



Digitized Automation for a Changing World

DVP-ES3 / EX3 / SV3 / SX3 Series Hardware and Operation Manual

DVP-ES3 Series Operation Manual

Revision History

Version	Revision	Date
1 st	The first version was published.	2019/09/05
2 nd	<ol style="list-style-type: none">1. Changed the name of this manual from DVP-ES3 Series Operation Manual to DVP-ES3 Series Hardware and Operation Manual to correspond to the main idea of this manual better.2. Added new product information, DVP02PU-E2, in every chapter.3. Chapter 1: Updated the overview contents in Section 1.2, updated contents of high efficiency and serial control interface with multiple function in Section 1.3.4. Chapter 2: Updated ingress protection (IP ratings) and safety ratings in Section 2.1. Added information concerning communication port isolation for DVP32ES311T and updated input voltage / current, input isolation, leakage current, maximum load of resistance, inductance and bulb, minimum load, input isolation, and life cycle curve explanation in Section 2.2.2 and 2.3. Updated information concerning isolation in Section 2.4. Updated rated measurement range, maximum measurable temperature range for DVP04PT-E2 and DVP06PT-E and updated information concerning isolation for DVP04TC-E2 in Section 2.5. Added a new Section "positioning module specifications" in Section 2.6.5. Chapter 3: Updated hard disk drive capacity in Section 3.1. Updated ISPSof^t installing steps in Section 3.1.1.6. Chapter 4: Updated notes on installation in Section 4.2. Added power consumption information for new modules in Section 4.5.4. Added a new Section "wiring positioning modules for DVP02PU-E2" in Section 4.10.7. Chapter 5: Updated what to do with retainable / non-retainable data when PLC is from OFF to ON in Section 5.1.3. Added an example of using the counter with CNT instruction in Section 5.2.10. Added an example of using the high-speed counter with DCNT instruction in Section 5.2.11. Added more explanation on data mapping in Section 5.2.12. Added explanation on module device function for DVP02PU-E2 in Section 5.3.6.8. Chapter 6: Updated ISPSof^t software example images and contents accordingly.	2021/09/10

Version	Revision	Date
	<p>9. Chapter 7: Added a new size SDHC for SDHC typed memory card in Section 7.1.2.</p> <p>10. Chapter 9: Updated specification in Section 9.3. Added explanations on EIP Builder operation in Section 9.3.7 to 9.4.7. Deleted the software images from the 3rd party. Updated the Delta EIP Product List in Section 9.9. Added a new Section "Network Security" in Section 9.10.</p> <p>11. Chapter 10: Added an explanation on output mapping area for ES3 Series PLC CPU, when it acts as a Master in Section 10.1.2. Added a new Section "Refreshing Mechanism in the Input/output Mapping Area" in Section 10.1.3. Corrected the typo SR289 to SR829 in Section 10.5.1.</p> <p>12. Chapter 11: Updated the procedure in Section 11.1.1. Added a new module, positioning module, and updated the contents in Communication Service in Section 11.1.2. Added Execution Timing of Interrupts in Section 11.1.3. Updated contents in Operating Modes in Section 11.2.1.</p> <p>13. Chapter 12: Updated Troubleshooting SOP in Section 12.1.3. Updated the steps to do when encountering a program syntax error in Section 12.1.4. Added new error codes 16#19B0~16#19FC and updated error codes 16#2001~16#2027 in Section 12.2. Added a new Section "Troubleshooting for Positioning Modules (PU)" in Section 12.3.2. Added new error codes 16#19B0~16#19FC and 16#C000~16#CFFF in Section 12.4.</p> <p>14. Appendix A: Added a new Section "Notes on Utilizing USB Communication" in Section A.3.</p> <p>15. Appendix C: Updated the contents of Connecting a power cable and a ground in Section C1.2.</p> <p>16. Appendix D: Updated the chapter numbers.</p>	
3rd	<p>1. Chapter 1: Updated the overview contents.</p> <p>2. Chapter 2: Added the specification of maximum inrush current in section 2.2, updated hardware resolution in section 2.5.1, updated the supply voltage, input current, maximum input frequency, and resistance of the maximum load in section 2.6.1.</p> <p>3. Chapter 4: Added a warning sign in section 4.10.</p> <p>4. Updated the contents in CR#43 in sections from 5.3.1 to 5.3.5. Added a note for PID Control Registers in section 5.3.4.</p> <p>5. Chapter 8: Added more descriptions for the selection,</p>	2022/03/11

Version	Revision	Date
	<p>Select Action When 24 Vdc Input Unstable in section 8.2.2.1.</p> <p>6. Chapter 10: Added AS100 series PLC CPUs that support CANopen network in section 10.2.4.3.</p>	
4 th	<p>1. Added product information including DVP32ES300TEC, DVP-EX3, DVP-SX3, DVP-SV3 and DIADesigner operational information in every chapter.</p> <p>2. Chapter 11: Added introduction on EtherCAT functionality and operation.</p> <p>3. Appendix C: Updated EMC requirements on installation in section C.1.2.</p>	2023/12/12
5 th	<p>1. Chapter 1: Updated the current specifications for the DVP-SV3/SX3 series digital I/O modules, added left-side high-speed communication modules (DVPEN 02-SL/DVPPN02-SL) and remote I/O communication modules, and the description on digital I/O points supported by DVP-SV3/SX3 series CPU modules.</p> <p>2. Chapter 2: Updated the Ethernet port specification and electrical specifications for DVP-ES3/EX3 Series.</p> <p>3. Chapter 4: Updated digital input wirings; added DVPEN02-SL/DVPPN02-SL and remote I/O communication modules and their power consumption information in section 4.2.5.4.</p> <p>4. Chapter 7: Updated the file paths in the memory card for backup and restoration.</p> <p>5. Chapter 8: Updated the contents in section 8.2.2 Configuring a Module and section 8.4.2 Parameter Setting.</p> <p>6. Chapter 9: Updated the supported device type for Periodic IO Connection in section 9.3.2, and the description of CPU Error code in section 9.11.5.1.</p> <p>7. Chapter 11: Updated the EtherCAT Master specification in section 11.2 and EtherCAT Master function description in section 11.6; added sections 11.9 to 11.14 (DIADesigner operation examples).</p> <p>8. Chapter 14: Updated the solution to the CPU module error 16#200A and added error codes 16#1402 and 16#1404.</p>	2025/07/30

DVP-ES3/EX3/SV3/SX3 Series

Hardware and Operation Manual

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** All the Windows screenshots are used with permission from Microsoft.*

Chapter 1 Product Introduction

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1.1 Introduction

This manual introduces the block-type high-end applicational DVP-ES3/EX3 Series PLC CPU and slim-type high-end applicational DVP-SV3/SX3 Series PLC CPU; their functions, electrical specifications, hardware configuration, appearances, dimensions, as well as wiring and so forth are presented here. Refer to DVP Series Module Manual for more information on the extension I/O modules of DVP-ES3/EX3 and DVP-SV3/SX3 Series PLC CPU.

Related Manuals

The related manuals for DVP-ES3/EX3/SV3/SX3 Series programmable logic controllers are listed below.

- DVP-ES3/EX3/SV3/SX3 Series Programming Manual

This manual introduces programming for the DVP-ES3/EX3/SV3/SX3 Series programmable logic controllers, covering basic instructions, and applied instructions.

For DVP-ES2/SX2 Series PLC, refer to DVP-ES2/EX2/EC5/SS2/SA2/SX2/SE/SE2 & TP Operation Manual – Programming;
for DVP-SV2 Series PLC, refer to DVP-PLC Operation Manual – Programming.

- ISPSoft User Manual / DIADesigner Software User Manual.

This manual introduces the use of the ISPSoft software / DIADesigner Software, programming language (Ladder, SFC, FBD, and ST), POU, and tasks.

DVP-ES3 Series PLC can only use ISPSoft / DIADesigner for programming, NOT WPLSoft.

DVP-ES300TEC/EX3/SV3/SX3 can only use DIADesigner for programming, Neither ISPSoft nor WPLSoft.

- DVP-ES3/EX3/SV3/SX3 Series Hardware and Operation Manual

This manual introduces the DVP-ES3 hardware, including electrical specifications, dimensions, CPU functions, devices, extension I/O module placement, troubleshooting.

- DVP Series Module Manual

This manual introduces the extension modules, including communication modules, analog modules, and temperature measurement modules.

1.1.1 DVP-ES3/EX3 Series CPU Modules and Their Extension Modules

Classification	Model Name	Description
DVP-ES3 Series CPU module	DVP32ES311T	24 VDC powered CPU module Transistor, NPN output (sinking), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 32 I/Os (16 DI + 16 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP32ES300T	100-240 VAC powered CPU module Transistor, NPN output (sinking), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 32 I/Os (16 DI + 16 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP32ES300R	100-240 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 32 I/Os (16 DI+16 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP48ES300T	100-240 VAC powered CPU module Transistor, NPN output (sinking), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 48 I/Os (24 DI + 24 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP48ES300R	100-240 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 48 I/Os (24 DI + 24 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP64ES300T	100-240 VAC powered CPU module NPN output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 64 I/Os (32 DI + 32 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP64ES300R	100-240 VAC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 64 I/Os (32 DI + 32 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks

Classification	Model Name	Description
	DVP80ES300T	<p>100-240 VAC powered CPU module</p> <p>Transistor, NPN output (sinking), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 80 I/Os (40 DI + 40 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks</p>
	DVP80ES300R	<p>100-240 VAC powered CPU module</p> <p>Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 80 I/Os (40 DI + 40 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks</p>
DVP-ES3 EtherCAT communication CPU module	DVP32ES300TEC	<p>100-240 VAC powered CPU module</p> <p>Transistor, NPN output (sinking), 1x Ethernet / EtherCAT port, 2x RS-485 ports, 1x USB port, 1x Micro SD interface, supporting 32 I/Os (16 DI +16 DO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks;</p> <p>Supported EtherCAT Master 8 axes point to point positioning control (for Delta drives only)</p>
DVP-EX3 Series CPU module	DVP22EX300T	<p>100-240 VAC powered CPU module</p> <p>Transistor, NPN output (sinking), 2x Ethernet ports (can act as a switch), 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 22 I/Os (12 DI + 8 DO + 2 AI) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks</p>
	DVP22EX300R	<p>100-240 VAC powered CPU module</p> <p>Relay output, 2x Ethernet ports (can act as a switch), 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 22 I/Os (12 DI + 8 DO + 2 AI) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks</p>
	DVP36EX300T	<p>100-240 VAC powered CPU module</p> <p>Transistor, NPN output (sinking), 2x Ethernet ports (can act as a switch), 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 36 I/Os (16 DI + 16 DO + 2 AI + 2 AO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks</p>

Classification	Model Name	Description
	DVP36EX300R	100-240 VAC powered CPU module Relay output, 2x Ethernet ports (can act as a switch), 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 36 I/Os (16 DI + 16 DO + 2 AI + 2 AO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
	DVP28EX300MT	100-240 VAC powered CPU module Transistor, NPN output (sinking), 2x Ethernet ports (can act as a switch), 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 28 I/Os (4 Diff. DI + 8 DI + 4 Diff. DO + 2 AI + 2 AO) and up to 256 I/Os. Program capacity: 64K steps, removable terminal blocks
Digital input/output module	DVP08XM211N	8 inputs; 24 VDC; 5 mA
	DVP08XP211R	4 inputs; 24 VDC; 5 mA 4 Relay outputs; 250 VAC; Below 30 VDC 2 A/input, 5 A/COM
	DVP08XP211T	4 inputs; 24 VDC; 5 mA 4 NPN (sinking) outputs; 5 – 30 VDC; 0.5 A/input, 4 A/COM
	DVP08XN211R	8 Relay outputs; 250 VAC; Below 30 VDC 2 A/output, 5 A/COM
	DVP08XN211T	8 NPN (sinking) outputs; 5 – 30 VDC 0.5 A/output, 4 A/COM
	DVP16XM211N	16 inputs; 24 VDC; 5 mA
	DVP16XP211R	8 inputs; 24 VDC; 5 mA 8 Relay outputs; 250 VAC; Below 30 VDC 2 A/input, 5 A/COM
	DVP16XP211T	8 inputs; 24 VDC; 5 mA 8 NPN (sinking) outputs; 5 – 30 VDC 0.5 A/input, 4 A/COM
	DVP16XN211R	16 Relay outputs; 250 VAC; Below 30 VDC 2 A/output, 5 A/COM
	DVP16XN211T	16 NPN (sinking) outputs; 5 – 30 VDC

Classification	Model Name	Description
Analog input/output module		0.5 A/output, 4 A/COM
	DVP24XP200R	16 inputs; 24 VDC; 5 mA 8 Relay outputs; 250 VAC; Below 30 VDC 2 A/input, 5 A/COM
	DVP24XP200T	16 inputs; 24 VDC; 5 mA 8 NPN (sinking) outputs; 5 – 30 VDC 0.5 A/input, 4 A/COM
	DVP24XN200R	24 Relay outputs; 250 VAC; Below 30 VDC 2 A/output, 5 A/COM
	DVP24XN200T	24 NPN (sinking) outputs; 5 – 30 VDC 0.5 A/output, 4 A/COM
	DVP32XP200R	16 inputs; 24 VDC; 5 mA 8 Relay outputs; 250 VAC; Below 30 VDC 2 A/input, 5 A/COM
	DVP32XP200T	16 inputs; 24 VDC; 5 mA 16 NPN (sinking) outputs; 5 – 30 VDC 0.5 A/input, 4 A/COM
	DVP04AD-E2	4-channel analog input; Hardware resolution 14 bits: -5V to +5V, -10V to +10V, -20 mA to +20 mA; Hardware resolution 13 bits: 0/4 to 20 mA; Conversion time: 400 μ s/channel
Digital input/output module	DVP02DA-E2	2-channel analog input; Hardware resolution 14 bits: -10V to +10V, -20 mA to +20 mA; Conversion time: 400 μ s/channel
	DVP04DA-E2	4-channel analog input module; Hardware resolution 14 bits: -10V to +10V, -20 mA to +20 mA; Conversion time: 400 μ s/channel
	DVP06XA-E2	4-channel analog input; Hardware resolution 14 bits: -5V to +5V, -10V to +10V, -20 mA to +20 mA; Hardware resolution 13 bits: 0/4 to 20 mA;

Classification	Model Name	Description
		Conversion time: 400 μ s/channel; 2-channel analog output Hardware resolution 14 bits: -10V to +10V, -20 mA to +20 mA; Conversion time: 400 μ s/channel
Temperature measurement module	DVP04PT-E2	4-channel, 2-wire/3-wire RTD; Sensor type: Pt100 / Pt1000 / Ni100 / Ni1000 / 0-300 Ω / 0-3000 Ω ; Resolution: 0.1°C/0.1°F (16 bits); Conversion time: 200 ms/channel; PID controller
	DVP06PT-E2	6-channel, 2-wire/3-wire RTD; Sensor type: Pt100 / Pt1000 / Ni100 / Ni1000 / Cu50 / Cu100 / 0-300 Ω / 0-3000 Ω / 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
Positioning module	AS02PU-A	2-axis motion control; 5-24 VDC, 1 differential input (A/B/Z phase), maximum hardware input frequency at 200 kHz, 24 VDC, 5 mA, 5 inputs, maximum hardware input frequency at 1 kHz, 5 VDC, 2-axis (4 points) differential outputs, maximum output frequency at 200 kHz
Connection kit	DVPAEXT01-E2	For connecting I/O extension modules

1.1.2 DVP-SV3/SX3 Series CPU Modules and Their Extension Modules

Classification	Model Name	Description
Power supply module	DVPPS01	Input: 100-240 VAC, 50/60 Hz Output: 24 VDC/1A, 24 W
	DVPPS02	Input: 100-240 VAC, 50/60 Hz Output: 24 VDC/2A, 48 W
	DVPPS05	Input: 100-240 VAC, 50/60 Hz Output: 24V DC/5A, 120 W
DVP-SV3 Series CPU module	DVP28SV311T	24 VDC powered CPU module Transistor, NPN output (sinking), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 28 I/Os (16 DI + 12 DO) and up to 256 inputs and 252 outputs. Program capacity: 64K steps, removable terminal blocks
	DVP28SV311R	24 VDC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 28 I/Os (16 DI + 12 DO) and up to 256 inputs and 252 outputs. Program capacity: 64K steps, removable terminal blocks
	DVP28SV311S	24 VDC powered CPU module Transistor, PNP output (sourcing), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 28 I/Os (16 DI + 12 DO) and up to 256 inputs and 252 outputs. Program capacity: 64K steps, removable terminal blocks
DVP-SX3 Series CPU module	DVP20SX311T	24 VDC powered CPU module Transistor, NPN output (sinking), 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 20 I/Os (8 DI + 6 DO + 4 AI + 2 AO) and up to 248 inputs and 246 outputs. Program capacity: 64K steps, removable terminal blocks
	DVP20SX311R	24 VDC powered CPU module Relay output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 20 I/Os (8 DI + 6 DO + 4 AI + 2 AO) and up to 248 inputs and 246 outputs.

Classification	Model Name	Description
Digital I/O module		Program capacity: 64K steps, removable terminal blocks
	DVP20SX311S	24 VDC powered CPU module PNP output, 1x Ethernet port, 2x RS-485 ports, 1x USB & CAN port, 1x Micro SD interface, supporting 20 I/Os (8 DI + 6 DO + 4 AI + 2 AO) and up to 248 inputs and 246 outputs. Program capacity: 64K steps, removable terminal blocks
	DVP06SN11R	6 Relay outputs; 250 VAC; Below 30 VDC 6 A/output
	DVP08SN11R	8 Relay outputs; 250 VAC; Below 30 VDC 1.5 A/output, 5 A/COM
	DVP08SN11T	Transistor, 8 NPN outputs (sinking), 30 VDC; 55°C, 0.1 A/output; 50°C, 0.15 A/output; 45°C, 0.2 A/output; 40°C, 0.3 A/output; 2 A/COM
	DVP16SN11T	Transistor, 16 NPN outputs (sinking), 30 VDC; 55°C, 0.1 A/output; 50°C, 0.15 A/output; 45°C, 0.2 A/output; 40°C, 0.3 A/output; 2A/COM
	DVP08SP11R	4 inputs; 24 VDC; 4.2 mA 4 Relay outputs; 250 VAC; Below 30 VDC; 1.5 A/output, 5 A/COM
	DVP08SP11T	4 inputs; 24 VDC; 4.2 mA 4 transistor outputs, 30 VDC; 55°C 0.1 A/output; 50°C 0.15 A/output; 45°C, 0.2 A/output; 40°C, 0.3 A/output, 2 A/COM
	DVP08SM11N	8 inputs; 24 VDC; 4.2 mA
	DVP08SM10N	8 inputs; 85-132 VAC (50 to 60 Hz) ; 9.2 mA (10 VAC/60 Hz)
	DVP08SN11TS	8 transistor outputs (sourcing); 30 VDC; 55°C, 0.3 A/output, 2 A/COM
	DVP08ST11N	8 inputs (dip switch)
	DVP16SP11R	8 inputs; 24 VDC; 4.2 mA 8 Relay outputs; 250 VAC; Below 30 VDC; 1.5 A/output, 5 A/COM
	DVP08SP11TS	4 inputs; 24 VDC; 4.2 mA

Classification	Model Name	Description
		4 transistor outputs (sourcing), 30 VDC; 55°C 0.3 A/output, 2 A/COM
	DVP16SP11T	8 inputs; 24 VDC; 4.2 mA 8 transistor outputs (sinking), 30 VDC; 55°C 0.1A/output; 50°C, 0.15 A/output; 45°C, 0.2 A/output; 40°C, 0.3 A/output, 2 A/COM
	DVP16SP11TS	8 inputs; 24 VDC; 4.2 mA 8 transistor outputs (sourcing); 30 VDC; 55°C, 0.3 A/output, 2 A/COM
	DVP16SN11TS	16 transistor outputs (sourcing); 30 VDC; 55°C, 0.3 A/output, 2 A/COM
	DVP16SM11N	16 inputs; 24 VDC; 4.2 mA
	DVP32SN11TN	32 inputs; 24 VDC; 4.2 mA
	DVP32SM11N	32 transistor outputs (sinking); 5-30 VDC; 0.1 A/output; 55°C, 1.0 A/COM; 25°C, 2.2 A/COM
Analog I/O module	DVP04AD-S2	4 channel analog inputs (differential) 14-bit resolution: -10 to 10 V, -6 to 10 V 13-bit resolution: -20 to 20 mA, -12 to 20 mA Conversion time: 3 ms/channel
	DVP04DA-S2	4 channel analog outputs 12-bit resolution: 0 to 10 V, 2 to 10 V, 0 to 20 mA, 4 to 20 mA Conversion time: 3 ms/channel
	DVP06XA-S2	4 channel analog inputs (differential) 12-bit resolution: -10 to 10 V, -6 to 10 V 11-bit resolution: -20 to 20 mA, -12 to 20 mA Conversion time: 3 ms/channel 2 channel analog outputs 12-bit resolution: 0 to 10 V, 2 to 10 V, 0 to 20 mA, 4 to 20 mA Conversion time: 3 ms/channel
	DVP02DA-S	2 channel analog outputs 12-bit resolution: 0 to 10 V, 2 to 10 V, 0 to 20 mA, 4 to 20 mA Conversion time: 3 ms/channel
	DVP06AD-S	6 channel analog inputs

Classification	Model Name	Description
		14-bit resolution: -10 to 10 V, -6 to 10 V 13-bit resolution: -20 to 20 mA, -12 to 20 mA Conversion time: 3 ms/channel
Left-side high-speed analog I/O module	DVP04AD-SL	4 channel analog inputs (differential) 16-bit resolution: -10 to 10 V, -5 to 5 V, -20 to 20 mA 15-bit resolution: 0 to 20 mA, 4 to 20 mA Conversion time: 250 μ s/channel
	DVP04DA-SL	4 channel analog outputs (differential) 16-bit resolution: 0 to 10 V, -10 to 10 V 15-bit resolution: 0 to 20 mA, 4 to 20 mA Conversion time: 250 μ s/channel
Left-side high-speed load cell module	DVP201LC-SL	1 channel 24-bit resolution: 0 to 80 mV/V Built-in RS-485 communication port, capable of standalone operation.
	DVP211LC-SL	1 channel 24-bit resolution: 0 to 80 mV/V I/O: 2DI/4DO/1AO Built-in RS-485 communication port, capable of standalone operation.
	DVP202LC-SL	2 channels 24-bit resolution: 0 to 80 mV/V Built-in RS-485 communication port, capable of standalone operation.
	DVP02LC-SL	2 channels 20-bit resolution: 0 to 6 mV/V
	DVP01LC-SL	1 channel 20-bit resolution: 0 to 6 mV/V
Temperature measurement module	DVP04PT-S	4-channel, 2-wire/3-wire RTD; Sensor type: Pt100 / Pt1000 / Ni100 / Ni1000 / LG-Ni1000 / Cu100 / Cu50 / 0 to 300 Ω / 0 to 3000 Ω ; Resolution: 0.1°C/0.18°F; Conversion time: 200 ms/channel;

Classification	Model Name	Description
		PID controller
	DVP06PT-S	6-channel, 2-wire/3-wire RTD; Sensor type: Pt100 / Pt1000 / Ni100 / Ni1000 / LG-Ni1000 / Cu100 / Cu50 / 0 to 300 Ω / 0 to 3000 Ω; Resolution: 0.1°C/0.18°F; Conversion time: 160 ms/channel
	DVP04TC-S	4-channel thermocouple; Sensor type: J, K, R, S, T; Resolution: 0.1°C/18°F; Conversion time: 200 ms/channel PID controller
	DVP08NTC-S	8-channel thermistor (NTC) Sensor type: Pt1000, Ni1000, LG-Ni1000, CTN10K, CTN100K, NTC20K, NTC30K, PT-42H, PT-43, PT-51F, PT-25E2, PT-312, KTY81, two user-defined tables Resolution: 0.1°C
	DVP02TUN-S	2 generic analog inputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII Thermistor: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 Resolution: 0.1°C (16-bit) 4 transistor (sinking) outputs: 24 VDC/300 mA Output points: controlled by PID or manual
	DVP02TUR-S	2 generic analog inputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII Thermistor: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 Resolution: 0.1°C (16-bit) 4 relay outputs: 240 VAC/2 A Output points: controlled by PID or manual
	DVP02TUL-S	2 generic analog inputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII Thermistor: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100,

Classification	Model Name	Description
		Ni120, Ni1000, LG-Ni1000 Resolution: 0.1°C (16-bit) 2 analog outputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Resolution: 12-bit Output points: controlled by PID or manual
Remote temperature measurement module	DVP02TKN-S	2 generic analog inputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII Thermistor: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 Resolution: 0.1°C (16-bit) 4 transistor (sinking) outputs: 24 VDC/300 mA Output points: controlled by PID or manual
		2 generic analog inputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII Thermistor: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 Resolution: 0.1°C (16-bit) 4 relay outputs: 240 VAC/2 A Output points: controlled by PID or manual
	DVP02TKL-S	2 generic analog inputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII Thermistor: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 Resolution: 0.1°C (16-bit) 2 analog outputs: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Resolution: 12-bit Output points: controlled by PID or manual
Positioning module	DVP01PU-S	Single axis positioning module; 200k Hz
Left-side positioning module	DVP02PU-SL	2-axis motion control 5-24 VDC, 1 differential input (A/B/Z phase), maximum hardware input frequency at 200k Hz, 24 VDC, 5 mA, 5 inputs, maximum hardware input frequency at 1 kHz, 5 VDC, 2-axis (4 points) differential outputs, maximum output frequency at 200k Hz

Classification	Model Name	Description
Left-side high-speed communication module	DVPEN01-SL	Ethernet module; 10/100 Mbps
	DVPEN02-SL	Ethernet module; 10/100 Mbps
	DVPPN02-SL	PROFINET module; 100 Mbps
	DVPDNET-SL	DeviceNet Master module; 500 kbps
	DVPCOPM-SL	CANopen Master module; 1 Mbps
	DVPPF02-SL	PROFIBUS DP Slave module; 12 Mbps
	DVPSCM12-SL	RS-485/RS-422 series communication module; 460 kbps
	DVPSCM52-SL	BACnet MS/TP Slave module; 460 kbps
Remote IO communication module	RTU-485	RTU-485 remote I/O communication module, with DVP slim series I/O modules connected on its right side
	RTU-CN01	CANopen remote I/O communication module, with DVP slim series I/O modules connected on its right side
	RTU-ECAT	EtherCAT remote I/O communication module, with DVP slim series I/O modules connected on its right side
	RTU-EN01	Ethernet remote I/O communication module, which can be connected to DVP slim series I/O modules

1.2 Overview

DVP-ES3/EX3 PLC CPU is an advanced block controller and DVP-SV3/SX3 is an slim-type advanced controller. The CPU module supports up to 4-axis pulse-type positioning output, 8-axis CANopen communication positioning output (for Delta Servo system), and up to 4 sets of high-speed counter inputs. With a variety of network communication options, it provides powerful connectivity and enables various network device connections through convenient software configuration.

DVP-ES3/EX3/SV3/SX3 PLC CPU also provides structured programming, allowing users to distribute programs across multiple tasks and package commonly used programs into function blocks for reuse. With ISPSoft/DIADesigner, users can select different IEC 61131-3 programming languages, including ladder diagrams (LD), structured texts (ST), sequential function charts (SFC), and continuous function chart (CFC), according to their needs or programming preferences.

The DVP-ES3 PLC CPU system features a visual hardware configuration software that enables users to quickly set up the system hardware configuration. The built-in memory card function in the CPU module allows for rapid backup and restoration of system settings. This manual describes the basic operation functions of the DVP-ES3/EX3/SV3/SX3 PLC CPU system, enabling users to quickly get started with the system.

1.3 Characteristics

(1) High efficiency

- A 32-bit high-speed processor is used. The module executes each basic instruction at 25 ns speed and each moving instruction at 150 ns. 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 adopts a SoC architecture and features 4 built-in high-speed counters, each supporting a maximum input frequency of 200 kHz. It also supports up to four-axis (8 points) high-speed positioning output at 200 kHz.

(2) Supporting more inputs and outputs

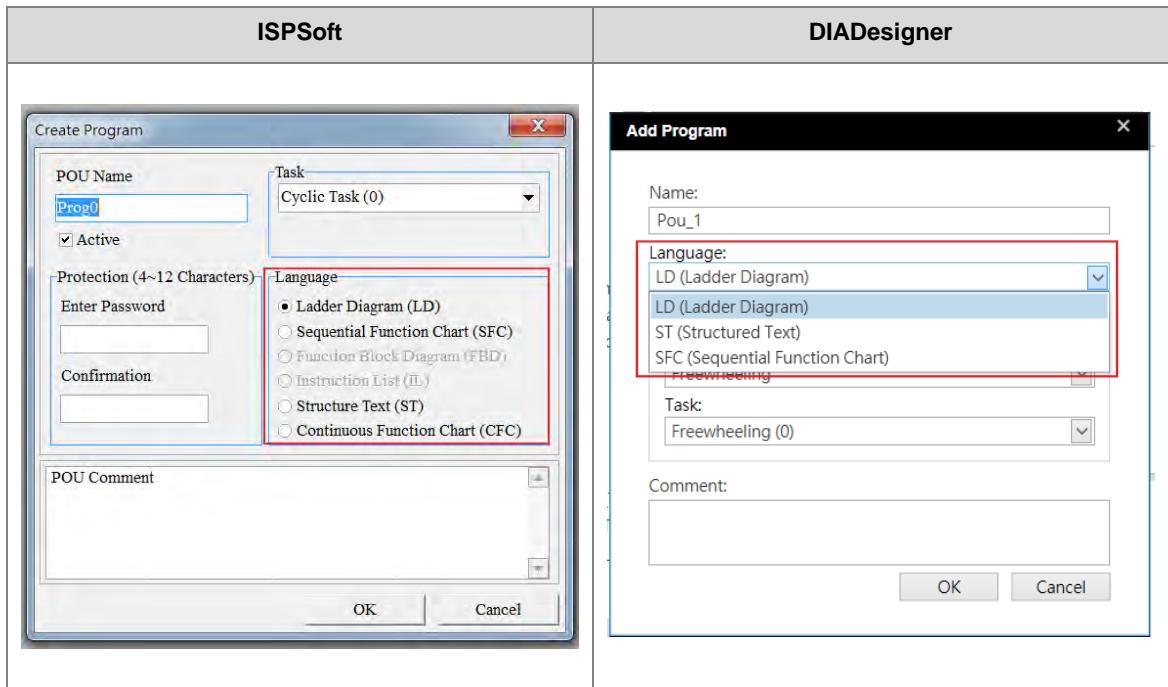
- The DVP-ES3/EX3 PLC CPU supports up to 256 digital I/Os (inputs + outputs) or 8 analog I/O modules.
- The DVP-SV3/SX3 PLC CPU supports up to 512 digital I/Os (256 inputs + 256 outputs), including 16 fixed DIs and 16 fixed DOs occupied by the CPU, plus a maximum of 240 extension inputs and 240 extension outputs, as well as 8 right-side special modules and 8 left-side high-speed special modules. It is recommended not to connect more than 14 right-side slim type extension modules.

(3) Larger program capacity and memory

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

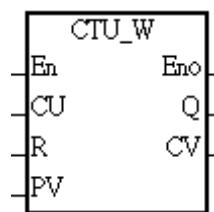
(4) Supporting IEC 61131-3

- The DVP-ES3/EX3/SV3/SX3 PLC CPU supports IEC 61131-3.
- There are four types of programming languages: ladder diagram (LD), sequential function chart (SFC), structure text (ST) and continuous function chart (CFC).
NOTE: ISPSoft version 3.08 or higher support ES3 Series PLC. DIADesigner V1.30 or higher support ES300TEC, EX3/SV3/SX3 Series PLC.
- You can select a programming language according to your preference. The programming languages support mutual calling, enabling easier integration of programs written by different users.



(5) Strong function block

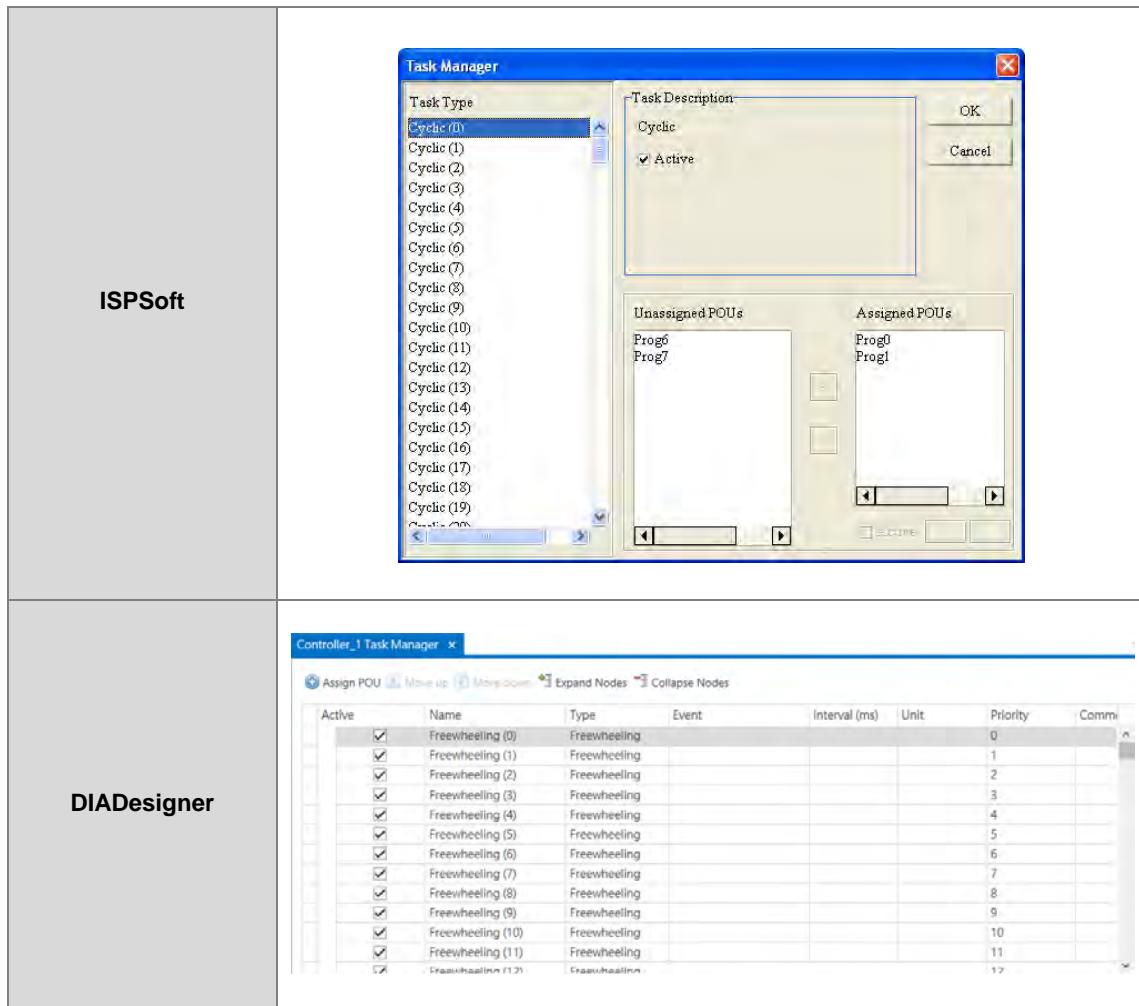
- Supports both standard IEC61131-3 function blocks and convenient functions blocks provided by Delta Electronics. You can also package frequently used functions into function blocks, making programs more structured and convenient to use.
- The symbol for a function block in a ladder diagram is similar 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, without needing 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 ISPSof to provide confidentiality for function block. The internal program of function blocks cannot be accessed, protecting industry patents from infringement.

(6) Task

- You can assign 283 tasks at most to a program. Among these tasks, 32 are cyclic/noncyclic, 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/EX3/SV3/SX3 PLC CPU provides a standard USB 2.0 interface. USB 2.0 increases the data transfer speed, reducing time for program upload/download, monitoring, and hardware debugging. No need to purchase a dedicated communication cable for the CPU module. A standard USB cable can be used to connect to the CPU module.

(8) Serial control interface (RS-485 and CAN) with multiple functions

- DVP-ES3/EX3/SV3/SX3 Series CPU modules provide two RS-485 serial communication interfaces, COM1 and COM2, which can be set as either master or slave.

- Built-in CAN communication port is for Delta Special Drive (8-axis servo and 8 motor drives) and CANopen DS301 communication mode (up to 64 Slaves).

(9) High-speed Ethernet communication interface

- DVP-ES3/EX3/SV3/SX3 Series CPU modules are equipped with a 10/100 M Ethernet communication interface and support webpage, Modbus TCP, Ethernet/IP Scanner/Adapter, and socket services.
- DVP-EX3 Series PLC CPU is built with 2x Ethernet ports (can act as a switch).

(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 the device setting values

Parameter storage: device value

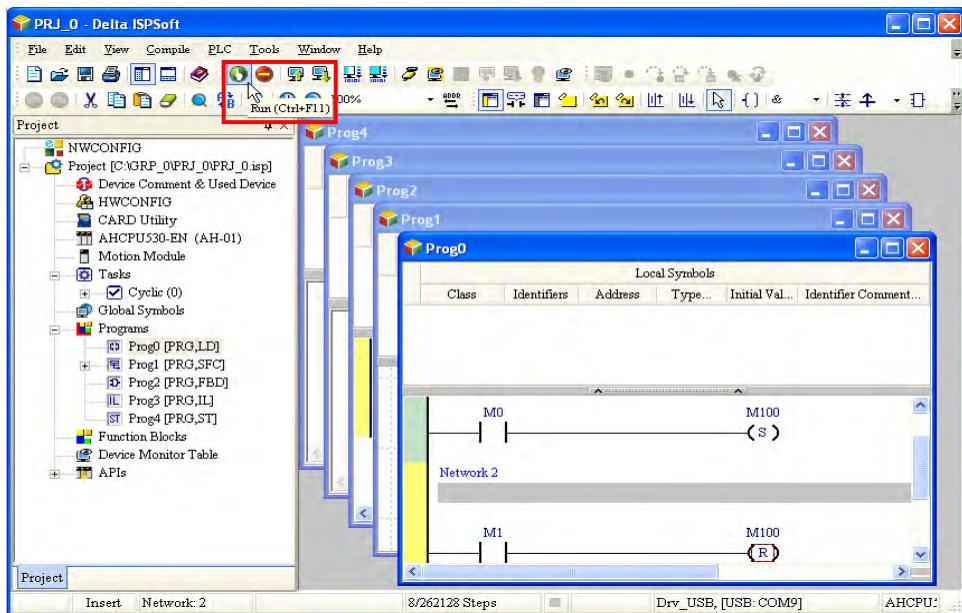
Log storage: system error log and system status log

(11) Supporting on-line debugging mode

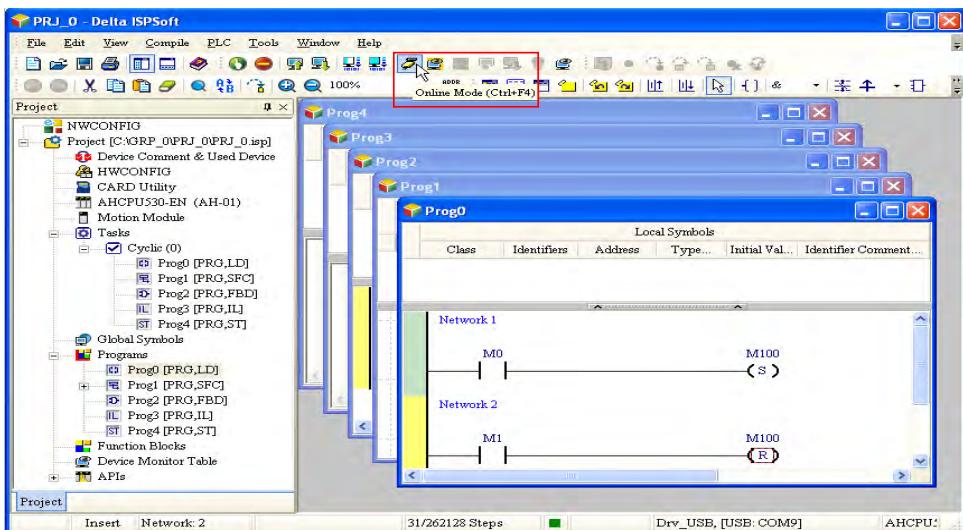
- You can use the on-line debugging mode in the DVP-ES3/EX3/SV3/SX3 PLC CPU after a single instruction step completes, or after a breakpoint is specified, to find bugs in the program.
- The CPU module must be running to enter the debugging mode. After enabling the on-line monitoring function, click . The debugging screen varies from programming language to programming language, but the same operation applies to these programming languages. For the DVP-ES3/EX3/SV3/SX3 PLC CPU, structured text (ST) does not support debugging mode, and sequential function charts (SFC) supports debugging mode during the action and the transition.

● ISPSoft

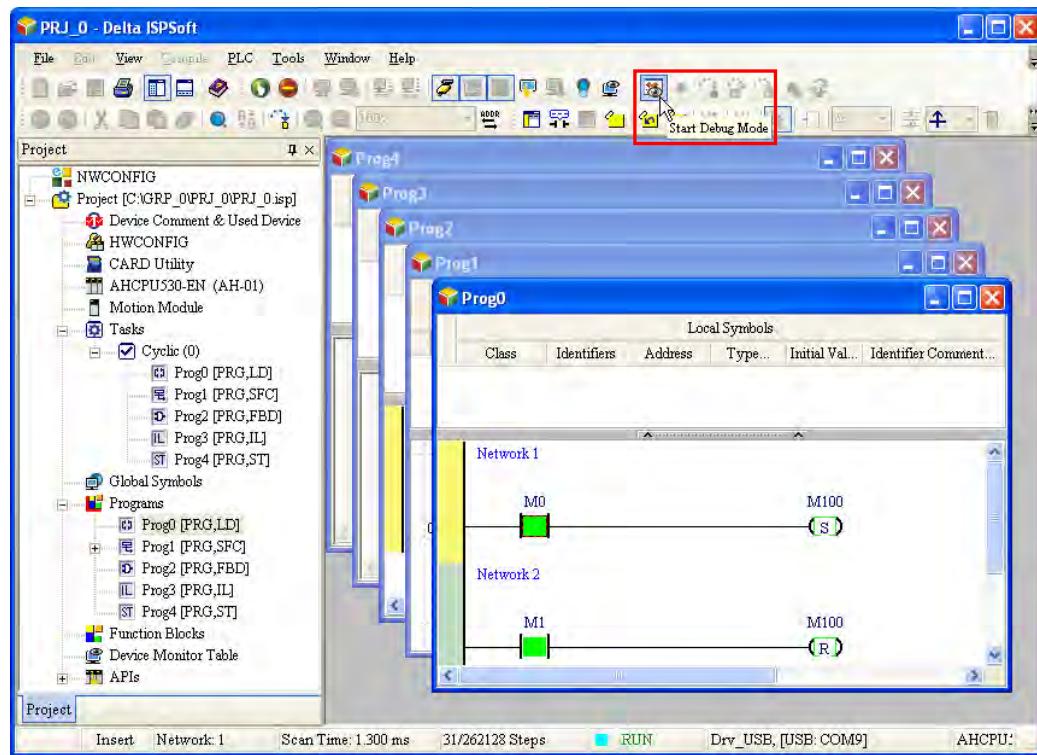
Step 1: Set the PLC to RUN



Step 2: Enter online mode



Step 3: Enter debugging mode



● DIADesigner

Step 1: Set the PLC to RUN



Step 2: Entering the on-line mode



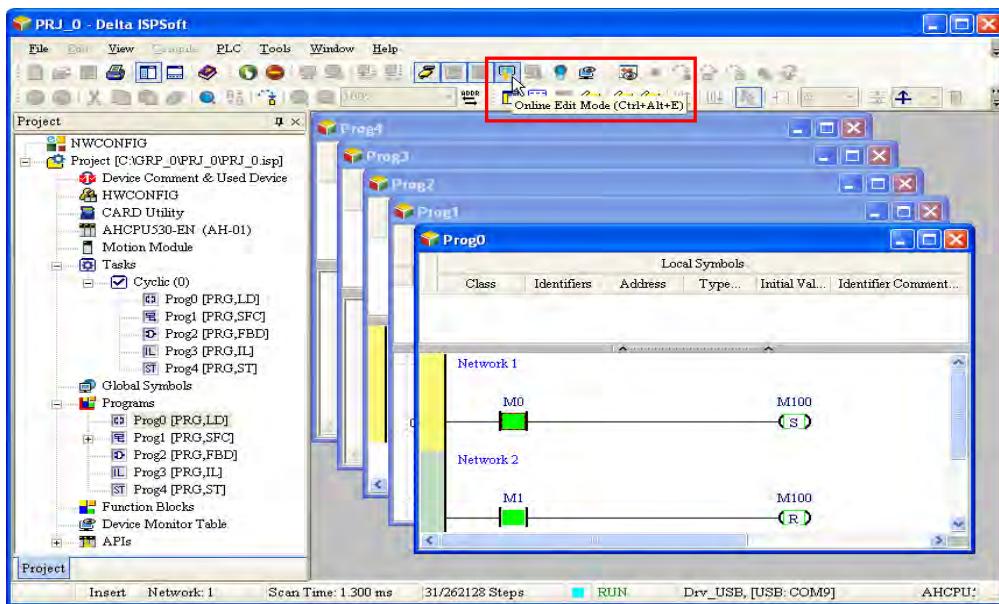
Step 3: Enter debugging mode



(12) On-line editing mode

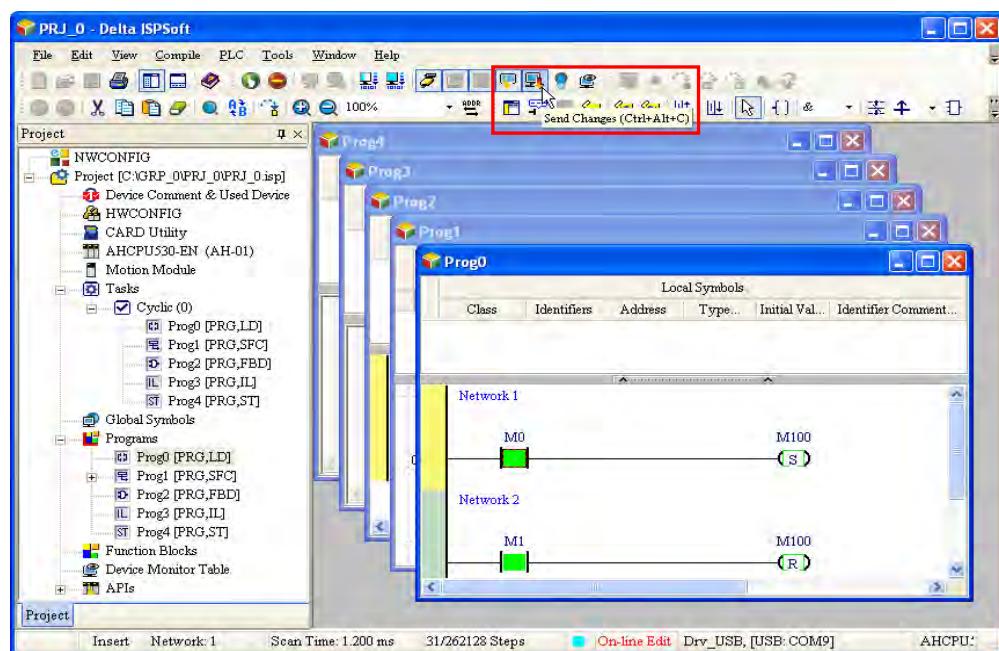
- The on-line editing mode allows you to update the program without affecting the system operation.
- **ISPSoft**

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



2. After the program is modified and compiled, you can update the program in the CPU module by

clicking .



- **DIADesigner**

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



2. After the program is modified and compiled, you can update the program in the CPU module by

clicking .



MEMO

Chapter 2 Specifications and System Configuration

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2.1 DVP-ES3/EX3 Series

2.1.1 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 (NOT UL Certified)
EMC (electromagnetic compatibility)	Refer to Appendix C for more information.
Vibration resistance	Tested with: 5 Hz \leq f \leq 8.4 Hz, constant amplitude 3.5 mm; 8.4 Hz \leq f \leq 150 Hz, constant acceleration 1 g 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 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, UL508
Atmospheric pressure	Operating: 1013 to 795 hPa (altitude: 0–2000 m) Storage: 1013 to 660 hPa (altitude: 0–3500 m)
Enclosure flammability rating	UL 94 V-0

2.1.2 CPU Module Specifications

2.1.2.1 Functional specifications

Item	DVP32ES311T, DVPxxES300R/T, DVP32ES300TEC, DVPxxEX300R/T, DVP28EX300MT	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 256 digital I/Os are supported. The 256 I/Os are shared by the PLC CPU (8 DIs and 8 Dos). It is recommended not to connect more than 8 analog modules.	
Number of tasks	283 tasks (32 cyclic tasks; 16 I/O interrupts; 4 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)	For programming in software
Stepping relay [S]	2048 (S0-S2047)	
Index register [E]	10 (E0-E9)	
Special auxiliary relay [SM]	4096 (SM0-SM4095)	

Item	DVP32ES311T, DVPxxES300R/T, DVP32ES300TEC, DVPxxEX300R/T, DVP28EX300MT	Remark												
Special data register [SR]	2048 (SR0–SR2047)													
Serial communication port	2x RS-485													
Ethernet port	10/100 M; ES3 Series: single port; EX3 Series: two ports; supporting Modbus TCP and Ethernet/IP Scanner/Adapter protocols	Refer to the section 9.3 for more details on Ethernet specifications												
USB port	Mini B type USB													
Storage interface	SD Card (Micro SD); maximum storage: 32G													
Real-time clock	<p>Years, months, days, hours, minutes, seconds and weeks</p> <p>The accuracy</p> <table border="1"> <thead> <tr> <th>Environment</th><th>Cold</th><th>Normal</th><th>Hot</th></tr> </thead> <tbody> <tr> <td>0°C /32°F</td><td>25°C /77°F</td><td>55°C /131°F</td><td></td></tr> <tr> <td>Deviation (seconds per month)</td><td>-117</td><td>52</td><td>-132</td></tr> </tbody> </table>	Environment	Cold	Normal	Hot	0°C /32°F	25°C /77°F	55°C /131°F		Deviation (seconds per month)	-117	52	-132	Maintains timing for about one week during power-off via electric double layer capacitor
Environment	Cold	Normal	Hot											
0°C /32°F	25°C /77°F	55°C /131°F												
Deviation (seconds per month)	-117	52	-132											
CANopen DS301 (Master)	Maximum node: 64; maximum bytes: 2000	Built-in CAN communication port (except DVP32ES300TEC)												
CANopen DS301 (Slave)	Maximum PDO: 8; maximum bytes: 8													
EtherCAT communication port	Supports EtherCAT Master 8 axes point-to-point positioning control; transmission rate: 100 Mbps Note: only Delta servos ASDA-A2-E, ASDA-A3-E, ASDA-B3-E, and Delta inverters C2000 and CH2000 are supported.	Only applicable to DVP32ES300TEC												

2.1.2.2 Electrical specifications

Model Item	DVP32ES311T
Supply voltage	24 VDC (20.4 VDC to 28.8 VDC) (-15% to +20%)
Communication port isolation	USB, COM1, COM2, and Ethernet ports: 500 VAC
Weight	390 g

Model Item	DVPxxES300R/T, DVP32ES300TEC, DVPxxEX300R/T, DVP28EX300MT
Supply voltage	100 to 240VAC (-15% to 10%), 50 / 60 Hz \pm 5%
Fuse capacity	2.5 A / 250 VAC
Power consumption	70 VA _{MAX}
DC24V current output	500 mA
Protection	DC 24 V output with short-circuit protection
Over voltage category	OVC II
Surge voltage protection	3,000 VAC (Primary-secondary), 3,000 VAC (Primary-FE), 500 VAC (Secondary-FE)
Insulation impedance	≥ 5 M Ω (the isolation between each input/output point and the ground should be 500 VAC)
Grounding	The ground wire diameter should not be less than the diameters of the cables connected to the terminals L and N. If using multiple pieces of PLC, use a single-point ground.
Communication port isolation	USB, COM1, COM2, Ethernet, EtherCAT (applicable to DVP32ES300TEC) ports: 500 VAC

- Weight

Model	DVP-ES3 Series								
	32ES 300T	32ES 300R	48ES 300T	48ES 300R	64ES 300T	64ES 300R	80ES 300T	80ES 300R	32ES 300TEC
Weight (g)	571	627	657	732	758	868	863	997	538

Model	DVP-EX3 Series				
	22EX 300T	22EX 300R	36EX 300T	36EX 300R	28EX 300MT
Weight (g)	538	588	637	675	637

- Electrical specifications for the inputs on DVP-ES3 Series PLC CPU. The signals passing through the inputs are 24 VDC signals.

Item	Model	DVP32ES311T	DVP48ES300T	DVP64ES300T	DVP80ES300T
	DVP32ES300T				DVP80ES300R
	DVP32ES300TEC		DVP48ES300R	DVP64ES300R	
	DVP32ES300R				
Number of inputs		16 (X0–X17)	24 (X0–X27)	32 (X0–X37)	40 (X0–X47)
Connector type					Removable terminal blocks
Input type					Digital input
Input form					Direct current (sinking or sourcing)
Input voltage/ current					24 VDC S/S, S/S0: 80 mA; S/S1: 120 mA; X0–X47: 5 mA
Action level	OFF→ON				>15 VDC
	ON→OFF				<5 VDC
Response time	OFF→ON				X0–X7: 1.5 µs X10–X17: 50 µs X20–X47: 10 ms
	ON→OFF				
Maximum input frequency					X0–X7: 200 kHz X10–X17: 10 kHz X20–X47: 50 Hz
Input impedance					X0–X7: 3.9 kΩ X10–X47: 5.6 kΩ
Input isolation					500 VAC
Input display					When the optocoupler is driven, the input LED indicator is ON.

- Electrical specifications for the inputs on DVP-EX3 Series PLC CPU. The signals passing through the inputs are 24 VDC signals.

Item	Model	DVP22EX300T DVP22EX300R	DVP36EX300T DVP36EX300R	DVP28EX300MT		
Number of inputs		12 (X0 to X13)	16 (X0 to X17)	12 (X0 to X13)		
Connector type	Removable terminal blocks					
Input type	Digital input					
Input form	Direct current (sinking or sourcing)		X0+ to X3+/X0- to X3-: Differential X4 to X7 / X10 to X13: Direct current (sinking or sourcing)			
Input voltage/ current	24 VDC S/S: 80 mA X0 to X17: 5 mA		X0+ to X3+/X0- to X3-: 5 VDC, 5 mA X4 to X7 / X10 to X13: 24 VDC, 5 mA S/S: 40 mA			
Action level	OFF→ON	>15 VDC		X0+ to X3+/X0- to X3-: >0.2 VDC X4 to X7 / X10 to X13: >15 VDC		
	ON→OFF	<5 VDC		X0+ to X3+/X0- to X3-: <-0.2 VDC X4 to X7 / X10 to X13: <5 VDC		
Response time	OFF→ON	X0 to X7: 1.5 µs X10 to X17: 50 µs		X0+ to X3+/X0- to X3-: 0.125 µs X4 to X7: 1.5 µs X10 to X13: 50 µs		
	ON→OFF					
Maximum input frequency	X0 to X7: 200 kHz X10 to X17: 10 kHz		X0+ to X3+/X0- to X3-: 4 MHz X4 to X7: 200 kHz X10 to X13: 10 kHz			
Input impedance	X0 to X7: 3.9 kΩ X10 to X17: 5.6 kΩ		5.6 kΩ			
Input isolation	500 VAC					
Input display	When the optocoupler is driven, the input LED indicator is ON.					
Analog input channels	2					
Analog input conversion time^{*1}	3 ms / channel					
Analog input resolution	12 bits					
Analog input mode	-10 V to 10 V; -20 mA to 20 mA; 4 mA to 20 mA; channels closed					
Analog linearity deviation	Normal temperature environment: ±0.5%; All temperature environment: ±1.0%					
Analog input impedance	≥1 MΩ (Voltage mode) 250 Ω (Current mode)					
Analog input isolation	When there is isolation between analog and digital electricals and there is no isolation among analog channels. Isolation between analog electrical and grounding: 500 VAC Isolation between analog and digital electrical: 500 VAC					

*1: Analog input data updates automatically in every PLC scan cycle. If you need to update the input data before the PLC scan cycle, you can use REF instruction.

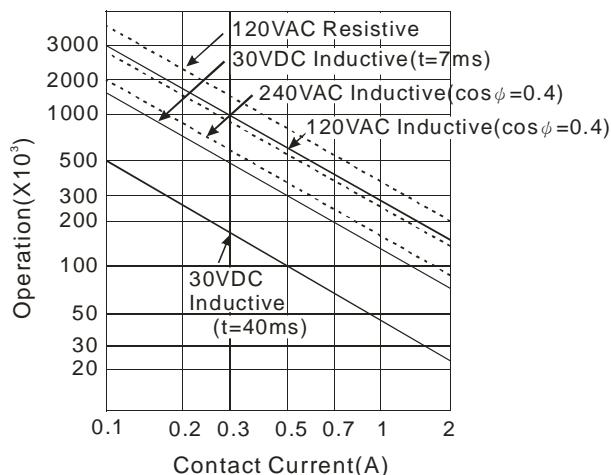
● Electrical specifications for the outputs on DVP-ES3 Series.

Model Item	DVP-ES3 Series	32ES300 R	48ES300 R	64ES300 R	80ES300 R	32ES311 T	32ES300 T/TEC	48ES300 T	64ES300 T	80ES300 T			
Number of outputs	16	24	32	40	16	16	16	24	32	40			
Connector type													
Output form				Relay				Transistor-T (sinking)					
Voltage				10 to 250 VAC, 5 to 30 VDC				5 to 30 VDC					
Leakage current				-				<100 uA					
Max. inrush current				-				Transistor-T (sinking): 0.8 A Tested when Ta = 25 °C, VDS = 30 VDC, and inrush current = 1 ms					
Maximum load	Resistance	2 A/output, 5 A/COM				0.5 A/output, 4 A/COM ^{*2}							
	Inductance	Life cycle curve ^{*3}				N/A							
	Bulb	20W DC/100W AC				N/A							
Minimum load				1 mA / 5 V									
Input isolation				300 VAC				500 VAC					
Switching frequency^{*1}				≤ 1 Hz				Y0 to Y7: 200 kHz Y10 to Y47 ≤ 1 kHz					
Maximum Response time	OFF→ON	Approximately 10 ms				Y0 to Y7: 1.5 μ s Y10 to Y47: 100 μ s							
	ON→OFF					Y0 to Y7: 1.5 μ s Y10 to Y47: 100 μ s							

*1: The scan cycle affects the frequency.

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

*3: Life cycle curve: The lifetime of a relay terminal varies with the working voltage, the load type (the power factor $\cos\phi$, the time constant $t(L/R)$), and the current passing through the terminal. The relation is shown in the life cycle curve below. The life cycle curve is shown below.



● Electrical specifications for the outputs on DVP-EX3 Series.

Model Item	22EX300R	36EX300R	22EX300T	36EX300T	28EX300MT		
Number of outputs	8	16	8	16	12		
Connector type	Removable terminal blocks						
Output form	Relay		Transistor		Y0+ to Y3+/Y0- to Y3-: Differential; Y4 to Y7 /Y10 to Y13: Transistor		
Voltage	10 to 250 VAC; 5 to 30 VDC		5 to 30 VDC		Y0+ to Y3+/Y0- to Y3-: 5 VDC; Y4 to Y7 /Y10 to Y13: 5 to 30 VDC		
Leakage current	–		<100 uA				
Max. inrush current	–		Transistor-T (sinking): 0.8A Tested when Ta = 25 °C, VDS = 30 VDC, and inrush current = 1 ms				
Maximum load	Resistance	2 A/output, 5 A/COM		0.5 A/output, 4 A/COM*2	Y0+ to Y3+/Y0- to Y3-: 20 mA/COM; (+ and - are grouped, e.g. Y0+ and Y0-); Y4 to Y7 /Y10 to Y13: 0.5 A/output; 4 A/COM*2		
	Inductance	Life cycle curve*3		N/A			
	Bulb	20W DC/100W AC		N/A			
Minimum load		1mA/5V					
Input isolation		3000 VAC		500 VAC			
Switching frequency*4		≤1 Hz		Y0 to Y7: 200 kHz Y10 to Y17 ≤1kHz	Y0+ to Y3+/Y0- to Y3- : 4 MHz; Y4 to Y7: 200 kHz Y10 to Y13: 1 kHz		
Response time	OFF→ON	Around 10 ms	Y0 to Y7: 1.5 μs Y10 to Y17: 100 μs		Y0+ to Y3+/Y0- to Y3-: 0.125 μs; Y4 to Y7: 1.5 μs Y10 to 13: 100 μs		
	ON→OFF		Y0 to Y7: 1.5 μs Y10 to Y17: 100 μs		Y0+ to Y3+/Y0- to Y3-: 0.125 μs; Y4 to Y7: 1.5 μs Y10 to 13: 100 μs		
Analog output channels		2 (applicable for 36EX3/28EX3)					
Analog output conversion time*4		2 ms / channel (36EX3/28EX3)					
Analog output resolution		12-bit (applicable to 36EX3/28EX3)					
Analog output mode		-10 V to 10 V (voltage mode) / 0 to 20 mA (current mode) (applicable to 36EX3/28EX3)					

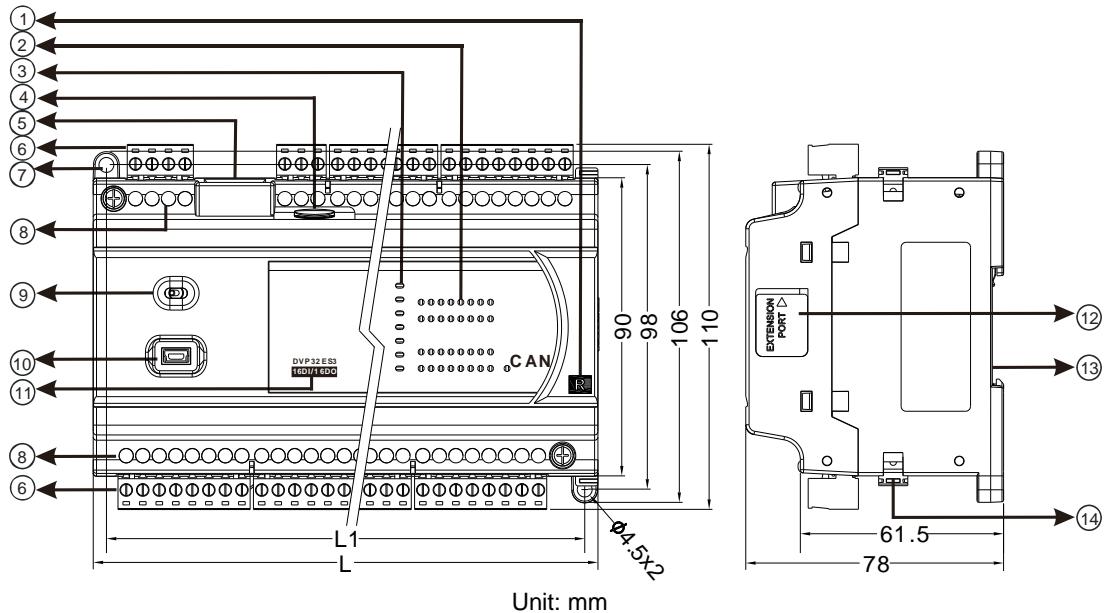
Item \ Model	22EX300R	36EX300R	22EX300T	36EX300T	28EX300MT
Analog output isolation					<p>There is isolation between analog and digital electricals.</p> <p>No isolation among analog channels.</p> <p>Isolation between analog electrical and grounding: 500 VAC</p> <p>Isolation between analog and digital electrical: 500 VAC</p>

*1-*3: Refer to the electrical specifications for the outputs on DVP-ES3 Series from the previous table.

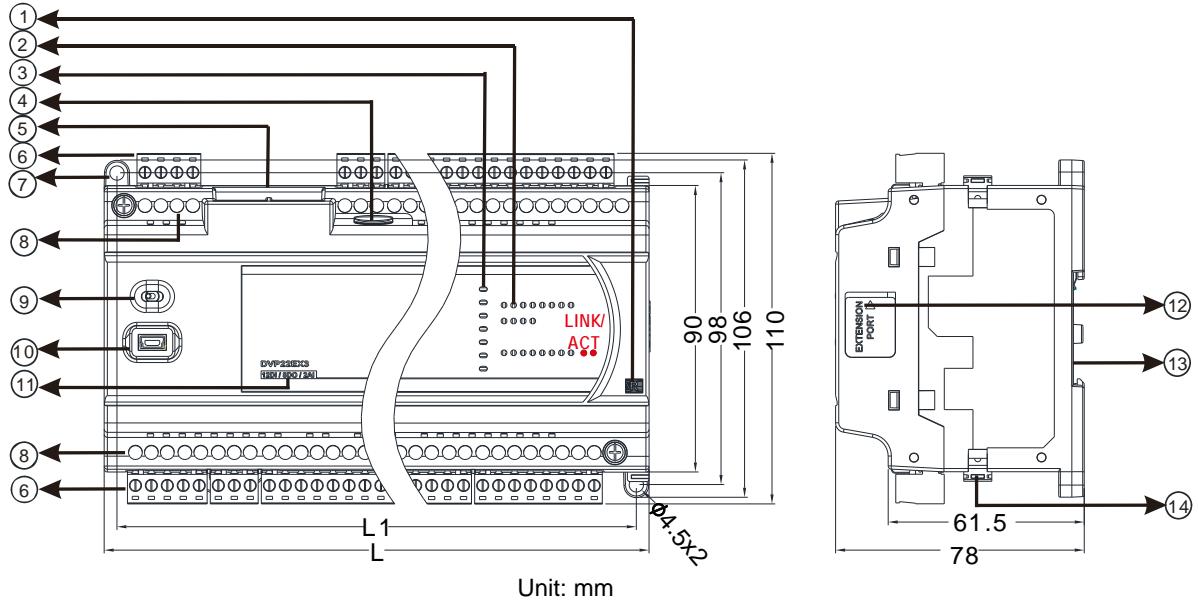
*4: Analog input data updates automatically in every PLC scan cycle. If you need to update the input data before the PLC scan cycle, you can use REF instruction.

2.1.2.3 CPU Module Profiles

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



- DVP22EX300R/DVP22EX300T/DVP36EX300R/DVP36EX300T/DVP28EX300MT/32ES300TEC



- Diameter chart

DVP	32ES311T	32ES311T	32ES300R/T 32ES300TEC 22EX300R/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 indicator 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.
2	CAN communication LED (applicable to ES3 Series)	ON: In communication OFF: No communication
	LINK/ACT E1, E2 communication LED (application to EX3 / 32ES300TEC)	ON: Communication port is connected. Blinking: Data in transmission OFF: Communication port is NOT connected.
	Power LED	Power status of the CPU module
	Run LED	Operating status of the module ON: PLC program is running. OFF: PLC program is stopped. Blinking: PLC 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 and OFF): Error Blinking rapidly (0.2 seconds ON and OFF): Low voltage ON: Scan timeout
	USB communication LED	
	COM1/COM2 communication LED	Communication status OFF: No communication
	CAN communication LED (applicable to EX3)	Blinking: In communication
	ECAT communication LED (applicable to 32ES300TEC)	EtherCAT status Green LED ON: Communication card is working normally. (Slaves are all in Operational State.) Red LED ON: The connection between Master and Slave is NOT connected. Red LED Blinking (2 seconds ON and OFF): Slave is NOT connected. Red LED Blinking (0.5 seconds ON and OFF): Slave status is abnormal. OFF: EtherCAT Master is NOT activated.
3	LINK/ACT LED (applicable to ES3)	ON: Communication port is connected. Blinking: Data in transmission OFF: Communication port is NOT connected.
	SD card slot	For inserting a SD card
4	RJ45 communication port	An interface for RJ45 communication ES3 is built with a single RJ45 port (Ethernet); EX3 is built with a dual RJ45 ports (Ethernet); 32ES300TEC is built with two RJ45 ports: #1 EtherCAT port, #2 Ethernet port
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

Number	Name	Description
10	USB port	Mini USB communication port
11	Model name	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

2.1.2.4 CPU Module Input/Output Terminals

● DVP32ES300R

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17				
DVP32ES300R (16DI/16DO)																											
D+	D-	SG	D+	D-	CAN	CAN	GND	•	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	•	C1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

2

● DVP32ES300T

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17				
DVP32ES300T (16DI/16DO)																											
D+	D-	SG	D+	D-	CAN	CAN	GND	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

● DVP32ES300TEC

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21							
L	N	•	±	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17							
DVP32ES300TEC (16DI/16DO)																											
+24V	24G	•	D+	D-	SG	D+	D-	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

● DVP32ES311T

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
24V	0V	•	±	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17							
DVP32ES311T (16DI/16DO)																											
D+	D-	SG	D+	D-	CAN	CAN	GND	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

● DVP48ES300R

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17			
DVP48ES300R (24DI/24DO)																										
D+	D-	SG	D+	D-	CAN	CAN	GND	•	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	•	C1	Y10	Y11	Y12	Y13			
25	26	27	28	29	30	31	32	33																		
S/S1	X20	X21	X22	X23	X24	X25	X26	X27																		

→
Y14 Y15 Y16 Y17 • C2 Y20 Y21 Y22 Y23 Y24 Y25 Y26 Y27
25 26 27 28 29 30 31 32 33 34 35 36 37 38

● DVP48ES300T

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17			
DVP48ES300T (24DI/24DO)																										
D+	D-	SG	D+	D-	CAN	CAN	GND	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11	Y12	Y13			
25	26	27	28	29	30	31	32	33																		
S/S1	X20	X21	X22	X23	X24	X25	X26	X27																		

→
Y14 Y15 Y16 Y17 UP2 ZP2 Y20 Y21 Y22 Y23 Y24 Y25 Y26 Y27
25 26 27 28 29 30 31 32 33 34 35 36 37 38

● **DVP64ES300R**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
L	N	•	±	+24V	24G	•	S/S0	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17	
DVP64ES300R (32DI/32DO)																								
D+	D-	SG	D+	D-	CAN+	CAN-	GND	•	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	•	C1	Y10	Y11	Y12	Y13	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41								
S/S1	X20	X21	X22	X23	X24	X25	X26	X27	X30	X31	X32	X33	X34	X35	X36	X37								
Y14	Y15	Y16	Y17	•	C2	Y20	Y21	Y22	Y23	Y24	Y25	Y26	Y27	•	C3	Y30	Y31	Y32	Y33	Y34	Y35	Y36	Y37	
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	

● **DVP64ES300T**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
L	N	•	±	+24V	24G	•	S/S0	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17	
DVP64ES300T (32DI/32DO)																								
D+	D-	SG	D+	D-	CAN+	CAN-	GND	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11	Y12	Y13	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
S/S1	X20	X21	X22	X23	X24	X25	X26	X27	X30	X31	X32	X33	X34	X35	X36	X37	X40	X41	X42	X43	X44	X45	X46	X47
Y14	Y15	Y16	Y17	UP2	ZP2	Y20	Y21	Y22	Y23	Y24	Y25	Y26	Y27	UP3	ZP3	Y30	Y31	Y32	Y33	Y34	Y35	Y36	Y37	
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49

● **DVP80ES300R**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
L	N	•	±	+24V	24G	•	CAN+	CAN-	GND	S/S0	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17	
DVP80ES300R (40DI/40DO)																											
D+	D-	SG	D+	D-	•	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	•	C1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	•	C2	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52			
S/S1	X20	X21	X22	X23	X24	X25	X26	X27	X30	X31	X32	X33	X34	X35	X36	X37	X40	X41	X42	X43	X44	X45	X46	X47			
Y20	Y21	Y22	Y23	Y24	Y25	Y26	Y27	•	C3	Y30	Y31	Y32	Y33	Y34	Y35	Y36	Y37	•	C4	Y40	Y41	Y42	Y43	Y44	Y45	Y46	Y47
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

● **DVP80ES300T**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
L	N	•	±	+24V	24G	•	CAN+	CAN-	GND	S/S0	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17	
DVP80ES300T (40DI/40DO)																											
D+	D-	SG	D+	D-	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	UP2	ZP2	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52			
S/S1	X20	X21	X22	X23	X24	X25	X26	X27	X30	X31	X32	X33	X34	X35	X36	X37	X40	X41	X42	X43	X44	X45	X46	X47			
Y20	Y21	Y22	Y23	Y24	Y25	Y26	Y27	UP3	ZP3	Y30	Y31	Y32	Y33	Y34	Y35	Y36	Y37	UP4	ZP4	Y40	Y41	Y42	Y43	Y44	Y45	Y46	Y47
28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55

● **DVP22EX300R**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20								
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13								
DVP22EX300R (12DI/8DO/2AI)																											
D+	D-	SG	D+	D-	CAN+	CAN-	GND	•	C0	Y0	Y1	Y2	Y3	•	C1	Y4	Y5	Y6	Y7	•	•	V0+	I0+	V10-	V1+	I1+	VI1-
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

● **DVP22EX300T**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13
DVP22EX300T (12DI/8DO/2AI)																			
D+	D-	SG	D+	D-	CAN+	CAN-	GND	•	•	UP	ZP	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										
V0+	I0+	V10-	V1+	I1+	V11-														

● **DVP28EX300MT**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L	N	•	±	+24V	24G	SG1	X0+	X0-	X1+	X1-	X2+	X2-	X3+	X3-	S/S	X4	X5	X6	X7	X10	X11	X12	X13
DVP28EX300MT (12DI/12DO/2AI/2AO)																							
D+	D-	SG	D+	D-	CAN+	CAN-	GND	•	•	SG0	Y0+	Y0-	Y1+	Y1-	Y2+	Y2-	Y3+	Y3-	•	UP	ZP	Y4	Y5
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30																		
V0+	I0+	V10-	V1+	I1+	V11-																		
Y6	Y7	Y10	Y11	Y12	Y13	•	•	VO0	IO0	AG	VO1	IO1	AG										
25	26	27	28	29	30	31	32	33	34	35	36	37	38										

● **DVP36EX300R**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
DVP36EX300R (16DI/16DO/2AI/2AO)																							
D+	D-	SG	D+	D-	CAN+	CAN-	GND	•	C0	Y0	Y1	Y2	Y3	•	C1	Y4	Y5	Y6	Y7	•	C2	Y10	Y11
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30																		
V0+	I0+	V10-	V1+	I1+	V11-																		
Y12	Y13	Y14	Y15	Y16	Y17	•	•	VO0	IO0	AG	VO1	IO1	AG										
25	26	27	28	29	30	31	32	33	34	35	36	37	38										

● **DVP36EX300T**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L	N	•	±	+24V	24G	•	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
DVP36EX300T (16DI/16DO/2AI/2AO)																							
D+	D-	SG	D+	D-	CAN+	CAN-	GND	•	•	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP1	ZP1	Y10	Y11
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30																		
V0+	I0+	V10-	V1+	I1+	V11-																		
Y12	Y13	Y14	Y15	Y16	Y17	•	•	VO0	IO0	AG	VO1	IO1	AG										
25	26	27	28	29	30	31	32	33	34	35	36	37	38										

2.1.2.5 DVP-EX3 Analog Inputs / Outputs

- Two Analog Inputs

Item	Voltage Input	Current Input
Analog signal	-10 to +10 V	-20 to 20 mA / 4 to 20 mA
Resolution	12-bit	11-bit
Input impedance	$\geq 1M\Omega$	250Ω
Conversion time	3 ms / CH	
Analog to digital conversion range	-2000 to 2000	-1000 to 1000 (-20 to 20 mA) 0 to 1000 (4 to 20 mA)
Digital value output	SR168 (CH1), SR169 (CH2)	

You can use the program to read the values in SR to obtain the corresponding A/D conversion value for the channel.

- Two Analog Outputs (applicable to DVP36EX3 and DVP28EX3)

Item	Voltage Output	Current Output
Analog signal	-10 to +10 V	0 to 20 mA
Resolution	12-bit	12-bit
Input impedance	$\geq 1K\Omega$	$\leq 500\Omega$
Conversion time	2 ms / CH	
Analog to digital conversion range	-2000 to 2000	0 to 4000
Digital value output	SR172 (CH1), SR173 (CH2)	

You can use the instruction MOV to move the value to the SR to obtain the corresponding voltage output value.

2.2 DVP-SV3/SX3 Series

2.2.1 General Specifications

Item	Specifications
Operating temperature	-0 to 55°C
Storage temperature	-25 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 (NOT UL Certified)
EMC (electromagnetic compatibility)	Refer to Appendix C for more information.
Vibration resistance	Tested with: 5 Hz \leq f \leq 8.4 Hz, constant amplitude 3.5 mm; 8.4 Hz \leq f \leq 150 Hz, constant acceleration 1 g 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 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, UL508
Atmospheric pressure	Operating: 1013 to 795 hPa (0–2000 m) Storage: 1013 to 660 hPa (0–3500 m)
Enclosure flammability rating	UL 94 V-0

2.2.2 CPU Module Specifications

2.2.2.1 Functional specifications

Item	DVP28SV311T DVP28SV311R DVP28SV311S	DVP20SX311T DVP20SX311R DVP20SX311S	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 240 digital inputs and 240 outputs are supported. It is recommended NOT to connect more than 8 right-side extension modules or 8 left-side extension modules.		
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	512		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)		For programming in software
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)		

Item	DVP28SV311T DVP28SV311R DVP28SV311S	DVP20SX311T DVP20SX311R DVP20SX311S	Remark											
Serial communication port	2x RS-485													
Ethernet port	10/100 M; ES3 Series: single port; EX3 Series: two ports; supporting Modbus TCP and Ethernet/IP Adapter protocols		Refer to the section 9.3 for more details on Ethernet specifications											
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 The accuracy <table border="1" data-bbox="516 684 1040 886"> <thead> <tr> <th>Environment</th><th>Cold</th><th>Normal</th><th>Hot</th></tr> </thead> <tbody> <tr> <td>0°C /32°F</td><td>25°C /77°F</td><td>55°C /131°F</td><td></td></tr> <tr> <td>Deviation (seconds per month)</td><td>-117</td><td>52</td><td>-132</td></tr> </tbody> </table>	Environment	Cold	Normal	Hot	0°C /32°F	25°C /77°F	55°C /131°F		Deviation (seconds per month)	-117	52	-132	Maintains timing for about one week during power-off via electric double layer capacitor
Environment	Cold	Normal	Hot											
0°C /32°F	25°C /77°F	55°C /131°F												
Deviation (seconds per month)	-117	52	-132											
CANopen DS301 (Master)	Maximum node: 64; maximum bytes: 2000													
CANopen DS301 (Slave)	Maximum PDO: 8; maximum bytes: 8		Built-in CAN communication port											

2.2.2.2 Electrical specifications

Model Item	DVP28SV 311T	DVP28SV 311R	DVP28SV 311S	DVP20SX 311T	DVP20SX 311R	DVP20SX 311S
Supply voltage	24 VDC (20.4 VDC–28.8 VDC) (-15% to +20%)					
Fuse capacity	4 A / 30 VDC					
Power consumption	4 W	4.5 W	4 W	5 W	5.5 W	5 W
Protection	24 VDC output with short-circuit protection					
Surge voltage protection	0.5 KV					
Grounding	1. Grounding spring should be used under rail grounding. 2. The wire diameter of the power supply grounding wiring shall not be smaller than that of the 24V and 0V wire diameter at the power supply end.					
Communication port isolation	Coupling voltage: 1 KV					
Weight	249.4 g	278.9 g	249 g	253.9 g	270 g	255.5 g

- Electrical specifications for the inputs on DVP-SV3/SX3 Series PLC CPU. The signals passing through the inputs are 24 VDC signals.

Model Item	DVP28SV311T DVP28SV311R DVP28SV311S	DVP20SX311T DVP20SX311R DVP20SX311S
Number of inputs	16 (X0 to X17)	8 (X0 to X7)
Connector type	Removable terminal blocks	
Input type	Digital input	
Input form	Direct current (sinking or sourcing)	
Input voltage/ current	24 VDC, 5 mA	
Action level	OFF→ON	>15 VDC
	ON→OFF	<5 VDC
Response time	OFF→ON	X0 to X7: < 2.5 µs X10 to X17: < 50 µs
	ON→OFF	X0 to X7: < 2.5 µs X10 to X17: < 50 µs
Maximum input frequency	X0 to X7: 200 kHz X10 to X17: 10 kHz	
Input impedance	4.7 kΩ	
Input isolation	Coupling voltage: 1 KV	
Input display	When the optocoupler is driven, the input LED indicator is ON.	
Analog input channels	N/A	4
Analog input conversion time*1	N/A	3 ms / channel
Analog input resolution	N/A	12 bits

Item	Model	DVP28SV311T DVP28SV311R DVP28SV311S	DVP20SX311T DVP20SX311R DVP20SX311S
Analog input mode		N/A	-10 V to 10 V; -20 mA to 20 mA; 4 mA to 20 mA; channels closed
Analog linearity deviation		N/A	Normal temperature environment: $\pm 0.5\%$; All temperature environment: $\pm 1.0\%$
Analog input impedance		N/A	$\geq 1 \text{ M}\Omega$ (Voltage mode) 250Ω (Current mode)
Analog input isolation	<p>When there is isolation between analog and digital electricals and there is no isolation among analog channels.</p> <p>Isolation between digital electrical and grounding: 500 VAC</p> <p>Isolation between analog and digital electrical: 500 VAC</p> <p>Isolation between analog electrical and grounding: 500 VAC</p> <p>Isolation between 24 VDC and grounding: 500 VAC</p>		

*1: Analog input data updates automatically in every PLC scan cycle.

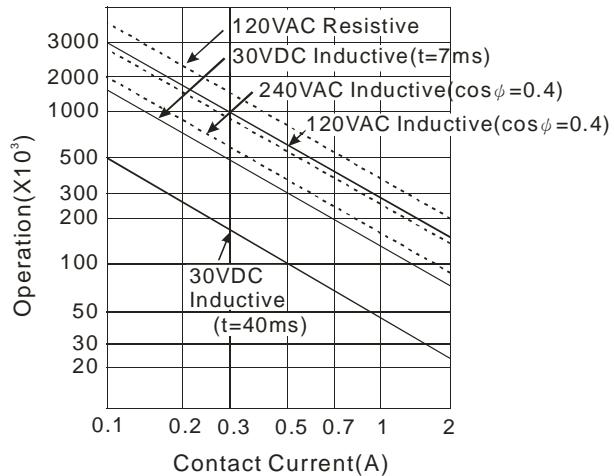
● Electrical specifications for the outputs on DVP-SV3/SX3 Series.

Item	Model	DVP28SV311R	DVP28SV311T	DVP28SV311S			
		DVP20SX311R	DVP20SX311T	DVP20SX311S			
Connector type	Removable terminal blocks						
Output form	Relay		Transistor-T (sinking)	Transistor-P (sourcing)			
Number of digital outputs	SV3: 12 points (Y0 to Y7, Y10 to Y13) SX3: 6 points (Y0 to Y5)						
Voltage	10 to 250 VAC; 5 to 30 VDC		5 to 30 VDC	5 to 30 VDC			
Maximum load	Resistance	1.5 A/output, 4.5 A/COM	0.5 A	0.5 A			
	Inductance	Life cycle curve ^{*3}	N/A	N/A			
	Bulb	20W (24 VDC) 100W (230 VAC)	N/A	N/A			
Switching frequency^{*1}	Resistance	1 Hz	200 kHz	200 kHz			
	Inductance	0.5 Hz	N/A	N/A			
	Bulb	1 Hz	N/A	N/A			
Response time	OFF→ON	10 ms	2.5 μs	2.5 μs			
	ON→OFF						
Analog output channels	2 (applicable to SX3)						
Analog output conversion time^{*4}	2 ms / channel (applicable to SX3)						
Analog output resolution	12-bit (applicable to SX3)						
Analog output mode	-10 V to 10 V/0 to 20 mA (applicable to SX3)						
Digital output isolation	Coupling Voltage: 1 KV						
Analog 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 VAC Isolation between an analog circuit and a ground: 500 VAC Isolation between an analog circuit and a digital circuit: 500 VAC Isolation between the 24 VDC and a ground: 500 VAC						

*1: The scan cycle affects the frequency.

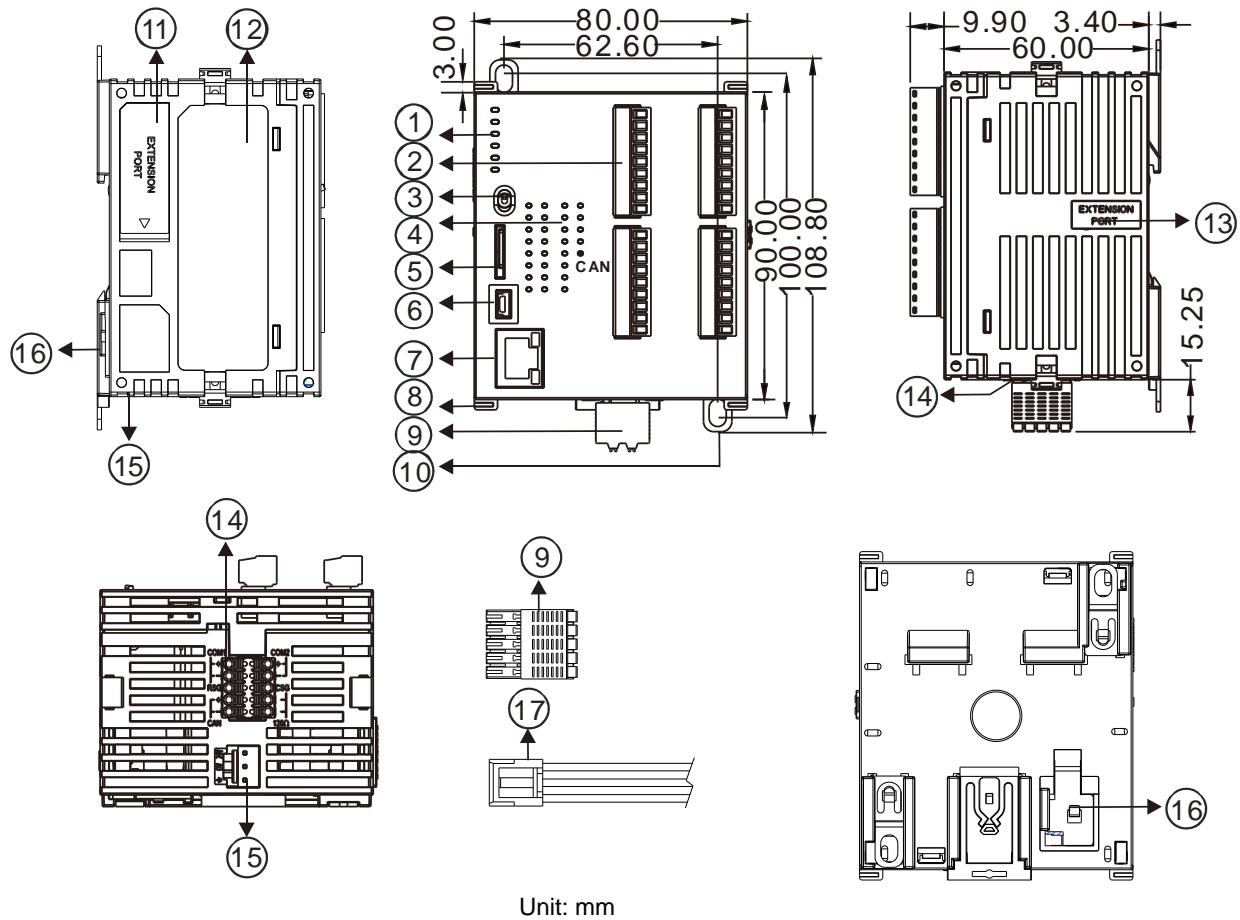
*2: UP, ZP should include external aid power 24 VDC (-15% to +20%) and the rated consumption is around 1 mA/point.

*3: Life cycle curve: The lifetime of a relay terminal varies with the working voltage, the load type (the power factor $\cos\phi$, the time constant $t(L/R)$), and the current passing through the terminal. The relation is shown in the life cycle curve below. The life cycle curve is shown below.



*4: Analog input data updates automatically in every PLC scan cycle.

2.2.2.3 CPU Module Profiles



● LED indicator descriptions

Number	Name	Description
1	Power LED	Power status of the CPU module ON: Power is being supplied. OFF: Power is NOT supplied.
	Run LED	Operating status of the module ON: PLC program is running. OFF: PLC program is stopped. Blinking: PLC 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 and OFF): Error Blinking rapidly (0.2 seconds ON and OFF): Low voltage ON: Scan timeout
	USB communication LED	Communication status
	COM1 communication LED	OFF: No communication Blinking: In communication
2	Removable terminal blocks	Connects the module and the wiring module
3	RUN/STOP	RUN: executes the program
		STOP: stops the program
4	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.
	CAN communication LED	ON: In communication OFF: No communication
5	SD card slot	For inserting a SD card
6	USB port	Mini USB communication port
7	Ethernet port	An interface for Ethernet communication
8	I/O module securing clip	Secures the modules
9	10-pin removable terminal block	Connects the COM1, COM2, CAN ports
10	DIN rail slot (35 mm)	For the DIN rail
11	Left-side external module connection port	Connects the left-side modules
12	Label	Nameplate
13	Right-side external module connection port	Connects the right-side modules
14	COM1/COM2/CAN port	An interface for RS-485/CAN communication
15	Power port	For power supply
16	Grounding spring	For grounding
17	Power cable	For transmitting electrical power

2.2.2.4 CPU Module Input/Output Terminals

DVP20SX311R		DVP20SX311T		DVP20SX311S	
V0+	S/S		V0+	S/S	
I0+	X0		I0+	X0	
VI0-	X1		VI0-	X1	
V1+	X2		V1+	X2	
I1+	X3		I1+	X3	
VI1-	X4		VI1-	X4	
V2+	X5		V2+	X5	
I2+	X6		I2+	X6	
VI2-	X7		VI2-	X7	
V3+	C0		V3+	●	
I3+	Y0		I3+	C0	
VI3-	Y1		VI3-	Y0	
FE	Y2		FE	Y1	
VO0	●		VO0	Y2	
IO0	C1		IO0	Y3	
VO1	Y3		VO1	Y4	
IO1	Y4		IO1	Y5	
AG	Y5		AG	●	
DVP28SV311R		DVP28SV311T		DVP28SV311S	
S/S	C0		S/S	C0	
X0	Y0		X0	Y0	
X1	Y1		X1	Y1	
X2	Y2		X2	C0	
X3	●		X3	Y2	
X4	C1		X4	Y3	
X5	Y3		X5	C1	
X6	Y4		X6	Y4	
X7	Y5		X7	Y5	
S/S	C2		S/S	C1	
X10	Y6		X10	Y6	
X11	Y7		X11	Y7	
X12	Y10		X12	●	
X13	●		X13	C2	
X14	C3		X14	Y10	
X15	Y11		X15	Y11	
X16	Y12		X16	Y12	
X17	Y13		X17	Y13	

2.2.2.5 DVP-SX3 Analog Inputs / Outputs

- Four Analog Inputs

Item	Voltage Input	Current Input
Analog signal	-10 to +10 V	-20 to 20 mA / 4 to 20 mA
Resolution	12-bit	11-bit
Input impedance	$\geq 1 \text{ M}\Omega$	250Ω
Conversion time	3 ms / CH	
Analog to digital conversion range	-2000 to 2000	-1000 to 1000 (-20 to 20 mA) 0 to 1000 (4 to 20 mA)
Digital value output	SR168 (CH1), SR169 (CH2), SR170 (CH3), SR171 (CH4)	

You can use the program to read the values in SR to obtain the corresponding A/D conversion value for the channel.

- Two Analog Outputs

Item	Voltage Output	Current Output
Analog signal	-10 to +10 V	0 to 20 mA
Resolution	12-bit	12-bit
Input impedance	$\geq 1 \text{ K}\Omega$	$\leq 500 \Omega$
Conversion time	2 ms / CH	
Analog to digital conversion range	-2000 to 2000	0 to 4000
Digital value output	SR172 (CH1), SR173 (CH2)	

You can use the instruction MOV to move the value to the SR to obtain the corresponding voltage output value.

2.3 Power Supply Module

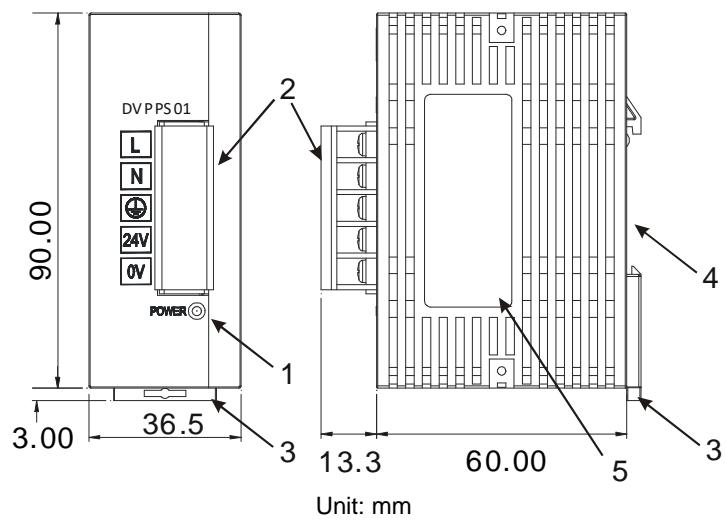
2.3.1 General Specifications

● DVPPS01 / DVPPS02 / DVPPS05

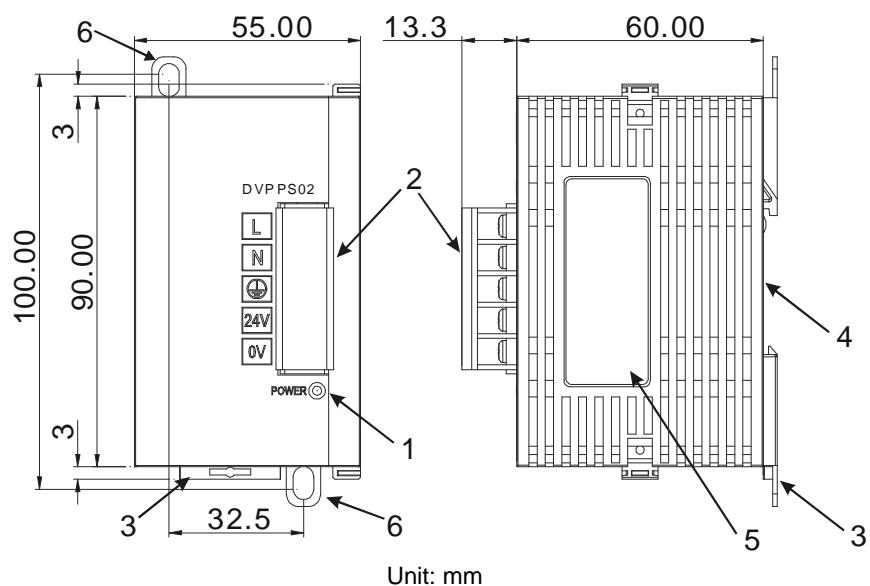
Item \ Model	DVPPS01	DVPPS02	DVPPS05
Supply voltage	100 to 240VAC (-15% to +10%), 50/60 Hz		
Output voltage	24 VDC ($\pm 3\%$)		
Maximum output current	1 A	2 A	5 A
Ripple & Noise	Less than 100 mV _{p-p} @ full load		
Efficiency	78% to 87% @ full load		More than 88% @ full load
Overcurrent / short circuit protection	Auto recovery		
Overvoltage / overtemperature protection	--		<p>Overvoltage protection: When the device is experiencing overvoltage, power it off for 5 seconds and it will be back to normal after powering on again.</p> <p>Overtemperature protection: When the device is experiencing overtemperature, power it off for 5 seconds and after the internal temperature is below 85°C, powering it on again.</p>
Ground	The diameter of the ground should not be less than the diameters of the cables connected to the terminals L and N. (When multiple PLCs are used at the same time, be sure to ground each one separately.)		
Weight	158 g	250 g	488 g

2.3.2 Power Supply Module Profiles

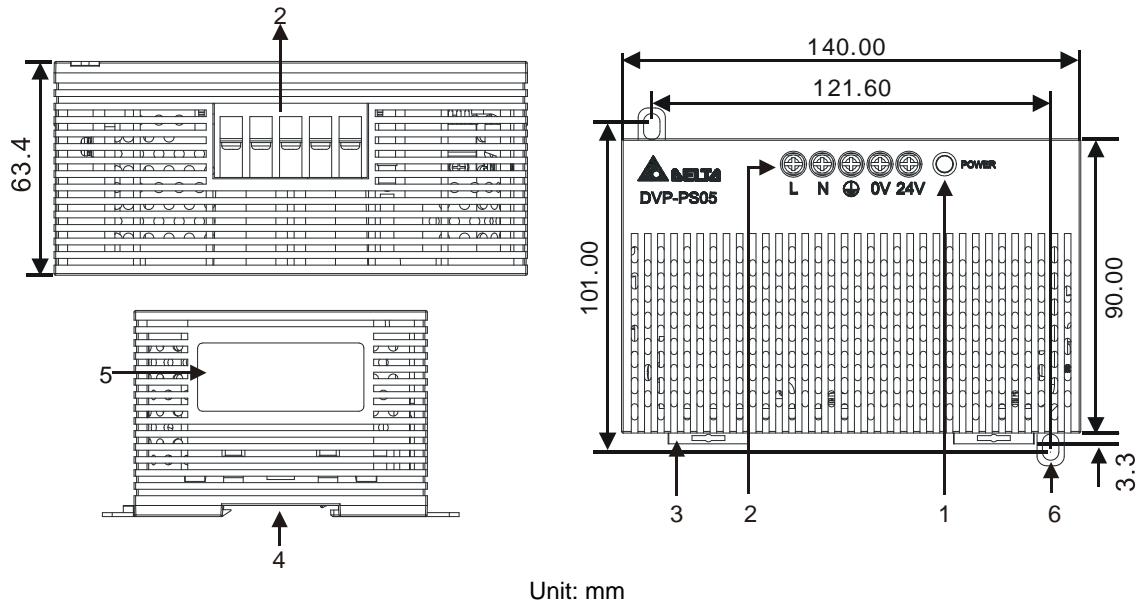
- DVPPS01



- DVPPS02



● DVPPS05



Number	Name	Description
1	Power LED	Power status of the power module
2	Output terminal configuration	24V: DC power output: 24 VDC 0V: DC power output reference ground
2	Input terminal configuration	LG: Line ground L: AC power input (Line) N: AC power input (Neutral) ⏚ : Earth ground terminal
3	DIN rail clip	Secures the module onto the DIN rail
4	DIN rail slot (35 mm)	For the DIN rail
5	Label	Nameplate
6	Mounting hole	Used for the module to be securely attached or mounted to a surface

Chapter 3 Installing Software

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3.2	Installing DIADesigner	3-11
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3.3.2	Uninstalling COMMGR	3-16

Before developing an DVP-ES3/EX3/SV3/SX3 Series system, you need to install ISPSof / DIADesigner and COMMGR. ISPSof / DIADesigner 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 ISPSof / DIADesigner and DVP-ES3/EX3/SV3/SX3 Series hardware.

3.1 Installing and Uninstalling ISPSof

- System requirements

Item	System requirement		
Operating system	Windows XP / 7 / 8 / 10		
CPU	Pentium 1.5 G or above		
Memory	256 MB or above (512 MB or above is recommended.)		
Hard disk drive	Capacity: 5000 MB or above		
CD-ROM drive	This is optional for installing ISPSof.		
Monitor	Resolution: 800×600 or above (suggested setting: 1024x768/96 dpi)		
Keyboard/Mouse	A general keyboard/mouse or devices compatible with Windows		
Printer	A printer with a driver for Windows. This is needed to print projects.		
RS-232 port	For connecting to a PLC	One of them is used, but a PLC that is connected must have a corresponding port. (*1)	
USB port	For connecting to a PLC		
Ethernet port	For connecting to a PLC		
Communication software	COMMGR, a communication manager, must be installed. (*2)		
Supported Models	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.		

*1. ISPSof 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.

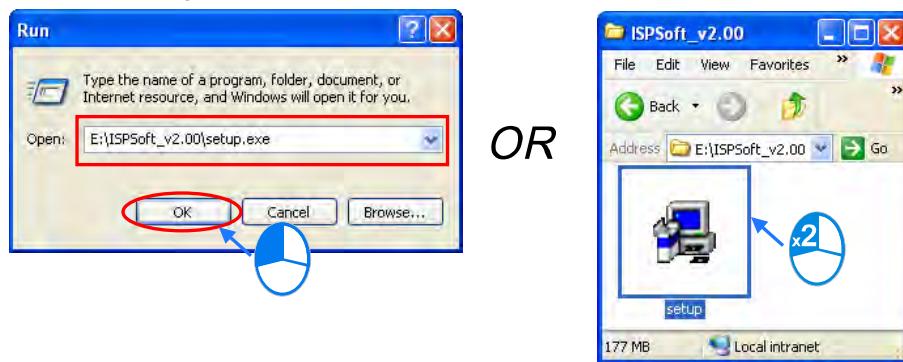
*2. Refer to section 3.3 for more information about COMMGR.

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

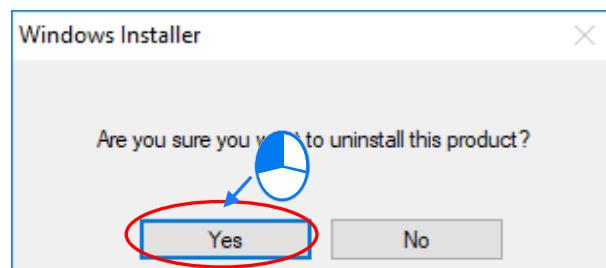
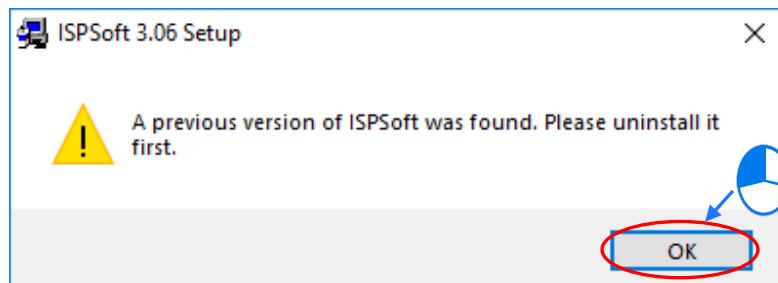
3.1.1 Installing ISPSoft

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

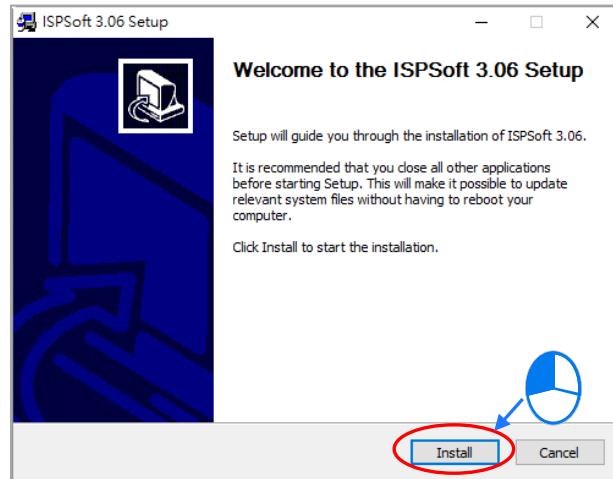
- (1) Start your computer and enter the operating system. You have to log in to the system as a system administrator before installing ISPSoft.
- (2) Put an ISPSoft CD in the CD-ROM drive, or download the installation program from the official Delta website <http://www.deltaww.com/> to download ISPSoft. (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.



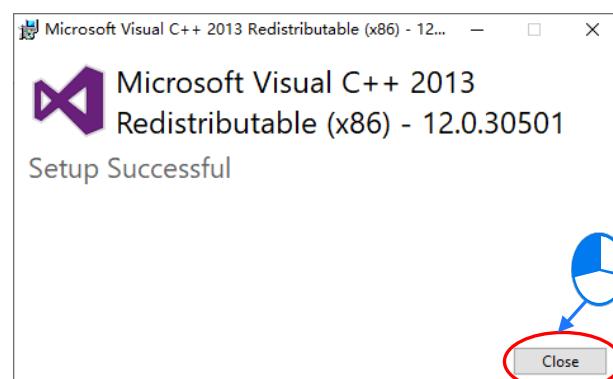
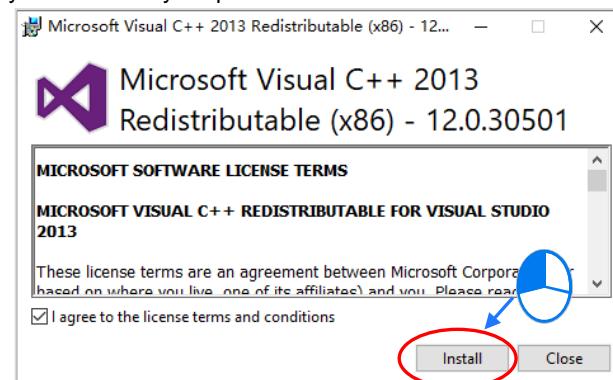
- (4) When a previous version of the ISPSoft is found, click **OK** and then **Yes** to uninstall that version shown in the pop-up windows (see below).



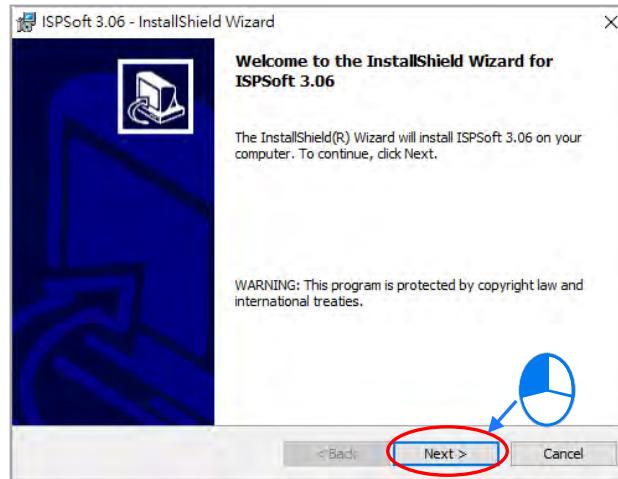
(5) Click **Install** once Shield Wizard window appears.



(6) It is required to have Microsoft Visual C++ 2013 on your computer. If Microsoft Visual C+ 2013 is NOT installed on your computer, the system will ask your permission to start the installation. Follow the steps below.

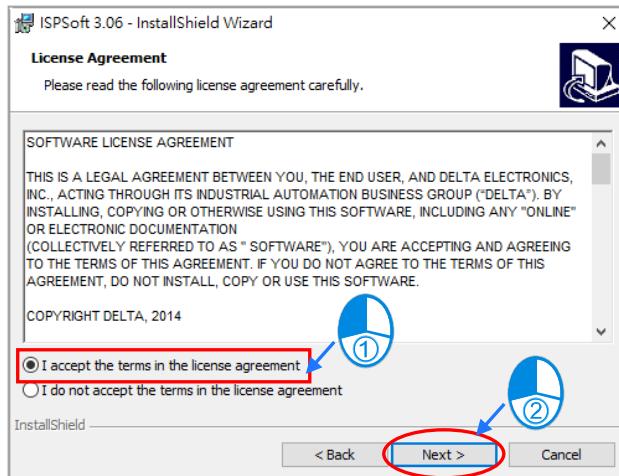


(7) Then, click **Next** for the next step.

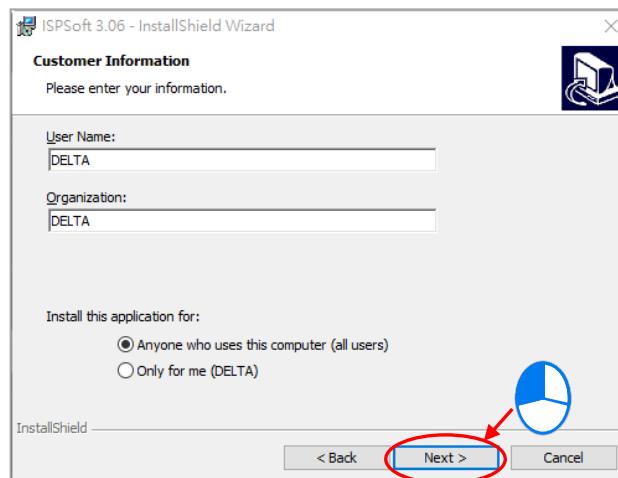


3

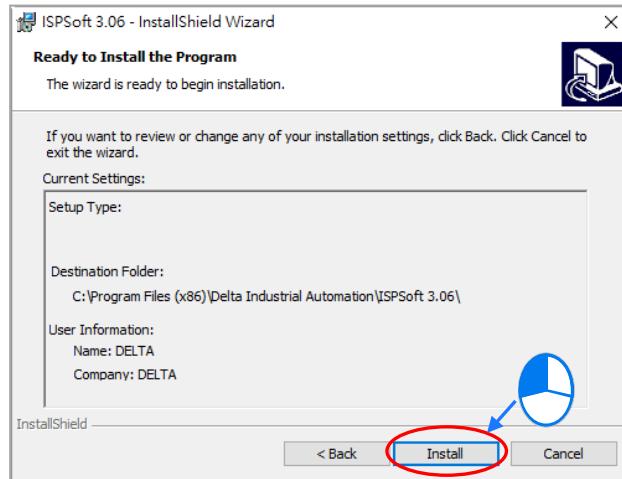
(8) Choose **I accept the terms in the license agreement**. Click **Next** to proceed to the next step.



(9) Fill in the blanks and then click **Next** for the next step.

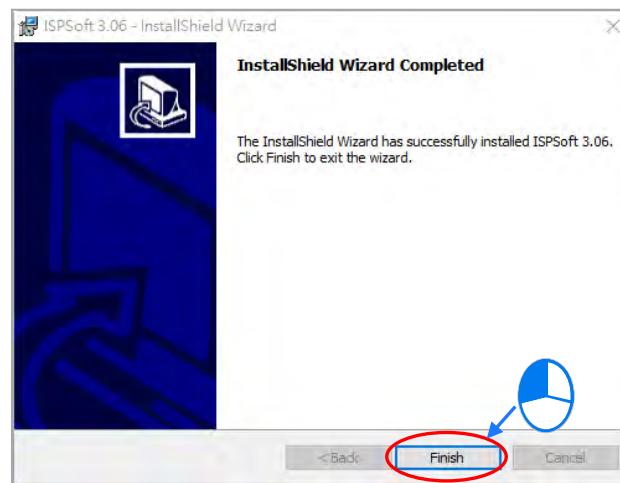
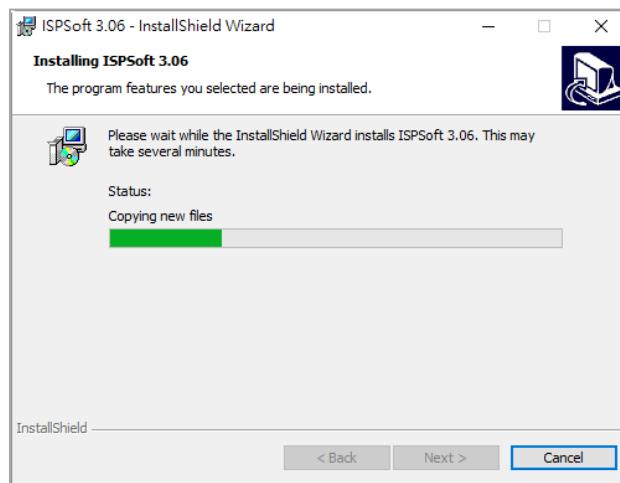


(10) Check the installation information, and then click **Install**.

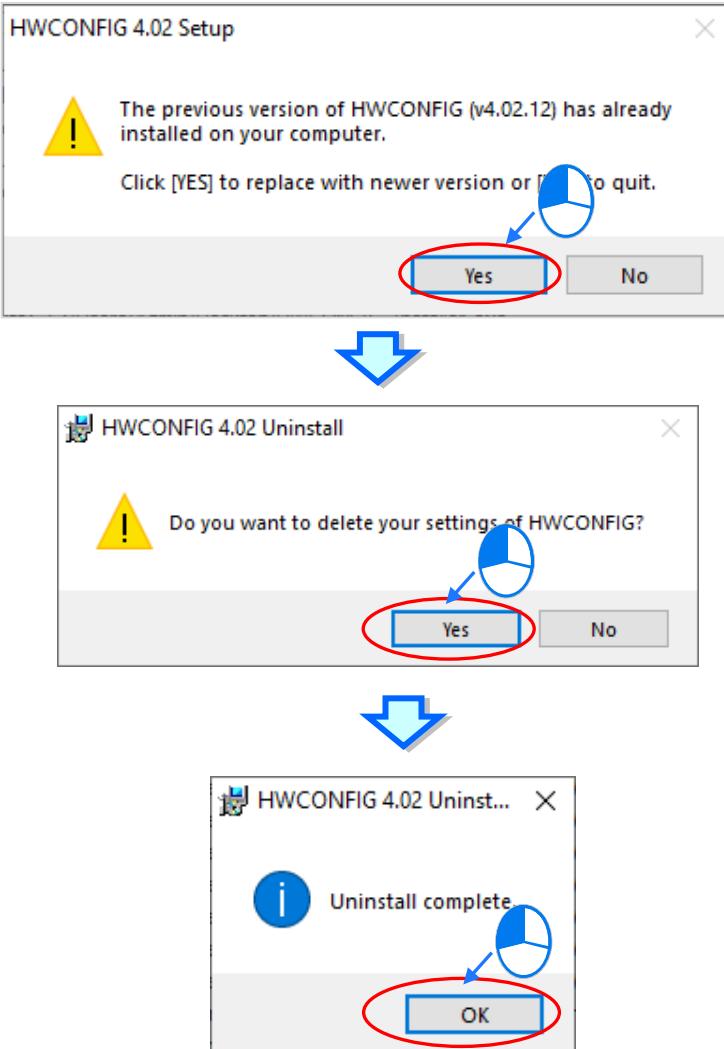


3

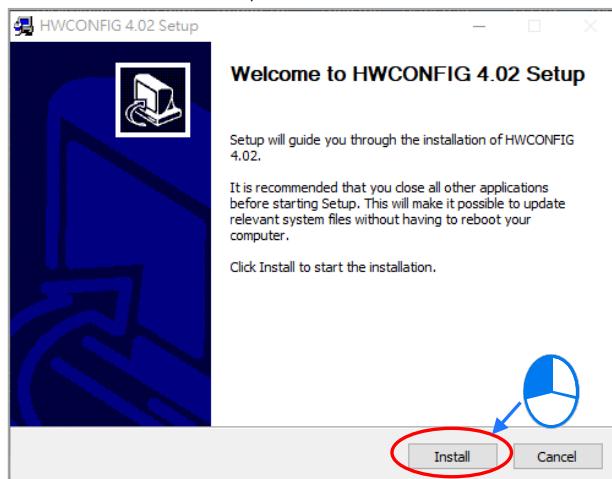
(11) After installation is complete, click **Finish** to continue the next step.



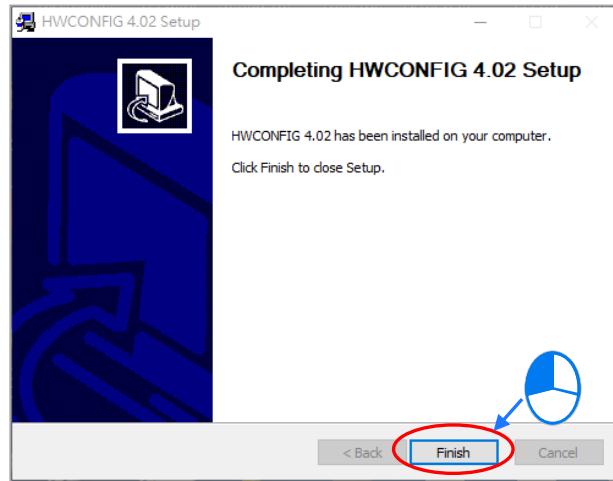
(12) After that HWONFIG will be installed. If there is a previous version of HWCONFIG, the system will ask if you want to replace the old HWCONFIG with a new one. Click **OK** and then make sure if you want to delete your HWCONFIG settings. And then the old version of HWCONFIG is removed.



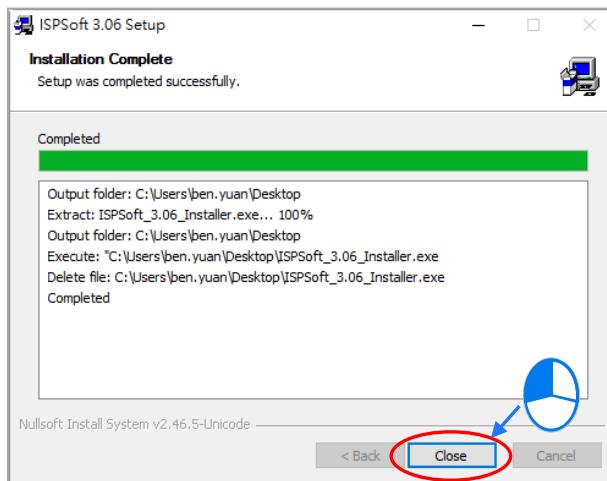
(13) After the old version of HWCONFIG is removed, an installation of a new HWCONFIG will begin.



(14) After the installation of HWCONFIG is complete, click **Finish**.



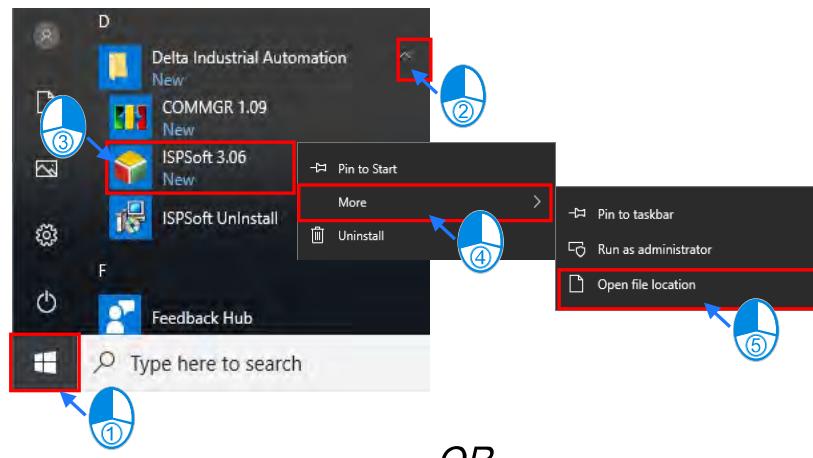
(15) When installation is complete, shortcuts to the software is created on the desktop and Start menu. Click **Close** to exit the setup.



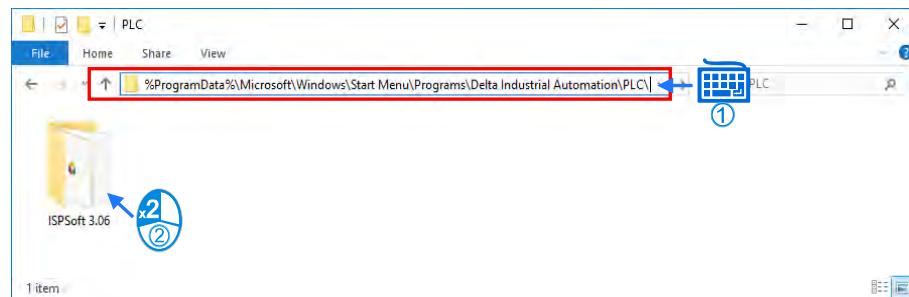
3.1.2 Uninstalling ISPSoft

(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:

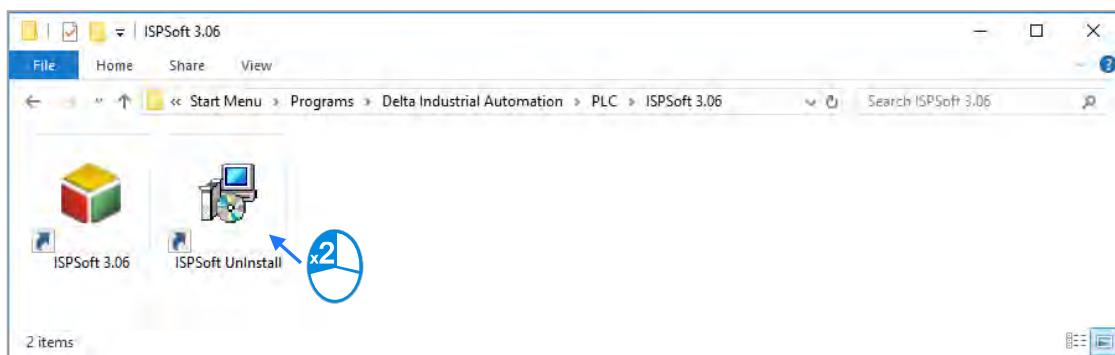
- Method 1: Choose **ISPSoft x.xx** from the Windows list, click **More** then select **Open file location**.
- Method 2: Place **%ProgramData%\Microsoft\Windows\Start Menu\Programs\Delta Industrial Automation\PLC** in the address box and press **Enter**. Then, double click ISPSoft x.xx file.



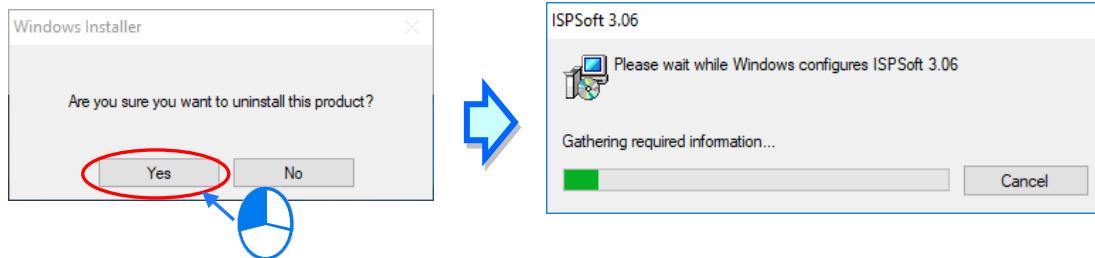
OR



(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

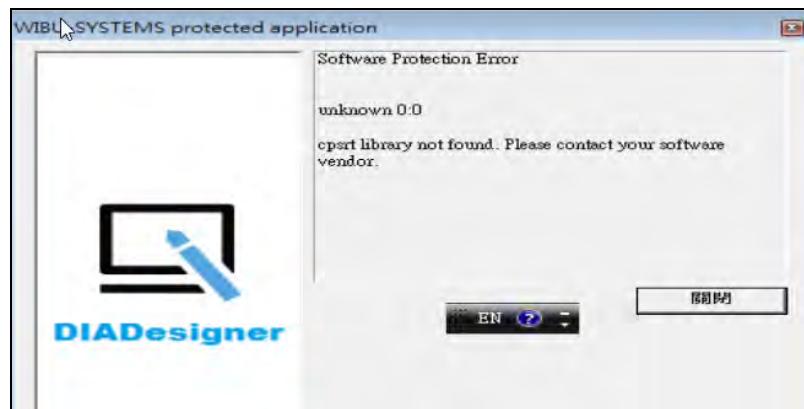
3.2 Installing DIADesigner

- System requirements

Project	System Requirement
Operating System	Windows 10 (32/64 bits)
CPU	Intel Core i5 M520 2.4 GHz or later
Memory	4 GB or more
Hard Disk Drive	15 GB or more
Monitor	Resolution: 1024 x 768 pixels or 1920 x 1080 pixels
Keyboard/Mouse	General Keyboard Mouse or Windows compatible device
PC interface	Ethernet, USB, Serial port (depends on product interface)
Software	Need to install .Net Framework 4.7.2

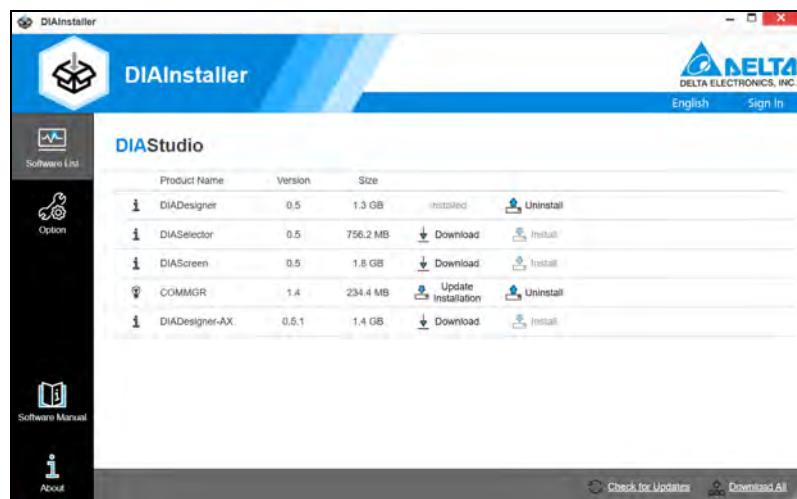
Before installation begins, make sure the computer used for installing DIADesigner meets the minimum system requirements listed above.

Note: DIADesigner V1.2.3 is NOT compatible with Windows 7 operating systems. If you are installing DIADesigner V1.2.3 on Windows 7, an error message will be shown as below.



The **DIAIInstaller** is a software installer which assists you to download and install **DIASTUDIO** software applications. You can download, install, and update products such as **DIASElector**, **DIADesigner**, **DIAScreen**, and **COMMGR**. Go to <https://diastudio.deltaww.com/> to download the **DIASTUDIO** for **DIAIInstaller**.

Refer to Software Download manual for detailed information.

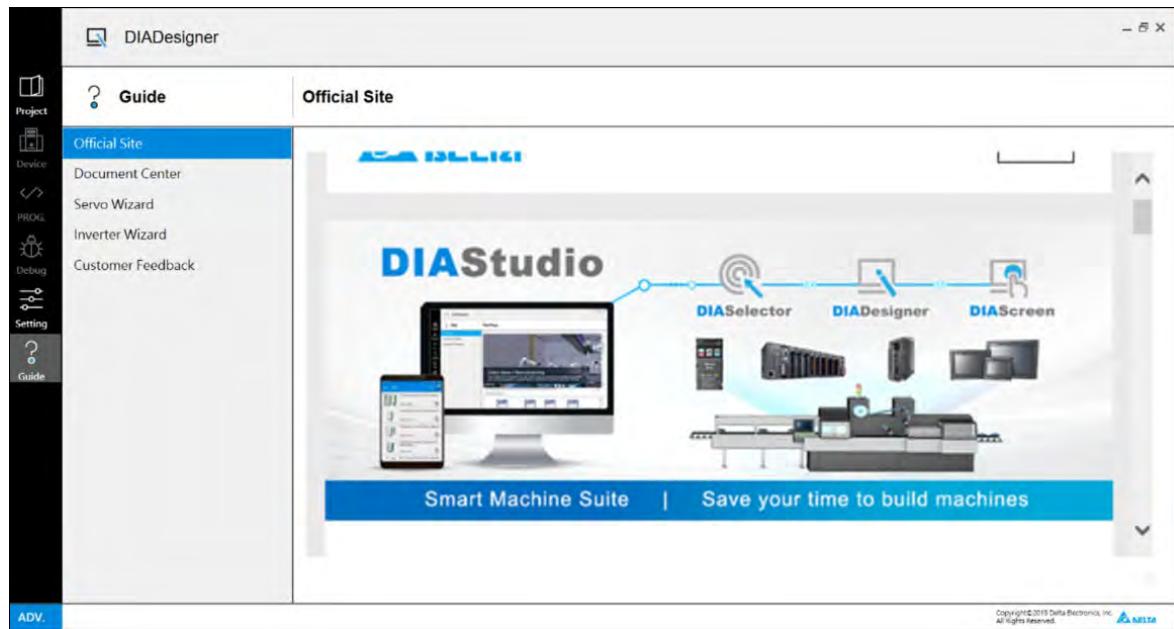


3

After installing DIADesigner, double-click its shortcut icon to launch DIADesigner.



DIADesigner displays the startup screen as shown in the following figure.

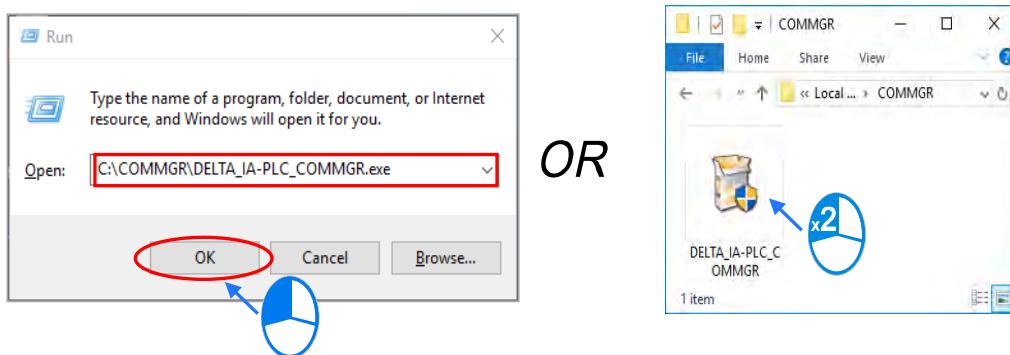


3.3 Installing and Uninstalling COMMGR

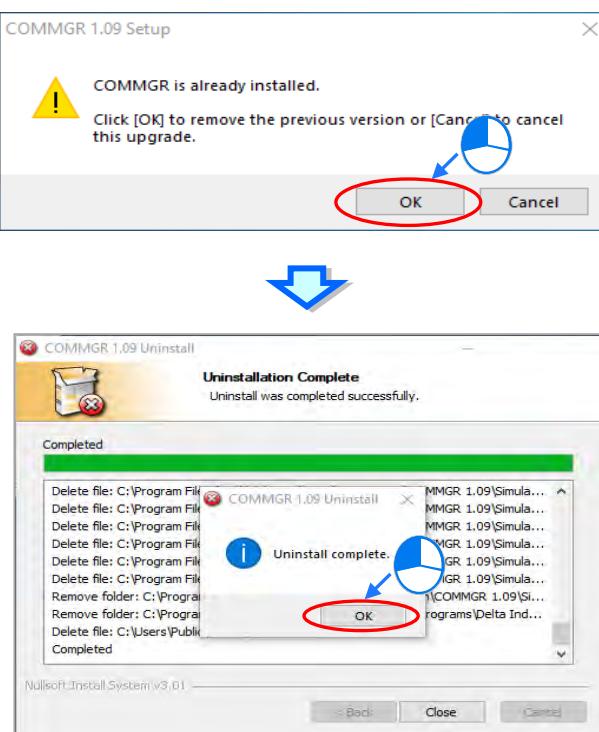
3.3.1 Installing COMMGR

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

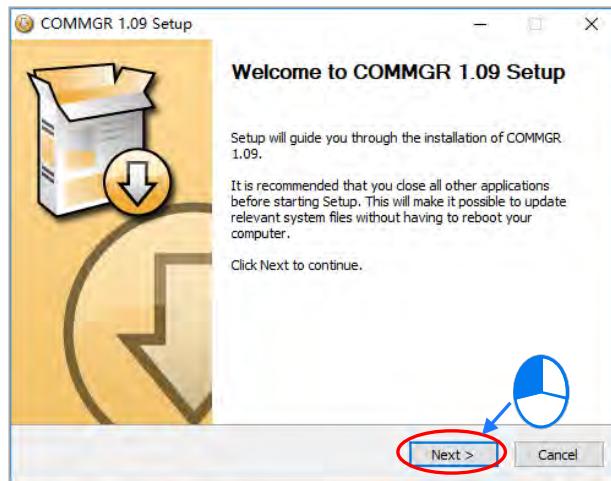
- (1) Start your computer and enter the operating system. You have to log in to the system as a system administrator before installing COMMGR.
- (2) Put a COMMGR CD in the CD-ROM drive, or download the installation program from the official Delta website <http://www.deltaww.com/>. (The installation programs 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.



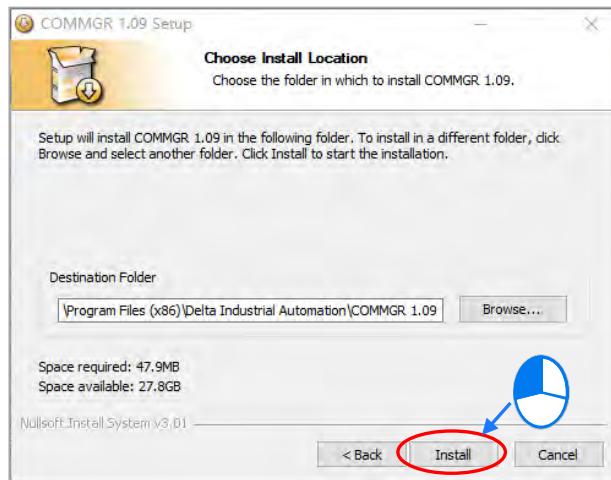
- (4) When the previous version of COMMGR is installed, click **OK** to remove that version shown in the pop-up window (see below) and when uninstall is complete, click **OK** again.



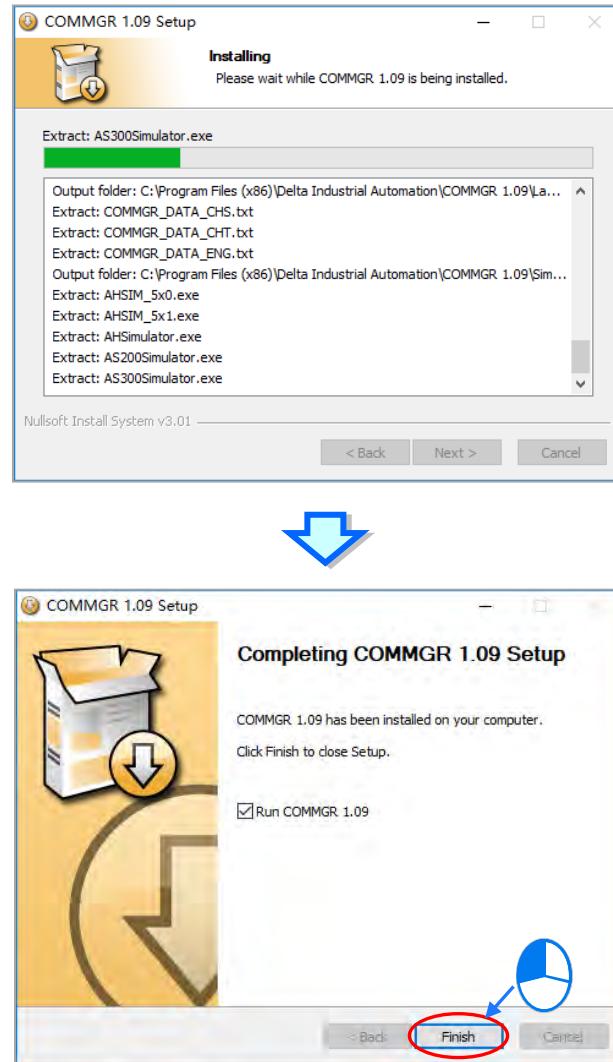
(5) Click **Next** after the Setup window appears.



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

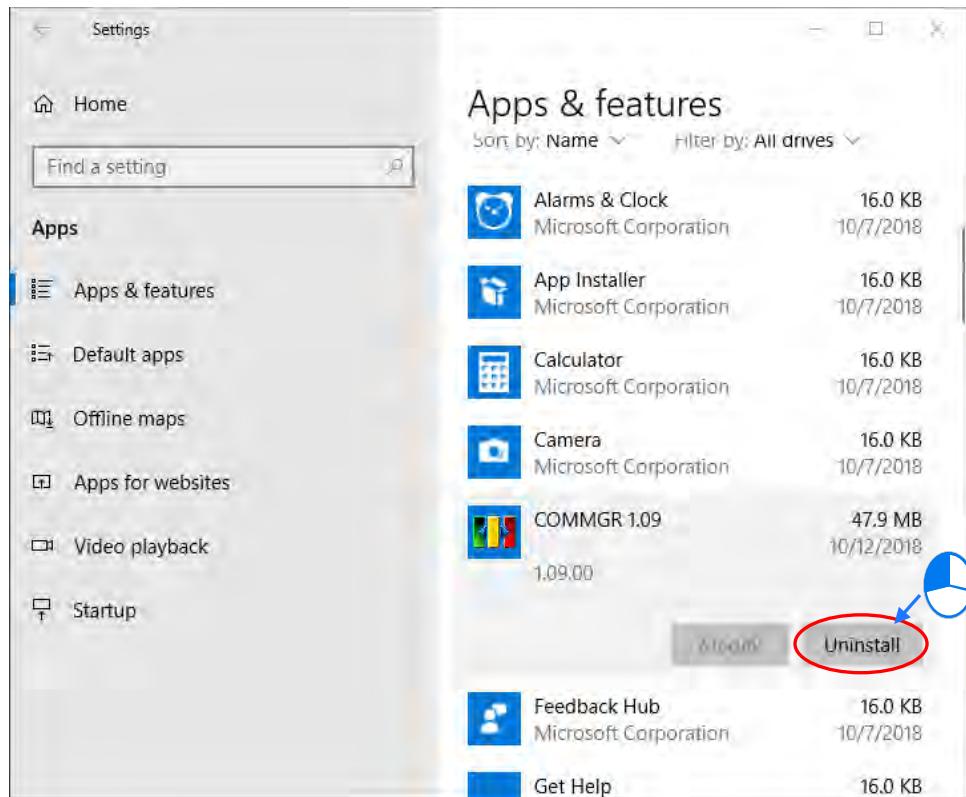


(7) When the installation is complete, the shortcut for COMMGR is created on the Start menu, click **Finish** to close the setup.

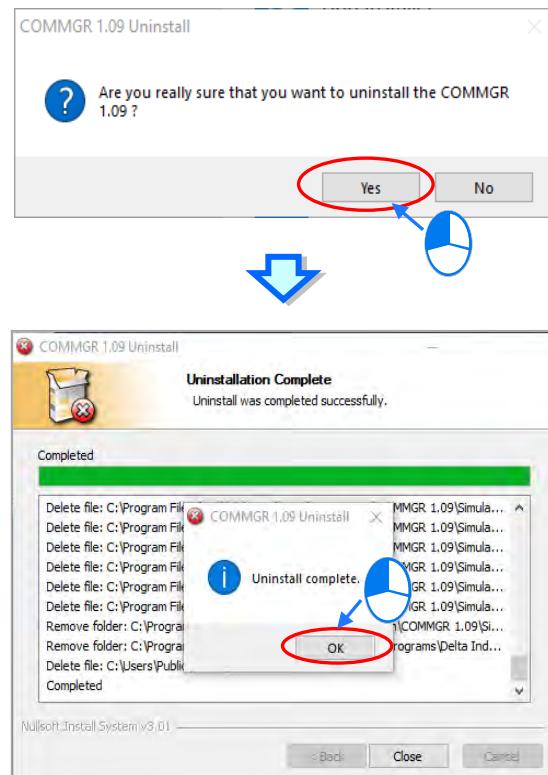


3.3.2 Uninstalling COMMGR

(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.



Chapter 4 Installing Hardware

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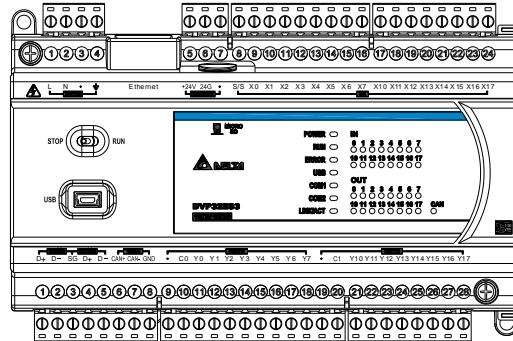
4.1 DVP-ES3/EX3 Series

4.1.1 DVP-ES3/EX3 Hardware Framework

The DVP-ES3/EX3 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 more advanced application requirements, the DVP-ES3/EX3 series programmable logic controllers provide more flexible system extension framework. Under such hardware framework, you do not need to use several CPU modules to control the system if there are excessive I/O points or the device is too far away. This new hardware framework maintains the integrity of the system and allows users to work more efficiently during the project development process.

One CPU module is the minimum requirement for DVP-ES3/EX3 hardware framework.

DVP-ES3/EX3 CPU module (the example below uses DVP-ES3 AC power supply model)



The following lists the limits for setting up a common framework of the DVP-ES3/EX3 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 have no more than 56 DO points.

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

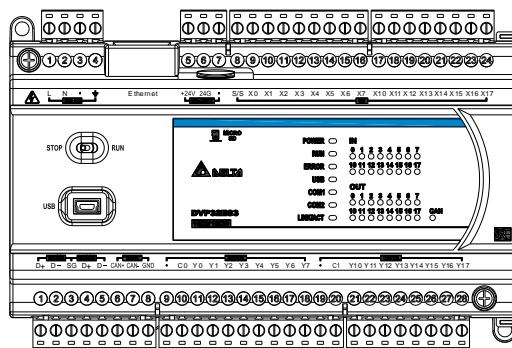
Limit 3: The maximum power consumption of CPU module and extension module should be within the range of what a CPU module or a power module can supply. Refer to section 4.1.5.4 for the maximum power consumption of modules.

4.1.1.1 Necessary Components

A functioning DVP-ES3/EX3 Series system consists of the following two necessary components.

- **CPU module (AC power)**

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 various business sectors with several types of CPU modules. 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 choose communication cables to use according to the actual usage situation.

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

Interface	Connector	Application
Communication port	5-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

4.1.1.2 Optional Components

- **Extension modules**

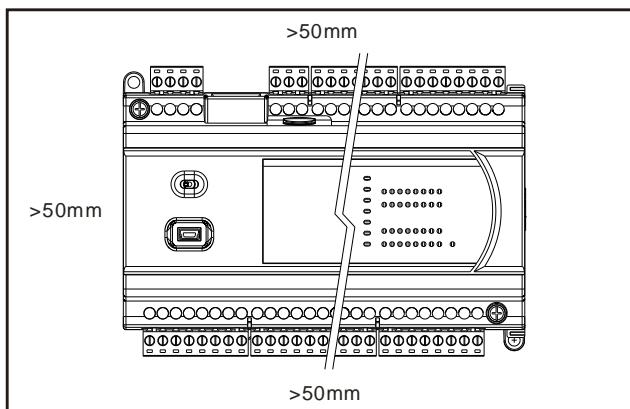
Apart from the standard communication ports on a CPU module, the CPU module is equipped with I/O functions. Refer to section 1.1.2 for a selection of extension modules. You can find a suitable extension module according to your needs.

4.1.2 Notes on Installation

- System integrators shall be responsible for assembly of the control system and the safety of the system integration.
- If using the device other than those described in the standard, or in environments that do not meet the specifications in this manual, the designed protection for the device in the presence of conducted and/or radiated interference may be reduced.
- DVP32ES311T: For power supplies, it is required to use safety extra-low voltage circuit (SELV) or a galvanic separation with double insulation (DI) or reinforced insulation (RI) between the primary and secondary side.
- Use only a clean, dry and soft cloth to clean this module.
- 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.

4.1.3 Installation

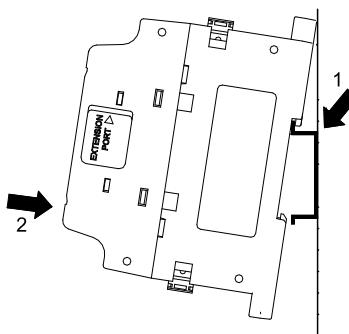
A PLC has to be installed in a closed control box. In order to ensure that the PLC radiates heat normally, the space between the PLC and the control box must be larger than 50 millimeters.



- 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.

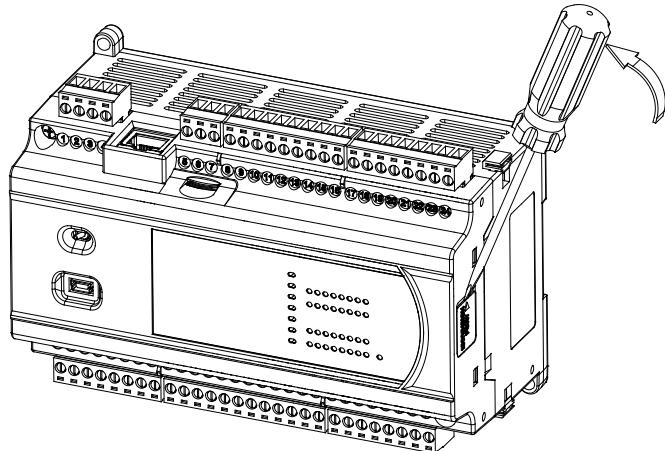
4.1.3.1 Mounting the Module

- Direct mounting: Use M4 screws to mount the module through the mounting hole.
- DIN rail installation and removal: The module can be secured onto a cabinet by using the DIN rail. To secure the module onto the DIN rail, link it onto the rail as the figure below shown (1) and gently push it up on the clip as the figure below shown (2) until you hear a click. To remove it, use a flat head screwdriver and press it gently on the groove of the retaining clip, pull down the retaining clip and gently pull the PLC away from the DIN rail.

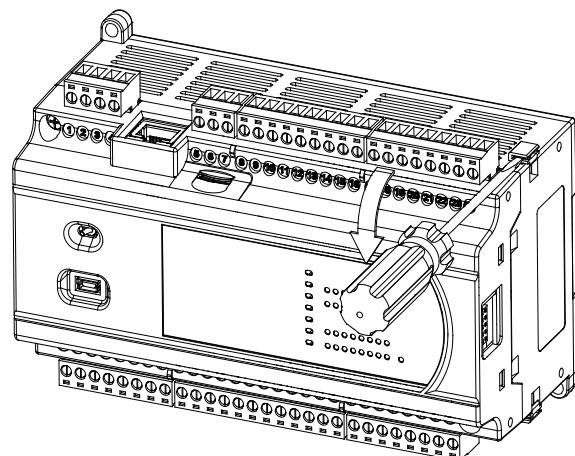


4.1.3.2 Linking the CPU Module and a Module

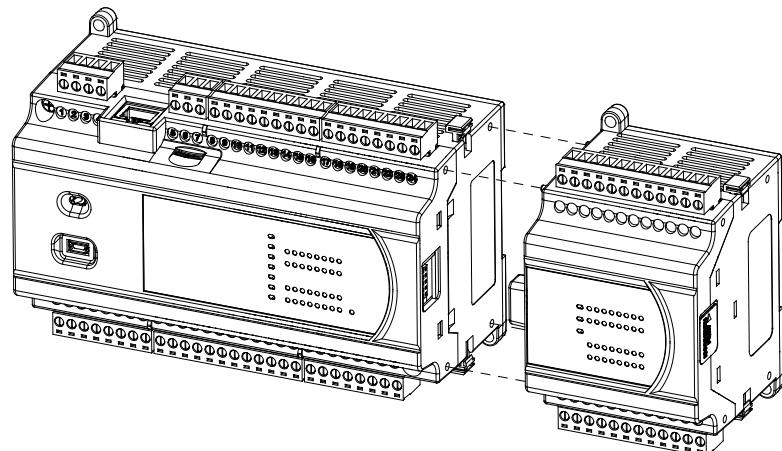
Step 1: Use a flat head screwdriver to open the side cover on the CPU module for linking a module.



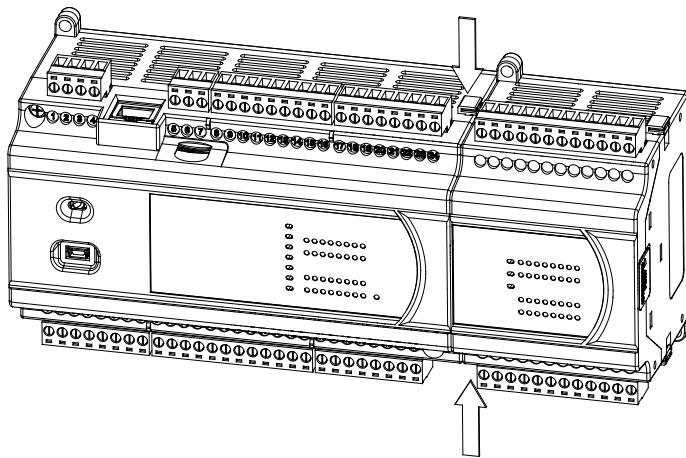
Step 2: Use a flat head screwdriver to release the I/O module securing clip.



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.

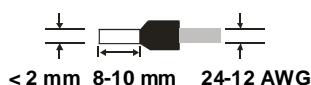


4.1.4 Wiring

	<ul style="list-style-type: none"> Before installing or wiring a module, you must verify that the external power supply is turned off. Otherwise, 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 the protective ground connection (PE)  and functional ground (FE)  are 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.
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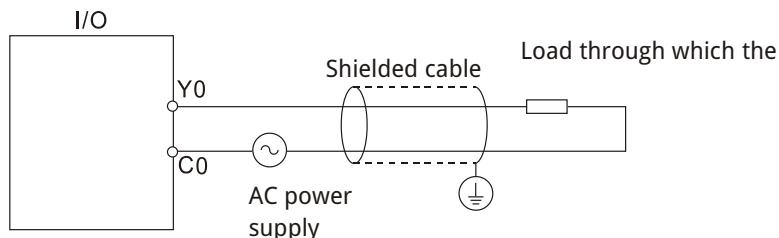
- Things to note while wiring an I/O module

- (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) For wiring, use single-wire cables or two-wire cables with a diameter of 24 AWG to 12 AWG and use it with a less than 2 mm needle type terminal (with the insulated coating crimp sleeve). Only use copper conducting wires with a temperature rating of 60/75°C. The tightening torque of the PLC terminal screw is 3.8 kgf-cm (3.3 lbf-in).



Note: The wire diameter specifications are different, since the output wiring of the relay model varies depending on the type of power supply provided. For details, refer to section 4.1.7.1.

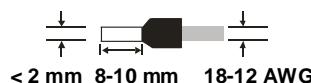
- (4) Keep the input cables, output cables, and power cable separate from one another.
- (5) If the main circuit and the power cable cannot be separated from each other, use a shielded cable, and ground it at the side of the I/O module. In some cases, the shielded cable can be grounded at the opposite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

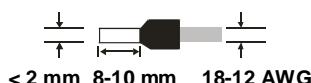
1. Use correct and independent method to grounding.
2. Use single-wire cables or two-wire cables in a diameter of 18 AWG to 12 AWG and with less than 2 mm pin-typed terminals.



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 18-12AWG 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.



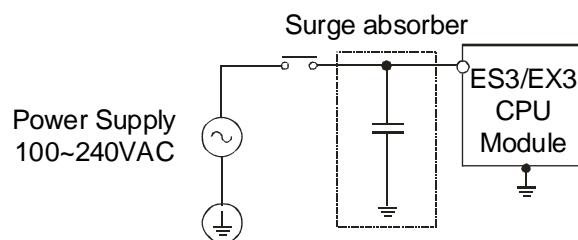
- (2) If cables are connected to the terminals \ominus/\pm , you must ground the cables. Do not connect \ominus/\pm to any devices. If \ominus/\pm are not grounded, the PLC will be susceptible to noise. Since \ominus/\pm carries electric potential, you will get an electric shock if you touch the metal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

4.1.5 Connecting Power Cables

4.1.5.1 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.

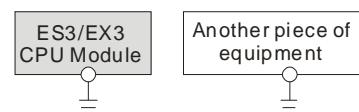


Things to note while grounding

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.

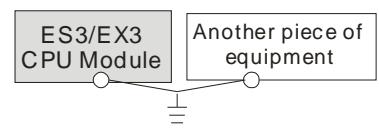
4.1.5.2 Grounding

- 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.



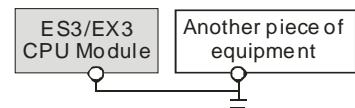
The single-point ground is better.

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



The common-point ground is permitted.

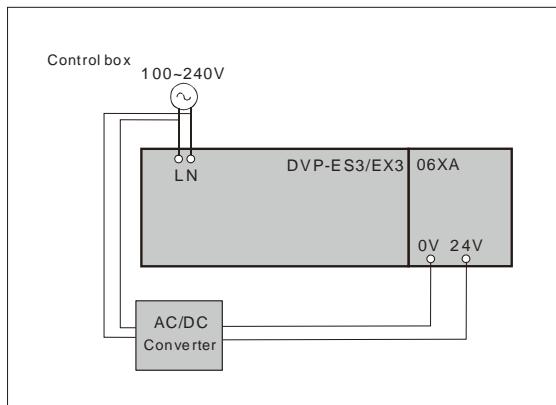
- Do not connect equipment ground wires together as shown on the right.



The equipment can not be grounded in this way.

4.1.5.3 Wiring Power Supply

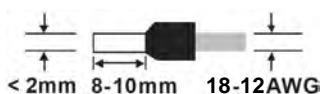
- **Connecting an AC power cable**



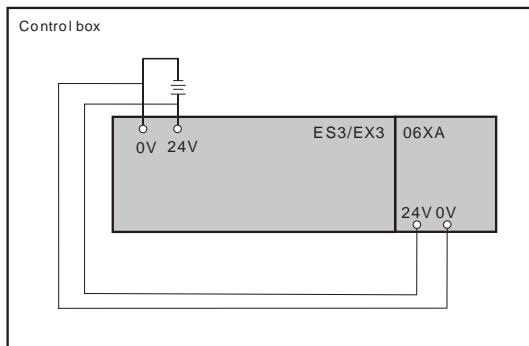
4

The power input of DVP-ES3/EX3 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 12 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.

4.1.5.4 Power Consumption

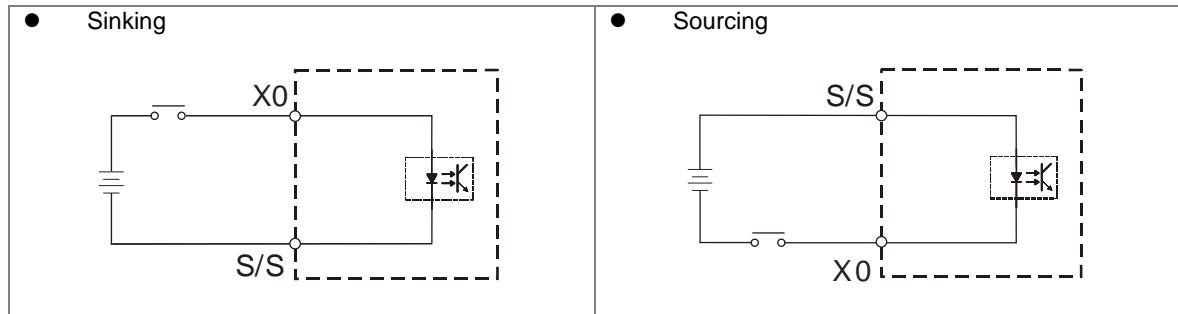
Classification	Model name	Internal power consumption (mA)	Internal power consumption (W)	External power consumption (W)
CPU module	DVP32ES311T	100	2.4	0.48
	DVP32ES300T	100	2.4	0.48
	DVP32ES300R	180	4.32	-
	DVP48ES300T	100	2.4	0.72
	DVP48ES300R	220	5.28	-
	DVP64ES300T	110	2.64	0.96
	DVP64ES300R	260	6.24	-
	DVP80ES300T	110	2.64	1.2
	DVP80ES300R	300	7.2	-
	DVP32ES300TEC	130	3.12	0.48
	DVP22EX300T			
	DVP22EX300R			
	DVP28EX300MT	150	3.6	0.48
	DVP36EX300T	150	3.6	0.72
	DVP36EX300R	210	5.04	0.72
Digital /O module	DVP08XM211N	10	0.24	-
	DVP08XP211R	30	0.72	-
	DVP08XP211T	12	0.29	0.12
	DVP08XN211R	55	1.32	-
	DVP08XN211T	12	0.29	0.24
	DVP16XM211N	14	0.34	-
	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	-
	DVP24XP200T	14	0.34	0.36
	DVP24XN200R	14	0.34	-
	DVP24XN200T	18	0.43	0.72
	DVP32XP200R	14	0.34	-

Classification	Model name	Internal power consumption (mA)	Internal power consumption (W)	External power consumption (W)
Analog I/O module	DVP32XP200T	16	0.38	0.72
	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
Positioning module	DVP02PU-E2	60	1.44	-

4.1.6 Wiring Digital Input Terminals on CPU Modules

4.1.6.1 Direct Current Power Supply (24 VDC)

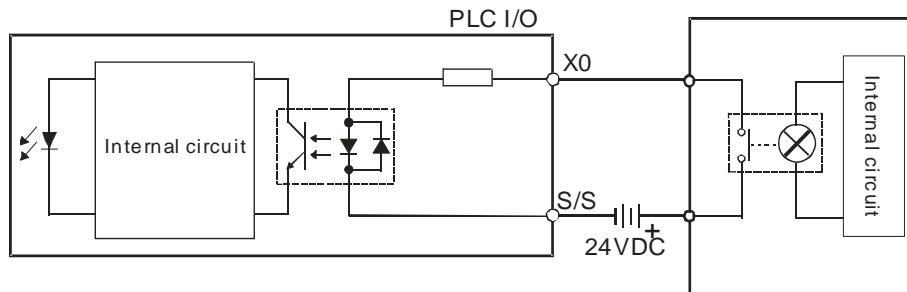
When the digital input signal is DC input, there are two DC input types, Sinking and Sourcing. See the definition below.



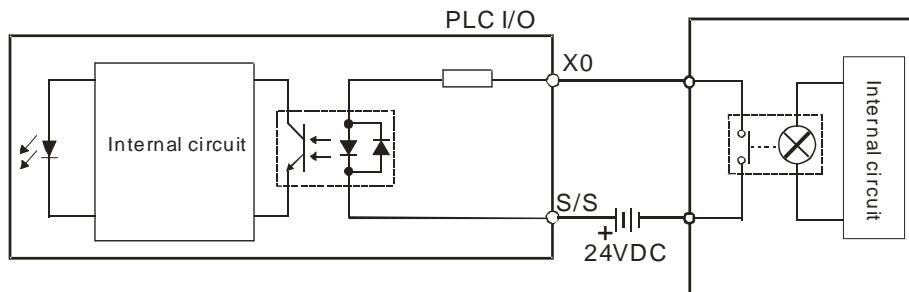
4

4.1.6.2 Relay Types

- Sinking**

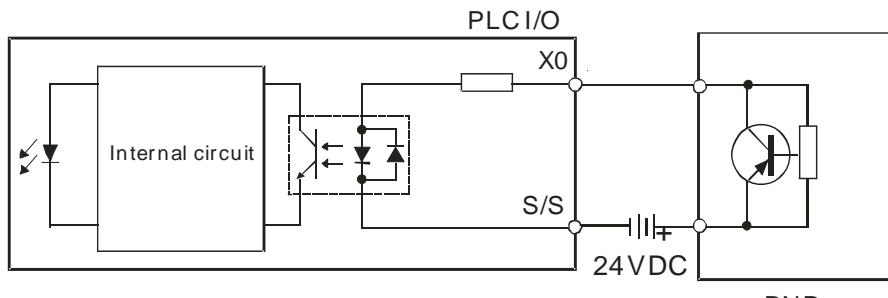


- Sourcing**

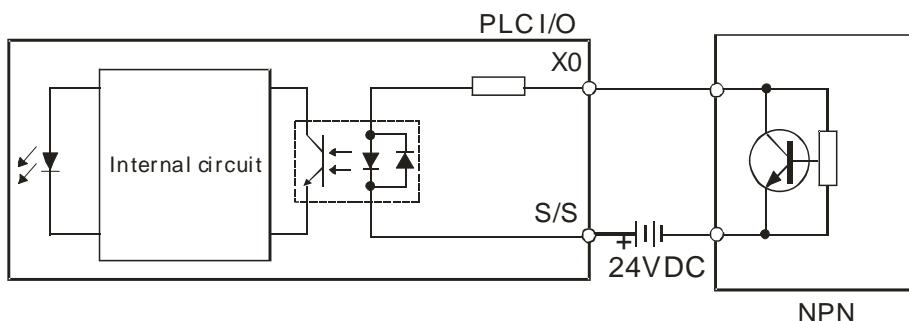


4.1.6.3 Two-Wire Open-Collector Input Types

- **Sinking**

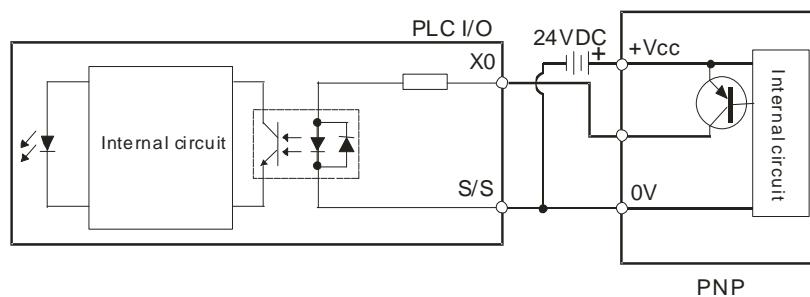


- **Sourcing**

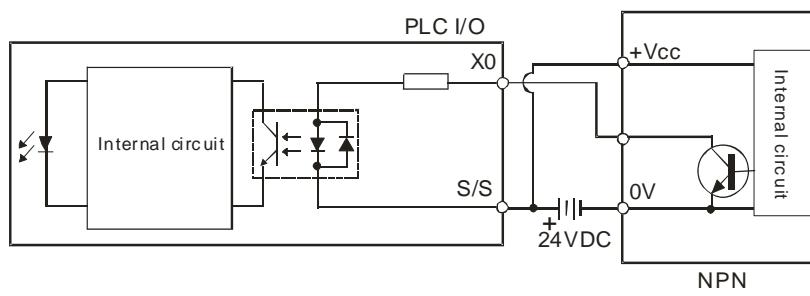


4.1.6.4 Three-Wire Open-Collector Input Types

- **Sinking**



- **Sourcing**

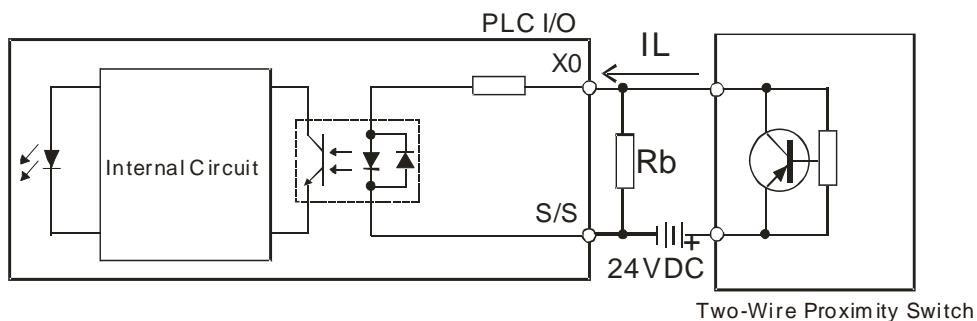


4.1.6.5 Two-Wire Proximity Switch

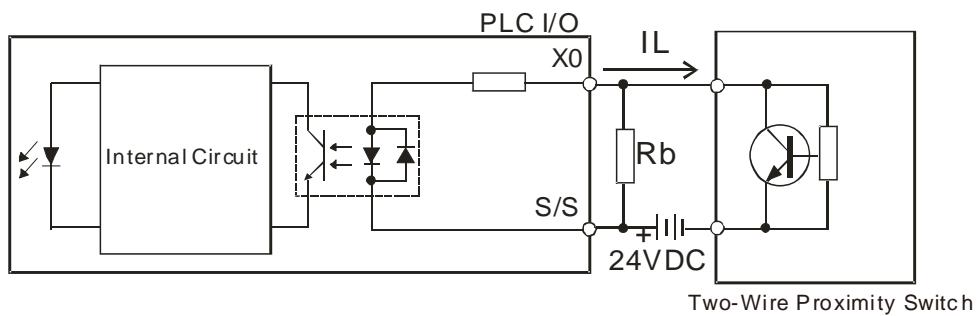
Use the two-wire proximity switch whose leakage current IL is less than 1 mA when the switch is OFF. If the leakage current is larger than 1 mA, connect the divider resistance Rb using the formula below. (A wattage of at least 1 W is recommended.)

$$Rb \leq \frac{6}{IL-1} \text{ (k}\Omega\text{)}$$

- **Sinking**

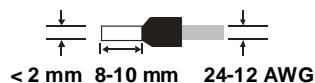


- **Sourcing**



4.1.7 Wiring Digital Output Terminals on CPU Modules

Use single-wire cables or two-wire cables in a diameter of 24 AWG to 12 AWG and with less than 2 mm pin-typed terminals. Only use copper conducting wires with a temperature rating of 60/75°C. The tightening torque of the PLC terminal screw is 3.8 kgf-cm (3.3 lbf-in).

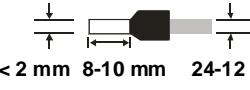
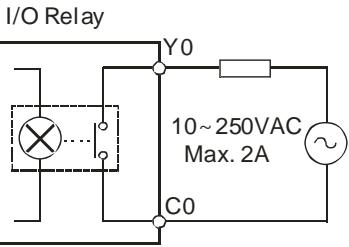
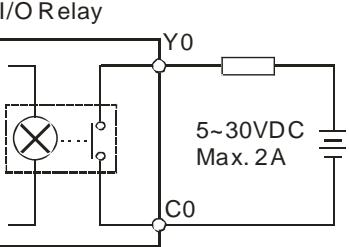


4.1.7.1 Output Circuits

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

1. Relay output

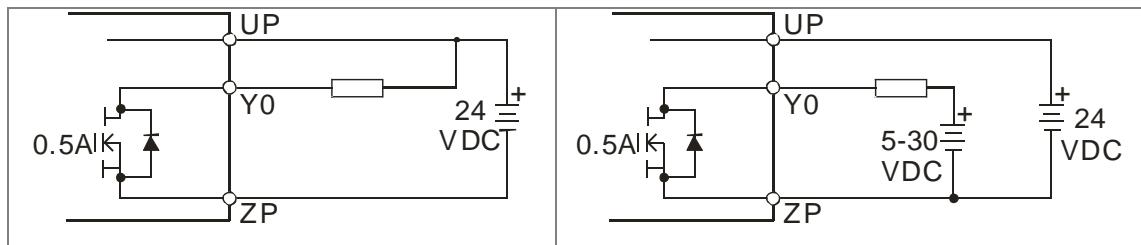
The wire diameter specifications are different, since the output wiring of the relay model varies depending on the type of power supply provided. Only use copper conducting wires with a temperature rating of 60/75°C. And the tightening torque of the PLC terminal screw is 3.8 kgf-cm (3.3 lbf-in).

	AC Power	DC Power
Specification	 < 2 mm 8-10 mm 18-16 AWG	 < 2 mm 8-10 mm 24-12 AWG
Wiring	<p>I/O Relay</p>  <p>10~250VAC Max. 2A</p>	<p>I/O Relay</p>  <p>5~30VDC Max. 2A</p>

Note: Use the same voltage (10-250 VAC or 5-30 VDC) for the output terminals of the relays in the same common point COM (those with the same color in the figure below).

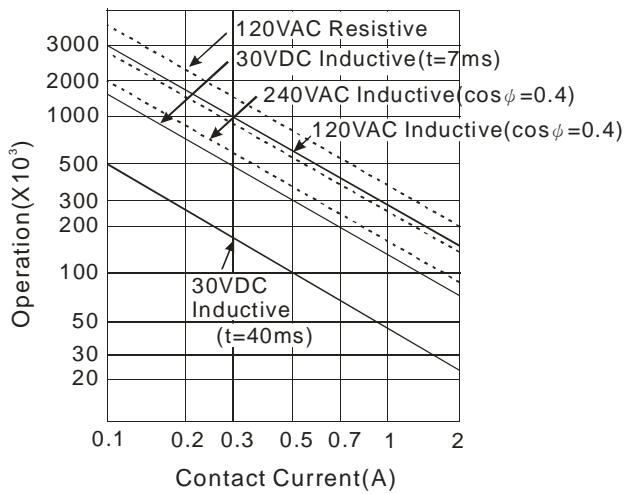


2. Transistor output

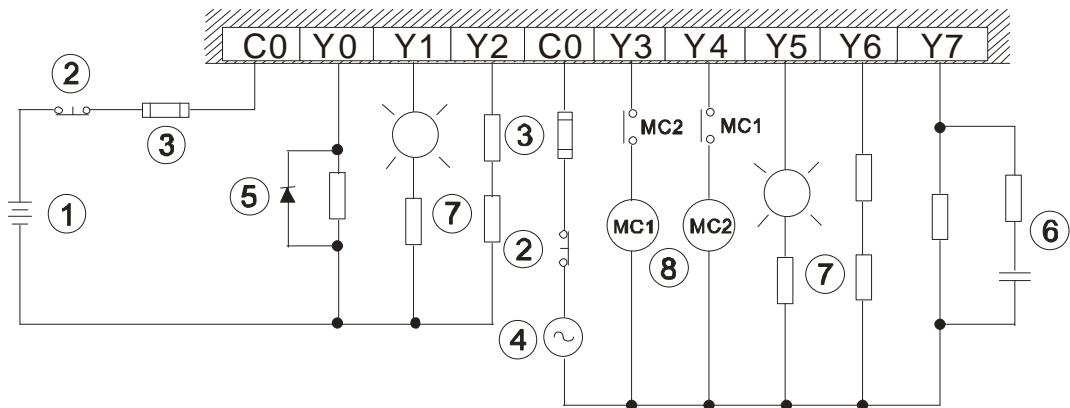


4.1.7.2 Relay Output Circuit

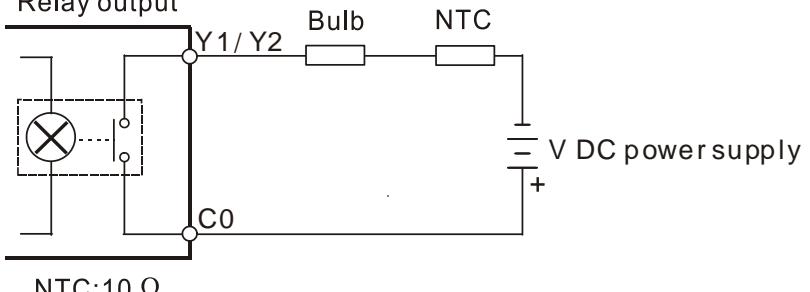
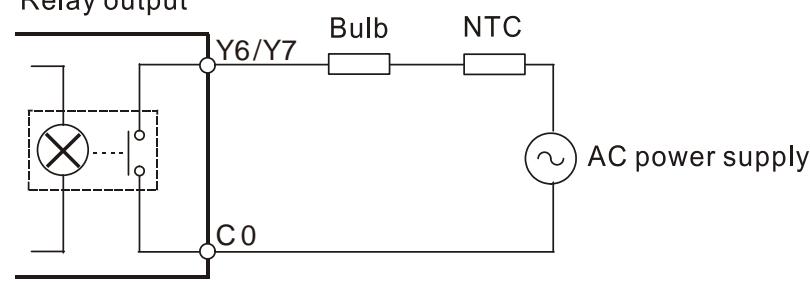
Relay terminals have no polarity. They can be used with alternating current that passes through a load, or with direct current that passes through a load. The maximum current that can pass through every relay terminal is 2 A, and refer to each product specification for the maximum current that can pass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



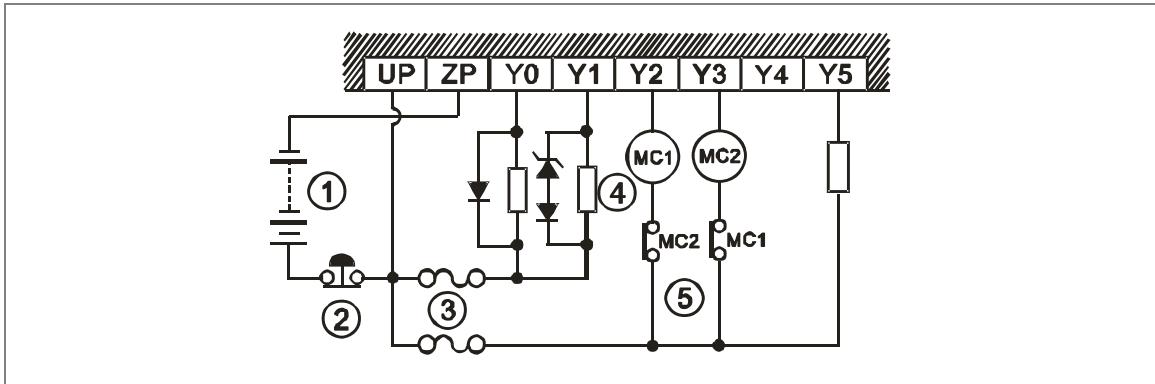
- Relay output circuit



①	Direct-current power supply
②	Emergency: stop using an external switch.
③	Fuse: to protect the output circuit, a fuse having a breaking capacity between 5 A to 10 A is connected to the common terminal.
④	Alternating-current power supply
⑤	<p>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.</p> <p>Relay output</p> <p>D: 1N4001 diode</p>
⑥	<p>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.</p> <p>Relay output</p> <p>R: 100~120 Ω C: 0.1~0.24 uF</p>

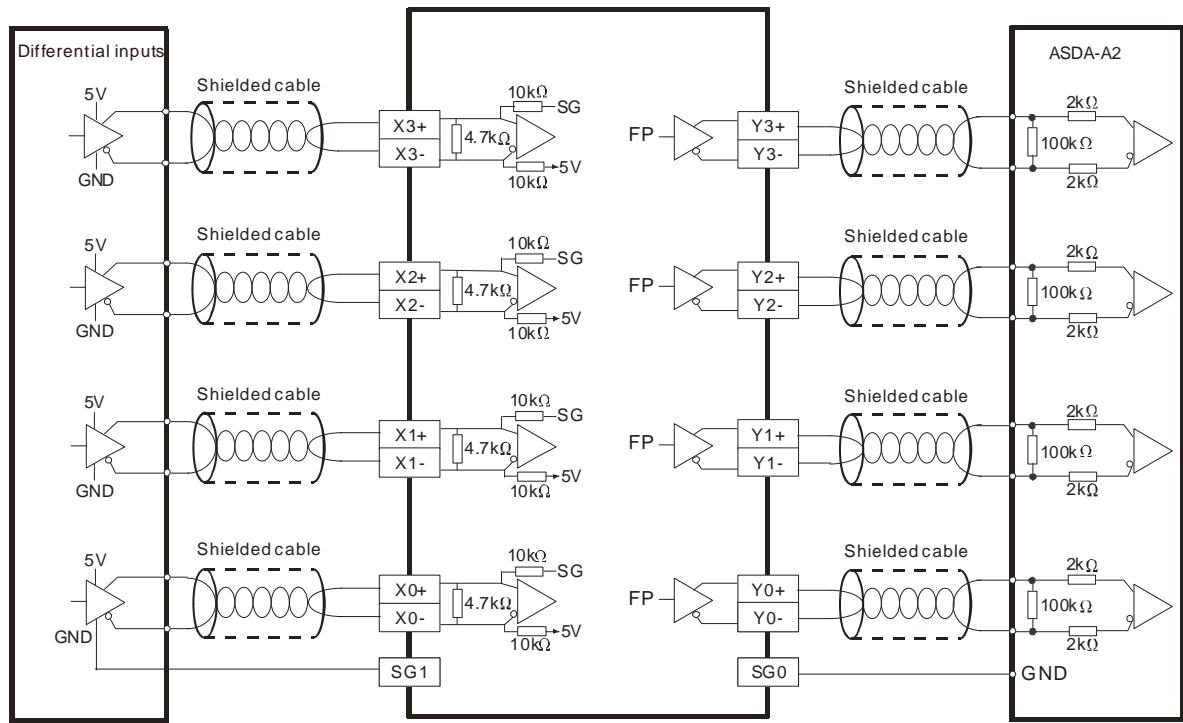
	<p>A bulb (incandescent lamp) is used as a DC load. A thermistor is connected in series to absorb the surge current that occurs when the load is ON.</p> <p>Relay output</p>  <p>NTC: 10 Ω</p>
⑦	<p>A bulb (neon lamp) is used as an AC load. A thermistor is connected in series to absorb the surge current that occurs when the load is ON.</p> <p>Relay output</p>  <p>NTC: 10 Ω</p>
⑧	<p>Mutually exclusive output: For example, Y3 controls the clockwise rotation of the motor, and Y4 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.</p>

4.1.7.3 Transistor Output Circuit (NPN)

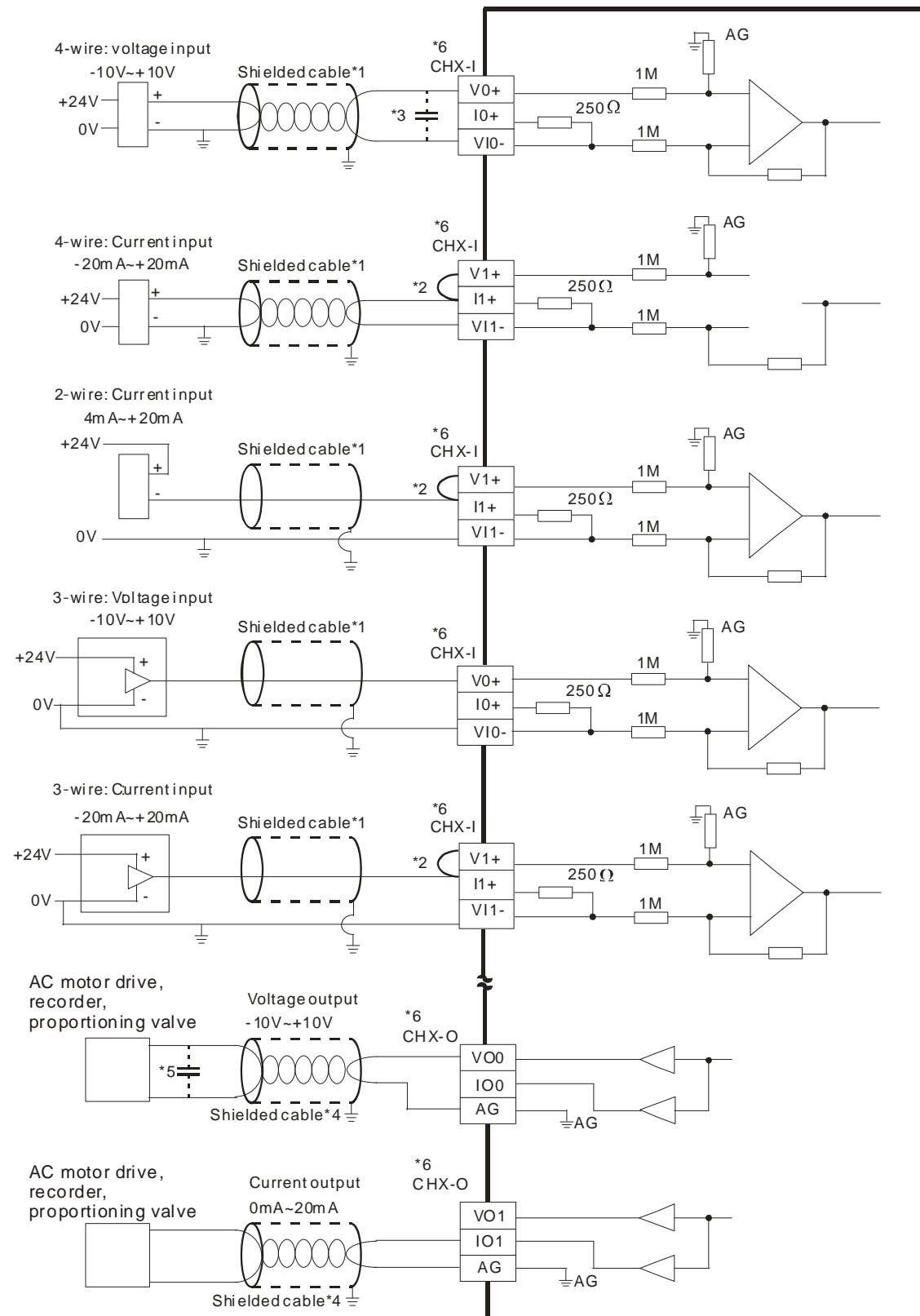


①	Direct-current power supply
②	Emergency stop
③	Fuse
④	<p>Using surge absorbing diodes to extend the lifespan of contacts</p> <p>1. A diode is connected in parallel to absorb the surge voltage: used in low-power situations.</p> <p>D: 1N4001 Diode or its equivalent</p>
⑤	<p>2. A diode and Zener are connected in parallel to absorb the surge voltage: used in high-power and power-on/off frequently situations.</p> <p>D: 1N4001 Diode or its equivalent ZD: 9V Zener, 5W</p>
⑥	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.

4.1.8 Wiring Differential Input/Output Module (28EX300MT)



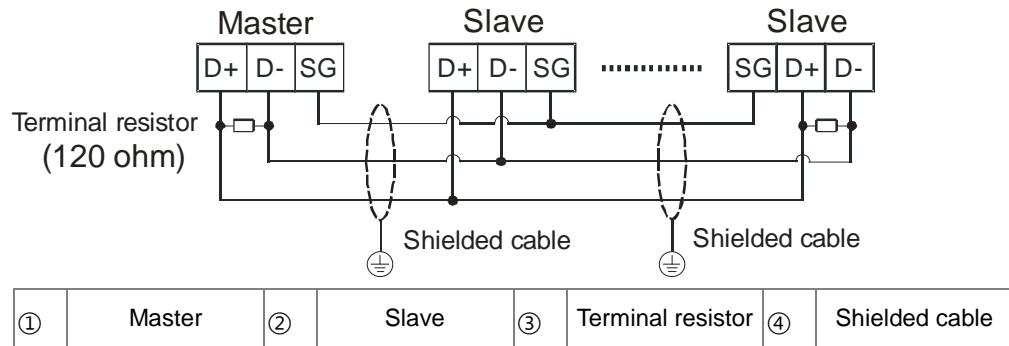
4.1.9 Wiring PLC CPU Analog Input /Output Module (EX3 Series)



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

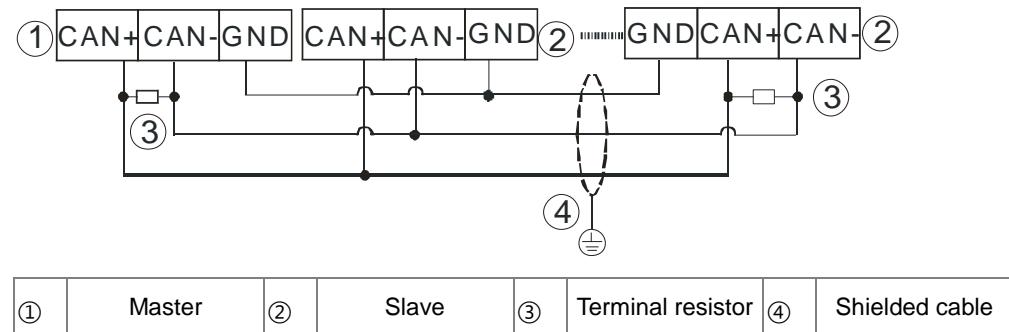
- *2. If the module is connected to a current signal, the terminals Vn and In+ (n=0–1) must be short-circuited.
- *3. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor having a capacitance between 0.1–0.47 μ F and a working voltage of 25 V.
- *4. Use shielded cables to isolate the analog output signal cable from other power cables.
- *5. If variability in the input loading results in interference within the wiring, connect the module to a capacitor having a capacitance between 0.1–0.47 μ F and a working voltage of 25 V.
- *6. The wording "CHX-I" indicates that you can use those five wiring methods for every input channel. The wording "CHX-O" indicates that you can use those two wiring methods for every output channel.
- *7. Use terminals with the same length (less than 200 m) and use terminal resistors of less than 100 ohm.

4.1.10 Wiring RS-485 Terminals



Note: Use two-wire shielded cables in a diameter of 20 AWG to ensure a quality communication.

4.1.11 Wiring CANopen Terminals

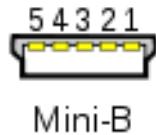


Note:

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

4.1.12 Recommended USB Wiring for the PLC CPU

Pin	Function
1	VBUS (4.4–5.25 V)
2	D–
3	D+
4	Ground
5	Ground

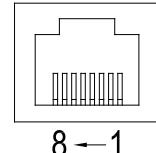


When it is the first time to use USB communication, follow the steps below.

- If it is the first time to use USB port to communicate, please refer to Appendix A: Installing a USB Driver.
- Time to use the USB port: uploading/downloading PLC programs, monitoring during calibration and upgrading firmware.
- NOT suggested to use the USB port: applications that require a long and un-interruptible communication.
- What to do when a communication failure occurs: unplug any communication connector from the USB port and then plug the connector back. After that, reconnect and try communication again.

4.1.13 Recommend Ethernet/EtherCAT Wiring for the PLC CPU

Pin	Signal	Description
1	TX+	Transmitting data (positive pole)
2	TX-	Transmitting data (negative pole)
3	RX+	Receiving data (positive pole)
4	--	N/C
5	--	N/C
6	RX-	Receiving data (negative pole)
7	--	N/C
8	--	N/C



Refer to Chapter 9 and 11 for more details on Ethernet/EtherCAT Wiring.

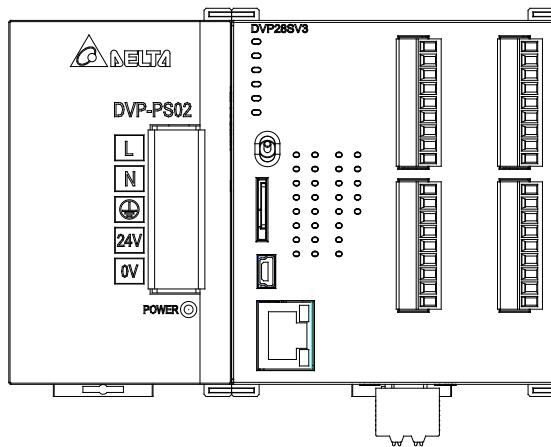
4.2 DVP-SV3/SX3 Series

4.2.1 DVP-SV3/SX3 Hardware Framework

The DVP-SV3/SX3 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 more advanced application requirements, the DVP-SV3/SX3 series programmable logic controllers provide more flexible system extension framework. Under such hardware framework, you do not need to use several CPU modules to control the system if there are excessive I/O points or the device is too far away. This new hardware framework maintains the integrity of the system and allows users to work more efficiently during the project development process.

The minimum framework of the DVP-SV3/SX3 series system consists of one CPU module (DVP-SV3/SX3 PLC CPU) and one power supply module (DVPPS01 /DVPPS02/DVPPS05). The power supply module converts AC into DC, providing PLC CPU with direct current power supply. A CPU module is the nucleus of a complete DVP Series system. It is responsible for controlling and managing the whole system. DVP Series PLC CPU provides various business sectors with several types of CPU modules. Select a CPU module according to your needs.

Example of a minimum framework: power supply module (on the left side of the PLC CPU) and DVP-SV3/SX3 CPU module (the example below uses DVP28SV3)



● Communication cable

Several communication interfaces are included in a CPU module, and many types of network modules are available. You can choose communication cables based on the actual usage situation.

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

Interface	Connector	Application
Communication port	10-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

● Extension modules

Apart from the standard communication ports on a CPU module, the CPU module is equipped with I/O functions. Refer to section 1.1.3 for a selection of extension modules. You can find a suitable extension module according to your needs.

The following lists the limits for setting up a common framework of the DVP-SV3/SX3 PLC system. Exceeding the first three limits causes the PLC to send an error message.

Limit 1: The maximum number of digital I/O points is 512 (256 inputs and 256 outputs). The built-in digital I/O points of the CPU module are included. (If DI points are 262, and DO points are 60, that means the DI points exceed the limit range.)

Limit 2: On the right side of the PLC CPU, you can connect up to 8 modules including analog I/O modules, temperature measurement modules, positioning modules, communication modules.

Limit 3: On the left side of the PLC CPU, you can connect up to 8 modules including high-speed analog I/O modules, high-speed load cell modules, high-speed communication modules.

Limit 4: 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 4.2.5.4 for the maximum power consumption of modules.

Limit 5: Up to 14 right-side extension modules can be connected to a DVP slim type PLC CPU. The input point starts from X20 and output point starts from Y20. Refer to the combination example below.

PLC	Model	Number of inputs	Number of outputs	Input number	Output number
MPU	SX3	8	6	X0–X7	Y0–Y5
EXT1	16SP11T	8	8	X20–X27	Y20–Y27
EXT2	08SM11N	8	0	X30–X37	-
EXT3	06SN11R	0	6	-	Y30–Y35
EXT4	08SP11R	4	4	X40–X43	Y40–Y43

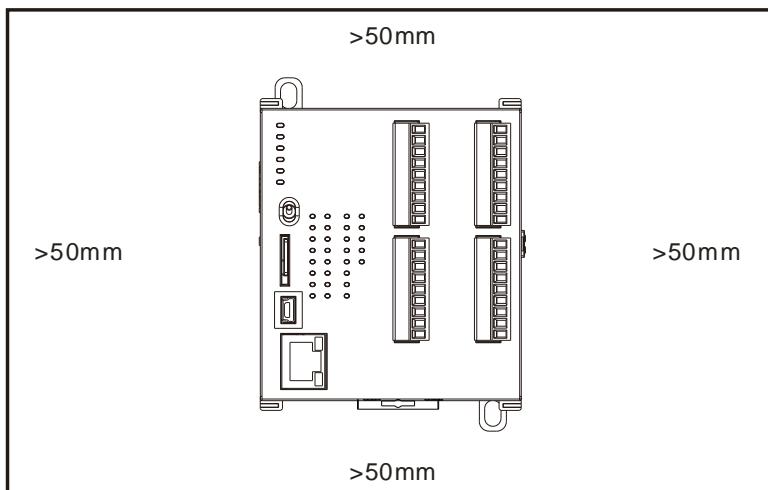
- Though the 3rd extension module 06SN11R will be regarded as a module with 8 output points, the number of corresponding actual output points will only be 6; the last 2 output points are excluded.
- Though the 4th extension module 08SP11R will be regarded as a module with 8 input points and 8 output points, the number of corresponding actual output points will only be 4 and input points will only be 4; the last 4 input and 4 output points are excluded.
- To have a more orderly arrangement, it is recommended to install modules with true to number of points first.

4.2.2 Notes on Installation

- System integrators shall be responsible for assembly of the control system and the safety of the system integration.
- If using the device other than those described in the standard, or in environments that do not meet the specifications in this manual, the designed protection for the device in the presence of conducted and/or radiated interference may be reduced.
- Make sure to use certified power supplies with dual insulation and Safety Extra-Low Voltage (SELV) output and ensure that they comply with UL60950 or UL62368 or UL61010-1 and UL61010-2-201, either LPS (Limited Power Source) or LE (Limited Energy) requirements.
- Use only a clean, dry and soft cloth to clean this module.
- 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.

4.2.3 Installation

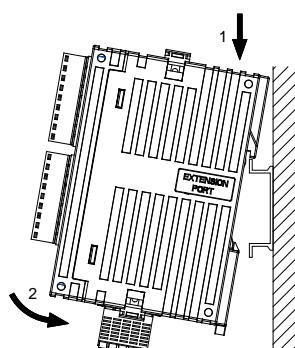
A PLC has to be installed in a closed control box. In order to ensure that the PLC radiates heat normally, the space between the PLC and the control box must be larger than 50 millimeters.



- 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.

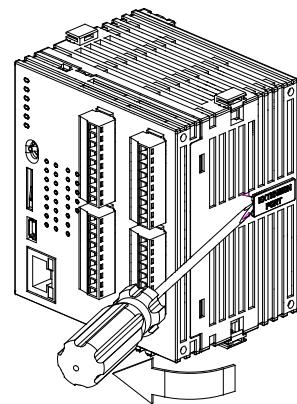
4.2.3.1 Mounting the Module

- Direct mounting: Use M4 screws to mount the module through the mounting hole.
- DIN rail installation and removal: The module can be secured onto a cabinet by using the DIN rail. To secure the module onto the DIN rail, link it onto the rail as the figure below shown (1) and gently push it up on the clip as the figure below shown (2) until you hear a click. To remove it, use a flat head screwdriver and press it gently on the groove of the retaining clip, pull down the retaining clip and gently pull the PLC away from the DIN rail.

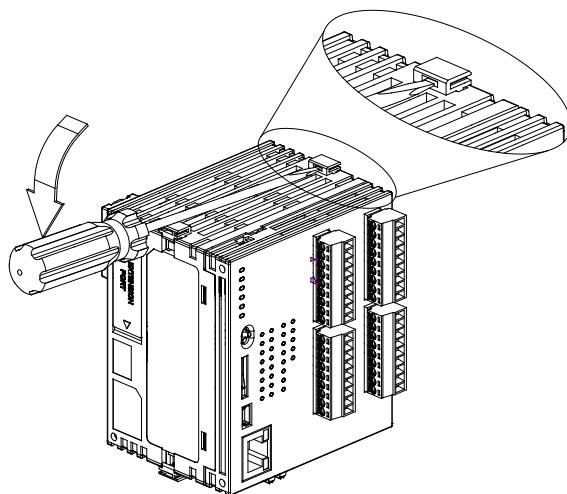


4.2.3.2 Linking the CPU Module and a Module

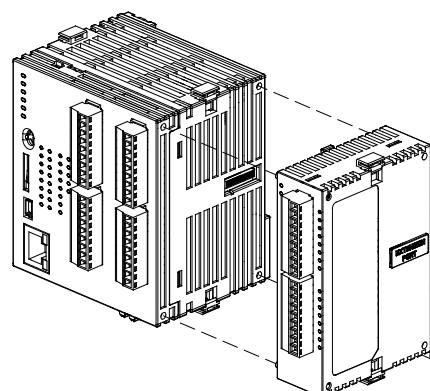
Step 1: Use a flat head screwdriver to open the side cover on the CPU module and you will see a connecting port.



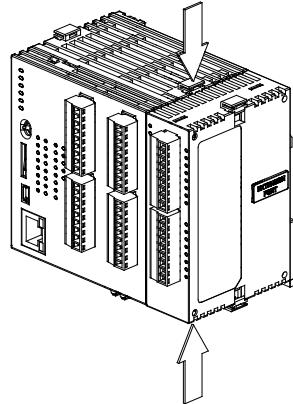
Step 2: Use a flat head screwdriver to release the I/O module securing clip.



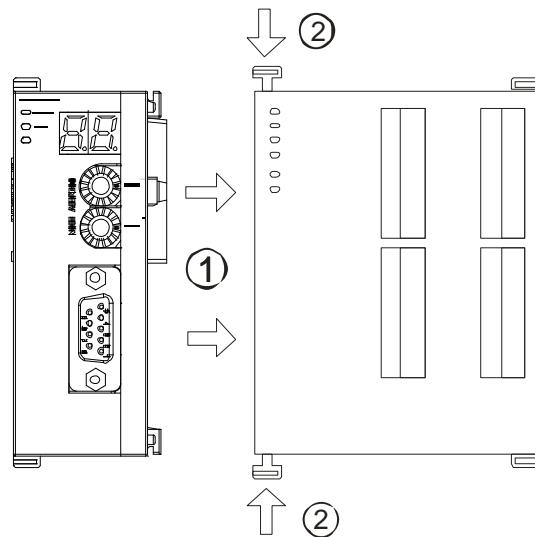
Step 3: Connect the CPU module and the module through the connecting port.



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



4 The following is a left-side extension module; you can connect it to the CPU module the same way as the right-side extension module does as the example shown above.



4.2.4 Wiring

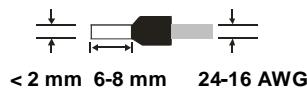


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	<ul style="list-style-type: none"> Before installing or wiring a module, you must verify that the external power supply is turned off. Otherwise, you may get an electric shock, or the product may be damaged. After you complete installing or wiring 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 the protective ground connection (PE)  and functional ground (FE)  are 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.
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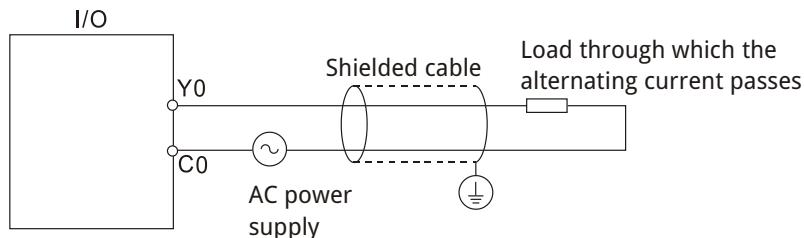
- Things to note while wiring an I/O module

- (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) For wiring, use single-wire cables or two-wire cables with a diameter of 24 AWG to 16 AWG and use it with a less than 2 mm needle type terminal (with the insulated coating crimp sleeve). Only use copper conducting wires with a temperature rating of 60/75°C. The tightening torque of the PLC terminal screw is 2.0 kgf-cm (1.77 lbf-in).



Note: The wire diameter specifications are different, since the output wiring of the relay model varies depending on the type of power supply provided. Refer to sections 4.2.7.1 and 4.2.9.1 for more details.

- (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.



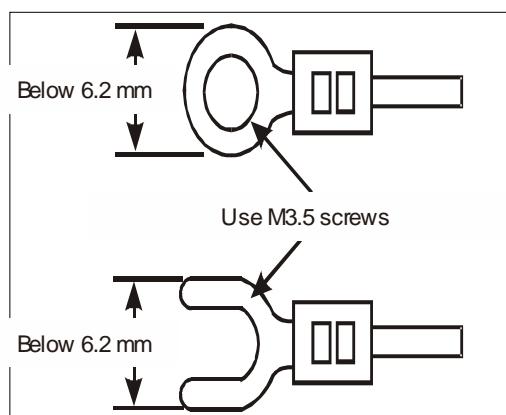
- (6) If you wire a module through conduit, you must ground the conduit correctly.
- (7) Keep 24 VDC input cables separate from 110 VAC input cables and 220 VDC input cables.
- (8) If the wiring length is more than 200 meters (686.67 inches), leakage current can result from parasitic capacitance, and the system will not function properly.

Note: If cables are connected to the terminals \oplus/\ominus , you must ground the cables. Do not connect \oplus/\ominus to any devices. If \oplus/\ominus are not grounded, the PLC will be susceptible to noise. Since \oplus/\ominus carries electric potential, you will get an electric shock if you touch the metal parts.

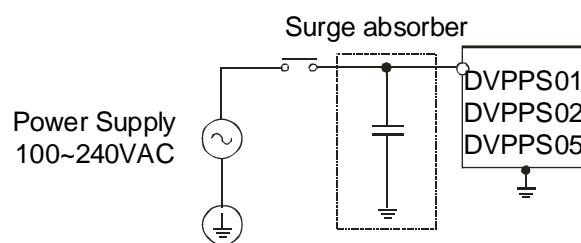
4.2.5 Connecting Power Cables

4.2.5.1 Precautions

1. Connect the power supply to the 24 VDC and 0 V terminals. The power supply ranges from 20.4 to 28.8 VDC. When the power supply voltage drops below 20.4VDC, the PLC will stop operating, all outputs will turn off, and the ERROR LED will flash rapidly.
2. If the power-off time is less than 10 ms, the PLC operates unaffected. If the power-off time is longer than 10 ms, the PLC will stop operating and all the outputs will be off. When the power resumes, the PLC resumes to operate. (There are auxiliary relays and registers with power-off retention in the PLC. You need to pay attention to their use when planning a program.)
3. Use O-type or Y-type terminals for I/O wiring terminals. The specification for the terminals is as shown on the left. Tighten PLC terminal screws to a torque of 5 to 8kg-cm (4.3 to 6.9 in-lbs).



4. Avoid tiny metal material enter DVPPS01/02/05 when screwing and wiring. After finishing wire, remove the affix that pasted on the heat sink for heat dissipation.
5. Only use copper conducting wires with a temperature rating of 60/75°C.
6. To prevent electrical surge from lightning, install a surge protector as shown below.



■ Environment

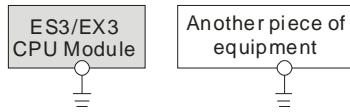
1. DO NOT install the DVPPS01/02/05 in environments with heavy dust, oil fumes, metallic dust, or corrosive or flammable gases.
2. DO NOT install the DVPPS01/02/05 in environments with high temperature or high humidity.
3. DO NOT install the DVPS01/02/05 in areas with direct vibration and impact.

4.2.5.2 Grounding

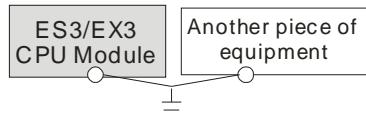
- The ground wire diameter should not be less than the diameters of the cables connected to the terminals L and N.
- If using multiple pieces of equipment, use a single-point ground.
- Use wire with a diameter of 1.6 mm or larger for grounding.

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

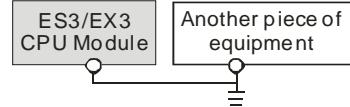
- Do not connect equipment ground wires together as shown on the right.



The single-point ground is better.

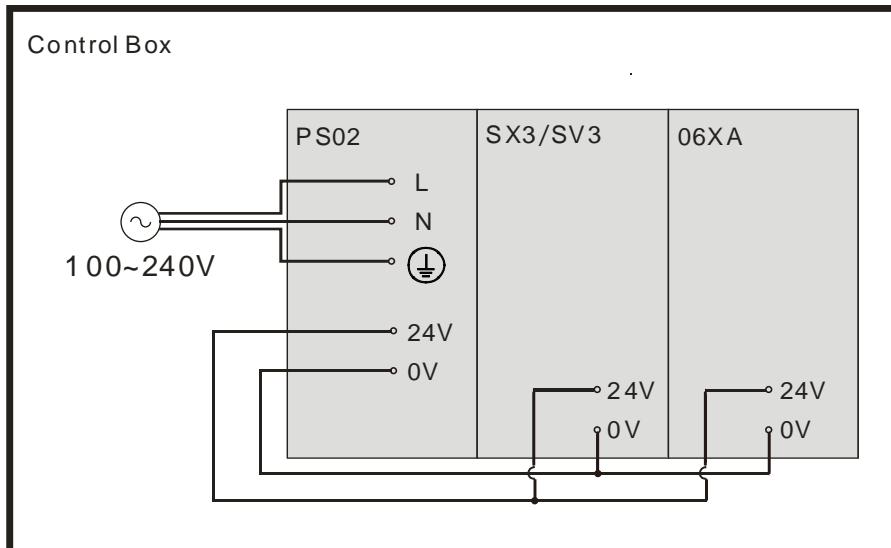


The common-point ground is permitted.



The equipment can not be grounded in this way.

4.2.5.3 Wiring Power Supply



4.2.5.4 Power Consumption

Classification	Model name	Internal power consumption (mA)	Internal power consumption (W)	External power consumption (W)
CPU module	DVP28SV311T	166.67	4	4
	DVP28SV311R	187.5	4.5	4
	DVP28SV311S	166.67	4	4
	DVP20SX311T	208.3	5	4
	DVP20SX311R	229.2	5.5	4
	DVP20SX311S	208.3	5	4
Digital I/O module	DVP06SN11R	82	1.5	36
	DVP08SN11R	55	1.5	5
	DVP08SN11T	55	1.5	1.2
	DVP16SN11T	65	1	1.2
	DVP08SP11R	35	1.5	5
	DVP08SP11T	35	1.5	1.2
	DVP08SM11N	15	1	0.05
	DVP08SM10N	40	1	0.08
	DVP08SN11TS	15	1.5	2
	DVP08ST11N	55	0.5	0
	DVP16SP11R	65	2	5
	DVP08SP11TS	15	1.5	1.25
	DVP16SP11T	65	2	1.2
	DVP16SP11TS	30	2	2
	DVP16SN11TS	30	1	2
	DVP16SM11N	25	2	0.1
	DVP32SN11TN	40	1.5	2
	DVP32SM11N	40	1	0.16
Analog I/O module	DVP04AD-S2	30	2	0.083
	DVP04DA-S2	30	4	0.167
	DVP06XA-S2	30	2	0.083
	DVP02DA-S	30	3	0.125
	DVP06AD-S	30	2	0.083
Left-side high-speed analog I/O module	DVP04AD-SL	40	3.5	0.015
	DVP04DA-SL	40	3.5	0.08
Left-side high-speed load cell module	DVP201LC-SL	100	5	-
	DVP211LC-SL	150	5	4.03
	DVP202LC-SL	140	5	-
	DVP02LC-SL	40	3	0.125
	DVP01LC-SL	40	3	0.125
Temperature measurement module	DVP04PT-S	30	2	0.083
	DVP06PT-S	83	2	-
	DVP04TC-S	30	2	0.083
	DVP08NTC-S	30	1	-
	DVP02TUN-S	55	2.4	0.6
	DVP02TUR-S	60	2.4	0.6
	DVP02TUL-S	75	2.4	0.04
	DVP02TKN-S	55	2.4	-
	DVP02TKR-S	60	2.4	-
	DVP02TKL-S	75	2.4	-

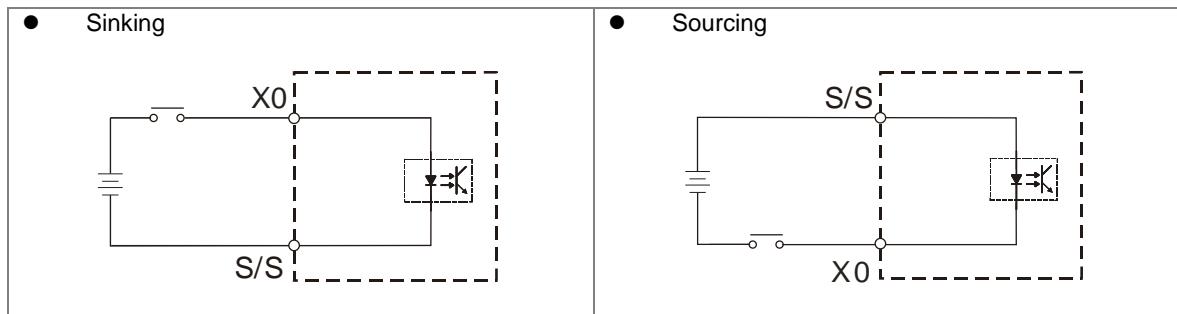
Classification	Model name	Internal power consumption (mA)	Internal power consumption (W)	External power consumption (W)
Positioning module	DVP01PU-S	100	2.52	0.105
Left-side positioning module	DVP02PU-SL	45	1.08	-
Left-side high speed communication module	DVPEN01-SL	62.5	1.5	-
	DVPEN02-SL	54	1.3	-
	DVPPN02-SL	54	1.3	-
	DVPDNET-SL	50	1.2	0.026
	DVPCOPM-SL	50	1.2	-
	DVPPF02-SL	60	1.5	-
	DVPSCM12-SL	62.5	1.5	-
	DVPSCM52-SL	62.5	1.5	-
Remote I/O communication module	RTU-485	62.5	1.5	-
	RTU-CN01	104.2	2.5	-
	RTU-ECAT	75	1.8	-
	RTU-EN01	41.7	1	-

4.2.6 Wiring Digital Input Terminals on DVP-SV3 Series

4.2.6.1 Direct Current Power Supply (24 VDC)

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

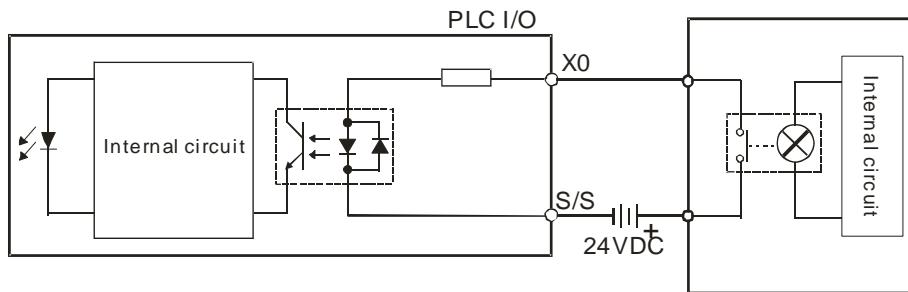
See the definition below.



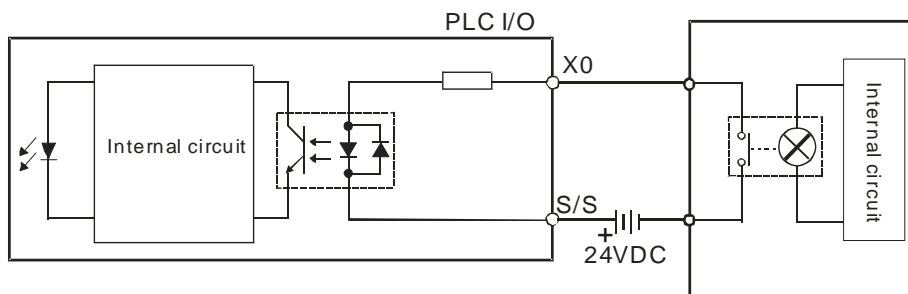
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4.2.6.2 Relay Types

- Sinking

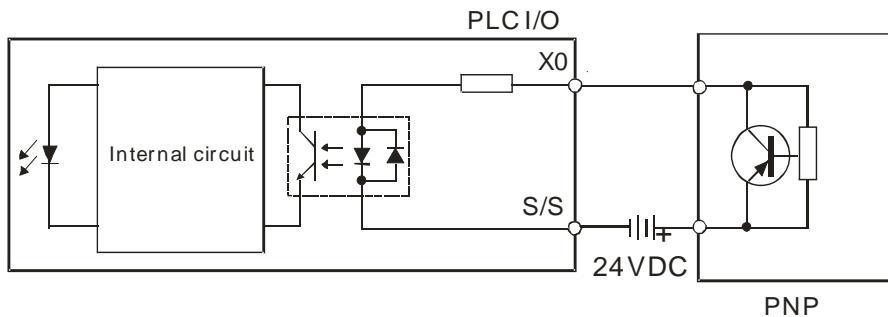


- Sourcing

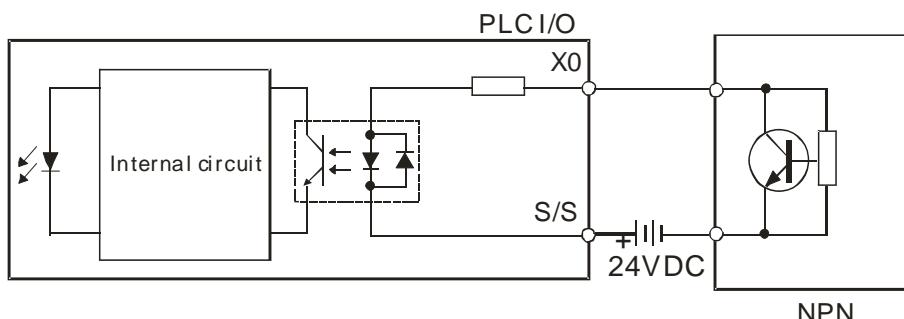


4.2.6.3 Two-Wire Open-Collector Input Types

- **Sinking**

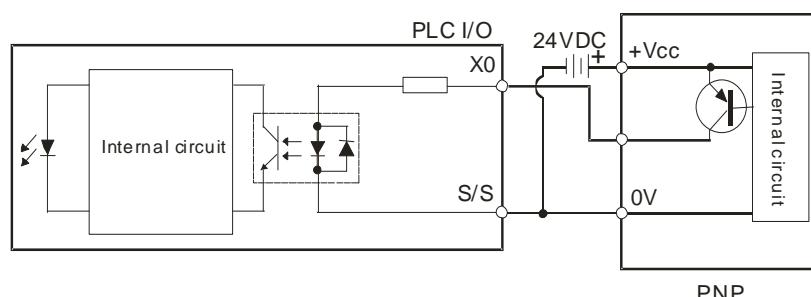


- **Sourcing**

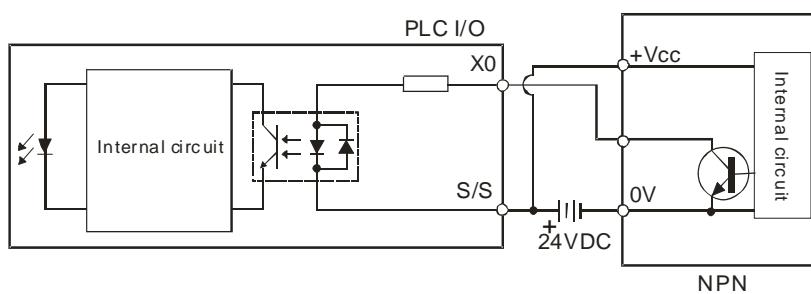


4.2.6.4 Three-Wire Open-Collector Input Types

- **Sinking**



- **Sourcing**

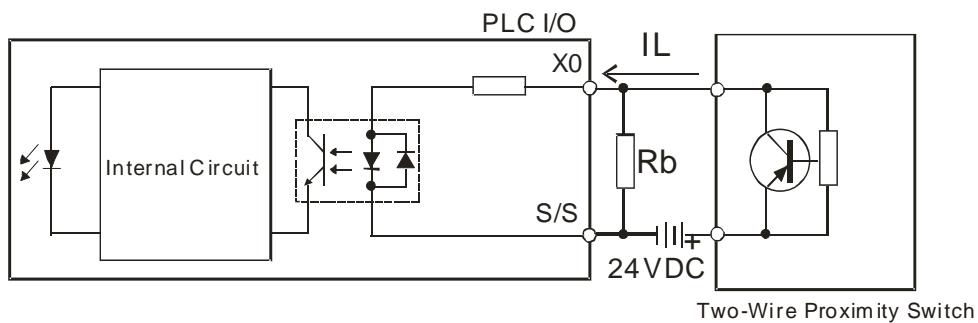


4.2.6.5 Two-Wire Proximity Switch

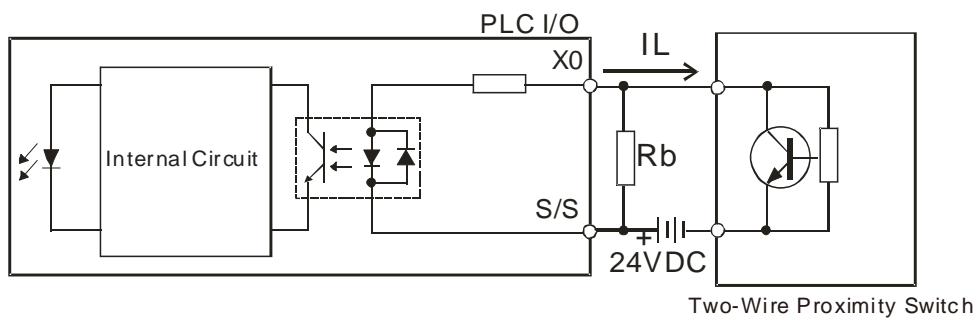
Use the two-wire proximity switch whose leakage current IL is less than 1 mA when the switch is OFF. If the leakage current is larger than 1 mA, connect the divider resistance Rb using the formula below. (A wattage of at least 1 W is recommended.)

$$Rb \leq \frac{6}{IL-1} \text{ (k } \Omega \text{)}$$

- **Sinking**

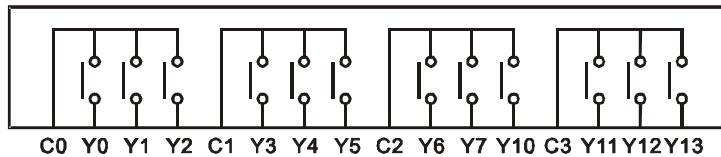


- **Sourcing**



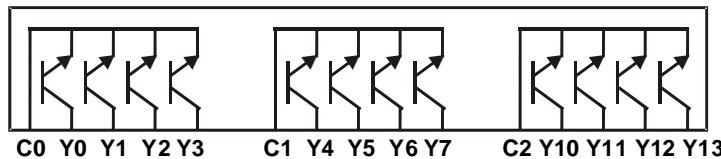
4.2.7 Wiring Digital Output Terminals on DVP-SV3 Series

1. There are two types of output modules: relays and transistors. When wiring the output terminals, pay attention to the connection of the common terminals.
2. For relay models, the output terminals Y0, Y1, and Y2 share the common terminal C0; Y3, Y4, and Y5 share the common terminal C1; Y6, Y7, and Y10 share the common terminal C2; Y11, Y12, and Y13 share the common terminal C3. Operation indication: When there is any activity on the output point, its indicator light on the front will be ON.



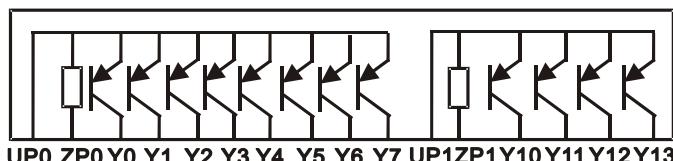
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3. For transistor models (NPN), the output terminals Y0, Y1, Y2 and Y3 share the common terminal C0; Y4, Y5, Y6 and Y7 share the common terminal C1; Y10, Y11, Y12 and Y13 share the common terminal C2.



4. For transistor models (PNP), the output terminals Y0 to Y7 share the common terminals UP0 and ZP0; Y10 to Y13 share the common terminals UP1 and ZP1.

Note: UP0 and UP1 operate independently inside the PLC.



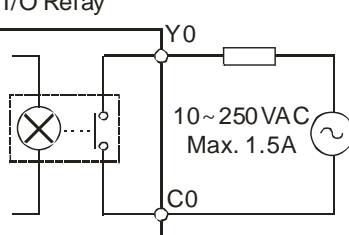
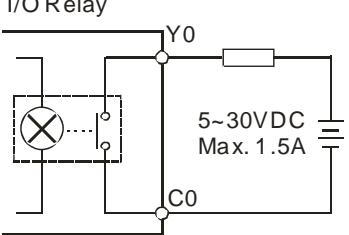
5. Isolation circuit: Optocouplers are used between the internal circuit of the PLC and the input module to achieve signal isolation.

4.2.7.1 Output Circuits (Relay & Transistor)

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

- **Relay output**

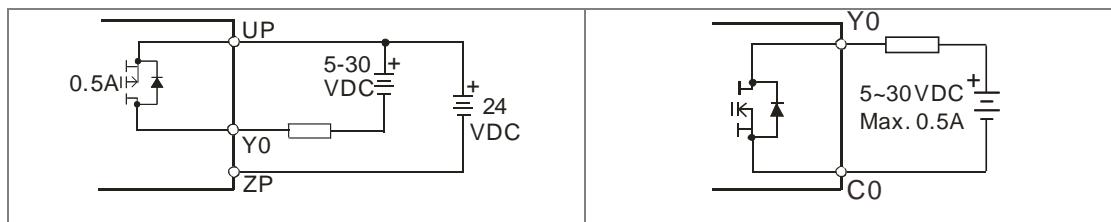
The wire diameter specifications are different, since the output wiring of the relay model varies depending on the type of power supply provided. Only use copper conducting wires with a temperature rating of 60/75°C. The tightening torque of the PLC terminal screw is 2.0 kgf-cm (1.77 lbf-in).

Specification	AC Power			DC Power		
		< 2 mm 6-8 mm	18-16 AWG		< 2 mm 6-8 mm	24-16 AWG
Wiring	<p>I/O Relay</p>  <p>Y0</p> <p>10~250 VAC Max. 1.5A</p> <p>C0</p>			<p>I/O Relay</p>  <p>Y0</p> <p>5~30VDC Max. 1.5A</p> <p>C0</p>		

Note: Use the same voltage (10-250 VAC or 5-30 VDC) for the output terminals of the relays in the same common point COM (those with the same color in the figure below).

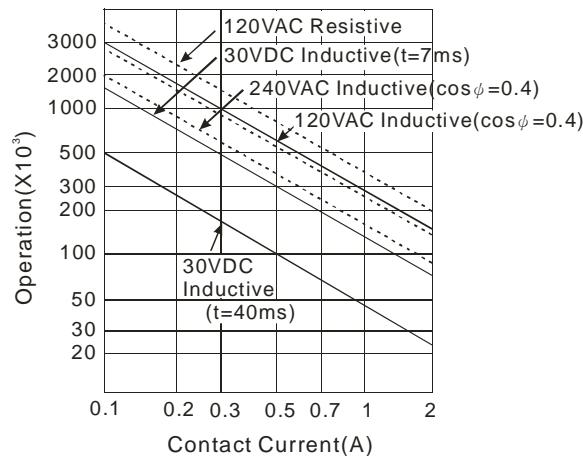


- **Transistor output**

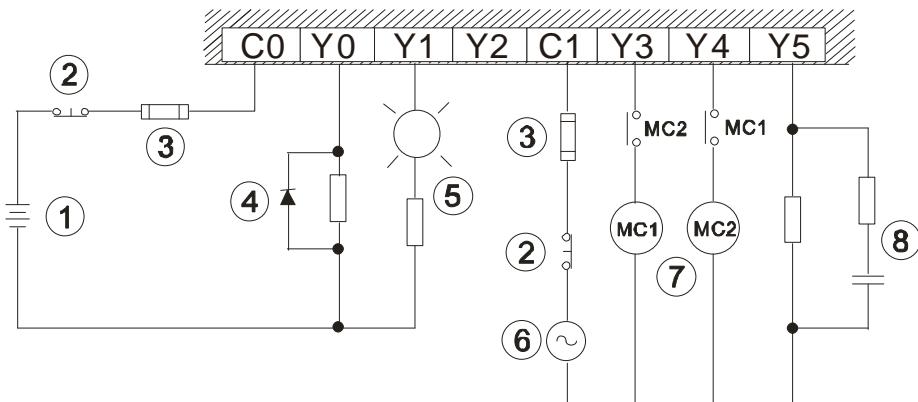


4.2.7.2 Relay Output Circuit

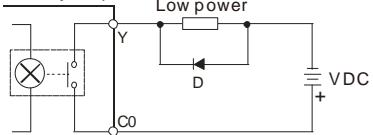
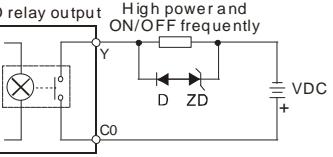
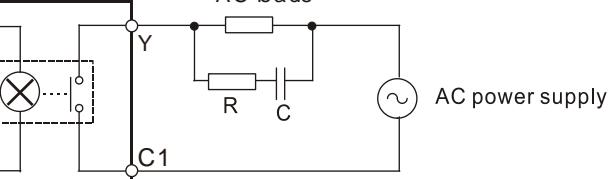
Relay terminals have no polarity. They can be used with alternating current that passes through a load, or with direct current that passes through a load. The maximum current that can pass through every relay terminal is 1.5 A and the maximum current that can pass through every common terminal is 4.5 A. The lifetime of a relay terminal varies with the working voltage, the load type (the power factor $\cos\phi$), and the current passing through the terminal. The relation is shown in the life cycle curve below.



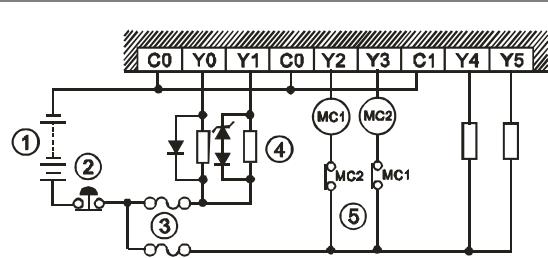
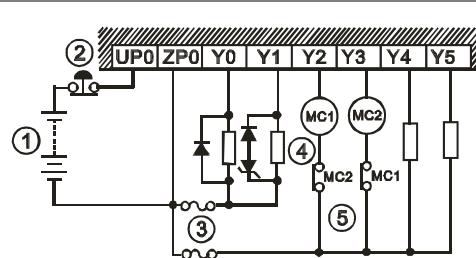
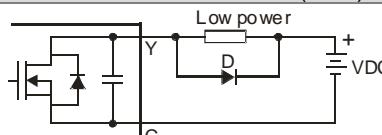
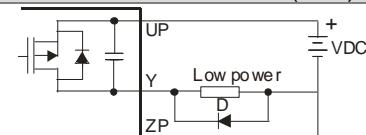
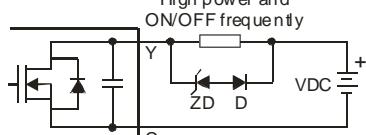
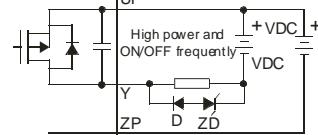
- Relay output circuit

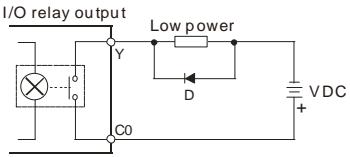
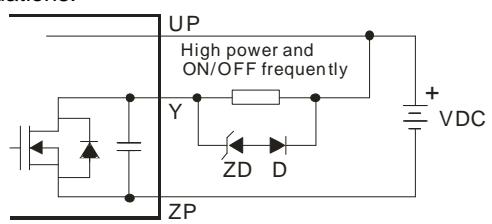


①	Direct-current power supply
②	Emergency: stop using an external switch.
③	Fuse: to protect the output circuit, a fuse having a breaking capacity between 5 A to 10 A is connected to the common terminal.

	<p>Using surge absorbing diodes to extend the lifespan of contacts</p> <p>A diode is connected in parallel to absorb the surge voltage: used in low-power situations</p> <p>I/O relay output</p>  <p>D: 1N4001 Diode or its equivalent</p>
④	<p>A diode and Zener are connected in parallel to absorb the surge voltage: used in high-power and power-on/off frequently situations.</p> <p>I/O relay output</p>  <p>ZD 9V Zener, 5W</p>
⑤	A bulb (incandescent lamp) is used as a resistive load.
⑥	Alternating-current power supply
⑦	Mutually exclusive output: For example, using Y3 and Y4 to control the forward and reverse rotation of the corresponding motor, creating an interlock in the external circuit. Combined with the PLC internal program, this ensures that there are safety measures in place for any abnormal or sudden situations.
⑧	<p>Surge absorber: noises can be reduced on AC loads.</p> <p>I/O relay output</p>  <p>AC loads</p> <p>AC power supply</p> <p>R: 100~120 Ω</p> <p>C: 0.1~0.24 uF</p>

4.2.7.3 Transistor Output Circuit

DVP28SV311T (NPN)		DVP28SV311S (PNP)	
			
(1) Direct-current power supply			
(2) Emergency stop			
(3) Fuse			
<p>Since the output of the transistor module is open collector, if Y0/Y1 is set as pulse outputs, the output current of the resistors must be greater than 0.1 A to ensure normal operation.</p> <p>1. A diode is connected to absorb the surge voltage: used in low-power situations</p>			
 <p>D: 1N4001 Diode or its equivalent</p>	 <p>D: 1N4001 Diode or its equivalent</p>	 <p>D: 1N4001 Diode or its equivalent ZD: 9V Zener, 5W</p>	 <p>D: 1N4001 Diode or its equivalent ZD: 9V Zener, 5W</p>
<p>2. A diode and Zener are connected to absorb the surge voltage: used in high-power and power-on/off frequently situations.</p>			

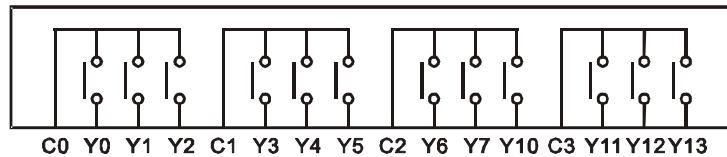
	<p>Using surge absorbing diodes to extend the lifespan of contacts A diode is connected in parallel to absorb the surge voltage: used in low-power situations.</p>  <p>D: 1N4001 Diode or its equivalent</p>
④	<p>A diode and Zener are connected in parallel to absorb the surge voltage: used in high-power and power-on/off frequently situations.</p>  <p>D: 1N4001 Diode or its equivalent ZD: 9V Zener, 5W</p>
⑤	<p>Mutually exclusive output: For example, using Y3 and Y4 to control the forward and reverse rotation of the corresponding motor, creating an interlock in the external circuit. Combined with the PLC internal program, this ensures that there are safety measures in place for any abnormal or sudden situations.</p>

4.2.8 Wiring Digital Input Terminals on DVP-SX3 Series

Refer to section 4.2.6 for more information.

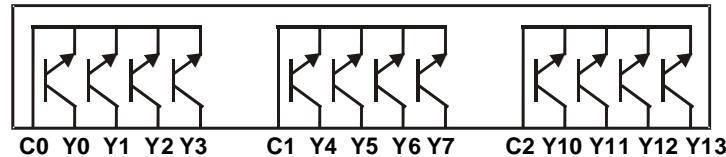
4.2.9 Wiring Digital Output Terminals on DVP-SX3 Series

1. There are two types of output modules: relays and transistors. When wiring the output terminals, pay attention to the connection of the common terminals.
2. For relay models, the output terminals Y0, Y1, and Y2 share the common terminal C0; Y3, Y4, and Y5 share the common terminal C1; Y6, Y7, and Y10 share the common terminal C2; Y11, Y12, and Y13 share the common terminal C3. Operation indication: When there is any activity on the output point, its indicator light on the front will be ON.

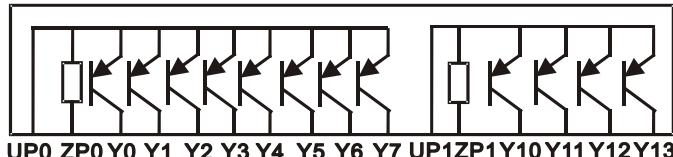


4

3. For transistor models (NPN), the output terminals Y0, Y1, Y2 and Y3 share the common terminal C0; Y4, Y5, Y6 and Y7 share the common terminal C1; Y10, Y11, Y12 and Y13 share the common terminal C2.



4. For transistor models (PNP), the output terminals Y0 to Y7 share the common terminals UP0 and ZP0; Y10 to Y13 share the common terminals UP1 and ZP1.



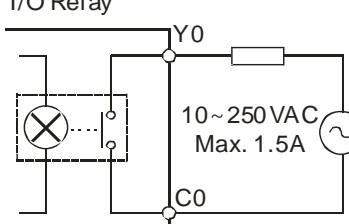
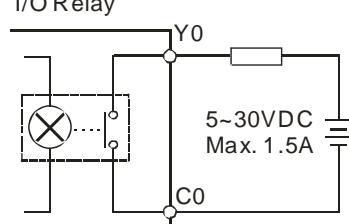
5. Isolation circuit: Optocouplers are used between the internal circuit of the PLC and the input module to achieve signal isolation.

4.2.9.1 Output Circuits (Relay & Transistor)

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

- **Relay output**

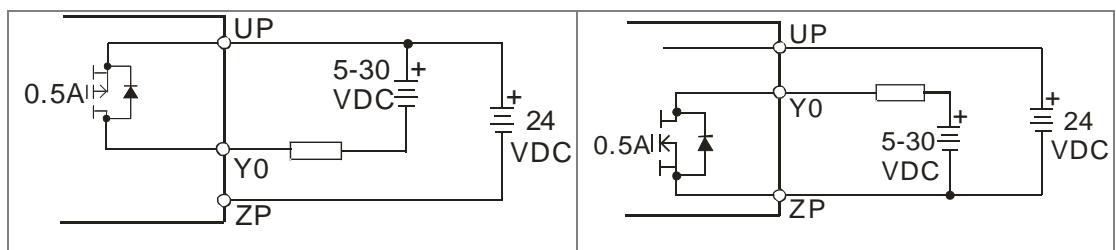
The wire diameter specifications are different, since the output wiring of the relay model varies depending on the type of power supply provided. Only use copper conducting wires with a temperature rating of 60/75°C. The tightening torque of the PLC terminal screw is 2.0 kgf-cm (1.77 lbf-in).

	AC Power	DC Power
Specification	 $< 2 \text{ mm}$ $6-8 \text{ mm}$ $18-16 \text{ AWG}$	 $< 2 \text{ mm}$ $6-8 \text{ mm}$ $24-16 \text{ AWG}$
Wiring	<p>I/O Relay</p>  <p>Y0 10~250 VAC Max. 1.5A</p> <p>C0</p>	<p>I/O Relay</p>  <p>Y0 5~30VDC Max. 1.5A</p> <p>C0</p>

Note: Use the same voltage (10-250 VAC or 5-30 VDC) for the output terminals of the relays in the same common point COM (those with the same color in the figure below).



- **Transistor output**



4.2.9.2 Relay Output Circuit

Refer to section 4.2.7.2 for more information.

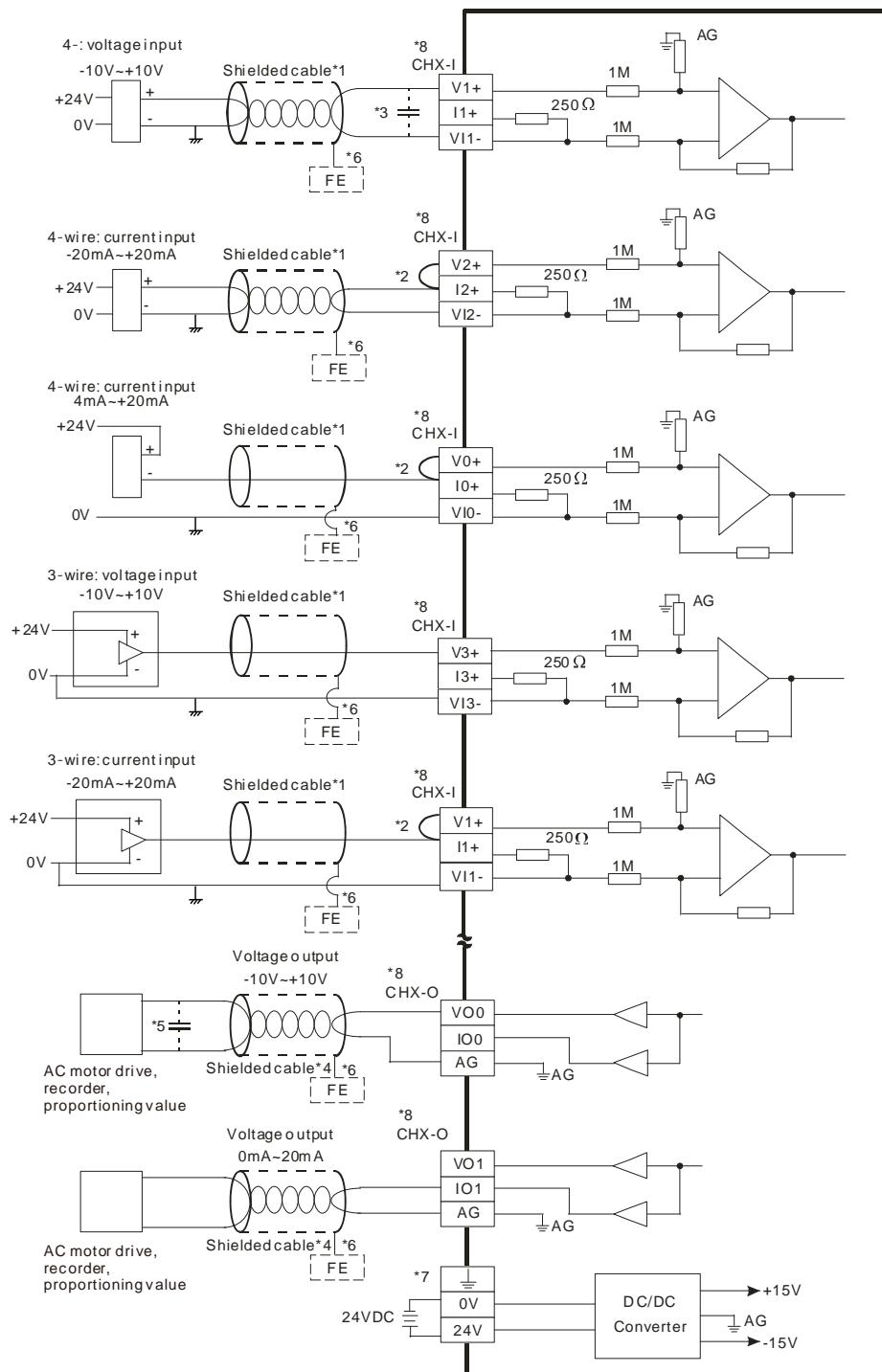
4.2.9.3 Transistor Output Circuit

DVP20SX311T (NPN)		DVP20SX311S (PNP)	
<p>① Direct-current power supply</p>			
<p>② Emergency stop</p>			
<p>③ Fuse</p>			
<p>④</p> <p>Since the output of the transistor module is open collector, if Y0/Y1 is set as pulse outputs, the output current of the resistors must be greater than 0.1 A to ensure normal operation.</p> <p>1. A diode is connected to absorb the surge voltage: used in low-power situations</p>		<p>DVP20SX311T (NPN)</p> <p>D: 1N4001 Diode or its equivalent</p> <p>DVP20SX311S (PNP)</p> <p>D: 1N4001 Diode or its equivalent</p>	
<p>2. A diode and Zener are connected to absorb the surge voltage: used in high-power and power-on/off frequently situations.</p>		<p>DVP20SX311T (NPN)</p> <p>D: 1N4001 Diode or its equivalent</p> <p>ZD: 9V Zener, 5W</p> <p>DVP20SX311S (PNP)</p> <p>D: 1N4001 Diode or its equivalent</p> <p>ZD: 9V Zener, 5W</p>	
<p>⑤</p> <p>Mutually exclusive output: For example, using Y3 and Y4 to control the forward and reverse rotation of the corresponding motor, creating an interlock in the external circuit. Combined with the PLC internal program, this ensures that there are safety measures in place for any abnormal or sudden situations.</p>			

4.2.10 Wiring SX3 Series Analog Input /Output

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.
- Use terminals with the same length (less than 200 m) and use terminal resistors of less than 100 ohm.



*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 V_n and I_{n+} ($n=0-3$) must be short-circuited.

*3. If variability in the input voltage results in interference within the wiring, connect the module to a capacitor having a capacitance between 0.1–0.47 μ F and a working voltage of 25 V.

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

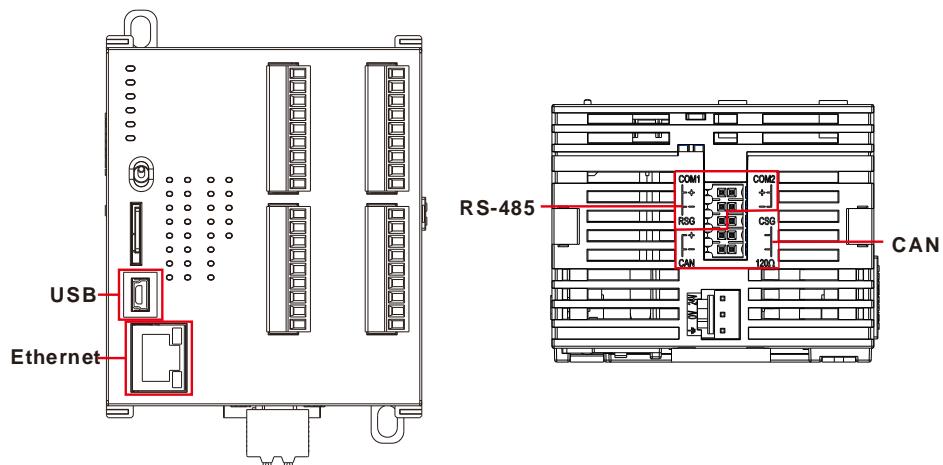
*5. If variability in the input loading results in interference within the wiring, connect the module to a capacitor having a capacitance between 0.1–0.47 μ F and a working voltage of 25 V.

*6. Connect the shielded cable to the terminal FE and to the ground terminal.

*7. Connect the $\frac{1}{2}$ to the terminal FE.

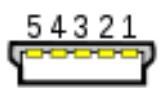
*8. The wording "CHX-I" indicates that you can use those five wiring methods for every input channel. The wording "CHX-O" indicates that you can use those two wiring methods for every output channel.

4.2.11 Wiring DVP-SV3/SX3 Communication Ports



- **USB port**

Pin	Function
1	VBUS (4.4–5.25 V)
2	D–
3	D+
4	Ground
5	Ground

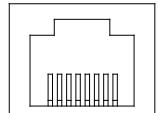


5 4 3 2 1
Mini-B

- If it is the first time to use USB port to communicate, refer to Appendix A : Installing a USB Driver.
- Time to use the USB port: uploading/downloading PLC programs, monitoring during calibration, and upgrading firmware.
- NOT suggested to use the USB port: applications that require a long and un-interruptible communication.
- What to do when a communication failure occurs: unplug any communication connector from the USB port and then plug the connector back. After that, reconnect and try communication again.

- **Ethernet port**

Pin	Signal	Description	
1	TX+	Transmitting data (positive pole)	
2	TX-	Transmitting data (negative pole)	
3	RX+	Receiving data (positive pole)	
4	--	N/C	
5	--	N/C	
6	RX-	Receiving data (negative pole)	
7	--	N/C	
8	--	N/C	

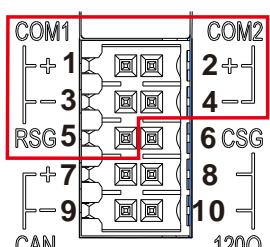


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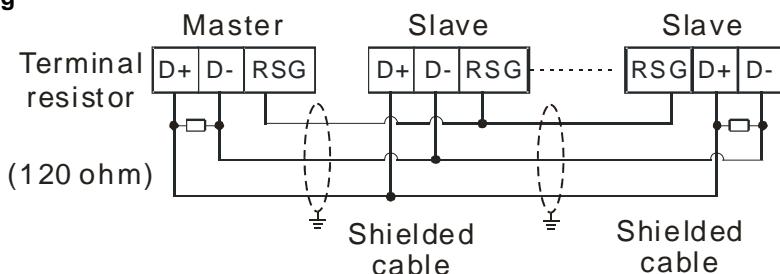
RS-485 Pins and Wiring

- **RS-485 Pins**

Pin	Signal	Description	
1	+	COM1 D+	
3	-	COM1 D-	
5	RSG	Signal Ground	
2	+	COM2 D+	
4	-	COM2 D-	

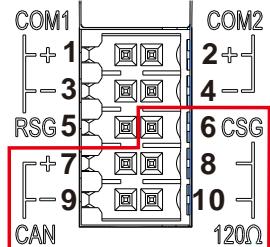


- **RS-485 Wiring**


CAN Pins and Wiring

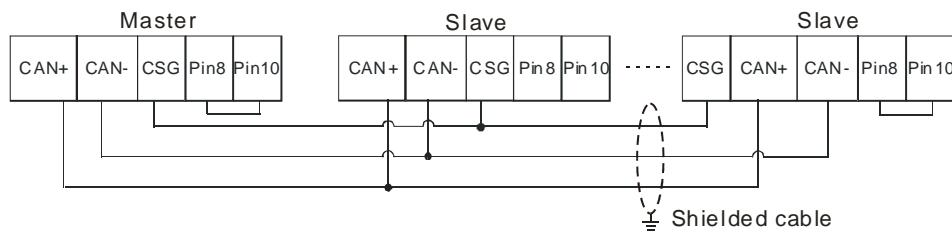
- **CAN Pins**

Pin	Signal	Description	
7	CAN+	CAN_H	
9	CAN-	CAN_L	
6	CSG	GROUND	
8		120 Ω	Terminal resistor
10			



Note: The built-in 120 Ω terminal resistor is activated by short-circuiting Pin8 and Pin10. This provides impedance matching for communication signals to reduce signal reflection interference and ensure normal signal transmission.

- **CAN Wiring**



1. It is recommended to use Daisy Chain for connection and be sure to use terminal resistor in the beginning and the end of the terminal arrangement.
2. Pin8 and Pin10 must be short-circuited to activate the built-in 120 Ω terminal resistor.

MEMO

Chapter 5 CPU and Module Devices

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5.1 Introduction on 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*1
	Output relay	Y	256	Y0–Y377*2
	Data register	D	48,0000	D0.0–D29999.15
		W	48,0000	W0.0–W29999.15*6
	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*6
	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*6
Constant*3	Decimal system	K	16 bits: -32768 to 32767 32 bits: -2147483648 to 2147483647	
Constant*4	Hexadecimal system	16#	16 bits: 16#0–16#FFFF 32 bits: 16#0–16#FFFFFF	
	Single-precision floating-point number	F	32 bits: $\pm 1.17549435^{-38}$ to $\pm 3.40282347^{+38}$	
String*5	String	”\$”	1–31 characters	

*1. For DVP-SV3/SX3 series PLC, 16 inputs (X0-X17) and 16 outputs (Y0-Y17) are taken. For DVP20SX3, only 8 inputs (X0-X7) are taken but since X10-X17 are reserved, the input point for extension is starting from X20.

*2. For DVP-SV3/SX3 series PLC, 16 inputs (X0-X17) and 16 outputs (Y0-Y17) are taken. For DVP28SV3, only 12 inputs (Y0-Y13) are taken but since Y14-Y17 are reserved, the output point for extension is starting from Y20. For DVP20SX3, only 6 outputs (Y0-Y5) are taken, but since Y6-Y17 are reserved, the output point for extension is starting from Y20.

*3: Constants are indicated by K in the device lists in Chapter 5 and Chapter 6 in the DVP-ES3/EX3/SV3/SX3 Series Programming Manual. When "K50" appears in the DVP-ES3/EX3/SV3/SX3 Series Programming Manual, enter only the number 50 in ISPSoft/DIADesigner.

*4: Floating-point numbers are indicated by F/DF in the device lists in Chapter 5 and Chapter 6 in the DVP-ES3/EX3/SV3/SX3 Series Programming Manual, but they are represented by decimal points in ISPSoft/DIADesigner. For example, for the floating-point number F500, enter 500.0 in ISPSoft/DIADesigner.

*5: Strings are indicated by \$ in Chapter 5 and Chapter 6 in the DVP-ES3/EX3/SV3/SX3 Series Programming Manual, but they are represented by quotes (" ") in ISPSoft/DIADesigner. For example, for the string of 1234, enter "1234" in ISPSoft.

*6: Used for editing in ISPSoft/DIADesigner only.

5.1.2 Basic Structure of I/O Storage

Device	Function	Access by bits	Access by words	Modify by ISPSoft/DIADesigner	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.	SM203=OFF	Cleared	Retained	Retained	Retained
	The state of device Y is retained.	SM203=OFF	Retained	Retained	Retained	Retained
	The state of device Y is cleared.	SM203=ON^{*3}	Cleared	Cleared	Retained	Retained
	The state of device Y is retained.	SM203=ON	Retained	Cleared	Retained	Retained
SM204 is ON. (All non-latched areas are cleared.)^{*2}			Cleared	Cleared	Retained	Retained
SM205 is ON. (All latched areas are cleared.)^{*2}			Retained	Retained	Retained	Cleared

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

*2: The SM switches from OFF to ON, the latched areas are cleared. After the clearing is complete, SM switches from ON to OFF automatically.

*3: When SM203=ON, the system clear the non-latched area once. This is available for ES3/EX3 PLC CPU with firmware V1.04.00 or later and for SV3/SX3 PLC CPU with firmware V1.00.00 or later.

5.1.4 Latched Areas in the Device Range

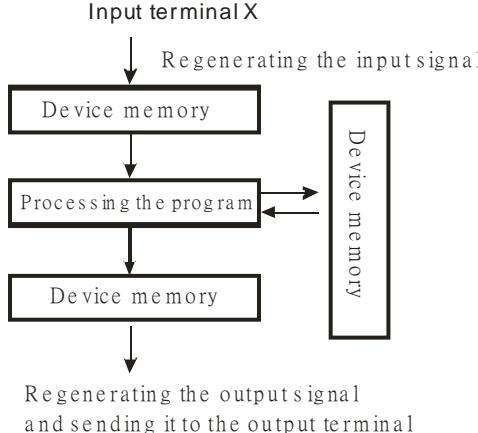
Device	Function	Device range	Latched area
X	Input relay	X0–X377	All devices are non-latched.
Y	Output relay	Y0–Y377	All devices are non-latched.
M ^{*1}	Auxiliary relay	M0–M8191	The default range is M6000–M8191.
SM	Special auxiliary relay	SM0–SM2047	Some devices are latched, and cannot be changed. Refer 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–D23999
		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 or Hardware Configuration in DIADesigner. 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/DIADesigner 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

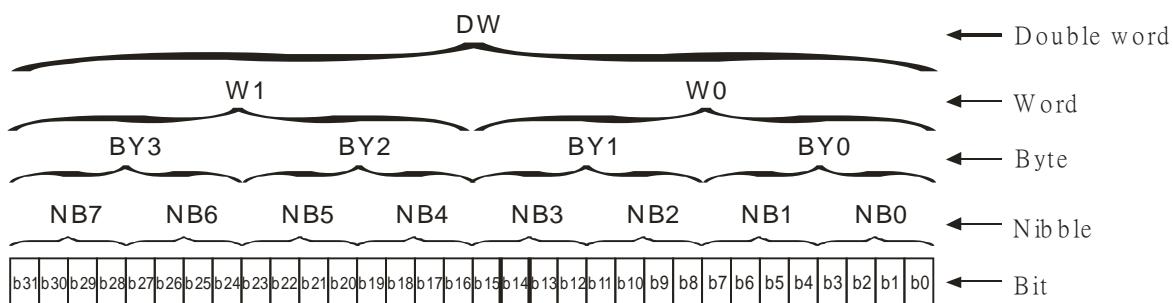
After the input signal is refreshed, the instructions in the program are executed in order from the start address of the program. The results are stored in the device memory.
- Regenerating the state of the output

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–FFFFFF 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 input 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. 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

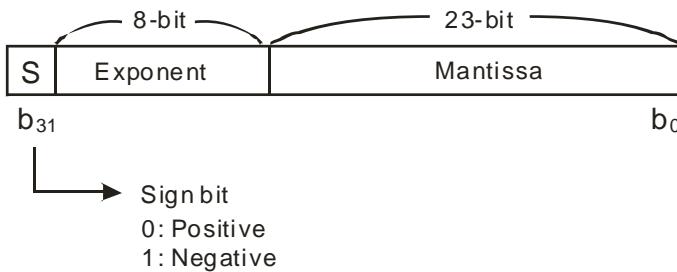
Binary Number (BIN)	Octal Number (OCT)	Decimal Number (DEC)	Binary Code Decimal (BCD)	Hexadecimal Number (HEX)
1101		13	-	D
1110		14	-	E
1111		15	-	F
10000		16	0001 0000	10
10001		17	0001 0001	11

5.2.2 Floating-point Numbers

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

5.2.2.1 Single-precision Floating-point Numbers

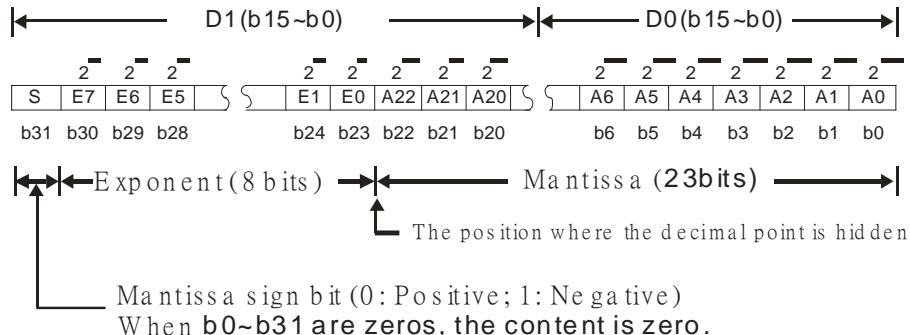
Floating-point numbers are represented by a 32-bit register. The representation adopts the IEEE754 standard, and the format shown in the following picture.



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/EX3/SV3/SX3 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, $10111=1.0111 \times 2^4$ (0111 is the mantissa, and 4 is the exponent.).

Step 3: Get the value of the exponent.

$$\therefore E-B=4 \rightarrow E-127=4 \therefore E=131=10000011_2$$

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

$$0\ 10000011\ 011100000000000000000000_2=41B80000_{16}$$

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.

$$1\ 10000011\ 011100000000000000000000_2=C1B80000_{16}$$

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= $\pm 1,000$ to $\pm 9,999$

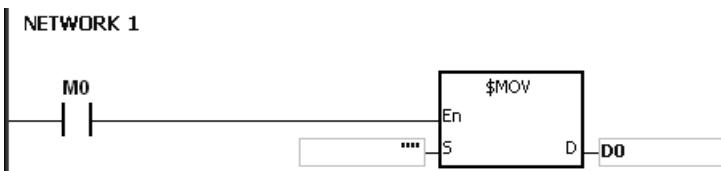
Exponent D1=-41 to +35

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

5.2.3 Strings

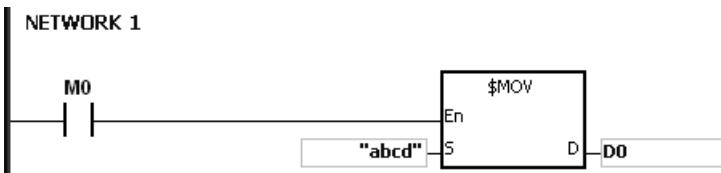
The PLC can process strings composed of ASCII codes (*1). A complete string begins with a start character, and ends with an ending character (NULL code). Strings can have maximum length of 31 characters, and ISPSSoft/DIA Designer automatically adds the ending character (16#00).

1. No string (NULL code) is moved.



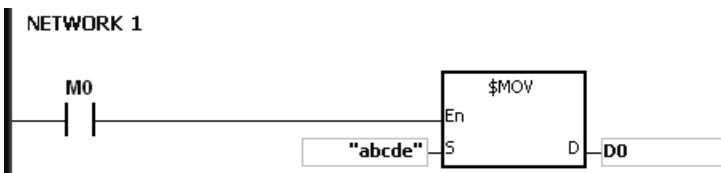
D0=0 (NULL)

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.

- Refreshing time for inputs

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.

Note: To refresh the inputs immediately during the scan cycle is only possible for the built-in input points (DX0 to DX17); not available for inputs points on digital I/O modules.

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: 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.

- Refreshing time for outputs

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
Note: To refresh the outputs immediately during the scan cycle is only possible for the built-in output points (DY0 to DY17); not available for outputs points on digital I/O modules.

5.2.6 Auxiliary Relays (M)

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

A. **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.

B. **For latched use:**

In latched use, if 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/EX3/SV3/SX3 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). Each flag, like auxiliary relay, 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. **For general use:**

In general use, if an electric power failure occurs when the PLC is running, the flag resets to the OFF state. When the power is restored, the flag remains in the OFF state.

B. **For latched use:**

In latched use, if an electric power failure occurs when the PLC is running, the state of the flag is retained. When the power is restored, the flag state remains the same as before the power failure.

5.2.9 Timers (T)

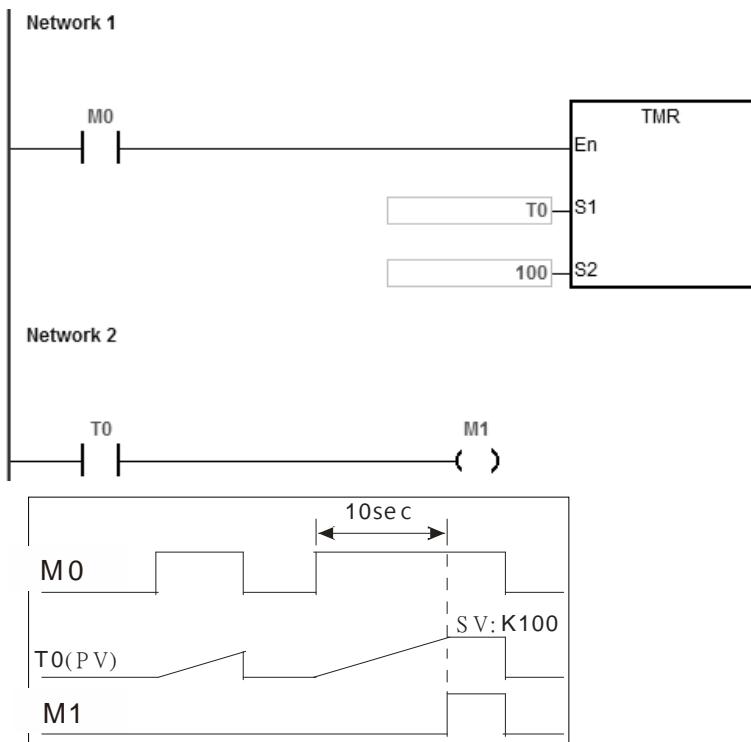
This topic describes the timers available in ISPSoft. Refer to the ISPSoft User Manual for more information on timers.

- 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 but the ST timer will not be reset.
- 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 \geq 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 value 100.
- When M0=OFF, the value of the timer is 0 and the output coil T0 is OFF.

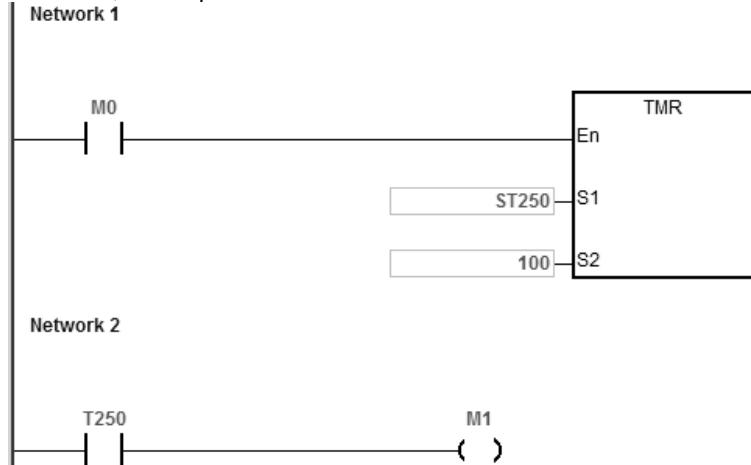


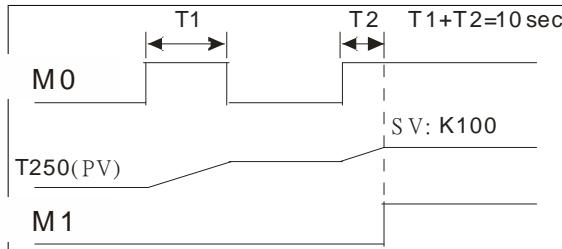
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B. Accumulative timers

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, 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

- 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.

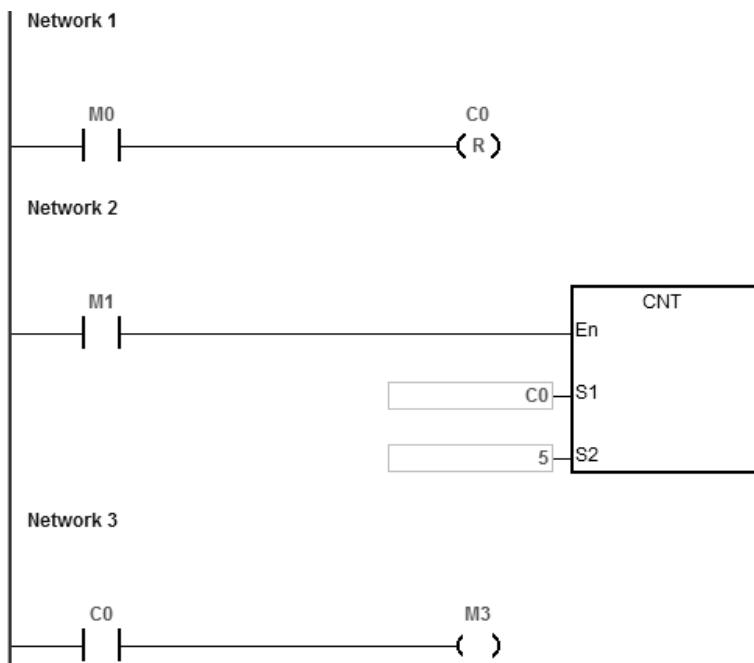
- Function of the counter

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:

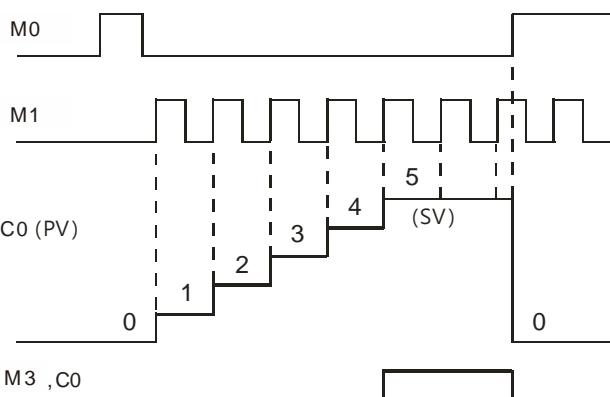
- Setting range: 0–32,767. Setting values 0 and 1 are equivalent: the output contact turns ON immediately upon the first count.
- For the general-purpose counter, the current value of the counter is cleared when power is lost. If the counter is latching, the current value and the contact state before power loss 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/DIA Designer 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.
6. This counter should work with CNT instruction (API1003); below shows an example of common usage.



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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 OFF. And then 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 becomes less than the 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.		

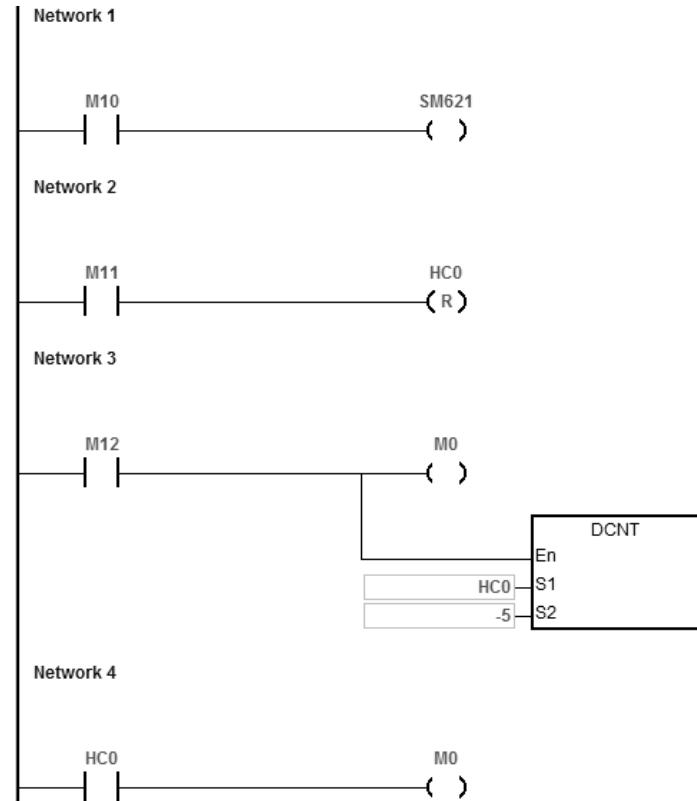
- 32-bit general-purpose addition/subtraction counter

- 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.
- 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.
- 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.
- 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 decremental value is 2,147,483,647.
- This HC counter should work with DCNT instruction (API1004); below shows an example of common usage.

- 32-bit high speed addition/subtraction counter

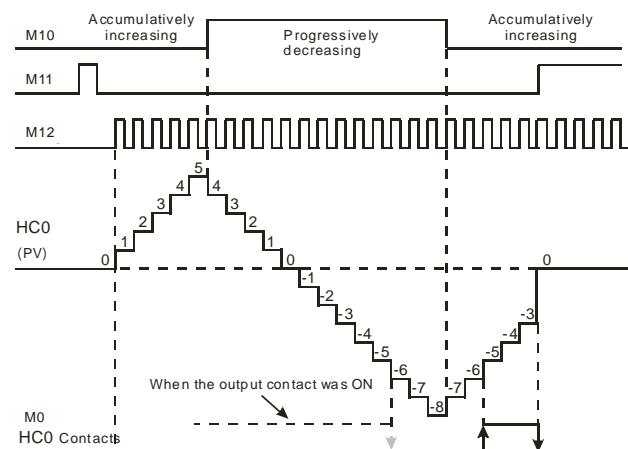
Refer to the instruction description of API1004 DCNT in DVP-ES3/EX3/SV3/SX3 Series Programming Manual for more details.

Example:



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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 ISPSof/DIA Designer User Manual for more information on refreshing the values in the control registers.

There are three 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 ISPSof/DIA Designer 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.
- Data mapping area for extension modules: When the PLC is connected to a module, the PLC exchanges data with the connected module at every scan cycle. The data is stored in data registers in PLC CPU and the data will be mapped to the control registers (CRs) in the extension modules. Refer to the following table for more details.

Types of extension modules	Data mapping areas	Remarks
Right-side extension module	D28000–D28079	Work with SM228 to enable/disable data mapping
Left-side extension module	D29000–D29079	Work with SM265 to enable/disable data mapping
Left-side DNET/COPM extension module	D16000–D19999	

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/EX3/SV3/SX3 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/EX3/SV3/SX3 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/DIADesigner.
- You can read the values in File registers while operating the PLC. Refer to the MEMW instruction (API 2303) in DVP-ES3/EX3/SV3/SX3 Series Programming Manual for more information about how to write to the File registers.

Chapter 6 Writing a Program

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Since ISPSoft and DIADesigner are similar in terms of program editing, this chapter will use ISPSoft software as an example for explanation. Refer to Chapter 8 of the DIADesigner User Manual for information related to DIADesigner software.

6.1 Quick Start

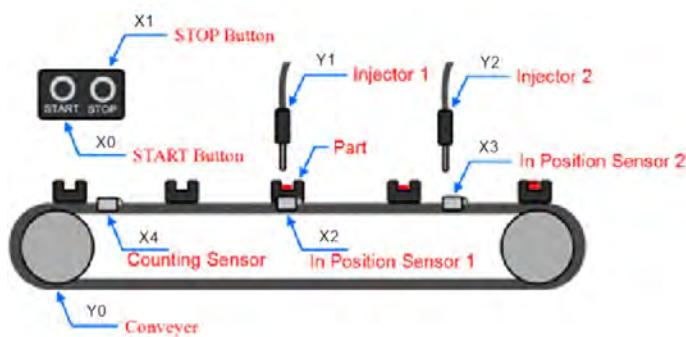
This chapter provides a simple example showing you how to create a traditional ladder diagram in ISPSoft.

To help users unfamiliar with IEC 61131-3 quickly understand ISPSoft's functions and learn to create ladder programs, this chapter does not introduce IEC 61131-3 programming concepts such as POU, function blocks, variables, etc.

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 reset the trigger signal to 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**.

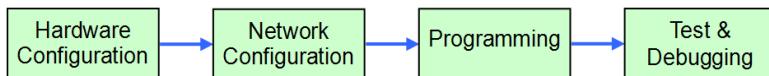
Type	ID	Description
Digital input	X0	START button
Digital input	X1	STOP button
Digital input	X2	In position sensor 1
Digital input	X3	In position sensor 2
Digital input	X4	Counting sensor
Digital output	Y0	Conveyer
Digital output	Y1	Trigger signal for injector 1
Digital output	Y2	Trigger signal for injector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

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.

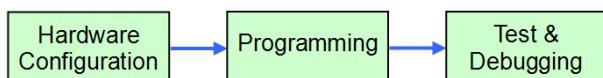
- **Programming**

After you write a program in ISPSoft, compile the program. If the compiling is unsuccessful, messages on the **Compile Message** page indicate 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.

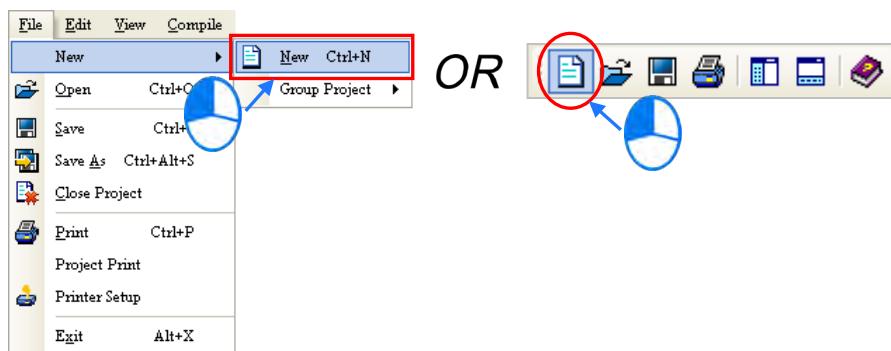
Because the example introduced in this chapter does not discuss a network configuration, you only perform the following procedure.



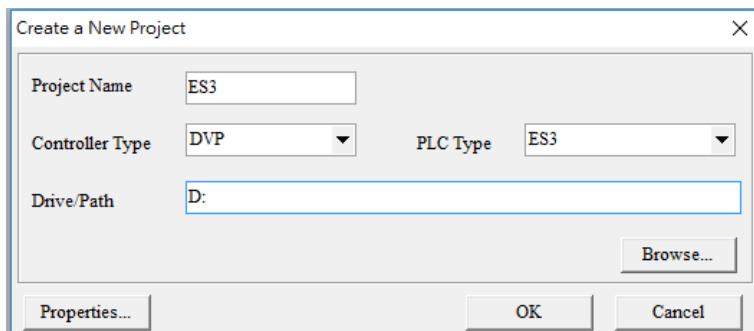
6.3 Creating a Project

This section will use ISPSOFT software as an example for explanation. Refer to section 4.2.2.3 of the DIADesigner User Manual for information related to DIADesigner software.

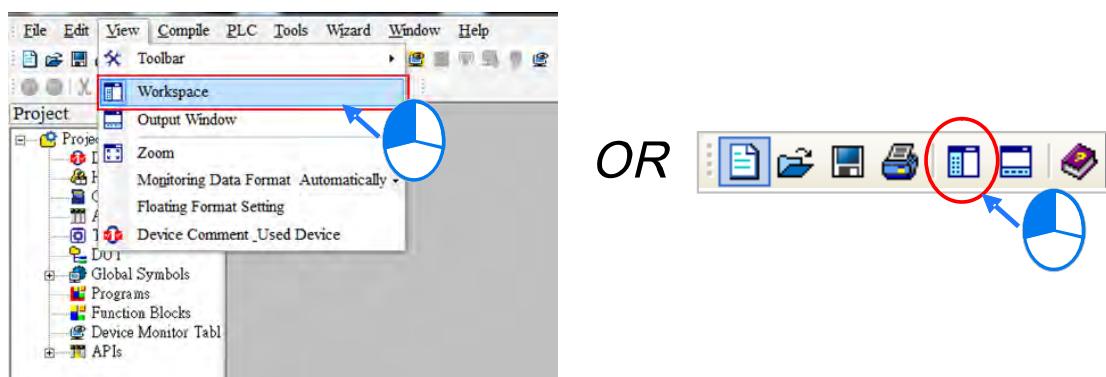
After you start ISPSOFT, on the **File** menu, point to **New**, and then click **New** to create a new project. You can also create a new project by clicking  on the toolbar after you start ISPSOFT.



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.



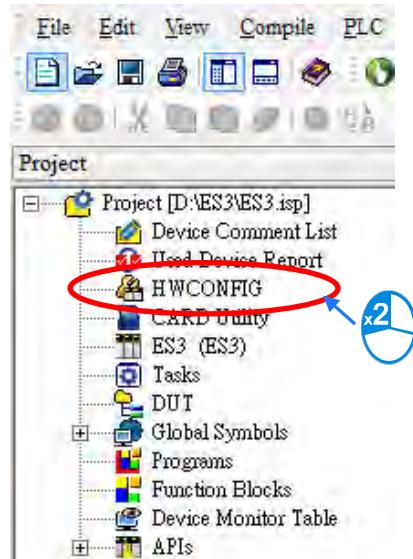
After you create the project, a project management area appears at the left side of the main screen. The relation between the items listed in the project management area is represented by a hierarchical tree structure. If the project management area does not appear, on the **View** menu, click **Workspace**,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



6.4 Hardware Configuration

This section will use ISPSoft software as an example for explanation. Refer to section 6.1 of the DIADesigner User Manual for information related to DIADesigner software.

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



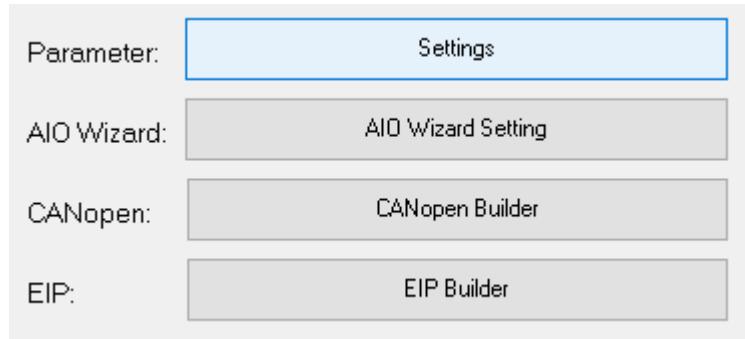
6.4.1 Configuring a Module

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

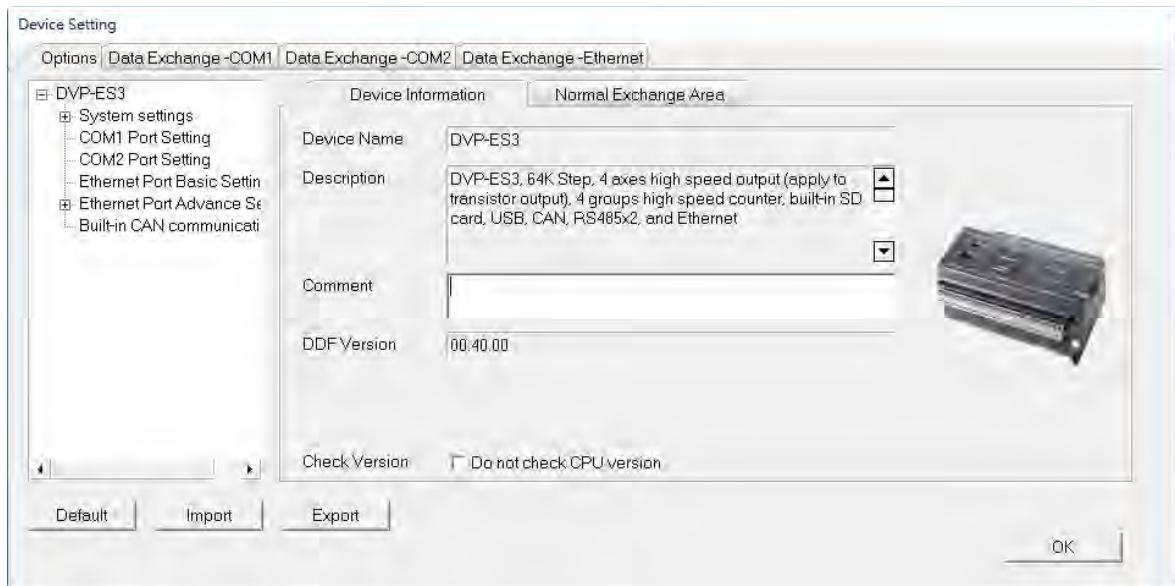


6.4.2 Setting the Parameters

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

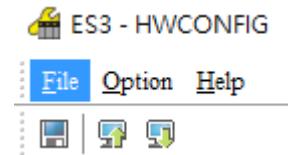
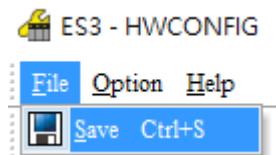


Click the setting tabs for specific parts of the setup at the top of the window and then select the setting items on the left for configuration.



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.



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

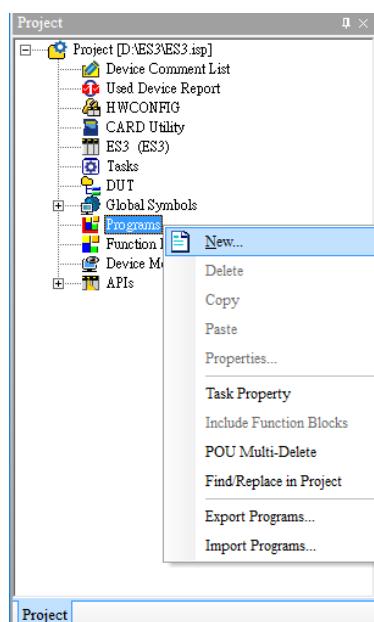
6.5 Creating a Program

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

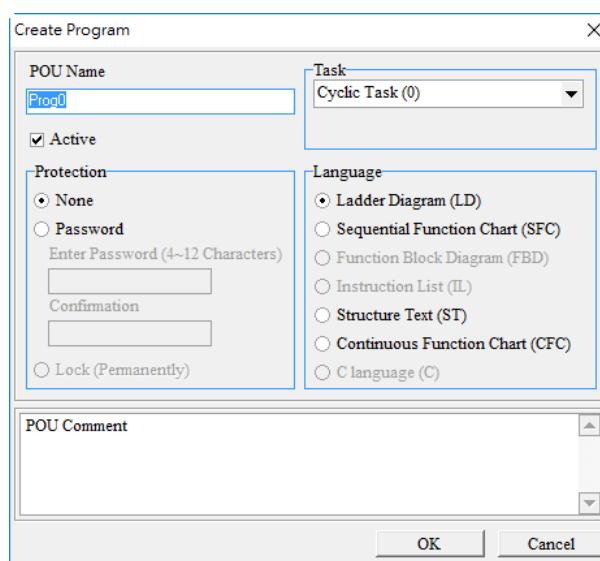
This section will use ISPSof software as an example for explanation. Refer to Chapter 8 of the DIADesigner User Manual for information related to DIADesigner software.

6.5.1 Adding a Ladder Diagram

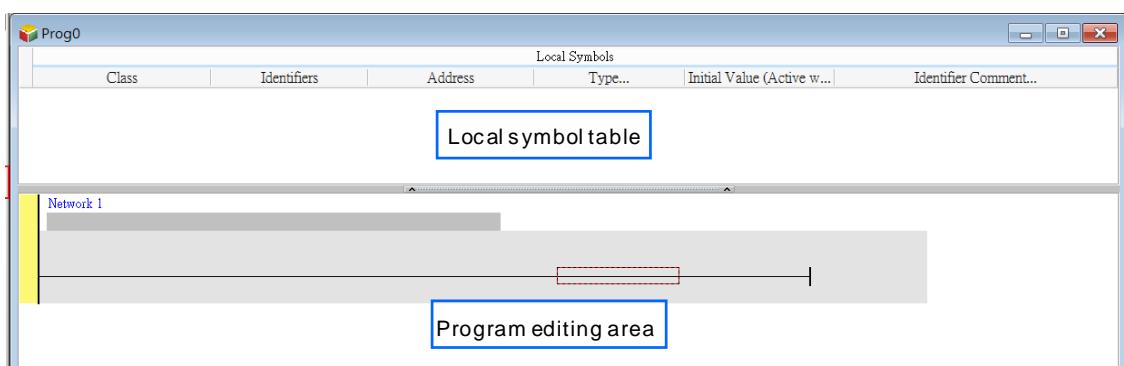
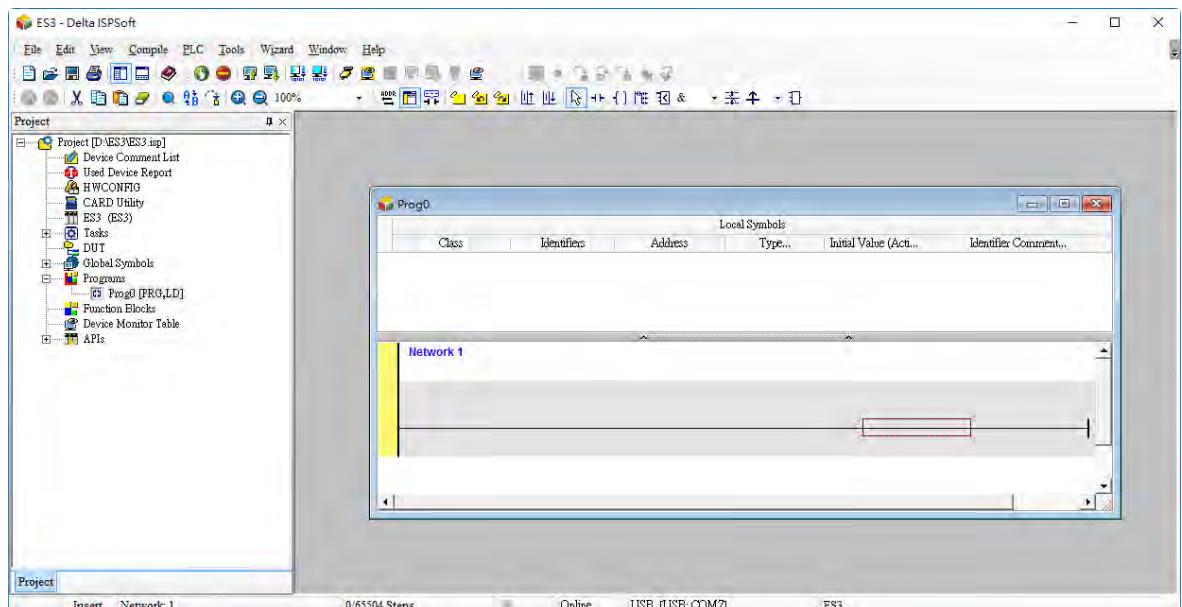
- (1) Right-click **Programs** in the project management area, point to **POU** (program organization unit), and then click **New....**



- (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
	None	Switches to the address mode
	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 or deletes a bookmark from the selected network
	Shift+Ctrl+P	Goes to the previous bookmarked position

Icon	Keyboard shortcut	Function
	Shift+Ctrl+N	Goes to the next bookmarked position
	Ctrl+I	Puts a network above the selected network
	Shift+Ctrl+I	Puts 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

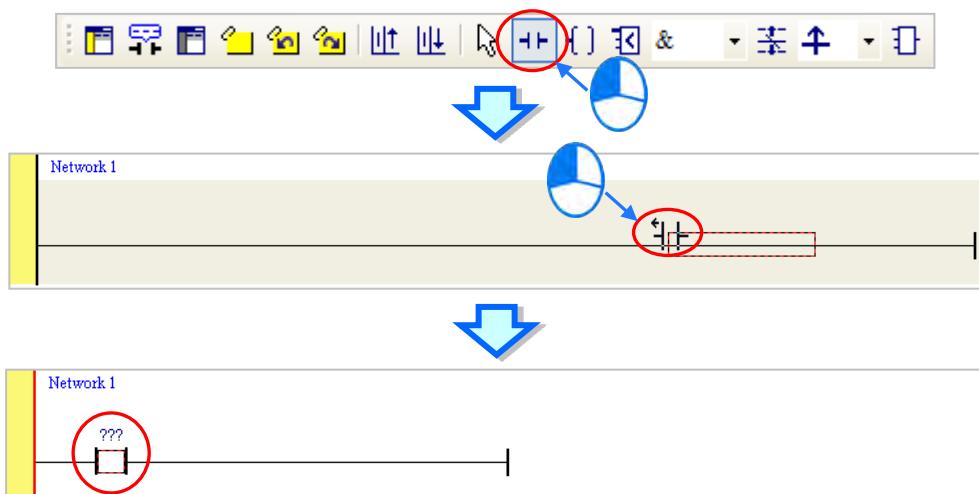
*. Refer to Section 6.5.3 for more information about typing an instruction.

6.5.2 Basic Editing – Creating a Contact and a Coil

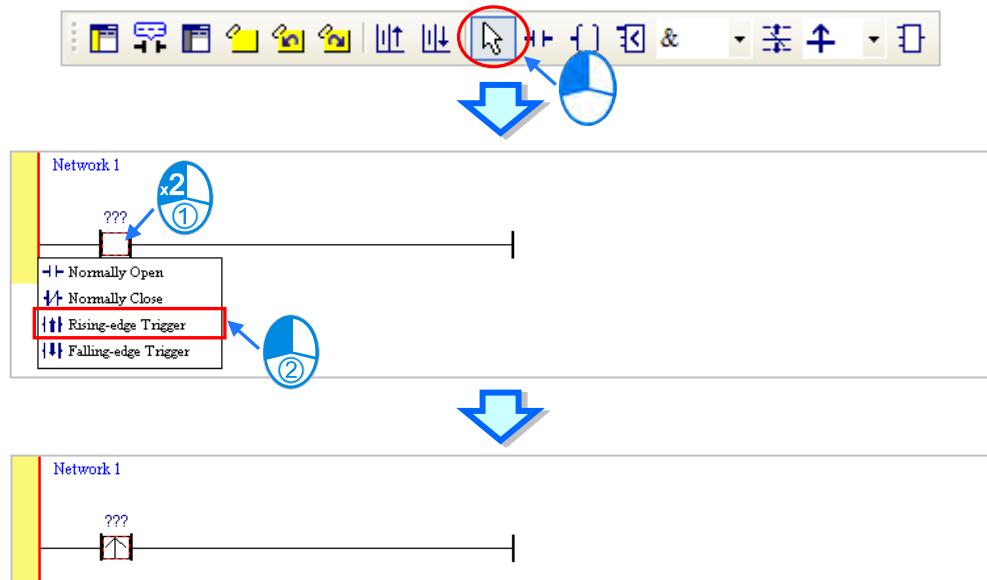
6

- 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.

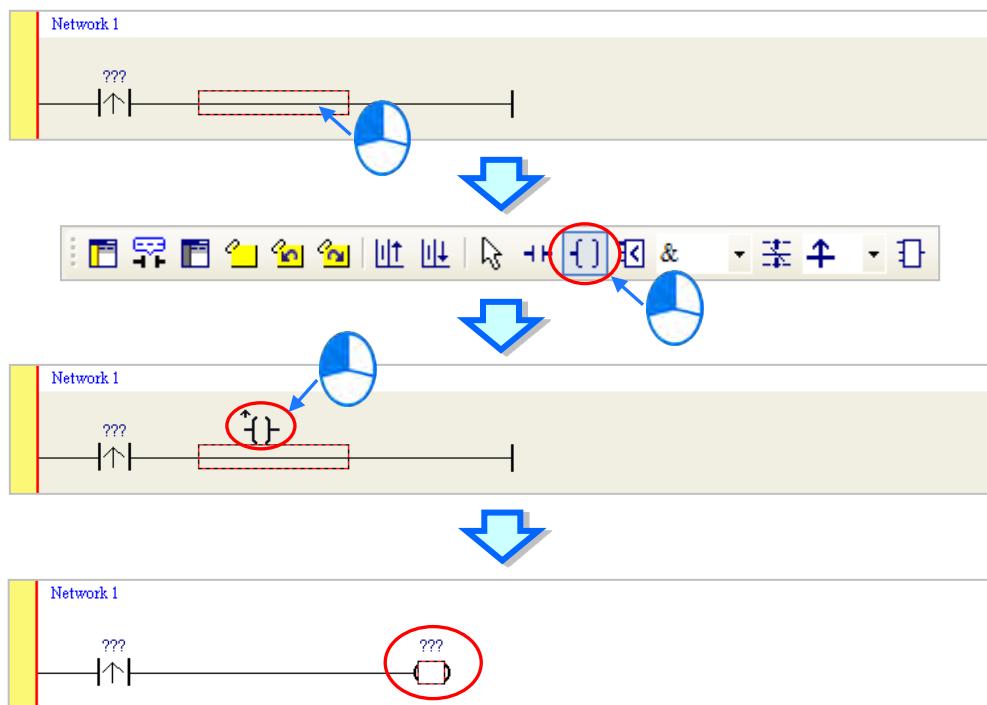


(2) Click  on the toolbar, or press Esc on the keyboard. After you double-click the contact, a list appears. The items on the list are **Normally Open**, **Normally Close**, **Rising-edge Trigger**, and **Falling-edge Trigger**. In this example, click **Rising-edge Trigger**.



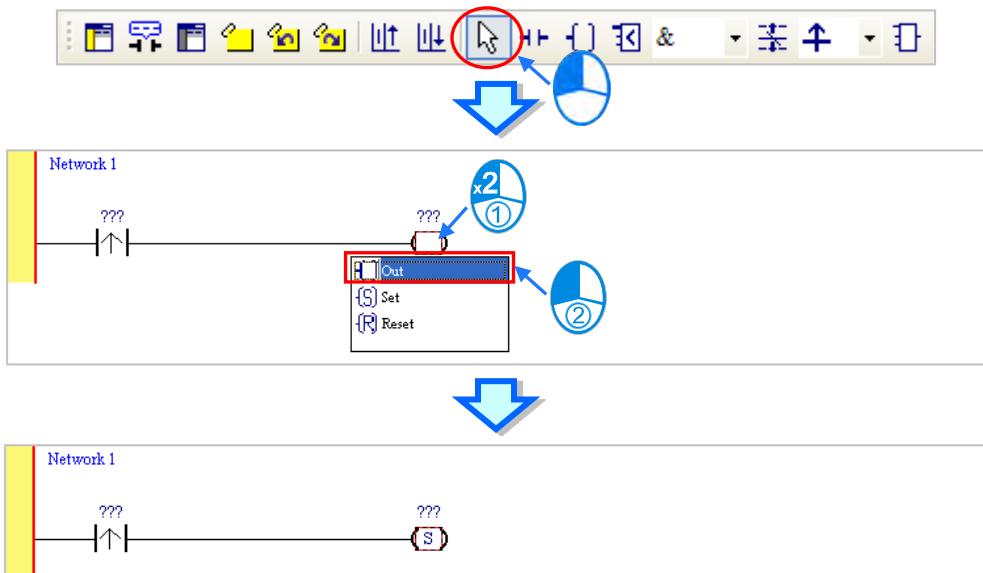
(3) Click the line at the right side of the contact, click  on the toolbar, and then move the mouse cursor to the red frame. The mouse cursor changes to a coil when the mouse cursor is above or under the red frame. Decide where to insert the coil. Decide where to insert the coil.

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.



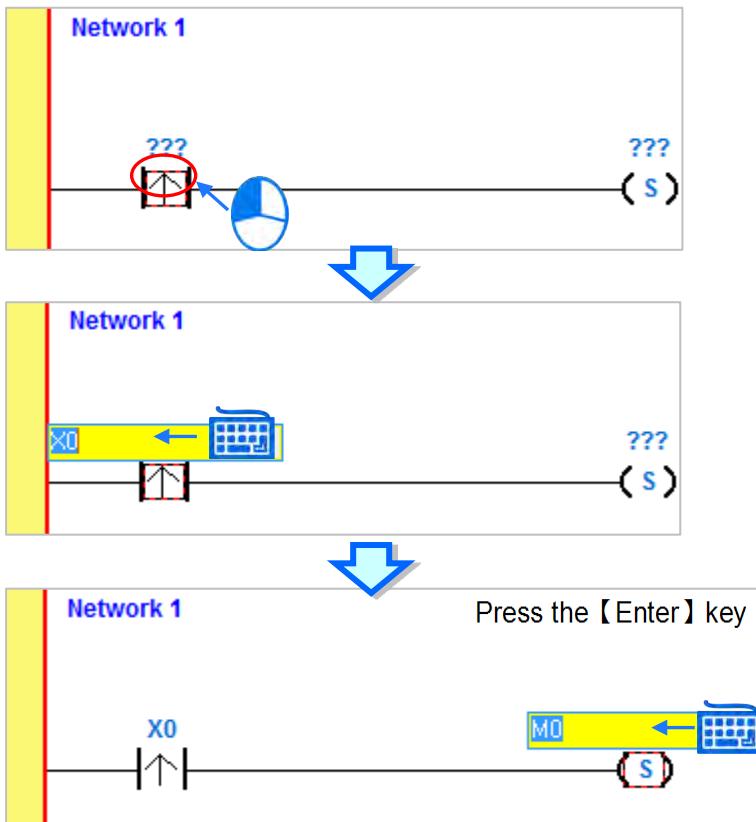
(4) Click  on the toolbar, or press Esc on the keyboard. After you double-click the coil, a list appears.

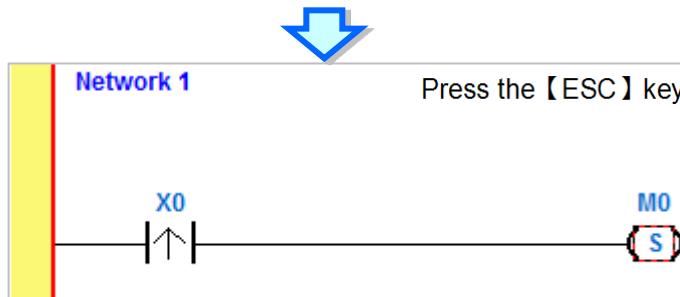
The items on the list are **Out**, **Set**, and **Reset**. In this example, click **Set**.



(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 completing all the fields, press Esc on the keyboard to finish editing.

In this example, type X0 in the box for the contact, and type M0 in the box for the coil.



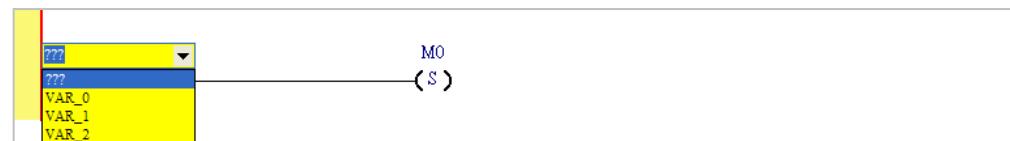


Additional remark

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 within 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, when the device is editable, clear the value in the device and then you can see the available symbols for you to assign to the object. Select a symbol with the mouse or the up/down key on the keyboard. Refer to Chapter 6 in the ISPSofTM User Manual for more information about symbols.

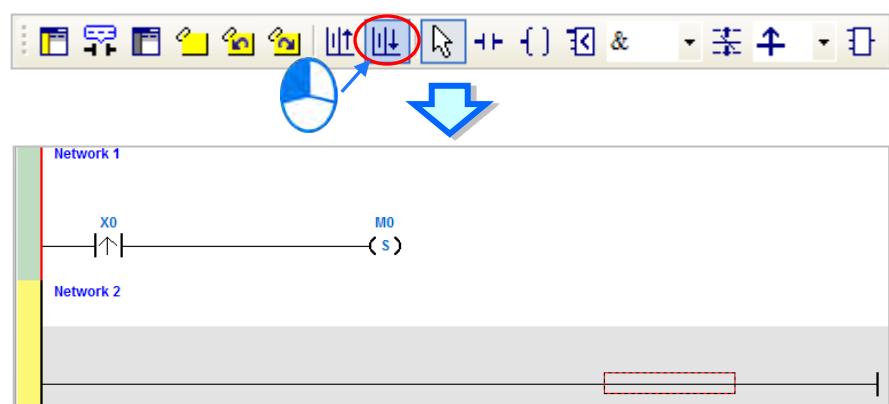


6

6.5.3 Basic Editing – Inserting a Network and Typing an Instruction

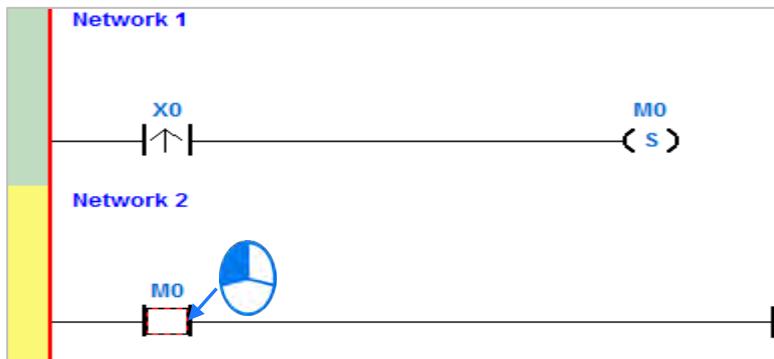
Click on the toolbar to place another network under the selected network; click on the toolbar to place another network above the selected network.

In this example, we add a new **Network 2** below **Network 1**.

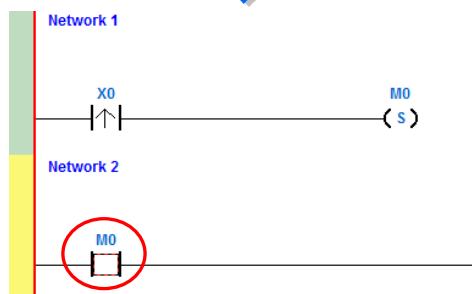
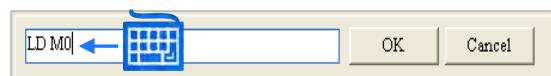


Create a contact and a coil by clicking  and  on the toolbar or by typing instructions.

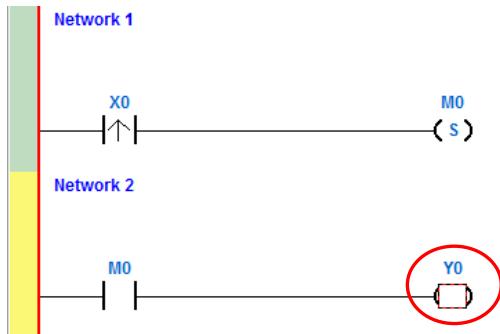
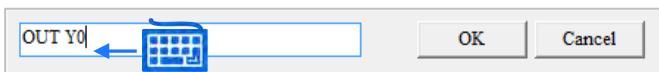
(1) Click the line in Network 2.



(2) Type the IL instruction "LD M0". This instruction is not case-sensitive. As soon as you press a key on the keyboard, an editing box automatically appears. After you finish typing the IL instruction, press Enter on the keyboard or click **OK** at the right side of the box.



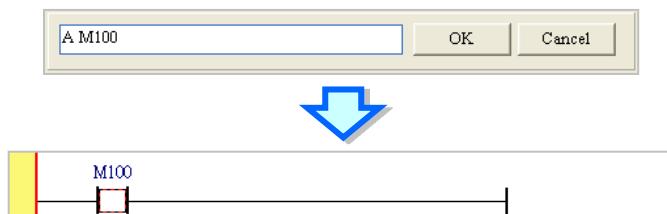
(3) Type the IL instruction "OUT Y0", and write the program as shown below.



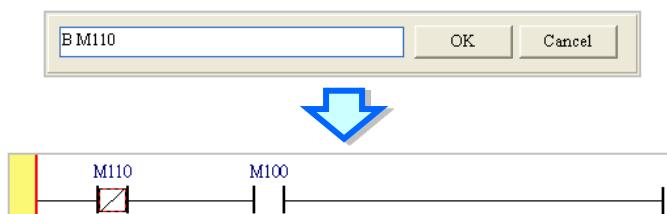
Additional remark

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

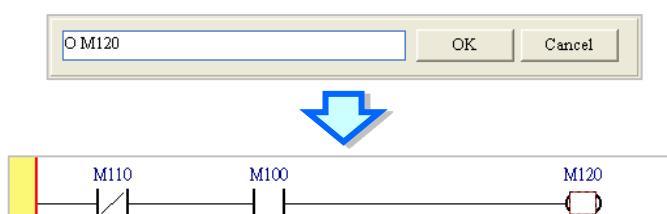
- To Insert a normally-open contact (contact A), type “A <device address>”



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

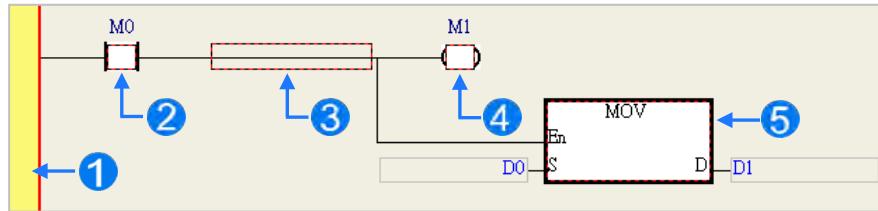


- To insert an output coil (OUT), type “O <device address>”



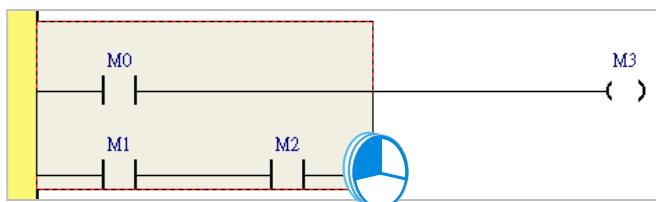
6.5.4 Basic Editing – Selecting a Network and Operation

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.

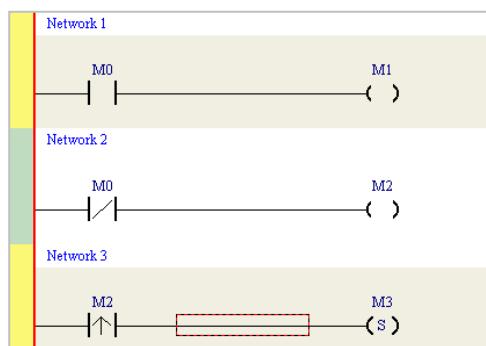


- ① Select the network
- ② Select the input contact
- ③ Select the network
- ④ Select the output coil
- ⑤ Select the block

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.

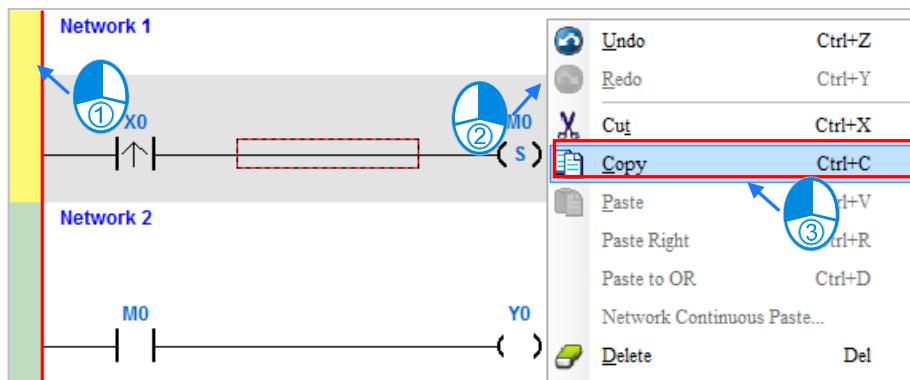


After selecting an object, right-click it to show the context menu.

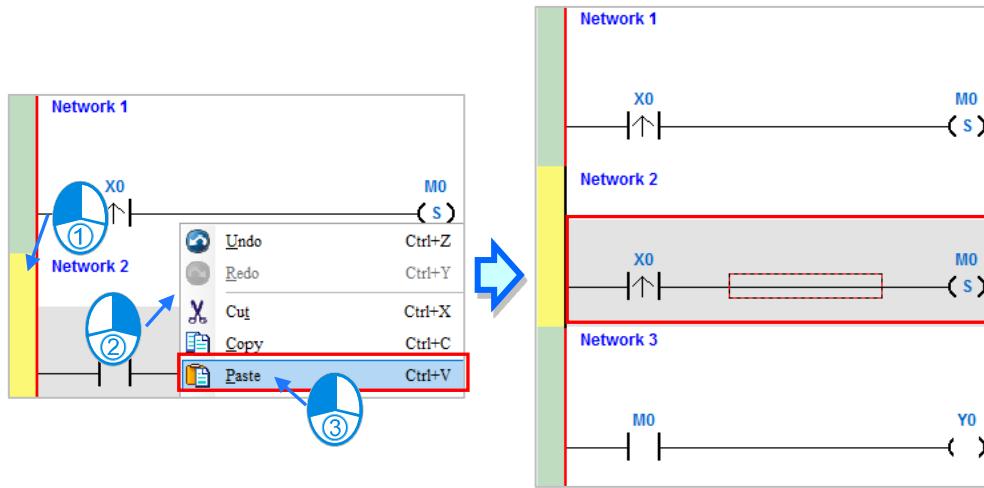
Item	Function
Undo	Undo the last action. You can undo up to 20 previous actions.
Redo	You can redo an action that has been undone.
Cut	Cut a device, block, or network.
Copy	Copy a device, block, or network.
Paste	Paste an object that has been copied or cut into the present position.
Paste right	Paste 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.
Auto Generate Symbols	Used on the contacts of the function block to generate symbols automatically.
Add to Device Monitor Table	Used on the selected contacts to quickly add the device to the Monitor Table.

Proceed with the steps in the example below.

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

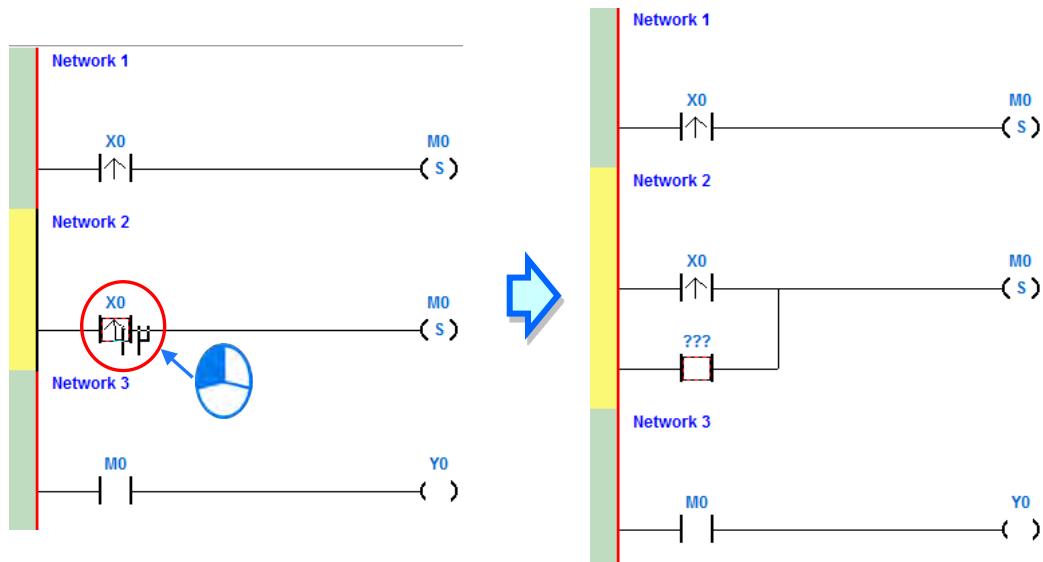


(2) Select Network 2, right-click Network 2, and then click **Paste**. A copy of Network 1 is put above Network 2, and Network 2 becomes Network 3.

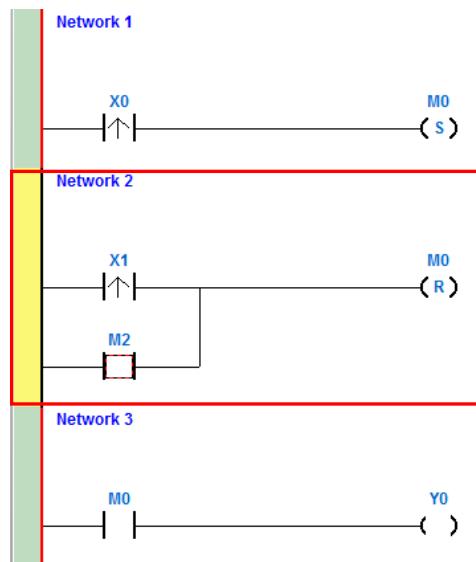


6.5.5 Basic Editing – Connecting a Contact in Parallel

(1) Click on the toolbar, and the mouse cursor changes to a contact. Then 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.

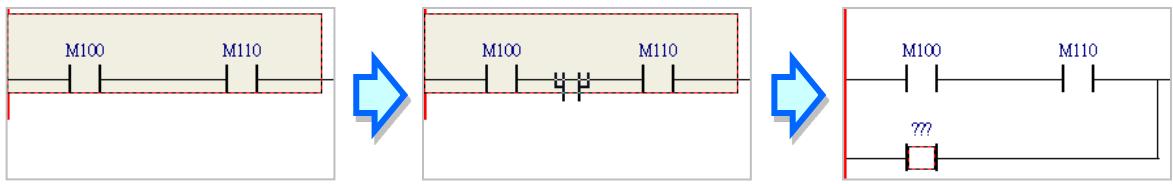


(2) Write the program in Network 2 as shown below.



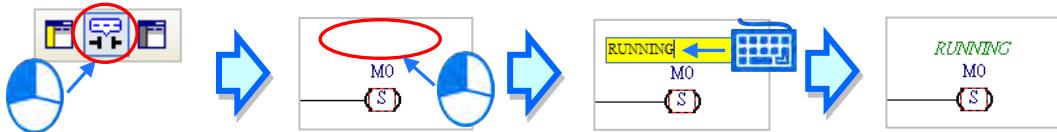
Additional remark

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

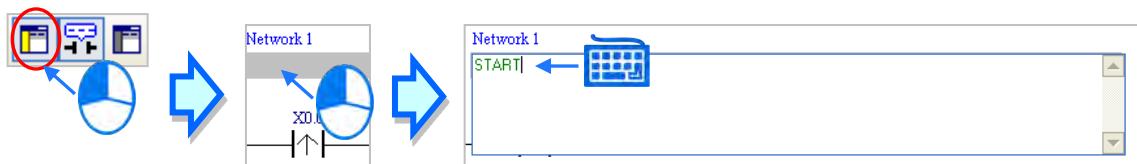


6.5.6 Basic Editing – Editing a Comment

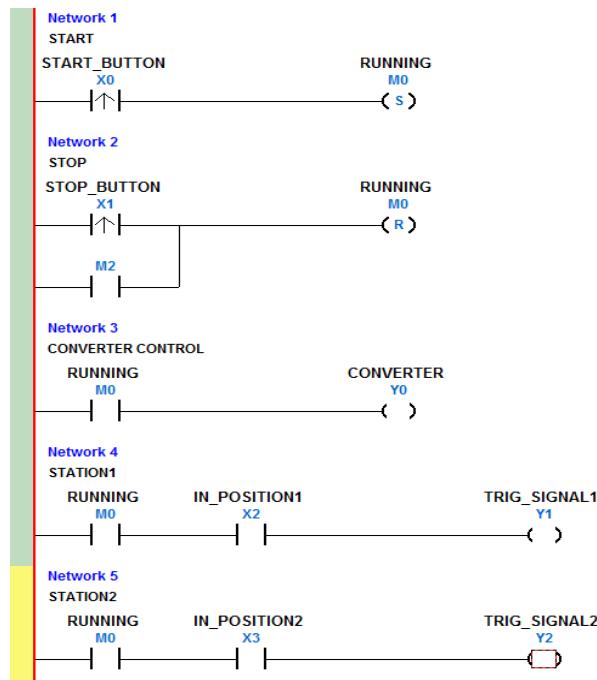
(1) Press  on the toolbar. Click the position above a device name, type a comment in the box, and then press Enter on the keyboard.



(2) Press  on the toolbar. Click the position under the 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.

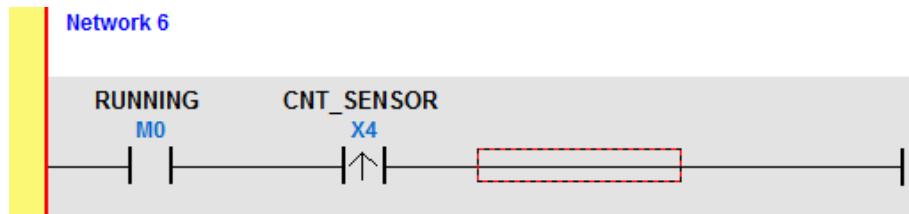


(3) Write the program shown below.



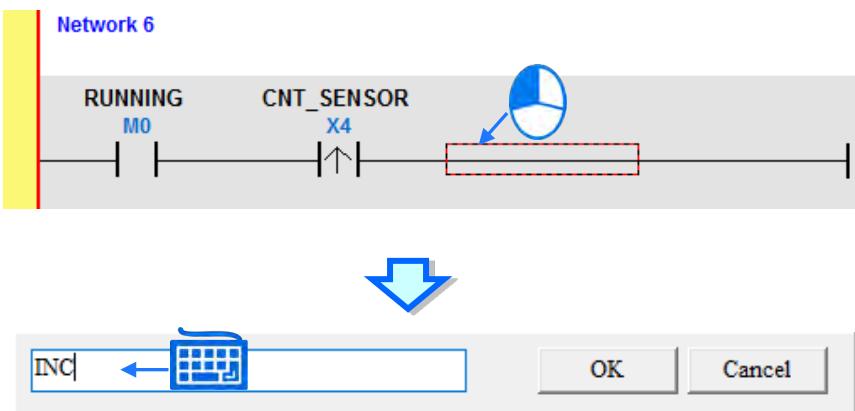
6.5.7 Basic Editing – Inserting an Applied Instruction

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.



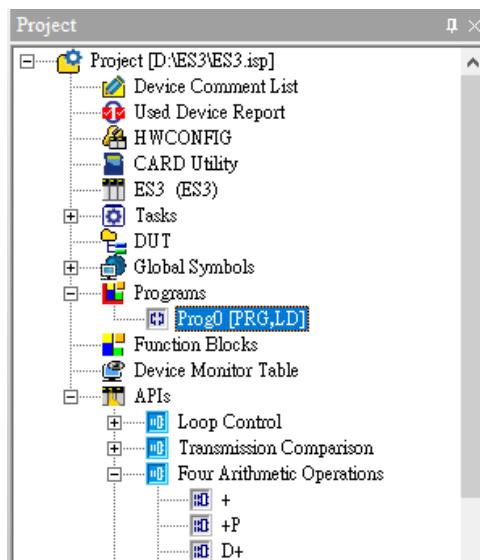
- Method 1

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

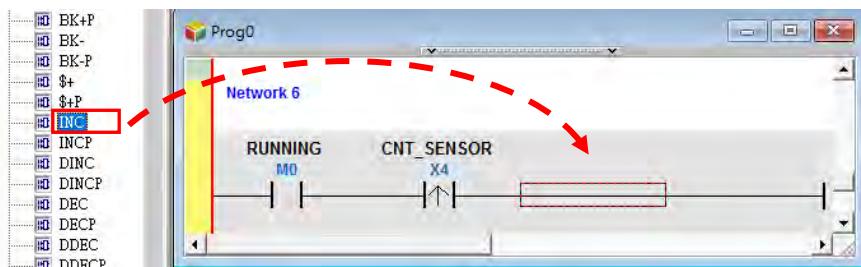


- Method 2

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

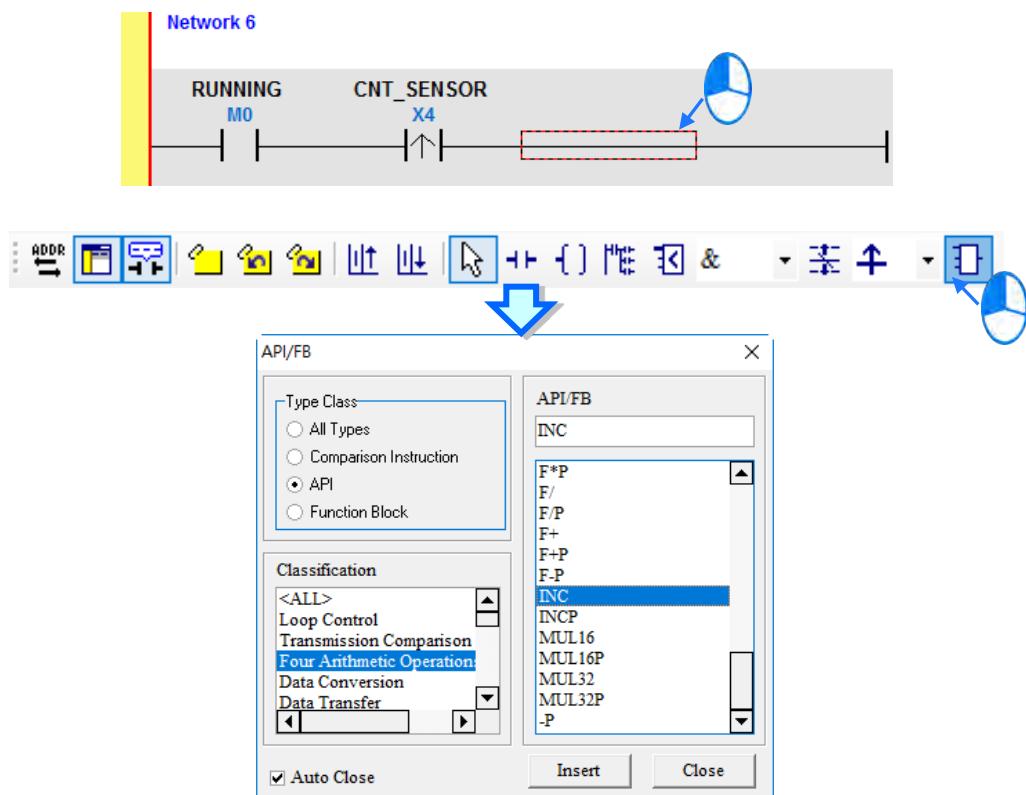


Click the instruction (INC in this example) that you want to insert, and then drag it to the desired position.

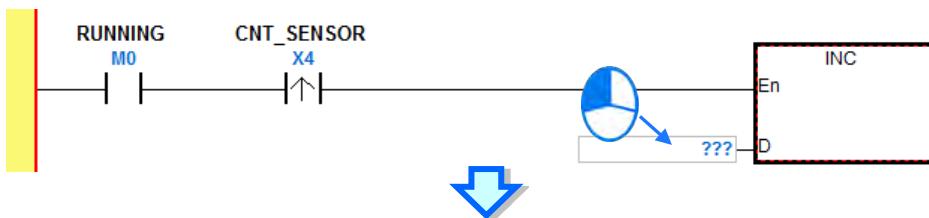


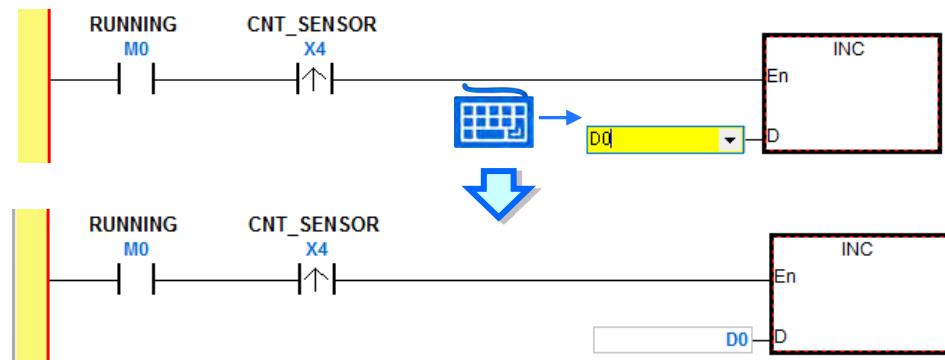
- Method 3

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**.



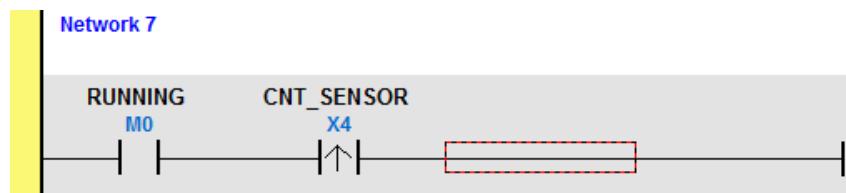
After you insert the instruction, assign a device address to the operand, and write the program shown below.





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

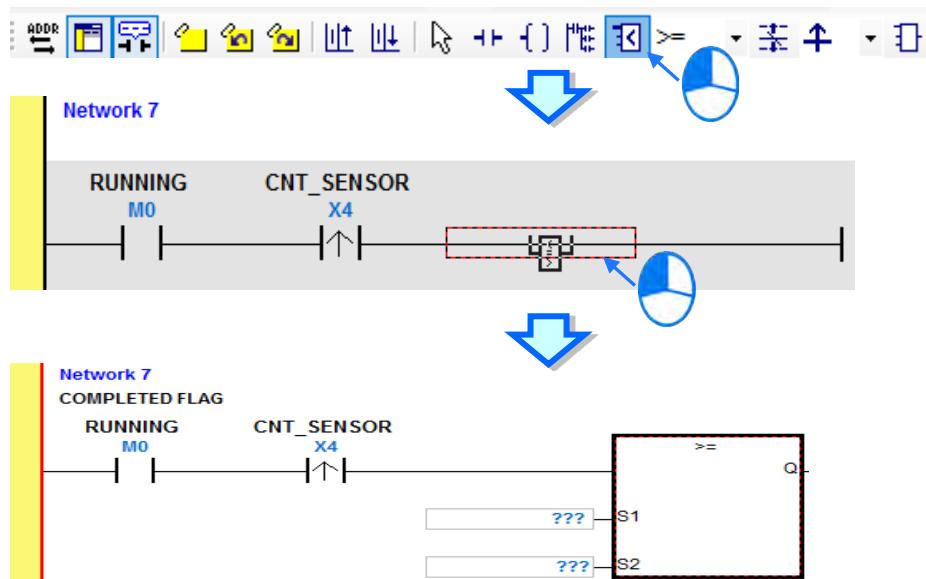
In addition to the three methods introduced in section 6.5.7, you can insert a comparison contact using the following steps. Add Network 7 under Network 6, and write the program shown below.



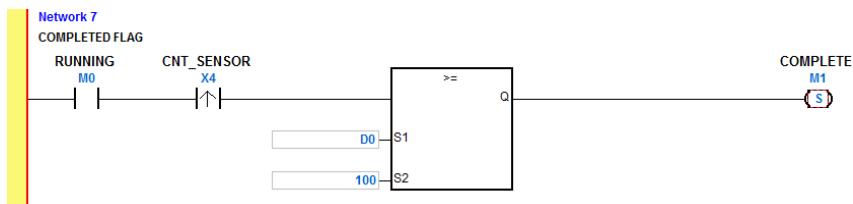
- (1) Click  on the toolbar, and then select an operator (\geq in this example).



- (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.

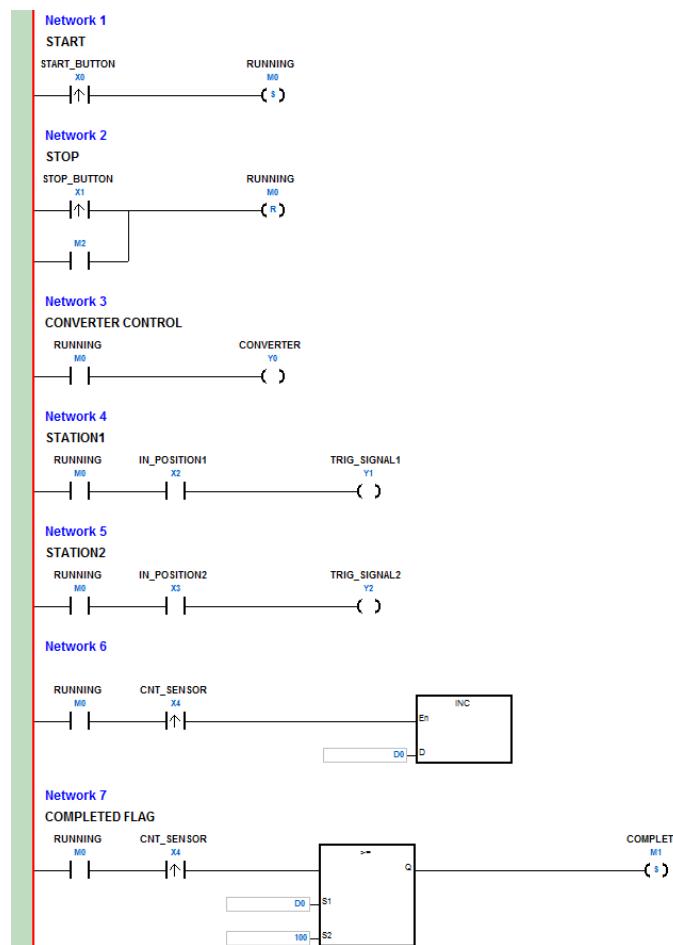


Write the program shown below. In WPLSoft, K precedes a decimal value and H precedes a hexadecimal value. To type a decimal value in ISPSoft, type it directly. To type a hexadecimal value in ISPSoft, type “16#” and the hexadecimal value; e.g. 16#7FFF. In ISPSoft, 8# precedes an octal value, and 2# precedes 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 10 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 system only checks the syntax and structure in the present window after you run the **Check** function. The system checks the entire project after you run the **Compile** function. If the system detects no errors in the project, it automatically generates the 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.



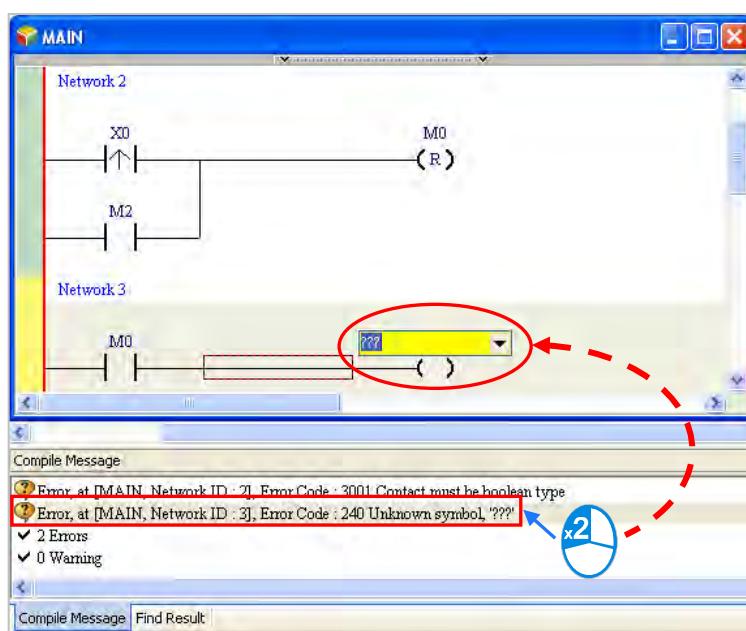
- **Compile**

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. By double-clicking the message, the system will automatically guide you to the location where the error occurred. After correcting the error, simply run the **Check** or **Compile** function again.

6



6.6 Testing and Debugging a Program

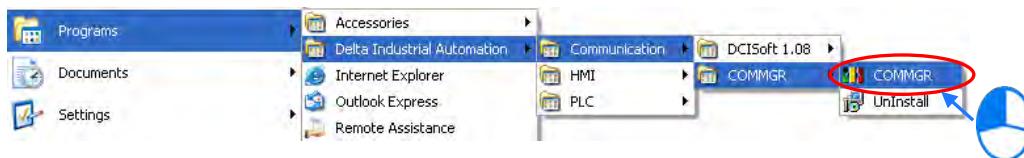
This section will use ISPSoft software as an example for explanation. Refer to Chapter 5 of the DIADesigner User Manual for information related to DIADesigner software.

6.6.1 Creating a Connection

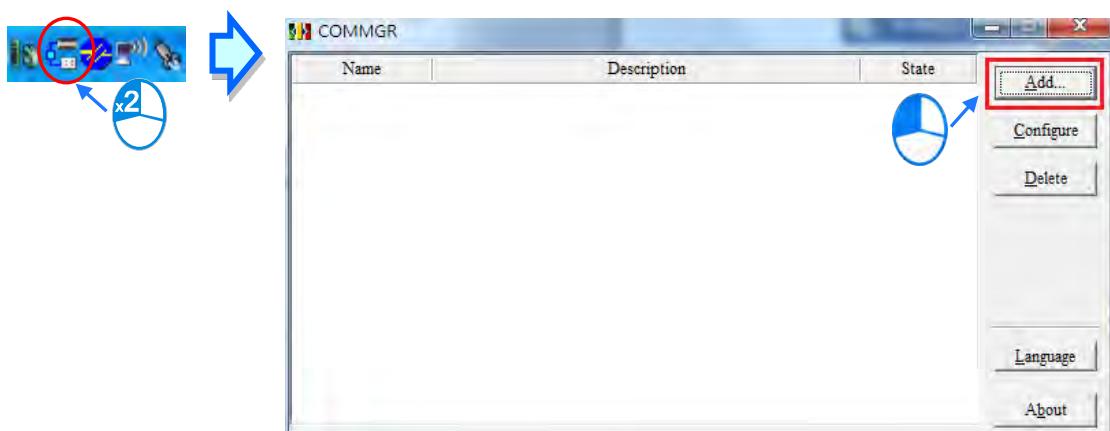
Before you download a program and parameters to a PLC or monitor them online, connect ISPSoft to the PLC. In this example, connect ISPSoft to the CPU module DVP32ES311T with a USB cable. Refer to Section 2.4 in the ISPSoft User Manual for more information about connecting ISPSoft to a PLC in other ways.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

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.

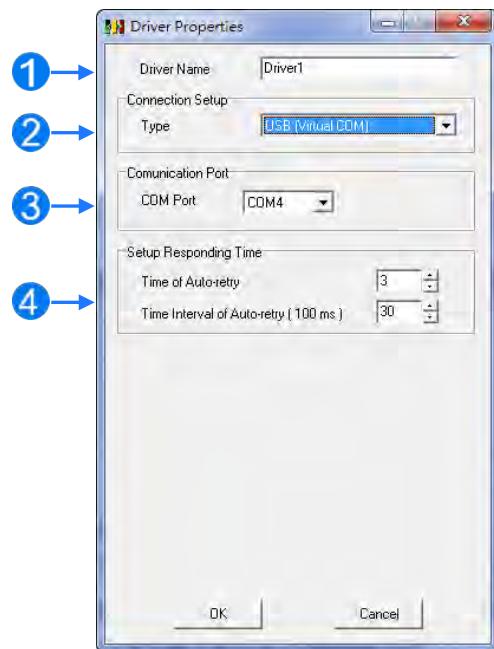
- (1) Make sure that the wiring is correct, and then power on the CPU module.
- (2) Connect the CPU module to the computer with a USB cable. If the USB driver for the DVP-ES3 series CPU module is already installed on the computer, **Delta PLC** appears in the **Device Manager** window, and a port number 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 is displayed on the system tray. If the COMMGR icon 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 COMMGR icon on the system tray to open the **COMMGR** window. Click **Add** in the **COMMGR** window to create a driver.



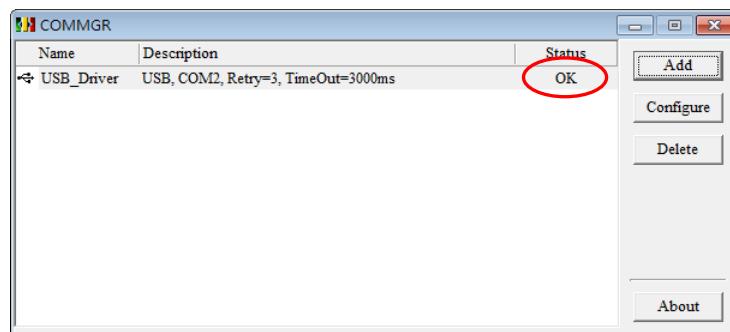
(5) Set the parameters in the **Driver Properties** dialog box, and then click **OK**.



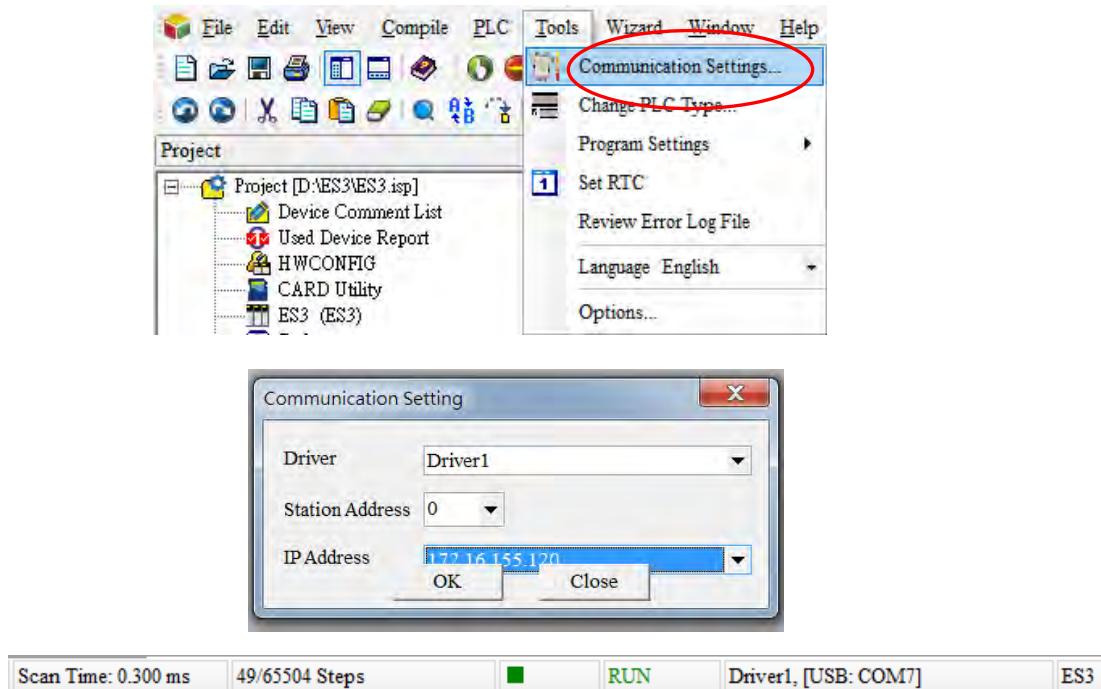
- ① Type a driver name in the **Driver Name** box.
- ② Select **USB (Virtual COM)** in the **Type** list in the **Connection Setup** section.
- ③ Select a communication port in the **COM Port** list. If the first two steps are complete, the connected PLC name and its communication port will be displayed in the **COM Port** dropdown menu.
- 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

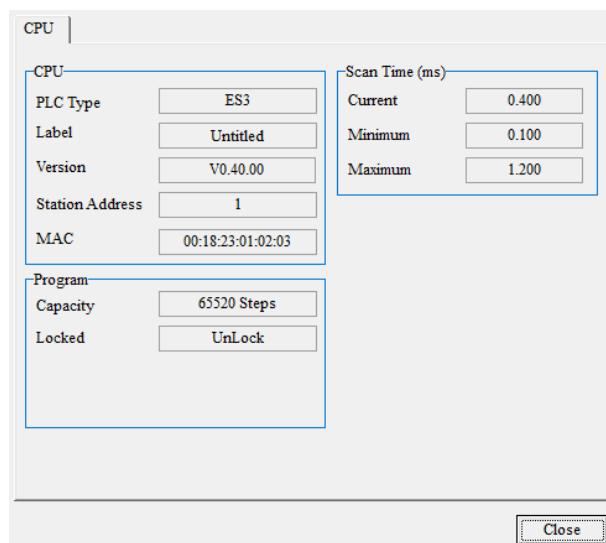
(6) After you finish the setup, check if the Status of Driver is OK, you can close the window. And COMMGR is successful installed in Windows.



(7) 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.



6
(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.

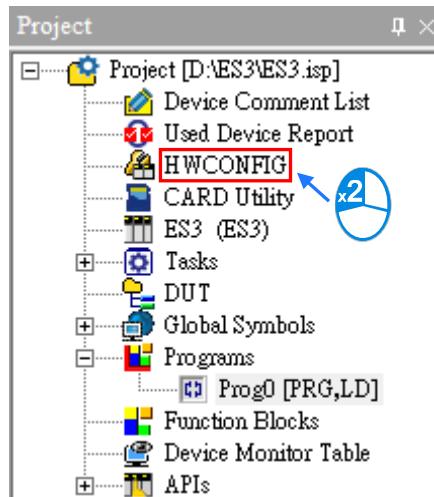


6.6.2 Downloading a Program and Parameters

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.

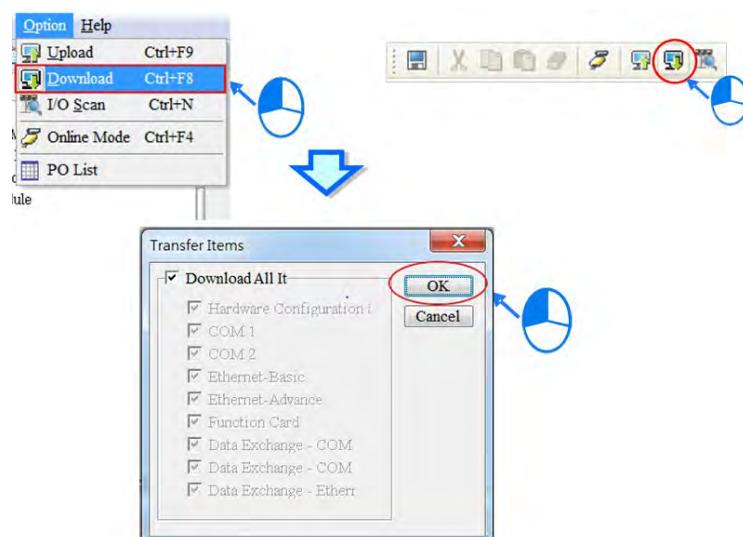
- **Downloading the hardware configuration**

- (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.

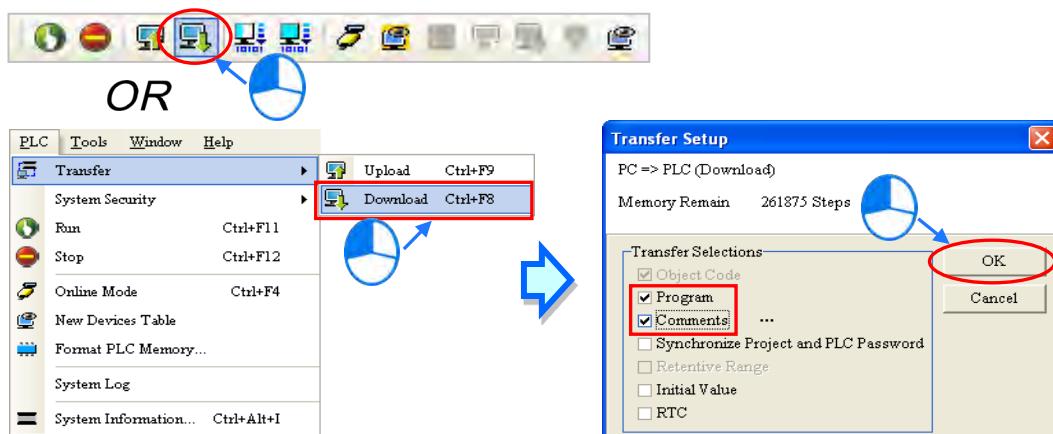
- (3) On the **Options** menu, click **Download**, or  on the toolbar. The **Transfer Items** dialog box appears. Click **OK** to download the hardware configuration to the CPU module.



(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, it indicates that 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**.



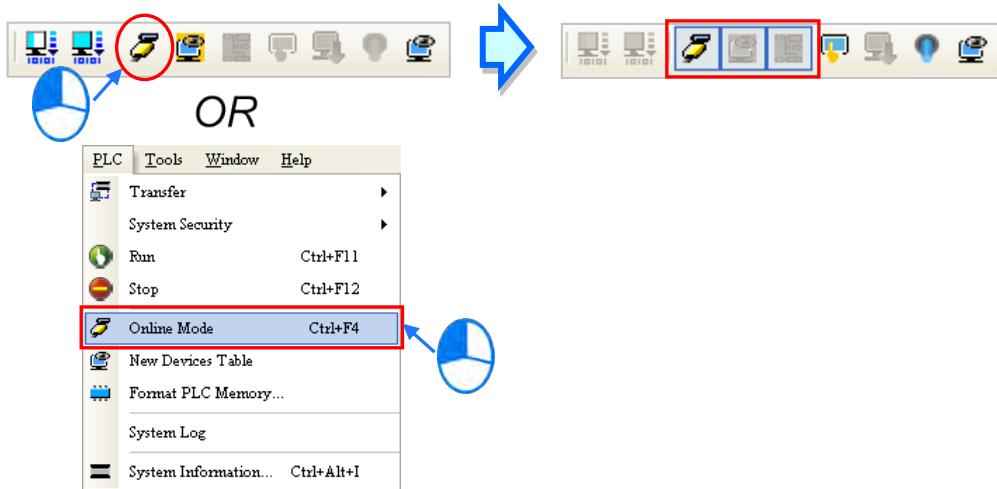
6.6.3 Connection Test

After you download a program to a PLC, you can monitor the execution status of the PLC through ISPSof. ISPSof 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, ISPSof updates only the status of the devices. The current program in ISPSof 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 ISPSof 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.

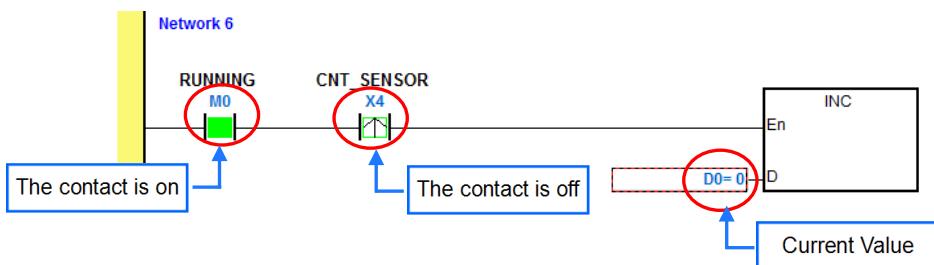
On the **PLC** menu, click **Online Mode**, or  on the toolbar, to enable the online monitoring function. The system also enables device monitoring mode and program monitoring mode.



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 current status of the devices is displayed in the original program editing window after you enable the program monitoring function.

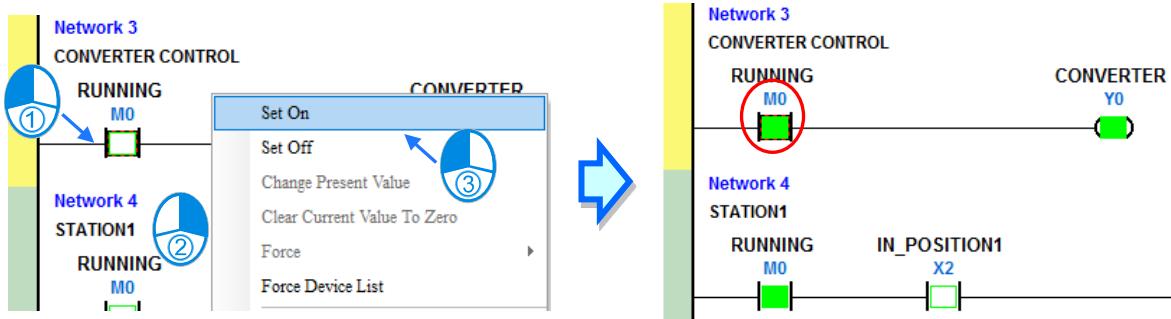


You can change the operating state of a PLC with the RUN/STOP switch on the PLC. You can also change the operating status of a PLC with the functions provided by ISPSOFT. On the **PLC** menu, click **Run** or  on the toolbar to start the PLC. On the **PLC** menu, click **Stop** or  on the toolbar to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



In the online monitoring mode, you can select a device, then right-click the device, and 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.

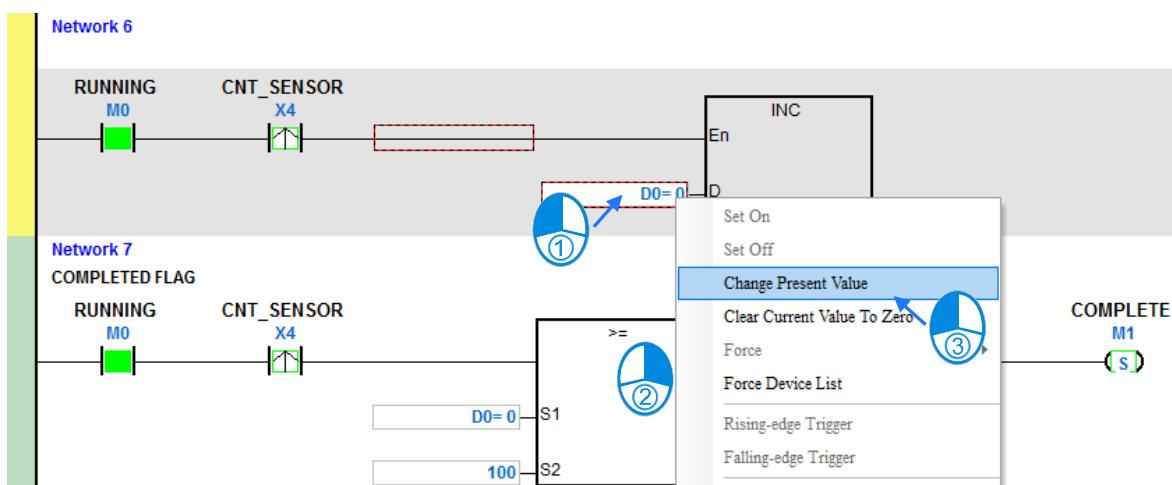
! Before you change the status of a device, make sure the operation does not cause damage to equipment or personnel.



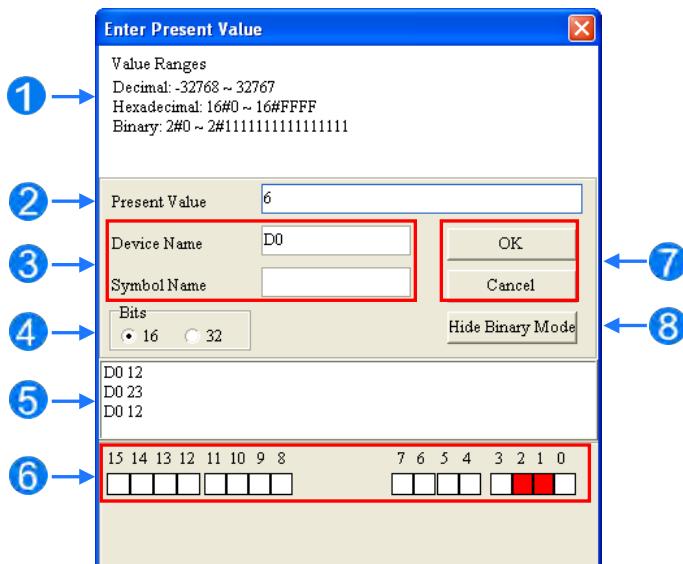
The table below describes the items in the context menu. The **Force** command only applies to input and output contacts.

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 to ON or OFF
Force Device List	Use tables to batch manage the force status of input or output contacts

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.

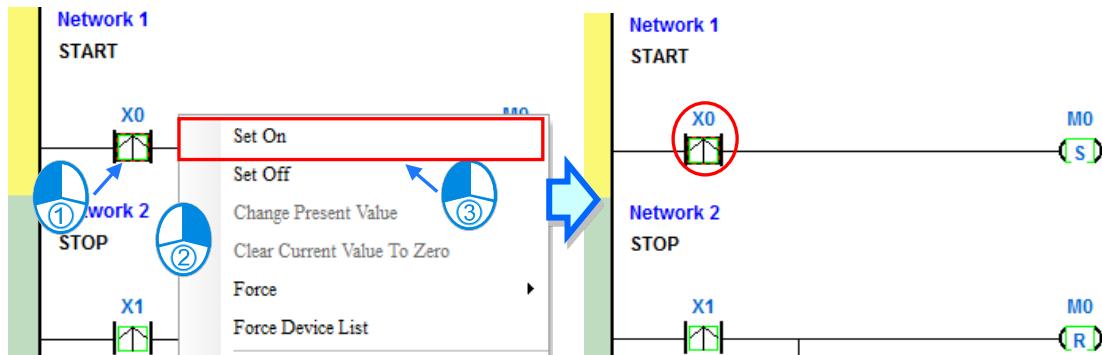


The list below describes the **Enter Present Value** dialog box.



- ① Message
- ② Type a value in the **Present Value** box.
- ③ Type the name of a device or a symbol whose present value you want to change
- ④ Type a 16-bit or 32-bit value.
- ⑤ Value change history (Format: Device name Value)
- ⑥ In binary mode, use the mouse to set the bit states.
- ⑦ Click **OK** to apply the setting values. Click **Cancel** to close the window without applying the values.
- ⑧ 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. If you try to set X0–X17 to ON or OFF in the program editing window, the actual external input signals will still continuously update these contact states.



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 to ON
Off (X/Y)	Force the selected input or output contact to 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 to ON or OFF, the program execution result does not affect the output state of this contact.

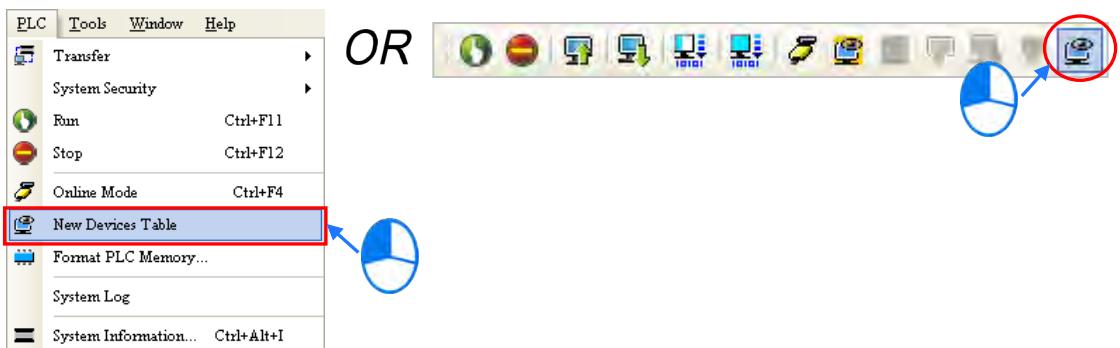


*. If you disable the online monitoring function, the contacts are not automatically released from the locked states. You must check whether the contacts need to be released from the locked states after you complete the test.

You can create a monitoring table online or offline.

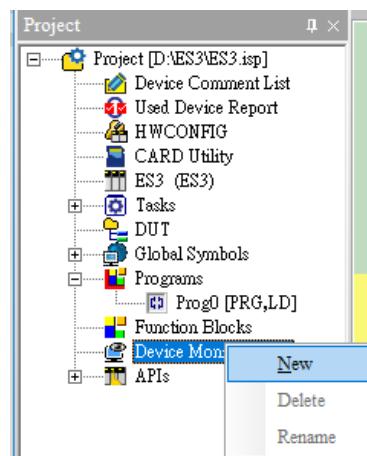
- **Method 1**

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

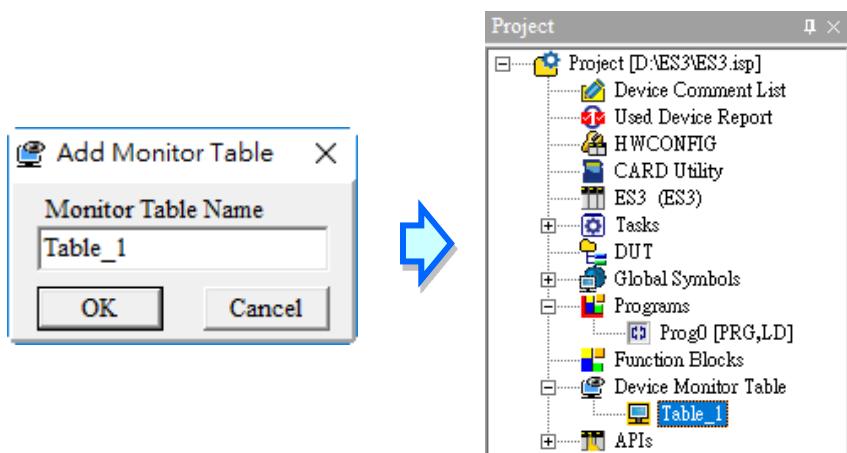


- **Method 2**

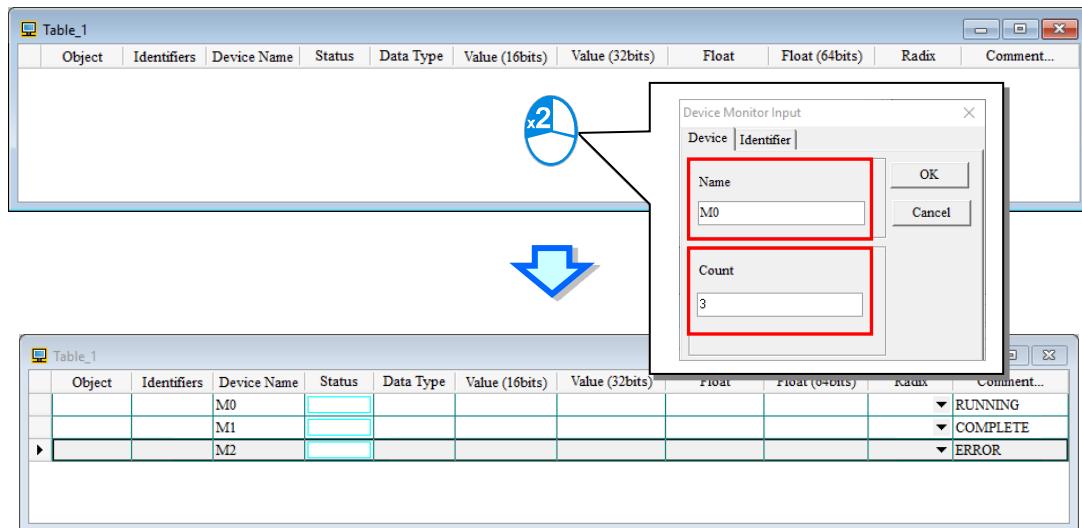
Right-click **Device Monitoring Table** in the project management area, and click **New**.



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.



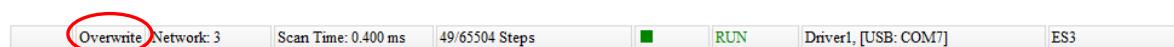
After you double-click the item, an item monitoring window appears. You can add items to be monitored to the window. To add an item to the window, double-click the blank space in the monitoring table, type a device name, a start address, and the number of devices to be monitored in the **Device Monitor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



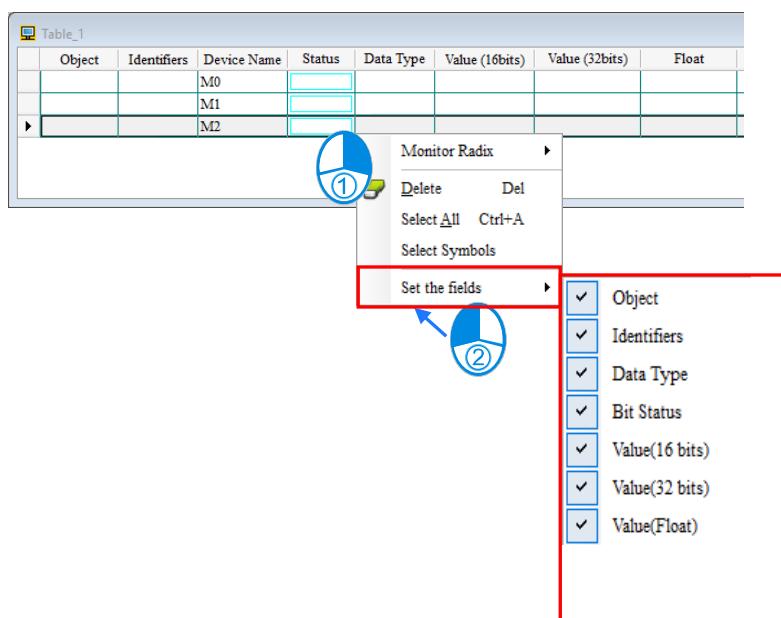
When adding device items to the monitoring table, press Insert key on the keyboard to switch between insert or replace mode. The selected mode displays in the status bar in ISPSOFT.

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

If you select replace mode, the new item overwrites the selected item in the monitoring table.



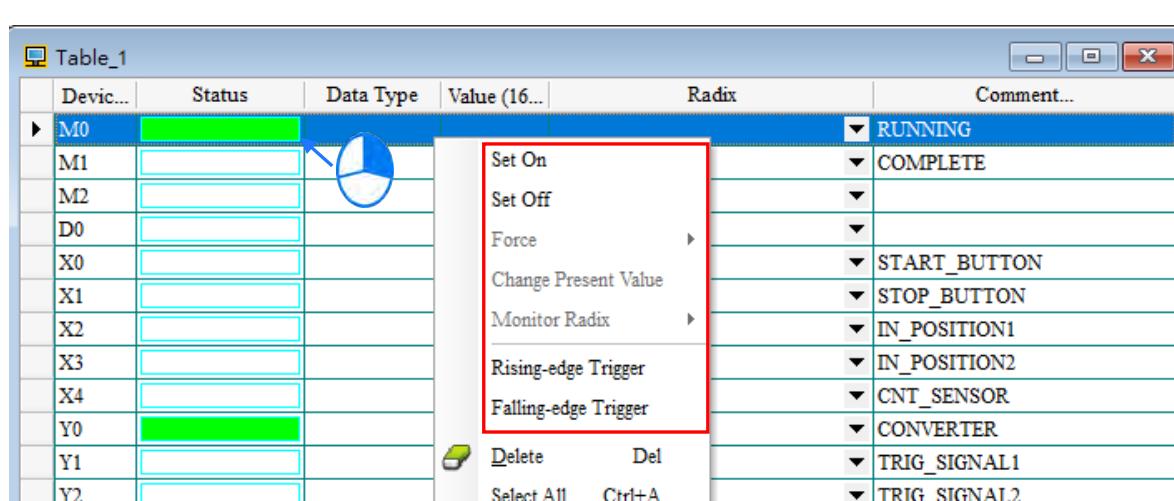
To hide certain columns in the monitoring table, right-click the monitoring table, point to **Set the Fields**, and clear certain items. After you clear an item, the corresponding column disappears.



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 that is the same as the one in the program editing window. You can change the item state or the item value by clicking an item in this context menu.



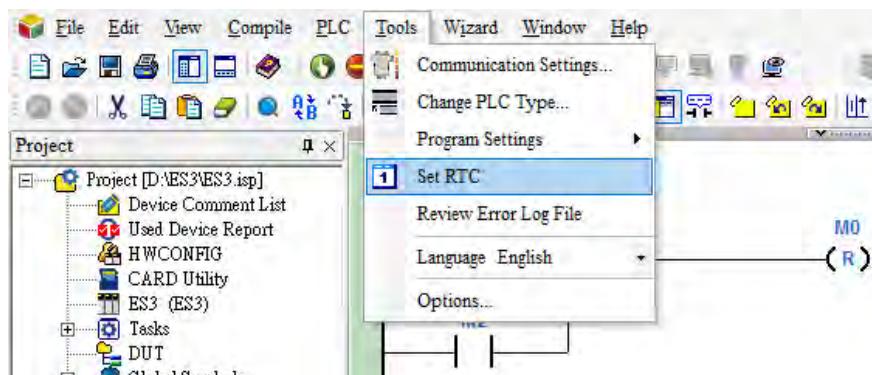
You can text and debug the program you created in this chapter through the monitoring table you created in this section. Refer to Chapter 18 in the ISPSof User Manual for more information about testing and debugging a program.

6.7 Setting a Real-time Clock

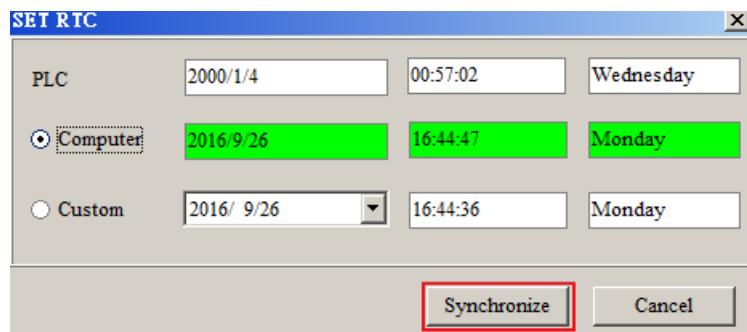
After you connect an DVP-ES3/EX3/SV3/SX3 Series CPU module to a computer, you can set the real-time clock in the CPU module through ISPSoft/DIA Designer.

● ISPSoft

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



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

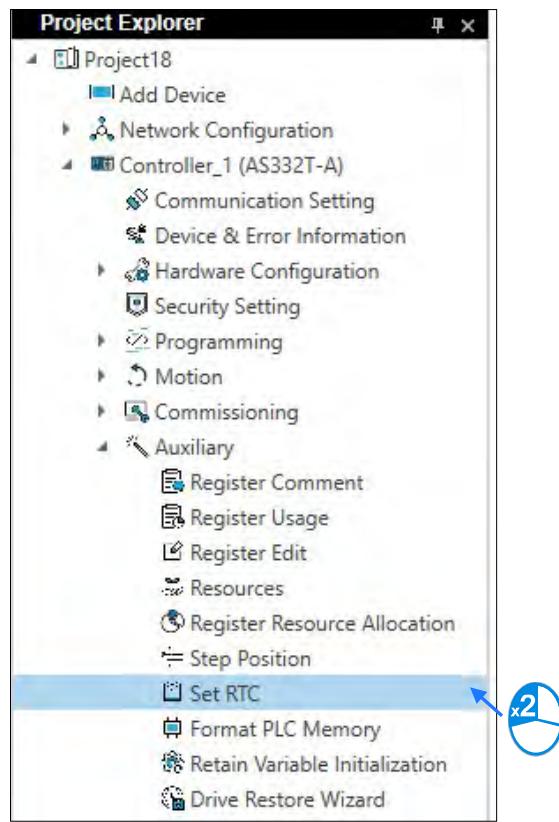


- (3) RTC setting is complete.

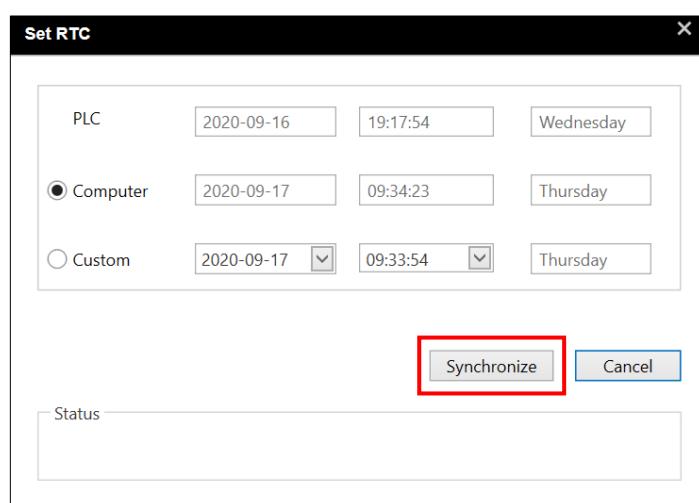


- **DIADesigner**

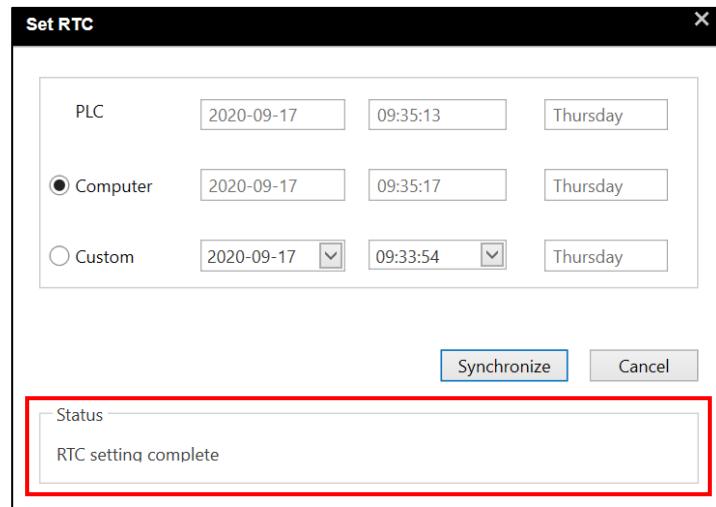
- (1) Go to *Project Explorer* > *Controller* > *Auxiliary* > *Set RTC*. And double-click **Set RTC** to open the setting page.



- (2) Select **Computer** and click **Synchronize** to have the time synchronized with the computer.



(3) Check the status to see if the setting is complete.



Chapter 7 Memory Card

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7.1 Overview of Memory Cards

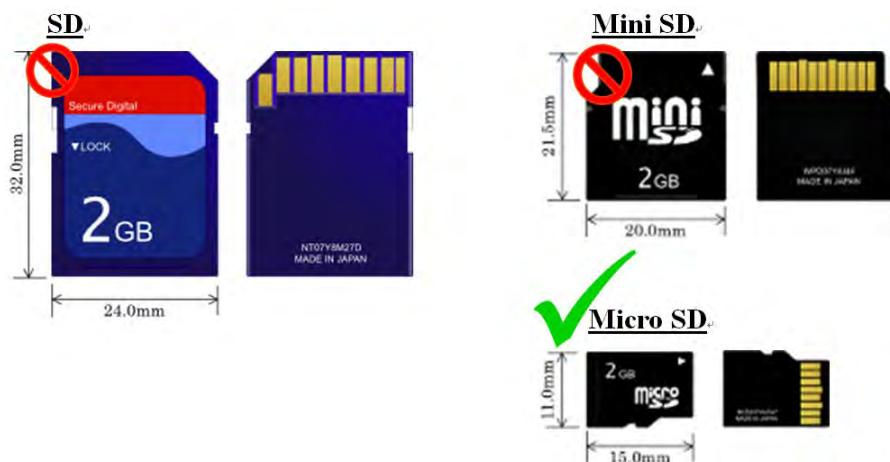
You can use either ISPSoft or DIADesigner to edit DVP-ES3. But only use DIADesigner to edit DVP-ES300TEC/EX3/SV3/SX3.

The DVP-ES3/EX3/SV3/SX3 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/EX3/SV3/SX3 CPU modules.

7.1.1 Appearances of Memory Cards

SD cards are classified into three types according to size: SD cards, Mini SD cards, and MicroSD cards.

DVP-ES3/EX3/SV3/SX3 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/EX3/SV3/SX3 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/EX3/SV3/SX3. Be sure to purchase products that meet these specifications.

- SD card families

Type	SD		SDHC			SDXC	
Capacity	32 MB to 2 GB		4 GB to 32 GB			32 GB to 2 TB	
File system	FAT16/FAT32			FAT32			exFAT (FAT64)
Size	SD	SDHC	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/EX3/SV3/SX3 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.

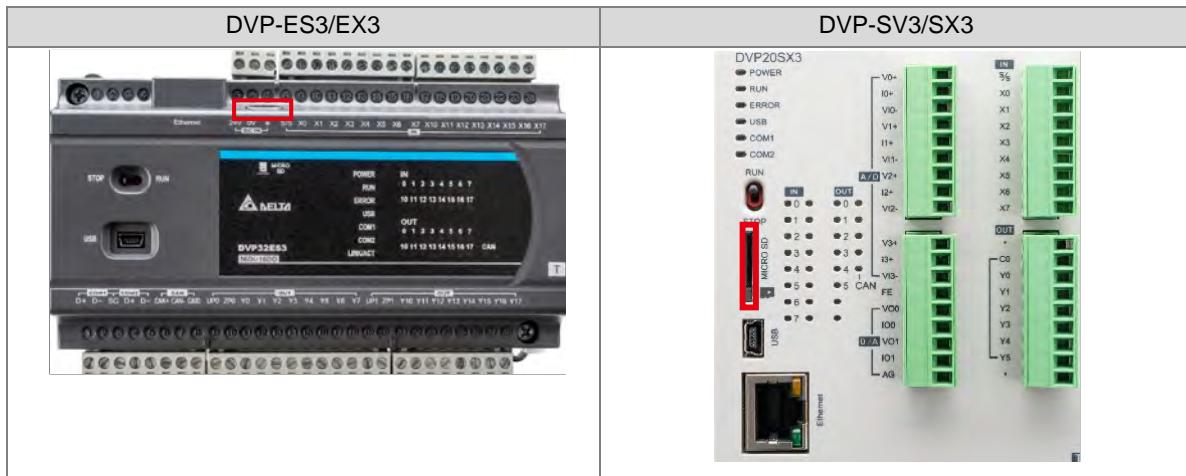
 When you format a memory card, you also delete all the data in the memory card. Verify whether you need to back up the data in a memory card before you format the memory card.

- (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

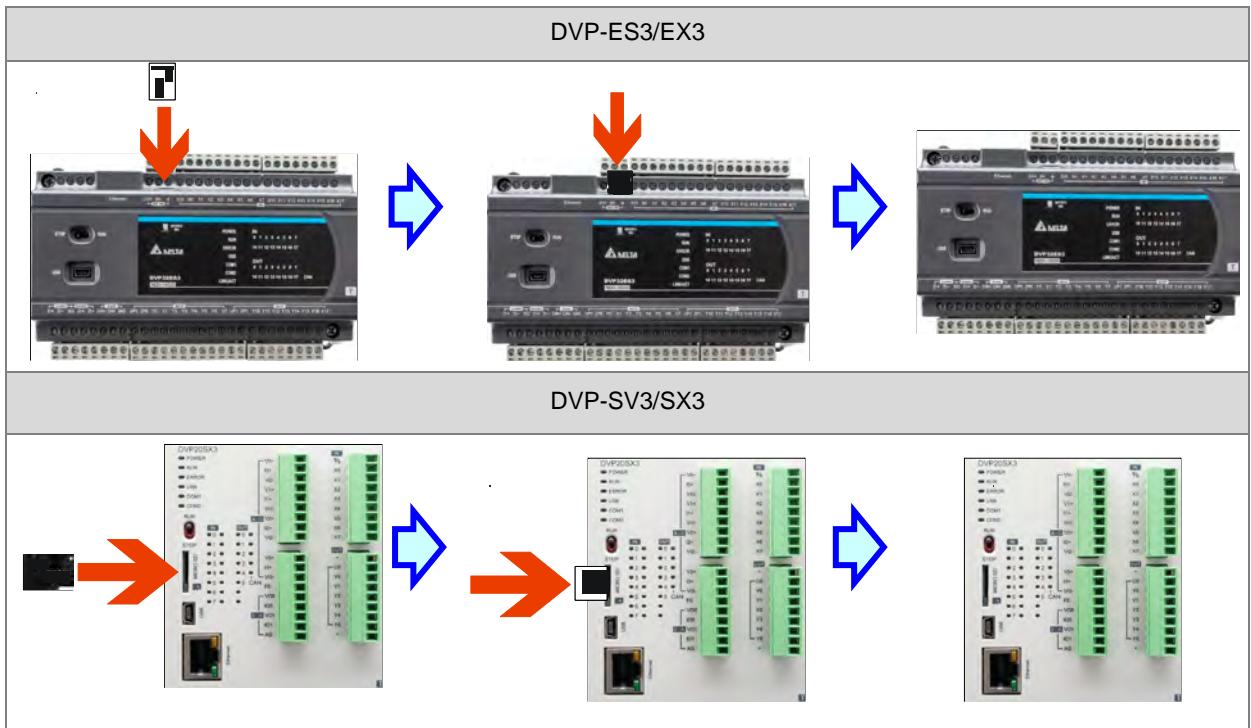
7.3.1 Memory Card Slot in a CPU Module

The memory card slot is on the front side of the DVP-ES3/EX3/SV3/SX3 PLC.



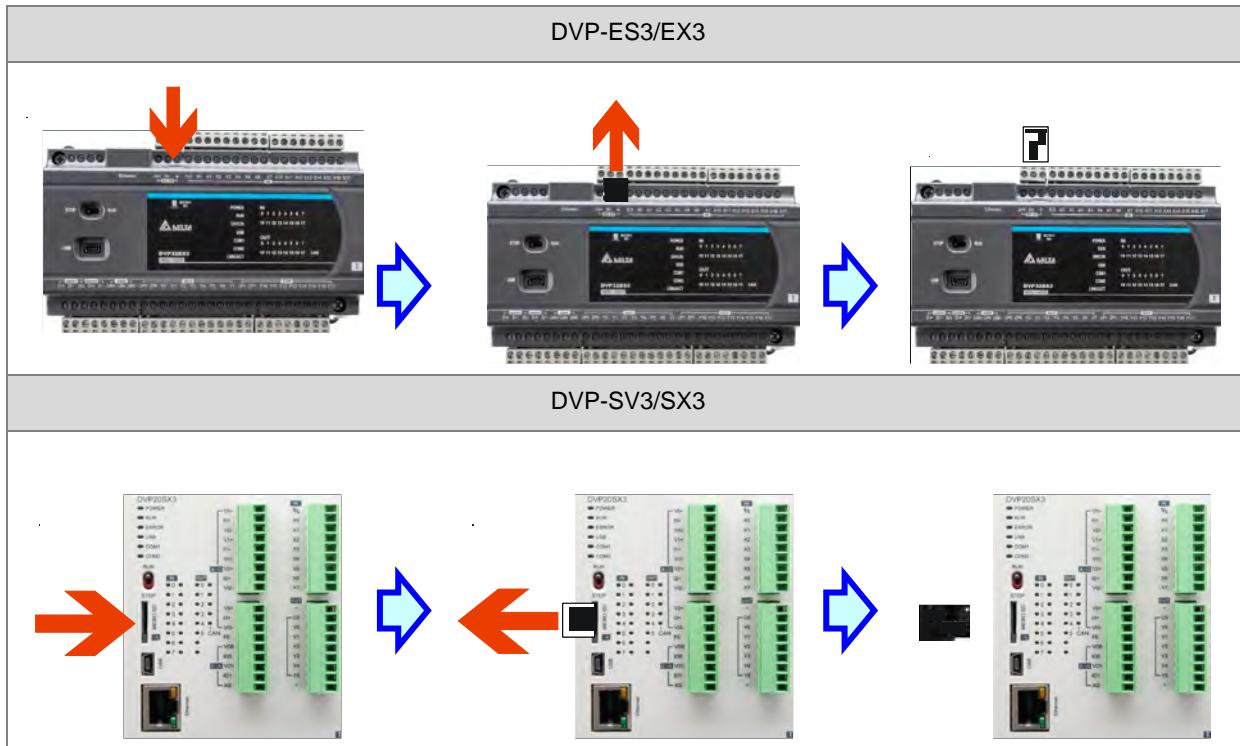
7.3.2 Installing a Memory Card

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.

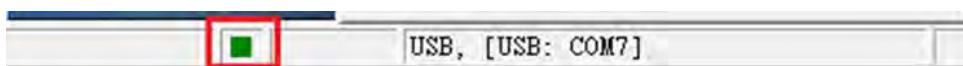


7.4 Memory Card Contents

7.4.1 Initializing a Memory Card

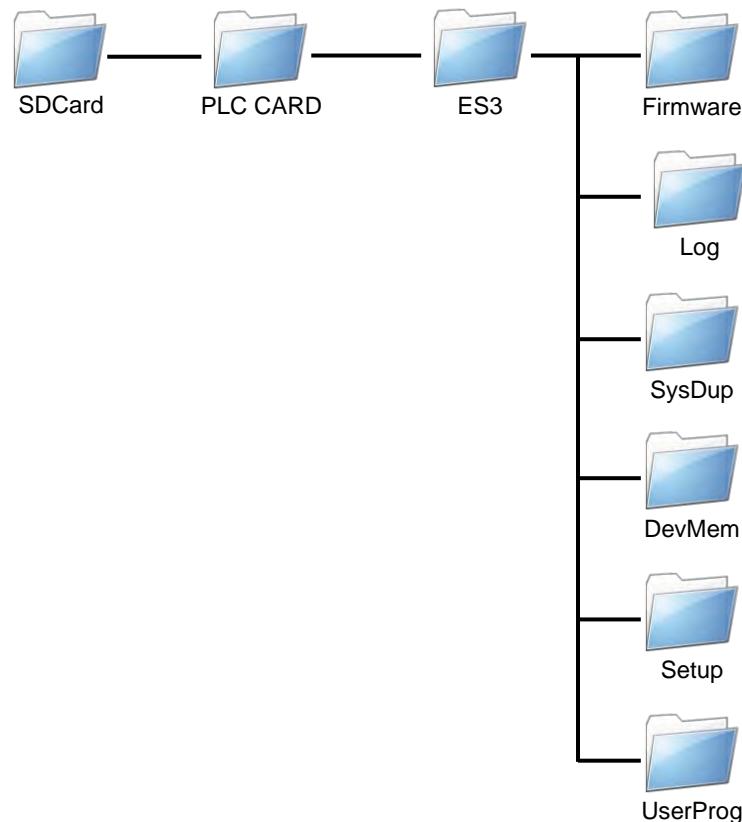
When you insert an SDHC card into a CPU module that is powered on, and use ISPSSoft / DIADesigner -> CARD Utility to back up a project, the system initializes the SDHC card, and creates a default folder named according to the model of the CPU module. (If the folder has already existed, the system does 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/EX3/SV3/SX3 System. The folder name is ES3. Several subfolders are contained inside the ES3 folder. Related files created by you and the DVP-ES3/EX3/SV3/SX3 system are stored in the subfolders.



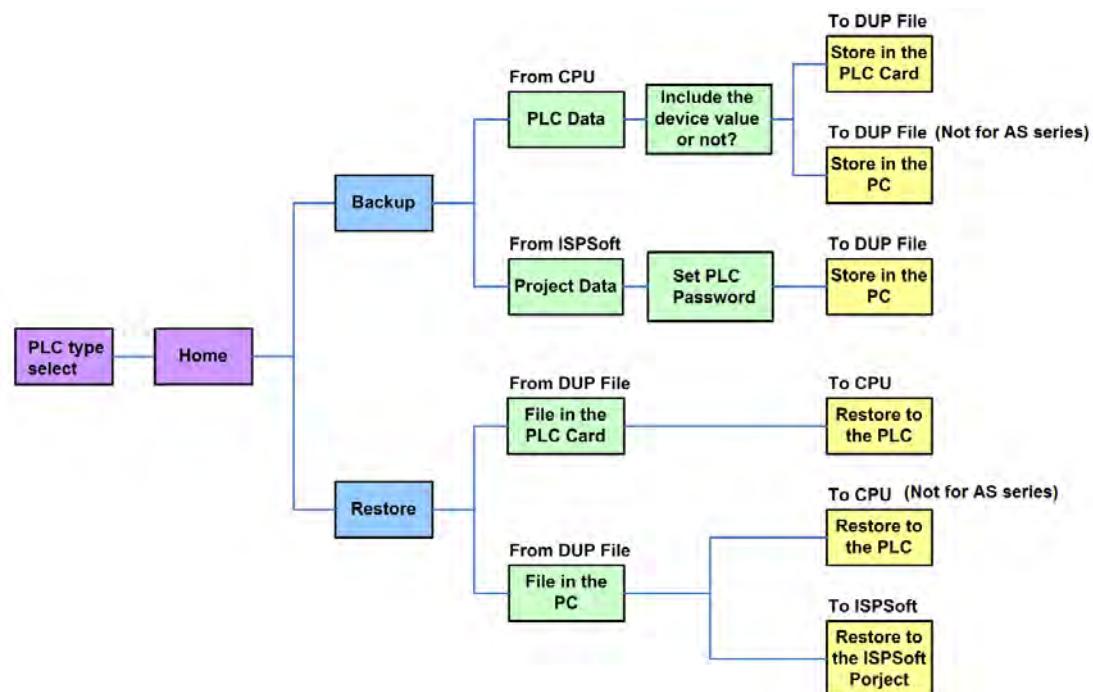
Folder	Description
Firmware	Stores firmware files (.ext)
Log	Stores Log files (.log)
SysDup	Stores backup files (.dup)
UserProg	Stores device memory files (.txt, .dmd, .csv)
DevMem, Setup	Reserved for the system use

7.5 Introduction to the CARD Utility

The DVP-ES3/EX3/SV3/SX3 CPU modules include SDHC slots, and you can back up and restore module data with a memory card. DIADesigner/ISPSof includes the **CARD Utility** for the DVP-ES3/EX3/SV3/SX3 CPU modules. With this utility, you can back up and restore data in a DVP-ES3/EX3/SV3/SX3 CPU module or backup and restore an ISPSof 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 CPU module. You can use either ISPSof or DIADesigner to edit DVP-ES3. But only use DIADesigner to edit DVP-ES300TEC/EX3/SV3/SX3.

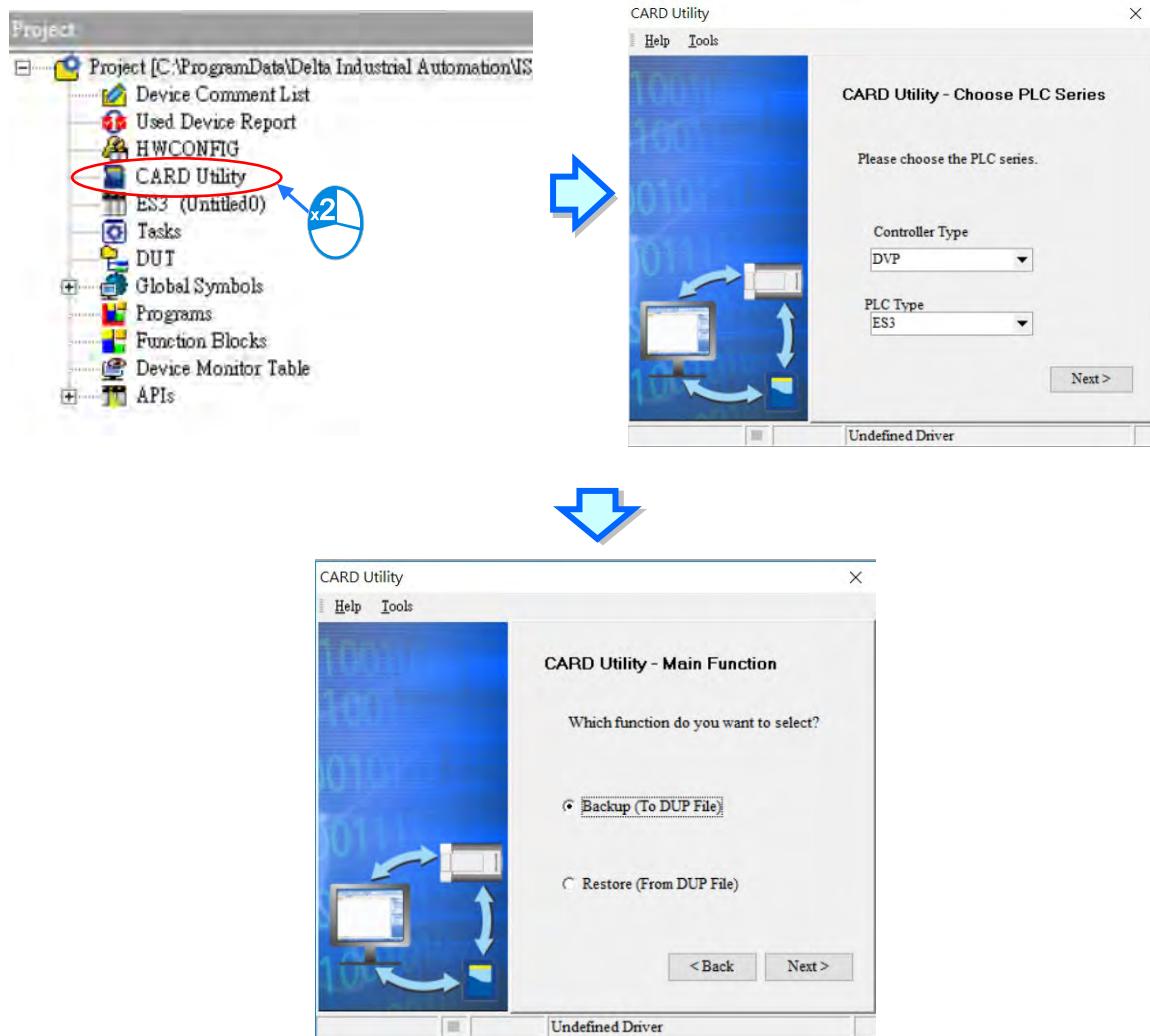
The list below describes the functions supported by the CARD Utility, including a flowchart.

- If you export data from a 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 CPU module.
- If you export an ISPSof project for a CPU module as a backup file (*.dup), you can only save the exported ISPSof 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 CPU module as values in the device and back them up. You can put a memory card with the backup file into the CPU module. You can copy a backup file (*.dup) saved on the computer into the CPU module connected to the computer, or restore the backup file to an ISPSof project. If you choose to restore the backup file to an ISPSof 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 ISPSof project for a CPU module, you can also restore data such as register editing (*.dvl), device status editing (*.dvb), and file register editing (*.wft) for the CPU module.



Note: The CARD Utility of DIADesigner does not include project restoration.

For ISPSof, double-click **CARD Utility** in the project management area to open the **CARD Utility** wizard. After selecting the controller type, click **Next** to proceed.



For DIADesigner, add a device in and then go to **Controller -> Auxiliary -> CARD Utility**.

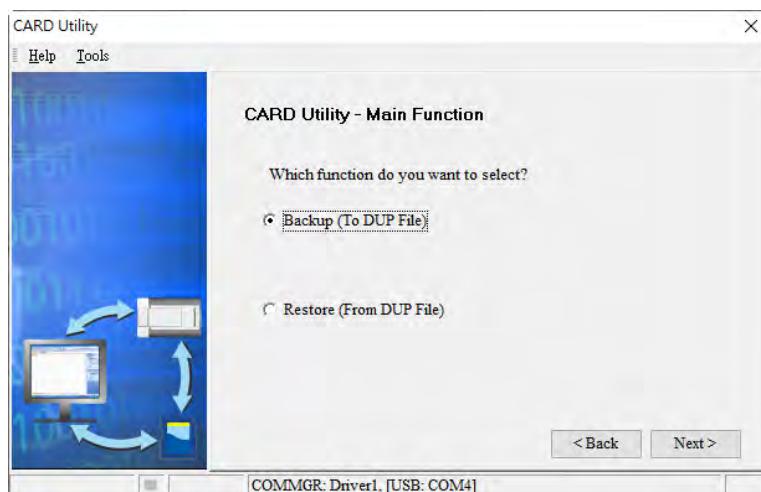


7.6 Backing Up a Project

If the backup source or backup destination is a DVP series CPU module or memory card, make sure that ISPSoft/DIADesigner is connected to the 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. For ISPSoft operation, refer to Section 2.4 in the ISPSoft User Manual; for DIADesigner operation, refer to Chapter 5 in the DIADesigner User Manual for more information.

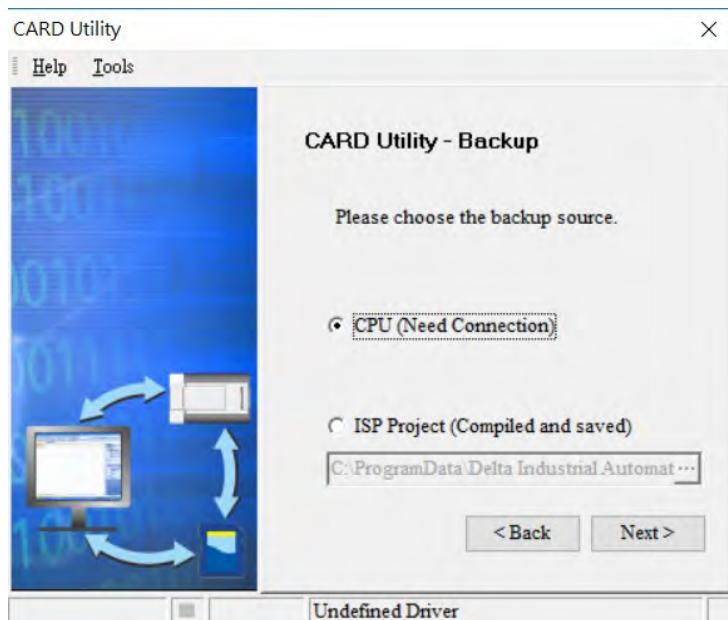
The following operation demonstration is for ISPSoft.

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

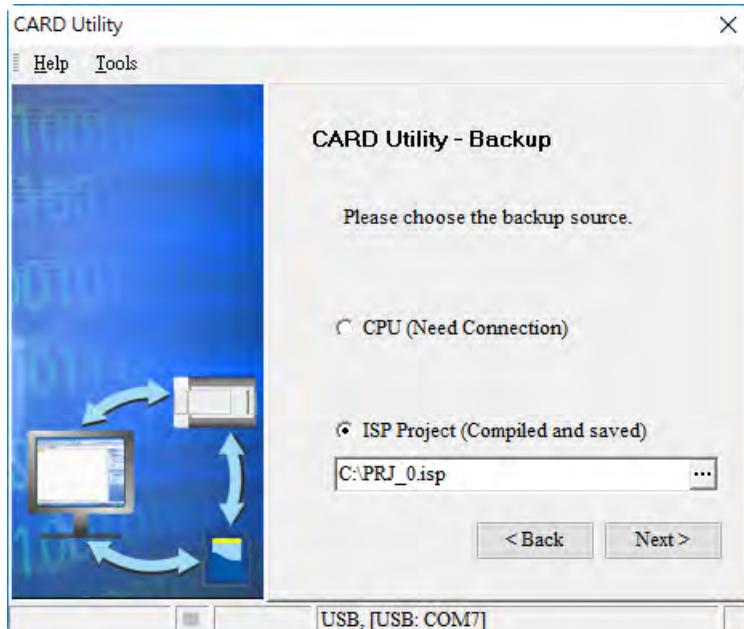


- (2) Select a backup source, and then click **Next**.

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

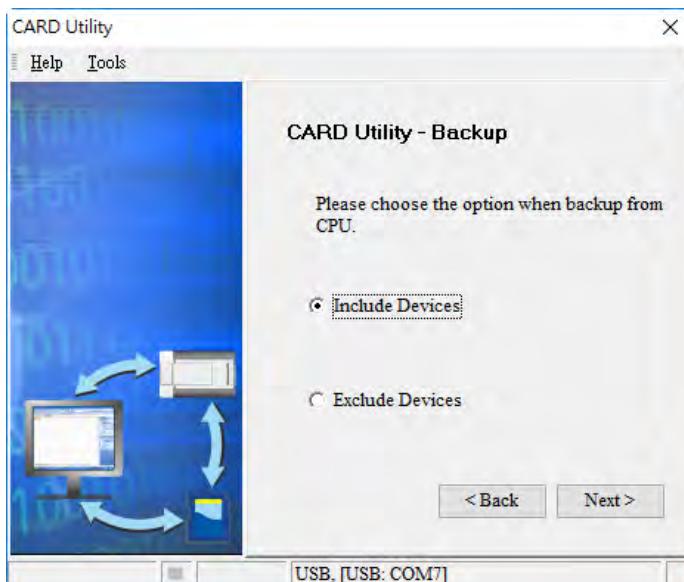


b. If you select the **ISP Project (Compiled and saved)**, the backup file is stored in your computer. Click  and select an isp file in the **Open** dialog box. If the program in the isp file selected is not compiled, a message appears when you back up the isp file. Open the isp file with ISPSoft, compile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

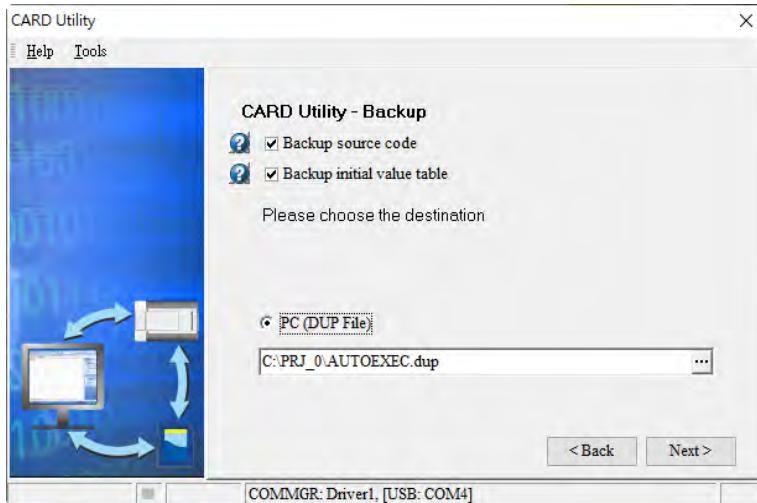


(3) After you select **CPU (Need Connection) / ISP Project (Compiled and saved)**, click **Next**,

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 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.

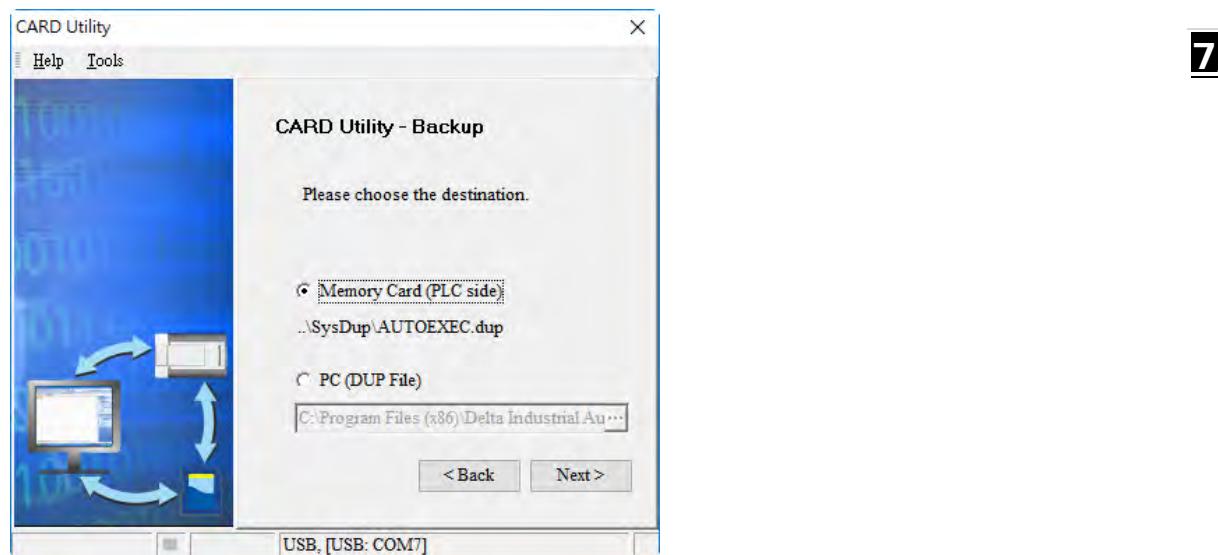
a. If you select **Memory Card (PLC Side)**, the filename of the backup file is **AUTOEXEC.dup**, and the backup file paths are shown below.

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

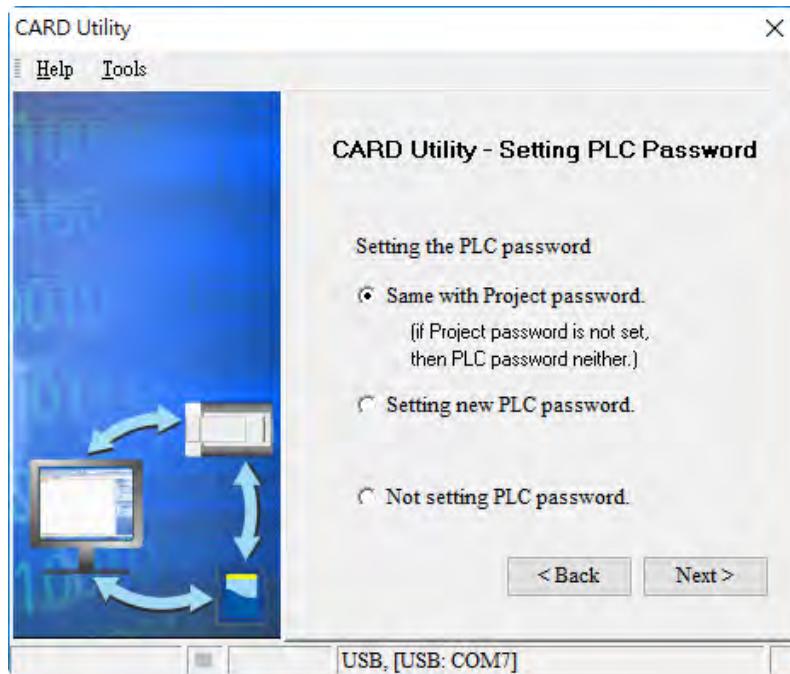
DVP-EX3: Root directory of the memory card\SDCard\PLC CARD\EX3\SysDup\AUTOEXEC.dup

DVP-SV3: Root directory of the memory card\SDCard\PLC CARD\SV3\SysDup\AUTOEXEC.dup

DVP-SX3: Root directory of the memory card\SDCard\PLC CARD\SX3\SysDup\AUTOEXEC.dup

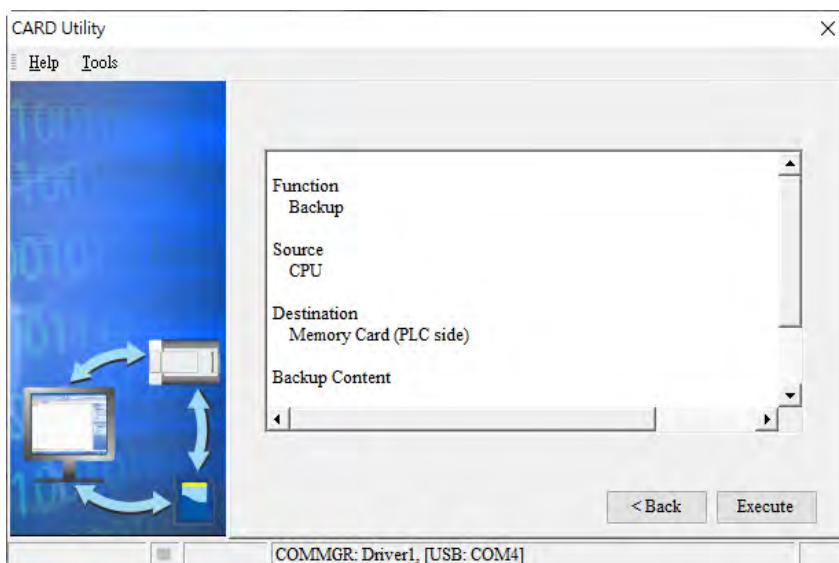


b. If you select **PC (DUP File)**, click , select a folder in the **Save in** list in the **Save As** dialog box, and type a filename in the **File name** box. When you select the backup source for the ISPSoft Project, set the PLC password. You can set the password to be the same as the Project password, 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.

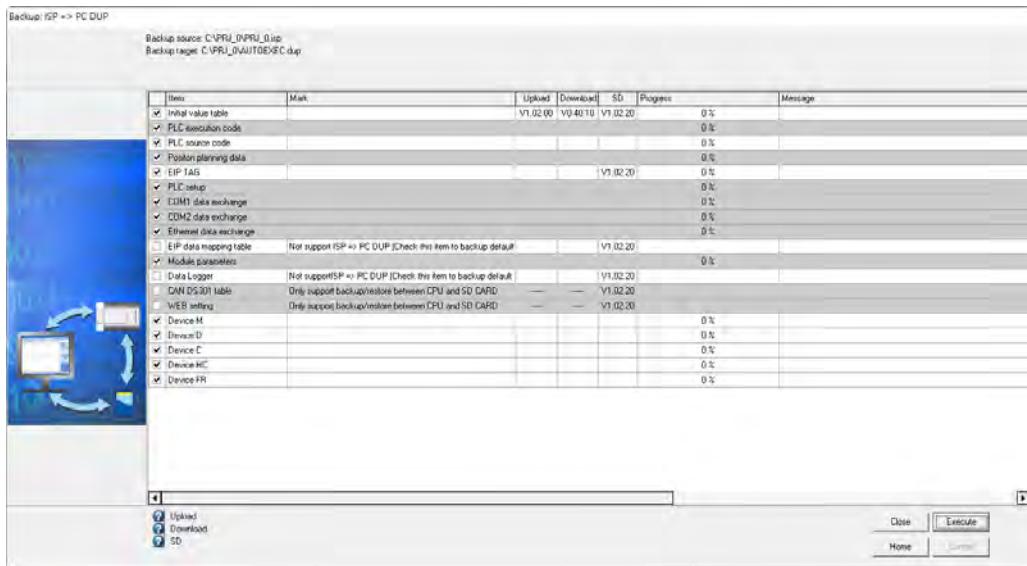


(5) After that you can see the summary. Make sure that the summary in the **CARD Utility** wizard is consistent with the data backup you want to perform, and then click **Execute**.

a. When the source for back up is from CPU:

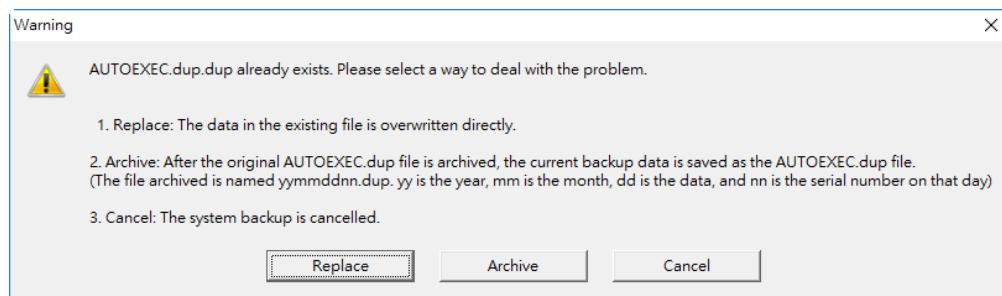


b. When the source for back up is from ISP Project:



(6) The CPU module still performs the data backup even if you click **Cancel**. You can turn off the 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.
ISPSof project → Computer	The backed up data includes the program ID and the project password set in the ISPSof project.

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

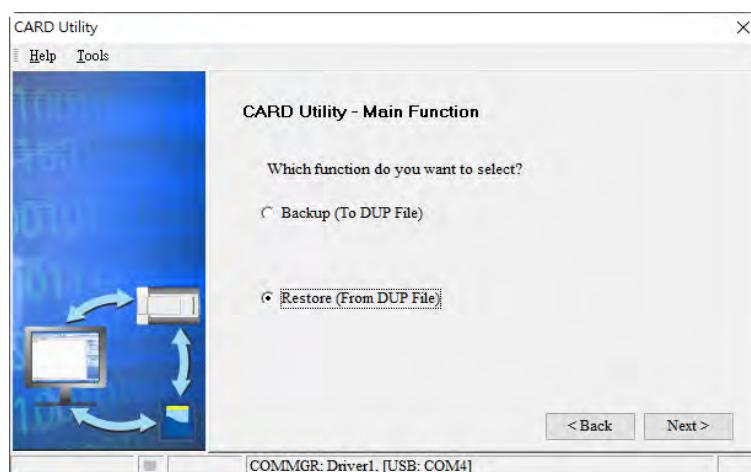


7.7 Restoring a Project

If the restoration source or restoration destination is a CPU module or memory card, make sure that ISPSOFT is connected to the 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. For ISPSOFT operation, refer to Section 2.4 in the ISPSOFT User Manual; for DIADesigner, refer to Chapter 5 in the DIADesigner User Manual for more information.

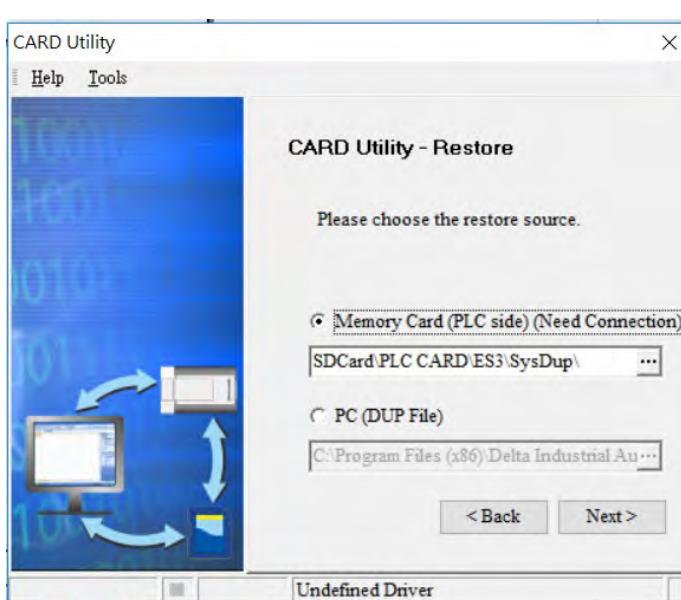
The following operation demonstration is for ISPSOFT.

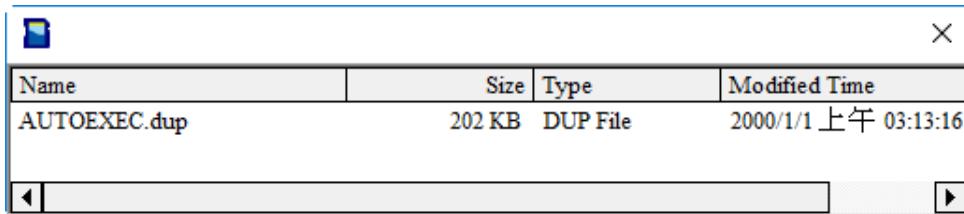
- (1) Select **Restore (From DUP File)** in the **CARD Utility** wizard and then click **Next**.



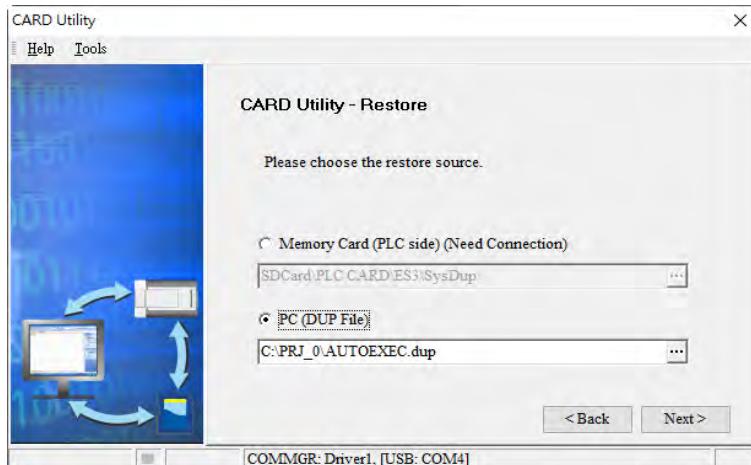
- (2) Select a restoration source, click **...** and then select a backup file to be restored.

- 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.



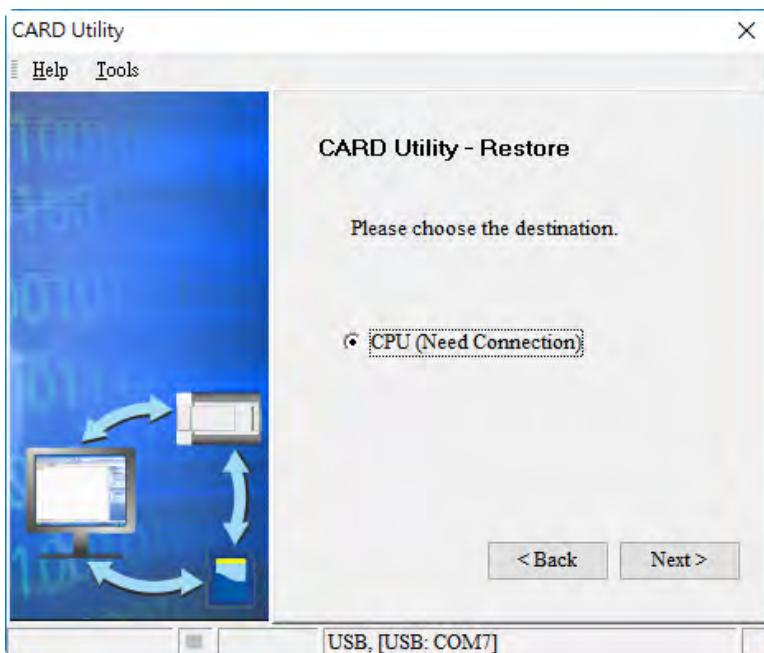


b. If you select **PC (Need Connection)**, the backup files in the PC display in a window after you click . Double-click a backup file in the window to choose it. (Note: The CARD Utility of DIADesigner does NOT include project restoration.)

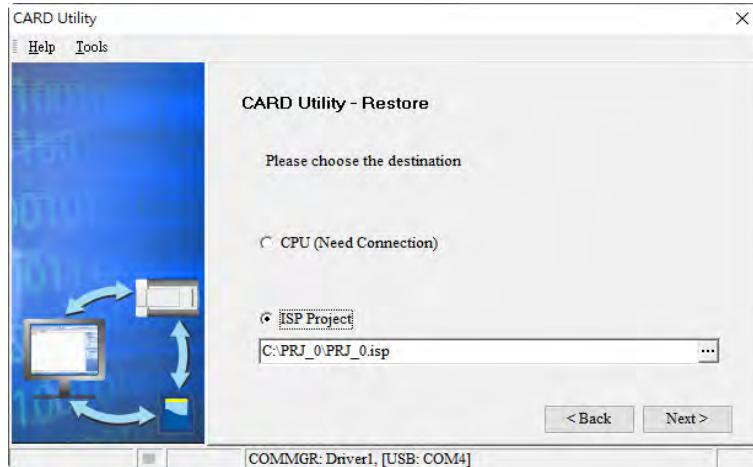


(3) Select a restoration destination, and then click **Next**.

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

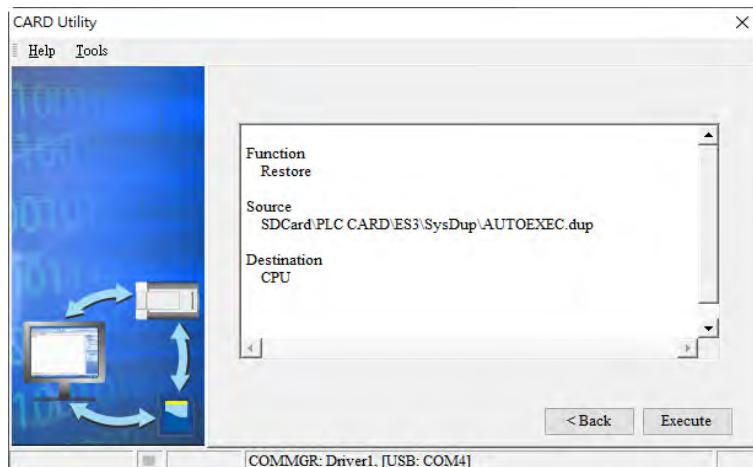


b. If you select **ISP Project**, click **...**, and then specify a filename and a path. If the specified path point to a file that already exists, the file is overwritten when you restore the data.

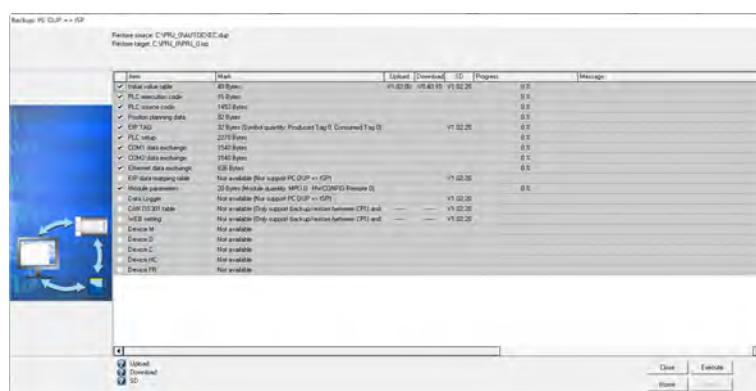


(4) Make sure that the summary in the **CARD Utility** wizard is consistent with the data restoration you want to perform and then click **Execute**.

a. The source for restoration is from SD Card.



b. The source for restoration is from the CPU.



If you click **Cancel** in the process of restoring data to the CPU module, the data is not completely restored. The 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 CPU module to stop the data restoration from being performed. To prevent the CPU module from operating incorrectly, restore the 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 → CPU module	<ul style="list-style-type: none"> 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→ ISPSof project	The ID and the password in the backup file become the program ID and the project password in the ISPSof project.

(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.
DVP-ES3: Memory card root directory\SDCard\PLC CARD\ES3\SysDup\ES3_BACKUP.dup
DVP-EX3: Memory card root directory\SDCard\PLC CARD\ES3\SysDup\EX3_BACKUP.dup
DVP-SV3: Memory card root directory\SDCard\PLC CARD\ES3\SysDup\SV3_BACKUP.dup
DVP-SX3: Memory card root directory\SDCard\PLC CARD\ES3\SysDup\SX3_BACKUP.dup
- (2) Insert the memory card into the card slot when the CPU power is off.
- (3) 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.
- (4) 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	<ul style="list-style-type: none"> 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 set 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

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

DVP-EX3: Memory card root directory\SDCard\PLC CARD\EX3\Log\Error.log

DVP-SV3: Memory card root directory\SDCard\PLC CARD\SV3\Log\Error.log

DVP-SX3: Memory card root directory\SDCard\PLC CARD\SX3\Log\Error.log

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

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

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

DVP-EX3: Memory card root directory\SDCard\PLC CARD\EX3\Log\STATUS.log

DVP-SV3: Memory card root directory\SDCard\PLC CARD\SV3\Log\STATUS.log

DVP-SX3: Memory card root directory\SDCard\PLC CARD\SX3\Log\STATUS.log

Use ISPSof to read the status logs. ISPSof Tools -> Review Status Log File -> Open Log File

Chapter 8 Hardware Configuration and Data Exchange Setups

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8.1 Hardware Configuration Tool for DVP-ES3 Series Modules – ISPSoft 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

8 **AIO Wizard:** settings for the right-side extension modules

CANopen Builder: for CANopen communication

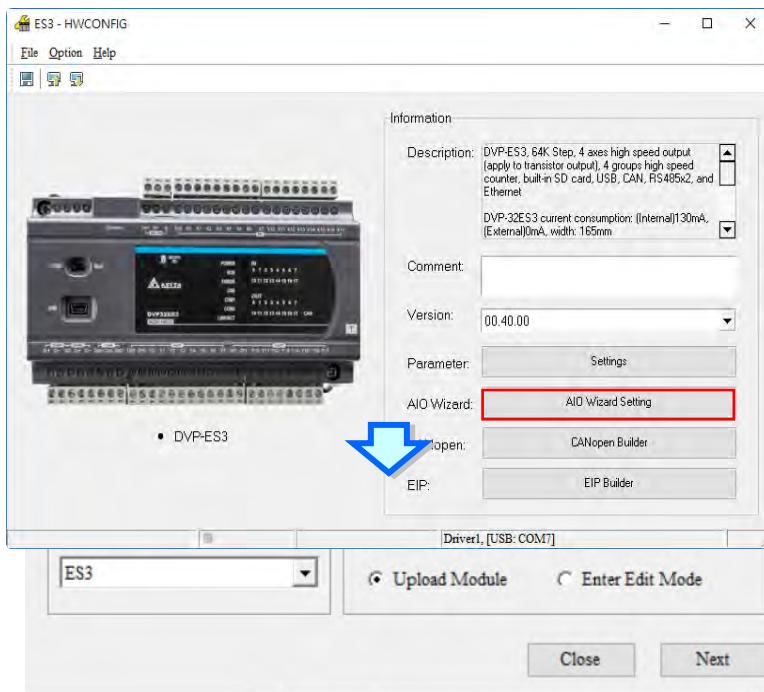
EIP Builder: for EIP communication

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.

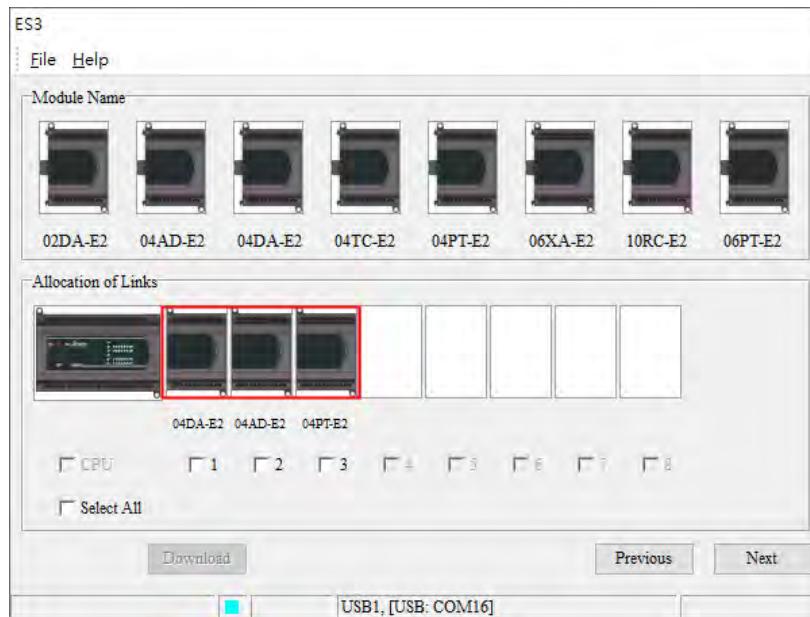
8.1.2 Configuring a Module

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. The following example demonstrates how to upload module data for a project of ES3+04DA-E2+DVP04AD-E2+04PT-E2.

Step 1. Go to AIO Wizard from HWCONFIG of ISPSoft and then click **Upload Module**.



Step 2. Click the module that you need to set up in the section of Allocation of Links to enter its setting page.



Step 3. Set up the parameters for the selected modules.

ES3

Help

Firmware Version 1.16 DVP04DA-E2

Channel 1

Output Mode Setting	-10V ~ +10V	Output Update Time	0	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Adjusted Gain Value	16000	<input type="checkbox"/> Disable/Enable Output when Exceeds the Limit
Upper Bound	32000	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited

Curve Default

Channel 2

Output Mode Setting	-10V ~ +10V	Output Update Time	0	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Adjusted Gain Value	16000	<input type="checkbox"/> Disable/Enable Output when Exceeds the Limit
Upper Bound	32000	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited

Curve Default

Channel 3

Output Mode Setting	-10V ~ +10V	Output Update Time	0	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Adjusted Gain Value	16000	<input type="checkbox"/> Disable/Enable Output when Exceeds the Limit
Upper Bound	32000	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited

Curve Default

Channel 4

Output Mode Setting	-10V ~ +10V	Output Update Time	0	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Adjusted Gain Value	16000	<input type="checkbox"/> Disable/Enable Output when Exceeds the Limit
Upper Bound	32000	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited

Curve Default

Import Export OK Cancel

ES3

Help

Firmware Version 1.2 DVP04PT-E2

Channel 1

Input Mode Setting	PT100	Average Times	10	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited
Upper Bound	32000			PID Setting

Curve Default

Channel 2

Input Mode Setting	PT100	Average Times	10	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited
Upper Bound	32000			PID Setting

Curve Default

Channel 3

Input Mode Setting	PT100	Average Times	10	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited
Upper Bound	32000			PID Setting

Curve Default

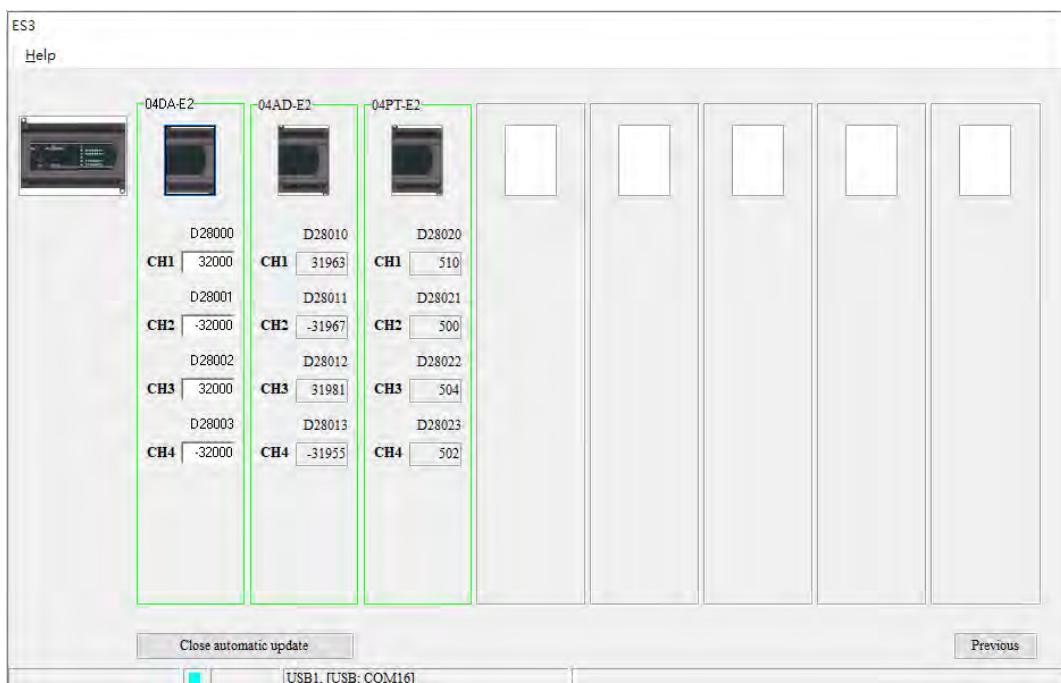
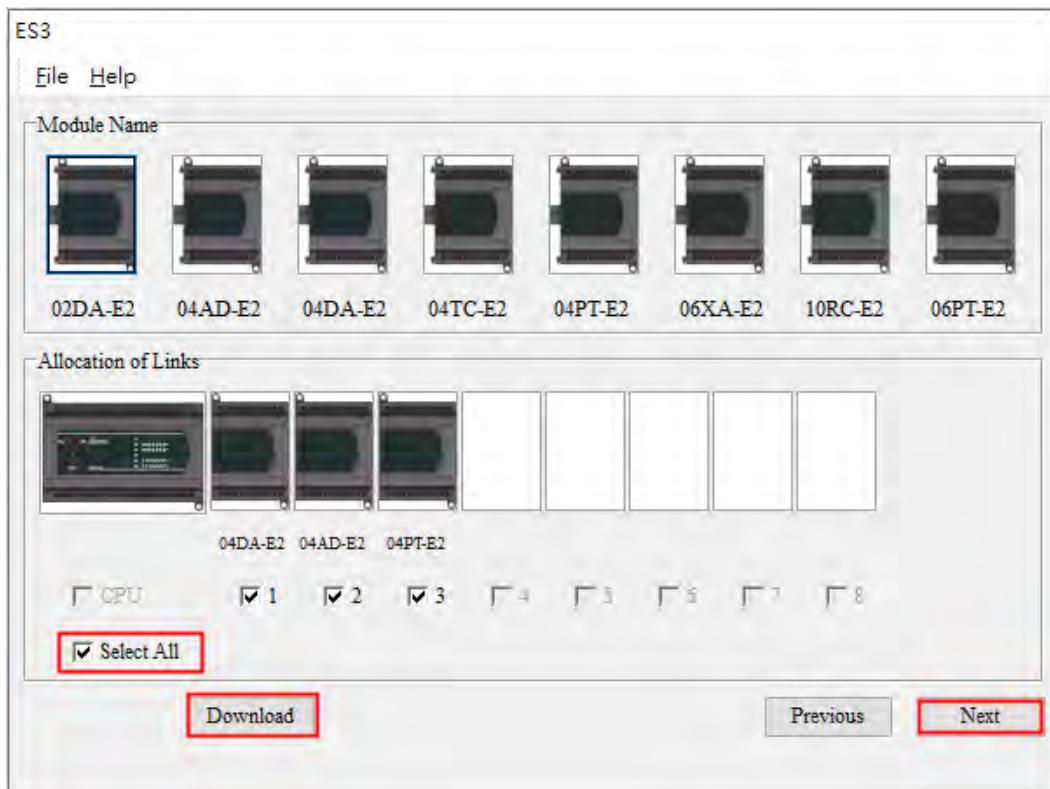
Channel 4

Input Mode Setting	PT100	Average Times	10	<input type="checkbox"/> Enable/Disable Limit Detection
Adjusted Offset Value	0	Lower Bound	-32000	<input type="checkbox"/> Set Value Changing Prohibited
Upper Bound	32000			PID Setting

Curve Default

Import Export OK Cancel

Step 4. Tick the option **Select All** and then click **Download** to have the parameters downloaded to your PLC. Click **Next** to enter the conversion setting page.



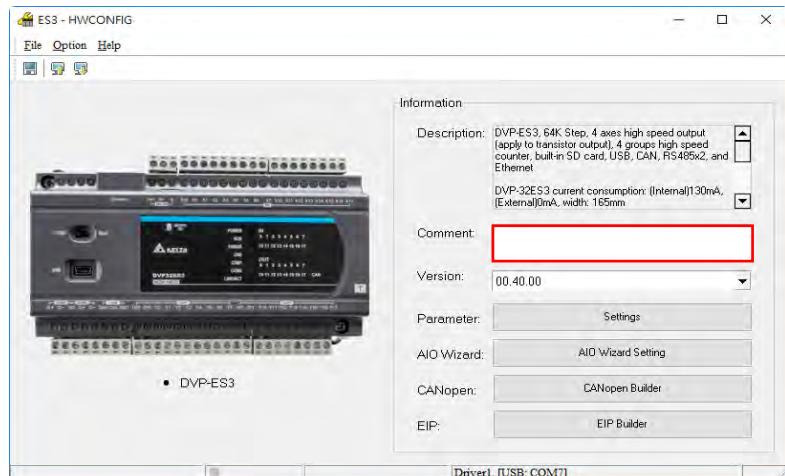
If the PLC is connected with a special extension module, the PLC uses the special extension module data mapping area to automatically correspond to CRs to update data. If you need to use this area, you need to pay attention not to use the same area repeatedly.

Extension module	Data mapping area	Remark
Right side extension module	D28000 to D28079	Used with SM228 to enable/disable the data exchange

Refer to section 2.2.16 from DVP-ES3/EX3/SV3/SX3 Series Programming Manual for more information.

8.1.3 Editing a Comment

You can add a comment directly in the Comment box.

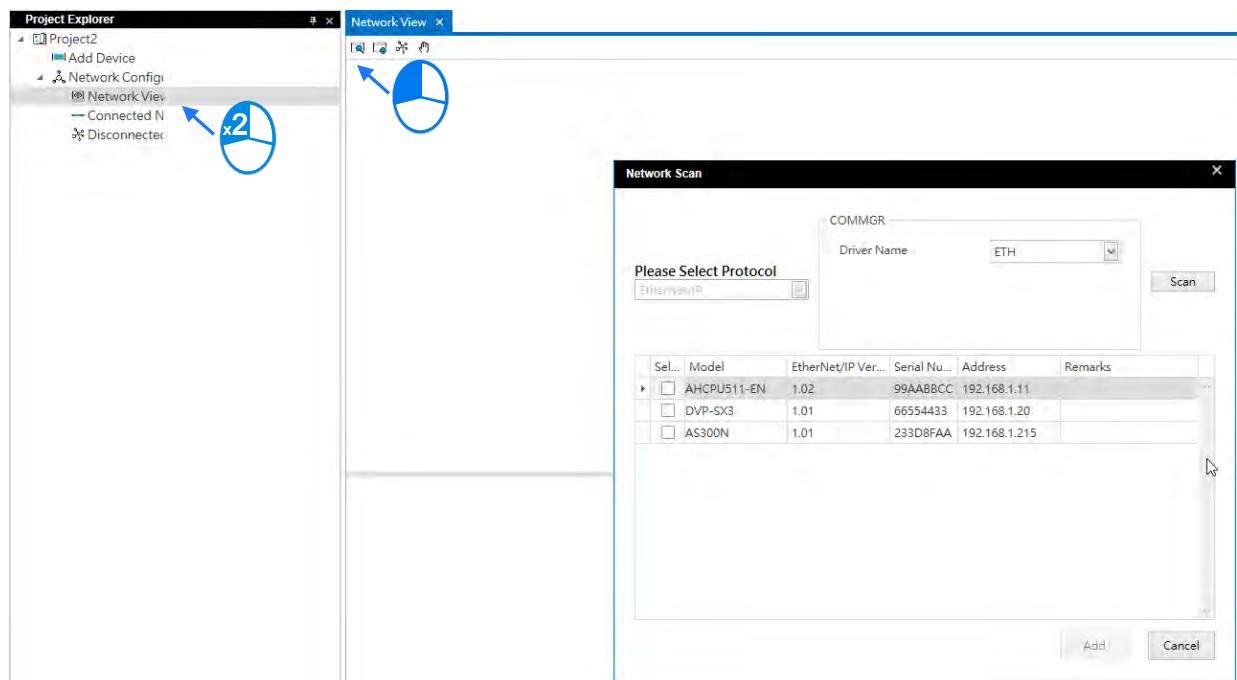


8.2 Hardware Configuration Tool for DVP-ES3/EX3/SV3/SX3 Series Modules – DIADesigner

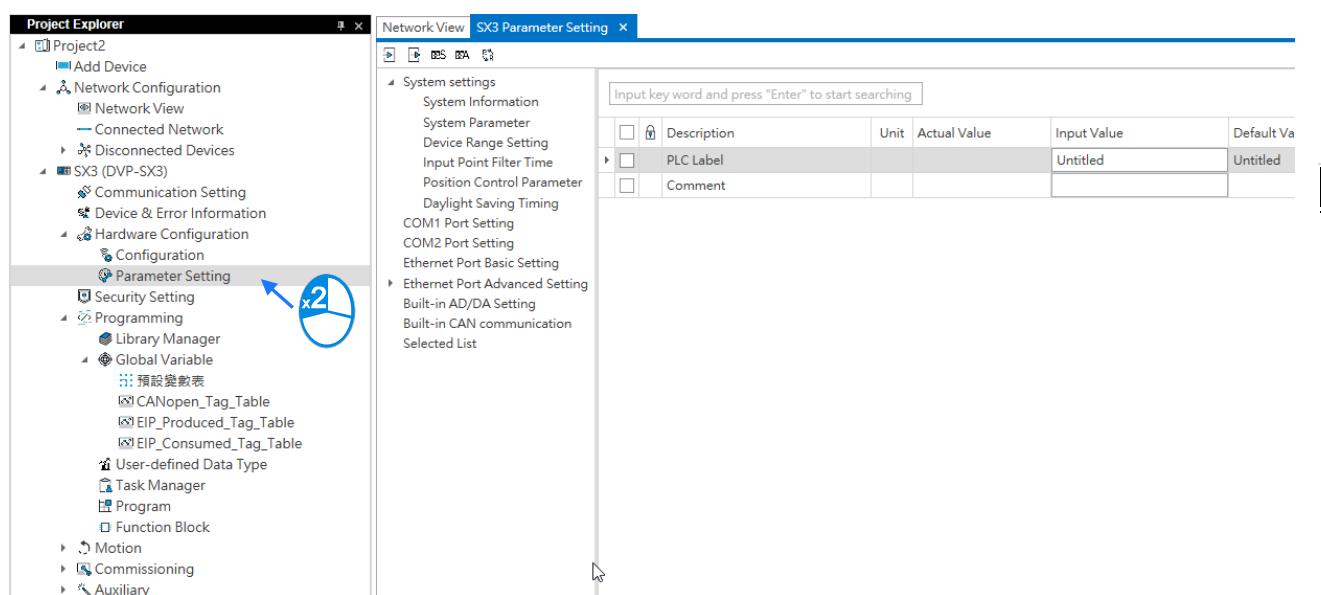
You must download all parameters set in DIADesigner to the CPU module for them to take effect.

8.2.1 Introduction of the DIADesigner Environment

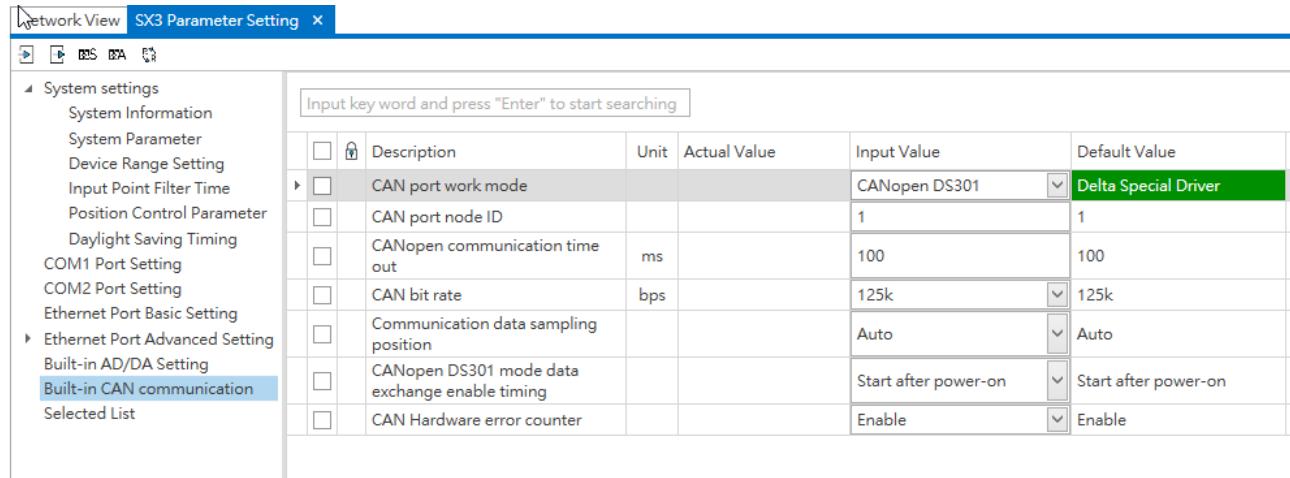
Double click **Network View** under **Network Config** in the project tree to open the setting page. After that, click the scan icon to search for the devices to be added.



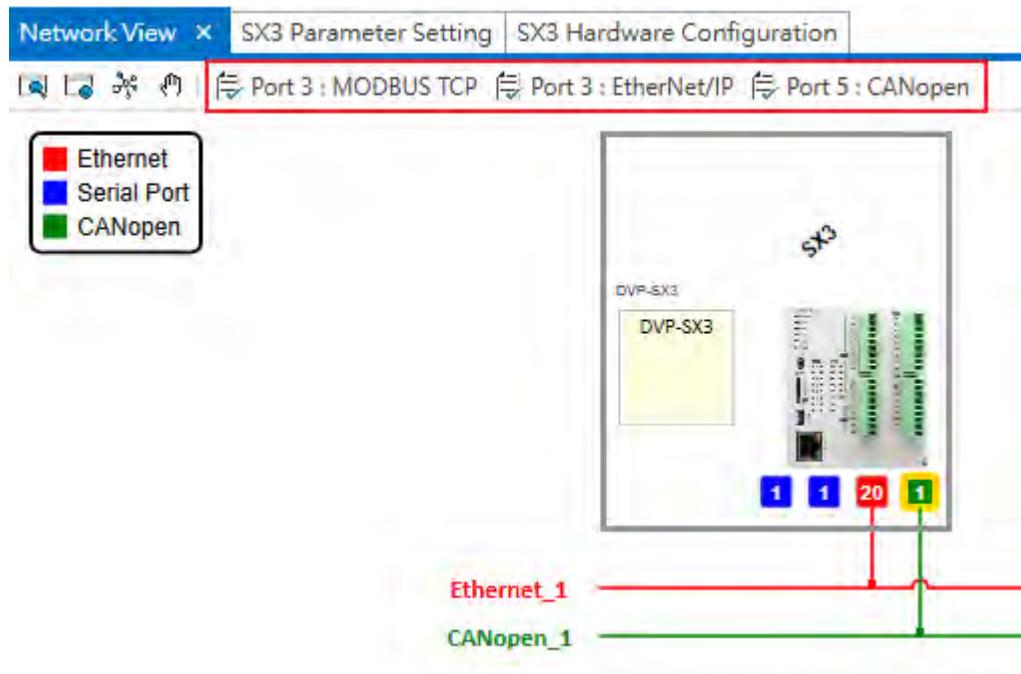
Double-click **Parameter Setting** to open the setting page.



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/EX3 Series CPU module. And for DVP-SV3/SX3 series, you can install extension modules on its both sides (left and right). There are Configurations (for CPU modules) and Parameter Setting (for CPU parameters) under the Hardware Configuration. And the built-in CAN communication setting allows you to change the CAN port work mode.



Use Network View to set up different communication protocols. After the network is established, you can find the communications in the Network View and by double-clicking the created communications, e.g. Ethernet and CANopen, you can open the setting page for advanced configuration and parameter settings.



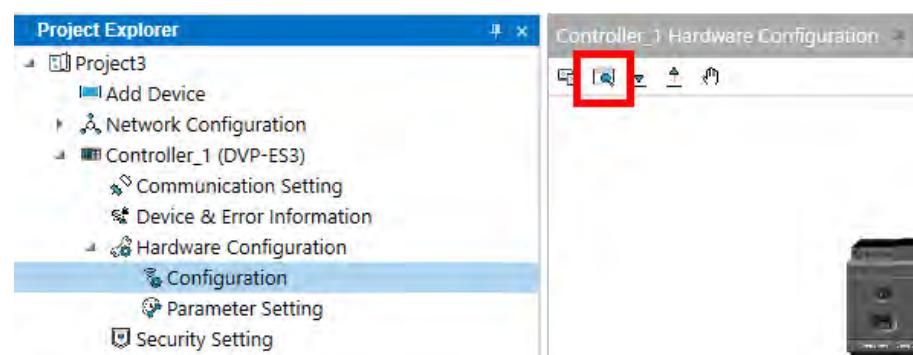
8.2.2 Configuring a Module

For DVP-ES3/EX3 Series, you can configure its right-side modules. For DVP-SX3/SV3, you can configure left and right modules. This section introduces the following functions: the I/O Scan, Instant Arrangement, and Module Parameter Download.

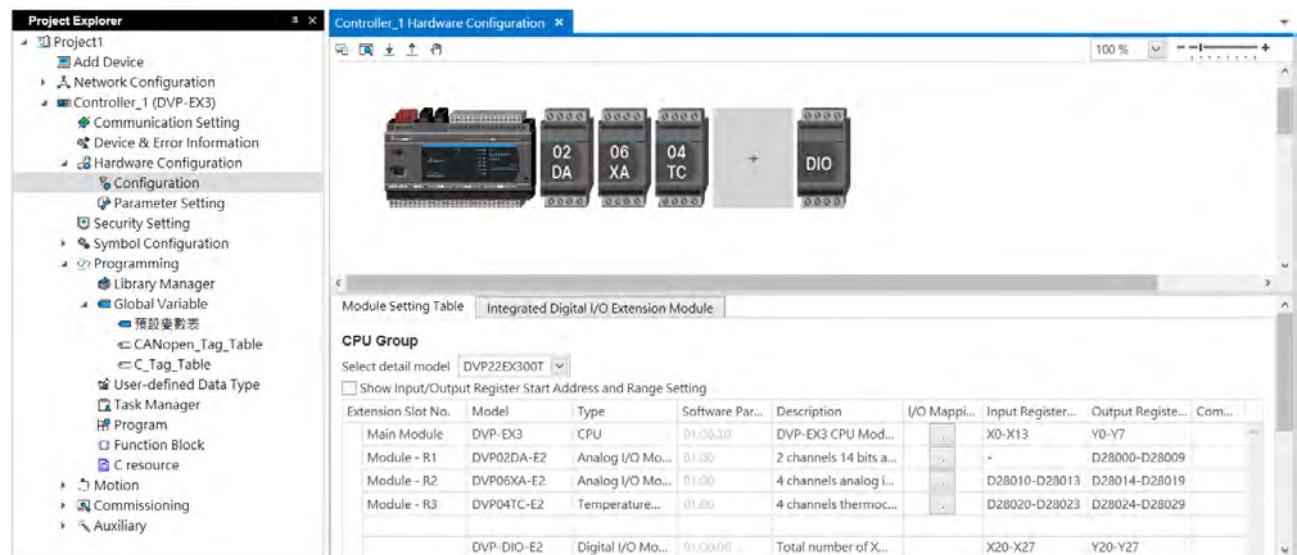
8.2.2.1 I/O Scan

Double-click **Configuration** under the added controller to open the setting page. Click I/O scan  to obtain the information of the I/O modules that are actually connected to the PLC CPU.

Note: The DVP-SV3/SX3 should be in the RUN state to execute I/O scan.



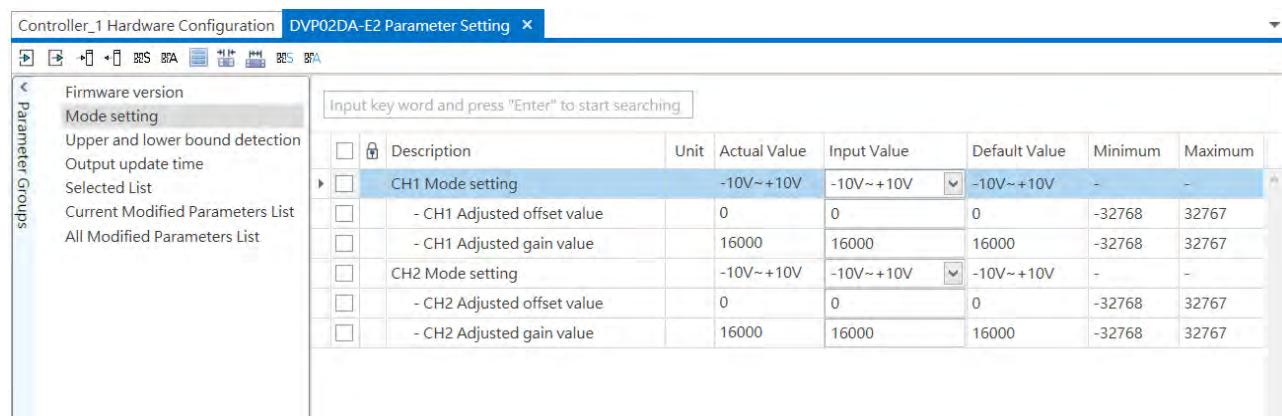
The scan results will appear in the window, including module placement information, module models, and the input/output range of digital I/O modules. (For digital I/O modules, only the total number of input/output points can be obtained and will be displayed on the Integrated Digital I/O Extension Module page.) Additionally, the current status of each module's parameters will also be scanned.



I/O mapping information is also displayed in the scan results. When modules require frequent data updates, such as analog input modules continuously updating received analog signals and converting them into data the PLC CPU can process, the system will automatically configure corresponding device addresses for data access. These configured device addresses will be shown in the 'Input Register Range' and 'Output Register Range' columns of the module configuration table. The data register ranges corresponding to various special modules are provided in the table below. For detailed information, please refer to DVP-ES3/EX3/SV3/SX3 Series Programming Manual Section 2.2.16 SM/SR Supplementary Explanation - Expansion Module Points, Counts, and Model Codes.

Extension module	Data mapping area	Remark
Right side extension module	D28000 to D28079	
Left side extension module (DVP-SV3/SX3)	D29000 to D29079	
Left side extension module DNET/COPM (DVP-SV3/SX3)	D16000 to D19999	Set the timing for modules to update in "Module Auto Mapping Area update method".

Double-click the module icon to open the module parameter editor window for configuration. During the I/O scan, the current status of the module's parameters is also read back and simultaneously updated in the module's parameter editor.

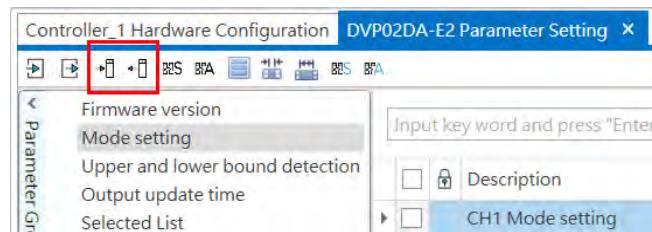


8.2.2.1 Instant Arrangement

Within the module's parameter editor, you'll find **Instant Write**  and **Instant Read**  icons. By clicking the Instant Write icon 

You can use an analog module in online mode to observe its input and output values, enabling you to adjust each channel's offset and gain incrementally. Keep in mind that parameters sent via the Instant Write icon are solely for immediate adjustments and are not persistent; they'll be lost, and the module will revert to its default settings upon power loss. Therefore, once your adjustments are complete, you must save the final parameter settings from PC to the PLC CPU memory through the Module Parameter Download process (see Section 8.2.2.3). These saved settings will then be automatically transferred from the PLC to the module each time the system starts. (As an alternative, you can directly write values to the module's CR parameters using a TO instruction.)

Note: Real-time adjustments are only possible when the DVP-SV3/SX3 PLC is in RUN mode.



8.2.2.3 Module Parameter Download

Previously, when using expansion modules (like analog input modules) and needing to set specific parameters, such as channel mode or averaging times, users had to consult the Control Register (CR) tables provided in the module's manual. They then had to manually add TO instructions to their PLC program to configure parameters for each module individually. Now, the PLC CPU offers a more standardized module parameter download mechanism, ideal for applications involving fixed models and standardized systems.

See the comparison of different settings for I/O module configuration method selection below.

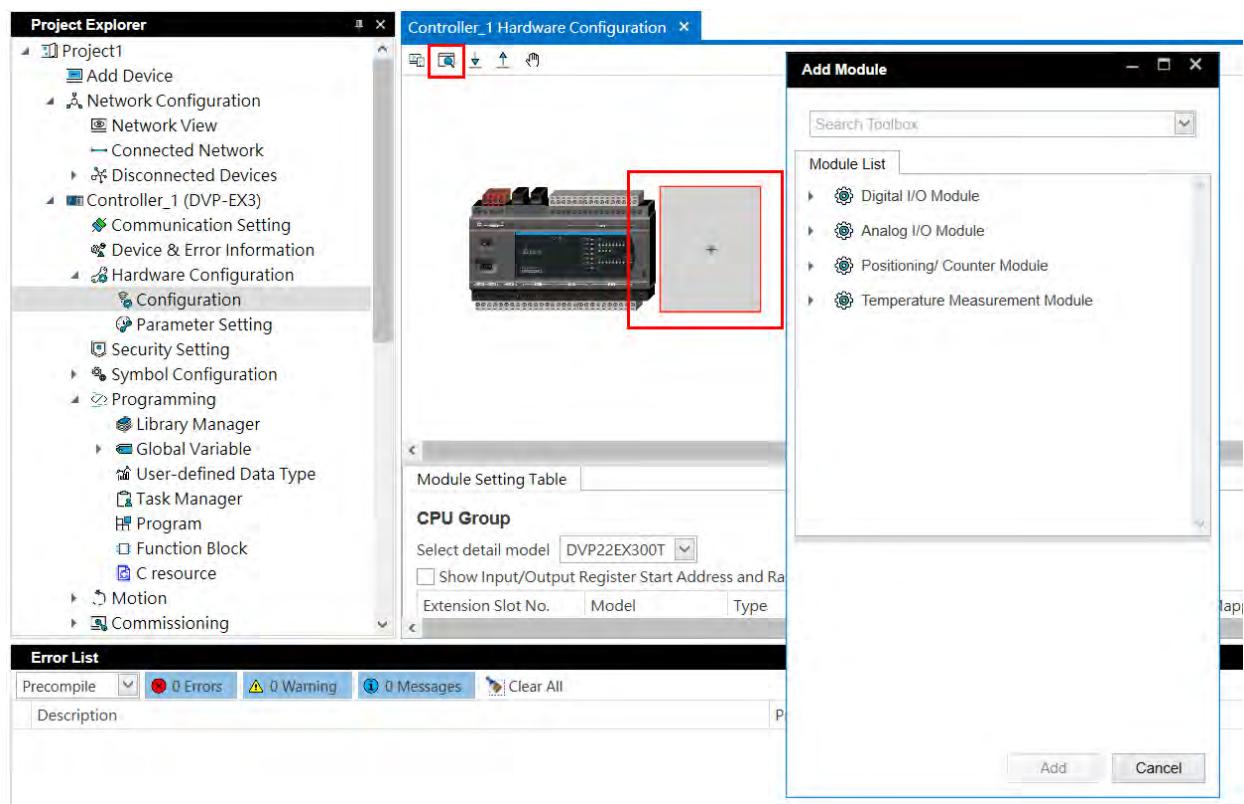
I/O module configuration method selection	
Setting value	Description
Auto (TO instruction)	<p>Automatically operates based on actually connected modules. Users manually add TO instructions to the PLC program to configure parameters for each module individually. This method is highly flexible, but it involves more complex programming. It's best suited for applications where you need to individually customize modules.</p>
Manual (Module parameters are configured by the PLC CPU.)	<ul style="list-style-type: none"> ● Parameter location: Once downloaded to the PLC CPU's internal memory, module parameters are configured by the PLC CPU. ● Timing of parameter application: When the PLC CPU switches from STOP to RUN, parameters are immediately applied to each module. <ul style="list-style-type: none"> • First STOP → RUN after the PLC is powered on for the first time. • First STOP → RUN after recovering from LV (low voltage). • First STOP → RUN after clicking "Download (PC → PLC)" in DIADesigner. • First STOP → RUN after restoring a backup file. ● Requirements <ul style="list-style-type: none"> • I/O Modules: It's critical that the number and layout of I/O modules—this includes any expansion modules on either side—are identical to the PLC CPU's initial configuration. • Digital Modules: The total I/O count (X and Y points) of the expansion digital I/O modules must also match. <ul style="list-style-type: none"> • If the actual connected module configuration doesn't match the stored settings, the PLC CPU will stop running and report an error. • To add or remove modules after the configuration has been downloaded, you'll need to download the configuration again. ● This is suitable for applications with fixed module configurations that require rapid deployment. ● Note: this function is available for PLC CPU with firmware version 1.10.00 or later.

Example of I/O module configuration (Manual): Module parameters are configured by the PLC CPU.

1. System design – Number of modules and layout

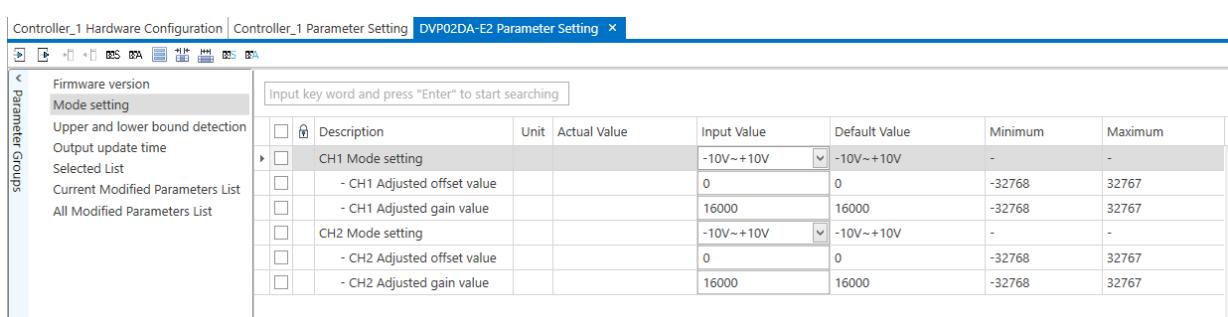
Double-click **Configuration** under the added controller to open the setting page. Click I/O scan  to obtain the information of the I/O modules that are actually connected to the PLC CPU. Or double-click the plus sign to open the Module List, and then select the modules from the list.

Note: The DVP-SV3SX3 should be in the state of RUN to execute I/O scan.



2. Configure the parameters for the I/O modules.

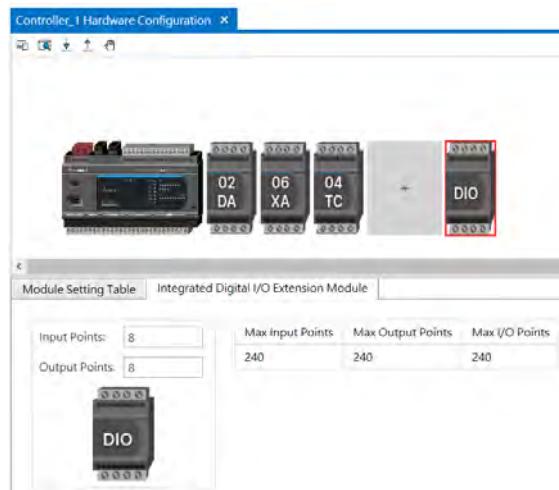
Click the module icon and then double-click Open Parameter Setting or double-click the module icon to open the module parameter editor window for configuration. Configure the parameters such as channel mode, averaging times and so forth for the modules in their sequence order. The setting values will be downloaded and store in the PLC CPU's internal memory and the module parameters will be configured by the PLC CPU as the following steps shown.



3. Configure the parameters for the DIO modules.

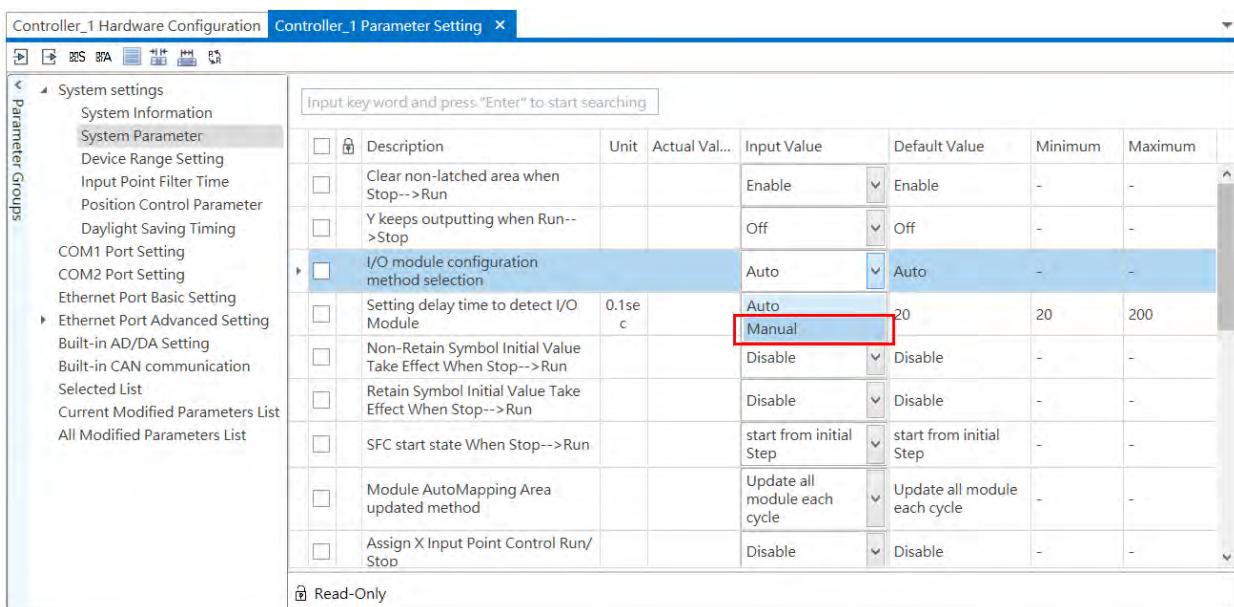
Since digital I/O cannot be configured independently, you can use the setting page under the 'Integrated Digital I/O Extension Module' tab to plan the total input/output points for all the connected digital I/O extension modules. If digital I/O modules are connected, using I/O scan will automatically generate a set of integrated modules (either DVP-DIO-E2 for ES3/EX3 PLC CPUs or DVP-DIO-S for DVP-SV3/SX3). If modules are added manually, these integrated modules must also be added manually, along with their corresponding total input/output points.

Note: The total inputs/outputs will be downloaded to the PLC CPU. Once the PLC CPU switches from STOP to RUN, it will check if these settings match the physically connected modules.



4. I/O module configuration method selection

Set the value of I/O module configuration method selection under System Parameter of System Setting to Manual (available for PLC CPU with FW V1.10.0 or later). Selecting this option means execution will follow the user-defined hardware configuration. The PLC CPU will automatically match the configuration when it detects modules during power-up. Upon the PLC CPU's initial run, it will configure the modules using the pre-planned parameters.



Verification items

✓ I/O Modules

It's critical that the number and layout of modules—this includes any expansion modules on either side—are identical to the PLC CPU's initial configuration.

✓ Digital I/O Modules

The total I/O count (X and Y points) of the expansion digital I/O modules must also match.

- ✓ If the actual connected module configuration doesn't match the stored settings, the PLC CPU will stop running and report an error.
- ✓ To add or remove modules after the configuration has been downloaded, you'll need to download the configuration again.

Timing of parameter application

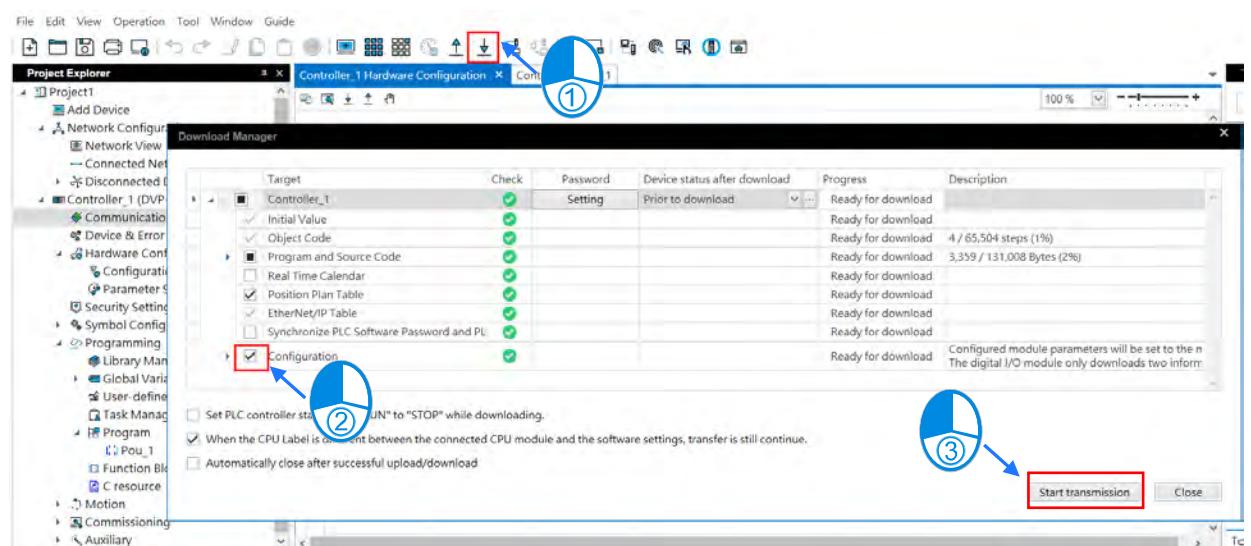
Once downloaded to the PLC CPU's internal memory, module parameters are configured by the PLC CPU.

The PLC CPU switches from STOP to RUN to apply configured parameters in these events:

- ✓ During the initial power-up.
- ✓ Following a low voltage occurrence.
- ✓ When 'Download (PC to PLC)' is clicked in DIADesigner.
- ✓ When 'Restore' is clicked in DIADesigner.

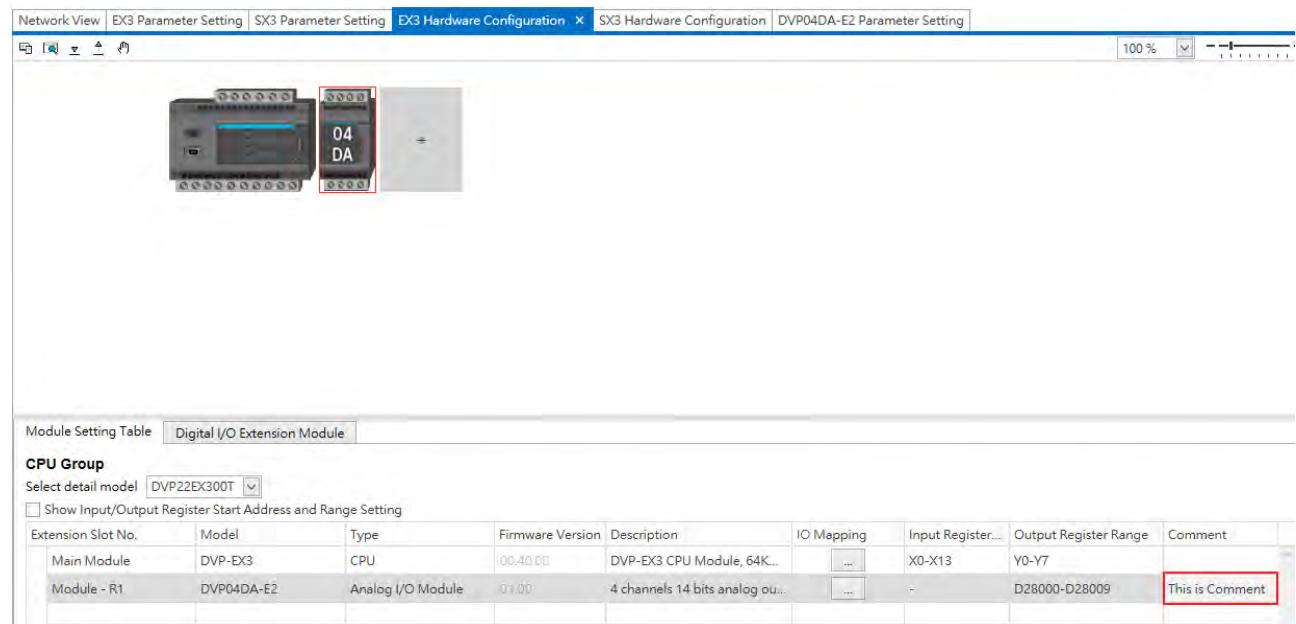
5. Download

Click Download icon  (PC to PLC) to open the Download Manager window. Ensure the parameters are selected and then click **Start transmission**. Once the transmission is complete, the module parameter download is done. If you need to check the downloaded parameters, you can click the Upload icon  (PLC to PC) to upload the parameters from the PLC CPU memory.



8.2.3 Editing a Comment

You can add a comment directly in the Comment box.

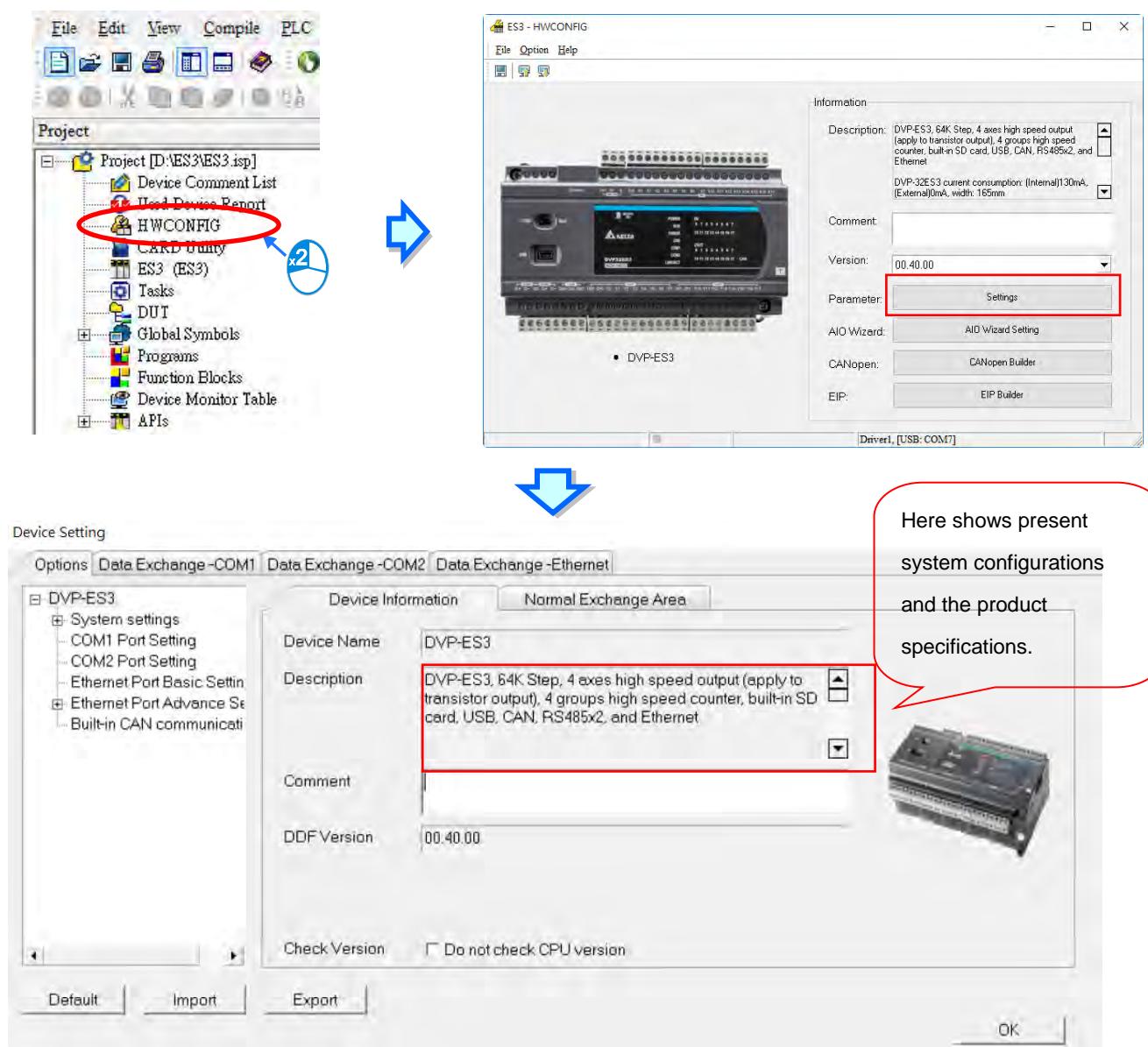


8.3 Setting the Parameters in a DVP-ES3 Series CPU Module – ISPSoft

8.3.1 Opening the PLC Parameter Setting Window

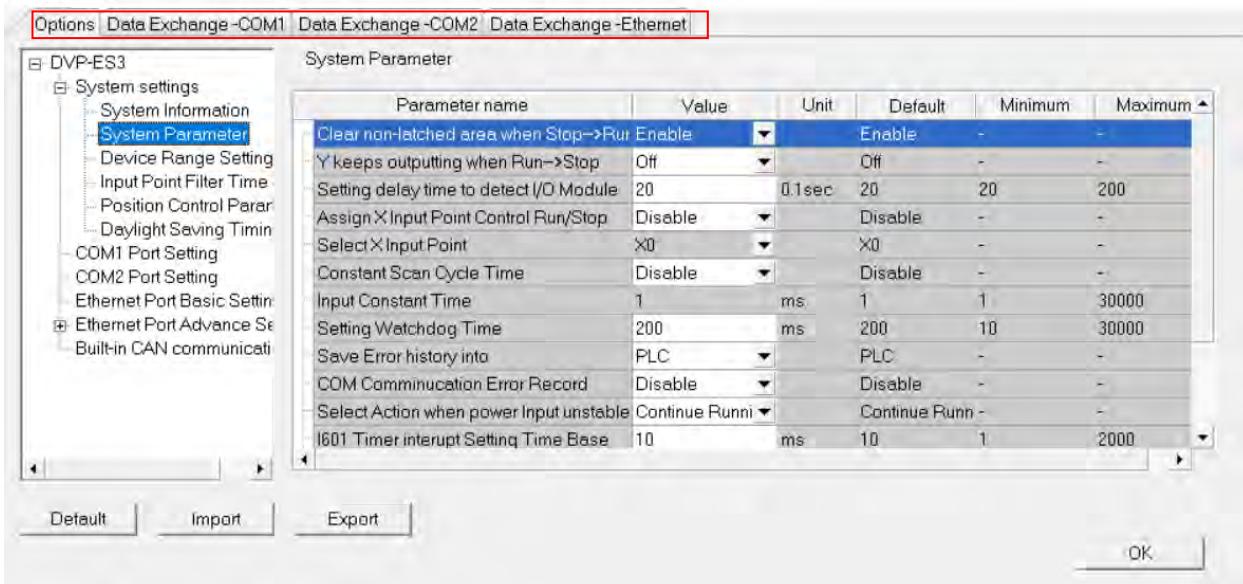
After you double-click **HWCONFIG** in the project management area, the ES3 Series setting page appears. Click **Settings** button to set up the CPU parameters.

* 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 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. Refer to section 8.3.2 for more information.

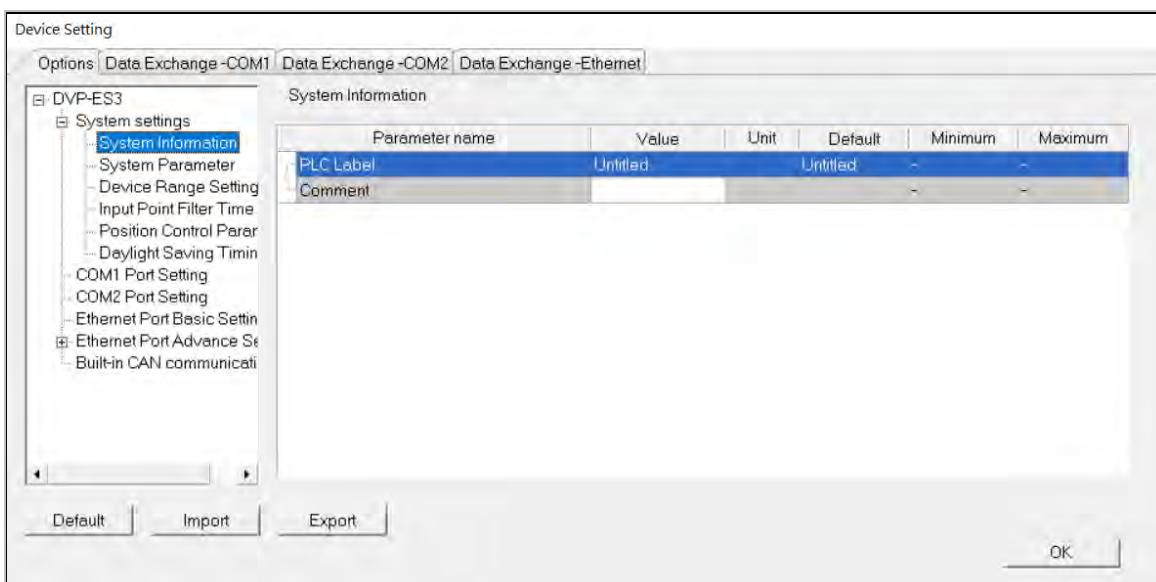
Device Setting



8.3.2 Setting the Basic CPU Parameters

8.3.2.1 System Settings

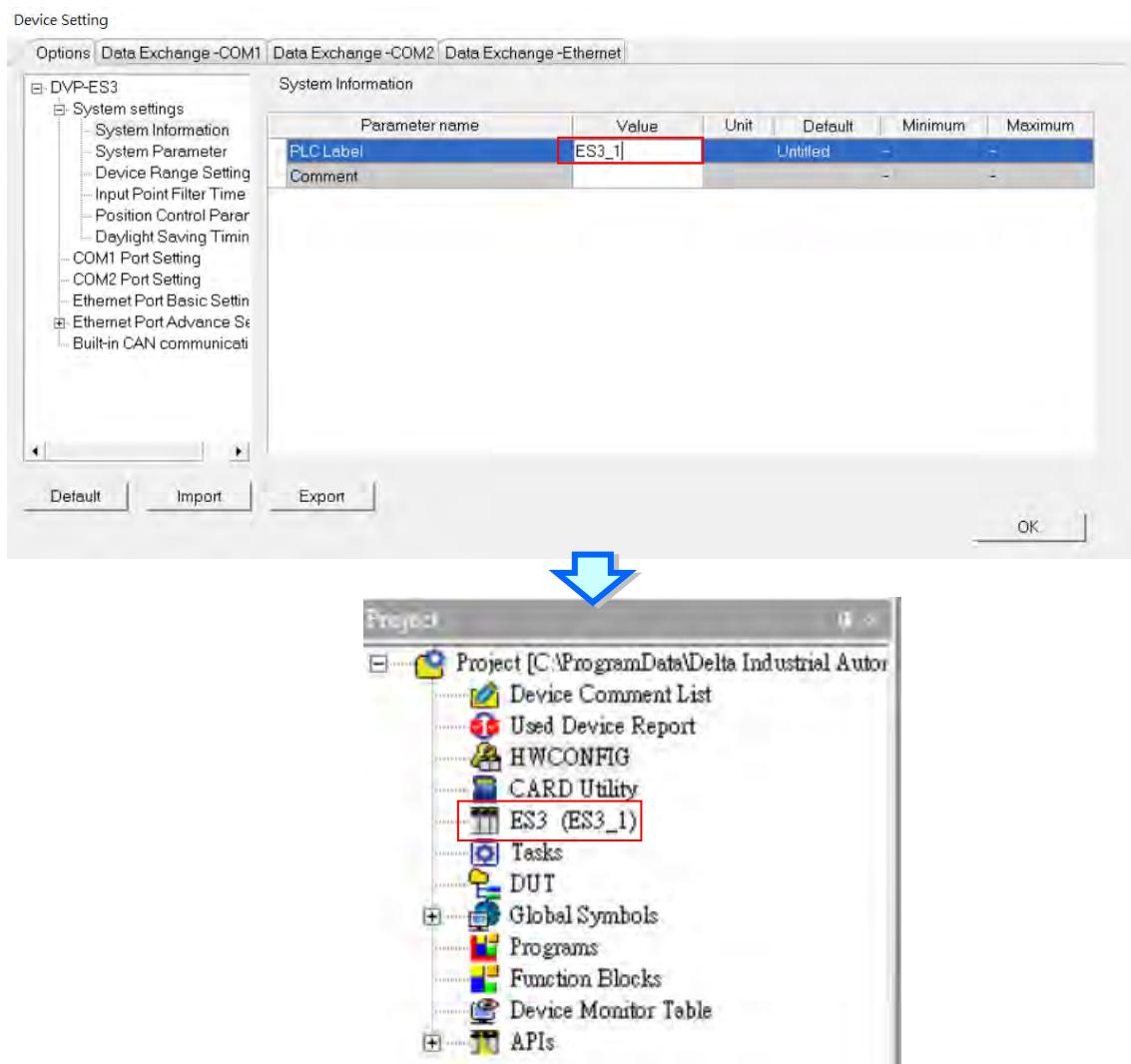
In the Device Setting dialog box, click the **Options** tab, and unfold the **System settings** to set up the settings of **System Information**, **System Parameter**, **Device Range Setting**, **Input Point Filter Time**, **Position Control Para**, and **Daylight Saving Timing**.



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.

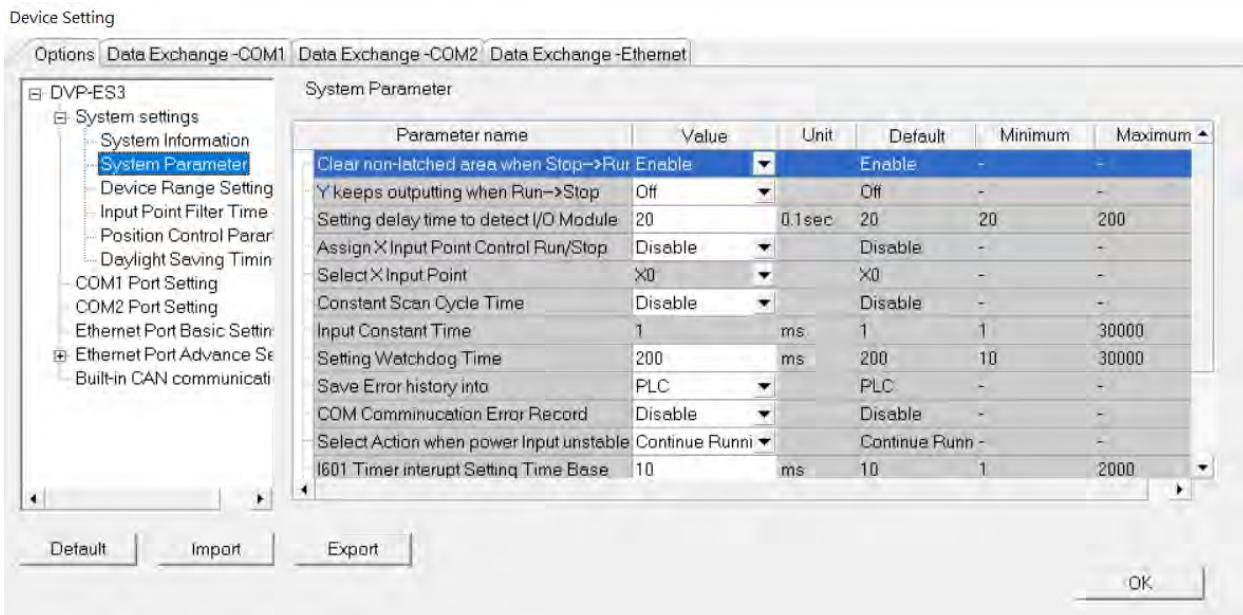
After you create an ISPSoft project, the default project name is the name of the CPU module, and it is attached to the model in the project management area. You can change the default name of the CPU module in the **Value** box of the PLC Label.



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 delay time after powering on the CPU module before detecting an I/O 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 20 error logs. If there are more than 20 error logs, the oldest error log is overwritten by the latest error log.

➤ **PLC & SD Card**: when there are more than 20 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**

When the 24 VDC power is unstable and insufficient for 20 to 100 ms, it will be recorded in the error log and SM7 will be ON. What to do when the 24 VDC power is unstable:

➤ **Continue Running when power is stable**: all the operations will be stopped, and PLC CPU waits till the power is stable for 2 seconds, and then PLC begins to run.

➤ **Into Error Status:** When the 24 VDC power is unstable, PLC CPU Stops and the ERROR LED blinks rapidly.

Check and solve the problem. After all the problem is solved, supply PLC CPU with power and turn it on. If the power voltage is too low, the communication cannot go on. If the communication is working, it means the power is back on. But you still need to clarify what caused the power unstable.

● **I601 Timer interrupt Setting Time Base**

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

During PLC execution, you can use SR421 to modify the interrupt timing.

● **I602 Timer interrupt Setting Time Base**

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

During PLC execution, you can use SR422 to modify the interrupt timing.

● **I603 Timer interrupt Setting Time Base**

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

During PLC execution, you can use SR423 to modify the interrupt timing.

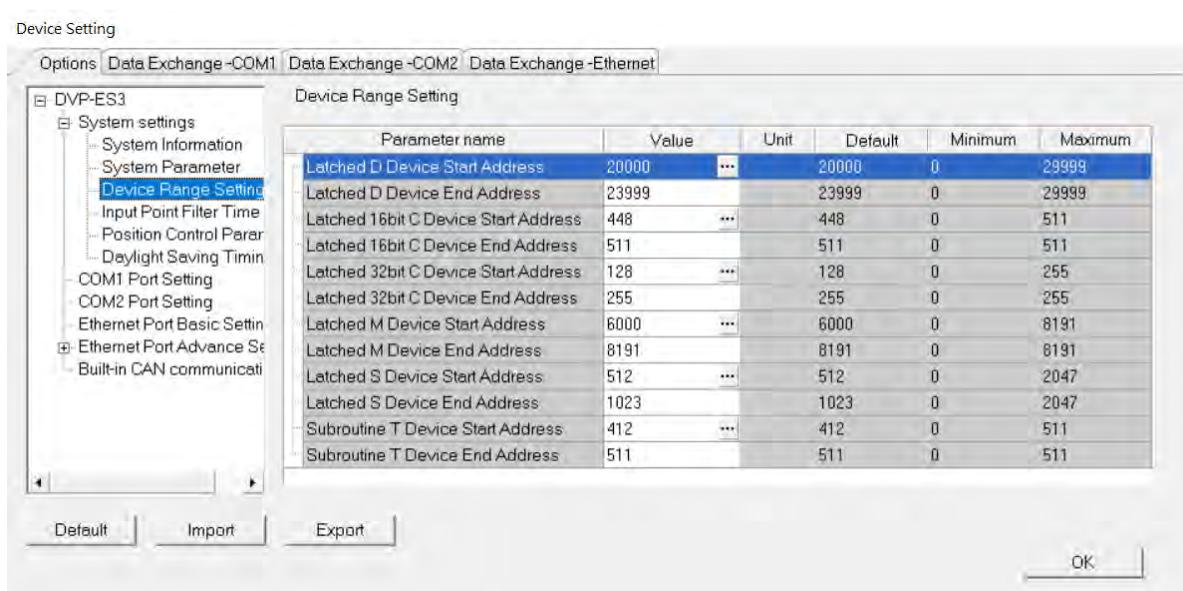
● **I604 Timer interrupt Setting Time Base**

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

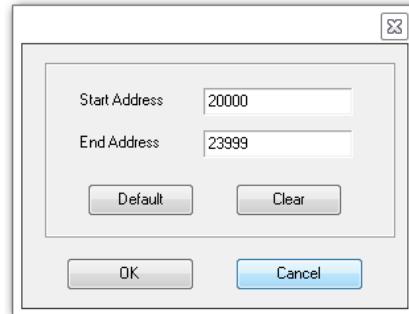
During PLC execution, you can use SR424 to modify the interrupt timing.

Device Range Setting

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

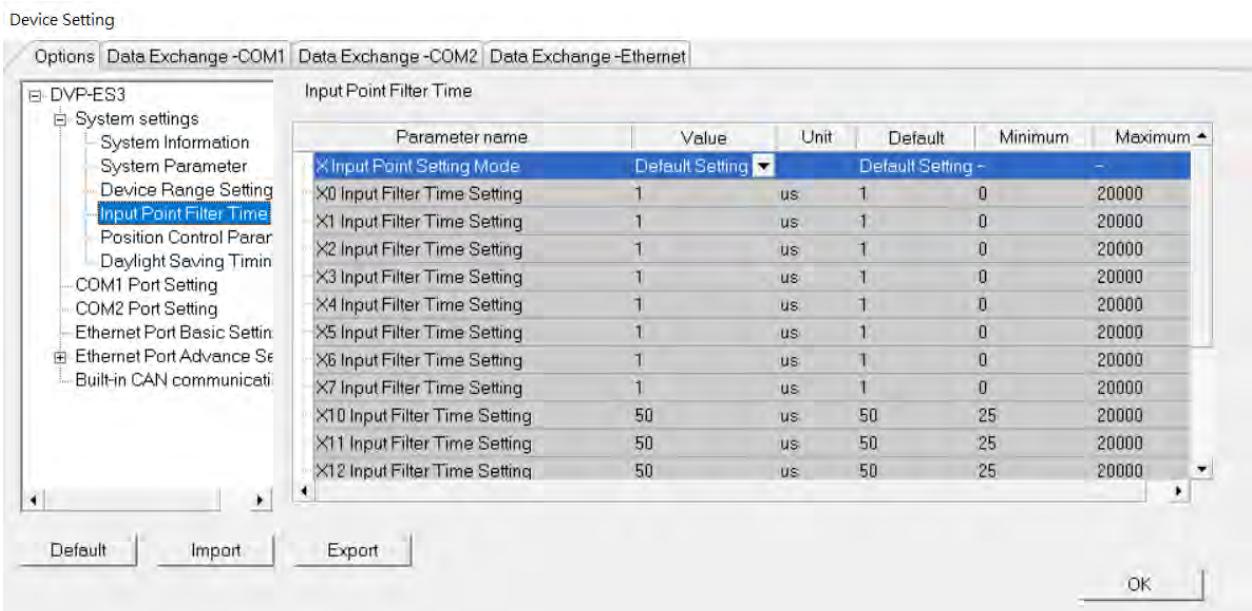


Click  to open the parameter dialog box to set the start and end address. In the dialog box, click **Default** to restore the setting to the default values; click **Clear** to clear the set values; click **OK** to save the values and close the dialog box; click **Cancel** to discard the setting and close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

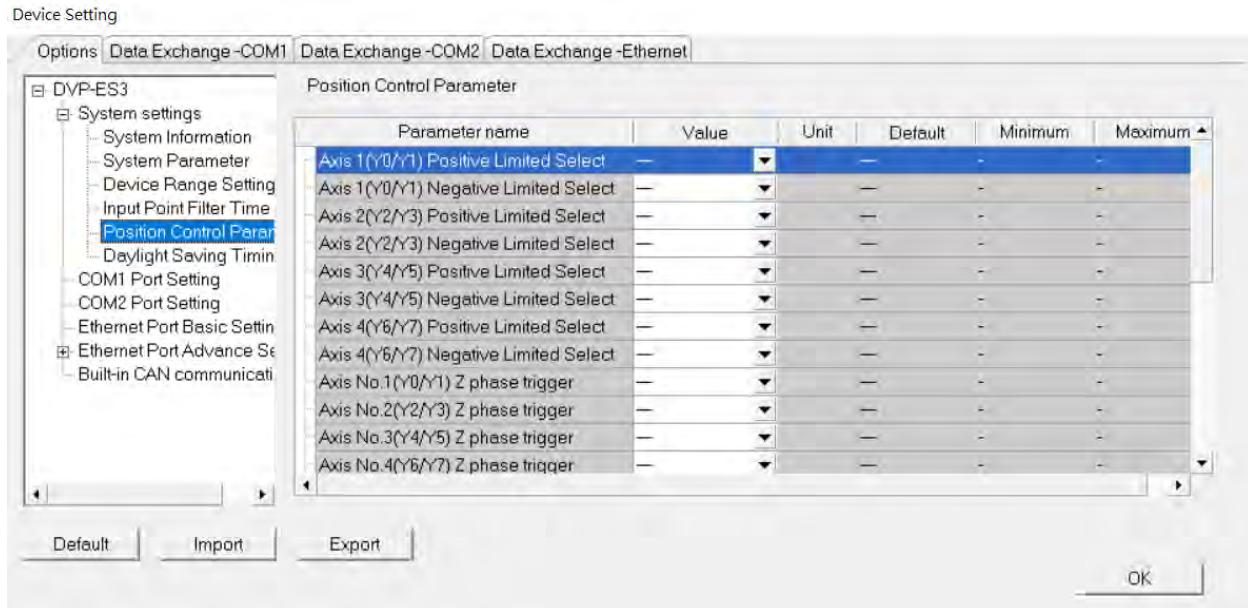
- X0–X17 Input Point Filter Time

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 to axis 4 channels; 12 limit points can be set at most.

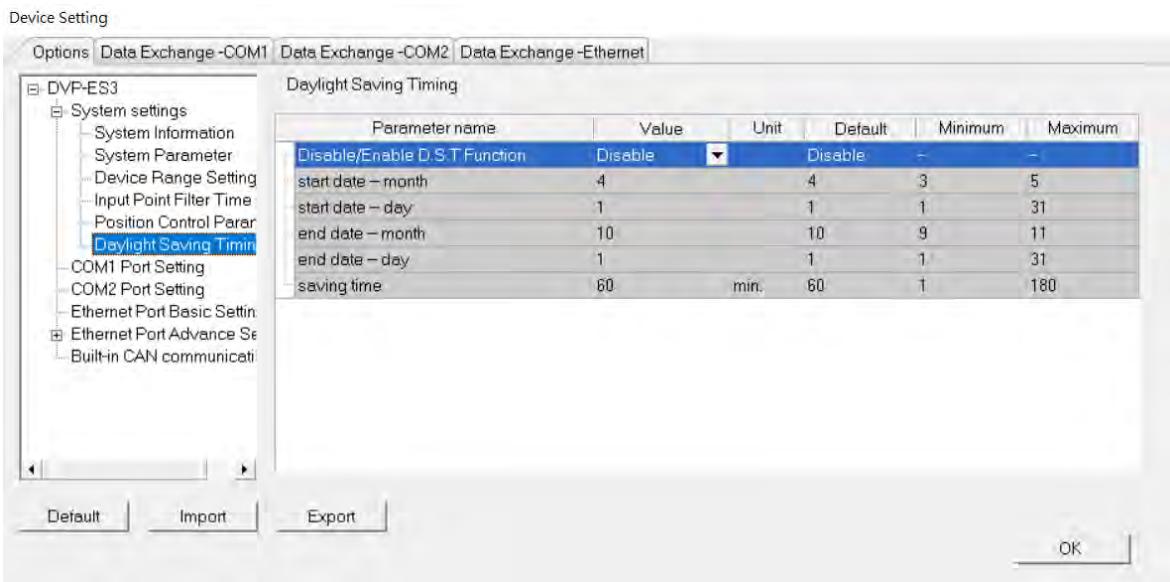
It also allows you to set specified input points as Z phase triggers for axis No. 1 to 4, select outputs to clear after home return, and, and configure positive/negative limited positions.



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

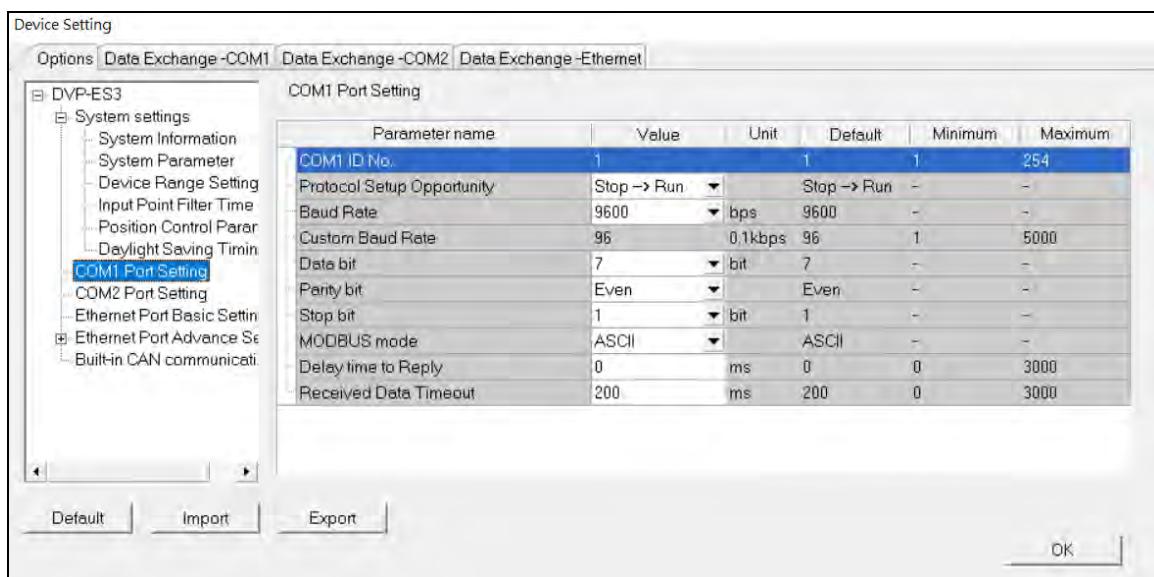
- **Example explanation:** example from the above image and all the options are enabled.

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	Shown after 60 minutes
4/01	01:00:01	00:00:01	
: (to)	: (to)	: (to)	
9/30	23:59:59	22:59:59	

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

8.3.2.2 COM1 & COM2 Port Setting

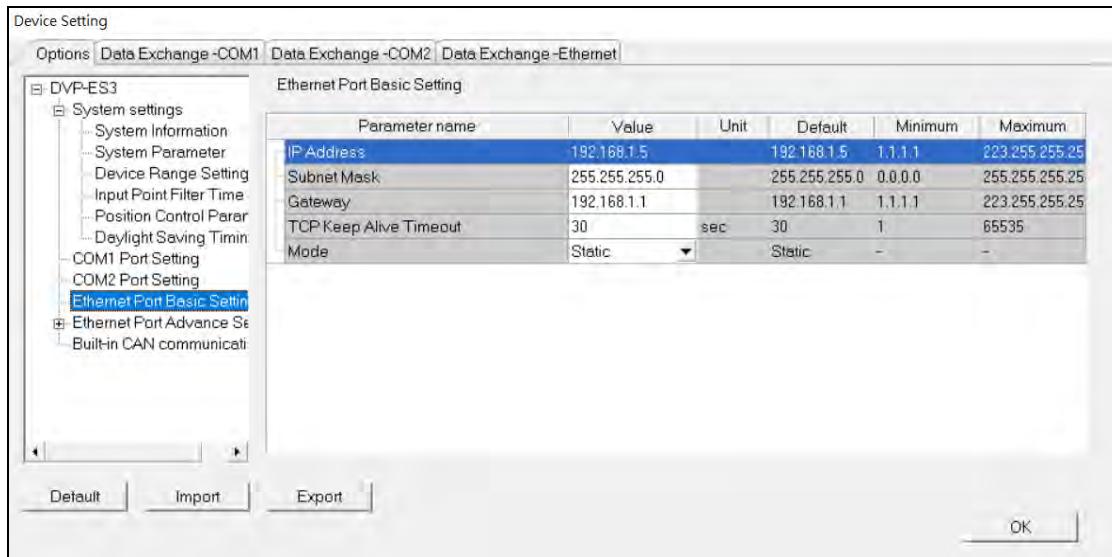
The DVP-ES3 Series CPU module has two communication ports. There are two areas to set the parameters, one for each communication port.



- ① 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.
- ② 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.
- ③ Select a communication speed in the **Baud Rate** list, or select **Custom** and enter a new rate.
- ④ Set the communication parameters for the port.
- ⑤ 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.
- ⑥ **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.

8.3.2.3 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.

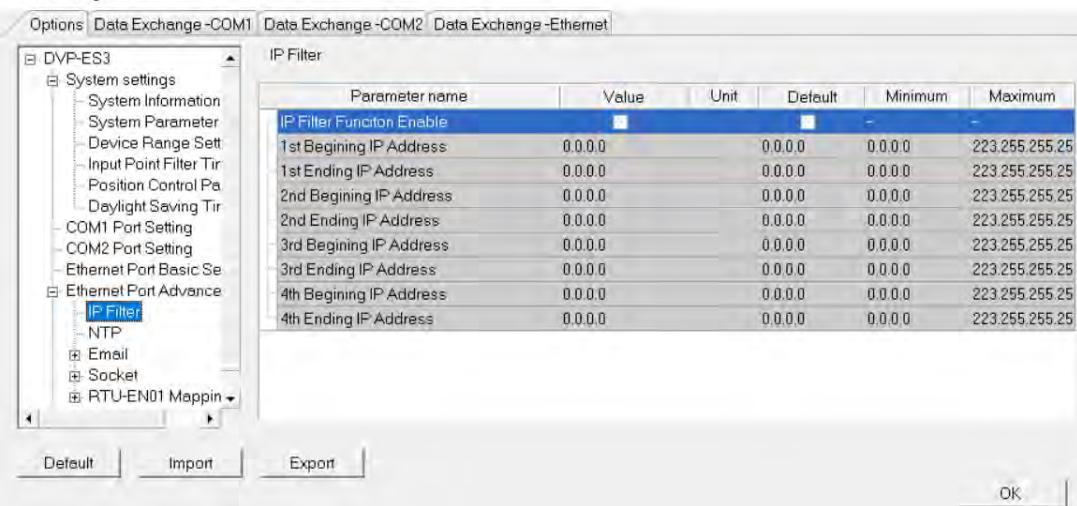
8.3.2.4 Ethernet Port Advanced Setting

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

IP Filter

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.

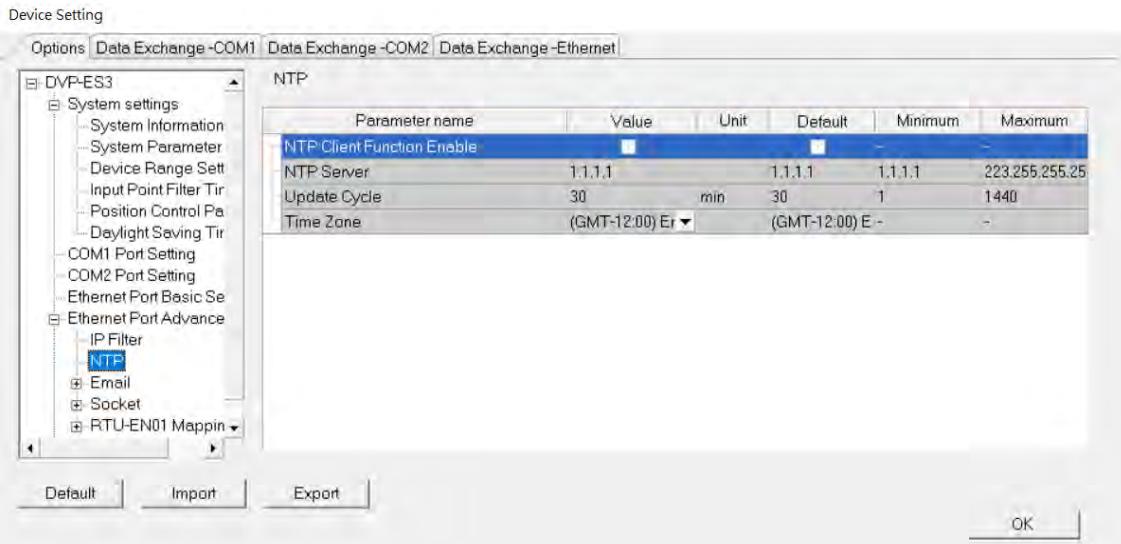
Device Setting



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.

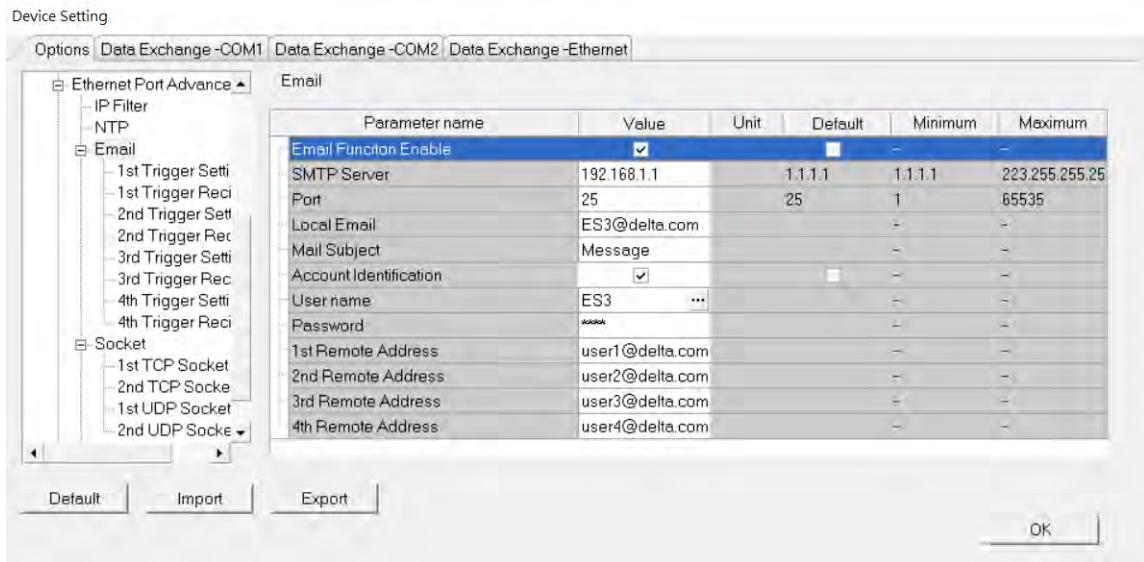


8

- Set the IP address for an NTP server. The CPU module corrects its internal time by connecting periodically to the server.
- Set a time interval for correcting the time in the CPU module. If the interval is 30 minutes, the CPU module connects to the NTP server every 30 minutes.
- Select a time zone in the **Time Zone** list.

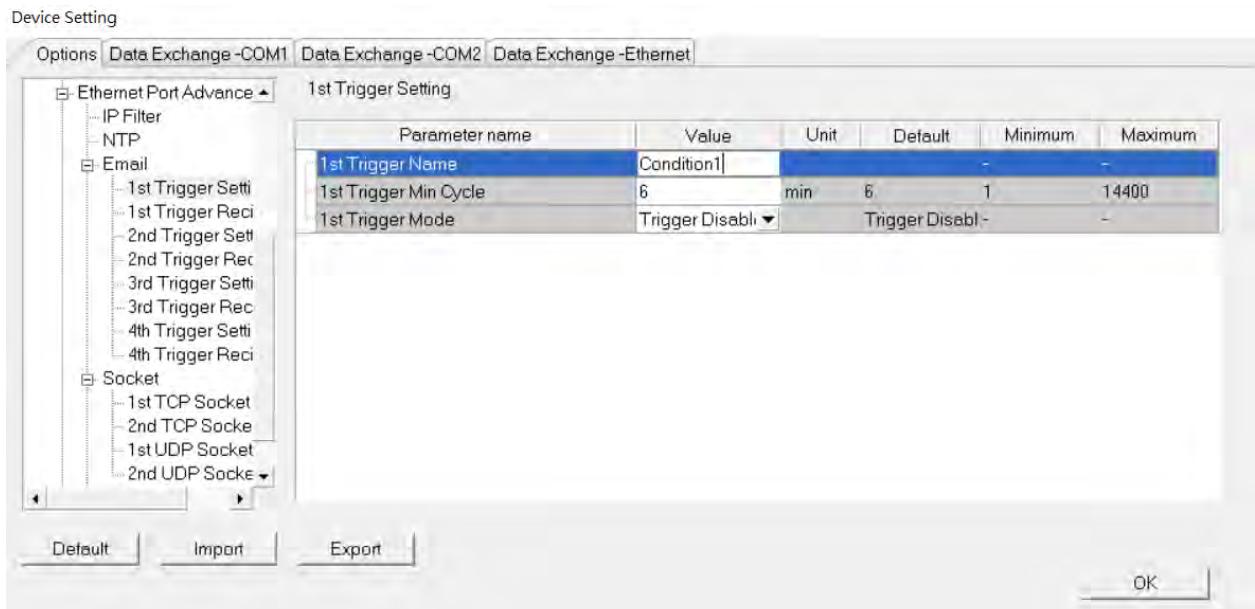
Email

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 4 sets of conditions for sending email to up to 4 groups of email addresses.



- ① Select **Email Function Enable** to enable the function.
- ② Set an IP address for 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.
- ③ 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.
- ④ Type the target email addresses.

Click **1st Trigger Setting** and enter a **Trigger Name** and a minimum interval in **Trigger Min Cycle**. Then select a **Trigger Mode**. When the sending condition is met, the system sends an email periodically. However, during the same period, the system does not send the same email again, even if the condition occurred again and 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.

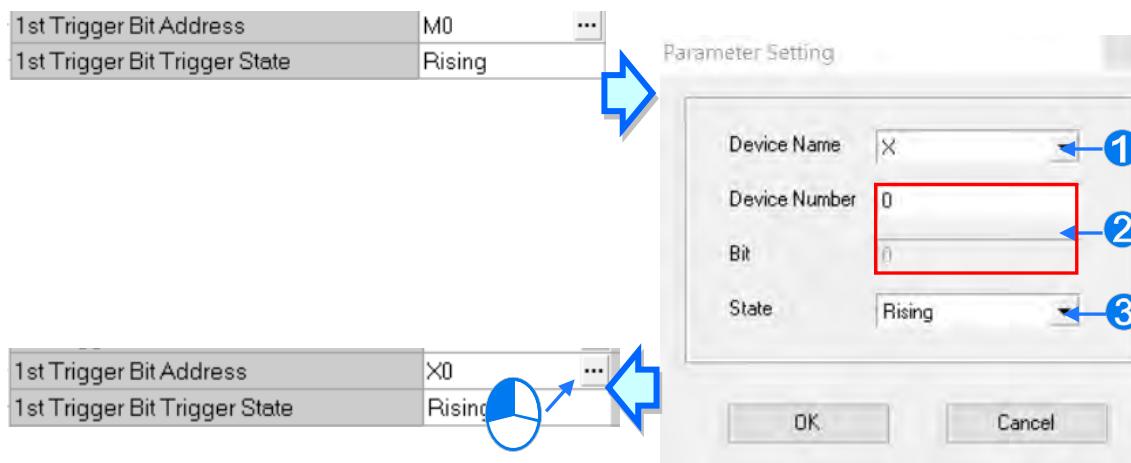
b) All Errors: Send an email if an error occurs in the CPU module.

● 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.



① Device Name: Select a device type.

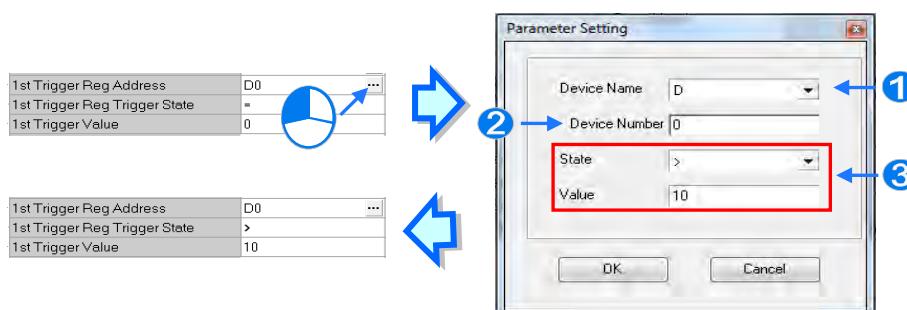
② Device Number & Bit: Type a device address; if the device type selected is X/Y, you must specify a bit number as well.

③ State: Select **Rising** or **Falling**.

8

● 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.



① **Device Name:** Users can select a device type in the **Device Name** drop-down list.

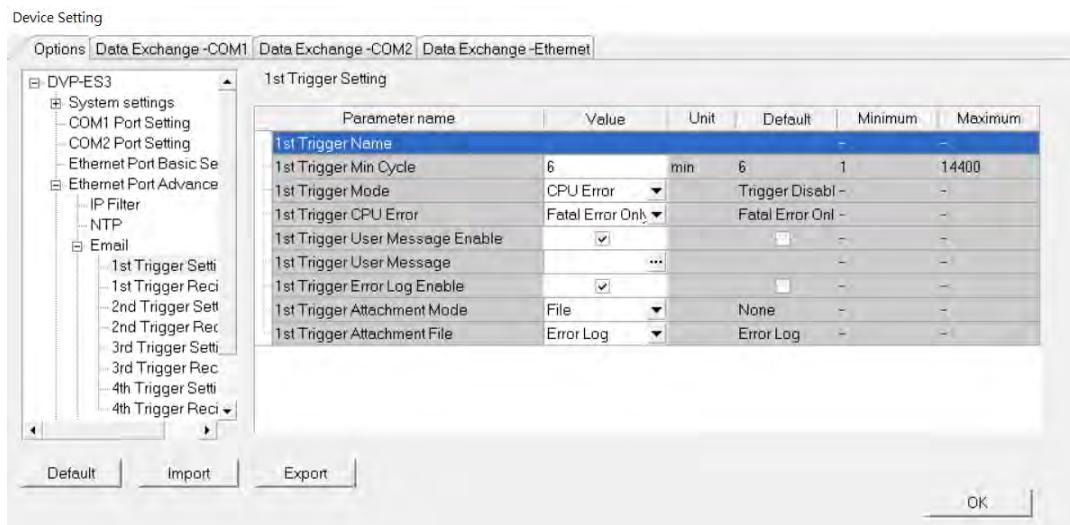
② **Device Number:** Users can type a device address in the **Device Number** field.

③ **State & Value:** Users can set a 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.

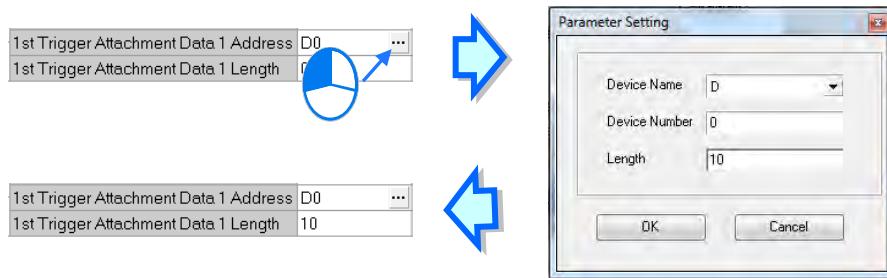
If you select **None**, no attachment is inserted.

● 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.



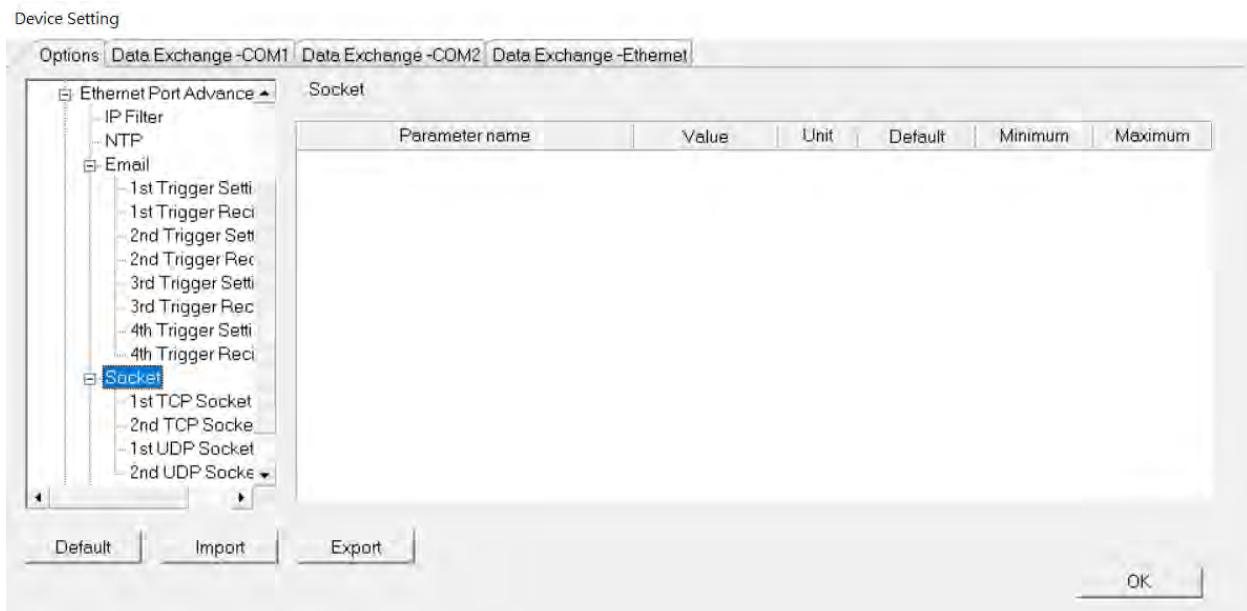
Select the recipient's remote address for the triggered email in the **Trigger Recipient** table. You can set the specific email address in the setting option of **Email**.

Sockets

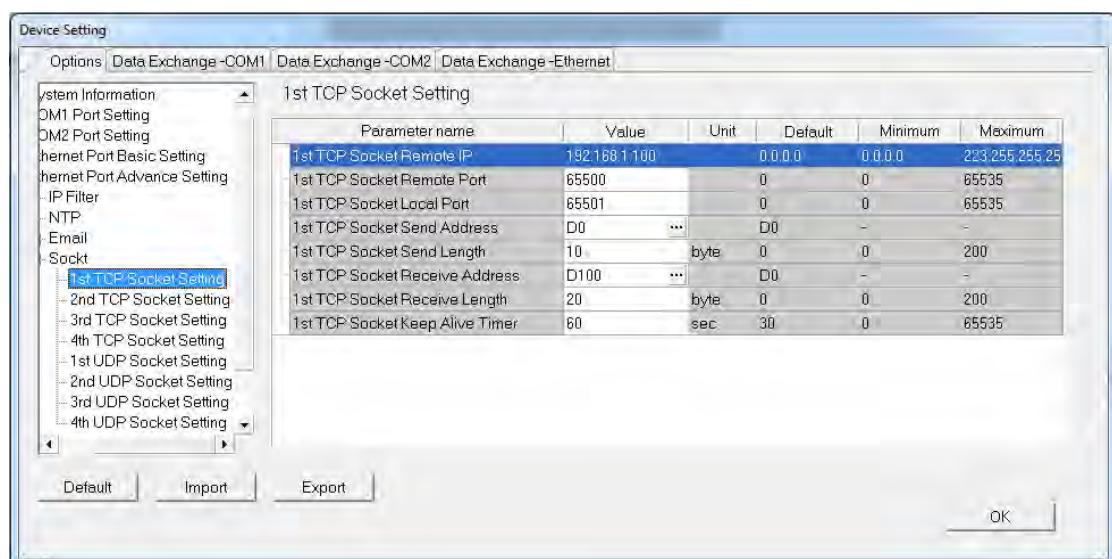
In the **Socket** table, set COM port parameters for data transmission through Ethernet.

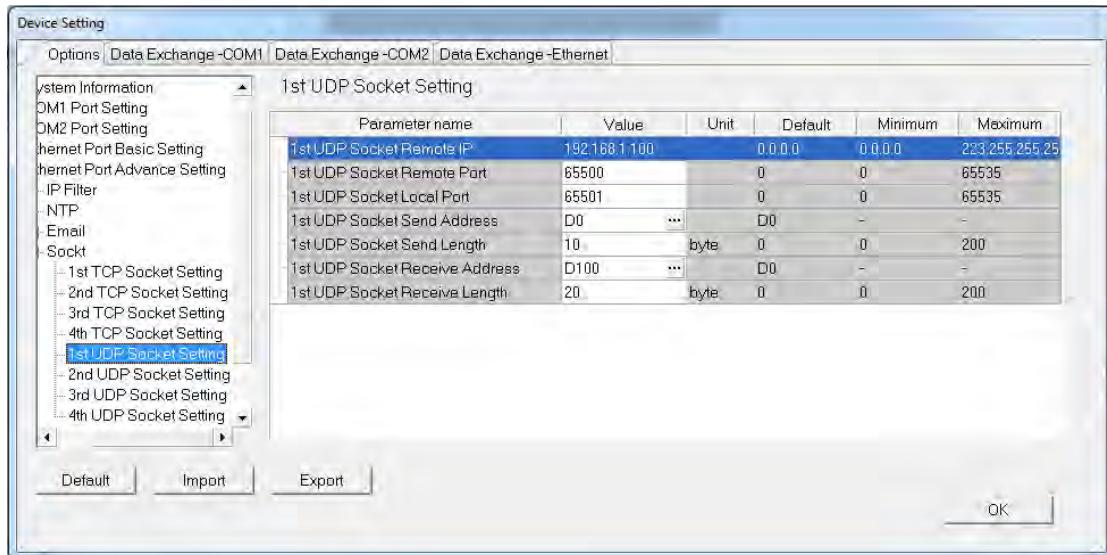
You must use this function with specific applied instructions; refer to the DVP-ES3 Series Programming Manual for more information.

Refer to the related documents or manuals for more information about sockets, as sockets are not described here.



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 4 connections in each of the 4 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 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 that of 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.

Take the image above for example, the IP address of the remote device is set to 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, then the remote device and the local CPU module can transmit data through this TCP connection.

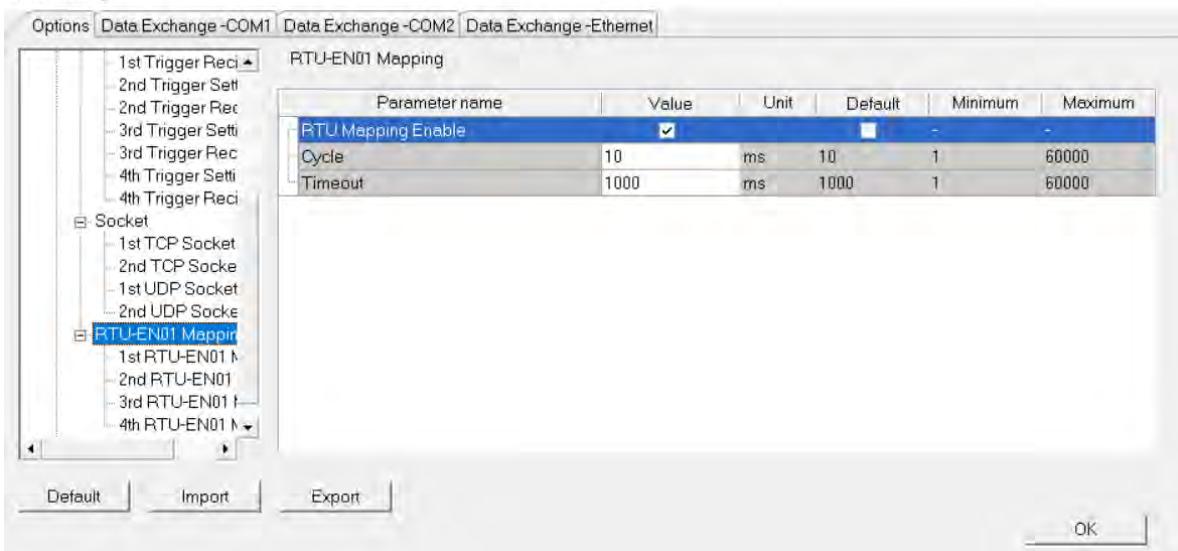
If the local CPU module sends 10-word data to the remote device, the data is stored in D0–D9 before the data is sent. If the local CPU module receives 20-word data from the remote device, the data is stored in D100–D119.

If the length of data received is larger than the setting value, 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, 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.

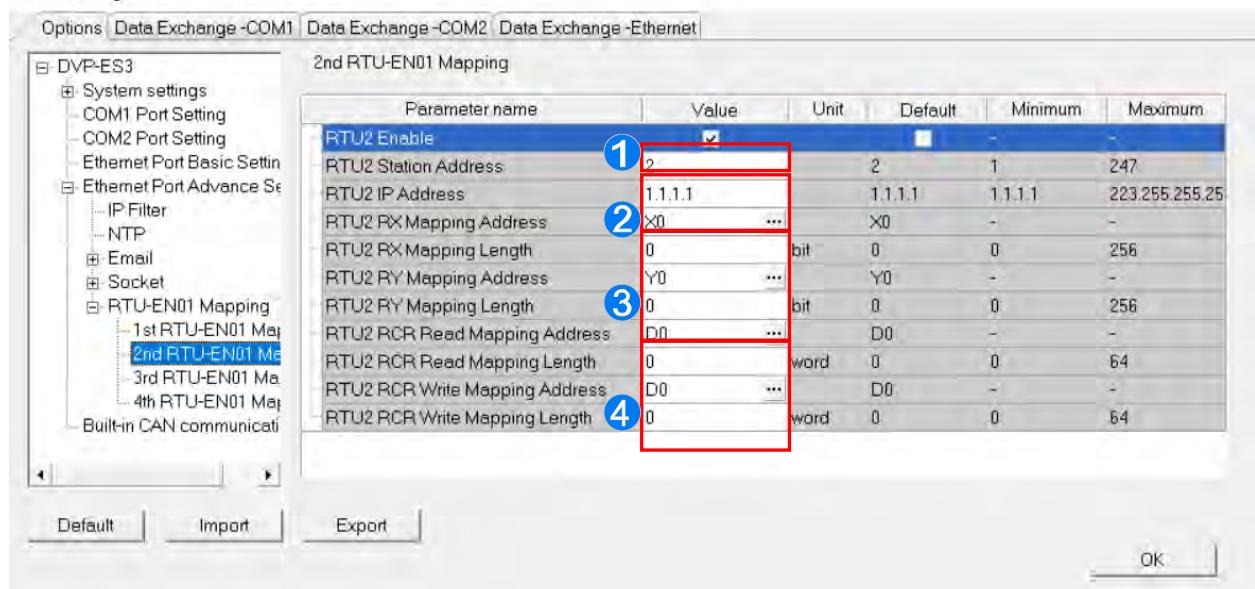
Device Setting



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 occurs 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.

Device Setting



① Select **RTU1 Enable** to enable this RTU function. You can set each RTU individually.

② Set a station address and an IP address.

- ❸ Set the **RX Mapping Address** and **RX Mapping Length** to map the digital input points of the DI module connected to RTU to the X/M devices of the DVP-ES3 Series module.
Set the **RY Mapping Address** and **Mapping Length** to map the digital output points of the DO module to the Y/M devices of the DVP-ES3 Series module.

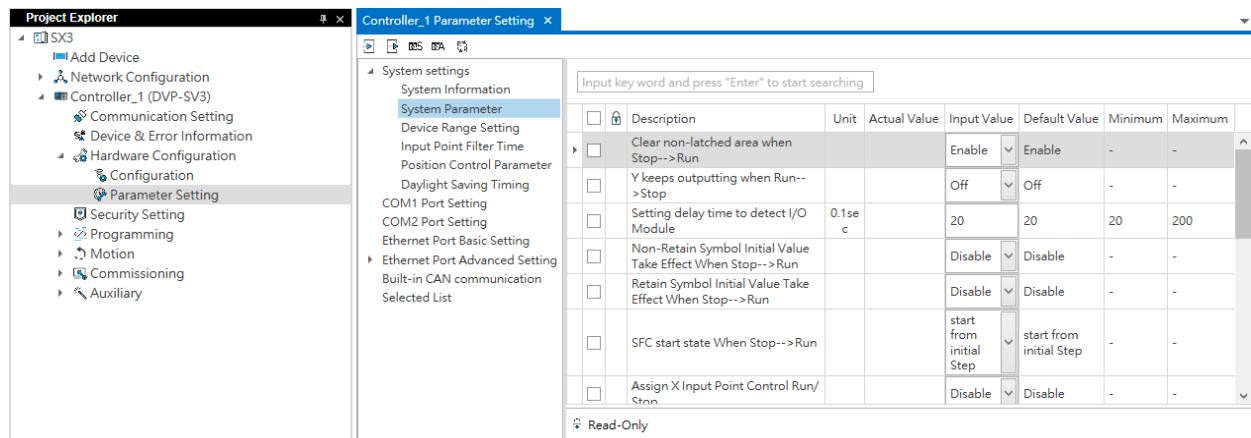
- ❹ Set the **RCR Read Mapping Address** and **RCR Read Mapping Length** to map the analog input points of the AI module connected to RTU to D/SR devices of the DVP-ES3 Series module.
Set the **RCR Write Mapping Address** and **RCR Write Mapping Length** to map the analog output points of the AO module to D/SR devices of the DVP-ES3 Series module.

8.4 Setting the Parameters in a DVP-ES3/EX3/SV3/SX3 Series CPU Module – DIADesigner

8.4.1 Opening the Controller Parameter Setting Window

Double-click **Parameter Setting** under **Controller** in the project tree to open the setting page.

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



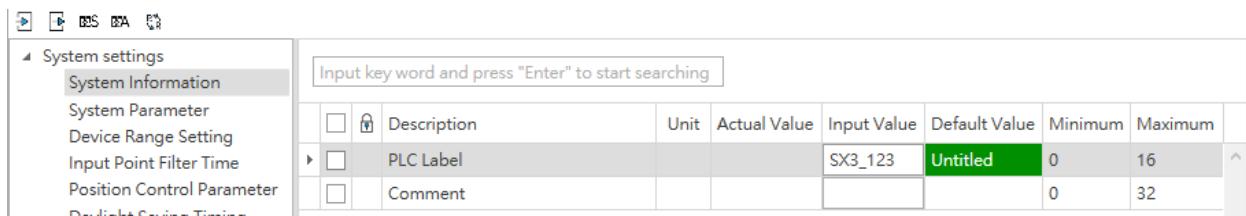
8.4.2 Parameter Setting

8.4.2.1 System Settings - System Information

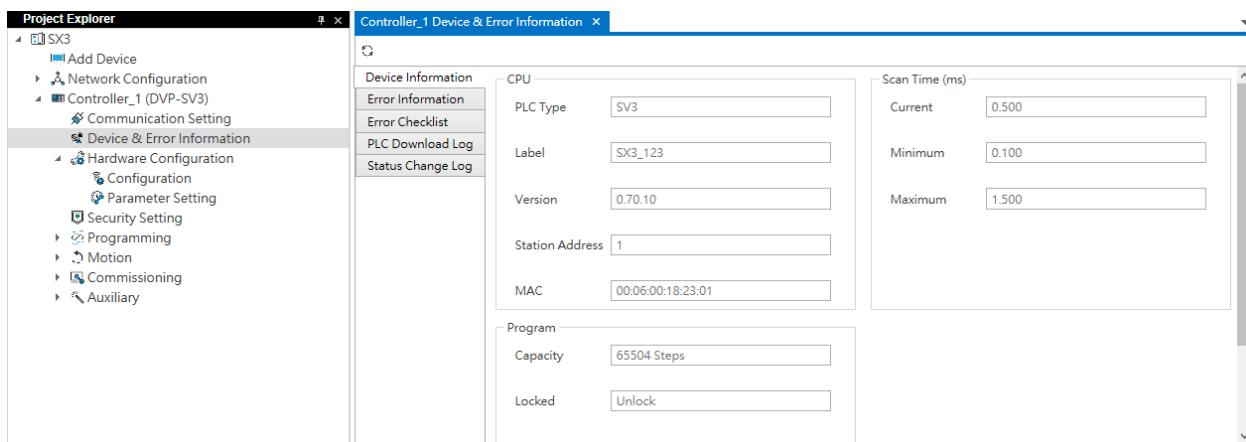
Unfold the **System settings** to find settings for **System Information**, **System Parameter**, **Device Range Setting**, **Input Point Filter Time**, **Position Control Para**, and **Daylight Saving Timing**.

System Information

On the System Information page, you can edit two parameters: **PLC Label** and **Comment**. You can enter up to 16 characters in the Name section and up to 32 characters in the Comment section. You can use spaces and special characters in these two sections. But please note that a Chinese character occupies two characters.

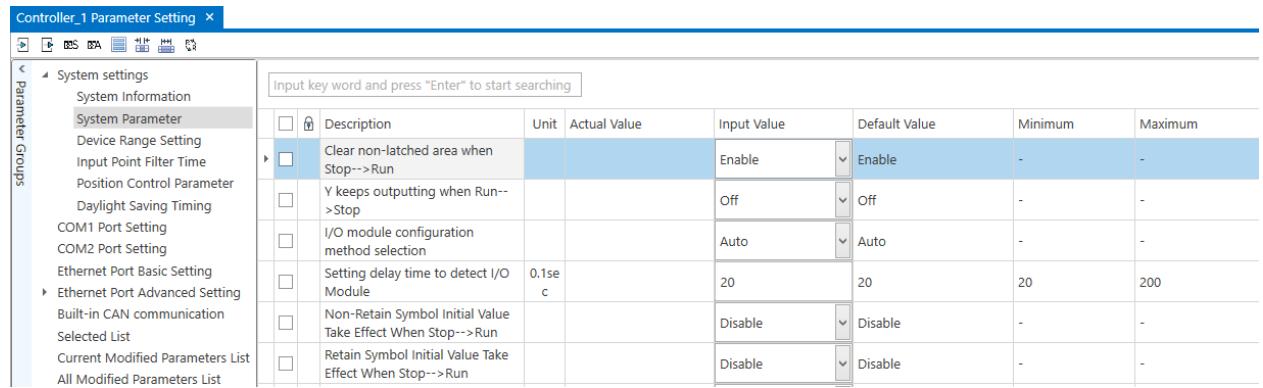


The edited name can be found in the **Device & Error Information** under **Controller**. You can identify a device by the device name.



8.4.2.2 System Settings - System Parameter

Select **System Parameter** and its setting page appears on the right. You can set **Description**, **Unit**, **Actual Value**, **Default Value**, **Minimum Value**, and **Maximum Value** for each setting items.



The screenshot shows the 'Controller_1 Parameter Setting' window with the 'System Parameter' tab selected. The left sidebar lists various system settings like 'System Information', 'Device Range Setting', and 'Position Control Parameter'. The main area is a table with columns: Description, Unit, Actual Value, Input Value, Default Value, Minimum, and Maximum. The table contains several rows, with the first row being 'Clear non-latched area when Stop->Run' set to 'Enable'.

	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
1	Clear non-latched area when Stop->Run		Enable	Enable	-	-	-
2	Y keeps outputting when Run-->Stop		Off	Off	-	-	-
3	I/O module configuration method selection		Auto	Auto	-	-	-
4	Setting delay time to detect I/O Module	0.1se c	20	20	20	200	
5	Non-Retain Symbol Initial Value Take Effect When Stop->Run		Disable	Disable	-	-	-
6	Retain Symbol Initial Value Take Effect When Stop->Run		Disable	Disable	-	-	-

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

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

- **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.

- **I/O module configuration method selection**

- **Auto:** Automatically operates based on actually connected modules, without checking if the number or arrangement of modules matches the downloaded configuration. Users must manually configure module parameters using the TO instruction.
- **Manual:** The PLC CPU will automatically match the configuration when it detects modules during power-up. Upon the PLC CPU's initial run, it will configure the modules using the pre-planned parameters.

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

This sets the delay time after powering on the CPU module before detecting an I/O module.

- **Non-Retain Symbol Initial Value Take Effect When Stop --> Run**

When Enable is selected, the values of non-retentive symbols will revert to their initial values when the PLC switches from STOP to RUN.

- **Retain Symbol Initial Value Take Effect When Stop --> Run**

When Enable is selected, the values of retentive symbols will revert to their initial values when the PLC switches from STOP to RUN.

- **SFC start state When Stop --> Run**

Set the SFC Step execution position.

➤ **Start from initial step:** When the PLC switches from STOP to RUN, the SFC Step will begin execution from the initial step.

➤ **Start from last executing step:** When the PLC switches from STOP to RUN, the SFC Step will resume execution from where it last left off.

- **Module Auto Mapping Area Updated Method**

When modules require frequent data updates, such as analog input modules continuously updating received analog signals and converting them into data the PLC CPU can process, the system will automatically configure corresponding device addresses for data access. These configured device addresses will be shown in the 'Input Register Range' and 'Output Register Range' columns of the module configuration table. The data register ranges corresponding to various special modules are provided in the table below. For detailed information, please refer to DVP-ES3/EX3/SV3/SX3 Series Programming Manual Section 2.2.16 SM/SR Supplementary Explanation - Expansion Module Points, Counts, and Model Codes.

Extension module	Data mapping area	Remark
Right side extension module	D28000 to D28079	
Left side extension module (DVP-SV3/SX3)	D29000 to D29079	
Left side extension module DNET/COPM (DVP-SV3/SX3)	D16000 to D19999	Set the timing for modules to update in "Module Auto Mapping Area update method".

The PLC CPU uses an auto-mapping area to manage module I/O. In every scan cycle, it automatically pulls module input values into the Input Registers and pushes values from the Output Registers to the module outputs. By selectively refreshing fewer modules through this parameter setting, you can significantly shorten the overall scan cycle.

➤ **Update all modules each cycle:** Update all modules.

➤ **Update 1 module each cycle:** The first scan refreshes ONE module, starting with the 1st module on the right (and left). The second scan then refreshes the 2nd module on the right (and left), and this process continues sequentially.

➤ **Update 2 modules each cycle:** The first scan refreshes TWO modules, starting with the 1st and 2nd module on the right (and left). The second scan then refreshes the 3rd and 4th module on the right (and left), and this process continues sequentially. If only three modules are connected, the second scan will refresh the 3rd and 1st modules.

- Update 4 modules each cycle: The first scan refreshes FOUR modules, starting with the 1st, 2nd, 3rd, and 4th module on the right (and left). The second scan then refreshes the 5th, 6th, 7th, and 8th module on the right (and left), and this process continues sequentially. If only five modules are connected, the second scan will refresh the 5th, 1st, 2nd, and 3rd modules.
- Disable: Disable auto mapping. Users can then manually read module input values or set module output values using FROM/TO instructions.

- **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 20 error logs. If there are more than 20 error

logs, the oldest error log is overwritten by the latest error log.

- **PLC & SD Card:** when there are more than 20 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**

When the 24 VDC power is unstable and insufficient for 20 to 100 ms, it will be recorded in the error log and SM7 will be ON. What to do when the 24 VDC power is unstable:

- Continue Running when power is stable: all the operation will be stopped and PLC CPU waits till the power is stable for 2 seconds and then PLC begins to run.
- Into Error Status: When the 24 VDC power is unstable, PLC CPU Stops and the ERROR LED blinks rapidly.

Check and solve the problem. After all the problem is solved, supply PLC CPU with power and turn it on. If the power voltage is too low, the communication cannot go on. If the communication is working, it means the power is back on. But you still need to clarify what caused the power unstable.

- **I601 Timer interrupt Setting Time Base**

Sets the interval for triggering the 1601 timer interrupt. This function is used together with Timer Interrupt 0. During PLC execution, you can use SR421 to modify the interrupt timing.

- **I602 Timer interrupt Setting Time Base**

Sets the interval for triggering the 1602 timer interrupt. This function is used together with Timer Interrupt 1. During PLC execution, you can use SR422 to modify the interrupt timing.

- **I603 Timer interrupt Setting Time Base**

Sets the interval for triggering the 1603 timer interrupt. This function is used together with Timer Interrupt 2. During PLC execution, you can use SR423 to modify the interrupt timing.

- **I604 Timer interrupt Setting Time Base**

Sets the interval for triggering the 1604 timer interrupt. This function is used together with Timer Interrupt 3. During PLC execution, you can use SR424 to modify the interrupt timing.

- **EIP Remote IO Mode**

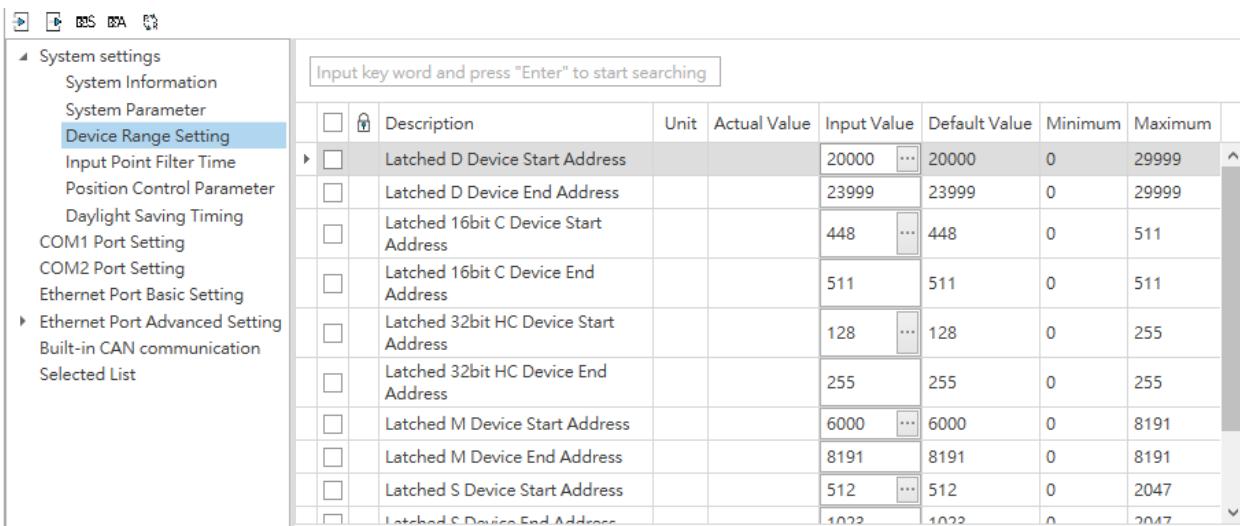
When Enable is selected, PLC is in EIP Remote IO Mode. When the PLC functions as an EtherNet/IP (EIP) slave, its RUN/STOP status will synchronize with the EIP master.

- **EIP Remote IO Mode Disconnection Handling**

- Stop: If the **EIP remote I/O mode** loses connection, the **PLC will stop running**.
- Keep Run: If the **EIP remote I/O mode** loses connection, the **PLC will keep running**.

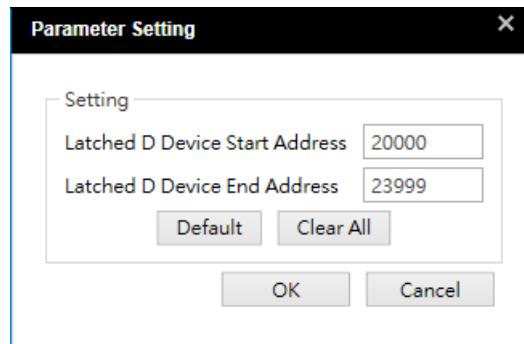
8.4.2.3 System Settings - Device Range Setting

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



Input key word and press "Enter" to start searching								
		Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
		Latched D Device Start Address		20000	...	20000	0	29999
		Latched D Device End Address		23999	23999	0	29999	
		Latched 16bit C Device Start Address		448	448	0	511	
		Latched 16bit C Device End Address		511	511	0	511	
		Latched 32bit HC Device Start Address		128	128	0	255	
		Latched 32bit HC Device End Address		255	255	0	255	
		Latched M Device Start Address		6000	6000	0	8191	
		Latched M Device End Address		8191	8191	0	8191	
		Latched S Device Start Address		512	512	0	2047	
		Latched S Device End Address		1022	1022	n	2047	

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.



8.4.2.4 System Settings - 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.

Input key word and press "Enter" to start searching

	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
	X Input Point Setting Mode				Default Setting	-	-
	X0 Input Filter Time Setting	us		1	1	0	20000
	X1 Input Filter Time Setting	us		1	1	0	20000
	X2 Input Filter Time Setting	us		1	1	0	20000
	X3 Input Filter Time Setting	us		1	1	0	20000
	X4 Input Filter Time Setting	us		1	1	0	20000
	X5 Input Filter Time Setting	us		1	1	0	20000
	X6 Input Filter Time Setting	us		1	1	0	20000
	X7 Input Filter Time Setting	us		1	1	0	20000
	X10 Input Filter Time Setting	us		50	50	25	20000
	X11 Input Filter Time Setting	us		50	50	25	20000

Read-Only

- 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.

8.4.2.5 System Settings - Position Control Parameter

The parameters on **Position Control Parameter** table set to specify input points as the positive and negative limits of axis 1 to axis 4 channels; 12 limit points can be set at most.

It also allows you to set specified input points as Z phase triggers for axis No. 1 to 4, select outputs to clear after home return, and, and configure positive/negative limited positions.

Input key word and press "Enter" to start searching								
		Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
▶	☐	Axis 1(Y0/Y1) Positive Limited Select		---	▼	---	-	-
▶	☐	Axis 1(Y0/Y1) Negative Limited Select		---	▼	---	-	-
▶	☐	Axis 2(Y2/Y3) Positive Limited Select		---	▼	---	-	-
▶	☐	Axis 2(Y2/Y3) Negative Limited Select		---	▼	---	-	-
▶	☐	Axis 3(Y4/Y5) Positive Limited Select		---	▼	---	-	-
▶	☐	Axis 3(Y4/Y5) Negative Limited Select		---	▼	---	-	-
▶	☐	Axis 4(Y6/Y7) Positive Limited Select		---	▼	---	-	-
▶	☐	Axis 4(Y6/Y7) Negative Limited Select		---	▼	---	-	-

Read-Only

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

8.4.2.6 System Settings - 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**

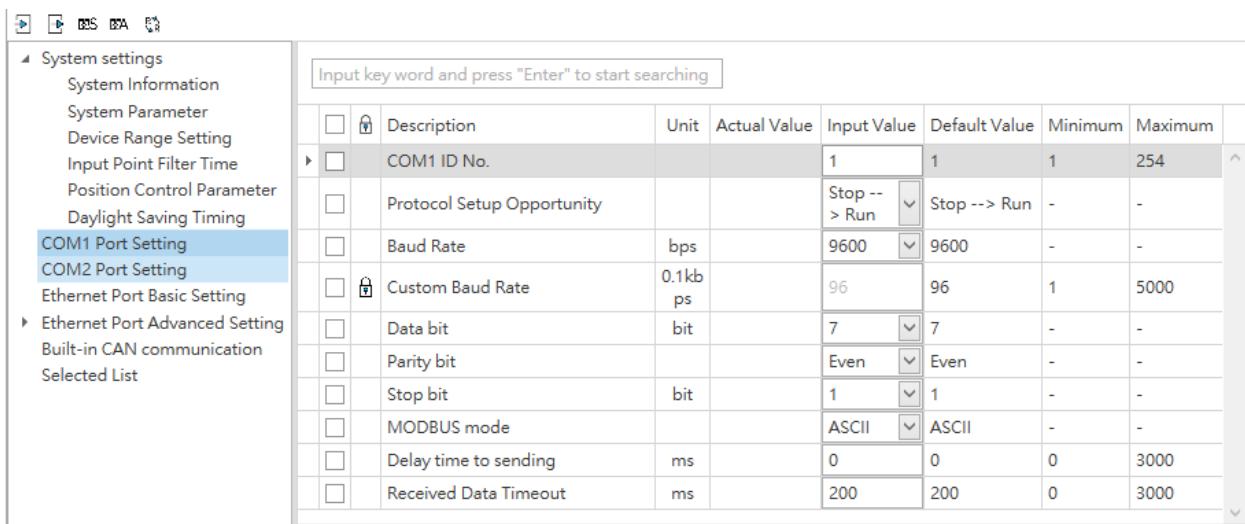
Sets daylight saving time in minutes

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

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

8.4.2.7 COM1 & COM2 Port Settings

The DVP-ES3/EX3/SV3/SX3 Series CPU module come with one or two communication ports, depending on the models. The setting items for COM1 and COM2 are the same; you can set the parameters for COM1 and COM2 ports respectively.



- 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 Baud Rate** and enter a new rate.
- ❹ Set the communication parameters, Data bit, Parity bit, Stop bit, and Modbus mode for the port.
- ❺ Set the **Delay time to sending**: when the DVP-ES3/EX3/SV3/SX3 CPU module receives communication, it waits for the set time before responding to the remote modules.
- ❻ Set the **Received Data Timeout**: when the DVP-ES3/EX3/SV3/SX3 Series CPU module acts as a master and sends out communication commands, if no response is received within the set time, it is considered a timeout.

8.4.2.8 Ethernet Port Basic Setting

Click **Ethernet Port Basic Setting** to see the setting 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.

Input key word and press "Enter" to start searching							
	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
▶	IP Address		192.168.1.5	192.168.1.5	1.1.1.1	223.255.255.255	
▶	Subnet Mask		255.255.255.0	255.255.255.0	0.0.0.0	255.255.255.255	
▶	Gateway		192.168.1.1	192.168.1.1	1.1.1.1	223.255.255.255	
▶	TCP Keep Alive Timeout	sec	30	30	1	65535	
▶	Mode		Static	Static	-	-	

8.4.2.9 Ethernet Port Advanced Setting

Click **Ethernet Port Advanced Setting** to see the setting page. There are setups for **IP Filter**, **NTP**, **Email**, **Socket**, and **RTU-EN01 mapping**.

IP Filter

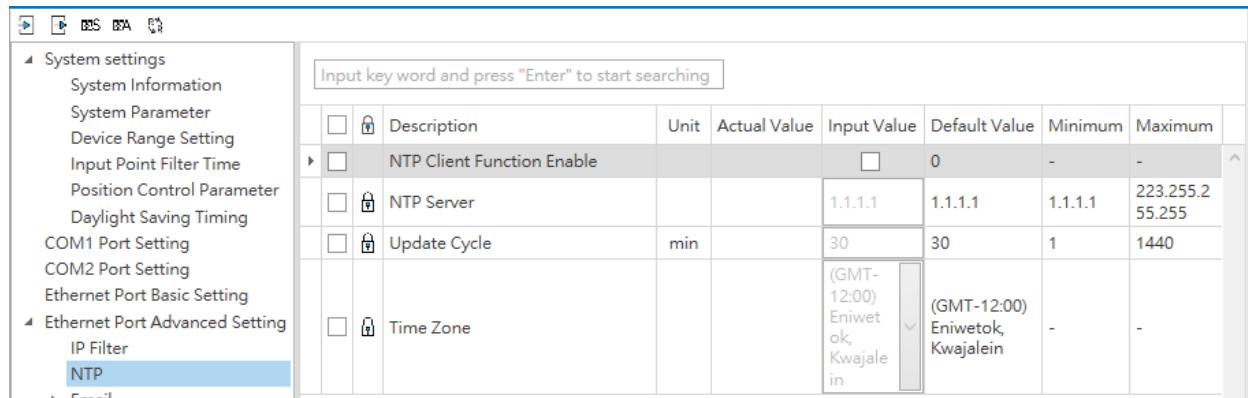
Devices whose IP addresses are listed in the table are allowed to communicate with the CPU module; the CPU module discards data packets sent from devices whose IP addresses are not in the table. Devices on a network are filtered. This setting ensures that objects communicating with the CPU module are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

Input key word and press "Enter" to start searching							
	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
▶	IP Filter Funciton Enable		0	0	-	-	
▶	1st Beginning IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	
▶	1st Ending IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	
▶	2nd Beginning IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	
▶	2nd Ending IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	
▶	3rd Beginning IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	
▶	3rd Ending IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	
▶	4th Beginning IP Address		0.0.0.0	0.0.0.0	0.0.0.0	223.255.255.255	

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.

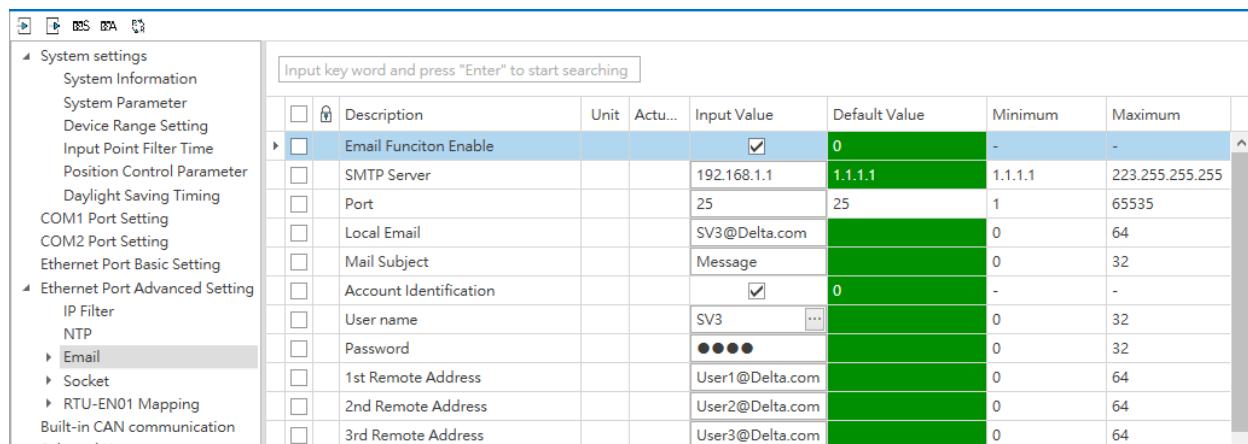


Input key word and press "Enter" to start searching							
	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
▶	<input type="checkbox"/> NTP Client Function Enable			<input type="checkbox"/>	0	-	-
▶	<input type="checkbox"/> NTP Server		1.1.1.1	1.1.1.1	1.1.1.1	223.255.255.255	
▶	<input type="checkbox"/> Update Cycle	min	30	30	1	1440	
▶	<input type="checkbox"/> Time Zone		(GMT-12:00) Eniwetok, Kwajalein	(GMT-12:00) Eniwetok, Kwajalein	-	-	

- ① Select **NTP Client Function Enable** to enable this function.
- ② Set the IP address for an **NTP server**. The CPU module corrects its internal time by connecting periodically to the server.
- ③ **Update Cycle**: Set a time interval for correcting the time in the CPU module. If the interval is 30 minutes, the CPU module connects to the NTP server every 30 minutes.
- ④ 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 4 sets of conditions for sending email to up to 4 groups of email addresses.

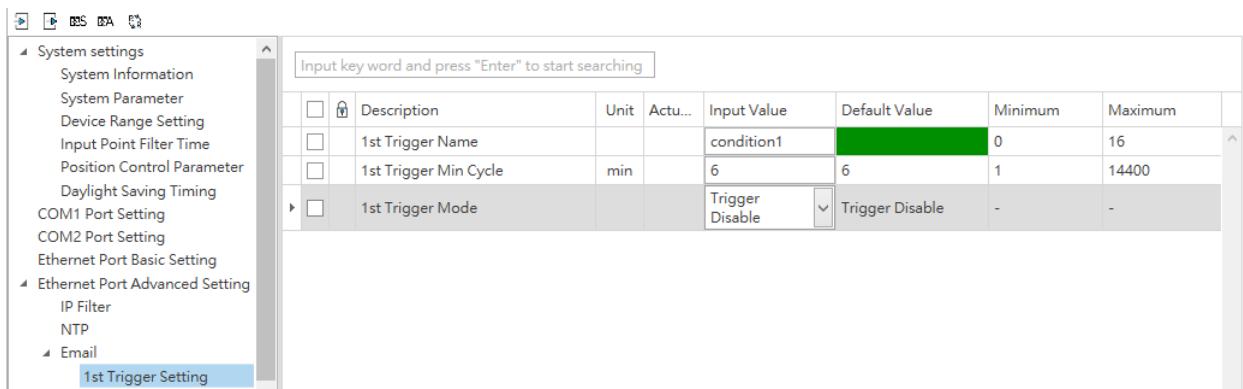


Input key word and press "Enter" to start searching							
	Description	Unit	Actual Value	Input Value	Default Value	Minimum	Maximum
▶	<input checked="" type="checkbox"/> Email Function Enable		<input checked="" type="checkbox"/>	0	-	-	-
▶	<input type="checkbox"/> SMTP Server		192.168.1.1	1.1.1.1	1.1.1.1	223.255.255.255	
▶	<input type="checkbox"/> Port		25	25	1	65535	
▶	<input type="checkbox"/> Local Email		SV3@Delta.com		0	64	
▶	<input type="checkbox"/> Mail Subject		Message		0	32	
▶	<input type="checkbox"/> Account Identification		<input checked="" type="checkbox"/>	0	-	-	-
▶	<input type="checkbox"/> User name		SV3		0	32	
▶	<input type="checkbox"/> Password		*****		0	32	
▶	<input type="checkbox"/> 1st Remote Address		User1@Delta.com		0	64	
▶	<input type="checkbox"/> 2nd Remote Address		User2@Delta.com		0	64	
▶	<input type="checkbox"/> 3rd Remote Address		User3@Delta.com		0	64	

- ① Select **Email Function Enable** to enable this function.
- ② Set an IP address for the **SMTP server**. Set the **Port** of SMTP server and set the sender's **Local Email** address. Type the **Mail Subject** to appear at the start of the subject of every email.

- ③ Select **Account identification** checkbox to authenticate the connection with a **user name** and a **password** when logging into an SMTP server.
- ④ Type the **Remote Addresses**.

Click **1st Trigger Setting** and enter a **Trigger Name** and a minimum interval in **Trigger Min Cycle**. Then select a **Trigger Mode**. When the sending condition is met, the system sends an email periodically. However, during the same period, the system does not send the same email again, even if the condition occurred again and 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 CPU operation manuals for more information on errors occurring in CPU modules. After you select **CPU Error**, you can further select **Fatal Error Only** or **All Errors**.

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

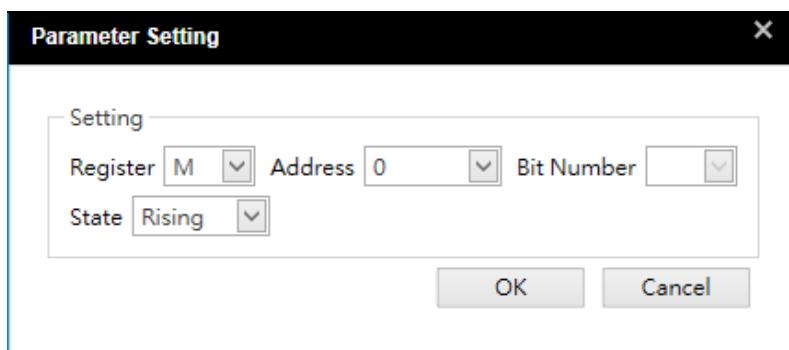
b) **All Errors**: Send an email if an error occurs in the CPU module.

● 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 M0 switches from OFF to ON, it triggers sending an email. To set a condition, click the **...** button in the following dialog box.



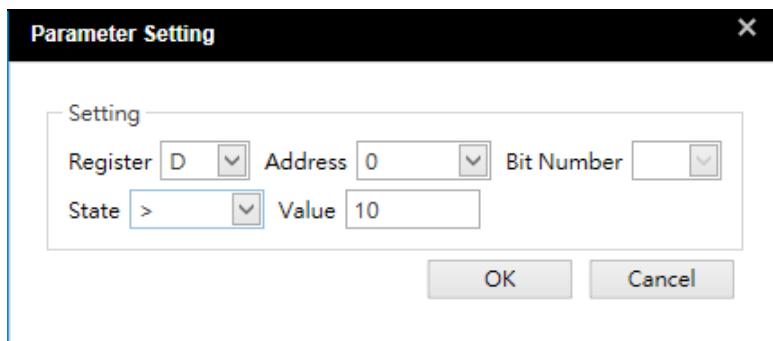
● **Register:** Select a device type.

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

● **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.



● **Register:** Users can select a device type.

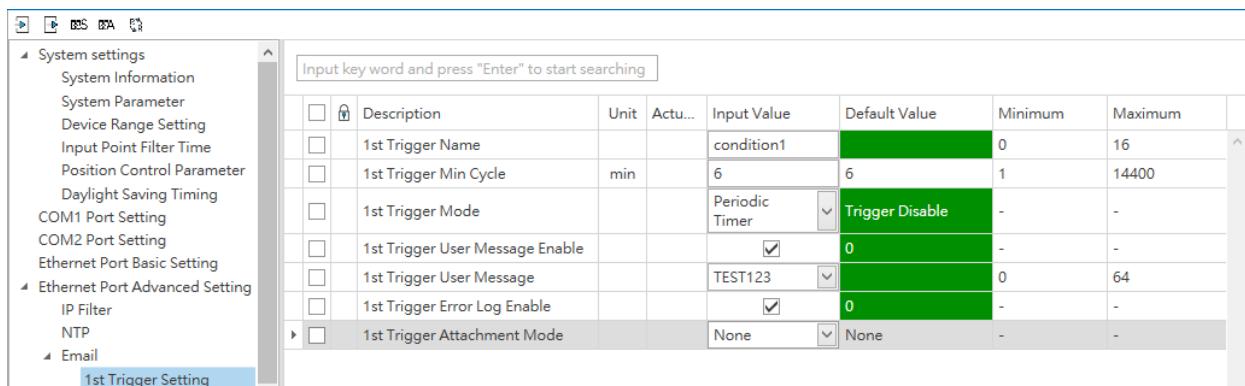
● **Address and Bit Number:** Users can type a device address.

● **State & Value:** Users can set a 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** and then you can add a message as the email content in the dialog box.

If you select the **Trigger Error Log Enable**, 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.

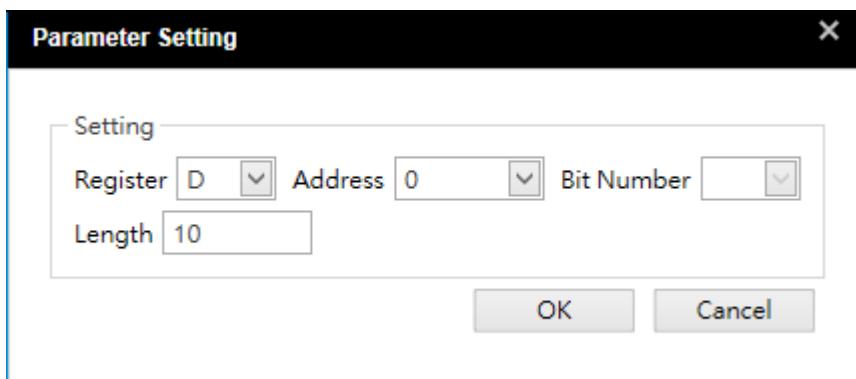
If you select **None**, no attachment is inserted.

- **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, if the condition is met, the values in D0–D9 are sent as an attachment as the example shown here.



Select the recipient's remote address for the triggered email in the **Trigger Recipient** table. You can set the specific email address in the setting option of **Email**.

The screenshot shows the "Trigger Recipient" table in the Device Config software. The table has columns: Description, Unit, Actu..., Input Value, Default Value, Minimum, and Maximum. The table rows are:

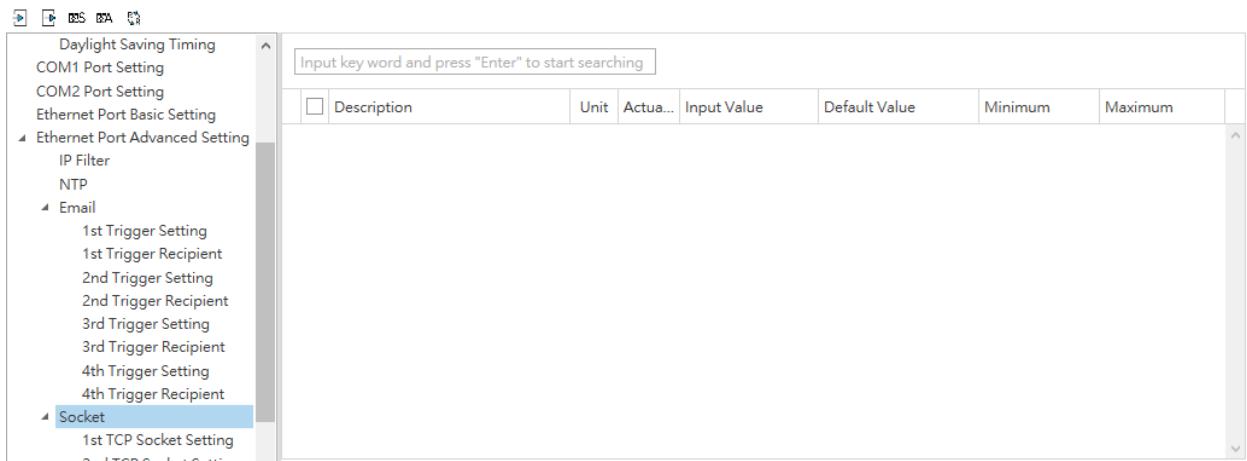
Description	Unit	Actu...	Input Value	Default Value	Minimum	Maximum
1st Remote Address			<input checked="" type="checkbox"/>	0	-	-
2nd Remote Address			<input type="checkbox"/>	0	-	-
3rd Remote Address			<input checked="" type="checkbox"/>	0	-	-
4th Remote Address			<input type="checkbox"/>	0	-	-

Sockets

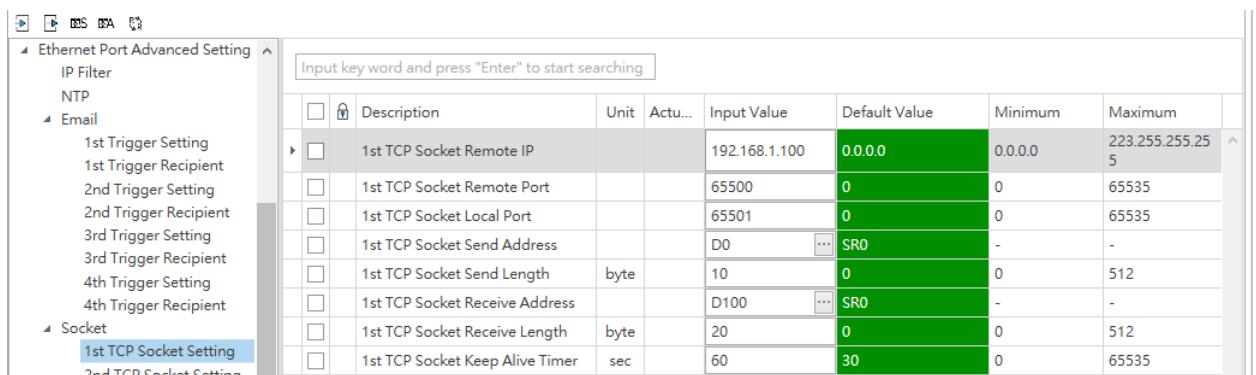
In the **Socket** table, set COM port parameters for data transmission through Ethernet.

You must use this function with specific applied instructions; refer to the DVP-ES3 Series Programming Manual for more information.

Refer to the related documents or manuals for more information about sockets, as sockets are not described here.



The system for the DVP-ES3/EX3/SV3/SX3 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 connections through both protocols 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 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 0–512 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 0–512 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.

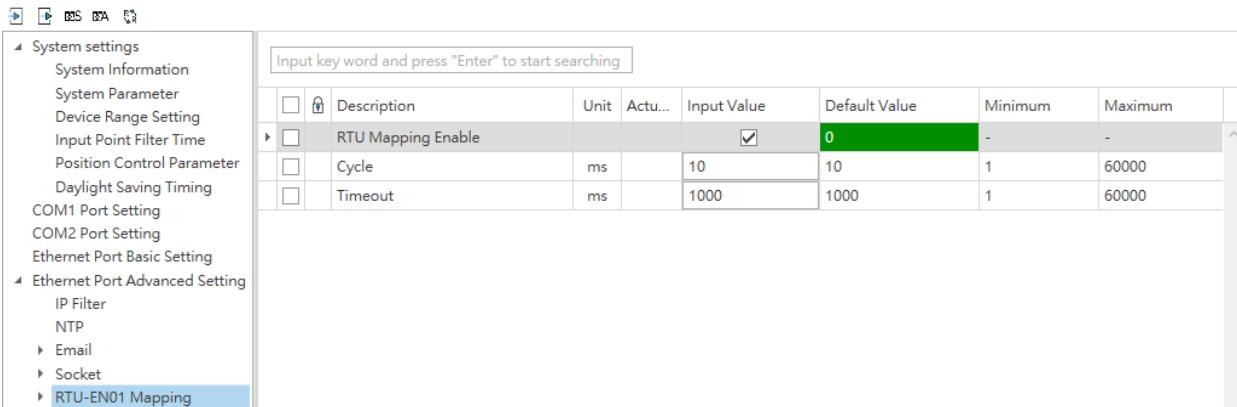
The port number used by the local CPU module and that of the remote device cannot be the same, and the devices where you store the sent data cannot overlap the devices where you store the received data. Take the image above for example, if the IP address of the remote device is 192.168.1.100, the port number used by the remote device is 65500, the port number used by the local CPU module is 65501, then 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, 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, the data is stored in the devices starting from D100, and the values in devices where no new data is stored are unchanged.

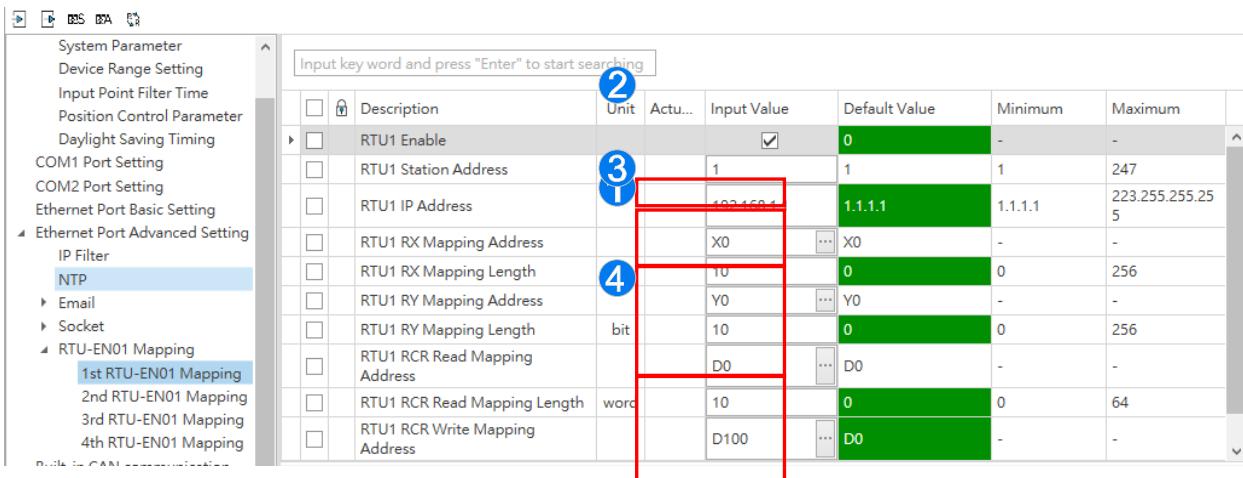
If no data is transmitted, and 60 seconds have elapsed, the CPU module closes the socket and terminates the connection.

In the **RTU-EN01 Mapping** table, you can set a Delta RTU-EN01 slave in connection with a DVP-ES3/EX3/SV3/SX3 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/EX3/SV3/SX3 Series module. Set the update cycle in **Cycle** box and a timeout in **Timeout** box. It means a timeout occurs when RTU does not give a reply within the timeout set.

The data mapping between each group of RTU-EN01 and DVP-ES3/EX3/SV3/SX3 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.

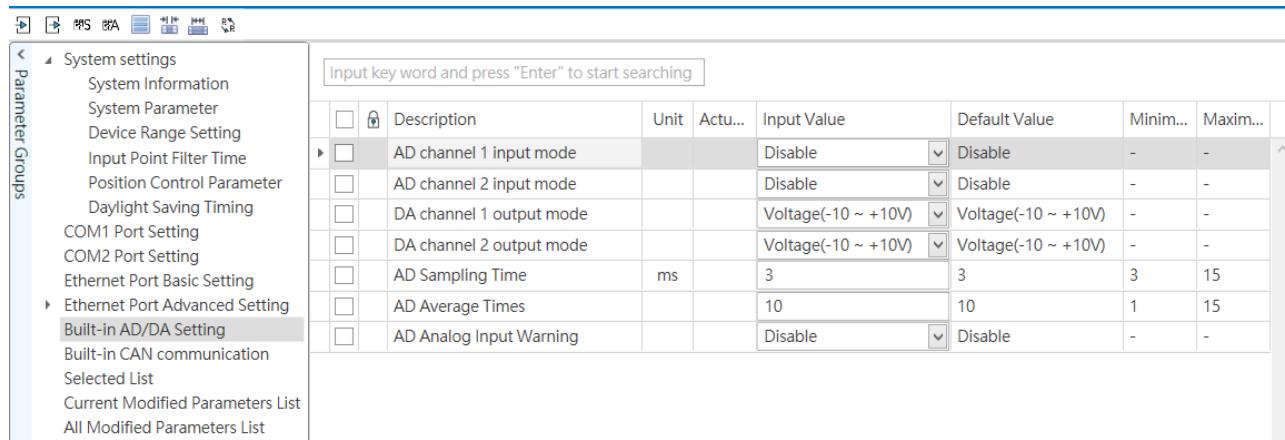


Description	Unit	Actu...	Input Value	Default Value	Minimum	Maximum
RTU1 Enable			0	-	-	
RTU1 Station Address		1	1	1	247	
RTU1 IP Address		192.168.1.1	1.1.1.1	1.1.1.1	223.255.255.255	
RTU1 RX Mapping Address	X0		X0	-	-	
RTU1 RX Mapping Length	10		0	0	256	
RTU1 RY Mapping Address	Y0		Y0	-	-	
RTU1 RY Mapping Length	bit	10	0	0	256	
RTU1 RCR Read Mapping Address	D0		D0	-	-	
RTU1 RCR Read Mapping Length	word	10	0	0	64	
RTU1 RCR Write Mapping Address	D100		D0	-	-	

- ① Select **RTU1 Enable** to enable this RTU function. You can set each RTU individually.
- ② Set a station address and an IP address.
- ③ Set the **RX Mapping Address** and **RX Mapping Length** to map the digital input points of the DI module connected to RTU to the X/M devices of the DVP-ES3 Series module.
Set the **RY Mapping Address** and **Mapping Length** to map the digital output points of the DO module to the Y/M devices of the DVP-ES3 Series module.
- ④ Set the **RCR Read Mapping Address** and **RCR Read Mapping Length** to map the analog input points of the AI module connected to RTU to D/SR devices of the DVP-ES3 Series module.
Set the **RCR Write Mapping Address** and **RCR Write Mapping Length** to map the analog output points of the AO module to D/SR devices of the DVP-ES3 Series module.

8.4.2.10 Built-in AD/DA Setting

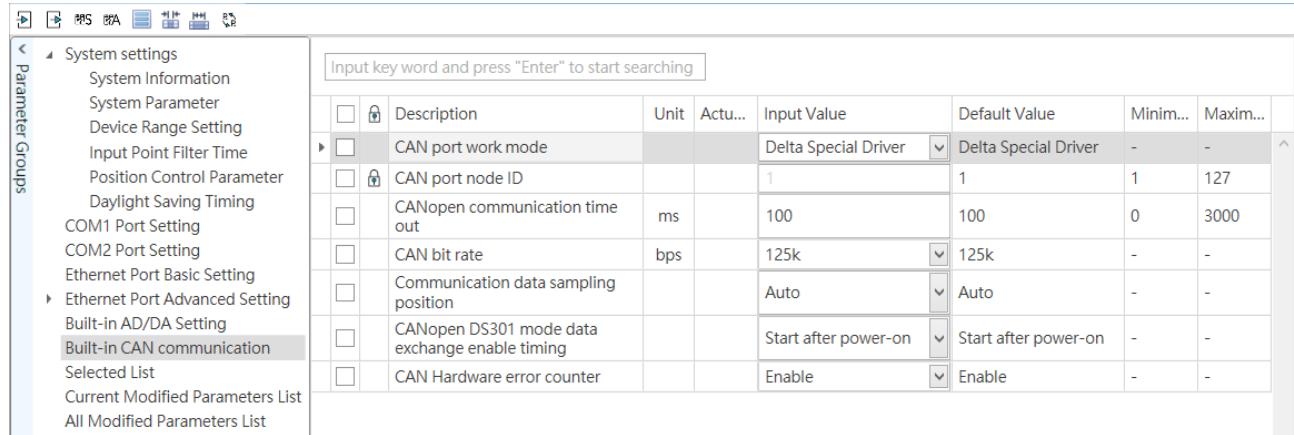
Click **Built-in AD/DA Mode Setting** in the project list to access this feature. Here, you can configure the PLC CPU's AD/DA mode and select the appropriate input/output mode via parameter settings.



- **AD channel 1/2 input mode:** You can select current, voltage or disable.
- **AD channel 1/2 output mode:** You can select current or voltage.
- **AD Sampling Time:** The setting range is 3 to 5 ms.
- **AD Average Times:** The setting range is 1 to 15.
- **AD Analog Input Warning:** When set to Enable, if the analog input goes out of range, the analog input alarm flag SM27 will be set to ON, the ERROR LED will blink, and the analog input alarm code will be displayed in SR27.

8.4.2.11 Built-in CAN Communication

Click **Built-in CAN communication** in the project list to access this feature. Here, you can configure the PLC CPU's CAN communication mode. For more details on the configurations, refer to Chapter 10.



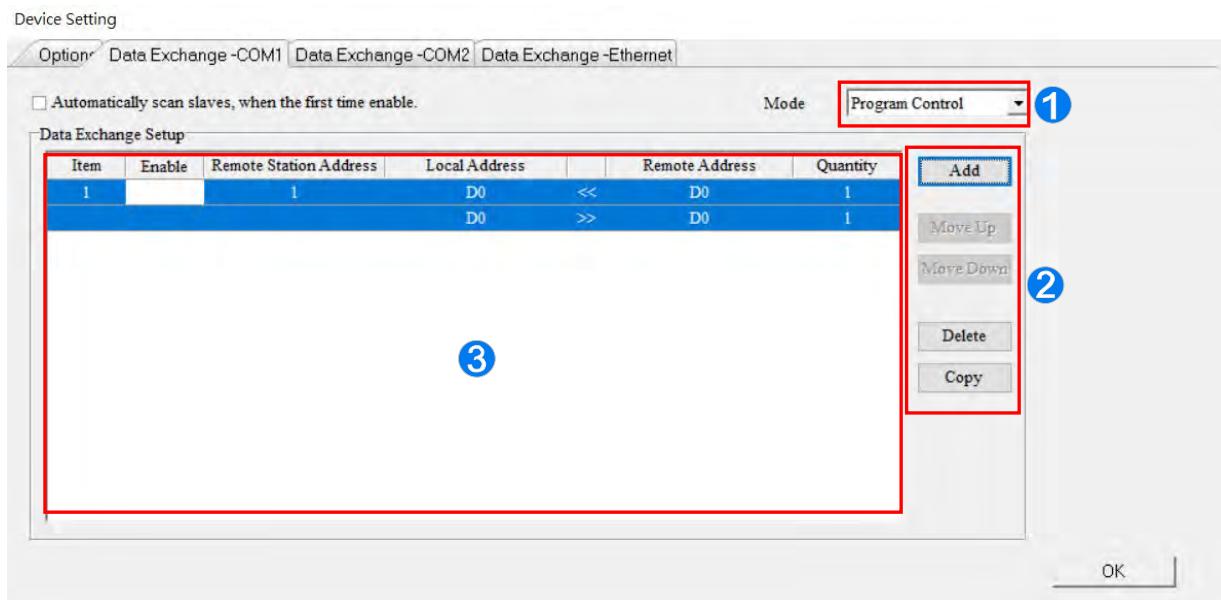
- **CAN port work mode:** Selections are “Delta Special Driver”, “CANopen DS301”, and “Delta Special Driver and CANopen DS301 mode”. The mode Delta Special Driver is for Delta servo and inverter products, while the mode CANopen is designed for DS301 standard communication protocol applications.
- **CAN port node ID:** When the mode Delta Special Driver and CANopen DS301 is selected, you can set up its node ID here.
- **CANopen communication time out:** When communication does not respond within the set time, it's considered a timeout.
- **CAN bit rate:** Selections are “10 kHz”, “20 kHz”, “25 kHz”, “50 kHz”, “125 kHz”, “250 kHz”, “500 kHz”, and “1000 kHz”.
- **Communication data sampling position:** Selections are “Auto”, “60%”, “65%”, “70%”, “75%”, “80%”, “50%”, and “500 kbps_10TQ_70%”. It is recommended to use default 'Auto'. However, if communication with a slave device is unstable, you can select an appropriate percentage of the provided data sampling points and see if the communication resumes stability. If stability is restored, you can then revert to the default 'Auto' setting.
- **CANopen DS301 mode data exchange enable timing:** This function is available when CAN port work mode is selected to CANopen DS301. Specify when DS301 PDO data exchange is initiated, and selections are “Start after power-on” and “Start after CPU running”.
- **CAN Hardware error counter:** Selections are “Enable” and “Disable”.

8.5 Data Exchange

8.5.1 Device Settings Dialog Box Descriptions - ISPSoft

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.



- ➊ 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.
- ➋ Add a new row in the data exchange table in area ➌ 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.
- ➌ 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 this 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,

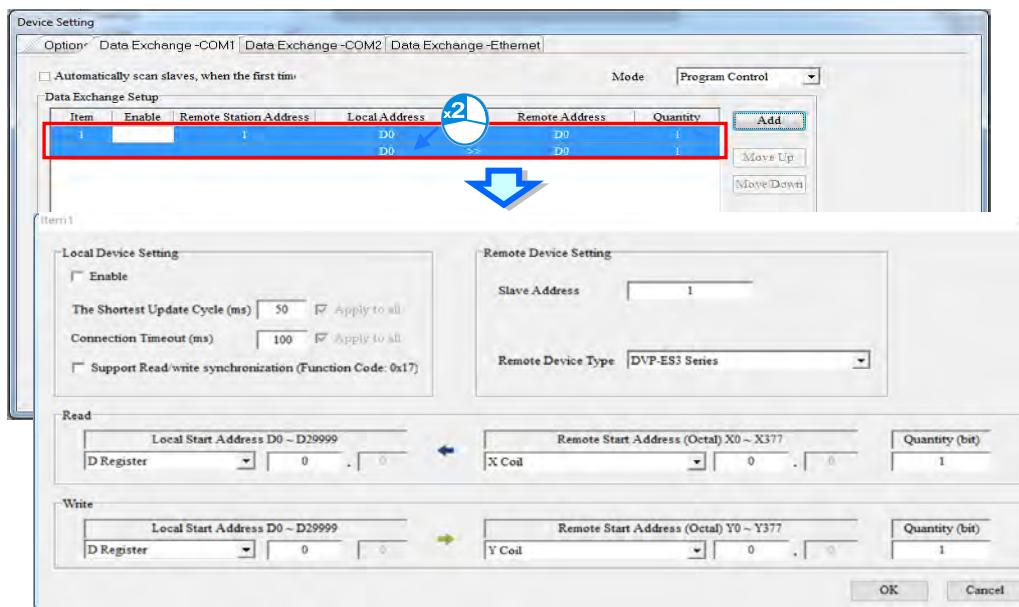
	and IP under the Ethernet tab.
Local Address	The device address range used by the master in the data exchange table
<< / >>	「<<」 : Input: the data block where the master reads from a slave 「>>」 : Output: the data block where the master writes to a slave
Remote Address	This is the device address range 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.

8.5.1.1 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, upon receiving the command from the master, it may result in read/write failure due to the inability to recognize the function code.

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: The input data length.

● Write

The DVP-ES3 Series module writes data to a remote device.

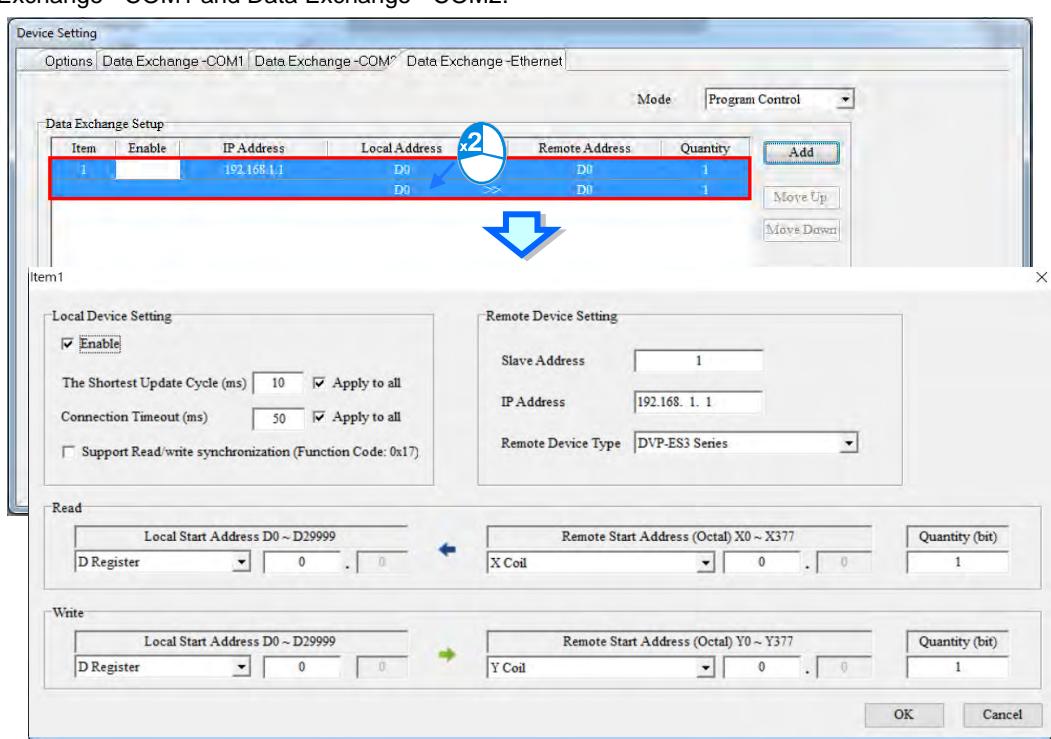
Local Start Address: The device type and start address of the source data for the DVP-ES3 Series module.

Remote Start Address: The device type and start address of the remote device where data is to be written.

Quantity: The output data length.

8.5.1.2 Data Exchange - Ethernet

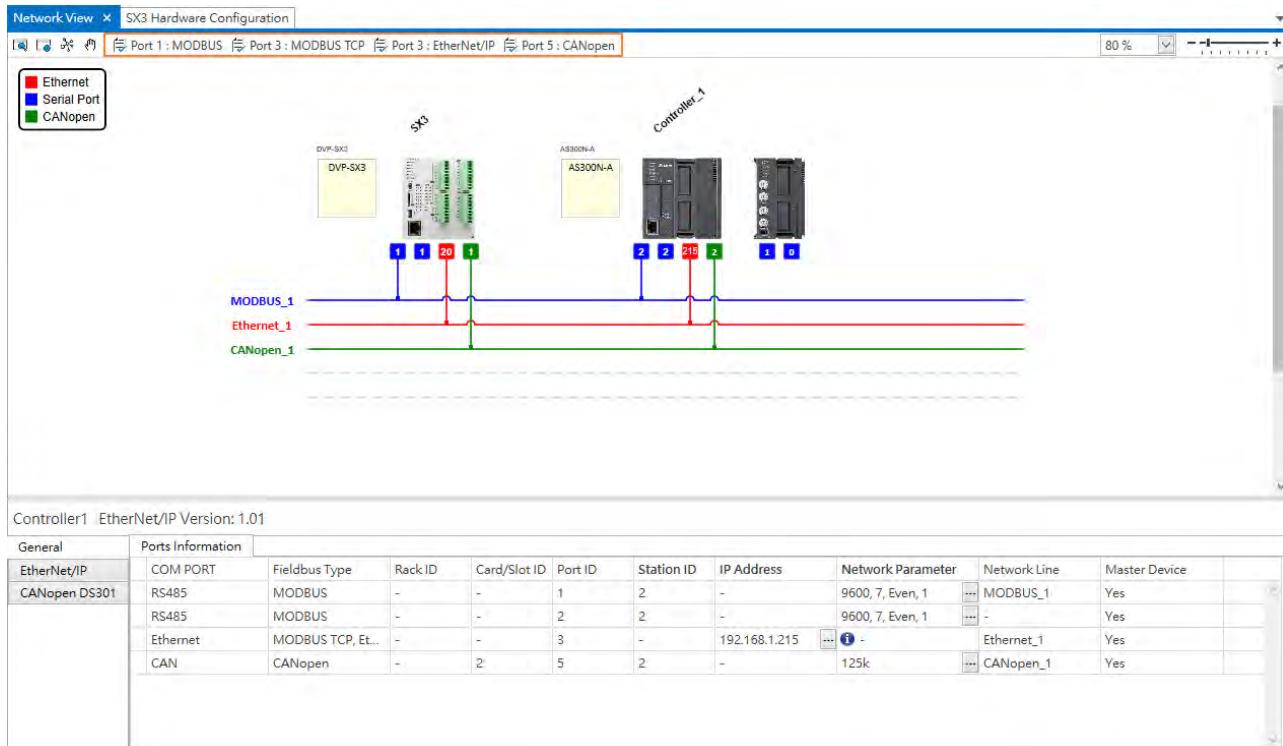
On the **Data Exchange - Ethernet** tab, double click a row in the data exchange table to set to open the **Item** dialog box as shown below. The settings are almost the same as those for **Data Exchange - COM1** and **Data Exchange - COM2**, except that the target slave model option in **Remote Device 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.

8.5.2 Device Settings Dialog Box Descriptions - DIADesigner

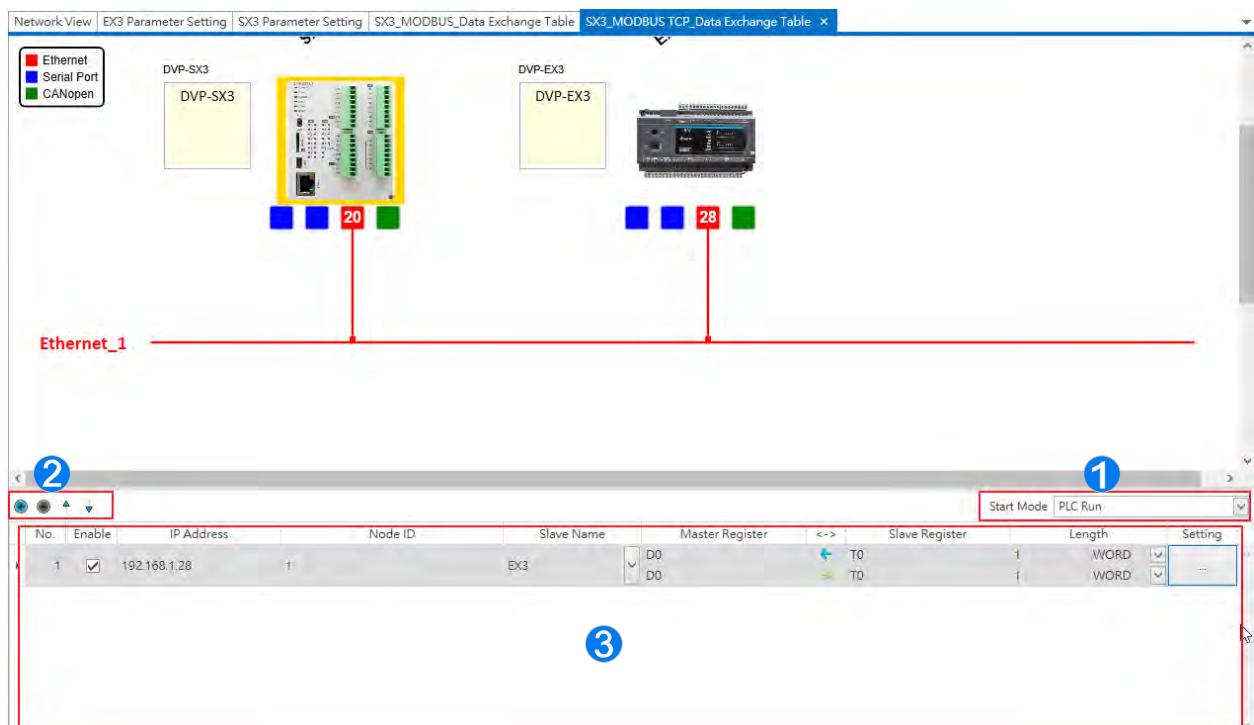
In the Network View, you can find the corresponding colors for supported protocols on the upper left, red for Ethernet, blue for Serial Port, green for CANopen. Drag the same colored-port icon to the same colored lines to establish connections.



These types of parameters are used to create a data exchange table for the built-in communication ports of the DVP-ES3/EX3/SV3/SX3 series models. The DVP-ES3/EX3/SV3/SX3 series models can act as masters for exchanging data with remote devices acting as slaves.

8.5.2.1 Data Exchange - Modbus and Modbus TCP

You can set up the Ethernet port through the Modbus TCP protocol, and set up the COM1 and COM2 ports (serial port) through Modbus protocol. For CANopen port, it is set through CANopen protocol. The setting options for the aforementioned ports are the same though they are on different setting pages as the figure shown below.

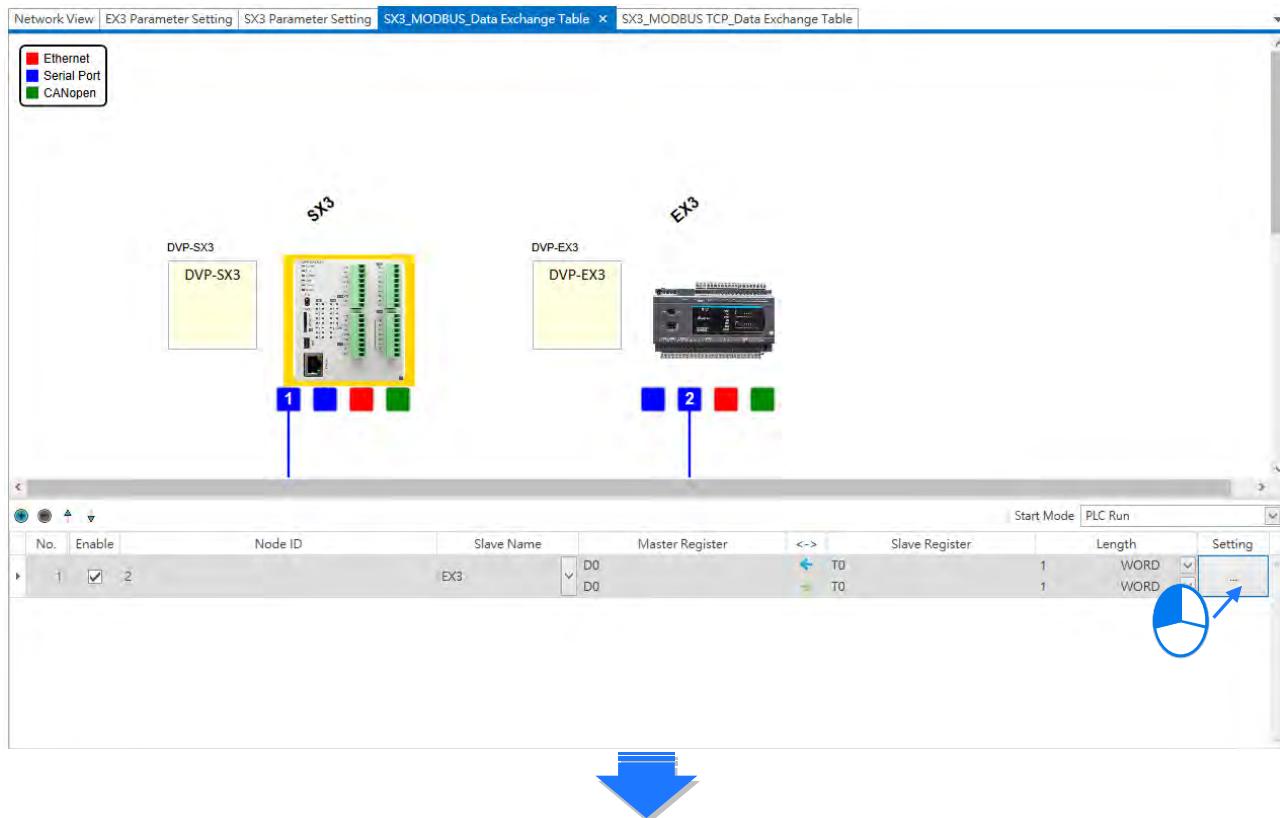


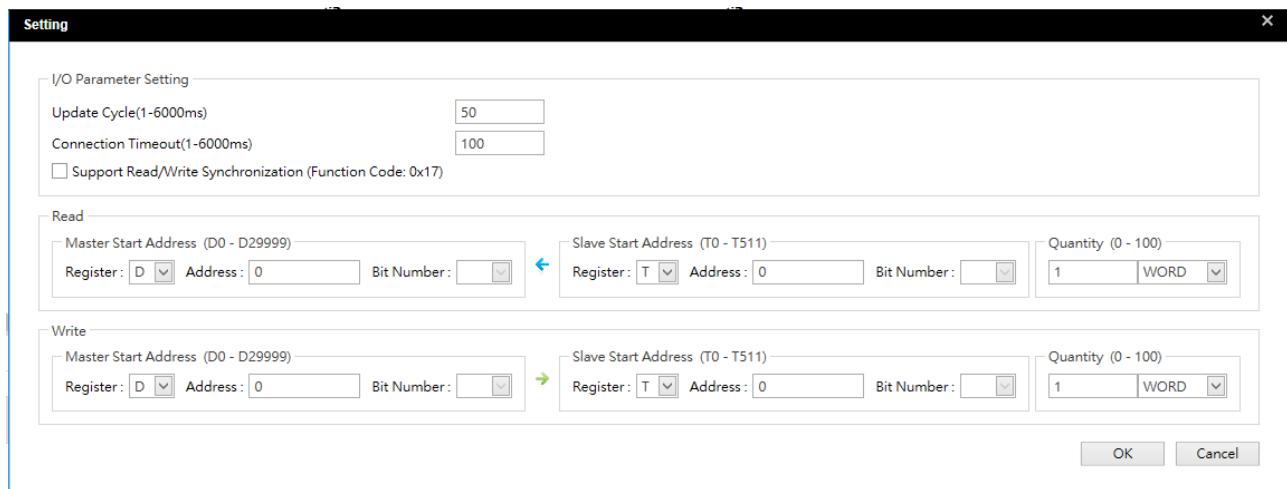
- ➊ When you set the **Mode** to **Program Control**, the program in the PLC determines whether to perform the set data exchange. **PLC Run** means that the set data exchange is performed automatically when PLC is in the RUN state. **Always Enable** means that the data exchange is performed constantly when the PLC is powered on.
- ➋ Click to add a new row in the data exchange table. Use and to move the selected row up or down to change the order of data exchange. Click to delete the selected row.
- ➌ The following introduces the items shown in the data exchange table.

Name	Description
No.	The order number of the data exchange
Enable	Enable this data exchange table when executing data exchange
IP address	This column is exclusively for Modbus TCP protocol. The IP address can be used in multiple data exchange tables.
Node ID	Node ID indicates the slave address of the data exchange table. The same node ID can be used in multiple data exchange tables.

Slave name	You can find the supported series name and the standard Modbus devices from the drop-down list. If you select a supported series, devices will be used in the slave registers. If you select a standard Modbus device or a Delta robot series, a hexadecimal format address will be used in the slave registers.
Master register	Here shows the devices used for Maser in the data exchange table.
	 /  : Input: the section where the master reads data from a slave.  : Output: the section where the master writes data into a slave.
Slave register	Here shows the devices/addresses used for Slave in the data exchange table.
Length	Here shows the quantity of registers used in the row (the quantity varies according to the unit).
Setting	The content value of this data exchange can be set here.

Click “Setting” in the page of Modbus Data Exchange Table to open the setting page.





Update Cycle (1-6000 ms): Set the cycle time for the execution of data exchange.

Connection Timeout (1-6000 ms): if the target device does NOT respond within this set time, the connection will be seen as timeout.

Support Read/Write Synchronization (Function Code: 0x17): By using specific Modbus function codes, the master can perform both read and write operations in a single command to improve data exchange efficiency. However, when configuring, you need to make sure all devices used in the data exchange support the synchronous read/write Modbus function codes. Otherwise, upon receiving the command from the master, it may result in read/write failure due to the inability to recognize the function code.

● **Read (⬅ : Input:** the section where the master reads data from a slave.)

The DVP-ES3/EX3/SV3/SX3 Series reads data from a remote device. Here you can set up the start address for both master and slave, and then set up the quantity and the data type.

● **Write (➡ : Output:** the section where the master writes data into a slave.)

The DVP-ES3/EX3/SV3/SX3 Series writes data into a remote device. Here you can set up the start address for both master and slave, and then set up the quantity and the data type.

8.5.2.2 Data Exchange - Ethernet/IP

The data exchange setting page for EtherNet/IP is as shown below. You can set the master registers / variables, slave parameters, and a lot more here.

Network View SX3 Hardware Configuration SX3_EtherNet/IP_Data Exchange Table x Controller_1_CANopen_Data Exchange Table

Ethernet Serial Port CANopen

DVP-SX3 SX3 AS300N-A Controller_1

Ethernet_1

Setting

Connection

I/O Parameter Setting

- RPI(ms) (5 - 1000): 20
- Multicast: Point-to-Point
- Timeout: RPI x 4
- Trigger Mode: Trigger Cyclic
- EDS Comparison Rule: Compatible

Connection Path Parameter

- Input Instance (101 - 101): 101
- Output Instance (100 - 100): 100
- Configure Instance (128 - 128): 128

Configure

No.	Name	Value
1	Conn1_Input DeviceType	D
2	Conn1_Input DeviceQuantity	200
3	Conn1_Input DeviceIndex	1000
4	Conn1_Output DeviceType	D
5	Conn1_Output DeviceQuantity	200
6	Conn1_Output DeviceIndex	0

Read

- Master Start Address (D0 - D29999): Register: D, Address: 0
- Slave Start Address (D0 - D29999): Register: D, Address: 1000
- Length (0 - 500): 200, BYTE

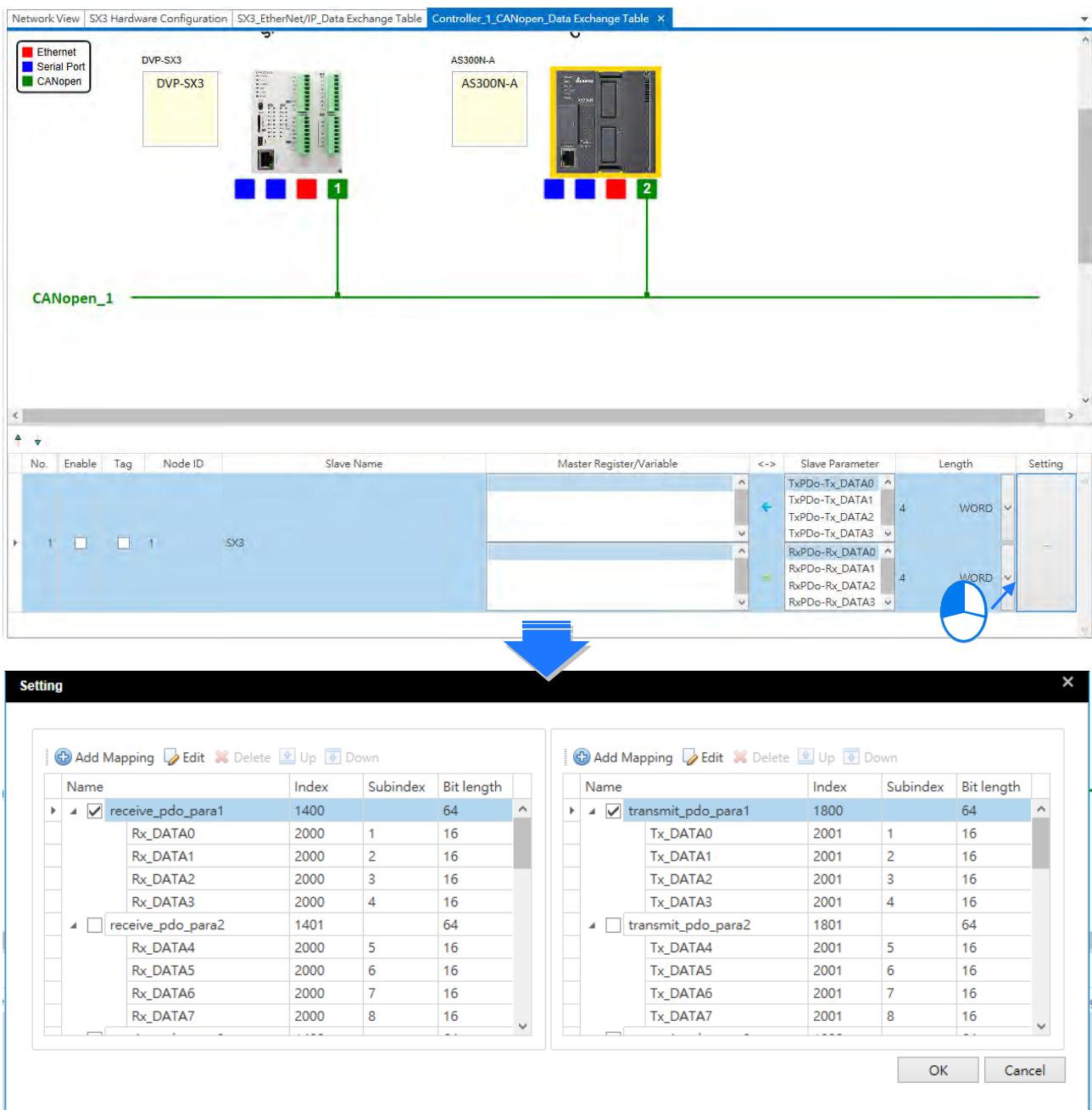
Write

- Master Start Address (D0 - D29999): Register: D, Address: 0
- Slave Start Address (D0 - D29999): Register: D, Address: 0
- Length (0 - 500): 200, BYTE

OK Cancel

8.5.2.3 Data Exchange - CANopen

The data exchange setting page for CANopen is as shown below. You can set the master registers / variables, slave parameters, and a lot more here.



MEMO

Chapter 9 EtherNet/IP Specification and Operation

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Since ISPSoft and DIADesigner are similar in terms of program editing, this chapter will use ISPSoft software as an example for explanation. Refer to Chapter 7 of the DIADesigner User Manual for information related to DIADesigner software.

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>

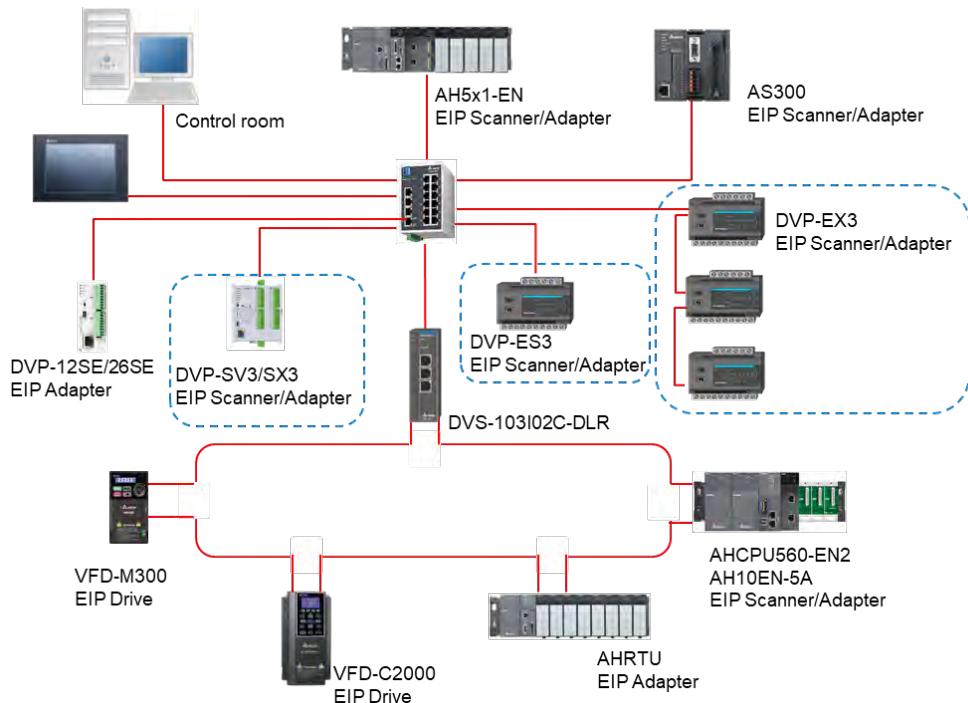
9.1.2 Definitions of Common Network Terms

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)	<ul style="list-style-type: none"> • 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.
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/SV3/SX3 Series supports single port Ethernet; thus you can install and configure devices with embedded switch technology over EtherNet/IP. DVP-EX3 Series supports dual port and linear topology.



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/bytes 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/SV3/SX3 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. DVP-EX3 Series supports dual port and linear topology. Refer to Section 9.2.2.2 for more information on installation.

9.2.2 Network Cable Installation

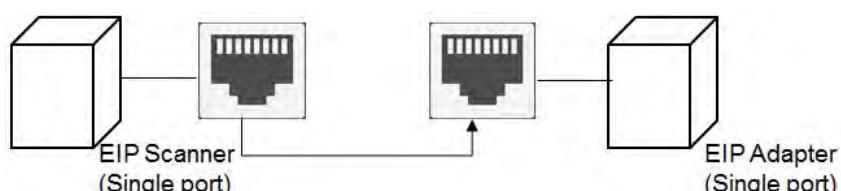
Each EtherNet/IP device is connected to an Ethernet switch with a CAT 5e cable. Please use Delta standard cables and the DVS series industrial switches. Refer to the Delta PLC/HMI Cable Selection Guide for more information.

9.2.2.1. Single Port Device

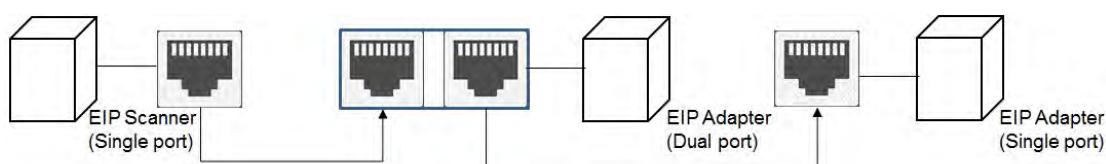
You can use a single port device to build up either a linear or a star network topology. An Ethernet switch and an Ethernet tab are required to create a star topology or a ring topology.

Linear Topology

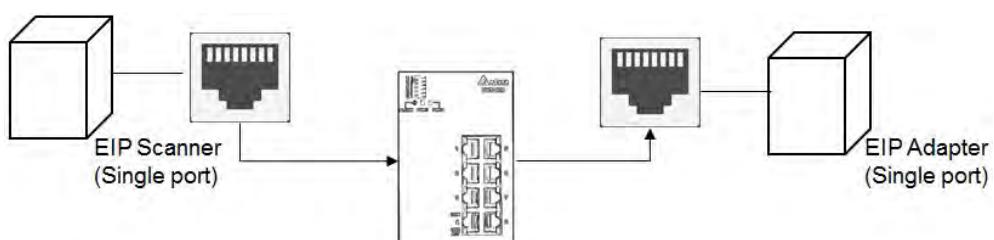
- Linear Topology 1



- Linear Topology 2



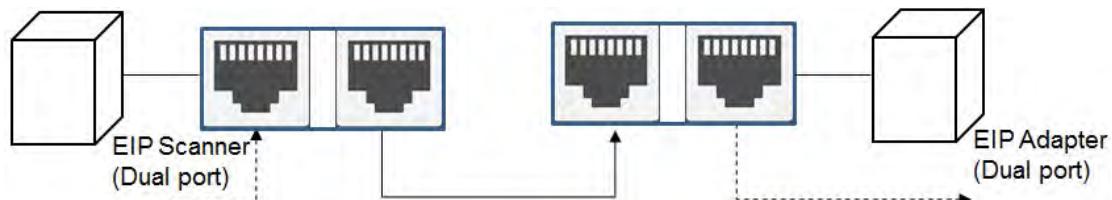
Star Topology



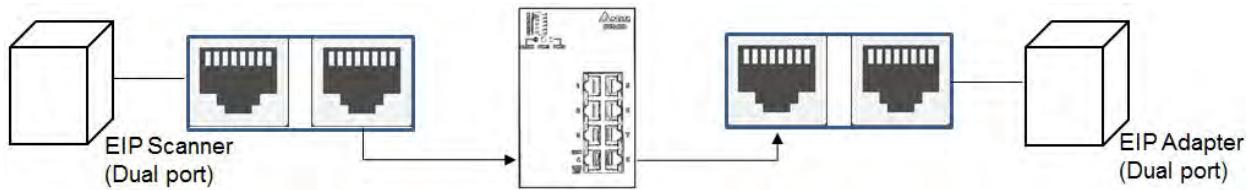
9.2.2.2. Dual Port Device

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 9.9.2 for DLR supported series.

Linear Topology

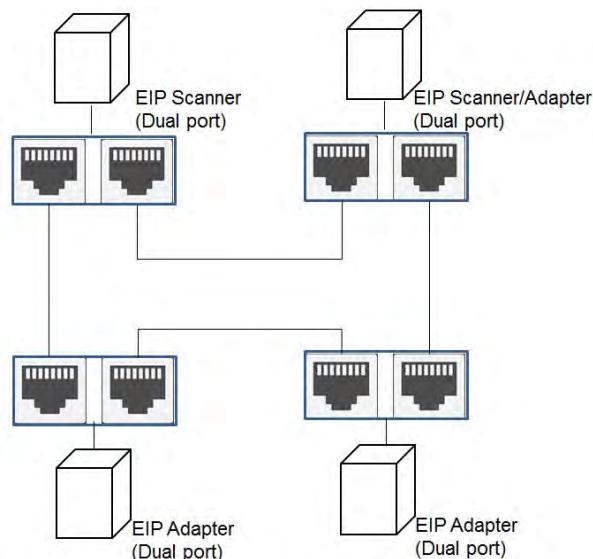


Star Topology

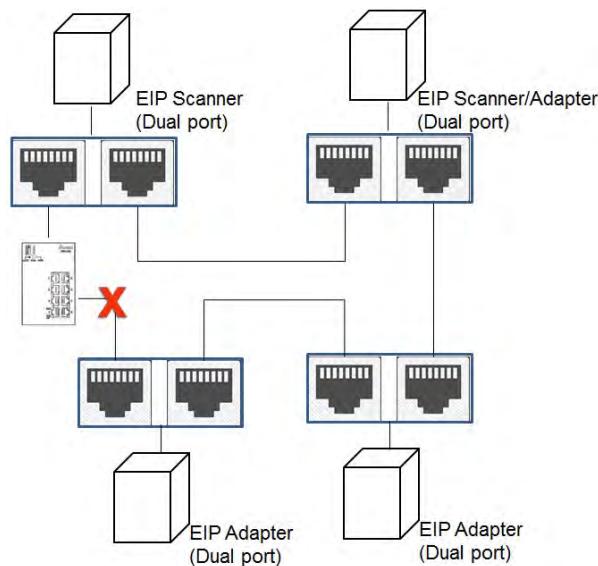


Ring Topology

A DLR function is required to create a ring topology. Refer to Section 9.8.2 for DVP-ES3 that support DLR.



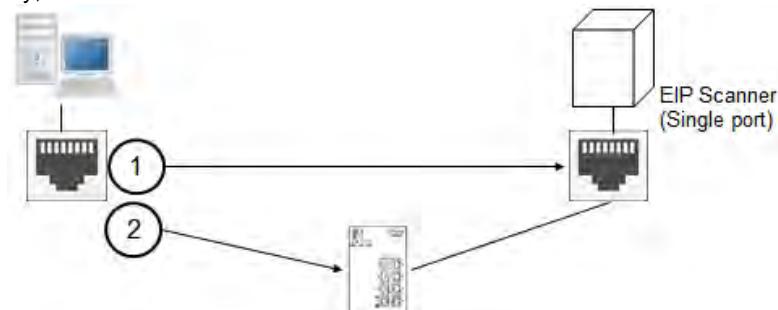
ES Series PLC CPU does NOT support DLR. If you need to join a DLR network, it is suggested to use a switch with DLR function, DVS-103I02C-DLR.



9.2.2.3 EIP Builder Software

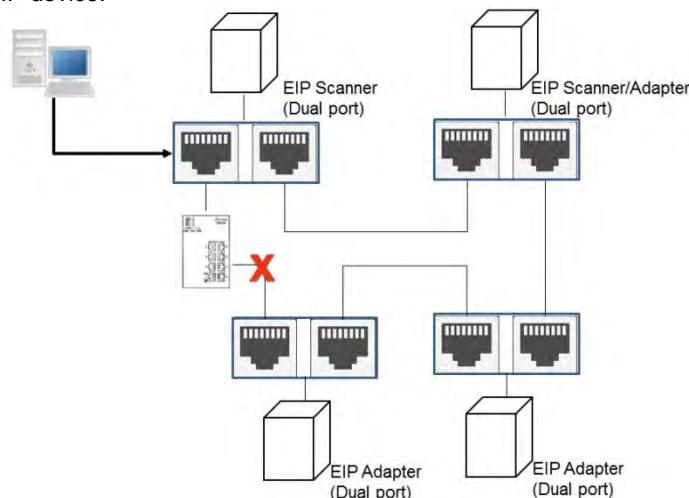
Linear and star topology

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.

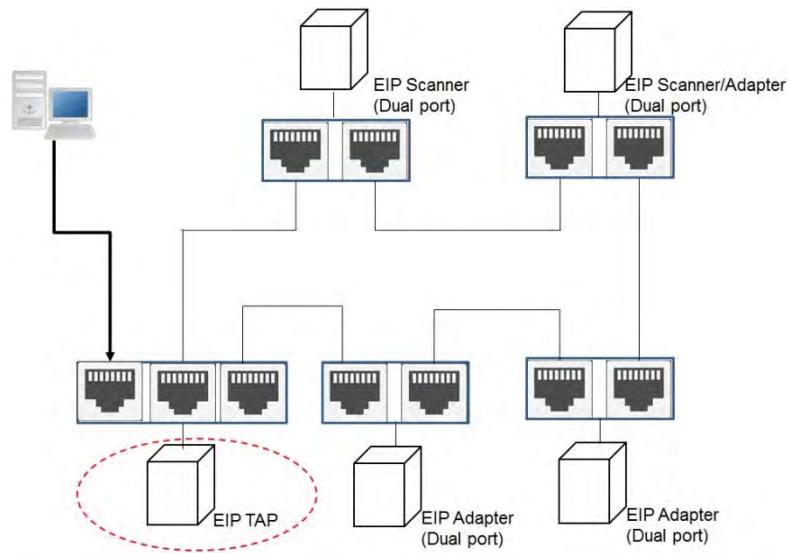


Ring topology

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 a switch with DLR function, DVS-103I02C-DLR to connect your PC so that the ring topology stays intact.



9.3 Specifications

9.3.1 Ethernet Specification

Model	DVP-ES3/SV3/SX3 Series
Communication Protocols	EtherNet/IP Scanner / Adapter, MODBUS TCP
Protocols	BOOTP, DHCP, SMTP, NTP, Socket, HTTP
Communication Speed	10/100 BASE-TX, Auto-Detection
Communication Interface	RJ-45 with Auto MDI/MDIX
Numbers of the Ethernet Port	1

Model	DVP-EX3 Series
Communication Protocols	EtherNet/IP Scanner / Adapter, MODBUS TCP
Protocols	BOOTP, DHCP, SMTP, NTP, Socket, HTTP
Communication Speed	10/100 BASE-TX, Auto-Detection
Communication Interface	RJ-45 with Auto MDI/MDIX, switched Ethernet
Numbers of the Ethernet Port	2

Item / per transmission	Specification	
	DVP-ES3/EX3/SV3/SX3 Series	
MODBUS TCP	Maximum connection quantity for Client	16
	Maximum connection quantity for Server	16
	Max. data length	100 words
Socket (communication port) *1	TCP connection quantity	V1.06.00 or previous versions: 2
	UDP connection quantity	V1.08.00 or later versions: 8
SMTP (for emailing)	Emailing quantity	4

*1: 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/EX3/SV3/SX3 Series	
General	Device type	Scanner / Adapter	
	Topology type	Star topology or linear topology (DVP-EX3)	
Periodic I/O Connection	CIP connection number (for a data exchange table)	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	
	Supported devices	D/M	D/SR
Non-periodic 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/EX3/SV3/SX3 Series to connect to other devices through Ethernet/IP:

- When DVP-ES3 Series PLC CPU acts as a Scanner, it can connect up to 8 devices. Each device can establish up to 16 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.
- When DVP-ES3/EX3/SV3/SX3 Series PLC CPU acts as an Adapter, it can connect up to 8 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.

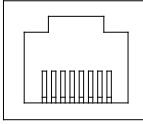
- When DVP-ES3/EX3/SV3/SX3 Series PLC CPU acts as a Scanner and an Adapter simultaneously. It can connect up to 8 devices (for example 4 Scanners and 4 Adapters). For Scanner, each device can establish up to 16 connections for data mapping. And for Adapter, each device can establish up to 8 connections for data mapping. You can also use explicit message for data mapping at the same time, up to 8 explicit message connections can be created for Scanner and Adapter respectively.
- Using device M takes 2 bytes (16 bits) as a unit in data length for IO connections, for example M0 to M15 (16 bits), M12 to M43 (32 bits). If you need to store the data of 200 bits from M100 to M299, the data length should be set in a value larger than 200 bits and in bytes it will be 26 bytes (26 bytes = 208 bits), the actual devices to be mapped will be M100 to M307. D0.0 will be stored in M100 (the first bit). Pay attention on the data length and the devices to be occupied.

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	



8 ← 1

9.3.3.2 Communication LED Indicator

LED Indicator	LED Status	Description
LINK / ACT	Green	ON
		● Connected to Ethernet ● No transmission over Ethernet
		● Connected to Ethernet ● Packets transmitting/receiving over Ethernet
	OFF	● Not connected to Ethernet

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--&dataTypeID=8;&check=1&hl=en-US>

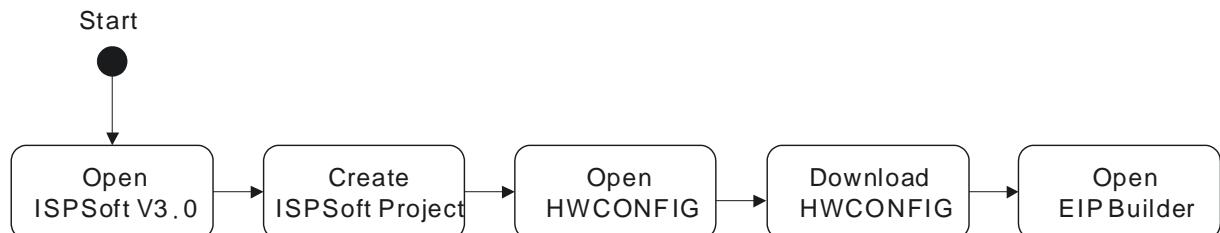
9.4.1 Run the EIP Builder

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 9.9.3 for a list of Delta EIP Scanner products supported by EIP Builder.

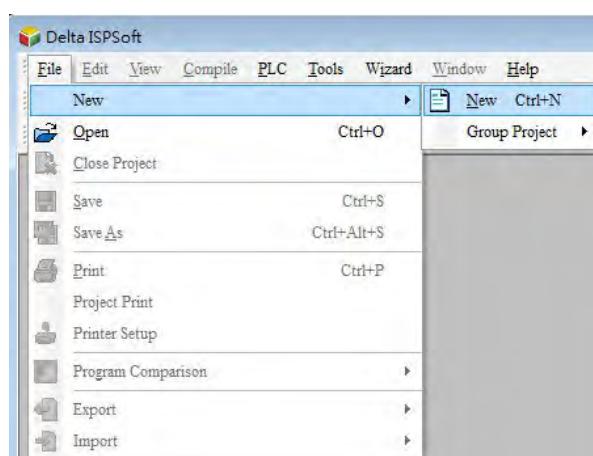
9.4.1.1 Run the EIP Builder via an EIP Scanner

- **Steps to run EIP Builder**

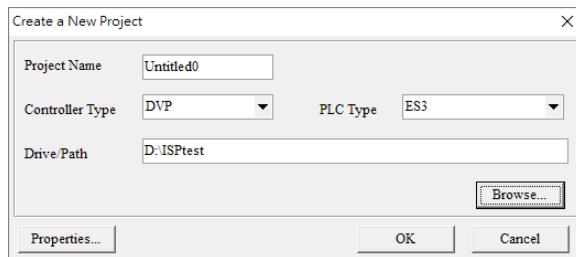
Run EIP Builder from an EIP Scanner product.



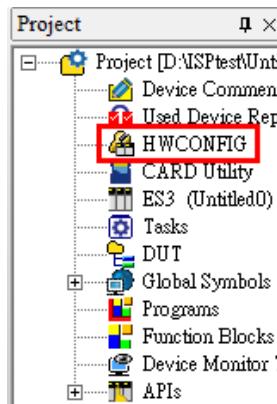
1. Open ISPSoft V3.0: click the **Start** menu and go to **Programs > Delta Industrial Automation > ISPSoft**.
2. Create a new project: on the **File** menu, click **New** to display the Create a New Project dialog box.



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/EX3/SV3/SX3 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/EX3/SV3/SX3 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)

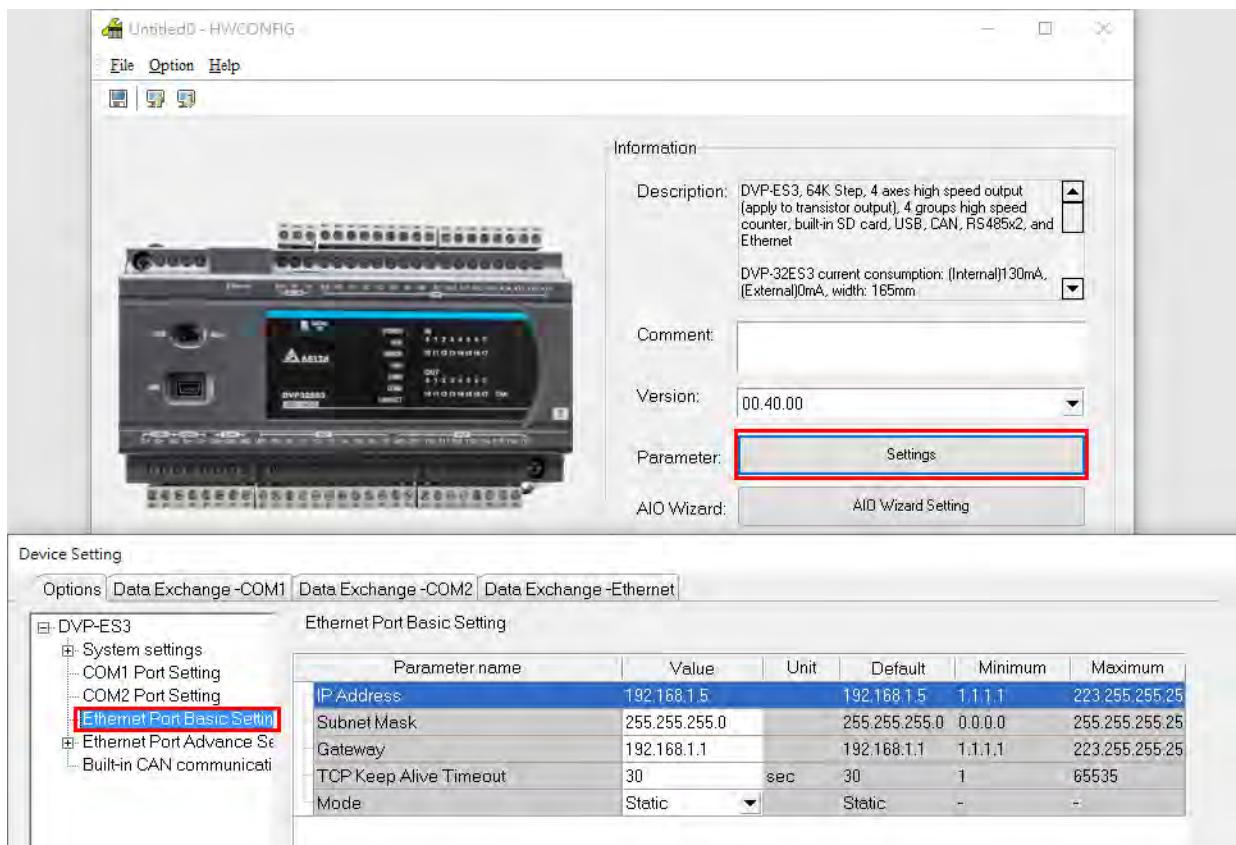
- **Steps to set the IP address**

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/EX3/SV3/SX3 Series.

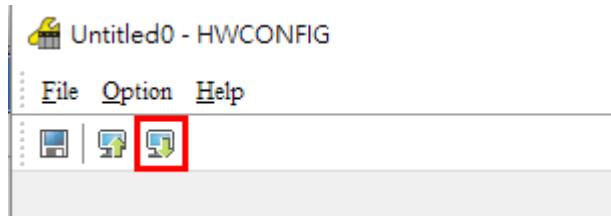


Refer to Section 9.4.1.1 for how to set up an EIP module in HWCONFIG.

1. Configure the network parameters
 - ◆ Double-click HWCONFIG to open the 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.



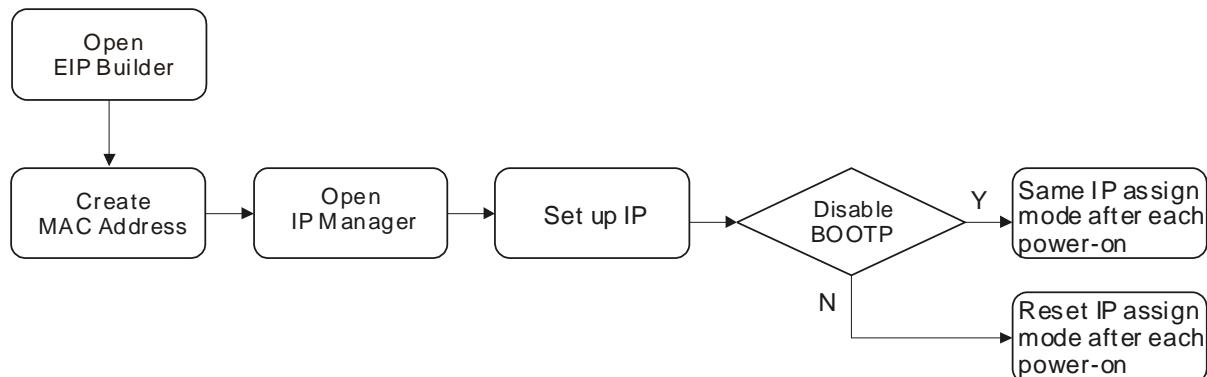
2. Save and download the settings from HWCONFIG: on the **File** menu click **Save** to save the settings and then on the **Options** menu, click **Download** or click the Download button on the toolbar.



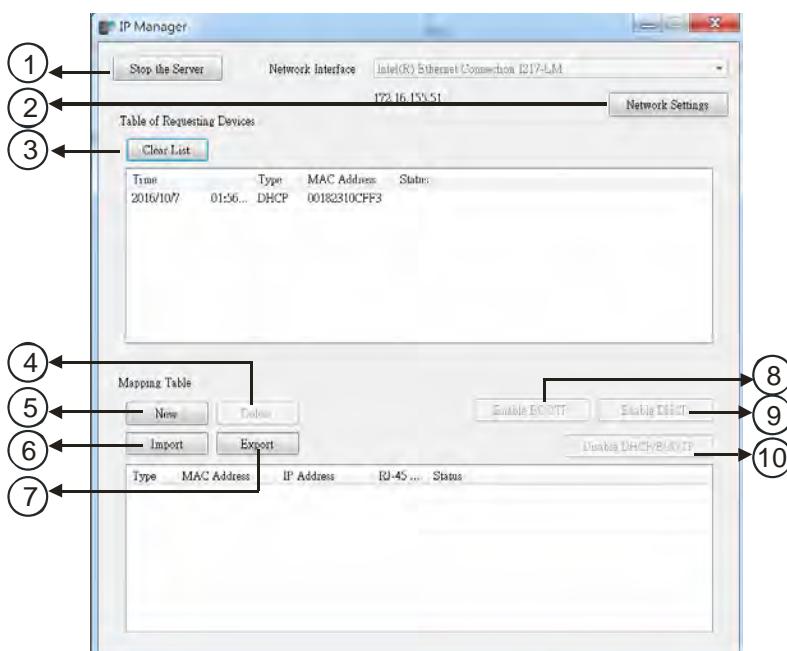
9.4.2.3 Set the IP Address (BOOTP/DHCP)

- **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.

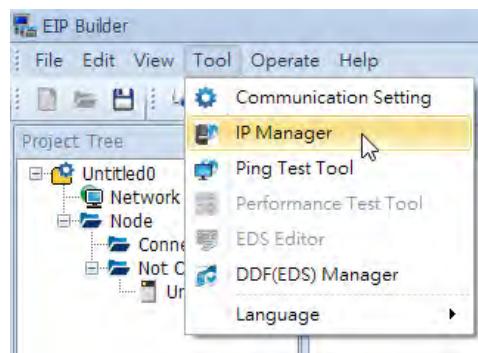
- **Steps to set the IP address:**

1. MAC address: find the MAC address on the EIP device. The MAC address uniquely identifies the device.

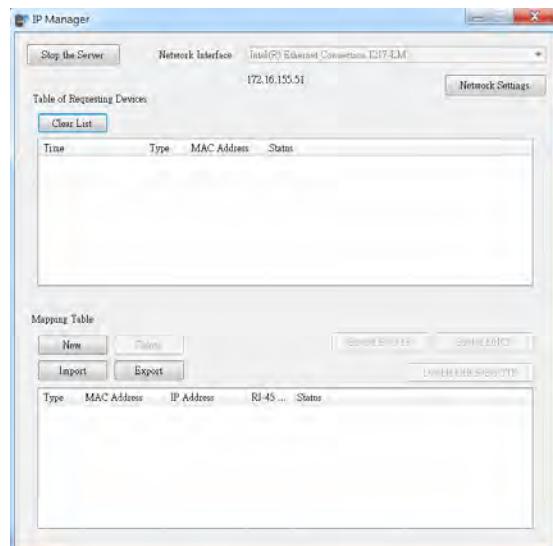


2. Open the IP Manager

- ◆ In EIP Builder on the **Tool** menu, click **IP Manager**.

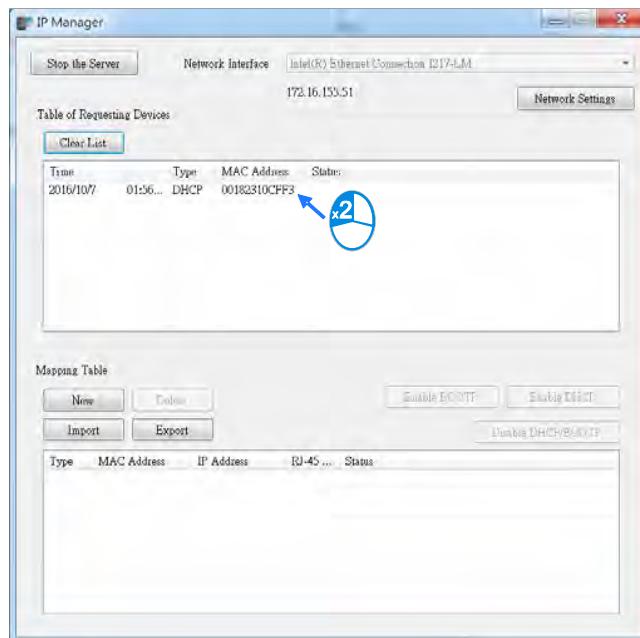


- ◆ The IP Manager can be the BOOTP/DHCP Server, receiving IP address requests from devices. The IP Manager window is shown below.

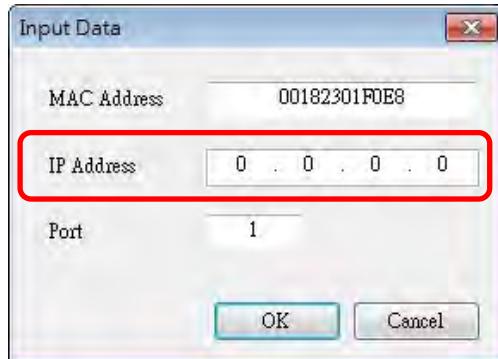


3. Set up the IP address

- ◆ Double-click the listed MAC address for your device to open the Input Data dialog box.

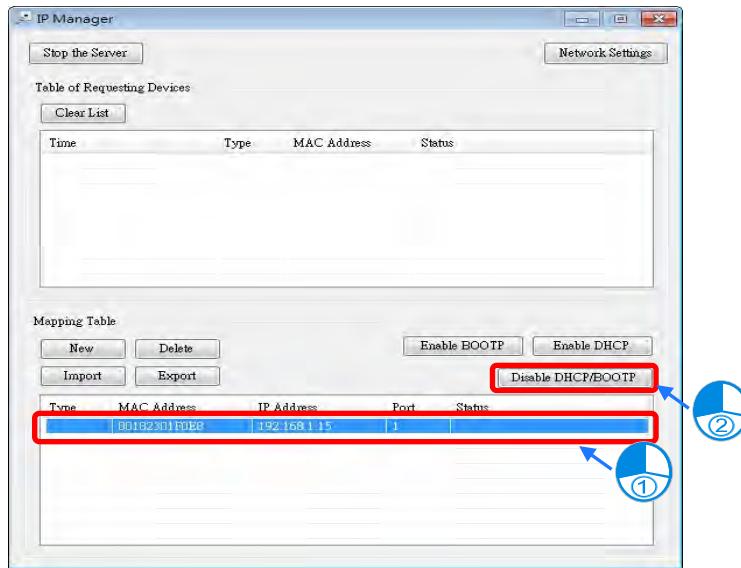


- ◆ Enter the IP address and click **OK**.



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.

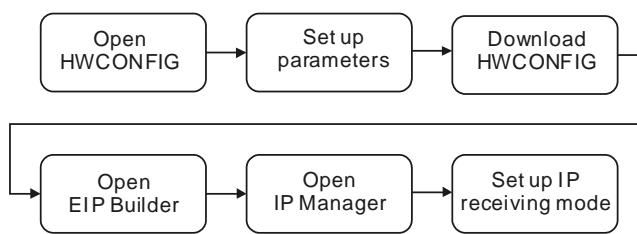


Notes

- 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

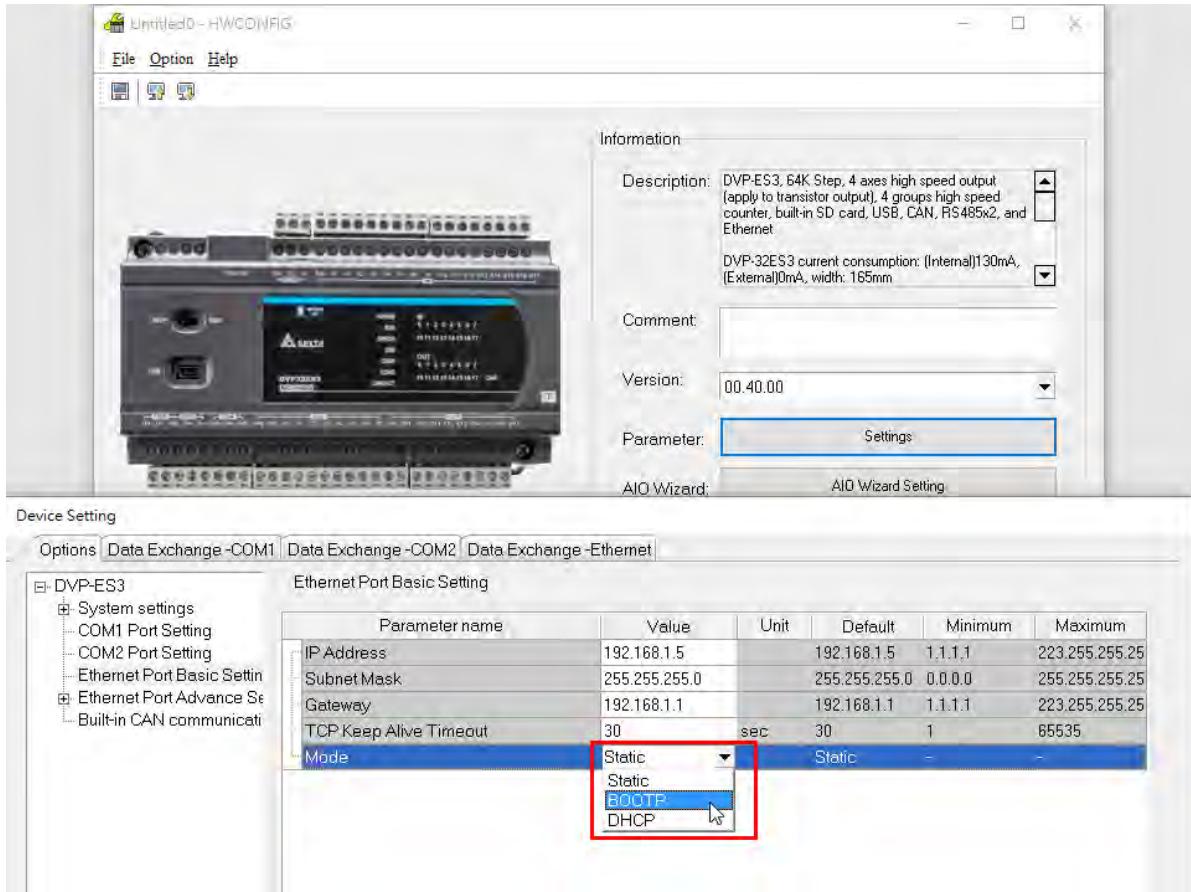
To enable the DHCP or BOOTP function again, use the device software to make the change. Using the DVP-ES3/EX3/SV3/SX3 Series as an example: from the **Start** menu, start ISPSsoft, then HWCONFIG, and then IP Manager. In IP Manager sets the IP address to the receiving mode.



● 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.

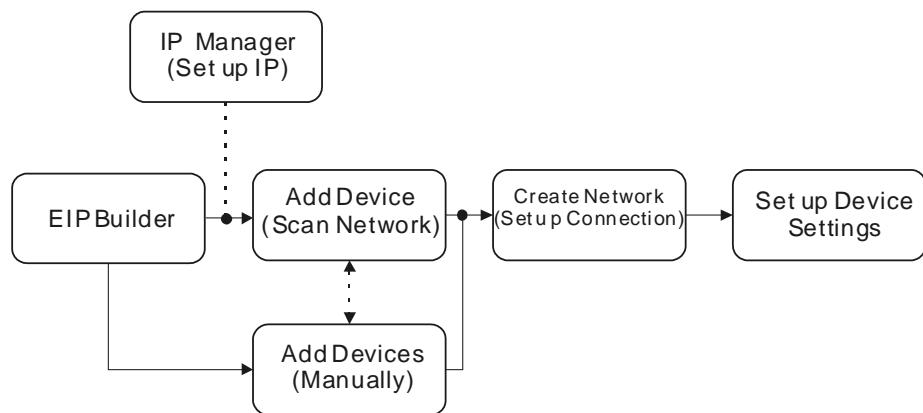
- ◆ Double-click HWCONFIG to open the Setting Page.
- ◆ Click **Settings** to open the Device Setting Page and click **Option** tab and select the option **Ethernet Port Basic Settings** to set the Mode to **BOOTP** or **DHCP**.



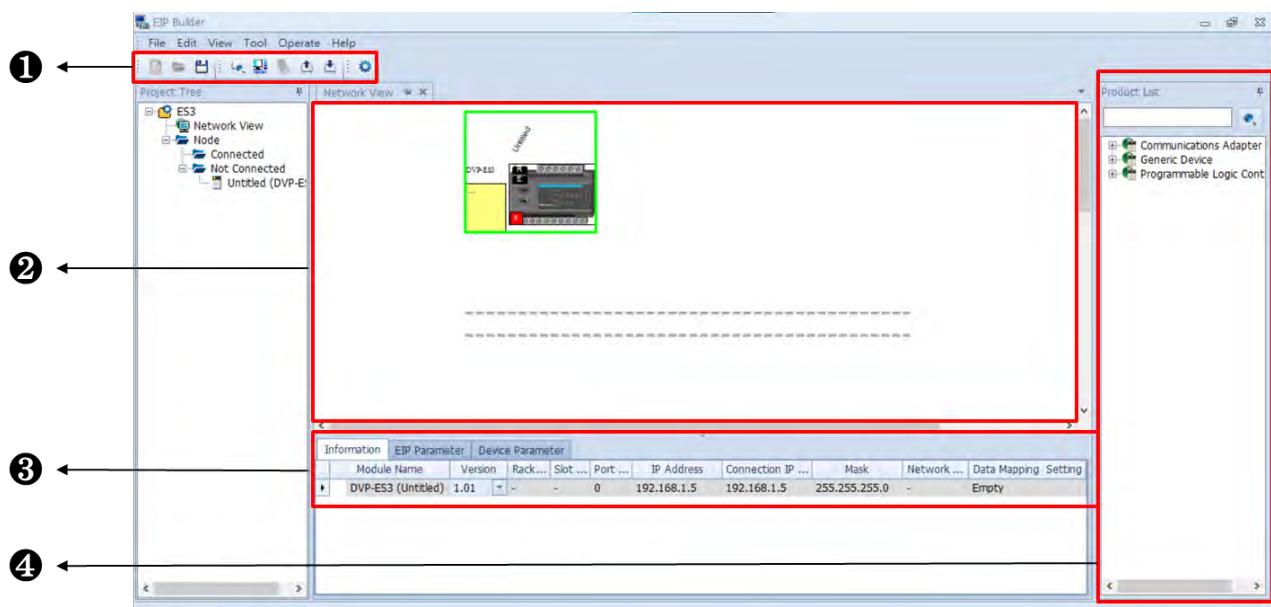
3. Download the settings from HWCONFIG
 - ◆ Refer to Section 9.4.1.1 for more information.
4. Open EIP Builder.
 - ◆ Refer to Section 9.4.1.1 for more information.
5. Open the IP Manager
 - ◆ Refer to Section 9.4.2.3 for more information.
6. Open the IP setup page
 - ◆ Refer to Section 9.4.2.3 for more information.

9.4.3 Network

EIP Builder provides a graphical user interface, and you can see the devices and their EtherNet/IP connections in the Network View. This section provides an overview of how to add your devices to the network connections.



Descriptions of the EIP Builder Window



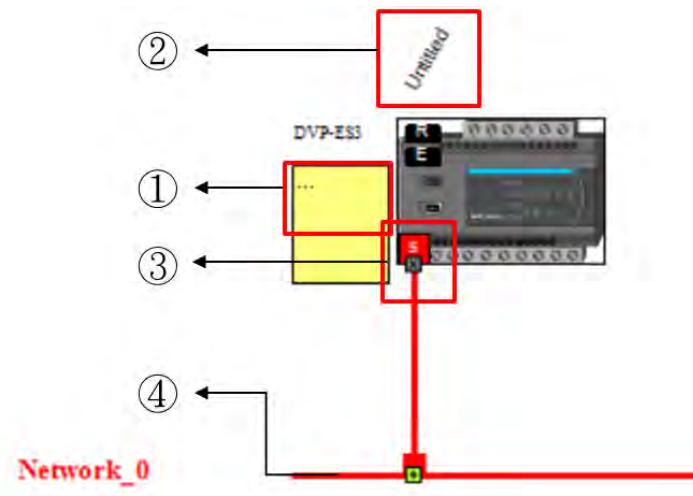
	Item	Definition
❶	Toolbar	Toolbar buttons
❷	Network View	Displays the connected devices and their connection status
❸	Configuration Area	Displays the configurations and allows you to set the parameters
❹	Product List	Displays the available devices that can be connected to EtherNet/IP

① Toolbar buttons



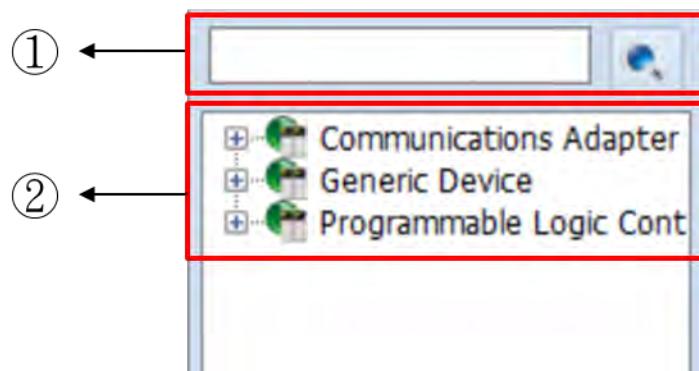
Icon	Name	Definition
	New	Creates a new EIP Builder project
	Open	Opens an existing project
	Save	Saves the project
	Output window	Opens message
	Help	Opens the help file
	Cut	Cuts the selected item
	Copy	Copies the selected item
	Paste	Pastes the selected item
	Delete	Deletes the selected item
	Scan Network	Scans the network for device availability
	Check	Checks if the project is planned properly
	On-line Mode	Switches to on-line mode
	Uploader	Uploads from a device
	Downloader	Downloads to a device
	Setup Button	Opens the communication setting; set up the path connecting the PC to the EIP Scanner.

② Network View



	Name	Definition
①	Station Name	Name of the station; you can also add notes here.
②	Device Name	Name of the device
③	Ethernet COM Port	Displays the number of devices with Ethernet communication ports. The last digit of the IP address is shown on the COM port.
④	Network_0	Displays the connection status; devices on the same line indicate they are in the same network.

④ Product List

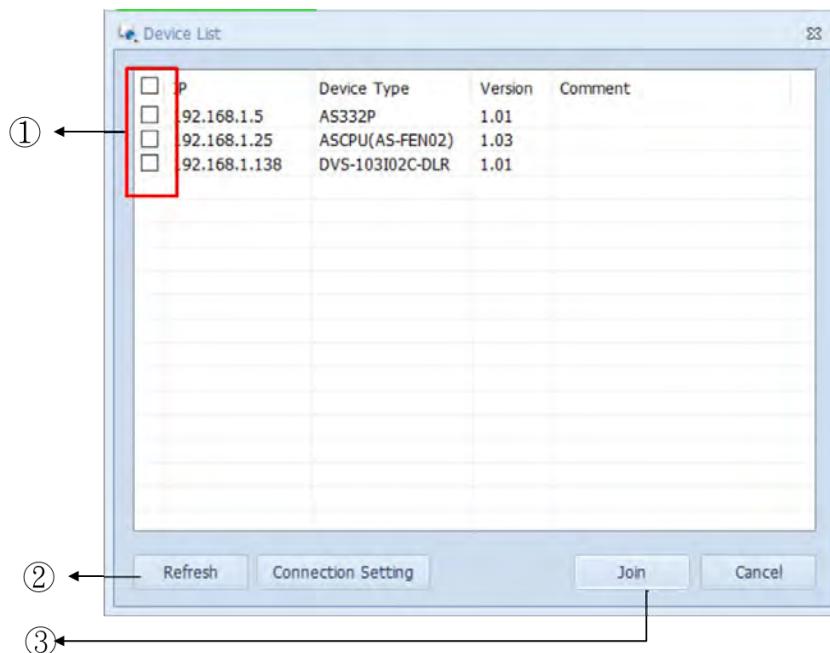


	Name	Definition
①	Search Bar	Type the module name you want to find; if no match is found, that means there is no EDS file in the system matching the module name.
②	Product List	Categorizes the devices according to the EtherNet/IP definition; devices from third parties are in the Others folder.

9.4.4 Add Devices

9.4.4.1 Add Devices by Scanning the Network

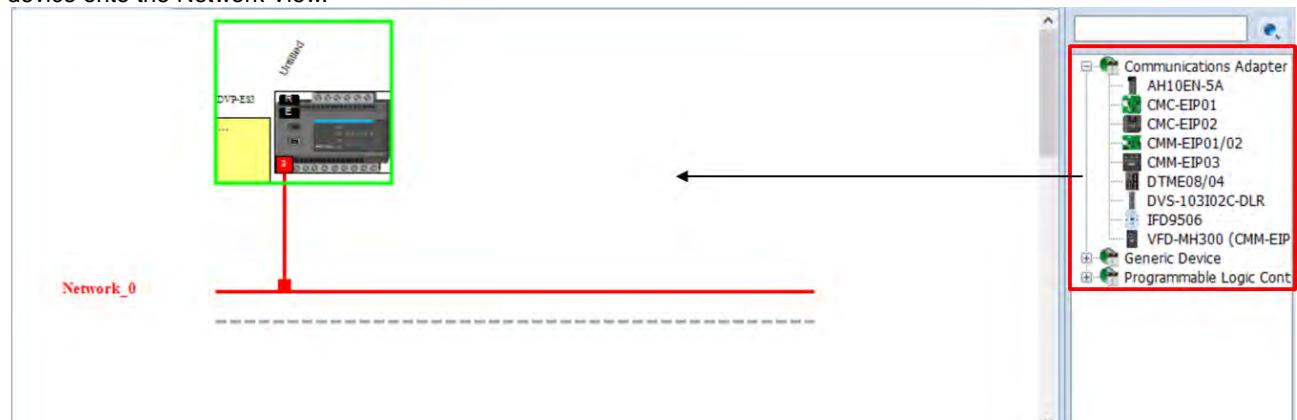
Click  and EIP Builder will start to scan the network and then the available devices will be displayed in the list. Check the one you'd like to add.



	Name	Definition
①	Selection checkboxes	Select the devices you want to add to the network view.
②	Refresh	Refreshes the network view (scans the network again)
③	Join	Adds the selected device to the network view

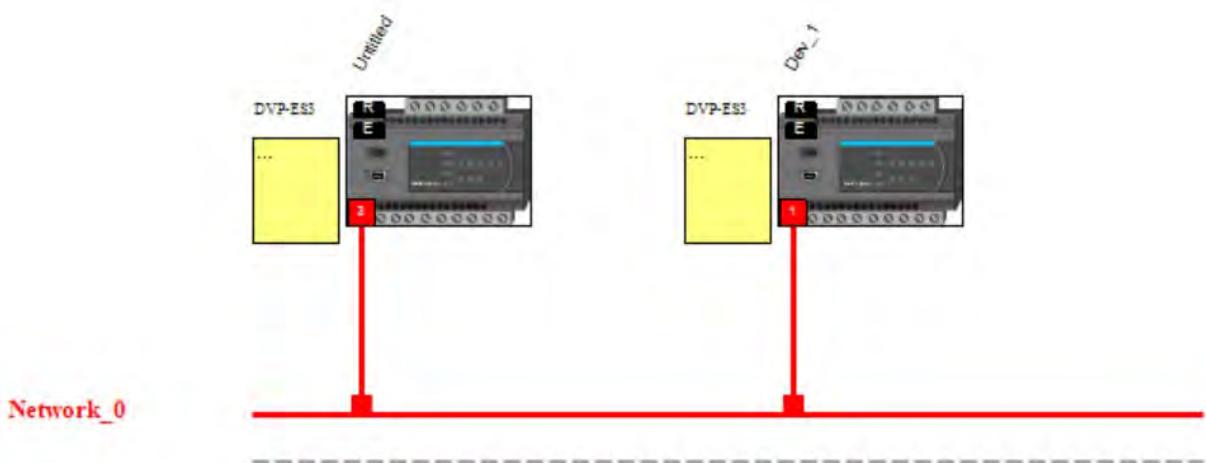
9.4.4.2 Add Devices Manually

1. Select the devices to add from the Product List. You can also enter the module name in the search bar. Drag the device onto the Network View.



2. Create the network

Drag the Ethernet communication port of the device to the network to create a new connection.



3. Click the tabs in the Information window to view and edit the EIP Parameter and the EDS Parameter.

- **Information Tab**

This tab contains the Module Name, Version, Rack, Slot, IP address, Mask, Network and Data Exchange Setting. After the editing is complete, you need to download the data mapping table to update the changes.

Information	EIP Parameter	Device Parameter
Module Name	Version	Port No.
DVP-ES3 (Dev_1)	1.01	0

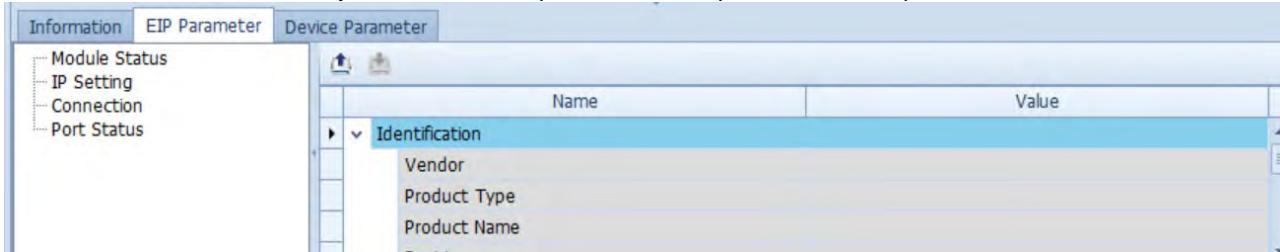
- **EIP Parameter Tab**

This tab contains parameter information from the EDS file. When offline, you can check only the connection parameters for setting up the EDS filtering rules.

- ◆ **Disable Keying:** Disable key checking the product information versions.
- ◆ **Compatible Keying:** Check if the product information and its master version match and check the minor version for compatibility.
- ◆ **Exact Match:** Check if the product information, and both the master version and minor version match.



When the device is connected, you can click the Upload button to upload the related parameters from the device.



	Name	Definition
①	Module Status	<ul style="list-style-type: none"> Identification: displays information regarding Vendor, Product Type, Product Name, Revision, etc. Status: displays connection status, including Major Fault, Minor Fault, Internal State, Configuration Status, and Module Identity.
②	IP Setting	<ul style="list-style-type: none"> Port1: indicates port 1 of the device, for editing IP Address, Subnet Mask, Gateway Address, and Host Name. <p>Note: when there is a Port2, that means there are 2 Ethernet communication ports.</p>
③	Connection	<ul style="list-style-type: none"> EDS parameters filtering rules include Disable Keying, Compatible Keying, and Exact Match.
④	Port Status	<ul style="list-style-type: none"> Displays Link Status, Speed, Duplex, Negotiation Status and Hardware Fault.

- EDS Parameter Tab:** this is not supported for the DVP-ES3/EX3/SV3/SX3 PLC CPU; the software closes itself when this Tab is selected.

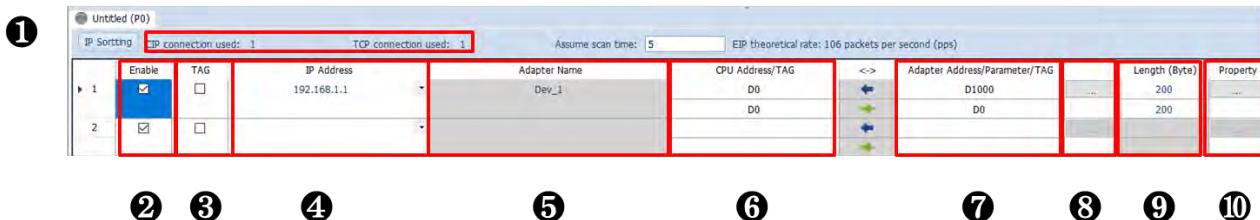
9.4.5 Data Mapping

9.4.5.1 Descriptions on the Data Mapping Page

When the connection between devices is established, you can use data mapping to exchange data between devices. This section provides an overview of how to create a data mapping table.

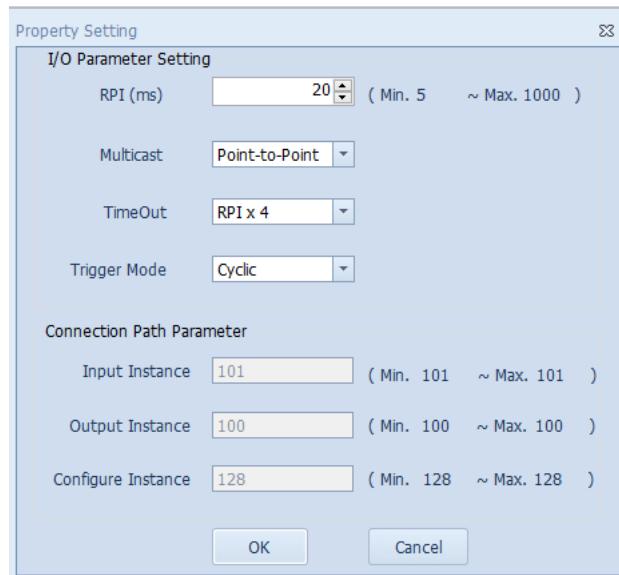


Descriptions for the Data Mapping:



	Name	Definition
①	Connection Count	Data mapping connection count; each IP address corresponds to one independent TCP connection and each row represents one independent CIP connection. The number of connections cannot exceed the maximum number of connections for the Scanner. For the DVP-ES3/EX3/SV3/SX3 PLC CPU, the maximum number of connections is 8.
②	Enable	Enable and disable data mapping for the connection.
③	TAG	Use TAG to perform data mapping with adapters. After selecting this check box, <ul style="list-style-type: none"> • The directional arrow points left of (←) (READ only) • Registers cannot be used in this row. • The length format is defined by the data format in the Global Symbols; you cannot change the length format here. • You must create a Consumed TAG in the Global Symbols in ISPSoft before using this function.
④	IP address	The IP address of the Adapter to connect to. After the data mapping connection is established, the system loads the connected device's IP address. You can also select the device's IP address from the list to add and edit the connection.
⑤	Adapter name	Once you select the IP address, its name is displayed but cannot be modified here. Refer to Section 9.4.3 ② for more information on how to change the device name.
⑥	CPU register address	Starting address of the data mapping's register. Devices D and M are supported. Using device D or device M takes 2 bytes as a unit in data length.
⑦	Select the TAG check box ③.	Select the Consumed TAG name from the list.
	Adapter address/parameter	Target adapter's register address / parameters
⑧	Select the TAG check box ③.	Input the name of the Produced TAG for other connected EIP devices. The default name is the same as the name shown in ⑥.
	I/O mapping table	Set up the IN/OUT parameters. When there is no I/O representative table presented for the Adapter, the parameters cannot be opened, for example in some PLCs.
⑨	Length	Set the data mapping length; unit: byte; the data limit is determined by EDS file; the maximum is 500 bytes. You cannot change the length format here when using TAG.
⑩	Property	Set the advanced data mapping parameters.

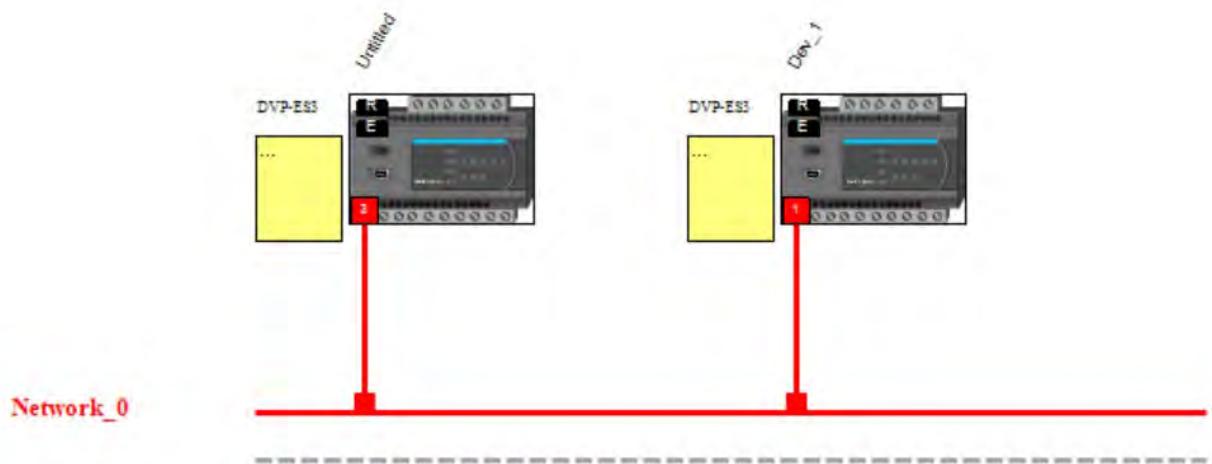
⑩ Property



Name	Definition
Requested Packet Interval (RPI)	Time interval to request packets through the I/O connection, unit: ms
Multicast	Communication mode setup: Multicast or Point-to-Point
Timeout	Sets the timeout according to the RPI or a multiple of RPI (RPI*X). The minimum value is 100 ms to reduce timeout occurrence. When a value that is less than 100 ms is treated as 100 ms.
Trigger Mode	Cyclic : renews data cyclically Change of State : renews data once there is any change Application : renews data according to the product setup
Input Instance	You can edit input instance, output instance and configure instance in some of the EDS files. The instance number is the same as the data mapping connection number. You can tell the mapped data is from which corresponding device by the instance number.
Output Instance	
Configure Instance	

9.4.5.2 Steps to Set up and Download Parameters

1. Create a data mapping table (*):
 - ◆ Right-click the COM port on the Ethernet Scanner, and click **Data Mapping** to open the Data Mapping Table.



2. Set the Data Mapping Parameters
 - ◆ Type the parameters in the data mapping table. The unit for data length is byte. See the example below.
 - a) Reading D500–D599 from the Adapter with the IP address 192.168.1.1 to the D0–D99 in the Scanner.
 - b) Writing D200–D299 from the Scanner to D100–D199 in the Adapter with the IP address 192.168.1.1

IP Address	Adapter Name	CPU Address/TAG	Adapter Address/Parameter/TAG	Length (Byte)	Property
192.168.1.1	Dev_1	D0 D200	D500 D100	200 200	...

- c) One Adapter can create multiple connections for data mapping. Each IP address corresponds to one independent TCP connection and each row represents one independent CIP connection. The number of connections cannot exceed the maximum number of connections for the Scanner. For the ES3 PLC CPU, the maximum number of connections is 8.
- d) Properties: Set the advanced data mapping parameters.
- e) Click Download.



* There is no need to use registers when using TAG function to perform data mapping. You can enter the IP address to establish a connection to the tag of other device. Refer to the next section for more details on TAG.

9.4.6 TAG Function

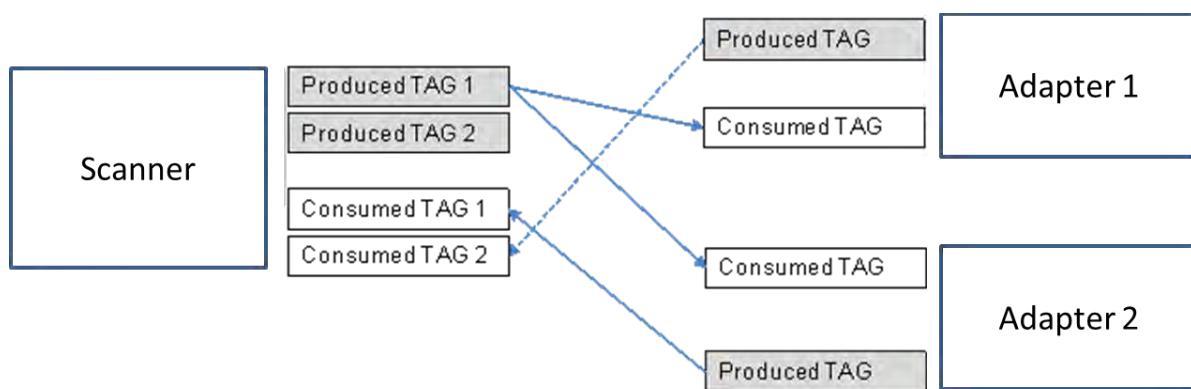
Users can use TAG function to transmit data among different controllers. Controllers can share TAGs while they are attached to the same network, such as EtherNet/IP. TAG can be further defined as Produced TAG and Consumed TAG.

1. Produced TAG: a tag that a controller makes available for other controller. Multiple controllers (EIP scanner devices) can simultaneously consume (receive) the data. A produced tag sends its data to consumed tags (consumers) without using logic.

2. Consumed TAG: a tag that receives the data of a produced tag. The data type of the consumed tag and the produced tag must be matched (including any array dimensions).

Before connecting to a Produced TAG, users should check the IP address and the names of the TAGs (Produced TAG and Consumed TAG). One controller can have multiple TAGs created, including produced TAG and consumed TAG. See the example below:

Create a General Device in the Network View as shown below and then set the IP address to be used as a Produced TAG. For adding a device, please refer to Section 9.4.3.



The following Delta products support TAG function:

DVP-ES3/EX3 Series PLC CPU

DVP-SV3/SX3 Series PLC CPU

AS Series PLC CPU: V1.08.20 or later

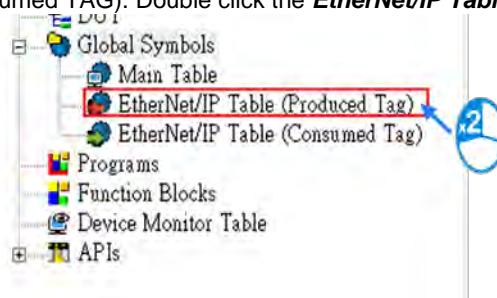
ISPSofware: V3.09 or later

DOPSoft software (Delta HMI editing software for DOP-100 series): V4.00.07 or later

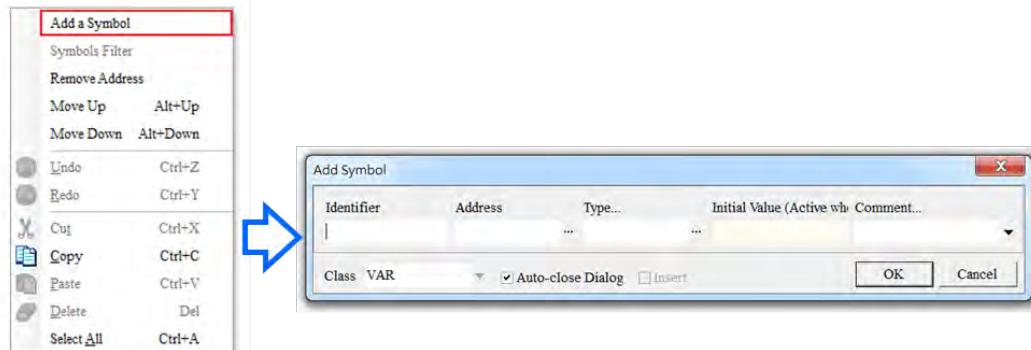
9.4.6.1 Produced TAG

How to create a Produced TAG:

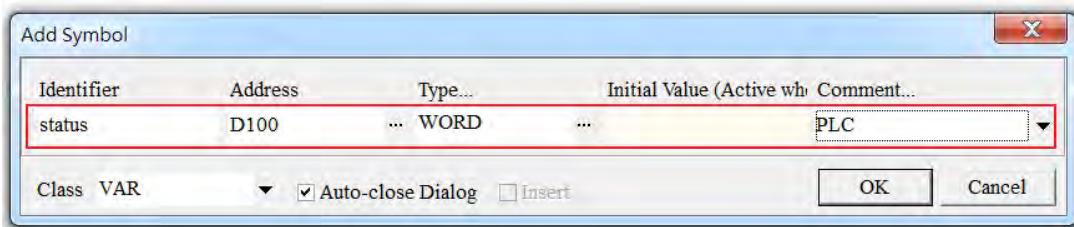
1. Open the ISPSoft software and unfold the Global Symbols item to see the EtherNet/IP Table (Produced TAG) and EtherNet/IP Table (Consumed TAG). Double click the **EtherNet/IP Table (Produced TAG)**.



2. After double clicking the **EtherNet/IP (Produced TAG)** option, the EtherNet/IP Table (Produced TAG) will show up for editing.
3. Right click on the EtherNet/IP Table (Produced TAG) to see the context menu and select the option **Add a Symbol**. And then an Add Symbol window will appear.



4. Set up the Produced TAG: as the example shown below.



Name	Description
Identifier	User can create a name for the TAG in the PLC; up to 40 characters can be used.
Address	The address is corresponding to the registers or bits in the PLC; selections are data register and M bits.
Data Type	The data type BOOL, WORD, DWORD, INT, DINT, REAL, and ARRAY are supported. One-dimensional array is supported; up to 512 byte can be used.
Initial Value	N/A
Comment	Descriptions can be added to describe the TAG; up to 128 characters are supported.

After the setups are complete, download the parameters to the PLC. Other controllers can receive the data of a produced tag via the consumed tag. For the creation of a consumed TAG, refer to the manual from the controller to be used for data transmissions.

9.4.6.2 Consumed TAG

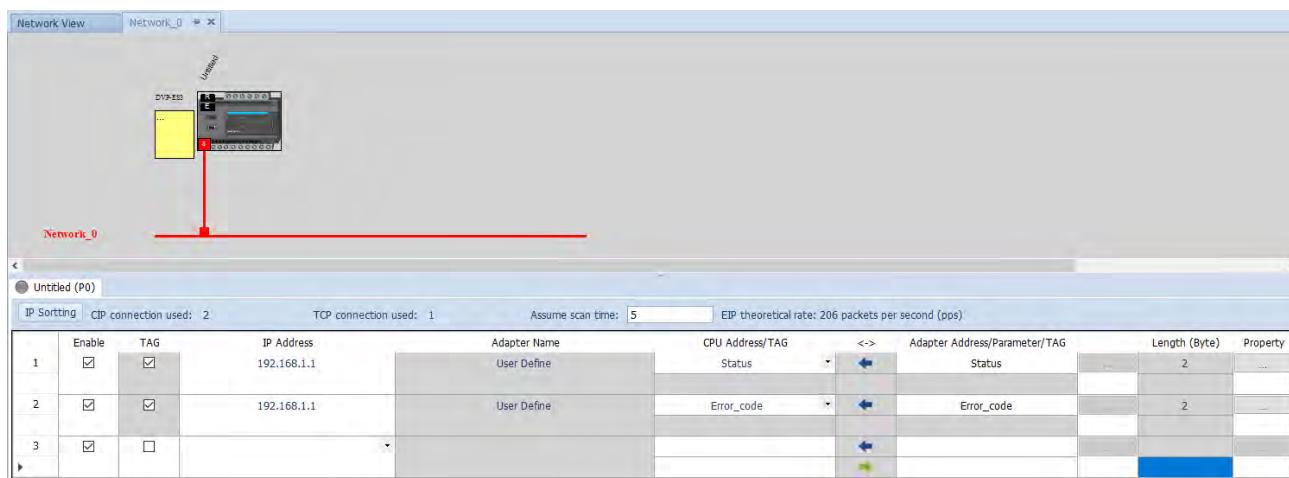
The way to create a consumed TAG is the same the way to create a Produced TAG. Refer the section above for more information. After the setups are complete, download the parameters to the PLC, even if using one's own EIP data mapping table.

9.4.6.3 Use TAG to Execute Data Mapping

You can enter the IP address to be connected to other TAGs so that creating a General Device is not necessary.

Once you select the TAG check box, the directional arrow is to the left with (\leftarrow) (READ only)

1. Enter the IP address of the TAG device to be connected



2. Select the created Consumed TAG from the CPU register address /TAG column.



After you select the TAG, the software shows the same TAG name in the register address / parameters / address for the Adapter. You can modify the TAG name to have the same name as the Produced TAG name.

3. Set the properties

4. Click the Downloader button on the tool bar to open the Project Downloader window.

9.4.7 Diagnosis

EIP Builder can provide diagnostic information on the connection and data mapping status. For the connection status, refer to the Adapter connection status and indicator in the Network View tab; and for data mapping status and error codes, refer to Network_0 in the data mapping tab.

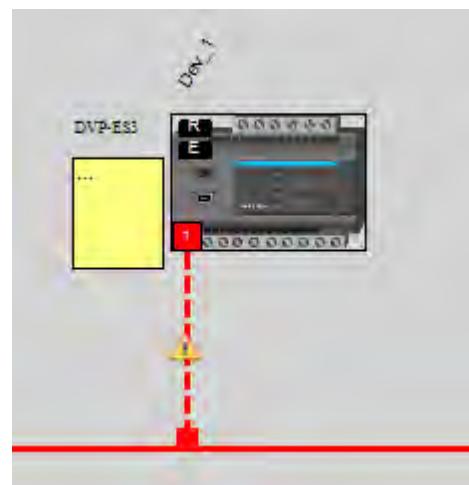
- **Steps to view network status**

1. Click the On-line Mode button on the toolbar.



2. Network View (Connection Status)

- a) Click the Network View tab to check the device status from the indicators: for example RUN / STOP and Error indicators for the PLC.
- b) The dotted line and the warning sign indicate a connection error, as shown below.



3. Network_0 (Data Mapping):

Click the Network_0 tab to check the data mapping status and the error codes for Network_0. For error code definitions, refer to Section 9.6.2.

9.5 Explicit Message

All connections in EtherNet/IP can be divided into explicit messaging connections and implicit (or I/O) messaging connections. For details on using implicit messages, please refer to Section 9.4.5. This section provides an overview of how the DVP-ES3/EX3/SV3/SX3 Series PLC CPU uses explicit messaging instructions.

When the DVP-ES3/EX3/SV3/SX3 Series PLC CPU acts a Scanner, you can use the EIPRW instruction (API 2208) to read and write Objects. When EIP Builder uses Objects as parameters, each Object includes various parameters. For details on the EIPRW instruction, please refer to the DVP-ES3/EX3/SV3/SX3 Series Programming Manual.

For details on Objects that are supported by the ES3 Series PLC CPU, please refer to Section 9.8.

9.6 Troubleshooting

This section provides an overview of error codes and troubleshooting for the DVP-ES3/EX3/SV3/SX3 Series PLC.

9.6.1 EtherNet/IP Error Codes and Their Solutions

Here lists the EtherNet/IP error codes and solutions for reference. These error codes can be checked, under the connection mode in the EtherNet/IP data exchange table of HWCONFIG. Alternatively, they can also be found in the DVP-ES3/EX3/SV3/SX3 series EtherNet/IP status code special registers (SR1020 to SR1051).

Error Code (HEX)	Description	Solutions
0100	Duplicated I/O Connections	<ul style="list-style-type: none"> Check the data exchange table to confirm if this I/O Connection has already been set up. Change the connection number (for example, from Connection1 to Connection2).
0106	Conflicts in establishing I/O connections with multiple Scanners.	<ul style="list-style-type: none"> Remove other devices with Scanner functionality from the network to ensure that there are no other Scanners connected to this Adapter. If multiple Scanners are required, adjust the connection settings to Multicast and change the connection established by the second Scanner to Listen only.
0110	Adapter configuration is set incorrectly.	<ul style="list-style-type: none"> Check if the status of I/O connection is STOP. Restart the I/O connection. Contact the adapter manufacturer to obtain the correct EDS file.
0111	Adapter RPI is set incorrectly.	<ul style="list-style-type: none"> Check if the adapter RPI settings exceed the specifications. Contact the adapter manufacturer to obtain the correct EDS file.
0113	Insufficient I/O connections	<ul style="list-style-type: none"> Check if the product connection exceeds the specification. Reduce the number of connections to the adapter. Contact the adapter manufacturer to obtain the correct EDS file.
0114	The Vender ID or the Product Code in the EDS file is mismatched.	<ul style="list-style-type: none"> Check if the product information and the EDS file matched. Reload the EDS file. Contact the adapter manufacturer to obtain the correct EDS file.
0115	The device type in the EDS file is mismatched.	
0116	The revision in the EDS file is mismatched.	

Error Code (HEX)	Description	Solutions
0119	Non-Listen only connection establishment failed.	<ul style="list-style-type: none"> Check if the I/O connections are established in the system configuration. Check if the scanner I/O connections are functioning.
011C	The parameters of Transport class and Trigger in the EDS file are mismatched.	
011E	The direction in the EDS file is mismatched.	
011F	Output fixed / variable flag in the EDS file is incorrect.	
0120	Input fixed / variable flag in the EDS file is incorrect.	<ul style="list-style-type: none"> Check if the product information and the EDS file matched.
0121	The output priority in the EDS file is incorrect.	<ul style="list-style-type: none"> Reload the EDS file.
0122	The input priority in the EDS file is incorrect.	<ul style="list-style-type: none"> Contact the adapter manufacturer to obtain the correct EDS file.
0123	The output connection type in the EDS file is incorrect.	
0124	The input connection type in the EDS file is incorrect.	
0125	The output redundant ownership in the EDS file is incorrect.	
0126	The configuration size in the EDS file is incorrect.	<ul style="list-style-type: none"> Check if the product information and the EDS file matched. Reload the EDS file. Contact the adapter manufacturer to obtain the correct EDS file.
0127	Adapter input size is set incorrectly.	<ul style="list-style-type: none"> Check the input size setting in the connection parameters. Contact the adapter manufacturer to obtain the correct EDS file.
0128	Adapter output size is set incorrectly.	<ul style="list-style-type: none"> Check the output size setting in the connection parameters. Contact the adapter manufacturer to obtain the correct EDS file.

Error Code (HEX)	Description	Solutions
0129	The configuration path in the EDS file is incorrect.	<ul style="list-style-type: none"> Check if the product information and the EDS file matched. Reload the EDS file. Contact the adapter manufacturer to obtain the correct EDS file.
012D	Incorrect Consumed Tag parameter	<ul style="list-style-type: none"> Check if the parameters in the Consumed tag are set correctly.
012E	Incorrect Produced Tag parameter	<ul style="list-style-type: none"> Check if the parameters in the Produced tag are set correctly.
0132	The EDS file does not support Null forward open.	<ul style="list-style-type: none"> Check if the product information and the EDS file matched. Reload the EDS file. Contact the adapter manufacturer to obtain the correct EDS file.
0203	I/O connection timeout	<ul style="list-style-type: none"> There has been a disconnection or no response from the server after establishing a connection. Check the network connection status. Check if the Adapter is working properly. Increase the RPI value.
0204	Communication timeout when establishing I/O connections	<ul style="list-style-type: none"> Connection establishment failed, adapter did not respond. Check if the IP address is correct. Check if there is an IP address conflict. Check if the device to be connected supports EtherNet/IP Adapter. Check if the network cable connection is normal. Check if the Adapter is working properly.
0302	The network configuration exceeds the product's PPS specification.	<ul style="list-style-type: none"> Check the IO connection specifications of the Scanner and Adapter. Increase the RPI value or reduce the number of connections.
0315	Adapter input/output instance parameter setting error	<ul style="list-style-type: none"> Check if the product information and the EDS file matched. Reload the EDS file. Contact the adapter manufacturer to obtain the correct EDS file.

9.7 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.

9.7.1 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:**



9.7.2 Create a New Project

- Open Studio 5000 and under **Create**, click **New Project**.
- Select a PLC and select the chassis.
- Click Finish to create the new project.
- After creating the project, Studio 5000 displays the Controller Organizer and workspace.

9.7.3 Create a Scanner

Next, add the 1756-EN2TR Ethernet/IP module, and then connect to the Ethernet/IP devices through the Ethernet/IP module.

9.7.3.1 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.

9.7.4 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.

9.7.4.1 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.
- Follow the instructions in the wizard and then click **Finish** to complete importing the EDS file.

9.7.4.2 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.
- 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/EX3/SV3/SX3 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.

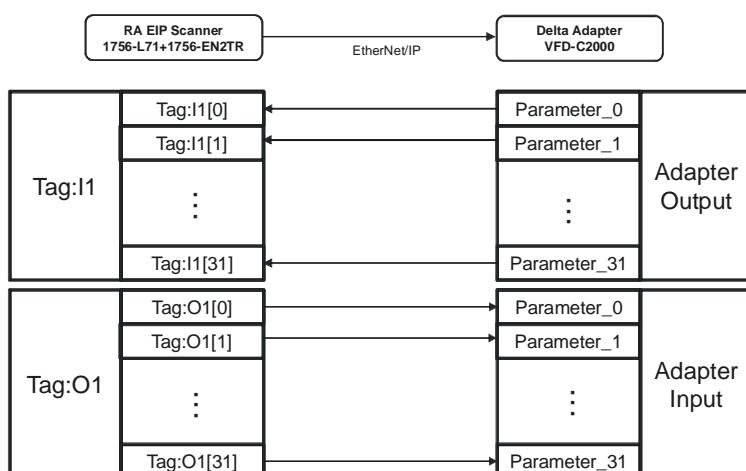
9.7.4.3 Editing Corresponding Addresses for DVP-ES3/EX3/SV3/SX3

Refer to section 9.8.5 Assembly Object for defaults of mapping address. Refer to section 9.7.4.4 on how to open Program TAG and modify the contents of TAG:C to edit the mapping addresses. Refer to section 9.8.5 Assembly Object for details on TAG:C.

9.7.4.4 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.

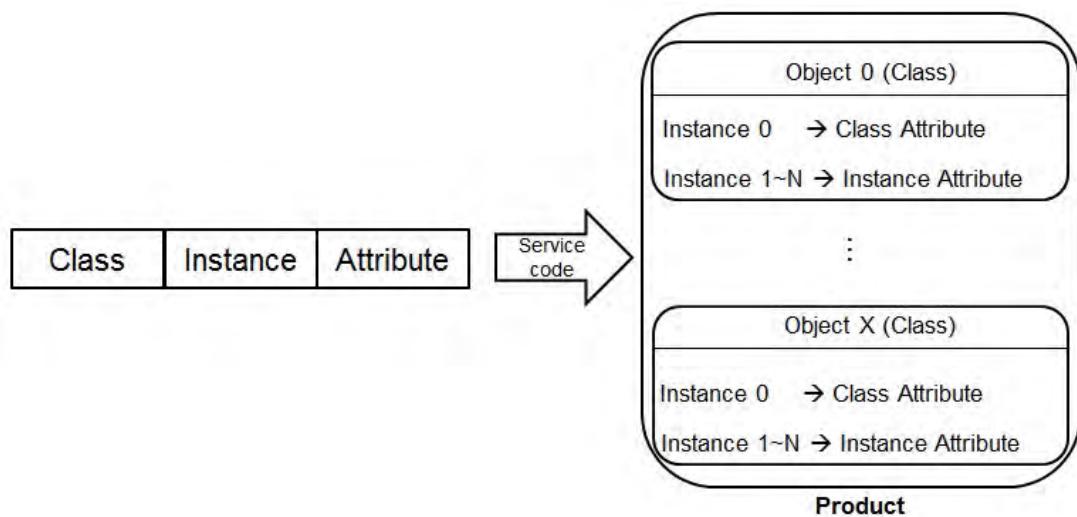
- Click **Program TAGs** to display the Tags window.
- Tags are listed in the **Name** column. Tag names begin with a product name and end with **C** or **I1** or **O1**.
- Tag name: C indicates the tag contains information from the Adapter EDS file, including Input and Output parameters. You can edit 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.



9.8 CIP Object

9.8.1 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 9.8.2 for the data type definitions. Refer to Section 9.8.3 to 9.8.19 for object contents. You can use explicit messages to read and write Objects. DVP-ES3/EX3/SV3/SX3 Series PLC acts as a Scanner, you can use EIPRW instruction to read and write Objects. Refer to DVP-ES3/EX3/SV3/SX3 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)

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)

9.8.2 Data Type

This section provides an overview of the data types supported by objects.

Data Type	Description								
BOOL	False (H'00) or True (H'01)								
SIGNED INTEGER	SINT (1 byte), INT (2 bytes), DINT (4 bytes), LINT (8 bytes)								
Number	1st	2nd	3rd	4th	5th	6th	7th	8th	
SINT	0LSB								
INT	0LSB	1LSB							
DINT	0LSB	1LSB	2LSB	3LSB					
LINT	0LSB	1LSB	2LSB	3LSB	4LSB	5LSB	6LSB	7LSB	
Example: DINT value = H'12345678									
Number	1st		2nd		3rd		4th		
DINT	78		56		34		12		

Data Type	Description																																																																				
UNSIGNED INTEGER	USINT (1 byte), UINT (2 bytes), UDINT (4 bytes), ULINT (8 bytes) Ex: UDINT value = H'AABBCCDD <table border="1" data-bbox="425 399 1303 512"> <tr> <td data-bbox="425 399 568 453">Number</td><td data-bbox="568 399 711 453">1st</td><td data-bbox="711 399 917 453">2nd</td><td data-bbox="917 399 1060 453">3rd</td><td data-bbox="1060 399 1303 453">4th</td></tr> <tr> <td data-bbox="425 453 568 512">UDINT</td><td data-bbox="568 453 711 512">DD</td><td data-bbox="711 453 917 512">CC</td><td data-bbox="917 453 1060 512">BB</td><td data-bbox="1060 453 1303 512">AA</td></tr> </table>									Number	1st	2nd	3rd	4th	UDINT	DD	CC	BB	AA																																																		
Number	1st	2nd	3rd	4th																																																																	
UDINT	DD	CC	BB	AA																																																																	
STRING	ASCII CODES, 1 or 2 bytes/words STRING: 2 bytes character count + 1 byte character <table border="1" data-bbox="425 669 1389 781"> <tr> <td data-bbox="425 669 568 723"></td><td data-bbox="568 669 870 723">Contents (Char count)</td><td colspan="8" data-bbox="870 669 1472 723">Contents (String contents)</td></tr> <tr> <td data-bbox="425 723 568 781">STRING</td><td data-bbox="568 723 711 781">04</td><td data-bbox="711 723 870 781">00</td><td data-bbox="870 723 1013 781">4D</td><td data-bbox="1013 723 1156 781">69</td><td data-bbox="1156 723 1298 781">6C</td><td data-bbox="1298 723 1441 781">6C</td><td data-bbox="1441 723 1472 781"></td><td data-bbox="1441 723 1472 781"></td><td data-bbox="1441 723 1472 781"></td></tr> </table> STRING2: 2 bytes character count + 2 byte character <table border="1" data-bbox="425 916 1389 1028"> <tr> <td data-bbox="425 916 568 970"></td><td data-bbox="568 916 870 970">Contents (Char count)</td><td colspan="8" data-bbox="870 916 1472 970">Contents (String contents)</td></tr> <tr> <td data-bbox="425 970 568 1028">STRING2</td><td data-bbox="568 970 711 1028">04</td><td data-bbox="711 970 870 1028">00</td><td data-bbox="870 970 1013 1028">4D</td><td data-bbox="1013 970 1156 1028">00</td><td data-bbox="1156 970 1298 1028">69</td><td data-bbox="1298 970 1441 1028">00</td><td data-bbox="1441 970 1472 1028">6C</td><td data-bbox="1441 970 1472 1028">00</td><td data-bbox="1441 970 1472 1028">6C</td></tr> </table> SHORT_STRING: 1 bytes character count + 1 byte character <table border="1" data-bbox="425 1140 1389 1253"> <tr> <td data-bbox="425 1140 568 1194"></td><td data-bbox="568 1140 870 1194">Contents (Char count)</td><td colspan="8" data-bbox="870 1140 1472 1194">Contents (String contents)</td></tr> <tr> <td data-bbox="425 1194 568 1253">STRING</td><td data-bbox="568 1194 711 1253">04</td><td data-bbox="711 1194 870 1253">4D</td><td data-bbox="870 1194 1013 1253">69</td><td data-bbox="1013 1194 1156 1253">6C</td><td data-bbox="1156 1194 1298 1253">00</td><td data-bbox="1298 1194 1441 1253">6C</td><td data-bbox="1441 1194 1472 1253">6C</td><td data-bbox="1441 1194 1472 1253"></td><td data-bbox="1441 1194 1472 1253"></td></tr> </table>										Contents (Char count)	Contents (String contents)								STRING	04	00	4D	69	6C	6C					Contents (Char count)	Contents (String contents)								STRING2	04	00	4D	00	69	00	6C	00	6C		Contents (Char count)	Contents (String contents)								STRING	04	4D	69	6C	00	6C	6C		
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Fixed LENGTH BIT STRING	BYTE (1 byte), WORD (2 bytes), DWORD (4 bytes), LWORD (8 bytes) <table border="1" data-bbox="425 1307 1441 1596"> <tr> <td data-bbox="425 1307 568 1361"></td><td data-bbox="568 1307 711 1361">1st</td><td data-bbox="711 1307 870 1361">2nd</td><td data-bbox="870 1307 1013 1361">3rd</td><td data-bbox="1013 1307 1156 1361">4th</td><td data-bbox="1156 1307 1298 1361">5th</td><td data-bbox="1298 1307 1441 1361">6th</td><td data-bbox="1441 1307 1472 1361">7th</td><td data-bbox="1441 1307 1472 1361">8th</td></tr> <tr> <td data-bbox="425 1361 568 1419">Byte</td><td data-bbox="568 1361 711 1419">7...0</td><td data-bbox="711 1361 870 1419"></td><td data-bbox="870 1361 1013 1419"></td><td data-bbox="1013 1361 1156 1419"></td><td data-bbox="1156 1361 1298 1419"></td><td data-bbox="1298 1361 1441 1419"></td><td data-bbox="1441 1361 1472 1419"></td><td data-bbox="1441 1361 1472 1419"></td></tr> <tr> <td data-bbox="425 1419 568 1477">WORD</td><td data-bbox="568 1419 711 1477">7...0</td><td data-bbox="711 1419 870 1477">15...8</td><td data-bbox="870 1419 1013 1477"></td><td data-bbox="1013 1419 1156 1477"></td><td data-bbox="1156 1419 1298 1477"></td><td data-bbox="1298 1419 1441 1477"></td><td data-bbox="1441 1419 1472 1477"></td><td data-bbox="1441 1419 1472 1477"></td></tr> <tr> <td data-bbox="425 1477 568 1536">DWORD</td><td data-bbox="568 1477 711 1536">7...0</td><td data-bbox="711 1477 870 1536">15...8</td><td data-bbox="870 1477 1013 1536">23...16</td><td data-bbox="1013 1477 1156 1536">31...24</td><td data-bbox="1156 1477 1298 1536"></td><td data-bbox="1298 1477 1441 1536"></td><td data-bbox="1441 1477 1472 1536"></td><td data-bbox="1441 1477 1472 1536"></td></tr> <tr> <td data-bbox="425 1536 568 1596">LWORD</td><td data-bbox="568 1536 711 1596">7...0</td><td data-bbox="711 1536 870 1596">15...8</td><td data-bbox="870 1536 1013 1596">23...16</td><td data-bbox="1013 1536 1156 1596">31...24</td><td data-bbox="1156 1536 1298 1596">39...32</td><td data-bbox="1298 1536 1441 1596">47...40</td><td data-bbox="1441 1536 1472 1596">55...48</td><td data-bbox="1441 1536 1472 1596">63...56</td><td data-bbox="1441 1536 1472 1596"></td></tr> </table>										1st	2nd	3rd	4th	5th	6th	7th	8th	Byte	7...0								WORD	7...0	15...8							DWORD	7...0	15...8	23...16	31...24					LWORD	7...0	15...8	23...16	31...24	39...32	47...40	55...48	63...56															
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LWORD	7...0	15...8	23...16	31...24	39...32	47...40	55...48	63...56																																																													
STRINGI	A single string consists of multiple language representation <table border="1" data-bbox="425 1650 1441 2039"> <tr> <th data-bbox="425 1650 663 1709">Name</th><th data-bbox="663 1650 901 1709">Data Type</th><th colspan="8" data-bbox="901 1650 1441 1709">Meaning</th></tr> <tr> <td data-bbox="425 1709 663 1799">Number</td><td data-bbox="663 1709 901 1799">USINT</td><td colspan="8" data-bbox="901 1709 1441 1799">The number of internationalized character strings</td></tr> <tr> <td data-bbox="425 1799 663 1933">Strings</td><td data-bbox="663 1799 901 1933">Array of: Struct of:</td><td colspan="8" data-bbox="901 1799 1441 1933">Array of individual internationalized character strings</td></tr> <tr> <td data-bbox="425 1933 663 2039">LanguageChar1</td><td data-bbox="663 1933 901 2039">USINT</td><td colspan="8" data-bbox="901 1933 1441 2039">The first ASCII character of the ISO 639-2/T language</td></tr> </table>									Name	Data Type	Meaning								Number	USINT	The number of internationalized character strings								Strings	Array of: Struct of:	Array of individual internationalized character strings								LanguageChar1	USINT	The first ASCII character of the ISO 639-2/T language																											
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Strings	Array of: Struct of:	Array of individual internationalized character strings																																																																			
LanguageChar1	USINT	The first ASCII character of the ISO 639-2/T language																																																																			

Data Type	Description			
	LanguageChar2	USINT	The second ASCII character of the ISO 639-2/T language	
	LanguageChar3	USINT	The third ASCII character of the ISO 639-2/T language	
	CharStringStruct	USINT	The structure of the character string, limited to the Elementary Data type value 0xD0 (STRING), 0xD5 (STRING2), 0xD9 (STRINGN) and 0xDA (SHORT_STRING)	
	CharSet	UINT	The character set which the character string is based on which comes from IANA MIB Printer Code (RFC 1759).	
	International String	Defined in CharStringStruct	An array of 8-bit octet elements which is the actual international character string	
ISO 639-2/T language:				
	Language	First Character	Second Character	Third Character
	English	e	n	G
	French	f	r	e
	Spanish	s	p	a
	Italian	i	t	a
STRUCT	STRUCT of: Composed of any data types. Ex.: STRUCT of { BOOL, UINT, DINT } = { TRUE, H'1234, H'56789ABC }			
ARRAY	Array of: Composed of one data type. Ex.: ARRAY of UINTs = { 1, 2, 3 }			
EPATH	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 "			

9.8.3 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 have 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
8	Minor Recoverable Fault	0: No minor recoverable fault detected 1: Minor recoverable fault detected

Bit (s)	Name	Description
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

9.8.4 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
H'03	Number Active	Get	UINT	H'0	The number of connected connections

9.8.5 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

9.8.6 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.
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.

9.8.7 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.

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

Class Attribute	Name	Access Rule	Data Type	Values	Description
	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

9.8.8 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.

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
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.

9.8.9 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

- 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_S TRING	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_S TRING	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 reset
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

9.8.10 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

9.8.11 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	Get/Set	BOOL	H'00	Y0 bit register
H'01	Y1	Get/Set	BOOL	H'00	Y1 bit register
H'02–H'0FE	Y2–Y376	Get/Set	BOOL	H'00	Y2–Y376 bit register
H'FF	Y377	Get/Set	BOOL	H'00	Y377 bit register

9.8.12 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	Get/Set	BOOL	H'00	D0.0 bit register
H'01	D0.1	Get/Set	BOOL	H'00	D0.1 bit register
H'02–H'752FE	D0.2–D29999.14	Get/Set	BOOL	H'00	D0.2–D29999.14 bit register
H'752FF	D29999.15	Get/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	Get/Set	INT	H'00	D0 word register
H'01	D1	Get/Set	INT	H'00	D1 word register
H'02–H'752E	D2–D29998	Get/Set	INT	H'00	D2–D29998 word register
H'752F	D29999	Get/Set	INT	H'00	D29999 word register

9.8.13 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	Get/Set	BOOL	H'00	M0 bit register
H'01	M1	Get/Set	BOOL	H'00	M1 bit register
H'02-H'1FFE	M2–M8190	Get/Set	BOOL	H'00	M2–M8190 bit register
H'1FFF	M8191	Get/Set	BOOL	H'00	M8191 bit register

9.8.14 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	Get/Set	BOOL	H'00	S0 bit register
H'01	S1	Get/Set	BOOL	H'00	S1 bit register
H'02-H'7FE	S2–S2046	Get/Set	BOOL	H'00	S2–S2046 bit register
H'7FF	S2047	Get/Set	BOOL	H'00	S2047 bit register

9.8.15 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	Get/Set	BOOL	H'00	T0 bit register
H'01	T1	Get/Set	BOOL	H'00	T1 bit register
H'02–H'1FE	T2–T510	Get/Set	BOOL	H'00	T2–T510 bit register
H'1FF	T511	Get/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	Get/Set	INT	H'00	T0 word register
H'01	T1	Get/Set	INT	H'00	T1 word register
H'02–H'1FE	T2–T510	Get/Set	INT	H'00	T2–T510 word register
H'1FF	T511	Get/Set	INT	H'00	T511 word register

9.8.16 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	Get/Set	BOOL	H'00	C0 bit register
H'01	C1	Get/Set	BOOL	H'00	C1 bit register
H'02–H'1FE	C2–C510	Get/Set	BOOL	H'00	C2–C510 bit register
H'1FF	C511	Get/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	Get/Set	INT	H'00	C0 word register
H'01	C1	Get/Set	INT	H'00	C1 word register
H'02–H'1FE	C2–C510	Get/Set	INT	H'00	C2–C510 word register
H'1FF	C511	Get/Set	INT	H'00	C511 word register

9.8.17 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	Get/Set	BOOL	H'00	HC0 bit register
H'01	HC1	Get/Set	BOOL	H'00	HC1 bit register
H'02–H'FE	HC2–HC254	Get/Set	BOOL	H'00	HC2–HC254 bit register
H'FF	HC255	Get/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	Get/Set	DINT	H'00	HC0 word register
H'01	HC1	Get/Set	DINT	H'00	HC1 word register
H'02–H'FE	HC2–HC254	Get/Set	DINT	H'00	HC2–HC254 word register
H'FF	HC255	Get/Set	DINT	H'00	HC255 word register

9.8.18 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	Get/Set	BOOL	H'00	SM0 bit register
H'01	SM1	Get/Set	BOOL	H'00	SM1 bit register
H'02–H'FFE	SM2–SM4095	Get/Set	BOOL	H'00	SM2–SM4095 bit register
H'FFF	SM4096	Get/Set	BOOL	H'00	SM4096 bit register

9.8.19 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	Get/Set	INT	H'00	SR0 word register
H'01	SR1	Get/Set	INT	H'00	SR1 word register
H'02–H'7FE	SR2–SR2046	Get/Set	INT	H'00	SR2–SR2046 word register
H'7FF	SR2047	Get/Set	INT	H'00	SR2047 word register

9.9 Delta EIP Product List

9.9.1 Delta EIP Products

Positioning	Product	Firmware Version
Mid-range PLC	AHCPU501-EN, AHCPU511-EN, AHCPU521-EN, AHCPU531-EN	V2.00
	AHCPU560-EN2	V1.00
	AH10EN-5A	V2.00
	AHRTU-ETHN-5A	V1.00
	AH10EMC-5A	V1.00
	AS300 Series	V1.00
	AS200 Series	V1.00
	AS100 Series	V1.10
	AS300 Series + AS-FEN02	V1.06 (AS-FEN02: V1.00)
Small PLC	AS00SCM-A + AS-FEN02	V2.02 (AS-FEN02: V1.00)
	DVPES2-E Series	V3.60
	DVP26SE	V1.00
	DVP12SE	V2.00
	DVP-ES3/EX3 Series	V1.00
Inverter	DVP-SV3/SX3	V1.00
	CMM-EIP01/02 Communication Card (+ VFD-MS300 Series)	V1.00
	CMC-EIP01 (+ VFD-C2000 Series)	V1.06
	CMM-EIP03 (+ VFD-M300 Series)	V1.00
	CMC-EIP02 (+ VFD-C2000 Series)	V1.00

9.9.2 Delta EIP Products, DLR (Device Level Ring) supported

Positioning	Product	Firmware Version
Mid-range PLC	AHCPU560-EN2	V1.00
	AH10EN-5A	V2.00
	AHRTU-ETHN-5A	V1.00
Inverter	CMM-EIP03 (+ VFD-M300 Series)	V1.00
	CMC-EIP02 (+ VFD-C2000 Series)	V1.00
Switch	DVS-103I02C-DLR	V1.00

9.9.3 Delta EIP Products, Scanner supported

Positioning	Product	Firmware Version
Mid-range PLC	AHCPU501-EN, AHCPU511-EN, AHCPU521-EN, AHCPU531-EN	V2.00
	AHCPU560-EN2	V1.00
	AH10EN-5A	V2.00
	AS300 Series, AS200 Series	V1.00
	AS100 Series	V1.10
Small PLC	DVP-ES3/EX3	V1.00
	DVP-SV3/SX3	V1.00
Motion Controller	AX-3 Series	V1.00

9.10 Network Security

To enhance security and performance of the system, it is suggested to use closed network or LAN with firewall protection to prevent cyber-attacks.

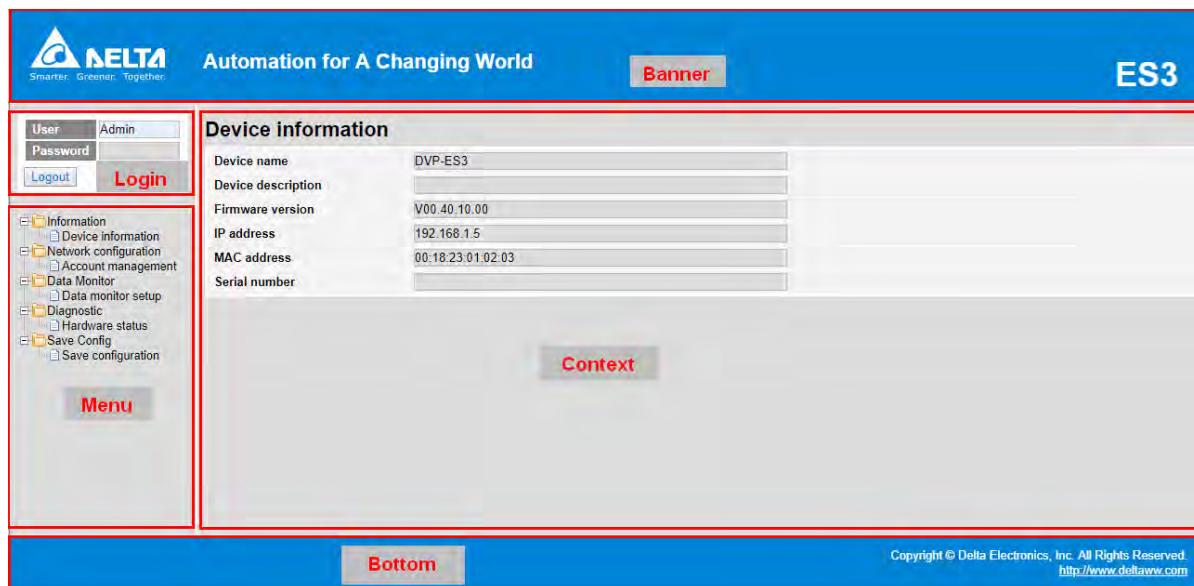
9.11 Operation and Monitor on the Web

9.11.1 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/EX3/SV3/SX3 Series PLC.

9.11.1.1 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

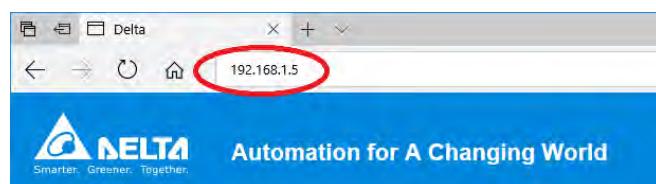
9.11.1.2 Using the Webpage

List of browsers that support DVP-ES3/EX3/SV3/SX3 Series webpage:

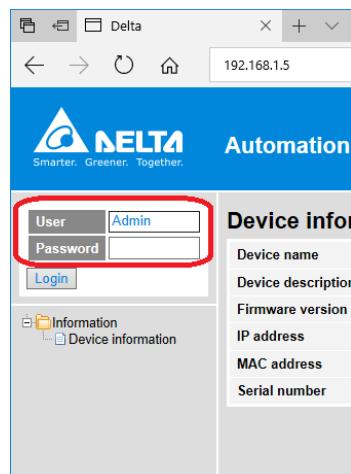
Provider	Browser	Supported versions
Microsoft	Internet Explorer	V10.0 and later
Microsoft	Edge	V20 and later
Google	Chrome	V14 and later
Mozilla	Firefox	V17 and later
Apple	Safari	V5.1 and later

- **Operation Steps:**

- Open your browser, enter DVP-ES3 IP address in the search bar to connect to DVP-ES3 PLC.



- 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.



9.11.1.3 Login

You need to login to your account to set up.

- **Operation Steps:**

- Provide the login information to login.

A screenshot of a login interface. It features two input fields: 'User' and 'Password', both with dark grey backgrounds and white text. Below these is a blue 'Login' button. The entire interface is set against a light grey background.

- After login successfully, the user field shows your account name (read only). After setting up, you can click **Logout** here to leave this webpage.

A screenshot of the same login interface after a successful login. The 'User' field now contains the text 'Admin' in a light grey, read-only font. The 'Password' field is empty. The 'Login' button has been replaced by a 'Logout' button at the bottom.

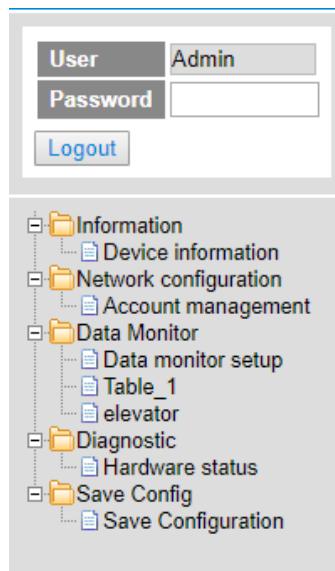
Item	Description
User	Your account name
Password	Your password
“Login” / “Logout”	Login: to enter the webpage Logout: to leave the webpage

9.11.1.4 Menu

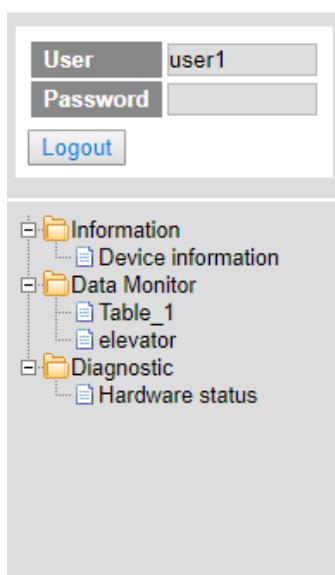
The menu shows data based on the permission of the current user.

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.



9.11.2 Device Information

Here provides DVP-ES3/EX3/SV3/SX3 Series PLC product information.

You do not need to log in to see the device information. This page is read only, not for editing.

Device information	
Device name	DVP-ES3
Device description	
Firmware version	V00.40.10.00
IP address	192.168.1.5
MAC address	00:18:23:01:02:03
Serial number	

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

9.11.3 Network configuration

You can set network related configurations here.

9.11.3.1 Account management

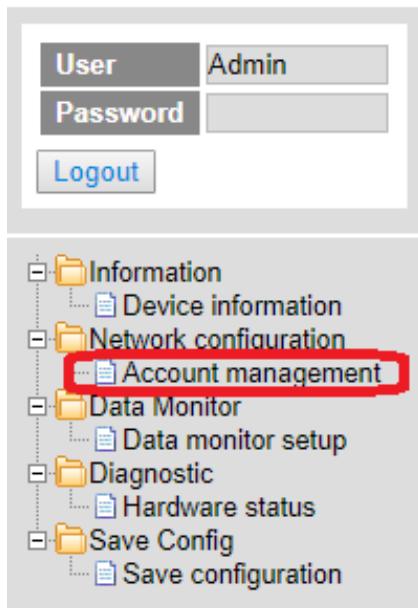
You can set 3 kinds of access types for up to 8 user accounts.

Account management				
No.	User ID	Password	Access type	Delete
1	Admin		Administrator	<input type="button" value="Delete"/>
2			Administrator	<input type="button" value="Delete"/>
3			Administrator	<input type="button" value="Delete"/>
4			Administrator	<input type="button" value="Delete"/>
5			Administrator	<input type="button" value="Delete"/>
6			Administrator	<input type="button" value="Delete"/>
7			Administrator	<input type="button" value="Delete"/>
8			Administrator	<input type="button" value="Delete"/>
<input type="button" value="Apply"/>				

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). <ul style="list-style-type: none"> ● 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). <ul style="list-style-type: none"> ● 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. <ul style="list-style-type: none"> ● 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 logging 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.

Account management

No.	User ID	Password	Access type	Delete
1	Admin		Administrator	<input type="button" value="Delete"/>
2	user1	Write/Read	<input type="button" value="Delete"/>
3	user2	Read	<input type="button" value="Delete"/>
4			Administrator	<input type="button" value="Delete"/>
5			Administrator	<input type="button" value="Delete"/>
6			Administrator	<input type="button" value="Delete"/>
7			Administrator	<input type="button" value="Delete"/>
8			Administrator	<input type="button" value="Delete"/>

c. Double-click **Save configuration** to open the setting page.

The screenshot shows a navigation menu on the right side of a screen. At the top, there are fields for 'User' (set to 'Admin') and 'Password'. Below these are 'Logout' and a 'Logout' button. The main area contains a tree structure with the following items:

- Information
 - Device information
- Network configuration
 - Account management
- Data Monitor
 - Data monitor setup
- Diagnostic
 - Hardware status
- Save Config
 - Save configuration

The 'Save configuration' item under 'Save Config' is highlighted with a red box.

d. Click **Save** to save and download the settings to the device.

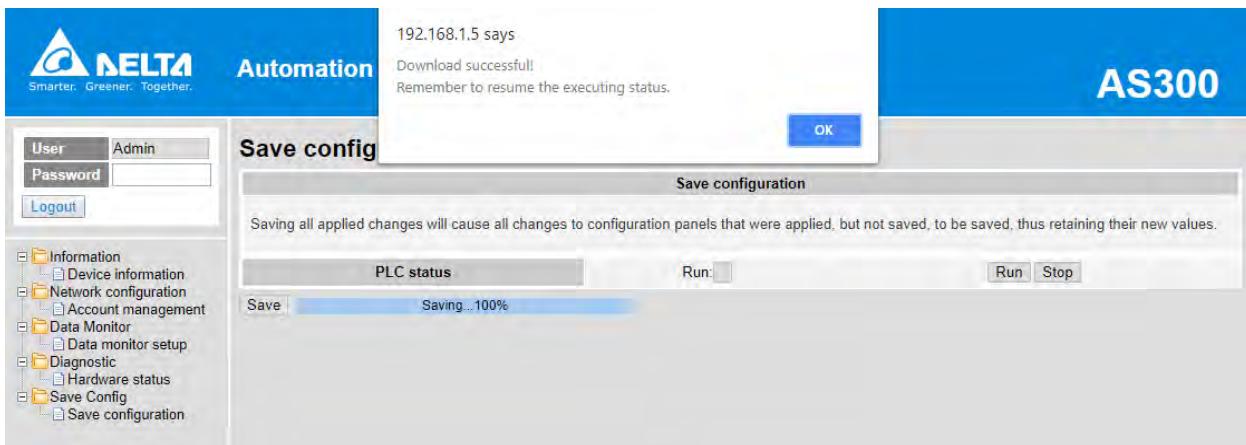
Save configuration

Save configuration

Saving all applied changes will cause all changes to configuration panels that were applied, but not saved, to be saved, thus retaining their new values.

PLC Status Run:

e. After download is complete, it will be prompted with a Download successful message.



9.11.4 Data Monitoring

You can set monitoring related configurations here.

9.11.4.1 Data Monitoring Setup Page

You can set up 4 pages of monitoring data and up to 30 items can be monitored on each page.

9

Data monitor setup						
No.	Table name	Device quantity	Default update cycle (1s-60s)	Edit	Delete	
1	Table_1	17	1	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	
2		0	10	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	
3	Table_3	0	1	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	
4	Table_4	0	5	<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	

Table name: Table_1

No.	Device	Radix	Read only	Description
1	M0	Binary	<input type="checkbox"/>	
2		Signed Decimal	<input type="checkbox"/>	
3	Y0	Signed Decimal	<input type="checkbox"/>	
4	Y0.15	Unsigned Decimal	<input type="checkbox"/>	
5	HC0	Hexadecimal	<input type="checkbox"/>	
6		Octal	<input type="checkbox"/>	
7	Y0.0	Binary	<input type="checkbox"/>	
8		32bit Signed decimal	<input type="checkbox"/>	
9	X0.0	32bit Unsigned decimal	<input type="checkbox"/>	
10		32bit Hex	<input type="checkbox"/>	
11		32bit Octal	<input type="checkbox"/>	
12	D400	32bit Binary	<input type="checkbox"/>	
13	D401	32bit Float	<input type="checkbox"/>	
14	D402	64bit Double	<input type="checkbox"/>	
15	D403		<input type="checkbox"/>	
16			<input type="checkbox"/>	
17	D400		<input type="checkbox"/>	
18	D400		<input type="checkbox"/>	
19	HC123		<input type="checkbox"/>	
20			<input type="checkbox"/>	
21	C0		<input type="checkbox"/>	
22			<input type="checkbox"/>	
23			<input type="checkbox"/>	
24			<input type="checkbox"/>	
25			<input type="checkbox"/>	
26			<input type="checkbox"/>	
27			<input type="checkbox"/>	
28			<input type="checkbox"/>	
29			<input type="checkbox"/>	
30			<input type="checkbox"/>	

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 logging in, double-click **Data monitor setup** to open the setting page.



b. Use "Edit" to edit the table name, device quantity, and update cycle time.

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.

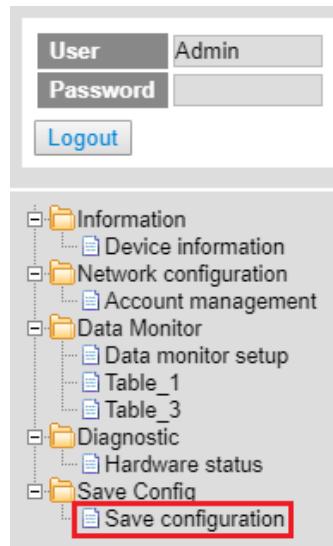
Table name: Elevator					
No.	Device	Radix	Read only	Description	
1		Signed Decimal ▾	<input type="checkbox"/>		
2		Signed Decimal ▾	<input type="checkbox"/>		
3		Signed Decimal ▾	<input type="checkbox"/>		
4		Signed Decimal ▾	<input type="checkbox"/>		
5		Signed Decimal ▾	<input type="checkbox"/>		

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.

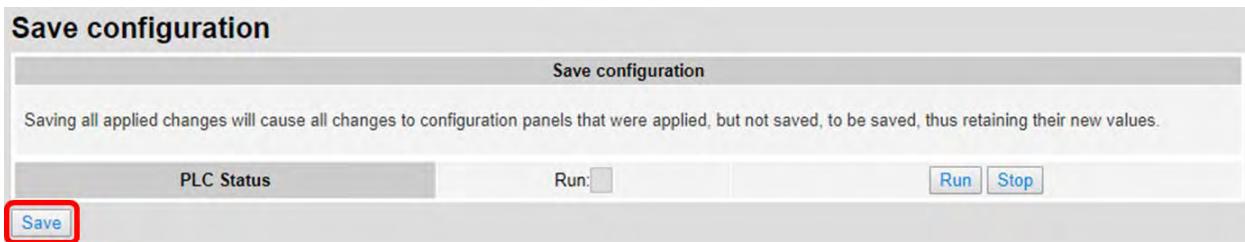
Table name: Elevator					
No.	Device	Radix	Read only	Description	
1	M0	Binary ▾	<input type="checkbox"/>		
2		Signed Decimal ▾	<input type="checkbox"/>		
3	Y0	Signed Decimal ▾	<input type="checkbox"/>		
4	Y63.15	Binary ▾	<input type="checkbox"/>		
5	HC0	32bit Octal ▾	<input type="checkbox"/>		
6		Signed Decimal ▾	<input type="checkbox"/>		
7	Y0.0	Binary ▾	<input type="checkbox"/>		
8		Signed Decimal ▾	<input type="checkbox"/>		
⋮					
28		Signed Decimal ▾	<input type="checkbox"/>		
29		Signed Decimal ▾	<input type="checkbox"/>		
30		Signed Decimal ▾	<input type="checkbox"/>		

Apply

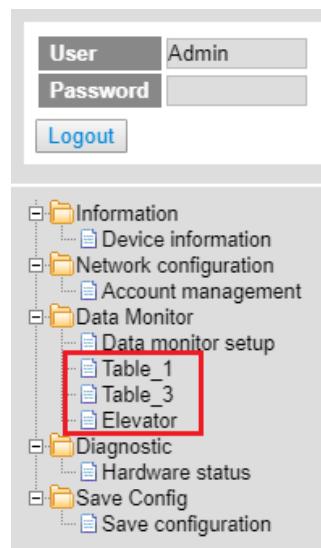
e. Double-click **Save configuration** to open the setting page.



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.

9.11.4.2 Data Monitor Table Pages

The setting results are shown as below.

Table name: Table_1		Monitor status: 	Update cycle (1s ~ 60s): 1 +	Floating Format Setting: 3 ▼				
No.	Device	Status	Value	Radix	Description	Set Status	Set value	Set
1	M0			Binary		ON	OFF	Set
2						ON	OFF	Set
3	Y0		K57	Signed Decimal		ON	OFF	Set
4	Y53.15			Binary		ON	OFF	Set
5	HC0		0000000000	32bit Octal		ON	OFF	Set
6						ON	OFF	Set
7	Y0.0	 		Binary		ON	OFF	Set
8						ON	OFF	Set
9	X0.0			Binary		ON	OFF	Set
10						ON	OFF	Set
11						ON	OFF	Set
12	D400		H3576	Hexadecimal		ON	OFF	Set
13	D401		H4641	Hexadecimal		ON	OFF	Set
14	D402		H8090	Hexadecimal		ON	OFF	Set
15	D403		H404B	Hexadecimal		ON	OFF	Set
16						ON	OFF	Set
17	D400		12365.365	32bit Float	32	ON	OFF	Set
18	D400		55.000	64bit Double	64	ON	OFF	Set

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.

9.11.5 Diagnostic

You can set diagnostic related configurations here.

9.11.5.1 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/EX3/SV3/SX3 Series, the hardware status page looks like below.

Hardware status

Hardware status			
Refresh cycle (1s ~ 60s): <input type="button" value="-"/> <input type="text" value="10"/> <input type="button" value="+"/>			
Extension No.	Module name	Status	Error code
CPU module	DVP-ES3	Run: <input type="button" value="Run"/> <input type="button" value="Stop"/> Err: <input type="button" value=""/>	

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	The most recent error codes occurred on the CPU module, synchronized with SR180; 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.

9.11.6 Configurations

9.11.6.1 Save Configuration Page

You can save the configurations and download the parameters to your device here.

Save configuration

Save configuration		
Saving all applied changes will cause all changes to configuration panels that were applied, but not saved, to be saved, thus retaining their new values.		
PLC Status	Run: <input type="button" value="Run"/> <input type="button" value="Stop"/>	<input type="button" value="Save"/>

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.

Chapter 10 CANopen Function and Operation

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Since ISPSoft and DIADesigner are similar in terms of program editing, this chapter will use ISPSoft software as an example for explanation. Refer to Chapter 6 of the DIADesigner User Manual for information related to DIADesigner software.

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/EX3/SV3/SX3 Series PLC is equipped with CANopen communication port. The CAN port conforms to basic communication protocol CANopen DS301, which 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/EX3/SV3/SX3 Series. You set the CANopen station address and the communication rate with this software. ISPSoft/DIADesigner is the programming software for the DVP-ES3/EX3/SV3/SX3 Series.
5. This chapter mainly focuses on the CANopen functions. Refer to Section 10.3 for terminology definitions.

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.
NMT error control monitors slave disconnection. The NMT error control is classified into two types: Heartbeat and Node Guarding. The DVP-ES3/EX3/SV3/SX3 Series PLC only supports Heartbeat.
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 data from or write 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: 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, and 1 Mbps.

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/EX3/SV3/SX3 Series in the CANopen network is controlled by a master.

- It supports the NMT error control.

The DVP-ES3/EX3/SV3/SX3 Series only supports Heartbeat.

- It supports the PDO (process data object) service.
 - The PDO message transmits the immediate input 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/EX3/SV3/SX3 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/EX3/SV3/SX3 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

When ES3 Series PLC CPU acts as a Master, 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 (Master → Slave)	1894 bytes
D24032–D24978	TxPDO mapping area (Master ← Slave)	1894 bytes

When ES3 Series PLC CPU acts 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 (Slave ← Master)	64 bytes
D25032–25063	TxPDO mapping area (Slave → Master)	64 bytes

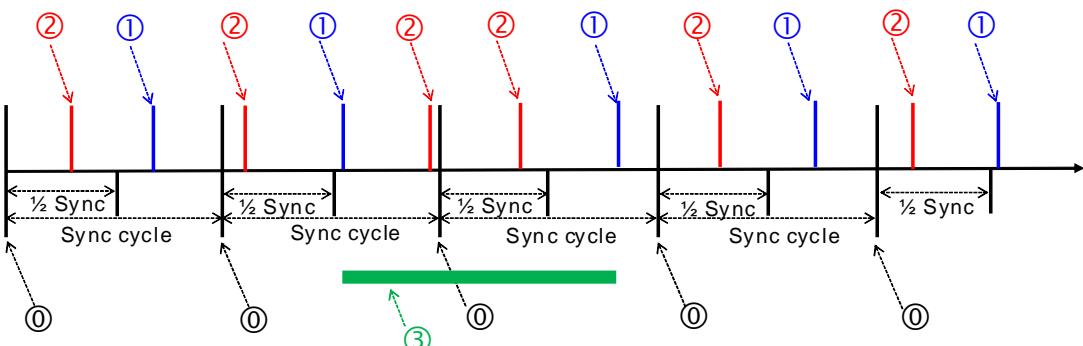
10.1.3 Refreshing Mechanism in the Input/Output Mapping Areas

When ES3 Series PLC CPU acts as a Master, the factors, including PLC scan time and the synchronization options, affect the refreshing mechanism for data mapping in the input/output mapping area. Here we list three scenarios in synchronous mode and one scenario in non-synchronous mode for your reference.

- **Synchronous mode**

Scenario A: $\frac{1}{2}$ synchronization cycle time (for the slave to send data) > PLC scan time

A half of the synchronization cycle time is longer than a PLC scan time: at least one PDO will be sent within one synchronization cycle time.



Explanation:

①: Once the synchronization cycle starts, the timer starts to count. The counted time should be longer than a half of the set synchronization time (a rounded-down number) for Master to send PDO to Slave.

②: After PLC scan time ends, PLC CPU refreshes to update the synchronization task:
PLC CPU sends PDO and then clears the counted time.

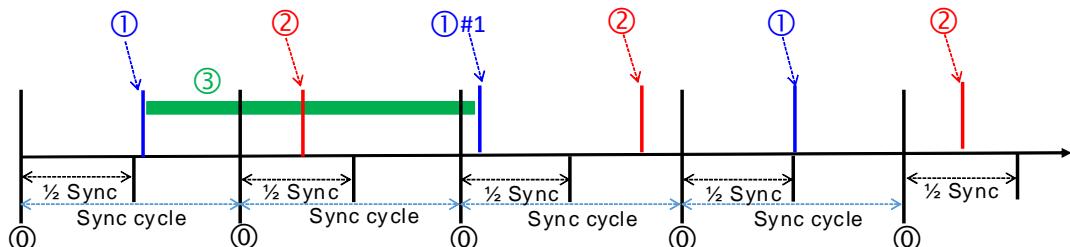
③: After PLC scan time ends, PLC CPU refreshes to update the synchronization task:
The counted time of the synchronization cycle is less than half of the synchronization cycle time (for the slave to send data), or the PDO had already been sent before, the PDO here cannot be sent and the time of the synchronization cycle continues to be counted.

④: From the cases in the green section, we know that the time for the PDO to be sent does NOT equal to the time to perform synchronization, but what we can be sure is that a Master can send at least one PDO within every synchronization cycle.

Scenario B:

$\frac{1}{2}$ synchronization cycle time (for the slave to send data) \leq PLC scan time $<$ synchronization cycle time

A half of the synchronization cycle time is less than a PLC scan time and the PLC scan time is less than or equals to a whole synchronization cycle time: it is possible that zero PDO will be sent during a synchronization cycle.

**Explanation:**

①: Once the synchronization cycle starts, the timer starts to count. The counted time should be longer than a half of the set synchronization time (a rounded-down number) for Master to send PDO to Slave.

①: After PLC scan time ends, PLC CPU refreshes to update the synchronization task:
PLC CPU sends PDO and then clears the counted time.

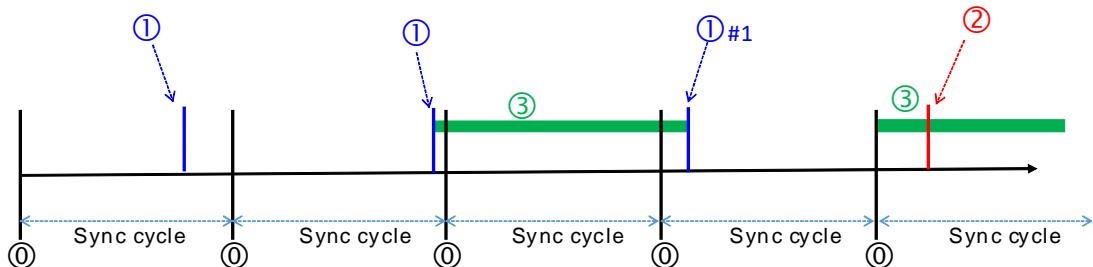
①#1: There was no PDO sent from the previous synchronization cycle. Before PLC scan time ends, the next synchronization cycle comes and the counted time is longer than a half of the set synchronization time (a rounded-down number), PLC CPU sends PDO and then clears the counted time.

②: After PLC scan time ends, PLC CPU refreshes to update the synchronization task:
The counted time of the synchronization cycle is less than half of the synchronization cycle time (for the slave to send data), the PDO here cannot be sent and the time of the synchronization cycle continues to be counted.

③: From the cases in the green section, we know that the time for the PDO to be sent does NOT equal to the time to perform synchronization, and it is possible that Master can send zero PDO during a synchronization cycle.

Scenario C:**Synchronization cycle time < = PLC scan time**

The synchronization cycle time is less than a PLC scan time: it is possible that zero PDO will be sent during a synchronization cycle.

**Explanation:**

①: Once the synchronization cycle starts, the timer starts to count. The counted time should be longer than a half of the set synchronization time (a rounded-down number) for Master to send PDO to Slave.

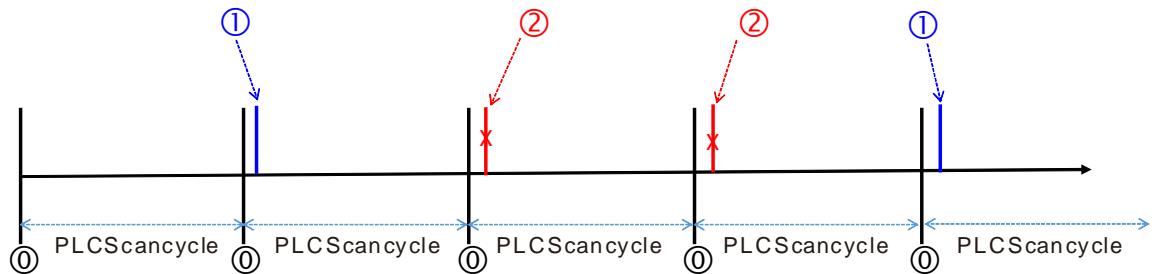
①: After PLC scan time ends, PLC CPU refreshes to update the synchronization task:
PLC CPU sends PDO and then clears the counted time.

①#1: There was no PDO sent from the previous synchronization cycle. Before PLC scan time ends, the next synchronization cycle comes and the counted time is longer than a half of the set synchronization time (a rounded-down number), PLC CPU sends PDO and then clears the counted time.

②: After PLC scan time ends, PLC CPU refreshes to update the synchronization task:
The counted time of the synchronization cycle is less than half of the synchronization cycle time (for the slave to send data), the PDO here cannot be sent and the time of the synchronization cycle continues to be counted.

③: From the cases in the green section, we know that the time for the PDO to be sent does NOT equal to the time to perform synchronization, and it is possible that Master can send zero PDO during a synchronization cycle. The chance of Master not sending any PDO during a synchronization cycle is higher than what happened in scenario B.

- **Non-synchronous mode**

**Explanation:**

①: After PLC scan time ends, PLC CPU refreshes to update the task of sending PDO.

②: If the data in PDO changes, PLC CPU sends PDO.

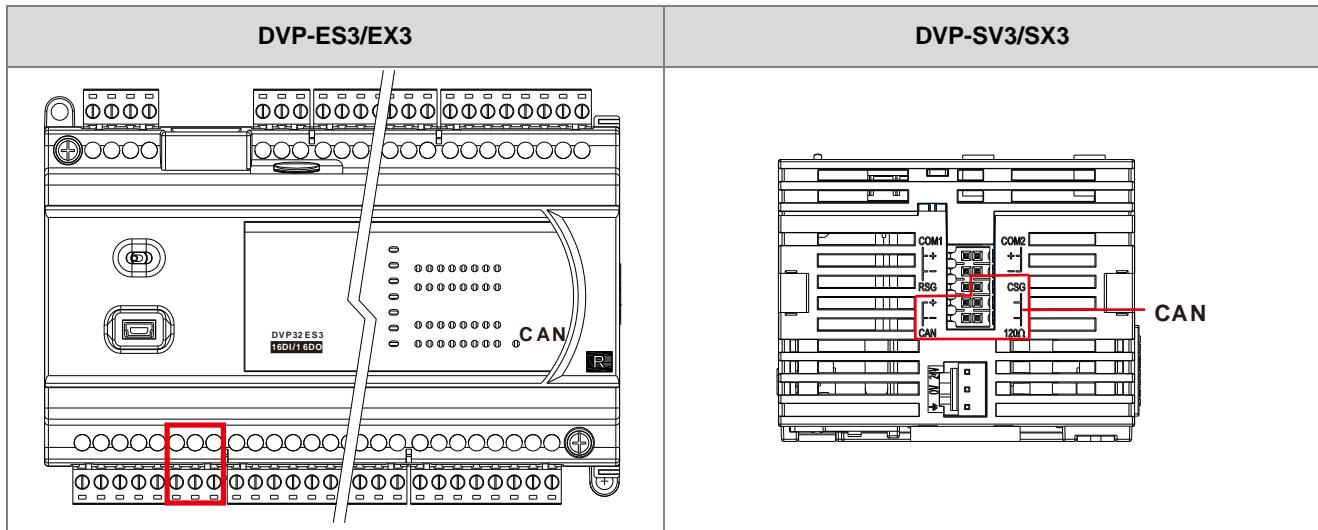
②: The data in PDO remains the same, the PDO here is NOT sent.

Note: You can use the function of setting up the PLC scan time to ensure PLC CPU checks the task of sending PDO in every set scan time.

10.2 Installation and Network Topology

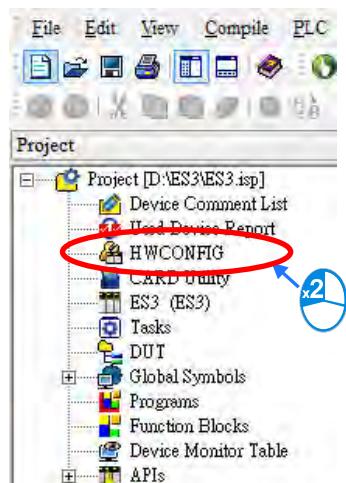
This section introduces the physical dimensions of DVP-ES3/EX3/SV3/SX3 Series PLC, the HWCONFIG settings, the CAN interface, the CANopen network framework, and the maximum communication distance.

10.2.1 CANopen Communication Port

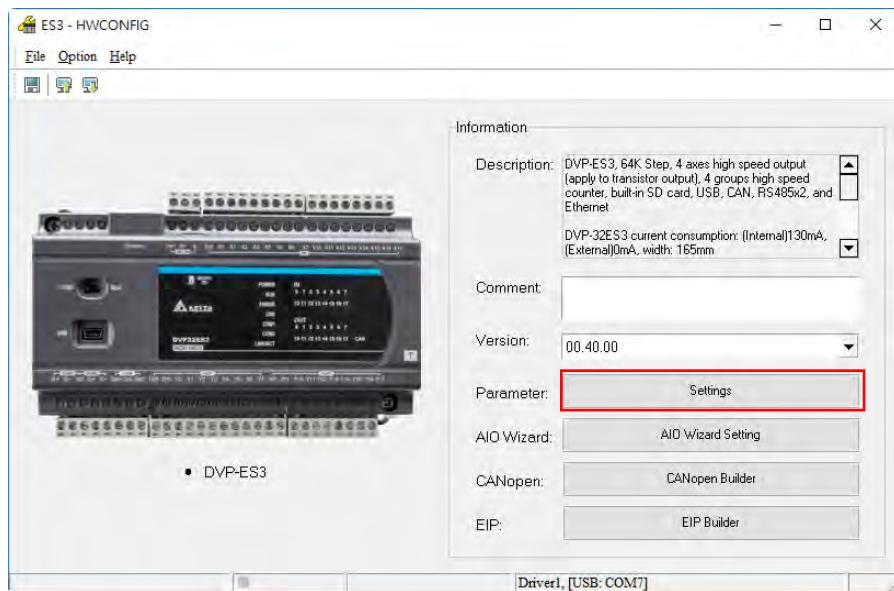


10.2.2 Configure the DVP-ES3 Series PLC with HWCONFIG

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

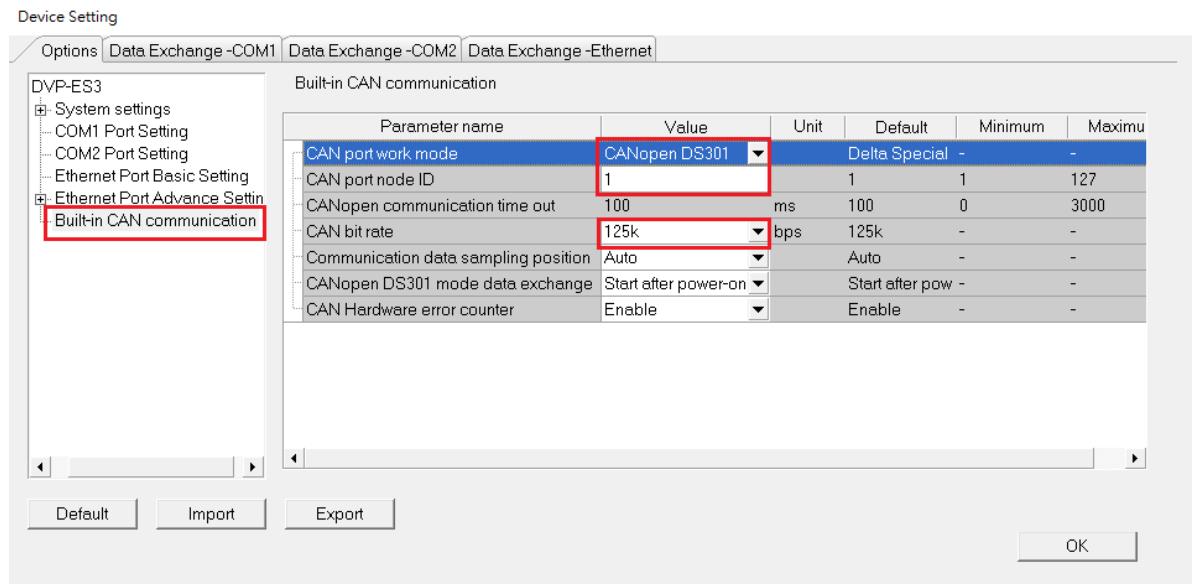


2. Click Settings to open the **Device Setting** page.

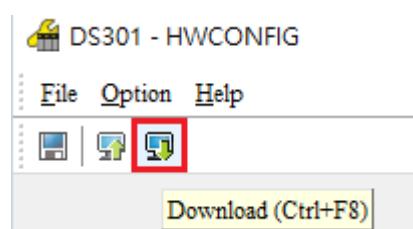


3. Select the working mode, node ID, and the bit rate for DVP-ES3.

- * Working mode: CANopen DS301
- * Node ID: 1
- * Bit rate: 125k bps (the default, or you can select your own bit rate)



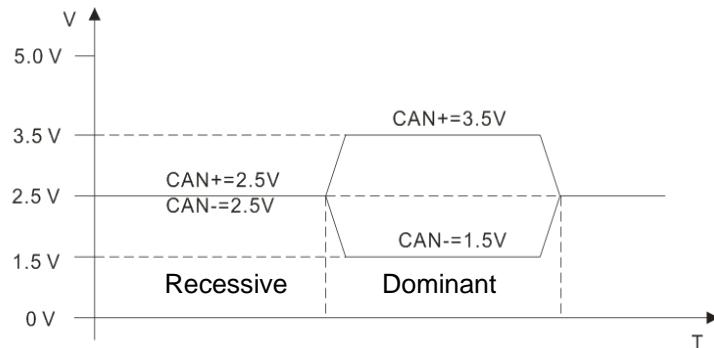
4. When finished, click the **Download** button on the toolbar to download the settings to the PLC.



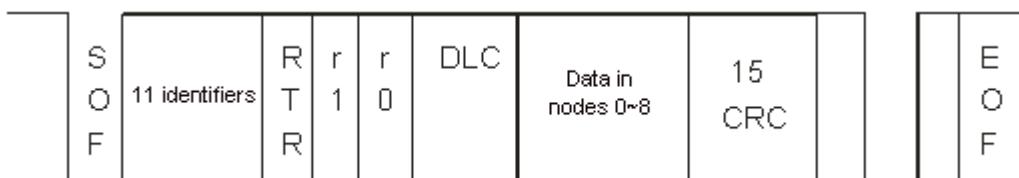
10.2.3 The CAN Interface and Network Topology

10.2.3.1 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.

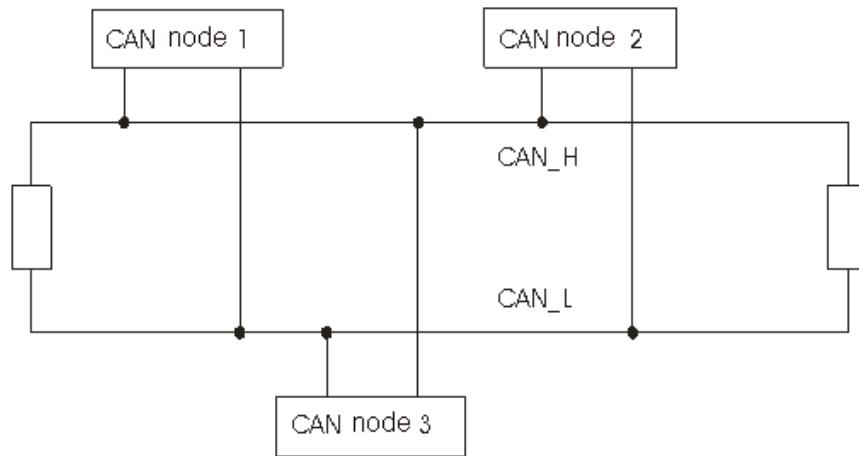


The following picture shows the data frame format. The CAN nodes transmit the CAN messages to the network from left to right.



10.2.3.2 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 is shown below.



10.2.3.3 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 connector.
- 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.

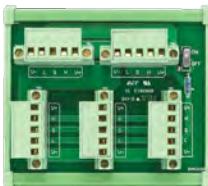
Transmission rate (bit/seconds)	20K	50K	125K	250K	500K	1M
Maximum communication distance (meters)	2500	1000	500	250	100	25

- 4) The list below shows the Delta network products for the CANopen network.

Product	Model	Function
AS324MT AS-FCOPM	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 AS228P-A AS228R-A AS218TX-A AS218PX-A AS218RX-A	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 basic communication protocol CANopen DS301. It supports master and slave modes. The CAN communication terminal is

Product	Model	Function
		equipped with a 120 Ω resistor. You can use a short circuit to use this resistor.
	AS132P-A AS132T-A AS132R-A AS148P-A AS148T-A AS148R-A AS164P-A AS164T-A AS164R-A	AS100 Series PLC is built with CAN communication port. The CAN port conforms to basic communication protocol CANopen DS301. It supports master and slave modes.
	DVP32ES300R DVP32ES300T DVP32ES311T DVP48ES300R DVP48ES300T DVP64ES300R DVP64ES300T DVP80ES300R DVP80ES300T	The DVP-ES3 Series PLC is built with CAN communication port. The CAN port conforms to basic communication protocol CANopen DS301. It supports master and slave modes.
	DVP32ES200RC DVP32ES200TC	The DVP-ES2-C series PLC is built with CAN communication port. The CAN port conforms to basic communication protocol CANopen DS301. It supports master and slave modes.
	DVP22EX300T DVP22EX300R DVP36EX300T DVP36EX300R DVP28EX300MT	The DVP-EX3 Series PLC is built with CAN communication port. The CAN port conforms to basic communication protocol CANopen DS301. It supports master and slave modes.
	DVP28SV311T DVP28SV311R DVP28SV311S DVP20SX311T DVP20SX311R DVP20SX311S	The DVP-SV3/SX3 Series PLC is built with CAN communication port. The CAN port conforms to basic communication protocol CANopen DS301. It supports master and slave modes.
	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 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, 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.

10.3 The CANopen Protocol

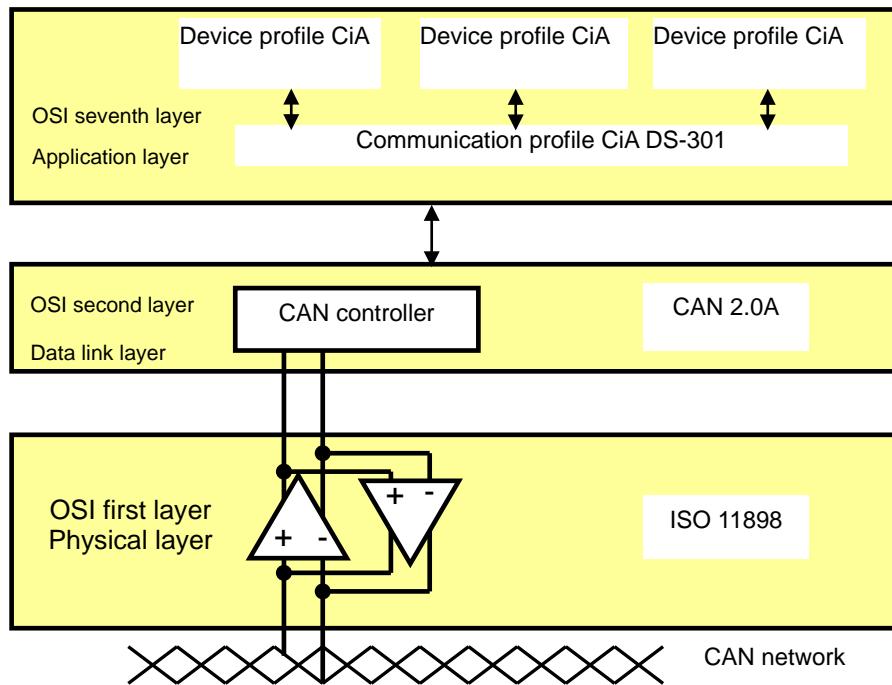
10.3.1 Introduction to the CANopen Protocol

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).

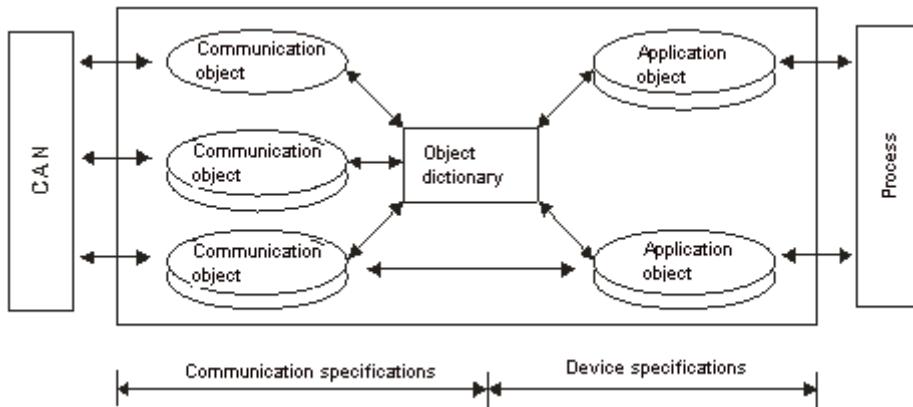
In the OSI model, the relation between the CAN standard and the CANopen protocol is described in the following diagram.



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 1-8 bytes. 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.

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	

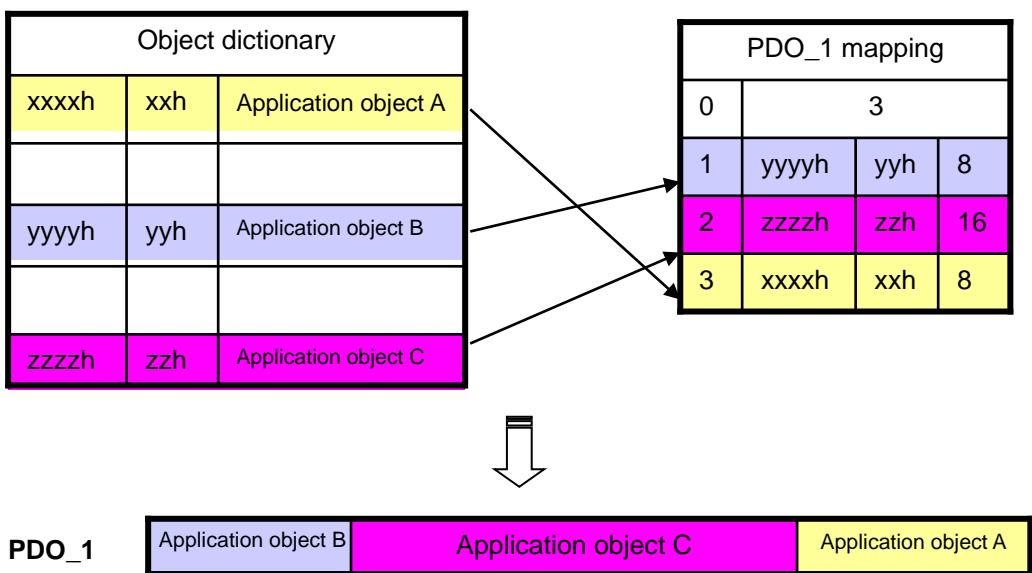
Mode 0: The PDO information is transmitted only when the PDO data changes and the synchronous signal is received.

Modes 1–240: One piece of PDO information is transmitted every 1–240 synchronous signals.

Mode 254: The trigger is defined by 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 from and write to 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) +Node-ID	Requested code	Object index		Object subindex	Requested data			
		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) +Node-ID	Reply code	Object index		Object subindex	Reply data			
		LSB	MSB		bit7-0	bit15-8	bit23-16	bit31-24

The definition of the reply code in the reply message:

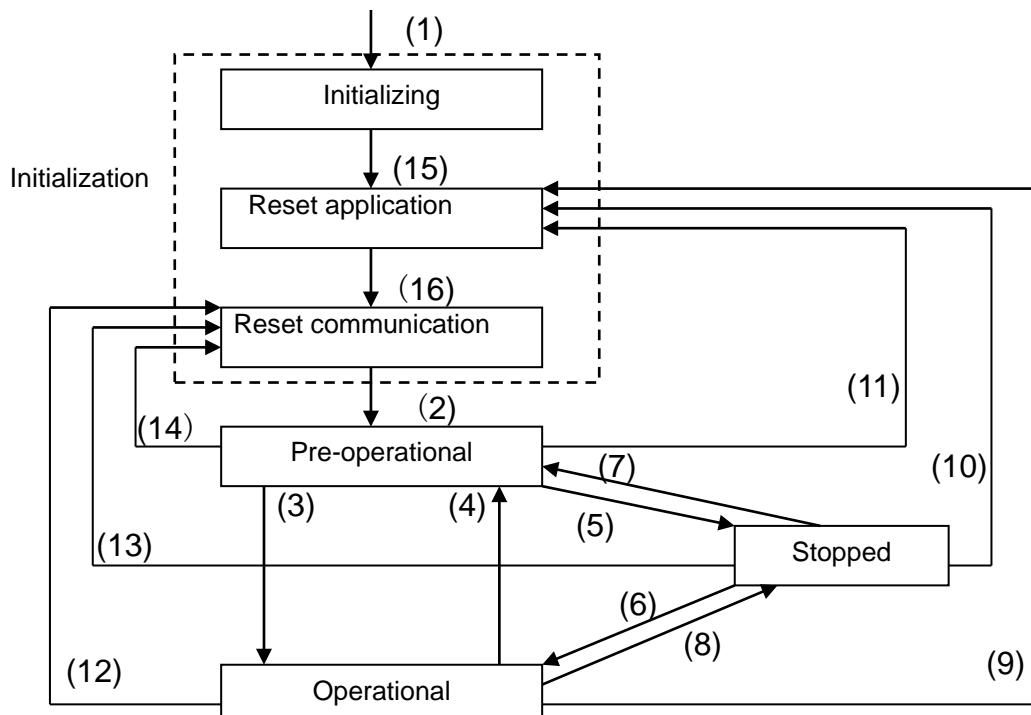
Reply code (Hex)	Description
43	Reading 4-byte data
4B	Reading 2-byte data
4F	Reading 1-byte data
60	Writing 1/2/4-byte data
80	Stopping the current SDO function

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

The control message format for the node state:

COB-ID	Byte 0	Byte 1
0	Command specifier (CS)	Slave address (0: Broadcast)

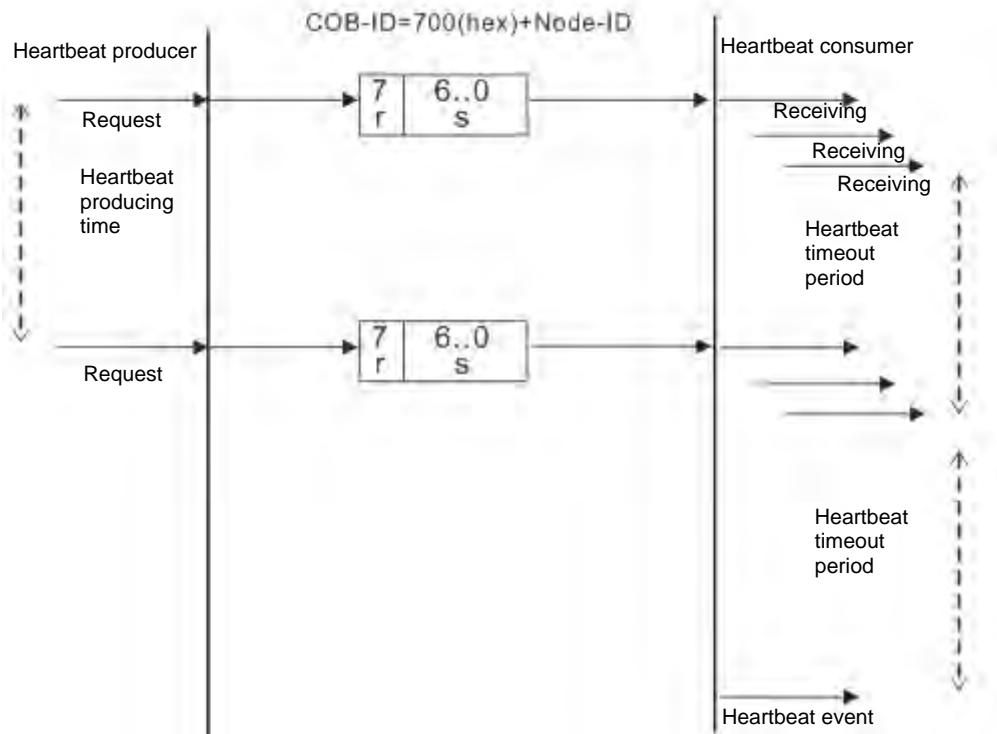
The command specifiers:

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/EX3/SV3/SX3 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 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.

4. 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 implements the network clock signal. Every device decides whether to use this event for 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.

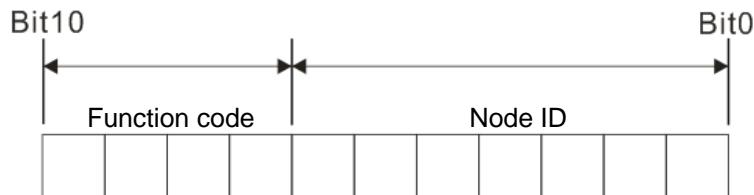
The format of the emergency message:

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

1. The CANopen master can only send one SDO, NMT, or Emergency request message to the same device at a time.
2. 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 4; when writing, it is 4 plus the byte number of data types of index and subindex, and the maximum value is 8. If the data type of the index and subindex is word, the data length is 6. If the data type is byte, the data length is 5.
- 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

PLC device	Response message		
		High byte	Low byte
D24002	Type	Node ID	
D24003	Message Data	High byte of main index	Low byte of main index
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: The target device is currently 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 4; when reading, the data length is decided by the data type of index and subindex.
- Node ID: the node address of the target equipment on CANopen network.
- Type: in the SDO response message, 43 (Hex) refers to reading 4 bytes of data; 4B (Hex) refers to reading 2 bytes of data; 4F (Hex) refers to reading 1 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

PLC device	Request message		
		High byte(Hex)	Low byte(Hex)
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 to trigger the sending of the NMT request message. The ReqID range is between 00–FF (Hex).
- 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	ReqID	Status code
D24001		Reserved	Reserved
D24002		Reserved	Node ID

- When status code is 1, the NMT operation has succeeded. When status code is not 1, 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		Reserve	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 to trigger the sending of the Emergency request message. The ReqID range is between 00–FF (Hex).
- 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 1, 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

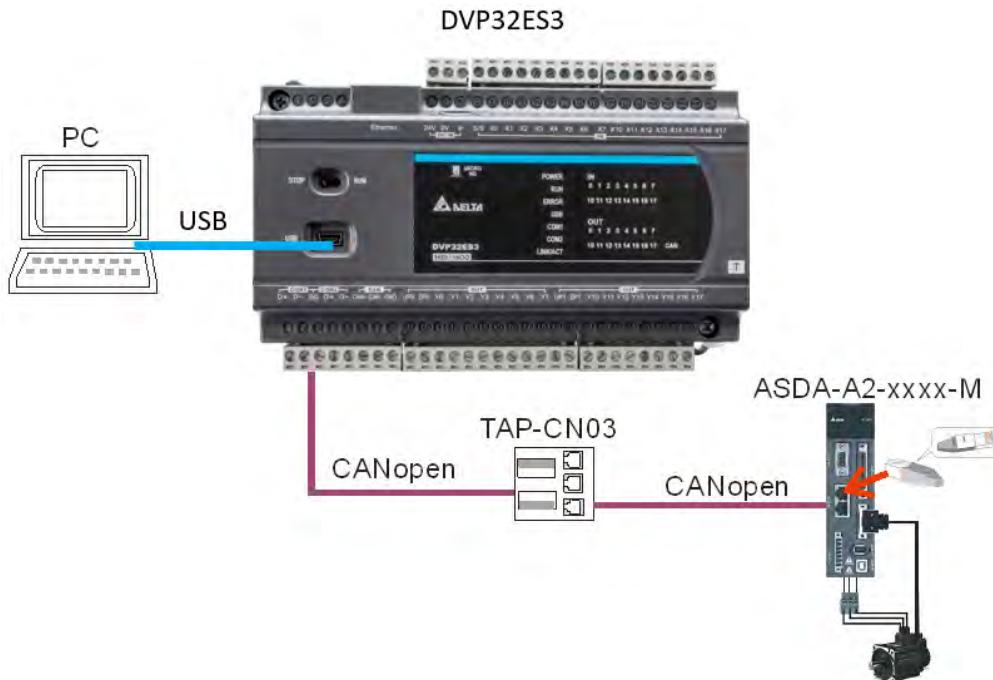
10.4.4 Example of Sending SDO through the Ladder Diagram

The following uses DVP-ES3 as a demonstration example. For EX3/SV3/SX3, the operations are all the same.

1. Control Requirement:

Read the value of P0-09 from the servo through SDO.

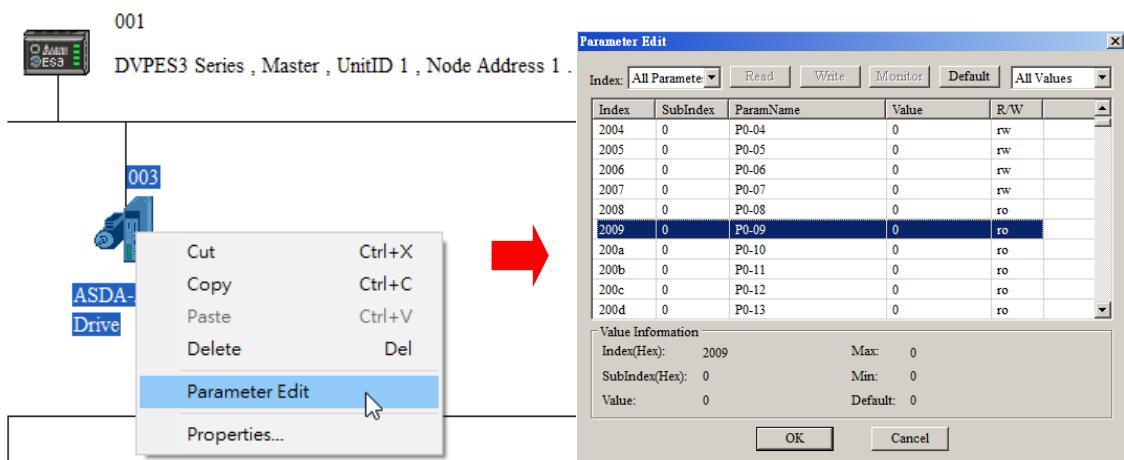
2. Hardware Connection:



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.

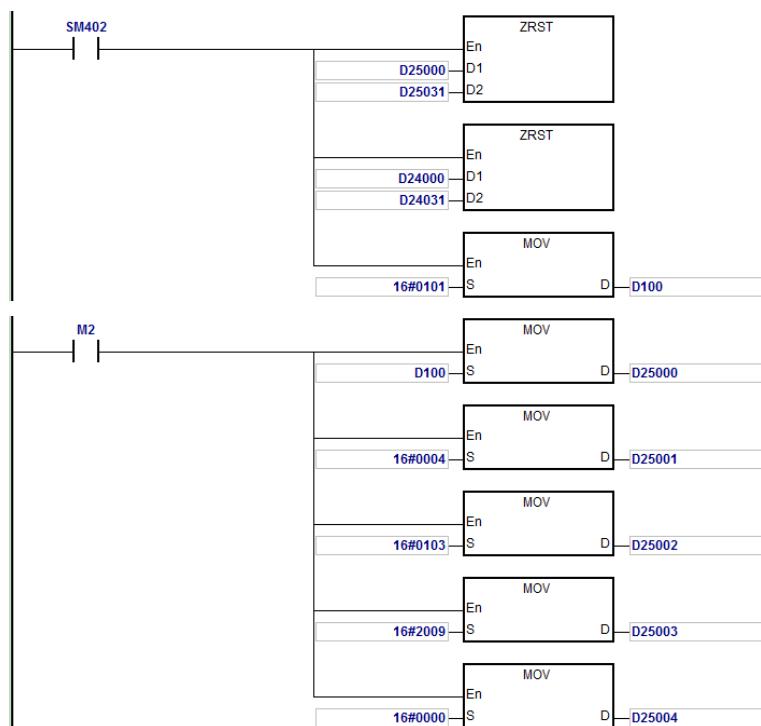
For more details on how to operate the network configuration interface, refer to Section 11.1.1 in the CANopen Builder software help file.



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
	D25001	0004	Reserved
	D25002	0102	Type = 01
	D25003	2009	Index high byte = 20
	D25004	0000	Reserved

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
	D24001	0006	Reserved
	D24002	4303	Type = 43
	D24003	2009	Main index high byte = 20
	D24004	0004	Reserved
	D24005	0100	Datum 1= 01

10.5 Troubleshooting

10.5.1 CANopen Network Node State Display

1. In the DVP-ES3/EX3/SV3/SX3 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
SR829	Flag for the state of the slave 49–64
SR821	Version of CANopen DS301
SR822	Displays the CANopen baud rate (unit: 1 kpps)

2. As a master, the DVP-ES3/EX3/SV3/SX3 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 correspondences 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 AS Series PLC is the master:

Code	Indication	How to correct
0	The node is error free or the node is not configured.	N/A
E0	AS Series PLC master module receives the emergency message sent from slave.	Read the relevant message with the PLC program

Code	Indication	How to correct
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/EX3/SV3/SX3 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/EX3/SV3/SX3 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/EX3/SV3/SX3 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/EX3/SV3/SX3 Series PLC is the slave:

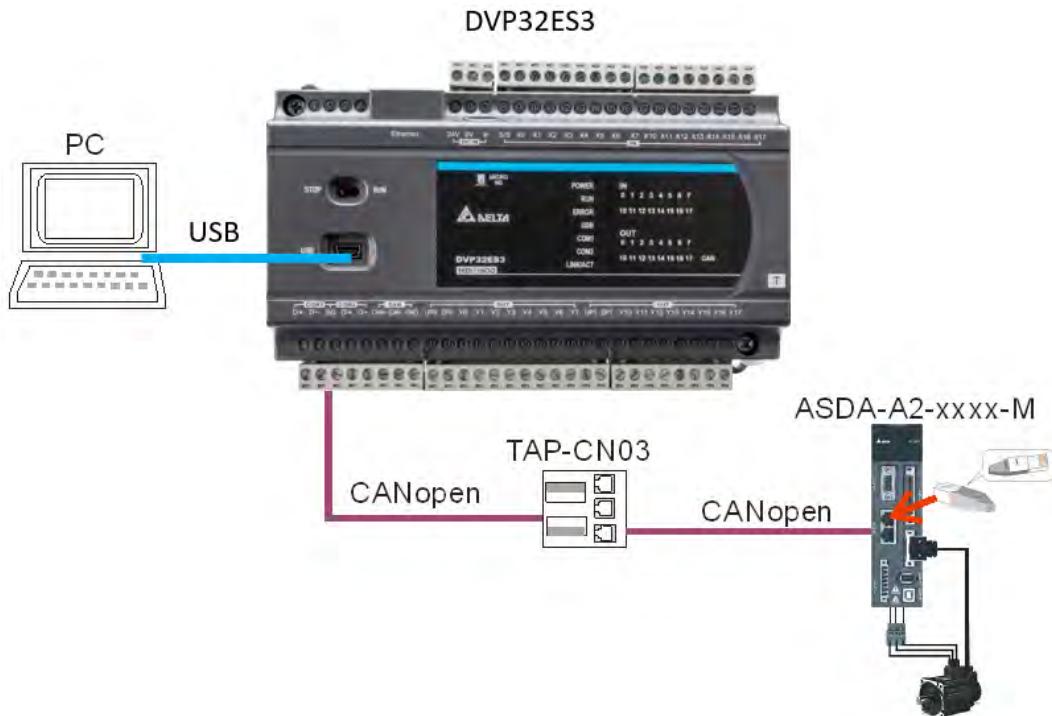
Code	Indication	How to correct
0	Working normally	<p>N/A</p> <p>Note: When the heartbeat alarm function is not activated, if the connection is normal before a disconnection occurs, the code for the slave will still be working normally after the connection is back on.</p>
A0	The PLC is being initialized.	--
A1	The PLC is pre-operational.	<p>Check if the CANopen bus cable is properly connected.</p> <p>If the master communication is not activated, no handling is needed.</p>
A3	The data are being downloaded to the PLC.	Wait to finish downloading the configured data.
B0	Heartbeat message time-out	<p>Check if the CANopen bus cable is properly connected.</p> <p>Note: This error will only occur when the heartbeat function is activated.</p>
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/EX3/SV3/SX3 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 following uses DVP-ES3 as a demonstration example. For EX3/SV3/SX3, the operations are all the same.

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. Connecting 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.

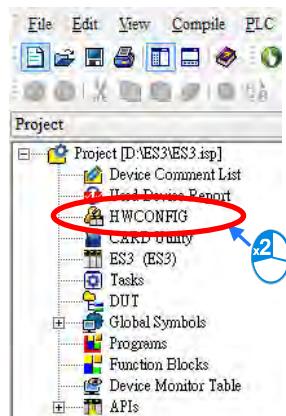
Parameter	Setting	Explanation
3-00	03	Node ID of the A2 servo is 3
3-01	400	CAN communication rate is 1 Mbps.
1-01	04	Speed mode
0-17	07	Drive displays the motor rotation speed (r/min)
2-10	101	Set DI1 as the signal for Servo On
2-12	114	Set DI3 as the signal _SPD0 for speed selection
2-13	115	Set DI4 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: 1 Mbps.

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.

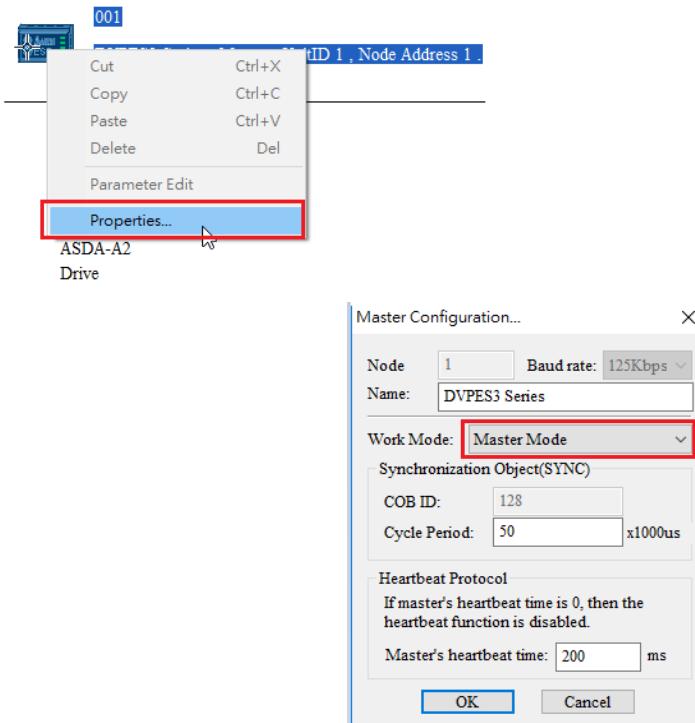
A. In ISPSoft, double-click **HWCONFIG** in the project management area to start **HWCONFIG**.



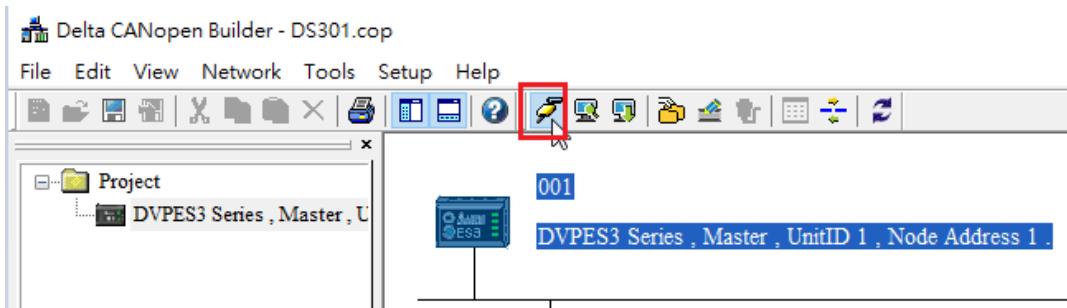
B. Click **CANopen Builder**.



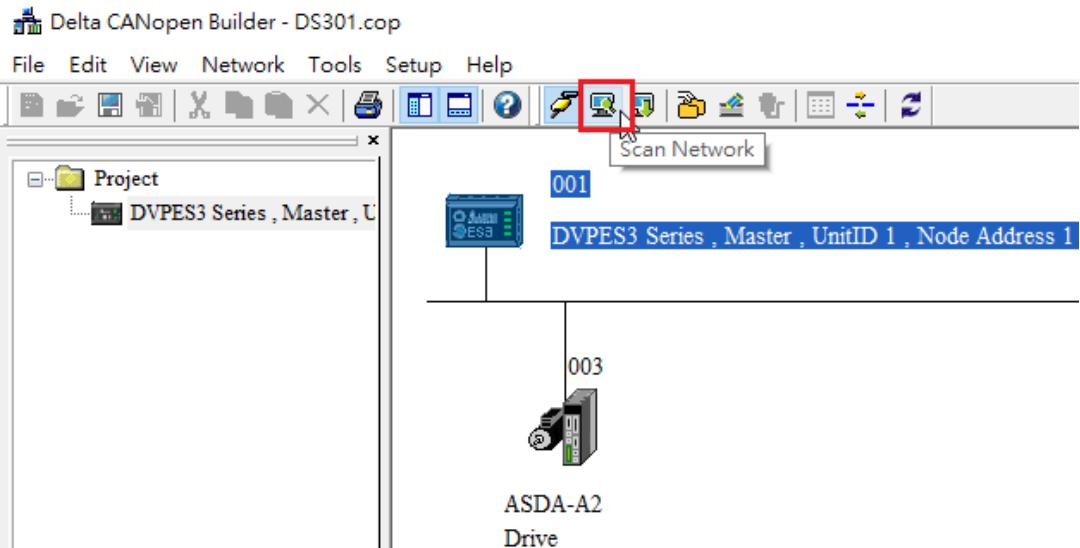
C. If DVP-ES3 is in master mode, you can skip this step. If not, you can go to Properties and set it to Master mode. After that, download the parameter to DVP-ES3. Power off DVP-ES3 for 2 seconds, then supply power again and proceed to the next step.



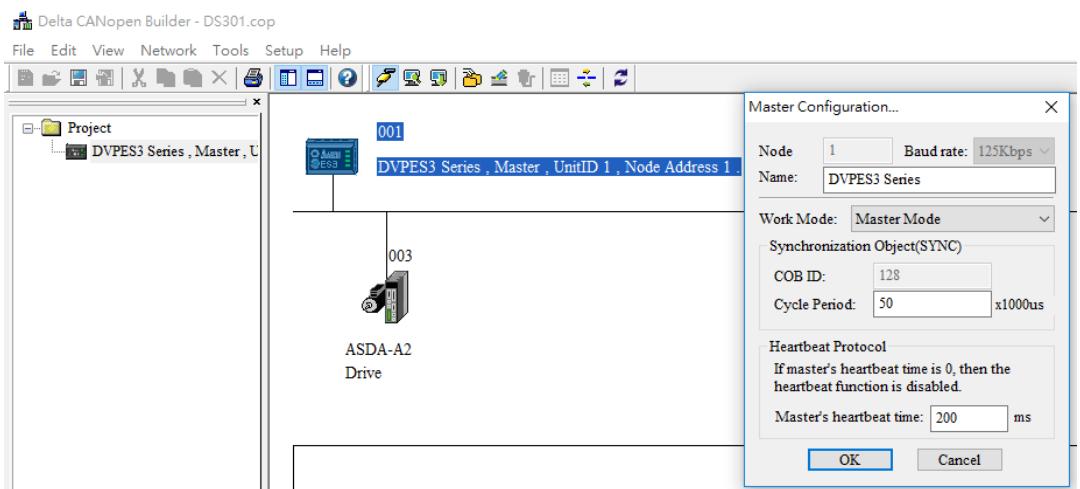
D. Click the Online  button on the Toolbar to enter on-line mode.



E. Click the Scan Network  button on the Toolbar to scan the network.



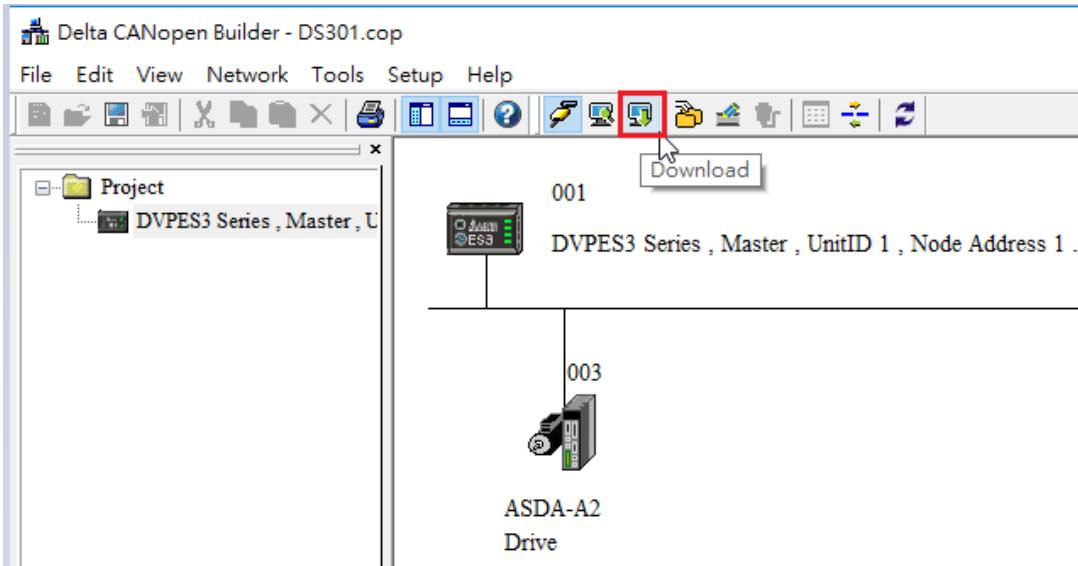
F. On the Network menu, click **Master parameter** to display the Master Configuration dialog box.



Item	Explanation	Default
Node ID	Node ID of DVP-ES3 Series PLC on the CANopen network	1
Baud rate	CANopen communication rate	1 M bit/second
Work mode	CANopen master/slave mode	Master
Cycle period	Cycle time for sending one SYNC message	50 ms
Master heartbeat time	Interval time for sending the master heartbeat message	200 ms

Configure the CANopen communication stations and rates in HWCONFIG.

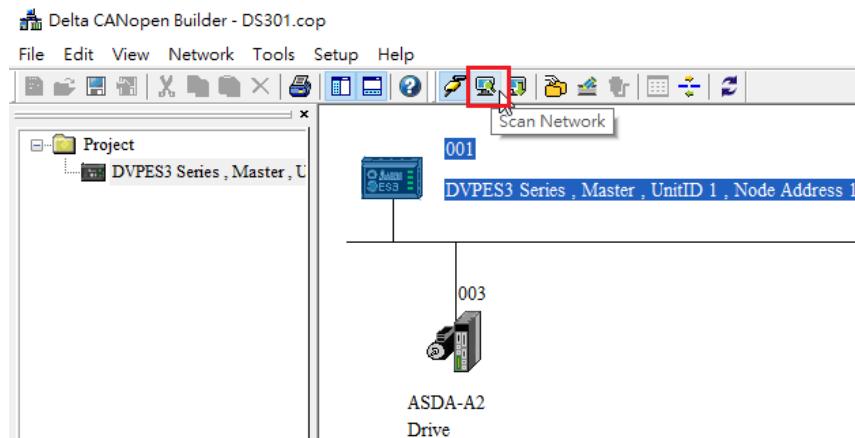
G. After you complete the previous steps, click the Download  button on the Toolbar to download the parameters to the PLC.



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. Configuring 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.

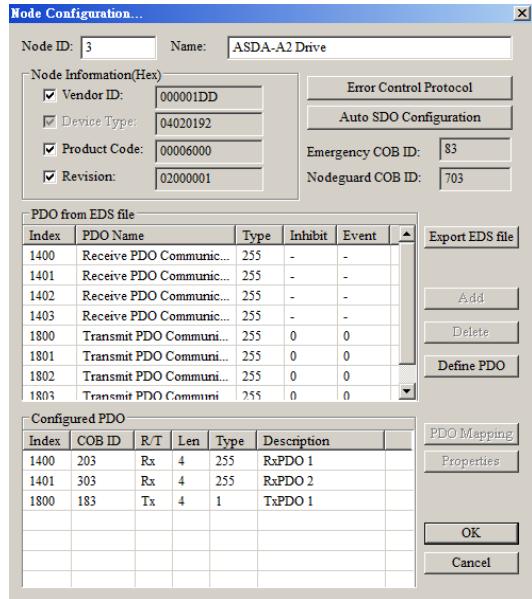
- **Auto SDO Configuration**

Performs 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.

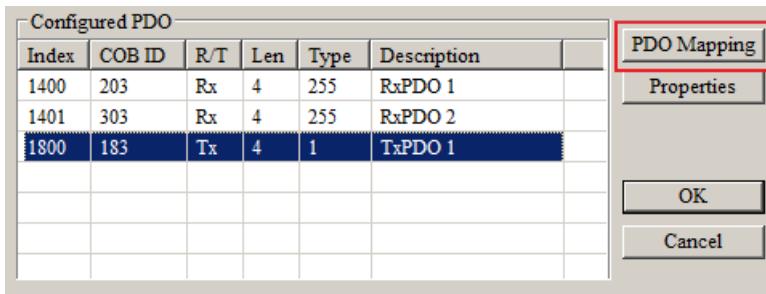


- **PDO Mapping:**

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 50 ms). In asynchronous transmission, the message is sent out when the PDO mapping parameter changes.

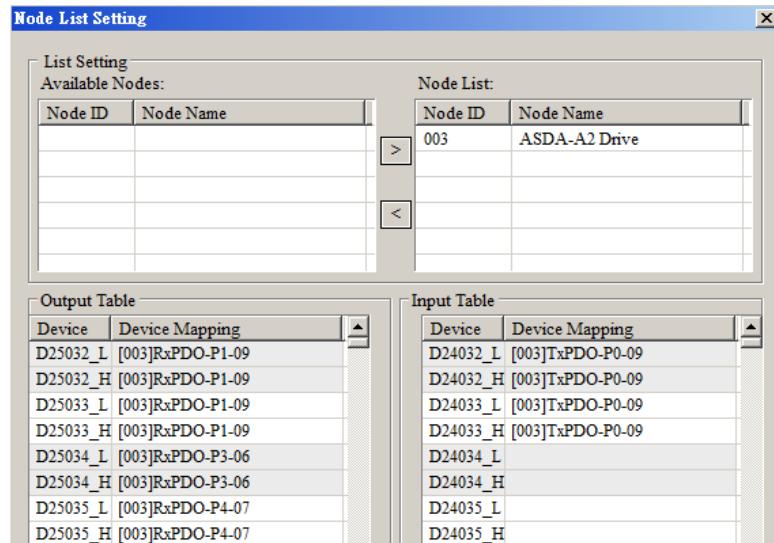
The following table describes the PDO Transmission types.

Transmission Type	Description		Remark
0	RxPDO	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.	SYNCH non-cycle
	TxPDO	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.	
N (N:1~240)	RxPDO	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.	SYNCH cycle
	TxPDO	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.	
254	RxPDO	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.	ASYNCH
	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 set 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.

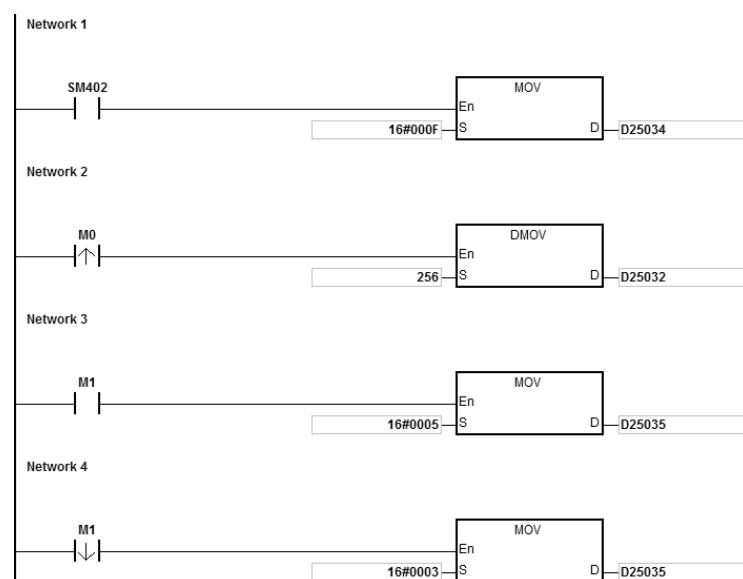
After you finish setting the above parameters, double click the master device to display the **Node List Setting** dialog box. Select ASDA-A2 Drive, and click **>** to move the A2 drive to the right-side list, and then download the configured data.



The mapping relation between master and slave:

DVP-ES3/EX3/SV3/SX3 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; 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/EX 3/SV3/SX3 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 (ES3) 0x0000006D (EX3) 0x0000006F (SV3) 0x0000006E (SX3)
	H'03	Revision number	Unsigned 32 bits	R	0x00010002
	--	RxPDO1 communication parameter			
H'1400	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
	--	RxPDO2 communication parameter			
H'1401	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
	--	RxPDO3 communication parameter			
H'1402	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

Index	Subindex	Object name	Data type	Attr.	Default value
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 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

Index	Subindex	Object name	Data type	Attr.	Default value
	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
	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'05	Timer	Unsigned 16 bits	RW	100
H'1801	--	TxPDO2 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 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			
	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'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

Index	Subindex	Object name	Data type	Attr.	Default value
	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
	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'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'04	The fourth 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

Index	Subindex	Object name	Data type	Attr.	Default value
H'1A07	--	TxPDO8 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

Chapter 11 EtherCAT Function and Operation

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11.1 Introduction

DVP32ES300TEC is equipped with EtherCAT communication port. Before using EtherCAT communication, complete the initialization of EtherCAT communication with API2820 INITEC instruction.

11.2 EtherCAT Port

- **System Specification**

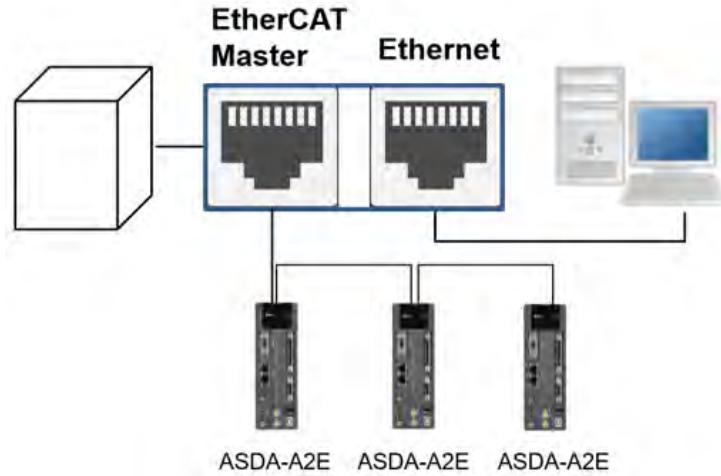
Item		Specification
Web	Max. connection number	8
	Function	<ul style="list-style-type: none"> ● View device information ● Account management ● Firmware update

- **EtherCAT Master Specification**

Item	Specification
EtherCAT master protocol	Supports Class B
Physical layer	100BASE-TX
Transmission rate	100 Mbps
Communication cycle	1,000 µs (it can NOT be modified.)
Synchronization jitter	Less than 10 ns
Topology structure	Line
Refresh mode	FreeRun
Transmission cable	Category 5e or above
Communication distance	The distance between two adjacent EtherCAT nodes should not exceed 100 meters.
Number of communication ports on the EtherCAT master	RJ45 x 1
Redundancy	This function is not supported.
Maximum number of slaves	24 (16 axes ^{*1} + 8 stations)
Node address range	1-24
Size of a single packet	IN: 1,486 bytes OUT: 1,486 bytes
Maximum data frames	1
Supported functionalities	<ol style="list-style-type: none"> 1. CoE communication services (Segmented Transfer, Complete Access, SDO Info service, PDO in CoE) 2. Delta drive instructions

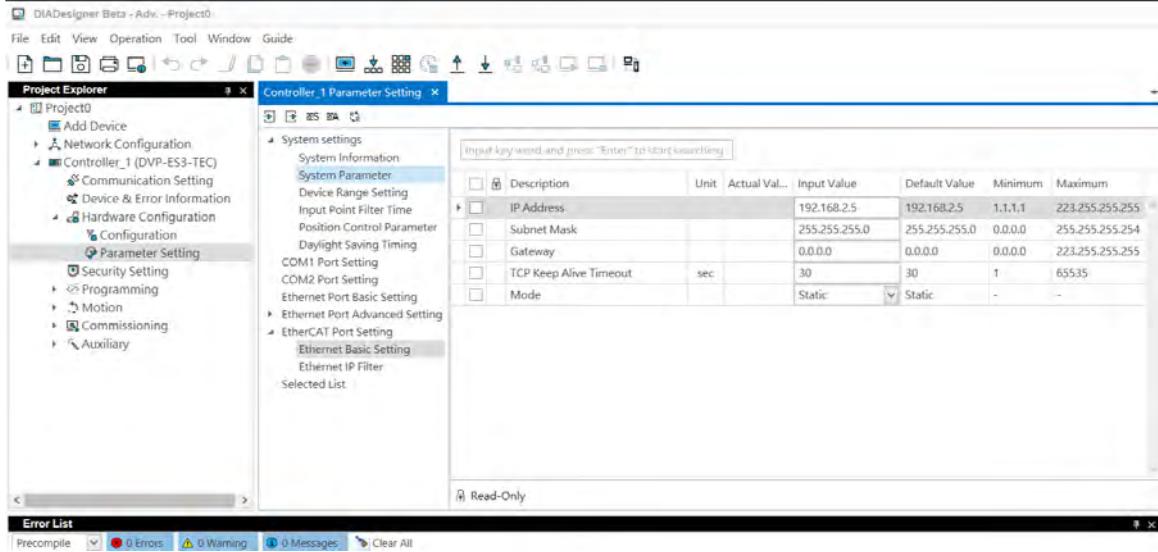
*1: The EtherCAT master mainly supports Delta servos and inverters for EtherCAT slaves. (For detailed models and third-party drives, refer to API 2820 INITEC instruction in the ES3/EX3/SV3/SX3 Series Programming Manual.)

11.3 Wiring



11.4 IP Settings

- Before the execution of API2820 INITEC instruction, the EtherCAT port can be seen as Ethernet port. Go to the EtherCAT setting webpage to see the basic information and perform firmware updates.
- For configuration on DVP32ES300TEC, go to DIADesigner → Controller (DVP-ES3-(TEC)) → Hardware Configuration → Parameter Setting → EtherCAT Port Setting → Ethernet Basic Setting.



Note: You can use **IP Manager Tool**, but do not use it to set up the IP address to avoid conflicts with the PLC CPU project.

11.5 SM/SR

Refer to API 2803 DRVIC instruction from programming manual for more information on SM/SR.

11.6 EtherCAT Master

1. DVP32ES300TEC CPU can connect to up to 16 axes such as Delta servos (ASDA-A2-E, ASDA-A3-E and ASDA-B3-E, etc.) and Delta inverters (C2000 and CH2000 Series, etc.).
2. After establishing the physical wiring between the EtherCAT communication port and the EtherCAT slave, programmers using ISPSoft can initialize the EtherCAT communication with the API2820 INITEC instruction; programmers using DIADesigner can adopt the EtherCAT topology configuration function introduced in section 11.9 for network topology. After that, the EtherCAT communication instructions can be used for operation. For Delta CANopen and EtherCAT communication instructions, please refer to section 6.27 in the ES3/EX3/SV3/SX3 Series Programming Manual.
3. The following EtherCAT instructions are supported.

API	Instruction code		Pulse instruction	Function	EtherCAT	
	16-bit	32-bit			Servo	Inverter
2801	ASDON	–	–	Servo-ON and Servo-OFF	V	V
2802	CASD	–	–	Setting the acceleration time and deceleration time for a servo	V	V
2803	–	DDRVIC	–	Servo relative position control	V	–
2804	–	DDRVA C	–	Servo absolute position control	V	–
2805	–	DPLSVC	–	Servo speed control	V	V
2806	ZRNC	DZRNC	–	Servo homing	V	–
2809	RSTD	–	–	Sending Reset or NMT command	V	V
2810	ZRNM	–	–	Setting the homing mode for Delta servo	V	–
2811	EMER	–	–	Reading Emergency message	V	V
2812	–	DCSFOC	–	Controlling the tracking function of a servo via communication	V	–
2817	–	DTQC	–	Torque control	V	–
2818	–	DTQLC	–	Speed of torque control	V	–
2820	INITEC	–	–	Initializing the slaves for EtherCAT communication	V	V
2821	ECATRW	–	–	Reading and writing EtherCAT SDO data	V	V
2822	MOTST	–	–	Reading Motion state of an EtherCAT slave	V	V
2823	ECATST	–	–	Reading the state of an EtherCAT slave	V	V

(Refer to section 6.27 Delta CANopen and EtherCAT Communication Instructions in ES3/EX3/SV3/SX3 Series Programming Manual for more details.)

4. After the EtherCAT communication initialization is completed, if the PLC switches from RUN to STOP, the EtherCAT master function will be turned off. At this time, the EtherCAT communication port can be used as a MODBUS TCP slave or used for web page functionality.

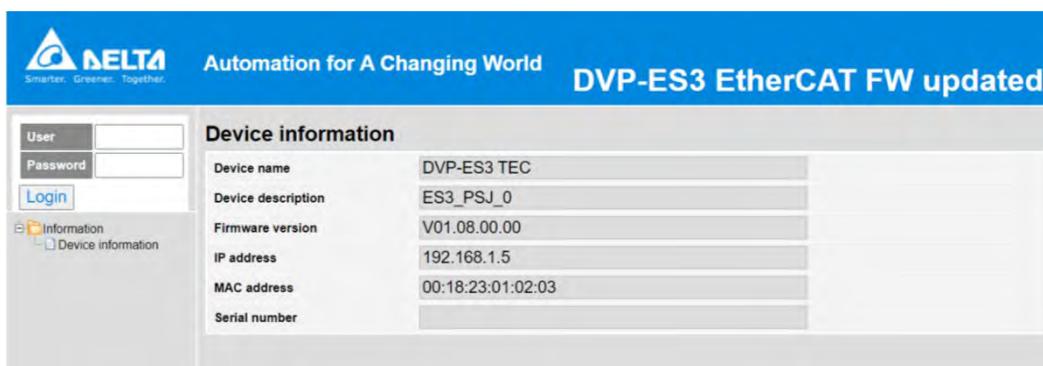
11.7 Webpage

After the IP configuration is complete, connect a network cable to the EtherCAT port, and then you can enter the IP address in the search bar of your browser to connect to DVP32ES300TEC to view basic information and update firmware. The supported browsers are listed below.

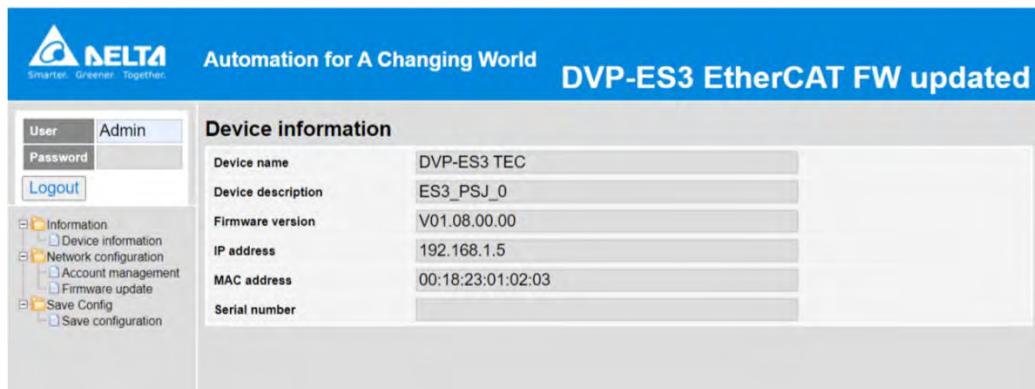
Supported browser		Version
Microsoft	Internet Explorer	V10.0 or later
Microsoft	Edge	V20 or later
Google	Chrome	V14 or later
Apple	Safari	V5.1 or later

1. Setting up the IP address in DIADesigner and then connecting a network cable to the EtherCAT port, after that you can enter the IP address in the search bar of your browser to connect to DVP32ES300TEC. Type the default value "Admin" in the field of User and no password is required to log in.

After logging in, you can see the device information as shown in the image below.



2. After logging in, you can go to the setting pages of each item on the left section of the screen.



- Information -> Device information: You can find basic product information in this section. This section is not password-protected; you can open this page without logging in.
- Network configuration -> Account management: You can block unauthorized remote access to protect data and product security by setting up the username and password in this section. After configuration is complete, click “Apply” and “Save configuration”.

Account management

No.	User ID	Password	Access type	Delete
1	Admin	<input type="text"/>	Administrator	<input type="button" value="Delete"/>

- Network configuration -> Firmware update: Upload the firmware file through the webpage to update firmware of the EtherCAT port (function card).
Note: It is recommended to set access permissions on the account management page to avoid unauthorized remote firmware updates.

Firmware update

Select the firmware file	<input type="button" value="Choose File"/> No file chosen	<input type="button" value="Update"/>
Update status	Ready	

- Save config -> Save configuration: After any setting is done, you need to go to this page to save the configurations for the changes to take effect.

Save configuration

Save configuration	
Saving all applied changes will cause all changes to configuration panels that were applied, but not saved, to be saved, thus retaining their new values.	
<input type="button" value="Save"/>	

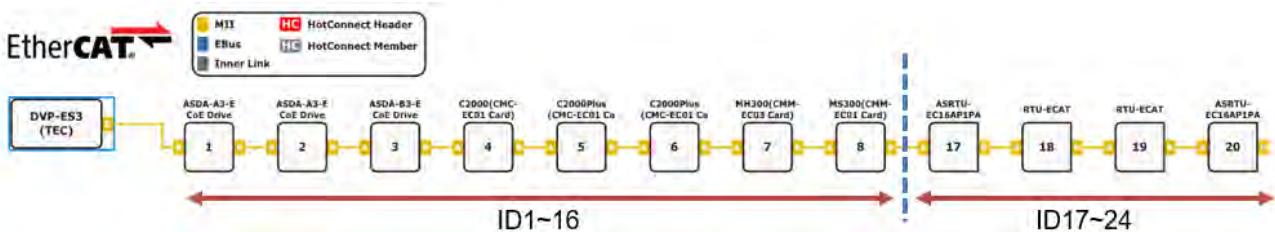
11.8 Network Security

To enhance security and performance of the system, it is suggested to use closed network or LAN with firewall protection to prevent cyber-attacks.

11.9 EtherCAT Topology Configuration

EtherCAT Topology Configuration is used to plan the topology connection relationship between the EtherCAT master and slave devices, as well as the configuration of the remote slave and its right-side modules, and generate subsequent EtherCAT I/O mapping.

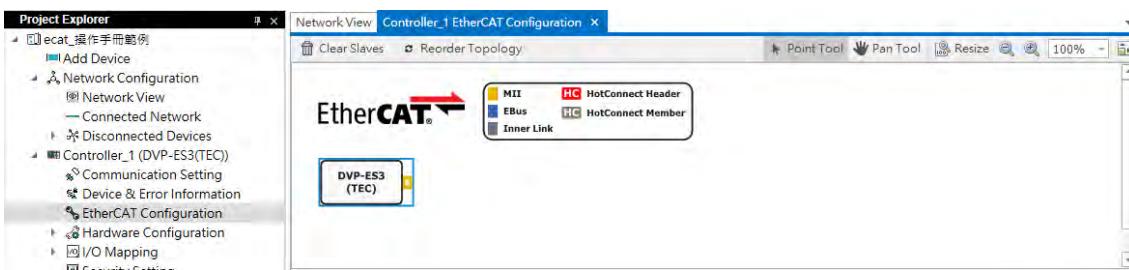
11.9.1 EtherCAT Topology Configuration Rules



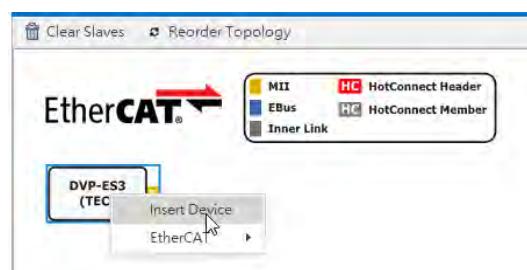
1. Delta provides special instructions for ASDA-A2-E/ASDA-A3-E/ASDA-B3-E/ASDA-E3-E, C2000/C2000 Plus, CH2000, MH300 and MS300 slaves. For the topology configuration, it is required to configure the station IDs of the slaves within the range of 1 to 16 and connect them with EtherCAT cables in sequence without skipping any station IDs. For any newly-added Delta servo, this manual will not be updated. Please refer to the list displayed by DIADesigner.
2. RTU modules and third-party EtherCAT devices must be configured with station IDs ranging from 17 to 24, and also be connected in sequence without skipping any station IDs.

11.9.1 Configuring a Remote Slave

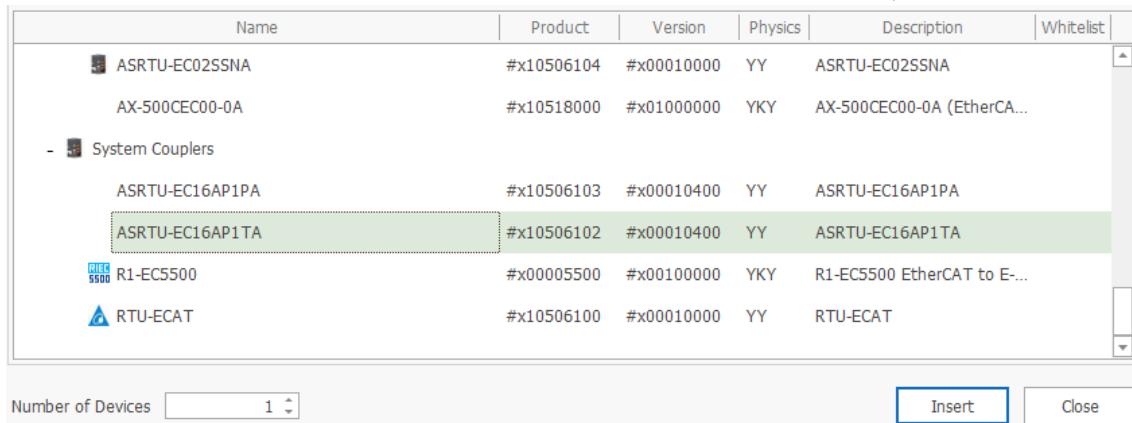
1. Refer to Chapter 7 in the DIADesigner Software User Manual for more information.
2. In **Project Explore**, double-click **EtherCAT Configuration**.



3. Right-click on the PLC and select **Insert Device**.



4. Select the desired slave to be inserted and then click **Insert**. Once the device is inserted, click **Close**.

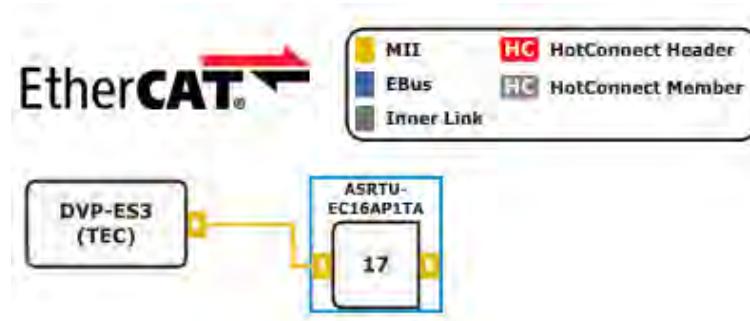


The screenshot shows a table of EtherCAT devices. The device 'ASRTU-EC16AP1TA' is selected and highlighted with a green border. The table has columns for Name, Product, Version, Physics, Description, and Whitelist. Below the table, there is a 'Number of Devices' input field set to 1, and two buttons: 'Insert' (highlighted in blue) and 'Close'.

Name	Product	Version	Physics	Description	Whitelist
ASRTU-EC02SSNA	#x10506104	#x00010000	YY	ASRTU-EC02SSNA	
AX-500CEC00-0A	#x10518000	#x01000000	YKY	AX-500CEC00-0A (EtherCA...	
- System Couplers					
ASRTU-EC16AP1PA	#x10506103	#x00010400	YY	ASRTU-EC16AP1PA	
ASRTU-EC16AP1TA	#x10506102	#x00010400	YY	ASRTU-EC16AP1TA	
R1-EC5500	#x00005500	#x00100000	YKY	R1-EC5500 EtherCAT to E...	
RTU-ECAT	#x10506100	#x00010000	YY	RTU-ECAT	

Number of Devices Insert Close

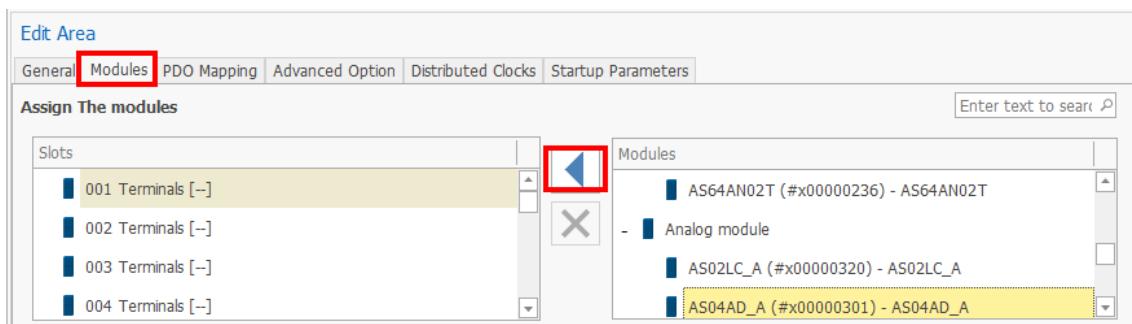
5. The following is the topology configuration of the newly added remote slave. (Station ID range of remote modules: 17 to 24)



6. The EtherCAT communication card here has no HotConnect configuration. Please configure the station number for the remote or third-party slave according to the recommended station ID in the software.

11.9.2 Configuring Right-Side Modules for a Remote Slave

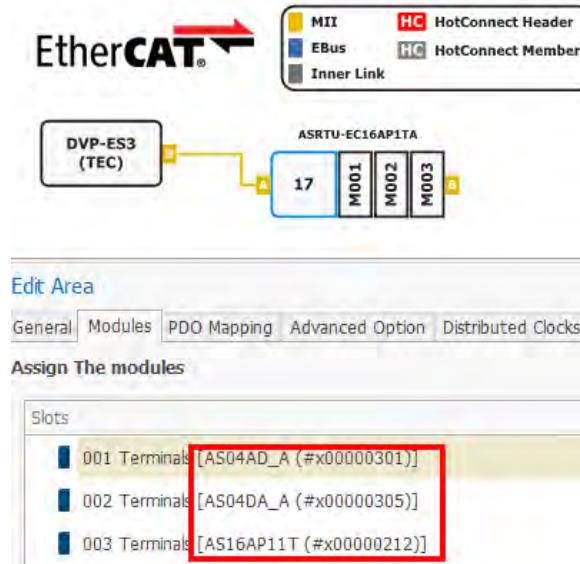
1. After adding a remote slave, you can add and remove its right-side modules in the **Modules** tab.



The screenshot shows the 'Edit Area' interface. The 'Modules' tab is selected. On the left, there is a list of slots: '001 Terminals [-]', '002 Terminals [-]', '003 Terminals [-]', and '004 Terminals [-]'. A red box highlights the 'Modules' tab, and a red arrow points to the 'Add' button (a plus sign) in the slot list. On the right, there is a list of available modules: 'AS64AN02T (#x00000236) - AS64AN02T', 'Analog module', 'AS02LC_A (#x00000320) - AS02LC_A', and 'AS04AD_A (#x00000301) - AS04AD_A'. A red box highlights the 'AS04AD_A' module.

2. Add right-side modules in sequence according to your actual need.

For instance: 04AD-A, 04DA-A and 16AP11T.



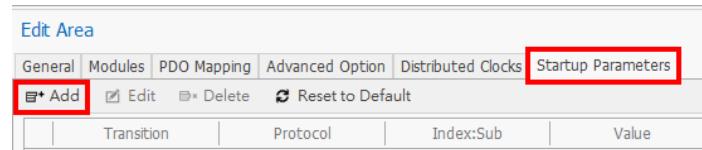
11.10 EtherCAT Startup Parameters

In the Startup Parameters tab, set up the parameter values for a remote module and its extension modules in advance. When the EtherCAT master establishes a successful connection with a remote module, corresponding parameter values configured in the Startup Parameters tab will be written in modules.

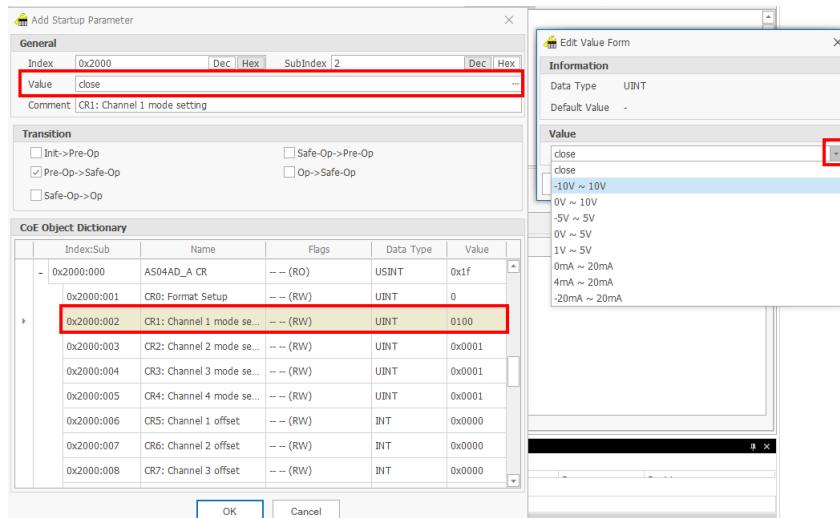
The following is the introduction of the mode settings of AIO modules and filter parameter settings of DIO modules in the Startup Parameters tab.

11.10.1 Setting Parameters of AI/AO Modules

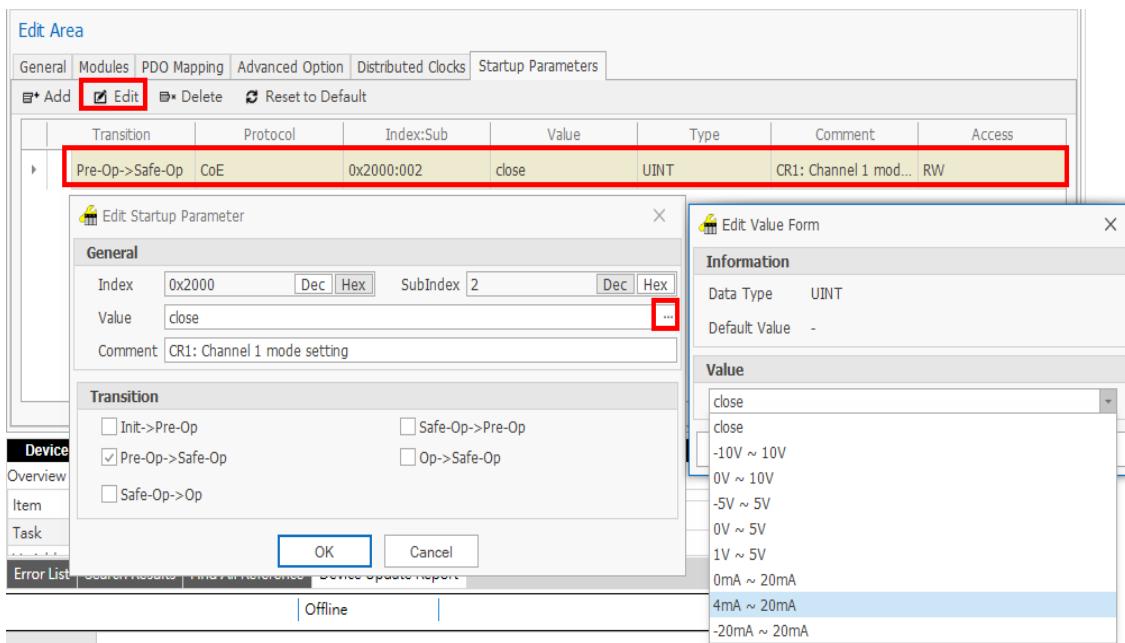
1. In the **Startup Parameters** tab, click **Add** to add the parameters to be written to modules.



2. Select **Channel 1 mode setting** of 04AD from **CoE Object Dictionary**, and then enter the **Value** box to select a mode from a dropdown list.



3. After selecting a mode, you can also use **Edit** to modify the mode setting.



4. Set the mode for 04AD-A.

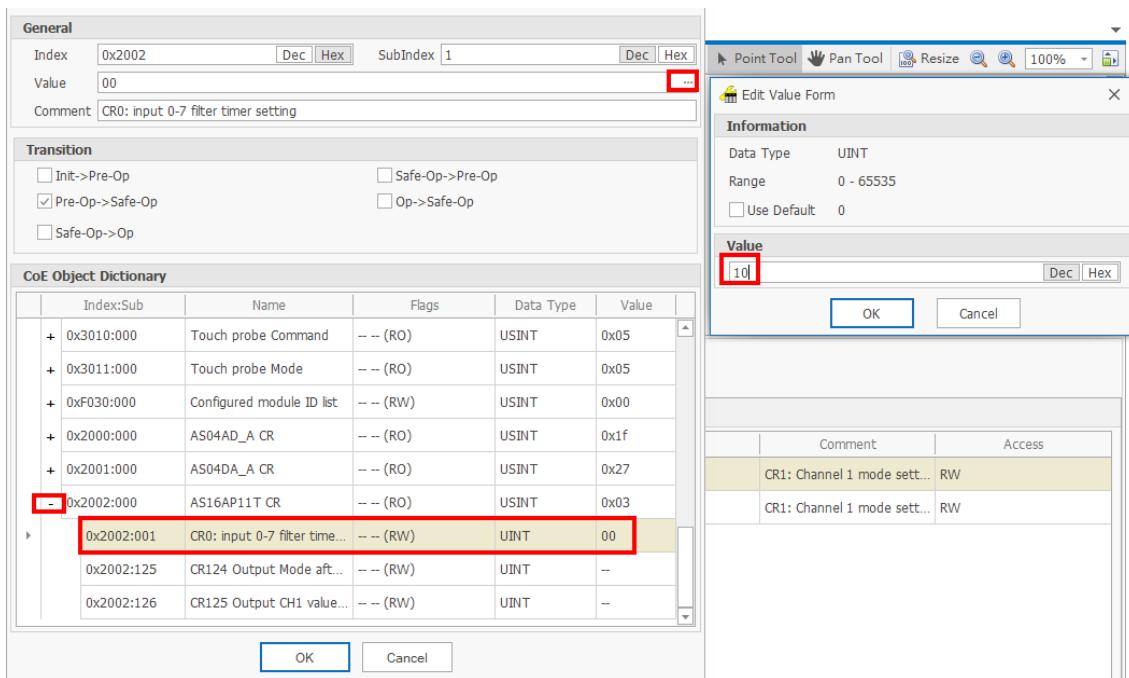
Pre-Op->Safe-Op	CoE	0x2000:003	-10V ~ 10V	UINT	CR2: Channel 2 mode setting
-----------------	-----	------------	--	------	-----------------------------

5. Set the mode for 04DA-A.

Pre-Op->Safe-Op	CoE	0x2001:002	-10V ~ 10V	UINT	CR1: Channel 1 mode setting
-----------------	-----	------------	--	------	-----------------------------

11.10.2 Setting Filter Parameters of DIO Module

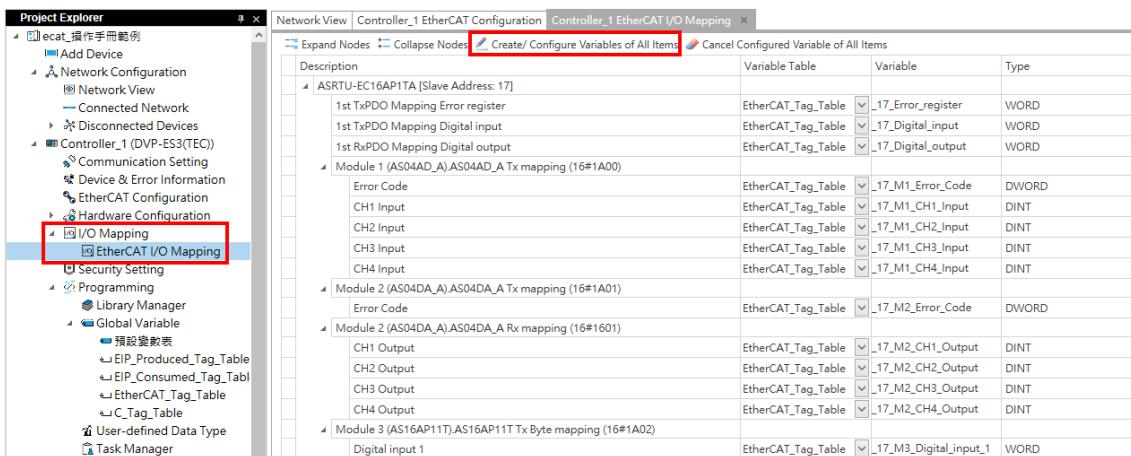
1. In the **Startup Parameters** tab, click **Add** to add the parameters to be written to the DIO module.
2. Select the **CR0: input 0 to 7 filter timer setting** item for AS16AP11T from **CoE Object Dictionary**, and then enter the **Value** box to set a value for the filter timer parameter.



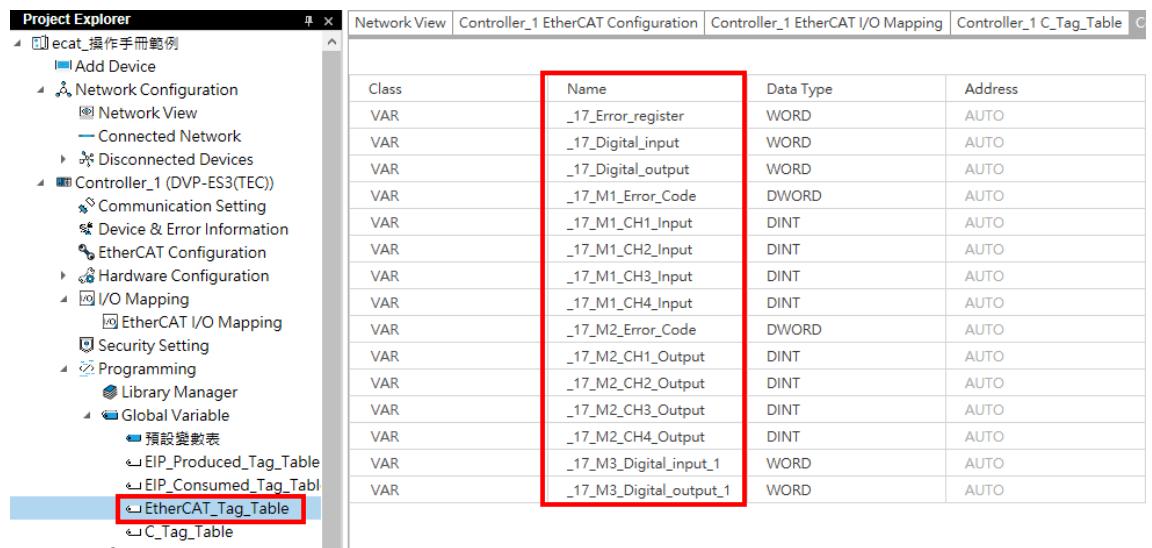
11.11 EtherCAT I/O Mapping

EtherCAT I/O Mapping is for planning the corresponding relationship between EtherCAT PDO mapping and variables. The EtherCAT I/O mapping can be used after the planning of EtherCAT topology is completed according to EtherCAT Topology Configuration.

1. In the left-side **Project Explorer**, double-click **EtherCAT I/O Mapping** under **I/O Mapping**.
2. Click **Create/Configure Variables of All Items** to automatically create variables.



3. The variables in the EtherCAT I/O Mapping page correspond to the configuration settings in the **PDO Mapping** tab of the EtherCAT Topology Configuration page. Also, the following EtherCAT_Tag_Table where corresponding variables are included is generated automatically in **Global Variable**.



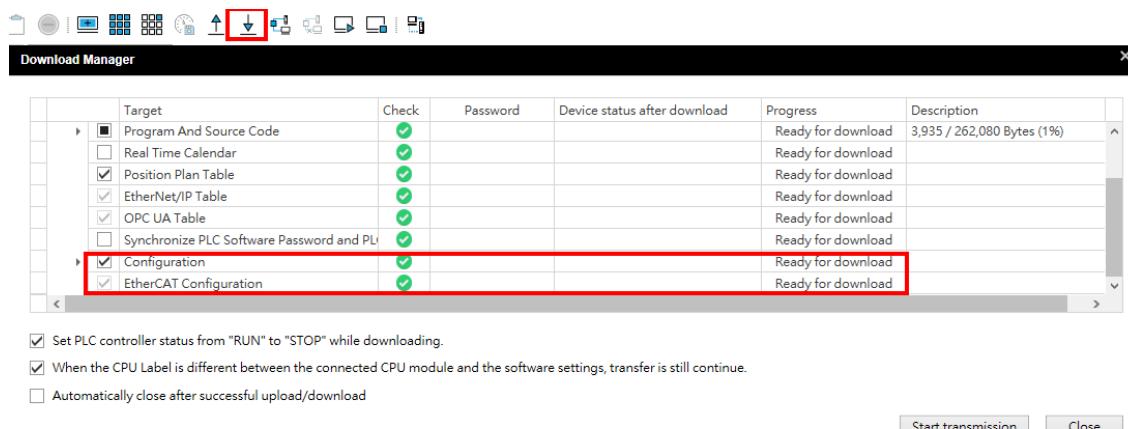
The screenshot shows the Project Explorer on the left and the EtherCAT Configuration tab on the right. The EtherCAT_Tag_Table is highlighted with a red box. The table lists 17 variables with their names, data types, and addresses.

Class	Name	Data Type	Address
VAR	_17_Error_register	WORD	AUTO
VAR	_17_Digital_input	WORD	AUTO
VAR	_17_Digital_output	WORD	AUTO
VAR	_17_M1_Error_Code	DWORD	AUTO
VAR	_17_M1_CH1_Input	DINT	AUTO
VAR	_17_M1_CH2_Input	DINT	AUTO
VAR	_17_M1_CH3_Input	DINT	AUTO
VAR	_17_M1_CH4_Input	DINT	AUTO
VAR	_17_M2_Error_Code	DWORD	AUTO
VAR	_17_M2_CH1_Output	DINT	AUTO
VAR	_17_M2_CH2_Output	DINT	AUTO
VAR	_17_M2_CH3_Output	DINT	AUTO
VAR	_17_M2_CH4_Output	DINT	AUTO
VAR	_17_M3_Digital_input_1	WORD	AUTO
VAR	_17_M3_Digital_output_1	WORD	AUTO

11.12 Configuration Download and Monitor Table

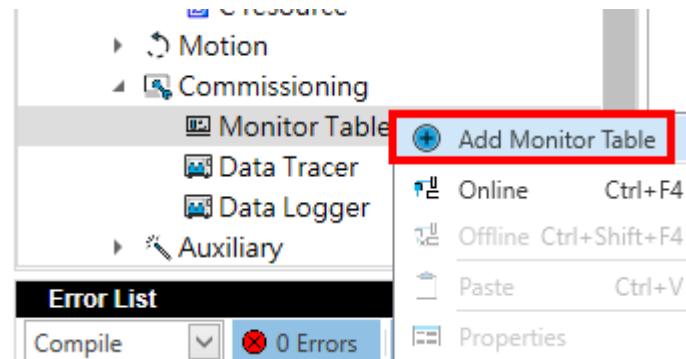
11.12.1 Configuration Download

1. After compilations is complete, click **Download > Download Manager**, to select the configuration you want to download, as shown in the figure below.

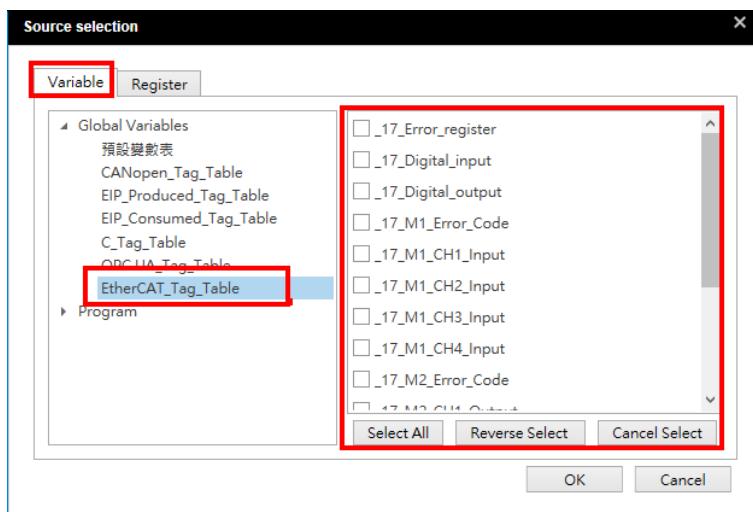


11.12.2 Monitor Table

1. In Project Explorer, right-click on **Monitor Table** to select **Add Monitor Table** from the context menu.



2. The variables from EtherCAT_Tag_Table are displayed in the monitor table.



3. Control the input and output of modules via the variables in the monitor table.

Example:

- Connect the output of 04DA to the input of 04AD.
- Set the digital value 16000 for 04DA (**_17_M2_CH1_Output**); then the analog value 16000 will be measured in 04AD (**_17_M1_CH1_Input**).

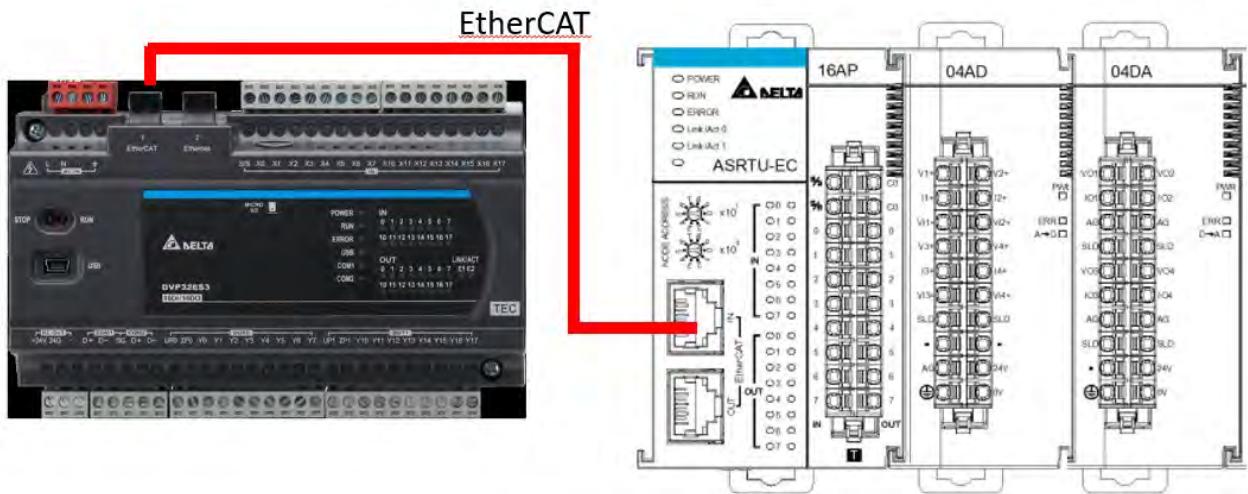
Source	Name	Address	Data Type	Display Data Format	Actual Value	Set Value
EtherCAT_Tag...	_17_Error_register		WORD	Auto	0	
EtherCAT_Tag...	_17_Digital_input		WORD	Auto	0	
EtherCAT_Tag...	_17_Digital_output		WORD	Auto	0	
EtherCAT_Tag...	_17_M1_Error_Code		DWORD	Auto	0	
EtherCAT_Tag...	_17_M1_CH1_Input		DINT	Auto	16004	
EtherCAT_Tag...	_17_M1_CH2_Input		DINT	Auto	-3	
EtherCAT_Tag...	_17_M1_CH3_Input		DINT	Auto	-259	
EtherCAT_Tag...	_17_M1_CH4_Input		DINT	Auto	-255	
EtherCAT_Tag...	_17_M2_Error_Code		DWORD	Auto	0	
EtherCAT_Tag...	_17_M2_CH1_Output		DINT	Auto	16000	16000
EtherCAT_Tag...	_17_M2_CH2_Output		DINT	Auto	0	
EtherCAT_Tag...	_17_M2_CH3_Output		DINT	Auto	0	
EtherCAT_Tag...	_17_M2_CH4_Output		DINT	Auto	0	
EtherCAT_Tag...	_17_M3_Digital_input_1		WORD	Auto	0	
EtherCAT_Tag...	_17_M3_Digital_output_1		WORD	Auto	0	

11.13 EtherCAT Operation Example

Add a remote slave module and this slave's right-side modules (04AD/04DA) for remote EtherCAT control through the DVP32ES300TEC.

11.13.1 Actual Hardware Configuration and Control Requirements

1. Actual hardware configuration

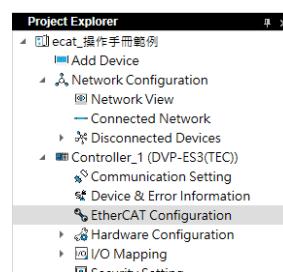


2. Control requirements

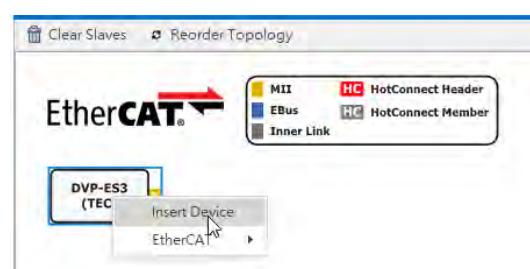
- The local output points Y0 to Y7 of ASRTU-EC16AP1TA are set to ON, and then the current states of its local input points X0 to X7 are monitored.
- AS04DA's channel 1 outputs the voltage to AS04AD's channel 1 through ASRTU-EC16AP1TA, and then the correct voltage signal can be confirmed by AS04AD.

11.13.2 EtherCAT Topology Configuration

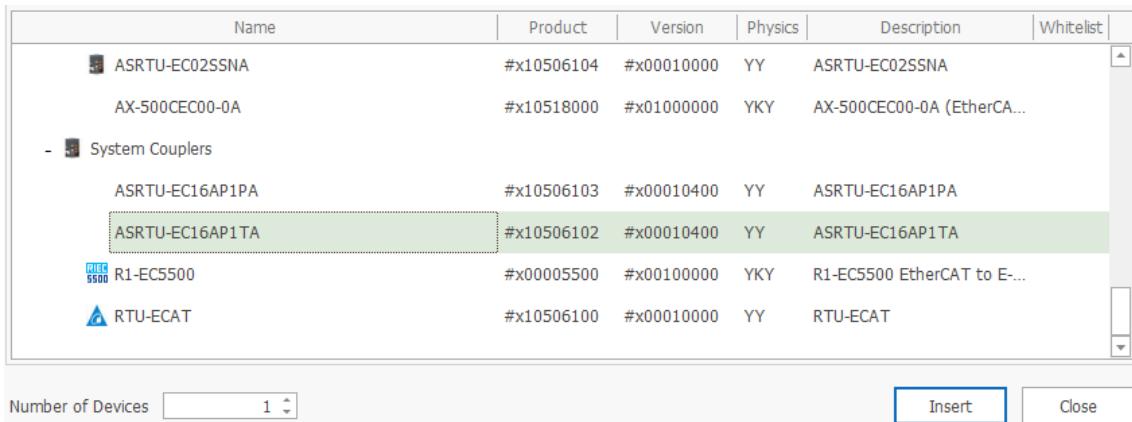
1. After opening the DIADesigner software, double-click **EtherCAT Configuration** in Project Explorer.



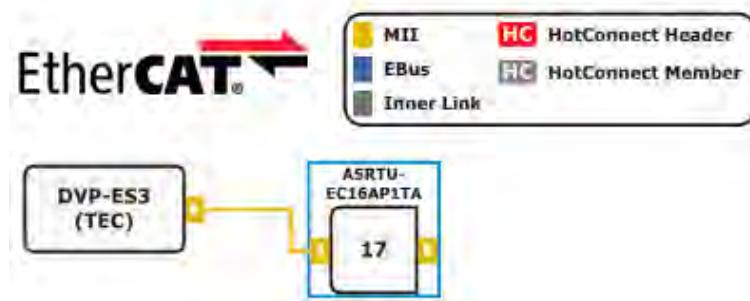
2. Right-click on the PLC and select **Insert Device**.



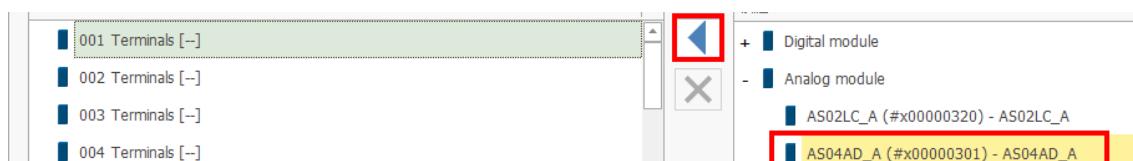
3. Select the slave device you want to insert, then click the **Insert** button. Afterwards, click **Close**.



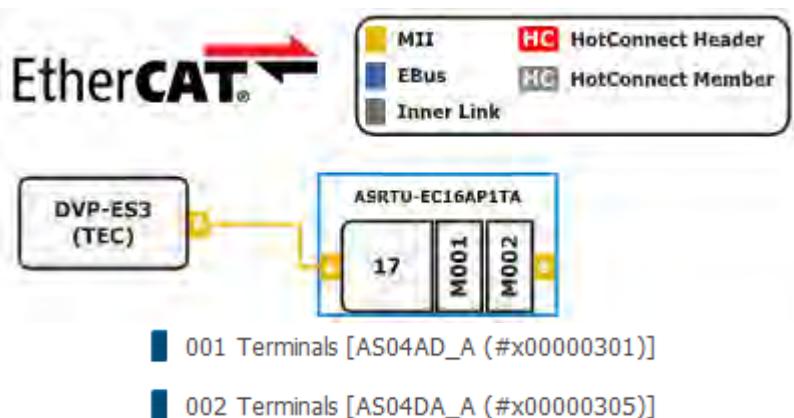
4. The following is the topology configuration of a newly added remote slave.
(Station ID range of a remote module: 17 to 24)



5. After adding a remote slave, you can add and remove its right-side modules in the **Modules** tab.

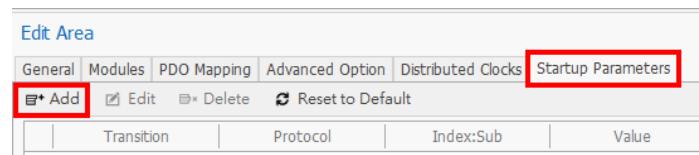


6. According to your actual need, add right-side modules 04AD and 04DA in sequence.

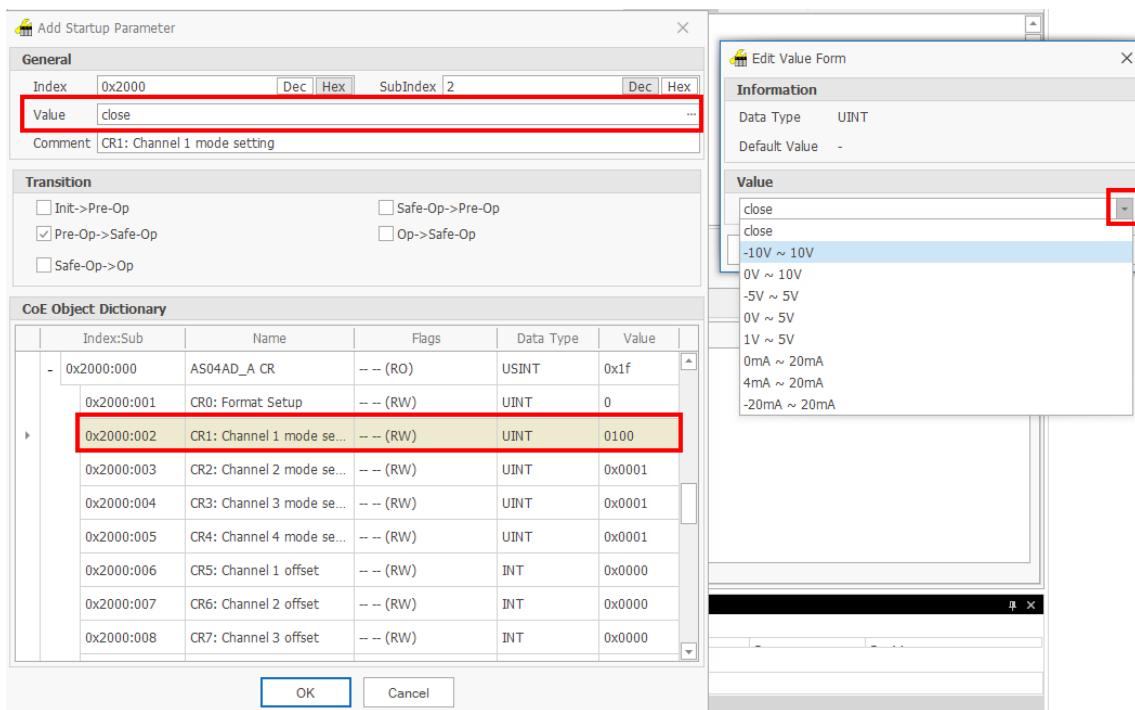


11.13.3 Startup Parameters Setting

1. In the Startup Parameters tab, click **Add** to add the parameters to be written into a module.



2. After selecting **CR1: Channel 1 mode setting** for 04AD from CoE Object Dictionary, enter the **Value** box to select a mode from its dropdown menu.

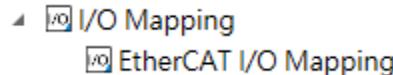


3. The following is the mode setting of 04AD-A.



11.13.4 EtherCAT I/O Mapping Configuration

1. In **Project Explorer**, double-click on **EtherCAT I/O Mapping** under **I/O Mapping**.



2. Click **Create/Configure Variables of All Items** to automatically create variables.

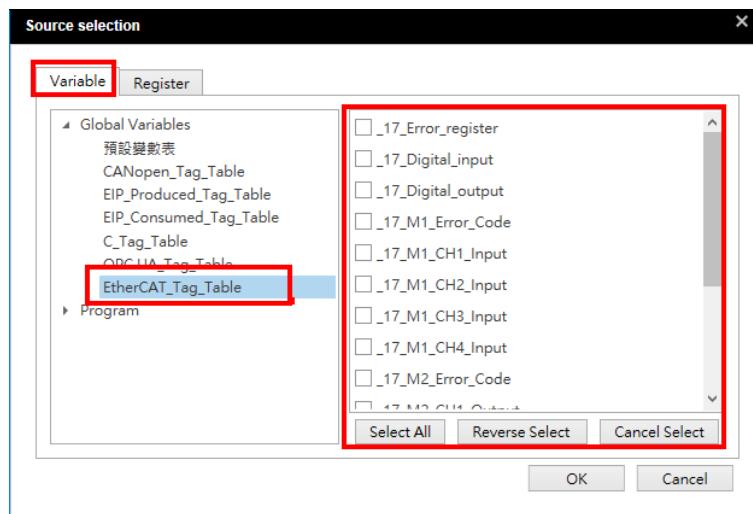
1st TxPDO Mapping Error register	EtherCAT_Tag_Table	WORD	
1st TxPDO Mapping Digital input	EtherCAT_Tag_Table	WORD	
1st RxPDO Mapping Digital output	EtherCAT_Tag_Table	WORD	
Module 1 (A504AD_A) A504AD_A Tx mapping (16#1A00)			
Error Code	EtherCAT_Tag_Table	DWORD	
CH1 Input	EtherCAT_Tag_Table	DINT	
CH2 Input	EtherCAT_Tag_Table	DINT	
CH3 Input	EtherCAT_Tag_Table	DINT	
CH4 Input	EtherCAT_Tag_Table	DINT	
Module 2 (A504DA_A) A504DA_A Tx mapping (16#1A01)	EtherCAT_Tag_Table	DWORD	
Error Code	EtherCAT_Tag_Table	DWORD	
Module 2 (A504DA_A) A504DA_A Rx mapping (16#1A01)	EtherCAT_Tag_Table	DWORD	
CH1 Output	EtherCAT_Tag_Table	DINT	
CH2 Output	EtherCAT_Tag_Table	DINT	
CH3 Output	EtherCAT_Tag_Table	DINT	
CH4 Output	EtherCAT_Tag_Table	DINT	

3. Meanwhile, the following EtherCAT_Tag_Table where corresponding variables are included is generated automatically in **Global Variable**.

Class	Name	Data Type	Address	Initial Value
VAR	_17_Error_register	WORD	AUTO	
VAR	_17_Digital_input	WORD	AUTO	
VAR	_17_Digital_output	WORD	AUTO	
VAR	_17_M1_Error_Code	DWORD	AUTO	
VAR	_17_M1_CH1_Input	DINT	AUTO	
VAR	_17_M1_CH2_Input	DINT	AUTO	
VAR	_17_M1_CH3_Input	DINT	AUTO	
VAR	_17_M1_CH4_Input	DINT	AUTO	
VAR	_17_M2_Error_Code	DWORD	AUTO	
VAR	_17_M2_CH1_Output	DINT	AUTO	
VAR	_17_M2_CH2_Output	DINT	AUTO	
VAR	_17_M2_CH3_Output	DINT	AUTO	
VAR	_17_M2_CH4_Output	DINT	AUTO	
VAR	_17_M3_Digital_input_1	WORD	AUTO	
VAR	_17_M3_Digital_output_1	WORD	AUTO	

11.13.5 Monitor and Control

1. Download the project to the PLC.
2. Open the monitor table and display the variables from EtherCAT_Tag_Table in the box as shown below.



3. Control AD and DA modules via the variables in the monitor table.

Example:

- A. Connect the output of 04DA to the input of 04AD.
- B. Set the digital value 16000 for 04DA (_17_M2_CH1_Output), which corresponds to the output 5 V; then the analog value 16000 will be measured in 04AD (_17_M1_CH1_Input), which corresponds to the input 5 V.

Source	Name	Address	Data Type	Display Data Format	Actual Value	Set Value
EtherCAT_Tag...	_17_Error_register		WORD	Auto	0	
EtherCAT_Tag...	_17_Digital_input		WORD	Auto	0	
EtherCAT_Tag...	_17_Digital_output		WORD	Auto	0	
EtherCAT_Tag...	_17_M1_Error_Code		DWORD	Auto	0	
EtherCAT_Tag...	_17_M1_CH1_Input		DINT	Auto	16004	
EtherCAT_Tag...	_17_M1_CH2_Input		DINT	Auto	-3	
EtherCAT_Tag...	_17_M1_CH3_Input		DINT	Auto	-259	
EtherCAT_Tag...	_17_M1_CH4_Input		DINT	Auto	-255	
EtherCAT_Tag...	_17_M2_Error_Code		DWORD	Auto	0	
EtherCAT_Tag...	_17_M2_CH1_Output		DINT	Auto	16000	16000
EtherCAT_Tag...	_17_M2_CH2_Output		DINT	Auto	0	
EtherCAT_Tag...	_17_M2_CH3_Output		DINT	Auto	0	
EtherCAT_Tag...	_17_M2_CH4_Output		DINT	Auto	0	
EtherCAT_Tag...	_17_M3_Digital_input_1		WORD	Auto	0	
EtherCAT_Tag...	_17_M3_Digital_output_1		WORD	Auto	0	

- C. Set the digital value 32000 for 04DA (_17_M2_CH1_Output), which corresponds to the output 10 V; then the analog value 32000 will be measured in 04AD (_17_M1_CH1_Input), which corresponds to the input 10 V.

EtherCAT_Tag...	_17_M1_CH1_Input	DINT	32000
EtherCAT_Tag...	_17_M1_CH2_Input	DINT	-4
EtherCAT_Tag...	_17_M1_CH3_Input	DINT	-261
EtherCAT_Tag...	_17_M1_CH4_Input	DINT	-262
EtherCAT_Tag...	_17_M2_Error_Code	DWORD	0
EtherCAT_Tag...	_17_M2_CH1_Output	DINT	32000

4. Control ASRTU's I/O via the variables in the monitor table.

Example:

A. Set Y0 to Y3 to ON by writing 16#000F in the output variable **_17_Digital_output**, and check if the current status of input points is correct through **_17_Digital_input**.

EtherCAT_Tag...	_17_Digital_input	WORD	1111	
EtherCAT_Tag...	_17_Digital_output	WORD	1111	16#000F

B. Set Y4 to Y7 to ON by writing 16#00F0 in the output variable **_17_Digital_output**, and check if the current status of input points is correct through **_17_Digital_input**.

EtherCAT_Tag...	_17_Digital_input	WORD	1111_0000	
EtherCAT_Tag...	_17_Digital_output	WORD	1111_0000	16#00F0

11.14 Additional Remarks

11.14.1 Stop the Output of Remote Module, AIO, and DIO Once the PLC Stops

- When the PLC is in the RUN or STOP state, the remote module and its right-side AIO and DIO modules can be controlled through the variables in EtherCAT_Tag_Table, as described in the operation examples in section 11.13.5.
- After SM203 is set to ON, the variables in EtherCAT_Tag_Table will be reset to 0, and the remote module and its right-side AIO and DIO modules will stop their output when the PLC stops.

SM203_OFF	The variables in EtherCAT_Tag_Table remain unchanged. AIO and DIO modules maintain their output.
SM203_ON	The variables in EtherCAT_Tag_Table are cleared to 0. AIO and DIO modules stop their output.

11.14.2 Stop the Output of Remote Module, AIO, and DIO Once EtherCAT Disconnected

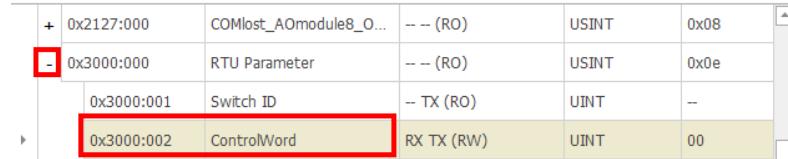
- Refer to ASRTU-EC Series Operation Manual to set up the status value for Bit0 to Bit1 of Control Word for ASRTU as follows.

Index	Subindex	Name	Data Type	Attribute	PDO mapping	Default
3000h	2	Control Word	UINT	RW	Yes	0

- The action description of status values:

Status value in Bit0 to Bit1	Description
00	The output values of local output points as well as right-side special modules and digital modules are cleared.
10	Local output points as well as right-side special modules and digital modules retain the output values before disconnection.

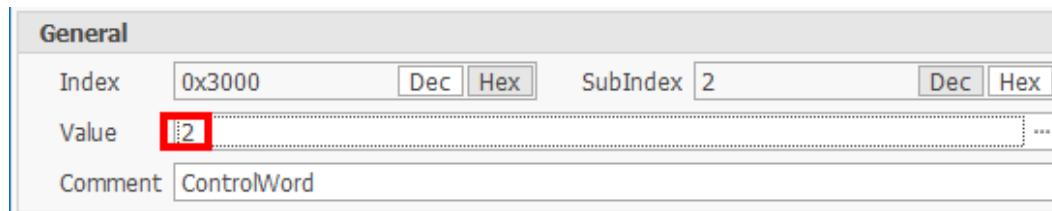
3. Add **ControlWord** in Startup Parameters tab.



The table shows the following data:

+	0x2127:000	COMlost_A0module8_O...	-- (RO)	USINT	0x08
-	0x3000:000	RTU Parameter	-- (RO)	USINT	0x0e
	0x3000:001	Switch ID	-- TX (RO)	UINT	-
▶	0x3000:002	ControlWord	RX TX (RW)	UINT	00

4. Write 2 in the **Value** field to set the status value of Bit0 to Bit1 to 10. When EtherCAT communication is disconnected, the remote module, AIO, and DIO will all stop outputting.



11.14.3 BYTE as PDO Mapping Data Type of a Delta Remote Module or Third-Party Slave

The data type is WORD or INT in the PLC CPU.

When the data type of the third-party slave configuration is BYTE, the corresponding mapped data type in the PLC CPU will still be treated as a WORD, with the low BYTE of the WORD corresponding to the slave data. The high BYTE value of the WORD in the PLC CPU remains unchanged during the data exchange.

Example:

If the BYTE data from the slave is 16#FF, the corresponding WORD data sent to the PLC CPU is 16#00FF.

And if the WORD data from the PLC CPU is 16#1234, the corresponding BYTE data sent to the slave is 16#34.

MEMO

Chapter 12 CPU Module Operating Principles

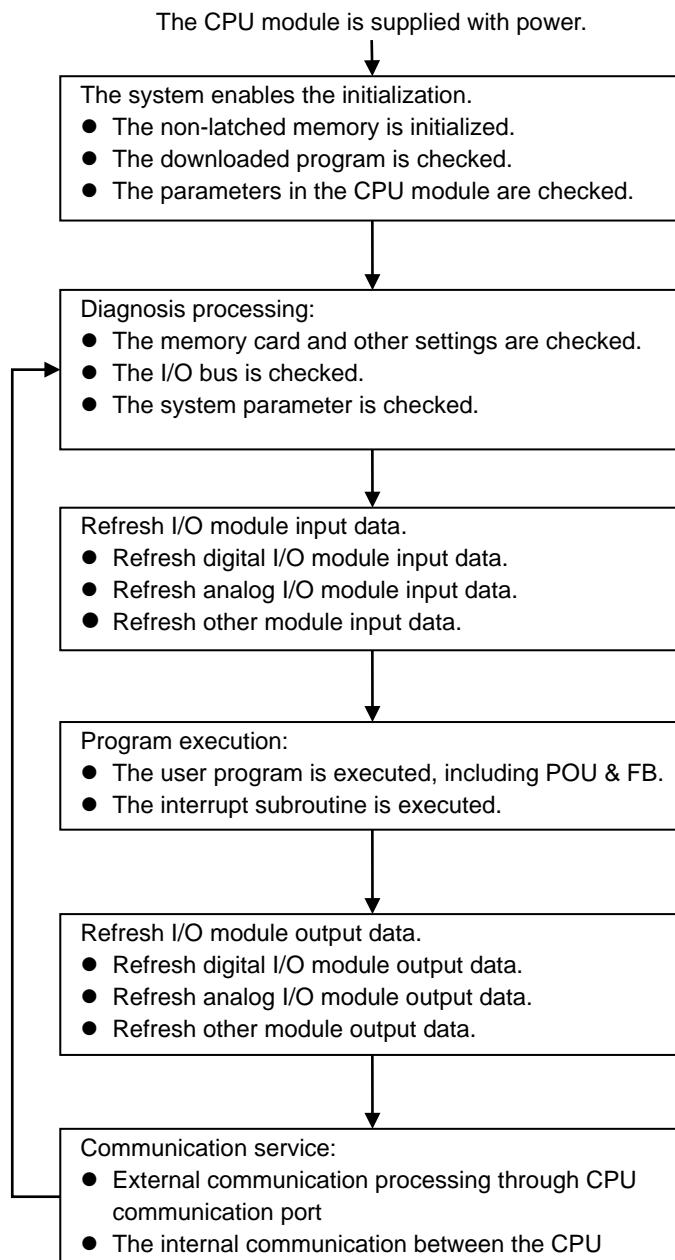
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12.1.3 Execution Timing of Interrupts	12-3
12.2 CPU Module Operating Modes	12-4
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12.1 CPU Module Operations

12.1.1 Procedure

The following diagram describes the operation of the CPU module.



12.1.2 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 followings.

- Refreshing data in a digital I/O module
- Refreshing data in analog I/O, temperature measurement and positioning modules

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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 quantity	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		Data register*

* Refer to special extension module exchange function from Section 2.2.16 of DVP-ES3/EX3/SV3/SX3 Programming Manual for more information.

- **Communication service**

This includes communication requests from external devices to the CPU and from the CPU to external devices. Although these services are performed intermittently, if a communication request involves a device component within the CPU module, the specified device's value or status will only be refreshed after the PLC program scans to the END instruction.

12.1.3 Execution Timing of Interrupts

Interrupts generally fall into three main categories: external input interrupts, timer interrupts, and event-triggered interrupts. Regardless of the type of interrupt triggered, the interrupt service routine only begins after every instruction in the user program has finished executing. At that point, the next instruction's execution address and status are saved. Then, the system jumps to the interrupt service routine. Once the interrupt service routine completes, it automatically returns to the previously saved location to resume execution.

12.2 CPU Module Operating Modes

12.2.1 Operating Modes

There are two operating modes in the CPU module for managing user programs and all tasks.

STOP mode: In this mode, the program is not executed. Users can perform the following tasks: initialize CPU configuration and other settings, transfer programs, check programs, force set/reset bits, and other preparatory work before program execution.

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RUN mode: In this mode, the program executes, and actions such as initializing CPU configuration and other settings cannot be performed.

12.2.2 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	Stop the execution of the program.	Execute I/O refreshing.	OFF. If you set the I/O to retain its previous output, the external output will keep that state.	The data in the program memories is retained.	
RUN	Execute the program.	Execute I/O refreshing.	The program controls the external output.		

- Relationship between the operating modes and tasks

Mode	Loop task	Interrupt task
STOP	Stop the execution of loop tasks.	Stop the execution of an interrupt task.
RUN	<ul style="list-style-type: none"> ● Tasks that are not currently active are in the HALT state. ● A task will execute if it is in the ON state or if the TKON instruction is executed. ● Conversely, if a task is in the OFF state or if the TKOFF instruction is executed, the task will not be executed. 	If the condition of the interrupt is met, execute the interrupt task.

- 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 13 Data Tracer and Data Logger

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13.2 Data Logger.....	13-7
13.2.1 About Data Logger	13-7
13.2.2 Related SM Flags and SR Registers.....	13-12

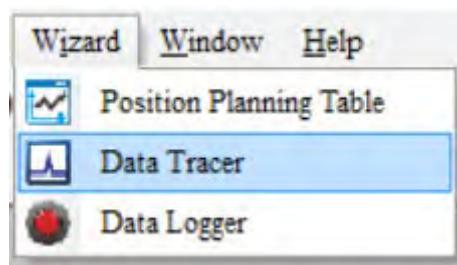
13.1 Data Tracer

13.1.1 About Data Tracer

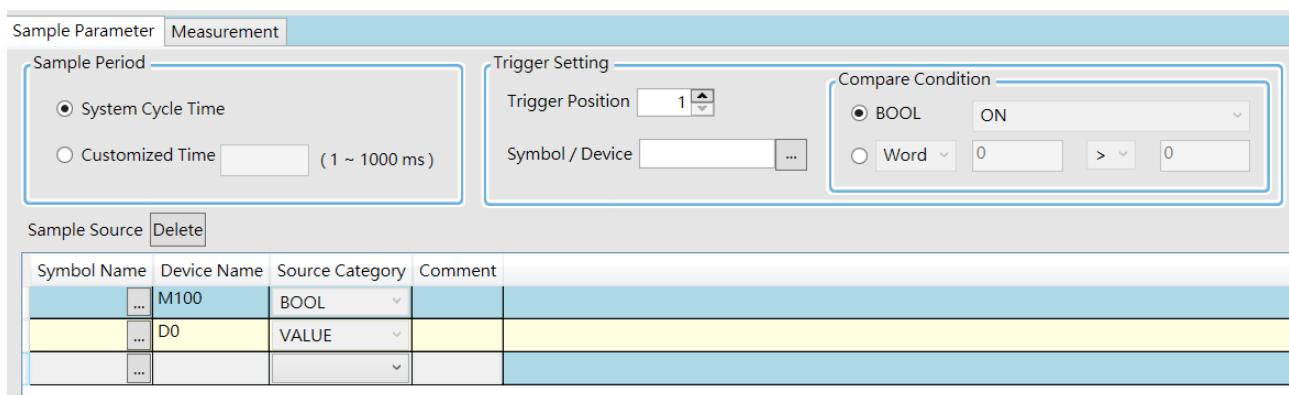
Data Tracer is used for the real-time collection of variable symbols, their values, and states within devices. This collection begins after a specified trigger condition is met, allowing for the drawing of curve charts to analyze value trends. Refer to Section 23.2 in the ISPSoft User Manual or Section 14.4.1 in the DIADesigner User Manual for more details.

● ISPSoft

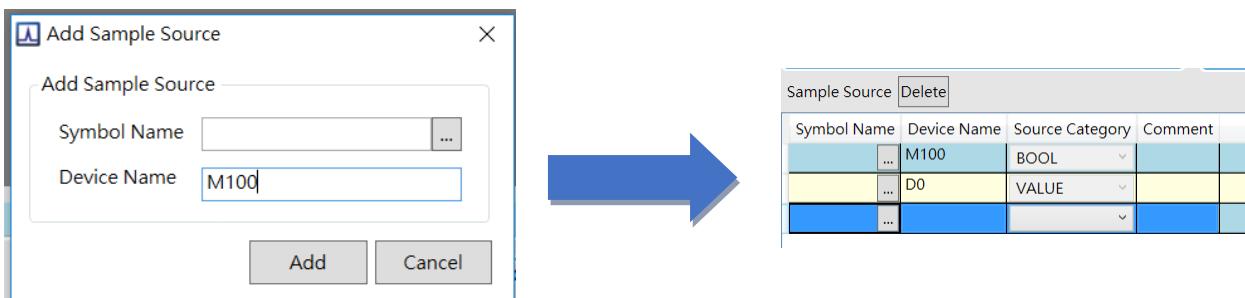
Step 1: Compile the current project before using this function. Click Wizard -> Data Tracer to open the Data Tracer window as shown below.



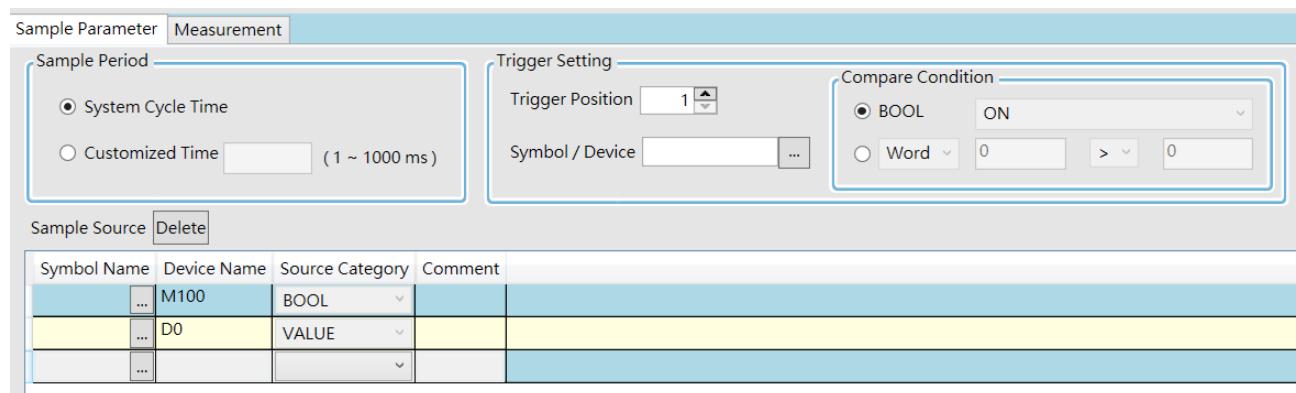
Step 2: Click the button of **Symbol Name** to open the **Add Sample Source** window.



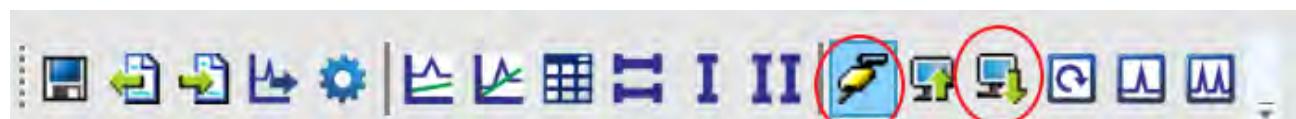
Step 3: Click the button of **Symbol Name** in the **Add Sample Source** window and select the variable symbol name to be added in the **Choose Symbol** window or directly type a device name in the **Device Name** box.



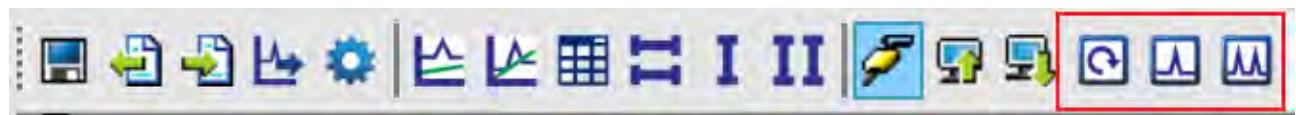
Step 4: Set up the sample period and trigger setting.



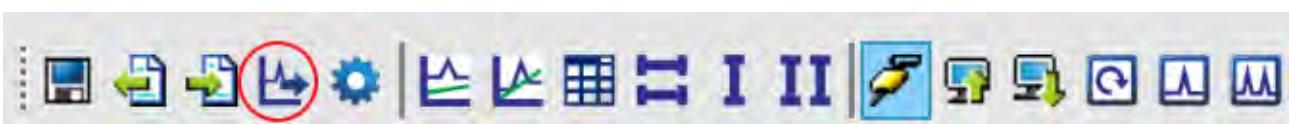
Step 5: After setting up the parameters, click on the icon toolbar to be in the online mode. Then click to download the settings to the PLC.



Step 6: 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.

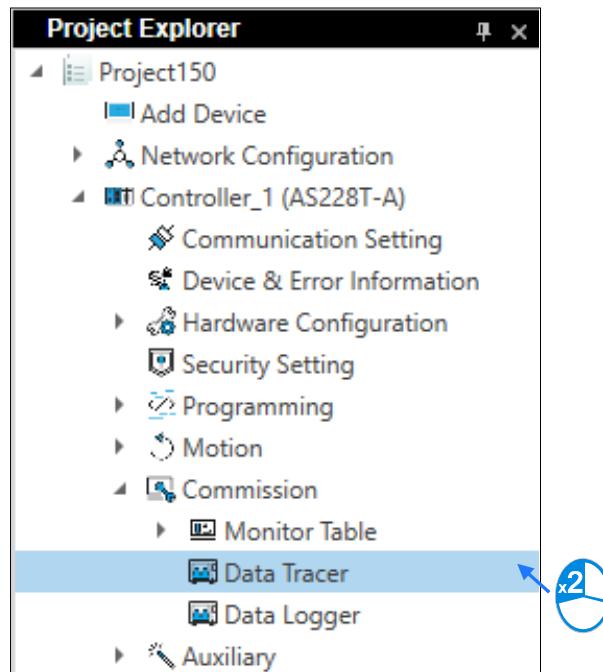


Step 7: Click on the icon toolbar to export the data to your computer for future use.



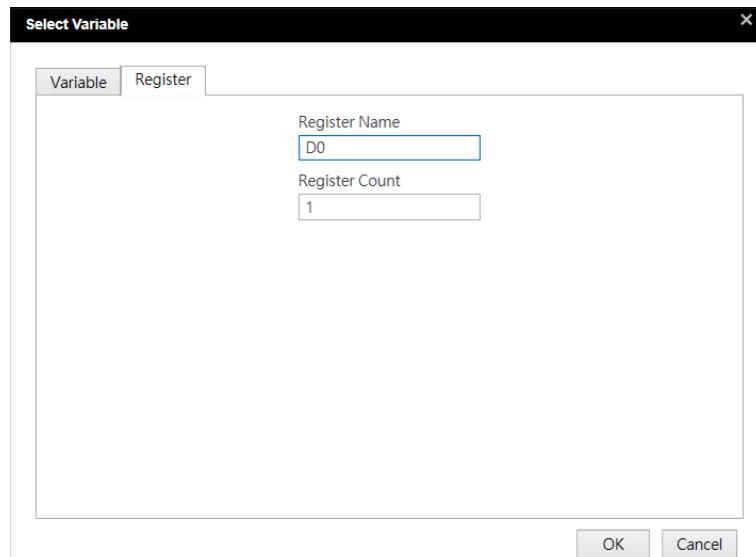
● DIADesigner

Step 1: Go to *Controller* -> *Commission* and double-click **Data Tracer** in the Project Explorer.



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Step 2: Type the variable or register that you'd like to sample as the image shown below.



Sampling Source		Add	Remove						
Enable	Color	Data Source	Variable	Register	Data Type	Latest Value	ΔY	Comment	
<input checked="" type="checkbox"/>	█	Default	Var_1	D0	WORD	195	0		
<input checked="" type="checkbox"/>	█	Default	Var_2	D1	DWORD	390	0		
<input checked="" type="checkbox"/>	█	Default	Var_3	D3	WORD	585	0		

Step 3: Set up the conditions of triggering and comparing.

- Sampling Period: _____

System Period User-defined Period (1~1000 ms)

- Trigger Setting _____

Trigger Position: (1~200) Variable/Register:

Compare Condition

BOOL: Word >

13

Step 4: Use the export button as shown below to export data and save data in the computer.

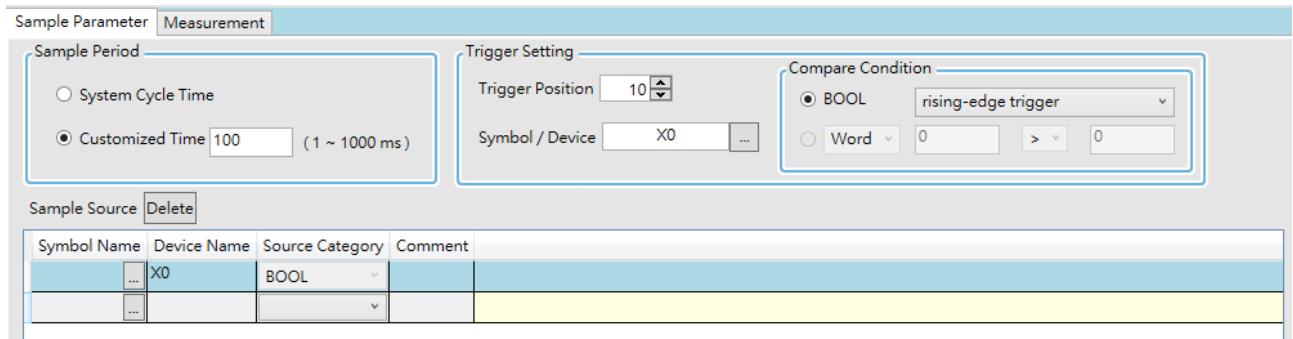


13.1.2 ISPSoft Demonstration Example

Assume X0 is an external input switch signal. In this case, use the **Data Tracer** function to measure the duration (width time) when X0 is ON.

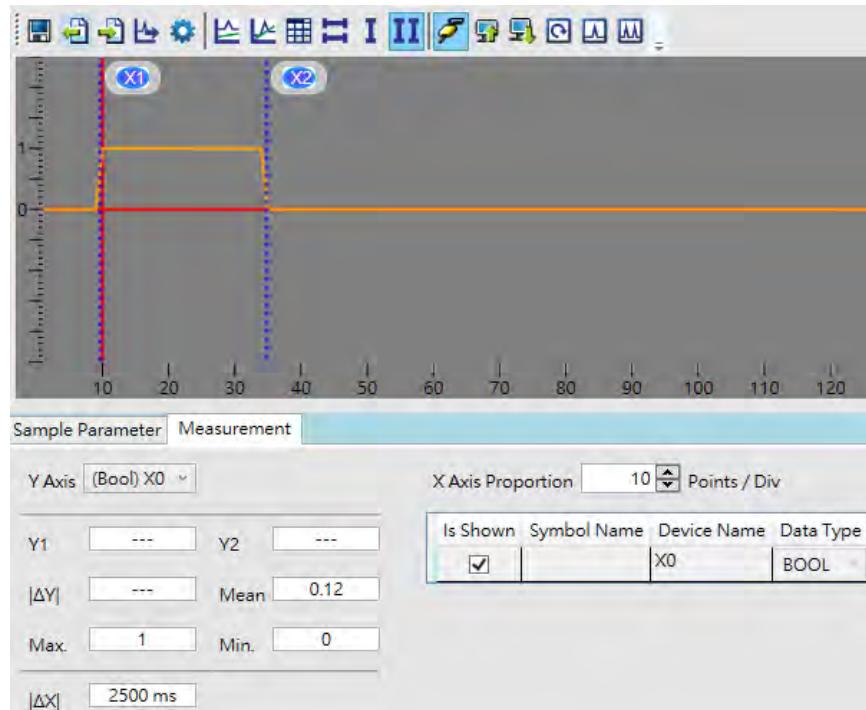
- **Operation steps:**

- ① Open Data Tracer and enter X0 for monitoring.
- ② Set the Customized Time to 100 ms to take sampling, 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 $|\Delta X|$ is 2500 ms, the time measured between two vertical lines, X1 and X2, for X0.



13.2 Data Logger

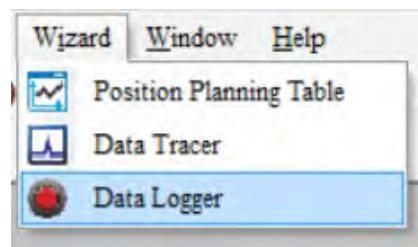
13.2.1 About Data Logger

Data Logger is used for the long-term recording of variable symbols, their values, and states within devices. The collected data is stored in the PLC and its memory card, enabling the drawing of curve charts for the analysis of value trends. Refer to Section 23.3 in the ISPSsoft User Manual or Section 14.4.2 in the DIADesigner User Manual for more details.

Operation A

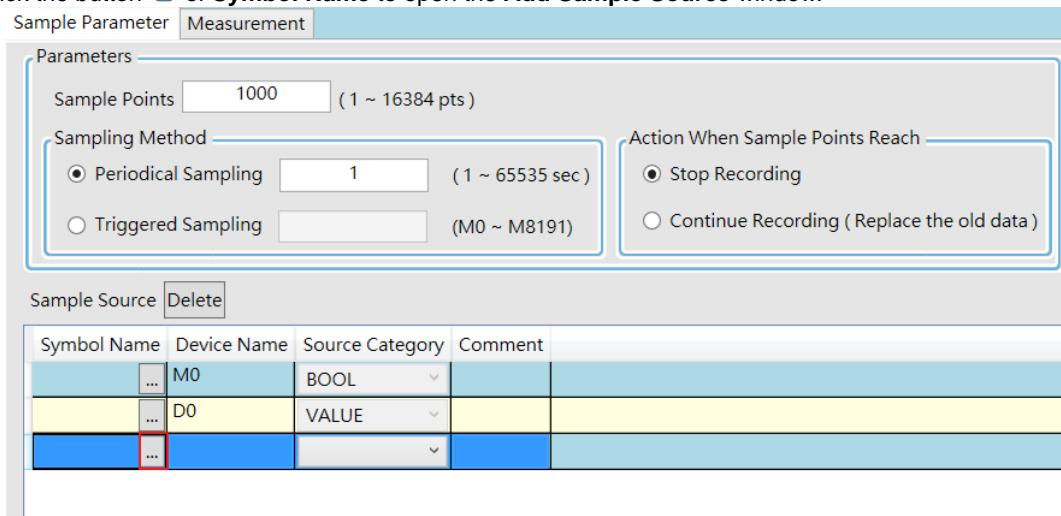
- ISPSsoft

Step 1: Compile the current project before using the function. Click Wizard -> Data Logger to open the Data Logger window as shown below.

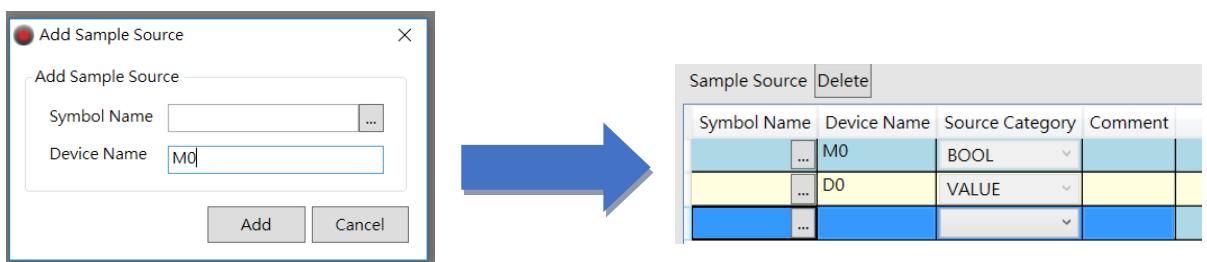


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Step 2: Click the button of **Symbol Name** to open the **Add Sample Source** window.



Step 3: 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.

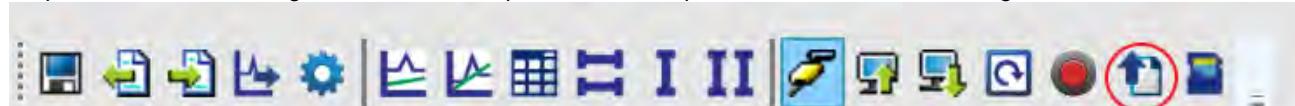


Step 4: After setting up the parameters, click  on the icon toolbar to be in the online mode. Then click  to download the settings to the PLC. And then click  to record data.

Note: From here you can also follow Operation B to complete the recording and saving.

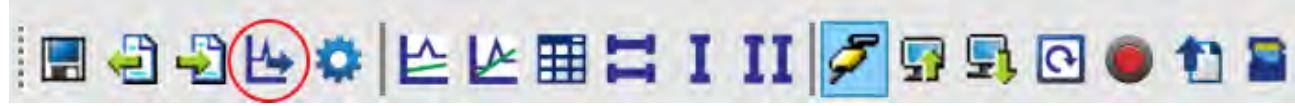


Step 5: When the recording is done, click the upload button to update the data for later viewing.



13

Step 6: Click  on the icon toolbar to export the data to your computer for future use.

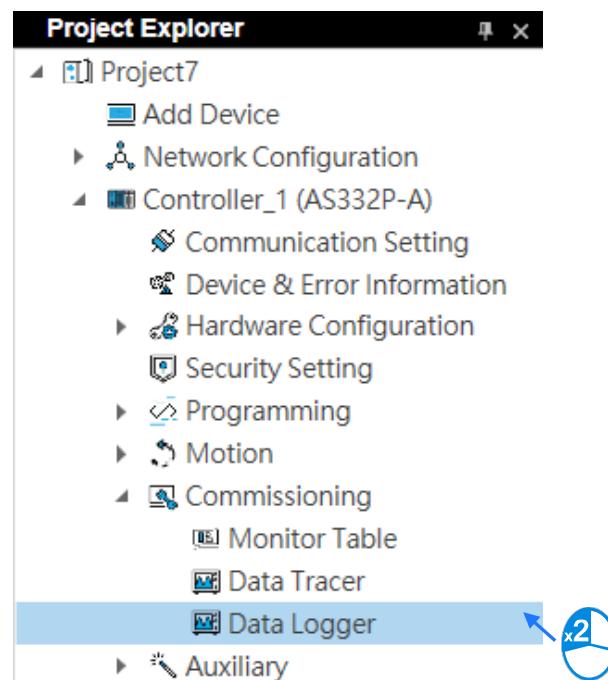


Step 7: Click  on the icon toolbar or use SM and SR to save the data to the SD Card installed on the PLC.

Operation A

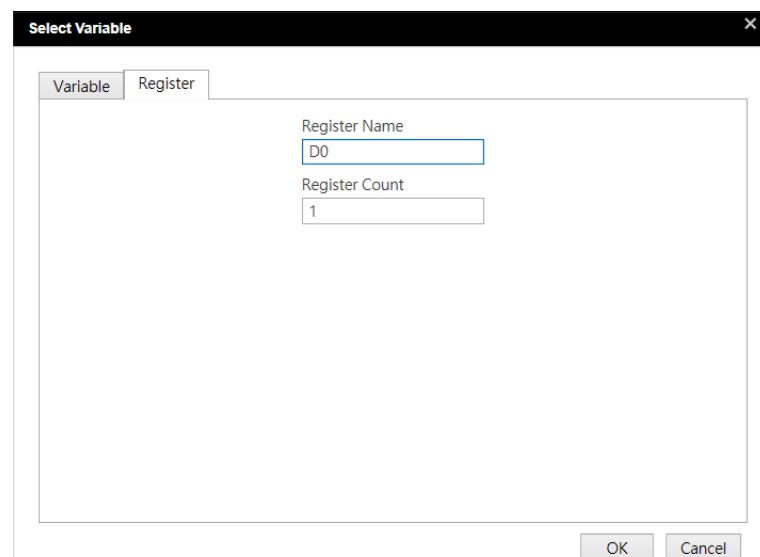
● DIADesigner

Step 1: Go to *Controller* -> *Commission* and double-click **Data Logger** in the Project Explorer.



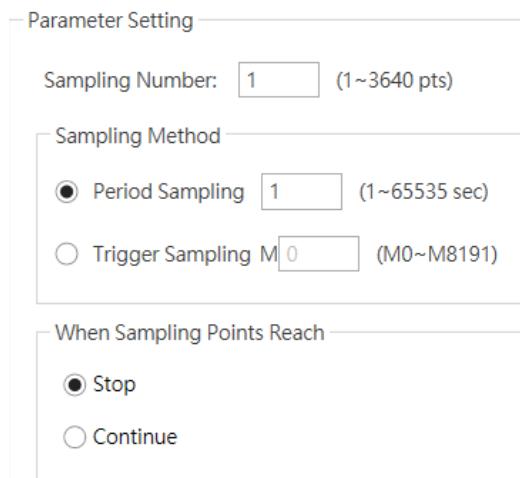
13

Step 2: Type the variable or register that you'd like to monitor as the image shown below.



Sampling Source		Add	Remove							
	Enable	Color	Data Source	Variable	Register	Data Type	Latest Value	ΔY	Comment	
▶	<input checked="" type="checkbox"/>		Default	Var_1	D0	WORD	195	0		
▶	<input checked="" type="checkbox"/>		Default	Var_2	D1	DWORD	390	0		
▶	<input checked="" type="checkbox"/>		Default	Var_3	D3	WORD	585	0		

Step 3: Set up the sampling number, sampling method and what to do after sampling points reached.



13

Step 4: Stay in the online mode and then download the settings to the PLC. After that click Start icon as shown below to execute data logger.

Note: If a long-term recording and saving application is required by a PLC program, refer to Operation B below.



Step 5: Use the export button as shown below to export data and save data in the computer.



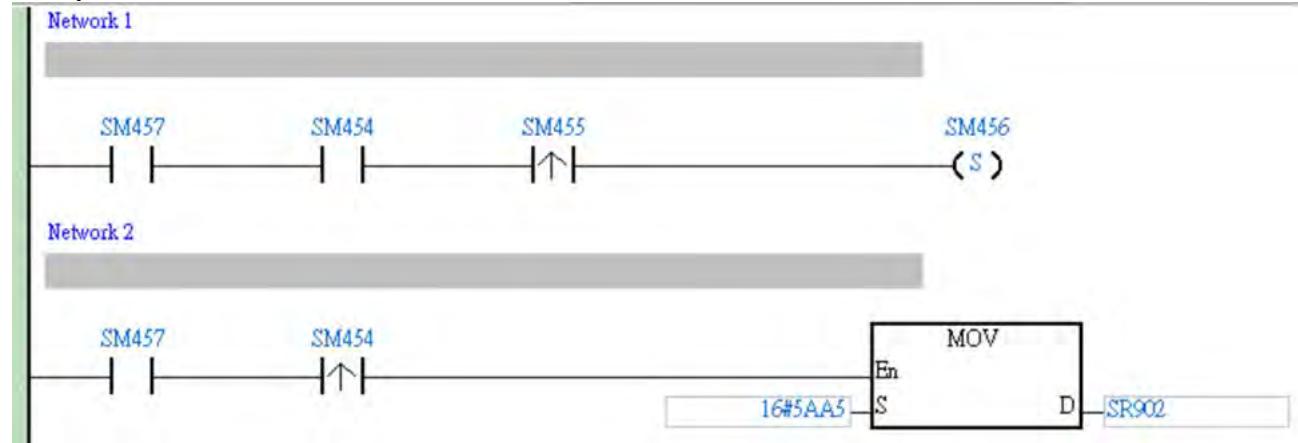
You can also use the save to a SD Card button as shown below to save data in the SD Card.



Operation B

You can also use SM flags or SR registers to control data recording, data saving, or to configure permanent data storage on an SD card. 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 data quantity has met the value set in SR900 (32-bit value), the system starts saving data to a SD card.

NOTE: When sending data to the SD card for storage, the PLC requires a period of uninterrupted time, approximately tens of milliseconds. During this period, the PLC will not execute interrupts. Therefore, before initiating data transfer to the SD card, ensure that the PLC is not currently executing any interrupts, especially external input interrupts.

- When SM455 is switching from OFF to ON, set SM456 to 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:
 - ES3: \SDCard\PLC CARD\ES3\Log
 - EX3: \SDCard\PLC CARD\EX3\Log
 - SV3: \SDCard\PLC CARD\SV3\Log
 - SX3: \SDCard\PLC CARD\SX3\Log
- ◆ Default file name
 - DATA_LOGGER_yyyymmdd_hhmmss.log
 - EX: DATA_LOGGER_20231108_161901.log

13.2.2 Related SM Flags and SR Registers

SM / SR	Attr.	Description
SM450	R	<p>Check here to see if a SD Card is installed in the PLC.</p> <p>ON: SD card inside</p> <p>OFF: No SD card</p>
SM452	R	<p>Check here to see if data is being stored on the SD card.</p> <p>ON: In the operation of storing</p> <p>OFF: Not in the operation of storing</p>
SM453	R	<p>Check here to see if there is any SD card operational error.</p> <p>ON: Abnormal</p> <p>OFF: Normal</p>
SR453	R	<p>Check here to see the last operational error code of the SD card.</p> <p>Note: Only available when SM453=ON</p>
SM454	R/W	<p>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.</p>
SM455	R	<p>Check here to see if the recorded number has reached the set limit.</p> <p>ON: The quantity of recordings has reached the set number or the SD card is in cycle recording.</p>
SM456	R/W	<p>Used with SR902 to activate the settings in SR902 for the SD card.</p> <p>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.</p>
SM457	R	<p>Check here to see if there is any valid, downloaded, recorded parameters in the data logger.</p> <p>ON: The valid recorded parameters are downloaded in data logger.</p>
SR900	R	<p>Check here to see the quantity of the recorded data (32-bit value).</p> <p>Note: It increments the number of the recorded data by 1 for each record.</p>
SR902	R/W	<p>Control codes for recorded data.</p> <ul style="list-style-type: none"> ● 16#5AA5: Store data to a default root and specify file name on the SD card. ● 0: The storing is done. ● Others: Invalid numbers <p>Note: Used with SM456 to activate this setting.</p>

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.

Chapter 14 Troubleshooting

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14.1 Troubleshooting

14.1.1 Basic Troubleshooting Steps

This chapter includes the possible errors that 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:

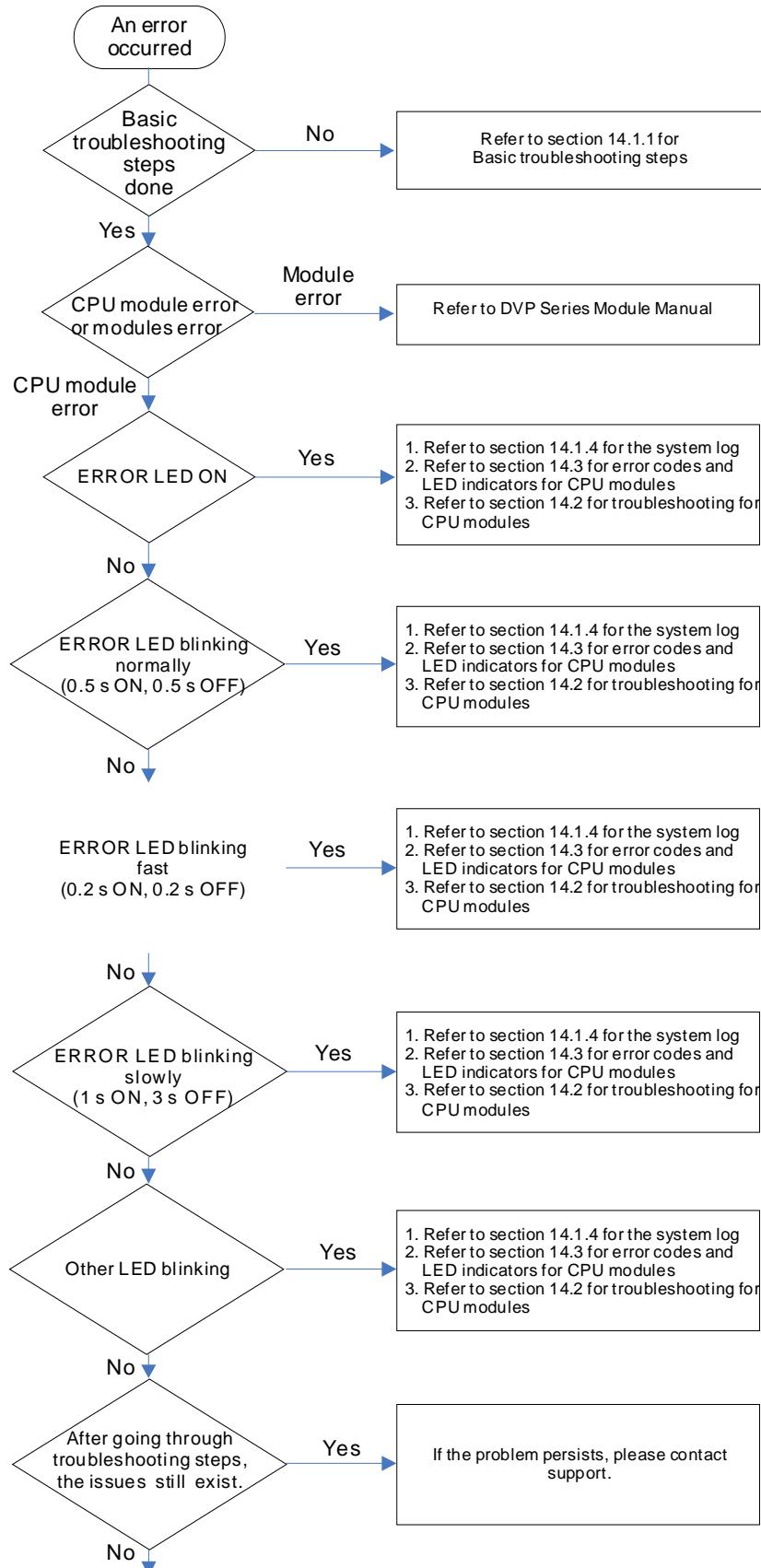
- DVP-ES3/EX3/SV3/SX3 Series or external devices
- CPU or extension modules
- Parameters or program settings

14.1.2 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.

14.1.3 Troubleshooting SOP



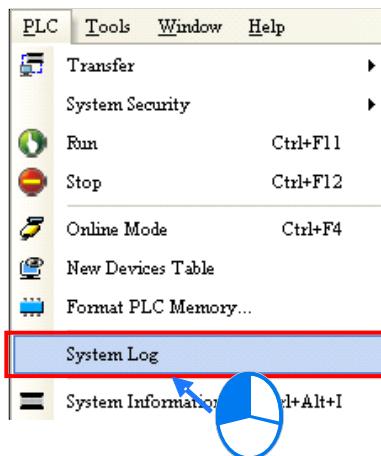
The system runs normally.

14.1.4 View System Log and Error Step

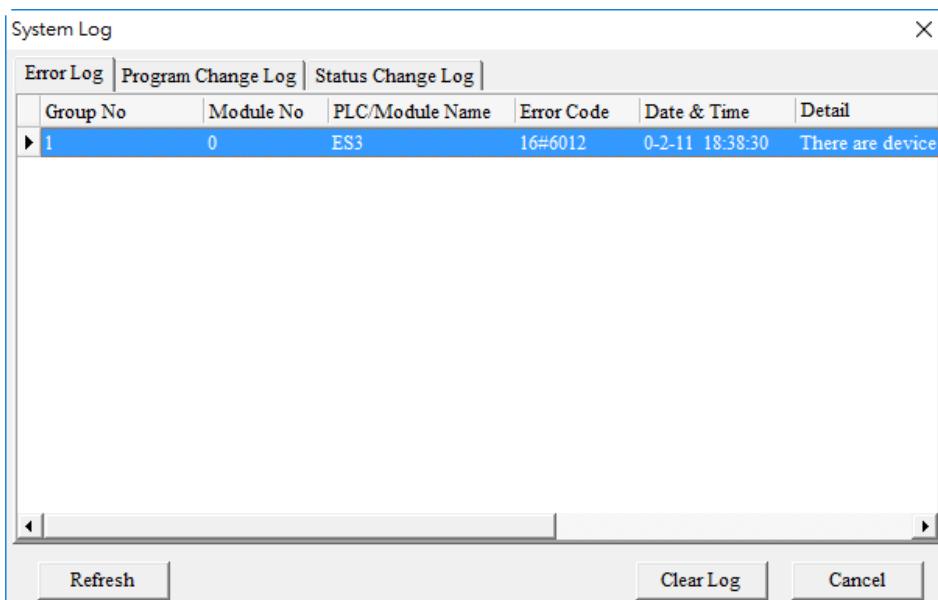
If ISPSoft is connected to the CPU module, you can view actions and errors in the CPU by clicking **System Log** on the **PLC** menu. The CPU can store up to 20 error log sets. After the 20 sets are stored, the 1st log is replaced with the 21st if there are new logs coming in, and the old logs are replaced with the new ones sequentially. When the memory card is installed in the CPU module, 20 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.

● ISPSoft

- (1) On the **PLC** menu, click **System Log**.



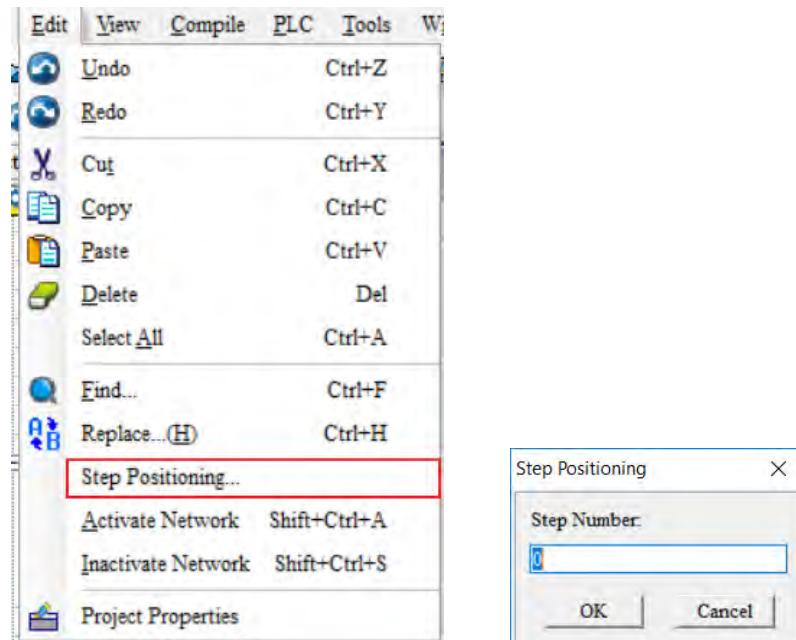
- (2) The **System Log** window appears. Click **Refresh** to refresh the log; click **Clear Log** to clear the error log in the window and the error log in the CPU module.



- Group No.: Fixed as 1, which indicates the CPU module.
- Module No.: Fixed as 0
- PLC/Module name: Model names of the CPU 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.
- Detail: Shows the descriptions for the error.

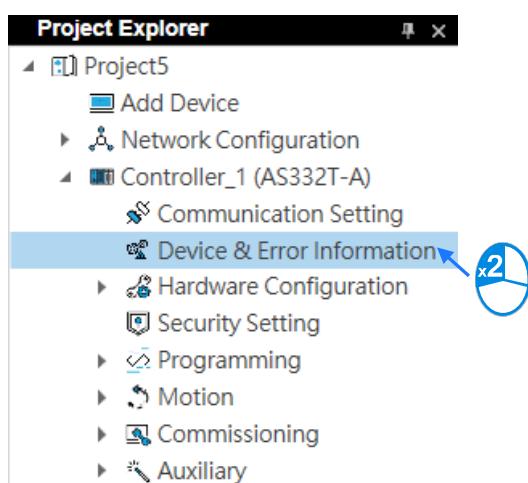
(3) If the error that occurred is an exceeding device range error (SM0 = ON), stored in SR0 or is a program syntax error (SM5 = ON), stored in SR4, you can use the following steps to see the problematic step in the program.

- SM0 = ON: Check the value (32-bit) in SR1 to see the latest exceeding device range error in the program.
- SM5 = ON: Check the value (32-bit) in SR5 to see the latest syntax error step in the program.
- After knowing which the problematic step is, go to ISPSoft -> Edit -> Step positioning and then enter the number of the problematic step, the system will take you to the specified step in the program.

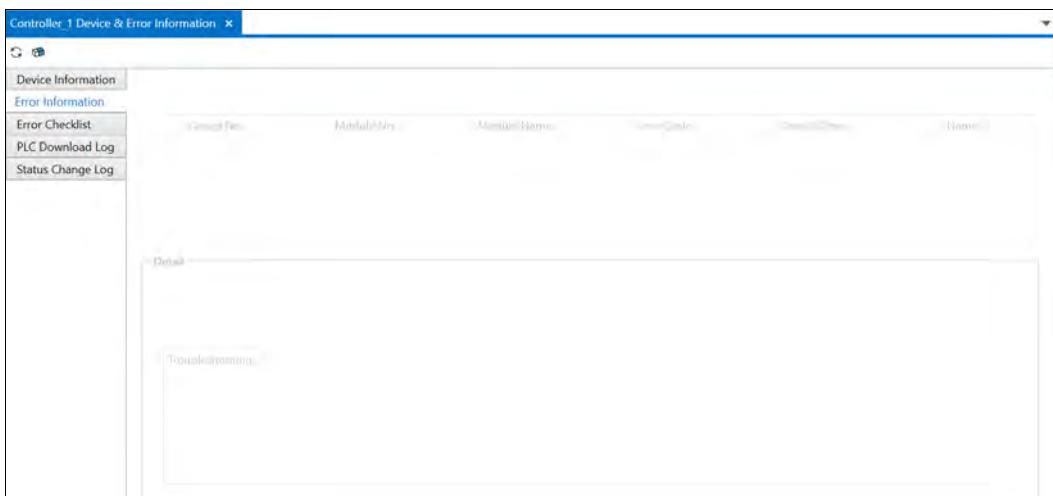


● DIADesigner

(1) Double-click **Device & Error Information** under **Controller** in the project tree.



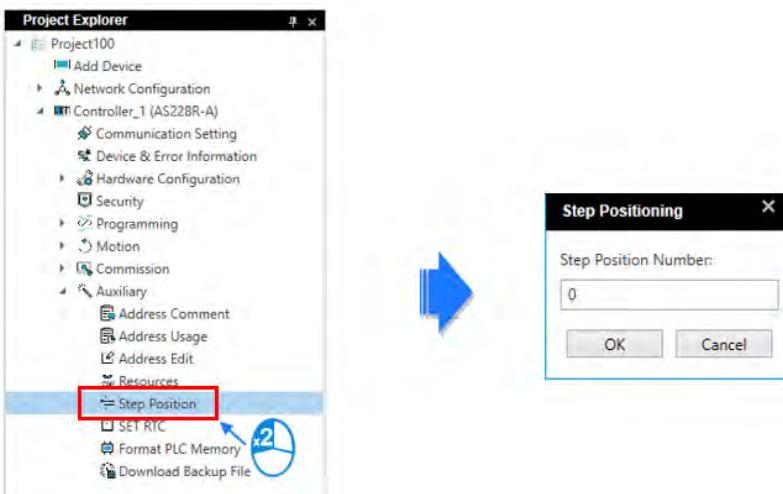
(2) The **Device & Error Information** window appears. Click  to refresh the log and click  to clear the error log in the window and the error log in the CPU module.



- Group No.: Group numbers for errors that occurred.
- Module No.: Module numbers for errors that occurred
- Module name: Module names for errors that occurred
- 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.
- Name: Shows error information.
- Detail: Shows the detailed descriptions for the error.
- Troubleshooting: Shows methods for resolving errors.

(3) If the error that occurred is an exceeding device range error (SM0 = ON), stored in SR0 or is a program syntax error (SM5 = ON), stored in SR4, you can use the following steps to see the problematic step in the program.

- SM0 = ON: Check the value (32-bit) in SR1 to see the latest exceeding device range error in the program.
- SM5 = ON: Check the value (32-bit) in SR5 to see the latest syntax error step in the program.
- After knowing which the problematic step is, go to DIADesigner -> Controller -> Auxiliary -> Step Position and then enter the number of the problematic step, the system will take you to the specified step in the program.



14.2 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.

Note: You can also find error log stored in SR; refer to Chapter 2 in the DVP-ES3/EX3/SV3/SX3 Series Programming Manual for more information.

14.2.1 ERROR LED Indicator 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

14.2.2 ERROR LED Indicator Blinking (0.5 s ON, 0.5 s OFF)

Error Code (16#)	Description	Solution	Flag	Log
000C	The program in the PLC is damaged.	Download the program again.	SM9	V
000D	Initial values for devices and PLC program are not downloaded completely.	Download the program again.	SM9	V
0010	CPU memory is denied.	If the problem persists, contact the local authorized distributors.	SM9	V
0020	CPU execution speed does not reach its maximum speed.	If the problem persists, contact the local authorized distributors.	SM9	V
002E	CPU external memory access is denied.	If the problem persists, contact the local authorized distributors.	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
1000 I 10FF	System error	If the problem persists, contact the local authorized distributors.	-	V

Error Code (16#)	Description	Solution	Flag	Log
1402	The extension module's settings do not match HWCONFIG.	<p>1. Check your I/O module configuration Since the PLC CPU's "I/O Module Configuration Method Selection" is set to manual, it's required that your module quantity and arrangement exactly match the configuration in the CPU. Use DIADesigner to upload the hardware configuration, and check the configuration for consistency.</p> <p>2. If configuration changes If you've altered the configuration, please re-download the hardware configuration. Alternatively, you can switch the CPU's system parameter "I/O Module Configuration Method Selection" to automatic, which will disable the comparison of module quantity and arrangement.</p>	SM10	V
1404	Extension module communication timeout	<p>1. Confirm that the module is connected to the PLC CPU, then power it off and on again.</p> <p>2. If the problem persists, contact the local authorized distributors.</p>	SM10	V
140F	Number of input and output points set in the DIO module exceeds the range.	Check if the total number of inputs and outputs exceeds the limit (ES3/EX3: max 240 points; SV3/SX3: max 480 points).	SM10	V
1410 I 1413	The right-side module cannot be detected.	Check if the right-side module is correctly connected.	SM10	V
1414	The number of modules powered is inconsistent with the the number checked.	When power-on, check if the automatic comparison function is enabled or disabled (SM227), and check the number of extension points and the number of units set in SR1553 to SR1555.	SM10	V
1420	Initialization error on the left-side modules (number of left-side modules exceeds 8 units.)	Check the number of modules.	SM10	V
1421 I 1424	The communication of the left-side module times out or the model name is incorrect.	Check if the module is correctly connected or if the module model is the same as the connected one.	SM10	V
1425	Memory detection error on the left-side module.	Check if the module is correctly connected.	SM10	V
200A	Invalid instruction	Check the program, compile the program again, and download the project to the PLC 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.	-	V

14.2.3 ERROR LED Indicator Blinking Rapidly (0.2 s ON, 0.2 s OFF)

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

14.2.4 ERROR LED Indicator Blinking Slowly (1 s ON, 3 s OFF)

Error Code (16#)	Description	Solution	Flag	Log
0040	The converted value of the built-in AD input channel 1 exceeds the range.	Check the actual input signal.	SM27	H
0041	The converted value of the built-in AD input channel 2 exceeds the range.	Check the actual input signal.	SM27	H
0042	The converted value of the built-in AD input channel 3 exceeds the range.	Check the actual input signal.	SM27	H
0043	The converted value of the built-in AD input channel 4 exceeds the range.	Check the actual input signal.	SM27	H
0044	Current input 4-20 mA mode in the built-in AD input channel 1 is disconnected.	Check the wiring.	SM27	H
0045	Current input 4-20 mA mode in the built-in AD input channel 2 is disconnected.	Check the wiring.	SM27	H
0046	Current input 4-20 mA mode in the built-in AD input channel 3 is disconnected.	Check the wiring.	SM27	H
0047	Current input 4-20 mA mode in the built-in AD input channel 4 is disconnected.	Check the wiring.	SM27	H
1900 - 191C	Heartbeat errors occurred in the slave under CANopen/ECAT mode	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

14.2.5 RUN and ERROR Indicators Blinking Simultaneously (0.5 s ON, 0.5 s OFF)

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.

14.2.6 RUN and ERROR Indicators Blinking Alternately (RUN LED is ON for 0.5 seconds, then ERROR LED is ON for 0.5 seconds, repeating in sequence)

This happens when the CPU module memory card is backing up, restoring, or saving data.

14.2.7 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 maximum number of password attempts has been exceeded on the PLC	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.	<ol style="list-style-type: none"> 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 problem persists, contact the local authorized distributors. 	SM6	V
0051	The latched special data registers are abnormal.	<ol style="list-style-type: none"> 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 problem persists, contact the local authorized distributors. 	SM6	V
0052	The memories in the latched auxiliary relays are abnormal.	<ol style="list-style-type: none"> 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 problem persists, contact the local authorized distributors. 	SM6	V
0054	The latched counters are abnormal.	<ol style="list-style-type: none"> 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 problem persists, contact the local authorized distributors. 	SM6	V
0055	The latched 32-bit counters are abnormal.	<ol style="list-style-type: none"> 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

Error Code (16#)	Description	Solution	Flag	Log
		2. If the problem persists, contact the local authorized distributors.		
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 problem persists, contact the local authorized distributors.	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 problem persists, contact the local authorized distributors.	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
19B0	Heartbeat timeout occurred in the slave mode	Check the CANopen connection cable.	-	V
19B1	The data length of PDO (process data object) in the slave mode is not matched with the setting.	Revise the PDO data length setting in the slave mode and download the setting again.	-	V

Note: For error codes 19E1 to 19E8, refer to the data of SR830 to SR893 (which contain error codes for slaves 1 to 64) to identify the faulty slave station.

19E1	The data length of PDO (process data object) in the slave mode is not matched with the setting of the scan list. Refer to CANopen communication related descriptions in the operation manual for more details on the error codes 19E1 to 19E8.	Revise the PDO data length setting in the slave mode and download the setting again.	-	V
19E2	PDO in the slave mode is not received.	Check if the configurations are correctly set.	-	V
19E3	The function of auto downloading SDO fails at the first startup.	Check if the SDO contents for auto downloading are correct.	-	V
19E4	PDO configurations are set incorrectly.	Make sure to set the PDO configurations correctly.	-	V
19E5	The main settings are not consistent with the connected slave.	Make sure the connected slaves are the ones configured in ISPSof.	-	V
19E6	This slave does NOT exist in this network.	Make sure the power supply of slave is normal and slave is correctly connected to the network.	-	V

Error Code (16#)	Description	Solution	Flag	Log
19E7	Timeout on the slave error control	Make sure the power supply of slave is normal and slave is correctly connected to the network.	-	V
19E8	The node IDs of master and slave are duplicated.	Set the node ID of the master or the slave again and make sure their node IDs are unique.	-	V
19F3	Error in the configuration	1. Download the parameter configuration again. 2. If the problem persists, contact the local authorized distributors.	-	V
19F4	CANopen communication is in the BUS-OFF state.	1. Check if the network cable is normal and the shielded cable is grounded. 2. Check if the start and end of the network cable are both connected with a 121 Ω terminal resistor. 3. Check if all the node devices run at the same baud rate on the network.	-	V
19FB	The sending registers exceed the range.	Revise the time to synchronize (suggested to use a longer time).	-	V
19FC	The receiving registers exceed the range.	Revise the time to synchronize (suggested to use a longer time).	-	V
2001	Not in the right mode for the ASDA-A2 while using the CANopen communication instruction.	1. Check if the operation mode for the built-in CAN function is correct. 2. Check the program for the syntax error step. Modify and compile the program and then download the program again.	SM0	V
2003	The device used in the program exceeds the device range.	Check the syntax error step in the program. Modify and compile the program and then download the program again.	SM0	V
200B	The operand n or the other constant operands K/H exceed the range.		SM0	V
200C	The operands overlap.		SM0	V
200D	The binary to binary-coded decimal conversion is incorrect.		SM0	V
200E	The string does not end with 00.		SM0	V
2012	Incorrect division operation		SM0	V
2013	The value exceeds the range of values that can be represented by the floating-point numbers.		SM0	V
2014	The task designated by the TKON or YKOFF instruction is incorrect or exceeds the range.		SM0	V
2017	The instruction BREAK is written outside of the FOR-NEXT loop.		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 Ethernet IP filter is set incorrectly.	Set the IP filter under Ethernet Port Advance for the CPU module in HWCONFIG again.	SM1108	X

Error Code (16#)	Description	Solution	Flag	Log
600D	RJ45 port is not connected.	Check the cable 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 data address in the email is set incorrectly.	Set up the trigger attachment mode in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Email > Trigger Setting.	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	Incorrect SMTP server address.	Check for the correct address and set up the SMTP server in HWCONFIG by clicking the CPU Module > 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 by clicking the CPU Module > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > TCP Socket.	-	X
6202	The remote communication port set in the TCP socket function is illegal.	1. Check the program and the related special data registers (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > TCP Socket.	-	X

Error Code (16#)	Description	Solution	Flag	Log
6206	The device which receives the data in the TCP socket function is illegal.	1. Check the program and the related special data registers (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > UDP Socket.	-	X
6212	There is no response from the remote device within 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 (SR). 2. Set the Ethernet parameter for the CPU module in HWCONFIG by clicking the CPU Module > Ethernet Port Advanced > Socket > TCP/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

Error Code (16#)	Description	Solution	Flag	Log
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 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 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

Error Code (16#)	Description	Solution	Flag	Log
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 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.		

14.3 Troubleshooting for Other Modules

The error codes and troubleshootings for the modules can be found in the DVP Series Module Manual.

14.4 Error Codes and ERROR LED Indicator States 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

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● LED Indicator State 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 (ON for 0.2 seconds, OFF for 0.2 seconds): unstable power supply or hardware Failure.
		Blinking normally (ON for 0.5 seconds, OFF for 0.5 seconds): system program errors or system cannot run.
	Warning Type	Blinking slowly (ON for 1 second and OFF for 3 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

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
0012	The PLC password is incorrect.	Continue					V
0026	RTC cannot keep track of the current time	Continue					V
002A	24 VDC power supply is not sufficient and then is recovered from low-voltage for less than 10 ms.	Continue		V			
002D	The maximum number of password attempts has been exceeded on the PLC.	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		
1402	The extension module's settings do not match HWCONFIG.	Stop			V		
1404	Extension module communication timeout	Stop			V		
140F	Number of input and output points set in the DIO module exceeds the range.	Stop			V		
1410 I 1413	The right-side module cannot be detected.	Stop			V		
1414	The number of modules powered is inconsistent with the the number checked.	Stop			V		
1420	Initialization error on the left-side module (number of left-side module exceeds 8 units.)	Stop			V		
1421 I 1424	The communication of the left-side module times out or the model name is incorrect.	Stop			V		

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
1425	Memory detection error on the left-side module.	Stop			V		
1800 - 180F	Errors occurred in the extension modules	Continue				V	
1900 - 191C	Heartbeat errors occurred in the slave under CANopen/ECAT mode	Continue				V	
1950	The initialization of the Delta ASD-A2 control has not yet been completed, the CANopen instructions cannot be executed.	Continue					V
19B0	Heartbeat timeout occurred in the slave mode	Continue					V
19B1	The data length of PDO (process data object) in the slave mode is not matched with the setting.	Continue					V
19E1	The data length of PDO (process data object) in the slave mode is not matched with the setting of the scan list. Refer to CANopen communication related descriptions in AS Series Operation Manual for more details on the error codes 19E1 to 19E8.	Continue					V
19E2	PDO in the slave mode is not received.	Continue					V
19E3	The function of auto downloading SDO fails at the first startup.	Continue					V
19E4	PDO configurations are set incorrectly.	Continue					V
19E5	The main settings are not consistent with the connected slave.	Continue					V
19E6	This slave does NOT exist in this network.	Continue					V
19E7	Timeout on the slave error control	Continue					V
19E8	The node IDs of master and slave are duplicated.	Continue					V
19F3	Error in the configuration	Continue					V
19F4	CANopen communication is in the BUS-OFF state.	Continue					V
19FB	The sending registers exceed the range.	Continue					V
19FC	The receiving registers exceed the range.	Continue					V
2001	Not in the right mode for the ASDA-A2 while using the CANopen communication instruction.	Continue					V

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
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
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 data address 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	Incorrect SMTP server address.	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

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
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
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 within 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 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 communication function code in Ethernet is incorrect.	Continue					V
7032	The device communication address used in Ethernet is incorrect.	Continue					V

Error code	Description	CPU status	ERROR LED indicator status				
			ON	Blinking fast	Blinking normally	Blinking slowly	OFF
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
7037	The device checksum for the communication serial port of Ethernet is incorrect.	Continue					V
7041	The 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
C000 - CFFF	The program syntax is incorrect.	Stop			V		



Appendix A Installing a USB Driver

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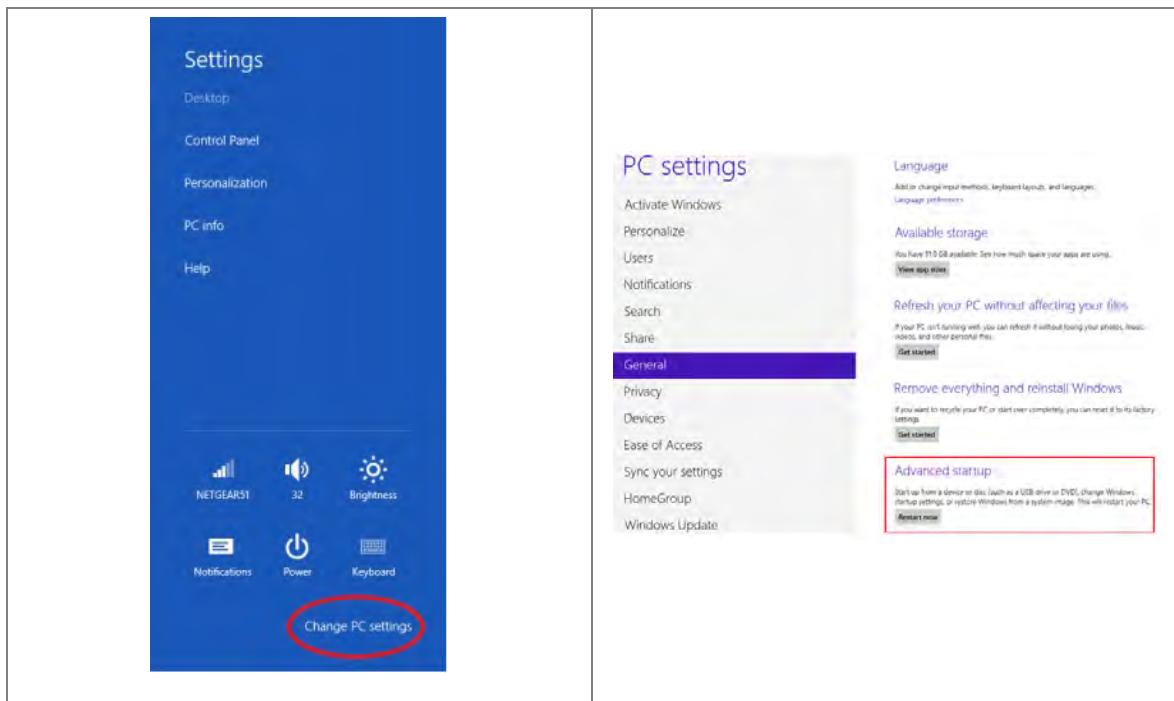
A.1 Disable Driver Signature Enforcement

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. After you disable the driver signature enforcement setting, it returns to its original state once you restart Windows.

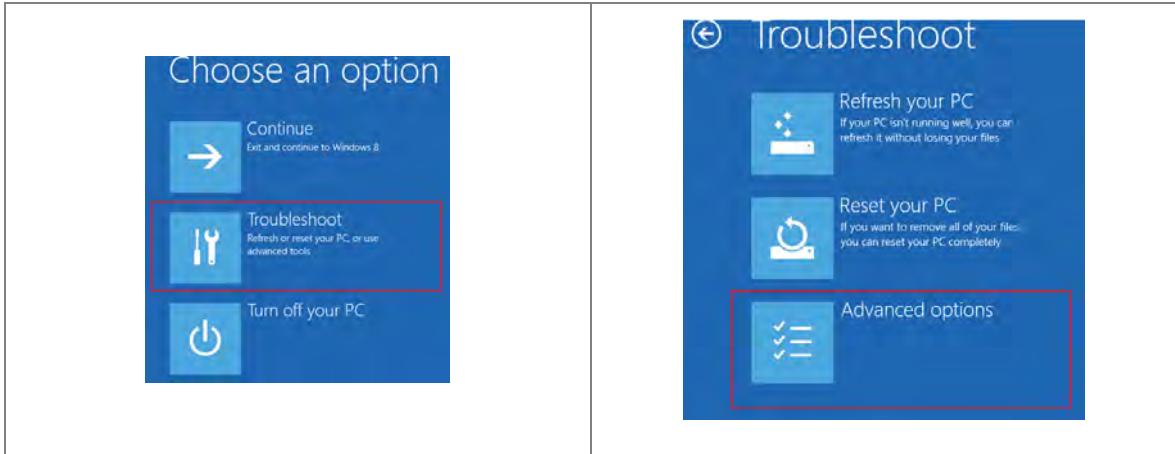
A.1.1 Disable Driver Signature Enforcement in Windows 8

Follow these steps to disable driver signature enforcement in Windows 8.

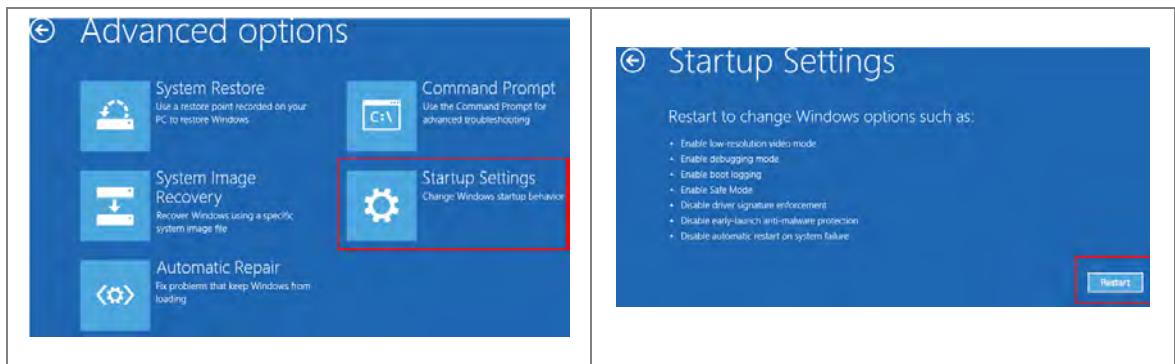
1. Press the Windows button  **【WIN】 + 【I】** on your keyboard to display the **Settings** window. Click **Change PC settings**.
2. The **PC settings** window appears. Click **General** and then click **Restart now** under **Advanced startup**.



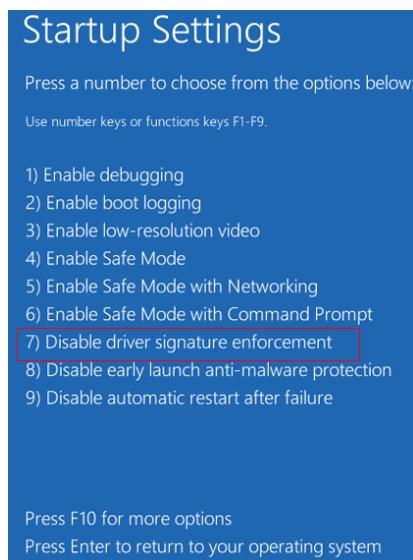
3. After the computer restarts, under **Choose an option**, click **Troubleshoot**. Under **Troubleshoot**, click **Advanced options**.



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. Then you can install the Delta PLC USB driver.

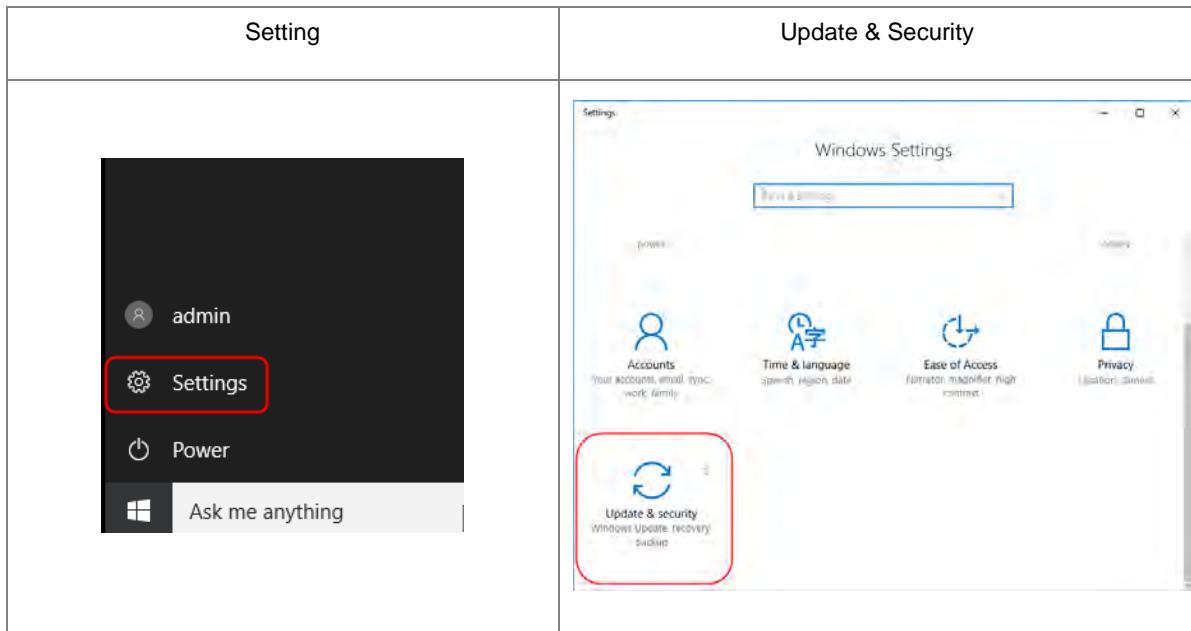


A.1.2 Disable Driver Signature Enforcement in Windows 10

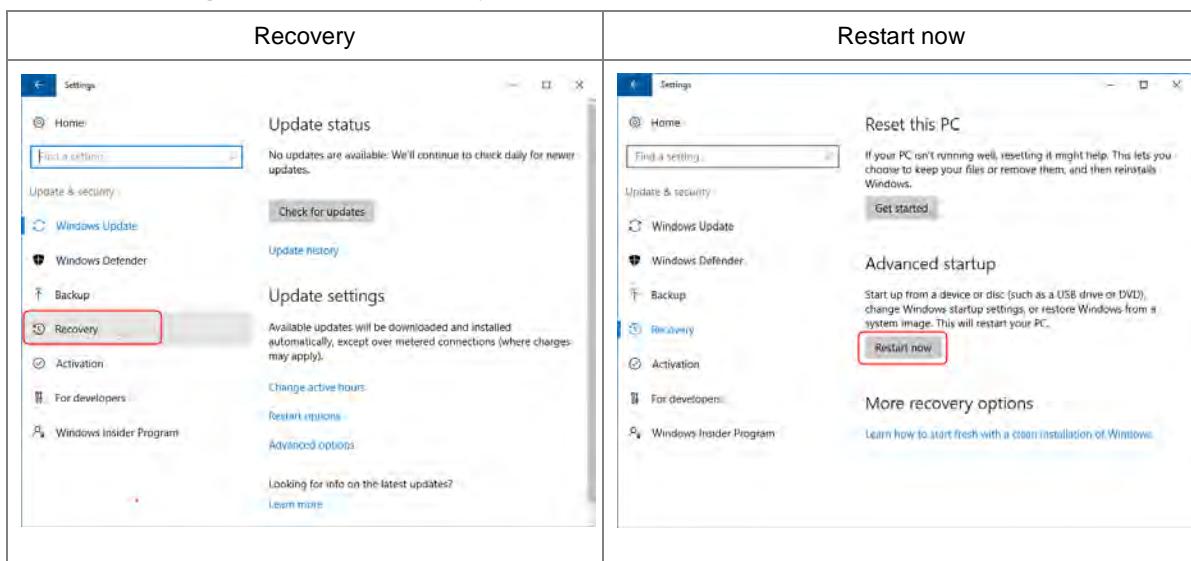
Follow these steps to disable driver signature enforcement in Windows 10.

1. Click the Windows **Start** button and then click **Settings**.

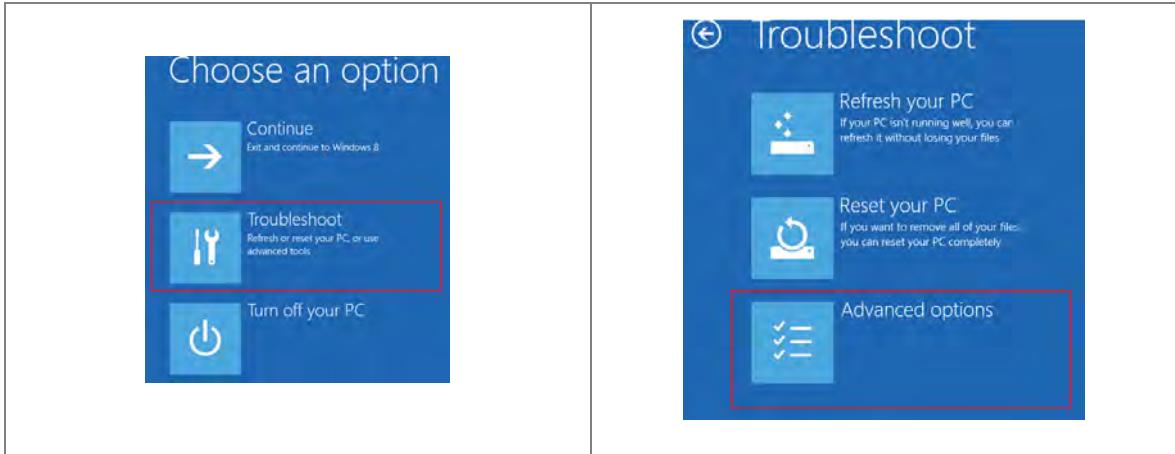
2. In the **Settings** window, click **Update & Security**.



3. In the **Settings** window, click **Recovery**, and then click **Restart now**.

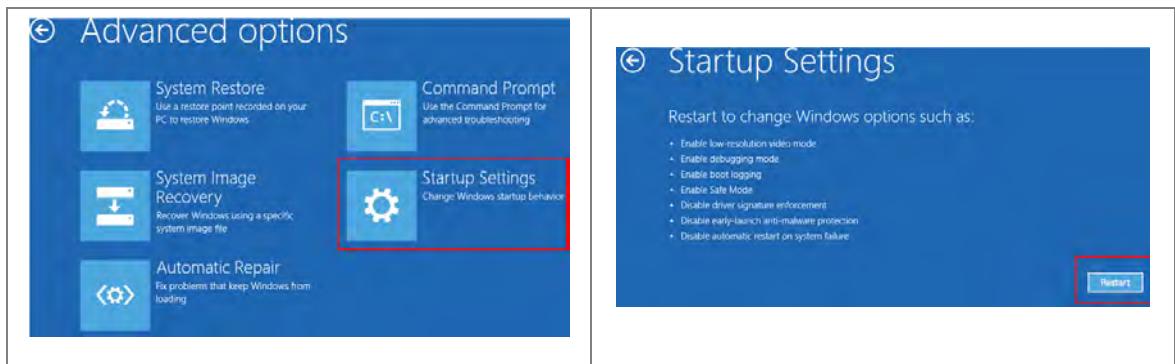


4. After the computer restarts, under **Choose an Option**, click **Troubleshoot**, and then click **Advanced options**.

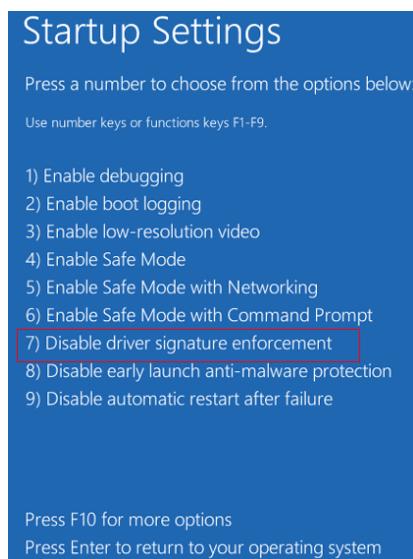


A

5. On the **Advanced options** page, click **Startup Settings**. On the **Startup Settings** page, click **Restart** to restart the computer.



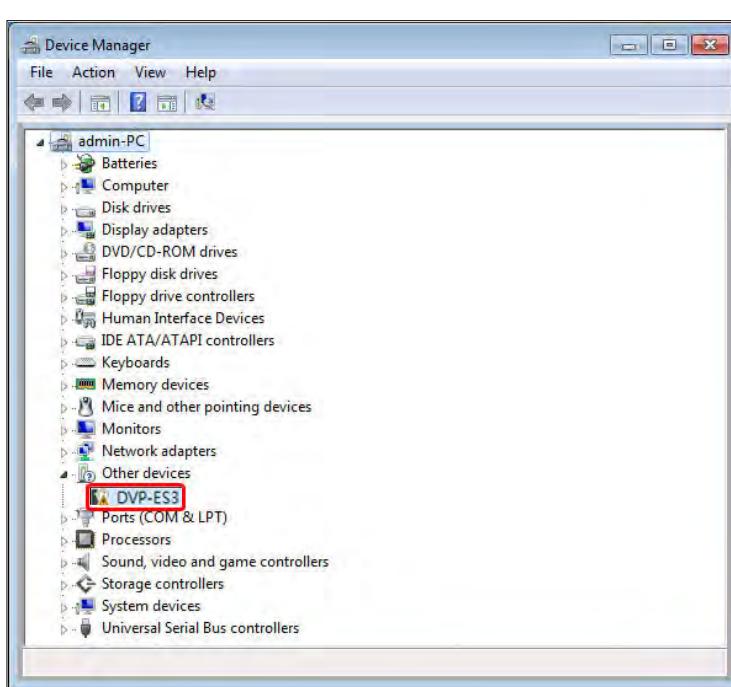
6. On your keyboard, press 7 or F7 to choose **Disable driver signature enforcement**, and the system directs you to the Windows 10 operating system page. Then you can install the Delta PLC USB driver.



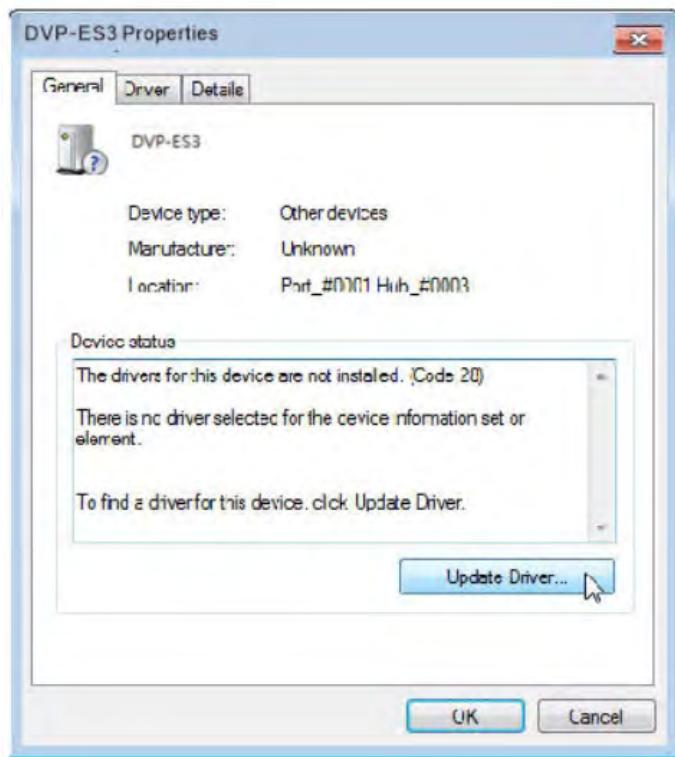
A.2 Installing the USB Driver

This section describes the steps to install the USB driver for a DVP-ES3/EX3/SV3/SX3 Series CPU module on Windows 10. To install the USB driver for a DVP-ES3/EX3/SV3/SX3 Series CPU module on another operating system, refer to the instructions in the operating system for information about installing new hardware. The installation method for the USB driver of the PLC CPU is the same, taking ES3 as an example below.

- (1) 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.
- (2) 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.



(3) In the **DVP-ES3 Properties** dialog box, click **Update Driver.....**



(4) Click **Browse my computer for driver software**.

How do you want to search for driver software?

→ **Search automatically for updated driver software**

Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.

→ **Browse my computer for driver software**

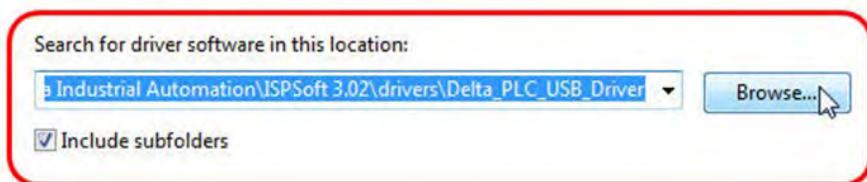
Locate and install driver software manually.

Cancel

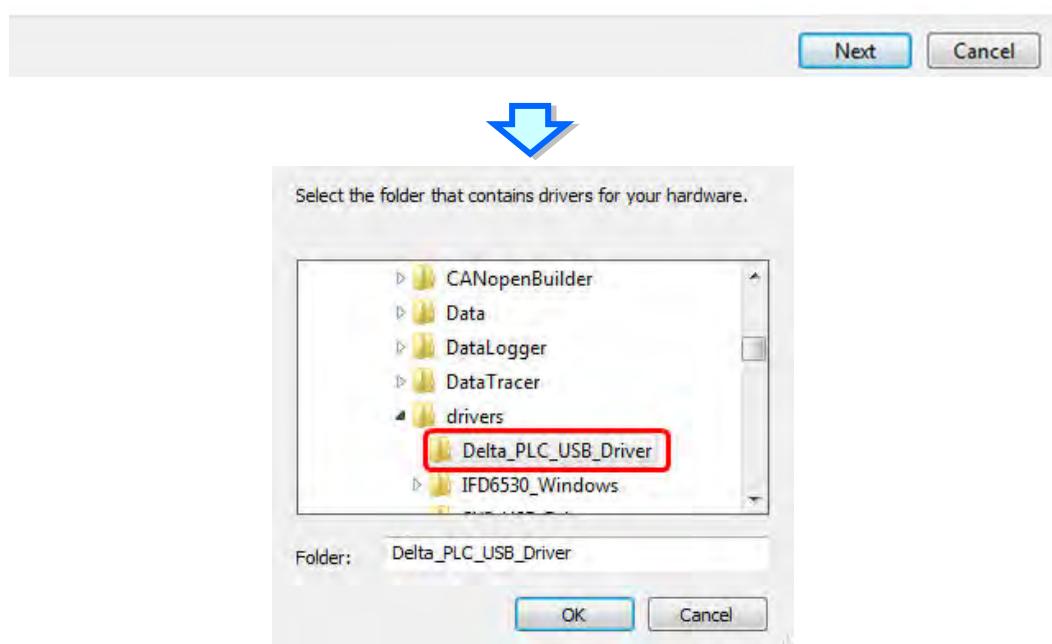
(5) After you install ISPSOFT version 3.18 or later, the driver for the DVP-ES3 Series CPU module is under the folder where you installed ISPSOFT (\drivers\Delta_PLC_USB_Driver\). Enter the path to the driver, or click **Browse** to browse to the correct folder. For DIADesigner, the path to the drives is *DIASTUDIO\DIADesigner\DIADesigner version\drivers\Delta_PLC_USB_Driver*.

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.

B [Browse for driver software on your computer](#)



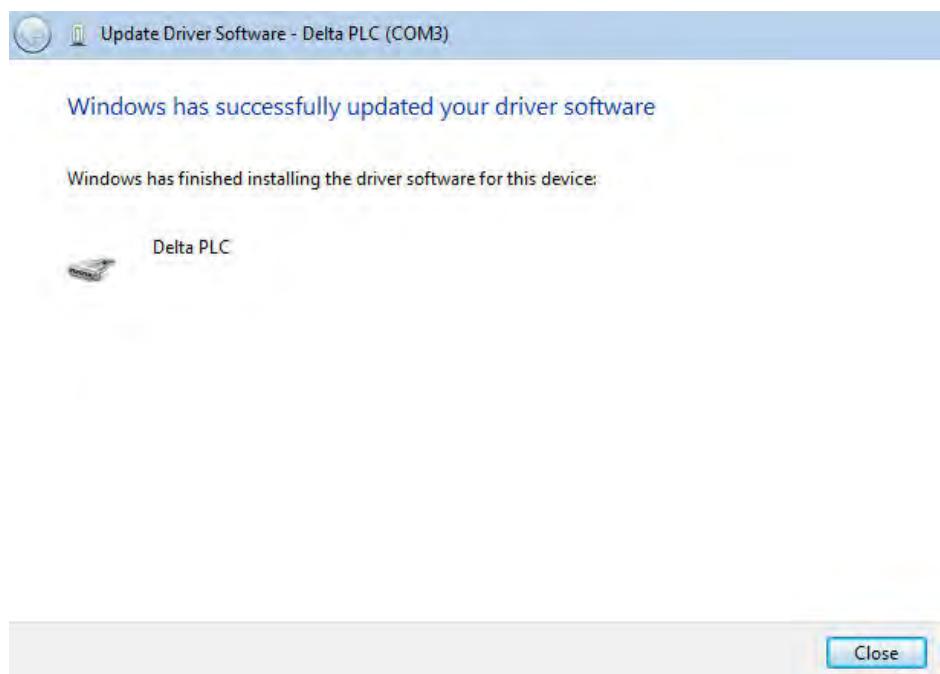
Let me pick from a list of device drivers on my computer
This list will show installed driver software compatible with the device, and all driver software in the same category as the device.



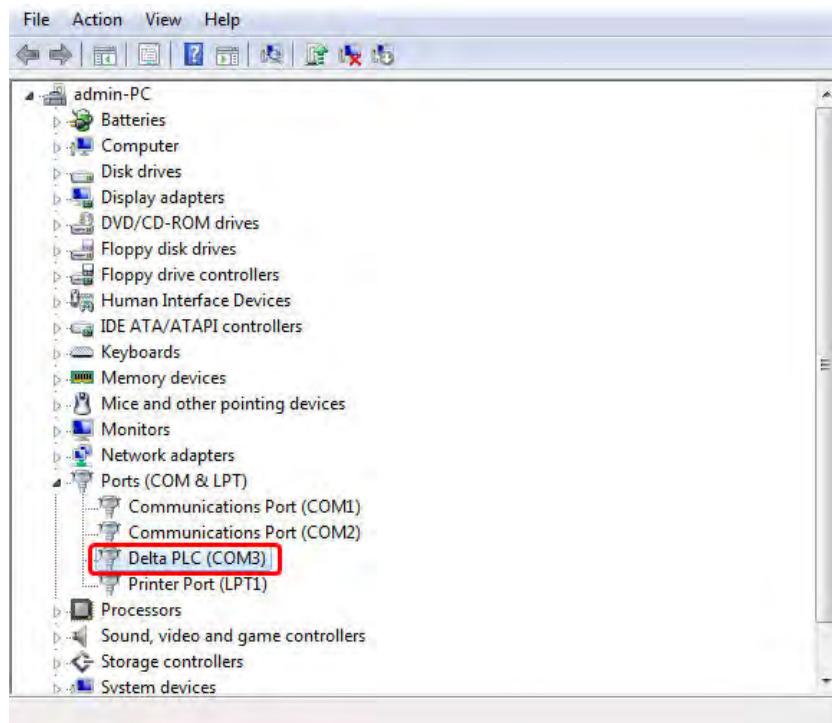
(6) Click **OK**. The system installs the driver. If the **Windows Security** window appears during the installation, click **Install this driver software anyway**.



(7) When the installation completes, click **Close**.



(8) 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.



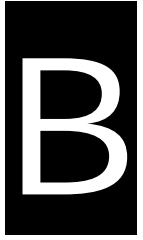
Additional remarks

- 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.

A.3 Notes on Utilizing USB Communication

- Suggested to use USB communication in the following occasions: PLC program upload / download, PLC parameters monitoring, and firmware upgrade.
- Suggested NOT to use USB communication for applications that require long time communication without any connection drop.
- When experiencing connection loss, you can unplug the USB cable and then plug it back in, and try the communication again.
- For the first time USB communication user, you need to install the USB driver for the ES3/EX3/SV3/SX3 Series PLC CPU.
- If the communication is still not working after unplugging and plugging, you need to open the Devices (Windows settings -> Devices) to see if the USB driver is still valid. The USB driver may be lost due to Windows updates. If your USB driver is invalid, install the USB driver again.

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Appendix B Device Addresses

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B.2 Function Codes and Number of Devices Supported for Modbus Protocols	B-3

B.1 Standard Modbus Device Addresses

Device	Type	Format	Device range	Modbus address (Decimal number)	DVP-ES3/EX3/SV3/SX3 Series (Hexadecimal number)
X	Bit	000	X0-X377	124577-124832	6000-60FF
Y	Bit	000	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	SR, D, T, C, HC, E	1-100 words, (1-50 for HC)
04	Read Input Registers	SR, D, T, C, HC, E	1-100 words, (1-50 for HC)
05	Force Single Coil	Y, M, SM, S, T, C, HC	1 bit
06	Preset Single Register	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 Registers	SR, D, T, C, HC, E	1-100 words, (1-50 for HC)
17	Read/Write Multiple Registers	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 ES3/EX3/SV3/SX3 Series System

C.1.1 DVP-ES3/EX3/SV3/SX3 Series System EMC Standards

The EMC standards that are applicable to a DVP-ES3/EX3/SV3/SX3 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 (μ V/m) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB (μ V/m) quasi-peak	
AC power port (conducted)	0.15-0.5 MHz	79 dB (μ V) quasi-peak	IEC 61000-6-4
		66 dB (μ V) average	
	0.5-30 MHz	73 dB (μ V) quasi-peak	
		60 dB (μ V) average	

- **EMS**

Environmental phenomenon	Reference standard	Test		Test level
Electrostatic discharge	IEC 61000-4-2	Contact		\pm 4 kV
		Air		\pm 8 kV
Radio frequency electromagnetic field Amplitude modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	80-1000 MHz	10 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
			60 Hz	30 A/m
			50 Hz	30 A/m

- **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 ES3/EX3/SV3/SX3 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.
- Make sure to ground the control box properly, and avoid insulation caused by the paint on the grounding bolts inside the control box.
- Minimize the gaps in the control box to prevent radio waves from leaking. Use an EMI gasket on the gaps in the control box to suppress radio wave leakage.

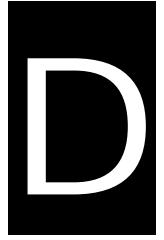
(2) Connecting a power cable and a ground

Connect the PLC system power cable and the ground as described below.

- Users can ground the module at any point on the aluminum rail, as well as at the module's ground terminal.
- 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

- It is recommended to use shielded cables, when connecting digital I/O modules and analog I/O modules including temperature modules.
- Ground the shielding cable at a single point.



Appendix D Maintenance and Inspection

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D.3.1 Periodic Inspection	D-4

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 PLC 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 PLC 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 PLC 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 PLC Series system and heat sources such as coils, heating devices, and resistors.
- To protect a PLC 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 PLC Series system and a controlled element, ensure that the modules are correctly and firmly installed.

D.2 Daily Maintenance

To keep a PLC Series system operating normally, ensure that the ambient environment and the PLC 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 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.
	Power module LED indicator	Check the status of power module	Please refer to its module manual for more information on LED indicators.	Please refer to its module manual for more information on troubleshooting.
	CPU module LED indicator	Check the status of CPU module		
	Extension module LED indicator	Check the status of extension module		

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 PLC Series system conform to the cautions listed in Section D.1, perform the periodic inspection described below. If you find any problems, follow the solution and perform any necessary maintenance.

D.3.1 Periodic Inspection

No.	Item		Inspection	Criterion	Remedy
1	Ambient environment		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 module.	Check the power supply.
3	Installation		Check whether the module is loose.	The module must be installed firmly.	Please refer to its module manual for more information on installing the module.
	Adhesion of dirt	Check the appearance.	Dirt must not be present.		
4	Connection	Looseness of terminal screws	Tighten the screws with a screwdriver.	The screws must not be loose.	Tighten the screws.

No.	Item	Inspection	Criterion	Remedy
	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 troubleshooting section 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.

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