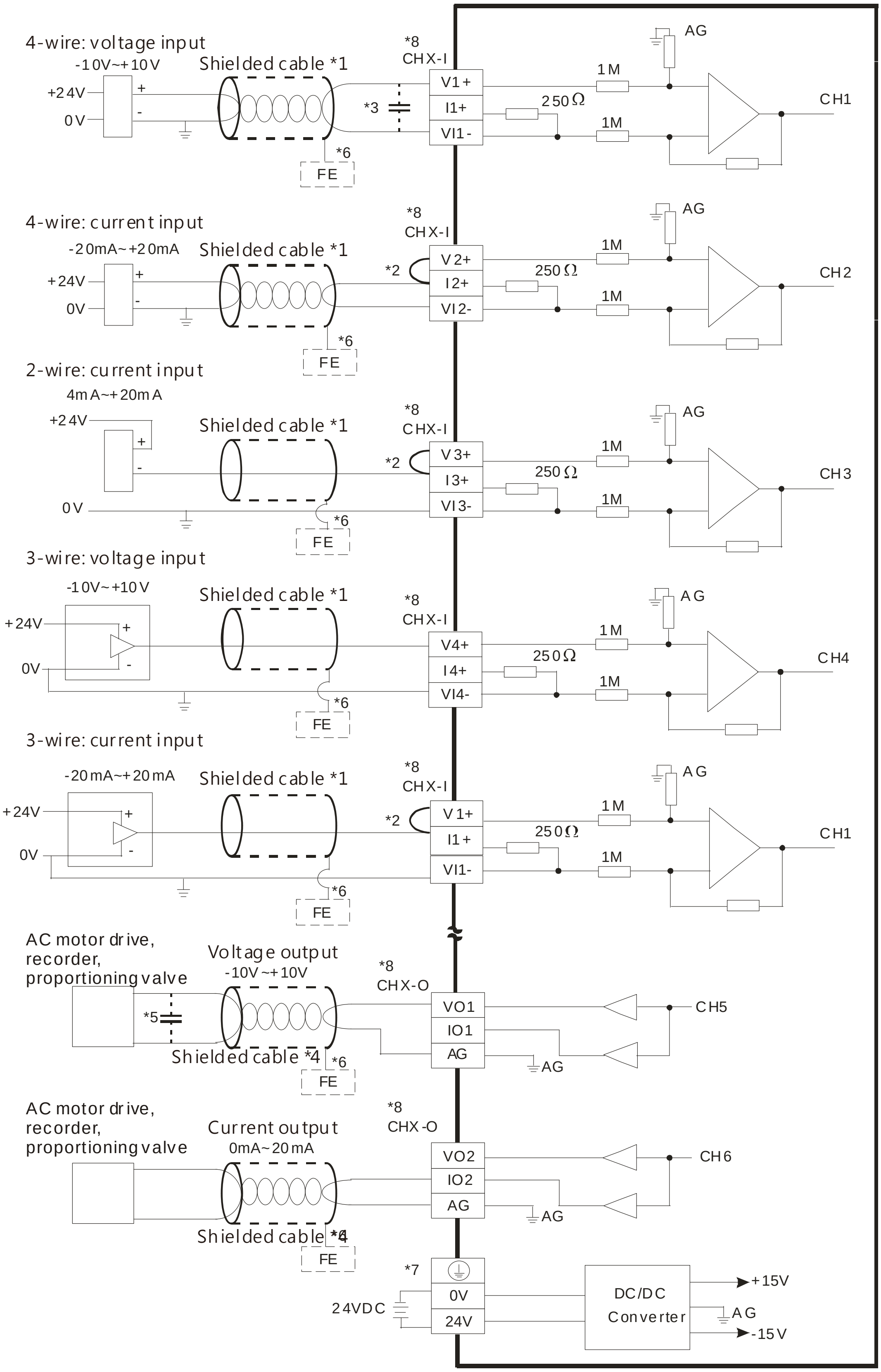
*1. Use shielded cables to isolate the analog input signal cable from other power cables.

*2. If noise in the input voltage results in noise interference in the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF with a working voltage of 25 V.

*3. Connect the terminal ⏚ to ground.

*4. Every channel can work with the wiring shown above.

4.8.3 Wiring DVP06XA-E2



*1. Use shielded cables to isolate the analog input/output signal cable from other power cables.

*2. If the module is connected to a current signal, the terminals Vn and In+ (n=1–4) must be short-circuited.

*3. If noise in the input voltage results in noise interference with the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF with a working voltage of 25 V.

*4. Use shielded cables to isolate the analog output signal cable from other power cables.

*5. If noise in the output voltage results in noise interference in the wiring, connect the module to a capacitor with a capacitance between 0.1 μF–0.47 μF with a working voltage of 25 V.

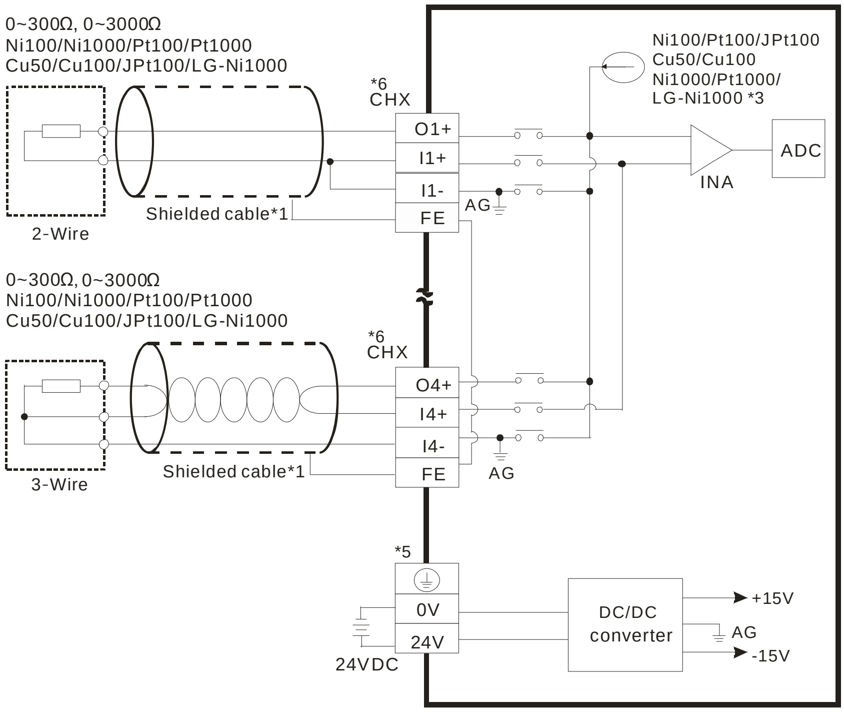
*6. Connect FE of the shielded cable to ground.

*7. Connect the terminal ⏚ to ground.

*8. CHX-I: Every channel can work with the input wiring shown above. CHX-O: Every channel can work with the output wiring shown above.

4.9 Wiring Temperature Measurement Modules

4.9.1 Wiring DVP04PT-E2 / DVP06PT-E2



*1. Use shielded twisted pair cables for temperature sensors, including Ni100/Ni1000, Pt100/Pt1000, Cu50/Cu100, JPt100, LG-Ni1000 for analog input module wiring and keep them away from power cables and other cables that generate noise. Use 3-wire temperature sensors. But if you use two-wire temperature sensors, In-+and In- must be short-circuited (where n is between 1–6).

*2. When the impedance to be measured is 0~300Ω or 0~3000Ω, it is recommended to use a 2-wire or 3-wire temperature sensor instead of a 4-wire one.

*3. Choose a suitable temperature sensor.

- DVP06PT-E2:

  When using temperature sensors such as Ni100, Pt100, JPt100, Cu50, Cu100 and 0~300 Ω impedance sensor, the internal excitation current is 1.0389 mA.

  When using temperature sensors such as Ni1000, Pt1000, LG-Ni1000 and 0~3000 Ω impedance sensor, the internal excitation current is 208.3μA。

- DVP04PT-E2：

  When using temperature sensors such as Ni100, Pt100 and 0~300 Ω impedance sensor, the internal excitation current is 1.53mA.

  When using temperature sensors such as Ni1000, Pt1000 and 0~3000 Ω impedance sensor, the internal excitation current is 200μA.

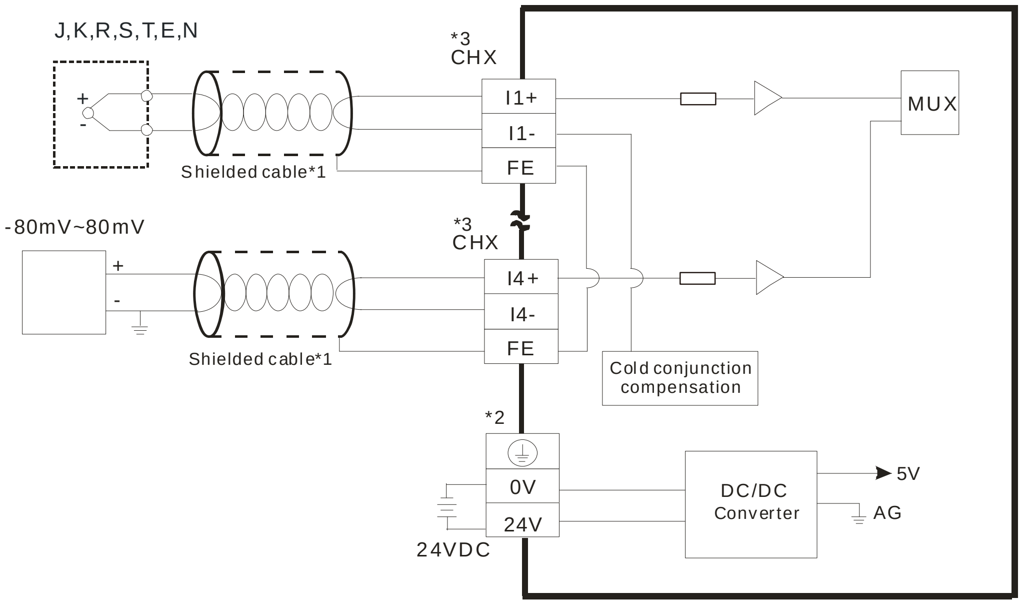
*4. Connect FE of the shielded cable to ground when the noise it too loud.

*5. Connect the terminal ⏚ to ground.

*6. CHX: Every channel can work with the input wiring shown above.

Note 1: use cables with the same length (less than 200 m) and use terminal resistors of less than 200 ohm.

4.9.2 Wiring DVP04TC-E2



*1. The cable connected to the input terminal should be the cable or the shielded twisted pair cable connected to a type J, K, R, S, T, E, N thermocouple. It should be kept separate from other power cables and cables that generate noise.

*2. Connect the terminal ⏚ to ground.

*3. CHX: Every channel can work with the input wiring shown above.

Note 1: only use copper conducting wires with a temperature rating of 60/75°C and the length must be less than 50 m.

Note2: TC modules must run for 30 minutes before they start to take any temperature measurement.

5

Chapter 5 CPU and Module Devices

Table of Contents

5.1 Introduction to CPU Devices

This section describes the values and strings processed by the PLC. It also describes the functions of devices, including input, output and auxiliary relays, as well as timers, counters, and data registers. The PLC simulates external devices in the PLC's internal memory, so the word "device" is a generic name that refers to all the internal memory locations in the PLC. A device can be a bit device or a word device. Bit devices simulate coils, contacts and flags, while word devices simulate registers.

5.1.1 Device Table

Type	Device name		Number of devices	Range
Bit device	Input relay	X	256	X0–X377
	Output relay	Y	256	Y0–Y377
	Data register	D	48,0000	D0.0–D29999.15
		W	48,0000	W0.0–W29999.15 *4
	Auxiliary relay	M	8192	M0–M8191
	Special auxiliary relay	SM	2048	SM0–SM4095
	Flag	S	2048	S0–S2047
	Timer	T	512	T0–T511
	Counter	C	512	C0–C511
	32-bit counter	HC	256	HC0–HC255
Word device	Input relay	X	64	X0–X63
	Output relay	Y	64	Y0–Y63
	Data register	D	30000	D0–D29999
		W	30000	W0–W29999 *4
	Special auxiliary relay	SR	2048	SR0–SR2047
	File register	FR	65536	FR0–FR65535
	Timer	T	512	T0–T511
	Counter	C	512	C0–C511
	32-bit counter	HC	256（512 words）	HC0–HC255
	Index register	E	10	E0–E9
			5	E10–E14 *4
Constant*1	Decimal system	K	16 bits: -32768 to 32767 32 bits: -2147483648 to 2147483647	
Constant*2	Hexadecimal system	16#	16 bits: 16#0–16#FFFF 32 bits: 16#0–16#FFFFFFFF	
	Single-precision floating-point number	F	32 bits: $\pm 1.17549435^{-38}$ to $\pm 3.40282347^{+38}$	
String*3	String	"$"	1–31 characters	

*1: Constants are indicated by K in the device lists in Chapter 5 and Chapter 6 in the DVP-ES3 Series Programming Manual. For example, when "K50" appears in the DVP-ES3 Series Programming Manual, enter only the number 50 in ISPSoft.

*2: Floating-point numbers are indicated by F/DF in the device lists in Chapter 5 and Chapter 6 in the DVP-ES3 Series Programming Manual, but they are represented by decimal points in ISPSoft. For example, for the floating-point number F500, enter 500.0 in ISPSoft.

*3: Strings are indicated by $ in Chapter 5 and Chapter 6 in the DVP-ES3 Series Programming Manual, but they are represented by quotes (“ ”) in ISPSoft. For example, for the string of 1234, enter “1234” in ISPSoft.

*4: Used for editing in ISPSoft only.

5.1.2 Basic Structure of I / O Storage

Device	Function	Access by bits	Access by words	Modify by ISPSoft	Force the bit ON/OFF
X	Input relay	OK	OK	OK	OK
Y	Output relay	OK	OK	OK	OK
M	Auxiliary relay	OK	-	OK	-
SM	Special auxiliary relay	OK	-	OK	-
S	Flag	OK	-	OK	-
T	Timer	OK	OK	OK	-
C	Counter	OK	OK	OK	-
HC	32-bit counter	OK	OK	OK	-
D	Data register	OK	OK	OK	OK
SR	Special data register	-	OK	OK	-
FR	File register	-	OK*1	-	-
E	Index register	-	OK	OK	-

*1: Use an instruction for writing to an FR.

5.1.3 Relation Between the PLC Action and the Device Type

PLC action \ Device type		Non-latched area		Latched area	
		Device Y	**Other devices**	**File register**	**Other devices**
Power: OFF→ON		Cleared	Cleared	Retained	Retained
Restore to defaults		Cleared	Cleared	Cleared	Cleared
STOP ↓ RUN*1	**The non-latched area is cleared.**	Cleared	Cleared	Retained	Retained
	The state of the non-latched area is retained.	Retained	Retained	Retained	Retained
RUN ↓ STOP*1	**The state of device Y is cleared.**	Cleared	Retained	Retained	Retained
	The state of device Y is retained.	Retained	Retained	Retained	Retained
SM204 is ON. (All non-latched areas are cleared.)		Cleared	Cleared	Retained	Retained
SM205 is ON. (All latched areas are cleared.)		Retained	Retained	Retained	Cleared

*1: For more on setting the states, see HWCONFIG in ISPSoft. The default for PLC STOP->RUN is “clear not-latched area”. The default for PLC RUN->STOP is “clear the state of device Y”.

5.1.4 Latched Areas in the Device Range

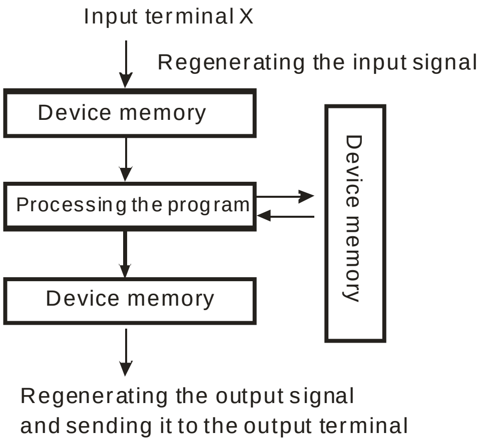
Device	Function	Device range	Latched area
X	Input relay	X0–X377	All devices are non-latched.
Y	Output relay	Y0–Y377	All devices are non-latched.
M*1	Auxiliary relay	M0–M8191	The default range is M6000–M8191.
SM	Special auxiliary relay	SM0–SM2047	Some devices are latched, and cannot be changed. Refer to the list of special auxiliary relays for more information.
S*1	Flag	S0–S2047	The default range is S512–S1023
T	Timer	T0–T511	All devices are non-latched.
C*1	Counter	C0–C511	The default range is C448–C511
HC*1	32-bit counter	HC0–HC255	The default range is HC128–HC255
D*1	Data register	D0–D29999	The default range is D20000–D29999
		W0–W29999	*2
FR	File register	FR0–FR65535	All devices are latched.
SR	Special data register	SR0–SR2047	Some are latched, and cannot be changed. Refer to the list of special data registers for more information.
E	Index register	E0–E9	All devices are non-latched.
		E10–E14	*2

*1: For more information on setting the latched area, see HWCONFIG in ISPSoft. Setting the latched area means the other areas are seen as non-latched areas. The range of latched areas cannot exceed the device range. For example, setting M600–M7000 as latched areas makes M0–M5999 and M7001–M8191 non-latched areas.

*2: Used for editing in ISPSoft only.

5.2. CPU Device Functions

The following flow chart shows the procedure for processing a program in the PLC.



- Regenerating the input signal
  1. Before the program is executed, the state of the external input signal is read into the memory location for the input signal.
  2. When program is executed, the state in the memory location for the input signal does not change even if the input signal changes from ON to OFF or from OFF to ON. The input signal is not refreshed until the next scan begins.
- Processing the program

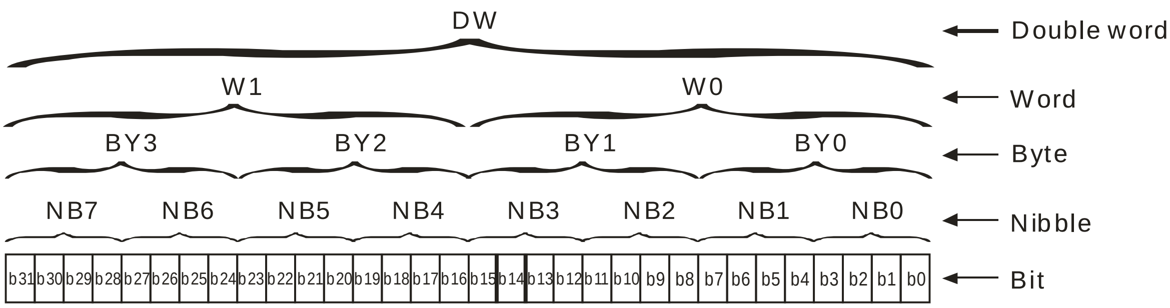
  After the input signal is refreshed, the instructions in the program are executed in order from the start address of the program. The results are stored in the device memory.
- Regenerating the state of the output

  After the instruction END is executed, the state in the device memory is sent to the specified output terminal.

5.2.1 Values and Constants

Name	Description
Bit	A bit is the basic unit in the binary system. Its state is either 1 or 0.
Nibble	A nibble is composed of four consecutive bits (for example b3–b0). Nibbles can represent 0–9 in the decimal system, or 0–F in the hexadecimal system.
Byte	A byte is composed of two consecutive nibbles (8 bits, b7–b0). Bytes can represent 00–FF in the hexadecimal system.
Word	A word is composed of two consecutive bytes (16 bits, b15–b0). Words can represent 0000–FFFF in the hexadecimal system.
Double word	A double word is composed of two consecutive words (i.e. 32 bits, b31–b0). Double words represent 00000000–FFFFFFFF in the hexadecimal system.

The relation among bits, nibbles, bytes, words, and double words in the binary system is shown in the picture below.



The PLC uses four types of values to execute the operation according to different control purposes.

1. Binary number (BIN)

   The PLC uses the binary system to operate on the values.

2. Octal number (OCT)
   DVP-PLC uses the octal number on the external inut and output device number. For example:

   External input device number: X0~X7, X10~X17, to X377.

   External output device number: Y0~Y7, Y10~Y17, to Y377.

3. Decimal number (DEC)

   The PLC uses decimal numbers for:

   - The setting value of a timer (T) or the setting value of a counter (C/HC); for example, TMR C0 50 (**constant K**).
   - The device number S, M, T, C, D, E; for example, M10 and T30 (device number)
   - **The constant K**, used as the operand in an applied instruction. For example, MOV 123 D0 **(constant K)**.

4. Binary-coded decimal (BCD)

   A decimal value that is represented by a nibble or four bits so that sixteen consecutive bits represent a four-digit decimal value.

5

5. Hexadecimal number (HEX)

   The PLC uses hexadecimal numbers for:

   - **The constant 16#**, used as the operand in an applied instruction; for example, MOV 16#1A2B D0 (hexadecimal constant).

The following table shows the corresponding values.

Binary Number (BIN)	**Octal Number (OCT)**	**Decimal Number (DEC)**	**Binary Code Decimal (BCD)**	**Hexadecimal Number (HEX)**
PLC internal execution	X and Y device number	Constant K, Device number	BCD related instruction	Constant 16#, Device number
0000		0	0000	0
0001		1	0001	1
0010		2	0010	2
0011		3	0011	3
0100		4	0100	4
0101		5	0101	5
0110		6	0110	6
0111		7	0111	7
1000		8	1000	8
1001		9	1001	9
1010		10	-	A
1011		11	-	B
1100		12	-	C
1101		13	-	D
1110		14	-	E

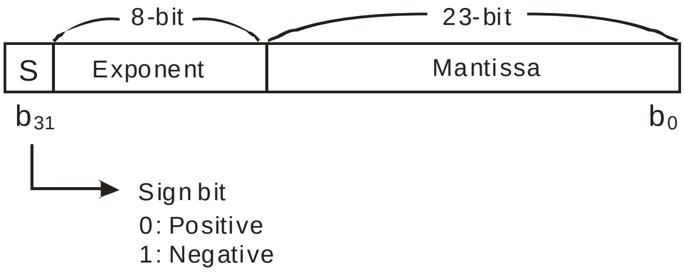
Binary Number (BIN)	Octal Number (OCT)	Decimal Number (DEC)	Binary Code Decimal (BCD)	Hexadecimal Number (HEX)
1111		15	-	F
10000		16	0001 0000	10
10001		17	0001 0001	11

5.2.2 Floating-point Numbers

Floating-point numbers are represented by decimal points in ISPSoft. For example, the floating-point number 500 is represented as 500.0.

5.2.2.1 Single-precision Floating-point Numbers

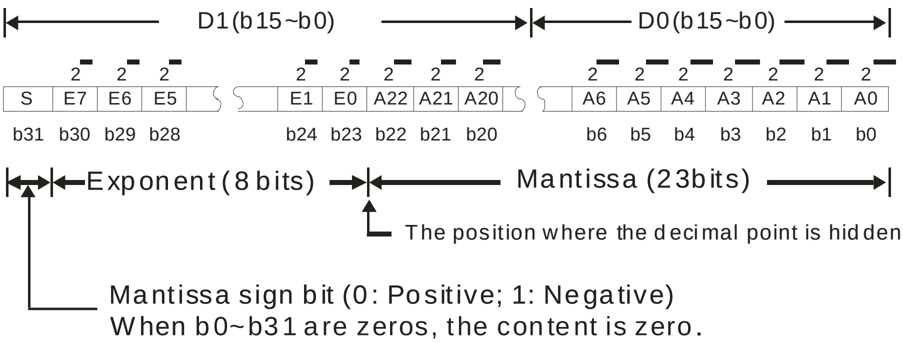
Floating-point numbers are represented by a 32-bit register. The representation adopts the IEEE754 standard, and the format shown in the following picture.



Equation: $(-1)^S \times 2^{E-B} \times 1.M; B=127$

The single-precision floating-point numbers range between $\pm 2^{-126}$ to $\pm 2^{+128}$, and correspond to the range between $\pm 1.1755 \times 10^{-38}$ to $\pm 3.4028 \times 10^{+38}$.

The DVP-ES3 Series PLC uses two consecutive registers for a 32-bit floating-point number. Take (D1, D0) for example.



Example 1:

23 is represented by a single-precision floating-point number.

Step 1: Convert 23 into the binary number, 23.0=10111.

Step 2: Normalize the binary number, 10111=1.0111 ×24 (0111 is the mantissa, and 4 is the exponent.).

Step 3: Get the value of the exponent.

∵ E-B=4→E-127=4 ∴ E=131=100000112

Step 4: Combine the sign bit, the exponent, and the mantissa to form the floating-point number.

0 100**0001**1 011**1000**0000**0000**0000**0000**$_2$=41B80000$_{16}$

Example 2:

-23 is represented by a single-precision floating-point number.

Converting -23.0 into the floating-point number uses the same steps as converting 23.0 into the floating-point number, except that the sign bit is 1.

1 100**0001**1 011**1000**0000**0000**0000**0000**$_2$=C1B80000$_{16}$

5.2.2.2 Decimal Floating-point Numbers

- Single-precision floating-point numbers and double-precision floating-point numbers can be converted into decimal floating-point numbers so people can read them. However, internally the PLC uses single-precision floating-point numbers and double-precision floating-point numbers.
- A 32-bit decimal floating-point number is represented by two consecutive registers. The constant is stored in the first register whose number is smaller while the exponent is stored in the register whose number is bigger. Take (D1, D0) for example.

$$\text{Decimal floating-point number}=[\text{Constant } D0]*10^{[\text{Exponent } D1]}$$

Base number D0=±1,000 to ±9,999

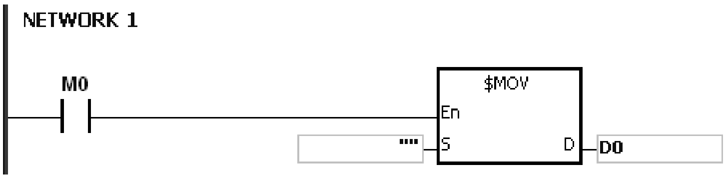
Exponent D1=-41 to +35

The base number 100 does not exist in D0 because 100 is represented by 1,000×10^{-1}. 32-bit decimal floating-point numbers range between ±1175×10^{-41} to ±402×10^{+35}.

5.2.3 Strings

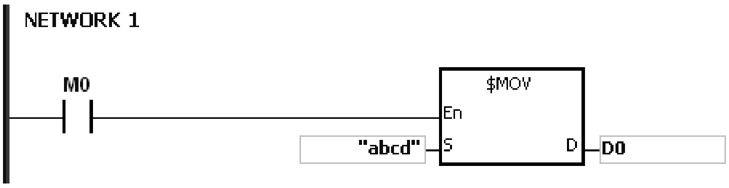
The PLC can process strings composed of ASCII codes (*1). A complete string begins with a start character, and ends with an ending character (NULL code). Strings can have maximum length of 31 characters, and ISPSoft automatically adds the ending character (16#00).

1. No string (NULL code) is moved.



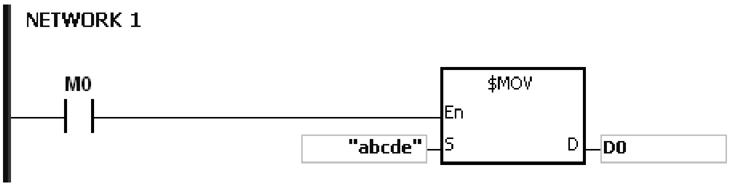
D0=0 (NULL)

2. The string has an even number of characters.



D0	16#62 (b)	16#61 (a)
D1	16#64 (d)	16#63 (b)
D2	0 (NULL)	

3. The string has an odd number of characters.



D0	16#62 (b)	16#61 (a)
D1	16#64 (d)	16#63 (b)
D2	0 (NULL)	16#65 (e)

*1: ASCII code chart

Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ASCII	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
Hex	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
ASCII	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
Hex	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
ASCII	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/

Hex	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
ASCII	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
Hex	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
ASCII	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Hex	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
ASCII	P	Q	R	S	T	U	V	W	X	Y	Z	☒	☒	☒	☒	☒
Hex	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
ASCII	`	a	b	c	d	e	f	g	h	i	j	k	l	M	n	o
Hex	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F
ASCII	p	q	r	s	t	u	v	w	x	y	z	{	|	}	–	☒

Note: ☒ represents an invisible character. Do not use it in strings.

5.2.4 Input Relays (X)

- Input function

  The input is connected to the input device (external devices such as button switches, rotary switches, and number switches), and the PLC reads the input signal. You can use input contact A or contact B several times in the program, and the ON/OFF state of the input varies with the ON/OFF state of the input device.

- Input number (the octal number)

  For the PLC, the input numbers start from X0. The number of inputs varies with the number of inputs on the digital input/output modules. The inputs are numbered according to the order in which the digital input/output modules are connected to the CPU module. The maximum number of inputs for the PLC is 256, and the input number range is between X0 to X377.

- Input type

  Inputs are classified into two types.

  1. Regenerated inputs: The PLC reads the state of a regenerated input before the program is executed; for example, LD X0.
  2. Direct input: The state of a direct input is read by the PLC during the execution of the instructions; for example, LD DX0.

5.2.5 Output Relays (Y)

- Output function

The output sends the ON/OFF signal to drive the load connected to the output, such as an external signal lamp, a digital display, or an electromagnetic valve. There are four types of outputs. They are relays, transistors (NPN and PNP), and TRIACs (thyristors). You can use the output contact A or contact B several times in the program. Use output Y only once in the program; otherwise, according the PLC’s program-scanning function, the state of the output depends on the circuit connected to the last output Y in the program.

- Output number (the octal number)

For the PLC, the output numbers start from Y0. The number of outputs varies with the number of outputs on the digital input/output modules. The outputs are numbered according to the order in which the digital input/output modules are connected to the PLC. The maximum number of outputs on the PLC is 256, and the range is between Y0 and Y377.

An output that is not used as an output device can be used as a general device.

- Output types

Outputs are classified into two types.

1. Regenerated output: The state of a regenerated output is not written until the program executes the END instruction, according to the states of the outputs; for example, OUT Y0.
2. Direct output: The state of a direct output is written by the PLC during the execution of the instructions, according to the states of the outputs; for example, OUT DY0.

5.2.6 Auxiliary Relays (M)

The auxiliary relay has contact A and contact B. It can be used several times in the program. You can combine the control loops by using the auxiliary relay, but you cannot drive the external load using the auxiliary relay. You can use the auxiliary relays in either of the following two ways.

1. For general use: In general use, if an electric power failure occurs when the PLC is running, the auxiliary relay resets to the OFF state. When the power is restored, the auxiliary relay remains in the OFF state.
2. For latched use: In latched use, ff an electric power failure occurs when the PLC is running, the state of the auxiliary relay is retained. When the power is restored, the relay state remains the same as before the power failure.

5.2.7 Special Auxiliary Relays (SM)

Every special auxiliary relay has its specific function. Do not use the special auxiliary relays which are not defined. Refer to section 2.2.7 in DVP-ES3 Series Programming Manual for more reference.

5.2.8 Flags (S)

You can easily use the flags in industrial automation to set a procedure. It is the most basic device in ladder diagram programming.

There are 2048 flags, (S0–S2047). Every flag is like an output relay in that it has an output coil, contact A, and contact B. You can use a flag several times in a program. There are two kinds of flags.

A. General-purpose flags

When the power is OFF during execution, all the device states are cleared to OFF. When the power is turned back ON, the device states are kept as OFF.

B. Latch-purpose flags

When the power is OFF during execution, all the device states are remembered. When the power is turned back ON, the devices states are restored as they are before the power interruption.

5.2.9 Timers (T)

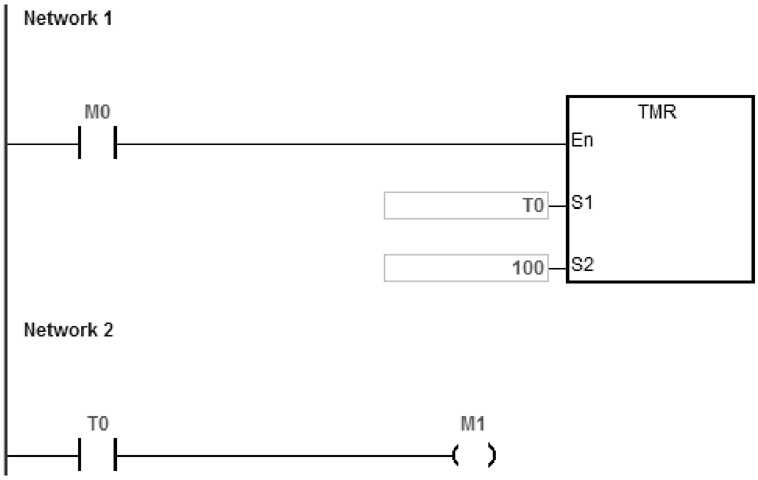
This topic describes the timers available in ISPSoft. Refer to the ISPSoft User Manual for more information on timers.

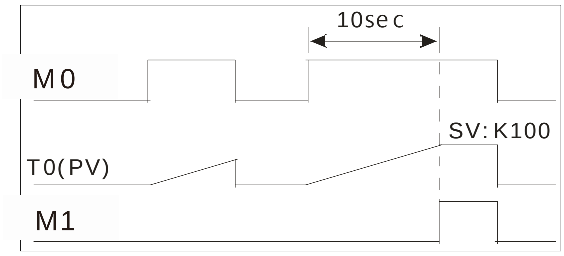
- 100 millisecond timer: The timer specified by the TMR instruction takes 100 milliseconds as the timing unit.
- 10 millisecond timer: The timer specified by the TMR instruction takes 10 milliseconds as the timing unit.
- 1 millisecond timer: The timer specified by the TMRH instruction takes 1 millisecond as the timing unit.
- The accumulative timers are ST0–ST511. If you want to use the device-monitoring function, these timers can monitor T0–T511.
- If you use the same timer repeatedly in a program, including in different TMR, TMRM and TMRH instructions, the timer setting value is the one that the timer matches first.
- If you use the same timer repeatedly in a program, the timer is OFF when one of the conditional contacts is OFF.
- If you use the same timer in a program as the timer for a subroutine’s exclusive use and an accumulative timer in the program, it is OFF when one of the conditional contacts is OFF.
- When the timer switches from ON to OFF and the conditional contact is ON, the timer is reset and counts again.
- When the TMR instruction is executed, the specified timer coil is ON and the timer begins to count. When the value of the timer matches the timer setting value (value of the timer ≧ setting value), the state of the contact is ON.

A. General-purpose timers

When the TMR instruction is executed, the general-purpose timer begins to count. When the value of the timer matches the timer setting value, the output coil is ON.

- When M0=ON and the timer takes 100 ms as the timing unit, the output coil T0 is ON when the value of the timer = timer setting value100.
- When M0=OFF or the power is off, the value of the timer is 0 and the output coil T0 is OFF.

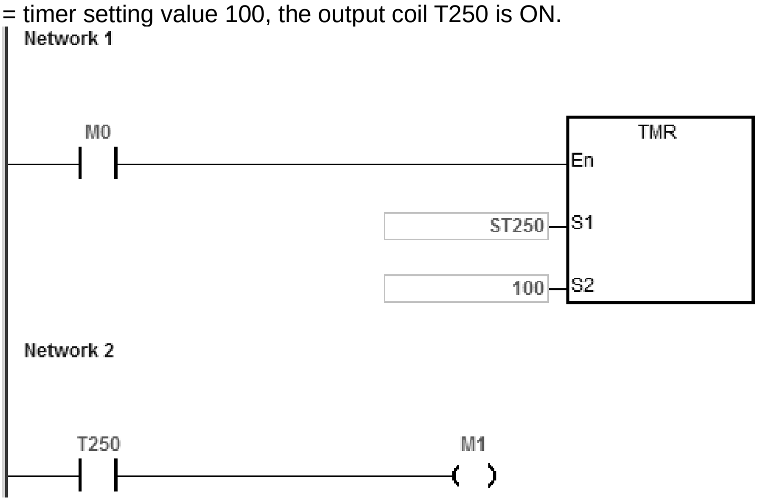


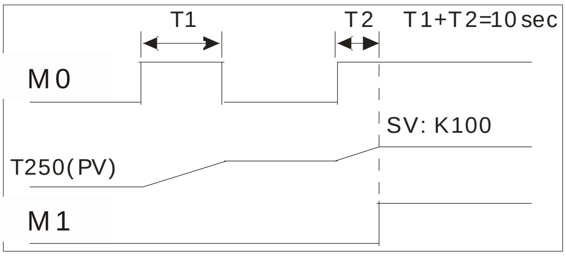


B. Accumulative timers

When the TMR instruction is executed, the accumulative timer begins to count. When the value of the timer matches the timer setting value, the output coil is ON. As long as you add the letter S in front of the letter T, the timer becomes an accumulative timer. When the conditional contact is OFF, the value of the accumulative timer is not reset. When the conditional contact is ON, the accumulative timer counts from the current value.

- When M0=ON and the timer T250 takes 100 ms as the timing unit, the output coil T250 is ON when the value of the timer = timer setting value 100.
- When M0=OFF or the power is off, the accumulative timer ST250 stops counting, and the value of the timer stays the same. When M0=ON, the value of the timer is the accumulating value. When the accumulated value = timer setting value 100, the output coil T250 is ON.





C. Timers used in function blocks

T412–T511 are the timers that you can use in the function block or in interrupts.

When the TMR or END instruction is executed, the timer in the functional block begins to count. When the value of the timer matches the timer setting value, the output coil is ON.

If you use a general-purpose timer in a function block or an interrupt, and the function or interrupt is not executed, the timer cannot count correctly.

5.2.10 Counters

5

- Characteristics of the 16-bit counter

Item	16-bit counter
Type	General type
Number	C0–C511
Direction	Counting up
Setting value	0–32,767
Specifying the counter setting value	The setting value can be either the constant or the value in the data register.
Change of the current value	The counter stops counting when the value of the counter matches the counter setting value.
Output contact	The contact is ON when the value of the counter matches the counter setting value.
Reset	When the instruction RST is executed, the current value is cleared to zero, and the contact is reset of OFF.
Action of the contact	After the scan is complete, the contact acts.

- Function of the counter

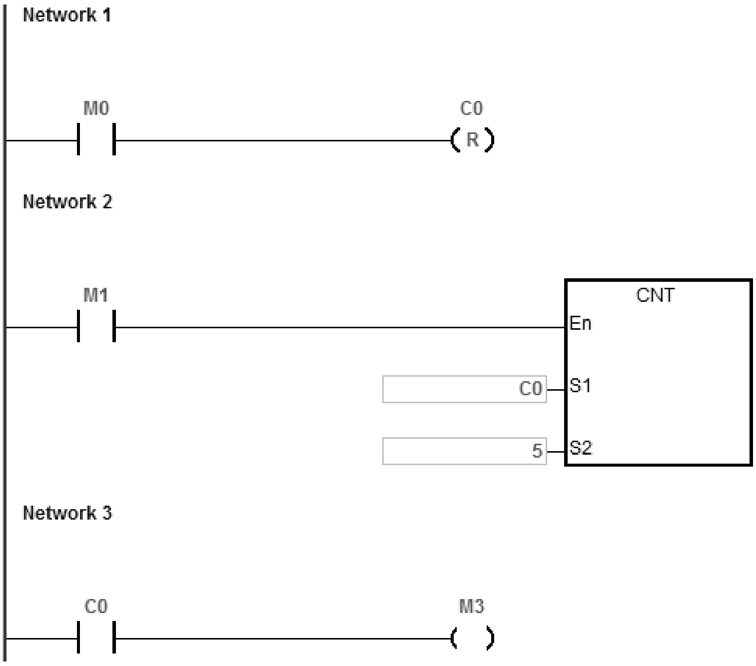
Each time the input switches from OFF to ON, the value of the counter is the same as the output coil. You can use either the decimal constant or the value in the data register as the counter setting value.

16-bit counter:

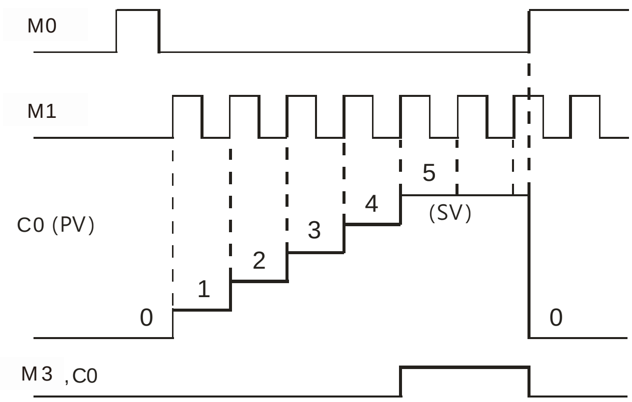
1. Setting range: 0–32,767. The setting values 0 and 1 mean the same thing in that the output contact is ON when the counter counts for the first time.
2. For the general-purpose counter, the current value of the counter is cleared when power is lost. If the counter is latching, the current value of the counter and the state of the contact before power was lost power are retained. The latched counter counts from the current value when the power supply is restored.
3. If you use the MOV instruction or ISPSoft to transmit a value larger than the counter setting value to the current value

register C0, the contact of the counter C0 is ON and the current value becomes the same as the counter setting value the next time X0.1 switches from OFF to ON.

4. You can use either the constant or the value in the data register as the counter setting value.
5. The counter setting value can be positive or negative. If the counter counts up from 32,767, the next value is 0.



1. When M0=ON, the RST instruction is executed, the current value of C0 is reset to zero, and the output contact of the counter C0 is FF. And M0=OFF, the execution of RST instruction is done.
2. When M1 changes from OFF to ON, the value of the counter increments by one.
3. When the value of the counter C0 reaches the counter setting value of 5, the contact of the counter C0 is ON (the current value of C0 = the counter setting value = 5). After that the trigger from M1 is not accepted by C0 and the current value of C0 stays at the value 5.



5.2.11 32-bit Counters (HC)

- Characteristics of the 32-bit counter

Item	32-bit counter		
Type	Up/down counter	Up counter	High-speed counter
Number	HC0–HC63	HC64–HC199	HC200–HC255
Direction	Counts up/down	Counts up	Counts up/down
Setting value	-2,147,483,648 to +2,147,483,647		
Specification of the counter setting value	The counter setting value can be either the constant or the value occupying two data registers (32-bit).		
Change of the current value	The counter keeps counting even after the value of the counter matches the counter setting value.		
Output contact	The contact is ON when the value of the addition counter matches the counter setting value. The contact is reset to OFF when the value of the subtraction counter matches the counter setting value.		
Reset	When the RST instruction is executed, the current value is cleared to zero, and the contact is reset to OFF.		
Action of the contact	After the DCNT instruction scan is complete, the contact acts.		

- 32-bit general-purpose addition/subtraction counter

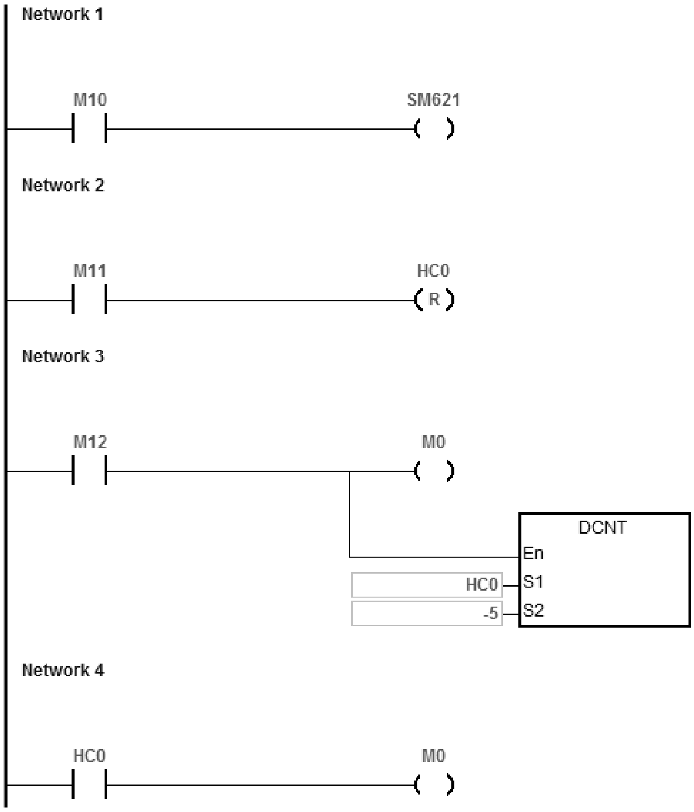
5

1. The difference between the 32-bit general-purpose addition counters and the 32-bit general-purpose subtraction counters depends on the states of the special auxiliary relays SM621–SM684. For example, the counter HC0 is an addition counter when SM621 is OFF, whereas HC0 is a subtraction counter when SM621 is ON.
2. You can use either the constant or the value in the data registers as the counter setting value, and this setting value can be positive or negative. If you use the value in the data registers as the counter setting value, this setting value occupies two consecutive registers.
3. For the general-purpose counter, the current value of the counter is cleared when power is lost. If the counter is latching, the current value of the counter and the state of the contact before loss of power is retained. The latched counter counts from the current value when power is restored.
4. If the counter counts up from 2,147,483,647, the next incremental value is -2,147,483,648. If the counter counts down from -2,147,483,648, the next incremental value is 2,147,483,647.

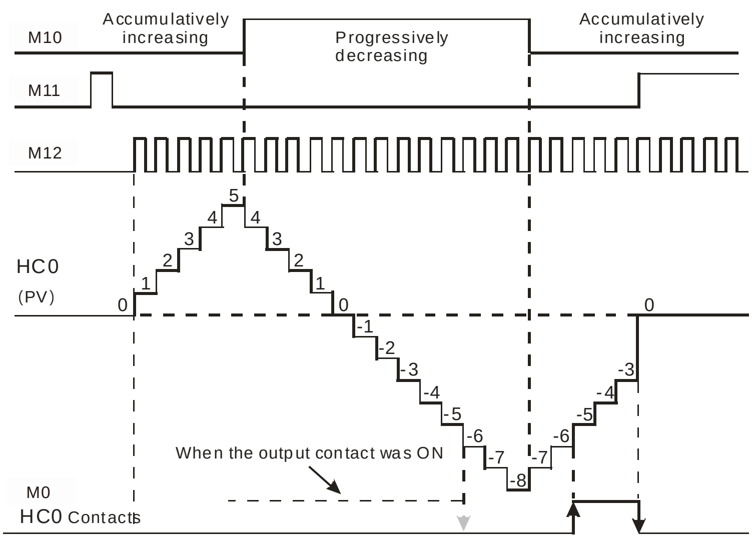
- 32-bit high speed addition/subtraction counter

Refer to the instruction description of API1004 DCNT in DVP-ES3 Series Programming Manual for more details.

Example:



1. M10 drives SM621 to determine the counting direction (up/down) for HC0.
2. When M11 changes from OFF to ON, the RST instruction is executed and the PV in HC0 is cleared to 0 and its contact is OFF.
3. When M12 changes from OFF to ON, PV for HC0 will count up (plus 1) or count down (minus 1).
4. When PV in HC0 changes from -6 to -5, the contact HC0 changes from OFF to ON. When PV in HC0 changes from -5 to -6, the contact HC0 changes from ON to OFF.



5.2.12 Data Registers (D)

The data register stores 16-bit data. The highest bit represents either a positive sign or a negative sign, and the values that the data registers can store range between -32,768 to +32,767.

Two 16-bit registers can be combined into a 32-bit register; for example, (D+1, D) in which the lower number register represents the low 16 bits. The highest bit represents either a positive sign or a negative sign, and the values that the data registers can store range between -2,147,483,648 to +2,147,483,647.

- Four 16-bit registers can be combined into a 64-bit register; for example, (D+3, D+2, D+1, D) in which the lower number register represents the lower 16 bits. The highest bit represents either a positive sign or a negative sign, and the values that the data registers can store range between -9,223,372,036,854,776 to +9,223,372,036,854,775,807.
- You can also use the data registers to refresh the values in the control registers in the modules other than digital I/O modules. Refer to the ISPSoft User Manual for more information on refreshing the values in the control registers.

There are two types of registers.

- General-purpose registers: When the PLC changes to RUN, or is disconnected, the value in the register is cleared to zero. If you want to retain the data when the PLC changes to RUN, Refer to the ISPSoft User Manual for more information. Note that the value is still cleared to zero when the PLC is disconnected.
- Latched register: If the PLC is disconnected, the data in the latched register is not cleared. In other words, the value before the disconnection is retained. If you want to clear the data in the latched area, you can use the RST or ZRST instructions.

5.2.13 Special Data Registers (SR)

Every special data register has its own definition and specific function. System status and the error messages are stored in the special data registers. Refer to section 2.2.14 in DVP-ES3 Series Programming Manual for more reference.

5.2.14 Index Register (E)

The Index register is a 16-bit data register. It is similar to the General register in that data can be read from it and written to it; however, it is mainly used as the index register. The range of index registers is E0–E9. Refer to section 4.4 in DVP-ES3 Series Programming Manual for more reference.

5.2.15 File Registers (FR)

- The DVP-ES3 Series PLC provides you with File registers for storing larger numbers of parameters.
- You can edit, upload, and download the parameters in the File registers through ISPSoft.
- You can read the values in File registers while operating the PLC. Refer to the MEMW instruction (API 2303) in DVP-ES3 Series Programming Manual for more information about how to write to the File registers.

5.3. Module Device Functions

5.3.1 DVP04AD-E2 Control Registers

CR#	Attrib.		Register name	Explanation
0	O	R	Model name	Set up by the system: DVP04AD-E2 model code = H’0080
1	O	R	Firmware version	Display the current firmware version in hex. format
2	O	R/W	CH1 input mode setting	Input mode: Default = H’0000. Mode 0 (H’0000): Voltage input (±10V) Mode 1 (H’0001): Voltage input (±5V) Mode 2 (H’0002): Voltage input (0 ~ +10V) Mode 3 (H’0003): Voltage input (0 ~ +5V) Mode 4 (H’0004): Current input (±20mA) Mode 5 (H’0005): Current input (0 ~ +20mA) Mode 6 (H’0006): Current input (+4~ +20mA) Mode -1 (H’FFFF): Channel 1 unavailable
3	O	R/W	CH2 input mode setting	
4	O	R/W	CH3 input mode setting	
5	O	R/W	CH4 input mode setting	
8	O	R/W	CH1 sampling range	Set sampling range in CH1 ~ CH4: Range = K1 ~ K100 Default = K10
9	O	R/W	CH2 sampling range	
10	O	R/W	CH3 sampling range	
11	O	R/W	CH4 sampling range	
12	X	R	CH1 average input value	Average value of input signals at CH1 ~ CH4
13	X	R	CH2 average input value	
14	X	R	CH3 average input value	
15	X	R	CH4 average input value	
20	X	R	CH1 present input value	Present value of input signals at CH1 ~ CH4
21	X	R	CH2 present input value	
22	X	R	CH3 present input value	
23	X	R	CH4 present input value	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 ~ CH4. Default = K0
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
#31	O	R/W	Adjusted Offset value of CH4	
34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value in CH1 ~ CH4. Default = K16,000
35	O	R/W	Adjusted Gain value of CH2	
36	O	R/W	Adjusted Gain value of CH3	
37	O	R/W	Adjusted Gain value of CH4	
Adjusted Offset Value, Adjusted Gain Value: Note1: When using Mode 6 for input, the channel do NOT provide setups for adjusted Offset or Gain value. Note2: When input mode changes, the adjusted Offset or Gain value automatically returns to defaults.				
40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing in CH1 ~ CH4. Default= H’0000.
41	X	R/W	Function: Save all the set values	Save all the set values, Default =H’0000
43	X	R	Error status	Register for storing all error status. Refer to table of error status for more information.
100	O	R/W	Function: Enable/Disable limit detection	Upper and lower bound detection, b0~b3 corresponds to Ch1~Ch4 (0: Enable/1: Disable). Default= H’0000.
101	X	R/W	Upper and lower bound status	Display the upper and lower bound status (0: Not exceed /1: Exceeds upper or lower bound value), b0~b3 corresponds to Ch1~Ch4 for lower bound detection result; b8~b11 corresponds

CR#	Attrib.		Register name	Explanation
				to CH1~CH4 for upper bound detection result.
102	O	R/W	Set value of CH1 upper bound	Set value of CH1~CH4 upper bound. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1~CH4 lower bound. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
Symbols: O: When CR#41 is set to H'5678, the set value of CR will be saved. X: Set value will not be saved. R: You can use FROM instruction to read data. W: You can use TO instruction to write data.				

※ CR#0 for module reset

You can use CR#0 to reset all the settings by simply writing H'4352 in CR#0 and wait for one second before turning the power OFF and then ON again, all the modules connected will be initialized. It is suggested to connect to only one module for module reset. And this is only available for firmware V1.10 or later.

※ CR#43: Error status value. See the table below:

Description					
bit0	K1 (H'1)	Power supply error	bit6	K64 (H'40)	CH4 Conversion error
bit1	K2 (H'2)	Hardware error	bit9	K512 (H'0200)	Mode setting error
bit2	K4 (H'4)	Upper/lower bound error	bit10	K1024 (H'0400)	Sampling range error
bit3	K8 (H'8)	CH1 Conversion error	bit11	K2048 (H'0800)	Upper / lower bound setting error
bit4	K16 (H'10)	CH2 Conversion error	bit12	K4096 (H'1000)	Set value changing prohibited
bit5	K32 (H'20)	CH3 Conversion error	bit13	K8192 (H'2000)	Communication breakdown on next module
Note: Each error status is determined by the corresponding bit (b0 ~ b13) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error					

Adjust A/D Conversion Curve

You can adjust the conversion curves according to the actual needs by changing the Offset value (CR#28 ~ CR#31) and Gain value (CR#34 ~ CR#37).

Offset: The corresponding voltage/current input value when the digital output value = 0.

Gain: The corresponding voltage/current input value when the digital output value = 16,000.

- **Equation for voltage input Mode0 / Mode2:**

$$Y = 16000 \times \left(\frac{X(V)}{10(V)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output, X=Voltage input

Resolution: 0.3125mV = 20V/64,000 = 10V/32,000

- **Equation for voltage input Mode1 / Mode3:**

$$Y = 16000 \times \left(\frac{X(V)}{5(V)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output, X=Voltage input

Resolution: 0.15625mV = 10V/64,000 = 5V/32,000

- **Equation for current input Mode4 / Mode5:**

$$Y = 16000 \times \left(\frac{X(mA)}{20(mA)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output, X=Current input

Resolution: 0.625μA = 40mA/64,000 = 20mA/32,000

- **Equation for current input Mode6:**

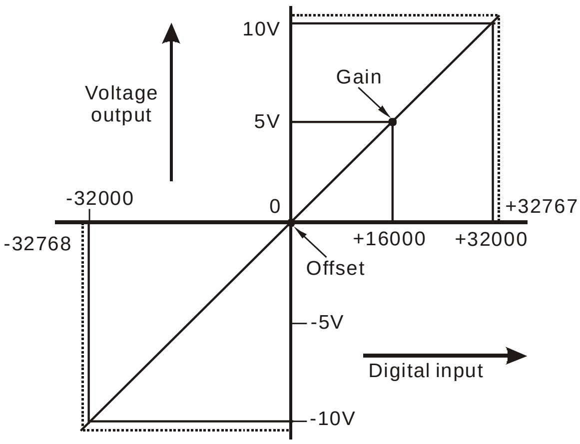
$$Y = 16000 \times \left(\frac{X(mA)}{20(mA)} \times 32000 - 6400 \right) \Big/ (19200 - 6400)$$

Y=Digital output, X=Current input

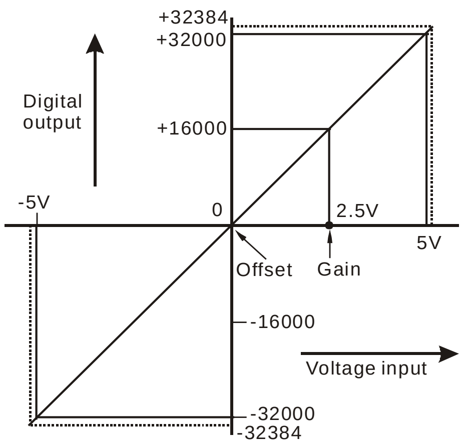
Resolution: 0.5μA = 16mA/32,000

Mode 0 of CR#2 ~ CR#5	-10V ~ +10V, Default: Gain = 16,000 (= $\frac{5V}{0.3125mV}$) , Offset = 0
Mode 1 of CR#2 ~ CR#5	-5V ~ +5V, Default: Gain = 16,000 (= $\frac{2.5V}{0.15625mV}$) , Offset = 0
Range of digital conversion	-32,000 ~ +32,000
Max./Min. range of digital conversion	-32,384 ~ +32,384

- **Mode 0:**

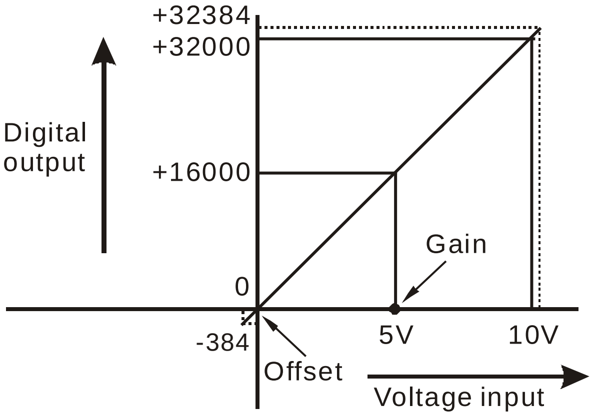


- **Mode 1:**

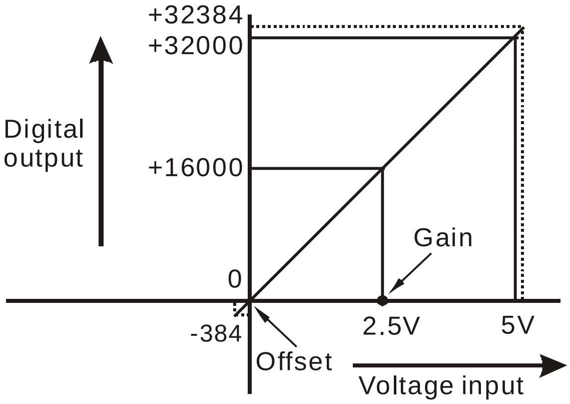


Mode 2 of CR#2 ~ CR#5	0V ~ +10V, Default: Gain = 16,000 (= $\frac{5V}{0.3125mV}$)· Offset = 0
Mode 3 of CR#2 ~ CR#5	0V ~ +5V, Default: Gain = 16,000 (= $\frac{2.5V}{0.15625mV}$)· Offset = 0
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	-384 ~ +32,384

- **Mode 2:**

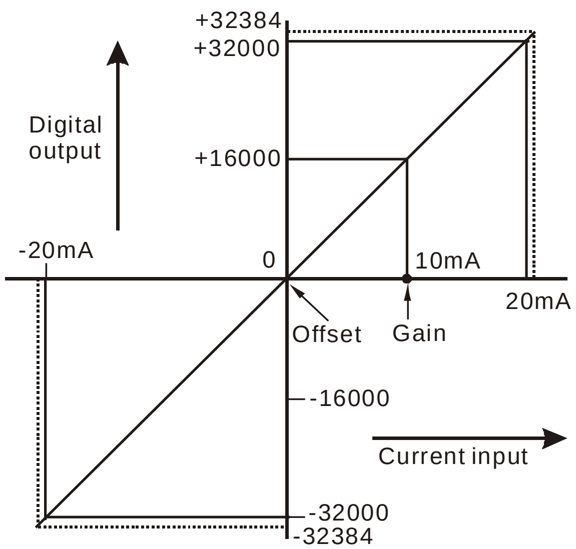


- **Mode 3:**



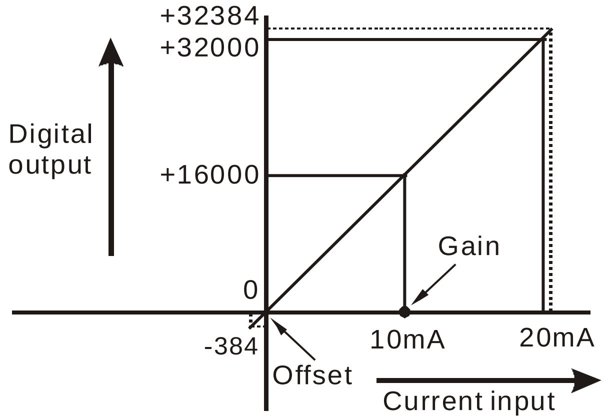
Mode 4 of CR#2 ~ CR#5	-20mA ~ +20mA, Default: Gain = 16,000 (= $\frac{10mA}{0.625uA}$) , Offset = 0
Range of digital conversion	-32,000 ~ +32,000
Max./Min. range of digital conversion	-32,384 ~ +32,384

- **Mode 4:**

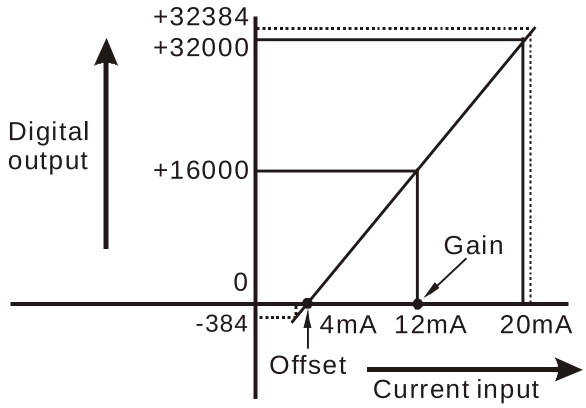


Mode 5 of CR#2 ~ CR#5	0mA ~ +20mA, Default: Gain = 16,000 (= $\frac{10mA}{0.625uA}$) , Offset = 0
Mode 6 of CR#2 ~ CR#5	+4mA ~ +20mA, Default: Gain = 19,200 (= $\frac{12mA}{0.625uA}$) , Offset = 6,400 (= $\frac{4mA}{0.625uA}$)
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	-384 ~ +32,384

- **Mode 5:**


+32384
+32000
Digital output
+16000
Gain
0
-384
10mA
20mA
Offset
Current input

- **Mode 6:**


+32384
+32000
Digital output
+16000
Gain
0
-384
4mA
12mA
20mA
Offset
Current input

5.3.2 DVP02DA-E2 / DVP4DA-E2 Control Registers

CR#	Attrib.		Register name	Explanation
0	O	R	Model name	Set up by the system, model code: DVP02DA-E2 = H'0041; DVP04DA-E2 = H'0081
1	O	R	Firmware version	Display the current firmware version in hex.
2	O	R/W	CH1 output mode setting	Output mode: Default = H'0000. Mode 0 (H'0000): Voltage output (±10V) Mode 1 (H'0001): Current output (0~+20mA) Mode 2 (H'0002): Current output (+4~+20mA) Mode -1 (H'FFFF): All channels are unavailable
3	O	R/W	CH2 output mode setting	
4	O	R/W	CH3 output mode setting	
5	O	R/W	CH4 output mode setting	
16	X	R/W	CH1 output signal value	Voltage output range: K-32,000~K32,000. Current output range: K0~K32,000. Default: K0. CR#18~CR#19 of DVP02DA-E2 are reserved.
17	X	R/W	CH2 output signal value	
18	X	R/W	CH3 output signal value	
19	X	R/W	CH4 output signal value	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 ~ CH4. Default = K0
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	
34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value of CH1 ~ CH4. Default = K16,000.
35	O	R/W	Adjusted Gain value of CH2	
36	O	R/W	Adjusted Gain value of CH3	
37	O	R/W	Adjusted Gain value of CH4	
Adjusted Offset Value, Adjusted Gain Value: Note1: When using Mode 2, the channel do NOT provide setups for adjusted Offset or Gain value. Note2: When output mode changes, the adjusted Offset or Gain value automatically returns to defaults.				
40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing in CH1 ~ CH4. Default= H'0000.
41	X	R/W	Function: Save all the set values	Save all the set values. Default =H'0000.
43	X	R	Error status	Register for storing all error status. Refer to table of error status for more information.
100	O	R/W	Function: Enable/Disable limit detection	Upper and lower bound detection, b0~b3 corresponds to CH1~CH4 (0: Disable/ 1: Enable). Default= H'0000.
101	X	R/W	Upper and lower bound status	Display the upper and lower bound status. (0: Not exceed /1: Exceeds upper or lower bound value), b0~b3 corresponds to Ch1~Ch4 for lower bound detection result; b8~b11 corresponds to CH1~CH4 for upper bound detection result..
102	O	R/W	Set value of CH1 upper bound	Set value of CH1~CH4 upper bound. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1~CH4 lower bound. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
114	O	R/W	Output update time of CH1	Set value of CH1~CH4 lower bound. Setting range: K0~K100. Default =H'0000.
115	O	R/W	Output update time of CH2	
116	O	R/W	Output update time of CH3	

CR#	Attrib.		Register name	Explanation
117	O	R/W	Output update time of CH4	
118	O	R/W	LV output mode setting	Set the output mode of CH1~CH4 when the power is at LV (low voltage) condition. Default= H'0000.
Symbols: O: When CR#41 is set to H'5678, the set value of CR will be saved. X: Set value will not be saved. R: You can use FROM instruction to read data. W: You can use TO instruction to write data.				

※ CR#0 for module reset

You can use CR#0 to reset all the settings by simply writing H'4352 in CR#0 and wait for one second before turning the power OFF and then ON again, all the modules connected will be initialized. It is suggested to connect to only one module for module reset. And this is only available for firmware V1.12 or later.

※ CR#43: Error status value. See the table below:

Description					
bit0	K1 (H'1)	Power supply error	bit11	K2048 (H'0800)	Upper / lower bound setting error
bit1	K2 (H'2)	Hardware error	bit12	K4096 (H'1000)	Set value changing prohibited
bit2	K4 (H'4)	Upper/lower bound error	bit13	K8192 (H'2000)	Communication breakdown on next module
bit9	K512 (H'0200)	Mode setting error			
Note: Each error status is determined by the corresponding bit (b0 ~ b13) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error					

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Adjust D/A Conversion Curve

You can adjust the conversion curves according to the actual needs by changing the Offset value (CR#28 ~ CR#31) and Gain value (CR#34 ~ CR#37).

Offset: The corresponding voltage/current input value when the digital output value = 0.

Gain: The corresponding voltage/current input value when the digital output value = 16,000.

- **Equation for voltage output Mode0:**

$$Y(V) = \left[\frac{X \times (Gain - Offset)}{16000} + Offset \right] \times \left(\frac{10(V)}{32000} \right)$$

Y=Voltage output, X=Digital input

Resolution: 0.3125mV = 20V/64,000

- **Equation for current output Mode1:**

$$Y(mA)=\left[\frac{X\times(Gain-Offset)}{16000}+Offset\right]\times\left(\frac{20(mA)}{32000}\right)$$

Y=Current output, X=Digital input

Resolution: 0.625μA = 20mA/32,000

- **Equation for current input Mode2:**

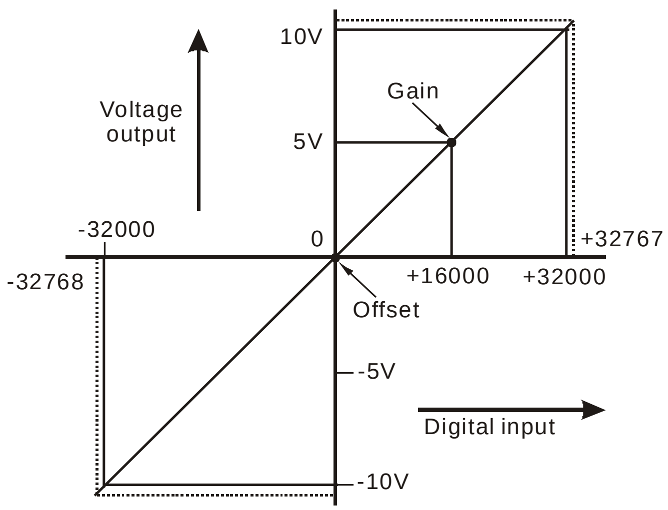
$$Y(mA)=\left[\frac{X\times(19200-6400)}{16000}+6400\right]\times\left(\frac{20(mA)}{32000}\right)$$

Y=Current output, X=Digital input

Resolution: 0.5μA = 16mA/32,000

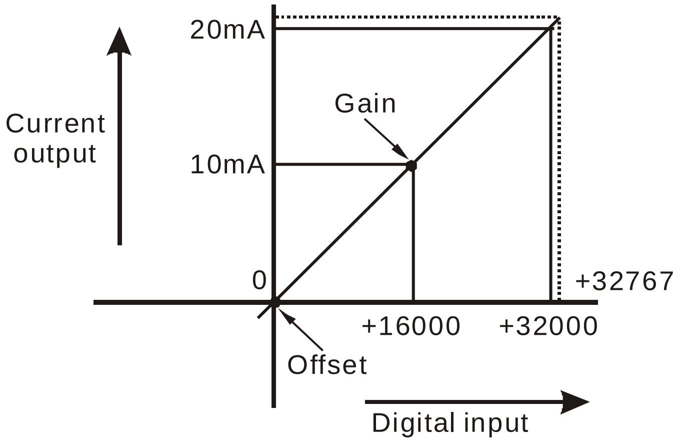
Mode 0 of CR#2 ~ CR#5	-10V ~ +10V, Default: Gain = 16,000 (= $\frac{5V}{0.3125mV}$) , Offset = 0
Range of digital conversion	-32,000 ~ +32,000
Max./Min. range of digital conversion	-32,768 ~ +32,767

- **Mode 0:**



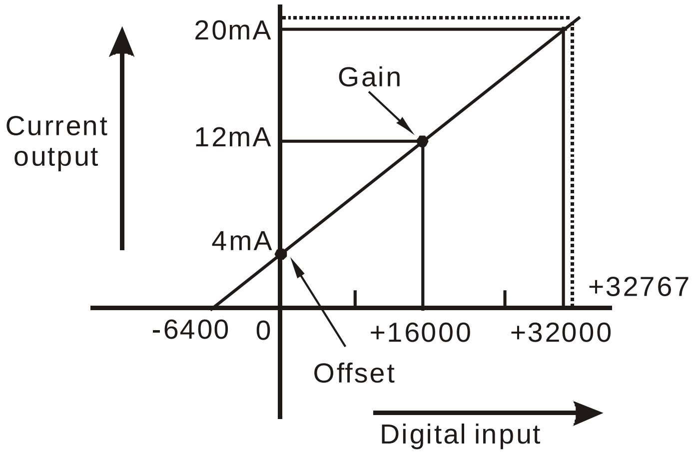
Mode 1 of CR#2 ~ CR#5	0mA ~ +20mA, Default: Gain = 16,000 (=$\frac{10mA}{0.625uA}$) , Offset = 0
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	0 ~ +32,767

- **Mode 1:**



Mode 2 of CR#2 ~ CR#5	+4mA ~ +20mA, Default: Gain = 19,200 ($=\frac{12mA}{0.625uA}$) · Offset = 6,400 ($=\frac{4mA}{0.625uA}$)
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	0 ~ +32,767

- **Mode 2:**



5.3.3 DVP06XA-E2 Control Registers

CR#	Attrib.		Register name	Explanation
0	O	R	Model name	Set up by the system: DVP06XA-E2 model code = H’00C4
1	O	R	Firmware version	Display the current firmware version in hex.
2	O	R/W	CH1 Input mode setting	Input mode: Default = H’0000. Take CH1 for example: Mode 0 (H’0000):Voltage input (±10V) Mode 1 (H’0001):Voltage input (±5V) Mode 2 (H’0002):Voltage input (0 ~+10V) Mode 3 (H’0003):Voltage input (0 ~+5V) Mode 4 (H’0004):Current input (±20mA) Mode 5 (H’0005):Current input (0 ~+20mA) Mode 6 (H’0006):Current input (4 ~+20mA) Mode -1 (H’FFFF):Channel 1 unavailable
3	O	R/W	CH2 Input mode setting	
4	O	R/W	CH3 Input mode setting	
5	O	R/W	CH4 Input mode setting	
6	O	R/W	CH5 output mode setting	Output mode: Default = H’0000. Take CH5 for example: Mode 0 (H’0000):Voltage output (±10V) Mode 1 (H’0001):Current output (0~+20mA) Mode 2 (H’0002):Current output (4~+20mA) Mode -1 (H’FFFF):Channel 5 unavailable
7	O	R/W	CH6 output mode setting	
8	O	R/W	CH1 average times	Average times setting of CH1 ~ CH4: Range = K1 ~ K100 Default = K10
9	O	R/W	CH2 average times	
10	O	R/W	CH3 average times	
11	O	R/W	CH4 average times	
12	X	R	CH1 average input value	Average value of input signals at CH1 ~ CH4
13	X	R	CH2 average input value	
14	X	R	CH3 average input value	
15	X	R	CH4 average input value	
16	X	R/W	CH5 output signal value	Voltage output range: K-32,000~K32,000. Current output range: K0~K32,000. Default: K0.
17	X	R/W	CH6 output signal value	
20	X	R	CH1 present input value	Present value of input signals at CH1 ~ CH4
21	X	R	CH2 present input value	
22	X	R	CH3 present input value	
23	X	R	CH4 present input value	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 ~ CH6 Default = K0. Definition of Offset in DVP06XA -E2: The corresponding voltage (current) input value when the digital output value = 0
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	
32	O	R/W	Adjusted Offset value of CH5	
33	O	R/W	Adjusted Offset value of CH6	
34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value in CH1 ~ CH6 Default = K16,000. Definition of Gain in DVP06XA-E2: The corresponding voltage (current) input value when the digital output value = 16,000.
35	O	R/W	Adjusted Gain value of CH2	
36	O	R/W	Adjusted Gain value of CH3	
37	O	R/W	Adjusted Gain value of CH4	
38	O	R/W	Adjusted Gain value of CH5	
39	O	R/W	Adjusted Gain value of CH6	

CR#	Attrib.		Register name	Explanation
Adjusted Offset Value, Adjusted Gain Value: Note 1: When using Mode 6 for input or Mode 2 for output, the channel do NOT provide setups for adjusted Offset and Gain value. Note 2: When mode changes, the adjusted Offset and Gain value returns to defaults.				
40	O	R/W	Set value changing prohibited	Prohibit set value changing in CH1 ~ CH4 Default= H'0000.
41	X	R/W	Save all the set values	Save all the set values, Default =H'0000
43	X	R	Error status	Register for storing all error status. Refer to table of error status for more information.
100	O	R/W	Enable/Disable limit detection	Upper and lower bound detection, b0~b5 corresponds to CH1~CH6 (0: Disable/ 1: Enable). Default= H'0000.
101	X	R/W	Upper and lower bound status	Display the upper and lower bound status. (0: Not exceed /1: Exceeds upper or lower bound value), b0~b5 corresponds to Ch1~Ch6 for lower bound detection result; b8~b13 corresponds to CH1~CH6 for upper bound detection result.
102	O	R/W	Set value of CH1 upper bound	Set value of CH1~CH6 upper bound. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
106	O	R/W	Set value of CH5 upper bound	
107	O	R/W	Set value of CH6 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1~CH6 lower bound. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
112	O	R/W	Set value of CH5 lower bound	
113	O	R/W	Set value of CH6 lower bound	
114	O	R/W	Output update time of CH5	Set output update time of CH5 ~ CH6
115	O	R/W	Output update time of CH6	
118	O	R/W	LV output mode setting of Ch5 ~ Ch6	Set the output mode of CH5~CH6 when the power is at LV (low voltage) condition. Default=0
Symbols: O: When CR#41 is set to H'5678, the set value of CR will be saved. X: Set value will not be saved. R: You can use FROM instruction to read data. W: You can use TO instruction to write data.				

※ CR#0 for module reset

You can use CR#0 to reset all the settings by simply writing H'4352 in CR#0 and wait for one second before turning the power OFF and then ON again, all the modules connected will be initialized. It is suggested to connect to only one module for module reset. And this is only available for firmware V1.14 or later.

※ CR#43: Error status value. See the table below:

Description					
bit0	K1 (H'1)	Power supply error	bit6	K64 (H'40)	CH4 Conversion error
bit1	K2 (H'2)	Hardware error	bit9	K512 (H'0200)	Mode setting error
bit2	K4 (H'4)	Upper/lower bound error	bit10	K1024 (H'0400)	Sampling range error
bit3	K8 (H'8)	CH1 Conversion error	bit11	K2048 (H'0800)	Upper / lower bound setting error
bit4	K16 (H'10)	CH2 Conversion error	bit12	K4096 (H'1000)	Set value changing prohibited

Description					
bit5	K32 (H'20)	CH3 Conversion error	bit13	K8192 (H'2000)	Communication breakdown on next module
Note: Each error status is determined by the corresponding bit (b0 ~ b13) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error					

Adjust A/D Conversion Curve

You can adjust the conversion curves according to the actual needs by changing the Offset value (CR#28 ~ CR#31) and Gain value (CR#34 ~ CR#37).

Offset: The corresponding voltage/current input value when the digital output value = 0.

Gain: The corresponding voltage/current input value when the digital output value = 16,000.

- **Equation for voltage input Mode0 / Mode2:**

$$Y = 16000 \times \left(\frac{X(V)}{10(V)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output, X=Voltage input

Resolution: 0.3125mV = 20V/64,000 = 10V/32,000

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- **Equation for voltage input Mode1 / Mode3:**

$$Y = 16000 \times \left(\frac{X(V)}{5(V)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output, X=Voltage input

Resolution: 0.15625mV = 10V/64,000 = 5V/32,000

- **Equation for current input Mode4 / Mode5:**

$$Y = 16000 \times \left(\frac{X(mA)}{20(mA)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output, X=Current input

Resolution: 0.625μA = 40mA/64,000 = 20mA/32,000

- **Equation for current input Mode6:**

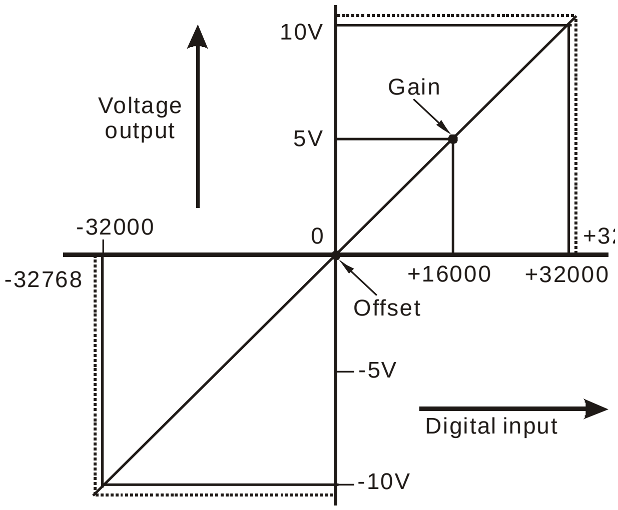
$$Y = 16000 \times \left(\frac{X(mA)}{20(mA)} \times 32000 - 6400 \right) \Big/ (19200 - 6400)$$

Y=Digital output, X=Current input

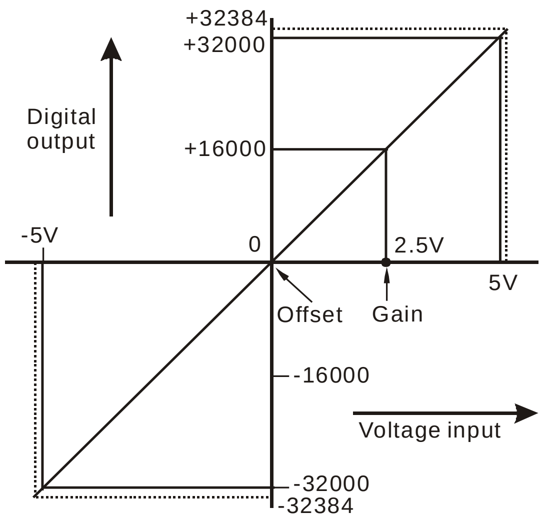
Resolution: 0.5μA = 16mA/32,000

Mode 0 of CR#2 ~ CR#5	-10V ~ +10V, Default: Gain = 16,000 (= $\frac{5V}{0.3125mV}$) , Offset = 0
Mode 1 of CR#2 ~ CR#5	-5V ~ +5V, Default: Gain = 16,000 (= $\frac{2.5V}{0.15625mV}$) , Offset = 0
Range of digital conversion	-32,000 ~ +32,000
Max./Min. range of digital conversion	-32,384 ~ +32,384

- **Mode 0:**

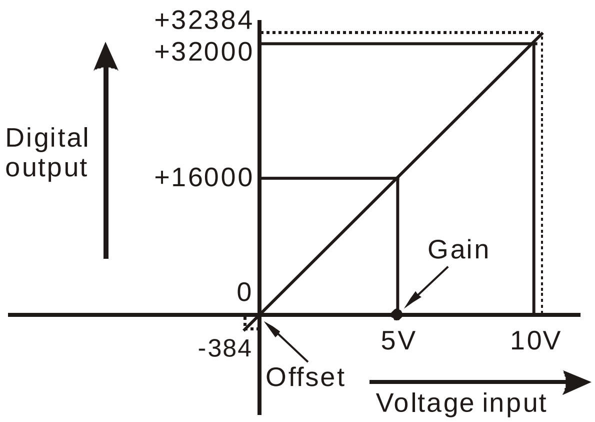


- **Mode 1:**

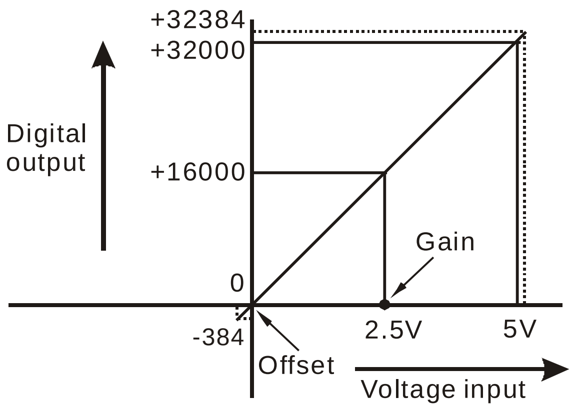


Mode 2 of CR#2 ~ CR#5	0V ~ +10V, Default: Gain = 16,000 (= $\frac{5V}{0.3125mV}$) · Offset = 0
Mode 3 of CR#2 ~ CR#5	0V ~ +5V, Default: Gain = 16,000 (= $\frac{2.5V}{0.15625mV}$) · Offset = 0
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	-384 ~ +32,384

- **Mode 2:**

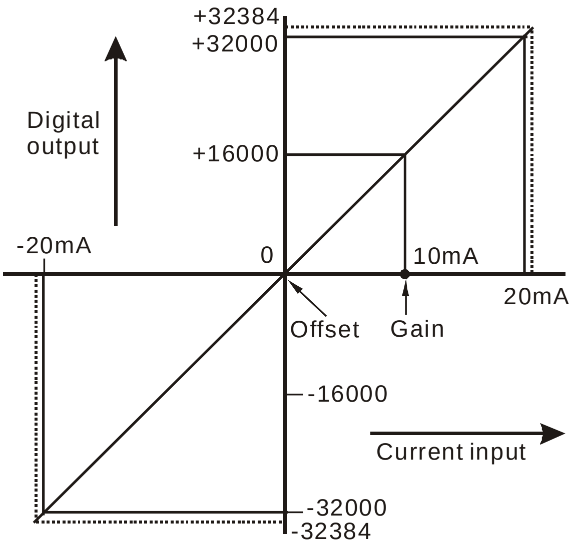


- **Mode 3:**



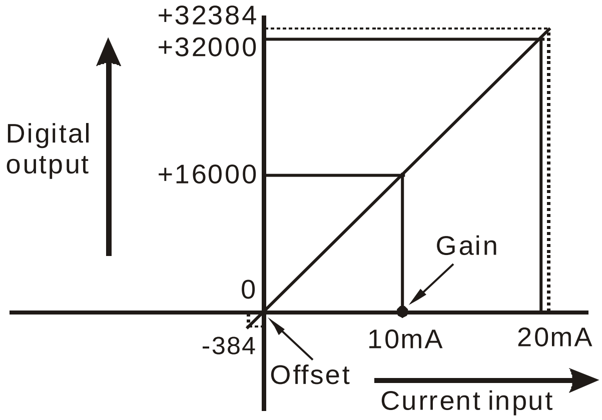
Mode 4 of CR#2 ~ CR#5	-20mA ~ +20mA, Default: Gain = 16,000 (= $\frac{10mA}{0.625uA}$) , Offset = 0
Range of digital conversion	-32,000 ~ +32,000
Max./Min. range of digital conversion	-32,384 ~ +32,384

- **Mode 4:**

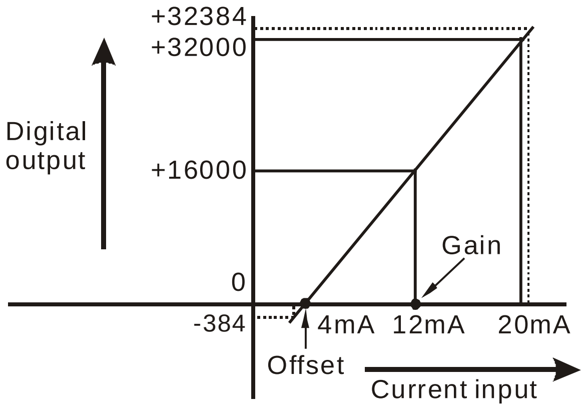


Mode 5 of CR#2 ~ CR#5	0mA ~ +20mA, Default: Gain = 16,000 (= $\frac{10mA}{0.625uA}$) , Offset = 0
Mode 6 of CR#2 ~ CR#5	+4mA ~ +20mA, Default: Gain = 19,200 (= $\frac{12mA}{0.625uA}$) , Offset = 6,400 (= $\frac{4mA}{0.625uA}$)
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	-384 ~ +32,384

- **Mode 5:**



- **Mode 6:**



Adjust D/A Conversion Curve

You can adjust the conversion curves according to the actual needs by changing the Offset value (CR#32 ~ CR#33) and Gain value (CR#38 ~ CR#39).

Offset: The corresponding voltage/current input value when the digital output value = 0.

Gain: The corresponding voltage/current input value when the digital output value = 16,000.

- **Equation for voltage output Mode0:**

$$Y(V)=\left[\frac{X\times(Gain-Offset)}{16000}+Offset\right]\times\left(\frac{10(V)}{32000}\right)$$

Y=Voltage output, X=Digital input

Resolution: 0.3125mV = 20V/64,000

- **Equation for current output Mode1:**

$$Y(mA)=\left[\frac{X\times(Gain-Offset)}{16000}+Offset\right]\times\left(\frac{20(mA)}{32000}\right)$$

Y=Current output, X=Digital input

Resolution: 0.625μA = 20mA/32,000

- **Equation for current input Mode2:**

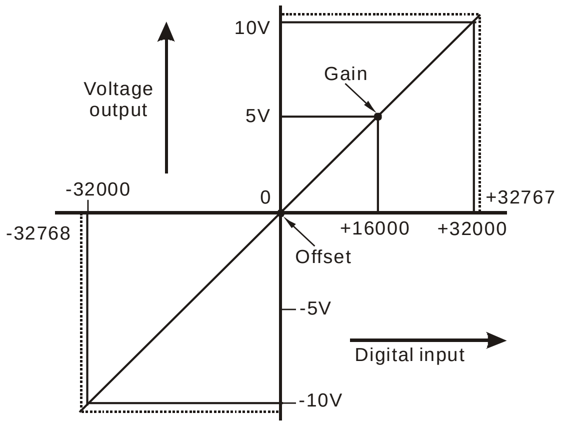
$$Y(mA)=\left[\frac{X\times(19200-6400)}{16000}+6400\right]\times\left(\frac{20(mA)}{32000}\right)$$

Y=Current output, X=Digital input

Resolution: 0.5μA = 16mA/32,000

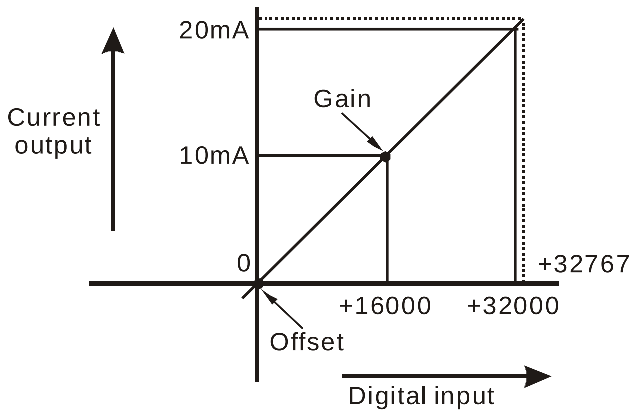
Mode 0 of CR#2 ~ CR#5	-10V ~ +10V, Default: Gain = 16,000 (= $\frac{5V}{0.3125mV}$) , Offset = 0
Range of digital conversion	-32,000 ~ +32,000
Max./Min. range of digital conversion	-32,768 ~ +32,767

- **Mode 0:**



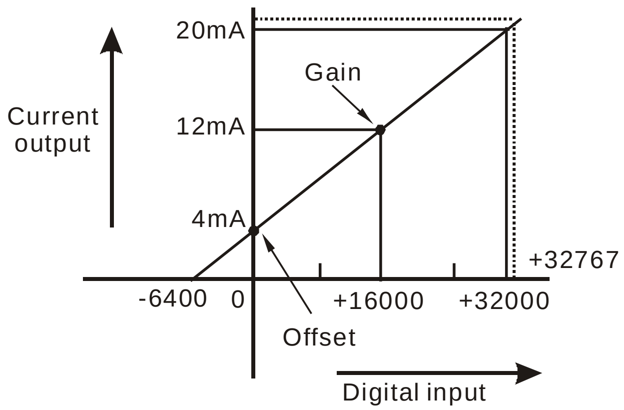
Mode 1 of CR#2 ~ CR#5	0mA ~ +20mA, Default: Gain = 16,000 ($=\frac{10mA}{0.625uA}$) , Offset = 0
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	0 ~ +32,767

- **Mode 1:**



Mode 2 of CR#2 ~ CR#5	+4mA ~ +20mA, Default: Gain = 19,200 ($=\frac{12mA}{0.625uA}$) · Offset = 6,400 ($=\frac{4mA}{0.625uA}$)
Range of digital conversion	0 ~ +32,000
Max./Min. range of digital conversion	0 ~ +32,767

- **Mode 2:**



5.3.4 DVP04PT-E2 / DVP06PT-E2 Control Registers

04PT	06PT	Attrib.		Register content	Description
0	0	O	R	Model name	DVP04PT-E2 model code = H'0082 DVP06PT-E2 model code = H'00C2
1	1	O	R	Firmware version	Display the current firmware version in hex.
2	2	O	R/W	CH1 Input mode setting	Input mode: Default = H'0000. Take CH1 for example: Mode 0 (H'0000): Pt100: -180°C ~ 800°C Mode 1 (H'0001): Ni100: -80°C ~ 170°C Mode 2 (H'0002): Pt1000: -180°C ~ 800°C Mode 3 (H'0003): Ni1000: -80°C ~ 170°C Mode 4 (H'0004): 0~300Ω Mode 5 (H'0005): 0~3000Ω Mode 6 (H'0006): JPt100 (-180°C ~ 500°C) Mode 7 (H'0007): Cu50 (-50°C ~ 150°C) Mode 8 (H'0008): Cu100 (-50°C ~ 150°C) Mode 9 (H'0009): LG-Ni1000 (-50°C ~ 180°C) Mode -1 (H'FFFF): Channel unavailable Note: 04PT-E2 do NOT support mode 6-9.
3	3	O	R/W	CH2 Input mode setting	
4	4	O	R/W	CH3 Input mode setting	
5	5	O	R/W	CH4 Input mode setting	
	6	O	R/W	CH5 Input mode setting	
	7	O	R/W	CH6 Input mode setting	
7		O	R/W	Temperature unit setting	Select the temperature unit (Celsius °C / Fahrenheit °F). Default = H'0 (°C)
8	8	O	R/W	CH1 average times	Average times setting of channel CH1 ~ CH6 Setting range: K1 ~ K100 Default = K10
9	9	O	R/W	CH2 average times	
10	10	O	R/W	CH3 average times	
11	11	O	R/W	CH4 average times	
	12	O	R/W	CH5 average times	
	13	O	R/W	CH6 average times	
12	14	X	R	Average temperature measured at CH1	Average temperature measured. Setting Temperature Unit : ● DVP04PT-E2: CR#7 ● DVP06PT-E2: CR#27
13	15	X	R	Average temperature measured at CH2	
14	16	X	R	Average temperature measured at CH3	
15	17	X	R	Average temperature measured at CH4	
	18	X	R	Average temperature measured at CH5	
	19	X	R	Average temperature measured at CH6	
20	20	X	R	Present temperature measured at CH1	Present temperature measured. Setting Temperature Unit : ● DVP04PT-E2: CR#7 ● DVP06PT-E2: CR#27
21	21	X	R	Present temperature measured at CH2	
22	22	X	R	Present temperature measured at CH3	
23	23	X	R	Present temperature measured at CH4	
	24	X	R	Present temperature measured at CH5	

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04PT	06PT	Attrib.		Register content	Description
	25	X	R	Present temperature measured at CH6	
	26	O	R/W	Mode 4 (H’0004): 0~300Ω. Temperature display decimal digit changes	In mode 4 (0~300Ω), temperature display decimal changes (0: 1 digit after the decimal place/ 1: 2 digits after the decimal place). Default= H0
	27	O	R/W	Temperature unit setting	Select the temperature unit (Celsius °C / Fahrenheit °F). Default = H’0(°C)
28	28	O	R/W	Adjusted offset value of CH1	Adjusted offset value, range K-1000 ~ K1000. Default = K0 Measured Value = Original Value – Adjusted offset value Unit Setup: ● DVP04PT-E2: CR#7 ● DVP06PT-E2: CR#27
29	29	O	R/W	Adjusted offset value of CH2	
30	30	O	R/W	Adjusted offset value of CH3	
31	31	O	R/W	Adjusted offset value of CH4	
	32	O	R/W	Adjusted offset value of CH5	
	33	O	R/W	Adjusted offset value of CH6	
40	40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing, b0~b5 corresponds to CH1 ~ CH6. Default =H’0000
41	41	X	R/W	Function: Save all the set values	Save all the set values. Default =H’0000
43	43	X	R	Error status	Register for storing all error status. See the table of error status for more information.
100	100	O	R/W	Function: Enable/Disable limit detection	Upper and lower bound detection, b0~b5 corresponds to CH1 ~ CH6 (0: Disable/ 1: Enable). Default= H’0000.
101	101	X	R/W	Upper and lower bound status	Display the upper and lower bound status (0: Not Exceeding; 1: Exceeding upper and lower bound value), b0~b5 corresponds to CH1 ~ CH6 lower bound, b8~b13 corresponds to CH1 ~ CH6 upper bound. Default =H’0000
102	102	O	R/W	Set value of CH1 upper bound	Set upper bound value. Default = K32000.
103	103	O	R/W	Set value of CH2 upper bound	
104	104	O	R/W	Set value of CH3 upper bound	
105	105	O	R/W	Set value of CH4 upper bound	
	106	O	R/W	Set value of CH5 upper bound	
	107	O	R/W	Set value of CH6 upper bound	
108	108	O	R/W	Set value of CH1 lower bound	Set lower bound value. Default = K-32000.
109	109	O	R/W	Set value of CH2 lower bound	
110	110	O	R/W	Set value of CH3 lower	

04PT	06PT	Attrib.		Register content	Description
				bound	
111	111	O	R/W	Set value of CH4 lower bound	
	112	O	R/W	Set value of CH5 lower bound	
	113	O	R/W	Set value of CH6 lower bound	

Symbols:
O: When CR#41 is set to H'5678, the set value of CR will be saved.
X: Set value will not be saved.
R: You can use FROM instruction to read data.
W: You can use TO instruction to write data.

※ CR#0 for module reset

You can use CR#0 to reset all the settings by simply writing H'4352 in CR#0 and wait for one second before turning the power OFF and then ON again, all the modules connected will be initialized. It is suggested to connect to only one module for module reset.

※ CR#43: Error status value. See the table below:

Description					
bit0	K1 (H'1)	Power supply error	bit6	K64 (H'40)	CH4 Conversion error
bit1	K2 (H'2)	Hardware error	bit9	K512 (H'0200)	Mode setting error
bit2	K4 (H'4)	Upper/lower bound error	bit10	K1024 (H'0400)	Sampling range error
bit3	K8 (H'8)	CH1 Conversion error	bit11	K2048 (H'0800)	Upper / lower bound setting error
bit4	K16 (H'10)	CH2 Conversion error	bit12	K4096 (H'1000)	Set value changing prohibited
bit5	K32 (H'20)	CH3 Conversion error	bit13	K8192 (H'2000)	Communication breakdown on next module

Note: Each error status is determined by the corresponding bit (b0 ~ b13) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error

- **PID Control Registers**

CR				Attrib.		Register content	Description
CH1	CH2	CH3	CH4				
120	140	160	180	O	R/W	Set temperature value	Please set the temperature value according to proper range of each sensor type. Default = K0
121	141	161	181	O	R/W	Sampling time (s)	Range: K1 ~ K30 (s). Default = K2
122	142	162	182	O	R/W	K_P	Proportional control constant. Default = K121
123	143	163	183	O	R/W	K_I	Integral constant. Default = K2,098
124	144	164	184	O	R/W	K_D	Derivative constant. Default = K-29
125	145	165	185	O	R/W	Upper limit of I value	Upper limit of I value. Default = K0
126	146	166	186	O	R/W	Lower limit of I value	Lower limit of I value. Default = K0
127	147	167	187	X	R	I value	Current accumulated offset value
128	148	168	188	O	R/W	Heating/cooling	0: Heater, 1: Cooler. Default = K0
129	149	169	189	O	R/W	Upper limit of output	Upper limit of output. Default = K32,000
130	150	170	190	O	R/W	Lower limit of output	Lower limit of output. Default = K0
131	151	171	191	X	R	Output percentage	Output percentage (Unit: 0.1%)
132	152	172	192	X	R	Output width (ms)	Width of control output. Unit: ms
133	153	173	193	X	R	Output cycle (ms)	Cycle of control output. Unit: ms

CR				Attrib.		Register content	Description
134	154	174	194	X	R	Output volume	Output volume
135	155	175	195	X	R/W	PID_RUN/STOP	0: STOP, 1: RUN. Default = K0
136	156	176	196	X	R/W	Auto-tuning	0: Disabled, 1: Auto-tuning. Default = K0

Symbols:
O: Set value will be saved.
X: Set value will not be saved.
R: You can use FROM instruction to read data.
W: You can use TO instruction to write data.

- **Adjust PT Conversion Curve**

You can adjust the conversion curves according to the actual needs by changing the Offset value.

Offset in DVP04/06PT-E2: Deviation digital value from the target value.

(Measured Value= Original Value – Adjust Value Offset)

- **Mode0 ~ Mode3, Mode6 ~ Mode9 : output unit 0.1°**

$$Y = \left(\frac{X(°)}{0.1(°)} - Offset \right)$$

Y= Digital output,

X= Measured temperature input

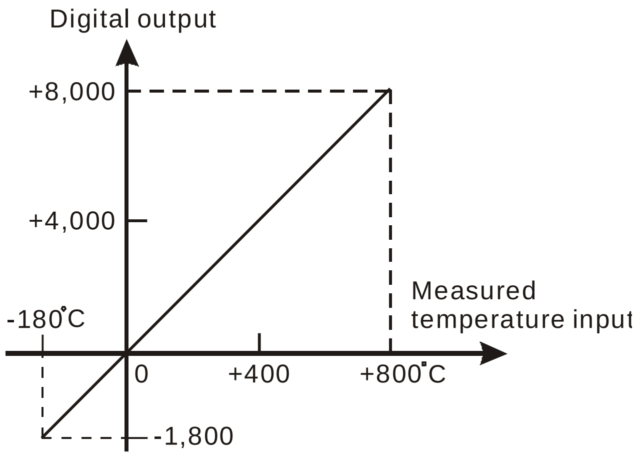
- **Mode4 ~ Mode5: output unit 0.1Ω**

$$Y = \left(\frac{X(\text{Ohm})}{0.1(\text{Ohm})} - Offset \right)$$

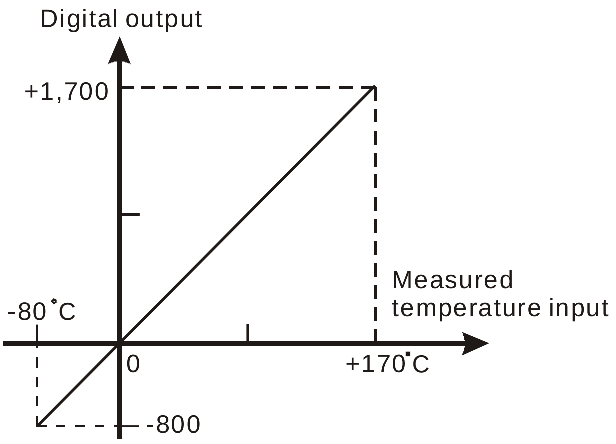
Y= Digital output,

X= Measured temperature input

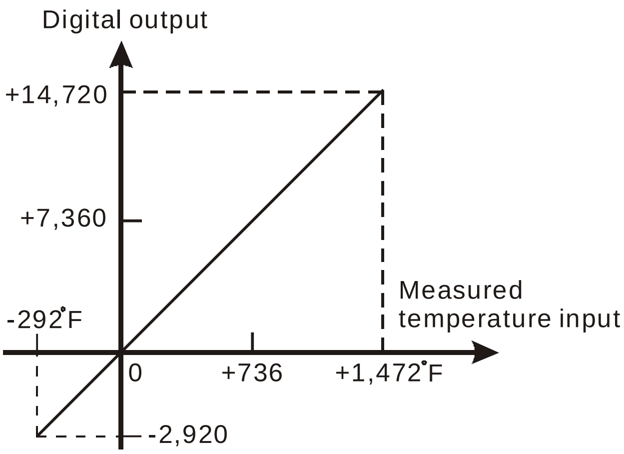
- **Mode 0：**



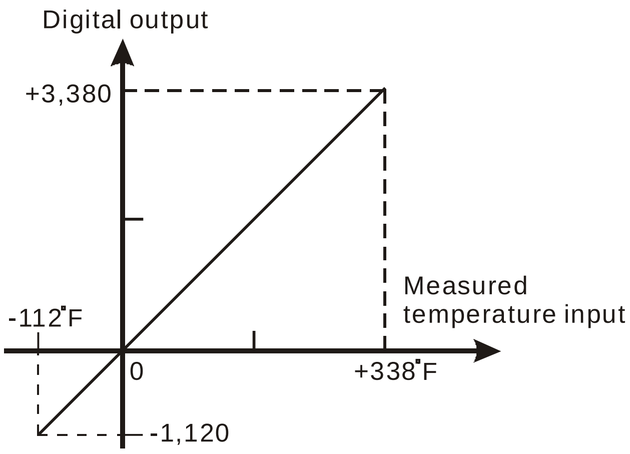
- **Mode 1:**



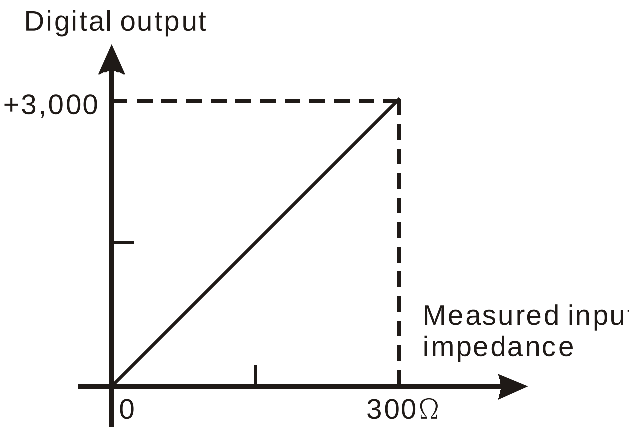
- **Mode 2:**



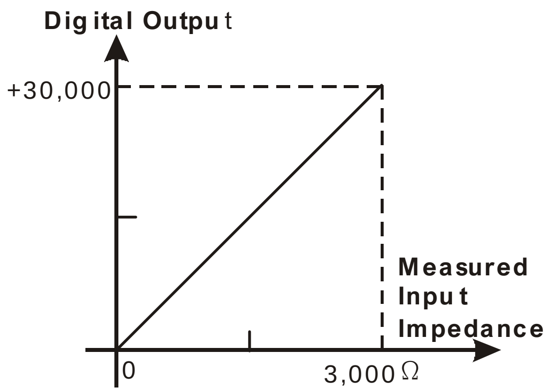
- **Mode 3 :**



- **Mode 4:**



- **Mode 5:**



5.3.5 DVP04TC-E2 Control Registers

CR#	Attrib.		Register content	Description
0	O	R	Model name	Set up by the system: DVP04TC-E2 model code = H’0083
1	O	R	Firmware version	Display the current firmware version in hex.
2	O	R/W	CH1 Input mode setting	Input mode: Default = H’0000. Take CH1 for example: Mode 0 (H’0000): J-type (-100°C ~1,150°C) Mode 1 (H’0001): K-type (-100°C ~ 1,350°C) Mode 2 (H’0002): R-type (0°C ~ 1,750°C) Mode 3 (H’0003): S-type (0°C ~ 1,750°C) Mode 4 (H’0004): T-type (-150°C ~ 390°C) Mode 5 (H’0005): E-type (-150°C ~ 980°C) Mode 6 (H’0006): N-type (-150°C ~ 1,280°C) Mode 7 (H’0007): -80mV~+80mV Mode -1(H’FFFF): Close
3	O	R/W	CH2 Input mode setting	
4	O	R/W	CH3 Input mode setting	
5	O	R/W	CH4 Input mode setting	
7	O	R/W	Temperature unit setting	Select the temperature unit (Celsius °C / Fahrenheit °F). Default = H0(°C)
8	O	R/W	CH1 sampling range	Set sampling range at CH1 ~ CH4 Range = K1 ~ K100 Default = K10
9	O	R/W	CH2 sampling range	
10	O	R/W	CH3 sampling range	
11	O	R/W	CH4 sampling range	
12	X	R	Average temperature measured at CH1	Average temperature measured at CH1 ~ Ch2 Temperature unit: set in CR#7
13	X	R	Average temperature measured at CH2	
14	X	R	Average temperature measured at CH3	Average temperature measured at CH3 ~ Ch4 Temperature unit: set in CR#7
15	X	R	Average temperature measured at CH4	
20	X	R	Present temperature measured at CH1	Present temperature measured at CH1 ~ CH4 Temperature unit: set in CR#7
21	X	R	Present temperature measured at CH2	
22	X	R	Present temperature measured at CH3	
23	X	R	Present temperature measured at CH4	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of Ch1 ~ Ch4. Default = K0 Range: K-400 ~ K400 Temperature unit: set in CR#7 Definition of Offset at Ch1 ~ Ch4 in DVP04TC-E2: Deviation digital value from the target value.
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	
40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing in CH1 ~ CH4
41	X	R/W	Function: Save all the set values	Save all the set values, Default =H’0000
43	X	R	Error status	Register for storing all error status. See the table of error status for more information.
100	O	R/W	Function: Enable / Disable limit detection	Upper and lower bound detection, b0~b3 corresponds to CH1 ~ CH4 (0: Disable/ 1: Enable). Default= H’0000.

CR#	Attrib.		Register content	Description
101	X	R/W	Upper and lower bound status	Display the upper and lower bound status (0: Not Exceeding; 1: Exceeding upper and lower bound value), b0~b3 corresponds to CH1 ~ CH4 lower bound, b8~b13 corresponds to CH1 ~ CH4 upper bound.
102	O	R/W	Set value of CH1 upper bound	Set value of CH1~CH4 upper bound. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1~CH4 lower bound. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
Symbols: O: When CR#41 is set to H'5678, the set value of CR will be saved. X: Set value will not be saved. R: You can use FROM instruction to read data. W: You can use TO instruction to write data.				

※ CR#43: Error status value. See the table below:

Description					
bit0	K1 (H'1)	Power supply error	bit6	K64 (H'40)	CH4 Conversion error
bit1	K2 (H'2)	Hardware error	bit9	K512 (H'0200)	Mode setting error
bit2	K4 (H'4)	Upper/lower bound error	bit10	K1024 (H'0400)	Sampling range error
bit3	K8 (H'8)	CH1 Conversion error	bit11	K2048 (H'0800)	Upper / lower bound setting error
bit4	K16 (H'10)	CH2 Conversion error	bit12	K4096 (H'1000)	Set value changing prohibited
bit5	K32 (H'20)	CH3 Conversion error	bit13	K8192 (H'2000)	Communication breakdown on next module
Note: Each error status is determined by the corresponding bit (b0 ~ b13) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error					

- **PID Control Registers**

CR				Attrib.		Register content	Description
CH1	CH2	CH3	CH4				
120	140	160	180	O	R/W	Set temperature value	Please set the temperature value according to proper range of each sensor type. Default = K0
121	141	161	181	O	R/W	Sampling time (s)	Range: K1 ~ K30 (s). Default = K2
122	142	162	182	O	R/W	K_P	Proportional control constant. Default = K121
123	143	163	183	O	R/W	K_I	Integral constant. Default = K2,098
124	144	164	184	O	R/W	K_D	Derivative constant. Default = K-29
125	145	165	185	O	R/W	Upper limit of I value	Upper limit of I value. Default = K0
126	146	166	186	O	R/W	Lower limit of I value	Lower limit of I value. Default = K0
127	147	167	187	X	R	I value	Current accumulated offset value
128	148	168	188	O	R/W	Heating/cooling	0: Heater, 1: Cooler. Default = K0
129	149	169	189	O	R/W	Upper limit of output	Upper limit of output. Default = K32,000
130	150	170	190	O	R/W	Lower limit of output	Lower limit of output. Default = K0
131	151	171	191	X	R	Output percentage	Output percentage (Unit: 0.1%)

CR				Attrib.		Register content	Description
132	152	172	192	X	R	Output width (ms)	Width of control output. Unit: ms
133	153	173	193	X	R	Output cycle (ms)	Cycle of control output. Unit: ms
134	154	174	194	X	R	Output volume	Output volume
135	155	175	195	X	R/W	PID_RUN/STOP	0: STOP, 1: RUN. Default = K0
136	156	176	196	X	R/W	Auto-tuning	0: Disabled, 1: Auto-tuning. Default = K0
Symbols: O: Set value will be saved. X: Set value will not be saved. R: You can use FROM instruction to read data. W: You can use TO instruction to write data.							

- **Adjust PT Conversion Curve**

You can adjust the conversion curves according to the actual needs by changing the Offset value (CR#28 ~ CR#31).

Offset: The corresponding voltage/current input value when the digital output value = 0.

- **Mode0 ~ Mode6: output unit 0.1°**

$$Y = \left(\frac{X(°)}{0.1(°)} - Offset \right)$$

Y= Digital output,

X= Measured temperature input

- **Mode7: 0.01 mV = 80 mV/8000**

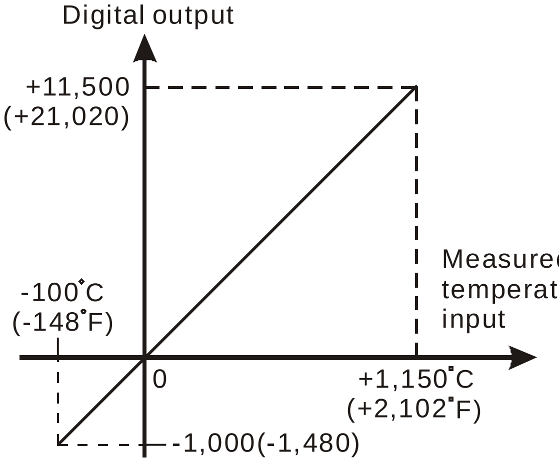
$$Y = \left(\frac{X(\mathrm{m}V)}{0.01(\mathrm{m}V)} - Offset \right)$$

Y= Digital output,

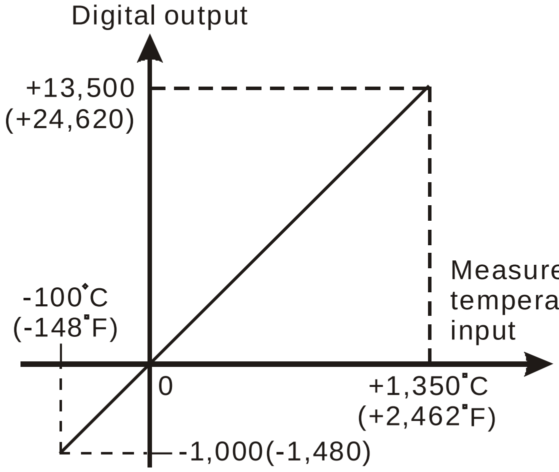
X= Current input

Mode 0 of CR#2~ CR#5	-100°C ~ 1150°C (-1000~11500) -148°F ~ 2102°F (-1480~21020)
Mode 1 of CR#2~ CR#5	-100°C ~ 1350°C (-1000~13500) -148°F ~ 2462°F (-1480~24620)
Mode 2, 3 of CR#2~ CR#5	0°C ~ 1750°C (0~17500) 32°F ~ 3182°F (320~31820)
Mode 4 of CR#2~ CR#5	-150°C ~ 390°C (-1500~3900) -238°F ~ 734°F (-2380~7340)
Mode 5 of CR#2~ CR#5	-150°C ~ 980°C (-1500~9800) -238°F ~ 1796°F (-2380~17960)
Mode 6 of CR#2~ CR#5	-150°C ~ 1280°C (-1500~12800) -238°F ~ 2336°F (-2380~23360)
Offset (CR#34 ~ CR#37)	Deviation digital value corresponds to 0°C/ °F

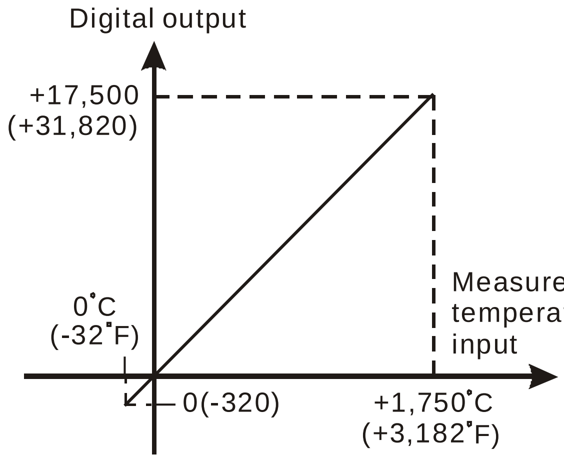
- **Mode 0: J-type thermocouple**



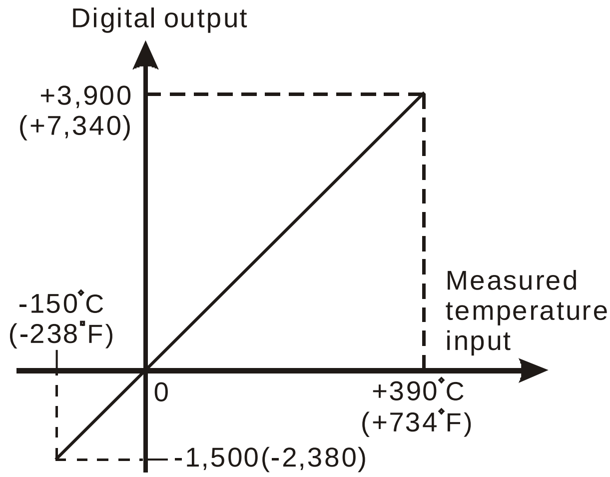
- **Mode 1: K-type thermocouple**



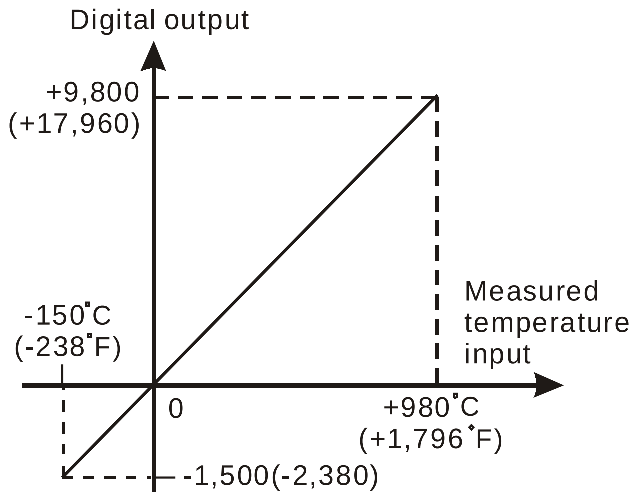
- **Mode 2: R-type thermocouple**
- **Mode 3: S-type thermocouple**



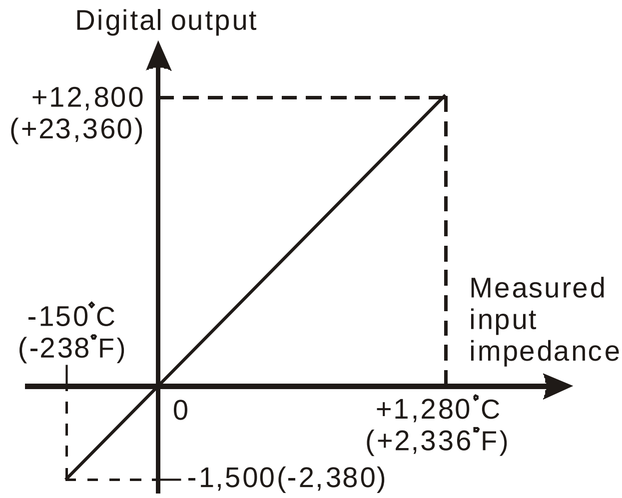
- **Mode 4: T-type thermocouple**



- **Mode 5: E-type thermocouple**



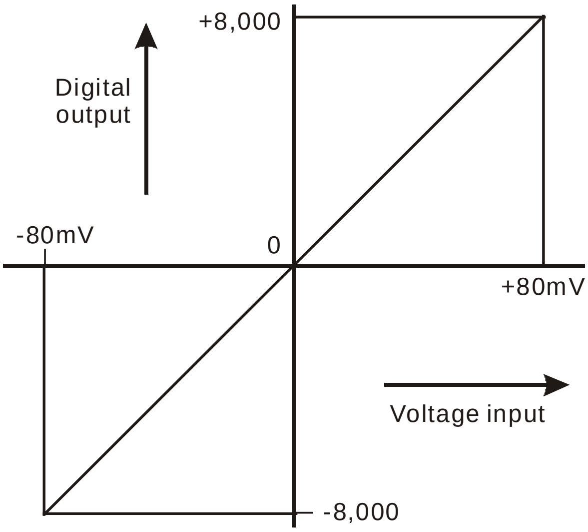
- **Mode 6: N-type thermocouple**



5

Mode 7 of CR#2~ CR#5	-80mV ~ +80mV (-8000~8000)

- **Mode 7:**



6

Chapter 6 Writing a Program

Table of Contents

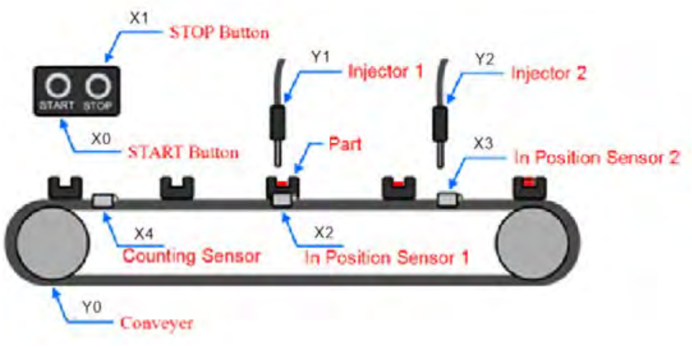
6.1 Quick Start

This chapter provides a simple example showing you how to create a traditional ladder diagram in ISPSoft. Because you may not be familiar with IEC 61131-3 and may not understand the functions provided by ISPSoft, the chapter does not introduce programming concepts related to IEC 61131-3. For example, the chapter does not include POUs, function blocks, variables, and so on.

6.1.1 Example

When the equipment in this example operates, the parts on the conveyor move from left to right. If a sensor senses that a part is under an injector, the PLC sends a trigger signal to the injector, and the injector injects the glue. The injection length is set externally and is not controlled by the PLC program . However, the PLC program must be able to turn the trigger signal OFF so that the trigger signal can be sent next time. There are two injectors above the conveyor, and the two injectors inject glue in the same way.

There is a sensor at the left side of the conveyor. When a part passes the sensor, the sensor value increases by one increment. When the sensor value is 100, the internal completion flag is set to ON. The flag state can be used by other procedures later. However, this example does not introduce the use of flag states.



6.1.2 Hardware

In this example, the DVP-ES3 series CPU module used is the **DVP32ES311T**.

Type	ID	Description
Digital input	X0	START button
Digital input	X1	STOP button
Digital input	X2	In position sensor 1
Digital input	X3	In position sensor 2
Digital input	X4	Counting sensor
Digital output	Y0	Conveyer
Digital output	Y1	Trigger signal for injector 1
Digital output	Y2	Trigger signal for injector 2

6.1.3 Program

(1) When the START button (X0) switches from OFF to ON, the internal operation flag is set to ON, and the conveyor (Y0) starts. When the STOP button (X1) switches from OFF to ON, an error occurs (the error flag is ON), the operation flag is reset to OFF, and the conveyor stops.

(2) When the in position sensor 1 (X2) is ON, the trigger signal for injector 1 (Y1) is set to ON. When the in position sensor 1 is OFF, the trigger signal for injector 1 is reset to OFF.

(3) When the in position sensor 2 (X3) is ON, the trigger signal for injector 2 (Y2) is set to ON. When the in position sensor 2 is OFF, the trigger signal for injector 2 is reset to OFF.

(4) When the counting sensor (X4) switches from OFF to ON, the sensor value increases by one increment. If the sensor value is larger than or equal to 100, the internal completion flag is set to ON.

6.2 Procedure for Creating a Project in ISPSoft

This section shows you the procedure for creating a project in ISPSoft. You can adjust the procedure according to your needs. Hardware Configuration → Network Configuration → Programming → Test & Debugging

- **Hardware configuration**

  You set the parameters such as a range of latched devices and a port number in a PLC. You configure the modules with a DVP-ES3 Series CPU module, and set the parameters in these modules.

- **Network configuration**

  If a system uses a network architecture, or devices need to exchange data, use the network configuration tool **NWCONFIG** in ISPSoft to configure a network and exchange data with COM as well as Ethernet.

- **Programming**

  After you write a program in ISPSoft, compile the program. If the compiling is unsuccessful, messages in the **Compile Message** page show where the errors occur.

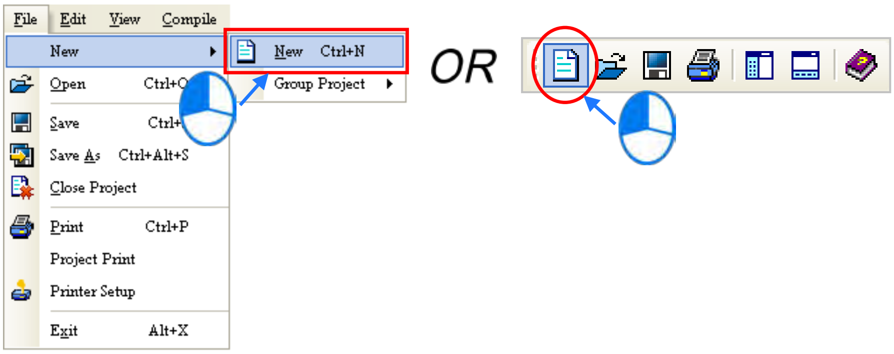
- **Testing and debugging**

  Download the compiled program, the hardware configuration, and the network configuration to a PLC. You can then test and debug the program online with the functions provided by ISPSoft.

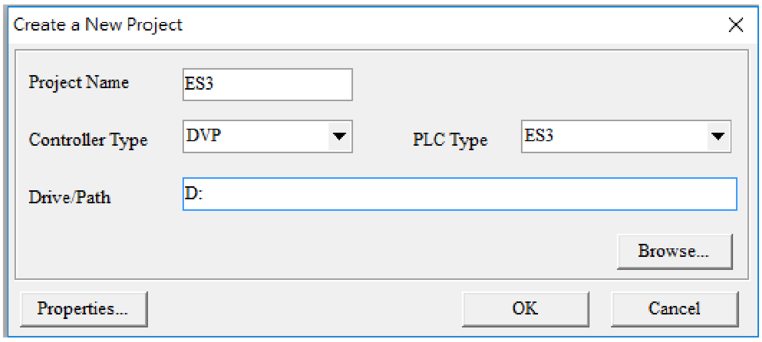
Because the example introduced in this chapter does not discuss a network configuration, you only perform the following procedure. Hardware Configuration → Programming → Test & Debugging

6.3 Creating a Project

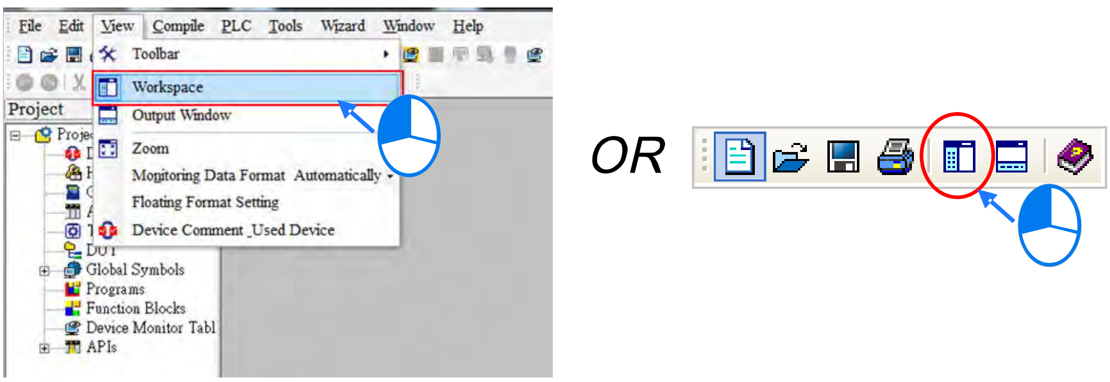
After you start ISPSoft, on the **File** menu, point to **New**, and then click **New** to create a new project. You can also create a new project by clicking on the toolbar after you start ISPSoft.



In the **Create a New Project** dialog box, type a project name in the **Project Name** box and a path in the **Drive/Path** box, select a PLC in the **PLC Type** drop-down list box, and then click **OK**. The PLC in this example is the DVP32ES3.

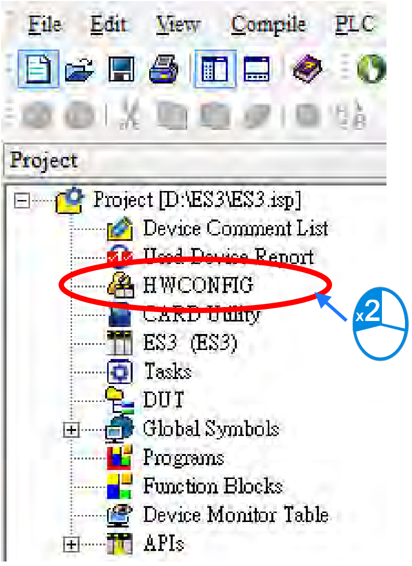


After you create the project, a project management area appears at the left side of the main screen. The relation between the items listed in the project management area is represented by a hierarchical tree structure. If the project management area does not appear, on the **View** menu, click **Workspace** , or click on the toolbar.



6.4 Hardware Configuration

After you double-click **HWCONFIG** in the project management area, the **HWCONFIG** window appears.

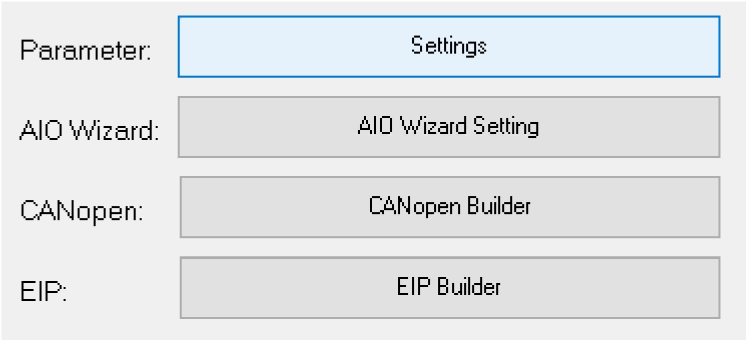


6.4.1 Configuring a Module

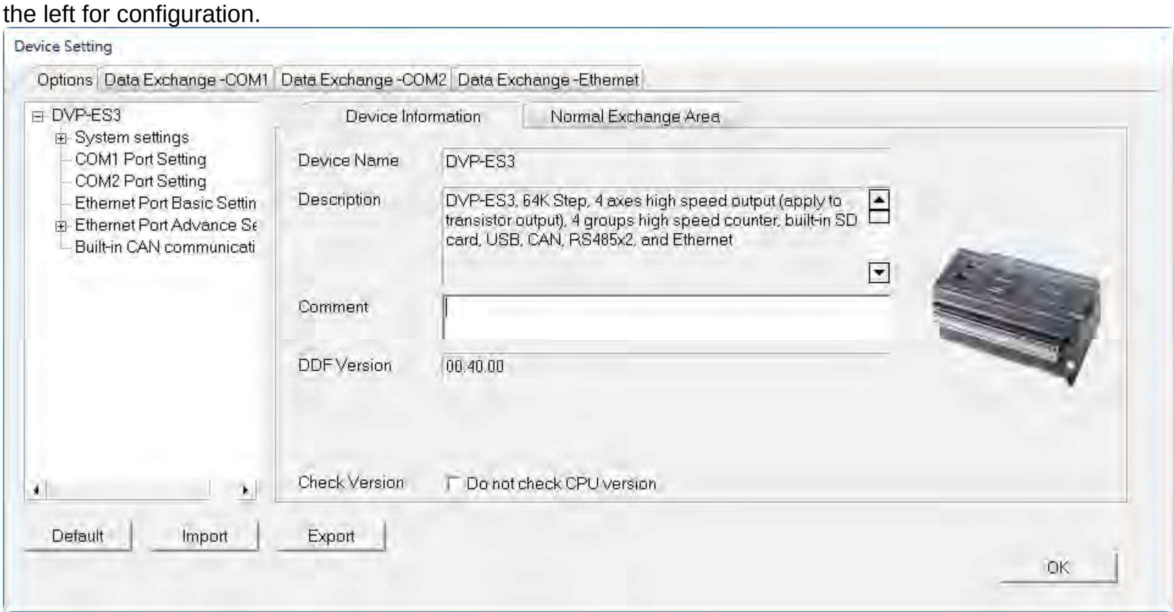
In the **HWCONFIG** window, the default setting is with a CPU module. Refer to Chapter 8 for more information.

6.4.2 Setting the Parameters

After you double-click the CPU module or the extension module, the **Device Setting** dialog box appears with the module information.



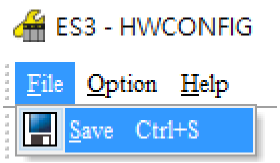
Click the setting tabs for specific parts of the setup at the top of the window and then select the setting items on the left for configuration.



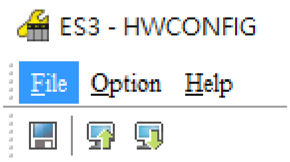
When the hardware configuration is complete, download the configuration and the settings to the CPU module.

Save the configuration and settings, and you can download them with the program later in the project.

On the **File** menu, click **Save** or  on the toolbar to save the configuration and settings, and then close the **HWCONFIG** window.



or



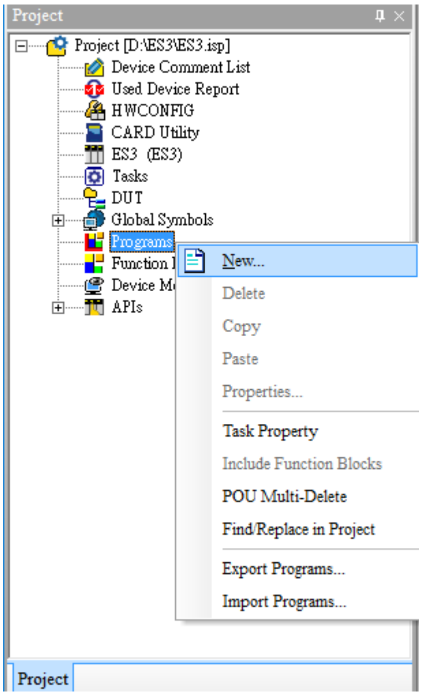
***. Refer to Chapter 8 for more information about HWCONFIG.**

6.5 Creating a Program

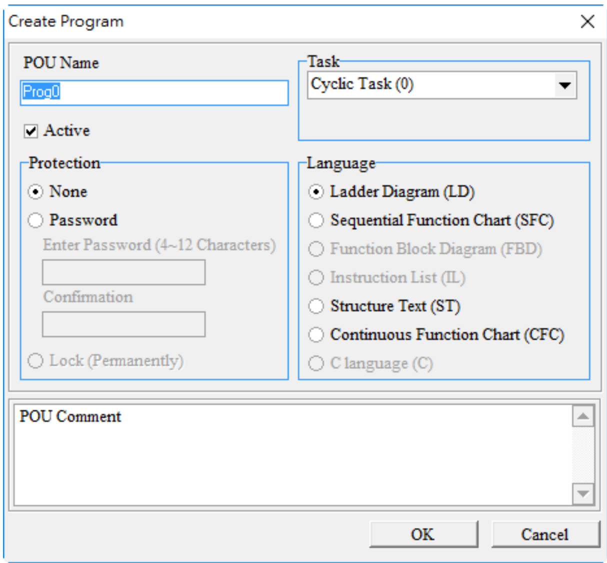
The following sections show you how to create a traditional ladder diagram in ISPSoft. The sections include creating a POU, editing a traditional diagram, and compiling a program.

6.5.1 Adding a Ladder Diagram

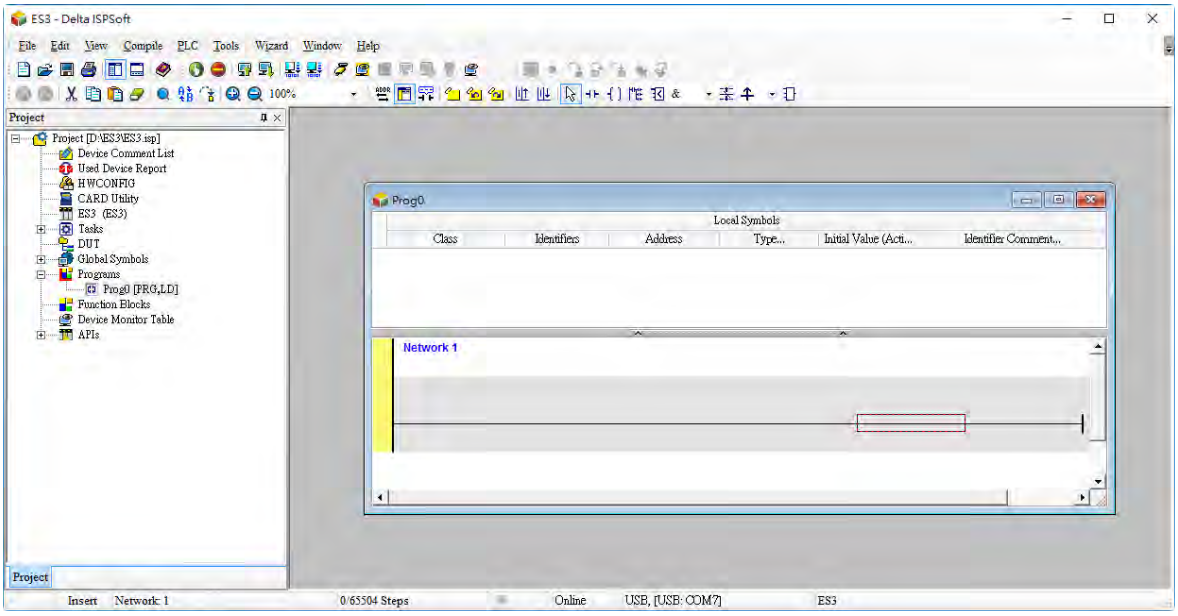
(1) Right-click **Programs** in the project management area, point to **POU** (program organization unit), and then click **New…**.

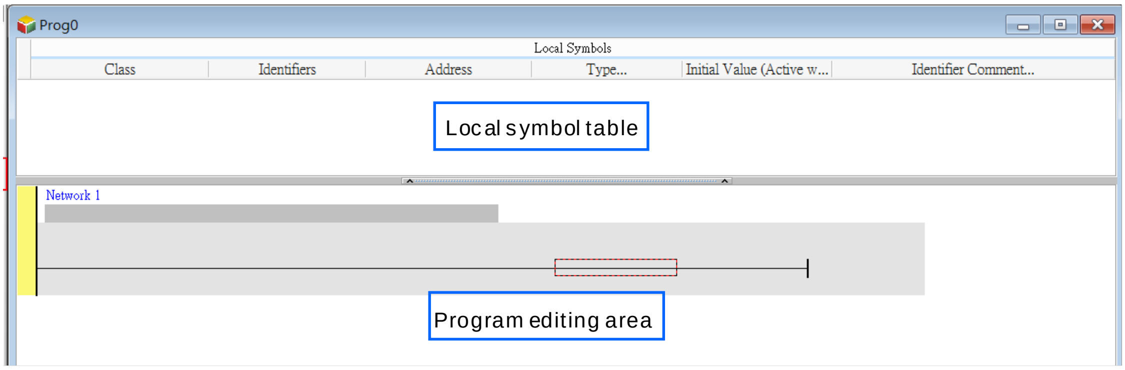


(2) In the Create Program dialog box, type a program name in the **POU Name** box, select **Ladder Diagram (LD)** in the **Language** section, and keep the other default values. Click **OK** after the setting is complete. A new program organization unit (POU) appears under **Programs** in the project management area.

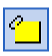


(3) After you add the POU, a program editing window appears in the main working area.





After the program editing window opens, the corresponding toolbar appears in the window. The list below describes the functions.

Icon	Keyboard shortcut	Function
	Shift+Ctrl+C	Display/hides the comments on the networks
	None	Displaying/hides the commands on the devices
	Shift+Ctrl+A	Activates/deactivates the selected network
	Shift+Ctrl+B	Adds a bookmark to the selected network selected or deletes a bookmark from the selected network
	Shift+Ctrl+P	Goes to the previous bookmarked position
	Shift+Ctrl+N	Goes to the next bookmarked position

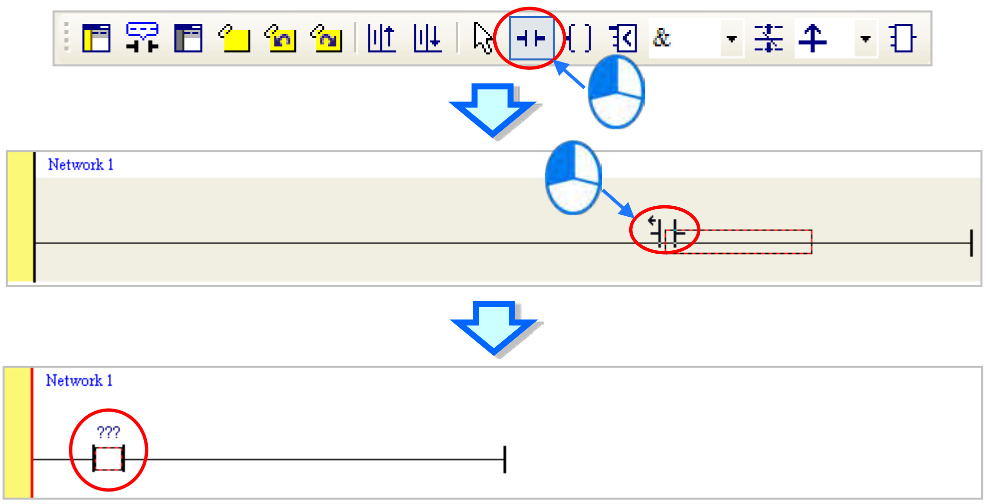
Icon	Keyboard shortcut	Function
	Ctrl+I	Puts a network above the selected network
	Shift+Ctrl+I	Put a network under the selected network
	ESC	Selects an item
	Typing an instruction	Inserts a contact
	Typing an instruction	Inserts a coil
	Typing an instruction	Inserts a comparison contact
&	Typing an instruction	Selects a type of comparison contact
	Typing an instruction	Inserts a block logic instruction (NP/PN/INV/FB_NP/FB_PN)
	Typing an instruction	Selects a type of block logic instruction (NP/PN/INV/FB_NP/FB_PN)
	Shift+Ctrl+U	Inserts an instruction or a function block

***. Refer to Section 6.5.3 for more information about typing an instruction.**

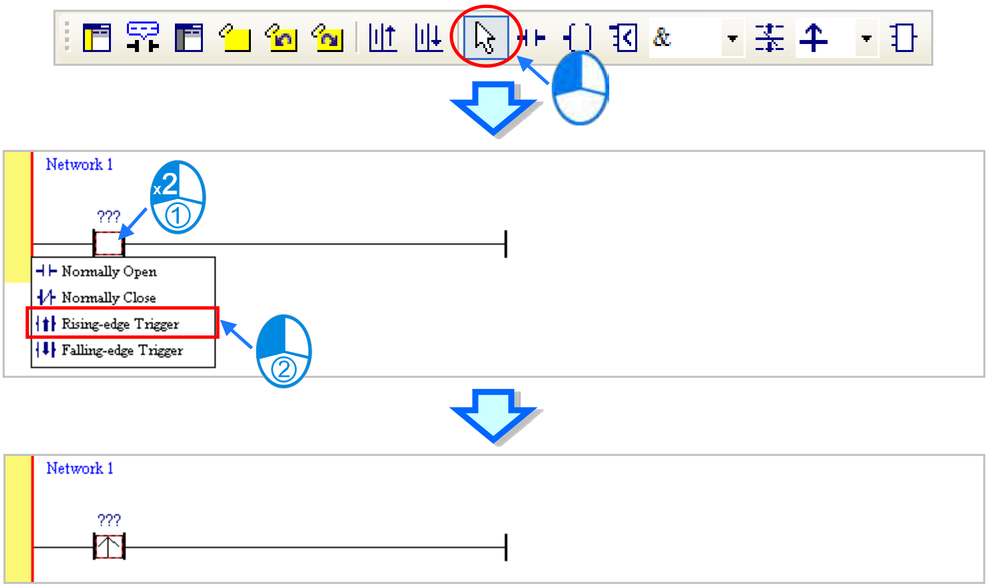
6.5.2 Basic Editing – Creating a Contact and a Coil

(1) Click on the toolbar, and then move the mouse cursor to the red frame in Network 1. The mouse cursor changes to a contact when the mouse cursor is moved to the left, right, or bottom of the red frame. Decide where to insert a contact. If you edit a ladder diagram, the mouse cursor must be near a position you want to edit. The system automatically arranges an inserted object; you cannot move the object.

In this example, you do not need to decide where to insert the contact. Place the mouse cursor near the red frame and click the left mouse button.

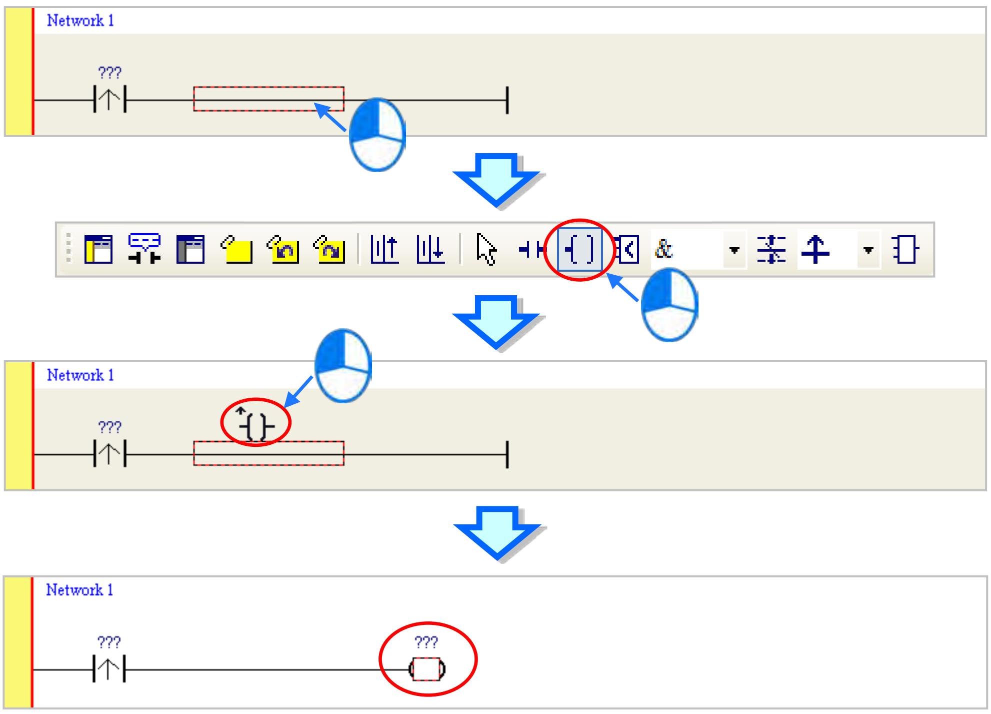


(2) Click [pointer icon] on the toolbar, or press Esc on the keyboard. After you double-click the contact, a list appears. The items on the list are **Normally Open**, **Normally Close**, **Rising-edge Trigger**, and **Falling-edge Trigger**. In this example, click **Rising-edge Trigger**.

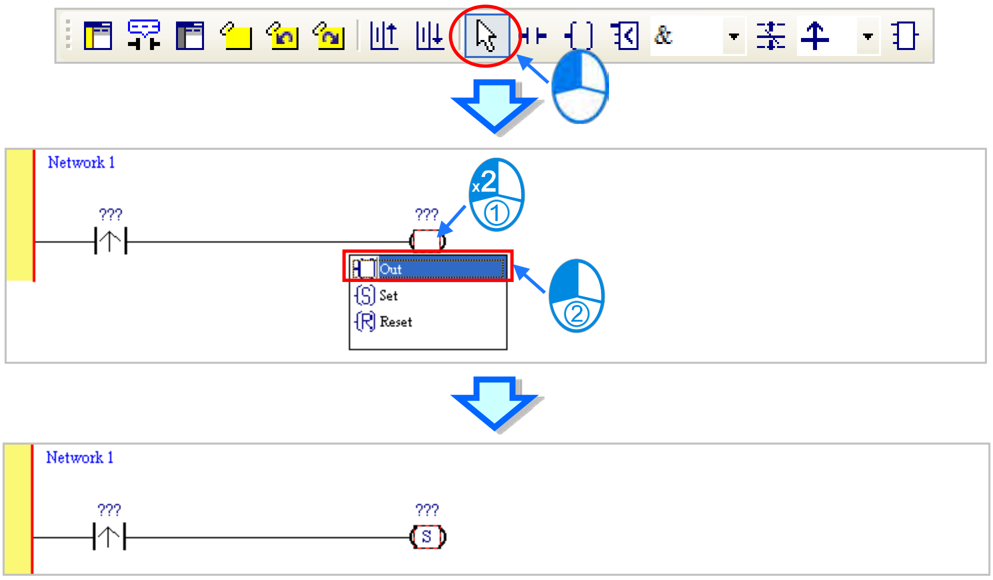


(3) Click the line at the right side of the contact, click [coil icon] on the toolbar, and then move the mouse cursor to the red frame. The mouse cursor changes to a coil when the mouse cursor is above or under the red frame. Decide where to insert the coil.

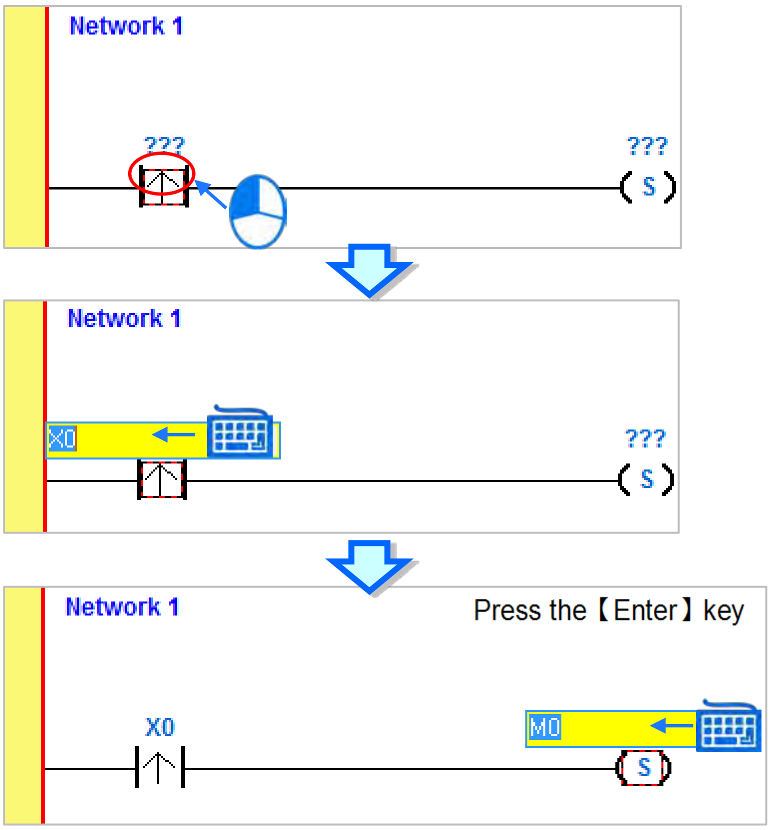
In this example, you do not need to decide where to insert the coil. Place the mouse cursor near the red frame and click the left mouse button.



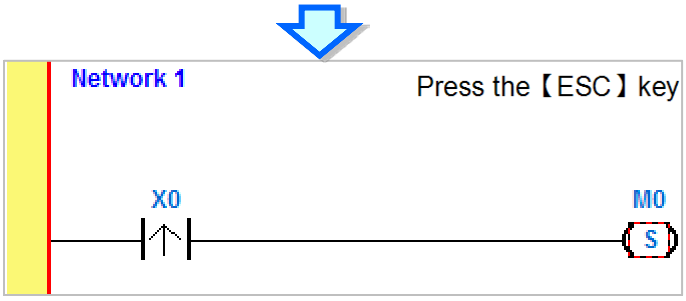
(4) Click  on the toolbar, or press Esc on the keyboard. After you double-click the coil, a list appears. The items on the list are **Out**, **Set**, and **Reset**. In this example, click **Set**.



(5) Click **???** above the contact, type a device address in the box, and then press Enter on the keyboard to jump to the next box in the network. After you type a device address in the box, press Esc on the keyboard to complete the editing. In this example, type X0 in the box for the contact, and type M0 in the box for the coil.



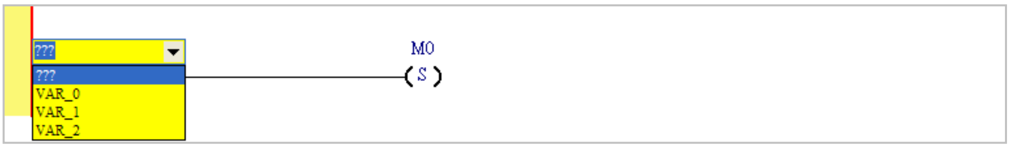
6



Additional remark

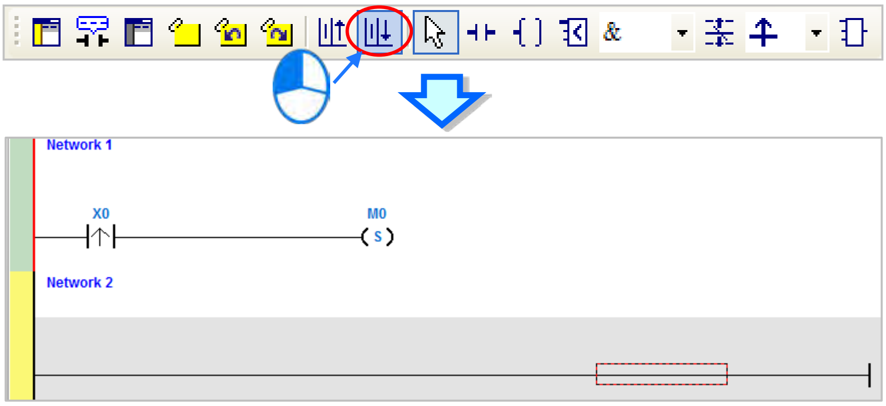
After you click a network and press Enter on the keyboard, you can edit a box. Press Enter on the keyboard to edit the next box in the network. Press Tab on the keyboard to select the next network. Use the keyboard to edit boxes. After you finish the editing, press Enter on the keyboard to jump to the next box. Press Esc on the keyboard to exit editing.

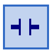
If you have declared symbols, click in a box, or press Page Down on the keyboard when you edit the box. The symbols on the drop-down list are the symbols that you can assign to the object. Select a symbol with the mouse or the up/down key on the keyboard. Refer to Chapter 6 in the ISPSoft User Manual for more information about symbols.



6.5.3 Basic Editing – Inserting a Network and Typing an Instruction

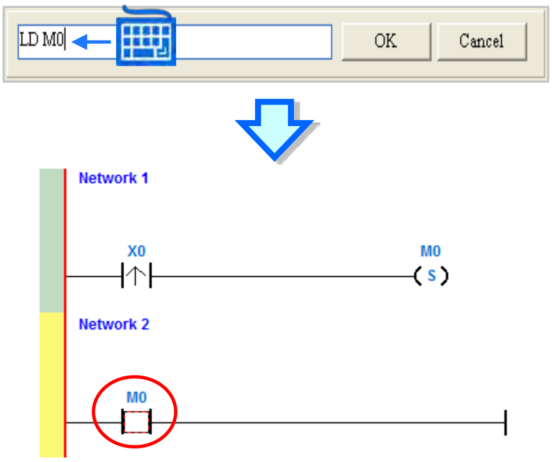
Click on the toolbar to select a network. Click on the toolbar to place another network above the selected network. In this example, Network 2 is under Network 1.



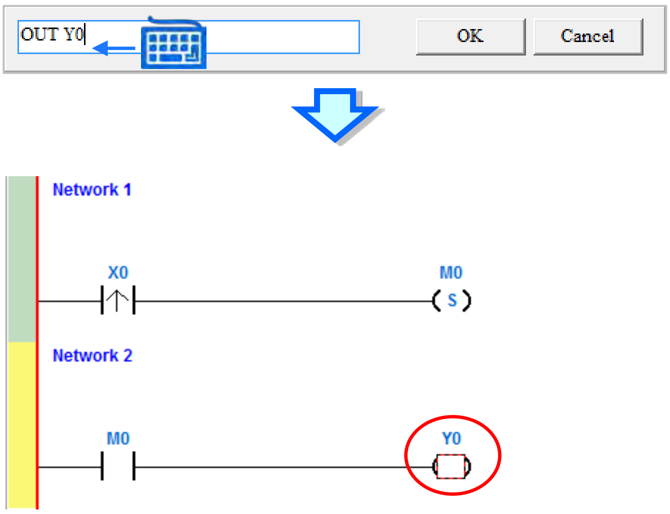
Create a contact and a coil by clicking  and  on the toolbar or by typing instructions.

(1) Click the line in Network 2.

(2) Type the IL instruction “LD M0”. This instruction is not case-sensitive. As soon as you type the IL instruction, a box which you can edit appears. After you finish typing the IL instruction, press Enter on the keyboard or click **OK** at the right side of the box.



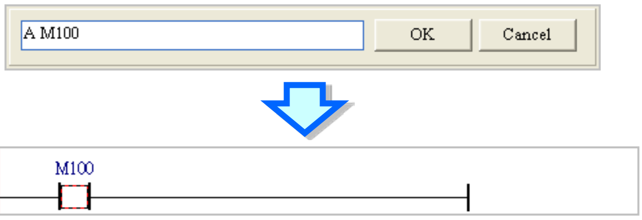
(3) Type the IL instruction “OUT Y0”, and write the program shown below.



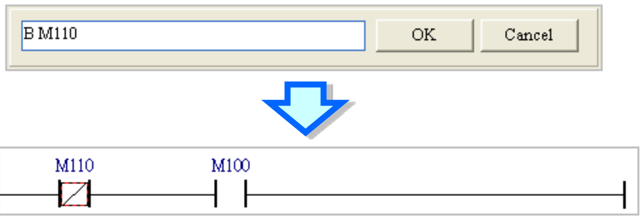
Additional remark

You create a contact and a coil by typing simple instructions. Refer to the description below. The instructions typed are not case-sensitive.

- To Insert a normally-open contact (contact A), type “A <device address>”



- To insert a normally-closed contact (contact B), type “B <device address>”



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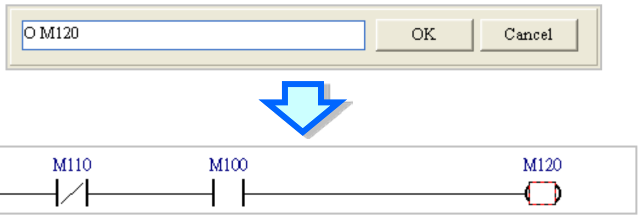
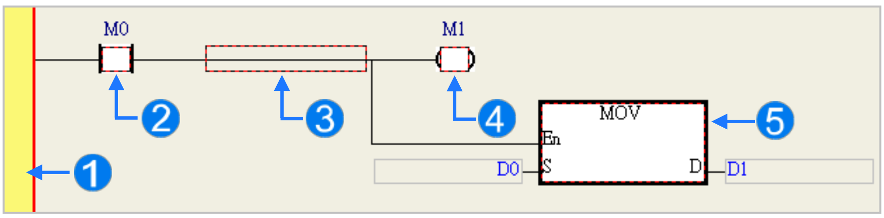
- To insert an output coil (OUT), type “O <device address>”



6.5.4 Basic Editing – Selecting a Network and Operation

Before you select an object in a network, press Esc on the keyboard, or click  on the toolbar. After the cursor appears as a small arrow, click the object in the network. The basic selection shows below.



❶ Select the network

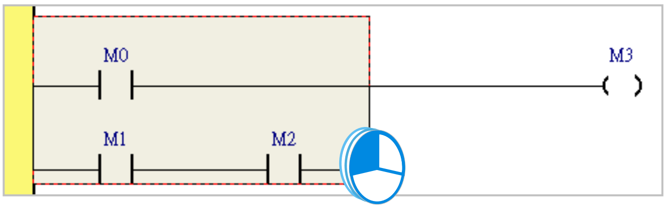
❷ Select the input contact

❸ Select the network

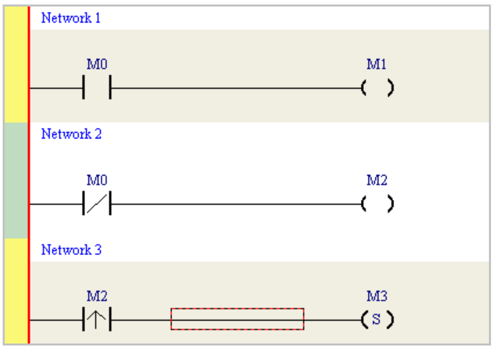
❹ Select the output coil

❺ Select the block

To select a group of devices, click a device and drag it to draw a frame around the group of devices. You can also select the group of devices by clicking the first device, pressing Ctrl+B on the keyboard, clicking the last device, and then pressing Ctrl+B on the keyboard. You must draw a frame around devices that are in the same network, and the devices must be adjacent to one another. Input and output devices cannot be in the same frame.



To select several networks, press and hold the Ctrl key on the keyboard and click the networks. You can also select a range of networks by pressing and holding Shift on the keyboard, clicking the first network within the range, and then clicking the last network within the range.



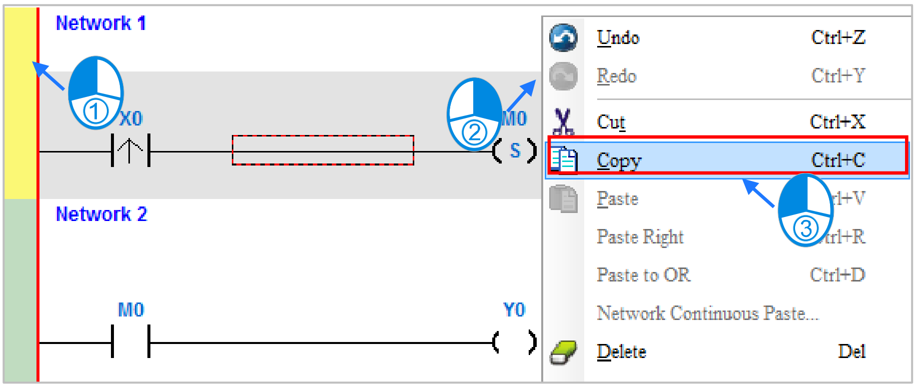
Right-click an object after selecting it to show the context menu.

Item	Function
Undo	Undo the last action. You can undo up to 20 previous actions.
Redo	You can redo an action that has been undone.
Cut	Cut a device, block, or network.
Copy	Copy a device, block, or network.

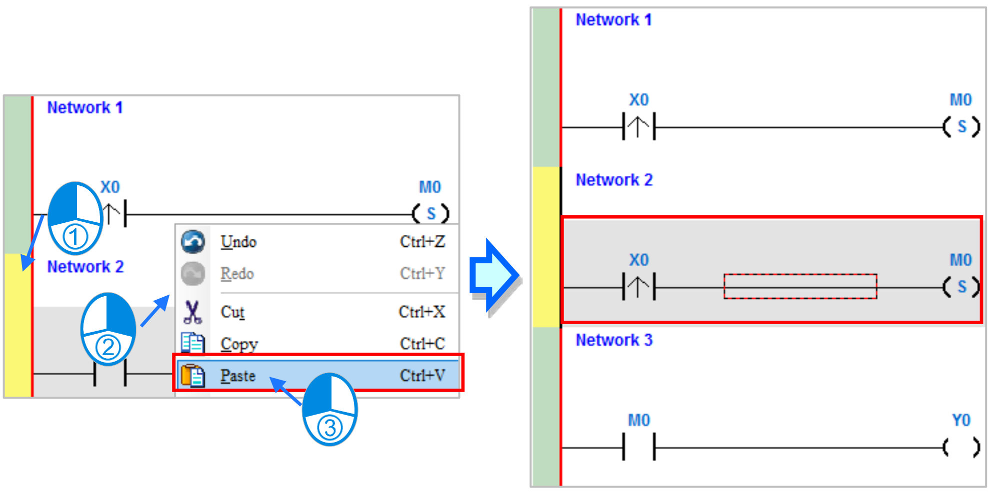
Item	Function
Paste	Paste an object that has been copied or cut into the present position.
Paste right	Paste an object at the right side of the selected position. The object is connected in series to the selected position.
Paste under	Paste an object under the selected position. The object is connected in parallel to the selected position.
Delete	Delete a device, block, or network.
Activate/Inactivate Network	Activate or deactivate the selected network. The deactivated network is ignored when you compile the program.

Proceed with the steps in the example below.

(1) Select Network 1, then right-click Network 1, and then click **Copy**.

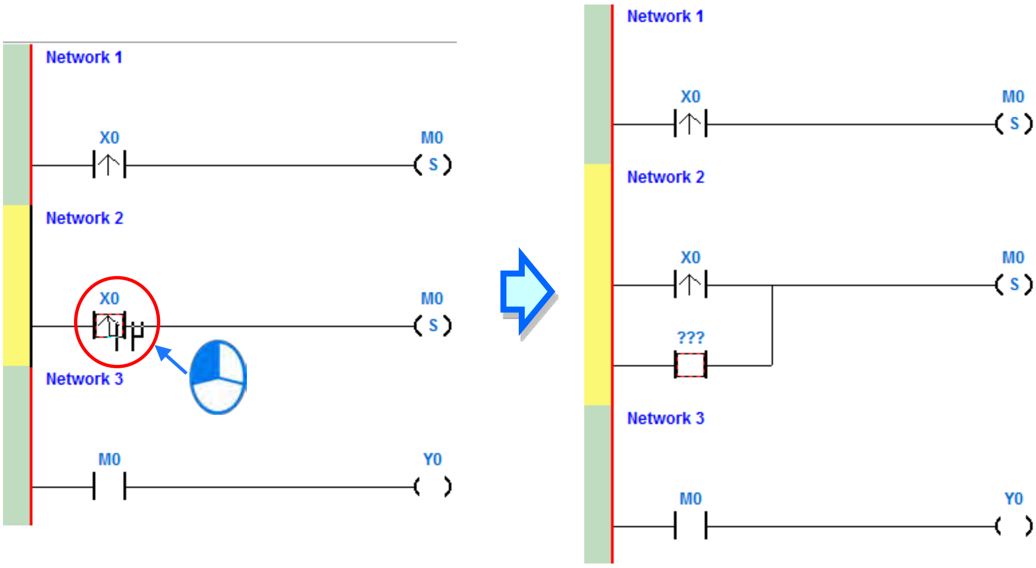


(2) Select Network 2, right-click Network 2, and then click **Paste**. A copy of Network 1 is put above Network 2, and Network 2 becomes Network 3.

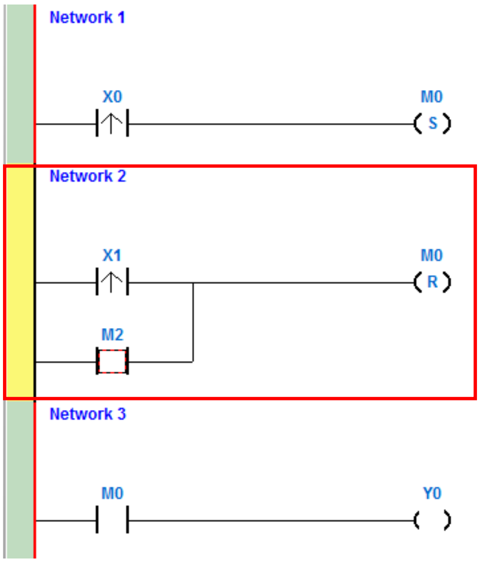


6.5.5 Basic Editing – Connecting a Contact in Parallel

(1) Click  on the toolbar, and then move the mouse cursor to the input contact in Network 2. The mouse cursor changes to a contact. Move the mouse cursor to the input contact in Network 2. After the mouse cursor changes to , click the left mouse button. This connects a contact in parallel with the input contact in Network 2.

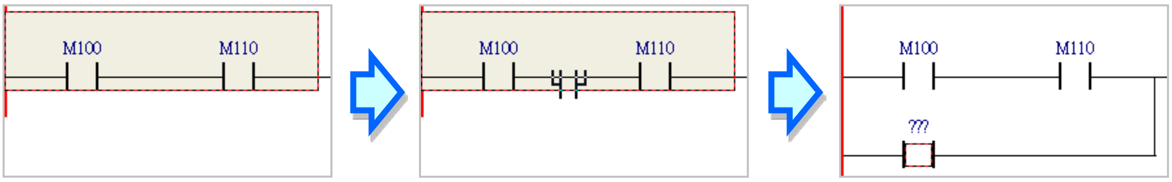


(2) Write the program in Network 2 shown below.



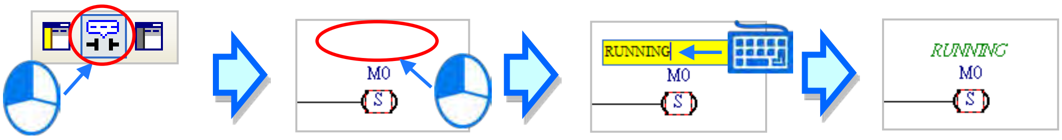
Additional remark

After you select a group of contacts, connect a contact to the group of contacts as described above.

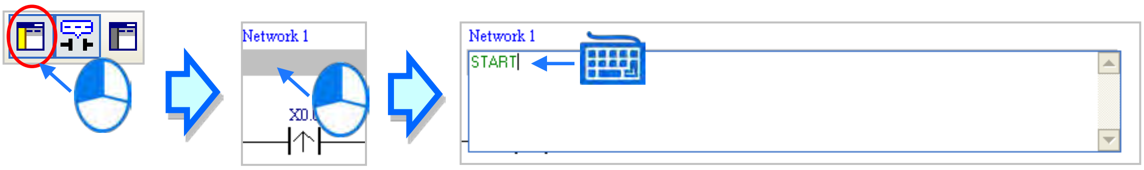


6.5.6 Basic Editing – Editing a Comment

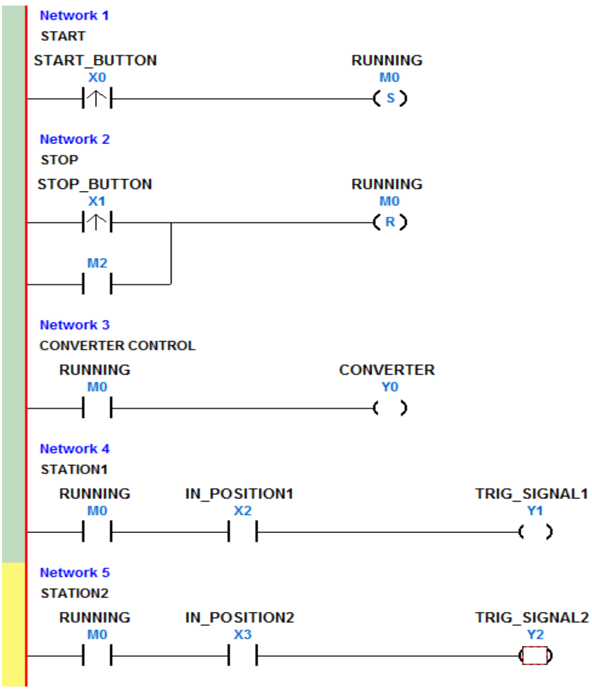
(1) Press on the toolbar. Click the position above a device name, type a comment in the box, and then press Enter on the keyboard.



(2) Press on the toolbar. Click the position under a network number, and then type a comment in the box. To start a new line of text, press Shift+Enter on the keyboard. Press Enter on the keyboard after the you complete the editing.

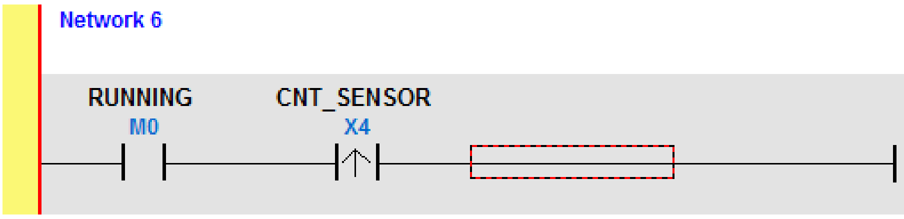


(3) Write the program shown below.



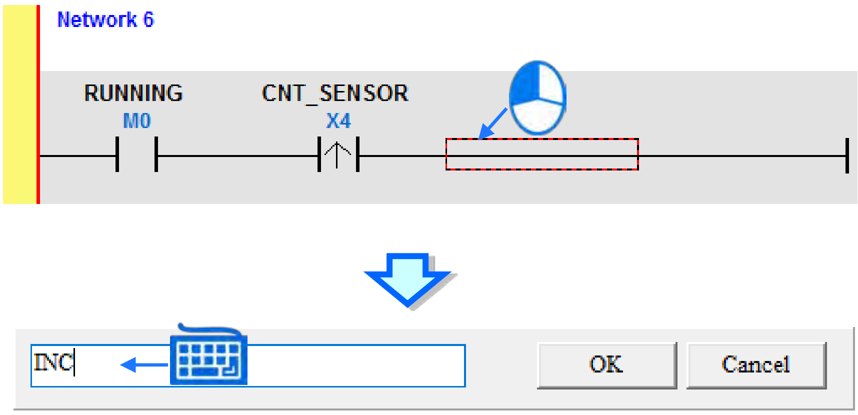
6.5.7 Basic Editing – Inserting an Applied Instruction

Add Network 6 under Network 5, and then write the program shown below. Insert an applied instruction in one of the three ways described below.



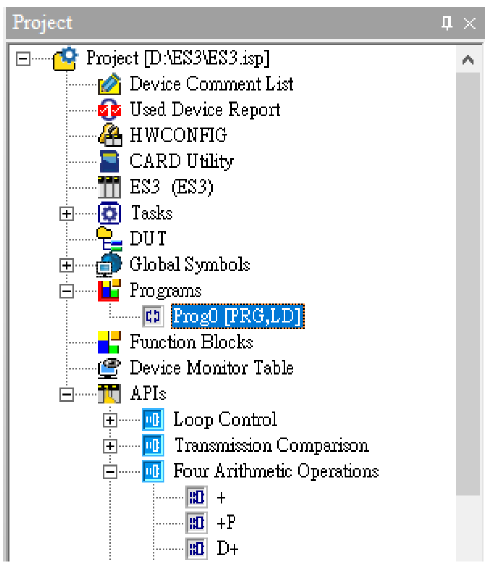
- Method 1

Click the position where you want to insert an instruction, type the instruction (INC in this example), and then press Enter on the keyboard.

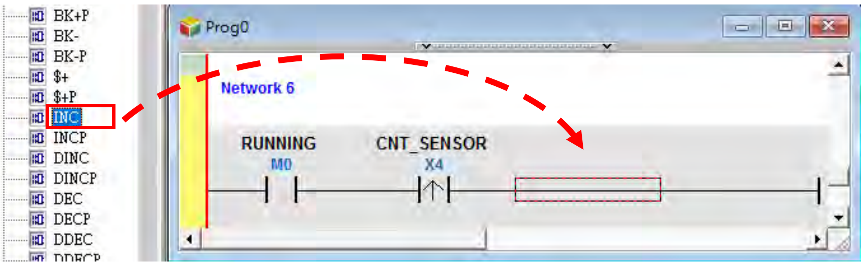


- Method 2

Click **APIs** in the project management area and find the instruction type.

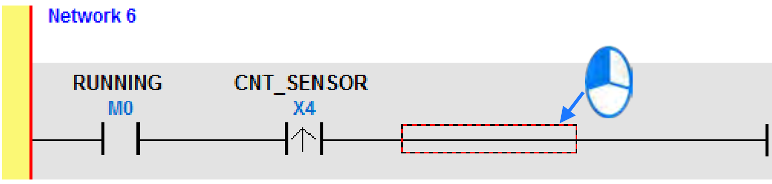


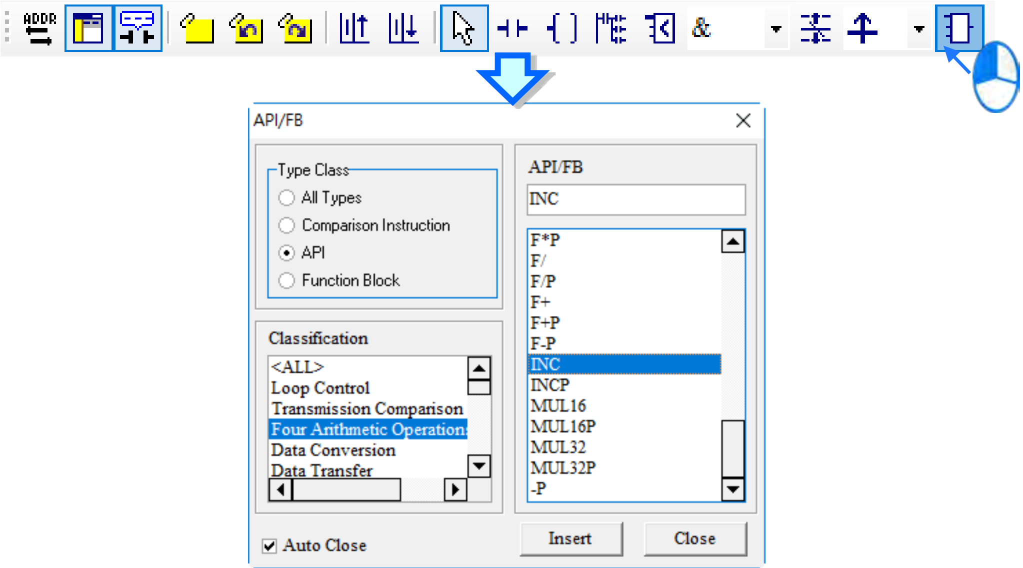
Click the instruction (INC in this example) that you want to insert, and then drag it to the desired position.



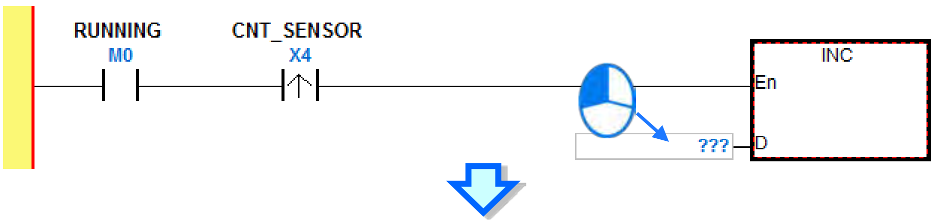
- Method 3

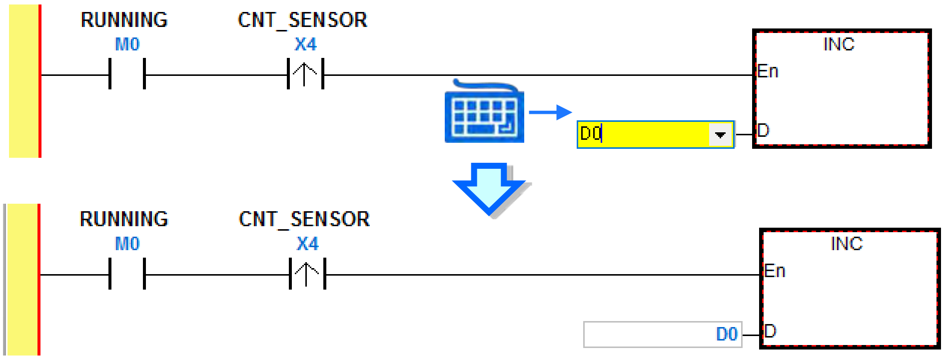
Click the position where you want to insert an instruction, click  on the toolbar, select the instruction (INC in this example) to insert in the **API/FB** dialog box, and then click **Insert**.





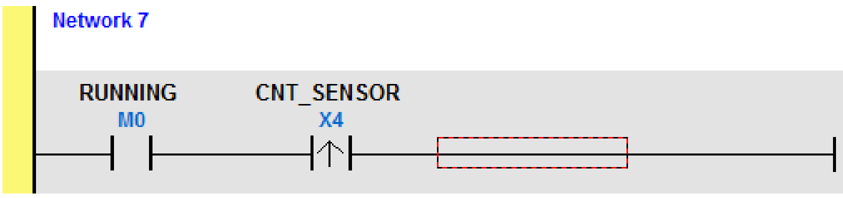
After you insert the instruction, assign a device address to the operand, and write the program shown below.



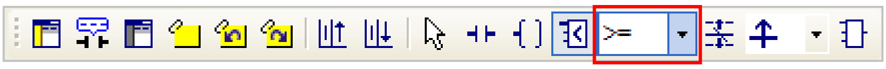


6.5.8 Basic Editing – Creating a Comparison Contact and Typing a Constant

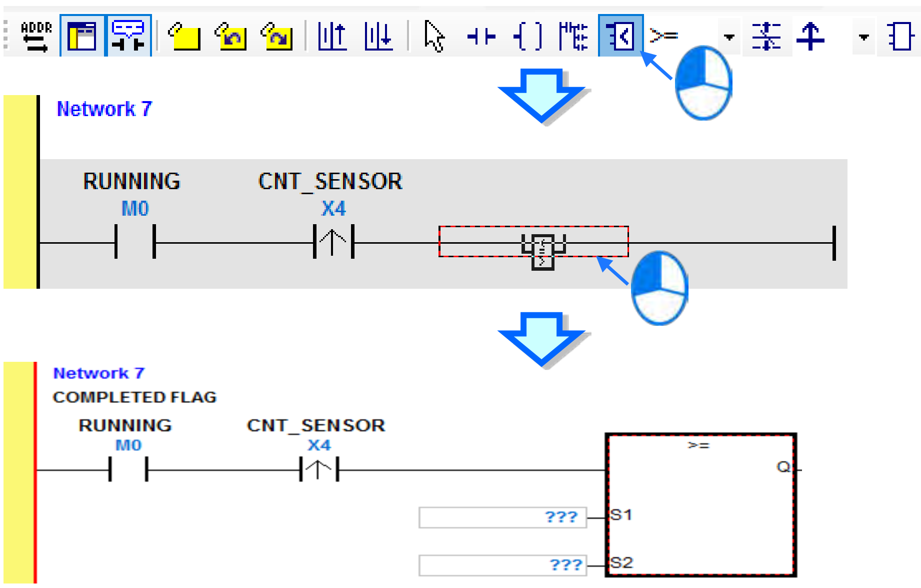
You can insert a comparison contact with the following steps. Add Network 7 under Network 6, and write the program shown below.



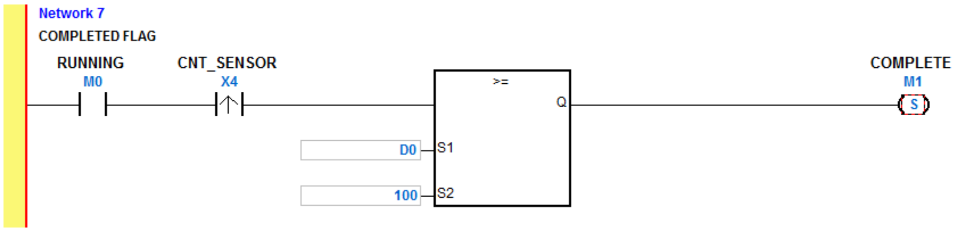
(1) Click  on the toolbar, and then select a operator (>= in this example).



(2) Click  on the toolbar, and then move the mouse cursor to the position where you want to insert the comparison contact. The mouse cursor changes to a comparison contact when you move the mouse to the left, right, or bottom of the red frame. Decide where to insert the comparison contact, and then click the left mouse button to insert the comparison contact.

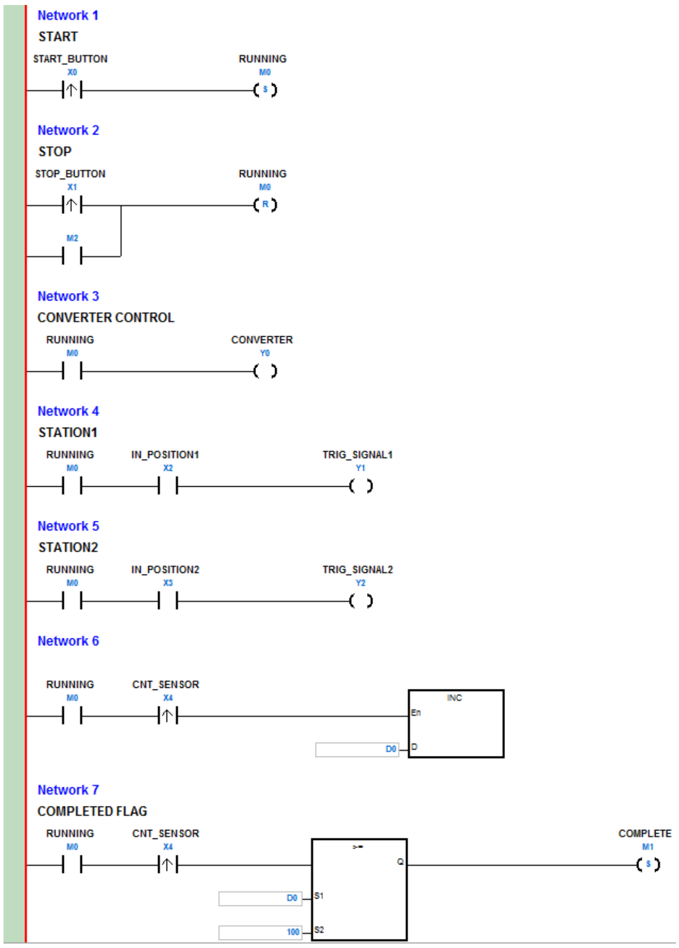


Write the program shown below. In ISPSoft, K precedes a decimal value and H precedes a hexadecimal value. To type a decimal value in ISPSoft, type it directly. To type a hexadecimal value in ISPSoft, type "16#" and the hexadecimal value; e.g. 16#7FFF. In ISPSoft, 8# precedes an octal value, and 2# precedes a binary value.



6.5.9 Writing a Program

The previous sections introduced creating a traditional ladder diagram in ISPSoft. Write the program shown below. Because the program is not yet compiled for the PLC, the mother line at the left side of the ladder diagram is colored red while you write the program. The following sections show how to compile and download the compiled program for testing.



***1. The program above saves in the folder …\ISPSoft x.xx\Project\Example\Gluing_System_C.**

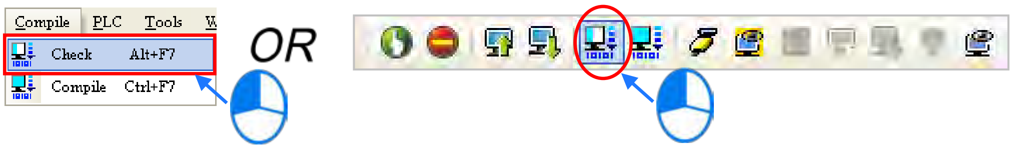
***2. Refer to Chapter 8 in the ISPSoft User Manual for more information about creating a ladder diagram.**

6.5.10 Checking and Compiling a Program

After you write a program, check the syntax of the programming language or compile the program. The syntax and structure in the present window are checked after you run the **Check** function. The system checks the entire project after you run the **Compile** function. If the system does not find any errors in the project, it automatically generates execution code. After you successfully compile the program, the mother line at the left side of the ladder diagram becomes black.

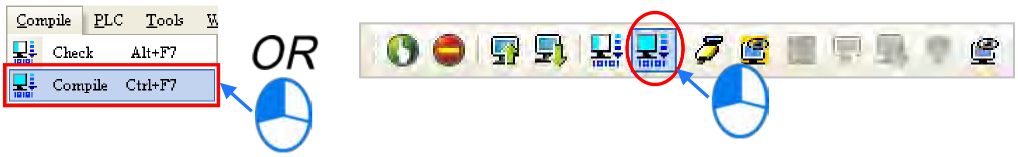
- **Check**

From the **Compile** menu, click **Check**, or  on the toolbar.

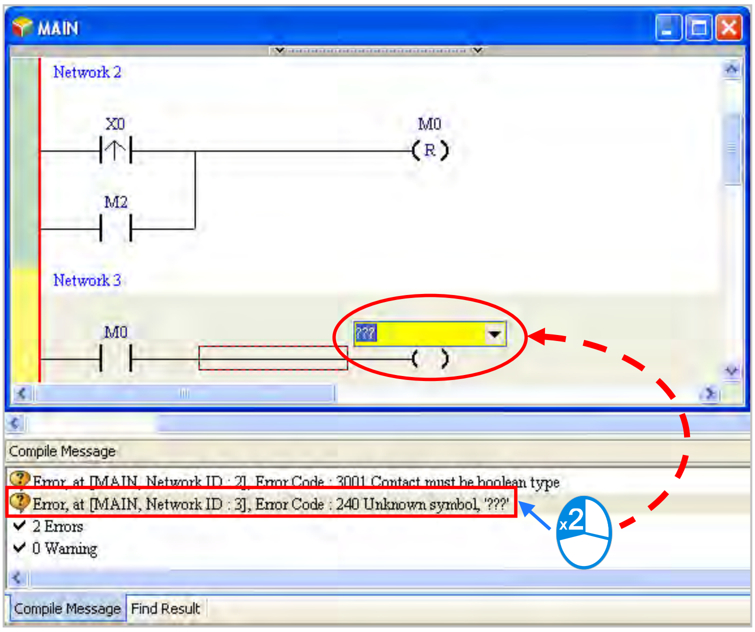


- **Compile**

From the **Compile** menu, click **Compile**, or  on the toolbar.



After you complete the check, the **Compile Message** page shows the check result. If there are any errors in the project, the **Compile Message** window shows the related message. After you click the message, the system automatically shows you where the error occurs. You can run the **Check** function or the **Compile** function after you correct the error.



6.6 Testing and Debugging a Program

6.6.1 Creating a Connection

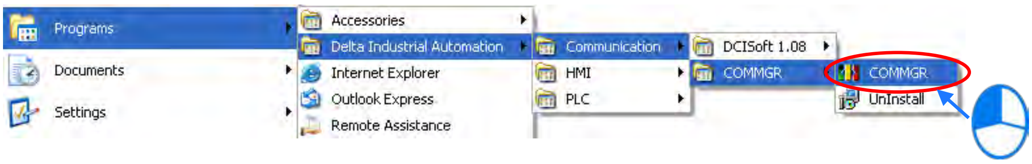
Before you download a program and parameters to a PLC or monitor them online, connect ISPSoft to the PLC. In this example, connect ISPSoft to the CPU module DVP32ES311T with a USB cable. Refer to Section 2.4 in the ISPSoft User Manual for more information about connecting ISPSoft to a PLC in other ways. Refer to the AS Operation Manual for more information about wiring.

<u>You can skip this section if you have connected ISPSoft to a PLC successfully as described in Section 2.4 in the ISPSoft User Manual.</u>

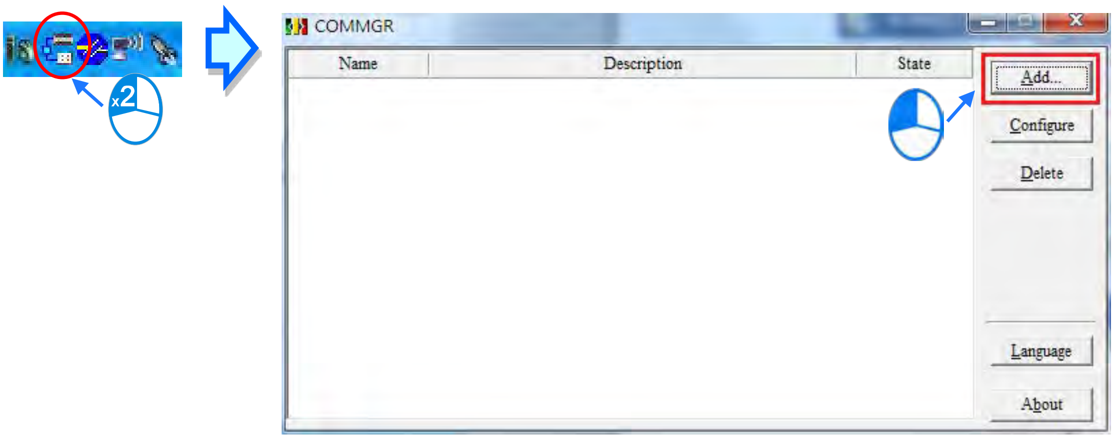
(1) Make sure that the wiring is correct, and then power on the CPU module.

(2) Connect the CPU module to the computer with a USB cable. If the USB driver for the DVP-ES3 series CPU module is installed on the computer, **Delta PLC** appears in the **Device Manager** window, and a port number is assigned to **Delta PLC**. Refer to Appendix A for more information about installing a USB driver.

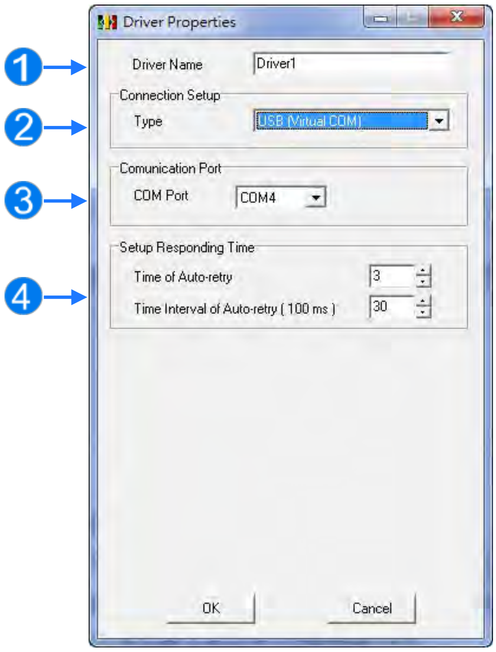
(3) Make sure that COMMGR is started and the icon representing COMMGR is displayed on the system tray. If the icon representing COMMGR is not displayed on the system tray, start COMMGR by clicking the shortcut on the **Start** menu (**Start** > **Programs** > **Delta Industrial Automation** > **Communication** > **COMMGR)**.



(4) Double-click the icon representing COMMGR on the system tray to open the **COMMGR** window. Click **Add** in the **COMMGR** window to create a driver.



(5) Set the parameters in the **Driver Properties** dialog box, and then click **OK**.



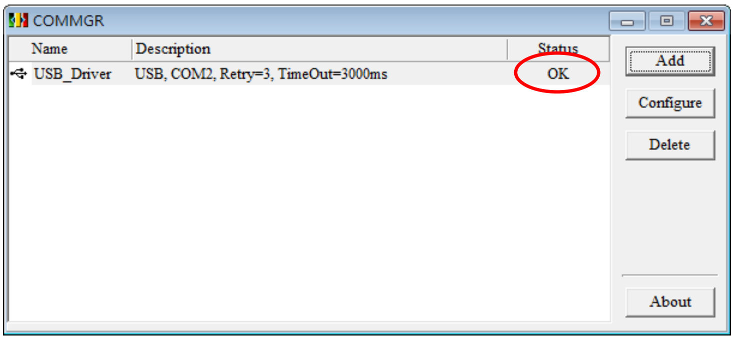
① Type a driver name in the **Driver Name** box.

② Select **USB (Virtual COM**) in the **Type** list in the **Connection Setup** section.

③ Select a communication port in the **COM Port** list. If the first two steps are complete, the connected PLC and its communication port display in the **COM Port** list.

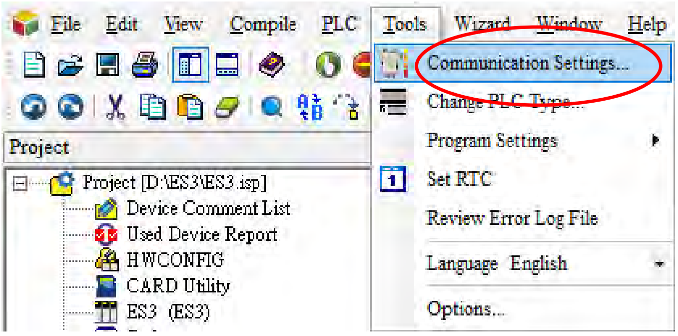
④ Select the number of times to retry the sending of a command if a connection error occurs in the **Time of Auto-retry** box, and select a retry interval in the **Time Interval of Auto-retry** box.

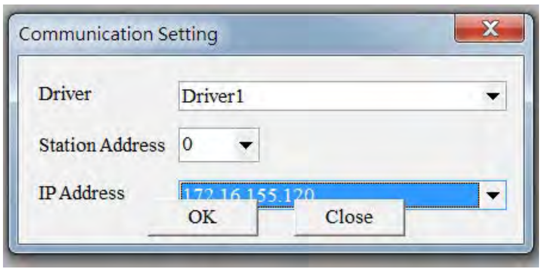
(6) After you finish the setup, USB_Driver appears in the COMMGR window. When the connection is normal, OK appears in the Status column.

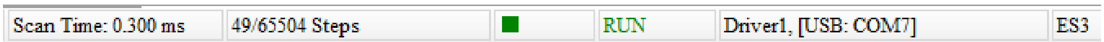


6

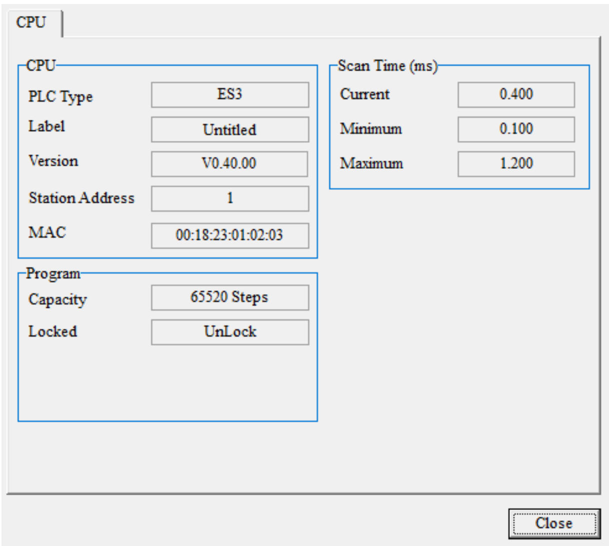
(7) Click the driver you created in the **COMMGR** window, and then click **Start**. Start ISPSoft, and then on the **Tools** menu, click **Communication Settings…**. In the **Communication Setting** dialog box, select the driver you created in the **Driver** list, select 0 in the **Station Address** list, and then click **OK**. The driver information displays in the ISPSoft status bar.







(8) On the **PLC** menu, click **System Information**. ISPSoft retrieves related information from the PLC. If the computer communicates with the CPU module normally, the related information retrieved from the PLC displays in the **System Information** dialog box.

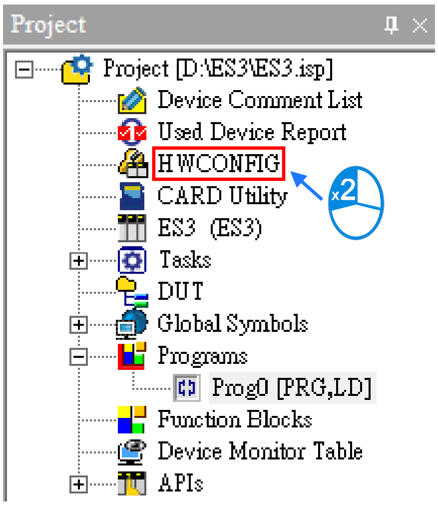


6.6.2 Downloading a Program and Parameters

If ISPSoft is correctly connected to a PLC, you can download the parameters and program in the project to the PLC. First, start ISPSoft and open the project you created in the previous sections. In this example, you download two types of parameters to the CPU module: hardware configuration and the program itself.

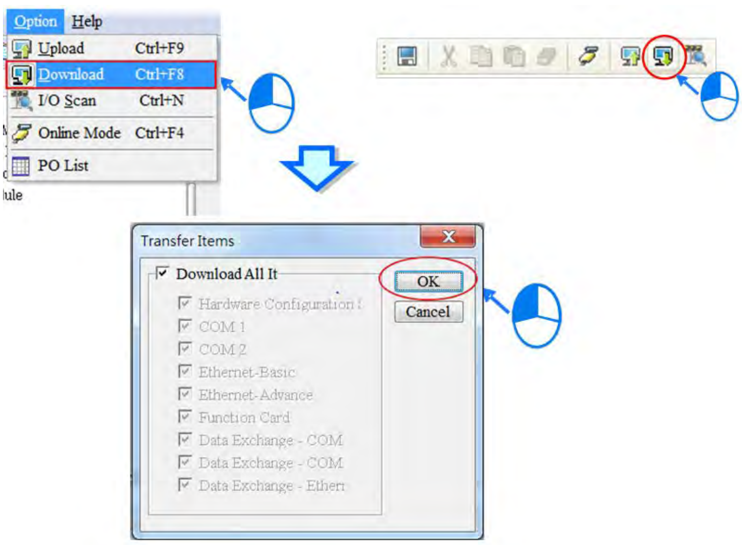
- **Downloading the hardware configuration**

(1) Double-click **HWCONFIG** in the project management area to open the **HWCONFIG** window.



(2) The hardware configuration displays in the window. Before you download the hardware configuration to the CPU module, make sure the actual hardware configuration is the same as the hardware configuration in the window.

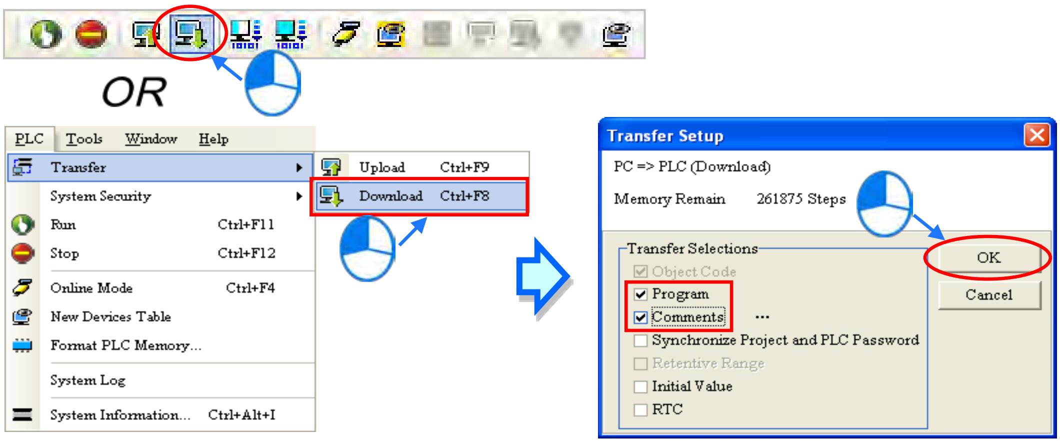
(3) On the **Options** menu, click **Download**, or  on the toolbar. The **Transfer Items** dialog box appears. Click **OK** to download the hardware configuration to the CPU module.



(4) After you successfully download the hardware configuration to the CPU module, the BUS FAULT LED indicator on the CPU module is OFF. Close the **HWCONFIG** window. If the BUS FAULT LED indicator on the CPU module is still ON or blinking, the CPU module is in an abnormal state. Make sure the actual hardware configuration is the same as the hardware configuration in the **HWCONFIG** window, and refer to the operation manual for more information about eliminating the error. Refer to Chapter 8 for more information about HWCONFIG.

- **Downloading the program**

After the program compiles, on the **PLC** menu point to **Transfer**, and then click **Download**. You can also click on the toolbar after the program compiles. In the **Transfer Setup** dialog box select the **Program** checkbox and the **Comments** checkbox so that you can upload the program in the CPU module later, and then click **OK**.



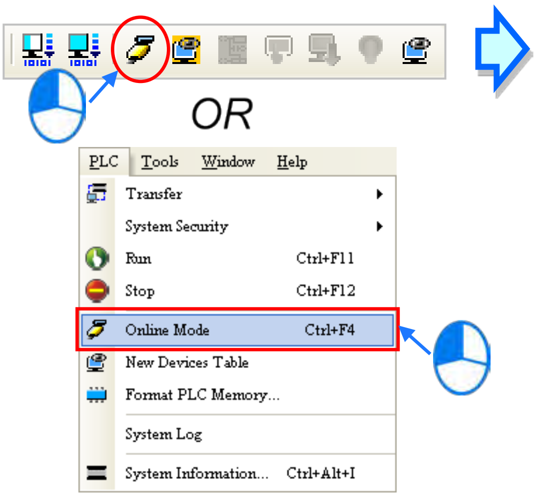
6.6.3 Connection Test

After you download a program to a PLC, you can monitor the execution status of the PLC through ISPSoft. ISPSoft provides two monitoring modes; device monitoring mode and program monitoring mode.

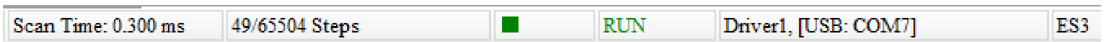
Monitoring mode	Description
Device monitoring mode	You can monitor the status of the devices in the PLC through the monitoring table. In this mode, ISPSoft updates only the status of the devices. The current program in ISPSoft does not have to be the same as the program in the PLC.
Program monitoring mode	In this mode, the operating status of the program is displayed in the program editing window. The present program in ISPSoft must be the same as the program in the PLC.

***. You can enable the device monitoring function without program monitoring; however, if you enable the program monitoring function, the device monitoring function is also enabled.**

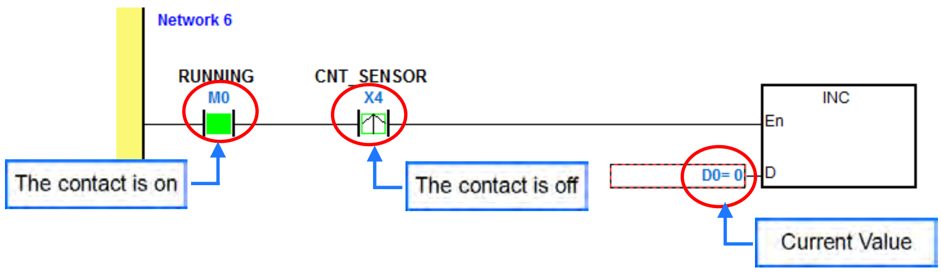
On the **PLC** menu, click **Online Mode**, or on the toolbar, to enable the online monitoring function. The system also enables device monitoring mode and program monitoring mode.



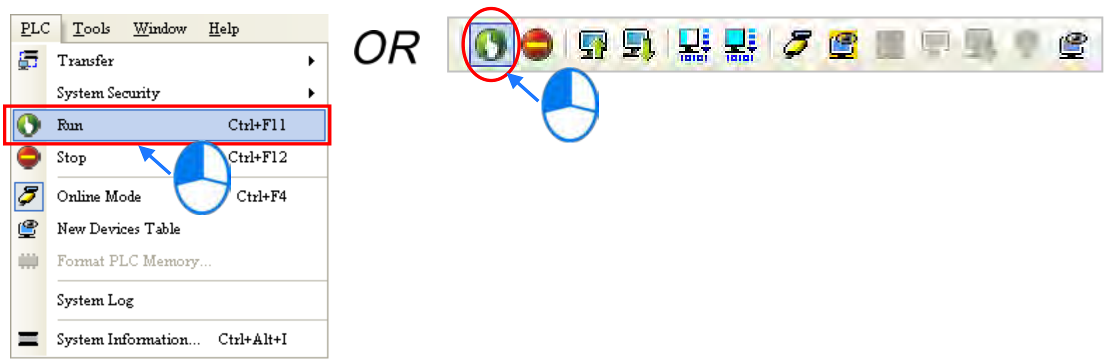
In the online monitoring mode, you can view the present scan time, the communication status, and the status of the PLC in the status bar in ISPSoft.



The present status of the devices display in the original program editing window after you enable the program monitoring function.

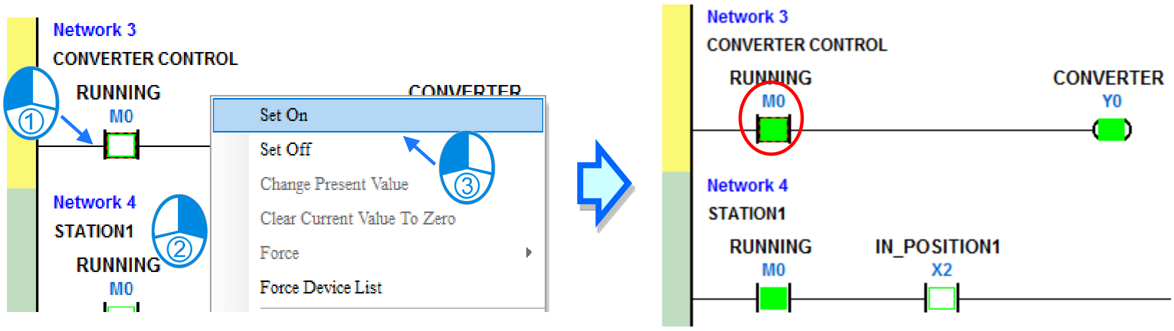


You can change the operating state of a PLC with the RUN/STOP switch on the PLC. You can also change the operating status of a PLC with the functions provided by ISPSoft. On the **PLC** menu, click **Run** or on the toolbar to start the PLC. On the **PLC** menu, click **Stop** or on the toolbar to stop the PLC.



In the online monitoring mode, you can select a device, then right-click the device, and the click a command on the context menu. During a test, you can change the status of a device or the value in a device by clicking an item on the context menu.

Before you change the status of a device, make sure the operation does not cause damage to equipment or personnel.

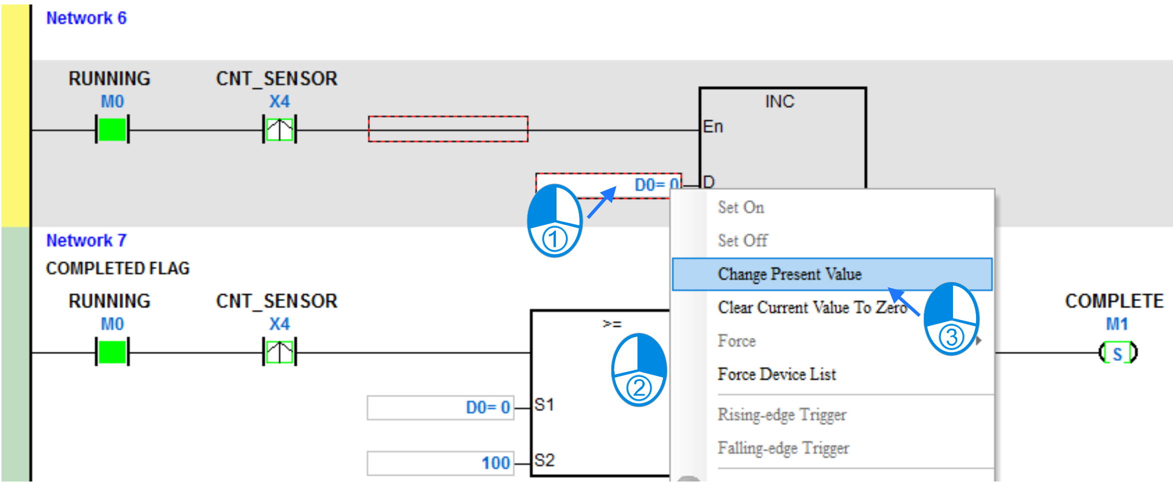


The table below describes the items in the context menu. The **Force** command only applies to input and output contacts.

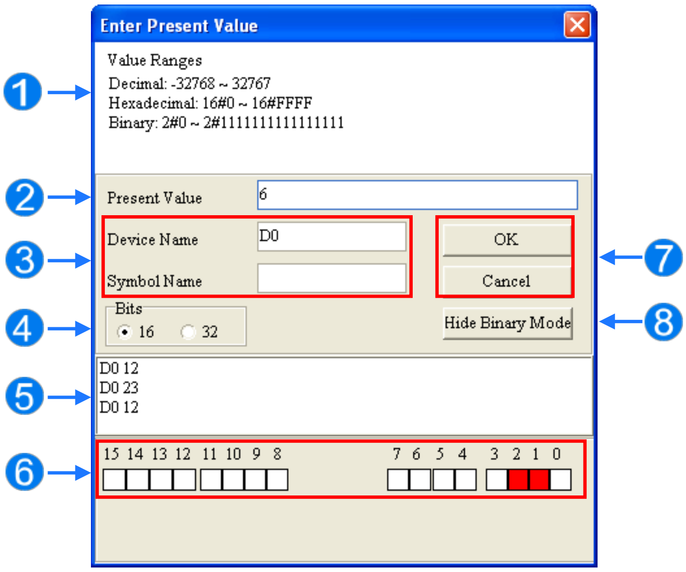
Item	Description
Set On	Set the contact selected to ON
Set Off	Set the contact selected to OFF
Rising-edge Trigger	No matter what the state of the selected contact is, the system sets the contact to OFF, and then sets it to ON.
Falling-edge Trigger	No matter what the state of the selected contact is, the system sets the contact to ON, and then sets it to OFF.
Force	Force an input contact or output contact ON or OFF
Force Device List	Force several input contacts or output contacts in the tables ON or OFF

To change the value in a device, right-click the device, click **Change Present Value**, and set a present value in the **Enter Present Value** dialog box.

6



The list below describes the **Enter Present Value** dialog box.



❶ Message

❷ Type a value in the **Present Value** box.

❸ Type the name of a device or a symbol whose present value you want to change

❹ Type a 16-bit or 32-bit value.

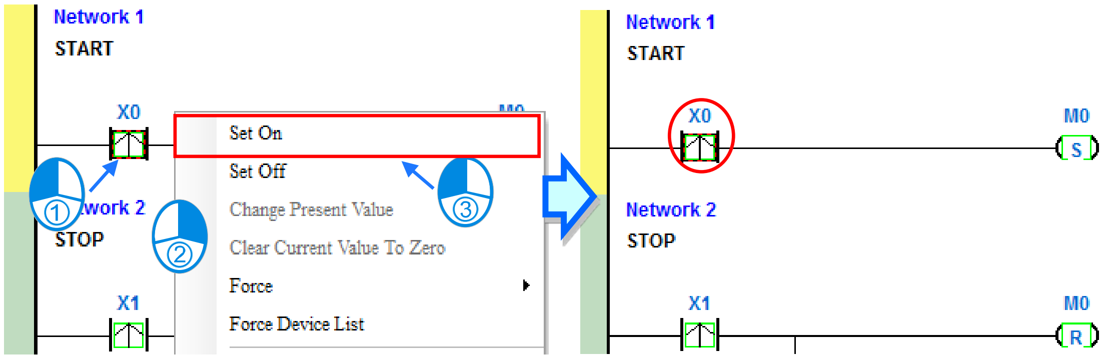
❺ Value change history (Format: Device name Value)

❻ In binary mode, use the mouse to set the bit states.

❼ Click **OK** to apply the setting values. Click **Cancel** to close the window without applying the values.

❽ Display or hide binary mode.

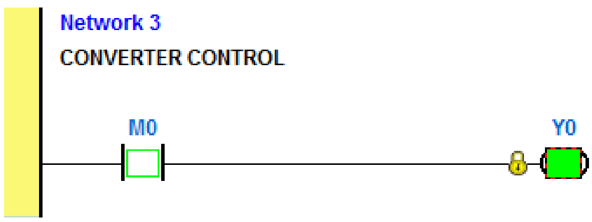
In this example, X0–X17 and Y0–Y17 are input and output devices assigned to the digital I/O module DVP32ES311T. After you download the hardware parameters to the CPU module, the states of X0–X17 are the same as the states of the inputs on the actual module. Even if you set X0–X17 to ON or OFF in the program editing window, the actual input signals update the states of X0–X17.



However, you can force an input contact ON or OFF during a test. Click an input or output contact to set, right-click the contact, point to **Force**, and click **On (X/Y)**, **Off (X/Y)**, **Release (X/Y)**, or **Release All**. If you force an input or output contact ON or OFF, a lock symbol appears at the left side of the contact.

Force	Description
On (X/Y)	Force the selected input or output contact ON
Off (X/Y)	Force the selected input or output contact OFF
Release (X/Y)	Release the contact from the locked state
Release All	Release all the contacts from the locked states

If you force an output contact in the program ON or OFF, the program execution result does not affect the output state of this contact.



***. If you disable the online monitoring function, the contacts are not automatically released from the locked states. You must check whether the contacts need to be released from the locked states after you complete the test.**

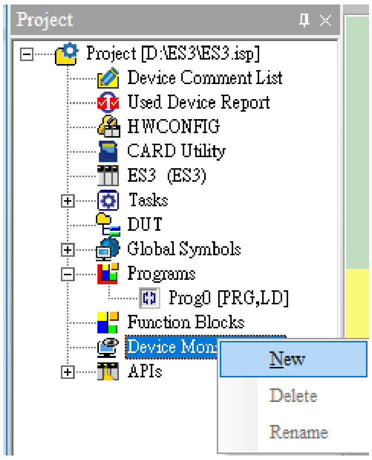
You can create a monitoring table online or offline.

- **Method 1**

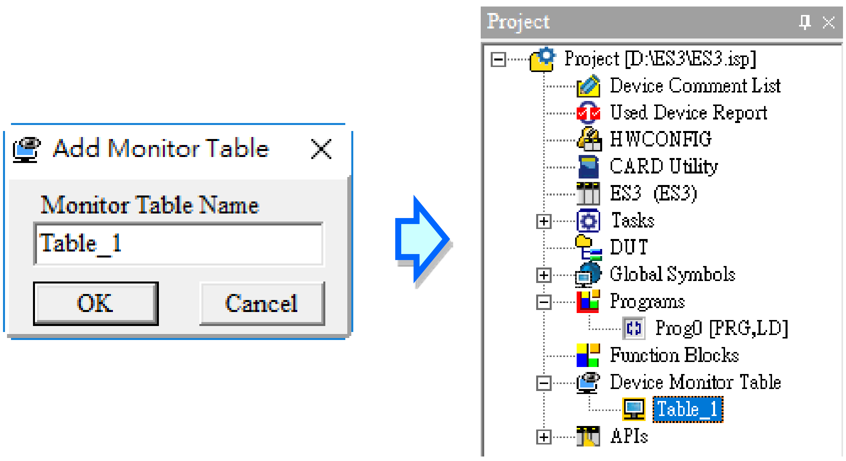
On the **PLC** menu, click **New Devices Table**, or  on the toolbar.

- **Method 2**

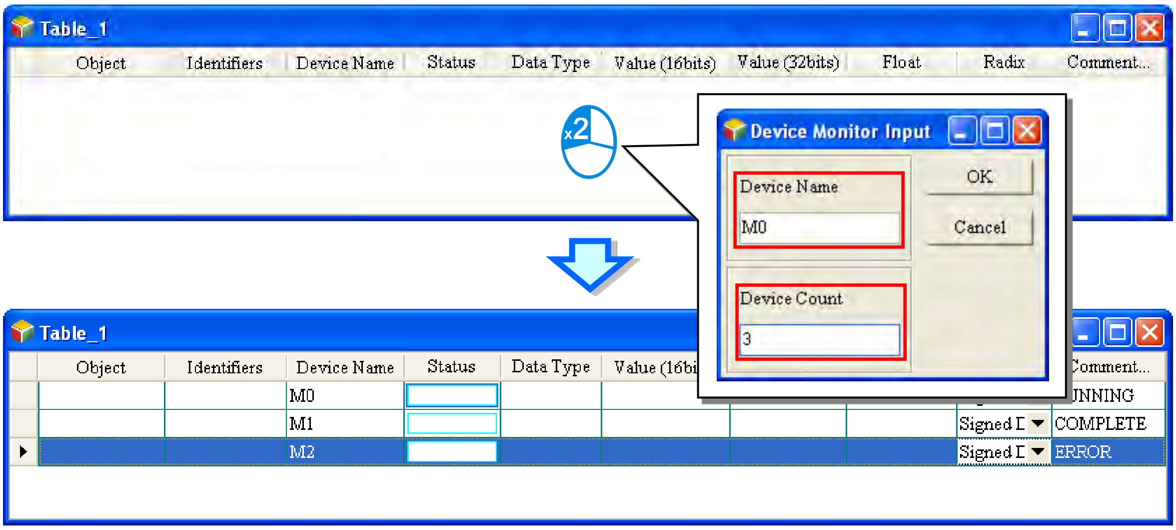
Right-click **Device Monitoring Table** in the project management area, and click **New**.



Type a table name in the **Add Monitor Table** dialog box, and then click **OK**. An item appears under **Device Monitor Table** in the project management area. Double-click the item to open the monitoring table. You can create several monitoring tables in the project, and the monitoring tables are saved with the project.



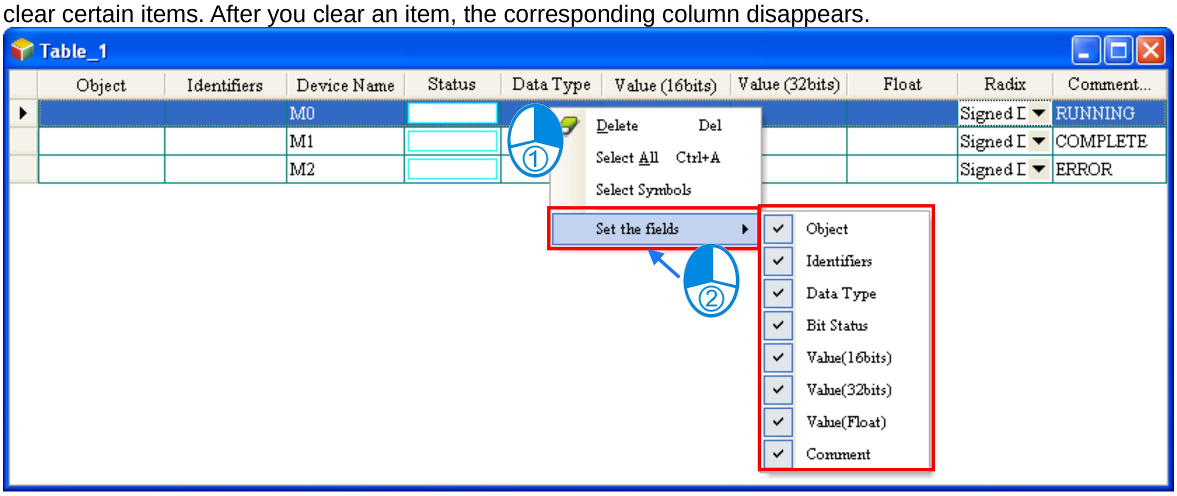
After you double-click the item, a item monitoring window appears. You can add items to be monitored to the window. To add an item to the window, double-click the blank space in the monitoring table, type a device name, type a start address, and the number of devices to be monitored in the **Device Monitor Input** dialog box. You can add up to 100 items to a monitoring table.



Press Insert on the keyboard to switch between inserting and replacing an item in the monitoring table. The selected mode displays in the status bar in ISPSoft.

If you select insert mode, the new item is added above the selected item in the monitoring table. If you select replacement mode, the new item overwrites the selected item in the monitoring table.

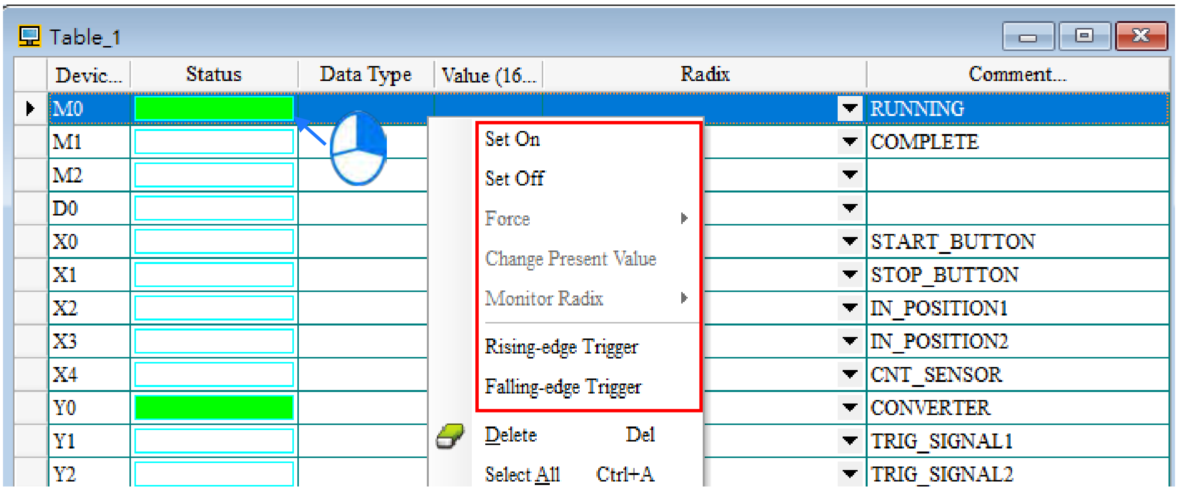
To hide certain columns in the monitoring table, right-click the monitoring table, point to **Set the Fields**, and clear certain items. After you clear an item, the corresponding column disappears.



The following describes the columns in the monitoring table.

Column	Description
Source	Source of a symbol
Identifier	Identifier of a symbol
Device name	Name of a monitored device
Status	State of a monitored bit device or a contact (ON or OFF).
Data type	Data type of a monitored symbol.
Value (16 bits)	In online mode, displays a 16-bit value.
Value (32 bits)	In online mode, displays a 32-bit value.
Float	In online mode, displays a 32-bit floating-point number.
Radix	Select a format to represent a value.
Comment	Display the comments on a device or on a symbol.

After you create the monitoring table, you can monitor the items in the monitoring table in online mode. Right-click an item in the monitoring table in online mode to display a context menu which is the same as the context menu in the program editing window. You can change the item state or the item value by clicking an item in this context menu.

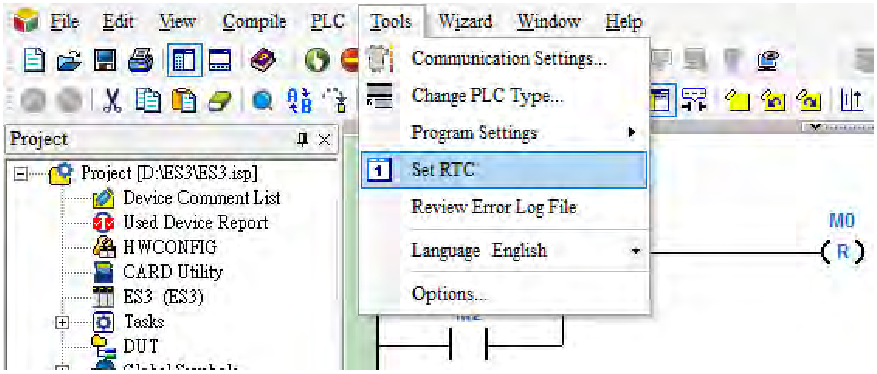


You can text and debug the program you created in this chapter through the monitoring table you created in this section. Refer to Chapter 17 in the ISPSoft User Manual for more information about testing and debugging a program.

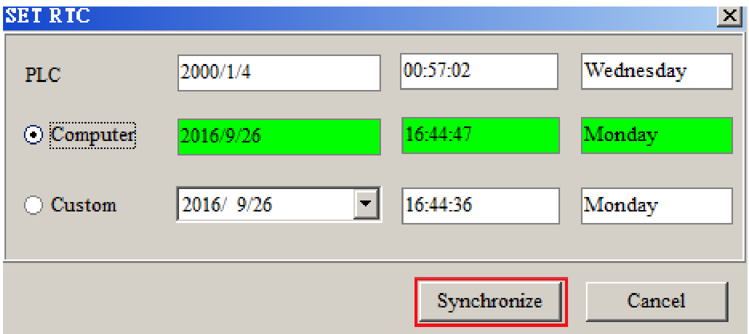
6.7 Setting a Real-time Clock

After you connect an DVP-ES3 Series CPU module to a computer, you can set the real-time clock in the CPU module through ISPSoft.

(1) On the **Tools** menu, click **Set RTC**.



(2) Select **Computer**, and then click **Synchronize** to complete setting the real time clock.



(3) RTC setting is complete.

7

Chapter 7 Memory Card

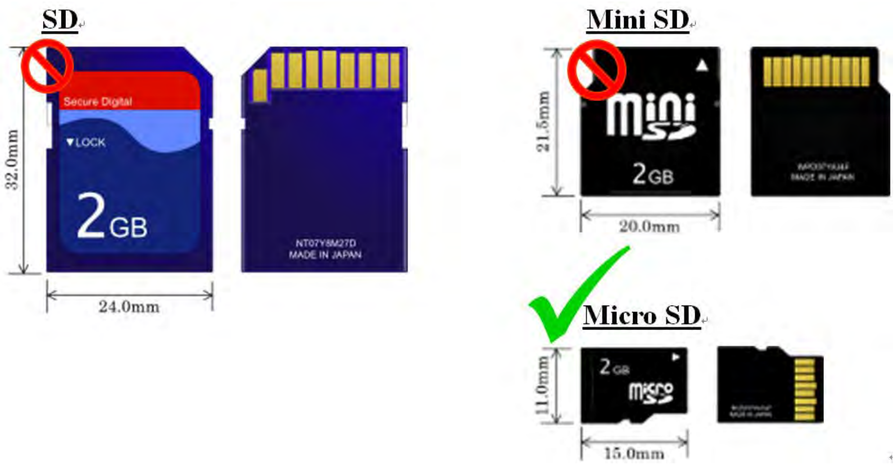
Table of Contents

7.1 Overview of Memory Cards

The DVP-ES3 Series CPU modules support standard MicroSD cards that meet the specifications in this chapter. This chapter describes the specifications and usage for the MicroSD cards supported by the DVP-ES3 Series CPU modules.

7.1.1 Appearances of Memory Cards

SD cards are classified into three types according to size: SD cards, MiniSD cards, and MicroSD cards. DVP-ES3 Series CPU modules support MicroSD cards.



7.1.2 Memory Card Specifications

SD cards are also classified into three types according to capacity: SD cards, SDHC cards, and SDXC cards. The DVP-ES3 Series currently only supports a maximum of 32GB in FAT32 format. SD card families are shown in the table below. The Micro SDHC in the SDHC column indicates the specifications supported by the DVP-ES3 Series. Be sure to purchase products that meet these specifications.

- SD card families

Type	SD		SDHC		SDXC	
Capacity	32 MB~2 GB		4 GB~32 GB		32 GB~2 TB	
File system	FAT16/FAT32		FAT32		exFAT (FAT64)	
Size	SD	SDHC	Mini SDHC	Micro SDHC	SDXC	Micro SDXC
Speed class rating	N/A		CLASS 2 (Min. 2 MB/Sec.) CLASS 4 (Min. 4 MB/Sec.) CLASS 6 (Min. 6 MB/Sec.) CLASS 10 (Min. 10 MB/Sec.)		CLASS 2 (Min. 2 MB/Sec.) CLASS 4 (Min. 4 MB/Sec.) CLASS 6 (Min. 6 MB/Sec.) CLASS 10 (Min. 10 MB/Sec.)	

7.2 Before using a Memory Card

7.2.1 Formatting a Memory Card

You may need to format a new SDHC memory card with the FAT32 file system before you use it for the first time. You cannot use an unformatted SDHC memory card in a DVP-ES3 Series CPU module.

The following example introduces the most common way to format an SDHC card: formatting an SDHC card through a card reader. Also carefully read the documents provided by the SDHC card manufacturer.

⚠ When you format a memory card, you also delete all the data in the memory card. Verify whether you need to back up the data in a memory card before you format the memory card.

(1) Insert the SDHC card into a card reader. The operating system detects a new storage device.

(2) Right-click the new storage device, and then click **Format**.

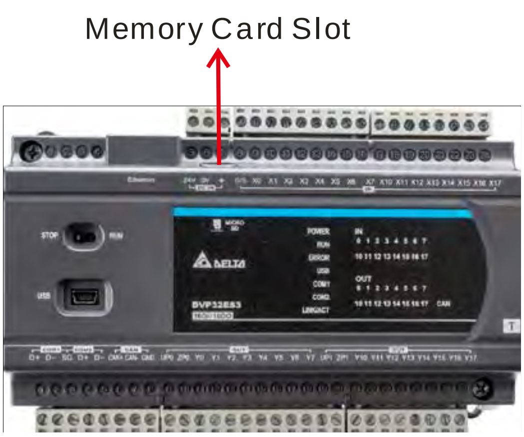
(3) You must format the memory card with the FAT32 file system. Do not change any other default settings. Click **Quick Format**, and then click **Start**.

(4) After you click **OK** in the warning window, the SDHC card formats.

7.3 Installing and Removing a Memory Card

7.3.1 Memory Card Slot in a CPU Module

The memory card slot is on the front side of the DVP-ES3 Series PLC.



7.3.2 Installing a Memory Card

Insert a memory card into the CPU module memory card slot and push it in until it clicks. Be sure the memory card is fixed firmly in the slot; if the memory card is loose, it is not installed correctly. The memory card can only be inserted in one direction. Do not force the memory card or you may damage the CPU module. The correct way to insert the memory card is shown below.

7.3.3 Removing a Memory Card

You can remove a memory card by pushing it in. The card then springs from the slot.

7.4 Memory Card Contents

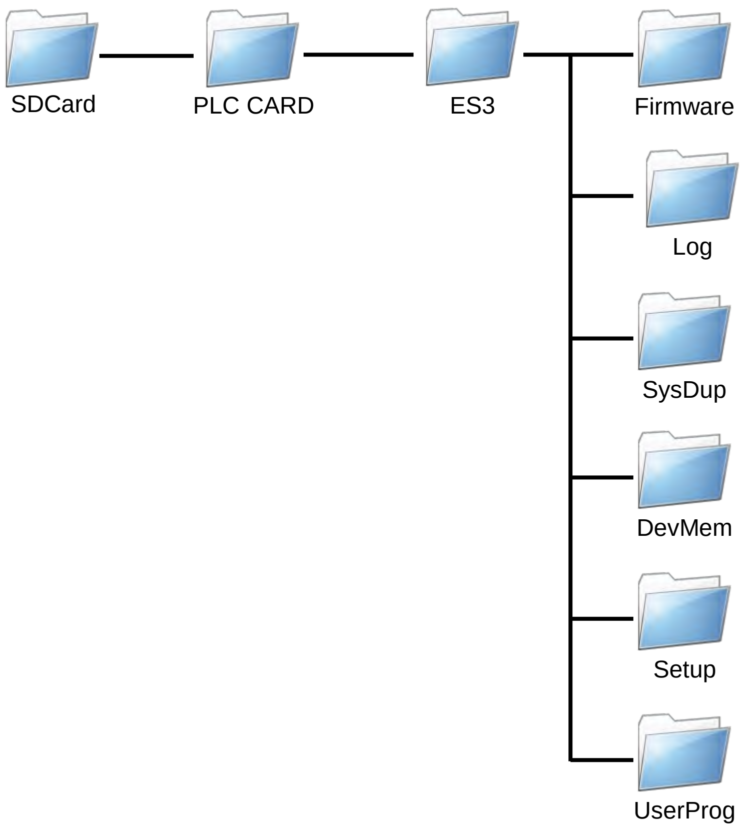
7.4.1 Initializing a Memory Card

When you insert an SDHC card into a CPU module that is powered on, and use ISPSoft -> CARD Utility to back up a project, the system initializes the SDHC card, and creates a default folder named according to the model of the CPU module. (If the folder is already existed, the system does not create a second folder for the same model.)

When the system initializes an SDHC card, it automatically adds any missing folders to the directory structure. However, if the initialization of a SDHC card fails, you cannot initialize the SDHC card again until you reformat it. When you initialize a memory card, the SYSTEM indicator in the software blinks.

7.4.2 Folder Structure in a Memory Card

The image below shows the default folder group created by a DVP-ES3 Series System. The folder name is ES3. Several subfolders are contained inside the ES3 folder. Related files created by you and the DVP-ES3 Series system are stored in the subfolders.



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Folder	Description
Firmware	Stores firmware files (.ext)
Log	Stores Log files (.log)
SysDup	Stores backup files (.dup)
UserProg	Stores device memory files (.txt, .dmd, .csv)
DevMem, Setup	Reserved for the system use

7.5 Introduction to the CARD Utility

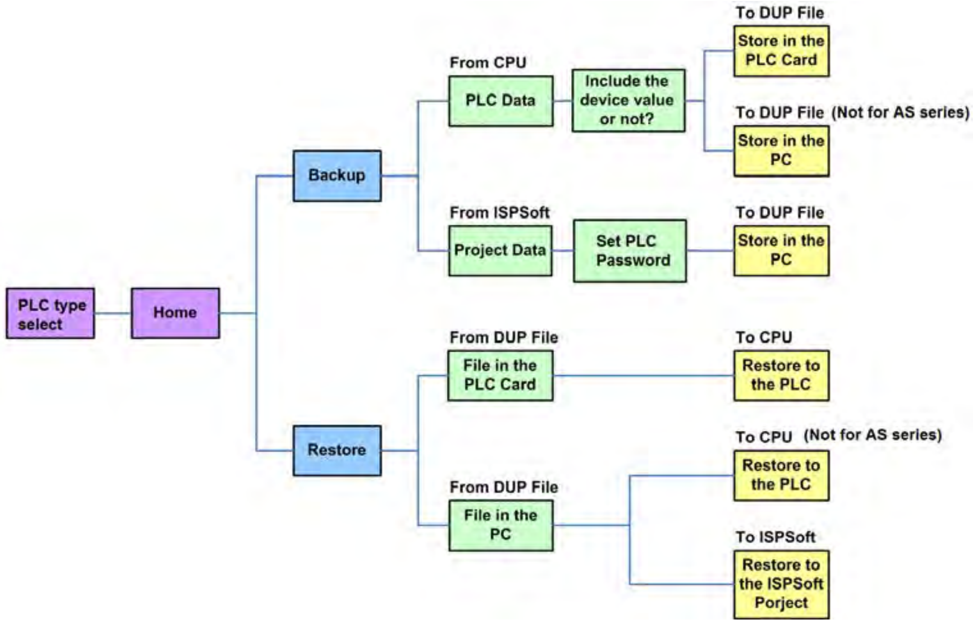
The DVP-ES3 Series CPU modules include SDHC slots, and you can back up and restore module data with a memory card. ISPSoft includes the CARD Utility for the DVP-ES3 Series CPU modules. With this utility, you can back up and restore data in a DVP-ES3 Series CPU module or backup and restore an ISPSoft project. The backup can include the program code, parameter settings, hardware configuration, and network configuration, as well as the values in the devices in a DVP-ES3 Series CPU module. Refer to Section 7.7.1 in the Operation Manual for more information about the specifications and usage of SDHC cards with DVP-ES3 Series CPU modules.

The list below describes the functions supported by the CARD Utility, including a flowchart.

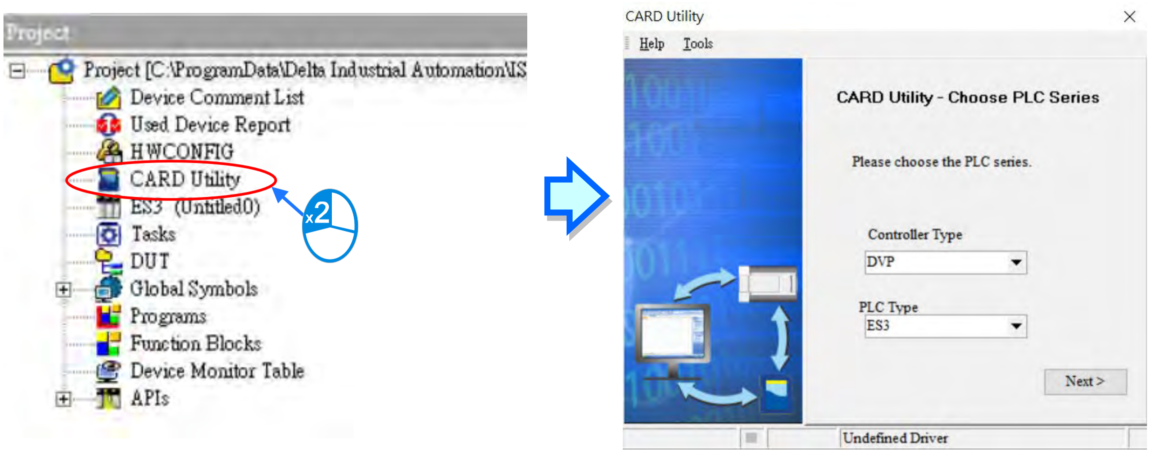
- If you export data from a DVP-ES3 Series CPU module as a backup file (*.dup), you can save the exported data in the memory card in the module or in a folder on the computer. You can also decide whether to back up the values in the devices in the DVP-ES3 Series CPU module.

- If you export an ISPSoft project for a DVP-ES3 Series CPU module as a backup file (*.dup), you can only save the exported ISPSoft project in a folder in the computer. You can see data such as register editing (*.dvl), device status editing (*.dvb), file register editing (*.wft) for the DVP-ES3 Series as values in the device and back them up. You can put a memory card with the backup file into the DVP-ES3 Series CPU module. You can copy a backup file (*.dup) saved on the computer into the DVP-ES3 Series CPU module connected to the computer, or restore the backup file to an ISPSoft project. If you choose to restore the backup file to an ISPSoft project, the system automatically skips the values in the devices and the hardware configuration in the backup file.

- If you restore the backup file (*.dup) from the PC to an ISPSoft project for a DVP-ES3 Series CPU module, you can also restore data such as register editing (*.dvl), device status editing (*.dvb), and file register editing (*.wft) for the DVP-ES3 Series.



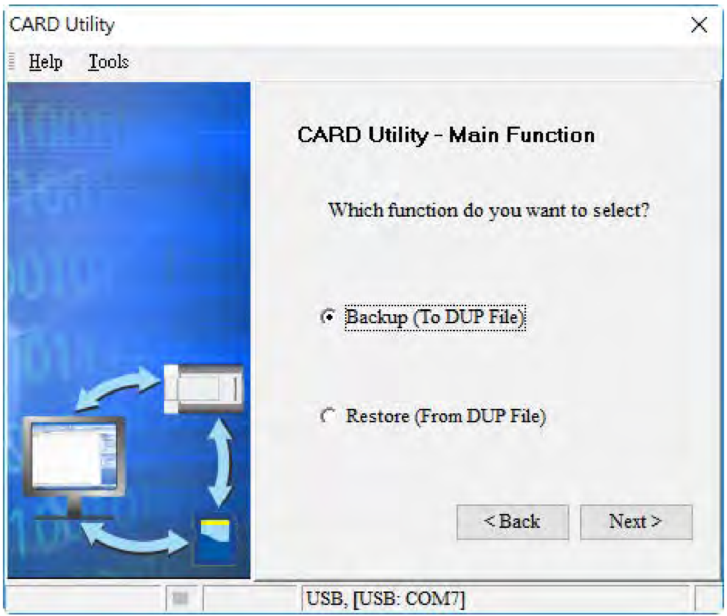
Double-click **CARD Utility** in the project management area to open the **CARD Utility** wizard. After selecting the controller type, click “Next” to proceed.



7.6 Backing Up a Project

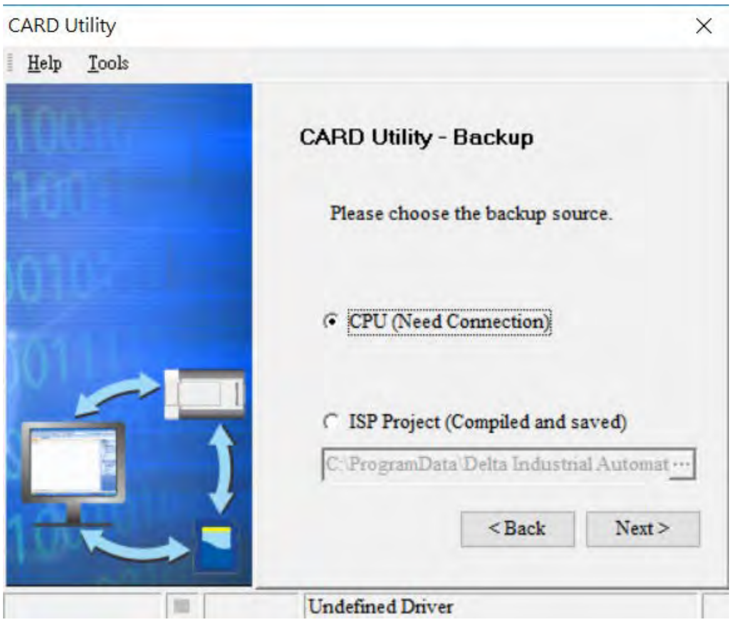
If the backup source or backup destination is a DVP-ES3 Series CPU module or memory card, make sure that ISPSoft is connected to the DVP-ES3 Series CPU module. During backup, the CPU LED and Error LED blinks alternatively and SM452 flag is ON. After the backup is done, the CPU LED and Error LED stops blinking and SM452 flag is OFF. Refer to Section 2.4 in the ISPSoft User Manual for more information.

(1) Select the **Backup (To DUP File)** option button in the **CARD Utility** wizard and then click **Next**.



(2) Select a backup source, and then click **Next**.

a. If you select the **CPU (Need Connection)**, the backup file is stored in the memory card.



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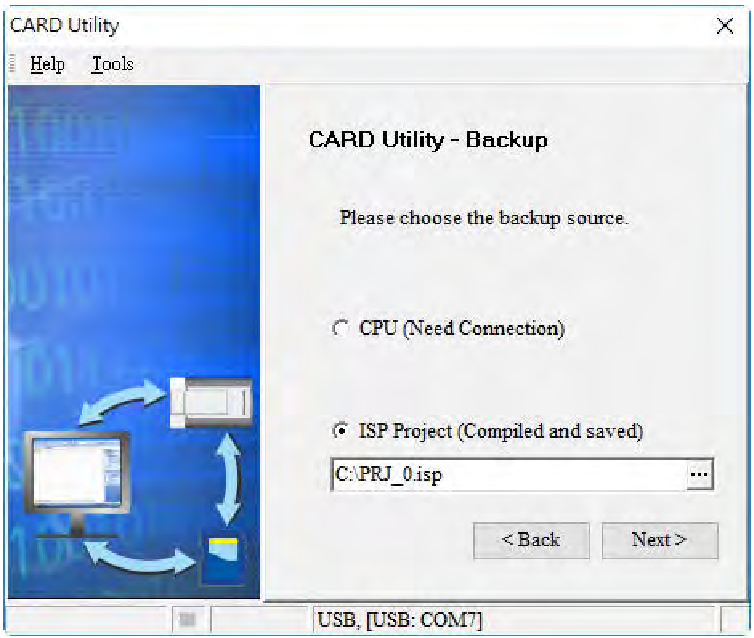
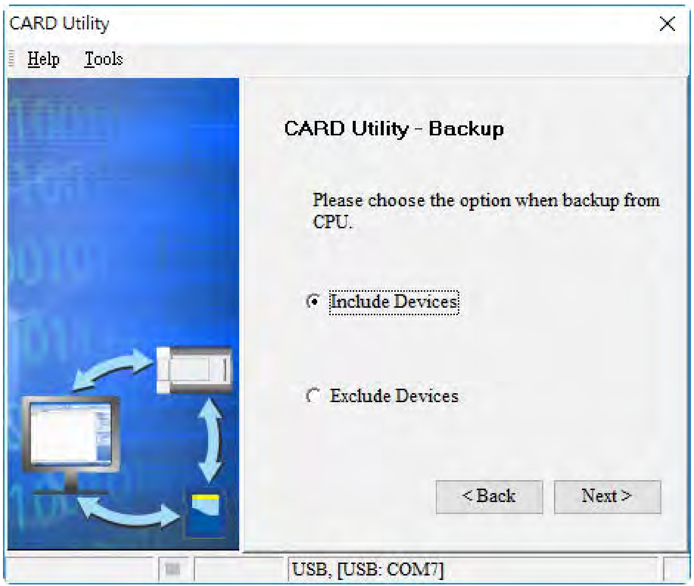
b. If you select the **ISP Project (Compiled and saved)**, the backup file is stored in your computer. Click ... and select an isp file in the **Open** dialog box. If the program in the isp file selected is not compiled, a message appears when you back up the isp file. Open the isp file with ISPSoft, compile the program in the isp file, and then save the isp file. After the program in the isp file is compiled, you can back up the isp file.

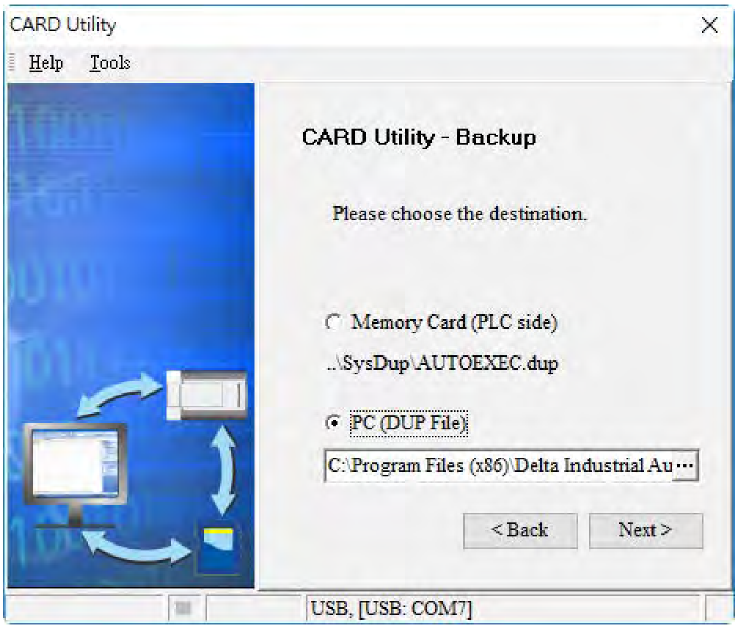


(3) After you select **CPU (Need Connection) / ISP Project (Compiled and saved)**, click **Next**,

a. If you select the **CPU (Need Connection)**, a prompted window appears. And you need to decide whether to back up the values in devices on the DVP-ES3 Series CPU module that is connected to ISPSoft.



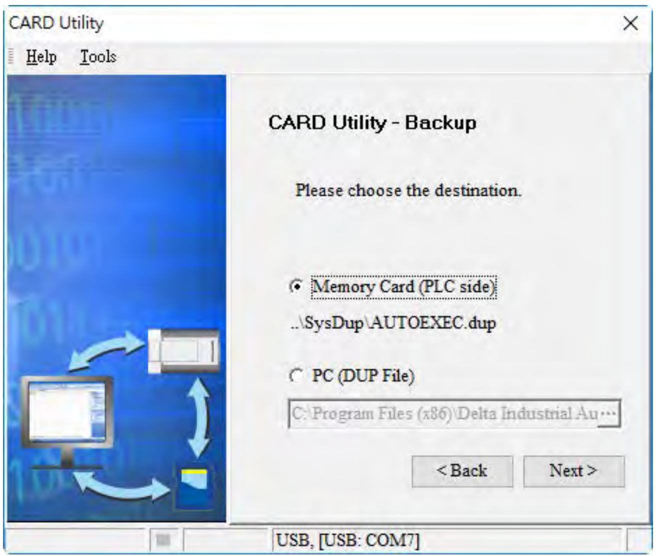
b. If you select the **ISP Project (Compiled and saved)**, the backup file is stored in your computer. Click … and select an isp file in the **Open** dialog box and then decide the file path where you'd like to store the backup file in your computer and then define its file name.



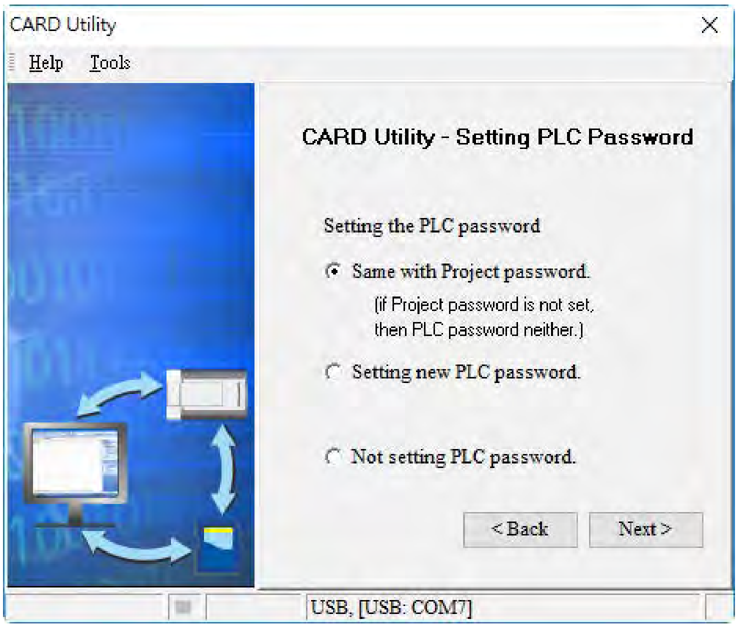
(4) Select a backup destination. If the backup source is an ISPSoft project, the backup destination must be a computer.

a. If you select **Memory Card (PLC Side)**, the filename of the backup file is **AUTOEXEC.dup**, and the backup file paths are shown below.

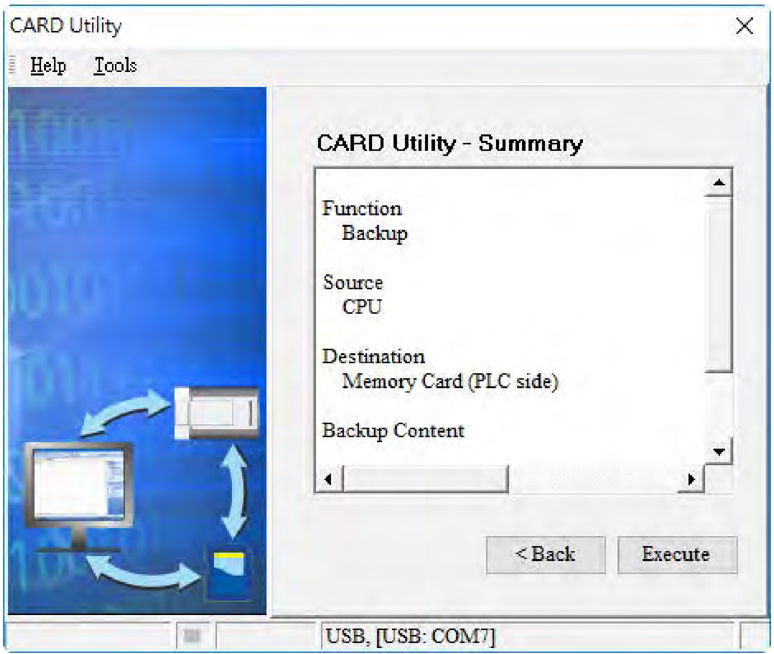
Root directory of the memory card\SDCard\PLC CARD\ES3\SysDup\AUTOEXEC.dup



b. If you select **PC (DUP File)**, click [...], select a folder in the **Save in** list in the **Save As** dialog box, and type a filename in the **File name** box. When you select the backup source for the ISPSoft Project, set the PLC password. You can set the password to be the same as the Project password, set a new PLC password, or not set a PLC password. If you do not set a password for the Project, the PLC password is also not set. When you select **Setting new PLC password**, the wizard looks like the following image. And you can set new PLC password and number of the attempt times.

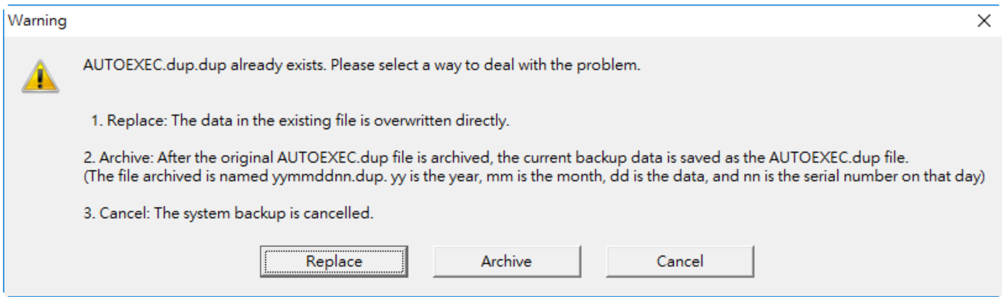


(5) After that you can see the summary. Make sure that the summary in the **CARD Utility** wizard is consistent with the data backup you want to perform, and then click **Execute**.



(6) The DVP-ES3 Series CPU module still performs the data backup even if you click **Cancel**. You can turn off the DVP-ES3 Series CPU module to stop the data backup; however, the backup file produced is not a complete backup file, and you must delete the backup file from the memory card.

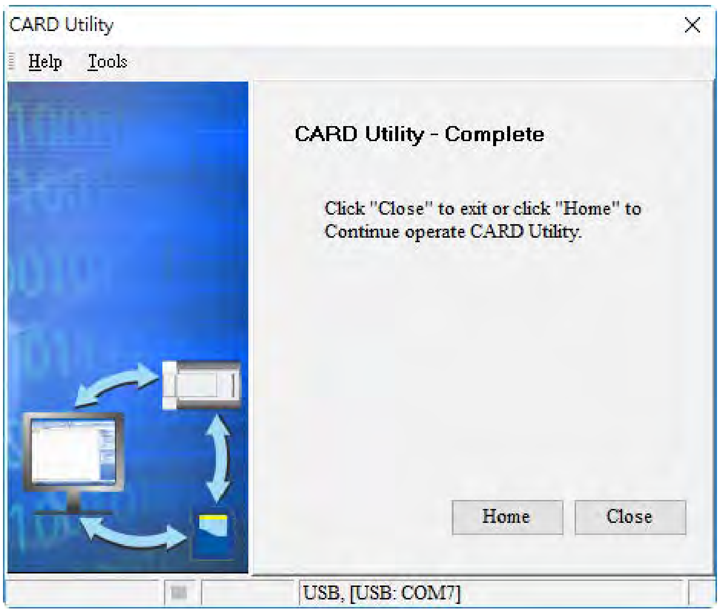
If you select **Memory Card (PLC Side)**, the filename of the backup file is **AUTOEXEC.dup**, and the backup file path is **Root directory of the memory card\ES3\SysDup\AUTOEXEC.dup**. If there is an old backup file in the memory card, the **Warning** message appears. Click **Replace**, **Archive**, or **Cancel** in the Warning message.



If the backed up data is protected by passwords, these passwords are also backed up.

Data backup	Description
CPU module → Memory card	The backed up data includes the PLC ID and the PLC password set in the CPU module.
ISPSoft project → Computer	The backed up data includes the program ID and the project password set in the ISPSoft project.

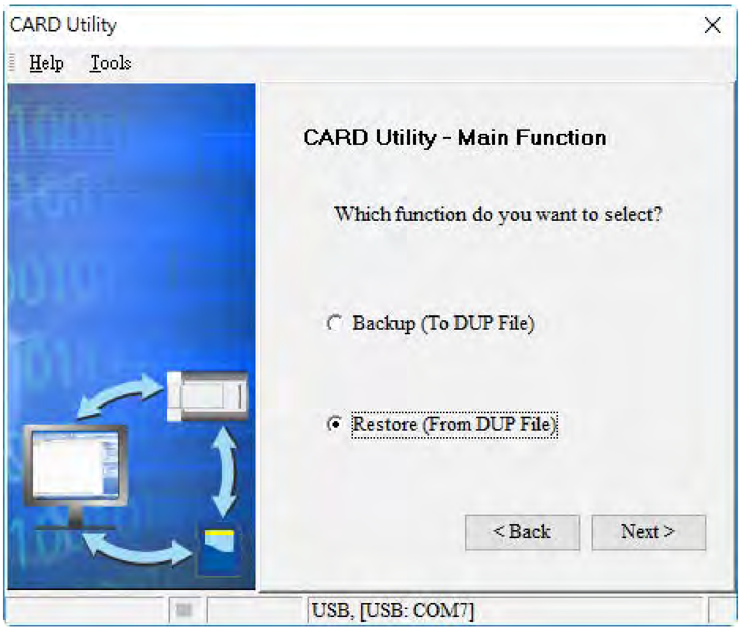
(7) After you perform the data backup, click **Home** or **Close** in the **CARD Utility** wizard.



7.7 Restoring a Project

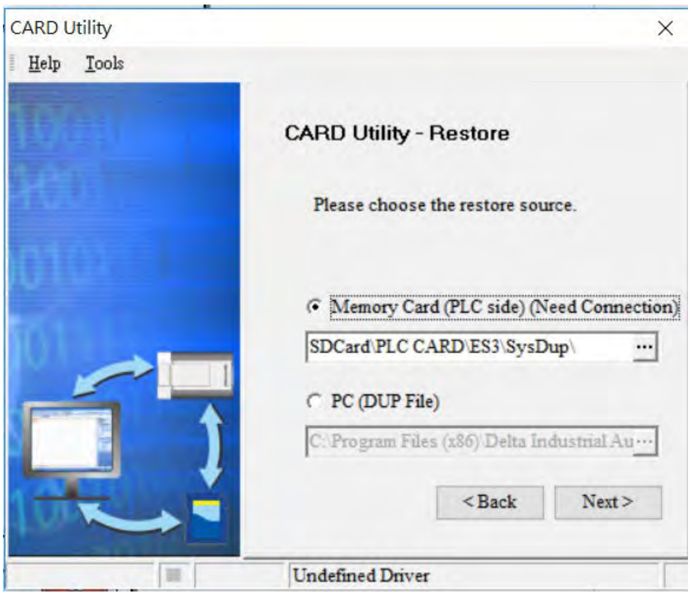
If the restoration source or restoration destination is a DVP-ES3 Series CPU module or memory card, make sure that ISPSoft is connected to the DVP-ES3 Series CPU module. During restoration, the CPU LED and Error LED blinks alternatively and SM452 flag is ON. After restoration is done, the CPU LED and Error LED stops blinking and SM452 flag is OFF. Refer to Section 2.4 in the ISPSoft User Manual for more information.

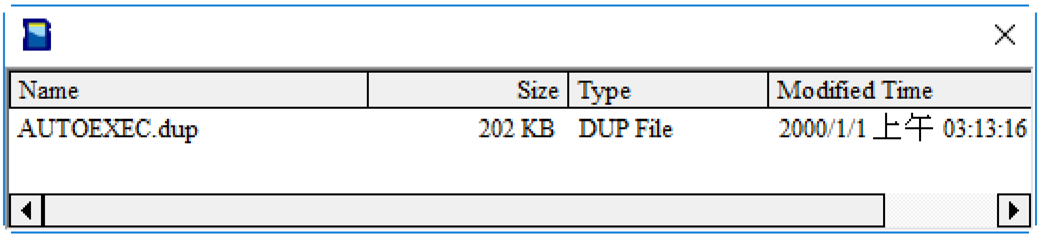
(1) Select **Restore (From DUP File)** in the **CARD Utility** wizard and then click **Next**.



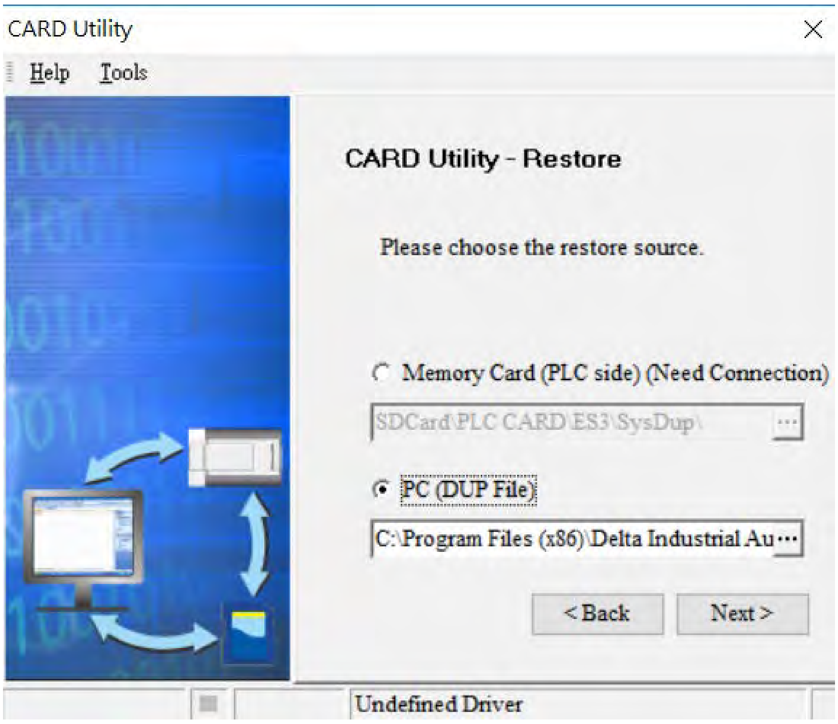
(2) Select a restoration source, click ... and then select a backup file to be restored.

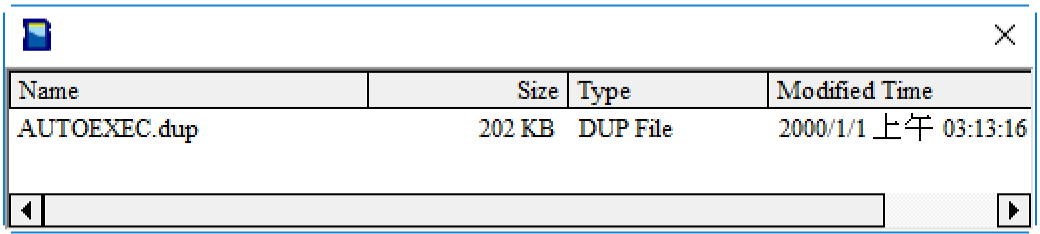
a. If you select **Memory Card (PLC side) (Need Connection)**, the backup files in the memory card display in a window after you click .... Double-click a backup file in the window to choose it.





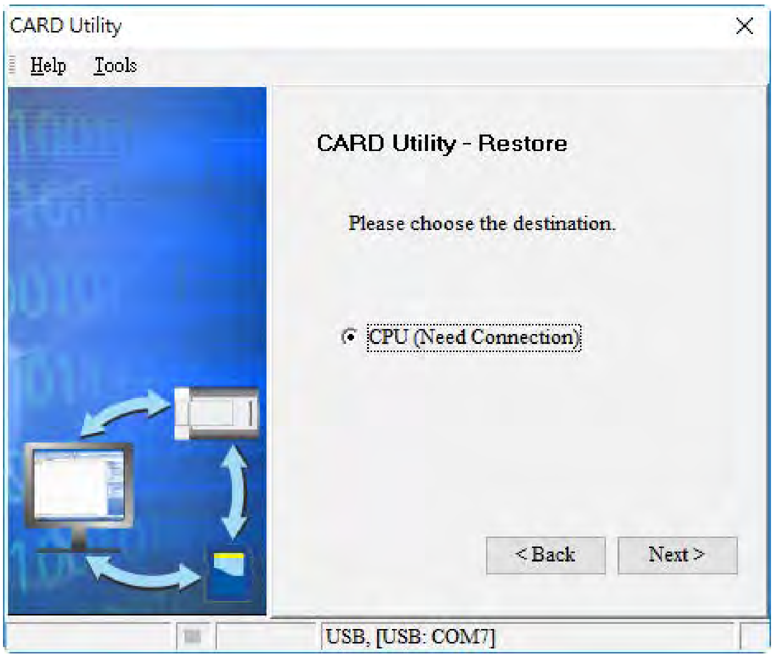
b. If you select **PC (Need Connection)**, the backup files in the PC display in a window after you click ···. Double-click a backup file in the window to choose it.



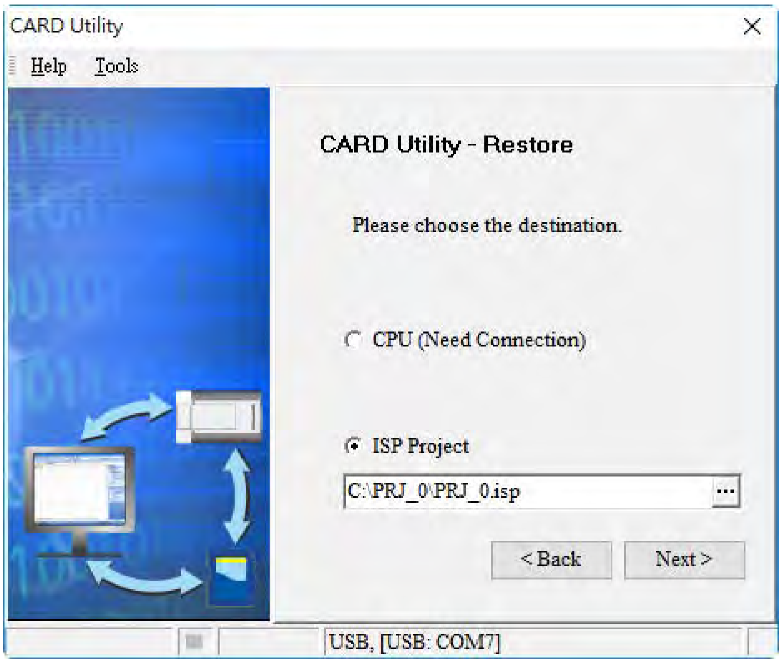


(3) Select a restoration destination, and then click **Next**.

a. To put the selected backup file into the DVP-ES3 Series CPU module, select **CPU (Need Connection)**. If the restoration source is the **CPU (Need Connection)**, the restoration destination must be the DVP-ES3 Series CPU module.



b. If you select **ISP Project**, click ..., and then specify a filename and a path. If the path specified point to a file that already exists, the file is overwritten when you restore the data.



(4) Make sure that the summary in the **CARD Utility** wizard is consistent with the data restoration you want to perform and then click **Execute**.

If you click **Cancel** in the process of restoring data to the DVP-ES3 Series CPU module, the data is not completely restored. The DVP-ES3 Series CPU module still performs the data restoration even if you click **Cancel** in the process of restoring a backup file in the memory card. You can turn off the DVP-ES3 Series CPU module to stop the data restoration from being performed. To prevent the DVP-ES3 Series CPU module from operating incorrectly, restore the DVP-ES3 Series CPU module to the factory setting, or perform the data restoration again.

The restoration source or restoration destination may contain a password and an ID. The following table describes the password and the ID process.

Data restoration	Description
Memory card → PU module	a. The ID in the backup file must be the same as the ID in the CPU module; otherwise the data is not restored. b. If there is a PLC password in the CPU module, the password in the backup file must be the same as the PLC password in the CPU module. Otherwise the data is not restored. c. If there is no PLC password in the CPU module, and there is a password in the backup file, the system restores the data, and the password in the backup file becomes the PLC password in the CPU.
Computer→ ISPSoft project	The ID and the password in the backup file become the program ID and the project password in the ISPSoft project.

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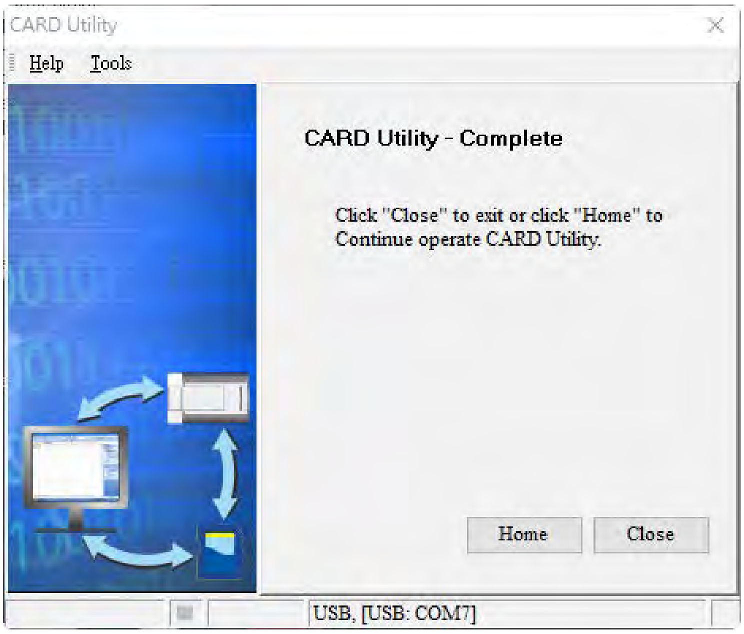
(5) After you perform the data restoration, click **Home** or **Close** in the **CARD Utility** wizard.



7.8 Restoration Starts Once CPU is supplied with Power

When the backup file in the memory card is consistent with the specific path and file name, the CPU can perform restoration once it is supplied with power. During restoration, the CPU LED and Error LED blinks alternatively and SM452 flag is ON. After restoration is done, the CPU LED and Error LED stops blinking and SM452 flag is OFF.

Operation Steps:

(1) Set up the backup file path and file name for the memory card backup file. The filename of the backup file is **BACKUP.dup** and the backup file paths are shown below.

Memory card root directory\SDCard\PLC CARD\ES3\SysDup\ES3_BACKUP.dup

Insert the memory card into the card slot when the CPU power is off.

(2) When the CPU power is on, it automatically checks if the memory card data is consistent with the PLC data. If not, the restoration begins. The data check is specifically on the data in CPU programs and HWCONFIG parameters.

(3) During the restoration, the CPU LED and Error LED blinks alternatively. Once the restoration is done, the blinking stops.

7.9 CPU Error Log

The system stores CPU error messages in the memory card whenever the quantity of the error messages reached to 20. You can also use special flag SM36 and special device SR36 to read the CPU error messages and state change logs. If there is error logs recorded in the memory card, the memory card keeps storing the error logs. You can change the file path to store other error logs or change the file name to store other error logs.

Special Device	Function Code Description
SR36	a. when the value is 0, it indicates there is no recording. b. when the value is 1234, it indicates the logs are stored in the memory card. c. when the value is 3456, it indicates the error logs and state change logs are stored in the memory card.

Operation Steps to read CPU error logs and state change logs:

Make sure the memory card is in the slot before reading the CPU error logs and state change logs.

(1) Set SM36 to ON and the value in SR36 to 1234 or 3456 to read the CPU error logs and state change logs.

(2) The root directory path of the memory card for the error log is

Memory card root directory\SDCard\PLC CARD\ES3\Log\Error.log

Use ISPSoft to read the error logs. ISPSoft Tools -> Review Error Log File -> Open Log File

The root directory path of the memory card for the status log is

Memory card root directory\SDCard\PLC CARD\ES3\Log\STATUS.log

(3) Use ISPSoft to read the status logs. ISPSoft Tools -> Review Error Log File -> Open Log File

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Chapter 8 Hardware Configuration and Data Exchange Setups

Table of Contents

8.1 Hardware Configuration Tool for DVP-ES3 Series Modules - HWCONFIG

HWCONFIG is a built-in hardware configuration tool in ISPSoft. You can set up CPU and module parameters, download/upload parameters, detect a hardware configuration online, and make a diagnosis through HWCONFIG.

You must download all parameters set in HWCONFIG to the CPU module for them to take effect.

8.1.1 Introduction of the HWCONFIG Environment

In ISPSoft, double-click **HWCONFIG** in the project management area to start **HWCONFIG**.

Delta Electronics provides you with specific configuration tools for some CPU modules. You can add extension modules to the right side of the DVP-ES3 Series CPU module. The system configuration area displays the present system configuration. When you modify the configuration in the system configuration area, the information in the information list updates.

Parameter: settings for CPU

AIO Wizard: settings for the right-side extension modules

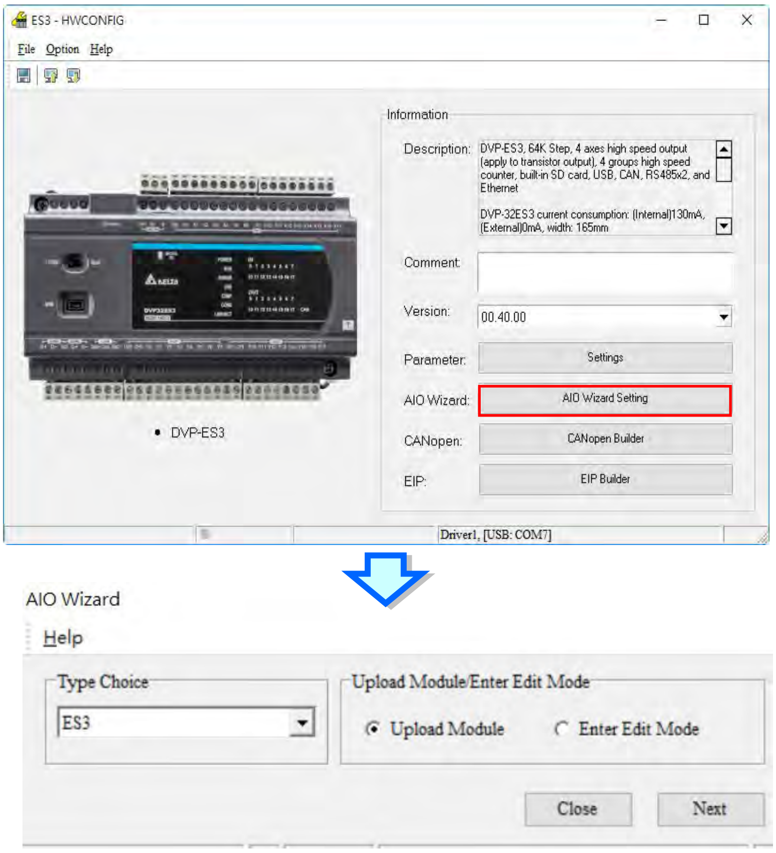
CANopen Builder: for CANopen communication

EIP Builder: for EIP communication

You can use tools such as CANopen Builder and EIP Builder to set advanced network assignments for the modules. Refer to the manuals for the communication software tools for more information on setting up communications.

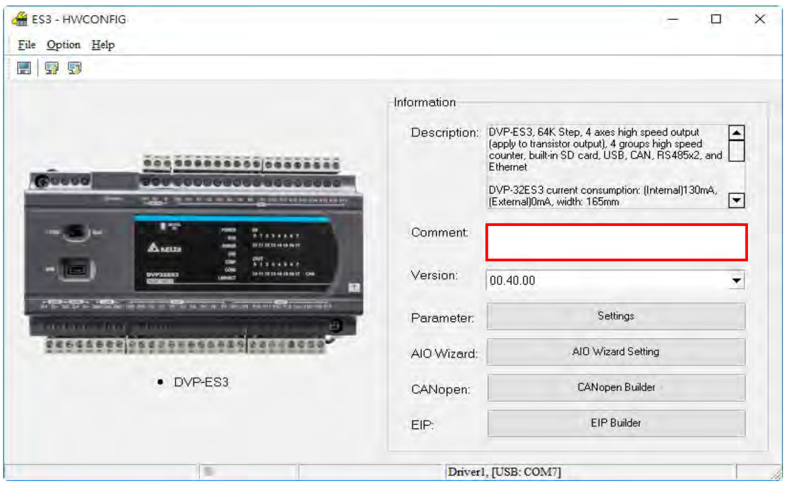
8.1.2 Configuring a Module

For DVP-ES3 Series, you need AIO Wizard to configure its right-side modules. Click AIO Wizard Setting to open the wizard. You can **Upload Module** or **Enter Edit Mode** by clicking the relevant radio buttons.



8.1.3 Editing a Comment

You can add a comment directly in the Comment box.

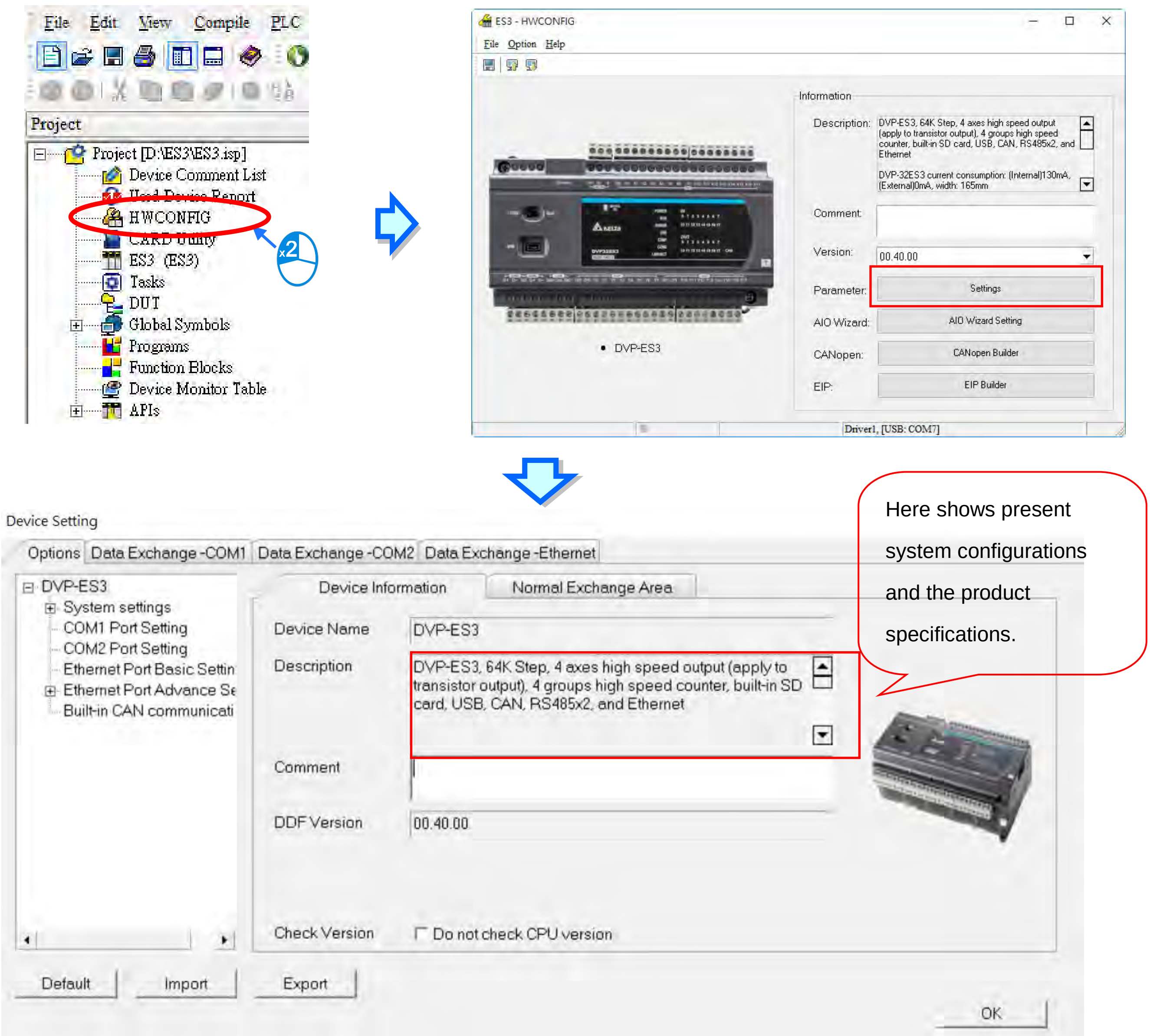


8.2 Setting the Parameters in a DVP-ES3 Series CPU Module

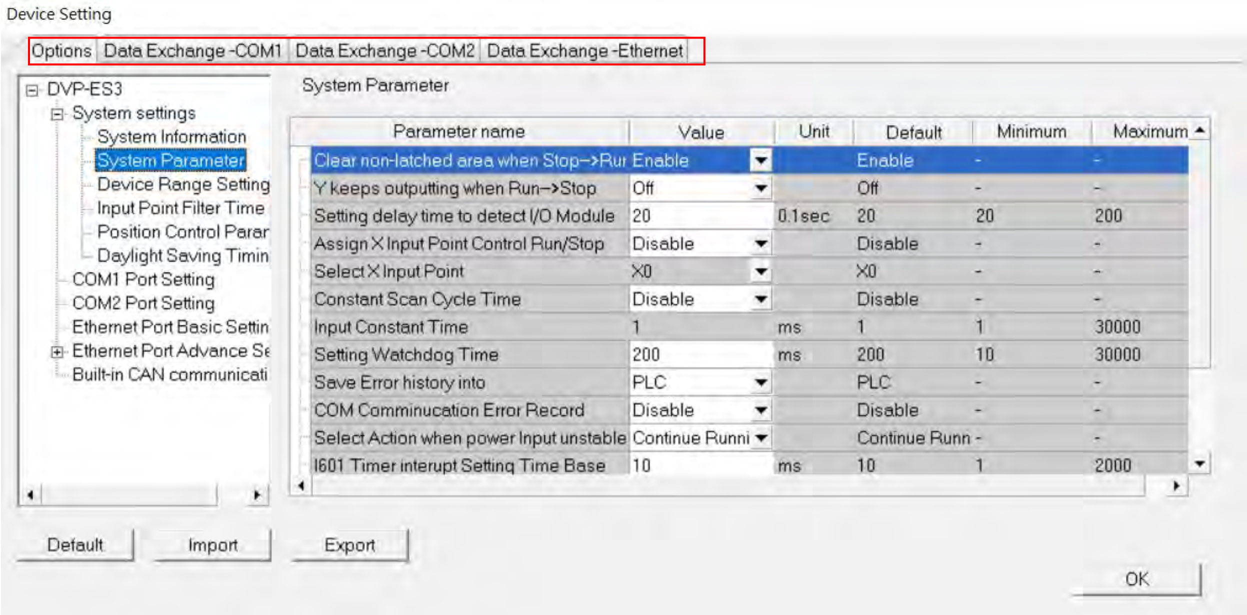
8.2.1 Opening the PLC Parameter Setting Window

After you double-click **HWCONFIG** in the project management area, the ES3 Series setting page appears. Click **Settings** button to set up the CPU parameters.

*** You must download the set parameters to the CPU module before they take effect.**



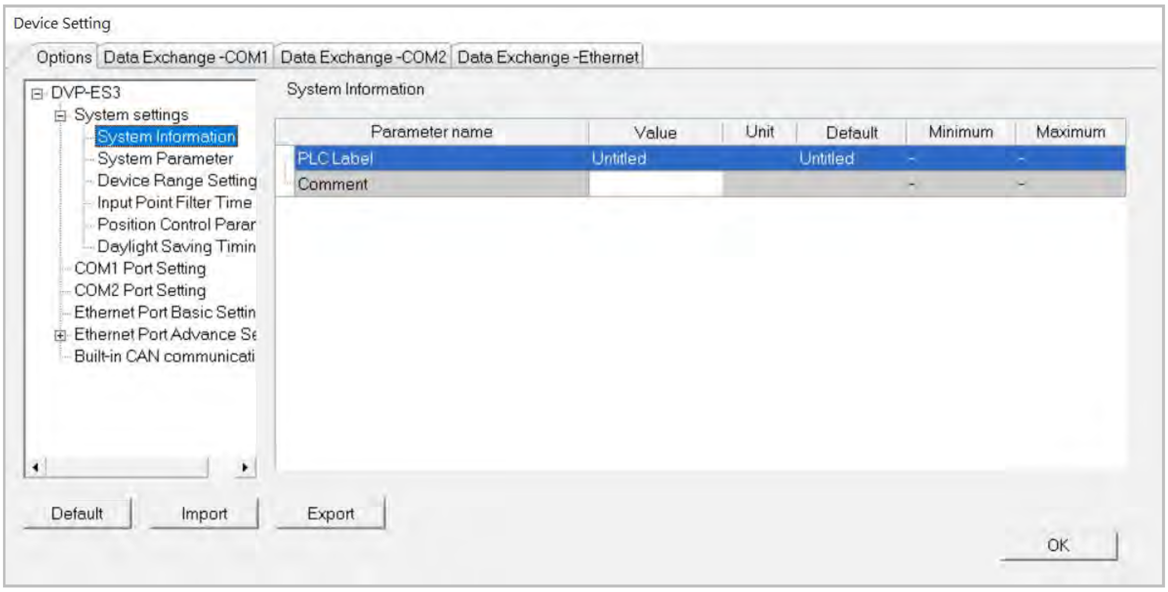
The parameters are classified into several types. Click the tabs at the top of the Device Setting dialog box and then click the setting options in the tree on the left. The setting parameters for the selected setting option appear on the right in the Device Setting dialog box. Click the option on the left, and then set **Value, Unit, Default, Minimum** and **Maximum** for each parameter**.**



8.2.2 Setting the Basic CPU Parameters

8.2.2.1 Options - System Information Page

In the Device Setting dialog box, click the **Options** tab, and unfold the **System settings** to set up the settings of **System Information, System Parameter, Device Range Setting, Input Point Filter Time, Position Control Para**, and **Daylight Saving Timing**.



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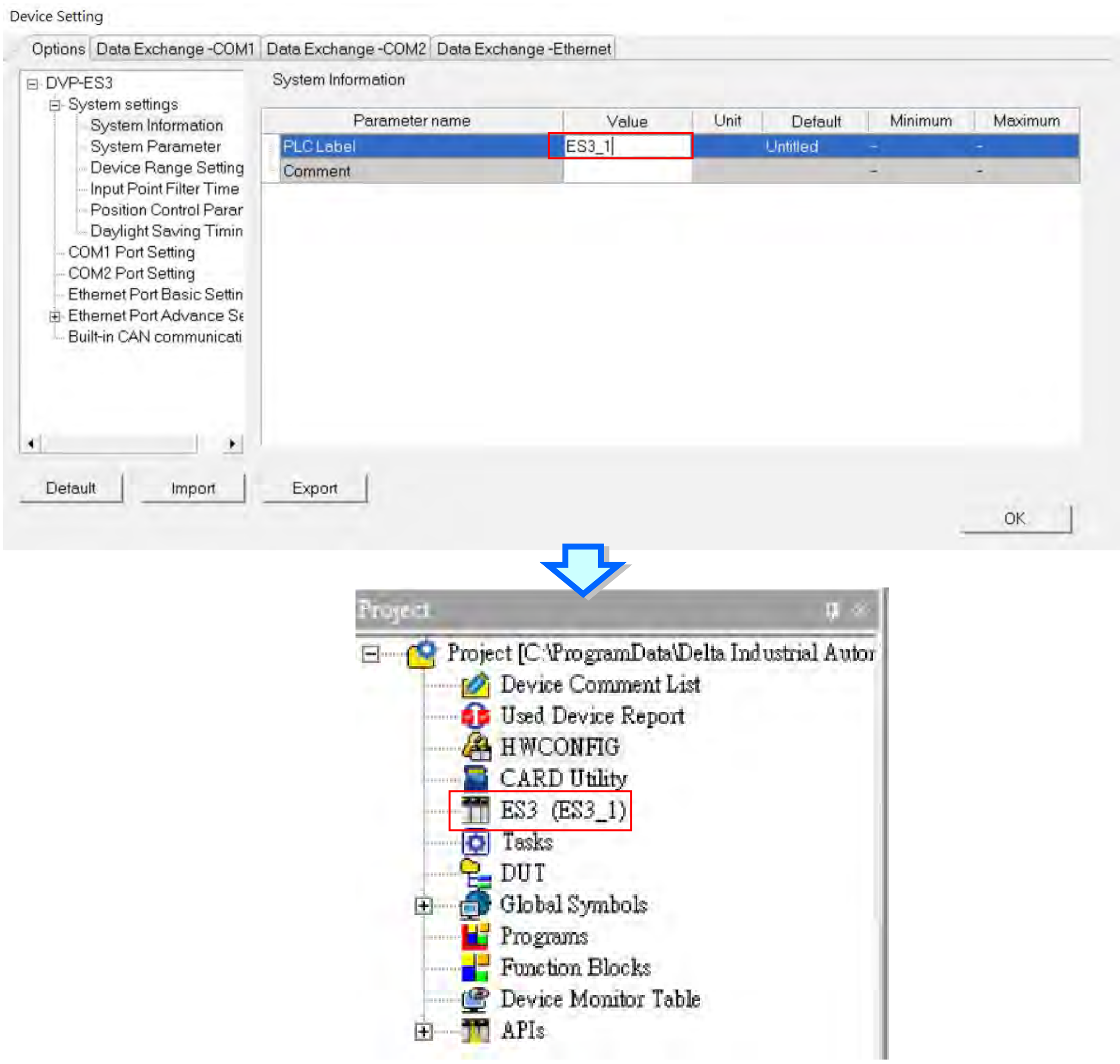
System Information

On the System Information page, you can edit two parameters: **Name** and **Comment**. You can enter up to 15 characters in the Name section and up to 30 characters in the Comment section. You can use spaces and special characters in these two sections, but note that a Chinese character occupies two characters.

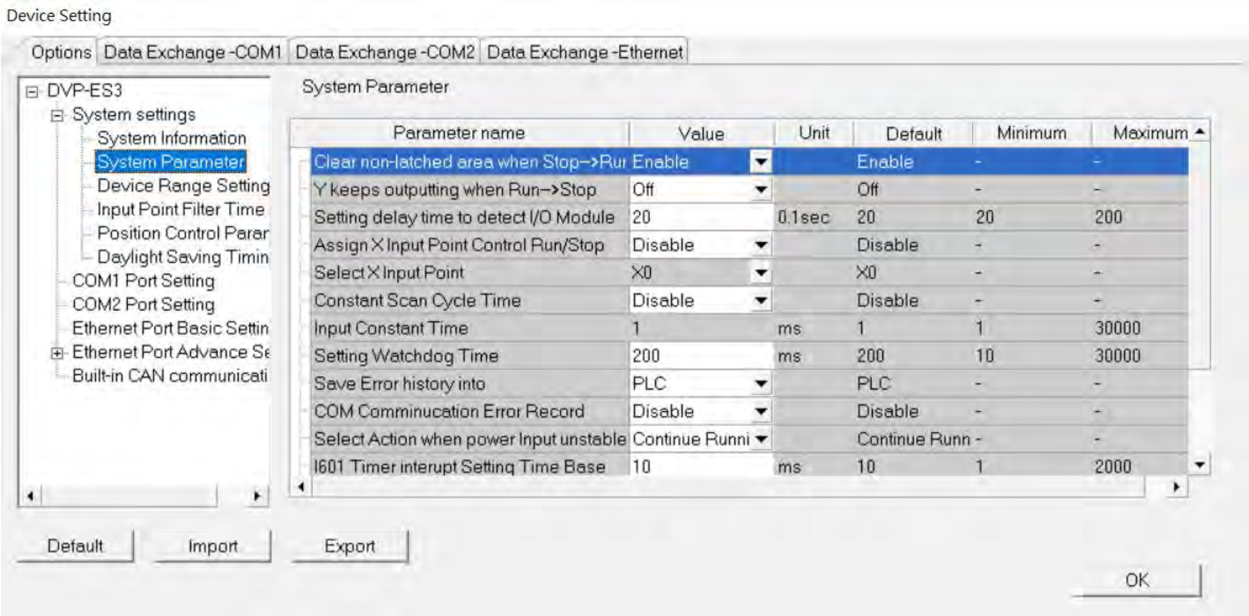
After you create an ISPSoft project, the default project name is the name of the CPU module, and it is attached to the model in the project management area. You can change the default name of the CPU module in the Value box of the PLC Label.



You can identify a device by means of device name. When several devices are connected on a network, you can check whether a device connected to the computer is the device you expect by the device name. If you want to download or upload the program, but the name of the CPU module is different from the name attached to the model in the project management area, the system reminds you to check the name of the CPU module and the name attached to the model in the project management area.

System Parameter

On the System Parameter page, you can set parameters by entering appropriate values or by selecting from a list.



- **Clear Non-latched area when Run → Stop**

  This determines whether the states and values of the non-latched devices are cleared when the PLC changes from Run to Stop.

  - **Disable:** all the states and values in the non-latched devices stay the same.
  - **Enable:** all the states and values in the non-latched devices are cleared and restored to defaults.

- **Y keeps outputting when RUN→Stop**

  This determines the states of the Y devices when the CPU module begins to run or stop.

  - **Off:** all Y devices are set to OFF.
  - **Retain:** the states of the Y devices stay the same.

- **Setting delay time to detect I/O Module**

  This sets the time to detect an I/O module after powering on the CPU module.

- **Assign X Input Point Control Run/Stop**

  This assigns an input point to have the CPU module run or stop.

  - **Disable**: run or stop the CPU module with the dip switch of the CPU module.
  - **Enable**: run or stop the CPU module with the assigned input point, and the dip switch of the CPU module still controls the run stop state of the CPU module.

- **Select X Input Point**

  If you select **Enable** in the previous option, you can select one input point to control the Run or Stop state of the CPU module from the dropdown list.

- **Constant Scan Cycle Time**

  This sets the minimum scan cycle time.

  - **Disable**: disables this function.
  - **Enable**: when the actual scan cycle time is less than the setting time, the CPU module waits until the setting time is met, and then starts the next scan. When the actual scan time is longer than the setting time, the CPU module starts the next scan after the actual scan time completes.

- **Input Constant Time**

  If you selected **Enable** in the previous option, you set the scan cycle time here. If the actual scan time is larger than the setting time, a watchdog timeout occurs when the CPU module operates.

- **Setting Watchdog Time**

  This parameter sets a timeout during which the program is scanned. The CPU module sends an error if the program execution exceeds the watchdog time.

- **Save Error History Info**

  This specifies where to store the error log.

  - **PLC**: store error logs in the PLC. The PLC can store up to twenty error logs. If there are more than twenty error logs, the oldest error log is overwritten by the latest error log.
  - **PLC & SD Card**: when there are more than twenty error logs, the oldest error log is backed up to the memory card before the oldest error log is overwritten in the PLC.

- **COM Communication Error Record**

  This parameter sets whether to enable the error record when there is an error at the COM port.

  - **Disable**: disables this function.
  - **Enable**: enables this function and starts recording COM errors in the error log.

- **Select Action When 24 Vdc Input Unstable**

  What to do when the 24 Vdc power is unstable

  - Continue Running when power stable: waits till the power is stable and then PLC begins to run.
  - Into Error Status: Stops and go to the error mode

- **I601 Timer interrupt Setting Time Base**

  Sets the interval for triggering the 1601 timer interrupt. This function is used together with Timer Interrupt 0.

- **I602 Timer interrupt Setting Time Base**

  Sets the interval for triggering the 1602 timer interrupt. This function is used together with Timer Interrupt 1.

- **I603 Timer interrupt Setting Time Base**

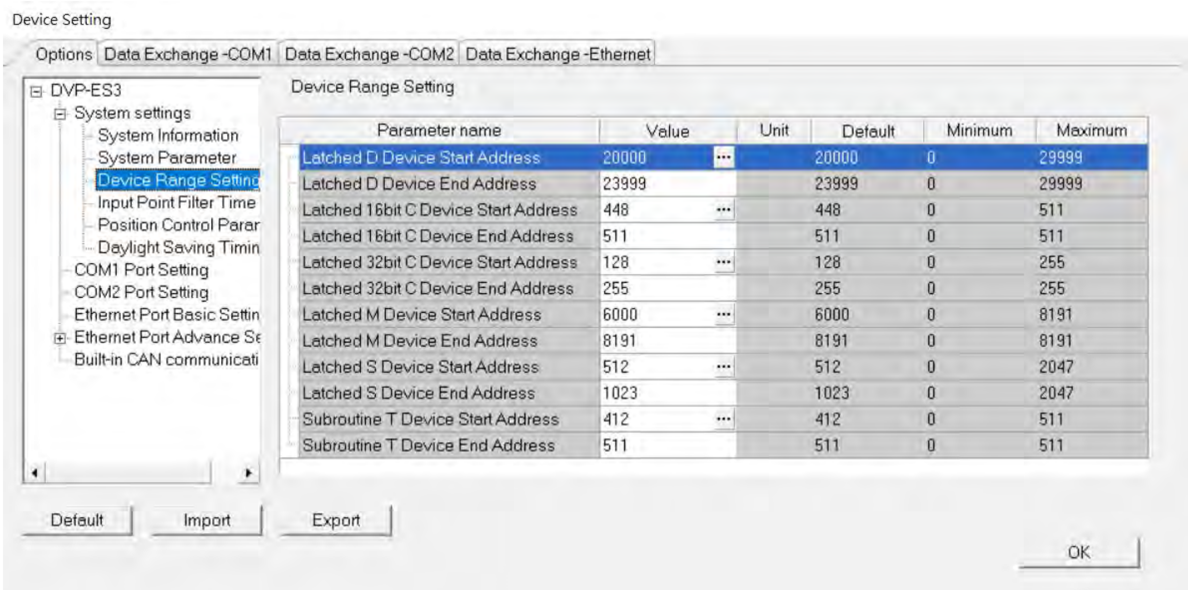
  Sets the interval for triggering the 1603 timer interrupt. This function is used together with Timer Interrupt 2.

- **I604 Timer interrupt Setting Time Base**

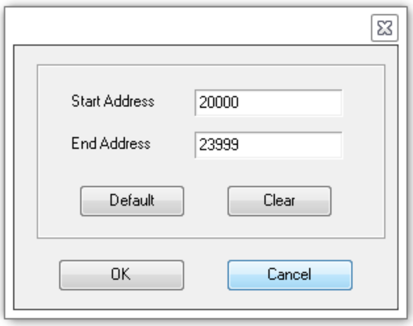
  Sets the interval for triggering the 1604 timer interrupt. This function is used together with Timer Interrupt 3.

Device Range Setting

The parameters on **Device Range Setting** table are shown in the following window.

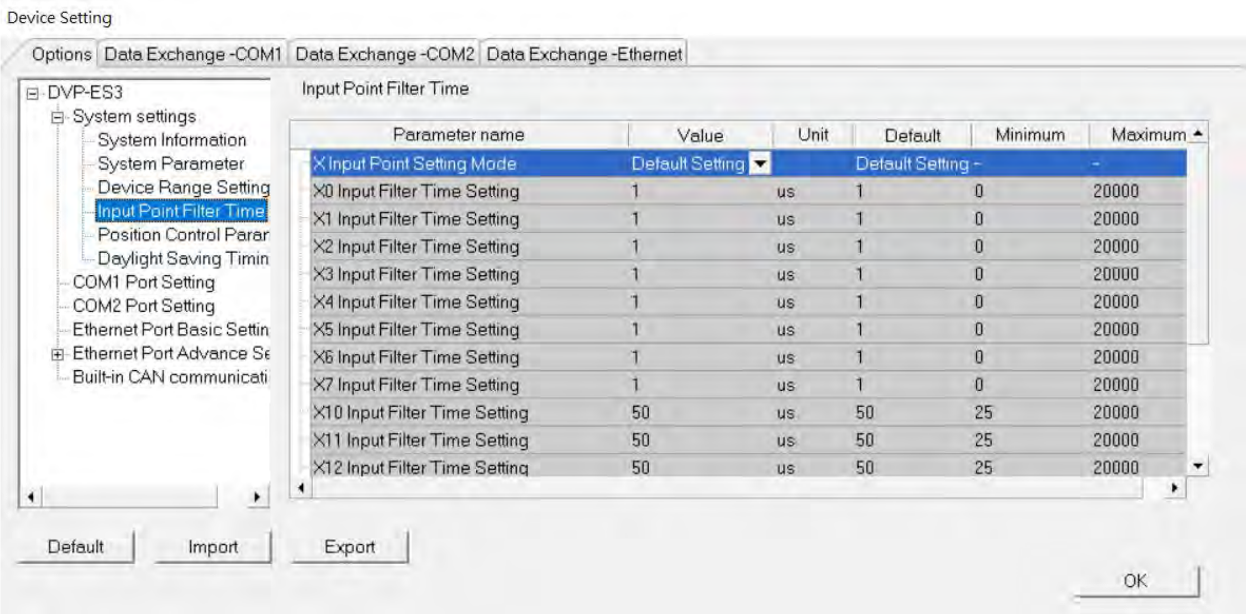


Click ··· to open the parameter dialog box to set the start and end address. In the dialog box, click **Default** to restore the setting to the default values; click **Clear** to clear the set values; click **OK** to save the values and close the dialog box; click **Cancel** to discard the setting and close the dialog box.



Input Point Filter Time

On the Input Point Filter Time page, you can set the input point filter time for each input. If the duration of the received signal time is less than the filter time setting value, it is processed as noise and filtered out. Select an appropriate filter time according to your needs.



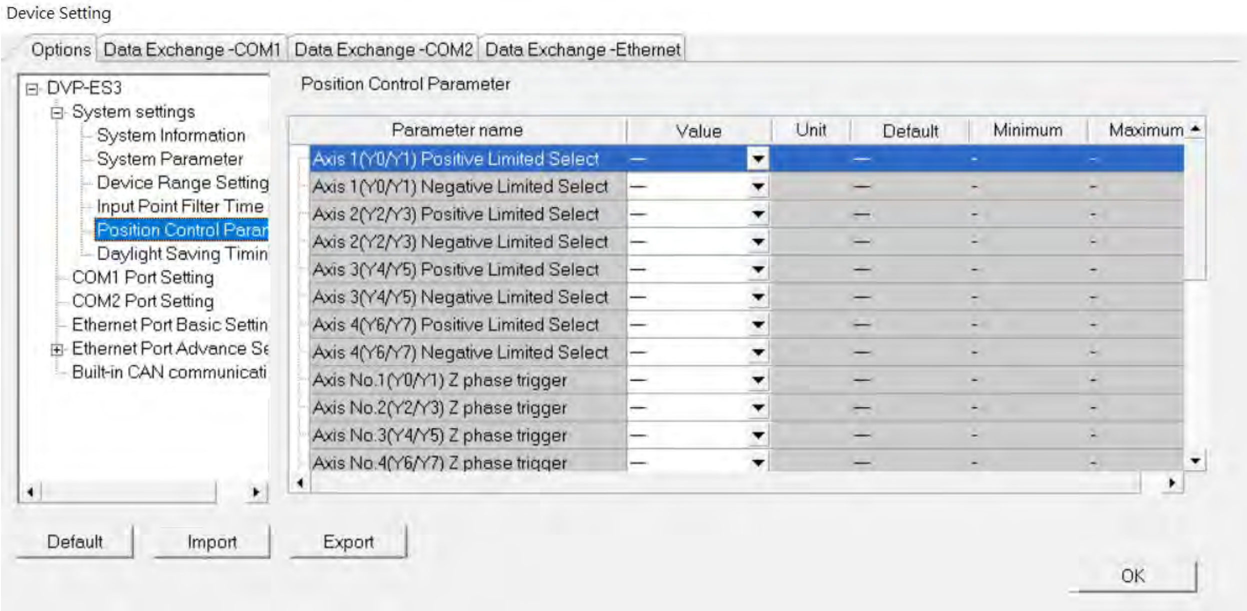
- X Input Point Filter for CPU module
  - **Default Setting**: uses the default values in the input point filter.
  - **Manual Setting**: uses the values you enter for the filter time for each X input point.

- X0–X17 Input Point Filter Time

  If you select **Manual Setting** for the previous parameter, you can set the filter time individually for X0–X17.

Position Control Parameter

The parameters on **Position Control Parameter** table set to specify input points as the positive and negative limits of axis 1~ axis 4 channels. 12 limit points can be set at most. Axis No. 1~4 can also be set as Z phase triggers, home function finish points and clear output selects or positive/negative limited position.



- Axis1 (Y0/Y1) Positive/negative Limited Select~ Axis4 (Y6/Y7) Positive/negative Limited Select: select the rising or falling edge trigger and X input point on the drop-down list.

- Axis1 (Y0/Y1) Z Phase Trigger ~ Axis4 (Y6/Y7) Z Phase Trigger:

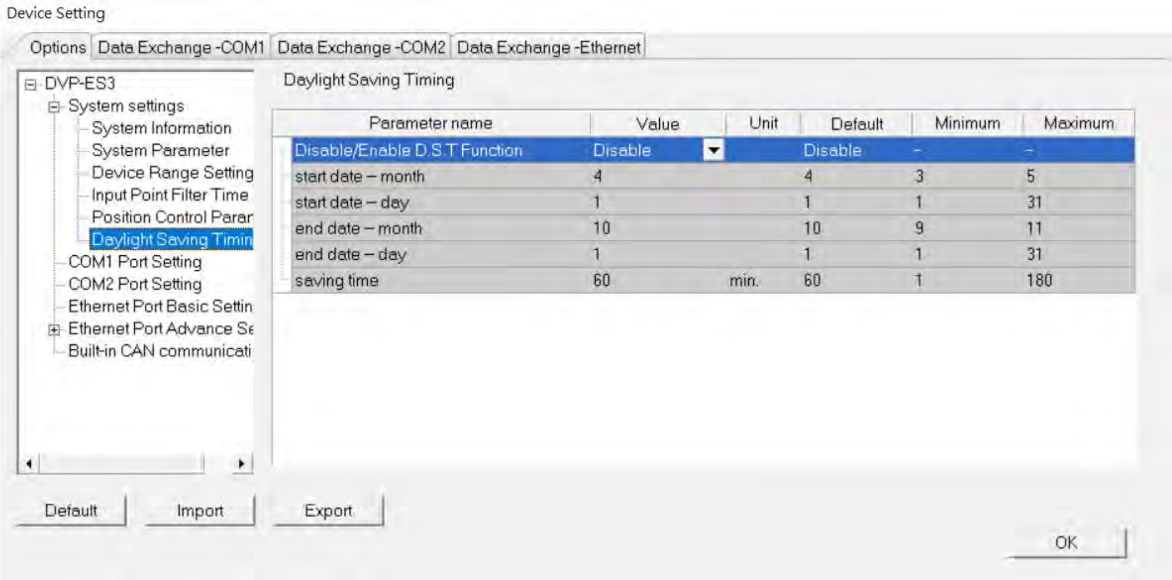
  Select the rising or falling edge trigger and X input point on the drop-down list.

- Axis1 (Y0/Y1) Home Function Finish and Clear Output Select ~ Axis4 (Y6/Y7) Home Function Finish and Clear Output Select: select the rising or falling edge trigger and X input point on the drop-down list.

- Axis1 (Y0/Y1) Positive/negative Limited Position ~ Axis4 (Y6/Y7) Positive/negative Limited Position: set up the number of pulses as the positive or negative limited position in axis 1~4; setting range is -2147483647 ~ 2147483647.

Daylight Saving Timing

Enable or disable this function on the Daylight Saving Timing page. Set daylight saving time and the set the time zones for daylight saving and the system acts accordingly.



- **Disable/Enable D.S.T Function**

  Sets whether or not to use daylight saving time.

- **Start Date – Month**

  Sets the month to start daylight saving

- **Start Date – Day**

  Sets the day to start daylight saving

- **End Date – Month**

  Sets the month to end daylight saving

- **Start Date – Day**

  Sets the day to end daylight saving

- **Saving time**

  Sets daylight saving time in minutes

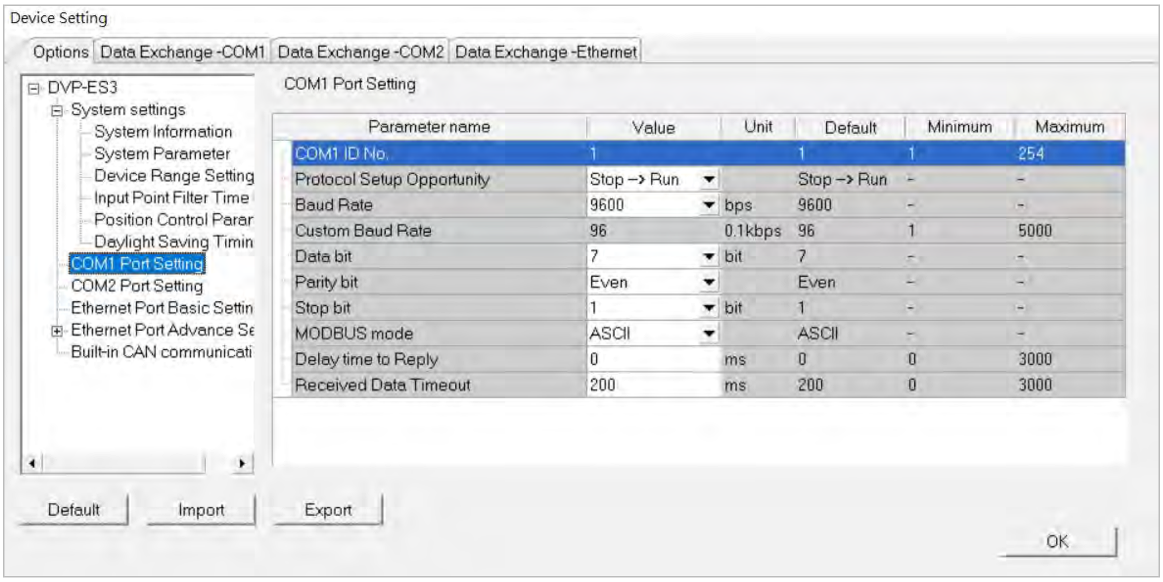
- **Example explanation:** example from the above image and all the options are enabled.

Date shown in SR	Time shown in SR	PLC time (Real Time Clock)	Remarks
3/31	23:59:58	23:59:58	Normal
3/31	23:59:59	23:59:59	
4/01	01:00:00	00:00:00	
4/01	01:00:01	00:00:01	Shown after 60 minutes
: (to)	: (to)	: (to)	

9/30	23:59:59	22:59:59	
10/01	00:00:00	(9/30) 23:00:00	
: (to)	: (to)	: (to)	
10/01	00:59:59	(9/30) 23:59:59	
10/01	00:00:00	00:00:00	Normal
10/01	00:00:01	00:00:01	

8.2.2.2 Options - COM1 & COM2 Port Setting

The DVP-ES3 Series CPU module has two communication ports. There are two areas to set the parameters, one for each communication port.



❶ Set a station address. You can identify a device on a network by the station address. The station address cannot be the same as the station address for another device on the same network. If the communication port functions as a slave, and there are other slaves, the station address of the communication port cannot be 0. Station address 0 broadcasts to all slaves in a communication protocol. If a master specifies in a data packet that data must be sent to station address 0, the data is sent to all slaves. No matter what the station address of these slaves are, these slaves receive the data packet addressed to station address 0.

❷ Set when the communication port runs. Select **Stop --> Run**, and communication works when the CPU module switches from Stop to Run. If you instead select **Power-on**, the communication starts working when you Power-on the module.

❸ Select a communication speed in the **Baud Rate** list, or select **Custom** and enter a new rate.

❹ Set the communication parameters for the port.

❺ Set the **Delay Time to Reply** when the DVP-ES3 CPU module receives communication and how long it waits before responding to the remote modules.

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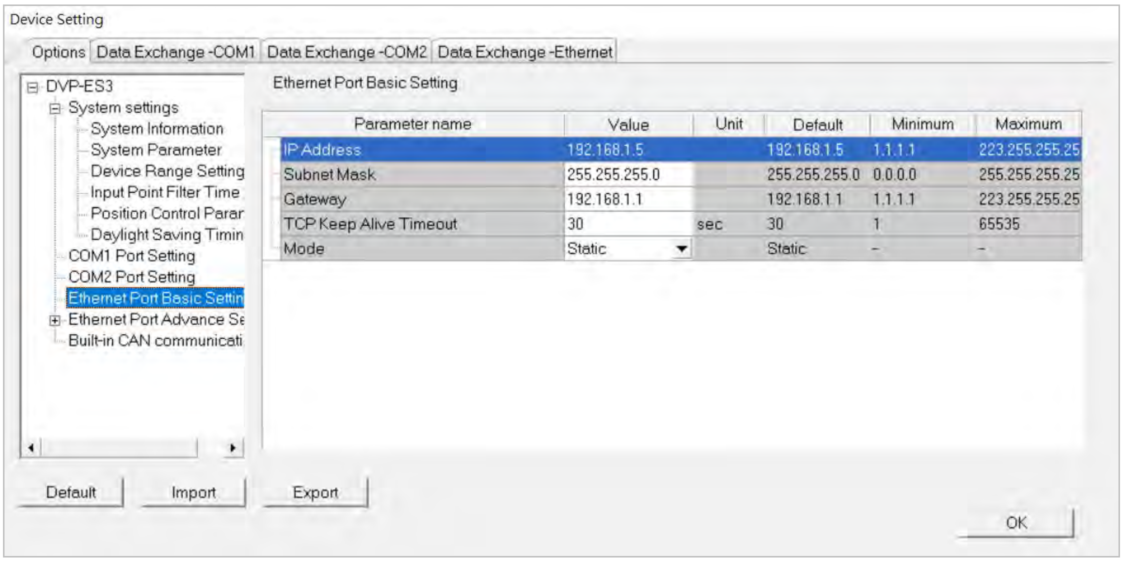
❻ **Received Data Timeout** applies when the DVP-ES3 Series CPU module acts as a server to send out communications. The timeout is how long the module waits before the received data times out.

8.2.2.3 Options - Ethernet Port Basic Setting

Click **Ethernet Port Basic Setting** to see the setup page. Set the communication parameters for the Ethernet port in the CPU module on this page.



Select **Static** in the **Mode** list to specify an IP address. Select **Dynamic** or **BOOTP** in the **Mode** list to assign an IP address from a DHCP/BOOTP server.

8.2.2.4 Options - Ethernet Port Advanced Setting

Click **Ethernet Port Basic Setting** to see the setup page. There are setups for **IP Filter, NTP, Email, Socket,** and **RTU mapping**.

IP Filter

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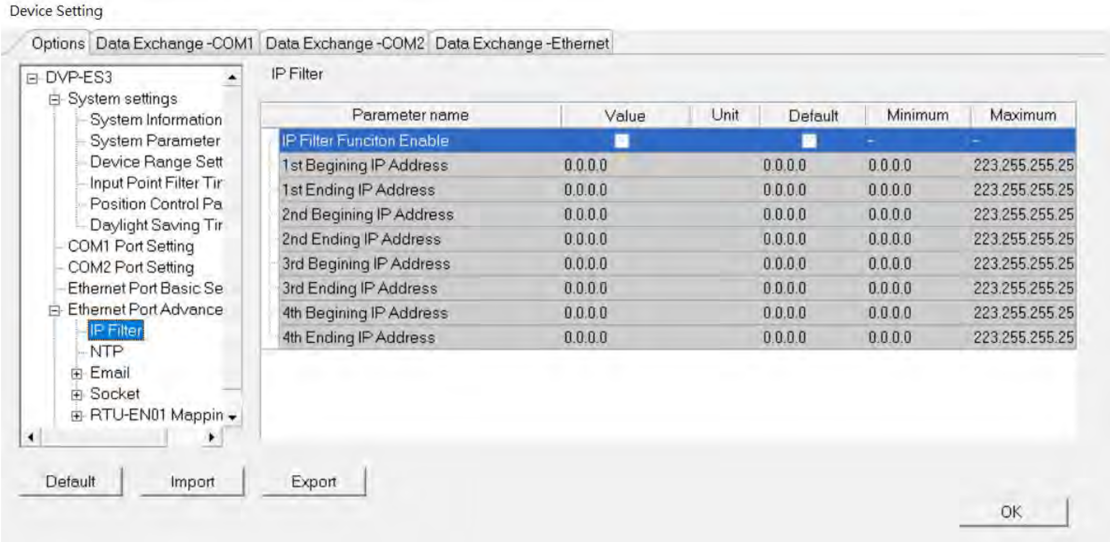
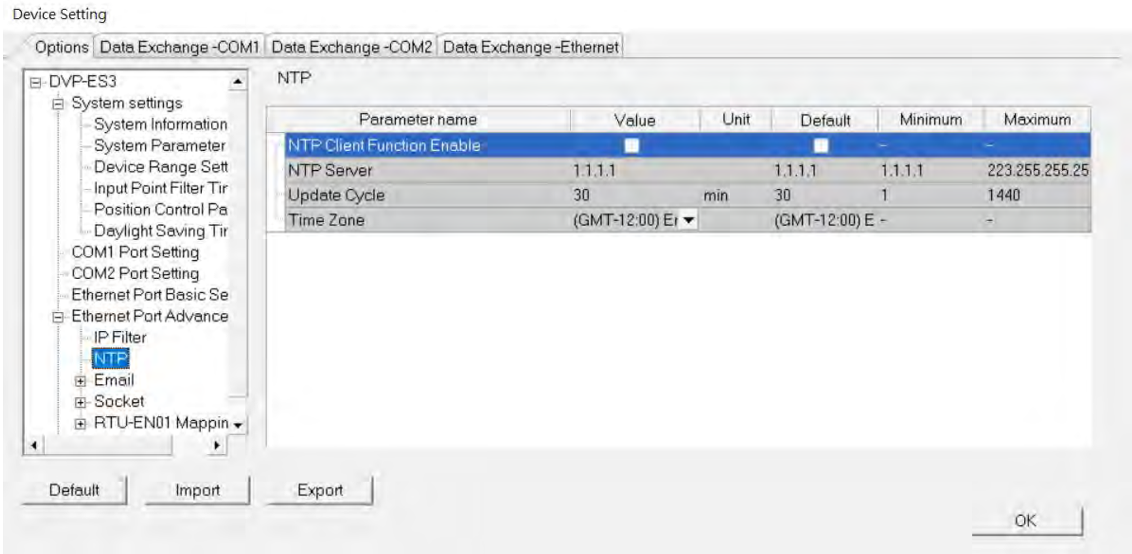
Devices whose IP addresses are listed in the table are allowed to communicate with the CPU module; the CPU module discards data packets sent from devices whose IP addresses are not in the table. Devices on a network are filtered. This setting ensures that objects communicating with the CPU module are known devices. You can set up to 8 address ranges for allowed devices.



NTP

Click NTP to synchronize the real-time clock in the CPU module to an NTP server. Please refer to related documents or manuals for more information about NTP.

Select the **NTP Client Function Enable** check box, and then set the related parameters.



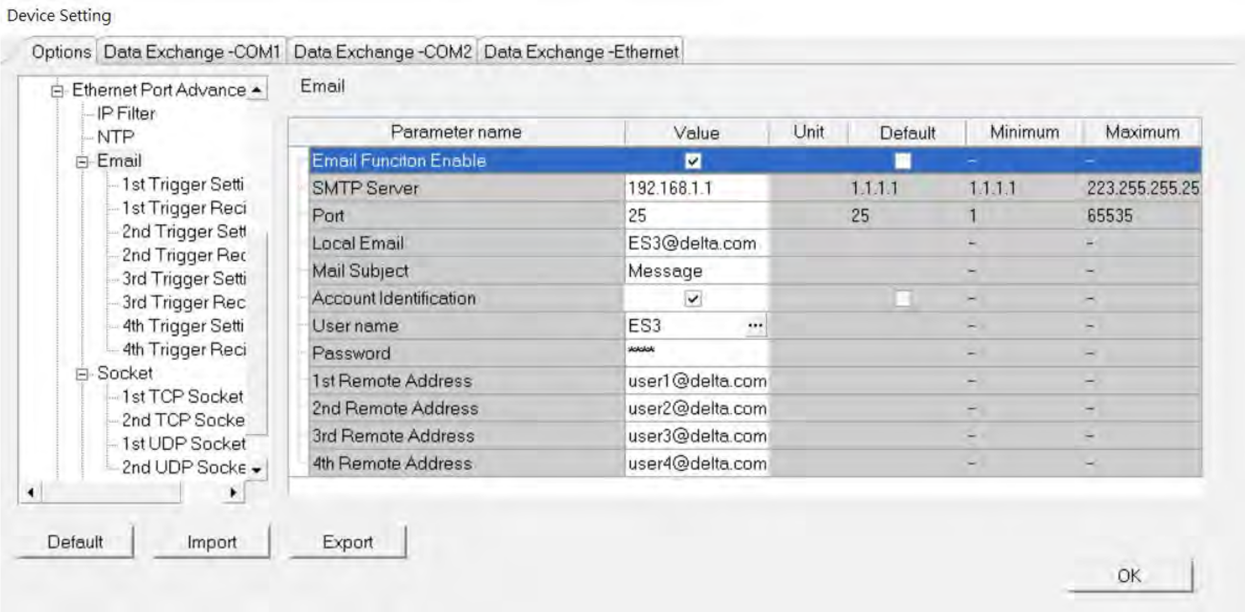
❶ Set the IP address of an NTP server. The CPU module corrects its internal time by connecting periodically to the server.

❷ Set a time interval for correcting the time in the CPU module. If the interval is thirty minutes, the CPU module connects to the NTP server every thirty minutes.

❸ Select a time zone in the **Time Zone** list.

Email

Click **Email** to set the email-related functions. The system sends email to the set email address after you enable the email function. You can set up to four sets of conditions for sending email to up to four groups of email addresses.



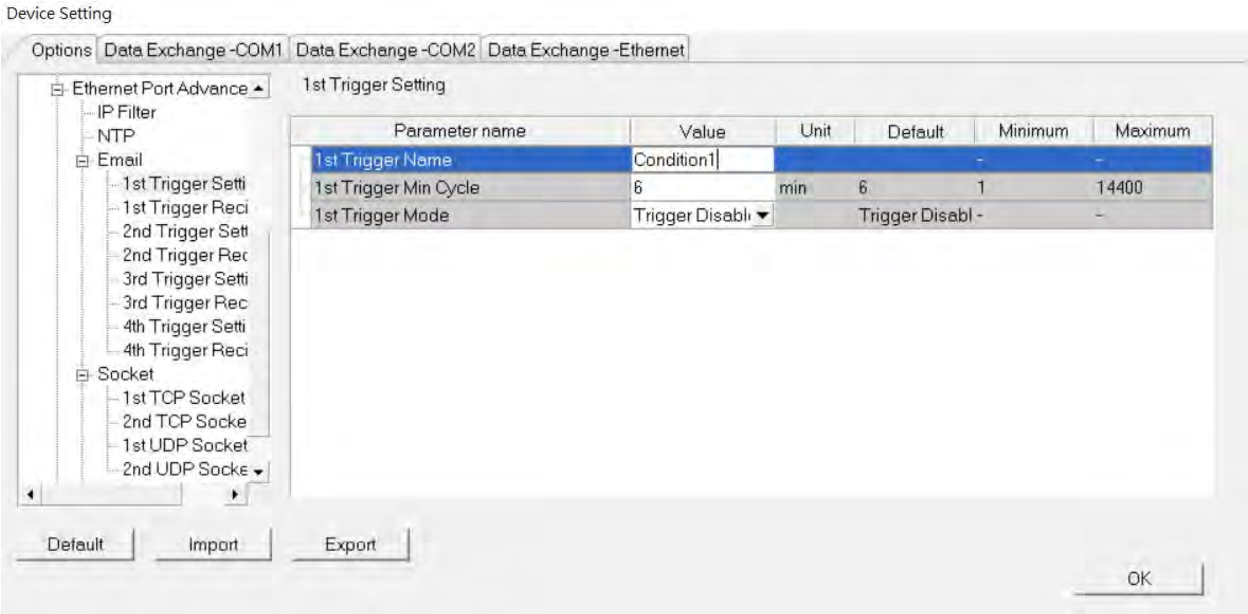
❶ Select **Email Function Enable** to enable the function.

❷ Set an IP address of the SMTP server. Set the COM port of SMTP server at the COM port and set the sender's local email address. Type the **Mail Subject** to appear at the start of the subject of every email.

❸ Select **Account identification** checkbox to enable the function to authenticate the connection with a user name and a password when logging into an SMTP server.

❹ Type the target email addresses.

Click **1st Trigger Setting** and type a trigger name in **Trigger Name box** and a minimum interval in **Trigger Min Cycle**. Then select a trigger condition in the **Trigger Mode** list. When the sending condition is met, the system sends an email every designated period of time. The system does not send the same email again.



You can set email trigger modes as follows.

- **CPU Error**

Trigger sending an email if an error occurs in the CPU module. Refer to the Operation manuals for more information about errors occurring in CPU modules. After you select **CPU Error**, select **Fatal Error Only** or **All Errors** in the list at the right side of the option.

a) Fatal Error Only: Send an email **if** a fatal error occurs in the CPU module.

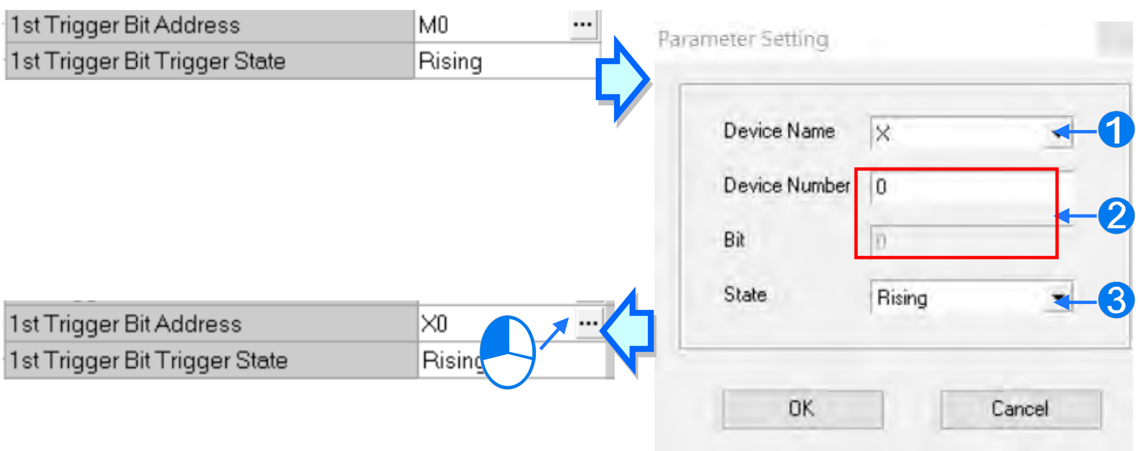
b) All Errors: Send an email if an error occurs in the CPU module.

- **CPU (RUN<=>STOP)**

Trigger sending an email when the CPU module begins to run, or when the CPU module stops running.

- **Bit Status Change**

Trigger sending an email if the state of a bit device specified meets a set condition. For example, if X0 switches from OFF to ON, it triggers sending an email. To set a condition, click the ... button in the following dialog box.



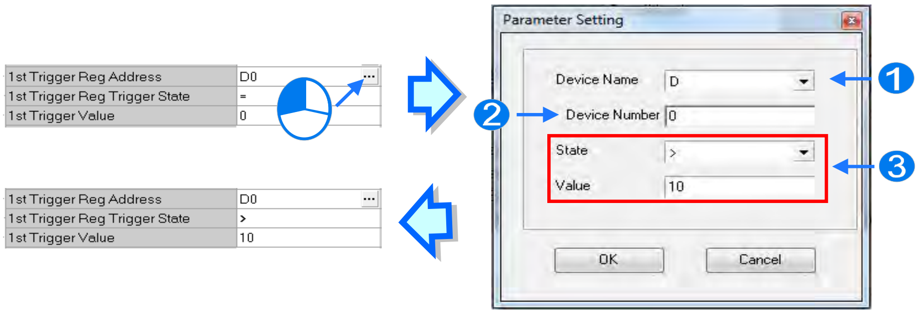
❶ **Device Name**: Select a device type.

❷ **Device Number & Bit**: Type a device address; if the device type selected is X/Y, you must specify a bit number as well.

❸ **State**: Select **Rising** or **Falling**.

●**Register Value Change**

Trigger sending an email if the value in a device specified meets a set condition. For example, if the value in D0 is larger than 10. To set a condition, click the ... button in the following dialog box.



❶ **Device Name**: Users can select a device type in the **Device Name** drop-down list.

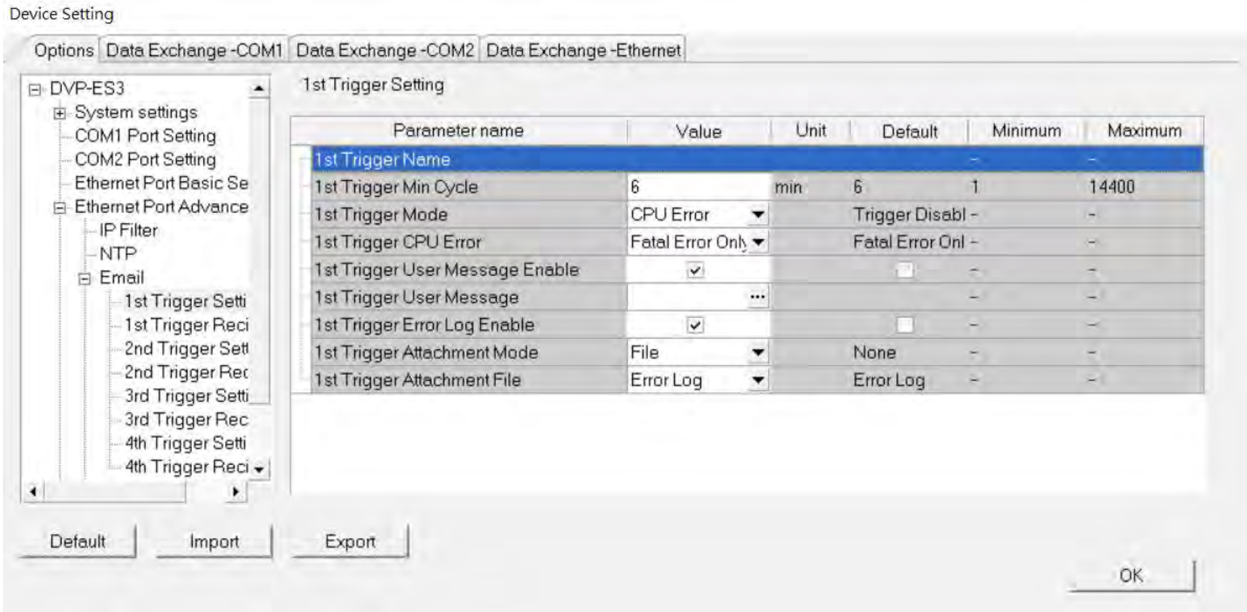
❷ **Device Number**: Users can type a device address in the **Device Number** field.

❸ **State & Value**: Users can set s condition of triggering the sending of an email here.

● **Periodic Timer**

The system periodically sends an email. How often the system sends an email depends on the **Trigger Min Cycle** interval in the **Trigger Setting** section.

When you set any trigger mode, the user message and error log related parameters appear.



Select the **Trigger User Message Enable** check box and then click the ... to the right side of **Trigger User Message**. Type some content for the email text in the dialog box.

If you select the **Error Log Enable** check box, the system automatically adds the error log to the email content.

Trigger Attachment Mode determines whether to add an attachment to the email. Check the maximum size allowed for the email file before adding an attachment. Refer to the relevant email operation manuals for more information.

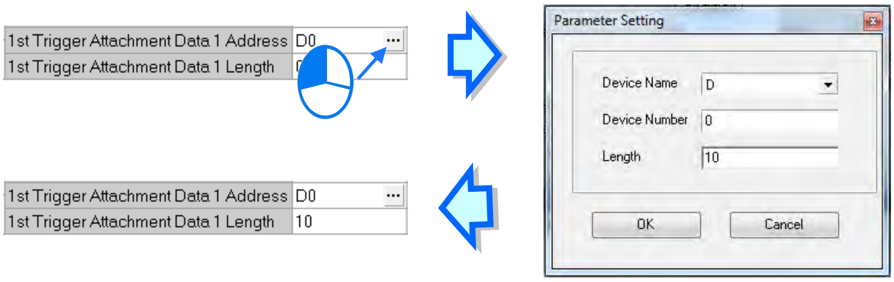
If you select **None**, no attachment is inserted.

- **File**

Allows you to select an error log or the system backup file from the memory card as the email attachment.

- **PLC Device**

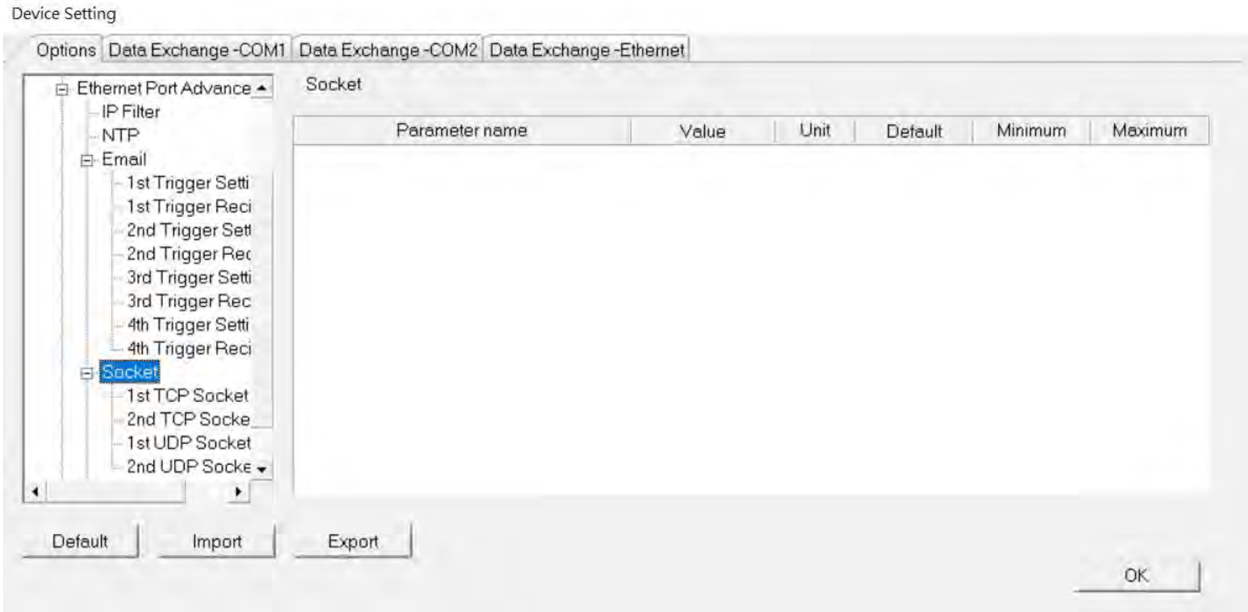
The system automatically retrieves the device states or values listed in the table as the email attachment. After you select this option, click ... in the following dialog box to open the **Attachment** dialog box. You can set a maximum of two groups of devices. For example, if the condition is met, the values in D0–D9 are sent as an attachment.



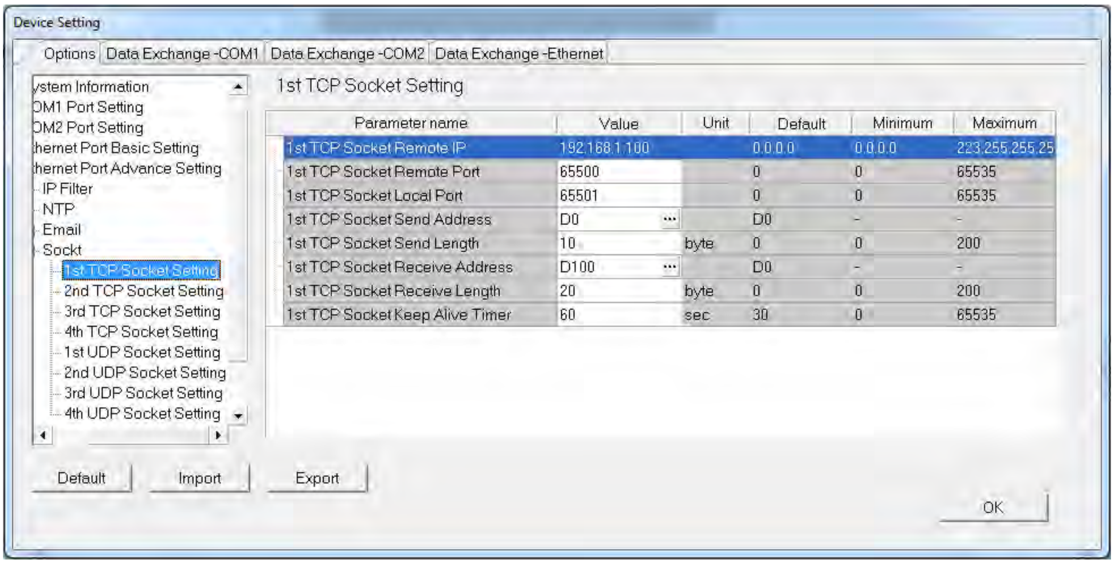
Select the receiver's target email address for the triggered email in the **Trigger Receiving** table. Set the specific email address in the **Email** section.

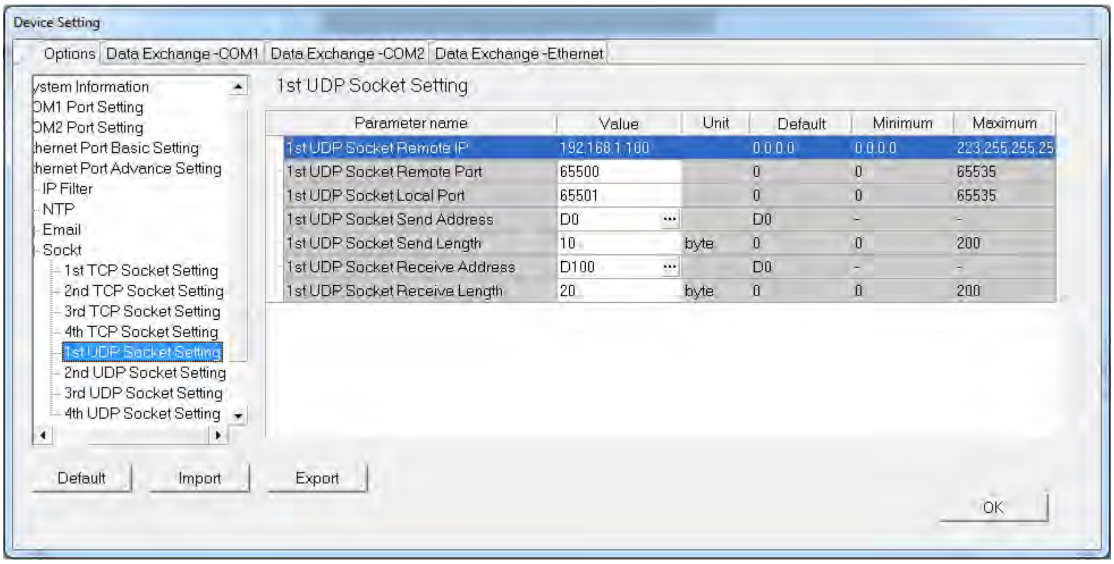
Sockets

You can set the parameters for sockets through which data is transmitted. You must use this function with specific applied instructions. Refer to the DVP-ES3 Series Programming Manual for more information, as sockets are not described here. Refer to the related documents or manuals for more information about sockets. In the **Socket** table, set COM port parameters for data transmission through Ethernet; however, you should use this function only with specific API instructions. For relevant details, refer to DVP-ES3 Series Programming Manual.



The system for the DVP-ES3 Series module supports data transmission between the CPU module and other CPU modules or devices through a socket as well as through TCP and UDP protocols. You can set up four connections in each of the four groups. Select the **Socket Function Enable** checkbox and then select settings in the **TCP** and **UDP** setting pages.





The parameters in the **TCP Socket Setting** are the same as the parameters in the **UDP Socket Setting** except that there is no **Keep Alive Timer** parameter in the UDP Socket Setting.

- **Remote IP**: Sets a remote IP address.
- **Remote Port**: Sets a communication port used by the remote device for this TCP connection. The port number must be between 0–65535.
- **Local Port**: Sets a communication port used by the local CPU module for this connection. The port number must be between 0–65535.
- **Send Address**: Sets an initial device in the CPU module where sent data is stored.
- **Send Length:** Sets the length of data sent by the local CPU module. The length must be between 0–200 bytes.
- **Receive Address**: Sets an initial device in the CPU module where received data is stored.
- **Receive Length**: Sets the length of data received by the local CPU module. The length must be between 0–200 bytes.
- **Keep Alive Timer**: Sets a maximum time to keep the connection alive. If no data is transmitted, and the keep alive period has elapsed, the CPU module automatically terminates the connection.

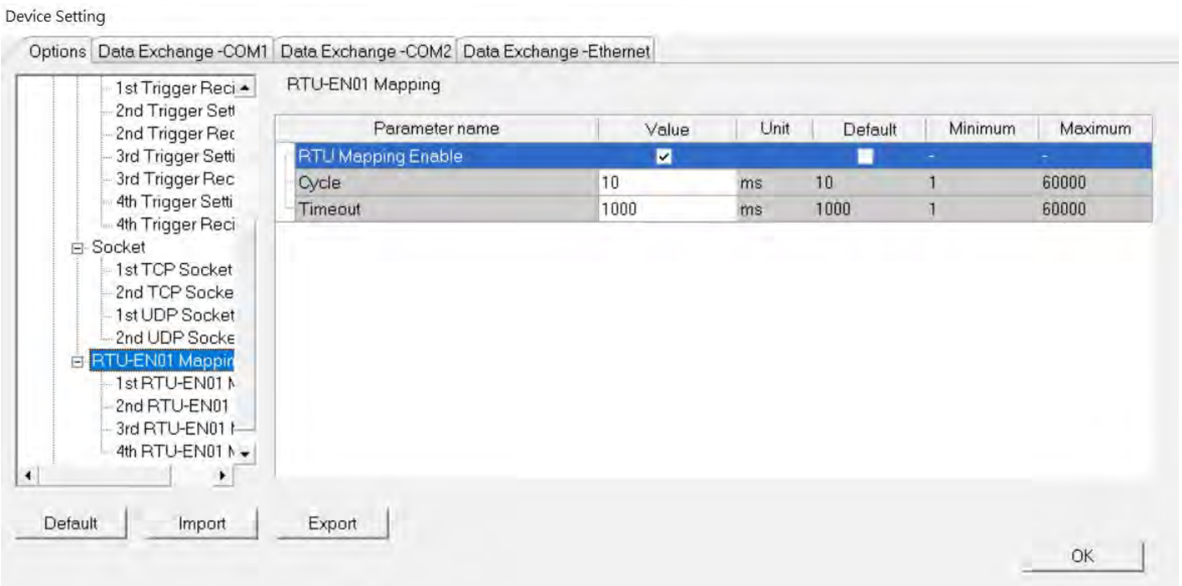
The port number used by the local CPU module and the port number used by the remote device cannot be the same, and the devices where you store the sent data cannot overlap the devices where you store the received data. If the IP address of the remote device is 192.168.1.100, the port number used by the remote device is 65500, the port number used by the local CPU module is 65501, and the remote device and the local CPU module can transmit data through this TCP connection.

If the local CPU module sends 10-word data to the remote device, the data is stored in D0–D9 before the data is sent. If the local CPU module receives 20-word data from the remote device, the data is stored in D100–D119.

If the length of data received is larger than the setting value for the length, the first 20 words of data are stored in D100–D119, and the remainder of the data is discarded. Likewise, if the length of data received is less than the setting value for the length, the data is stored in the devices starting from D100, and the values in devices where no new data is stored are unchanged.

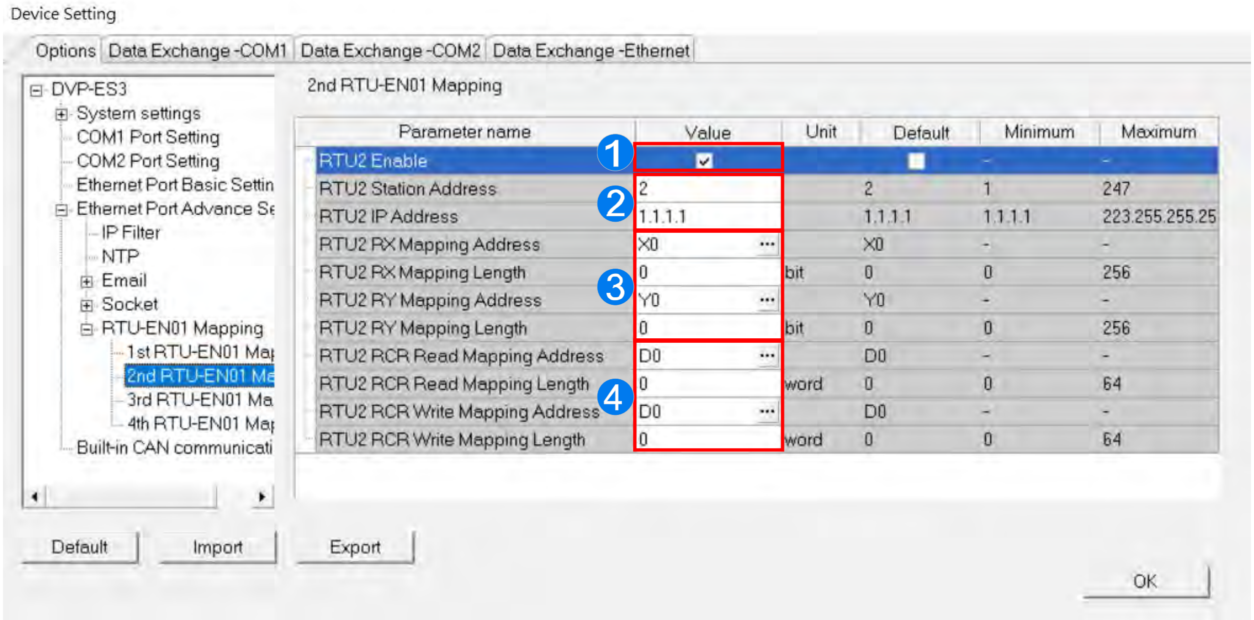
If no data is transmitted, and 60 seconds have elapsed, the CPU module closes the socket and terminates the connection.

In the **RTU Mapping** table, you can set a Delta RTU-EN01 slave in connection with a DVP-ES3 Series module. The remote device is controlled through Ethernet and you can connect up to 4 groups of RTU-EN01 in the network. Refer to the operation manual for setting and operation of RTU-EN01.



Select RTU Mapping Enable checkbox to enable the function of connection between RTU module and DVP-ES3 Series module. Set the update cycle in **Cycle** box and a timeout in **Timeout** box. It means a timeout when RTU does not give a reply within the timeout set.

The data mapping between each group of RTU-EN01 and DVP-ES3 Series module is set in the **RTU Mapping** section. RTU-EN01 and I/O module connected to it are set via DCISoft. For more information on DCISoft, refer to the operation manual.



❶ Select **RTU1 Enable** to enable this RTU function. You can set each RTU individually.

❷ Set a station address and an IP address.

❸ Set the RX mapping address and RX mapping length to make the digital input points for the DI module connected to RTU and mapped to X/M devices, as well as the length for the DVP-ES3 Series module. Set the RY mapping address and length to set the digital output points for the DO module mapped to Y/M devices, as well as the length for the DVP-ES3 Series module.

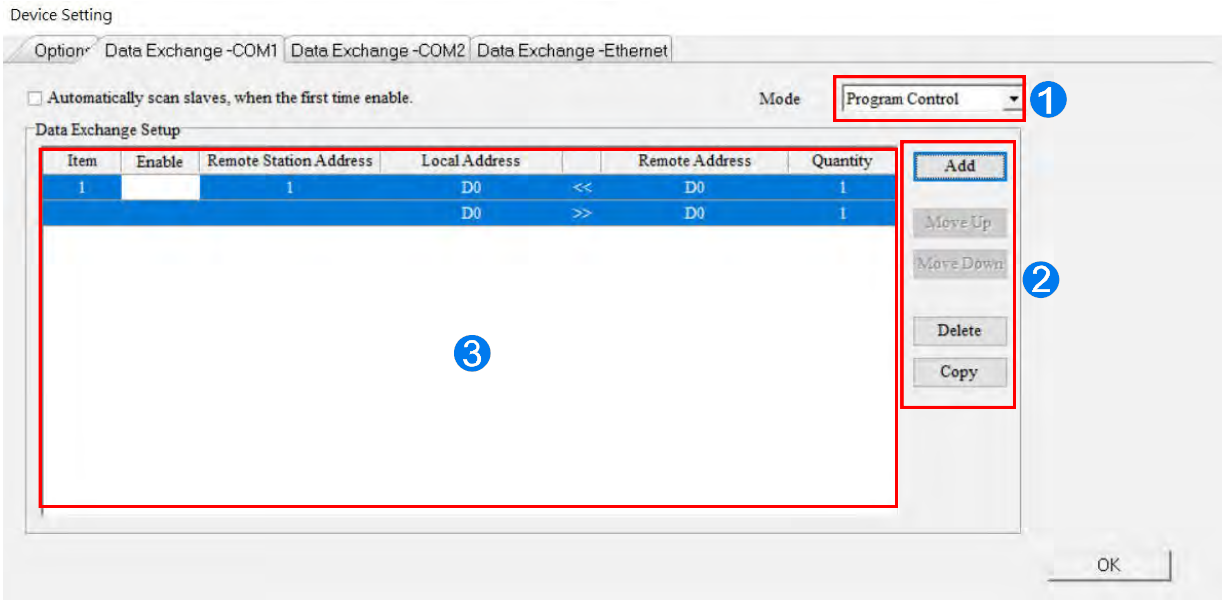
❹ Set the RCR Read mapping address and RCR Read mapping length to make the analog input points for the AI module connected to RTU and mapped to D/SR devices, as well as the length for the DVP-ES3 Series module. Use the RCR Write mapping address and length to set the analog output points for the AO module mapped to D/SR devices, as well as the length for the DVP-ES3 Series module.

8.3 Data Exchange

8.3.1 Device Settings Dialog Box Descriptions

In the Device Settings dialog box, after you click the Data Exchange-COM1, Data Exchange-COM2 or Data Exchange-Ethernet tab, you can set the parameters for the data exchange table for the communication port built into the DVP-ES3 Series module.

The DVP-ES3 Series module can be a master and exchange data with remote slave devices through COM1 and COM2 using the Modbus protocol, or through an Ethernet port using the Modbus TCP protocol.



❶ When you set the start **Mode** to **Program Control,** the program in the PLC determines whether to perform the set data exchange. **PLC Run** means that the set data exchange is performed automatically when PLC is in the RUN state. **Always Enable** means that the data exchange is performed constantly when the PLC is powered on.

❷ Add a new row in the data exchange table in area ❸ by clicking **Add**. Move the selected data exchange row up or down by clicking **Move Up** and **Move Down**. Delete the selected data exchange row by clicking **Delete**. Copy the selected data exchange row by clicking **Copy.** You can then paste it back into the table as the last row.

❸ The following table explains the columns in the data exchange table.

Name	Description
Item	The number of the block for data exchange
Enable	Selects whether to enable the data exchange table when the data exchange is performed.
Station Address/ IP Address	The slave station address for the data exchange table. You can set one address for multiple data exchange tables. It is a station address under the COM1 and COM2 tabs,

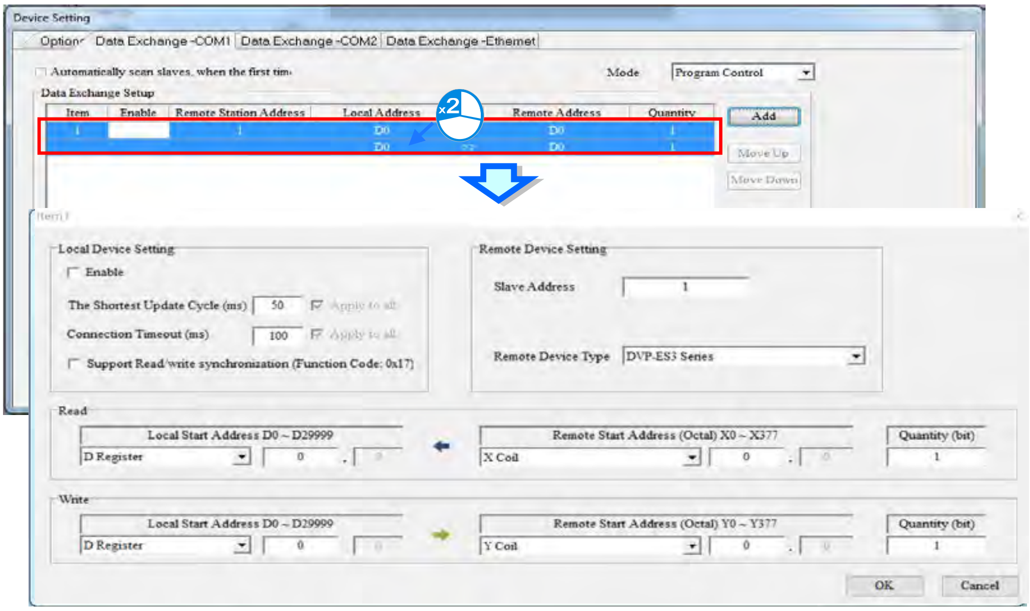
	and IP under the Ethernet tab.
Local Address	The device address range used by the master in the data exchange table
<< / >>	「<<」: Input: the data block where the master reads from a slave 「>>」: Output: the data block where the master writes to a slave
Remote Address	This is the device address range used by a slave in the data exchange table. The device range is in hexadecimal if the slave in the data exchange table is a user-defined Modbus Device.
Quantity	This is the size of the data exchange table, which is consistent with the result calculated from the device range.

8.3.1.1 Data Exchange - COM1 and Data Exchange - COM2

On the **Data Exchange-COM1** or **Data Exchange-COM2 tab**, double-click row in the data exchange table to set to open the **Item** dialog box as shown below. Select the **Enable** check box to enable the data exchange table in the mode mentioned above. **Remote Address** is the address of the target slave for data exchange. The **Shortest Update Cycle** is the period for data exchange of the data exchange table. The connection times out if the target device does not make any response within the time specified by **Connection Timeout**.

Select **Support Read/write synchronization (Function code 0x17)** to have the master complete reading and writing in a single command to improve the efficiency of data exchange. This uses the specific Modbus function code. Make sure that all devices in data exchange support the Modbus function code for read and write synchronization. Otherwise, the attempt to read and write fails due to the failure to identify function codes after receiving the command from the master device.

Remote Device Type is the model of a target slave including the Delta PLC and standard Modbus devices.



- **Read**

The DVP-ES3 Series module reads data from a remote device.

Local Start Address: The device type and start address of the devices where the DVP-ES3 Series module stores data.

Remote Start Address: The device type and start address of the remote device to be read.

Quantity: This is the input data length.

- **Write**

The DVP-ES3 Series module writes data to a remote device.

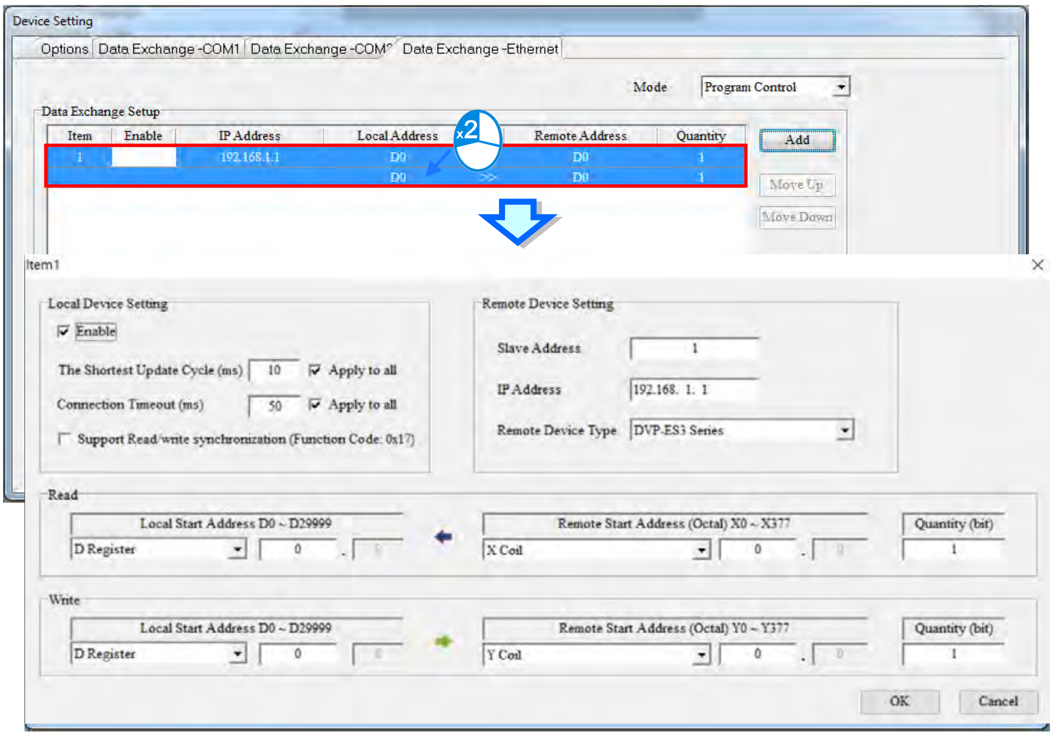
Local Start Address: The device type and start address of the source data for the DVP-ES3 Series module.

Remote Start Address: The device type and start address of the remote device where data is to be written.

Quantity: The output data length.

8.3.1.2 Data Exchange - Ethernet

On the **Data Exchange - Ethernet** tab, double click a row in the data exchange table to set to open the **Item** dialog box as shown below. The settings are almost the same as those for **Data Exchange - COM1** and **Data Exchange - COM2**, except that the target slave model option in **Remote Device Type** contains Delta PLC and standard Modbus TCP equipment, as well as the IP address for remote slaves. For other settings, refer to the descriptions of Data Exchange - COM1 and Data Exchange - COM2.



Select the **Apply to all** check box on the right side of **The Shortest Update Cycle** and **Connection Timeout** and then click **OK**. Selecting the check box writes the settings for **The Shortest Update Cycle** and **Connection Timeout** to other data tables on the tab **Data Exchange - Ethernet**. You can also set the data exchange tables separately without selecting the **Apply to all** check box.

MEMO

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Chapter 9. EtherNet/IP Specification and Operation

Table of Contents

9.1 Introduction

9.1.1 EtherNet/IP

EtherNet/IP (“IP” stands for “Industrial Protocol”) is an industrial Ethernet network managed by ODVA, Inc. (formerly Open DeviceNet Vendors Association, Inc.), a global trade and standards development organization.

EtherNet/IP works on a TCP/UDP/IP based Ethernet network and uses the most widely deployed collections of Ethernet standards to provide a broad range of applications in different industries that require high-speed and stability including Factory Automation (FA), Building Automation (BA), Process Automation (PA) and many more.

Delta covers a full range of controller and drive products supported by EtherNet/IP, including Programmable Logic Controllers (PLC), inverters, Human Machine Interfaces (HMI) and so on. Refer to Section 9.9 for a full product list that support EtherNet/IP. In addition, you can also use EDS files to connect to other brands of EtherNet/IP devices. You can run Delta EtherNet/IP software (EIP Builder) through the ISPSoft software V3.0 or later. Download the ISPSoft software at:

http://www.deltaww.com/services/DownloadCenter2.aspx?secID=8&pid=2&tid=0&CID=06&itemID=060301&typeID=1&downloadID=,&title=--%20Select%20Product%20Series%20--&dataType=8;&check=1&hl=en-US

9.1.2 Definitions of Common Network Terms

Term	Definition
ODVA	Open DeviceNet Vendor Association for EtherNet/IP
EIP	EtherNet/IP, an industrial Ethernet network, provides interoperability for system providers. IP stands for Industrial Protocol. The term “EIP” (EtherNet/IP) is used in this manual.
I/O Connection	Use the I/O connection to connect to EtherNet/IP and to exchange data cyclically.
Explicit Message	Connect to EtherNet/IP and to exchange data non-cyclically. Data is exchanged piece by piece through instructions.
RPI	Requested Packet Interval, through the I/O connection to connect to EtherNet/IP to exchange data at regular time intervals.
ACD	Address Conflict Detection to detect IP address duplications.
Produced/Consumed TAG (P/C TAG)	● You use TAGs for assigning and referencing memory locations for Rockwell PLCs, the same as registers for Delta PLCs. ● Produced tag: A tag that a controller makes available for other controllers. Multiple controllers can simultaneously consume (receive) the data. A produced tag sends its data to consumed tags (consumers) without using logic. ● Consumed tag: A tag that receives the data of a produced tag. The data type of the consumed tag and the produced tag must match (including any array dimensions). ● The data is transferred over Ethernet/IP. For example, PLC-A needs data from PLC-B, so PLC-B sends the data to PLC-A. Therefore, PLC-B is the producer and PLC-A is the consumer.

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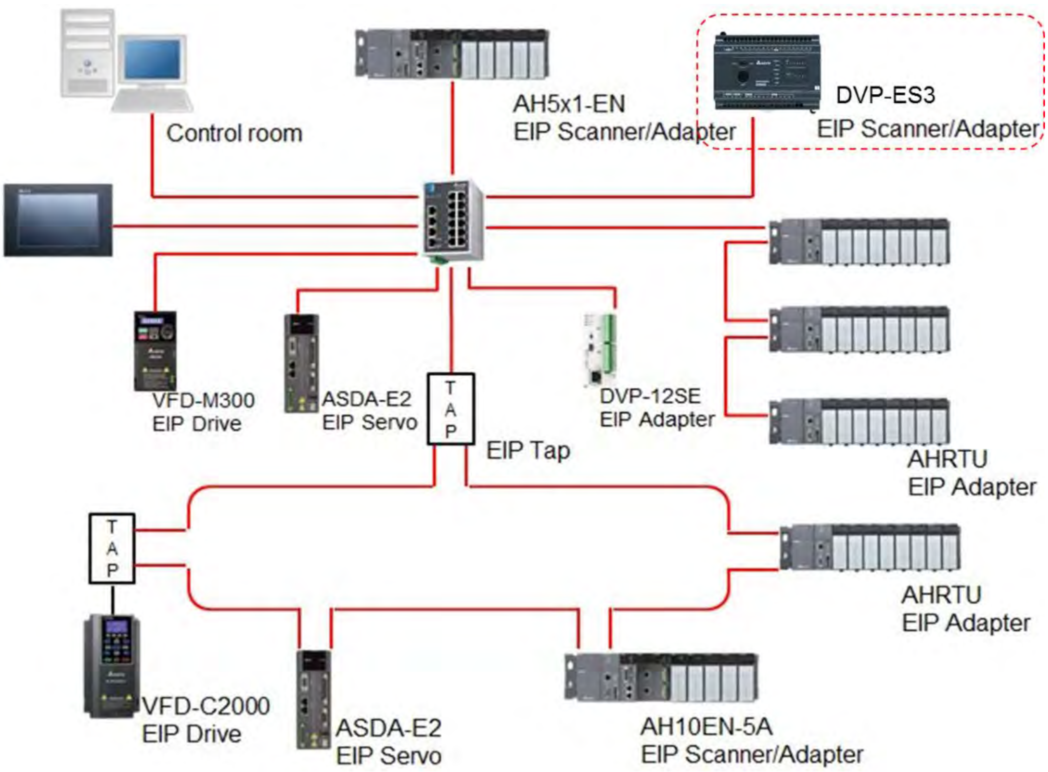
EDS	Electronic Data Sheets: EDS files are simple text files used by EtherNet/IP network configuration tools to help you identify EtherNet/IP products and easily commission them on a network.
Data Mapping	Exchanging data between devices
EIP Scanner	The master station is called an EIP Scanner in EtherNet/IP.
EIP Adapter	The slave station is called an EIP Adapter in EtherNet/IP.
DLR	Device Level Ring (DLR) provides fault-tolerant network design for daisy-chain and linear topology. The DLR protocol provides high network availability in a ring topology. It was intended primarily for implementation in EtherNet/IP end-devices that have two Ethernet ports and embedded switch technology, providing fast network fault detection and reconfiguration to support the most demanding control applications.
Modbus TCP	This is a Modbus variant used for communications over TCP/IP networks.

9.1.3 Ethernet Features

9.1.3.1 Delta EIP Architecture

This typical Delta EIP architecture includes an EIP Scanner and Adapters; data mapping is achieved between devices through an I/O connection and explicit messaging. The DVP-ES3 Series supports single port Ethernet; thus you can install and configure devices with embedded switch technology over EtherNet/IP.



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9.1.3.2 EIP Features

- **Flexibility**
  - Flexible topology: EIP devices may include single port Ethernet as well as dual port Ethernet, and provide applicable networks such as linear topology, ring topology and ring topology for faster expansion and easier management.
  - EtherNet/IP works on a TCP/UDP/IP based Ethernet network, uses most widely deployed collections of Ethernet standards, and supports Wi-fi connection. Even personnel with no IT background can build the network easily.
  - Applicable networks include linear topology, ring topology, star topology, Ethernet, EtherNet/IP, one or more LANs, etc. You can set configuration through USB or an interface.
- **Simplicity**
  - With a connector: Delta provides a full range of products, including human machine interfaces (HMI), programmable logic controllers (PLC), and inverter drives for application in an industrial operation. You can build a network simply through an RJ-45 connector, saving costs on cables and other connecting tools.
  - Single network: in place of the 3-tier industrial architecture, single network architecture provides 100MB/bits high-speed cyclical and non-cyclical data mapping functions, ensuring complete network diagnosis and effectively shortening debugging time.
  - Graphical user interface software: the EIP Builder uses a graphical user interface designed for intuitive operation.
- **Integration**
  - Data mapping: the EIP Builder provides a consistent setting interface, allowing you to reduce the time to learn and set up configurations.
  - Listed device parameters: the EIP Builder presents the device parameters in a list. Instead of looking them up in the user manual, you can quickly check on the parameters in the list.
  - EDS file: you can connect to Delta and other brands of EtherNet/IP products with EDS files.

9.2 Installation

9.2.1 EtherNet/IP Device

A Delta EtherNet/IP (EIP) device allows you to build a linear topology, ring topology, and star topology networks. A Delta EIP device includes the EIP Builder software, EIP Scanner, EIP Adapter, EIP Tap, and an Ethernet switch. EIP Scanners and EIP Adapters can be further divided into single port and dual port devices. The DVP-ES3 Series are single port devices. Refer to Section 9.2.2.1 for the single port setup and refer to Section 9.2.2.3 for the software installation.

9.2.2 Network Cable Installation

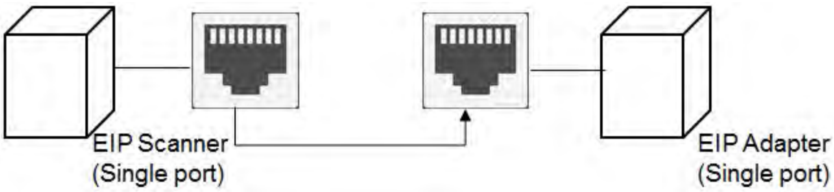
Each EtherNet/IP device is connected to an Ethernet switch with a CAT 5e cable. Please use Delta standard cables and the DVS series industrial switches. Refer to the Delta PLC/HMI Cable Selection Guide for more information.

9.2.2.1. Single Port Device

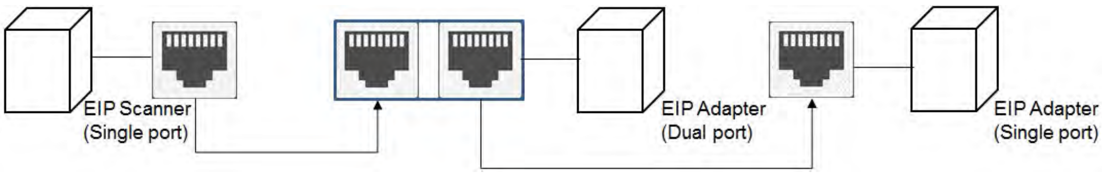
You can use a single port device to build up either a linear or a star network topology. An Ethernet switch and an Ethernet tab are required to create a star topology or a ring topology.

Linear Topology

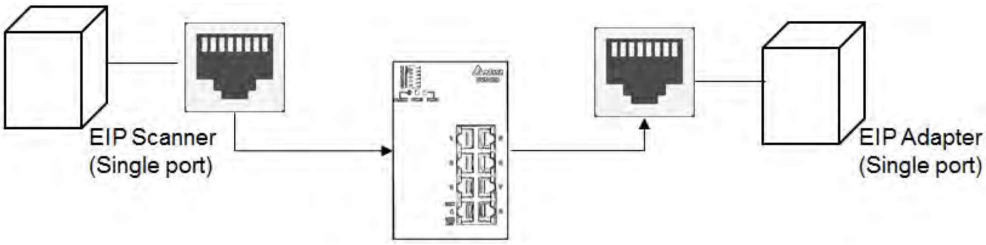
- **Linear Topology** 1



- **Linear Topology** 2



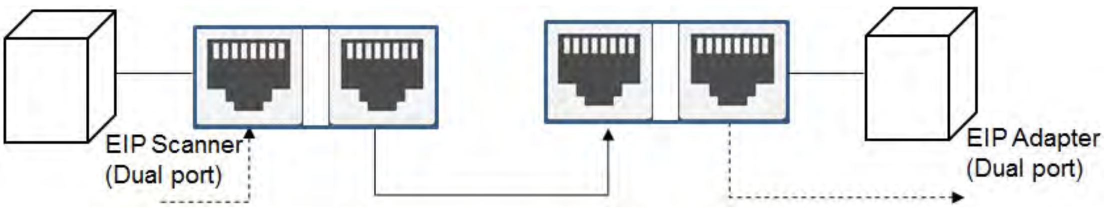
Star Topology



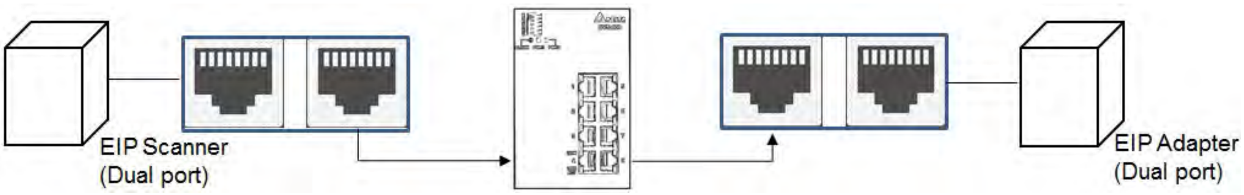
9.2.2.2. Dual Port Device

You can use a dual port device to build a linear, a star or a ring network topology. A DLR function is required to create a ring topology. Refer to Section 9.8.2 for DLR supported series.

Linear Topology

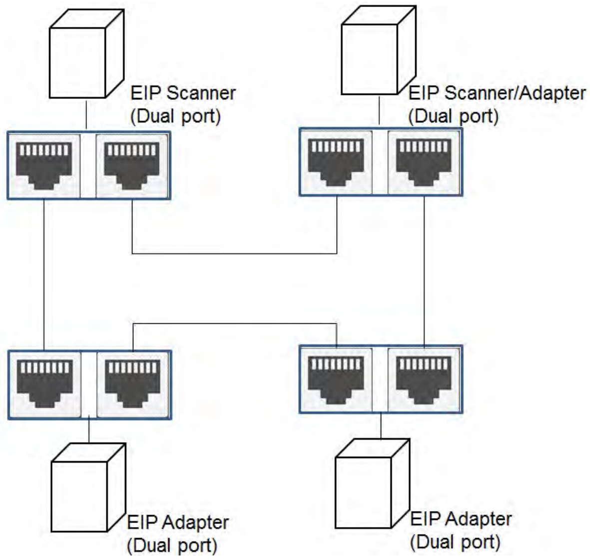


Star Topology

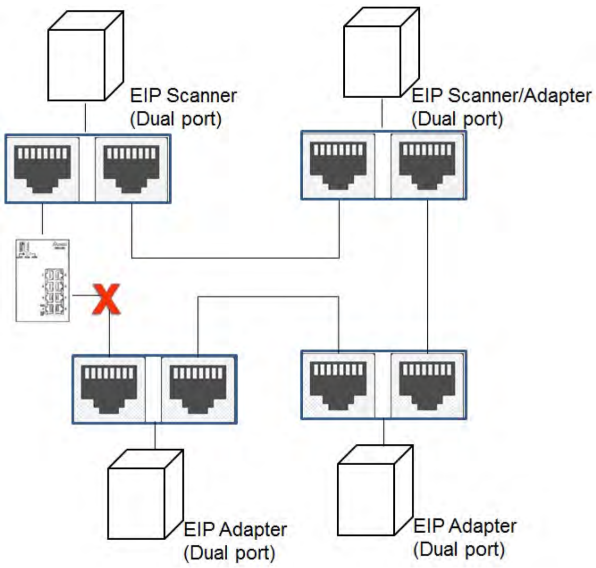


Ring Topology

A DLR function is required to create a ring topology. Refer to Section 9.8.2 for DVP-ES3 that support DLR.



When a switch is needed for the particular topology, the switch should support the DLR function. If not, the connection might fail.



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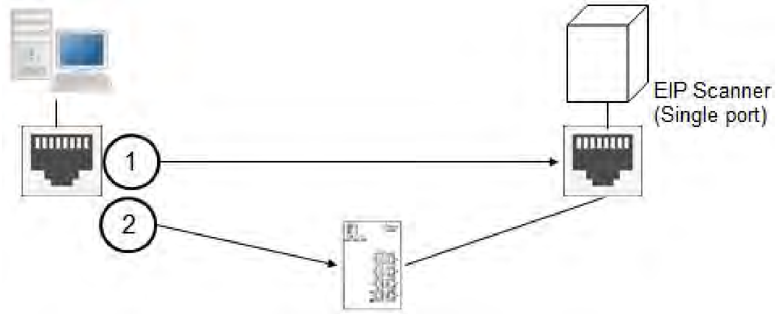
9.2.2.3 EIP Builder Software

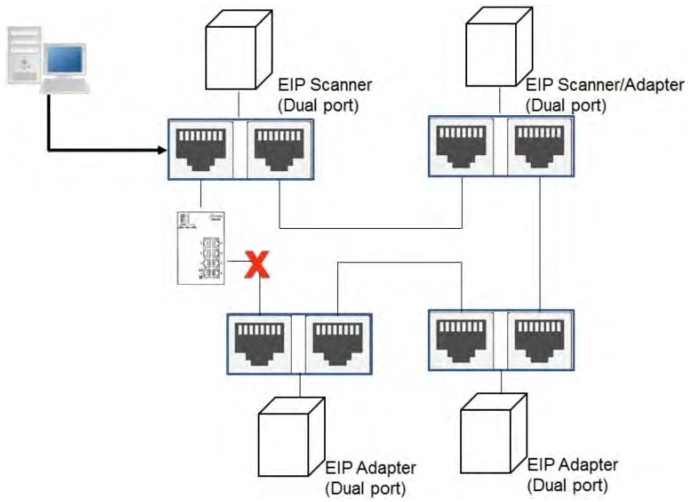
Linear and star topology

Install the EIP Builder software on your PC to monitor and configure the EIP devices. You can also connect an EIP device to your PCs directly, or use a switch to connect to the PCs.

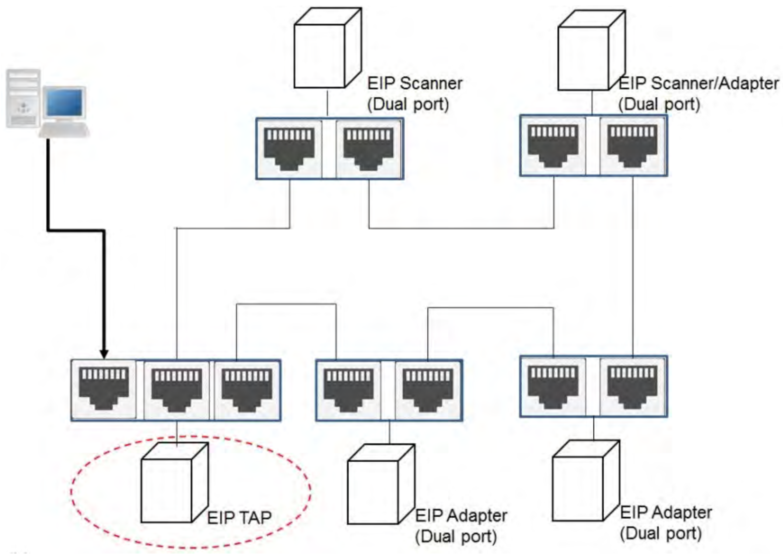


Ring topology

Install the EIP Builder on your PC to monitor and configure the EIP devices. Be sure to save a network connection for your PC to connect to the EIP device.



Alternatively, you can use an EIP tap to connect your PC so that the ring topology stays intact.



9.3 Specifications

9.3.1 Ethernet Specification

Model	DVP-ES3 Series
Communication Protocols	EtherNet/IP Scanner / Adapter, MODBUS TCP
Protocols	BOOTP, DHCP, SMTP, NTP, Socket, HTTP
Communication Speed	10/100 Mbps Auto-Detection
Communication Interface	RJ-45 with Auto MDI/MDIX
Numbers of the Ethernet Port	1

Item / per transmission		**Specification**
		DVP-ES3 Series
MODBUS TCP	**Maximum connection quantity for Client and Server*1**	16
	Max. data length	100 words
Socket (communication port) *2	**TCP connection quantity**	4
	UDP connection quantity	
SMTP (for emailing)	**Emailing quantity**	4

*1: The maximum connection is 16; a sum of client connection and server connection. For example, when client connection quantity is 10, only 6 connections are left for server. If you need more connections, use DVP-ES3 Series instead for more allowable connection quantity.

*2: Numbering is used for connections via the communication port. You can use connection 1 in TCP mode or UDP mode and up to 4 connections can be made per transmission.

9.3.2 EtherNet/IP Specification

Item		DVP-ES3 Series	
General	Device type	Scanner / Adapter	
	Topology type	Linear, Star topology	
CIP Network I/O Connection	CIP connection number	16	8
	TCP connection number	8 (for all connection types)	
	Requested Packet Interval (RPI)	5 ms – 1000 ms	
	Max. Transmission Speed	3000 pps	
	Max. Data Length/per transmission	500 bytes	
CIP Network Explicit Message	Class 3 (Connected Type)	8	8
	UCMM (Non-Connected Type, only uses TCP connections)	Total 8 (for all connection types)	
	CIP Objects	Identity, Message Router, Assembly, Connection Manager, Port, TCP/IP interface, Ethernet link, Vendor specific	
CIP Network TAG	Max. Consumed TAG Number	16	
	Max. Produced TAG Number	16	
	Max. Data Length	500 bytes (IO Connection) 400 bytes (Explicit Message)	
	Requested Packet Interval (RPI)	5 ms – 1000 ms	

Maximum number of connections when using DVP-ES3 Series to connect to other devices through Ethernet/IP:

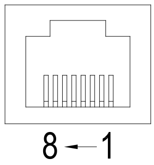
- DVP-ES3 Series can act as a Scanner and an Adapter simultaneously. It can connected up to 16 devices. Each device can establish up to 8 connections for data mapping. Data mapping types can be I/O connection and Consumed TAG. You can use explicit message for data mapping at the same time, up to 8 explicit message connections can be created.

9.3.3 EtherNet Communication Port

9.3.3.1 Communication Port Pin Assignment

Delta EtherNet/IP devices use CAT5e industrial Ethernet cables and can be connected via RJ-45 communication port.

Pin	Signal	Description	Pin	Signal	Description
1	Tx+	Transmit plus	5	--	N/C
2	Tx-	Transmit negative	6	Rx-	Receive negative
3	Rx+	Receive plus	7	--	N/C
4	--	N/C	8	--	N/C



9.3.3.2 Communication LED Indicator

LED Indicator		LED Status	Description
LINK / ACT	Green	ON	● Connected to Ethernet ● No transmission over Ethernet
		Blinking	● Connected to Ethernet ● Packets transmitting/receiving over Ethernet
		OFF	● Not connected to Ethernet

9

9.4 EIP Builder

The Delta EtherNet/IP software, EIP Builder, is embedded in ISPSoft. You run it from the ISPSoft software (version 3.0 or later). Download the ISPSoft software at:

http://www.deltaww.com/services/DownloadCenter2.aspx?secID=8&pid=2&tid=0&CID=06&itemID=060301&typeID=1&downloadID=,&title=--%20Select%20Product%20Series%20--&dataType=8;&check=1&hl=en-US

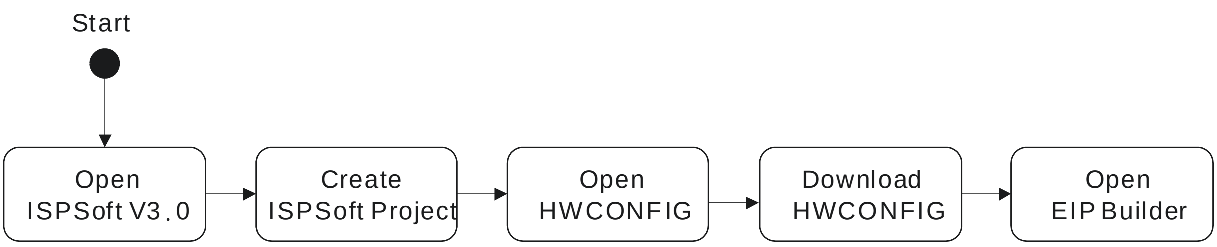
9.4.1 Run the EIP Builder

You can call EIP Builder from Delta EIP Scanner's HWCONFIG in ISPSoft. You can also call it independently to set up parameters for the Adapter. The Delta EIP Scanner is equipped with the EtherNet/IP communication PLC and the EtherNet/IP module. Refer to Section 9.8.3 for a list of Delta EIP Scanner products supported by EIP Builder.

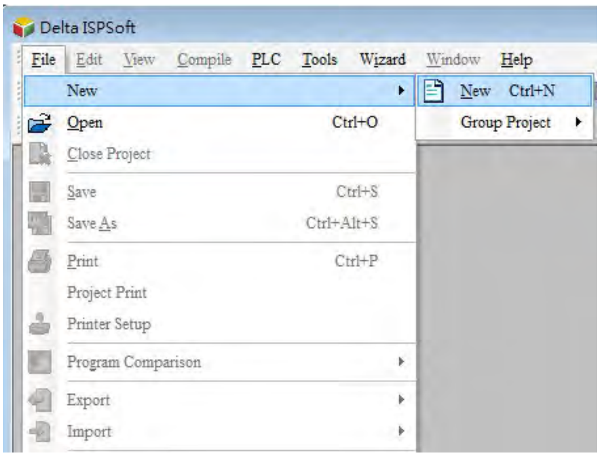
9.4.1.1 Run the EIP Builder via an EIP Scanner

- **Steps to run EIP Builder**

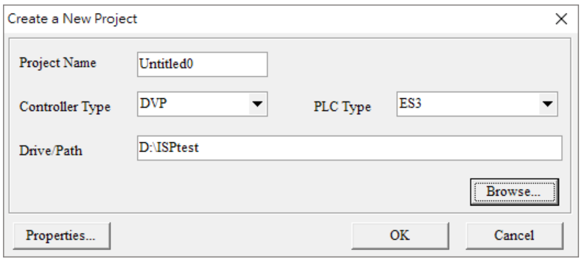
Run EIP Builder from an EIP Scanner product.



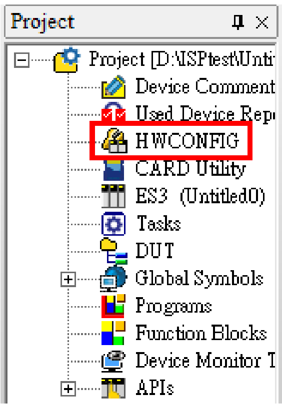
1. Open ISPSoft V3.0: click the **Start** menu and go to **Programs > Delta Industrial Automation > PLC > ISPSoft**
2. Create a new project: on the **File** menu, click **New** to display the Create a New Project dialog box.



3. Select a PLC: in the Create a New Project dialog box, select a PLC product that is supported by EIP builder.

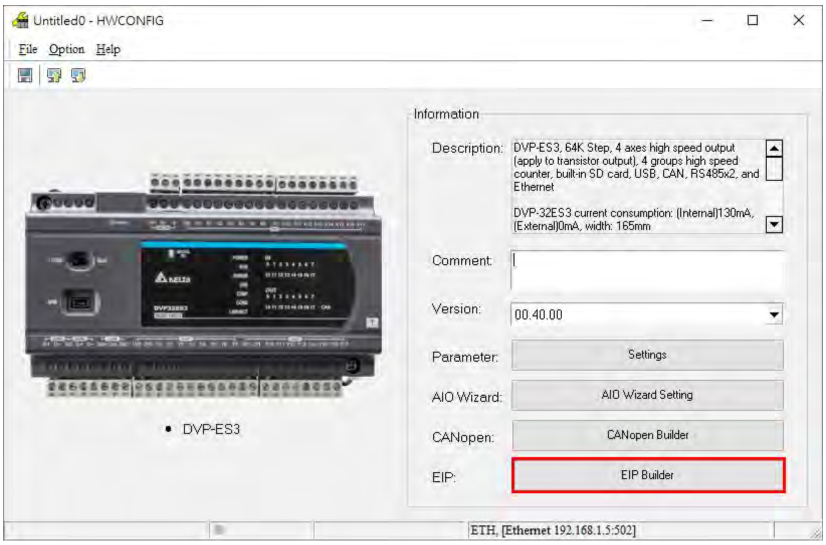


4. Open HWCONFIG: double-click **HWCONFIG** in the Project window.



5. Save and download the settings from HWCONFIG：on the **File** menu click **Save** to save the settings and then click the download button  on the toolbar to download the file to PLC. You must save the configuration in HWCONFIG before opening the other communication tools. While working in the communication tools, you cannot work in HWCONFIG.

6. Open EIP Builder: right-click the CPU module in the system configuration area point to **Communication Software** and then click **EIP Builder**.



9.4.2 Set up the IP Address

This section provides an overview of how to set up IP address for DVP-ES3 Series modules. Set up the IP address before configuring the EIP related parameters or data mapping settings.

9.4.2.1 IP Address Types

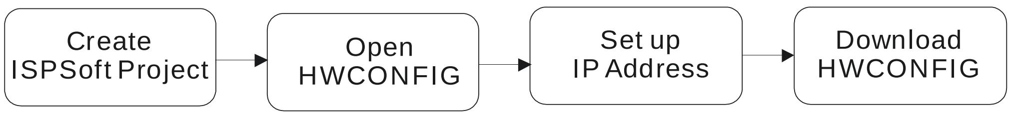
The DVP-ES3 supports 3 types of IP addressing, BOOTP, DHCP and static IP address.

Type of IP Address	Definition
BOOTP	Uses the TCP/IP Bootstrap Protocol (BOOTP) to set up the IP address, netmask and gateway. A BOOTP server may require some configuration. The BOOTP protocol is designed for a network in which each host has a permanent network connection.
DHCP	Uses the Dynamic Host Configuration Protocol (DHCP) to automatically obtain IP address, netmask, gateway, main computer name and the WINS server.
Static IP	You manually set the IP address, netmask and gateway.

9.4.2.2 Set the IP Address (Static IP)

- **Steps to set the IP address**

When using an EIP product with a static IP address, set up the IP address in HWCONFIG in ISPSoft. The following example uses the DVP-ES3 Series.

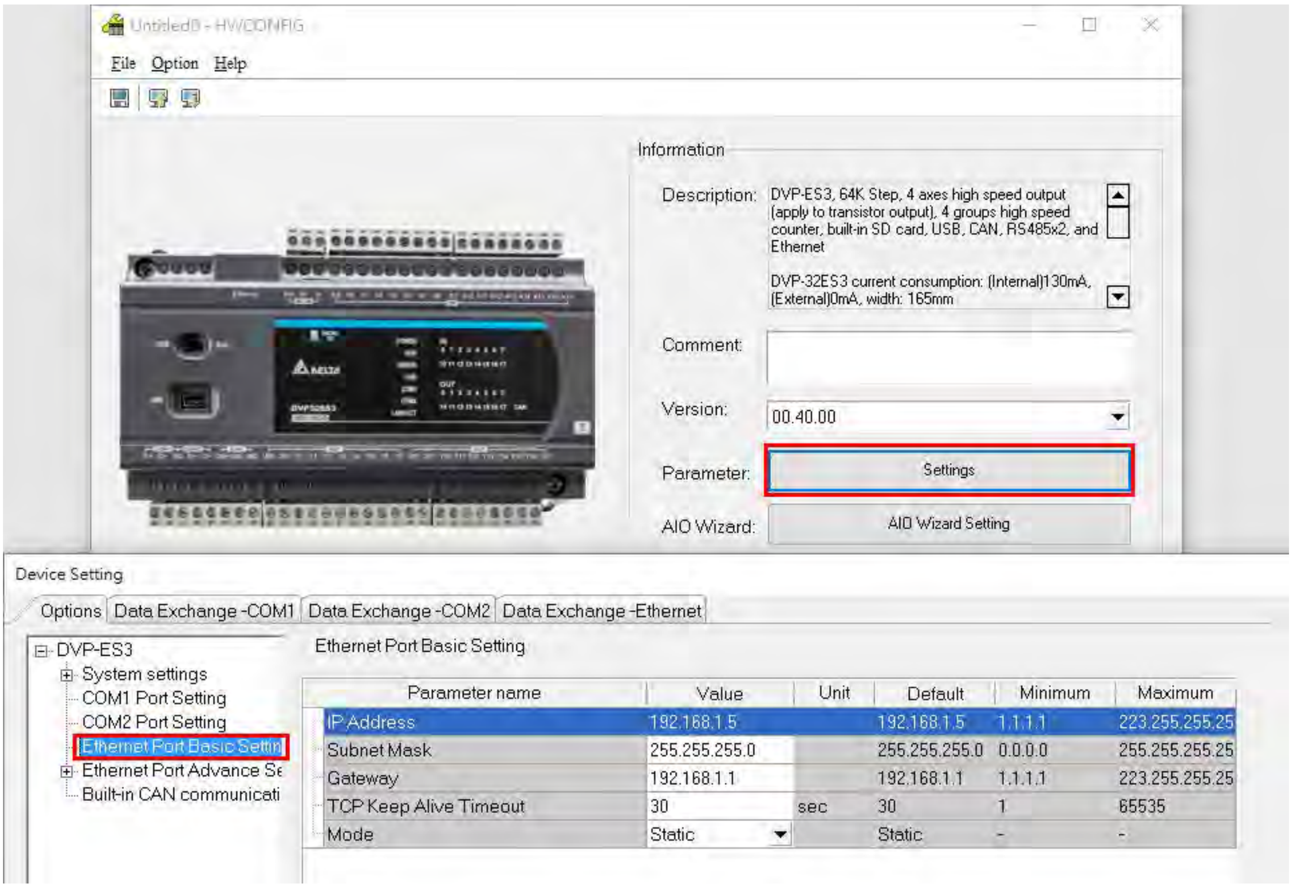


Refer to Section 9.4.1.1 for how to set up an EIP module in HWCONFIG.

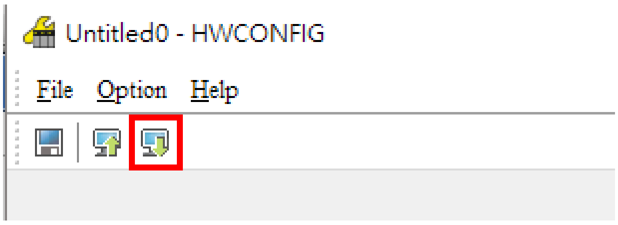
1. Configure the network parameters

◆ Double-click HWCONFIG to open the DVP-ES3 Setting Page.

◆ Click **Settings** to open the Device Setting Page and click **Option** tab and select the option **Ethernet Port Basic Settings** to set the IP Address.



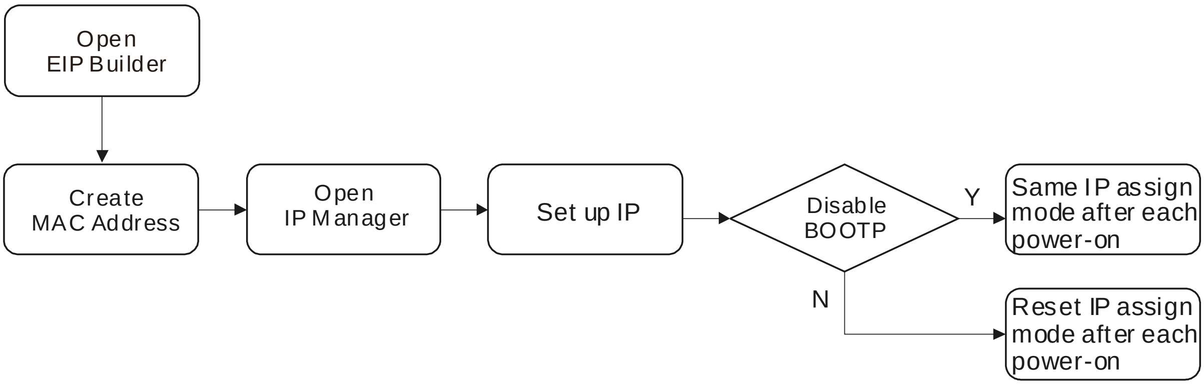
2. Save and download the settings from HWCONFIG: on the **File** menu click **Save** to save the settings and then on the **Options** menu, click **Download** or click the Download button on the toolbar.



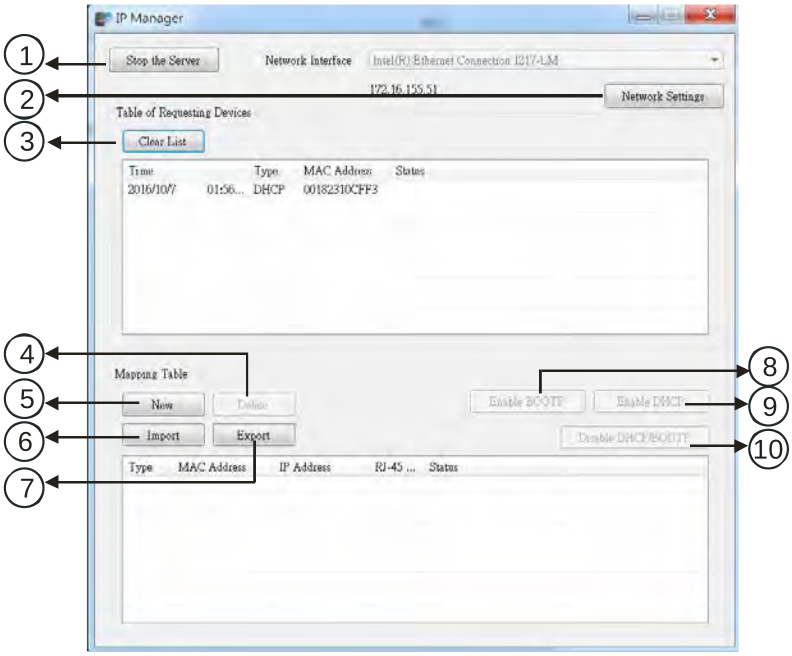
9.4.2.3 Set the IP Address (BOOTP/DHCP)

- **Steps to set the IP address**

  When using an EIP product with a BOOTP/DHCP IP address, users can set up the IP address through the IP Manager in the EIP Builder.



Descriptions for the IP Manager:



	Item	Definition
①	Stop the Server	Stops the BOOTP/DHCP server; the IP manager does not request an IP addresses from the BOOTP/DHCP server.
②	Network Settings	Opens a dialog box to set up the subnet mask, gateway, primary DNS, secondary DNS, and domain name.
③	Clear List	Clears the contents of the list.
④	New	Adds a new IP/MAC address.
⑤	Delete	Deletes the selected item from the list.

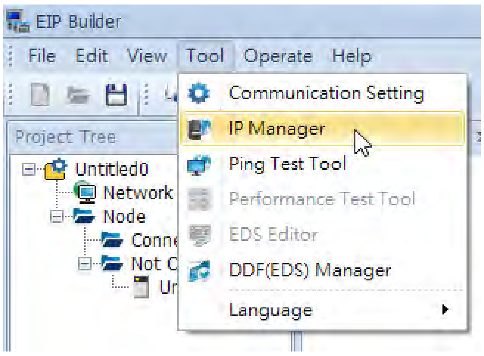
⑥	Import	Imports the IP/MAC address list; the file format is .CSV.
⑦	Export	Exports the IP/MAC address list; the file format is .CSV.
⑧	Enable BOOTP	Enables the BOOTP to assign an IP address for the selected item.
⑨	Enable DHCP	Enables the DHCP to assign an IP address to the selected item.
⑩	Disable BOOTP/DHCP	Disables the BOOTP/DHCP on the device; the device does not request an IP addresses from the server.

- **Steps to set the IP address:**

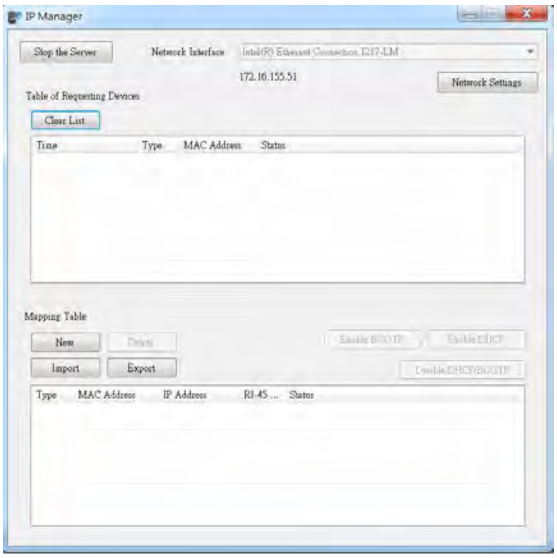
1. MAC address: find the MAC address on the EIP device. The MAC address uniquely identifies the device.

2. Open the IP Manager

◆ In EIP Builder on the **Tool** menu, click **IP Manager**.

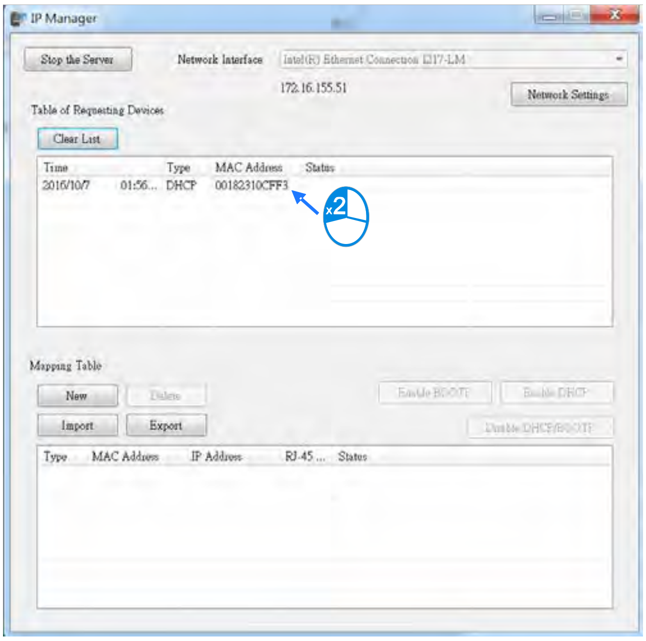


◆ The IP Manager can be the BOOTP/DHCP Server, receiving IP address requests from devices. The IP Manager window is shown below.

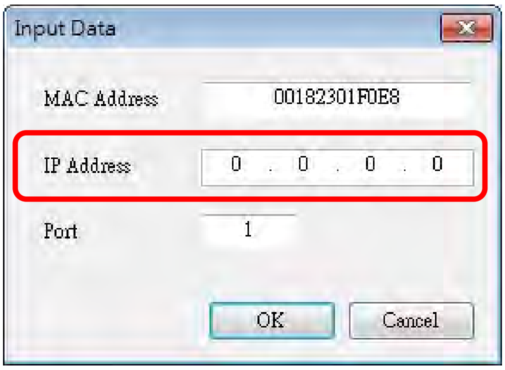


3. Set up the IP address

◆ Double-click the listed MAC address for your device to open the Input Data dialog box.

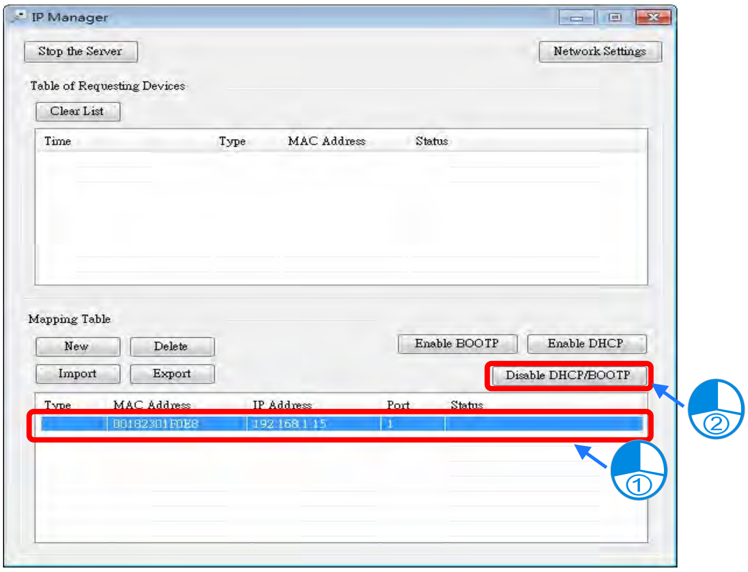


◆ Enter the IP address and click **OK**.



4. Disable DHCP/BOOTP

Click the device in the Mapping Table that you want to disable, then click **Disable DHCP/BOOTP**. The selected device does not send DHCP/BOOTP requests. To change the IP address receiving mode, refer to Section 9.4.2.4 for more information.

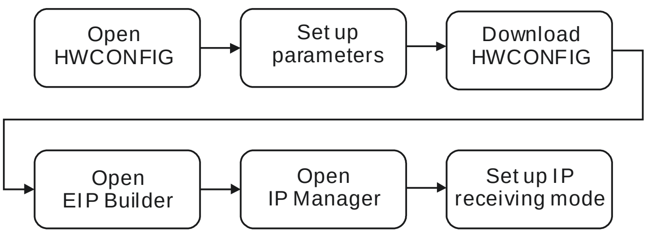


Notes

- Enable BOOTP: when the IP address receiving mode is BOOTP (BOOTP is enabled), the IP address is assigned, and the device sends out BOOTP requests for IP addresses during each power-on.
- Enable DHCP: when the IP address receiving mode is DHCP (DHCP is enabled), the IP address is assigned, and the device sends out DHCP requests for IP addresses during each power-on.
- Disable DHCP/BOOTP: when BOOTP is disabled, the device does not send out any DHCP/BOOTP requests for IP addresses during each power-on.

9.4.2.4 Re-enable BOOTP/DHCP

To enable the DHCP or BOOTP function again, use the device software to make the change. Using the DVP-ES3 Series as an example: from the **Start** menu, start ISPSoft, then HWCONFIG, and then IP Manager. In IP Manager sets the IP address to the receiving mode.

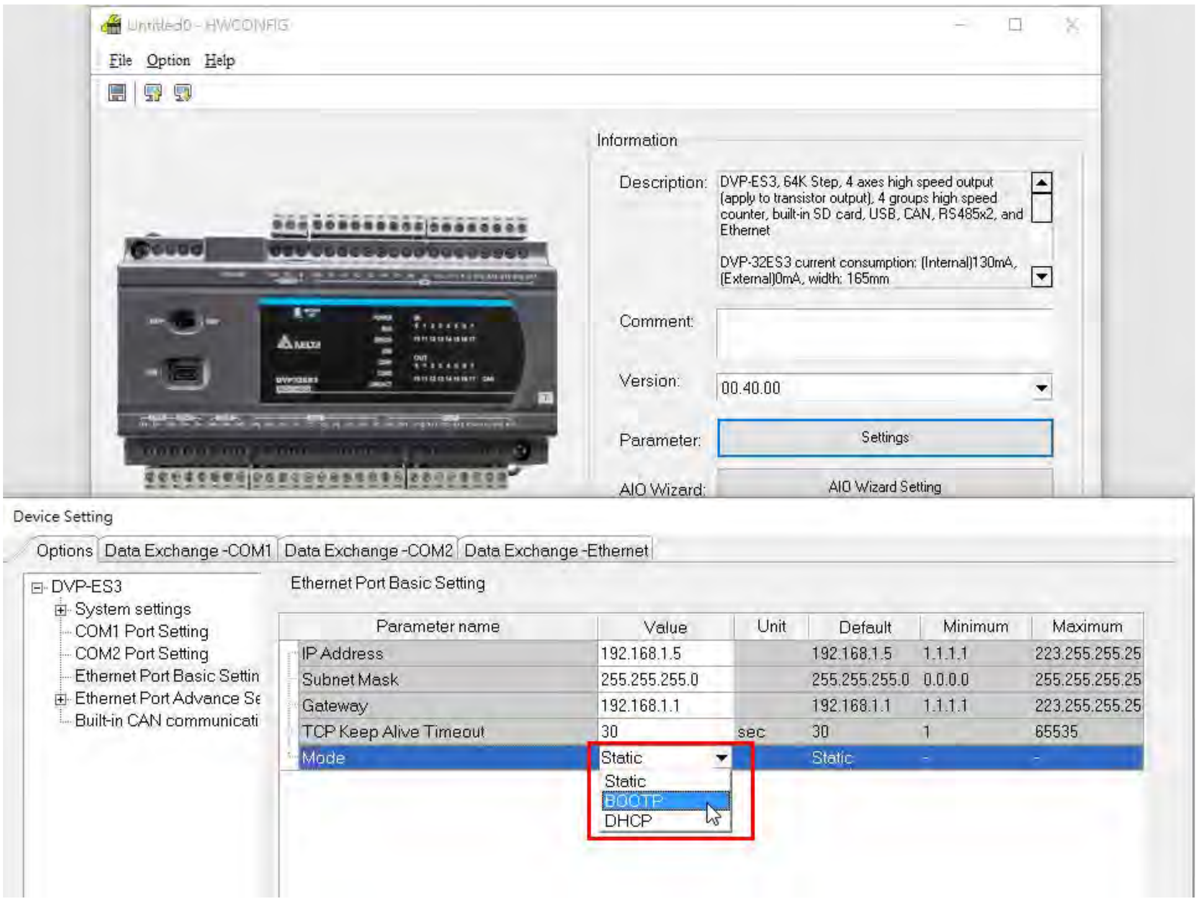


- **Steps to set device parameters**

1. Refer to Section 9.4.1.1 for how to start HWCONFIG.
2. Set the parameters: enable the IP address receiving mode to BOOTP/DHCP.

    ◆ Double-click HWCONFIG to open the DVP-ES3 Setting Page.

- Click **Settings** to open the Device Setting Page and click **Option** tab and select the option **Ethernet Port Basic Settings** to set the Mode to **BOOTP** or **DHCP**.



3. Download the settings from HWCONFIG
   - Refer to Section 9.4.1.1 for more information.
4. Open EIP Builder.
   - Refer to Section 9.4.1.1 for more information.
5. Open the IP Manager
   - Refer to Section 9.4.2.3 for more information.
6. Open the IP setup page
   - Refer to Section 9.4.2.3 for more information.

9

9.5 Troubleshooting

This section provides an overview of error codes and troubleshooting for the DVP-ES3 Series.

9.5.1 Error Code Classification

There are two types of error code categories for DVP-ES3 Series: Configuration Errors, and Application Errors. These error codes are defined by the ODVA for EtherNet/IP errors. Refer to the following table for DVP-ES3 Series error codes.

Error Code Classification		Description
1st Phase	2nd Phase	
Category	Item	
Configuration error	EDS files mismatched	Mismatched EDS files lead to I/O connection failure. *
	Data exchange setup error	Data exchange setup error lead to I/O connection failure. *
Application error	Ethernet/IP error	EtherNet/IP communication failure *
* Only the last 2 bytes of the error code are shown; for example, only 011C appears for the error code H'1101011C.		

9.5.2 Error Codes & How to fix them

9.5.2.1 Configuration Errors

(EIP Builder only shows Low word error codes)

Category	Error Code	Description	How to fix them
EDS Files Mismatched	H'1101011C	The Transport Class field values of the Transport Class and Trigger in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010114	The Vender ID or the Product Code in the EDS file is mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010115	The device type parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010116	The revision parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match.

Category	Error Code	Description	How to fix them
			2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'1101011E	The direction parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'1101011F	The fixed / variable output flag in the EDS file is mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010120	The fixed / variable input flag in the EDS file is mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010121	The output priority in the EDS file is mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010122	The input priority in the EDS file is mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010123	The output connection type parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010124	The input connection type parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H'11010125	The redundant ownership output parameters in the	1. Check if the product information and the EDS file match.

Category	Error Code	Description	How to fix them
		EDS file are mismatched.	2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H’11010126	The configuration size parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H’11010129	The configuration path parameters in the EDS file are mismatched.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
	H’11010132	The EDS file does not support Null forward open.	1. Check if the product information and the EDS file match. 2. Reload the EDS file. 3. Ask the vendor of the device for the EDS file.
Data Exchange Setup Error	H’12010100	I/O connections duplicated	1. Check if the system has created the I/O connections. 2. Change the connection type to Listen Only.
	H’12010106	Ownership conflict	1. Check the scanner owner. 2. Reconfigure the invalid scanner. 3. Change the connection to multicast.
	H’12010110	Target for connection not configured	1. Check the I/O connection status. 2. Activate the I/O connections again.
	H’12010111	Adapter RPI not supported	Check the RPI for the adapter.
	H’12010113	Out of connections	1. Check if the number of connections exceeds the limit. 2. Reduce the number of the product connections.
	H'12010119	Non-Listen only not opened	1. Check if the system has created the I/O connections. 2. Check the scanner I/O connection status.
	H’12010127	Invalid originator to target Size	Check the module number and the product setup file to see if they match.
	H’12010128	Invalid target to originator	Check the output size in the connection parameters.

Category	Error Code	Description	How to fix them
		Size	
	H’1201012D	Consumed TAG does not exist.	Check if the parameters in the Consumed tag are set correctly.
	H’1201012E	Produced TAG does not exist.	Check if the parameters in the Produced tag are set correctly.
	H’12010204	Unconnected request timeout	No response from the adapter; check if the power and the network connection for the adapter are working properly.
	H’12010302	Network bandwidth NOT available for data	1. Check the I/O connection limit between the scanner and the adapter. 2. Increase the RPI value or reduce the number of connections.
	H’12010315	Invalid segment in connection path	Check the module number and the product setup file to see if they match.

9.5.2.2 Application Error

Category	Error Code	Description	How to fix them
EtherNet/ IP Error	H’00010203	I/O connection timeout	1. Check the network connection status. 2. Check if the module is working properly. 3. Increase the RPI value.

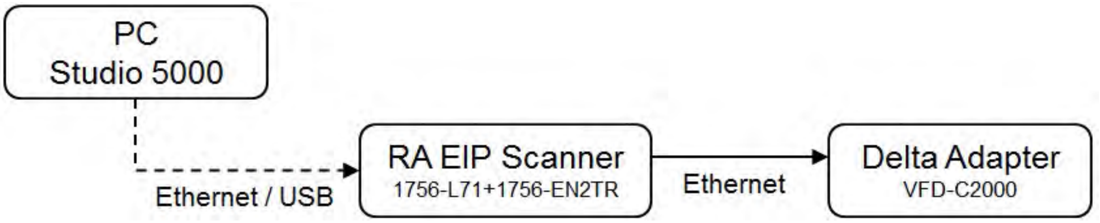
9

9.6 Studio 5000 Software Operation

This section provides an overview using Ethernet/IP to connect to a Delta Ethernet/IP Adapter with third party software. For this example we use the Rockwell Automation software Studio 5000.

9.6.1 Architecture

The Rockwell Automation (RA) EIP Scanner uses Ethernet to connect to a Delta Adapter. The PC connects to the RA Scanner through Ethernet or USB.



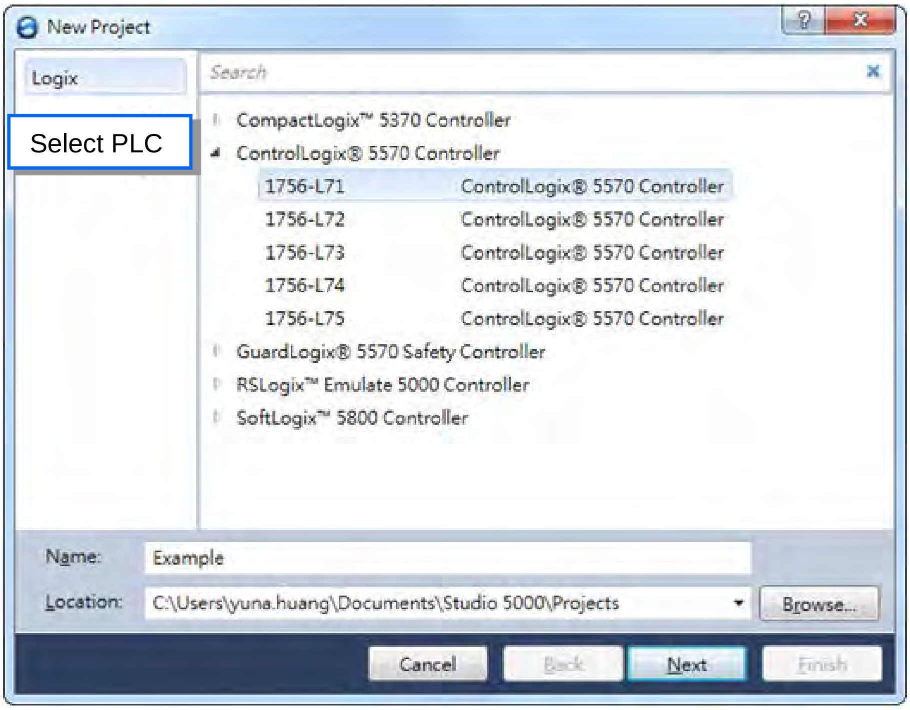
※ Rockwell Software Studio 5000, ControlLogix, RSLogix are registered trademarks of Rockwell Automation, Inc.

- **Operation Steps:**

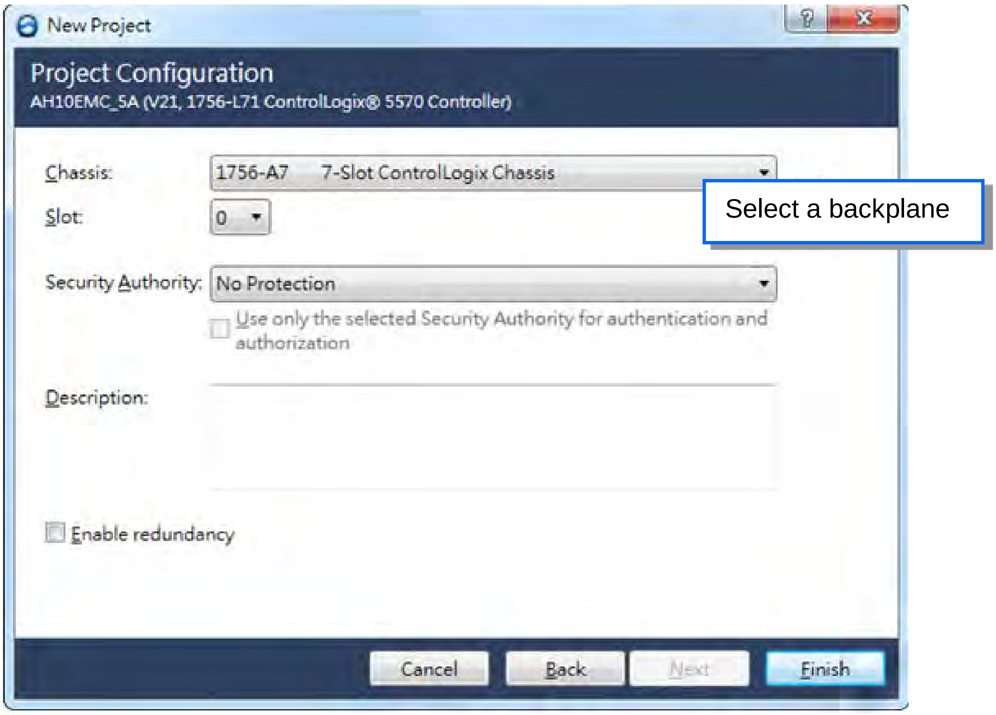
9.6.2 Create a New Project

- Open Studio 5000 and under **Create**, click **New Project**.

- Select a PLC and select the chassis. This example uses a 1756-L71.



- Click **Finish** to create the new project.



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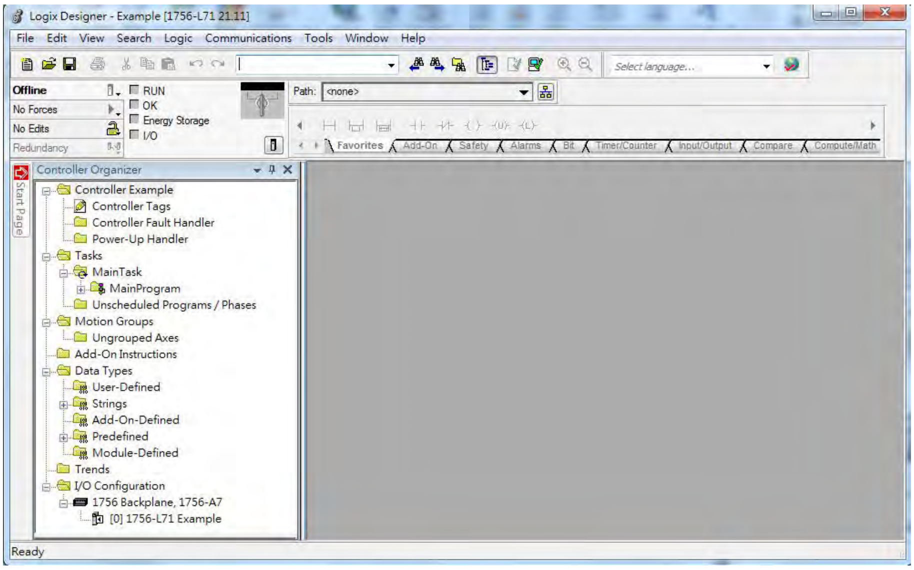
- After creating the project, Studio 5000 displays the Controller Organizer and workspace.

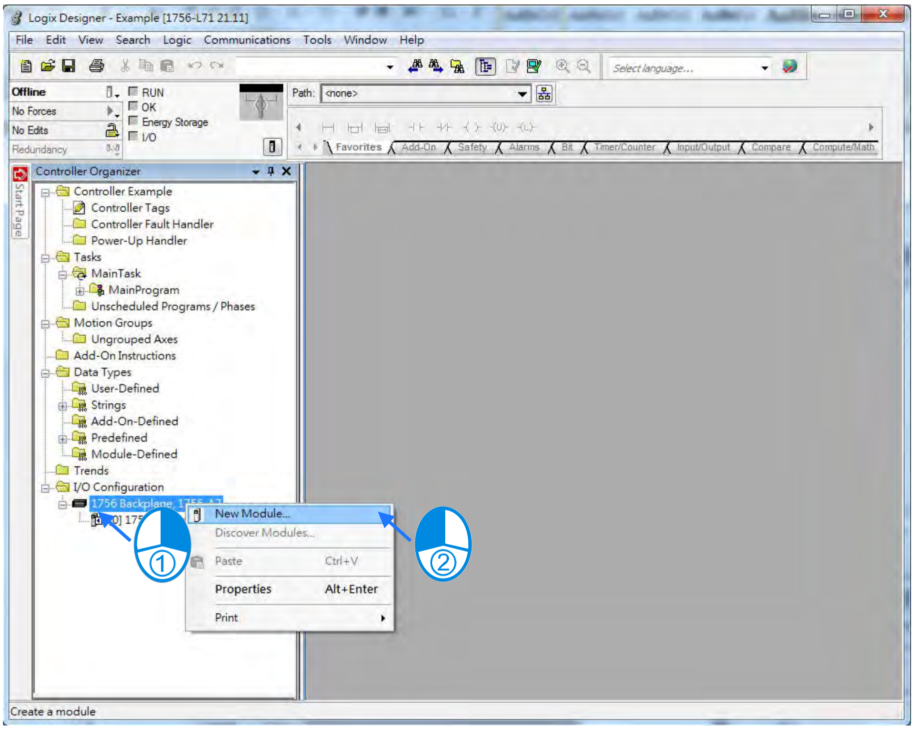


9.6.3 Create a Scanner

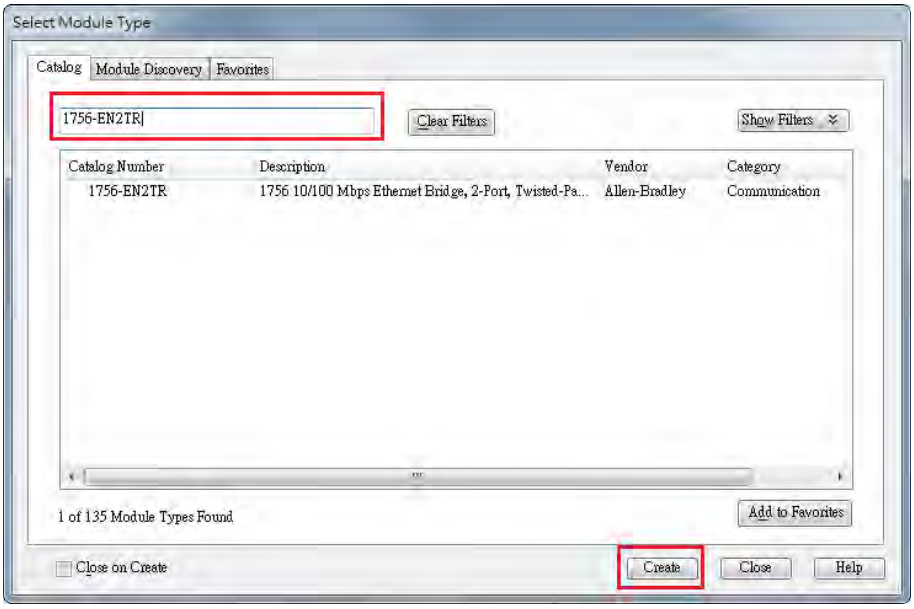
Next, add the 1756-EN2TR Ethernet/IP module, and then connect to the Ethernet/IP devices through the Ethernet/IP module.

9.6.3.1 Create a New Ethernet/IP Module

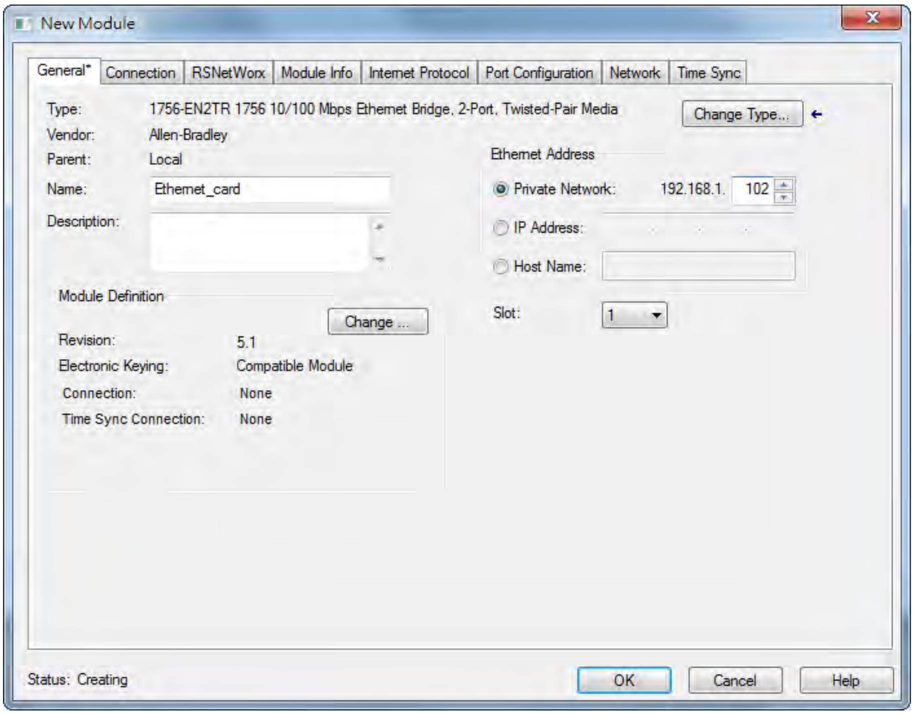
- Right-click **1756 Backplane 1756-A7** and then click **New Module**.



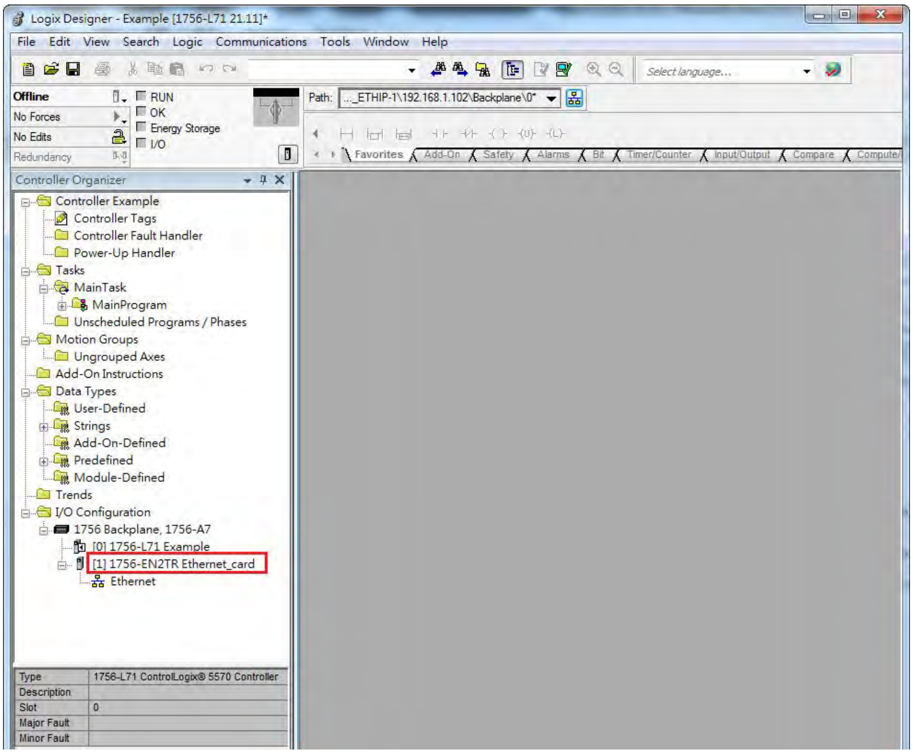
- Type **1756-EN2TR** in the filter field, click the **1756-EN2TR** module, and then click **Create**.



- Type the **Name**, **IP address** and other required information, and then click **OK** to add the EtherNet/IP module.



- The new 1756-EN2TR module appears in the Controller Organizer tree.

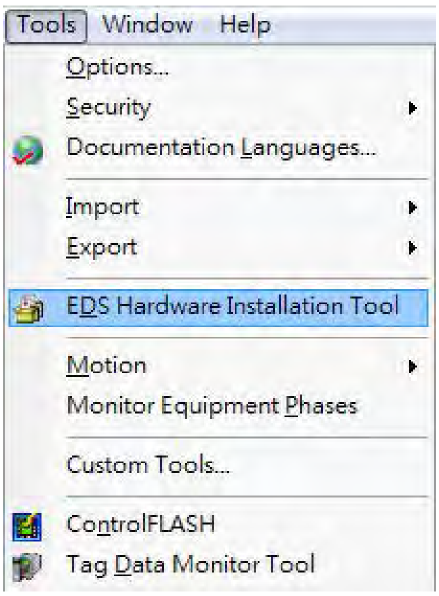


9.6.4 Connect to a Delta Adapter

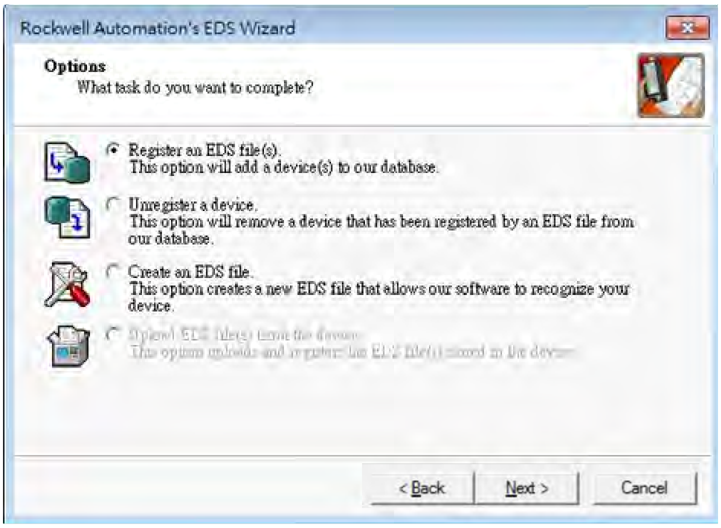
This section provides an overview of connecting to a Delta Ethernet/IP Adapter with the Rockwell Automation software Studio 5000.

9.6.4.1 Import an EDS file

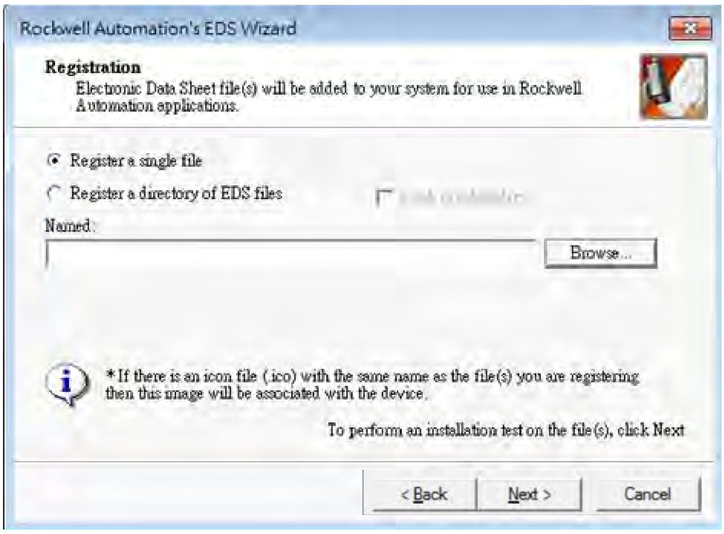
- In Studio 5000, on the **Tools** menu, click **EDS Hardware Installation Tool**.



- Select **Register an EDS file(s)** and click **Next**.



- Select **Register a single file** and click **Browse** to find the EDS file to import.



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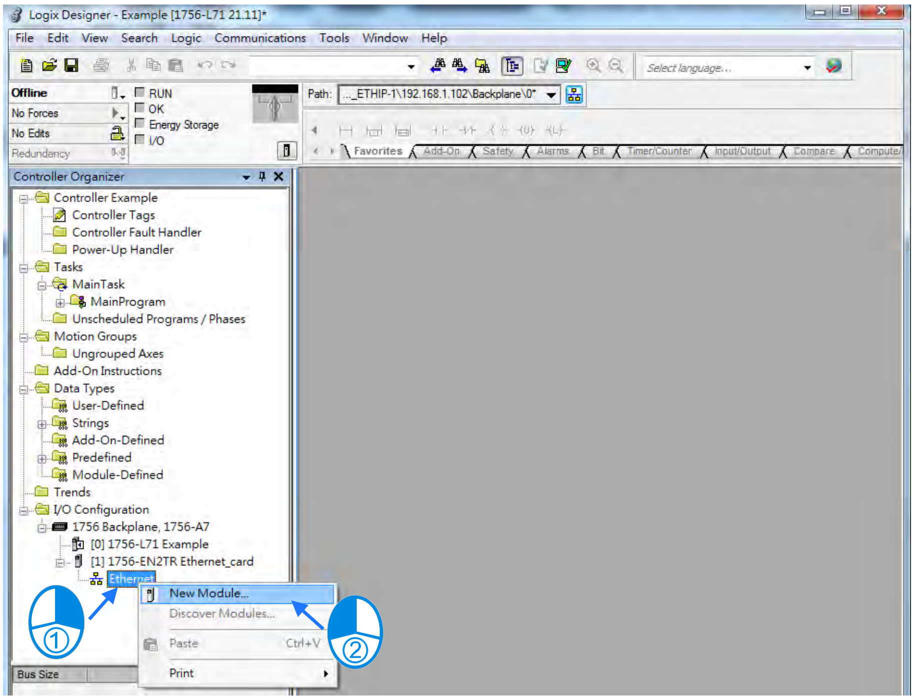
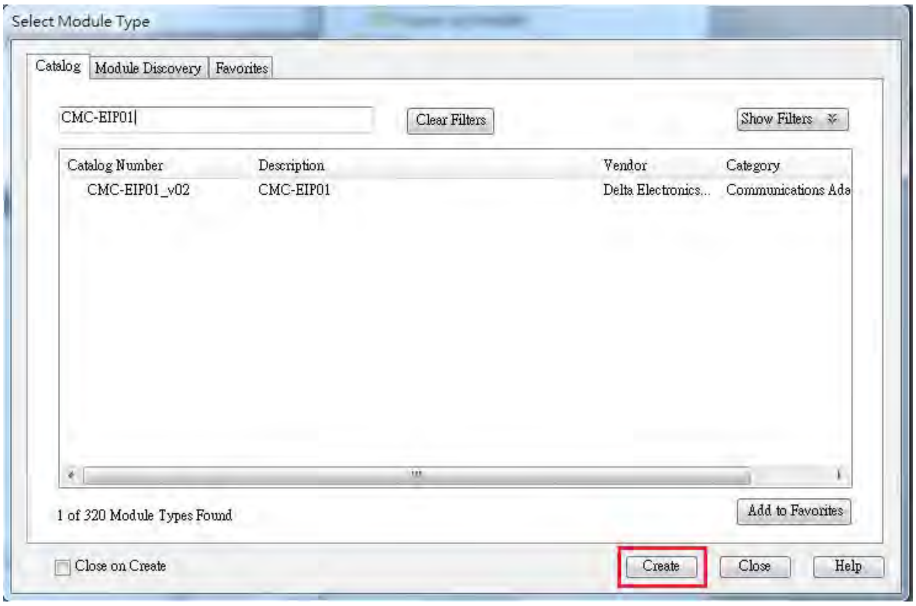
- Follow the instructions in the wizard and then click **Finish** to complete importing the EDS file.

9.6.4.2 Create an Adapter

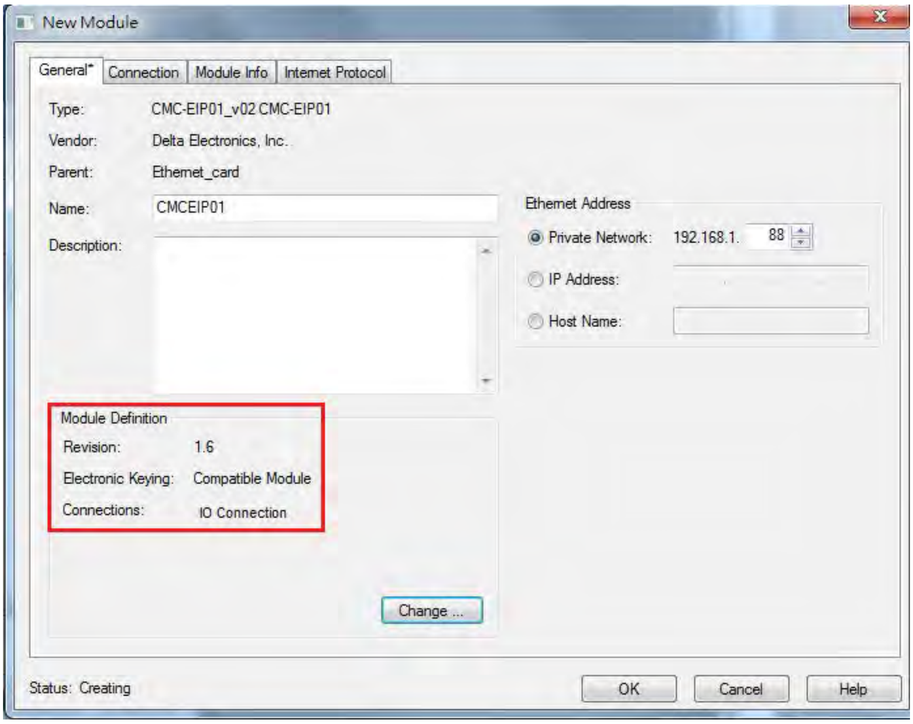
- In Studio 5000, in the Controller Organizer under 1756-EN2TR, right-click **Ethernet** and then click **New Module**.



- Type the module number of the imported Delta EDS file in the filter field, click the Delta module, and then click **Create**.



- Verify that the product name and IP address are the same as the information shown in the **Module Definition** section.



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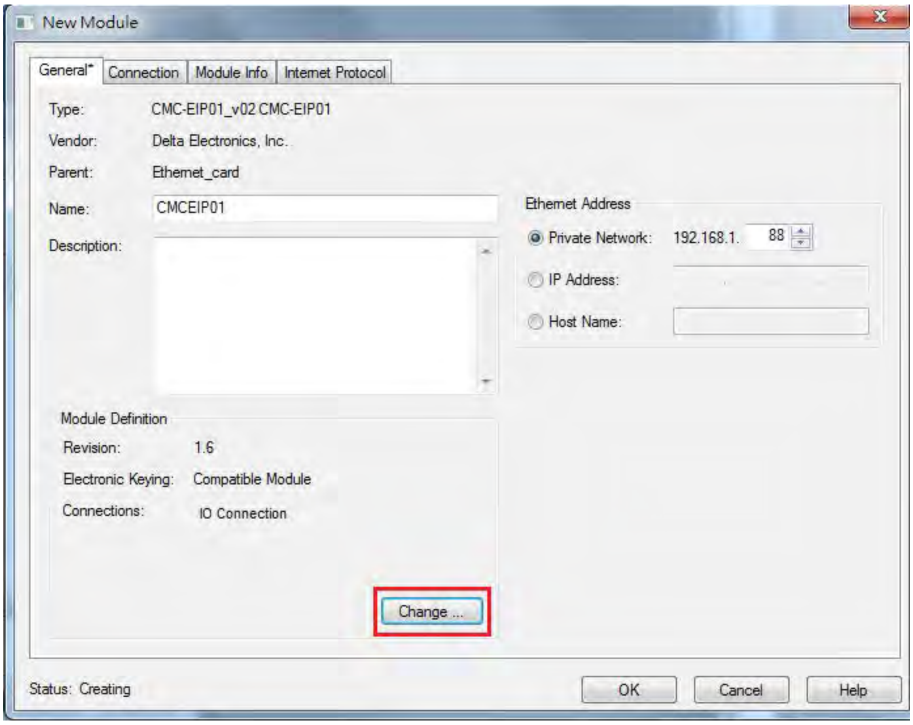
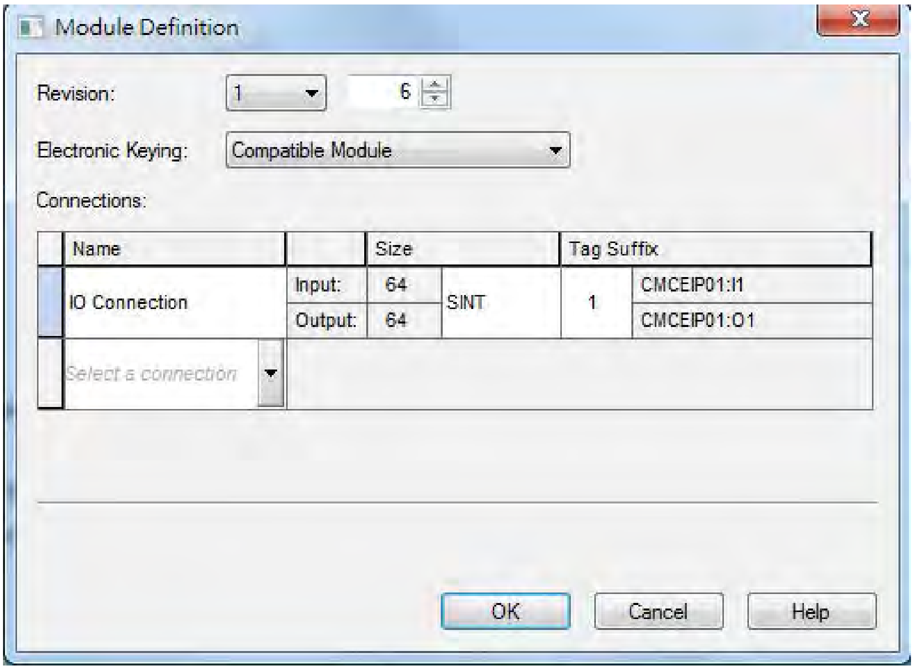
- Click **Change** if you need to make a change to the module definition.



- Modify the module definition

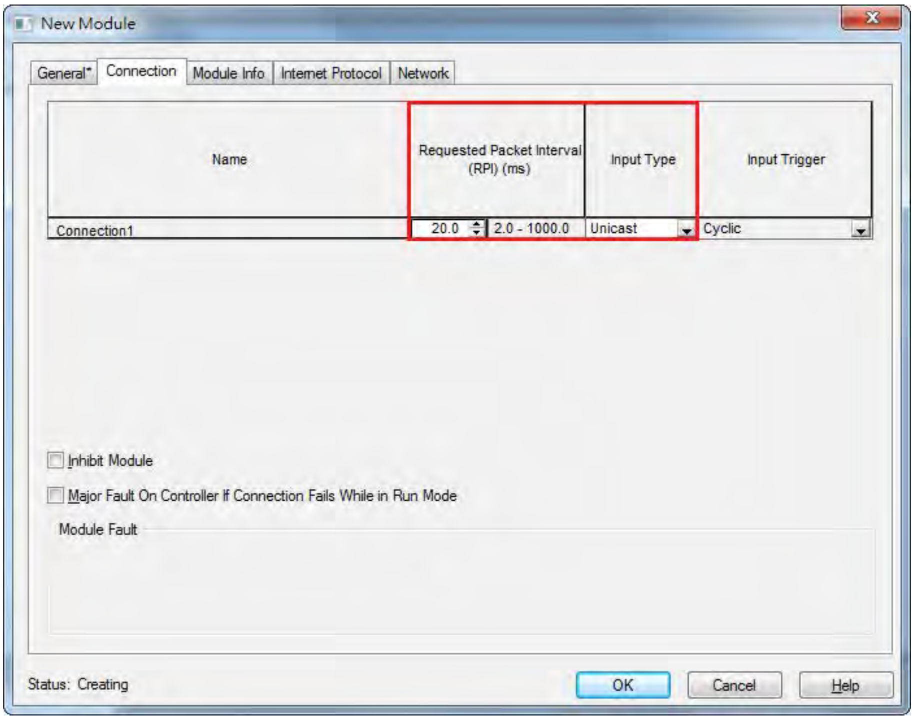
  1) Name: Click the arrow button to select a valid connection.

  2) Size: Rockwell PLC supports maximum 500 bytes data size. (Data for input contains 2 bytes of Serial Number and for output contains 4 bytes 32-bit Run-idle header and 2 bytes of Serial Number.) If using DVP-ES3 Series, you can set the maximum data length 498 SINT for input and 494 SINT for output.

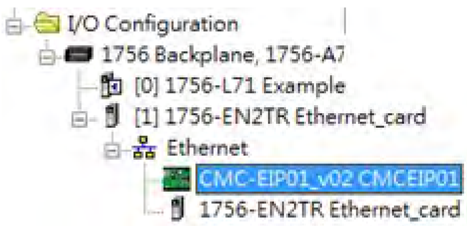


※ In general, there is no need to change the parameters from the imported EDS files which can usually be used without modification.

- In the New Module dialog box, click the **Connection** tab to modify the **Requested Packet Interval** and **Input Type** settings. The RPI uses the I/O connection to a Scanner to exchange data at regular intervals, and the units are micro-seconds. For **Input Type** select either **Unicast** or **Multicast**. The Input Type selections may vary for different products.



- Click **OK** to create the adapter. The new Delta Adapter appears in the Controller Organizer tree.



9.6.4.3 Editing Corresponding Addresses for DVP-ES3

Refer to section 9.7.5 Assembly Object for defaults of mapping address. Refer to section 9.6.4.5 on how to open Program TAG and modify the contents of TAG:C to edit the mapping addresses. Refer to section 9.7.5 Assembly Object for details on TAG:C.

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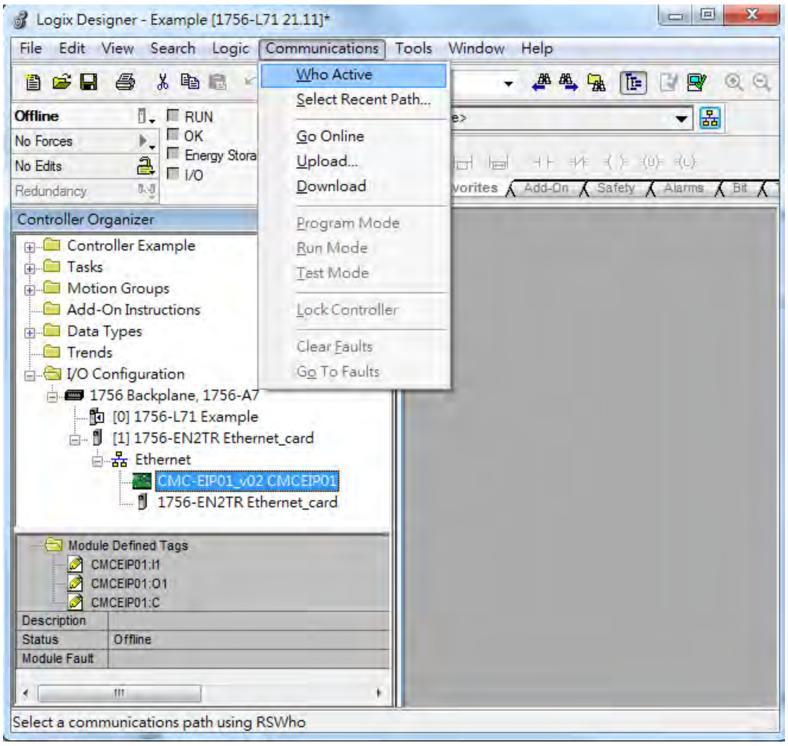
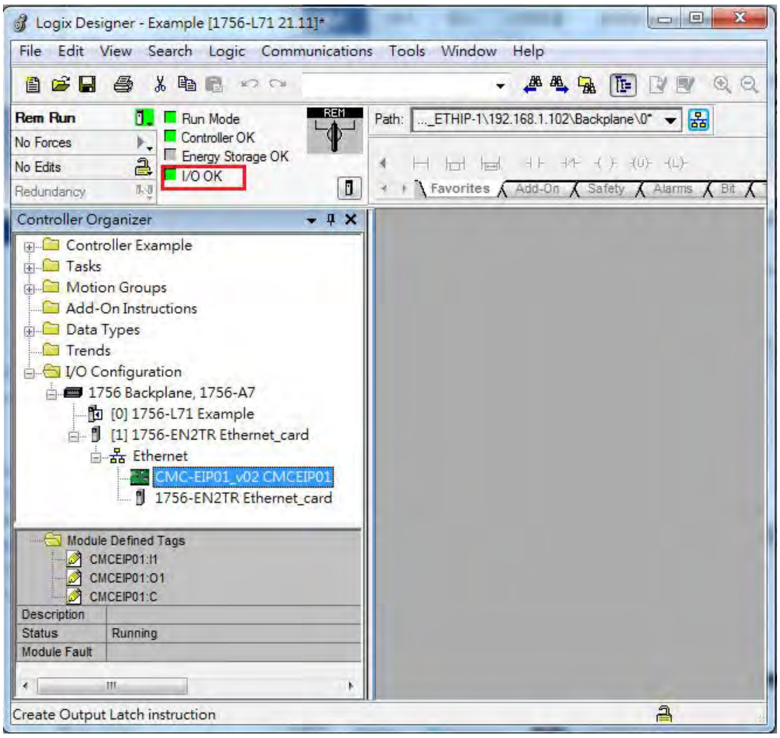
9.6.4.4 Download

The next step is to download the project to the PLC and go online.

- In Studio 5000, on the **Communications** menu, click **Who Active**. To establish a connection, select the Scanner connected to the PC, and then on the **Communications** menu click **Download**.



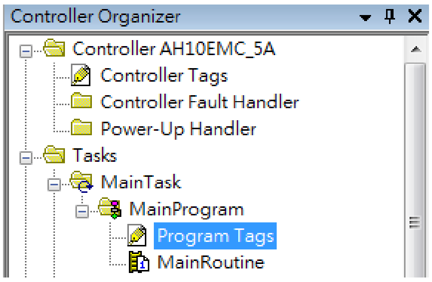
- After the connection is successfully established, the I/O status shows green by **I/O OK**.



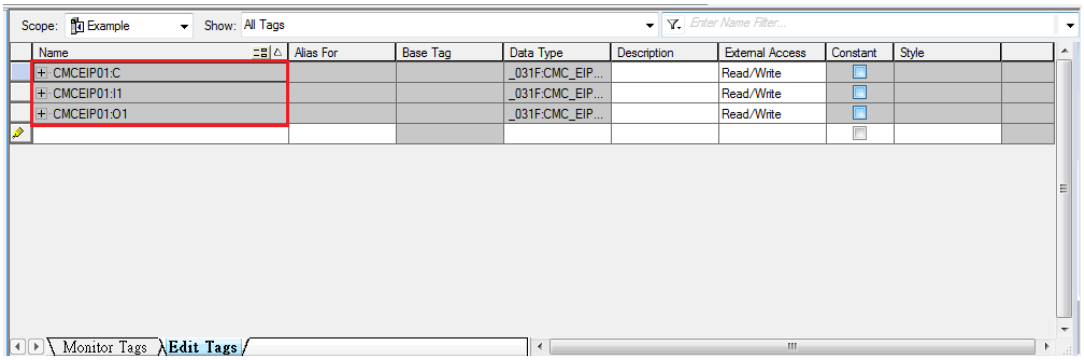
9.6.4.5 Data Mapping

In the Controller Organizer, you can map data, including Configuration, Input and Output parameters. When you create a device I/O Configuration, the tags are added automatically.

- Click **Program TAGs** to display the Tags window.



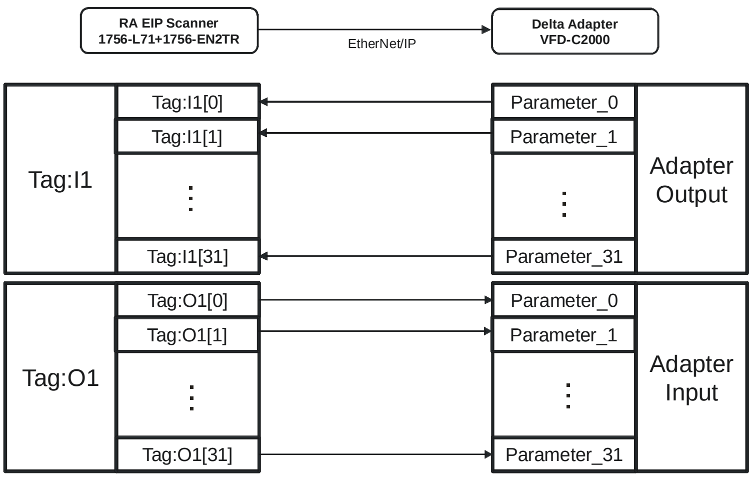
- Tags are listed in the **Name** column. Tag names begin with a product name and end with **C** or **I1** or **O1**, separated from the name by a colon (:), for example CMCEIP01:C, CMCEIP01:I1, and CMCEIP01:O1.



- Tag name：C indicates the tag contains information from the Adapter EDS file, including Input and Output parameters. You can edit these parameters in Studio 5000.

- Tag name：I1 indicates that the mapping starts from TAG：I1[0], and is mapped to the first parameters of the Adapter output. The length is the output length provided by the Adapter.

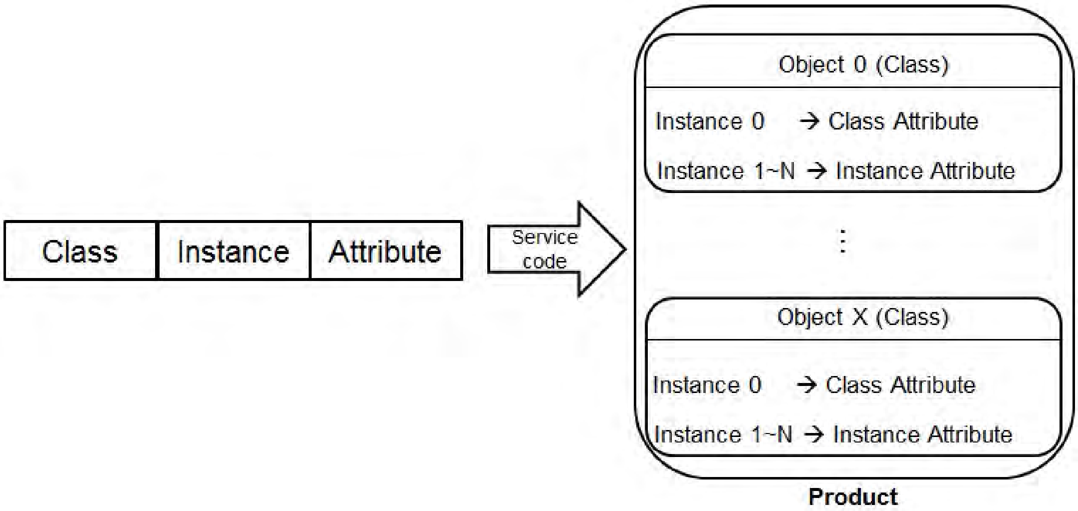
- Tag name: O1, indicates that the mapping starts from TAG：O1[0], and is mapped to the first parameters of the Adapter Input. The length is the input length provided by the Adapter.



9.7 CIP Object

9.7.1 Object List

CIP requires objects (groups of related data and behaviors associated with this data) to describe a device, how it functions, communicates, and to define its unique identity. Objects can be further defined by Class (a set of objects representing the same type of system), Instance (a copy of an object), and Attribute (data values). An object's instance and class have attributes, providing services and implementing behaviors. Instance 0 contains the basic information for every object, that is: version and length. Instance 1–N contains parameters for creating connections. You can get product parameters from the supported service code through objects.



The supported EtherNet/IP objects are listed in the following table. Refer to Section 9.7.2 for the data type definitions. Refer to Section 9.7.3~9.7.19 for object contents. You can use explicit messages to read and write Objects. When DVP-ES3 Series PLC acts as a Scanner, you can use EIPRW instruction to read and write Objects. Refer to DVP-ES3 Series Programming Manual for more details on EIPRW instruction (API2208).

Object Name	Function	Class ID
Identity Object	Provides identification of general information about the device.	1 (H'01)
Message Router Object	Provides a messaging connection point through which a client can address a service to any object class or instance residing in the physical device.	2 (H'02)
Assembly Object	Binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection and can be used to bind input data or output data.	4 (H'04)
Connection Manager Object	Provides connection and connectionless communications, including establishing connections across multiple subnets.	6 (H'06)
Port Object	Describes the communication interfaces that are present on the	244 (H'F4)

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Object Name	Function	Class ID
	device and visible to CIP, including USB, Ethernet/IP and more.	
TCP/IP Interface Object	Provides the mechanism to configure a device’s TCP/IP network interface; examples of configurable items include the device’s IP Address, Network Mask, and Gateway Address.	245 (H’F5)
Ethernet Link Object	Maintains link-specific counters and status information for an IEEE 802.3 communications interface.	246 (H’F6)
X Register	Bit/Word Register	848（H’350）
Y Register	Bit/Word Register	849（H’351）
D Register	Bit/Word Register	850（H’352）
M Register	Bit Register	851（H’353）
S Register	Bit Register	852（H’354）
T Register	Bit/Word Register	853（H’355）
C Register	Bit/Word Register	854（H’356）
HC Register	Bit/Word Register	855（H’357）
SM Register	Bit Register	856（H’358）
SR Register	Word Register	857（H’359）

9.7.2 Data Type

This section provides an overview of the data types supported by objects.

<table>
<tr><th>Data Type</th><th>Description</th></tr>
<tr><td>BOOL</td><td>False(H’00) or True(H’01)</td></tr>
<tr><td>SIGNED INTEGER</td><td>SINT(1 byte), INT(2 bytes), DINT(4 bytes), LINT(8 bytes)
<table>
<tr><th>Number</th><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th><th>7th</th><th>8th</th></tr>
<tr><td>SINT</td><td>0LSB</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>INT</td><td>0LSB</td><td>1LSB</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>DINT</td><td>0LSB</td><td>1LSB</td><td>2LSB</td><td>3LSB</td><td></td><td></td><td></td><td></td></tr>
<tr><td>LINT</td><td>0LSB</td><td>1LSB</td><td>2LSB</td><td>3LSB</td><td>4LSB</td><td>5LSB</td><td>6LSB</td><td>7LSB</td></tr>
</table>
Example: DINT value = H’12345678
<table>
<tr><th>Number</th><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th></tr>
<tr><td>DINT</td><td>78</td><td>56</td><td>34</td><td>12</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Data Type</th><th>Description</th></tr>
<tr><td>UNSIGNED INTEGER</td><td>
USINT(1 byte), UINT(2 bytes), UDINT(4 bytes), ULINT(8 bytes)
Ex: UDINT value = H’AABBCCDD
<table>
<tr><th>Number</th><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th></tr>
<tr><td>UDINT</td><td>DD</td><td>CC</td><td>BB</td><td>AA</td></tr>
</table>
</td></tr>
<tr><td>STRING</td><td>
ASCII CODES, 1 or 2 bytes/words
STRING: 2 bytes character count + 1 byte character
<table>
<tr><th></th><th colspan="2">Contents (Char count)</th><th colspan="4">Contents (String contents)</th></tr>
<tr><td>STRING</td><td>04</td><td>00</td><td>4D</td><td>69</td><td>6C</td><td>6C</td></tr>
</table>
STRING2: 2 bytes character count + 2 byte character
<table>
<tr><th></th><th colspan="2">Contents (Char count)</th><th colspan="8">Contents (String contents)</th></tr>
<tr><td>STRING2</td><td>04</td><td>00</td><td>4D</td><td>00</td><td>69</td><td>00</td><td>6C</td><td>00</td><td>6C</td><td>00</td></tr>
</table>
SHORT_STRING: 1 bytes character count + 1 byte character
<table>
<tr><th></th><th>Contents (Char count)</th><th colspan="4">Contents (String contents)</th></tr>
<tr><td>STRING</td><td>04</td><td>4D</td><td>69</td><td>6C</td><td>6C</td></tr>
</table>
</td></tr>
<tr><td>Fixed LENGTH BIT STRING</td><td>
BYTE (1 byte), WORD (2 bytes), DWORD (4 bytes), LWORD (8 bytes)
<table>
<tr><th></th><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th><th>7th</th><th>8th</th></tr>
<tr><td>Byte</td><td>7…0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>WORD</td><td>7…0</td><td>15…8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>DWORD</td><td>7…0</td><td>15…8</td><td>23…16</td><td>31…24</td><td></td><td></td><td></td><td></td></tr>
<tr><td>LWORD</td><td>7…0</td><td>15…8</td><td>23…16</td><td>31…24</td><td>39…32</td><td>47…40</td><td>55…48</td><td>63…56</td></tr>
</table>
</td></tr>
<tr><td>STRINGI</td><td>
A single string consists of multiple language representation
<table>
<tr><th>Name</th><th>Data Type</th><th>Meaning</th></tr>
<tr><td>Number</td><td>USINT</td><td>The number of internationalized character strings</td></tr>
<tr><td>Strings</td><td>Array of:
Struct of:</td><td>Array of individual internationalized character strings</td></tr>
<tr><td>LanguageChar1</td><td>USINT</td><td>The first ASCII character of the ISO 639-2/T language</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Data Type</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><td>LanguageChar2</td><td>USINT</td><td>The second ASCII character of the ISO 639-2/T language</td></tr>
<tr><td>LanguageChar3</td><td>USINT</td><td>The third ASCII character of the ISO 639-2/T language</td></tr>
<tr><td>CharStringStruct</td><td>USINT</td><td>The structure of the character string, limited to the Elementary Data type value 0xD0 (STRING), 0xD5 (STRING2), 0xD9 (STRINGN) and 0xDA (SHORT_STRING)</td></tr>
<tr><td>CharSet</td><td>UINT</td><td>The character set which the character string is based on which comes from IANA MIB Printer Code (RFC 1759).</td></tr>
<tr><td>International String</td><td>Defined in CharStringStruct</td><td>An array of 8-bit octet elements which is the actual international character string</td></tr>
</table>
ISO 639-2/T language:
<table>
<tr><th>Language</th><th>First Character</th><th>Second Character</th><th>Third Character</th></tr>
<tr><td>English</td><td>e</td><td>n</td><td>G</td></tr>
<tr><td>French</td><td>f</td><td>r</td><td>e</td></tr>
<tr><td>Spanish</td><td>s</td><td>p</td><td>a</td></tr>
<tr><td>Italian</td><td>i</td><td>t</td><td>a</td></tr>
</table>
</td></tr>
<tr><td>STRUCT</td><td>
STRUCT of: Composed of any data types.
Ex.: STRUCT of { BOOL, UINT, DINT } = { TRUE, H’1234, H’56789ABC }
<table>
<tr><th></th><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th><th>7th</th></tr>
<tr><td>Byte</td><td>01</td><td>34</td><td>12</td><td>BC</td><td>9A</td><td>78</td><td>56</td></tr>
</table>
</td></tr>
<tr><td>ARRAY</td><td>
Array of: Composed of one data type.
Ex.: ARRAY of UINTs = { 1，2，3 }
<table>
<tr><th>Number</th><th>1st</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th></tr>
<tr><td>Array</td><td>01</td><td>00</td><td>02</td><td>00</td><td>03</td><td>00</td></tr>
</table>
</td></tr>
<tr><td>EPATH</td><td>A path that consists of multiple segments and references the class, instance and attribute of another object.
Example：Identity Object, Instance attribute 5 = “ 20 01 24 01 30 05 “</td></tr>
</table>

9.7.3 Identity Object (Class ID: 01 Hex)

This object stores identity information that consists of the Vendor ID, Device Type, Product Code and Major Revision for your device.

- Service Code

Service code	Service Name	Attribute		Description
		Class Attribute	Instance Attribute	
H'01	Get_Attributes_All	X	V	Read all attributes
H'05	Reset	X	V	Resets the drive to the start-up state.
H'0E	Get_Attribute_Single	V	V	Read one attribute

- Class
  - Class ID: H'01

- Instance
  - H'00: Class Attribute
  - H'01: Instance Attribute
  - When Instance = 0, the Class Attributes are listed below.

Class Attribute	Name	Access Rule	Data Type	Values	Description
H'01	Revision	Get	UINT	H'1	Revision of this object
H'02	Max Instance	Get	UINT	H'1	Maximum instance number of this object
H'03	Number of Instance	Get	UINT	H'1	Number of object instances currently created at this class level of the device

- When Instance = 0, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'01	Vendor ID	Get	UINT	H'31F	Delta Electronics, Inc.
H'02	Device Type	Get	UINT	H'0C	Communication Adapter

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'03	Product Code	Get	UINT	H'4000	Product Code
H'04	Revision	Get	STRUCT	--	Revision of this device: Major / Minor
	Major Revision		USINT	H'01	Major Revision Range: H'01–H'7F
	Minor Revision		USINT	H'01	Minor Revision Range: H'01–H'FF
H'05	Status	Get	WORD	H'00	Status, refer to the following *1 table
H'06	Serial Number	Get	UDINT	H'abcd	The last 4 characters of the MAC address, ab:cd
H'07	Product Name	Get	STRING	Device name	The maximum length of a product name is 32 characters.

***1 Status Description (H'05)**

Bit (s)	Name	Description
0	Owned	Does the device has an owner connection?. 0: No 1: Yes
1	Reserved	0，Always OFF
2	Configured	Is the device configured? 0: No 1: Yes
3	Reserved	0，Always OFF
4-7	Extended Device Status	0: Self-testing 1: Firmware update 2: At least one faulted I/O connection 3: No I/O connections established 4: Non-volatile configuration error 5: Major fault 6: At least one I/O connection in run mode 7: At least one I/O connection established, all in idle mode. 8-15: Reserved

Bit (s)	Name	Description
8	Minor Recoverable Fault	0: No minor recoverable fault detected 1: Minor recoverable fault detected
9	Minor Unrecoverable Fault	0: No minor unrecoverable fault detected 1: Minor unrecoverable fault detected
10	Major Recoverable Fault	0: No major recoverable fault detected 1: Major recoverable fault detected
11	Major Unrecoverable Fault	0: No major unrecoverable fault detected 1: Major unrecoverable fault detected

9.7.4 Message Router Object (Class ID: 02 Hex)

This object provides a messaging connection point through which a client may address a service to any object class or instance residing in the physical device.

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	V	V	Read a single attribute

- Class
  - Class ID: H’02
- Instance
  - H’00: Class Attribute
  - H’01: Instance Attribute
  - When Instance = 0, the Class Attributes are listed below.

Class Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Revision	Get	UINT	H’01	Revision of this object

  - When Instance = 0, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’02	Number Available	Get	UINT	H’0	The maximum number of connections

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’03	Number Active	Get	UINT	H’0	The number of connected connections

9.7.5 Assembly Object (Class ID: 04 Hex)

This object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection and can be used to bind input data or output data.

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	V	V	Read a single attribute
H’10	Set_Attribute_Single	X	V	Edit a single attribute

- Class
    - Class ID：H’04
- Instance
    - H’00：Class Attribute
    - H’64：I/O Connection Output 1
    - H’65：I/O Connection Input 1
    - H’66：I/O Connection Output 2
    - H’67：I/O Connection Input 2
    - H’72：I/O Connection Output 8
    - H’73：I/O Connection Input 8
    - H’74-H’7A Reserved
    - H’80：Configuration 1
    - H’81：Configuration 2
    - H’87：Configuration 8
    - H’C：Listen-Only Connection Number

- When Instance = 0, the Class Attributes are listed below.

Class Attribute	Name	Access Rule	Data Type	Values	Description
H'01	Revision	Get	UINT	H'2	Revision of this object
H'02	Max Instance	Get	UINT	H'C7	The maximum number of instances

- When Instance = 64–87, the Instance Attributes are listed below. (Length of input and output is editable. The maximum length is 250 words; supports only even bytes)

I/O Message Connection			
Connection No.	**Function**	**Instance Attribute**	**Length**
Connection 1	Input (T→O)	0x65	D1000~D1099
	Output (O→T)	0x64	D0~D99
	Configuration	0x80	Refer to the table below
Connection 2	Input (T→O)	0x67	D1100~D1199
	Output (O→T)	0x66	D100~D199
	Configuration	0x81	Refer to the table below
Connection 3	Input (T→O)	0x69	D1200~D1299
	Output (O→T)	0x68	D200~D299
	Configuration	0x82	Refer to the table below
Connection 4	Input (T→O)	0x6B	D1300~D1399
	Output (O→T)	0x6A	D300~D399
	Configuration	0x83	Refer to the table below
Connection 5	Input (T→O)	0x6D	D1400~D1499
	Output (O→T)	0x6C	D400~D499
	Configuration	0x84	Refer to the table below
Connection 6	Input (T→O)	0x6F	D1500~D1599
	Output (O→T)	0x6E	D500~D599
	Configuration	0x85	Refer to the table below
Connection 7	Input (T→O)	0x71	D1600~D1699
	Output (O→T)	0x70	D600~D699

	Configuration	0x86	Refer to the table below
Connection 8	Input (T→O)	0x73	D1700~D1799
	Output (O→T)	0x72	D700~D799
	Configuration	0x87	Refer to the table below

Configure the contents of input and output to edit the mapping address.

Configuration Address	Data Type	Contents	Defaults (Connection 1)
Word[0]	UINT	Input corresponding element 0: D, 1:X, 2: Y	0
Word[1]	UINT	Reserved	200
Word[2-3]	DWORD	Input corresponding element number	1000
Word[4]	UINT	Output corresponding element 0: D, 2: Y	0
Word[5]	UINT	Reserved	200
Word[6-7]	DWORD	Output corresponding element number	0

9.7.6 Connection Manager Object (Class ID: 06 Hex)

Use this object for connection and connectionless communications, including establishing connections across multiple subnets.

- Service Code

Service Code	**Service Name**	**Support**		**Description**
		Class Attribute	**Instance Attribute**	
H’0E	Get_Attribute_Single	V	X	Read a single attribute
H’4E	Forward_Close	X	V	Close a connection
H’54	Forward_Open	X	V	Open a connection; the maximum data size is 511 bytes.

- Class
  - Class ID：H’06

- Instance
  - H’00：Class Attribute
  - H’01：Instance Attribute

- When Instance = 0, the Class Attributes are listed below.

Class Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Revision	Get	UINT	1	Revision of this object
H’02	Max Instance	Get	UINT	1	Maximum instance number of this object

- When Instance = 1, the Instance Attributes are listed below.

Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Open Requests	Get	UINT	H’0	Number of Forward Open service requests received.
H’02	Open Format Rejects	Get	UINT	H’0	Number of Forward Open service requests that were rejected due to bad format.
H’03	Open Resources Rejects	Get	UINT	H’0	Number of Forward Open service requests that were rejected due to lack of resources.
H’04	Open Other Rejects	Get	STRUCT	H’0	Number of Forward Open service requests that were rejected for reasons other than bad format or lack of resources.
H’05	Close Requests	Get	WORD	H’0	Number of Forward Close service requests received.
H’06	Close Format Rejects	Get	UDINT	H’0	Number of Forward Close service requests that were rejected due to bad format.

Attribute	Name	Access Rule	Data Type	Values	Description
H’07	Close Other Rejects	Get	STRING	H’0	Number of Forward Close service requests that were rejected for reasons other than bad format.
H’08	Connection Timeouts	Get	UINT	H’0	Total number of connection timeouts that have occurred in connections controlled by this Connection Manager.

9.7.7 Port Object (Class ID: F4 Hex)

This section describes the communication interfaces that are present on the device and visible to CIP, including USB, EtherNet/IP and more.

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’01	Get_Attributes_All	X	V	Returns a predefined listing of this objects’ attributes
H’0E	Set_Attribute_Single	V	V	Returns the contents of the specified attribute.

- Class
  - Class ID：H’F4

- Instance
  - H’00：Class Attribute
  - H’01：Instance Attribute
  - H’N: Instance #N Attribute, the number of the Ethernet port

  - When Instance = 0, the Class Attributes are listed below.

9

Class Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Revision	Get	UINT	1	Revision of this object
H’02	Max Instance	Get	UINT	1	Maximum instance number of this object
H’03	Number of Instance	Get	UINT	1	Number of object instances currently created at this class level of the device
H’08	Entry Port	Get	UINT	1	Communication port for EtherNet/IP
H’09	Port Instance Info	Get	ARRAY of STRUCT of	--	Port Instance information: Port Type + Port Number
	Port Type		UINT	H’04	EtherNet/IP, refer to the following *1
	Port Number		UINT	H’01	Identifies each communication port

- When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Port Type	Get	UINT	H’04	EtherNet/IP, refer to the following *1
H’02	Port Number	Get	UINT	H’01	Identifies each communication port
H’03	Link Object	Get	STRUCT of	--	Identifies Object attached to this port. Path length + Link Path
	Path Length		UINT	--	Path length
	Link Path		EPATH	--	Path segment
H’04	Port Name	Get	SHORT_ STRING	EIP1	Name of the communication port
H’07	Port Number and Node Address	Get	EPATH	01 01	Communication port number and node number of this device on port.

***1 Communication Port Type**

Communication Port Type	Description
1	Self-defined
2	ControlNet
3	ControlNet Redundant
4	EtherNet/IP
5	DeviceNet
201	Modbus/TCP
203	SERCOS III

9.7.8 TCP/IP Interface Object (Class ID: F5 Hex)

This object provides the mechanism to configure a device's TCP/IP network interface. Examples of configurable items include the device's IP Address, Network Mask, and Gateway Address.

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H'01	Get_Attributes_All	X	V	Read all attributes
H'0E	Get_Attribute_Single	V	V	Read one attribute
H'10	Set_Attribute_Single	X	V	Write one attribute

- Class
  - Class ID = H'F5
- Instance
  - H'00：Class Attribute
  - H'01：Instance Attribute
  - H'N: Instance #N Attribute, number of IP addresses that the device supported
  - When Instance = 0, the Class Attributes are listed below.

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Class Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Revision	Get	UINT	H’2	Revision of this object
H’02	Max Instance	Get	UINT	H’2	Maximum instance number of this object
H’03	Number of Instance	Get	UINT	H’2	Number of object instances currently created at this class level of the device

- When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Status	Get	DWORD	H’2	IP status, refer to the following *1
H’02	Configuration Capability	Get	DWORD	H’15	Configuration capability, refer to the following *2
H’03	Configuration Control	Get/Set	DWORD	H’0	Configuration Control, refer to the following *3
H’04	Physical Link Object：	Get	STRUCT of	--	Path to physical link object
	Path Size		UINT	H’0	Size of Path
	Path		EPATH	--	Logical segments identifying the physical link object
H’05	Interface Configuration：	Get/Set	STRUCT of	--	TCP/IP network interface configuration.
	IP Address		UDINT	H’C0A80005	The device’s IP address; 192.168.1.5
	Network Mask		UDINT	H’FFFFFF00	The device’s network mask: 255.255.255.0
	Gateway Address		UDINT	H’C0A80001	Default gateway address: 192.168.0.1
	Name Server		UDINT	0	Primary name server
	Name Server 2		UDINT	0	Secondary name server
	Domain Name		STRING	00 00	Default domain name

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'06	Host Name	Get/Set	STRING	Device name	Device name
H'13	Encapsulation Inactivity Timeout	Get/Set	UINT	120	EIP device active connection time; unit:0-3600 seconds

***1 Interface Status**

Status	Description
0	The Interface Configuration attribute has not been configured.
1	The Interface Configuration attribute contains valid configuration obtained from BOOTP, DHCP or non-volatile memory.
2	The Interface Configuration attribute contains valid configuration obtained from hardware.

***2 Interface Capability Flags**

Bit	Description
0	BOOTP Client
1	DNS Client
2	DHCP Client
3	DHCP-DNS Update
4	Configuration Settable
5	Hardware Configurable
6	Interface Configuration Change Requires Reset

***3 Interface Configuration Control**

Status	Description
0	The device uses the interface configuration values previously stored (for example, in non-volatile memory or through hardware switches).
1	The device obtains its interface configuration values through BOOTP.
2	The device obtains its interface configuration values through DHCP on start-up.

9.7.9 Ethernet Link Object (Class ID: F6 Hex)

This object maintains link-specific counters and status information for an IEEE 802.3 communications interface.

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’01	Get_Attributes_All	X	V	Read all attributes
H’0E	Get_Attributes_Single	V	V	Read one attribute

- Class
  - Class ID: H’F6

- Instance
  - H’00: Class Attribute
  - H’01: Instance Attribute
  - H’N: Instance #N Attribute, the number of the Ethernet port

  - When Instance = 0, the Class Attributes are listed below.

Class Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Revision	Get	UINT	H’03	Revision of this object
H’02	Max Instance	Get	UINT	H’021	Maximum instance number of this object
H’03	Number of Instance	Get	UINT	H’01	Number of object instances currently created at this class level of the device

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- When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’01	Interface Speed	Get	DWORD	H’64	Interface speed currently in use 10(H’0A), 100(H’64), 1000(H’3E8) Mbps
H’02	Interface Flags	Get	DWORD	H’F	Ethernet port status, refer to the following *1
H’03	Physical Address	Get	ARRAY of 6 USINTs	By Product	MAC address
H’0A	Interface Label	Get	SHORT_STRING	NA	Define the name of the Ethernet port For example: for port 1, the definition of the name in string is 01 31.
	Length		USINT	NA	The maximum length of the name is 16 words.
	Interface name		SHORT_STRING	NA	Use ASCII characters to name the Ethernet port name.
H’0B	Interface Capability	Get	STRUCT of:	--	Ethernet interface capability bits table *2
	Capability Bits		DWORD	H’00000007	Ethernet interface capability bits definition
	Speed/Duplex Options		STRUCT of:	--	Ethernet interface capability speed & duplex option definition
	Speed/Duplex Array Count		USINT	H’04	Ethernet interface capability speed & duplex array count
	Speed/Duplex Array		ARRAY of STRUCT of:	--	Ethernet interface capability speed & duplex array contents
	Interface Speed		UINT	NA	Ethernet interface speed; ex: H’0A: 10 bps and H’64: 100 bps
	Interface Duplex Mode		USINT	NA	Ethernet interface duplex mode; H’00: duplex mode and H’01: full duplex mode

***1 Interface Flag Table**

Bit (s)	Name	Description
0	Link Status	0 indicates an inactive link 1 indicates an active link
1	Half/Full Duplex	0 indicates half duplex 1 indicates full duplex
2-4	Negotiation Status	0：Auto-negotiation in progress 1：Auto-negotiation and speed detection failed 2：Auto negotiation failed but detected speed 3：Successfully negotiated speed and duplex 4：Auto-negotiation not attempted. Forced speed and duplex.
5	Manual Setting Requires Reset	Set to zero
6	Local Hardware Fault	0: the interface detects no local hardware fault 1: a local hardware fault is detected
7-31	Reserved	0

※2 Interface Capability Bits

Bits	Item	Description
0	Manual Setting Requires Reset	Indicates if the device requires a reset when instance attribute #6 (Interface Control attribute) changes. 0 indicates the device does not require a reset 1 indicates the device requires a rest
1	Auto-negotiate	0 indicates the interface does not support auto-negotiation 1 indicates the interface supports auto-negotiation
2	Auto-MDIX	0 indicates the interface does not support auto MDIX operation 1 indicates the interface supports auto MDIX operation
3	Manual Speed/Duplex	0 indicates the interface does not support speed/duplex setting. (Instance attribute #6, Interface Control attribute) 1 indicates the interface supports speed/duplex setting
4-31	Reserved	Should be 0

9.7.10 X Register (Class ID: 350 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’32	Read_Parameter	X	V	Read Parameter

- Class
  - Class ID：H’350
- Instance
  - H’01：Instance Attribute, Bit Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	X0	Get	BOOL	H’00	X0 bit register
H’01	X1	Get	BOOL	H’00	X1 bit register
H’02~H’FE	X2~X376	Get	BOOL	H’00	X2 –X376 bit register
H’FF	X377	Get	BOOL	H’00	X3377 bit register

9.7.11 Y Register (Class ID: 351 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute
H’32	Read_Parameter	X	V	Read Parameter

H’33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H’351

- Instance
  - H’01：Instance Attribute, Bit Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	Y0	Set	BOOL	H’00	Y0 bit register
H’01	Y1	Set	BOOL	H’00	Y1 bit register
H’02~H’0FE	Y2~Y376	Set	BOOL	H’00	Y2-Y376 bit register
H’FF	Y377	Set	BOOL	H’00	Y377 bit register

9.7.12 D Register (Class ID: 352 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute
H’32	Read_Parameter	X	V	Read Parameter
H’33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H’352
- Instance
  - H’01：Instance Attribute, Bit Register
  - H’02：Instance Attribute, Word Register

- When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	D0.0	Set	BOOL	H’00	D0.0 bit register
H’01	D0.1	Set	BOOL	H’00	D0.1 bit register
H’02-H’752FE	D0.2-D29999.14	Set	BOOL	H’00	D0.2-D29999.14 bit register
H’752FF	D29999.15	Set	BOOL	H’00	D29999.15 bit register

- When Instance = 2, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	D0	Set	INT	H’00	D0 word register
H’01	D1	Set	INT	H’00	D1 word register
H’02-H’752E	D2-D29998	Set	INT	H’00	D2-D29998 word register
H’752F	D29999	Set	INT	H’00	D29999 word register

9.7.13 M Register (Class ID: 353 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute
H’32	Read_Parameter	X	V	Read Parameter
H’33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H’353
- Instance
  - H’01：Instance Attribute, Bit Register

- When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'00	M0	Set	BOOL	H'00	M0 bit register
H'01	M1	Set	BOOL	H'00	M1 bit register
H'02-H'1FFE	M2-M8190	Set	BOOL	H'00	M2-M8190 bit register
H'1FFF	M8191	Set	BOOL	H'00	M8191 bit register

9.7.14 S Register (Class ID: 354 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H'0E	Get_Attribute_Single	X	V	Read one attribute
H'10	Set_Attribute_Single	X	V	Write one attribute
H'32	Read_Parameter	X	V	Read Parameter
H'33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H'354

- Instance
  - H'01：Instance Attribute, Bit Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'00	S0	Set	BOOL	H'00	S0 bit register
H'01	S1	Set	BOOL	H'00	S1 bit register
H'02-H'7FE	S2-S2046	Set	BOOL	H'00	S2-S2046 bit register
H'7FF	S2047	Set	BOOL	H'00	S2047 bit register

9.7.15 T Register (Class ID: 355 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H'0E	Get_Attribute_Single	X	V	Read one attribute
H'10	Set_Attribute_Single	X	V	Write one attribute
H'32	Read_Parameter	X	V	Read Parameter
H'33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H'355

- Instance
  - H'01：Instance Attribute, Bit Register
  - H'02：Instance Attribute, Word Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'00	T0	Set	BOOL	H'00	T0 bit register
H'01	T1	Set	BOOL	H'00	T1 bit register
H'02-H'1FE	T2-T510	Set	BOOL	H'00	T2-T510 bit register
H'1FF	T511	Set	BOOL	H'00	T511 bit register

  - When Instance = 2, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'00	T0	Set	INT	H'00	T0 word register
H'01	T1	Set	INT	H'00	T1 word register
H'02-H'1FE	T2-T510	Set	INT	H'00	T2-T510 word register
H'1FF	T511	Set	INT	H'00	T511 word register

9.7.16 C Register (Class ID: 356 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute
H’32	Read_Parameter	X	V	Read Parameter
H’33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H’356

- Instance
  - H’01：Instance Attribute, Bit Register
  - H’02：Instance Attribute, Word Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	C0	Set	BOOL	H’00	C0 bit register
H’01	C1	Set	BOOL	H’00	C1 bit register
H’02-H’1FE	C2-C510	Set	BOOL	H’00	C2-C510 bit register
H’1FF	C511	Set	BOOL	H’00	C511 bit register

- When Instance = 2, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	C0	Set	INT	H’00	C0 word register
H’01	C1	Set	INT	H’00	C1 word register
H’02-H’1FE	C2-C510	Set	INT	H’00	C2-C510 word register
H’1FF	C511	Set	INT	H’00	C511 word register

9.7.17 HC Register (Class ID: 357 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute
H’32	Read_Parameter	X	V	Read Parameter
H’33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H’357

- Instance
  - H’01：Instance Attribute, Bit Register
  - H’02：Instance Attribute, Word Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	HC0	Set	BOOL	H’00	HC0 bit register
H’01	HC1	Set	BOOL	H’00	HC1 bit register
H’02-H’FE	HC2-HC254	Set	BOOL	H’00	HC2-HC254 bit register
H’FF	HC255	Set	BOOL	H’00	HC255 bit register

  - When Instance = 2, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	HC0	Set	DINT	H’00	HC0 word register
H’01	HC1	Set	DINT	H’00	HC1 word register
H’02-H’FE	HC2-HC254	Set	DINT	H’00	HC2-HC254 word register
H’FF	HC255	Set	DINT	H’00	HC255 word register

9.7.18 SM Register (Class ID: 358 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute
H’32	Read_Parameter	X	V	Read Parameter
H’33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H’358

- Instance
  - H’01：Instance Attribute, Bit Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H’00	SM0	Set	BOOL	H’00	SM0 bit register
H’01	SM1	Set	BOOL	H’00	SM1 bit register
H’02~H’FFE	SM2~SM4095	Set	BOOL	H’00	SM2-SM4095 bit register
H’FFF	SM4096	Set	BOOL	H’00	SM4096 bit register

9.7.19 SR Register (Class ID: 359 Hex)

- Service Code

Service Code	Service Name	Support		Description
		Class Attribute	Instance Attribute	
H’0E	Get_Attribute_Single	X	V	Read one attribute
H’10	Set_Attribute_Single	X	V	Write one attribute

H'32	Read_Parameter	X	V	Read Parameter
H'33	Write_Parameter	X	V	Write Parameter

- Class
  - Class ID：H'359

- Instance
  - H'01：Instance Attribute, Bit Register
  - When Instance = 1, the Instance Attributes are listed below.

Instance Attribute	Name	Access Rule	Data Type	Values	Description
H'00	SR0	Set	INT	H'00	SR0 word register
H'01	SR1	Set	INT	H'00	SR1 word register
H'02-H'7FE	SR2-SR2046	Set	INT	H'00	SR2-SR2046 word register
H'7FF	SR2047	Set	INT	H'00	SR2047 word register

9.8 Delta EIP Product List

9.8.1 Delta EIP Products

Positioning	Product	Firmware Version
Mid-range PLC	AHCPU511-EN, AHCPU521-EN, AHCPU531-EN	V2.00
	AH10EN-5A	V2.00
	AHRTU-ETHN-5A	V1.00
	AH10EMC-5A	V1.00
	DVP-ES3 Series	V1.00
	AS200 Series	V1.00
Small PLC	DVP-ES2-E Series	V1.00
Inverter	VFD-MS300 Series (CMM-EIP01 Communication Card)	V3.60
	VFD-C2000 Series (CMC-EIP01 Communication Card)	V1.06

9.8.2 Delta EIP Products, DLR (Device Level Ring) supported

Positioning	Product	Firmware Version
Mid-range PLC	AH10EN-5A	V2.00
	AHRTU-ETHN-5A	V1.00

9.8.3 Delta EIP Products, Scanner supported

Positioning	Product	Firmware Version
Mid-range PLC	AHCPU511-EN, AHCPU521-EN, AHCPU531-EN	V2.00
	AH10EN-5A	V2.00
Small PLC	AS Series	V1.00
	DVP-ES3 Series	V1.00

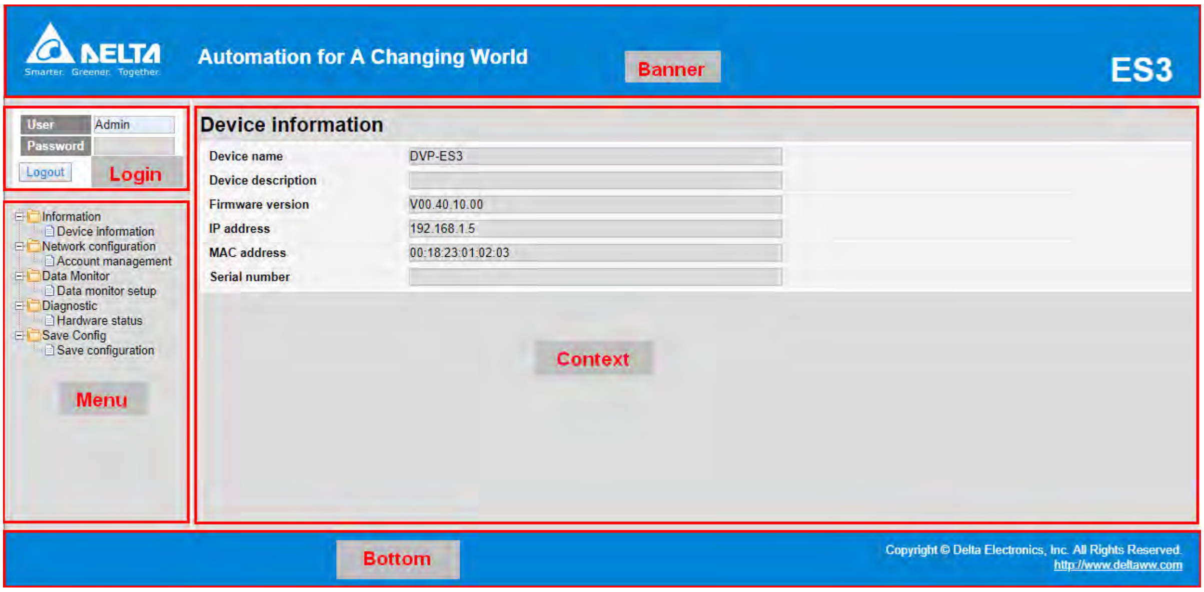
9.9 Operation and Monitor on the Web

9.9.1 Getting Started

You can enter DVP-ES3 Series PLC IP address in the search bar of your browser to connect to your device. After that you can set up and monitor DVP-ES3 Series PLC.

9.9.1.1 Exploring the webpage

After connected to the module, you can see the DVP-ES3 webpage with 5 sections as the image shown below.



Descriptions:

Section	Contents
Banner	Delta logo and the name of the connected device
Login	Username and password
Menu	Sitemap is shown in tree diagram. (The menu shows data based on the permission of the current user.)
Context	Main contents; click an item on the menu section, its content appears here.
Bottom	Copyright information and Delta webpage information

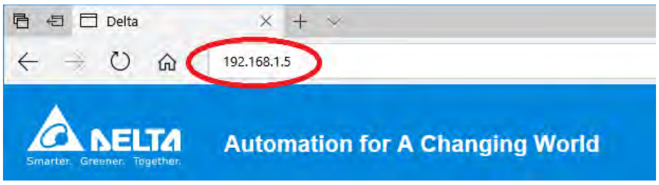
9.9.1.2 Using the Webpage

List of browsers that support DVP-ES3 webpage:

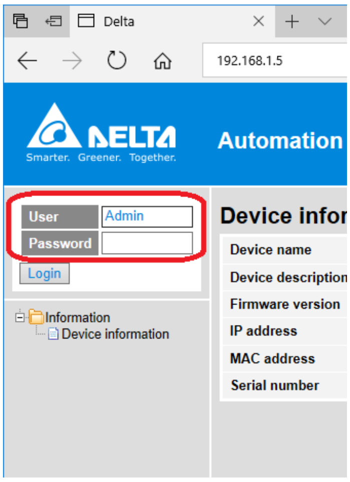
Provider	Browser	Supported versions
Microsoft	Internet Explorer	V10.0 and later
Microsoft	Edge	V20 and later
Google	Chrome	V14 and later
Mozilla	Firefox	V17 and later
Apple	Safari	V5.1 and later

- **Operation Steps:**

a. Open your browser, enter DVP-ES3 IP address in the search bar to connect to DVP-ES3 PLC.



b. After the webpage appears, enter “Admin” in the User section and click Login without entering any password. Set up the password after login to ensure security.

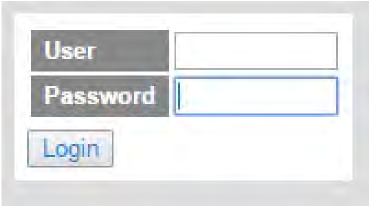


9.9.1.3 Login

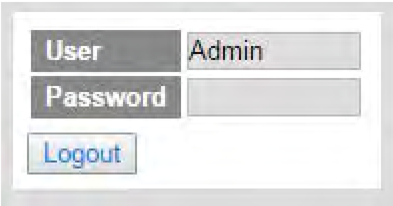
You need to login to your account to set up.

- **Operation Steps:**

a. Provide the login information to login.



b. After login successfully, the user field shows your account name (read only). After setting up, you can click **Logout** here to leave this webpage.



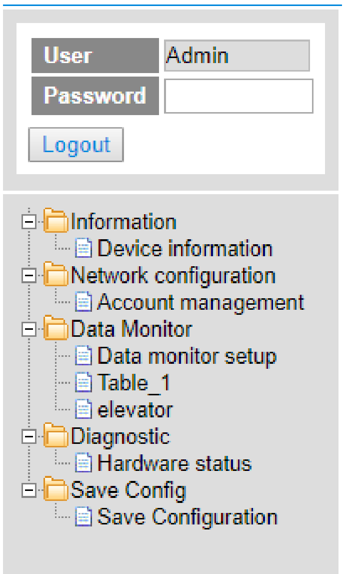
Item	Description
User	Your account name
Password	Your password
“Login” / “Logout”	Login: to enter the webpage Logout: to leave the webpage

9.9.1.4 Menu

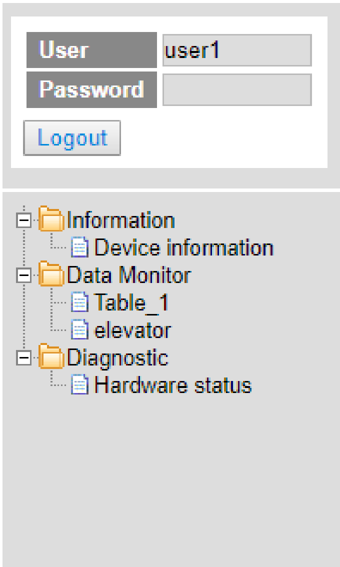
The menu shows data based on the permission of the current user.

Nodes	Permission		
	Administrator	**Write/Read**	**Read**
Device information	V	V	V
Account management	V		
Data monitor setup	V		
Data monitor table 1 - 4	V	V	Read-only
Hardware status	V	Read-only	Read-only
Save configuration	V		

- Log in as an Administrator, the following nodes appear.



- Log in with Write/Read permission, the following nodes appear.

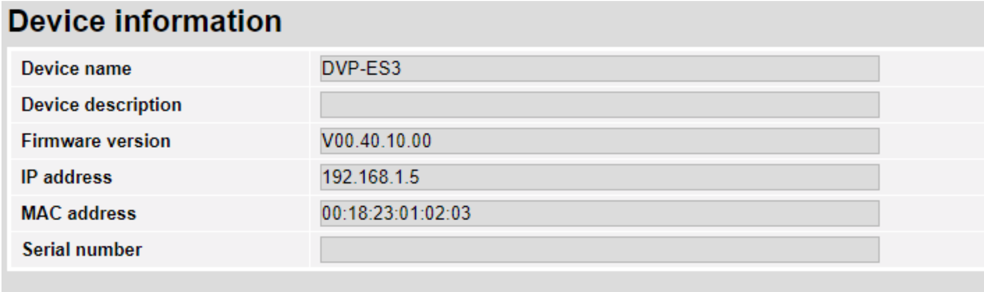


- Log in with Read only permission, the following nodes appear.

9.9.2 Device Information

Here provides DVP-ES3 Series PLC product information.

You do not need to log in to see the device information. This page is read only, not for editing.



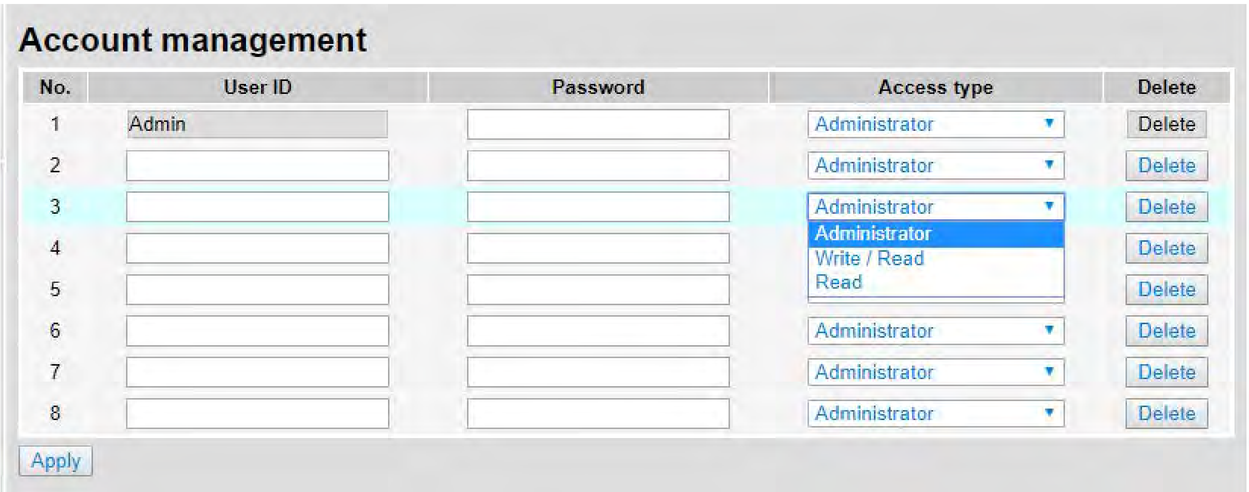
Item	Description
Device name	Product name
Device description	Device description that user defined in ISPsoft
Firmware version	Firmware version
IP address	Product IP address
MAC address	Product MAC address
Serial number	Product serial number

9.9.3 Network configuration

You can set network related configurations here.

9.9.3.1 Account management

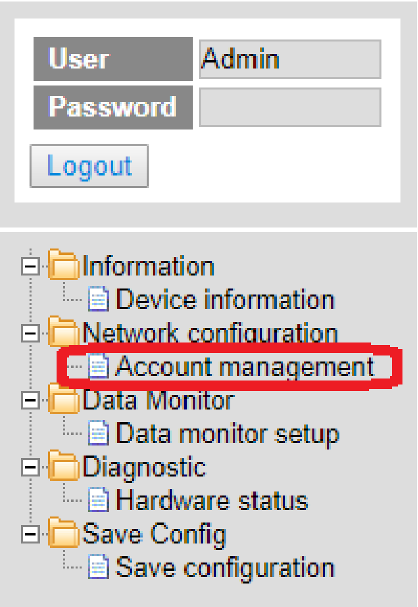
You can set 3 kinds of access types for up to 8 user accounts.



Item	Description
User ID	To name your user ID, you can use up to 16 characters from the following characters, A through Z (case-insensitive), 0 through 9, _ (underscore) , (comma) and . (dot) . ● The first default user ID is "Admin" (read only).
Password	To name your password, you can use up to 16 characters from the following characters, A through Z (case-insensitive), 0 through 9, _ (underscore) , (comma) and . (dot) . ● No password for the default user ID "Admin" (read only), you can set up the password later.
Access type	Administrator: You can set up all parameters and have permission to edit the password and permission. Write/Read: You can open the data monitor pages and the diagnostic page. You can also edit the parameters. Read: You can open the data monitor pages and the diagnostic page. But you cannot edit parameters. ● Default user is "Administrator".
"Delete"	Use "Delete" to clear the user ID and password.
"Apply"	Use "Apply" to save the settings.

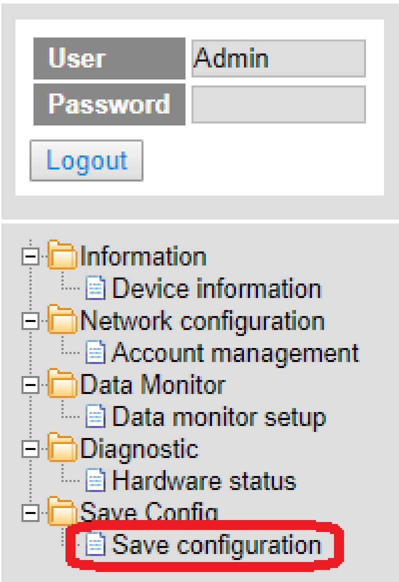
- **Operation Steps:**

a. After log in, double-click **Account management** to open the setting page.

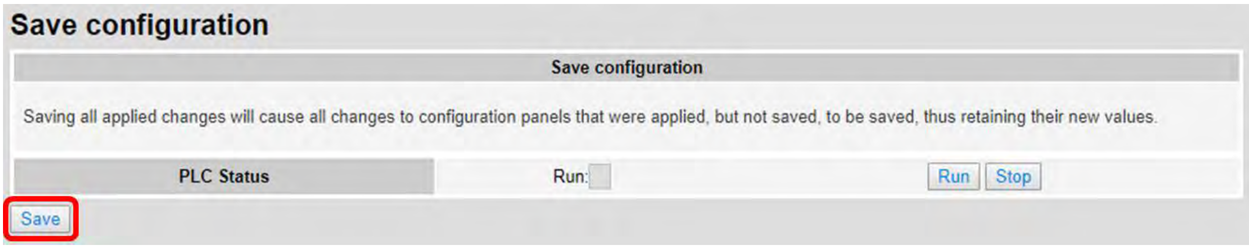


b. Set up the User ID, the password and the access type. After editing, click “Apply” to save the setting or click “Delete” to clear the account.

c. Double-click **Save configuration** to open the setting page.

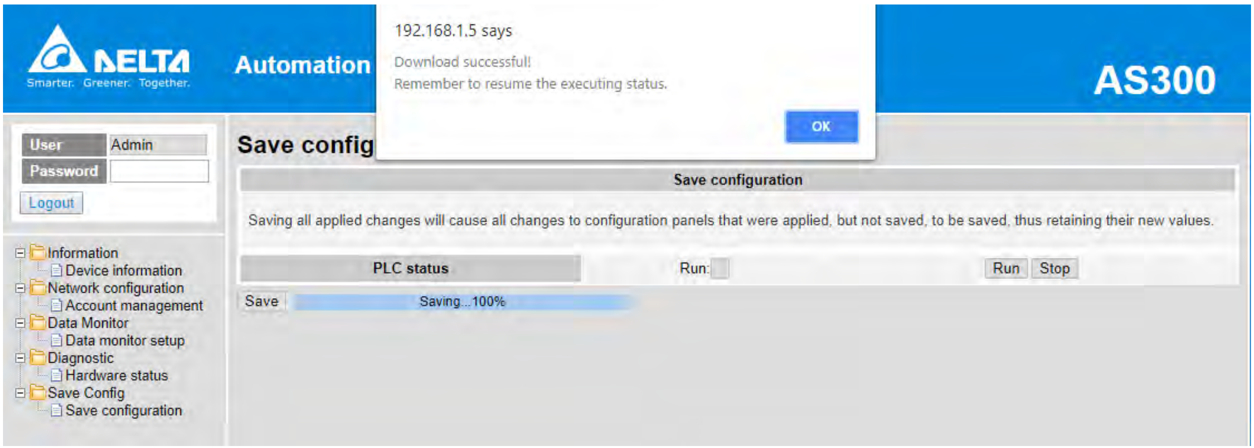


d. Click “Save” to save and download the settings to the device.



9

e. After download is complete, it will be prompted with a Download successful message.

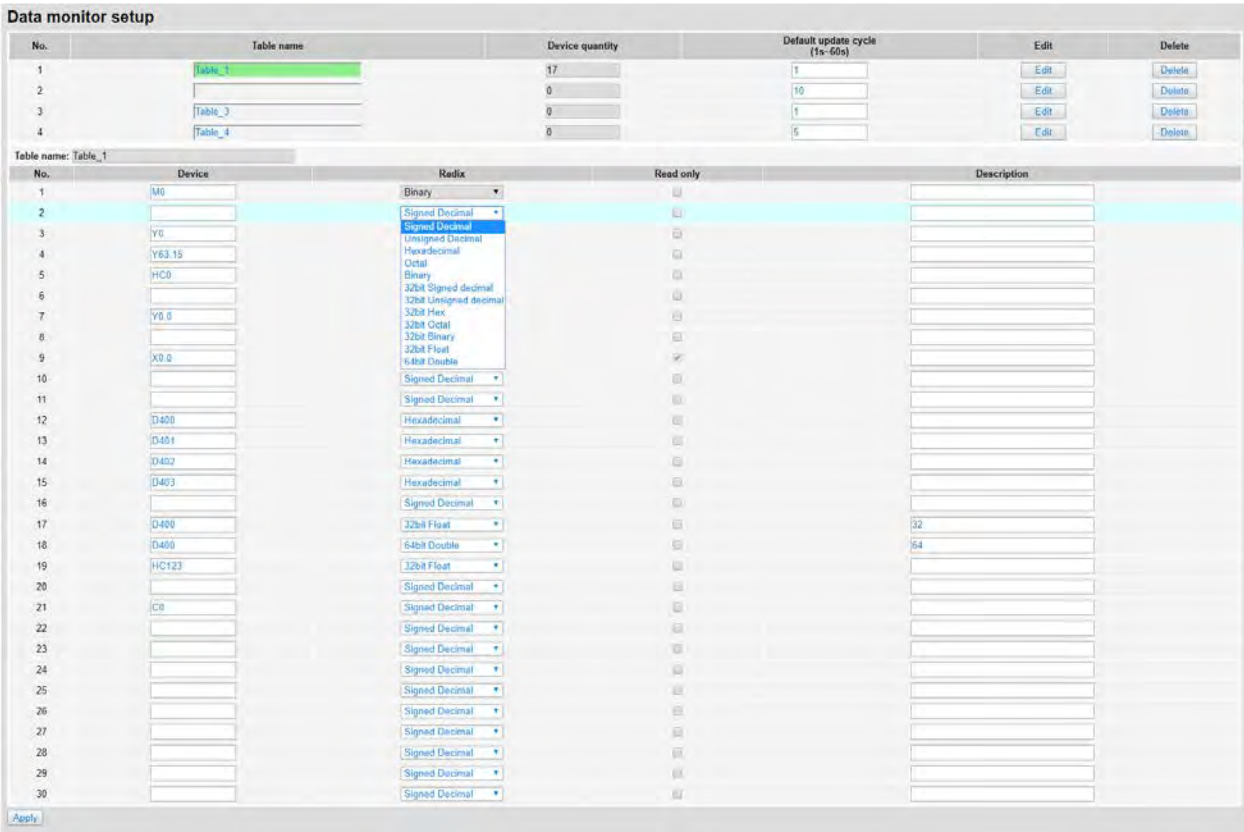


9.9.4 Data Monitoring

You can set monitoring related configurations here.

9.9.4.1 Data Monitoring Setup Page

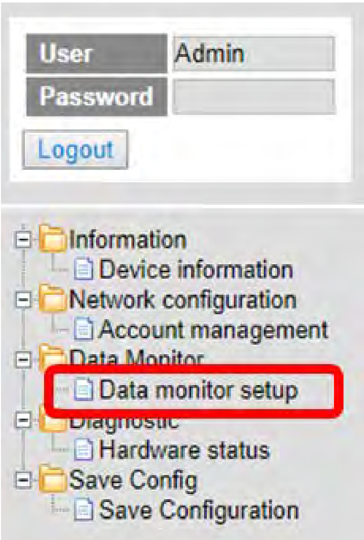
You can set up 4 pages of monitoring data and up to 30 items can be monitored on each page.



Item	Description
Table name	To name your table, you can use up to 16 characters from the following characters, A through Z (case-insensitive), 0 through 9, _ (underscore) , (comma) and . (dot) .
Device quantity	Device quantity to be monitored; default: read only
Default update cycle	Set up the updated cycle time; default: 5 seconds; unit: second
"Edit"	Click "Edit" to edit the table and the table name column turns green. The table contents appear below.
"Delete"	Click "Delete" to delete the table and its contents.
Device	Devices to be monitored; you can enter the following devices to monitor xX, yY, mM, sSmM, sSrR, dD, sS, tT, cC, hHcC and eE.
Radix	Positional numeral system to be shown on the monitoring page; available formats are Signed decimal, Unsigned decimal, Hexadecimal, Octal, Binary, 32bit Signed decimal, 32bit Unsigned decimal, 32bit Hexadecimal, 32bit Octal, 32bit Binary, 32bit Float and 64bit Double
Read only	Set up the monitored devices to read only or not.
Description	Add a description here for the table.
"Apply"	Click "Apply" to save the settings.

- **Operation Steps:**

a. After log in, double-click **Data monitor setup** to open the setting page.



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b. Use “Edit” to edit the table name, device quantity, and update cycle time.

Data monitor setup

No.	Table name	Device quantity	Default update cycle (1s~60s)	Edit	Delete
1	Table_1	17	1	Edit	Delete
2		0	10	Edit	Delete
3	Table_3	0	1	Edit	Delete
4	Elevator	0	10	Edit	Delete

c. The corresponding table contents appear below.

Table name: Elevator

No.	Device	Radix	Read only	Description
1		Signed Decimal	☐	
2		Signed Decimal	☐	
3		Signed Decimal	☐	
4		Signed Decimal	☐	
5		Signed Decimal	☐	

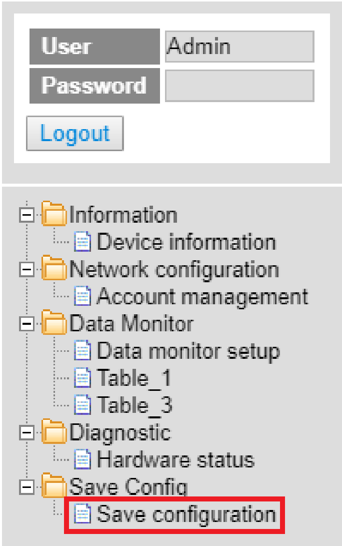
d. Edit the devices to be monitored, radix to be shown, read only or not and the description. After editing, click “Apply” to save the setting.

Table name: Elevator

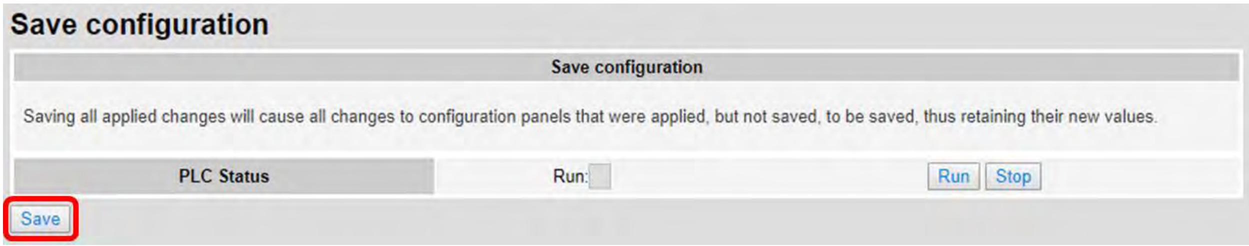
No.	Device	Radix	Read only	Description
1	M0	Binary	☐	
2		Signed Decimal	☐	
3	Y0	Signed Decimal	☐	
4	Y63.15	Binary	☐	
5	HC0	32bit Octal	☐	
6		Signed Decimal	☐	
7	Y0.0	Binary	☐	
8		Signed Decimal	☐	
⋮				
28		Signed Decimal	☐	
29		Signed Decimal	☐	
30		Signed Decimal	☐	

Apply

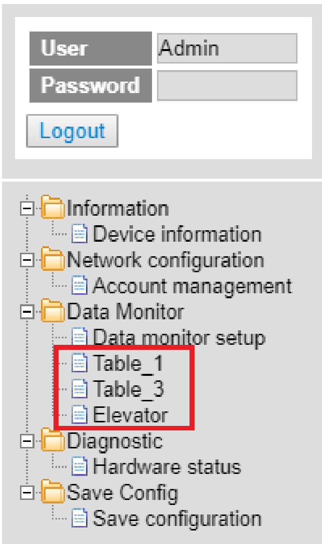
e. Double-click **Save configuration** to open the setting page.



f. Click "Save" to save and download the settings to the device.



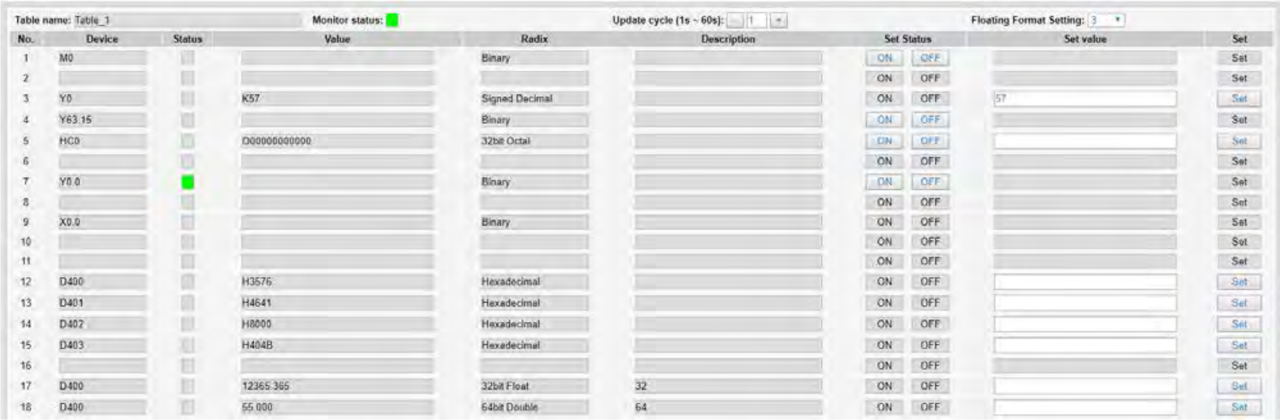
g. Once the download is complete, you can see the newly added table to be monitored under the Data Monitor node.



h. Note: The data monitor table must be downloaded to the device otherwise even if the data monitor table is created, it cannot be monitored.

9.9.4.2 Data Monitor Table Pages

The setting results are shown as below.



Item	Description
Table name	Name of the table; read only
Monitor status	Status of the monitoring; read only Yellow light: reading, Green light: reading complete, Red light: reading error
Update cycle	Update cycle time; default is what you set up in data monitor setup page; unit: second
"-"	Minus; click once to decrease 1; the minimum value is 1
"+"	Plus; click once to increase 1; the maximum value is 60
Floating format setting	Floating point setting; round down; default: round the number down to three decimal places
Device	Devices to be monitored; read only
Radix	Positional numeral system to be shown on the monitoring page; available formats are Signed decimal, Unsigned decimal, Hexadecimal, Octal, Binary, 32bit Signed decimal, 32bit Unsigned decimal, 32bit Hexadecimal, 32bit Octal, 32bit Binary, 32bit Float and 64bit Double
Description	Add a description here for the table; read only
Status	Status of bit; read only Green LED: ON; No LED: OFF
Value	Values in devices to be monitored; read only Signed decimal: K+ Number Unsigned decimal: K+ Number Hexadecimal: H + hex Number Octal: O + octal Number Binary: B + binary Number 32bit Signed decimal: K+ Number

Item	Description
	32bit Unsigned decimal: K+ Number 32bit Hexadecimal: H + hex Number 32bit Octal: O + octal Number 32bit Binary: B + binary Number 32bit Float: float Number 64bit Double: float Number
“On” / ”Off”	“ON”: the status of Bit is ON. “OFF”: the status of Bit is OFF. ● If the authority level for the logged in user is READ, this column is read only.
Set Value	Change the value for the device to be monitored ● Type the value in and click “SET” and the changed value appears in the VALUE column as the image shown above. ● If the authority level for the logged in user is READ, this column is read only.
“Set”	Click “Set” to confirm the changed value. ● If the authority level for the logged in user is READ, this column is read only.

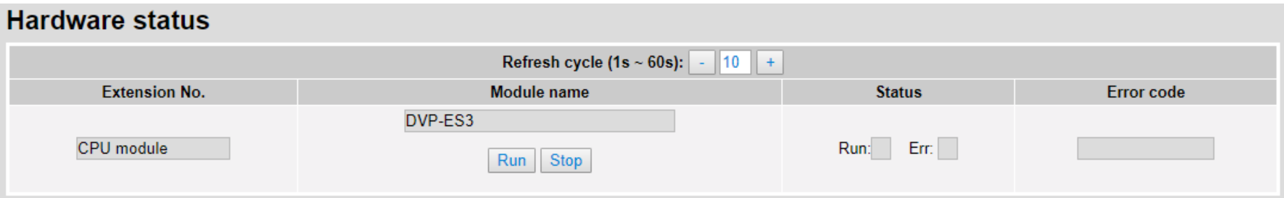
9.9.5 Diagnostic

You can set diagnostic related configurations here.

9.9.5.1 Hardware Status Page

This page displays information on hardware status and CPU module. You can set CPU to run or stop. Here also shows the CPU running status and error codes.

● For DVP-ES3 Series, the hardware status page looks like below.



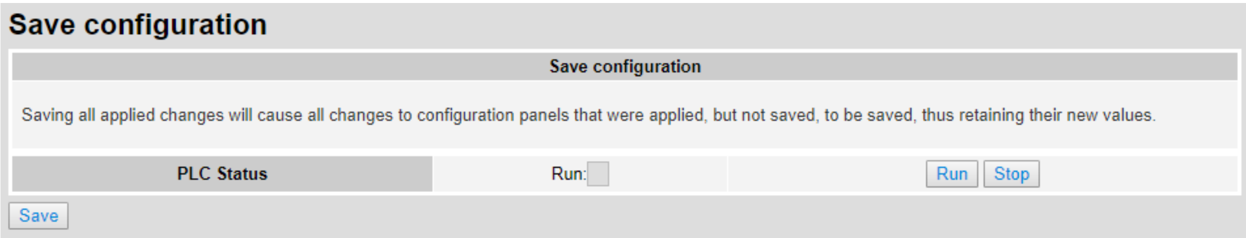
Item	Description
Refresh cycle	Refresh cycle time; default: 10; unit: second
“-“	Minus; click once to decrease 1; the minimum value is 1
“+“	Plus; click once to increase 1; the maximum value is 60
CPU module name	Name of the CPU module; read only

Item	Description
CPU Run LED	LED of CPU running status; read only Green light: RUN LED Not Lit: STOP
CPU Error LED	LED of CPU Error; read only
CPU Error code	Error codes of CPU module; read only
“Run” / “Stop”	Click “RUN” to set the running status to RUN Click “Stop” to set the running status to STOP ● If the authority level for the logged in user is WRITE/READ or READ, this column is read only.

9.9.6 Configurations

9.9.6.1 Save Configuration Page

You can save the configurations and download the parameters to your device here.



Item	Description
“Save”	Download the saved parameters to the device.
PLC Status	LED of PLC running status; read only Green light: RUN LED Not Lit: STOP
“Run” / “Stop”	Click “RUN” to set the running status to RUN Click “Stop” to set the running status to STOP

Note: The data monitor table must be downloaded to the device. If not, once you log out, close the page or restart the PLC, all the temporary saved parameters will be cleared.

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Chapter 10 CANopen Function and Operation

Table of Contents

10.1 Introduction to CANopen

1. Because of its simple wiring, immediate and stable communication, strong debugging ability, and low cost, the CANopen network is widely used in fields such as industrial automation, the automotive industry, the medical equipment industry, and the building trades.
2. The DVP-ES3 Series PLC is equipped with CANopen communication port. The CAN port conforms to the basic communication protocol CANopen DS301. It supports master and slave modes.
3. This chapter explains the functions of CANopen. In master mode, CANopen can support up to 64 slaves.
4. CANopen Builder is the CANopen network configuration software for the DVP-ES3 Series. You set the CANopen station address and the communication rate with this software. ISPSoft is the programming software for the DVP-ES3 Series.
5. This chapter mainly focuses on the CANopen functions. Refer to Section 10.3 for more information.

10.1.1 CANopen Function Descriptions

The CAN port has the following functions when acting as a master.

1. It supports the standard CANopen protocol DS301 V4.02.
2. It supports the NMT (network management object) service.
   - It supports NMT state control.

     Use NMT state control to control the state of a slave in the CANopen network.
   - It supports NMT error control.

     Use NMT error control detect the disconnection of a slave. The NMT error control is classified into two types; Heartbeat and Node Guarding. The DVP-ES3 Series PLC does not support Node Guarding.
3. It supports the PDO (process data object) service.
   - Use PDO messaging to transmit immediate input and output data.
   - It supports up to 256 RxPDO and 1894 bytes.
   - It supports up to 256 TxPDO and 1894 bytes.
   - It supports synchronous and asynchronous modes for the PDO transmission type.
4. It supports the SDO (Service Data Object) service.
   - Use SDO to read, write, or configure the slave parameters.
   - It supports standard SDO transmission mode.
   - It supports automatic SDO functions. You can write up to 20 pieces of data to a slave.
   - It supports using the SDO service in a PLC ladder diagram to read the data from a slave or write the data to a slave.
5. It supports the reading emergencies from a slave service.
   - Use this service to read an error or an alarm from a slave.
   - You can store up to 5 emergencies in a slave.

- You can read emergencies from a slave through a PLC ladder diagram.

6. It supports the SYNC object (synchronous object) service.
7. Several devices can operate synchronously through the synchronous object service.
8. The supported CANopen communication rates are: 20K, 50K, 125K, 250K, 500K, and 1Mbps.

The supported mapping data types are:

Storage	Data type
8-bit	SINT USINT BYTE
16-bit	INT UINT WORD
32-bit	DINT UDINT REAL DWORD
64-bit	LINT ULINT LREAL LWORD

The CAN port has the following functions when acting as a slave.

- It supports the standard CANopen protocol DS301 V4.02.
- It supports the NMT (network management object) service.
  - It supports the NMT state control.

  The state of the DVP-ES3 Series in the CANopen network is controlled by a master.
  - It supports the NMT error control.

  The DVP-ES3 Series supports Heartbeat but not Node Guarding.
- It supports the PDO (process data object) service.
  - The PDO message transmits the immediate input data and output data.
  - It supports up to 8 TxPDO and 8 RxPDO.
  - The PDO transmission type: synchronous mode and asynchronous mode
- It supports the emergency service.

  If an error or an alarm occurs in the DVP-ES3 series, the master is notified through the emergency service.

10.1.2 The Input/Output Mapping Areas

The following table lists the CANopen DS301 specifications for the AS DVP-ES3 Series PLC.

Type	Item	Description
Master	Maximum slave nodes	Up to 64 nodes
	Maximum transfer size of a PDO (Read + Write)	Up to 2000 Bytes (including some system configurations)
Slave	Maximum transfer size of a PDO (Read + Write)	Up to 8 PDOs; each PDO with up to 8 bytes can be transferred at a time

The output mapping areas are D25000-D25999, and the input mapping areas are D24000-D24999, as the following table shows.

Device in the PLC	Mapping area	Mapping length
D25000–D25031	SDO request information, NMT service information, and Emergency request information	64 bytes
D24000–D24031	SDO reply information, and Emergency reply information	64 bytes
D25032–D25978	RxPDO mapping area	1894 bytes
D24032–D24978	TxPDO mapping area	1894 bytes

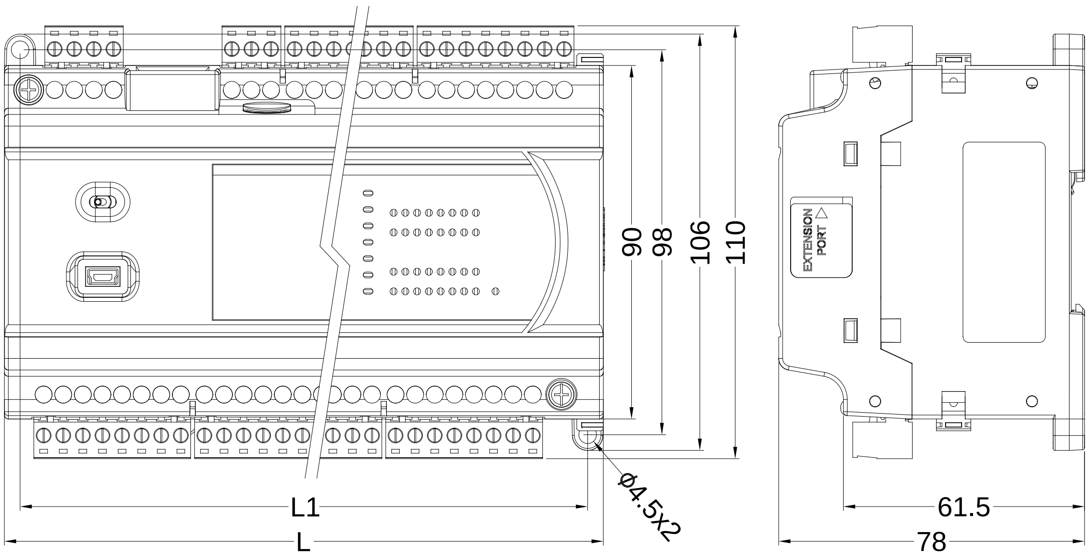
If a DVP-ES3 Series functions as a slave, the output mapping areas are D25032–25063, and the input mapping areas are D24032–24063 as the following table shows.

Device in the PLC	Mapping area	Mapping length
D24032~24063	RxPDO mapping area	64 bytes
D25032~25063	TxPDO mapping area	64 bytes

10.2 Installation and Network Topology

This section introduces the physical dimensions of DVP-ES3 Series PLC, the HWCONFIG settings, the CAN interface, the CANopen network framework, and the maximum communication distance.

10.2.1 The Dimensions of DVP-ES3 Series PLC

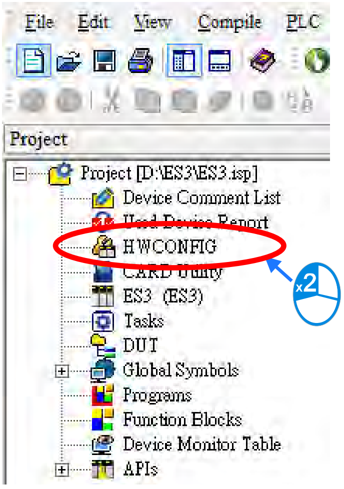


Unit: mm

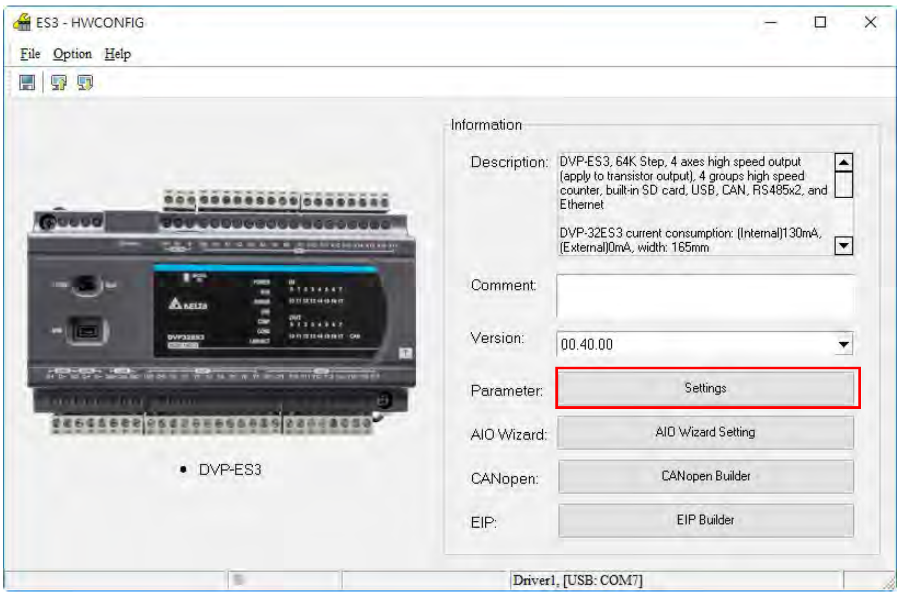
10.2.2 CANopen Communication Port

10.2.3 Configure the DVP-ES3 Series PLC with HWCONFIG

1. In ISPSoft, double-click **HWCONFIG** in the project management area to start **HWCONFIG**.



2. Click Settings to open the **Device Setting** page.

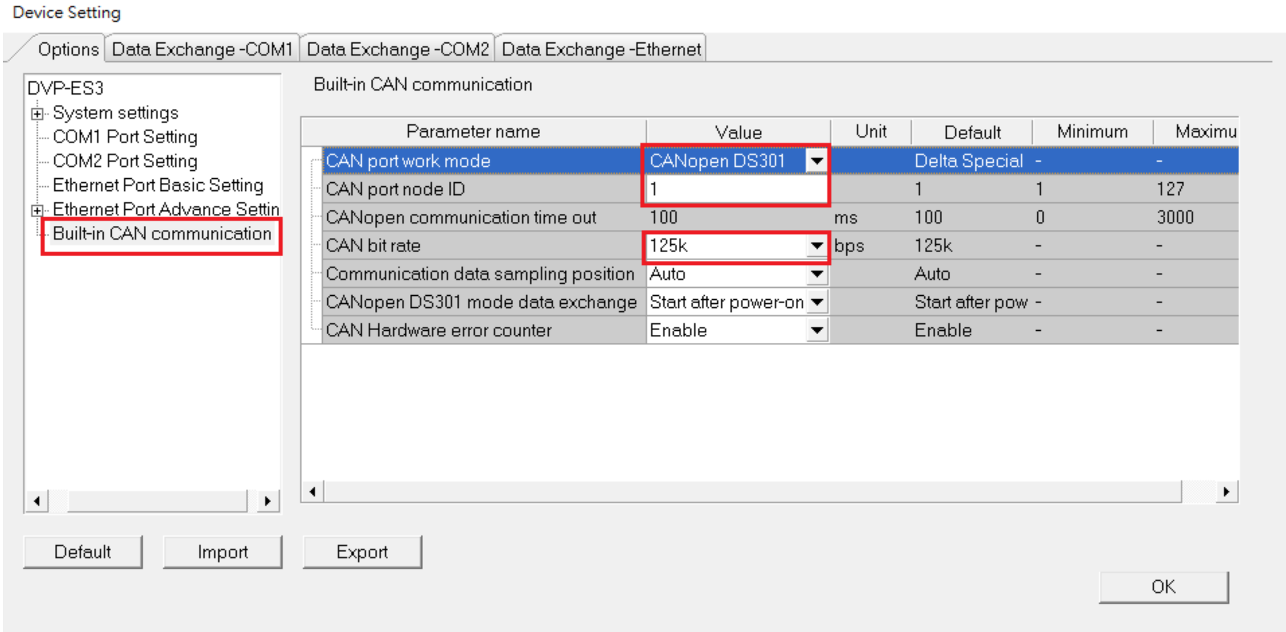


3. Select the working mode, node ID and the bit rate for DVP-ES3.

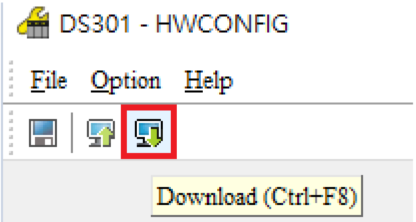
   * Working mode: CANopen DS301

   * Node ID: 1

   * Bit rate: 125k bps (the default, or you can select your own bit rate)



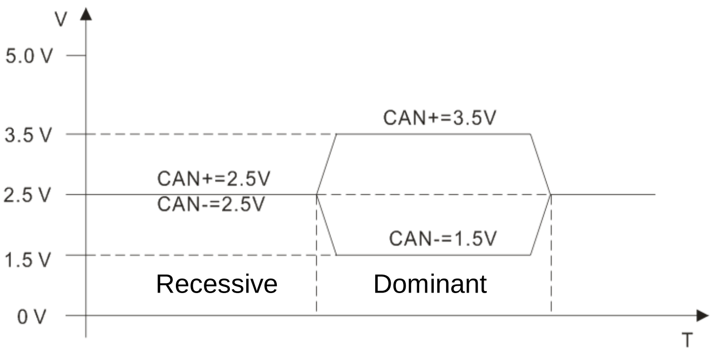
4. When finished, click the **Download** button on the toolbar to download the settings to the PLC.



10.2.4 The CAN Interface and Network Topology

10.2.4.1 Definitions of the CAN Signal and Data Types

The CAN signal is a differential signal. The voltage of the signal is the voltage difference between CAN+ and CAN-. The CAN+ and CAN- voltages take SG as a reference point. The CAN network can be in one of two states. One state is a dominant level, and is indicated by the logical “0”. The other state is a recessive level, and is indicated by the logical “1”. The CAN signal level shows below.



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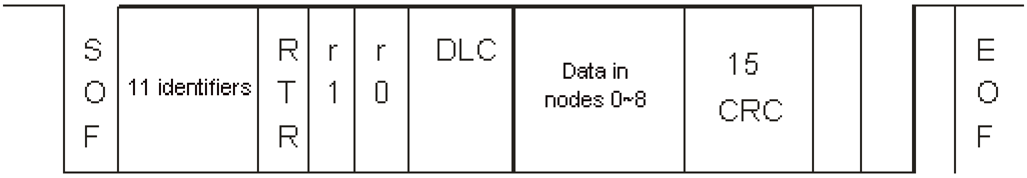
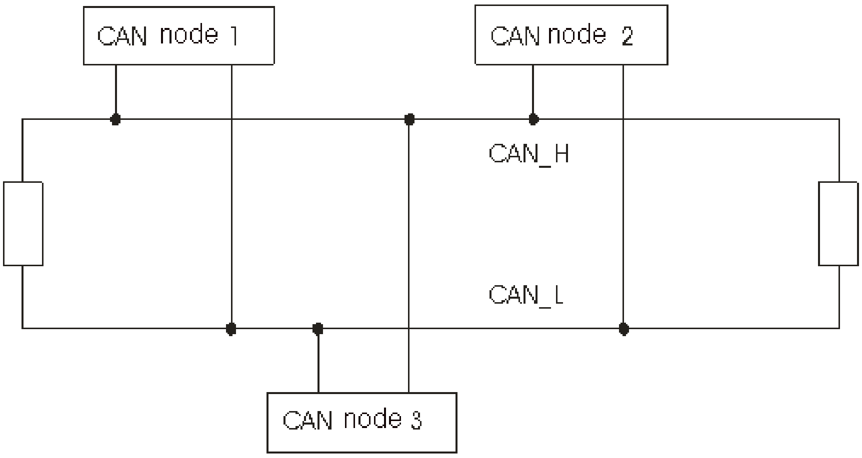
The following picture shows the data frame format. The CAN nodes transmit the CAN messages to the network from left to right.



10.2.4.2 The CAN Network Endpoint and the Topology Structure

In order to make the CAN communication more stable, the two endpoints of the CAN network are connected to 120 ohm terminal resistors. The topology structure of the CAN network appears below.



10.2.4.3 The Topology Structure of the CANopen Network

1) Use standard Delta cables when wiring the CANopen network. These cables are the thick cable UC-DN01Z-01A, the thin cable UC-DN01Z-02A, and the thin cable UC-DN01Z-02A. Separate the communication cables from any power cables to avoid interference.
2) Connect the CAN+ (white) and CAN- (blue), which are at the endpoints of the network, to 120 ohm resistors. Purchase the standard Delta terminal resistor (TAP-TR01) for use with the other devices and the RJ45 connecter.

3) Note the limitation on the length of the CANopen network. The transmission distance of the CANopen network depends on the transmission rate of the CANopen network. The following table shows the relation between the transmission rate and the maximum communication distance.

Transmission rate (bit/seconds)	20K	50K	125K	250K	500K	1M
Maximum communication distance (meters)	2500	1000	500	250	100	25

4) The list below shows the Delta network products for the CANopen network.

Product	Model	Function
	AS332T-A AS332P-A AS324MT-A AS320T-B AS320P-B AS300N-A	The AS300 series PLC can function as the CANopen master or slave when you install an AS-FCOPM function card. The AS-FCOPM is equipped with a 120 ohm resistor controlled by a switch.
	AS228T-A AS228P-A AS228R-A AS218TX-A AS218PX-A AS218RX-A	AS200 Series PLC is built with CAN communication port. The CAN port conforms to the basic communication protocol CANopen DS301. It supports master and slave modes. The CAN communication terminal is equipped with a 120 Ω resistor. You can use a short circuit to use this resistor.
	DVP32ES300R DVP32ES300T DVP32ES311T DVP48ES300R DVP48ES300T DVP64ES300R DVP64ES300T DVP80ES300R DVP80ES300T	The DVP-ES3 Series PLC has a built-in CAN interface. It can function as the CANopen master or slave.
	DVP32ES200RC DVP32ES200TC	The DVP-ES2-C series PLC has a built-in CAN interface. It can function as the CANopen master or slave.
	DVPCOPM-SL	DVPCOPM-SL is a module connected to the left side of an S series PLC. It can function as the CANopen master or slave. The PLCs that you can connect to the DVPCOPM-SL are the DVP-28SV, DVP-28SV2, DVP-SX2, DVP-SA2, and DVP-EH2-L.

Product	Model	Function
	IFD9503	The IFD9503 gateway converts CANopen to Modbus, and connects a device (with an RS-232 or RS-485 interface) that conforms to the standard Modbus protocol to a CANopen network. You can connect up to 15 devices.
	DVPCP02-H2	The CANopen slave module is connected to the right side of an EH2 series PLC. It can connect the EH2 series PLC to a CANopen network.
	IFD6503	This analyzes CANopen network data, and has ports both ends for a CAN interface and a USB interface. Use it to monitor CAN network data, or allow CAN nodes to transmit the data. The product is used with the Netview Builder software.
	ASD-A2-xxxx-M servo driver	This servo driver has a built-in CANopen interface. It controls positioning, speed, and torque.
	VFD-C2000/CP2000/C200 series AC motor drives	This AC motor drive has a built-in CANopen function, and controls positioning, speed, and torque. For the C2000/CP2000 series AC motor drives, you must purchase a CMC-COP01 to provide the CAN interface. Only the C200 series AC motor drive has the built-in CANopen interface.
	VFD-EC series AC motor drive	The EC series AC motor drive has a built-in CANopen interface. It controls speed and torque.

Product	Model	Function
	TAP-CN01	This CANopen network topology distribution box has a 120 ohm resistor enabled with a switch.
	TAP-CN02	This CANopen network topology distribution box has a 120 ohm resistor enabled with a switch.
	TAP-CN03	This CANopen network topology distribution box has a 120 ohm resistor enabled with switch.
	UC-CMC003-01A UC-CMC005-01A UC-CMC010-01A UC-CMC015-01A UC-CMC020-01A UC-CMC030-01A UC-CMC050-01A UC-CMC100-01A UC-CMC200-01A	These CANopen sub cables have RJ45 connectors at both ends. UC-CMC003-01A: 0.3 meters UC-CMC005-01A: 0.5 meters UC-CMC010-01A: 1 meter UC-CMC015-01A: 1.5 meters UC-CMC020-01A: 2 meters UC-CMC030-01A: 3 meters UC-CMC050-01A: 5 meters UC-CMC100-01A: 10 meters UC-CMC200-01A: 20 meters
	UC-DN01Z-01A UC-DN01Z-02A	CANopen network cable UC-DN01Z-01A: CANopen main cable UC-DN01Z-02A: CANopen sub cable
	TAP-TR01	This 120 ohm resistor has an RJ45 connector.

10

10.3 The CANopen Protocol

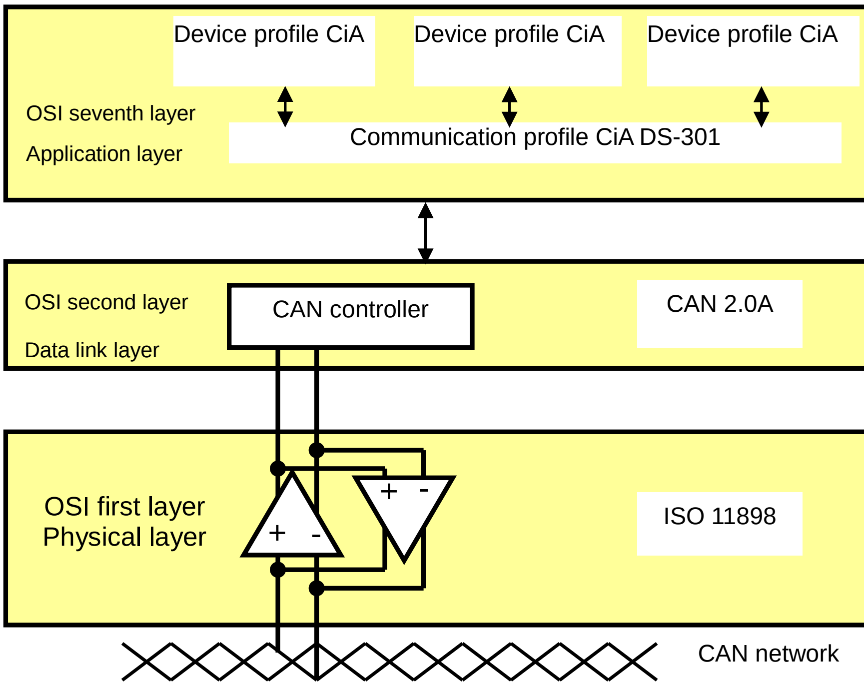
10.3.1 Introduction to the CANopen Protocol

The CAN (controller area network) fieldbus only defines the physical layer and the data link layer of a network. See the ISO11898 standard for information. The CAN fieldbus does not define the application layer. In practice, the hardware contains the physical layer and the data link layer. The CAN fieldbus itself is not complete, and needs a superior protocol to define the use of 11/29-bit identifier and 8-byte data.

The CANopen protocol is the superior protocol based on the CAN fieldbus. It is one of the protocols defined and maintained by CiA (CAN-in-Automation) and was developed on the basis of the CAL (CAN application layer) protocol, using a subset of the CAL communication and service protocols.

The CANopen protocol contains the application layer and the communication profile (CiA DS301). It also contains a framework for programmable devices (CiA 302), recommendations for cables and connectors (CiA 303-1), and SI units and prefix representations (CiA 303-2).

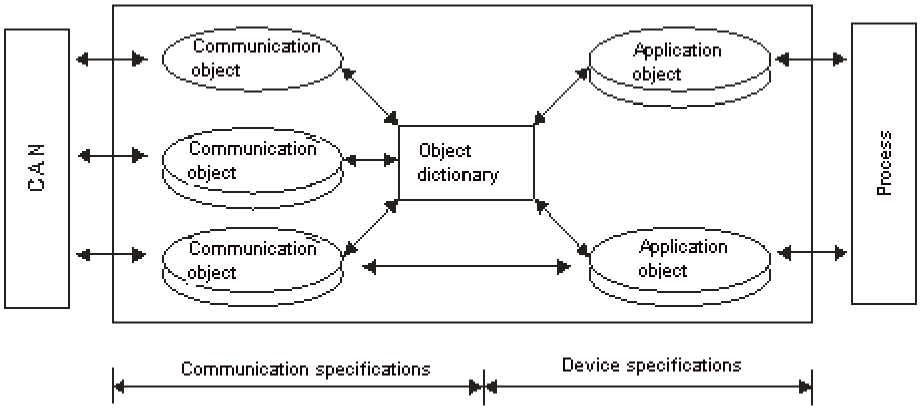
In the OSI model, the relation between the CAN standard and the CANopen protocol is described in the following diagram.



1. **The object dictionary**

   CANopen uses an object-based method to define a standard device. Every device is represented by a set of objects and can be visited by the network. The diagram below illustrates the CANopen device model. The object dictionary is the interface between the communication program and the superior application program.

   The core concept of CANopen is the device object dictionary (OD). It is an orderly set of objects. Every object has a 16-bit index for addressing and also defines an 8-bit subindex. Every node in the CANopen network has an object dictionary that includes the parameters that describe the device and the network behavior. The object dictionary of a node is also described in the electronic data sheet (EDS) for the device.



10.3.2 The CANopen Communication Object

The CANopen communication protocol contains the following communication objects.

1. PDO (process data object)

- The PDO provides the direct channel for the device application object, and transmits the real-time data. It has high priority. Every byte in the PDO CAN message data list transmits data, and the message usage rate is high.
- There are two kinds of uses for PDOs; data transmission and data reception. They are distinguished by Transmit-PDOs (TxPDOs) and Receive-PDOs (RxPDOs). Devices supporting TxPDOs are called PDO producers, and devices that receive PDOs are called PDO consumers.
- The PDO is described by the “producer/consumer mode”. The data transmits from one producer to one or many consumers. The data that can be transmitted is limited to between 1-byte and 8-byte data. After the producer transmits the data, the consumer does not need to reply to the data. Every node in the network detects the transmitted data and decides whether to process the received data .
- Every PDO is described by two objects in the object dictionary: the PDO communication parameters and the PDO mapping parameters

  PDO communication parameters: the COB-ID used by PDO, the transmission type, the prohibition time, and the counter cycle

  PDO mapping parameters: the object list in an object dictionary. These objects are mapped into the PDO, including the data length (in bits). To explain the contents of the PDO, the producer and the consumer both have to understand the mapping.

  The PDO transmission modes: synchronous and asynchronous

  Synchronous mode: synchronous periodic and synchronous non-periodic

  Asynchronous: The producer transmits the PDO when the data changes, or after a trigger.

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The following table lists supported transmission modes.

Type	PDO transmission				
	Periodic	Non-periodic	Synchronous	Asynchronous	RTR
0		X	X		
1 – 240	X		X		
254				X	
255				X	

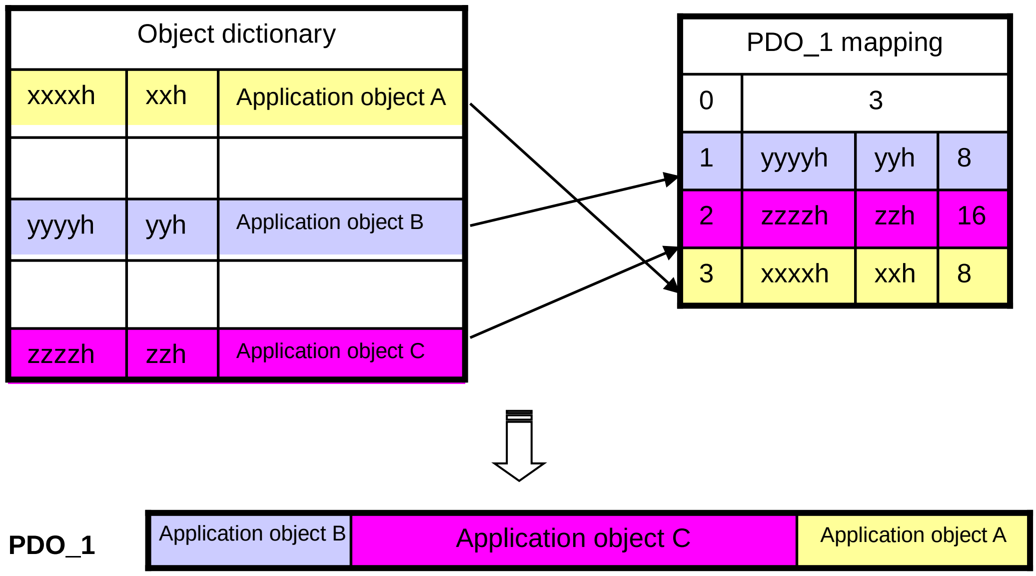
Mode 0: The PDO information is transmitted only when the PDO data changes and the synchronous signal is received.

Modes 1–240: One piece of PDO information is transmitted every 1–240 synchronous signals.

Mode 254: The trigger is defined the manufacturer. The definition in the PLC is the same as mode 255.

Mode 255: The PDO is transmitted when the data changes, or it is transmitted after a trigger.

All the data in the PDO has to be mapped from the object dictionary. The following diagram shows an example of PDO mapping.



The following table shows the data format for RxPDO and TxPDO.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Object identifier	Data							

2. SDO (service data object)

- The SDO builds the client/server relation between two CANopen devices. The client device can read the data from the object dictionary on the server device and write the data into the object dictionary on the server device. The SDO visit mode is “client/server” mode. The mode which is visited is the SDO server. Every CANopen device has at least one service data object that provides the visit channel for the object dictionary of the device. SDO can read all the objects in the object dictionary, and write all objects into the object dictionary.

- The SDO message contains the index and subindex information used to position the objects in the object dictionary, and the composite data structure can easily be passed by the SDO visit. After the SDO client sends the reading/writing request, the SDO server replies. The client and the server can stop SDO transmission. The requested message and the reply message are separated by different COB-IDs.
- The SDO can transmit the data in any length. If the data length is more than 4 bytes, the data must be transmitted by segment. The last segment of the data contains an end flag.
- The following table shows the structures of the SDO requested message and reply message.

The format of the requested message:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600 (Hex)	Requested code	Object index		Object subindex	Requested data			
+Node-ID		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

The definition of the requested code in the requested message:

Request code (Hex)	Description
23	Writing 4-byte data
2B	Writing 2-byte data
2F	Writing 1-byte data
40	Reading data
80	Stopping the current SDO function

The format of the reply message:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580(Hex)	Reply code	Object index		Object subindex	Reply data			
+Node-ID		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

The definition of the reply code in the reply message:

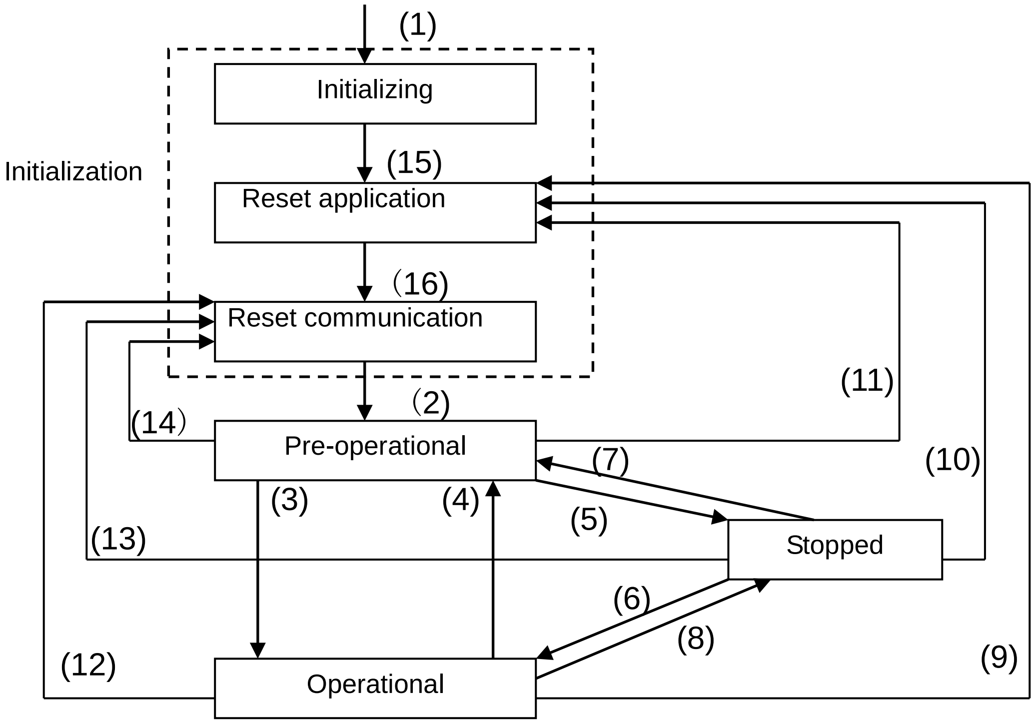
Reply code (Hex)	Description
43	Reading 4-byte data
4B	Reading 2-byte data
4F	Reading 1-byte data
60	Writing 1/2/4-byte data
80	Stopping the current SDO function

3. NMT (network management object)

The CANopen network management conforms to the master/slave mode. Only one NMT master exists in the CANopen network, and all other nodes are considered to be slaves. NMT includes three services: module control, error control, and boot-up services.

- **Module control services**

The master node in the CANopen network controls the slave by sending commands. The slave receives and executes the command, and does not need to reply. All CANopen nodes have internal NMT states. The slave node has four states: initialization, pre-operational, operational, and stop states. The following diagram illustrates the device states.



(1) After power is supplied, the device automatically enters the initialization state.

(2) After the initialization is complete, the device automatically enters the pre-operational state.

(3), (6) The remote node starts.

(4), (7) The device enters the pre-operational state.

(5), (8) The remote node stops.

(9), (10), (11) The application layer resets.

(12), (13), (14) The communication resets.

(15) After the initializing is complete, the device automatically enters the reset application state.

(16) After the reset application state is complete, the device automatically enters the reset communication state.

The following table shows the relation between the communication object and the state. You can only execute the communication object service in the correct state. For example, you can only execute SDO in the operational state and pre-operational states.

	Initialization	**Pre-operational**	**Operational**	**Stopped**
PDO			X	
SDO		X	X	
SYNC		X	X	
Time Stamp		X	X	
EMCY		X	X	
Boot-up	X			
NMT		X	X	X

10

The control message format for the node state:

COB-ID	Byte 0	Byte 1
0	Command specifier (CS)	Slave address (0: Broadcast)

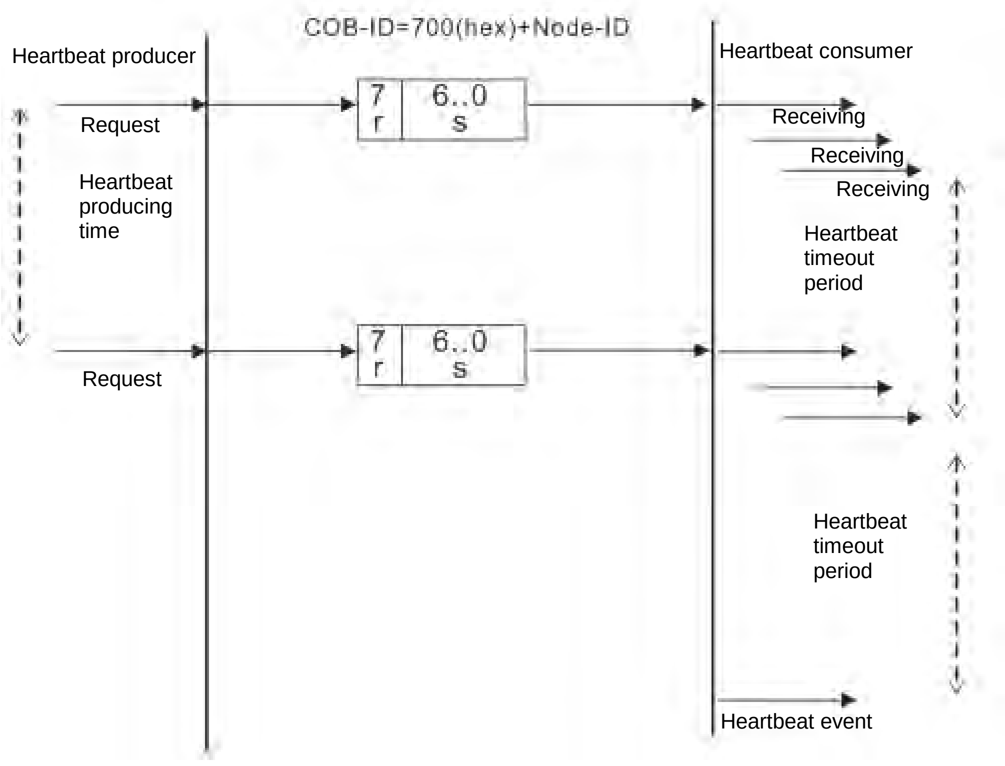
The command specifiers:

Command specifier (Hex)	Function
01	Start the remote node
02	Stop the remote node
80	Enter the pre-operational state
81	Reset the application layer
82	Reset the communication

- **Error control services**

The error control service detects the disconnection of a network node. The error control services are classified into two types: Heartbeat and Node Guarding. The DVP-ES3 Series PLC only supports Heartbeat. For example, the master can detect the disconnection of the slave only after the slave enables the Heartbeat service.

The following illustrates the Heartbeat principle. The Heartbeat producer transmits the Heartbeat message according to the set Heartbeat producing time. One or many Heartbeat consumers detect the message transmitted by the Heartbeat producer. If the consumer does not receive the message transmitted by the producer within the timeout period, there is a problem in the CANopen communication or the producer is disconnected.



- **Boot-up services**

  After the slave completes the initialization and enters the pre-operational state, it transmits the Boot-up message.

1. Other predefined CANopen communication objects (SYNC and EMCY)

- **SYNC Object (Synchronous object)**

  The synchronous object is the message that the master node periodically broadcasts on the CANopen network. This object recognizes the network clock signal. Every device decides whether to use the event use synchronous communication with other network devices depending on its configuration. For example, when controlling a driving device, the devices do not act immediately after they receive the command sent by the master. They do act when they receive the synchronous message. This makes multiple devices act synchronously.

  The format of the SYNC message:

COB-ID
80 (Hex)

- **Emergency object**

  The emergency object is used by a CANopen device to indicate an internal error. When an emergency error occurs in the device, the device sends the emergency message (including the emergency error code), and the device enters an error state. After the error is eliminated, the device sends another emergency message with emergency error code 0, and the device enters the normal state.

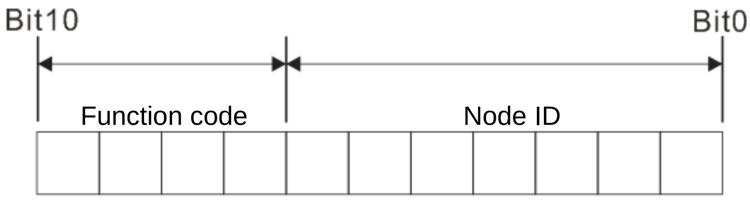
  The format of the emergency message:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
80 (Hex) +Node-ID	Emergency error code		Error register	Factory-defined error code				
	LSB	MSB						

Note: The value in the error register is mapped to index 1001 (Hex) in the object dictionary. If the value is 0, no error occurred. If the value is 1, a normal error occurred. If the value is H'80, an internal error occurred in the device.

10.3.3 The Predefined Connection Set

In order to decrease the configuration workload of the network, CANopen defines a default identifier. In the predefined connection set, the structure of the 11-bit identifier is as follows.



The following tables list the objects that are supported and the COB-IDs that are assigned to the objects.

1. The broadcast object in the predefined connection setting

Object	Function code	COB-ID	Index of the communication parameter
NMT	0000	0	-
SYNC	0001	128 (80h)	1005h, 1006h, 1007h
Time stamp	0010	256 (100h)	1012h, 1013h

2. The corresponding object in the predefined connection set

Object	Function code	COB-ID	Index of the communication parameter
Emergency	0001	129 (81h)–255 (FFh)	1014h, 1015h
PDO1 (TX)	0011	385 (181h)–511 (1FFh)	1800h
PDO1 (RX)	0100	513 (201h)–639 (27Fh)	1400h
PDO2 (TX)	0101	641 (281h)–767 (2FFh)	1801h
PDO2 (RX)	0110	769 (301h)–895 (37Fh)	1401h
PDO3 (TX)	0111	879 (381h)–1023 (3FFh)	1802h
PDO3 (RX)	1000	1025 (401h)–1151 (47Fh)	1402h
PDO4 (TX)	1001	1153 (481h)–1279 (4FFh)	1803h
PDO4 (RX)	1010	1281 (501h)–1407 (57Fh)	1403h
SDO (TX)	1011	1409 (581h)–1535 (5FFh)	1200h
SDO (RX)	1100	1537 (601h)–1663 (67Fh)	1200h
NMT Error Control	1110	1793 (701h)–1919 (77Fh)	1016h, 1017h

10.4 Sending SDO, NMT and Reading Emergency Message through the Ladder Diagram

You can edit the request message mapping area to affect the transmission of SDO, NMT and Emergency messages. The following table shows the corresponding relations between the request message mapping area, response message mapping area, and PLC device.

PLC device	Mapping area	Mapping length
D25000-D25031	SDO request message, NMT service message and Emergency request message	64 bytes
D24000-D24031	SDO response message and Emergency response message	64 bytes

The CANopen master can only send one SDO, NMT, or Emergency request message to the same device at a time. Clear the request message mapping area to zero when sending SDO, NMT, or Emergency request message through the WPL program.

10.4.1 Data Structure of SDO Request Message

Sending SDO through the ladder diagram reads or writes the slave parameter.

1. The data format of the SDO request message:

PLC device	Request message		
		High byte	Low byte
D25000	Message Header	ReqID	Command (Fixed to 01)
D25001		Reserved	Size
D25002		Type	Node ID
D25003	Message Data	High byte of main index	Low byte of main index
D25004		Reserved	Sub-index
D25005		Datum 1	Datum 0
D25006		Datum 3	Datum 2
D25007 - D25031		Reserved	

- ReqID: the request ID. Whenever an SDO request message is sent out, the message is given a ReqID for CANopen master to identify. When reading/writing another SDO message, the original ID number must be changed. In other words, reading/writing SDO is triggered by changing of the value of “ReqID”. The ReqID range is between 00–FF (Hex).
- Size: the length of the message data. The counting starts from D6253 with a byte as the unit. When reading, it is fixed to four and when writing, it is four plus the byte number of data types of index and subindex and the maximum value is eight. But when writing, if the data type of the index and subindex is word, the data length is six. The data length is file if the data type is byte.
- Node ID: the node address for the target equipment on a CANopen network.
- Type: 01 indicates the read access; 02 indicates the write access.

The following table shows the data format of the SDO response message.

PLC device	Response message		
		High byte	Low byte
D24000	Message Header	ResID	Status code
D24001		Reserved	Size
D24002		Type	Node ID
D24003	Message Data	High byte of main index	Low byte of main index

PLC device	Response message		
		High byte	Low byte
D24004		Reserved	Sub-index
D24005		Datum 1	Datum 0
D24006		Datum 3	Datum 2
D24007~D24031		Reserved	

- Status code:

  The following table lists the status code values in the response message.

Status code	Explanation
0	No data transmission request
1	SDO message transmission succeeds.
2	SDO message is being transmitted.
3	Error: SDO transmission time-out
4	Error: Illegal command code
5	Error: the length of the transmitted data is illegal.
6	Error: the length of the response data is illegal.
7	Error: Equipment to be sent messages is busy.
8	Error: Illegal type
9	Error: Incorrect node address
0A	Error message (See the error code for SDO response message)
0B-FF	Reserved

- ResID: the same as the request ID in the request message.
- Size: the length of the message data, maximum of 20 bytes. The unit is bytes. When writing, the maximum is four; the data length is decided by the data type of index and subindex when reading.
- Node ID: the node address of the target equipment on CANopen network.
- Type: in the SDO response message, 43 (Hex) refers to reading four bytes of data; 4B (Hex) refers to reading two bytes of data; 4F (Hex) refers to reading one byte of data; 60 (Hex) refers to writing 1/2/4 byte(s) of data; 80 (Hex) refers to stopping SDO command.

Example 1: write 010203E8 (Hex) to (Index_subindex) 212D_0 in slave of No. 3 through SDO; the data type of (Index_subindex) 212D_0 is double words (32 bits).

- Request data:

PLC device	Request message		
		High byte(Hex)	Low byte(Hex)
D25000	Message Header	ReqID=01	Command =01
D25001		Reserved =0	Size =8
D25002		Type =02	Node ID =03
D25003	Message data	Main index high byte =21	Main index low byte =2D
D25004		Reserved =0	Subindex =0
D25005		Datum 1=03	Datum 0=E8
D25006		Datum 3=01	Datum 2=02

- Response data:

PLC device	Response message		
		High byte(Hex)	Low byte(Hex)
D24000	Message Header	ResID =01	Command =01
D24001		Reserved =0	Size =4
D24002		Type =60	Node ID =03
D24003	Message data	Main index high byte =21	Main index low byte =2D
D24004		Reserved =0	Subindex =0
D24005		Datum 1=00	Datum 0=00
D24006		Datum 3=00	Datum 2=00

Example 2: read the value of (Index_subindex) 212D_0 in slave of No. 3 through SDO; the data type of (Index_subindex) 212D_0 is double words (32 bits).

- Request data:

PLC device	Request message		
		High byte(Hex)	Low byte(Hex)
D25000	Message Header	ReqID =01	Command =01
D25001		Reserved =0	Size =4
D25002		Type =01	Node ID =03
D25003	Message data	Main index high byte =21	Main index low byte =2D
D25004		Reserved =0	Subindex =0
D25005		Datum 1=0	Datum 0=0
D25006		Datum 3=0	Datum 2=0

10.4.2 Data Structure of NMT Message

Use the NMT service to manage the CANopen network such as start, operation, reset of nodes, etc.

The following table shows the data format of the NMT request message.

PLC device	Request message		
		High byte	Low byte
D25000	Message Header	ReqID	Command (Fixed to 01)
D25001		Reserved	Size (Fixed to 04)
D25002		Type (Fixed to 03)	Node ID
D25003	Message data	Reserved	NMT service code
D25004		Reserved	Node ID

- Command: Fixed to 01.
- ReqID: the request ID. Whenever an NMT request message is sent, the message is given a ReqID for the CANopen master to identify. Before another NMT request message is sent out, the original ID number must be changed. In other words, change the value of ReqID. The ReqID range is between

00–FF (Hex) to trigger sending the NMA request message.

- Node ID: the node address for the target equipment on the CANopen network (0: Broadcast).
- NMT service code:

NMT service code (Hex)	Function
01	Start remote node
02	Stop remote node
80	Enter the pre-operational state
81	Reset application
82	Reset communication

The following table shows the data format of the NMT Response message.

PLC device	Response message		
		High byte	Low byte
D24000	Message header	ResID	Status code
D24001		Reserved	Reserved
D24002		Reserved	Node ID

- When status code is 1, the NMT operation has succeeded. When status code is not equal to1, the NMT operation has failed and you should verify that the data in NMT request message is correct.
- Node ID: the node address for the target equipment on the CANopen network.

Example 1: Stop slave of No. 3 through NMT

- Request data:

PLC device	Request message		
		High byte (Hex)	Low byte (Hex)
D25000	Message header	ReqID =01	Command =01
D25001		Reserved =0	Size =04
D25002		Type =03	Node ID =03
D25003	Message data	Reserved	NMT service code =02
D25004		Reserved	Node ID =03

- Response data:

PLC device	Response message		
		High byte (Hex)	Low byte (Hex)
D24000	Message header	ResID=01	Status code =01
D24001		Reserved =0	Reserved =0
D24002		Reserved =0	Node ID =03

10.4.3 Data Structure of EMERGENCY Request Message

The Emergency request message communicates the slave error and alarm information.

The following table shows the data format of the Emergency request message.

PLC device	Request message		
		High byte	Low byte
D25000	Message header	ReqID	Command (Fixed to 1)
D25001		Reserved	Size (Fixed to 0)
D25002		Type (Fixed to 04)	Node ID
D25003~D25031	Message data	Reserved	

- Command: Fixed to 01.
- ReqID: the request ID. Whenever an Emergency message is sent, the message is given a ReqID for the CANopen master to identify. Before another Emergency request message is sent out, the original ID number must be changed. In other words, change the value of ReqID. The ReqID range is between 00–FF (Hex) to trigger the sending the Emergency request message.
- Node ID: the node address of the target equipment on CANopen network.

The following table shows data format of the Emergency response message.

PLC device	Response message		
		High byte (Hex)	Low byte (Hex)
D24000	Message header	ResID	Status code
D24001		Reserved	Size Fixed to 2A
D24002		Type (Fixed to 04)	Node ID
D24003	Message data	Total number of data	Number of data stored
D24004		Datum 1	Datum 0
D24005		Datum 3	Datum 2
D24006		Datum 5	Datum 4
D24007		Datum 7	Datum 6
D24008-D24011		Emergency2	
D24012-D24015		Emergency3	
D24016-D24019		Emergency4	
D24020-D24023		Emergency5	
D24024-D24031		Reserved	

- Command: Fixed to 01(Hex).
- When status code is 1, reading the Emergency message has succeeded. When status code is not equal to1, reading the Emergency message has failed and you should verify that the data in the Emergency message is correct.
- Node ID: the node address for the target equipment on the CANopen network.
- Total number of data: total number of Emergency messages CANopen master receives from the slave.
- Number of data stored: the latest number of Emergency messages CANopen master receives from the slave (5 messages at most).

- An Emergency 1 consists of the data in D6004-D6007 and every Emergency message consists of 8 bytes of data.

  The following table shows the data format of Emergency messages on the CAN bus. Datum 0–datum 7 in Emergency response message correspond to byte 0–byte 7 respectively.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
80 (Hex) +Node-ID	Emergency error code		Error storage register	Vendor custom error code				

  Example 1: read the Emergency message from the slave No.2, and the Emergency messages the slave sends out successively.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
82 (Hex)	43	54	20	14	0	0	0	0

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
82 (Hex)	42	54	20	15	0	0	0	0

- Request data:

PLC device	Request message		
		High byte	Low byte
D25000	Message header	ReqID=01	Command =01
D25001		Reserved	Size =0
D25002		Type =04	Node ID =03

- Emergency response data

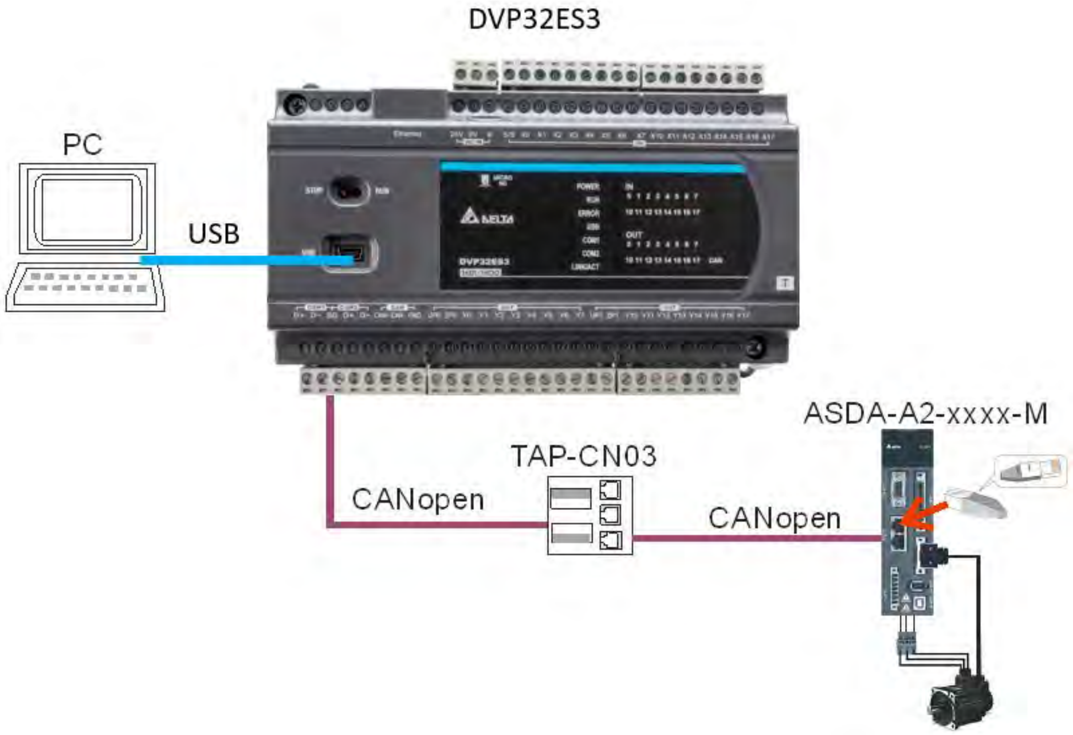
PLC device	Response message		
		High byte	Low byte
D24000	Message header	ResID=01	Status code =01
D24001		Reserved =0	Size =2A (Hex)
D24002		Type =04	Node ID =03
D24003	Message data	Total number of data =1	Number of data stored =1
D24004		Datum 1=54	Datum 0=42
D24005		Datum 3=20	Datum 2=14
D24006		Datum 5=0	Datum 4=0
D24007		Datum 7=0	Datum 6=0

10.4.4 Example of Sending SDO through the Ladder Diagram

1. Control Requirement:

Read the value of P0-09 from the servo through SDO.

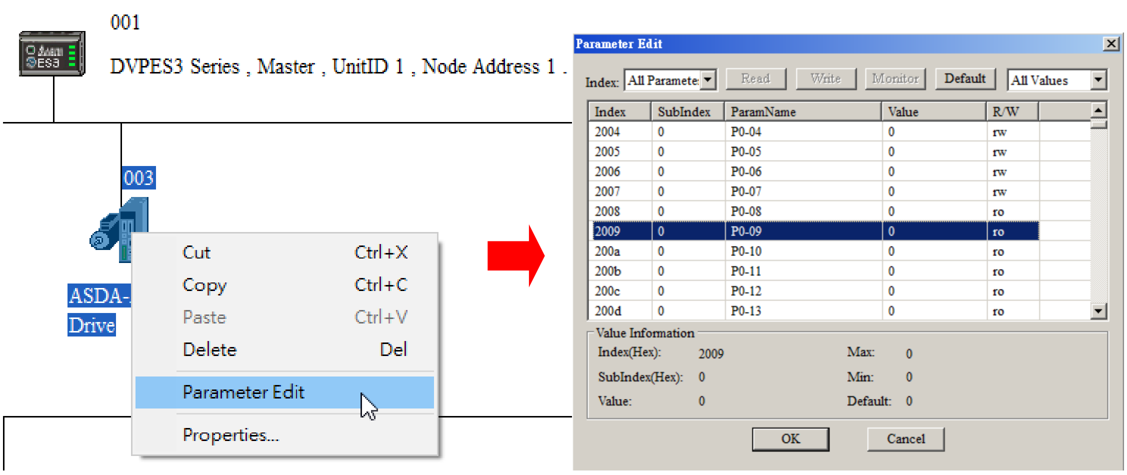
2. Hardware Connection:



3. The Corresponding Relation between Slave Parameter and Index/Subindex

The index_subindex corresponding to P0-09 in servo is 2009_0. In the CANopen Builder network configuration software, right click the servo icon, and then click **Parameter Edit**. In the **Parameter Edit** dialog box, you can see the index_subindex corresponding to the servo parameter.

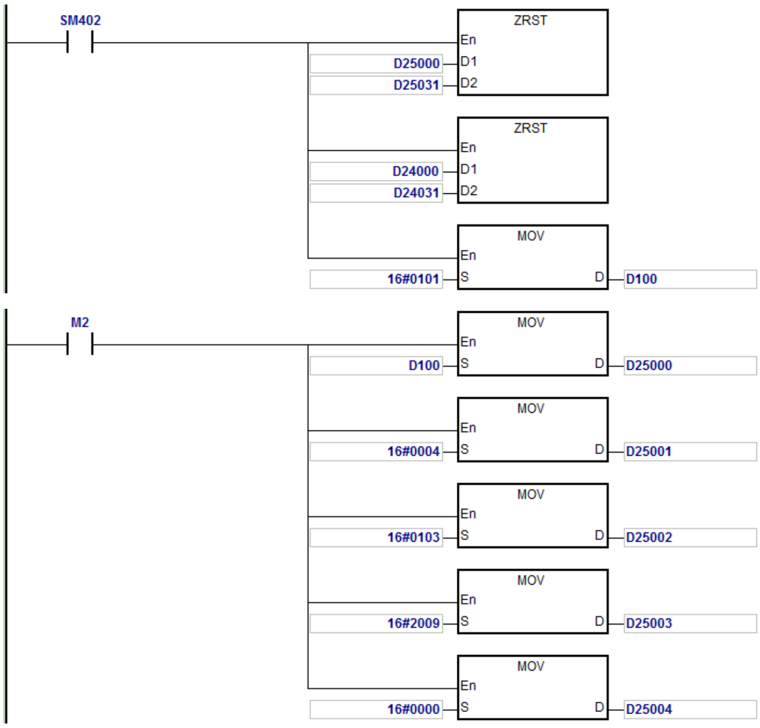
For more details on how to operate the network configuration interface, refer to Section 11.1.1 in the CANopen Builder software help file



4. The Structure of the Request Message Devices:

PLC device		Content (Hex)	Explanation	
			High byte (Hex)	Low byte (Hex)
SDO request message mapping area	D25000	0101	ReqID = 01	Command = 01
	D25001	0004	Reserved	Size = 04
	D25002	0102	Type = 01	Node ID = 03
	D25003	2009	Index high byte = 20	Index low byte = 09
	D25004	0000	Reserved	Subindex = 00

5. Editing the Ladder Diagram in ISPSoft



When M2=ON, after reading succeeds, the program stores the data from the target device in D24000–D24005. The value of D24005: 100 (Hex) is the value read from P0-09.

6. The Structure of the Response Message Devices:

PLC device		Content (Hex)	Explanation	
			High byte (Hex)	Low byte (Hex)
SDO response message mapping area	D24000	0101	ResID = 01	Status code = 01
	D24001	0006	Reserved	Size = 08
	D24002	4303	Type = 43	Node ID = 03
	D24003	2009	Main index high byte = 20	Index low byte = 09
	D24004	0004	Reserved	Subindex = 00
	D24005	0100	Datum 1= 01	Datum 0= 00

10.5 Troubleshooting

10.5.1 CANopen Network Node State Display

1. In the DVP-ES3 Series PLC, while you enable the CANopen function, it uses SR825–893 as the special registers as shown in the following table.

Special register	Function
SR825	Displays the state of CANopen DS301 Master
SR830–SR893	Displays the state of 64 nodes in the network
SR826	Flag for the state of the slave 1–16
SR827	Flag for the state of the slave 17–32
SR828	Flag for the state of the slave 33–48
SR289	Flag for the state of the slave 49–64
SR821	Version of CANopen DS301
SR822	Displays the CANopen baud rate (unit: 1kpps)

2. As a master, the DVP-ES3 Series PLC supports a maximum of 64 slaves ranging from node 1 to node 64. You can use SR826–829 to monitor the state of the nodes in the network. The 16 bits in SR826 correspond to 16 slaves and their corresponding relations are shown in the following table.

Bit	**b7**	**b6**	**b5**	**b4**	**b3**	**b2**	**b1**	**b0**
Node	Node 8	Node 7	Node 6	Node 5	Node 4	Node 3	Node 2	Node 1
Bit	**b15**	**b14**	**b13**	**b12**	**b11**	**b10**	**b9**	**b8**
Node	Node16	Node15	Node14	Node13	Node12	Node11	Node10	Node 9

When the node in the master node list is normal, the corresponding bit is OFF; when the node in the master node list is abnormal (for example, initializing fails or the slave is offline for some reason), the corresponding bit is ON.

3. The error code of every node is displayed through the corresponding special register (SR830–893) and the relations between special register and corresponding node (1–16) is shown in the following table. (You can also judge for other correspondings that are not listed here.)

Special register	**SR830**	**SR831**	**SR832**	**SR833**	**SR834**	**SR835**	**SR836**	**SR837**
Node	Node 1	Node 2	Node 3	Node 4	Node 5	Node 6	Node 7	Node 8
Special register	**SR838**	**SR839**	**SR840**	**SR841**	**SR842**	**SR843**	**SR844**	**SR845**
Node	Node 9	Node10	Node11	Node12	Node13	Node14	Node15	Node16

4. Node codes displayed in SR830–893 when the ASSeries PLC is the master:

Code	Indication	How to correct
0	The node is error free or the node is not configured.	N/A

Code	Indication	How to correct
E0	ASSeries PLC master module receives the emergency message sent from slave.	Read the relevant message with the PLC program
E1	PDO data length returned from the slave is not consistent with the length set in the node list.	Set the PDO data length of the slave and re-download.
E2	PDO of slave is not received.	Check and ensure the setting is correct.
E3	Downloading auto SDO fails.	Check and ensure auto SDO is correct.
E4	Configuration of PDO parameter fails.	Ensure that the PDO parameter setting is legal.
E5	Error in key parameter setting.	Ensure that the connected slave device is consistent with the configured slave in the software.
E6	The slave does not exist in the network	Ensure that the power supply of slave is normal and slave is correctly connected to the network.
E7	Slave error control is timed-out.	
E8	The node IDs of master and slave repeat.	Set the node ID of the master and slave again and ensure their node IDs are unique.

5. Codes displayed in SR825 when the DVP-ES3 Series PLC is the master:

Code	Indication	How to correct
0	In CANopen DS301 mode: the PLC works as master and is working normally. Not in CANopen DS301 mode: the master mode function is not activated.	N/A
F1	No slave in the list	Add slave into the node list and then re-download the configuration data.
F2	The data are being downloaded to the PLC	Wait to finish downloading the configuration data.
F3	The configuration receiving error in the PLC	Download parameter configuration again.
F4	Bus-OFF is detected.	Check that the CANopen bus cables are properly connected and ensure that all the node devices run at the same baud rate before you reboot.
F5	The PLC setting error such as incorrect node address	The node address in the DVP-ES3 Series PLC should be between: 1–127.
F8	Internal error; the error is detected in the internal memory	If the same error occurs after cycling the power, replace it with a new DVP-ES3 Series PLC.
FB	The sending buffer in the PLC is full.	Check that the CANopen bus cable is properly connected and then reboot.
FC	The receiving buffer in the PLC is full.	Check that the CANopen bus cable is properly connected and then reboot.

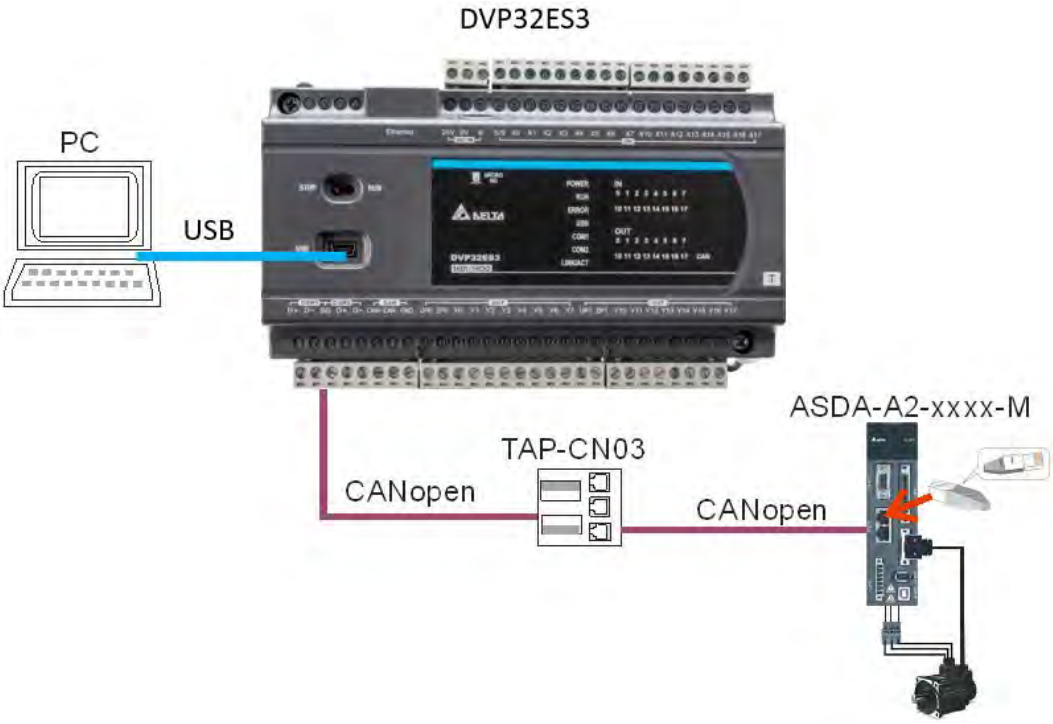
6. Codes displayed in SR825 when the DVP-ES3 Series PLC is the slave:

Code	Indication	How to correct
0	Working normally	N/A Note: When the heartbeat alam function is not activated, if the connection is normal before a disconnection occurs, the code for the slave will still be working normally after the connection is back on.
A0	The PLC is being initialized.	--
A1	The PLC is pre-operational.	Check if the CANopen bus cable is properly connected. If the master communication is not activated, no handling is needed.
A3	The data are being downloaded to the PLC.	Wait to finish downloading the configured data.
B0	Heartbeat message time-out	Check if the CANopen bus cable is properly connected.
B1	PDO data length returned from the slave is not consistent with the length set in the node list.	Reset the PDO data length in the slave and download the new setting to the DVP-ES3 Series PLC.
F4	BUS-OFF state is detected.	Check if the CANopen bus cables are properly connected and ensure that all the node devices run at the same baud rate before you reboot.
FB	The sending buffer in the PLC is full.	Check if the CANopen bus cable is properly connected and then reboot.
FC	The receiving buffer in the PLC is full.	Check if the CANopen bus cable is properly connected and then reboot.

10.6 Application Example

The DVP-ES3 Series PLC can control Delta A2 servo rotation, and monitor the actual rotation speed of the motor in real time. It does this by mapping the relevant servo drive parameters to the corresponding PDO, and reads or writes the relevant servo drive parameters through the CAN bus.

1. Connectting the Hardware



Note:

- Use a standard communication cable such as UC-DN01Z-01A / UC-DN01Z-02A / UC-CMC010-01A and connect the terminal resistors (Delta standard terminal resistor TAP-TR01) to both ends of the network when you construct the network.
- M of ASD-A2-xxxx-M refers to the model code and currently only the M-model servo supports CANopen communication.

2. Setting Servo Parameters:

- Set servo parameters as shown in the following table.

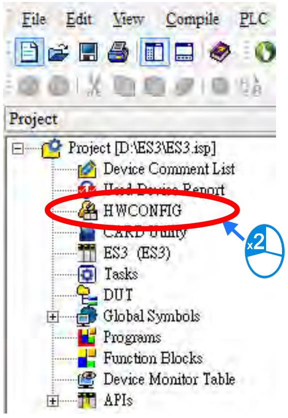
Parameter	Setting	Explanation
3-00	03	Node ID of the A2 servo is 2
3-01	400	CAN communication rate is 1Mbps.
1-01	04	Speed mode
0-17	07	Drive displays the motor rotation speed (r/min)
2-10	101	Set DI1 as the signal for Servo On
2-12	114	Set DI3 as the signal _SPD0 for speed selection
2-13	115	Set DI4 as the signal _SPD1 for speed selection

3. Setting the CANopen Baud Rate and Node ID of DVP-ES3 Series PLC

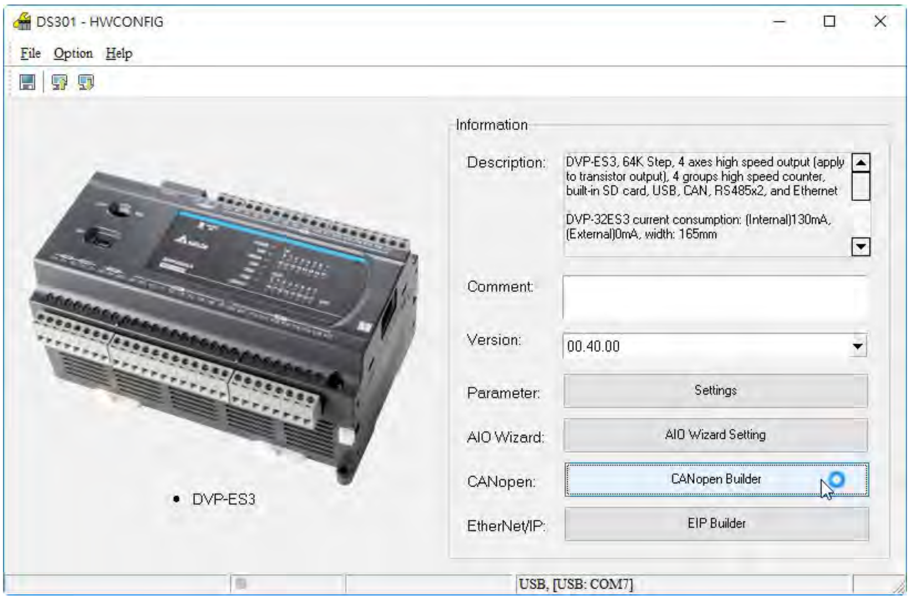
The DVP-ES3 Series PLC uses the default setting values: Node ID: 1 and baud rate: 1Mbps.

You set the CANopen Node ID and baud rate for the DVP-ES3 Series PLC in the CANopen Builder software, as shown in the following steps.

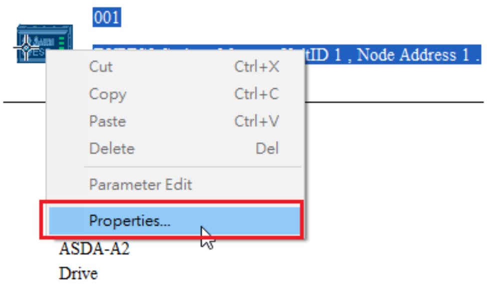
A. In ISPSoft, double-click **HWCONFIG** in the project management area to start **HWCONFIG**.

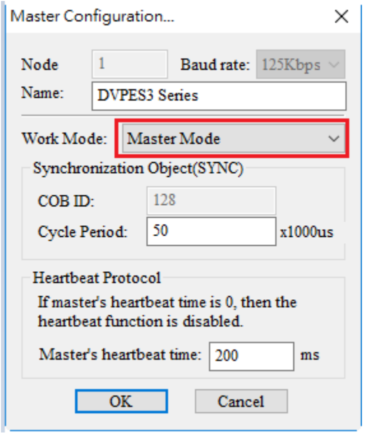


B. Click **CANopen Builder**.

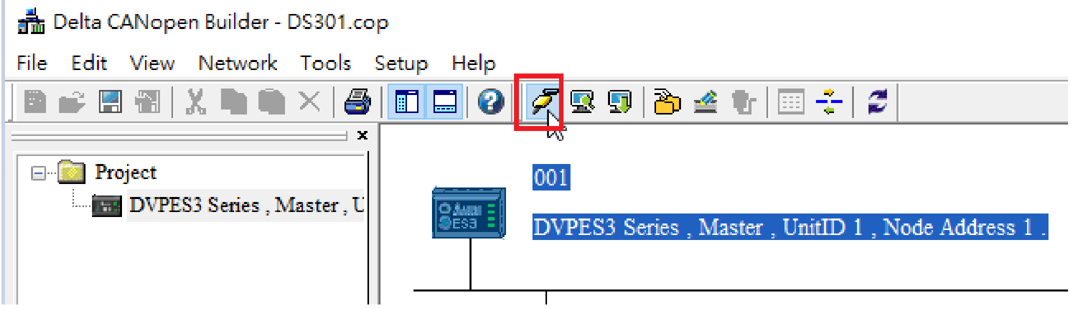


C. IF DVP-ES3 is in master mode, you can skip this step. If not, you can go to Properites and set it in Master mode. After that download the parameter to DVP-ES3. Set DVP-ES3 Power off for 2 seconds and supply power again and then proceed to the next step.

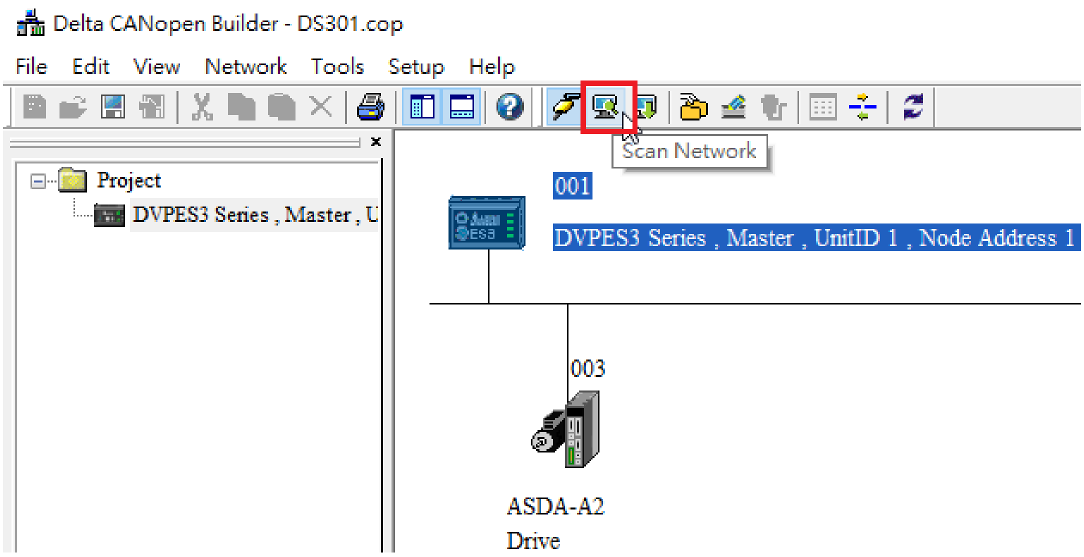




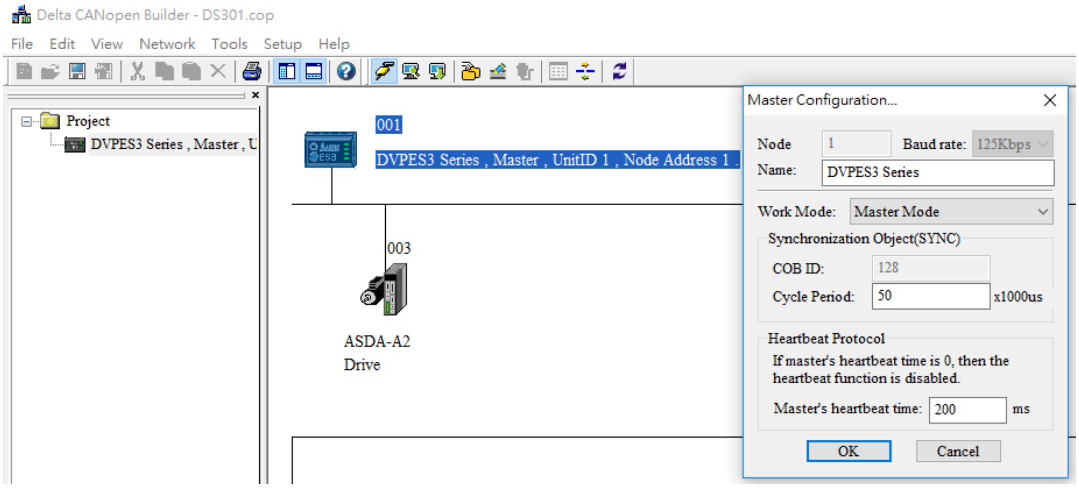
D. Click the Online  button on the Toolbar to enter on-line mode.



E. Click the Scan Network  button on the Toolbar to scan the network.



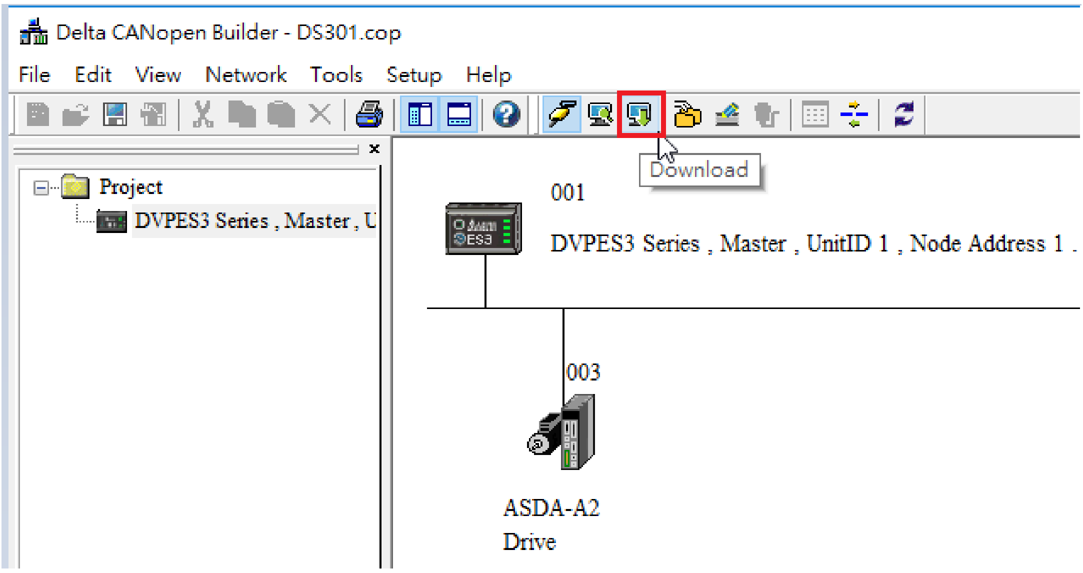
F. On the **Network** menu, click **Master parameter** to display the Master Configuration dialog box.



Item	Explanation	Default
Node ID	Node ID of DVP-ES3 Series PLC on the CANopen network	1
Baud rate	CANopen communication rate	1M bit/second
Work mode	CANopen master/slave mode	Master
Cycle period	Cycle time for sending one SYNC message	50ms
Master heartbeat time	Interval time for sending the master heartbeat message	200ms

Configure the CANopen communication stations and rates in HWCONFIG.

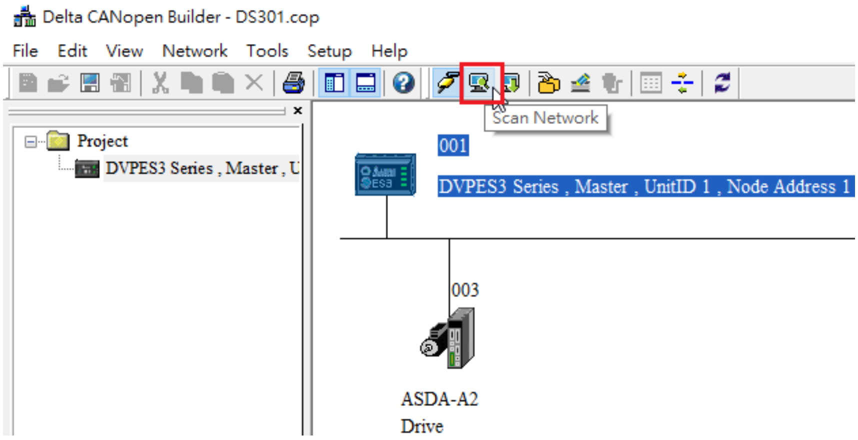
G. After you complete the previous steps, click the Download button on the Toolbar to download the parameters to the PLC.



Note: you must reboot the DVP-ES3 Series PLC to enable the downloaded parameters.

4. Scanning the Network:

On the **Network** menu, click **Online** or click the  button to scan for the master and slaves on the CANopen network. The master and slave found by the scan appear in CANopen Builder. For more information, refer to Section 11.1.1 in the CANopen Builder software help file.



5. Configurating Nodes:

Double click the slave icon in CANopen Builder to display the **Node configuration** dialog box.

- **Error Control Protocol**

  Sets the error control protocol for the master to monitor if the slave is offline.

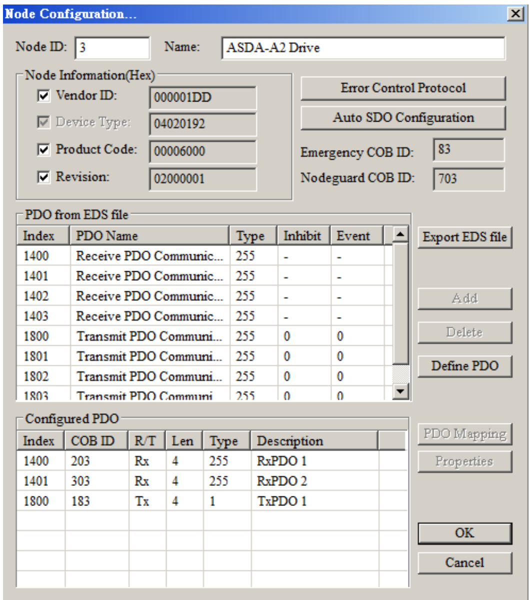
- **Auto SDO Configuration**

  Perform one write action to the slave parameter with SDO. The write action is finished when the slave enters the operational state from the pre-operational state. You can configure up to 20 SDOs by clicking Auto SDO configuration.

- **PDO Mapping** and **Properties**

  Sets the mapping parameter and transmission type for the PDO.

  For more details on the function of these buttons, refer to Section 11.1.1 in the CANopen Builder software help file.

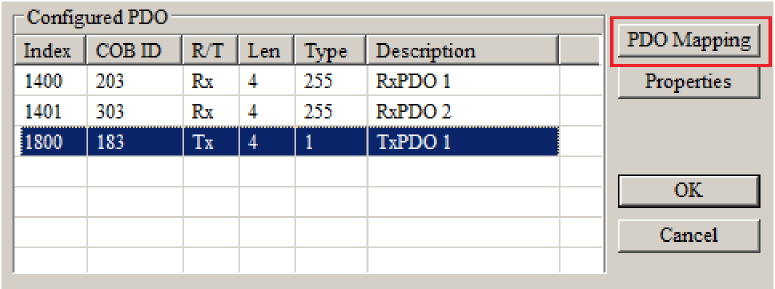


- PDO Mapping:

  RxPDO1: mapping parameter P1-09; transmission type 255.

  RxPDO2: mapping parameter P3-06, P4-07; transmission type 255.

  TxPDO1: mapping parameter P0-09; transmission type 1.



- PDO transmission type :

  PDOs can be classified into RxPDO or TxPDO. RxPDO data are sent from master to slave and TxPDO data are sent from slave to master.

  The PDO transmission types can be synchronous or asynchronous. In synchronous transmission, the master sends out the SYNC message in a fixed cycle. You set the length of the cycle in the Master Properties dialog box (default is 50ms). In asynchronous transmission, the message is sent out when the PDO mapping parameter changes.
  The following table describes the PDO Transmission types.

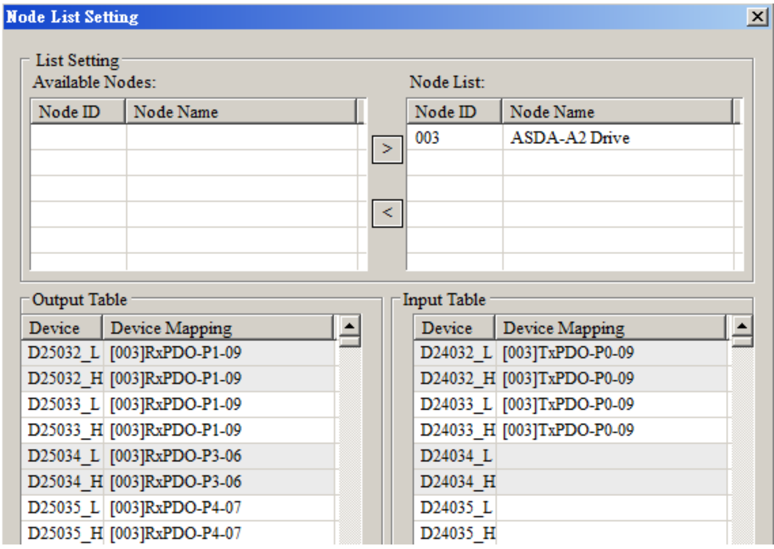
<table>
<tr><th colspan="2">Transmission Type</th><th>Description</th><th>Remark</th></tr>
<tr><td rowspan="2">0</td><td>RxPDO</td><td>When any change in the mapped data happens, RxPDO data is sent out immediately. The data the slave receives is valid only when receiving the next SYNCH message. RxPDO data is not sent out if there is no change in the data.</td><td rowspan="2">SYNCH non-cycle</td></tr>
<tr><td>TxPDO</td><td>When any change in the mapped data happens and the slave receives the SYNC message, the data are sent out immediately. The TxPDO data are valid immediately after master receives them. TxPDO data is not sent out if there is no change in the data.</td></tr>
<tr><td rowspan="2">N
（N:1–240）</td><td>RxPDO</td><td>After N messages are sent out, and regardless of whether the mapped data changes, the data that the slave receives is valid only when receiving the next SYNCH message.</td><td rowspan="2">SYNCH cycle</td></tr>
<tr><td>TxPDO</td><td>After N messages are sent out and regardless of whether the mapped data is changed, the data that the master receives is valid at once.</td></tr>
<tr><td>254</td><td>RxPDO</td><td>The mapped data is sent out immediately when it changes and is valid when the slaves receives it. RxPDO data is not sent out if there is no change in the data.</td><td>ASYNCH</td></tr>
</table>

Transmission Type		Description	Remark
	TxPDO	The slave sends out the data once every one Event timer time. After that, the TxPDO data is not allowed to be sent out within an inhibit timer time. When the Event timer and Inhibit timer are both equal to 0, the slave sends TxPDO data to the master immediately when the data changes, and the data that master receives is immediately valid.	
255	Same as Type254		

Note**:**

- Synchronous transmission type can fulfill multi-axis motion at the same time.
- If you monitor a real-time changing parameter such as the actual rotation speed of the motor, set the TxPDO to the synchronous transmission type; otherwise the frequent change in the slave data can block the CANopen network.

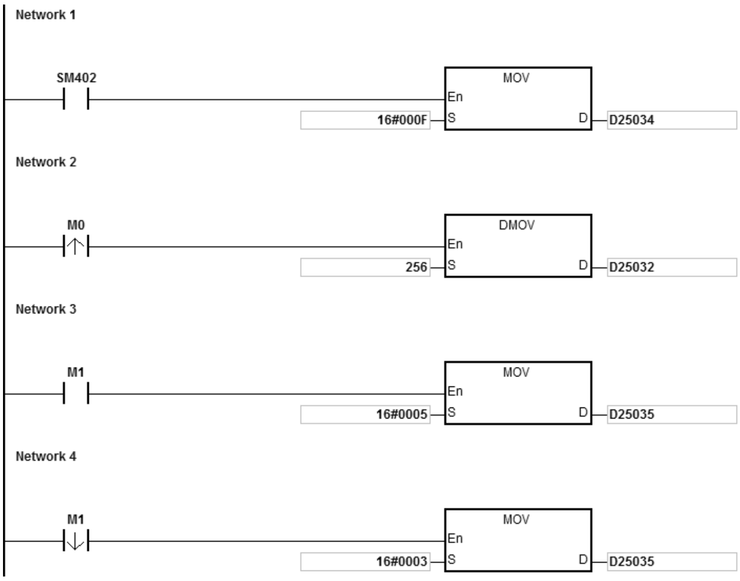
After you finish setting the above parameters, double click the master device to display the **Node List Setting** dialog box. Select ASDA-A2 Drive, and click **>** to move the A2 drive to the right-side list, and then download the configured data.



The mapping relation between master and slave:

DVP-ES3 Series PLC master register	Data transmission on CANopen bus	A2 device
D25032	⇨	Low word of P1-09 of servo
D25033		High word of P1-09 of servo
D25034		P3-06 of servo
D25037		P4-07 of servo
D24032	⇦	Low word of P0-09 of servo
D24033		High word of P0-09 of servo

6. Program control: D25032 is given the value 256 in ISPSoft; that is, the speed command is set as 256r/min in the following diagram.



7. Program explanation

When the DVP-ES3 Series PLC runs for the first time, set the parameter P3-06 for servo drive to F.

- When M0 switches from OFF to ON, the instruction writes 256 to D25032 and then writes the value to the servo parameter P1-09 through RxPDO1.
- When M1 switches from OFF to ON, change P4-07 to 5. DI1 and DI3 are ON. DI1 means the SERVO is ON and DI3 calls the speed specified by parameter P1-09 for servo rotation.
- When M1 switches from ON to OFF, the speed command becomes 0 and the motor stops running.

10.7 Object Dictionary

The following table lists the communication objects in the object dictionary.

Index	Subindex	Object name	Data type	Attr.	Default value
H'1000	H'00	Device type	Unsigned 32 bits	R	0x00000000
H'1001	H'00	Error register	Unsigned 8 bits	R	0
H'1005	H'00	COB-ID SYNC	Unsigned 32 bits	RW	0x00000080
H'1008	H'00	Manufacturer device name	Vis-String	R	DVP-ES3 Series PLC
H'1014	H'00	COB-ID EMCY	Unsigned 32 bits	R	0x80 + Node-ID
H'1016	--	Consumer heartbeat time			
	H'00	Number of valid subindex	Unsigned 8 bits	R	1
	H'01	Consumer heartbeat time	Unsigned 32 bits	RW	0
H'1017	H'00	Producer heartbeat time	Unsigned 16 bits	RW	0
H'1018	--	Identity Object			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	Vendor-ID	Unsigned 32 bits	R	0x000001DD
	H'02	Product code	Unsigned 32 bits	R	0x00000055
	H'03	Revision number	Unsigned 32 bits	R	0x00010002
H'1400	--	RxPDO1 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO1	Unsigned 32 bits	RW	0x00000200+ Node-ID
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1401	--	RxPDO2 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO2	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1402	--	RxPDO3 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO3	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
H'1402	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1403	--	RxPDO4 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO4	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1404	--	RxPDO5 communication			

Index	Subindex	Object name	Data type	Attr.	Default value
		parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO5	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1405	--	RxPDO6 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO6	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1406	--	RxPDO7 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO7	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1407	--	RxPDO8 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	3
	H'01	COB-ID of RxPDO8	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	0
H'1600	--	RxPDO1 mapping parameter			
H'1600	H'00	Number of valid subindex	Unsigned 8 bits	RW	4
	H'01	The first mapped object	Unsigned 32 bits	RW	0x20000110
	H'01	The second mapped object	Unsigned 32 bits	RW	0x20000210
	H'02	The third mapped object	Unsigned 32 bits	RW	0x20000310
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0x20000410
H'1601	--	RxPDO2 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1602	--	RxPDO3 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1603	--	RxPDO4 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0

Index	Subindex	Object name	Data type	Attr.	Default value
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1604	--	RxPDO5 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
H'1604	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1605	--	RxPDO6 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1606	--	RxPDO7 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1607	--	RxPDO8 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'01	The second mapped object	Unsigned 32 bits	RW	0
	H'02	The third mapped object	Unsigned 32 bits	RW	0
	H'03	The fourth mapped object	Unsigned 32 bits	RW	0
H'1800	--	TxPDO1 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO1	Unsigned 32 bits	RW	0x00000180+ Node-ID
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
H'1800	H'05	Timer	Unsigned 16 bits	RW	100
H'1801	--	TxPDO2 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO2	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1802	--	TxPDO3 communication parameter			

Index	Subindex	Object name	Data type	Attr.	Default value
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO3	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1803	--	TxPDO4 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO4	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1804	--	TxPDO5 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO5	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1805	--	TxPDO6 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO6	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
H'1805	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1806	--	TxPDO7 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO7	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1807	--	TxPDO8 communication parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	R	5
	H'01	COB-ID of TxPDO8	Unsigned 32 bits	RW	0x80000000
	H'02	Transmission mode	Unsigned 8 bits	RW	0xFF
	H'03	Inhibit time	Unsigned 16 bits	RW	50
	H'05	Timer	Unsigned 16 bits	RW	100
H'1A00	--	TxPDO1 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	4
	H'01	The first mapped object	Unsigned 32 bits	RW	0x20010110
	H'02	The second mapped object	Unsigned 32 bits	RW	0x20010210
	H'03	The third mapped object	Unsigned 32 bits	RW	0x20010310

Index	Subindex	Object name	Data type	Attr.	Default value
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0x20010410
H'1A01	--	TxPDO2 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
	H'03	The third mapped object	Unsigned 32 bits	RW	0
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0
H'1A02	--	TxPDO3 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
H'1A02	H'03	The third mapped object	Unsigned 32 bits	RW	0
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0
H'1A03	--	TxPDO4 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
	H'03	The third mapped object	Unsigned 32 bits	RW	0
H'1A04	--	TxPDO5 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
	H'03	The third mapped object	Unsigned 32 bits	RW	0
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0
H'1A05	--	TxPDO6 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
	H'03	The third mapped object	Unsigned 32 bits	RW	0
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0
H'1A06	--	TxPDO7 mapping parameter			
	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
	H'03	The third mapped object	Unsigned 32 bits	RW	0
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0
H'1A07	--	TxPDO8 mapping parameter			
H'1A07	H'00	Number of valid subindex	Unsigned 8 bits	RW	0
	H'01	The first mapped object	Unsigned 32 bits	RW	0
	H'02	The second mapped object	Unsigned 32 bits	RW	0
	H'03	The third mapped object	Unsigned 32 bits	RW	0
	H'04	The fourth mapped object	Unsigned 32 bits	RW	0

11

Chapter 11 CPU Module Operating Principles

Table of Contents

11.1 CPU Module Operations

11.1.1 Procedure

The following diagram describes the operation of the CPU module.

The CPU module is supplied with power.

The system enables the initialization.
- The non-latched memory is initialized.
- The downloaded program is checked.
- The parameters in the CPU module are checked.
- The parameters in the module table are checked.
- The module table in the CPU module is compared with the actual I/O configuration.
- The I/O setting is downloaded to the I/O module.
- If the memory card is installed, whether to execute the system copy procedure or not is checked.

Diagnosis processing:
- The memory card and other setting are checked.
- The I/O bus is checked.
- The system parameter is checked.

The data sent to the I/O module is refreshed.
- The data sent to the digital I/O module is refreshed.
- The data sent to the analog I/O module is refreshed.
- The data sent to other modules are refreshed.

Program execution:
- The user program is executed.
- The interrupt subroutine is executed.

The data sent from the I/O module is refreshed.
- The data sent from the digital I/O module is refreshed.
- The data sent from the analog I/O module is refreshed.
- The data sent from other modules are refreshed.

Communication service:
- The communication through the CPU module
- The communication through other I/O modules
- The internal communication between the CPU module and the I/O module

11.1.2 I/O Refreshing and Communication Service

- **Refreshing I/O**

The CPU module reads external I/O data periodically or outputs data to an external I/O. Refreshing the I/O includes the following.

- Refreshing data in a digital I/O module
- Refreshing data in an analog I/O module
- Refreshing data in a network module

All I/O refreshing executes in the same loop. The data in an input device refreshes before a program executes, and the data in an output device refreshes after the program executes.

Unit	Maximum data exchange	Data exchange area
Digital I/O module	Depends on the number of input/output channels in the unit.	Input relay/Output relay
Analog I/O module	Depends on the number of input/output channels in the unit.	Data register
Network module	Depends on the unit.	Data register

- **Communication service**

Communication service is the unscheduled communication service for a network module. It includes the communication requests sent from external equipment to a CPU module, and the communication requests sent from the CPU module to the external equipment.

11.2 CPU Module Operating Modes

11.2.1 Operating Modes

There are two operating modes. They can be used to control a user program and all tasks.

STOP mode: A program is not executed under this mode. Users can download a module table, initialize CPU configuration and other setting, download a program, check a program, and force a bit ON/OFF.

RUN mode: A program is executed under this mode. Users can not download a module table, and initialize CPU configuration and other setting.

11.2.2 Status and Operation under Different Operating Modes

The following table lists the status and operation states for RUN and STOP modes.

- **Basic operation**

CPU mode	Program	I/O refreshing	External output	Program memory	
				Non-latched area	Latched area
STOP	The execution of the program stops.	I/O refreshing executes.	OFF. If you set the I/O module so that the final state of the external output on the I/O module is retained, the final state of the external output on the I/O module is retained.	The data in the program memories is retained.	
RUN	The program executes.	I/O refreshing executes.	The program controls the external output.	The program controls the program memories.	

- **Relationship between the operating modes and tasks**

Mode	Loop task	Interrupt task
STOP	Execution of a loop tasks stops.	Execution of an interrupt task stops.
RUN	● The tasks that have not been executed are in the HALT state. ● If a task is active, or the instruction TKON is executed, the task executes. ● If a task is not active, or the instruction TKOFF executes, the task does not execute.	If the condition of the interrupt is met, the interrupt task executes.

- **Relationship between changing modes and the program memory**

Change of the mode	Non-latched area	Latched area
STOP→RUN	Data is cleared or retained depending on your setting.	The data is retained.
RUN→STOP	The data is retained.	The data is retained.

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Chapter 12 Troubleshooting

Table of Contents

12.1 Troubleshooting

12.1.1 Basic troubleshooting steps

This chapter includes the possible errors the can occur during operation, their causes, and corrective actions.

(1) Check the following:

- The PLC should be operated in a safe environment (consider environmental, electronic, and vibration safeties).
- Connect power supply correctly to the PLC.
- Secure the module, terminal, and cable installations.
- All LED indicators show correctly.
- Set all switches correctly.

(2) Check the following operational functions:

- Switch the RUN/STOP state
- Check the settings for the DVP-ES3 Series to RUN/STOP
- Check and eliminate errors from external devices
- Use the System Log function in ISPSoft to check system operation and logs

(3) Identify possible causes:

- DVP-ES3 Series or external device
- CPU or extension modules
- Parameters or program settings

12.1.2 Clear the Error States

Use the following methods to clear the error states. If the error source is not corrected, the system continues to show errors.

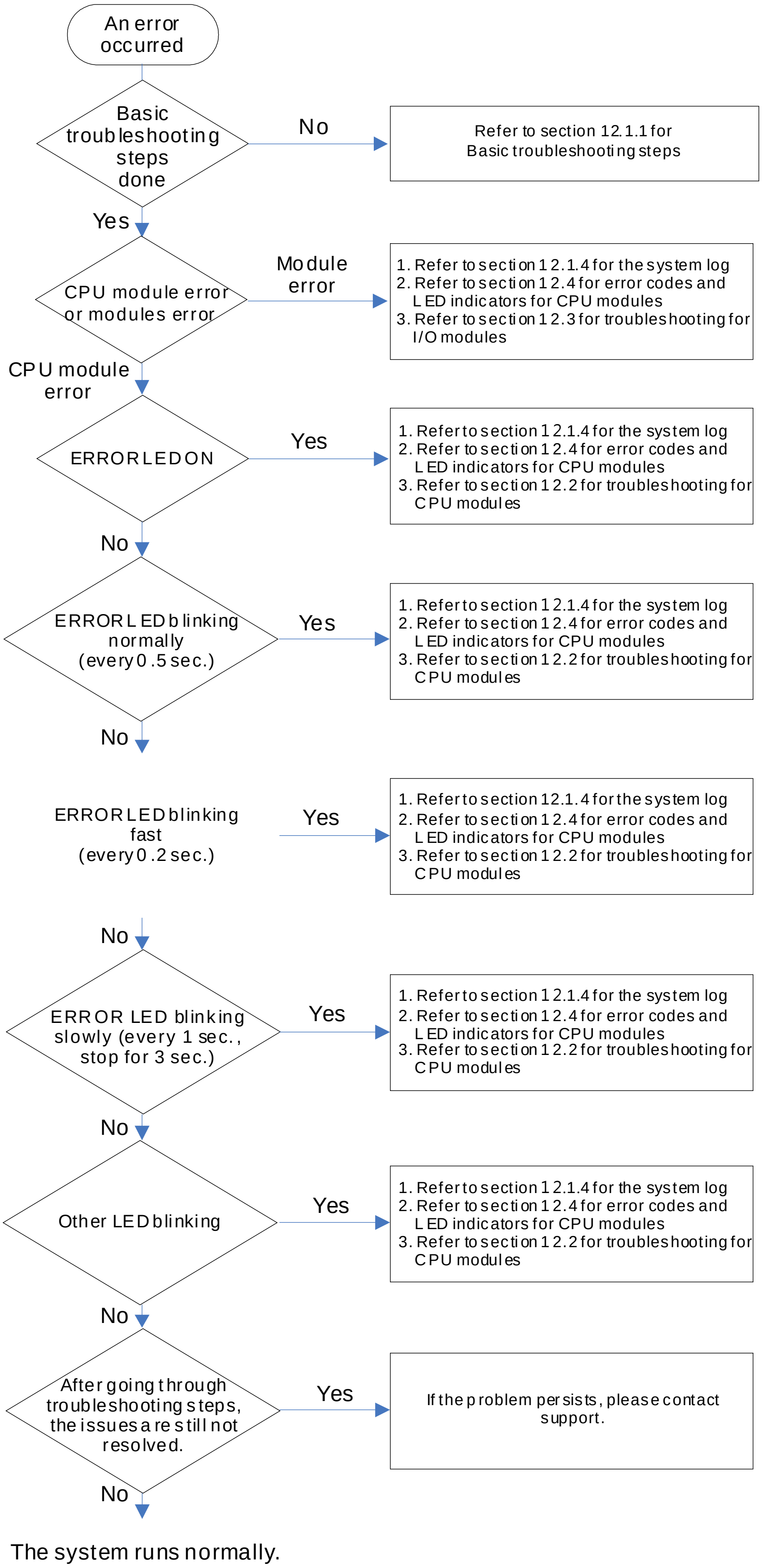
(1) Switch the CPU model state to STOP and then to RUN.

(2) Turn off the CPU and turn it on again.

(3) Use ISPSoft to clear the error logs.

(4) Reset the CPU to the default settings and download the program again.

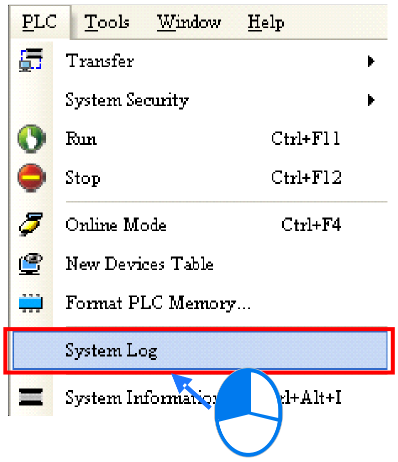
12.1.3 Troubleshooting SOP



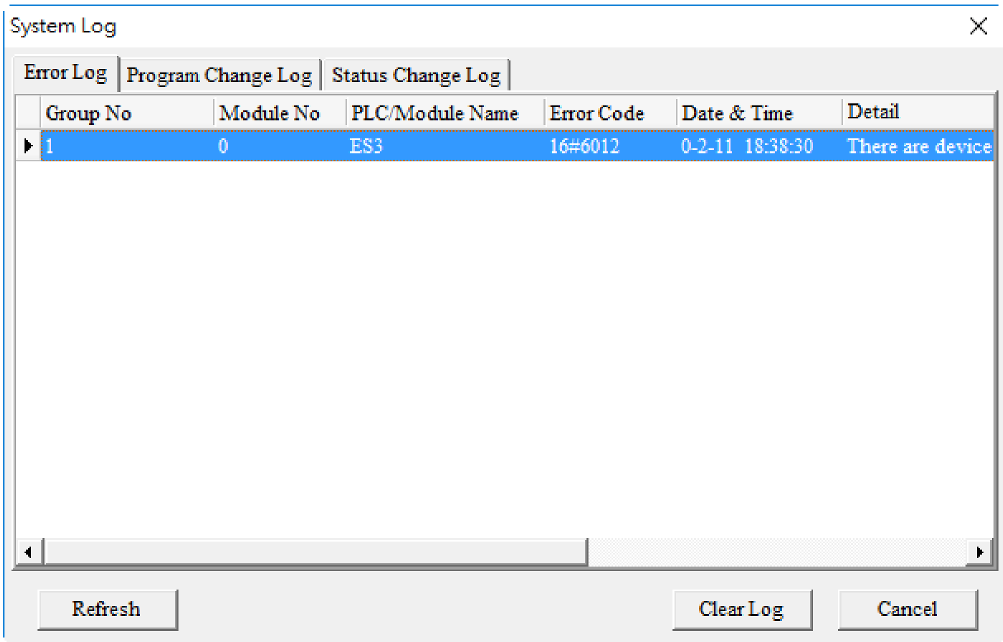
12.1.4 System Log

If ISPSoft is connected to a DVP-ES3 Series, you can view actions and errors in the DVP-ES3 Series by clicking **System Log** on the **PLC** menu. The CPU can store up to 20 error log sets. After the 20 sets are stored, the 1st log is replaced with the 21st if there are new logs coming in, and the old logs are replaced with the new ones sequentially. When the memory card is installed in the CPU module, 20 sets of the old logs are backed up in the memory card and up to 1000 logs can be recorded. If the stored logs exceed 1000, the oldest 20 logs are replaced with the newest 20 logs in the memory card.

(1) On the **PLC** menu, click **System Log**.



(2) The **System Log** window appears. Click **Clear Log** to clear the error log in the window and the error log in the CPU module, and reset the CPU module.



- Group No.: The number 1 indicates that the error occurred in the CPU module or the right-side module 1.
- Module No.: The number 0 indicates that the error occurred in the CPU module or the remote module. T
- PLC/Module name: Model names of the CPU, remote, and extension modules.
- Error Code: Error codes in the error log.
- Date & Time: The date and time the error occurred. The most recently occurring error is listed on the top.
- The last column shows the descriptions for the error.

12.2 Troubleshooting for CPU Modules

Check the LED indicators and the error codes from the CPU module and refer to the following table for troubleshooting. V in the Log column indicates the error is recorded in the log. X in the Log column indicates the error is not recorded in the log. H in the Log column indicates whether or not you can set recording the error in the log in HWCONFIG.

12.2.1 ERROR LED Indicators Are ON

Error Code (16#)	Description	Solution	Flag	Log
000A	Scan timeout	1. Check the setting of the watchdog timer in HWCONFIG. 2. Check whether the program causes a long scan time	SM8	V

12.2.2 ERROR LED Indicators Blinking Every 0.5 Seconds

Error Code (16#)	Description	Solution	Flag	Log
000C	The program in the PLC is damaged.	Download the program again.	SM9	V
0010	CPU memory is denied.	Contact the factory.	SM9	V
002E	CPU external memory access is denied.	Contact the factory.	SM9	V
002F	PLC programs are not consistent with the system logs.	Download the program again.	SM34	V
0102	The interrupt number exceeds the range.	Check the program, compile the program again, and download the program again.	SM5	X
0202	The MC instruction exceeds the range.	Check the program, compile the program again, and download the program again.	SM5	X
0302	The MCR instruction exceeds the range.	Check the program, compile the program again, and download the program again.	SM5	X
0D03	The operands used in DHSCS are not used properly.	Check the program, compile the program again, and download the program again.	SM5	X
0E05	The operands HCXXX used in DCNT are not used properly.	Check the program, compile the program again, and download the program again.	SM5	X
200A	Invalid instruction	Check the program, compile the program again, and download the program again.	SM5	V
6010	The number of MODBUS TCP connections exceeds the range.	Check the number of superior devices (maximum is 32).	SM 1092	V
6011	The number of EtherNet/IP connections exceeds the range.	Check the number of connections (maximum is 16).	SM 1093	V
C000 - CFFF	The program syntax is incorrect.	Save the PLC program and hand the file to the company or the technicians.		

12.2.3 ERROR LED Indicators Blinking Rapidly Every 0.2 Seconds

This happens when the power supply 24 VDC of the CPU module is disconnected, or the power supply is not sufficient, not stable or abnormal.

Error Code (16#)	Description	Solution	Flag	Log
002A	The external voltage is abnormal.	Check whether the external 24 V power supply to the module is normal.	SM7	V

12.2.4 ERROR LED Indicators Slow Blinking Every 3 Seconds and Lighting up for 1 Second

Error Code (16#)	Description	Solution	Flag	Log
1900 - 191C	Heartbeat errors occurred in the slave for the Delta ASD-A2 control.	1. Check the CANopen connection cable. 2. Check if the specific slave is working properly. Note: The last 2 digits of the error code represent the ID number of the slave (convert hexadecimal to decimal).	-	V

12.2.5 The LED RUN and ERROR Indicators are Blinking Simultaneously Every 0.5 Seconds

This happens when the firmware of the CPU module is being upgraded. If this happens once the power is supplied to the CPU module, it means errors occurred during the previous firmware upgrade. Users need to upgrade the firmware again or contact your point of purchase.

12.2.6 The RUN and LED Indicators are Blinking One After Another Every 0.5 Seconds.

This happens when the CPU module memory card is backing up, restoring, or saving.

12.2.7 Other Errors (Without LED Indicators)

Error Code (16#)	Description	Solution	Flag	Log
0011	The PLC ID is incorrect.	Check the PLC ID.	SM34	V
0012	The PLC password is incorrect.	Check the PLC password.	SM34	V
002D	The PLC maximum password attempts exceeded.	Reset the CPU module or restore the CPU module to its factory settings.	SM34	V
0050	The memories in the latched special auxiliary relays are abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again. 2. If the error still occurs, contact the factory.	SM6	V
0051	The latched special data registers are abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again.	SM6	V

		2. If the error still occurs, contact the factory.		
0052	The memories in the latched auxiliary relays are abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again. 2. If the error still occurs, contact the factory.	SM6	V
0054	The latched counters are abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again. 2. If the error still occurs, please contact the factory.	SM6	V
0055	The latched 32-bit counters are abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again. 2. If the error still occurs, contact the factory.	SM6	V
0056	The latched special auxiliary relay is abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again. 2. If the error still occurs, contact the factory.	SM6	V
0059	The latched data registers are abnormal.	1. Reset the CPU module or restore the CPU module to its factory settings, and then download the program and the parameters again. 2. If the error still occurs, contact the factory.	SM6	V
005D	The CPU module does not detect a memory card.	Check that the memory card is inserted correctly into the CPU module.	SM453	V
005E	The memory card is initialized incorrectly.	Check whether the memory card is broken.	SM453	V
0063	An error occurs when data is written to the memory card.	Check whether the file path is correct or whether the memory card is malfunctioning.	SM453	V
0064	A file in the memory card cannot be read.	Check whether the file path is correct, or whether the file is damaged.	SM453	V
1950	The initialization of the Delta ASD-A2 control has not yet been completed, the CANopen instructions cannot be executed.	1. Check the CANopen connection cable. 2. Check if the specific slave is working properly. 3. If nothing is wrong, initialize the Delta ASD-A2 again.	-	V
2001	Not in the right mode for the ASDA-A2 while using the CANopen communication instruction.	Check if the CANopen operation mode is correct.	SM0	V
2003	The device used in the program exceeds the device range.	Check the program, compile the program again, and download the program again.	SM0	V
200B	The operand n or the other constant operands K/H exceed the range.	Check the program, compile the program again, and download the program again.	SM0	V
200C	The operands overlap.	Check the program, compile the program again, and download the program again.	SM0	V
200D	The binary to binary-coded decimal conversion is incorrect.	Check the program, compile the program again, and download the program again.	SM0	V
200E	The string does not end with 00.	Check the program, compile the program again, and download the program again.	SM0	V
2012	Incorrect division operation	Check the program, compile the program again, and download the program again.	SM0	V
2013	The value exceeds the range of values that can be represented by the	Check the program, compile the program again, and download the program again.	SM0	V

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	floating-point numbers.			
2014	The task designated by the TKON or YKOFF instruction is incorrect or exceeds the range.	Check the program, compile the program again, and download the program again.	SM0	V
2017	The instruction BREAK is written outside of the FOR-NEXT loop.	Check the program, compile the program again, and download the program again.	SM0	V
2027	No such position planning table number or the format is incorrect.	1. Check the program, compile the program again, and download the program again. 2. Check the settings of the position planning table.	SM0	V
2028	High speed output instruction is being executed. Only one instruction can be executed at a time.	Refer to SR28 for the record of the axis number and rearrange the output control procedures.	-	V
6004	The IP address filter is set incorrectly.	Set the Ethernet parameter for the CPU module in HWCONFIG again.	SM1108	X
600D	RJ45 port is not connected.	Check the connection.	SM1100	X
6012	There are devices using the same IP address.	1. Check if there are devices using the same IP address. 2. Check if there is more than 1 DHCP or BOOTP server on the network.	SM1101	V
6100	The email connection is busy.	Retry the email connection later. This error does not cause the PLC to stop running. Solve the problem by means of the related flag in the program.	SM1113	X
6103	The trigger attachment mode in the email is set incorrectly.	Set up the trigger attachment mode in HWCONFIG > CPU Module > Device Setting > Options > Ethernet Port Advanced > Email > Trigger Setting > Trigger Attachment Mode.	SM1113	X
6104	The attachment in the email does not exist.	Check whether the attachment exists in the memory card.	SM1113	X
6105	The attachment in the email is oversized.	Check the size of the attachment. If the size is over 2 MB, the file cannot be sent as an attachment.	SM1113	X
6106	There is an SMTP server response timeout.	Check for the correct address and set up the SMTP server in HWCONFIG > CPU Module > Device Setting > Options > Ethernet Port Advanced > Email again.	SM1113	X
6107	There is an SMTP server response timeout.	1. Check whether the status of the SMTP server is normal. 2. Retry sending of the email later. This error does not cause the PLC to stop running. Solve the problem by means of the related flag in the program.	SM1113	X
6108	SMTP verification failed	Check for the correct ID/Password and set up in HWCONFIG > CPU Module > Device Setting > Options > Ethernet Port Advanced > Email again.	SM1113	X
6200	The remote communication IP address set in the TCP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > TCP Socket.	-	X
6201	The local communication port set in the TCP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module	-	X

		in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > TCP Socket.		
6202	The remote communication port set in the TCP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > TCP Socket.	-	X
6203	The device from which the data is sent in the TCP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > TCP Socket.	-	X
6206	The device which receives the data in the TCP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > TCP Socket.	-	X
6208	The data received through the TCP socket exceeds the device range.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > TCP Socket.	-	X
6209	The remote communication IP address set in the UDP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > UDP Socket.	-	X
620A	The local communication port set in the UDP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > UDP Socket.	-	X
620C	The device from which the data is sent in the UDP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > UDP Socket.	-	X
620F	The device which receives the data in the UDP socket function is illegal.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > UDP Socket.	-	X

6210	The data received through the UDP socket exceeds the device range.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > UDP Socket.	-	X
6212	There is no response from the remote device after the timeout period.	Make sure that the remote device is connected.	-	X
6213	The data received exceeds the limit.	1. Check the program and the related special data registers. 2. Set the Ethernet parameter for the CPU module in HWCONFIG CPU Module > Device Setting > Options > Ethernet Port Advanced > UDP Socket.	-	X
6214	The remote device refuses the connection.	Make sure the remote device operates normally.	-	X
6215	The socket is not opened.	Check whether operational sequence in the program is correct.	-	X
6217	The socket is opened.	Check whether operational sequence in the program is correct.	-	X
6218	The data has been sent through the socket.	Check whether operational sequence in the program is correct.	-	X
6219	The data has been received through the socket.	Check whether operational sequence in the program is correct.	-	X
621A	The socket is closed.	Check whether operational sequence in the program is correct.	-	X
7011	The device communication function code in COM1 is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7012	The device communication address used in COM1 is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7013	The device used in COM1 exceeds the device range.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7014	The device length of the communication data in COM1 exceeds the limit.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7017	The device checksum for the communication serial port of COM1 is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7021	The device communication function code in COM2 is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7022	The device communication address used in COM2 is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7023	The device used in COM2 exceeds the device range.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H

7024	The device length of the communication data in COM2 exceeds the limit.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7027	The device checksum for the communication serial port of COM2 is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7031	The device communication function code in the Ethernet is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7032	The device communication address used in the Ethernet is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7033	The device used in the Ethernet exceeds the device range.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7034	The device length of the communication data in the Ethernet exceeds the limit.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7037	The device checksum for the communication serial port of the Ethernet is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7041	The device communication function code in the USB is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7042	The device communication address used in the USB is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7043	The device used in the USB exceeds the device range.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7044	The device length of the communication data in the USB exceeds the limit.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7047	The device checksum for the communication serial port of the USB is incorrect.	1. Check the communication setting in the master and the slave. 2. Check the communication cable.	-	H
7203	Invalid communication function code	1. Refer to the function codes defined by the communication protocols. 2. Check if the product firmware and the software used are the most updated versions. 3. Make a note of the operation procedures and screenshots of the error windows and hand this note to the company or the technicians from the agents.	-	H
8105	The contents of the program downloaded are incorrect. The program syntax is incorrect.	1. Download the program and parameters again. 2. Check the communication cable. 3. Save all the projects and compress the projects into one compressed file and then hand this file to the company or the technicians from the agents.	-	H

8106	The contents of the program downloaded are incorrect. The length of the execution code exceeds the limit.	1. Download the program and parameters again. 2. Save all the projects and compress the projects into one compressed file and then hand this file to the company or the technicians from the agents.	-	H
8107	The contents of the program downloaded are incorrect. The length of the source code exceeds the limit.	1. Download the program and parameters again. 2. Save all the projects and compress the projects into one compressed file and then hand this file to the company or the technicians from the agents.	-	H
8000 - 8FFF	Errors occur between software and PLC.	1. Check if the product firmware and the software used are the most updated versions. 2. Make a note of the operation procedures and screenshots of the error windows and hand this note to the company or the technicians from the agents.		

12.3 Troubleshooting for Analog Modules (AD / DA / XA) and Temperature Modules (PT / TC)

Digital I/O, analog I/O, and temperature measurement modules can be installed in a DVP-ES3 Series system.

Error status is shown in error codes in CR#43. 0 indicates normal and 1 indicates error. Refer to the following table for more details.

Error Code	RUN LED	ERROR LED	Description	Solution
bit0	OFF	ON	The external voltage is abnormal.	Check the power supply.
bit1	RUN: Blinking STOP: OFF	Blinking	Hardware failure	Contact the factory.
bit2			Conversion value exceeds the set upper/lower value	Check the upper and lower value
bit3			The signal received by channel 1 exceeds the range of analog inputs (temperature).	Check the signal received by channel 1
bit4			The signal received by channel 2 exceeds the range of analog inputs (temperature).	Check the signal received by channel 2
bit5			The signal received by channel 3 exceeds the range of analog inputs (temperature).	Check the signal received by channel 3
bit6			The signal received by channel 4 exceeds the range of analog inputs (temperature).	Check the signal received by channel 4
bit7			The signal received by channel 5 exceeds the range of analog inputs (temperature).	Check the signal received by channel 5
bit8			The signal received by channel 6 exceeds the range of analog inputs (temperature).	Check the signal received by channel 6
bit9			Mode setting error	Check the mode setting
bit10			Average time setting error	Check the average time setting
bit11			Upper/lower value setting error	Check the upper/lower value setting
bit12			Set value cannot be changed.	Check the value in CR#40 (set value changing prohibited)
bit13			The later module is disconnected.	Check the wiring.

12.4 LED Indicators and Error Codes for CPU Modules

The error codes and LED indicators are presented in the following tables.

- **Descriptions used in the table**

a. Error code: If an error occurs in the system, an error code is generated.

b. Description: The description of the error

c. CPU status: If the error occurs, the CPU stops running, keeps running, or shows the status you defined for the error.

➢ Stop: The CPU stops running when the error occurs.

➢ Continue: The CPU keeps running when the error occurs.

d. LED indicator status: If the error occurs, the LED indicator is ON, OFF, or blinks.

➢ ERROR: System error

- **LED Indicator Description Table**

There are five types of error indicator states for of the CPU module errors, including LED indicator ON, OFF, blinking fast, blinking normally, and blinking slowly. When the LED indicator is ON, blinking fast/normally, clear the problems first in order to run the CPU module. When the LED indicator is blinking slowly, indicating a warning type of error codes, it does not require immediate action. Clear the problems when the module is powered off.

Module Type	LED Indicator	Descriptions
CPU	Error Type	**ON:** A serious error occurs in the module.
		Blinking fast (every 0.2 seconds): unstable power supply or hardware Failure.
		Blinking normally (every 0.5 second): system program errors or system cannot run.
	Warning Type	**Blinking slowly (every one second and off for three seconds):** a warning is triggered, but the system can still run.
		OFF: a warning is triggered, but the system can still run. You can modify the rules of how a warning is triggered, or use the SM/SR to show the warnings.

- **Error Code Description Table**

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
000A	Scan timeout	Stop	V				
000C	The program in the PLC is damaged.	Stop			V		
0010	The access to the memory in the CPU is denied.	Stop			V		
0011	The PLC ID is incorrect.	Continue					V
0012	The PLC password is incorrect.	Continue					V
0026	RTC cannot keep track of the current time	Continue					V
002A	24VDC power supply is not sufficient and then is recovered from low-voltage for less than 10 ms.	Continue		V			

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
002D	The PLC maximum password attempts exceeded.	Continue					V
002E	The access to the external memory of the CPU is denied.	Stop			V		
002F	PLC programs are not consistent with the system logs.	Stop			V		
0050	The memories in the latched special auxiliary relays are abnormal.	Continue					V
0051	The latched special data registers are abnormal.	Continue					V
0052	The memories in the latched auxiliary relays are abnormal.	Continue					V
0054	The latched counters are abnormal.	Continue					V
0055	The latched 32-bit counters are abnormal.	Continue					V
0056	The latched special auxiliary relay is abnormal.	Continue					V
0059	The latched data registers are abnormal.	Continue					V
005D	The CPU module does not detect a memory card.	Continue					V
005E	The memory card is initialized incorrectly.	Continue					V
0063	An error occurs when data is written to the memory card.	Continue					V
0064	A file in the memory card cannot be read.	Continue					V
0102	The interrupt number exceeds the range.	Stop			V		
0202	The MC instruction exceeds the range.	Stop			V		
0302	The MCR instruction exceeds the range.	Stop			V		
0D03	The operands used in DHSCS are not used properly.	Stop			V		
0E05	The operands HCXXX used in DCNT are not used properly.	Stop			V		
1800 - 180F	Errors occurred in the extension modules	Continue				V	
1900 - 191C	Heartbeat errors occurred in the slave of the Delta ASD-A2 control.	Continue				V	
1950	The initialization of the Delta ASD-A2 control has not yet been completed, the CANopen instructions cannot be executed.	Continue					V
2001	Not in the right mode for the ASDA-A2 while using the CANopen communication instruction.	Continue					V
2003	The device used in the program exceeds the device range.	Continue					V
200A	Invalid instruction	Stop			V		
200B	The operand n or the other constant operands K/H exceed the range.	Continue					V
200C	The operands overlap.	Continue					V

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
200D	The binary to binary-coded decimal conversion is incorrect.	Continue					V
200E	The string does not end with 00.	Continue					V
2012	Incorrect division operation	Continue					V
2013	The value exceeds the range of values which can be represented by the floating-point numbers.	Continue					V
2014	The task designated by the TKON or YKOFF instruction is incorrect, or exceeds the range.	Continue					V
2017	The instruction BREAK is written outside of the FOR-NEXT loop.	Continue					V
2027	No such position planning table number or the format is incorrect.	Continue					V
2028	The high speed output instruction is being executed. Only one instruction can be executed at a time.	Continue					V
6004	The IP address filter is set incorrectly.	Continue					V
600D	RJ45 port is not connected.	Continue					V
6010	The number of the MODBUS TCP connections exceeds the range.	Continue			V		
6011	The number of the EtherNet/IP connections exceeds the range.	Continue			V		
6012	There are devices using the same IP address.	Continue					V
6100	The email connection is busy.	Continue					V
6103	The trigger attachment mode in the email is set incorrectly.	Continue					V
6104	The attachment in the email does not exist.	Continue					V
6105	The attachment in the email is too big.	Continue					V
6106	There is an SMTP server response timeout.	Continue					V
6107	There is an SMTP server response timeout.	Continue					V
6108	SMTP verification failed	Continue					V
6200	The remote communication IP address set in the TCP socket function is illegal.	Continue					V
6201	The local communication port set in the TCP socket function is illegal.	Continue					V
6202	The remote communication port set in the TCP socket function is illegal.	Continue					V
6203	The device from which the data is sent in the TCP socket function is illegal.	Continue					V
6206	The device that receives the data in the TCP socket function is illegal.	Continue					V
6208	The data that is received through the TCP socket exceeds the device range.	Continue					V
6209	The remote communication IP address set in the UDP socket function is illegal.	Continue					V

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
620A	The local communication port set in the UDP socket function is illegal.	Continue					V
620C	The device from which the data is sent in the UDP socket function is illegal.	Continue					V
620F	The device that receives the data in the UDP socket function is illegal.	Continue					V
6210	The data that is received through the UDP socket exceeds the device range.	Continue					V
6212	There is no response from the remote device after the timeout period.	Continue					V
6213	The data received exceeds the limit.	Continue					V
6214	The remote device refuses the connection.	Continue					V
6215	The socket is not opened.	Continue					V
6217	The socket is opened.	Continue					V
6218	The data has been sent through the socket.	Continue					V
6219	The data has been received through the socket.	Continue					V
621A	The socket is closed.	Continue					V
7011	The device communication function code in COM1 is incorrect.	Continue					V
7012	The device communication address used in COM1 is incorrect.	Continue					V
7013	The device used in COM1 exceeds the device range.	Continue					V
7014	The device length of the communication data in COM1 exceeds the limit.	Continue					V
7017	The device checksum for the communication serial port of COM1 is incorrect.	Continue					V
7021	The device communication function code in COM2 is incorrect.	Continue					V
7022	The device communication address used in COM2 is incorrect.	Continue					V
7023	The device used in COM2 exceeds the device range.	Continue					V
7024	The device length of the communication data in COM2 exceeds the limit.	Continue					V
7027	The device checksum for the communication serial port of COM2 is incorrect.	Continue					V
7031	The device communication function code in Ethernet is incorrect.	Continue					V
7032	The device communication address used in Ethernet is incorrect.	Continue					V
7033	The device used in Ethernet exceeds the device range.	Continue					V
7034	The device length of the communication data in Ethernet exceeds the limit.	Continue					V

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
7037	The device checksum for the communication serial port of Ethernet is incorrect.	Continue					V
7041	The device communication function code in USB is incorrect.	Continue					V
7042	The device communication address used in USB is incorrect.	Continue					V
7043	The device used in USB exceeds the device range.	Continue					V
7044	The device length of the communication data in USB exceeds the limit.	Continue					V
7047	The device checksum for the communication serial port of USB is incorrect.	Continue					V
7203	Invalid communication function code	Continue					V
8105	The contents of the downloaded program are incorrect. The program syntax is incorrect.	Continue					V
8106	The contents of the downloaded program are incorrect. The length of the execution code exceeds the limit.	Continue					V
8107	The contents of the downloaded program are incorrect. The length of the source code exceeds the limit.	Continue					V
8000 - 8FFF	Errors occur between software and PLC.	Continue					V

13

Chapter 13 Data Tracer and Data Logger

Table of Contents

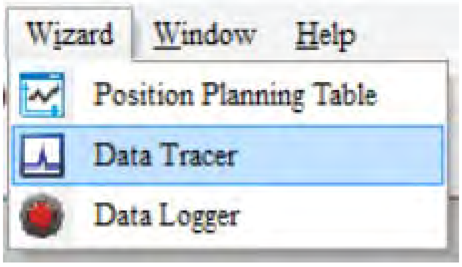
13.1 Data Tracer

13.1.1 About Data Tracer

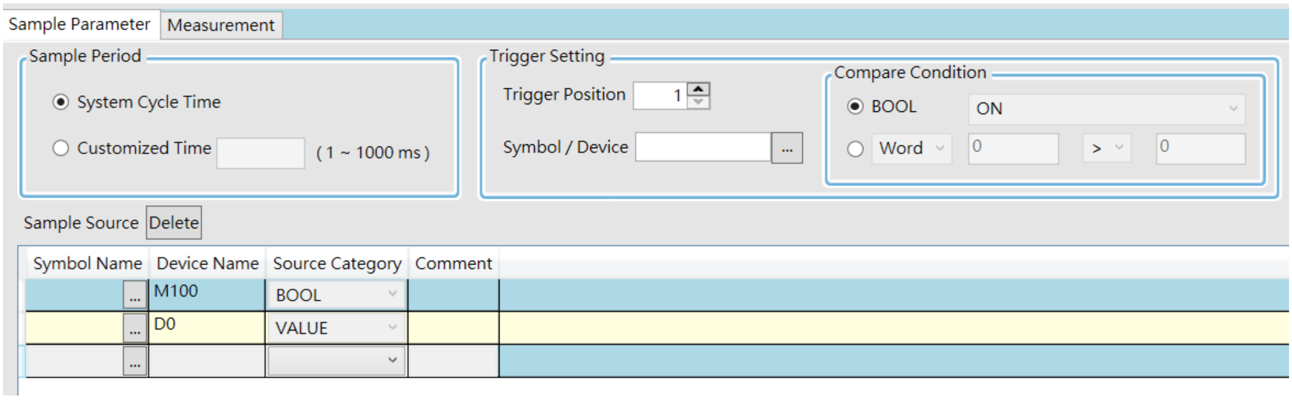
Data Tracer is used for the real-time collection of variable symbols, values, states in devices, after some trigger condition is met so as to draw curve charts for analysis of value trends. Refer to Section 22.2 in ISPSoft User Manual for more details.

Operation 1

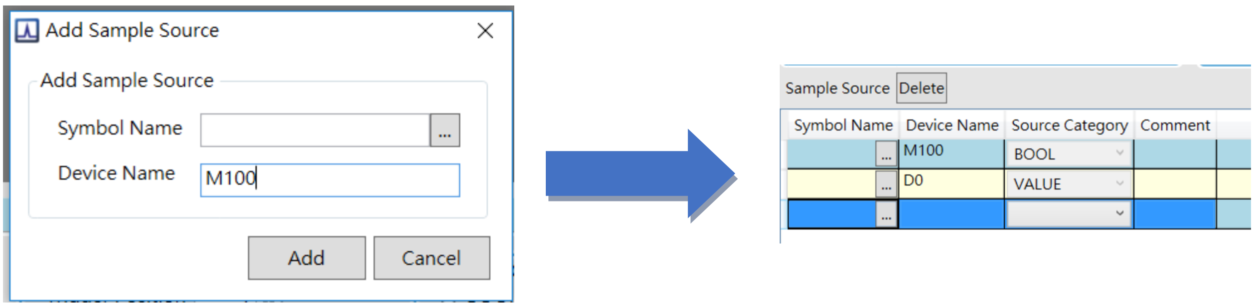
- Compile the current project before using the function. Click Wizard> Data Tracer to open the Data Tracer window as shown below.



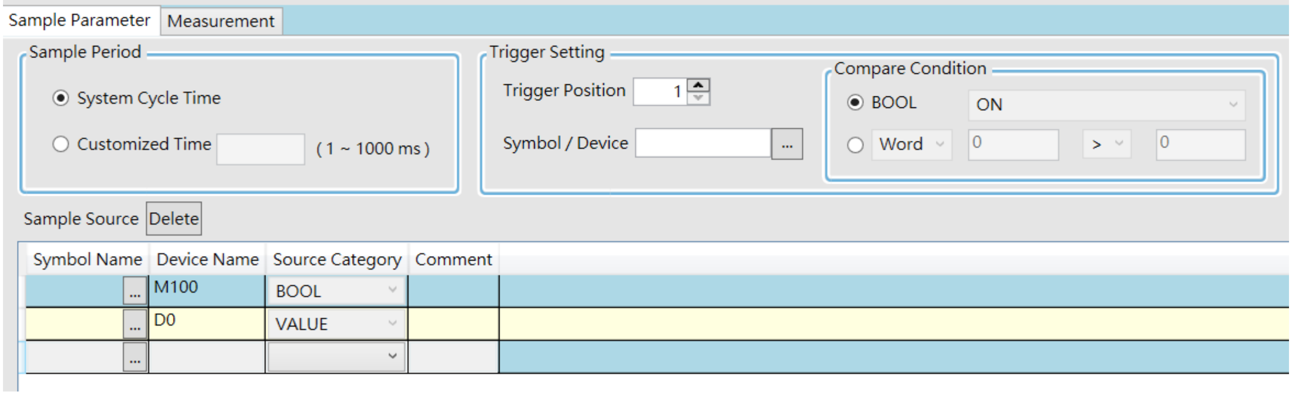
- Click the button of **Symbol Name** to open the **Add Sample Source** window.



- Click the button of **Symbol Name** in the **Add Sample Source** window and select the variable symbol name to be added in the **Choose Symbol** window or directly type a device name in the **Device Name** box.

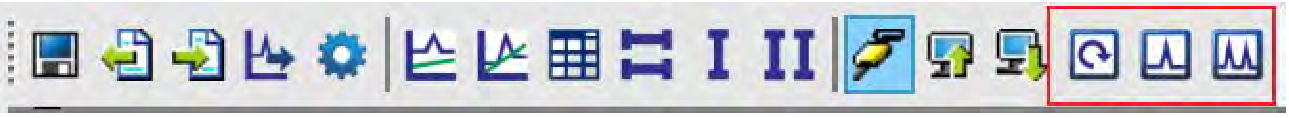


- Set up the sample period and trigger setting.

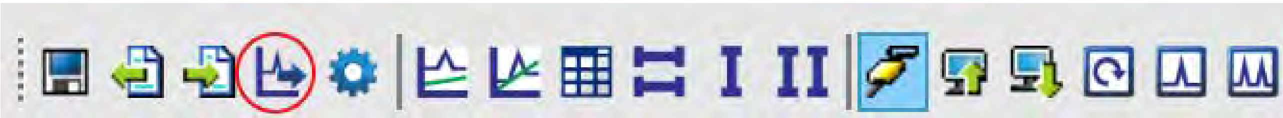


- After setting up the parameters, click on the icon toolbar to have the system in the online mode. Then click to download the settings to the PLC.

- After the sample parameter settings in the data tracer are completed and downloaded, any of the following three modes on the icon toolbar can be used for watching curves in the online mode.



- Click on the icon toolbar to export the data to your computer for future use.



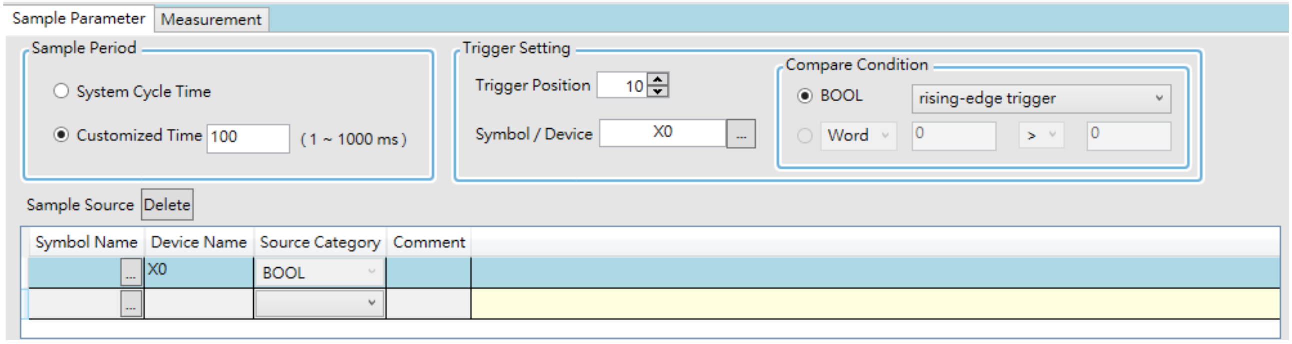
13.1.2 Example

If X0 is a signal to open/close externally. Use Data Trace to measure the width of time when X0 is ON.

- **Steps:**

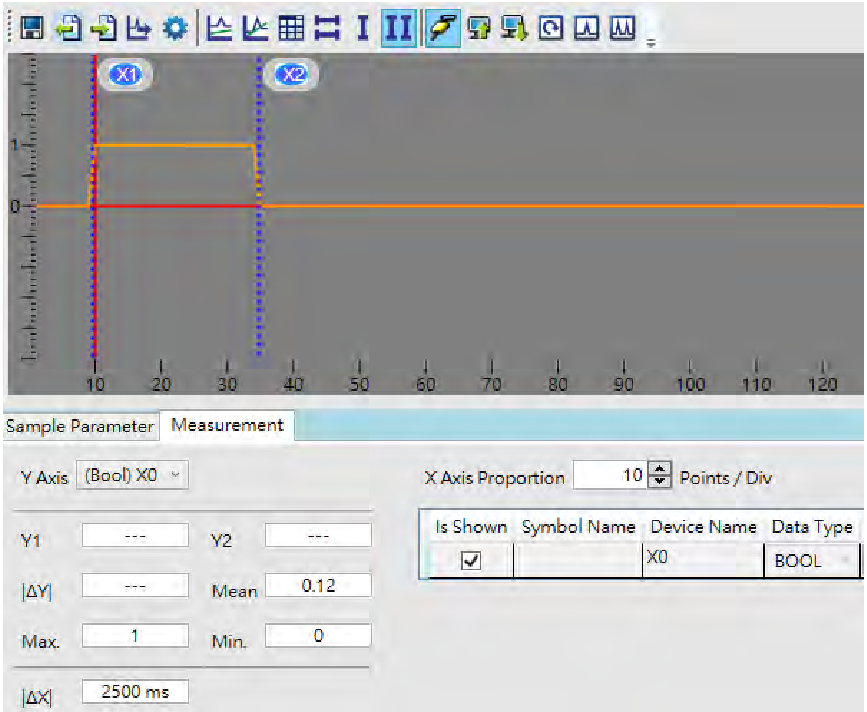
① Open Data Tracer and enter X0 for monitoring.

② Set the Customized Time to 100 ms to take samping, set the trigger device to X0, set the trigger position to 10, and then set the compare condition to ON as the image shown below.



③ Set the mode to One-shot trigger and wait for the trigger (ON). Once it is triggered, it displays the recorded curve data.

④ The value in **I Δ X1** is 2500 ms, the time measured between two vertical lines, X1 and X2. for X0.



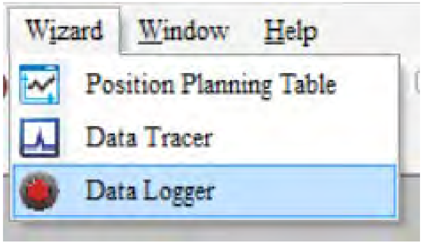
13.2 Data Logger

13.2.1 About Data Logger

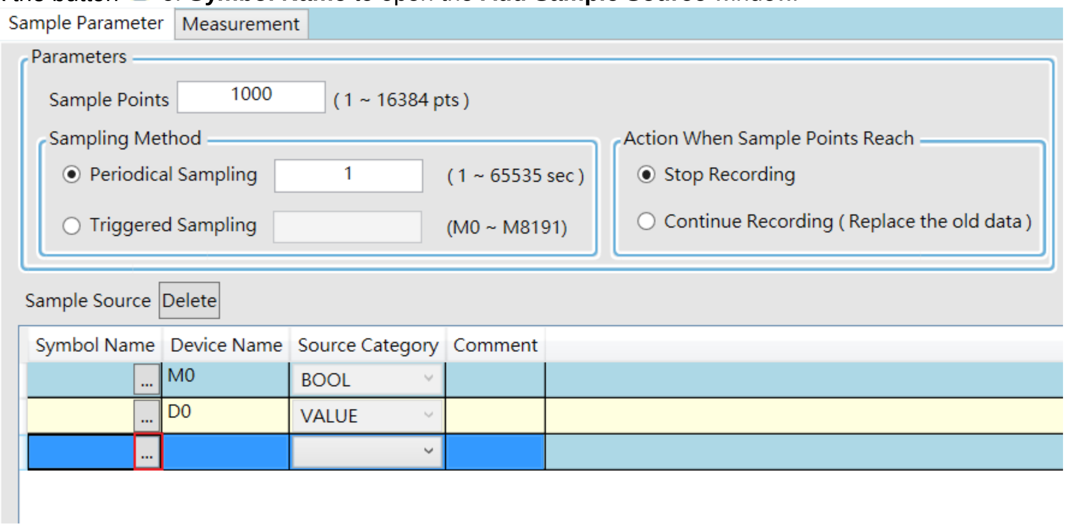
Data logger is used for the long-term recording of variable symbols, values, states in devices, and drawing curve charts. The data is stored in the PLC and the memory card of the PLC for analysis of value trends. Refer to Section 22.3 in ISPSoft User Manual for more details.

Operation A

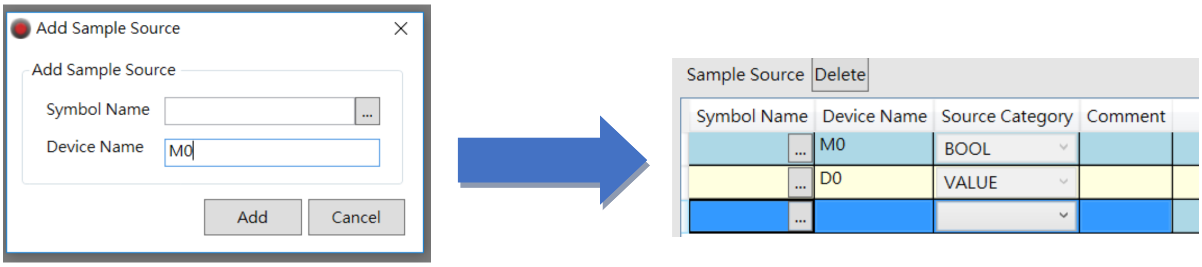
- Compile the current project before using the function. Click Wizard> Data Logger to open the Data Logger window as shown below.



- Click the button of **Symbol Name** to open the **Add Sample Source** window.

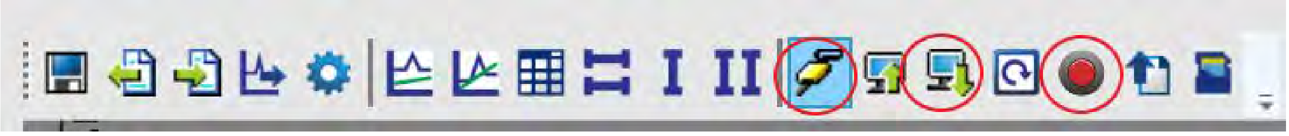


- Click the button of **Symbol Name** in the **Add Sample Source** window and select the variable symbol name to be added in the **Choose Symbol** window or directly type a device name in the **Device Name** box.

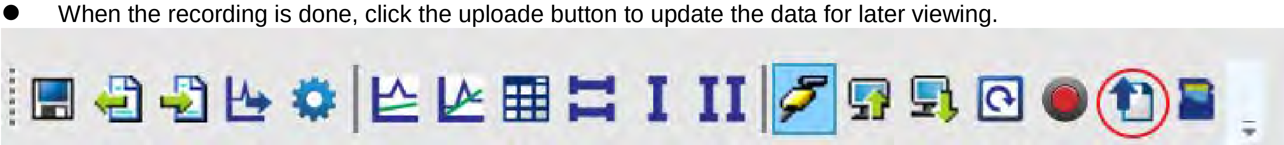


- After setting up the parameters, click  on the icon toolbar to have the system in the online mode. Then click  to download the settings to the PLC. And then click  to record data.

  Note: From here you can also follow Operation B to complete the recording and saving.



- When the recording is done, click the uploade button to update the data for later viewing.



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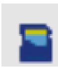
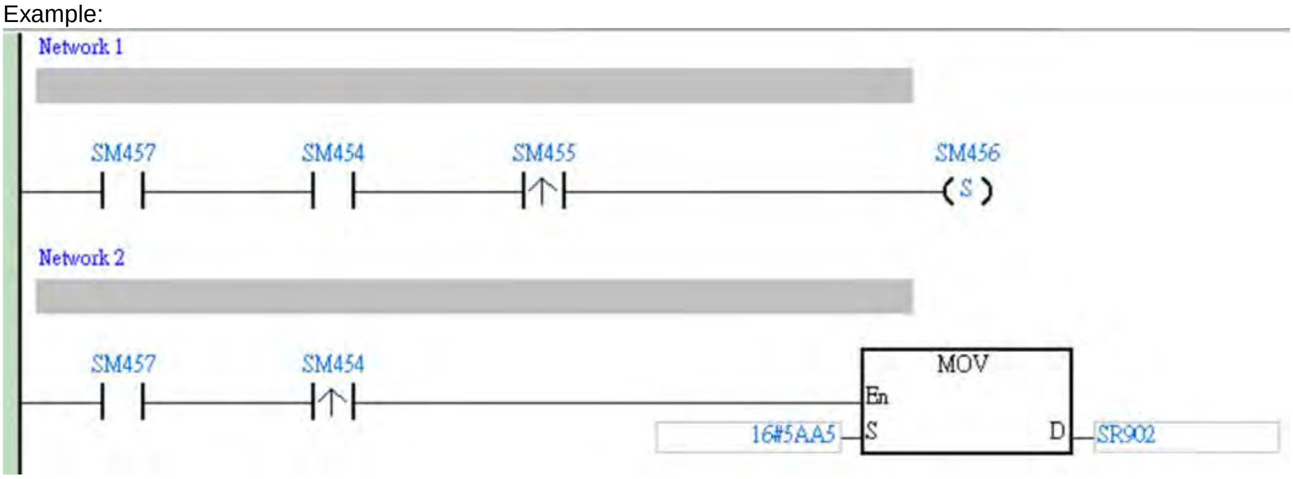
- Click  on the icon toolbar to export the data to your computer for future use.

- Click  on the icon toolbar or use SM and SR to save the data to the SD Card installed on the PLC.

Operation B

You can also use SM flags or SR registors to complete the data recording, data saving or set to store data on a SD card permanently. See the example below for reference.

Example:



- Check if the flag SM457 is ON. If the flag SM457 is ON, it indicates the valid recorded parameters are downloaded in data logger. And that means the operation A is done correctly.

- Use inputs to enable/disable or set the flag SM454 to ON for the PLC to start recording. If you need to store data on a SD card, set SR902=16#5AA5.

- When SM455 is ON or when the quantity of data has met the value set in SR900 (32-bit value), the system start saving data on a SD card.

  NOTE: While sending data to the SD card for storage, the PLC needs a period of undisturbing time, approximately tens of milliseconds. During this period, the PLC is not allowed to execute interrupts. Make sure the PLC is NOT executing any interrupts, especially the external input ones before starting to send data to the SD card for storage.

- When SM455 is switching from OFF to ON, set SM456 ON. And the PLC starts to store the recorded data on the SD card. The default path and the file name are as shown below:
  - Default saving path: \SDCard\PLC CARD\ES3\Log
  - Default file name
    DATA_LOGGER_yyyymmdd_hhmmss.log
    EX: DATA_LOGGER_20181108_161901.log

13.2.2 Related SM Flags and SR Registors

SM / SR	Attr.	Description
SM450	R	Check here to see if a SD Card is installed in the PLC. ON: SD card inside OFF: No SD card
SM452	R	Check here to see if data is being stored on the SD card. ON: In the operation of storing OFF: Not in the operation of storing
SM453	R	Check here to see if there is any SD card operational error. ON: Abnormal OFF: Normal
SR453	R	Check here to see the last operational error code of the SD card. Note: Only available when SM453=ON
SM454	R/W	Set this flag to ON/OFF to start or stop recording. The system will not set this flag to OFF automatically even if the space for recording is full. You need to set the flag to OFF manually.
SM455	R	Check here to see if the recorded number has reached the set limit. ON: The quantity of recordings has reached the set number or the SD card is in cycle recording.
SM456	R/W	Used with SR902 to activate the settings in SR902 for the SD card. Note: Set the flag from OFF to ON and the PLC starts to store the recorded data on the SD card when SR902=16#5AA5.
SM457	R	Check here to see if there is any valid, downloaded, recorded parameters in the data logger. ON: The valid recorded parameters are downloaded in data logger.
SR900	R	Check here to see the quantity of the recorded data (32-bit value). Note: It increments the number of the recorded data by 1 for each record.
SR902	R/W	Control codes for recorded data. ● 16#5AA5: Store data to a default root and specified file name on the SD card. ● 0: The storing is done. ● Others: Invalid numbers Note: Used with SM456 to activate this setting.

Note: "R" in the column of attribute (Attr.) indicates the item is read only and the status can be read here.

"W" in the column of attribute (Attr.) indicates you can set, delete or write a value for this item.

MEMO

A

Appendix A Installing a USB Driver

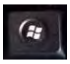
Table of Contents

A.1 Disable Driver Signature Enforcement

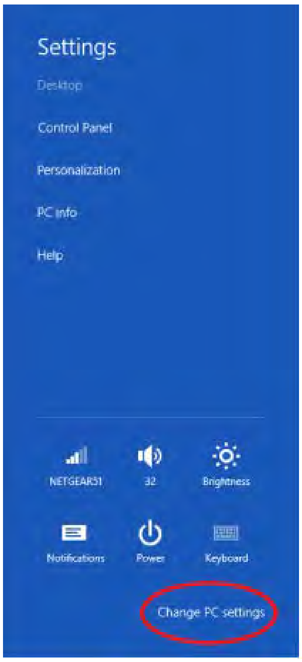
Driver signature enforcement provides a way to improve the security of the operating system by validating the integrity of a driver or system file each time it is loaded into memory. Because the Delta PLC USB driver does not include the driver signature, this section shows you how to disable driver signature enforcement in Windows to successfully install the Delta PLC USB driver. Once you disable the driver signature enforcement setting, it returns to its original state after you restart Windows.

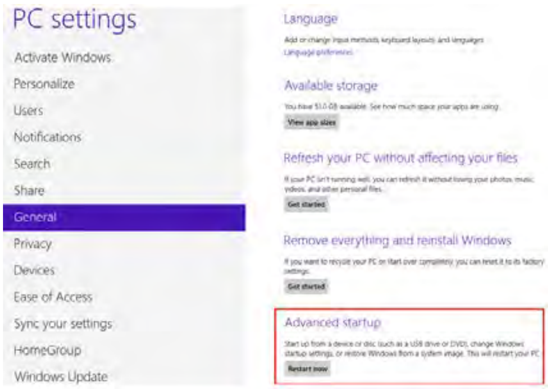
A.1.1 Disable Driver Signature Enforcement in Windows 8

Follow these steps to disable driver signature enforcement in Windows 8.

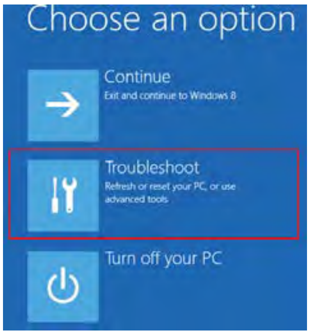
1. Press the Windows button  【WIN】+【I】 on your keyboard to display the **Settings** window. Click **Change PC settings**.

2. The **PC settings** window appears. Click **General** and then click **Restart now** under **Advanced startup**.

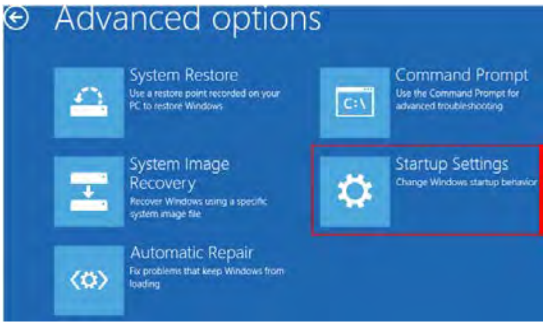


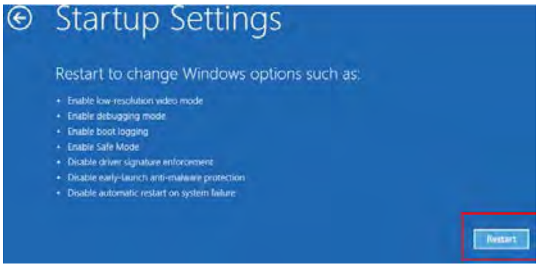


3. After the computer restarts, under **Choose an option**, click **Troubleshoot**. Under **Troubleshoot**, click **Advanced options**.

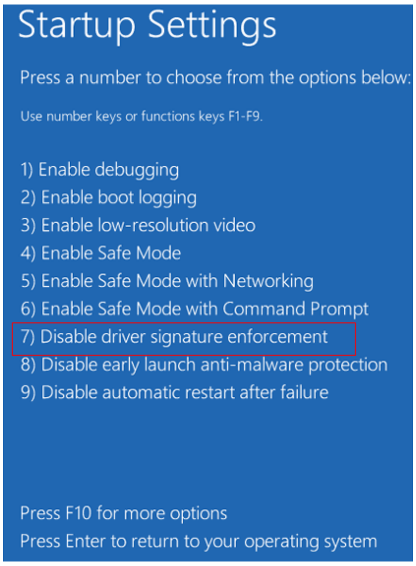


4. On the **Advanced options** page, click **Startup Settings**, and then on the **Startup Settings** page, click **Restart** to restart the computer.





5. Press the 7 or F7 key on your keyboard to choose **Disable driver signature enforcement**. Press Enter and the system directs you back to the Windows 8 operating system. Install the Delta PLC USB driver now by connecting the DVP-ES3 Series CPU module to your computer's USB port. Refer to Section A2 for the steps to install the USB driver.

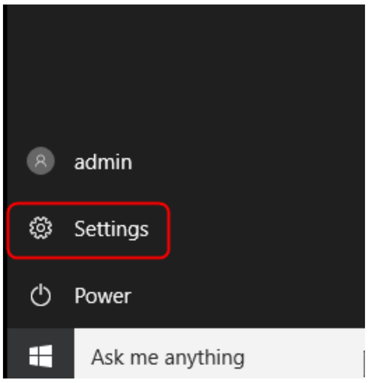
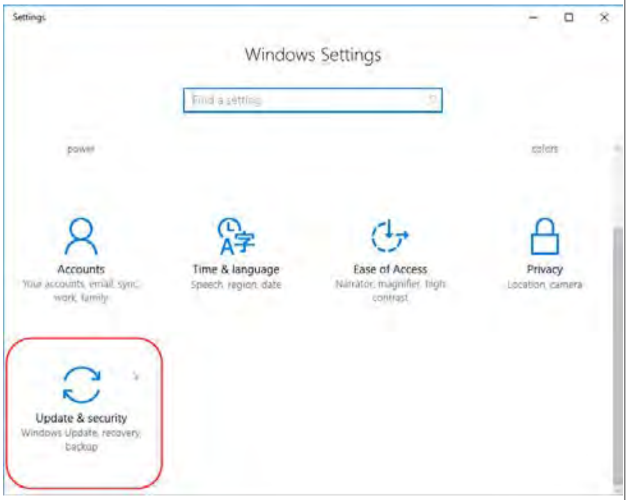


A.1.2 Disable Driver Signature Enforcement in Windows 10

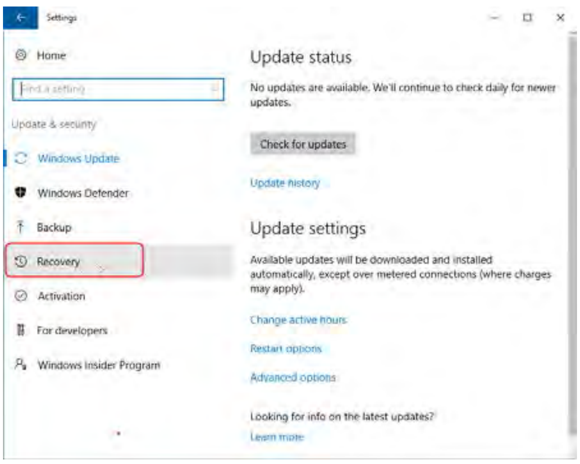
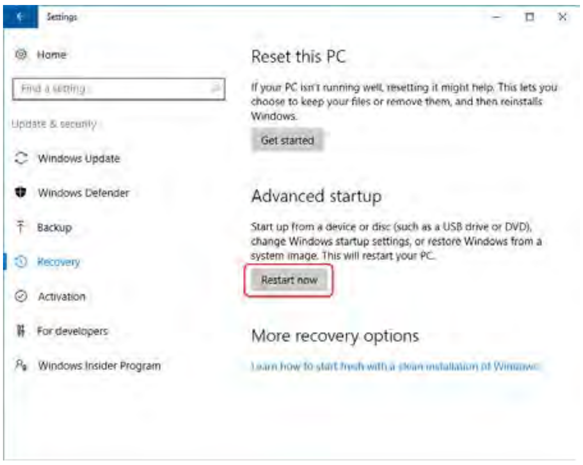
Follow these steps to disable driver signature enforcement in Windows 10.

1. Click the Windows **Start** button and then click **Settings**.

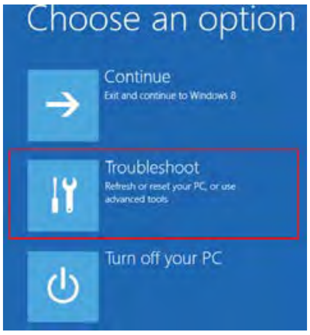
2. In the **Settings** window, click **Update & Security**.

Setting	Update & Security
	

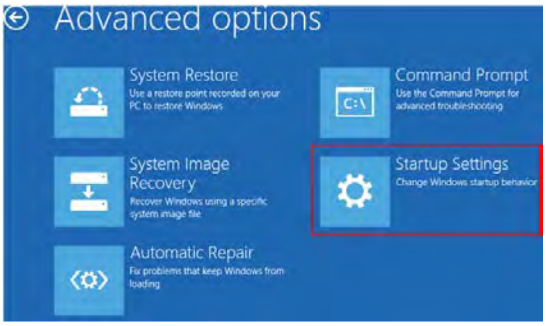
3. In the **Settings** window, click **Recovery**, and then click **Restart now**.

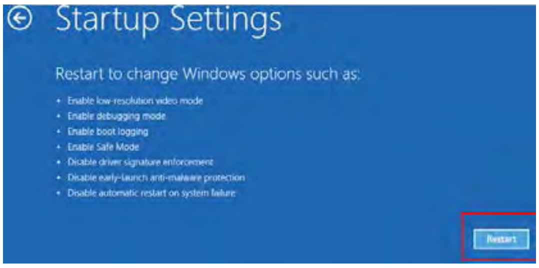
Recovery	Restart now
	

4. After the computer restarts, under **Choose an Option**, click **Troubleshoot**, and then click **Advanced options**.

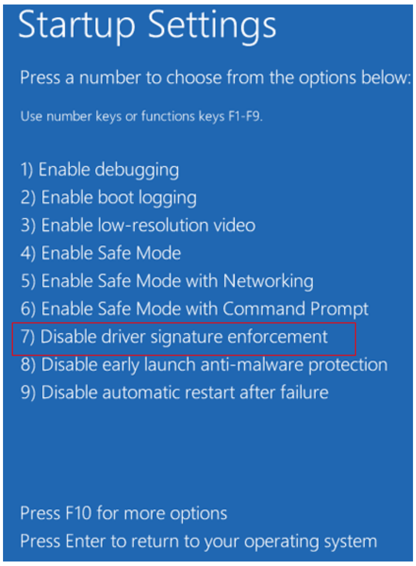


5. On the **Advanced options** page, click **Startup Settings**. On the **Startup Settings** page click **Restart** to restart the computer.





6. On your keyboard, press 7 or F7 to choose **Disable driver signature enforcement**, and the system directs you to the Windows 10 operating system page. Install the Delta PLC USB driver.



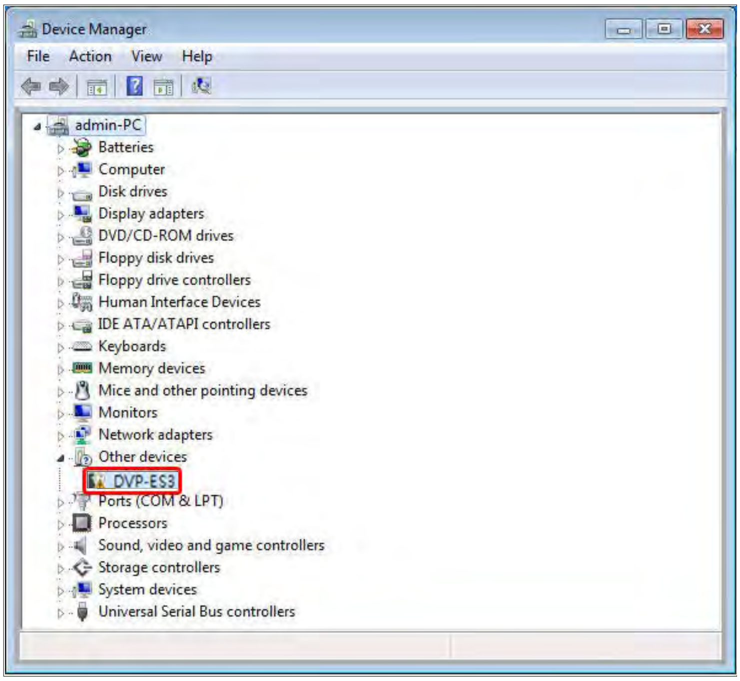
A.2 Installing the USB Driver for DVP-ES3 Series CPU Module

This section describes the steps to install the USB driver for a DVP-ES3 Series CPU module on Windows 10. To install the USB driver for a DVP-ES2 Series CPU module on another operating system, refer to the instructions in the operating system for information about installing new hardware.

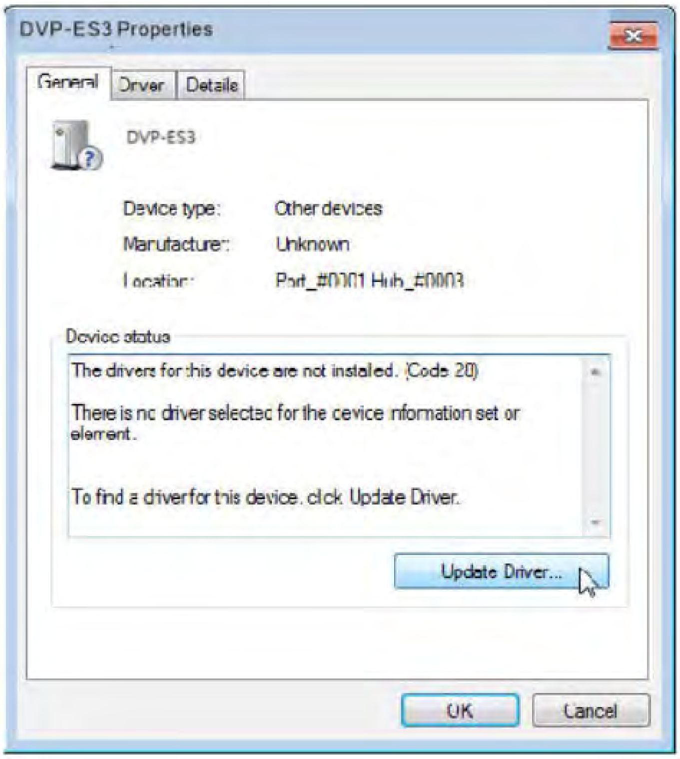
Before you install the USB driver, you must install ISPSoft version 3.00 or above on your computer.

Supply power to the DVP-ES3 Series CPU module. Connect the DVP-ES3 Series CPU module to a USB port on the computer with a USB cable.

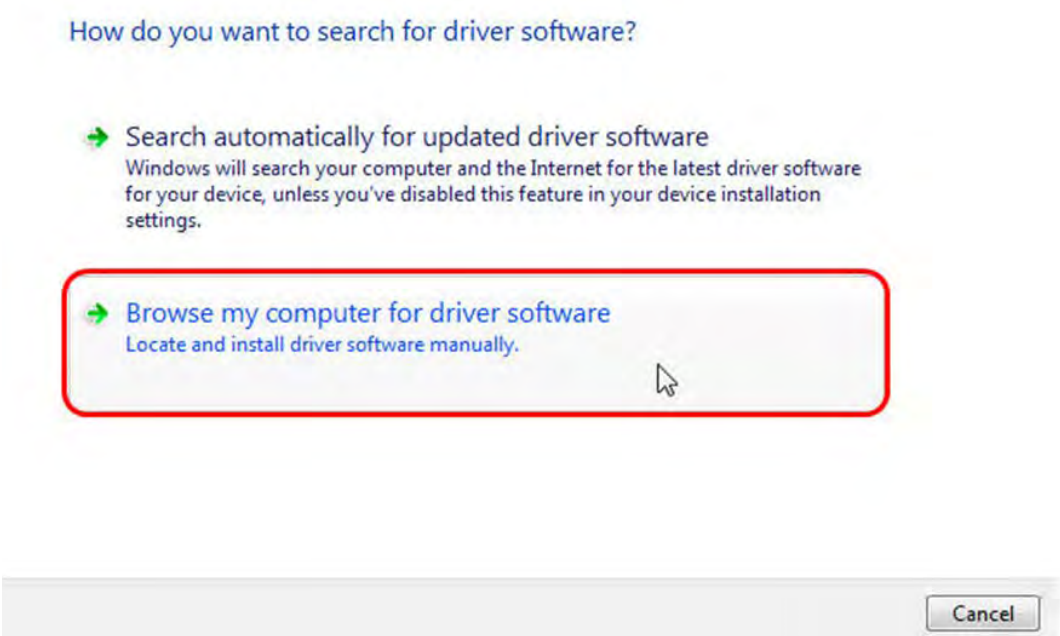
(1) Windows detects the module. From the Windows **Control Panel**, open the **Device Manager**. The name of the USB device appears in the Device Manager window. Double-click DVP-ES3.



(2) In the **DVP-ES3 Properties** dialog box, click **Update Driver…**.

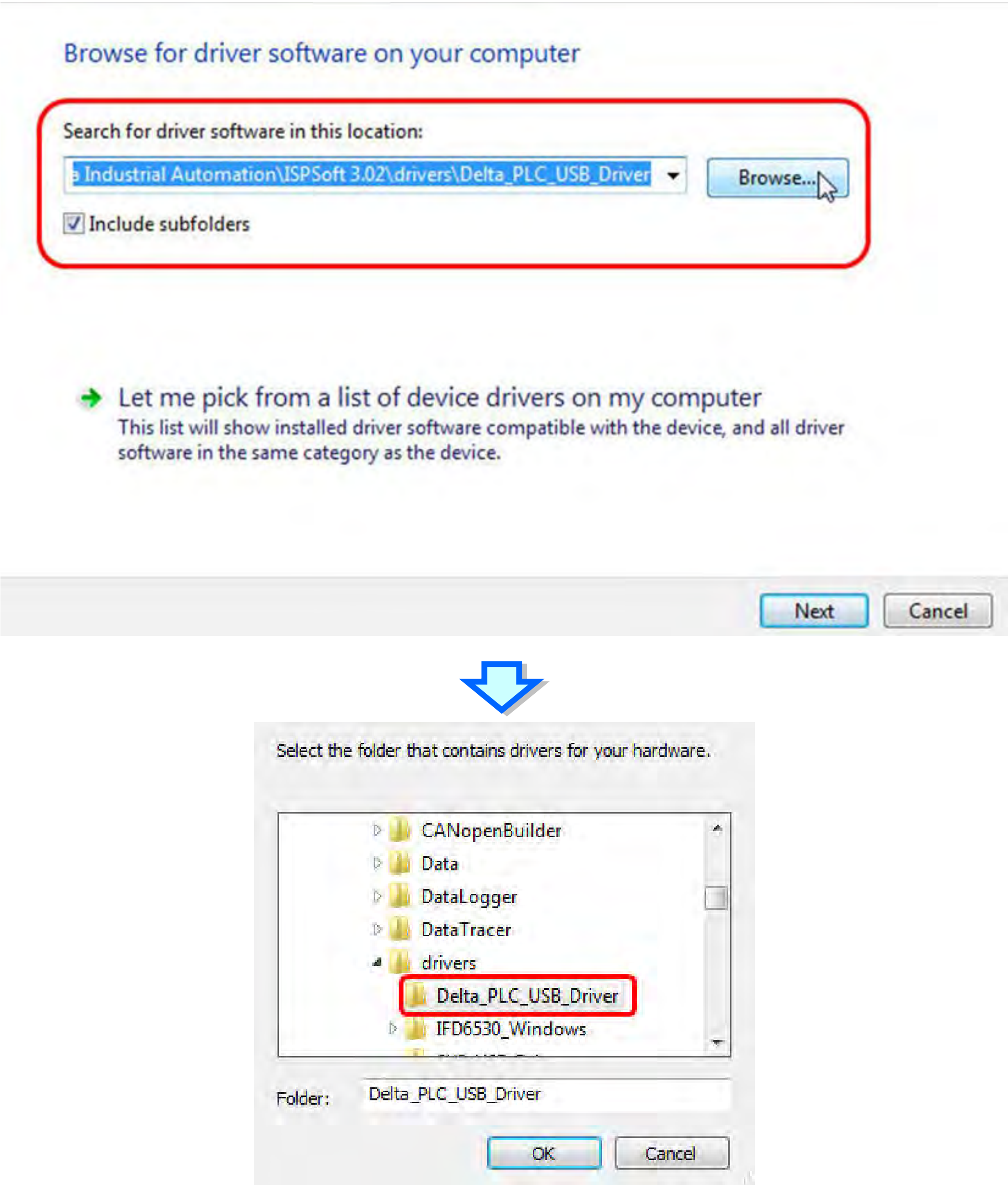


(3) Click **Browse my computer for driver software**.

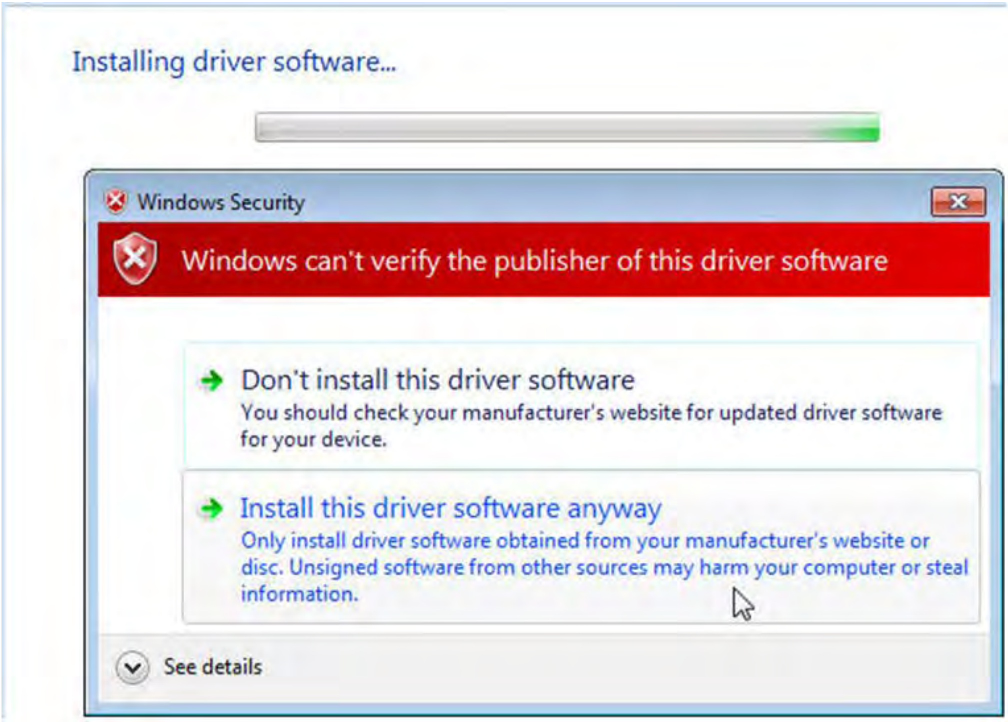


(4) After you install ISPSoft version 3.00 or later, the driver for the DVP-ES3 Series CPU module is under the folder where you installed ISPSoft ...**\ISPSoft\drivers\Delta_PLC_USB_Driver**. Enter the path to the driver, or click **Browse** to browse to the correct folder.

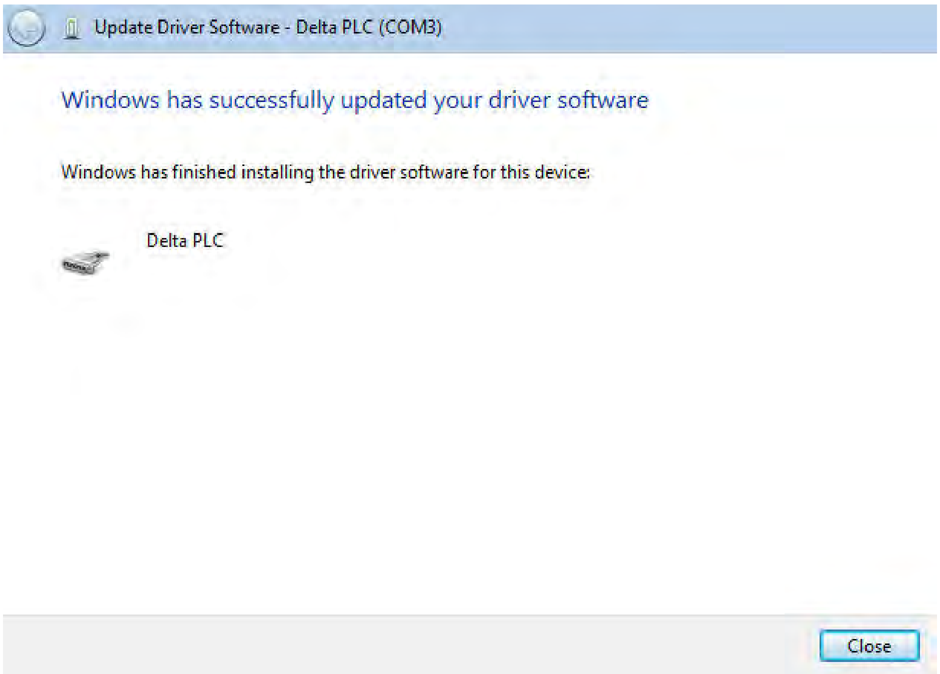
Specify the correct path. If you installed the driver for the DVP-ES3 series CPU module to another location, specify the corresponding path. Click **Next** to continue the installation.



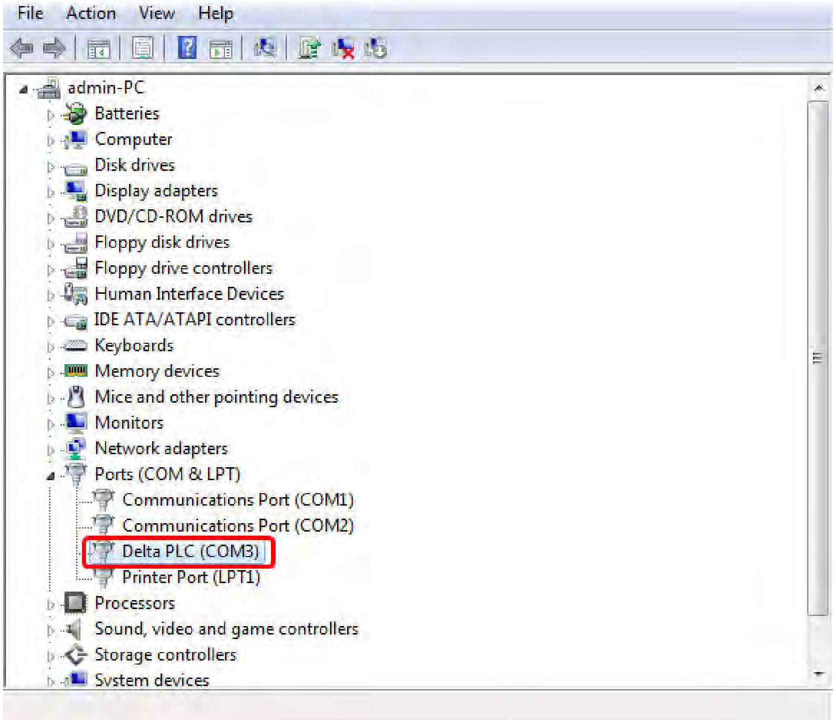
(5) Click **OK**. The system installs the driver. If the **Windows Security** window appears during the installation, click **Install this driver software anyway**.



(6) When the installation completes, click **Close**.



(7) Open the **Device Manager** window again. If the name of the Delta USB device appears under **Ports (COM & LPT)**, the installation of the driver is successful. The operating system assigns a communication port number to the USB device.



<u>**Additional remarks**</u>

- If you connect the PLC to a different USB port on the computer, the system may ask you to install the driver again. Install the driver again. After you install the driver, the communication port number that the operating system assigns to the USB device may have changed.

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Appendix B Device Addresses

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B.1 Standard Modbus Device Addresses

Device	Type	Format	Device range	Modbus address (Decimal number)	DVP-ES3 Series (Hexadecimal number)
X	Bit	OOO	X0~X377	124577~124832	6000~60FF
Y	Bit	OOO	Y0~Y377	040961~041216	A000~A0FF
M	Bit	DDDD	M0~M8191	000001~008192	0000~1FFF
SM	Bit	DDDD	SM0~SM4095	016385~020480	4000~4FFF
SR	Word	DDDD	SR0~SR2047	449153~451200	C000~C7FF
D	Word	DDDDD	D0~D29999	400001~430000	0000~752F
S	Bit	DDDD	S0~S2047	020481~022528	5000~57FF
T	Bit	DDD	T0~T511	057345~057856	E000~E1FF
	Word	DDD	T0~T511	457345~457856	E000~E1FF
C	Bit	DDD	C0~C511	061441~061952	F000~F1FF
	Word	DDD	C0~C511	461441~461952	F000~F1FF
HC	Bit	DDD	HC0~HC255	064513~064768	FC00~FCFF
	DWord	DDD	HC0~HC255	464513~464768	FC00~FCFF
E	Word	D	E0~E9	465025~465034	FE00~FE09

B.2 Function Codes and Number of Devices Supported for Modbus Protocols

Function code	Name	Description	Number of devices supported
01	Read Coil Status	X, Y, M, SM, S, T, C, HC	1~1600 bits
02	Read Discrete Input Status	X, Y, M, SM, S, T, C, HC	1~1600 bits
03	Read Holding Registers	X, Y, SR, D, T, C, HC, E	1~100 words, (1~50 for HC)
04	Read Input Registers	X	1~100 words
05	Force Single Coil	Y, M, SM, S, T, C, HC	1 bit
06	Preset Single Register	Y, SR, D, T, C, HC, E	1 word
0F	Force Multiple Coils	Y, M, SM, S, T, C, HC	1~1600 bits
10	Preset Multiple Register	Y, SR, D, T, C, HC, E	1~100 words, (1~50 for HC)
17	Read/Write Multiple Register	Y, SR, D, T, C, HC, E	1~100 words, (1~50 for HC)

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Appendix C EMC Standards

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C.1 EMC Standards for an AS Series System

C.1.1 DVP-ES3 Series System EMC Standards

The EMC standards that are applicable to a DVP-ES3 series system are listed in the following tables.

- **EMI**

Port	Frequency range	Level (Normative)	Reference standard
Enclosure port (radiated) (measured at a distance of 10 meters)	30-230 MHz	40 dB (μV/m) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB (μV/m) quasi-peak	
AC power port (conducted)	0.15-0.5 MHz	79 dB (μV) quasi-peak	IEC 61000-6-4
		66 dB (μV) average	
	0.5-30 MHz	73 dB (μV) quasi-peak	
		60 dB (μV) average	

- **EMS**

Environmental phenomenon	Reference standard	Test		Test level
Electrostatic discharge	IEC 61000-4-2	Contact		± 4 kV
		Air		± 8 kV
Radio frequency electromagnetic field Amplitude modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	2.0-2.7 GHz	1 V/m
			1.4-2.0 GHz	3 V/m
			2.0-2.7 GHz	3 V/m
			2.7-6.0 GHz	3 V/m
Power frequency magnetic field	IEC 61000-4-8	60 Hz		30 A/m
		50 Hz		30 A/m

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- **Conducted immunity test**

Environmental phenomenon		Fast transient burst	High energy surge	Radio frequency interference
Reference standard		**IEC 61000-4-4**	**IEC 61000-4-5**	**IEC 61000-4-6**
Interface/Port	**Specific interface/port**	**Test level**	**Test level**	**Test level**
Data communication	Shielded cable	1 kV	1 kV line-to-earth	10 V
	Unshielded cable	1 kV	1 kV line-to-earth	10 V
Digital and analog I/O	AC I/O (unshielded)	2 kV	2 kV line-to-earth 1 kV line-to-line	10 V
	Analog or DC I/O(unshielded)	1 kV	1 kV line-to-earth	10 V
	All shielded lines (to the earth)	1 kV	1 kV line-to-earth	10 V
Equipment power	AC power	2 kV	2 kV line-to-earth 1 kV line-to-line	10 V
	DC power	2 kV	0.5 kV line-to-earth 0.5 kV line-to-line	10 V
I/O power and auxiliary power output	AC I/O and AC auxiliary power	2 kV	2 kV line-to-earth 1 kV line-to-line	10 V
	DC I/O and DC auxiliary power	2 kV	0.5 kV line-to-earth 0.5 kV line-to-line	10 V

C1.2 Installation Instructions to meet EMC Standards

You must install an AS Series PLC in a control box. The control box protects the PLC and isolates electromagnetic interference generated by the PLC.

(1) Control box

- Use a conductive control box. Remove the paint on the plate bolts to ensure good contact between the inner plate and the control box.
- Connect the control box with a thick wire to ensure that the control box is well-grounded, even if there is high-frequency noise.
- The diameter of holes in the control box must be less than 10 millimeters (3.94 inches). Radio frequency noise may be emitted if the hole diameter is larger than 10 millimeters.
- Minimize the distance between the door of the control box and the PLC to prevent radio waves from leaking. You can also prevent radio waves from leaking by putting an EMI gasket on the painted surface.

(2) Connecting a power cable and a ground

Connect the PLC system power cable and the ground as described below.

- Provide a ground point near the power supply module. Use thick, short wires to connect the terminals LG and FG with the ground. The length of the wire should be less than 30 centimeters (11.18 inches). Noise generated by the PLC system is passed to the ground through LG and FG; therefore, the impedance should be as low as possible. Although the wires are used to reduce noise, they themselves carry a lot of noise. Using short wires can prevent the wires from acting as antennas.
- Twist the ground and the power cable together; the noise flowing through the power cable is then passed to the ground. The ground and the power cable do not need to be twisted if you install a filter on the power cable.

C1.3 Cables

Grounding a shielded cable

Cables drawn from the control box carry high-frequency noise. When they are outside of the control box, they are like antennas emitting noise. The cables connected to digital input/output modules, analog input/output modules, temperature measurement modules, network modules, and motion control modules should all be shielded cables to prevent the emission of noise. Using shielded cables also increases the resistance to external noise. You improve the resistance to noise if the signal cables that are connected to the digital input/output modules, analog input/output modules, temperature measurement modules, network modules, and motion control modules are all shielded cables that are grounded properly. If you do not use shielded cables or ground the shielded cables correctly, noise resistance will not improve. Make sure the shield of any connected cable contacts the control box. You must scrape any paint off of the control box at the contact point. All fastening must be metal, and the shield must contact the surface of the control box. Use washers to correct any unevenness or use an abrasive to level the surface.

Ground the shield of a shielded cable as close to a module as possible. Ensure that there is no electromagnetic induction between grounded cables.

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Appendix D Maintenance and Inspection

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D.1 Cautions

Observe the following precautions before performing maintenance and inspection. **Incorrect or careless operation will lead to injury or equipment damage.**

⚠ ● To prevent a breakdown of a DVP-ES3 Series system or a fire, ensure that the ambient environment does not contain corrosive substances such as chloride gas, sulfide gas or flammable substances such as oil mist, cutting powder, or dirt.

⚠ ● To prevent the connectors from oxidizing and to prevent electric shock, do not touch the connectors.

⚠ ● To prevent electric shock, turn off the power before pulling the connectors or loosening the screws.

⚠ ● To prevent cable damage, and to prevent the connectors from being loosened, do not put weight on the cables or pull on them.

⚠ ● Ensure that the input voltage is within the rated range.

⚠ ● To prevent product breakdown, fire, or injury, do not disassemble or alter the modules.

- To prevent a controlled element from malfunctioning, ensure that the program and parameters are written into a new CPU module before restarting the DVP-ES3 Series system.
- To prevent incorrect output or equipment damage, refer to the related manuals for more information about operating the modules.
- To prevent damage to the modules, touch grounded metal or wear an antistatic wrist strap to release static electricity from your body before working on a module.
- To prevent noise from causing system breakdown, keep a proper distance from the system when using a cell phone or communication device.
- Do not install a DVP-ES3 Series system in direct sun or in a humid environment.
- To prevent the temperature of an element from being too high, maintain a proper distance between the DVP-ES3 Series system and heat sources such as coils, heating devices, and resistors.
- To protect a DVP-ES3 Series system, install an emergency stop switch and an overcurrent protection device.
- Inserting and pulling a module several times can loosen the contact between the module and the backplane.
- To prevent an unexpected shock from resulting in damage to the DVP-ES3 Series system and a controlled element, ensure that the modules are correctly and firmly installed.

D.2 Daily Maintenance

To keep a DVP-ES3 Series system operating normally, ensure that the ambient environment and the DVP-ES3 Series system conform to the cautions listed in section 8.1. You can then perform the daily inspection described below. If you find any problems, follow the solution and perform any necessary maintenance.

D.2.1 Required Inspection Tools

- A screwdriver
- Industrial alcohol
- A clean cotton cloth

D.2.2 Daily Inspection

No.	Item		Inspection	Criterion	Remedy
1	Appearance		Check visually.	Dirt must not be present.	Remove the dirt.
2	Installing of a backplane		Check whether the set screws are loose.	The backplane must be installed firmly.	Tighten the screws.
			Check whether the backplane is installed on the DIN rail properly.		Install the backplane on the DIN rail properly.
3	Installing of a module		Check whether the module is loose that the projection is inserted into the hole on the backplane, and that the screw is tightened.	The projection under the module must be inserted into the hole in the backplane, and the screw must be tightened.	Install the module firmly.
4	Connection		Check whether the removable terminal block is loose.	The removable terminal block must not be loose.	Install the terminal block firmly.
			Check whether the connector is loose.	The connector must not be loose.	Tighten the screws on the connector.
5	Power supply module	POWER LED indicator	Check whether the POWER LED indicator is ON.	The POWER LED indicator must be ON.	Please refer to Chapter 9 for more information about troubleshooting.

No.	Item		Inspection	Criterion	Remedy
	CPU module	RUN LED indicator	When the CPU module is running, check whether the RUN LED is ON.	The RUN LED indicator must be ON.	
		ERROR LED indicator	Check whether the ERROR LED indicator is OFF.	The ERROR LED indicator must be OFF.	
		BUS FAULT LED indicator	Check whether the BUS FAULT LED indicator is OFF.	The BUS FAULT LED indicator must be OFF.	
		SYSTEM LED indicator	Check whether the SYSTEM LED indicator is OFF.	The SYSTEM LED indicator must be OFF.	
	LED indicators on an extension module*		Check whether the LED indicators on the extension module are ON.	If the LED indicators are ON, the module is operating normally.	

* Please refer to the Module Manual for more information related to the LED indicators on the extension modules.

D.3 Periodic Maintenance

In addition to daily inspection, you should perform periodic maintenance depending on the actual operating environment. After making sure that the ambient environment and the DVP-ES3 Series system conform to the cautions listed in Section 8.1, perform the periodic inspection described below. If you find any problems, follow the solution and perform any necessary maintenance.

D.3.1 Required Inspection Tools

- A screwdriver
- Industrial alcohol
- A clean cotton cloth
- A multimeter
- A thermometer
- A hygrometer

D.3.2 Periodic Inspection

No.	Item		Inspection	Criterion	Remedy
1	Ambient environment	Ambient temperature/humidity	The ambient temperature and the ambient humidity are measured by a thermometer and a hygrometer.	The ambient temperature and the ambient humidity must conform to the specifications for the modules or the backplane. If the specifications are different, the strictest specifications have priority.	To ensure that the system operates in a stable environment, determine why the environment varies, and resolve the issue.
		Atmosphere	Measure corrosive gas.	Corrosive gas must not be present.	
2	Supply voltage		Measure the AC power supply.	The power supply should meet the specifications for the power supply	Check the power supply.

No.	Item		Inspection	Criterion	Remedy
				module.	
3	Installation	Looseness	Check whether the module is loose.	The module must be installed firmly.	Please refer to Chapter 2 for more information on installing the module.
		Adhesion of dirt	Check the appearance.	Dirt must not be present.	Remove the dirt.
4	Connection	Looseness of terminal screws	Tighten the screws with a screwdriver.	The screws must not be loose.	Tighten the screws.
		Looseness of connectors	Pull the connectors.	The connectors must not be loose.	Tighten the screws on the connectors.
5	PLC system diagnosis		Check the error logs.	No new error occurs.	Please refer to Section 9.1.3 for more information.
6	Maximum scan time		Check the states of SR413 and SR414 through the device monitoring table in ISPSoft.	The maximum scan cycle must be within the range specified in the system specifications.	Determine why the scan time exceeds specifications.