Digitized Automation for a Changing World

DVP Series Module Manual

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DVP Series Module Manual

Revision History

Version	Revision	Date
1st	The first version was published.	2023/11/30
2nd	1.Chapter 1: Updated the voltage value of DVP-S Series digital input modules and added DVPEN02-SL and DVPPN02-SL contents in section 1.1.2. Added Notes on Installation in section 1.3.1. 2.Chapter 12: Deleted control register #47 of DVP02LC-SL in section 12.6.2. Added example for Filtering Mode function in section 12.7.2.4. 3.Chapter 13: Updated information on Master and Slave addresses and details on related quantities. Added description of DVPEN01-SL firmware version in section 13.1.6.8. Added information about DVP-SE2 models in section 13.2.7.1 and section 13.3.1. Added section 13.6 DVPEN02-SL, and section 13.7 DVPPN02-SL. 4.Chapter 14: Updated voltage specifications in section 14.1. Added Installation Precautions in section 14.3.1.	2025/02/21
3rd	1.Chapter 1: Added information about remote IO communication modules RTU-485/RTU-CN01/ RTU-ECAT/RTU-EN01 in section 1.1.2. 2.Chapter 2: Updated voltage specifications in sections 2.1, 2.5.2, 2.5.4, 2.5.7, 2.5.9, 2.5.11, 2.5.13, and 2.5.15, sink/source wiring diagrams in section 2.6.1.1 and the relay output voltage range in section 2.6.2.1. 3.Chapter 7: Updated the weights of all modules and the relay output voltage range in section 7.1, voltage specifications in sections 7.4.5, 7.4.6, 7.4.12, and 7.4.14, sink/source wiring diagrams in section 7.5.1.1, and the relay output voltage range in section 7.5.2.1. 4.Chapter 8: Updated hardware input limit range and Note 1 content in section 8.1.1 5.Chapter 13: Updated introductory information in section 13.3.1, added the CANopen configuration upload function in section 13.3.5.1.6 and SAE J1939 mode in section 13.3.6, and updated the description of CR#71 and contents for point 6 in section 13.5.5. 6.Chapter 15: a new chapter; added DVP-S series remote I/O communication modules.	2025/06/09
4th	1.Chapter 1: Updated the classification in section 1.1.1. Added DVP02DA-S2/DVP06AD-S2/RTU-PN12 models and updated the classification name in section 1.1.2. 2.Chapter 2: Updated the wirings in section 2.6.1.2 to	2025/11/28

Version	Revision	Date
	2.6.1.5. 3.Chapter 3: Added remarks regarding channel disabling for CR#2-CR#5 in section 3.5.1 and 3.5.3. 4.Chapter4: Updated remarks in section 4.1.1 and section 4.1.2. Added remarks regarding channel disabling for CR#2-CR#7 in section 4.5.1 and 4.5.2. 5.Chapter 7: Updated the wirings in section 7.5.1.2 to 7.5.1.6. 6.Chapter 8: Added content regarding DVP02DA-S2/DVP06AD-S2 models. 7.Chapter 9: Added remarks regarding channel disabling for CR#1 in section 9.4.1 and 9.4.2. Added remarks regarding channel disabling for CR#1-CR#4 in section 9.4.3. Added remarks regarding channel disabling for CR#11 in section 9.5.1.4. 8.Chapter 11: Added remarks regarding channel disabling for CR#2-CR#5 in section 11.4.1. 9.Chapter 13: Added content regarding firmware version 1.00 and later of DVPEN02-SL in section 13.6.1.1. Revised the content on communication features to work with DVP 2nd and 3rd generation PLCs; added EIP Adapter/MQTT Client specifications in section 13.6.1.2. Updated CR#46/CR#96-CR#98/CR#101-CR#102/CR#108-CR#110/CR#114 in section 13.6.5. Added SE2/SV2 models in section 13.6.6. Added detailing the functional description for DVPEN02-SL working with DVP 3rd generation PLCs in section 13.6.7. Updated troubleshooting steps for error code 0x1616 in section 13.6.9.4. Added warning codes 0x1821/0x1833/0x1834/0x1862/0x1869/0x186A/0x1872 in section13.6.9.5. Added status error codes for MODBUS TCP data exchange table in section 13.6.9.6. Updated web page password requirements in section 13.6.10.1. Added FreeRTOS and MbedTLS License Declaration in section 13.6.11. Updated linear and star topology diagrams in section 13.7.4.3. 10.Chapter 15: Added content regarding the special modules DVP02DA-S2 and DVP06AD-S2 in section 15.2.1.4 and 15.3.1.3. Added section 15.5 RTU-PN12. 11.Added Appendix A: EMC Standards.	

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Chapter 1 Introduction

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1.1 Introduction

The manual covers the usage instructions for special modules in the DVP-E (DVP-ES3/EX3/ES2/EX2) series and DVP-S (DVP-SV3/SX3/SV2/SX2/SA2/SS2/SE/SE2) series. This includes analog modules, temperature measurement modules, load cell modules, communication modules, etc. For specific details about the special modules in the DVP-EH series, please refer to the detailed installation manuals for each module.

1.1.1 DVP-E Series Modules

Classification	Model name	Description
Digital I/O module	DVP08XM211N	8-point input, 24 VDC, 5 mA
	DVP08XP211R	4-point input, 24 VDC, 5 mA 4-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP08XP211T	4-point input, 24 VDC, 5 mA 4-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
	DVP08XN211R	8-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP08XN211T	8-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
	DVP16XM211N	16-point input, 24 VDC, 5 mA
	DVP16XP211R	8-point input, 24 VDC, 5 mA 8-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP16XP211T	8-point input, 24 VDC, 5 mA, 8-point input 8-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
	DVP16XN211R	16-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP16XN211T	16-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
	DVP24XP200R	16-point input, 24 VDC, 5 mA 8-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP24XP200T	16-point input, 24 VDC, 5 mA 8-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
	DVP24XN200R	24-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP24XN200T	24-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
	DVP32XP200R	16-point input, 24 VDC, 5 mA 16-point relay output, 250 VAC, 30 VDC or below, 2 A/output, 5 A/COM
	DVP32XP200T	16-point input, 24 VDC, 5 mA 16-point transistor output (sinking), 5 to 30 VDC, 0.5 A/output, 4 A/COM
Analog I/O module	DVP04AD-E2	4-channel analog signal input 14-bit resolution: -5 to +5 V, -10 to +10 V, -20 to +20 mA 13-bit resolution: 0/4 to 20 mA conversion time: 400 μs/channel
	DVP02DA-E2	2-channel analog signal output 14-bit resolution: -10 to 10V, 0 to 20 mA, 4 to 20 mA conversion time: 400 μs/channel
	DVP04DA-E2	4-channel analog signal output 14-bit resolution: -10 to 10V, 0 to 20 mA, 4 to 20 mA conversion time: 400 μs/channel

Classification	Model name	Description
	DVP06XA-E2	4-channel analog signal input 14-bit resolution: -5 to +5 V, -10 to +10 V, -20 to +20 mA 13-it resolution: 0/4 to 20 mA conversion time: 400 μs/channel 2-channel analog signal output 14-bit resolution: -10 to 10 V, 0 to 20 mA, 4 to 20 mA conversion time: 400 μs/channel
Temperature measurement module	DVP04PT-E2	4-channel 3-wire or 2-wire RTD temperature sensing. Sensor type: Pt100, Pt1000, Ni100, Ni1000, 0 to 300 Ω, 0 to 3000 Ω resolution: 0.1ºC/0.1ºF (16-bit) conversion time: 200 ms/channel Equipped with PID temperature control
	DVP06PT-E2	6-channel 3-wire or 2-wire RTD temperature sensing. Sensor type: Pt100, Pt1000, Ni100, Ni1000, Cu50, Cu100, 0 to 300 Ω, 0 to 3000 Ω, JPt100, LG-Ni1000 resolution: 0.1ºC /0.1 ºF (16-bit) conversion time: 200 ms/channel Equipped with PID temperature control
	DVP04TC-E2	4-channel thermocouple temperature sensing Sensor type: J, K, R, S, T, E, N or -80 to +80mV resolution: 0.1ºC /0.1 ºF (16-bit converter) conversion time: 200 ms/channel Equipped with PID temperature control
Positioning module	DVP02PU-E2	2-axis positioning control. 5 to 24 VDC, one set of (A/B/Z phase) differential input, hardware input bandwidth up to 200 kHz. 24 VDC, 5 mA, 5-point input, hardware input bandwidth up to 1 kHz. 5 VDC, 2-axis (4 points) differential output, highest output frequency of 200 kHz
Extension cable interface module	DVPAEXT01-E2	Extension of I/O module usage

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1.1.2 DVP-S Series Modules

Classification	Model name	Description
Digital I/O module	DVP06SN11R	6-point relay output, 250 VAC/30 VDC or below, 6 A/output
	DVP08SN11R	8-point relay output, 250 VAC/30 VDC or below, 1.5 A/output, 5 A/COM
	DVP08SN11T	8-point transistor output (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	16-point transistor output (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
	DVP08SP11R	4-point input, 24 VDC, 4.2 mA 4-point relay output, 250 VAC, 30 VDC or below, 1.5 A/output, 5 A/COM
	DVP08SP11T	4-point input, 24 VDC, 4.2 mA 4-point transistor output (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
	DVP08SM11N	8-point input, 24 VDC, 4.2 mA
	DVP08SM10N	8-point input, 85 to 132 VAC (50 to 60 Hz), 9.2 mA (10 VAC/60 Hz)
	DVP08SN11TS	8-bit transistor output (sourcing), 30 VDC, 55°C 0.3 A/output, 2 A/COM
	DVP08ST11N	8-point input (DIP switch)
	DVP16SP11R	8-point input, 24 VDC, 4.2 mA 8-point relay output, 250 VAC/30 VDC or below, 1.5 A/output, 5 A/COM
	DVP08SP11TS	4-point input, 24 VDC, 4.2 mA 4-bit transistor output (sourcing), 30 VDC, 55°C 0.3 A/output, 2 A/COM
	DVP16SP11T	8-point input, 24 VDC, 4.2 mA 8-point transistor output (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
	DVP16SP11TS	8-point input, 24 VDC, 4.2 mA 8-bit transistor output (sourcing), 30 VDC, 55°C 0.3 A/output, 2 A/COM
	DVP16SN11TS	16-bit transistor output (sourcing), 30 VDC, 55°C 0.3 A/output, 2 A/COM
	DVP16SM11N	16-point input, 24 VDC, 4.2 mA
	DVP32SN11TN	32-point transistor output (sinking), 5 to 30 VDC, 0.1 A/output, 55°C 1.0 A/COM, 25°C 2.2 A/COM
	DVP32SM11N	32-point input, 24 VDC, 4.2 mA
Analog I/O module	DVP04AD-S2	4-channel analog signal input (Differential mode) 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 signal output 12-bit resolution: 0 to 10V, 2 to 10V, 0 to 20 mA, 4 to 20 mA conversion time: 3 ms/channel

Classification	Model name	Description
	DVP06XA-S2	4-channel analog signal input (Differential mode) 12-bit resolution: -10 to 10V, -6 to 10V 11- bit resolution: -20 to 20 mA, -12 to 20 mA conversion time: 3 ms/channel 2-channel analog signal output 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 DVP02DA-S2	2-channel analog signal output 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 DVP06AD-S2	6-channel analog signal input (Single-ended mode) 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 signal input (Differential mode) 16-bit resolution: -10 to 10 V, -5 to 5 V, -20 to 20 mA 15-bit resolution: 0 to 2 us 0 mA, 4 to 20 mA conversion time: 250 /channel
	DVP04DA-SL	4-channel analog signal output 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 us/channel
Left-side high-speed load cell module	DVP201LC-SL	one set of Load cell 24- bit resolution Measurement range: 0 to 80 mV/V Built-in RS-485 communication port, capable of standalone operation.
	DVP211LC-SL	one set of Load cell 24-bit resolution Measurement range: 0 to 80 mV/V Built-in I/O point control: 2DI/4DO/1AO Built-in RS-485 communication port, capable of standalone operation.
	DVP202LC-SL	two sets of Load cell 24-bit resolution Measurement range: 0 to 80 mV/V Built-in RS-485 communication port, capable of standalone operation.
	DVP02LC-SL	two sets of Load cell 20-bit resolution Measurement range: 0 to 6 mV/V
	DVP01LC-SL	one set of Load cell 20-bit resolution Measurement range: 0 to 6 mV/V

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Classification	Model name	Description
Temperature measurement module	DVP04PT-S	4-channel 3-wire or 2-wire RTD temperature sensing. Sensor type: Pt100, Pt1000, Ni100, Ni1000, LG-Ni1000, Cu100, Cu50, 0 to 300 Ω, 0 to 3000 Ω resolution: 0.1ºC/0.18ºF conversion time: 200 ms/channel Equipped with PID temperature control
	DVP06PT-S	6-channel 3-wire or 2-wire RTD temperature sensing. Sensor type: Pt100, Pt1000, Ni100, Ni1000, LG-Ni1000, Cu100, Cu50, 0 to 300 Ω, 0 to 3000 Ω resolution: 0.1ºC /0.18ºF conversion time: 160 ms/channel
	DVP04TC-S	4-channel thermocouple temperature sensing Sensor type: J, K, R, S, T resolution: 0.1ºC /0.18ºF conversion time: 200 ms/channel Equipped with PID temperature control
	DVP08NTC-S	8-channel thermistor (NTC) temperature sensor input. Sensor type: Pt1000, Ni1000, LG-Ni1000, CTN10K, CTN100K, NTC20K, NTC30K, PT-42H, PT-43, PT-51F, PT-25E2, PT-312, KTY81, two self-filled forms resolution: 0.1°C
	DVP02TUN-S	2-point universal analog input: 0 to 10V, 0 to 20 mA, 4 to 20 mA thermocouple: J, K, R, S, T, E, N, B , C, L, U, TXK (L), PLII input impedance: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 resolution: 16-bit, Sensor 0.1°C 4-point transistor output (sinking): 24 VDC/300 mA Output points: PID control/ manual control.
	DVP02TUR-S	2-point universal analog input: 0 to 10V, 0 to 20 mA, 4 to 20 mA thermocouple: J, K, R, S, T, E, N, B, C, L, U, TXK (L), PLII input impedance: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 resolution: 16-bit, Sensor 0.1°C 4-point relay output: 240 VAC/2 A Output points: PID control/ manual control.
	DVP02TUL-S	2-point universal analog input: 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 input impedance: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 resolution: 16-bit, Sensor 0.1°C 2-point analog output, 12-bit resolution: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Output points: PID control/manual control.

Classification	Model name	Description
Temperature measurement module	DVP02TKN-S	2-point universal analog input: 0 to 10V, 0 to 20 mA, 4 to 20 mA thermocouple: J, K, R, S, T, E, N, B , C, L, U, TXK (L), PLII input impedance: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 resolution: 16-bit, Sensor 0.1°C 4 -point transistor output (sinking): 24 VDC/300 mA Output points: PID control/manual control.
	DVP02TKR-S	2-point universal analog input: 0 to 10V, 0 to 20 mA, 4 to 20 mA thermocouple: J, K, R, S, T, E, N, B , C, L, U, TXK (L), PLII input impedance: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 resolution: 16-bit, Sensor 0.1°C 4 -point relay output: 240 VAC/2 A Output points: PID control/ manual control.
	DVP02TKL-S	2-point universal analog input: 0 to 10V, 0 to 20 mA, 4 to 20 mA thermocouple: J, K, R, S, T, E, N, B , C, L, U, TXK (L), PLII input impedance: Pt100, JPt100, Pt1000, Cu50, Cu100, Ni100, Ni120, Ni1000, LG-Ni1000 resolution: 16-bit, Sensor 0.1°C 2-point analog output, 12-bit resolution: 0 to 10 V, 0 to 20 mA, 4 to 20 mA Output points: PID control/ manual control.
Positioning module	DVP01PU-S	Single-axis 200 kHz positioning control expansion module
Left-side positioning module	DVP02PU-SL	2-axis positioning control. 5 to 24 VDC, one set of (A/B/Z phase) differential input, Hardware input bandwidth up to a maximum of 1 kHz 24 VDC, 5 mA, 5-point input, Hardware input bandwidth up to a maximum of 1 kHz 5 VDC, 2-axis (4 points) differential output, maximum output frequency of 200 kHz
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 station module, 500 Kbps
	DVPCOPM-SL	CANopen master station module, 1 Mbps
	DVPPF02-SL	PROFIBUS DP slave station module, 12 Mbps
	DVPSCM12-SL	RS-485/RS-422 serial communication module, 460 Kbps
	DVPSCM52-SL	BACnet MS/TP slave station module, 460 Kbps

Classification	Model name	Description
Remote I/O communication module	RTU-485	RTU-485 remote I/O communication module, with DVP-S series I/O modules connected on its right side
	RTU-CN01	CANopen remote I/O communication module, with DVP-S series I/O modules connected on its right side
	RTU-ECAT	EtherCAT remote I/O communication module, with DVP-S series I/O modules connected on its right side
	RTU-EN01	Ethernet remote I/O communication module, with DVP-S series I/O modules connected on its right side
	RTU-PN12	PROFINET remote I/O communication module, with DVP-S series I/O modules connected on its right side

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1.2 Specification

1.2.1 General Specification

Item	Specification
Operating environment temperature	0 to 55°C
Storage environment temperature	DVP-E Series: -40 to 70°C DVP-S Series: -25 to 70°C
Operating environment humidity	5 to 95%, non-condensing
Storage environment humidity	5 to 95%, non-condensing
Working environment	No corrosive gases present.
Installation location	Inside the control box (indoor use only)
Pollution degree	2
OVC level (Overvoltage category)	OVC II
Protection rating	IP20 (Not UL certified)
EMC regulation	Please refer to Appendix A
Vibration resistance	Tested with: 5 Hz ≦ f ≦ 8.4 Hz, constant amplitude 3.5 mm 8.4 Hz ≦ f ≦ 150 Hz, constant acceleration 1 g Duration of oscillation: 10 sweep cycles per axis on each direction of the 3 mutually perpendicular axes International standard specifications IEC 61131-2 & IEC 60068-2-6 (TEST Fc)
Impact	Tested with: Half-sine wave Strength of shock 15 g peak value, 11 ms duration; Shock direction: The shocks in each in direction per axis, on 3 mutually perpendicular axes (total of 18 shocks) International standard specifications IEC 61131-2 & IEC 60068-2-27 (TEST Ea)
Safety regulations	IEC 61131-2, UL 61010-2-201, UL 508
Applicable atmospheric pressure	Operating: 1013 to 795 hPa (Equivalent to an altitude of 0 to 2000 meters above sea level) Storage: 1013 to 660 hPa (Equivalent to an altitude of 0 to 3500 meters above sea level)
Enclosure fire protection rating	UL94V-0

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1.3 Installation Before Operation

1.3.1 Notes on Installation

- EN: System integrators shall be responsible for assembly of the control system and the safety of the system integration.

  FR: Lors de l'installation, la sécurité de tout système incorporant l'équipement est de la responsabilité de l'intégrateur du système.

- EN: 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.

  FR: Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la sécurité d'utilisation de l'équipement peut être compromise.

- EN: 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. (Not applicable to UL508 models.)

  FR: Veuillez-vous assurer d'utiliser une alimentation électrique certifiée avec une sortie SELV (Safety Extra Low Voltage) ou une alimentation certifiée fournissant une double isolation évaluée selon les normes UL 62368/UL60950 LPS (Source d'alimentation limitée), ou UL61010-1 et UL61010-2-201 (Énergie limitée). (Not applicable to UL508 models.)

- EN: Use only a clean, dry, and soft cloth to clean this module.

  FR: Utilisez un chiffon sec pour nettoyer le produit.

- EN: Before a module is installed, please make sure of the size of the module. To ensure sufficient installation space, you must consider the size of the communication cable connector and the room which needs to be reserved.

  FR: Avant d'installer un module, veuillez vous assurer de sa taille. Pour garantir un espace d'installation suffisant, vous devez tenir compte de la taille du connecteur du câble de communication et de la place qui doit être réservée.

- EN: Make sure that the work environment conforms to the specifications for the products. It is necessary to consider basic temperature/humidity control and dust/corrosion prevention.

  FR: Veillez à ce que l'environnement de travail soit conforme aux spécifications des produits. Il est nécessaire de contrôler la température et le taux d'humidité ainsi que l'absence de poussière et de produits corrosifs.

- EN: Electromagnetic interference can result in system malfunction. Therefore, you must design the EMC carefully. Please refer to Appendix A in this manual for more information on EMC standards.

  FR: Les interférences électromagnétiques peuvent entraîner un dysfonctionnement du système. C'est pourquoi vous devez étudier la CEM avec soin. Veuillez vous référer à l'annexe A de ce manuel pour plus d'informations sur les normes CEM.

- EN: If components such as screws and washers are specified in the manual, use components conforming to the specifications.

  FR: Si des composants tels que des vis et des rondelles sont spécifiées dans le manuel, n'utilisez que des composants conformes aux spécifications.

- EN: If a cable is connected to a communication port, make sure the cable connector is properly joined to the port on the module.

  FR: En cas d'utilisations d'un port de communication, assurez-vous que le connecteur du câble soit correctement raccordé au port du module.

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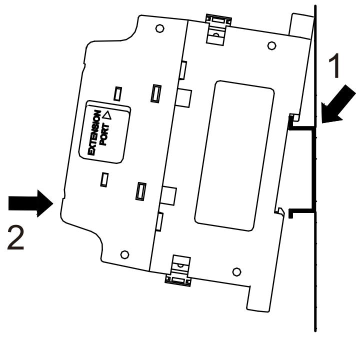
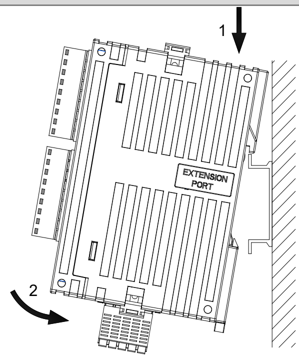
- EN: This product is an OPEN TYPE module and therefore should be installed in an enclosure free of airborne dust, humidity, electric shock, and vibration. The enclosure should prevent non-maintenance staff from operating the device (e.g., key, or specific tools are required for operating the enclosure) in case danger and damage on the device may occur.
  FR: Ce produit est un module de TYPE OUVERT et doit donc être installé dans une enceinte exempte de poussière en suspension, d'humidité, de chocs électriques et de vibrations. L'enceinte doit empêcher le personnel non qualifié d'utiliser l'appareil (par exemple, une clé ou des outils spécifiques sont nécessaires pour ouvrir l'enceinte.) afin d'éviter tout danger et dommage à l'appareil.

1.3.2 Module Installation

The installation methods for the module are illustrated as follows:

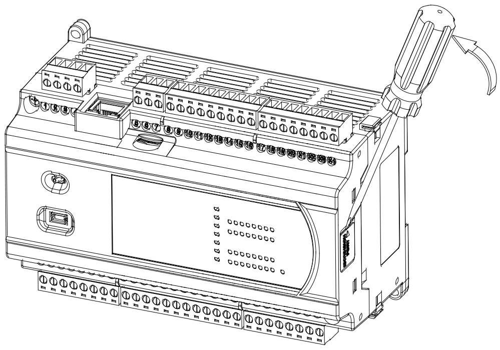
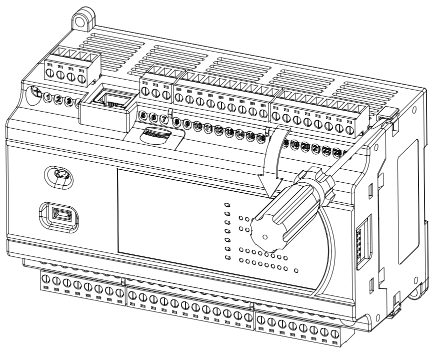
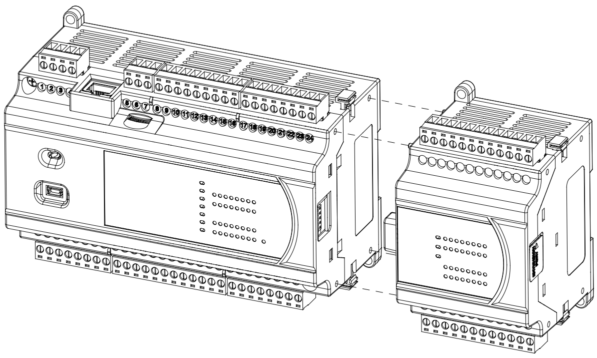
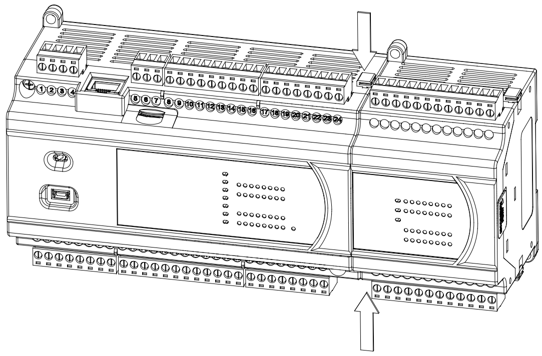
1. **Direct Screw Locking Method**: Please use M4 screws according to the product dimensions for direct locking.
2. **Installation on DIN Rail**: During installation, hang the groove at the back of the module in the direction of arrow 1 onto the aluminum rail. Press it down in the direction of arrow 2 until you hear a click sound, indicating the completion of the installation.

   To remove the module, use a flathead screwdriver to pry open the fixed plastic piece first, then lift and pull the module out in an upward direction.

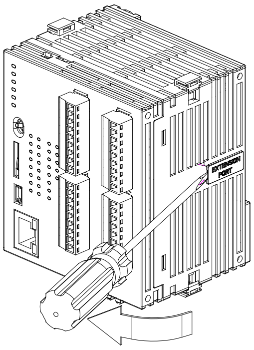
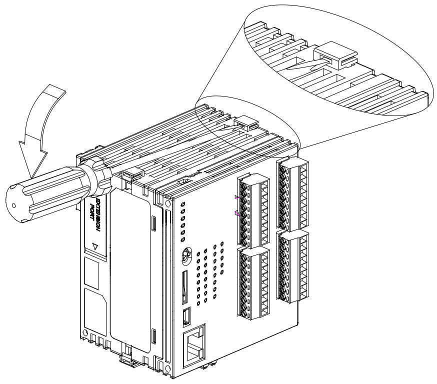
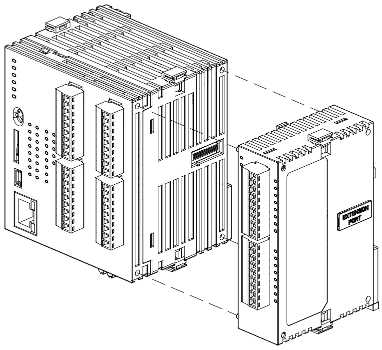
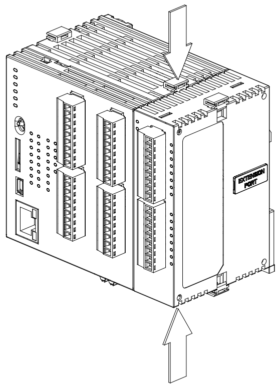
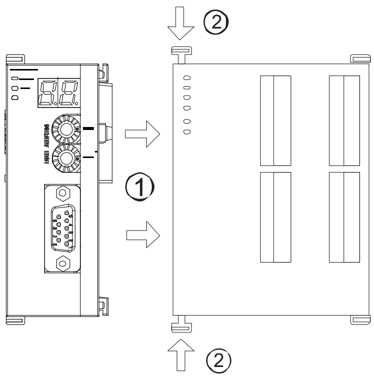
DVP-E Series	DVP-S Series
	

1.3.3 Connection and Installation of the PLC and Modules

1.3.3.1 Connection and Installation of DVP-E Series PLC and Modules

Step One: Use a flathead screwdriver to open the module connector port cover on the side of the PLC.	Step Two: Use a flathead screwdriver to pry open the locking tab of the I/O module.
	
Step Three: Connect the PLC I/O module connector port with the module connector port.	Step Four: Press the upper and lower locking tabs of the I/O module in the direction of the arrow to secure the modules in place.
	

1.3.3.2 Connection and Installation of DVP-S Series PLC and Modules

Step One: Use a screwdriver to open the expansion side cover, revealing the expansion module connection interface.	Step Two: Use the screwdriver to flip the expansion module locking tab upwards.
	
Step Three: Align the positioning holes of the host and the expansion module, then connect the host's expansion module interface with the expansion module. At this point, the PLC and the expansion module are tightly coupled.	Step Four: Press the expansion module locking tab downward to secure it, completing the assembly with the host system.
	
Note: The connection and installation method of the host with the left-side modules are the same as the installation with the right-side modules described above, as shown in the following diagram.	
	

1.4 Wiring

1.4.1 Notes on Wiring

- EN: During installation or wiring, it is imperative to ensure that all external power sources are switched off. Failure to turn off all power sources may result in electric shock to users or damage to the product.

  FR : Lors de l'installation ou du câblage, il est impératif de s'assurer que toutes les sources d'alimentation externes soient éteintes. Le non-respect de cette consigne pourrait entraîner un risque de choc électrique pour les utilisateurs ou des dommges au produit.

- EN: After completing the installation or wiring, when powering on or operating the module, it is essential to confirm the correct installation of the module terminal cover. Failure to do so may lead to electric shock or operational errors.

  FR: Une fois l'installation ou le câblage terminé, lors de la mise sous tension ou de l'utilisation du module, il est essentiel de vérifier que le capot terminal du module est correctement installé. Ne pas le faire pourrait entraîner un risque de choc électrique ou des erreurs opérationnelles.

- EN: The (Protective Ground) / (Functional Ground) terminals must be grounded using protective grounding conductors. Failure to do so may result in electric shock or operational errors.

  FR : Les bornes (Protective Ground) / (Functional Ground) doivent être mises à la terre à l'aide de conducteurs de mise à la terre de protection. Ne pas le faire pourrait entraîner un risque de choc électrique ou des erreurs opérationnelles.

- EN: When wiring the PLC, check the rated voltage and terminal configuration defined in the product specifications to ensure correct and safe wiring. Connecting an incorrect power supply or improperly wiring the product contrary to the rated values may pose risks such as fire or damage.

  FR: Lors du câblage du PLC, vérifiez la tension nominale et la configuration des bornes définies dans les spécifications du produit pour garantir un câblage correct et sûr. Connecter une alimentation incorrecte ou câbler le produit de manière contraire aux valeurs nominales peut entraîner des risques tels que l'incendie ou des dommages.

- EN: External wiring configurations should be carried out using dedicated tools for bending, welding, and proper soldering. Poor wiring configurations may lead to short circuits, fires, or operational errors.

  FR: Les configurations de câblage externe doivent être réalisées à l'aide d'outils dédiés pour le pliage, la soudure et un soudage approprié. Des configurations de câblage médiocres peuvent entraîner des courts-circuits, des incendies ou des erreurs opérationnelles.

- EN: It is crucial to ensure that each module is free of foreign objects such as iron filings or wiring residues. These foreign objects may cause fires, damage, or operational errors.

  FR: Il est crucial de s'assurer que chaque module est exempt de corps étrangers tels que des li mAilles de fer ou des résidus de câblage. Ces objets étrangers peuvent provoquer des incendies, des dommages ou des erreurs opérationnelles

1.4.2 DVP-E Series

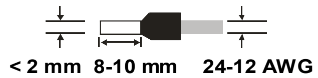
1. Module Wiring

(1) Definitions of Two-Wire, Three-Wire, and Four-Wire Configurations

- Two-Wire, Three-Wire (Passive Sensors): The sensor shares a power circuit with the system.
- Four-Wire (Active Sensors): The sensor utilizes an independent power supply and is recommended not to share the power circuit with the system.

(2) 

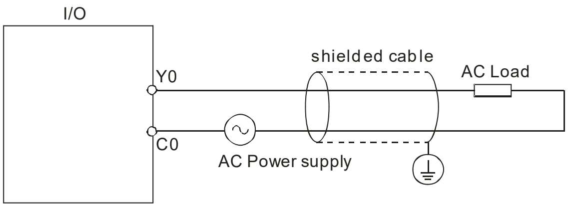
- EN: Please use 24-12 AWG single or multi-conductor cables to connect the terminal block and along with pin-typed terminals, bore diameter less than 2 mm (insulated with a protective sleeve) for wiring. PLC terminal screw torque is 3.8 kgf-cm (3.3 lbf-in), and only copper wires rated at 60/75°C should be used, as specified in the diagram.
- FR: Veuillez utiliser des fils de section 24-12 AWG (monobrins ou multibrins) munis d'embouts de moins de 2 mm de diamètre (isolé avec une manche de protection) pour les bornes d'E/S. Serrez les vis des bornes de l’automate avec un couple de 3.8 kgf-cm (3.3 lbf-in). Seuls des fils conducteurs en cuivre ayant une température nominale de 60/75°C doivent être utilisés, comme indiqué ci-dessous.



Note: For relay output wiring, the wire diameter specifications vary depending on the provided power type. Refer to section 2.6.2.1 for details.

(3) Please separate the input, output, and power lines.

(4) When it is not possible to keep a certain distance between the main circuit and power lines, use grouped shielded cables and ground them at the I/O end. In some environments, ground the other end.



(5) When using cable conduits for wiring, ensure proper grounding of the conduits.

(6) Separate the DC 24 V input line from the AC 110 V and 220 V input lines.

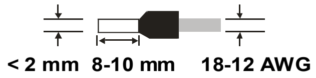
(7) When the wiring length exceeds 200 m (686.67 inches), leakage current may be generated by line capacitance, leading to system equipment malfunctions and damage.

2. Grounding

Grounding of the cable should be done according to steps (1) to (3).

(1) Use the correct independent grounding method.

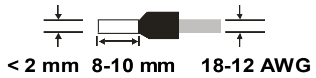
(2) Use 18-12 AWG single-core or multi-core wires for grounding, and it is recommended to use pin-typed terminals with a hole diameter smaller than 2 mm for wiring, as specified in the diagram.



(3) Place the grounding point close to the PLC and securely connect the grounding cable.

Caution:

1. For wiring of 110 V/220 V and 24 VDC power cables, use 18-12 AWG conductors. Twist the power conductors at the terminal connections, and it is recommended to use pin-typed terminals with a hole diameter smaller than 2mm for wiring, as specified in the diagram.



2. When wiring is connected to the terminals, ensure that it is grounded. Apart from grounding, do not connect the terminals to any other devices. Failure to ground the terminals may result in interference affecting the PLC or pose a risk of electric shock due to the potential of the terminals.

1.4.3 DVP-S Series

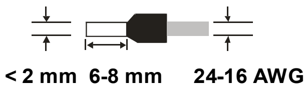
1. Module Wiring

(1) Definitions of Two-Wire, Three-Wire, and Four-Wire Configurations:

- Two, Three-Wire (Passive Sensors): Sensors share a power circuit with the system.
- Four-Wire (Active Sensors): Sensors use an independent power supply, and it is recommended not to share the power circuit with the system.

(2) 

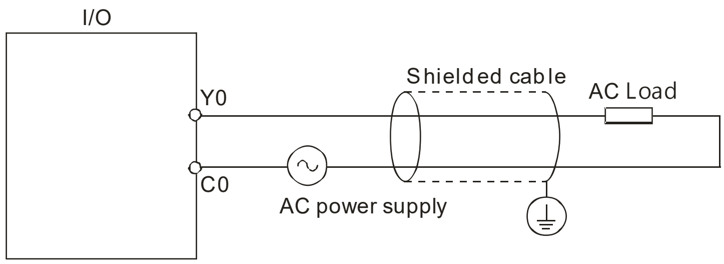
- EN: Please use 24-16 AWG single or multi-conductor cables to connect the terminal block and along with pin-typed terminals, bore diameter less than 2 mm (insulated with a protective sleeve) for wiring. PLC terminal screw torque is 2.0 kgf-cm (1.77 lbf-in), and only copper wires rated at 60/75°C should be used, as specified in the diagram.
- FR: Veuillez utiliser des fils de section 24-16 AWG (monobrins ou multibrins) munis d'embouts de moins de 2 mm de diamètre (isolé avec une manche de protection) pour les bornes d'E/S. Serrez les vis des bornes de l’automate avec un couple de 2.0 kgf-cm (1.77 lbf-in). Seuls des fils conducteurs en cuivre ayant une température nominale de 60/75°C doivent être utilisés, comme indiqué ci-dessous.



Note: For relay models, the output wiring specifications vary depending on the provided power type. Refer to section 7.6.2.1 for details.

(3) Please separate the input, output, and power lines.

(4) When it is not possible to keep a certain distance between the main circuit and power lines, use grouped shielded cables and ground them at the I/O end. In some environments, ground the other end.



(5) When wiring using conduit, ensure that the conduit is grounded in the correct manner.

(6) Please separate the DC 24 V input line from the AC 110 V and 220 V input lines.

(7) When the wiring length exceeds 200 m (686.67 inches), leakage current may be generated by line capacitance, leading to system equipment malfunctions and damage.

Caution:

When wiring is connected to the ⏚/⏚ terminals, ensure that it is grounded. Apart from grounding, do not connect the ⏚/⏚ terminals to any other devices. Failure to ground the ⏚/⏚ terminals may result in interference affecting the PLC or pose a risk of electric shock due to the potential of the ⏚/⏚ terminals.

2

Chapter 2 DVP-E Series Digital Input/Output Module

Table of Contents

2

2.1 General Specifications

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

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

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

Model (DVP) / Item		08XM 211N	08XP 211R	08XP 211T	16XM 211N	16XP 211R	16XP 211T	24XP 200R	24XP 200T	32XP 200R	32XP 200T
Number of inputs		8	4	4	16	8	8	16	16	16	16
Connector type		Removable terminal block									
Input type		Digital input									
Input form		Direct current (sinking or sourcing)									
Input voltage		24 VDC, 5 mA									
Action level	**OFF→ON**	>15 VDC									
	ON→OFF	<5 VDC									
Response time	**OFF→ON**	10 ms ±10%									
	ON→OFF	15 ms ±10%									
Input impedance		4.7 kΩ									
Input isolation		500 VAC									
Input display		When the optocoupler is driven, the input LED indicator is ON.									

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

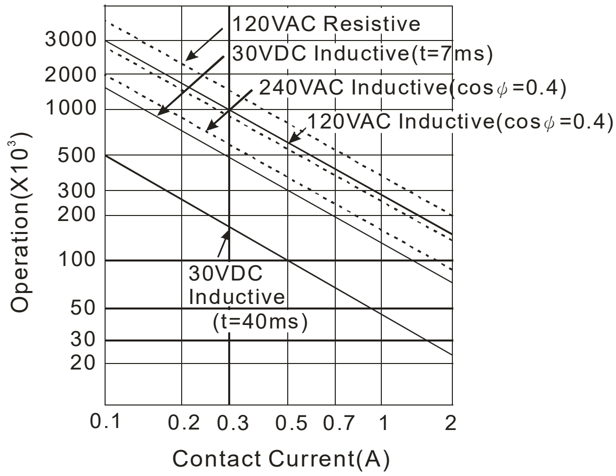
Item \ Model (DVP)	08XP 211R	08XN 211R	16XP 211R	16XN 211R	24XP 200R	24XN 200R	32XP 200R	08XP 211T	08XN 211T	16XP 211T	16XN 211T	24XP 200T	24XN 200T	32XP 200T
Number of outputs	4	8	8	16	8	24	16	4	8	8	16	8	24	16
Connector type	Removable terminal block													
Output type	Relay-R							Transistor-T						
Voltage	10 to 240 VAC, 5 to 30 VDC							5 to 30 VDC						
Leakage current	–							<10 uA						
Max. load: Resistance	2 A/output, 5 A/COM*3							0.3 A/output, 1.2 A/COM*2						
Max. load: Inductance	Life cycle curve*4							N/A						
Max. load: Bulb	20 WDC/100 WAC							N/A						
Minimum load	1 mA / 5 V													
Output isolation	1500 VAC							500 VAC						
Switching frequency*1	≦1 Hz							≦100 Hz						
Response time: OFF→ON	Approximately 10 ms							50 μs						
Response time: ON→OFF	Approximately 10 ms							200 μs						

*1. The scan cycle affects the frequency.

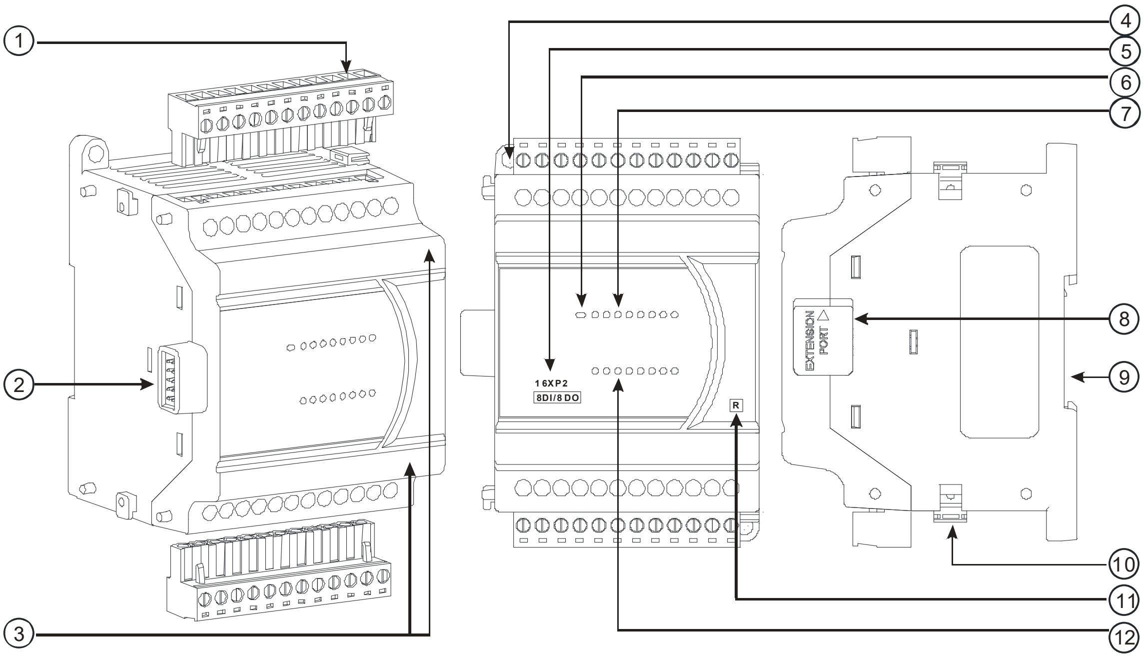
*2. UP, ZP should include external aid power 24 VDC (-15% to +20%) and the rated consumption is around 1 mA/point.

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

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

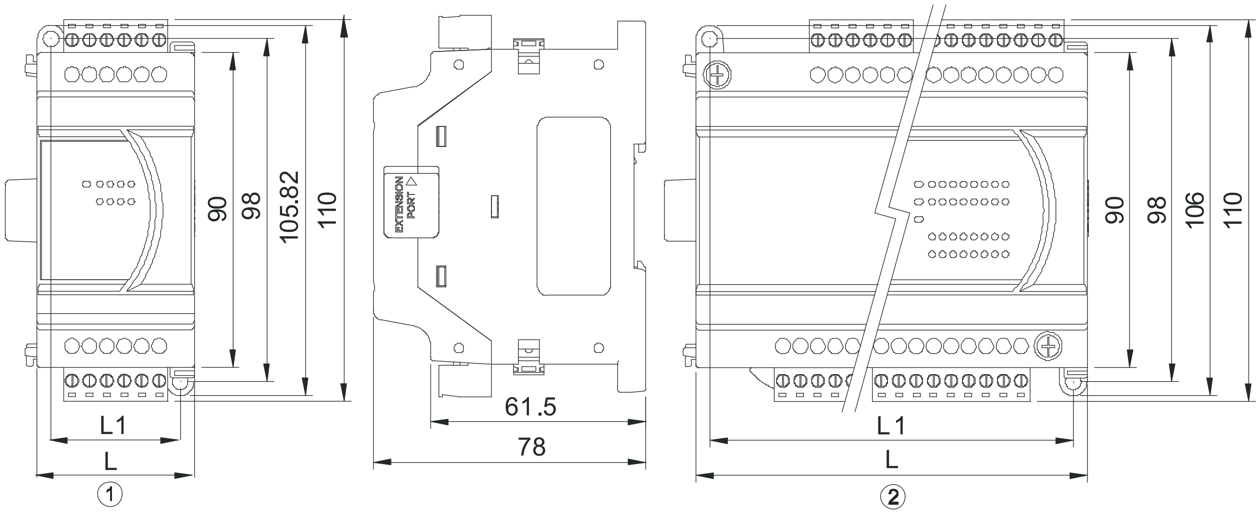


2.2 Module Profiles



No.	Name	Description
1	Removable terminal block	The inputs are connected to sensors. The outputs are connected to loads to be driven.
2	External module connection port	Connects the modules.
3	Terminal number	Terminal number
4	Mounting hole	Secures the module on the set
5	Model name	Model name of the module
6	Power indicator	Indicates the power state of the CPU module.
7	Input/Output indicator	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.
8	External module connection port	Connects the modules.
9	DIN rail slot (35 mm)	For the DIN rail.
10	I/O module securing clip	Secures the modules
11	Output type	R: Relay output T: Transistor output.
12	Input/Output LED	If there is an input signal, the input LED indicator is ON. If there is an output signal, the output LED indicator is ON.

2.3 Dimension



Unit: mm

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

2

2.4 Module Terminals

- **DVP08XM211N**

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

- **DVP08XN211R/T**

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

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

- **DVP08XP211R/T**

1	2	3	4	5	6
S/S	X0	X1	X2	X3	NC
DVP08XP2-R (4DI/4DO)					
C0	Y0	Y1	Y2	Y3	NC
1	2	3	4	5	6

1	2	3	4	5	6
S/S	X0	X1	X2	X3	NC
DVP08XP2-T (4DI/4DO)					
UP	ZP	Y0	Y1	Y2	Y3
1	2	3	4	5	6

- **DVP16XM211N**

1	2	3	4	5	6	7	8	9	10		
S/S	X0	X1	X2	X3	X4	X5	X6	X7	NC		
DVP16XM2 (16DI)											
S/S	X10	X11	X12	X13	X14	X15	X16	X17	NC	NC	NC
1	2	3	4	5	6	7	8	9	10	11	12

- **DVP16XN211R/T**

DVP16XN2-R (16DO)

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

DVP16XN2-T (16DO)

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

- **DVP16XP211R/T**

DVP16XP2-R (8DI/8DO)

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

DVP16XP2-T (8DI/8DO)

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

- **DVP24XP200R/T**

DVP24XP2-R (16DI/8DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
+24V	24G	NC	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7									
1	2	3	4	5	6	7	8	9	10	11	12									

DVP24XP2-T (16DI/8DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
+24V	24G	UP	ZP	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7									
1	2	3	4	5	6	7	8	9	10	11	12									

- **DVP24XN200R/T**

DVP24XN2-R (24DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	C0	Y0	Y1	Y2	Y3	C1	Y4	Y5	Y6	Y7	C4	Y20	Y21	Y22	Y23	NC	NC
+24V	24G	NC	NC	C2	Y10	Y11	Y12	Y13	C3	Y14	Y15	Y16	Y17	C5	Y24	Y25	Y26	Y27	NC	NC

DVP24XN2-T (24DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	UP0	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	UP2	ZP2	Y20	Y21	Y22	Y23	NC
+24V	24G	NC	NC	UP1	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	UP3	ZP3	Y24	Y25	Y26	Y27	NC

- **DVP32XP200R/T**

DVP32XP2-R (16DI/16DO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
+24V	24G	NC	C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	C1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

DVP32XP2-T (16DI/16DO)

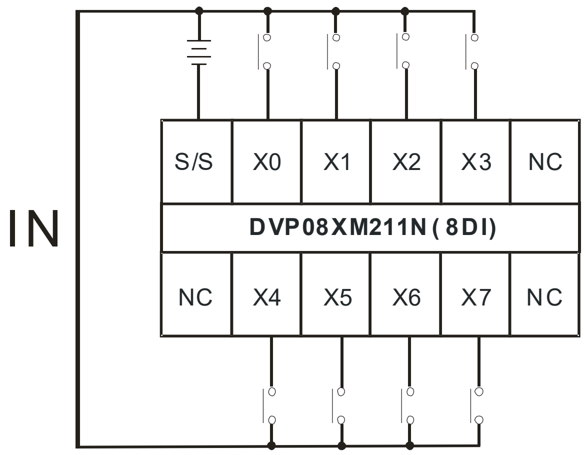
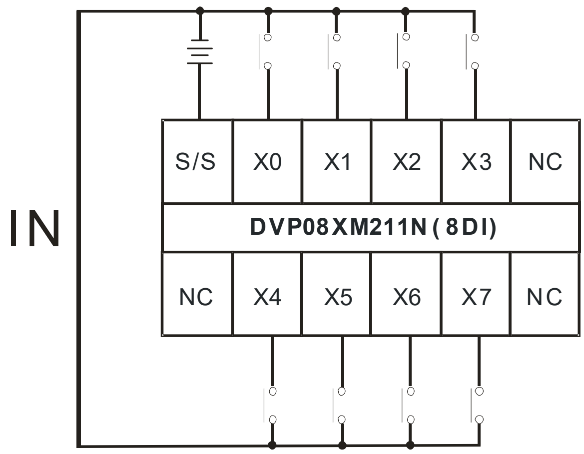
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
L	N	⏚	NC	S/S	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
+24V	24G	UP	ZP0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	ZP1	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17

2.5 Wiring

This section illustrates how to wire digital input/output modules. The wiring diagrams below also illustrate how the power supplies are connected to S/S, and COM. If you need more information about wiring of digital input/output terminals, refer to Section 2.6 in this manual.

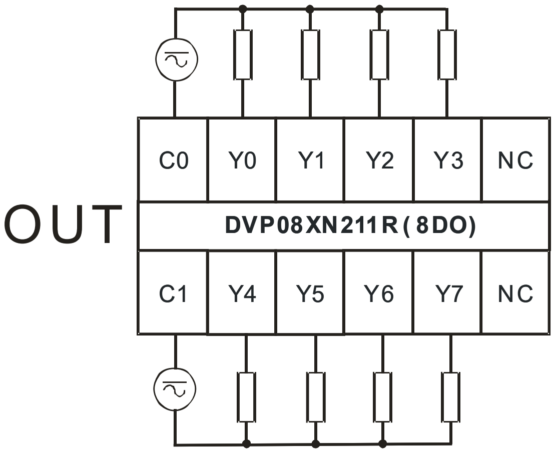
2.5.1 Wiring DVP08XM211N

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

Sinking	**Sourcing**
	

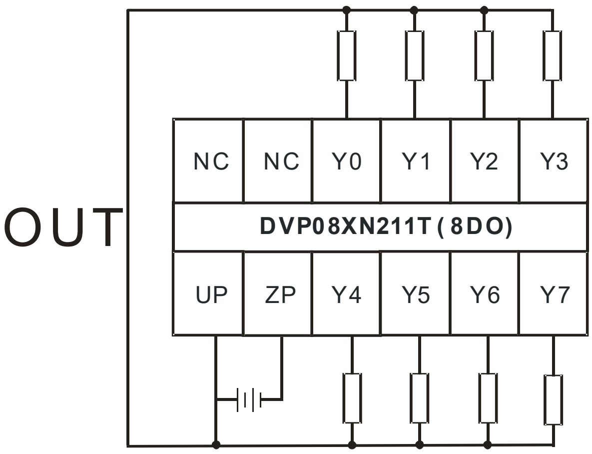
2.5.2 Wiring DVP08XN211R

Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM



2.5.3 Wiring DVP08XN211T

Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

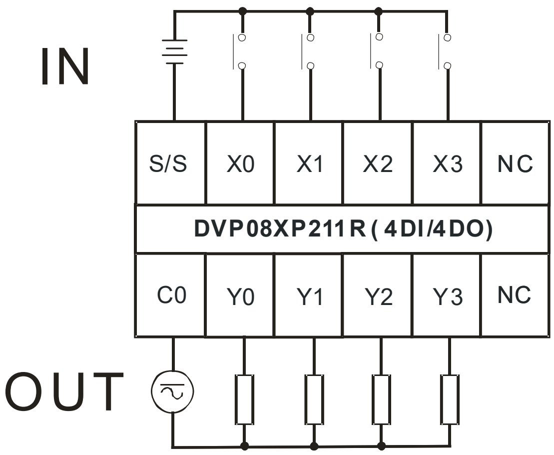


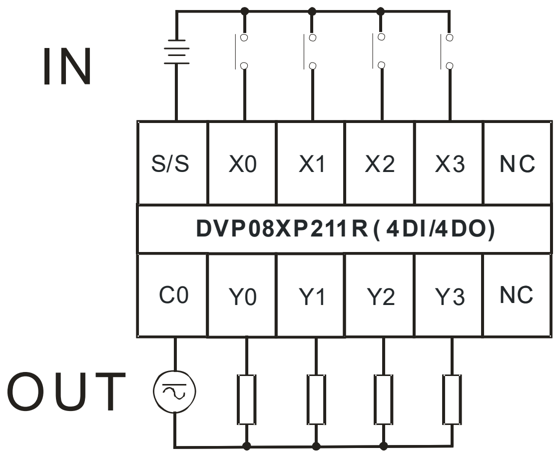
Note: You need to add external power supply 24 VDC (-15% to +20%) for UP and ZP; power consumption is up to 10 mA.

2.5.4 Wiring DVP08XP211R

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM

Sinking input and relay output	Sourcing input and relay output

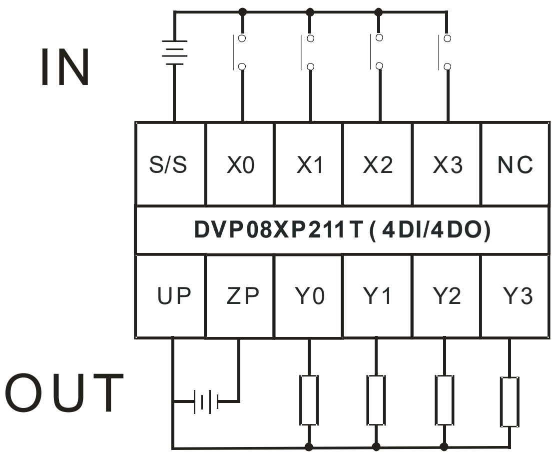


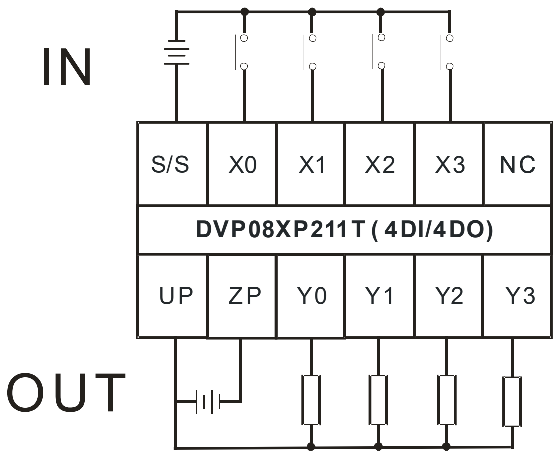


2.5.5 Wiring DVP08XP211T

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

Sinking input and output	Sourcing input and sinking output

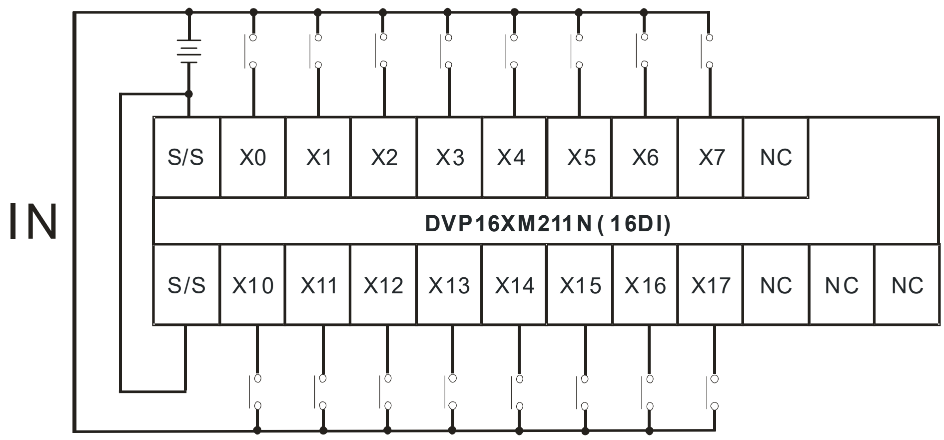
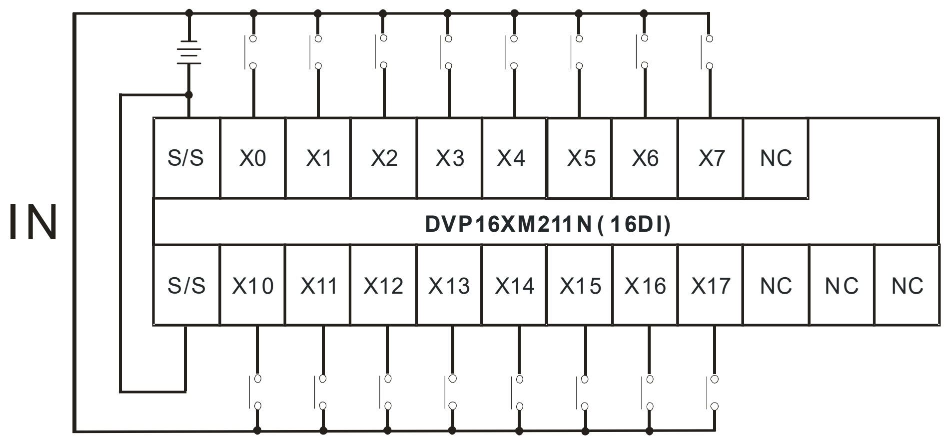




Note: You need to add external power supply 24 VDC (-15% to +20%) for UP and ZP; power consumption is up to 5 mA.

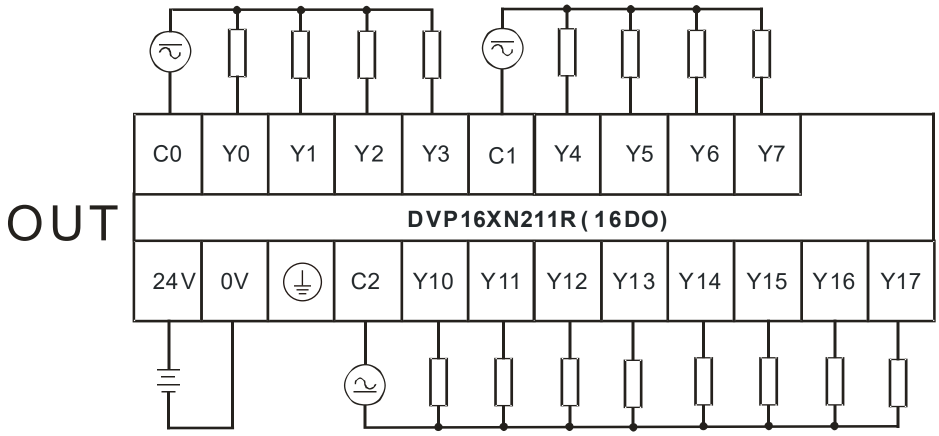
2.5.6 Wiring DVP16XM211N

Input from	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA

<table>
<tr><td>Sinking input</td><td>
</td></tr>
<tr><td>Sourcing input</td><td>
</td></tr>
</table>

2.5.7 Wiring DVP16XN211R

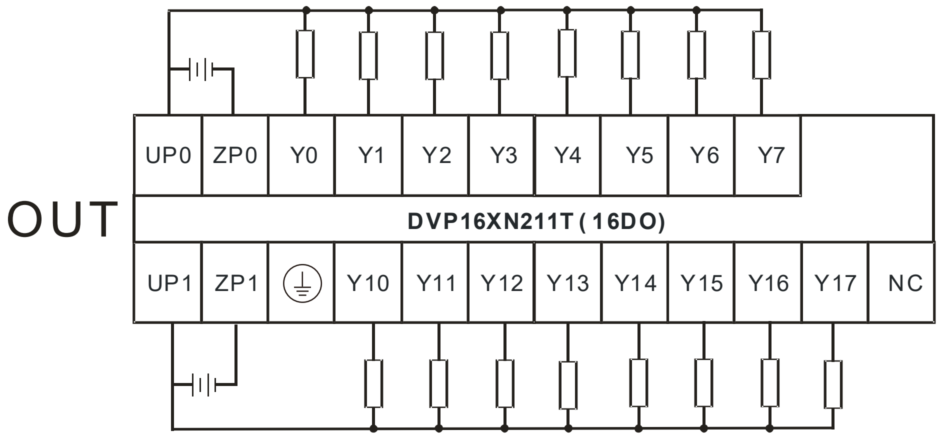
Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM



Note: Connect the terminal ⏚ to ground.

2.5.8 Wiring DVP16XN211T

Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM



Note:

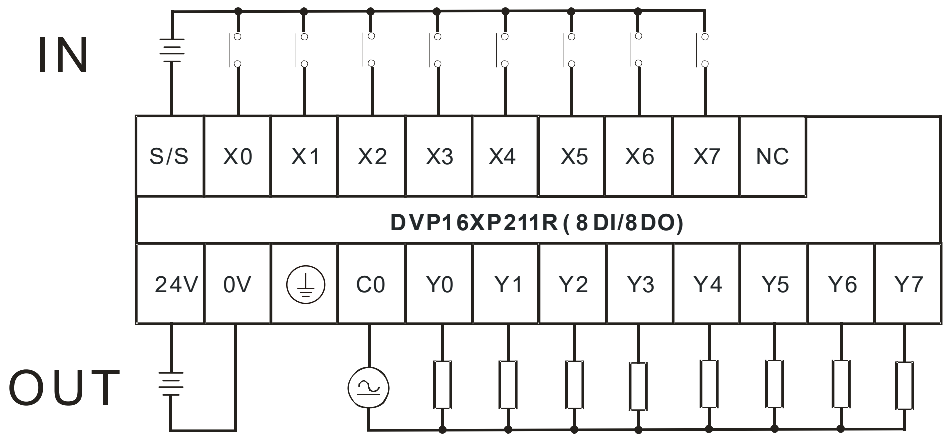
1. You need to add external power supply 24 VDC (-15% to +20%) for UP0, ZP0 and UP1, ZP1; power consumption is up to 30 mA.

2. Connect the terminal ⏚ to ground.

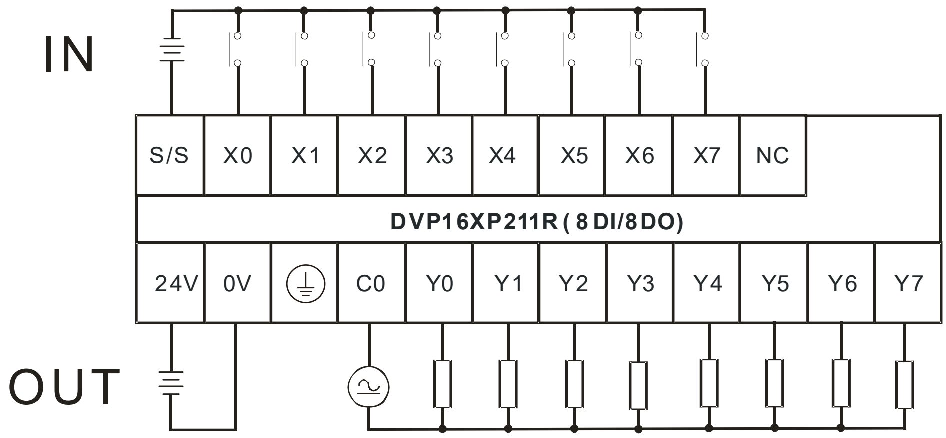
2.5.9 Wiring DVP16XP211R

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM

Sinking input and relay output



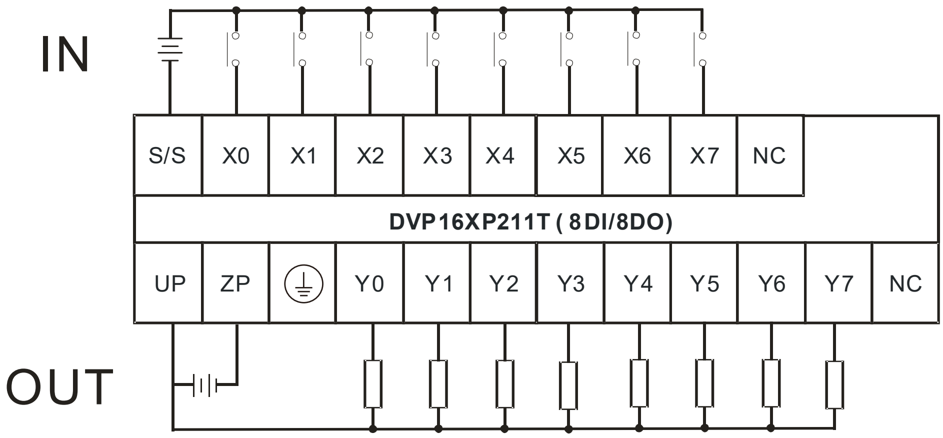
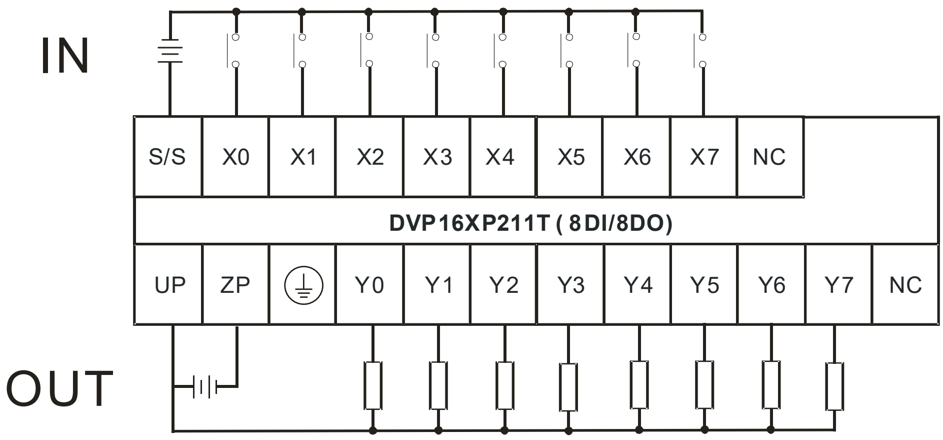
Sourcing input and relay output



Note: Connect the terminal ⏚ to ground.

2.5.10 Wiring DVP16XP211T

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

Sinking input and output	
Sourcing input and sinking output	

Note:

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

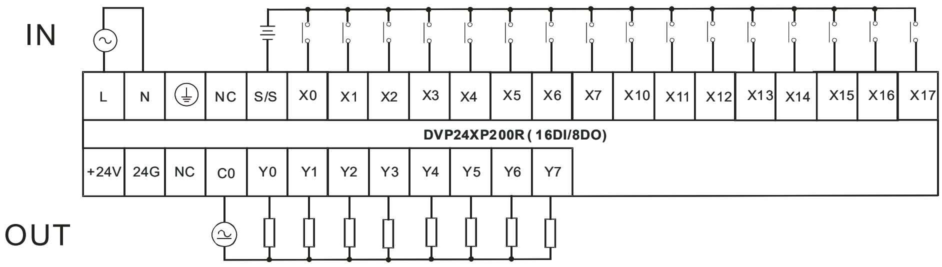
2. Connect the terminal to ground.

2

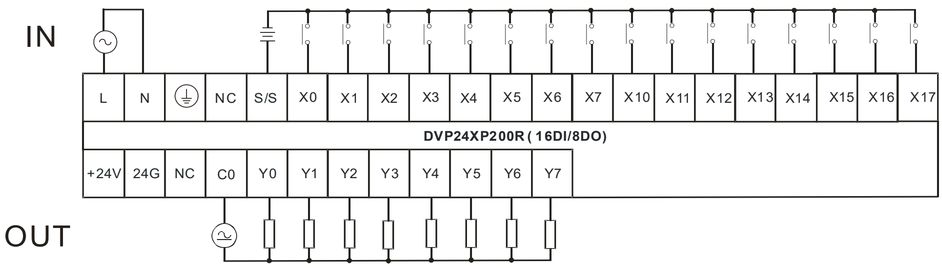
2.5.11 Wiring DVP24XP200R

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM

Sinking input and relay output



Sourcing input and relay output

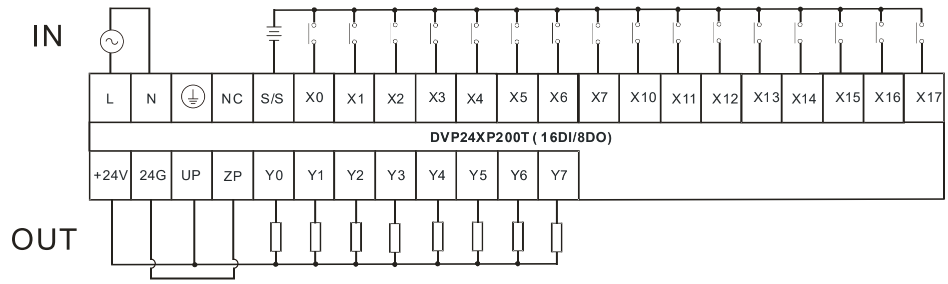
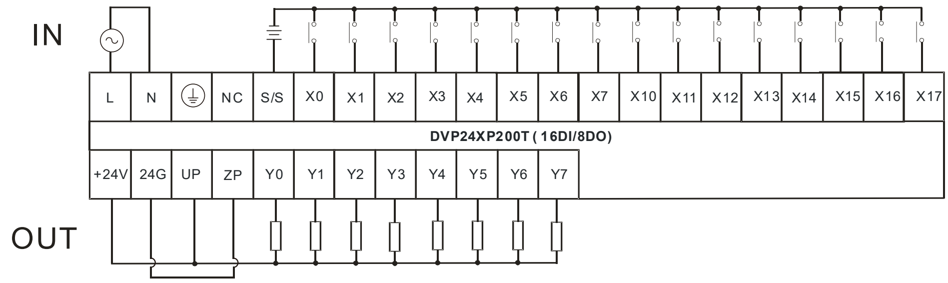


Note:

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

2.5.12 Wiring DVP24XP200T

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

Sinking input and output	
Sourcing input and sinking output	

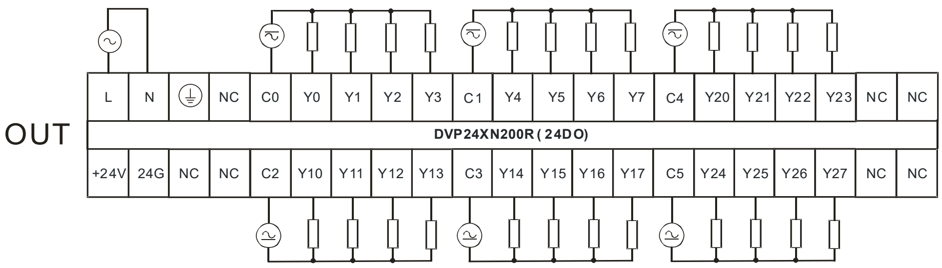
Note:

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

2. Connect the terminal ⏚ to ground.

2.5.13 Wiring DVP24XN200R

Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM



Note:

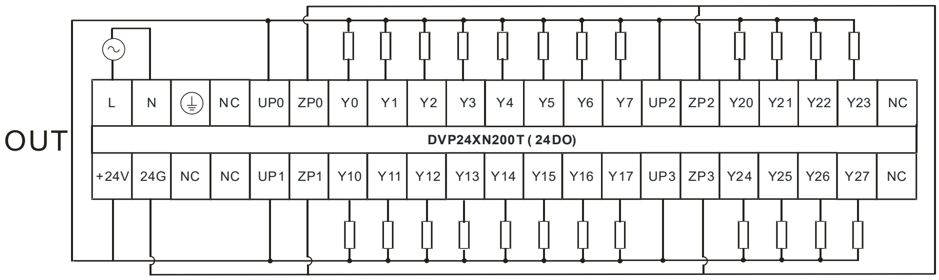
1. Connect the terminal ⏚ to ground.

2. The module has a built-in +24 V power supply for I/Os.

2

2.5.14 Wiring DVP24XN200T

Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

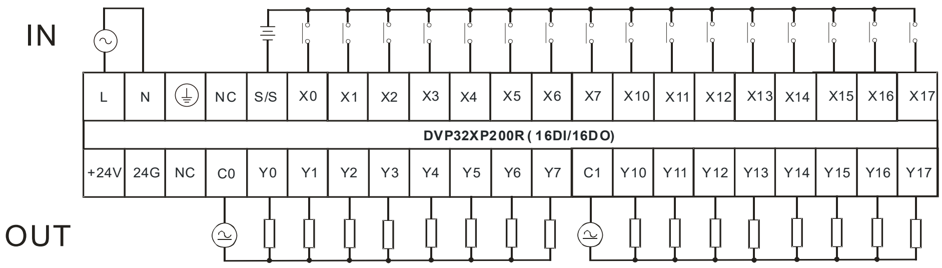
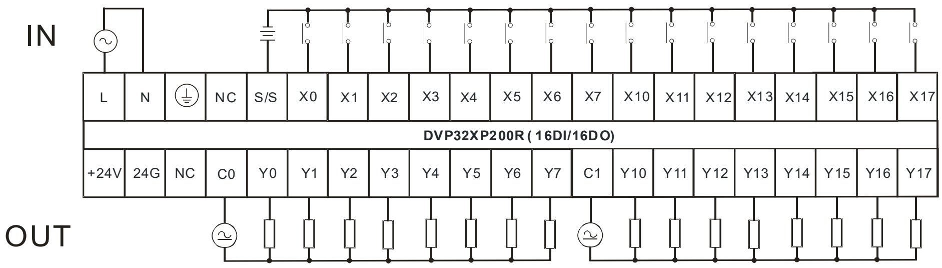


Note:

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

2.5.15 Wiring DVP32XP200R

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Relay
Voltage/Current specifications	10 to 240 VAC, 5 to 30 VDC, 2 A/output, 5 A/COM

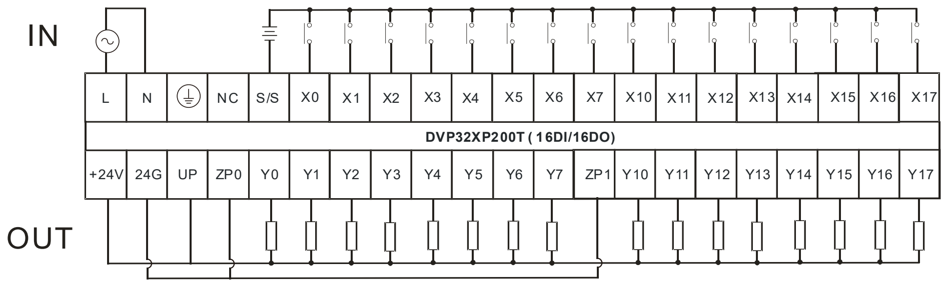
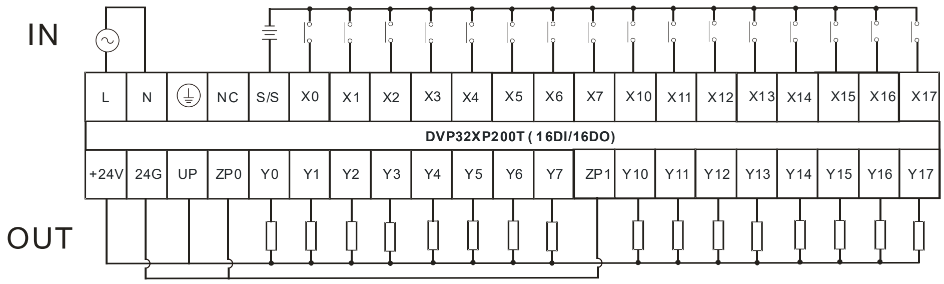
Sinking input and relay output	
Sourcing input and relay output	

Note:

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

2.5.16 Wiring DVP32XP200T

Input form	Direct current (sinking or sourcing)
Voltage/Current specifications	24 VDC, 5 mA
Output type	Transistor-T (sinking)
Voltage/Current specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

Sinking input and output	
Sourcing input and sinking output	

Note:

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

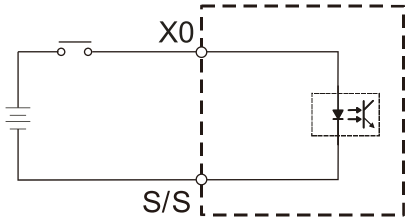
2.6 Wiring Digital Input/Output

2.6.1 Wiring Digital Input

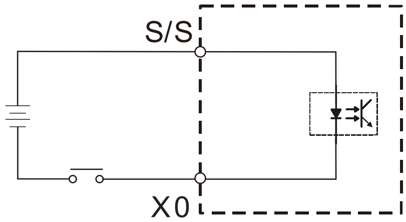
2.6.1.1 Direct Current Power Supply (24 VDC)

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

- Sinking

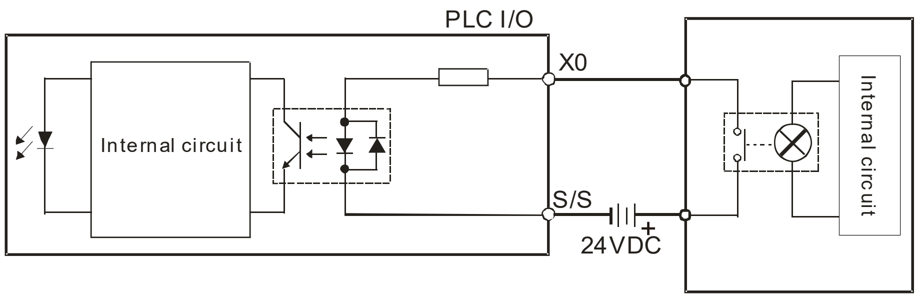


- Sourcing

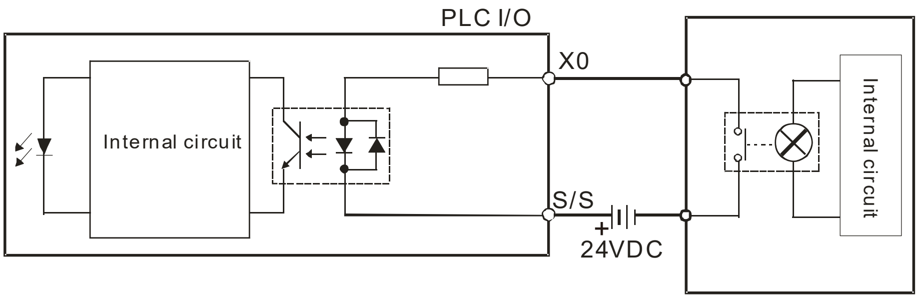


2.6.1.2 Wiring Input V.S. Relay Types

- **Sinking**

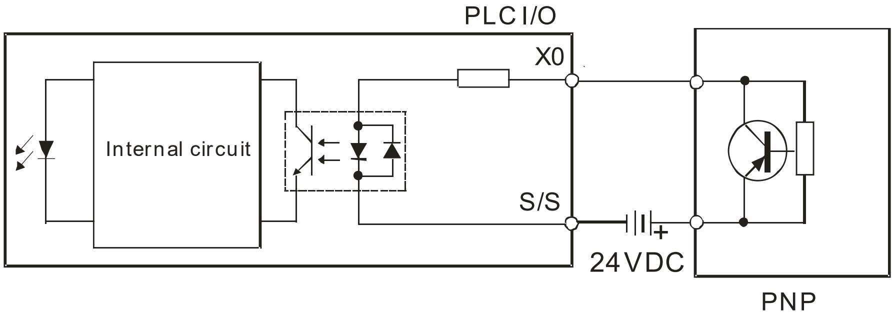


- **Sourcing**

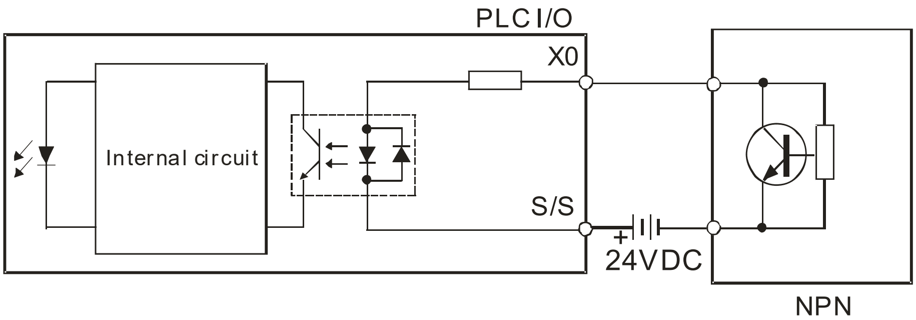


2.6.1.3 Wiring Input V.S. Two-Wire Open-collector Transistor Types

- **Sinking**

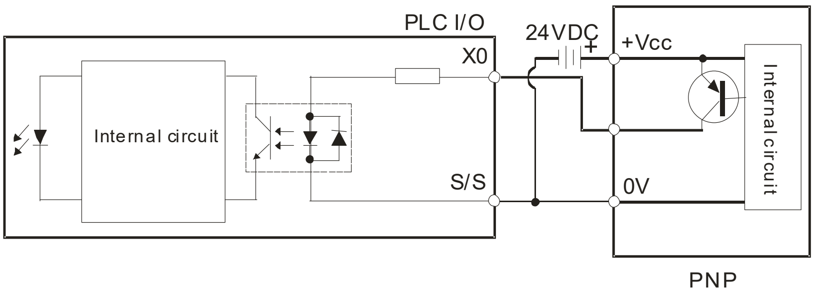


- **Sourcing**

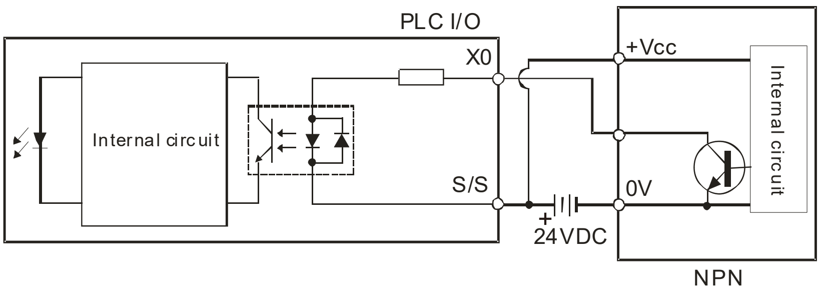


2.6.1.4 Wiring Input V.S. Three-Wire Open-collector Transistor Types

- **Sinking**



- **Sourcing**



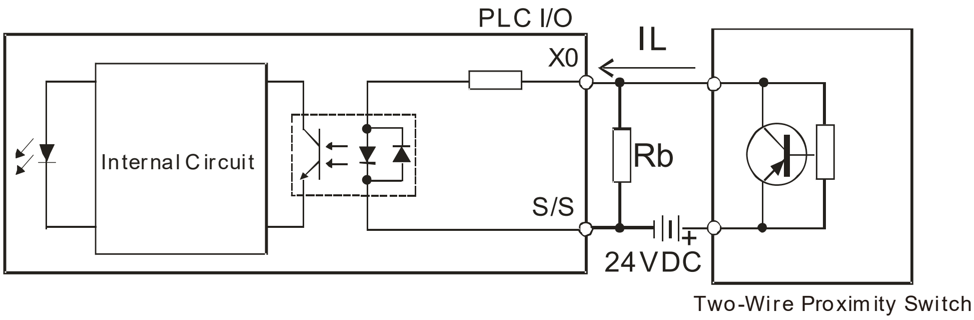
2

2.6.1.5 Wiring Input V.S. Two-Wire Proximity Switch

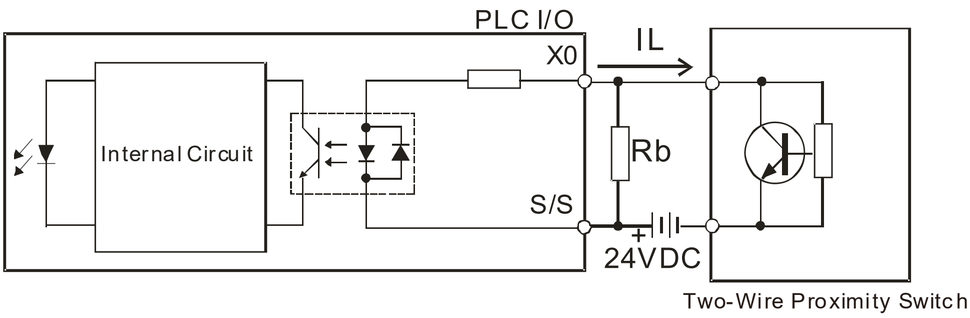
Use the two-wire proximity switch whose leakage current I_L is less than 1 mA when the switch is OFF. If the leakage current I_L is larger than 1 mA, connect the divider resistance Rb using the formula below. (A wattage of at least 1 W is recommended.)

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

- **Sinking**



- **Sourcing**



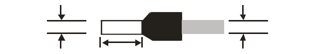
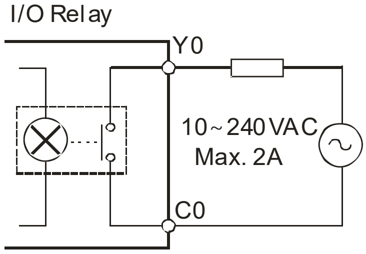
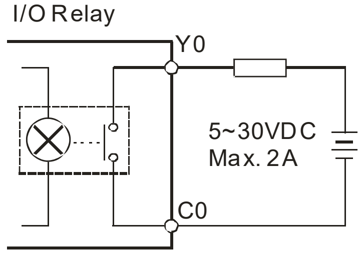
2.6.2 Wiring Digital Output

2.6.2.1 Output Circuits

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

1. **Relay output**

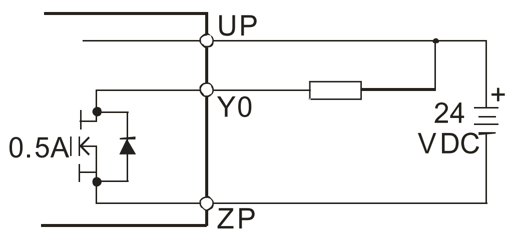
   Relay output wiring varies according to the provided power type and requires different wire sizes for different applications. The specifications are as shown in the diagram. The terminal screw torque at the PLC is 3.8 kgf-cm (3.3 lbf-in). Only copper wires rated for 60/75°C can be used.

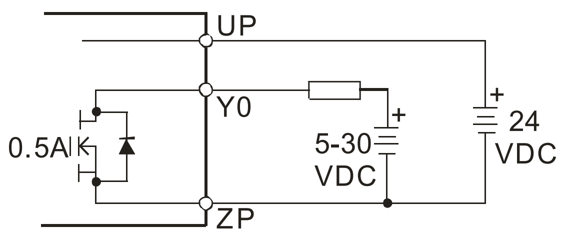
	AC power supply	DC power supply
Terminal Specifications		
Wiring		

*1. For the relay output terminals connected to the same common point COM (those with the same color in the diagram below), it is necessary to use the same voltage (10 to 240 VAC or 5 to 30 VDC).

C0	**Y0**	**Y1**	**Y2**	**Y3**	●	**C1**	**Y4**	**Y5**	**Y6**	**Y7**

2. **Transistor output**



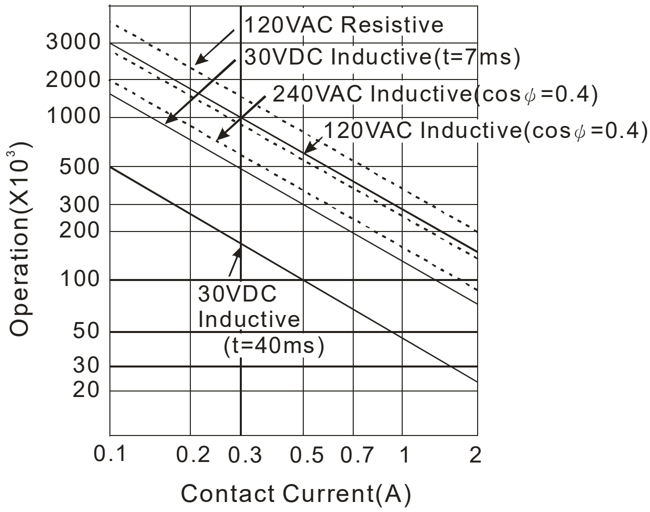


2

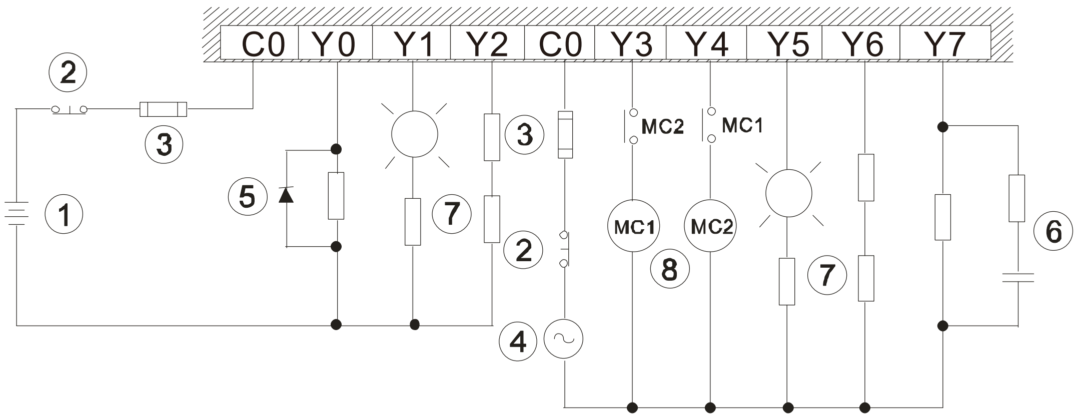
2.6.2.2 Relay Output Circuit

Relay terminals have no polarity. They can be used with alternating or direct current that passes through a load. The maximum current that can pass through every relay terminal is 2 A. The maximum current that can pass through every common terminal is 5 A.

The lifetime of a relay terminal varies with the working voltage, the load type (the power factor cosψ), and the current passing through the terminal. The relation is shown in the life cycle curve below.

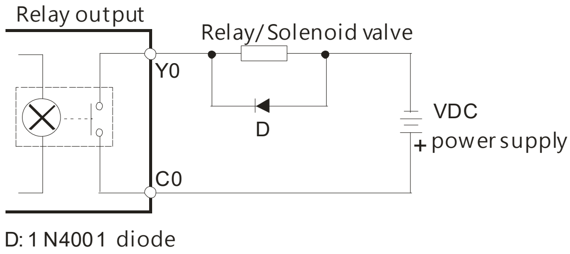


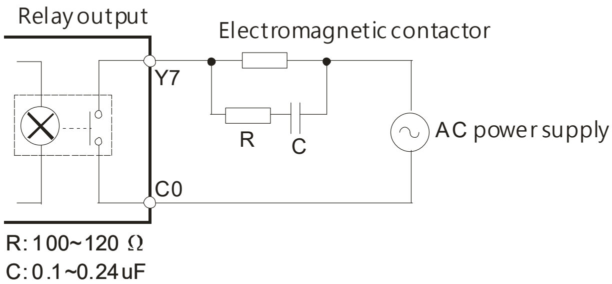
- **Relay output circuit**

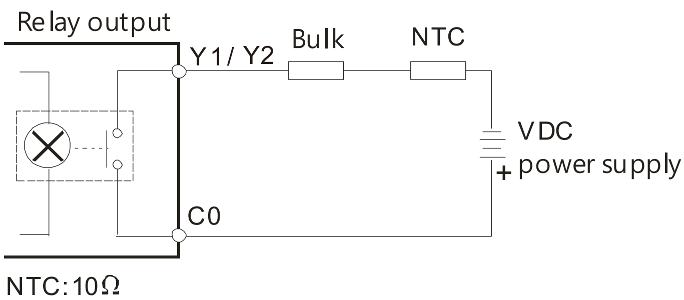


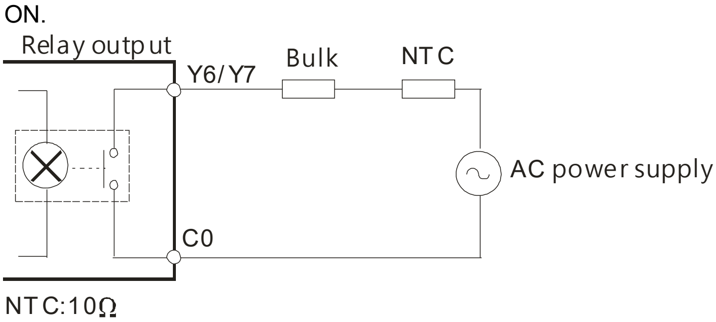
①	Direct-current power supply
②	Emergency stop using an external switch.
③	Fuse: to protect the output circuit, a fuse having a breaking capacity between 5 A to 10 A is connected to the common terminal of the output terminal.
④	Alternating-current power supply

<table>
<tr><td>⑤</td><td>A relay or a solenoid valve is used as a DC load. A diode is connected in parallel to absorb the surge voltage that occurs when the load is OFF.


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

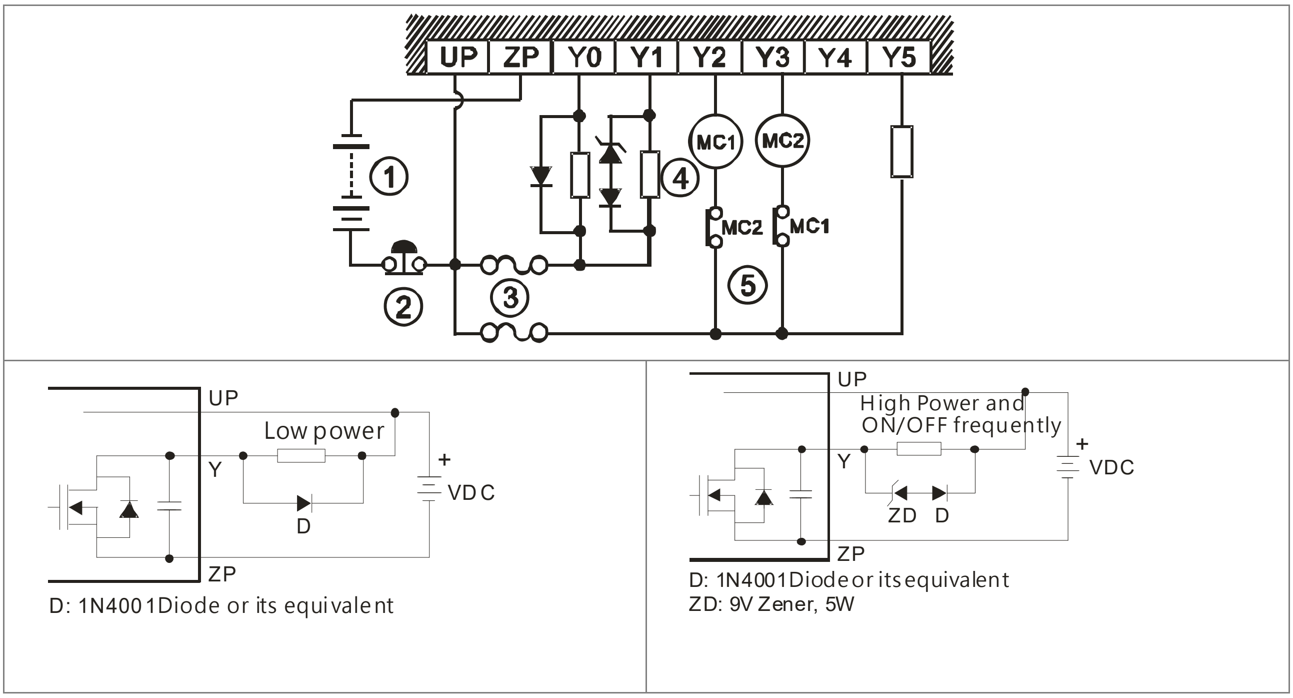

</td></tr>
<tr><td>⑦</td><td>A bulb (incandescent lamp) is used as a DC load. A thermistor is connected in series to absorb the surge current that occurs when the load is ON.


</td></tr>
<tr><td>⑦</td><td>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.


</td></tr>
<tr><td>⑧</td><td>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.</td></tr>
</table>

2

2.6.2.3 Transistor Output Circuit (NPN)



①	Direct-current power supply
②	Emergency stop
③	Fuse
④	Surge-absorbing diodes: increase contact life 1. A diode is connected in parallel to absorb the surge voltage: used in low-power situations (refer to Figure 1). 2. A diode and Zener are connected to absorb the surge voltage: used in high-power and power-on/off frequently situations (refer to Figure 2).
⑤	Mutually exclusive output: For example, Y2 controls the clockwise rotation of the motor, and Y3 controls the counterclockwise rotation of the motor. This interlock circuit and the program in the PLC ensure that there are protective measures if an abnormal condition occurs.

3

Chapter 3 DVP-E Series Analog Input/Output Module

Table of Content

3.1 General Specifications

3.1.1 DVP04AD-E2 Specifications

- **Electrical specifications**

Module name	DVP04AD-E2
Number of analog inputs	Four
Analog-to-digital conversion	Voltage input / Current input
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block (terminal pitch: 5 mm)
Conversion time	400 μs/channel
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.
Weight	204 g

- **Functional specifications**

Analog/digital module	Voltage input		Current input		
Analog input channels	4 channels				
Rated input range	±10 V	±5 V	±20 mA	0 to 20 mA	4 to 20 mA
Digital conversion range	±32,000	±32,000	±32,000	0 to 32,000	0 to 32,000
Hardware input limit*1	±10.12 V	±5.06 V	±20.24 mA	-0.24 to 20.24 mA	3.81 to 20.19 mA
Digital conversion limit*2	±32,384	±32,384	±32,384	-384 to +32,384	-384 to +32,384
Hardware resolution	14-bit	14-bit	14-bit	13-bit	13-bit
Input impedance	≧1 MΩ		250 Ω		
Absolute input range*3	±15 V		±32 mA		
Digital data format	16-bit two's complement number				
Average function	Yes, CR#8 to CR#11, setting range: K1 to K100				
Self-diagnosis function	Detecting if exceeding upper and lower limits or if channel disconnection occurs.				
Overall Accuracy	25° C/77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C/32° F to 131° F: The allowed error range is ±1% of full scale				
Response time	400 μs/channel				
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. If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2. If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit, and an out-of-range conversion error appears. For example, in the voltage input mode (-10 V to +10 V), when the input signal is 10.15 V, above the hardware upper limit, its digital value is limited to 32384 and the out-of-range conversion error appears. In the current input mode (4 to 20 mA), when the input signal is 0 mA, below the hardware lower limit, its digital value is limited to -384 and the out-of-range conversion error appears.

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

3.1.2 DVP02DA-E2/DVP04DA-E2 Specifications

- **Electrical specifications**

Module name	DVP02DA-E2	DVP04DA-E2
Number of analog outputs	Two	Four
Analog-to-digital conversion	Voltage output / Current output	
Supply voltage	24 VDC (20.4 to 28.8VDC) (-15% to +20%)	
Connector type	Removable terminal block (terminal pitch: 5 mm)	
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.	
Short circuit protection*1	Yes	
Weight	194 g	207 g

*1: The module is with short circuit protection, but prolonged short circuits can cause internal circuit damage. Current output can be open circuit.

- **Functional specifications**

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

3

3.1.3 DVP06XA-E2 Specification

- **Electrical specifications**

Module name	DVP06XA-E2
Number of analog inputs/outputs	Inputs: four; outputs: two
Analog-to-digital / digital-to-analog conversion	Voltage input / Current input; Voltage output / Current output
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block (terminal pitch: 5 mm)
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.
Weight	213 g

- **Functional specifications**

Digital data format	16-bit two's complement number
Response time	400 μs/channel
Overall accuracy	25°C / 77°F: The allowed error range is ±0.5% of full scale. 0°C to 55°C / 32°F to 131°F: The allowed error range is ±1% of full scale.
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/ an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 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

- **A/D Functional specifications**

	Voltage input		Current input		
Analog input channels	4 channels				
Rated input range	±10 V	±5 V	±20 mA	0 to 20 mA	4 to 20 mA
Digital conversion range	±32,000	±32,000	±32,000	0 to 32,000	0 to 32,000
Hardware input limit*1	±10.12 V	±5.06 V	±20.24 mA	-0.24 to 20.24 mA	3.81 to 20.19 mA
Digital conversion limit*2	±32,384	±32,384	±32,384	-384 to +32,384	-384 to +32,384
Hardware resolution	14-bit	14-bit	14-bit	13-bit	13-bit
Input impedance	≧1 MΩ		250 Ω		
Absolute input range*3	±15 V		±32 mA		
Average function	Yes, CR#8 to CR#11, setting range: K1 to K100				
Self-diagnosis function	Detecting if exceeding upper and lower limits or if channel disconnection occurs.				

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

*2: If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit, and an out-of-range conversion error appears. For example, in the voltage input mode (-10 V to +10 V), when the input signal is 10.15 V, exceeding the hardware upper limit, its digital value is limited to 32384 and the out-of-range conversion error appears. In the current input mode (4 to 20 mA), when the input signal is 0 mA, falling below the hardware lower limit, its digital value is limited to -384 and the out-of-range conversion error appears.

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

■ **D/A Functional specifications**

	Voltage output	Current output	
Analog output channels	2 channels		
Rated output range	-10 to 10V	0 to 20 mA	4 to 20 mA
Digital data range	-32,000 to +32,000	0 to +32,000	0 to +32,000
Digital data limit	-32,768 to +32,767	0 to +32,767	-6,400 to +32,767
Hardware resolution	14-bit	14-bit	14-bit
Maximum output current	5 mA	-	
Load impedance	1 KΩ to 2 MΩ	0 to 500 Ω	
Output impedance	5 Ω or lower		
Short circuit Protection	Yes. The module is with short circuit protection, but prolonged short circuits can cause internal circuit damage. Current output can be open circuit.		

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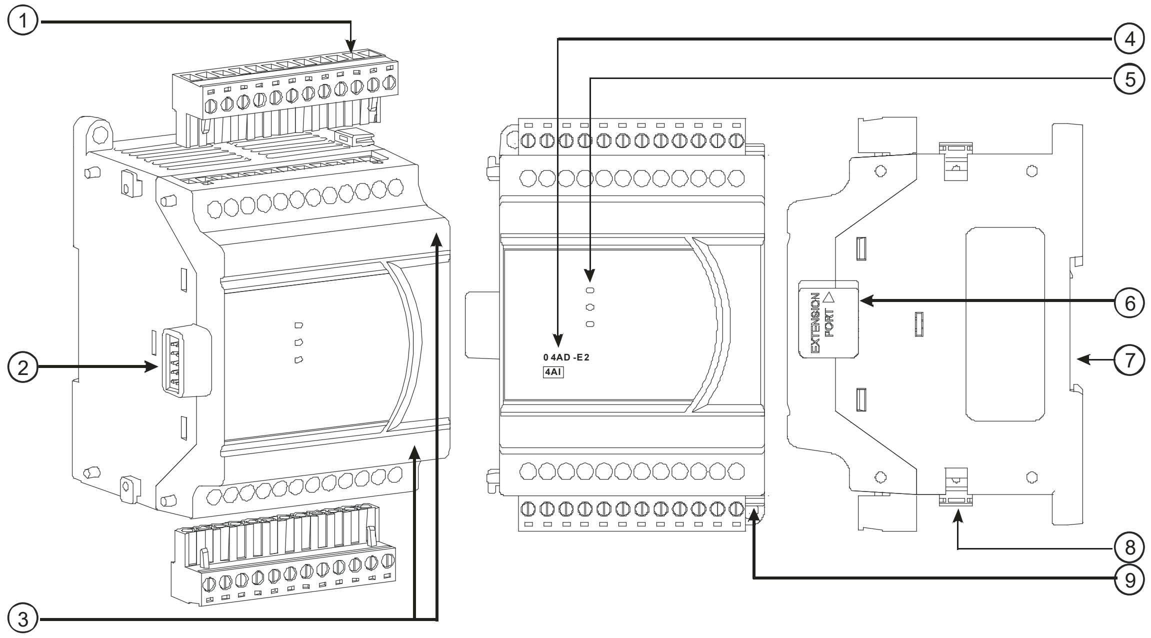
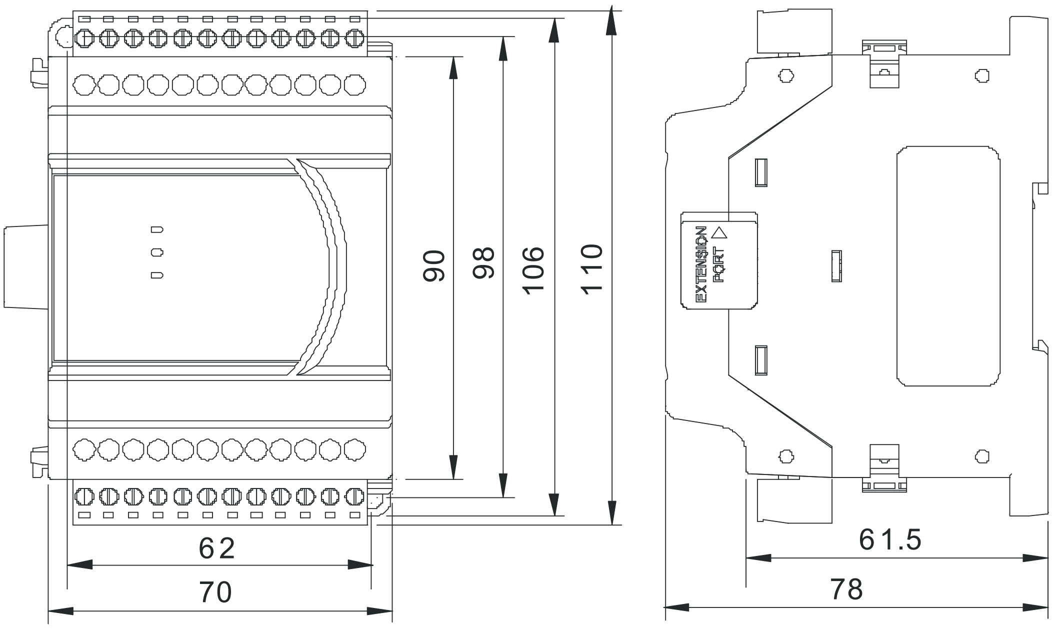
3.2 Module Profiles



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

3.3 Dimension



Unit: mm

3.4 Module I/O Terminals

• DVP04AD-E2

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

DVP04AD-E2 (4AI)

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

• DVP02DA-E2

DVP02DA-E2 (2AO)

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

• DVP04DA-E2

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

DVP04DA-E2 (4AO)

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

• DVP06XA-E2

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

DVP06XA-E2 (4AI/2AO)

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

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3.5 Control Registers

3.5.1 DVP04AD-E2 Control Registers

CR#	Attrib.		Register name	Description
0	O	R	Model name	Set up by the system: DVP04AD-E2 model code = H'0080 For detailed explanation, please see the list below.
1	O	R	Firmware version	Display the current firmware version in hex.
2	O	R/W	CH1 input mode setting	Input mode: Default = H'0000. Mode 0 (H'0000): Voltage input (±10 V) Mode 1 (H'0001): Voltage input (±5 V) Mode 2 (H'0002): Voltage input (0 to +10 V) Mode 3 (H'0003): Voltage input (0 to +5 V) Mode 4 (H'0004): Current input (±20 mA) Mode 5 (H'0005): Current input (0 to +20 mA) Mode 6 (H'0006): Current input (4 to +20 mA) Mode -1 (H'FFFF): Close Note: When the input mode is set to "Mode -1 (H'FFFF): Close", the measured value is fixed at the maximum positive integer 32767 (H'7FFF) instead of the maximum or minimum converted digital value, to indicate that the channel is turned off.
3	O	R/W	CH2 input mode setting	
4	O	R/W	CH3 input mode setting	
5	O	R/W	CH4 input mode setting	
8	O	R/W	CH1 average times	Set average times in CH1 to CH4 Range = K1 to K100 Default = K10
9	O	R/W	CH2 average times	
10	O	R/W	CH3 average times	
11	O	R/W	CH4 average times	
12	X	R	CH1 average input value	Average value of input signals at CH1 to CH4
13	X	R	CH2 average input value	
14	X	R	CH3 average input value	
15	X	R	CH4 average input value	
20	X	R	CH1 present input value	Present value of input signals at CH1 to CH4
21	X	R	CH2 present input value	
22	X	R	CH3 present input value	
23	X	R	CH4 present input value	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 to CH4. Default = K0
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	
34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value in CH1 to CH4. Default = K16,000
35	O	R/W	Adjusted Gain value of CH2	
36	O	R/W	Adjusted Gain value of CH3	
37	O	R/W	Adjusted Gain value of CH4	
Adjusted Offset Value, and adjusted Gain Value: Note1: When using Mode 6 for input, the channel does NOT allow adjustments to Offset or Gain values. Note2: When input mode changes, the adjusted Offset or Gain value automatically returns to defaults.				

CR#	Attrib.		Register name	Description
40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing in CH1 to CH4. Default= H'0000
41	X	R/W	Function: Save all the set values	Save the values of all retentive parameters. Default =H'0000
43	X	R	Error state	Register for storing all error states. Refer to the following table of error state values for more information.
100	O	R/W	Function: Enable/Disable limit detection	Upper and lower bound detection, b0 to b3 corresponds to Ch1 to Ch4 (0: Disable; 1: Enable). Default= H'0000
101	X	R/W	Upper and lower bound state	Display the upper and lower bound state. (0: Not exceed the upper or lower bound value; 1: Exceeds the upper or lower bound value) b0 to b3 corresponds to Ch1 to Ch4 for lower bound detection result; b8 to b11 corresponds to CH1 to CH4 for upper bound detection result.
102	O	R/W	Set value of CH1 upper bound	Set the upper bound value of CH1 to CH4. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set the lower bound value of CH1 to CH4. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
Symbols: O: Retentive CR. When CR#41 is set to H'5678, the values of the retentive CRs will be retained. X: Non-retentive CR. R: You can use FROM instruction to read the CR. W: You can use TO instruction to write data into the CR.				

※ **CR#0 for module reset**

You can use CR#0 to reset all settings by writing H'4352 in CR#0 and waiting for one second before turning the power OFF and then ON again. All parameter settings for this module will be reinitialized. It is suggested to connect only one module for module reset at a time to prevent the initialization process from affecting the normal operation of other modules. This feature is only available for firmware V1.10 or later.

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

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

※ **Adjust A/D Conversion Curve**

You can adjust the conversion curves as needed by changing the Offset value (CR#28 to CR#31) and Gain value (CR#34 to CR#37).

- **Equation for voltage input Mode 0 / Mode 2:**

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

Y=Digital output, X=Voltage input

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

- **Equation for voltage input Mode 1 / Mode 3:**

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

Y=Digital output, X=Voltage input

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

- **Equation for current input Mode 4/ Mode 5:**

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

Y=Digital output, X=Current input

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

- **Equation for current input Mode 6:**

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

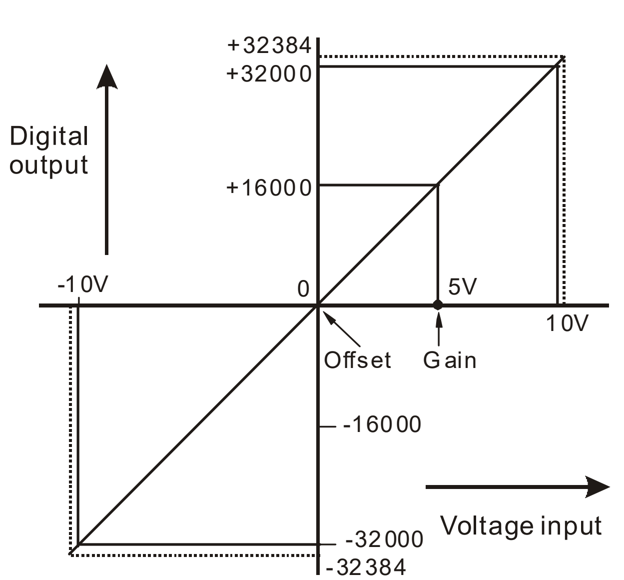
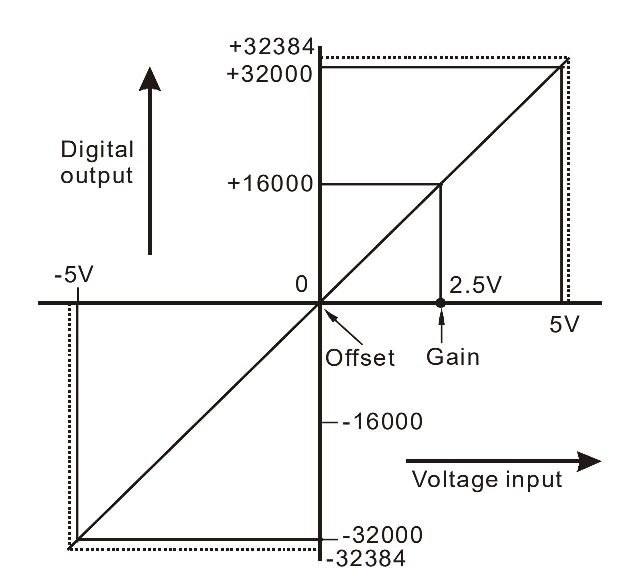
Y=Digital output, X=Current input

Resolution: 0.5 μA = 16 mA / 32,000

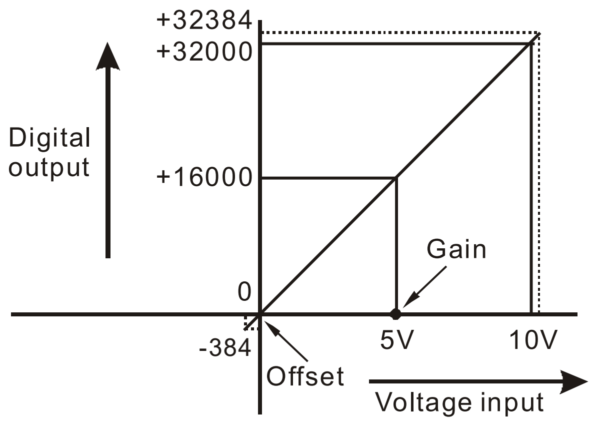
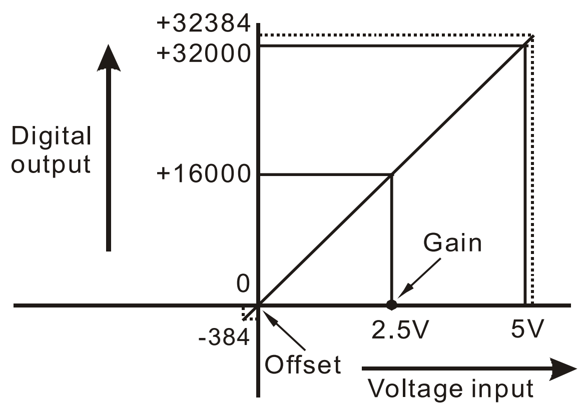
Gain: For the adjusted conversion curve, the Gain is calculated by dividing the voltage (or current) value corresponding to the digital value of 16000 by the resolution for the mode.

Offset: For the adjusted conversion curve, the Offset is calculated by dividing the voltage (or current) value corresponding to the digital value of 0 by the resolution for the mode.

Mode 0 of CR#2 to CR#5	-10 V to +10 V, Gain=16,000 (=$5V/312.5uV$), Offset=0
Mode 1 of CR#2 to CR#5	-5 V to +5 V, Gain=16,000 (=$2.5V/156.25uV$), Offset=0
Range of digital conversion	-32,000 LSB to +32,000 LSB
Max./Min. range of digital conversion	-32,384 LSB to +32,384 LSB

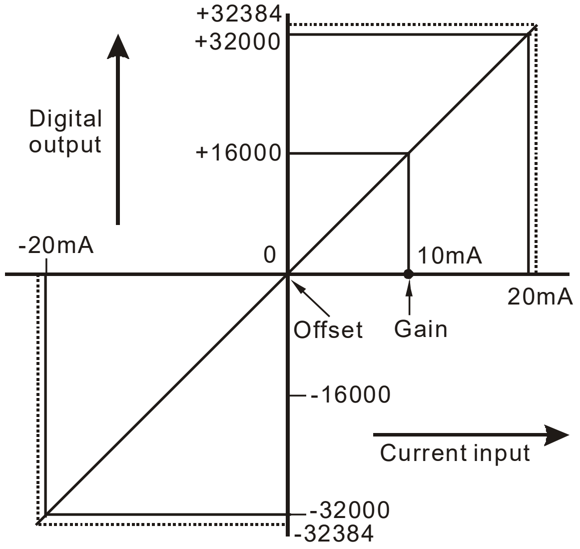
Mode 0	Mode 1
	

Mode 2 of CR#2 to CR#5	0 V to +10 V, Gain=16,000 (=$5V/312.5uV$), Offset=0
Mode 3 of CR#2 to CR#5	0 V to +5 V, Gain=16,000 (=$2.5V/156.25uV$), Offset=0
Range of digital conversion	0 LSB to +32,000 LSB
Max./Min. range of digital conversion	-384 LSB to +32,384 LSB

Mode 2	Mode 3
	

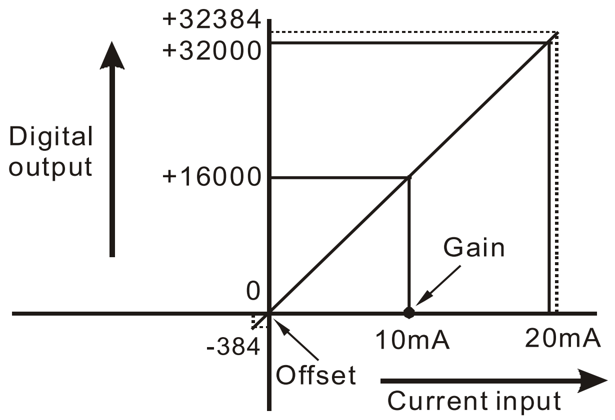
Mode 4 of CR#2 to CR#5	-20 mA to +20 mA, Gain=16,000 (=$10mA/625nA$), Offset=0
Range of digital conversion	-32,000 LSB to +32,000 LSB
Max./Min. range of digital conversion	-32,384 LSB to +32,384 LSB

Mode 4

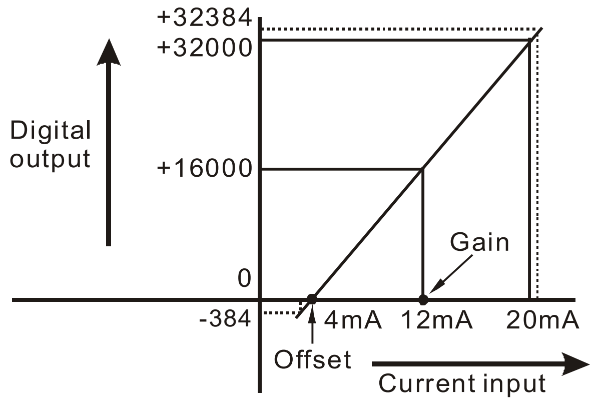


Mode 5 of CR#2 to CR#5	0 mA to +20 mA, default: Gain=16,000 (=$10mA/625nA$), Offset=0
Mode 6 of CR#2 to CR#5	+4 mA to +20 mA, Gain=19,200 (=$12mA/625nA$), Offset=6,400 (=$4mA/625nA$)
Range of digital conversion	0 LSB to +32,000 LSB
Max./Min. range of digital conversion	-384 LSB to +32,384 LSB

Mode 5



Mode 6



3.5.2 DVP02DA-E2/DVP04DA-E2 Control Registers

CR#	Attrib.		Register name	Description
0	O	R	Model name	Set up by the system, model code: DVP02DA-E2=H'0041; DVP04DA-E2=H'0081
1	O	R	Firmware version	Display the current firmware version in hex.
2	O	R/W	CH1 output mode setting	Output mode: Default = H'0000. Mode 0 (H'0000): Voltage output (±10 V). Mode 1 (H'0001): Current output (0 to +20 mA). Mode 2 (H'0002): Current output (+4 to +20 mA). Mode -1 (H'FFFF): Close
3	O	R/W	CH2 output mode setting	
4	O	R/W	CH3 output mode setting	
5	O	R/W	CH4 output mode setting	
16	X	R/W	CH1 output signal value	Voltage output range: K-32,000 to K32,000 Current output range: K0 to K32,000 Default: K0 CR#18 to CR#19 of DVP02DA-E2 are reserved.
17	X	R/W	CH2 output signal value	
18	X	R/W	CH3 output signal value	
19	X	R/W	CH4 output signal value	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 to CH4. Default = K0
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	
34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value of CH1 to CH4. Default = K16,000
35	O	R/W	Adjusted Gain value of CH2	
36	O	R/W	Adjusted Gain value of CH3	
37	O	R/W	Adjusted Gain value of CH4	
Adjusted Offset Value, and adjusted Gain Value: *1. When using Mode 2, the channel does NOT allow adjustments to the Offset or Gain values. *2. When output mode changes, the adjusted Offset or Gain value automatically returns to defaults.				
40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing in CH1 to CH4. Default= H'0000
41	X	R/W	Function: Save all the set values	Save the values of all retentive parameters. Default = H'0000.
43	X	R	Error state	Register for storing all error states. Refer to the table of error states for more information.
100	O	R/W	Function: Enable/Disable limit detection	Upper and lower bound detection, b0 to b3 corresponds to CH1 to CH4 (0: Disable; 1: Enable). Default= H'0000.

CR#	Attrib.		Register name	Description
101	X	R/W	Upper and lower bound state	Display the upper and lower bound state. (0: Not exceed the upper or lower bound value ; 1: Exceeds the upper or lower bound value) b0 to b3 corresponds to Ch1 to Ch4 for lower bound detection result; b8 to b11 corresponds to CH1 to CH4 for upper bound detection result.
102	O	R/W	Set value of CH1 upper bound	Set value of CH1 to CH4 upper bound. Default = K32000
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1 to CH4 lower bound. Default = K-32000
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
114	O	R/W	Output update time of CH1	Set value of CH1 to CH4 output update time. Setting range: K0 to K100. Default = H'0000
115	O	R/W	Output update time of CH2	
116	O	R/W	Output update time of CH3	
117	O	R/W	Output update time of CH4	
118	O	R/W	LV output mode setting	Set the output mode of CH1 to CH4 when the power is at LV (low voltage) condition. Default= H'0000
Symbols: O: Retentive CR. When CR#41 is set to H'5678, the values of the retentive CRs will be retained. X: Non-retentive CR. R: You can use FROM instruction to read the CR. W: You can use TO instruction to write data into the CR.				

※ **CR#0 for module reset**

You can use CR#0 to reset all settings by writing H'4352 in CR#0 and waiting for one second before turning the power OFF and then ON again. All parameter settings for this module will be reinitialized. It is suggested to connect only one module for module reset at a time to prevent the initialization process from affecting the normal operation of other modules. This feature is only available for firmware V1.12 or later.

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

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

※ **Adjust D/A Conversion Curve**

You can adjust the conversion curves as needed by changing the Offset value (CR#28 to CR#31) and Gain value (CR#34 to CR#37).

Gain: For the adjusted conversion curve, the Gain is calculated by dividing the voltage (or current) value corresponding to the digital value of 16000 by the resolution for the mode.

Offset: For the adjusted conversion curve, the Offset is calculated by dividing the voltage (or current) value corresponding to the digital value of 0 by the resolution for the mode.

- **Equation for voltage output Mode0:**

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

Y=Voltage output, X=Digital input

Resolution: 0.3125 mV = 20 V/64,000

- **Equation for current output Mode1:**

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

Y=Current output, X=Digital input

Resolution: 0.625 μA = 20 mA/32,000

- **Equation for current output Mode2:**

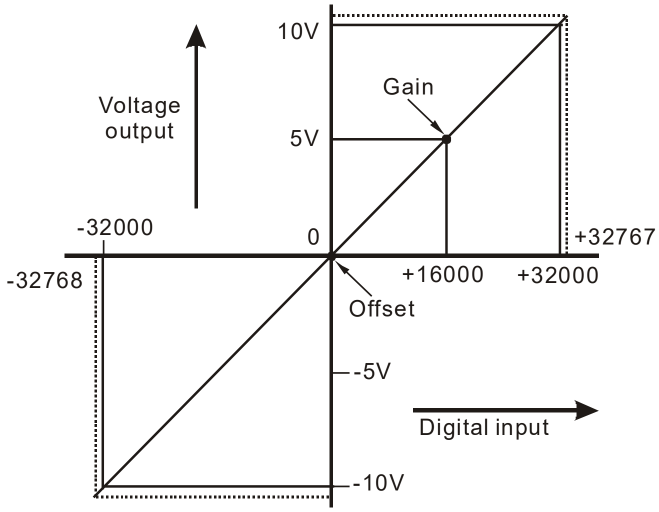
$$Y(mA) = \left[\frac{X \times (19200 - 6400)}{16000} + 6400\right] \times \left(\frac{20(mA)}{32000}\right)$$

Y=Current output, X=Digital input

Resolution: 0.5 μA = 16 mA/32,000

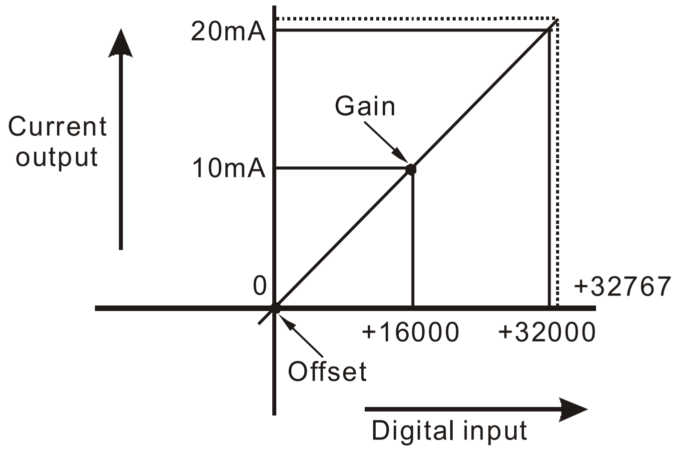
Mode 0 of CR#2 to CR#5	-10 V to +10 V, Gain=16,000 (=$5V/312.5uV$), Offset=0
Range of digital conversion	-32,000 to +32,000
Max./Min. range of digital conversion	-32,768 to +32,767

Mode 0

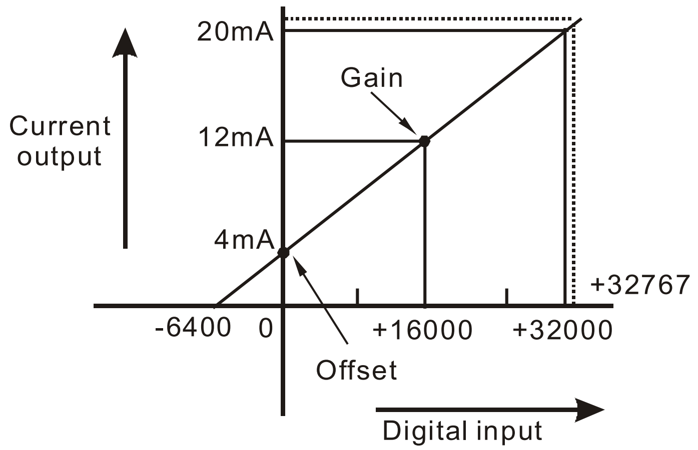


Mode 1 of CR#2 to CR#5	0 mA to +20 mA, Gain=16,000 (=$10mA/625nA$), Offset=0
Range of digital conversion	0 LSB to +32,000 LSB
Max./Min. range of digital conversion	0 LSB to +32,767 LSB

Mode 1



Mode 2 of CR#2 to CR#5	+4 mA to +20 mA, Gain=19,200 (=$12mA/0.625\mu A$), Offset=6,400 (=$4mA/0.625\mu A$)
Range of digital conversion	0 $_{LSB}$ to +32,000 $_{LSB}$
Max./Min. range of digital conversion	-6400 $_{LSB}$ to +32,767 $_{LSB}$

Mode 2


3.5.3 DVP06XA-E2 Control Registers

CR#	Attrib.		Register name	Description
0	O	R	Model name	Set up by the system: DVP06XA-E2 model code = H'00C4
1	O	R	Firmware version	Display the current firmware version in hex.
2	O	R/W	CH1 Input mode setting	Input mode: Default = H'0000 Mode 0 (H'0000): Voltage input (±10 V) Mode 1 (H'0001): Voltage input (±5 V) Mode 2 (H'0002): Voltage input (0 to +10 V) Mode 3 (H'0003): Voltage input (0 to +5 V) Mode 4 (H'0004): Current input (±20 mA) Mode 5 (H'0005): Current input (0 to +20 mA) Mode 6 (H'0006): Current input (4 to +20 mA) Mode -1 (H'FFFF): Close When the input mode is set to "Mode -1 (H'FFFF): Close", the measured value is fixed at the maximum positive integer 32767 (H'7FFF) instead of the maximum or minimum converted digital value, to indicate that the channel is turned off.
3	O	R/W	CH2 Input mode setting	
4	O	R/W	CH3 Input mode setting	
5	O	R/W	CH4 Input mode setting	
6	O	R/W	CH5 output mode setting	Output mode: Default = H'0000. Take CH5 for example: Mode 0 (H'0000): Voltage output (±10 V) Mode 1 (H'0001): Current output (0 to +20 mA) Mode 2 (H'0002): Current output (4 to +20 mA) Mode -1 (H'FFFF): Channel 5 unavailable
7	O	R/W	CH6 output mode setting	
8	O	R/W	CH1 average times	Average times setting of CH1 to CH4: Range = K1 to K100 Default = K10
9	O	R/W	CH2 average times	
10	O	R/W	CH3 average times	
11	O	R/W	CH4 average times	
12	X	R	CH1 average input value	Average value of input signals at CH1 to CH4
13	X	R	CH2 average input value	
14	X	R	CH3 average input value	
15	X	R	CH4 average input value	
16	X	R/W	CH5 output signal value	Voltage output range: K-32,000 to K32,000 Current output range: K0 to K32,000. Default: K0
17	X	R/W	CH6 output signal value	
20	X	R	CH1 present input value	Present value of input signals at CH1 to CH4
21	X	R	CH2 present input value	
22	X	R	CH3 present input value	
23	X	R	CH4 present input value	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 to CH3 Default = K0.
29	O	R/W	Adjusted Offset value of CH2	

CR#	Attrib.		Register name	Description
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	Set the adjusted Offset value of CH4 to CH6 Default = K0.
32	O	R/W	Adjusted Offset value of CH5	
33	O	R/W	Adjusted Offset value of CH6	
34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value in CH1 to CH6 Default = K16,000
35	O	R/W	Adjusted Gain value of CH2	
36	O	R/W	Adjusted Gain value of CH3	
37	O	R/W	Adjusted Gain value of CH4	
38	O	R/W	Adjusted Gain value of CH5	
39	O	R/W	Adjusted Gain value of CH6	
Adjusted Offset Value, and adjusted Gain Value: Note 1: When using Mode 6 for input or Mode 2 for output, the channel does NOT allow adjustments to Offset and Gain values. Note 2: When mode changes, the adjusted Offset and Gain value returns to defaults.				
40	O	R/W	Set value changing prohibited	Prohibit set value changing in CH1 to CH4. Default= H’0000.
41	X	R/W	Save all the set values	Save the values of all retentive parameters. Default =H’0000
43	X	R	Error state	Register for storing all error states. Refer to table of error state for more information.
100	O	R/W	Enable/Disable limit detection	Upper and lower bound detection, b0 to b5 corresponds to CH1 to CH6 (0: Disable/ 1: Enable). Default= H’0000.
101	X	R/W	Upper and lower bound status	Display the upper and lower bound status. (0: Not exceed /1: Exceeds upper or lower bound value), b0 to b5 corresponds to Ch1 to Ch6 for lower bound detection result; b8 to b13 corresponds to CH1 to CH6 for upper bound detection result.
102	O	R/W	Set value of CH1 upper bound	Set value of CH1 to CH6 upper bound. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
106	O	R/W	Set value of CH5 upper bound	
107	O	R/W	Set value of CH6 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1 to CH6 lower bound. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
112	O	R/W	Set value of CH5 lower bound	
113	O	R/W	Set value of CH1 lower bound	
114	O	R/W	Output update time of CH5	Set output update time of CH5 to CH6. Default = H’0000.
115	O	R/W	Output update time of CH6	

CR#	Attrib.		Register name	Description
118	O	R/W	LV output mode setting of Ch5 to Ch6	Set the output mode of CH5 to CH6 when the power is at LV (low voltage) condition. Default= H'0000
Symbols: O: Retentive CR. When CR#41 is set to H'5678, the values of the retentive CRs will be retained. X: Non-retentive CR. R: You can use FROM instruction to read the CR. W: You can use TO instruction to write data into the CR.				

※ **CR#0 for module reset**

You can use CR#0 to reset all settings by writing H'4352 in CR#0 and waiting for one second before turning the power OFF and then ON again. All parameter settings for this module will be reinitialized. It is suggested to connect only one module for module reset at a time to prevent the initialization process from affecting the normal operation of other modules. This feature is only available for firmware V1.14 or later.

3

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

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

※ **Adjust A/D Conversion Curve**

You can adjust the conversion curves as needed by changing the Offset value (CR#28 to CR#31) and Gain value (CR#34 to CR#37).

Gain: For the adjusted conversion curve, the Gain is calculated by dividing the voltage (or current) value corresponding to the digital value of 16000 by the resolution for the mode.

Offset: For the adjusted conversion curve, the Offset is calculated by dividing the voltage (or current) value corresponding to the digital value of 0 by the resolution for the mode.

3

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

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

Y=Digital output, X=Voltage input

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

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

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

Y=Digital output, X=Voltage input

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

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

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

Y=Digital output, X=Current input

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

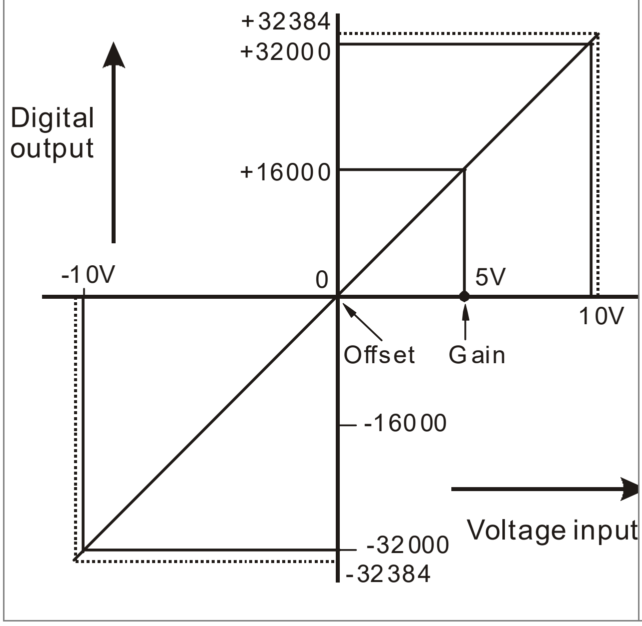
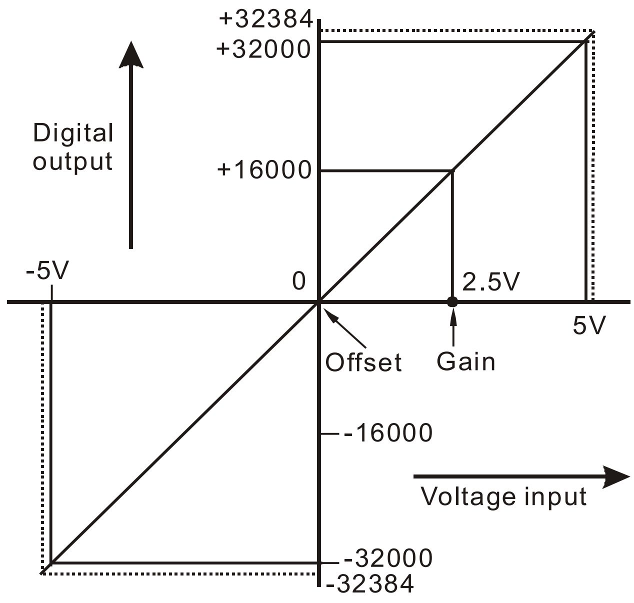
- **Equation for current input Mode6:**

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

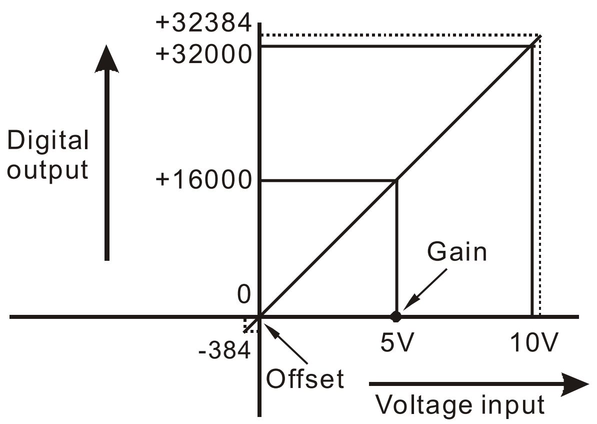
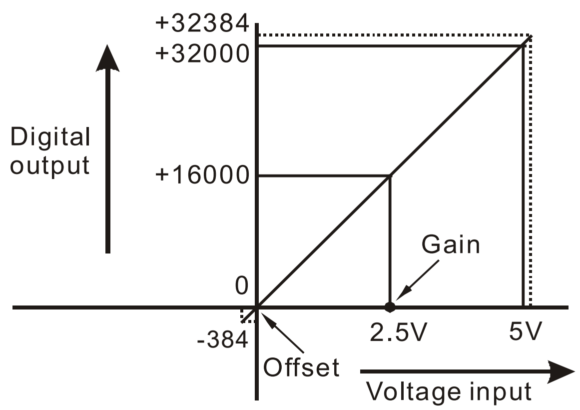
Y=Digital output, X=Current input

Resolution: 0.5 μA = 16 mA/32,000

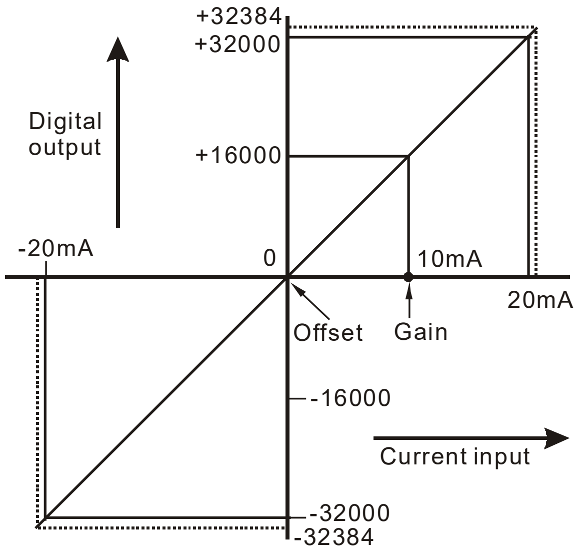
Mode 0 of CR#2 to CR#5	-10 V to +10 V, Gain=16,000 (=$5V/312.5uV$), Offset=0
Mode 1 of CR#2 to CR#5	-5 V to +5 V, Gain=16,000 (=$2.5V/156.25uV$), Offset=0
Range of digital conversion	-32,000 LSB to +32,000 LSB
Max./Min. range of digital conversion	-32,384 LSB to +32,384 LSB

Mode 0	Mode 1
	

Mode 2 of CR#2 to CR#5	0 V to +10 V, Gain=16,000 (=$5V/312.5uV$), Offset=0
Mode 3 of CR#2 to CR#5	0 V to +5 V, Gain=16,000 (=$2.5V/156.25uV$), Offset=0
Range of digital conversion	0 LSB to +32,000 LSB
Max./Min. range of digital conversion	-384 LSB to +32,384 LSB

Mode 2	**Mode 3**
	

Mode 4 of CR#2 to CR#5	-20 mA to +20 mA, Gain=16,000 (=$10mA/625nA$), Offset=0
Range of digital conversion	-32,000 LSB to +32,000 LSB
Max./Min. range of digital conversion	-32,384 LSB to +32,384 LSB

Mode 4


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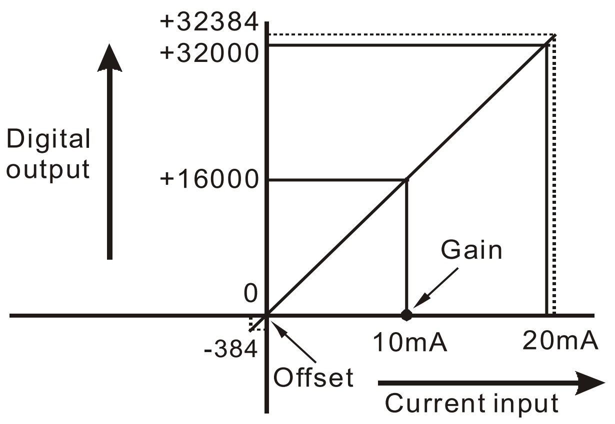
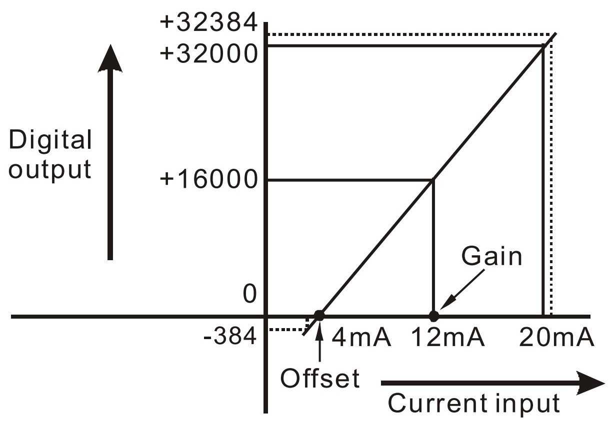
Mode 5 of CR#2 to CR#5	0 mA to +20 mA, Gain=16,000 (= $10mA/625nA$), Offset=0
Mode 6 of CR#2 to CR#5	+4 mA to +20 mA, Gain=19,200 (= $12mA/625nA$), Offset=6,400 (= $4mA/625nA$)
Range of digital conversion	0 LSB to +32,000 LSB
Max./Min. range of digital conversion	-384 LSB to +32,384 LSB

Mode 5	**Mode 6**
	

※ **Adjust D/A Conversion Curve**

You can adjust the conversion curves as needed by changing the Offset value (CR#32 to CR#33) and Gain value (CR#38 to CR#39).

Gain: For the adjusted conversion curve, the Gain is calculated by dividing the voltage (or current) value corresponding to the digital value of 16000 by the resolution for the mode.

Offset: For the adjusted conversion curve, the Offset is calculated by dividing the voltage (or current) value corresponding to the digital value of 0 by the resolution for the mode.

- **Equation for voltage output Mode0:**

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

Y=Voltage output, X=Digital input

Resolution: 0.3125 mV = 20 V/64,000

- **Equation for current output Mode1:**

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

Y=Current output, X=Digital input

Resolution: 0.625 μA = 20 mA/32,000

- **Equation for current output Mode2:**

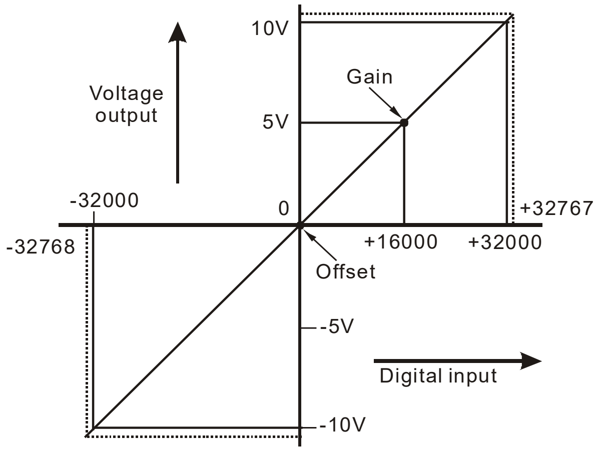
$$Y(mA) = \left[\frac{X \times (19200 - 6400)}{16000} + 6400\right] \times \left(\frac{20(mA)}{32000}\right)$$

Y=Current output, X=Digital input

Resolution: 0.5 μA = 16 mA/32,000

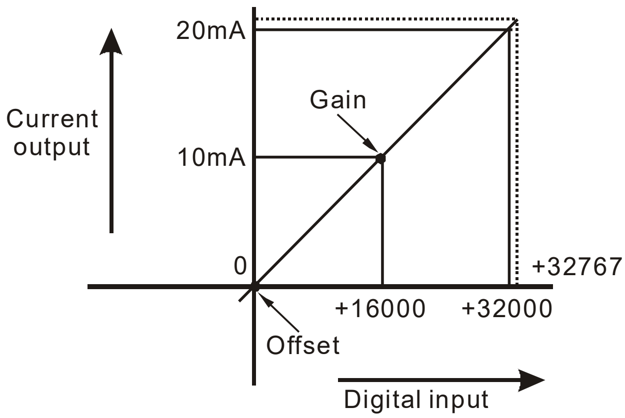
Mode 0 of CR#6 to CR#7	-10 V to +10 V, Gain=16,000 (=$5V/312.5uV$), Offset=0
Range of digital conversion	-32,000 LSB to +32,000 LSB
Max./Min. range of digital conversion	-32,768 LSB to +32,767 LSB

Mode 0

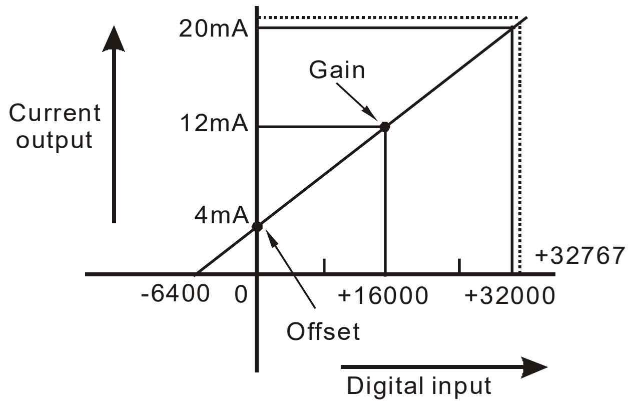


Mode 1 of CR#6 to CR#7	0 mA to +20 mA, Gain=16,000 (=$10mA/625nA$), Offset=0
Range of digital conversion	0 LSB to +32,000 LSB
Max./Min. range of digital conversion	0 LSB to +32,767 LSB

Mode 1



Mode 2 of CR#6 to CR#7	+4 mA to +20 mA, Gain=19,200 (=$12mA/625nA$), Offset=6,400 (=$4mA/625nA$)
Range of digital conversion	0 $_{LSB}$ to +32,000 $_{LSB}$
Max./Min. range of digital conversion	-6400 $_{LSB}$ to +32,767 $_{LSB}$

Mode 2


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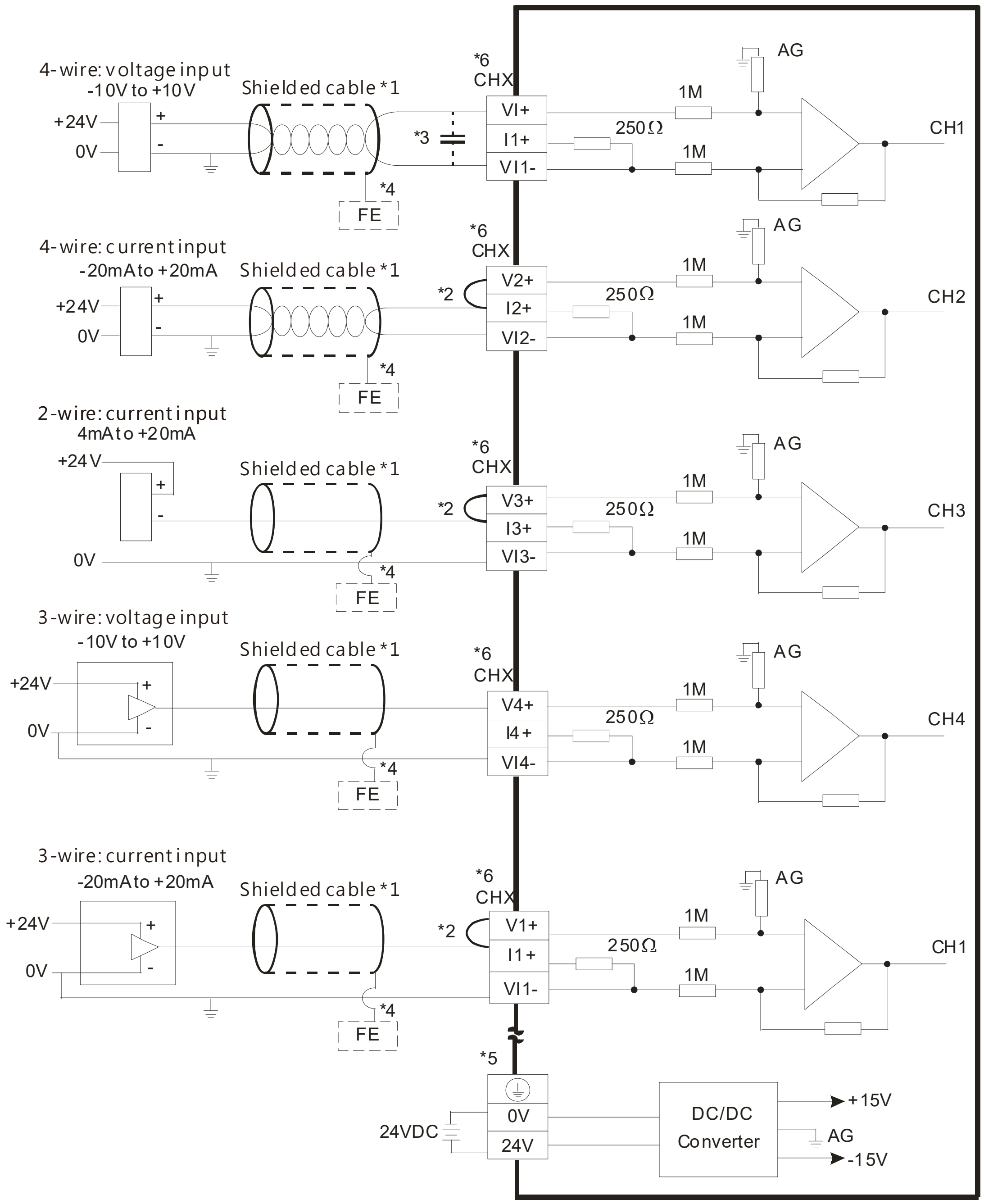
3.6 Wiring

3.6.1 Wiring DVP04AD-E2



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

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

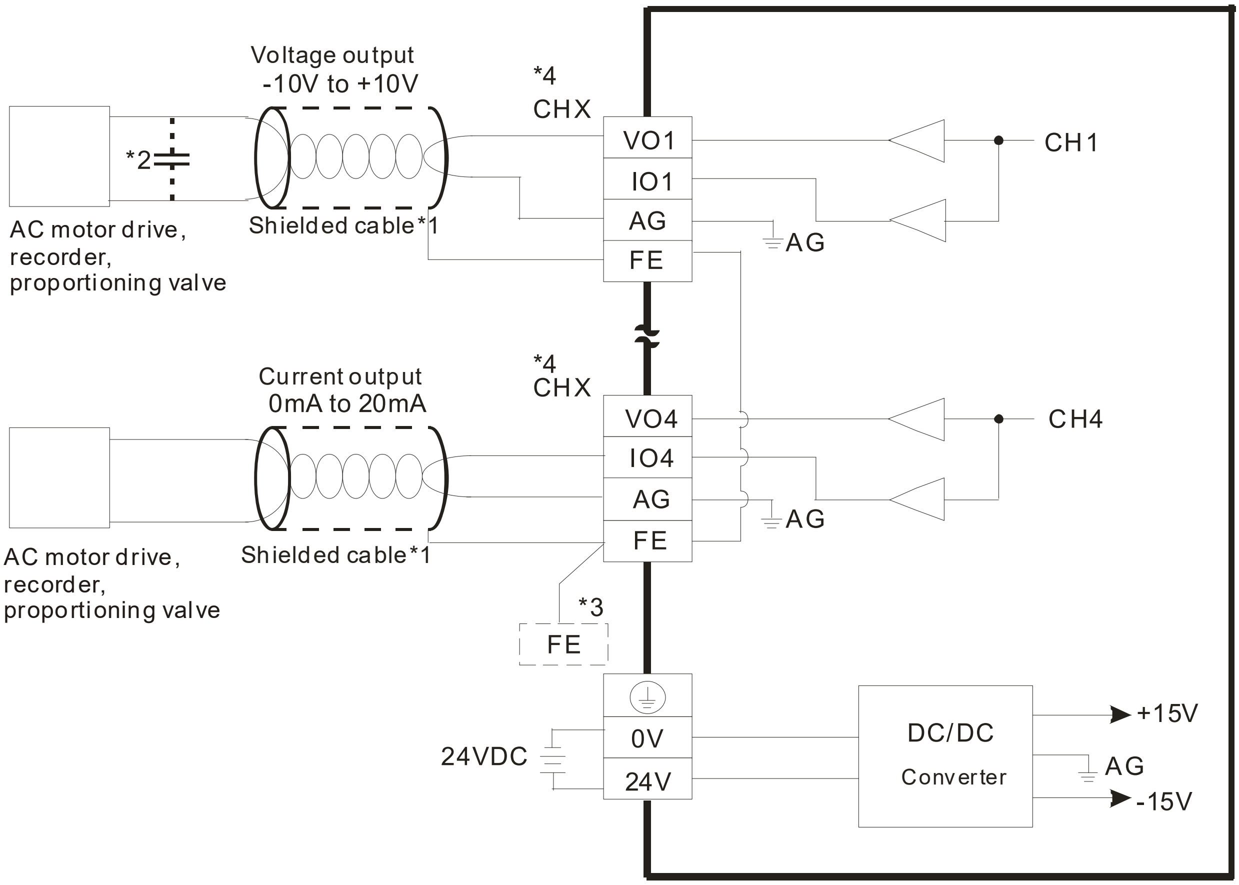
*3. If noise in the input voltage results in noise interference in the wiring, connect the module to a capacitor with a capacitance between 0.1–0.47 μF with a working voltage of 25 V.

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

*5. Connect the terminal ⏚ to ground.

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

3.6.2 Wiring DVP02DA-E2/DVP04DA-E2



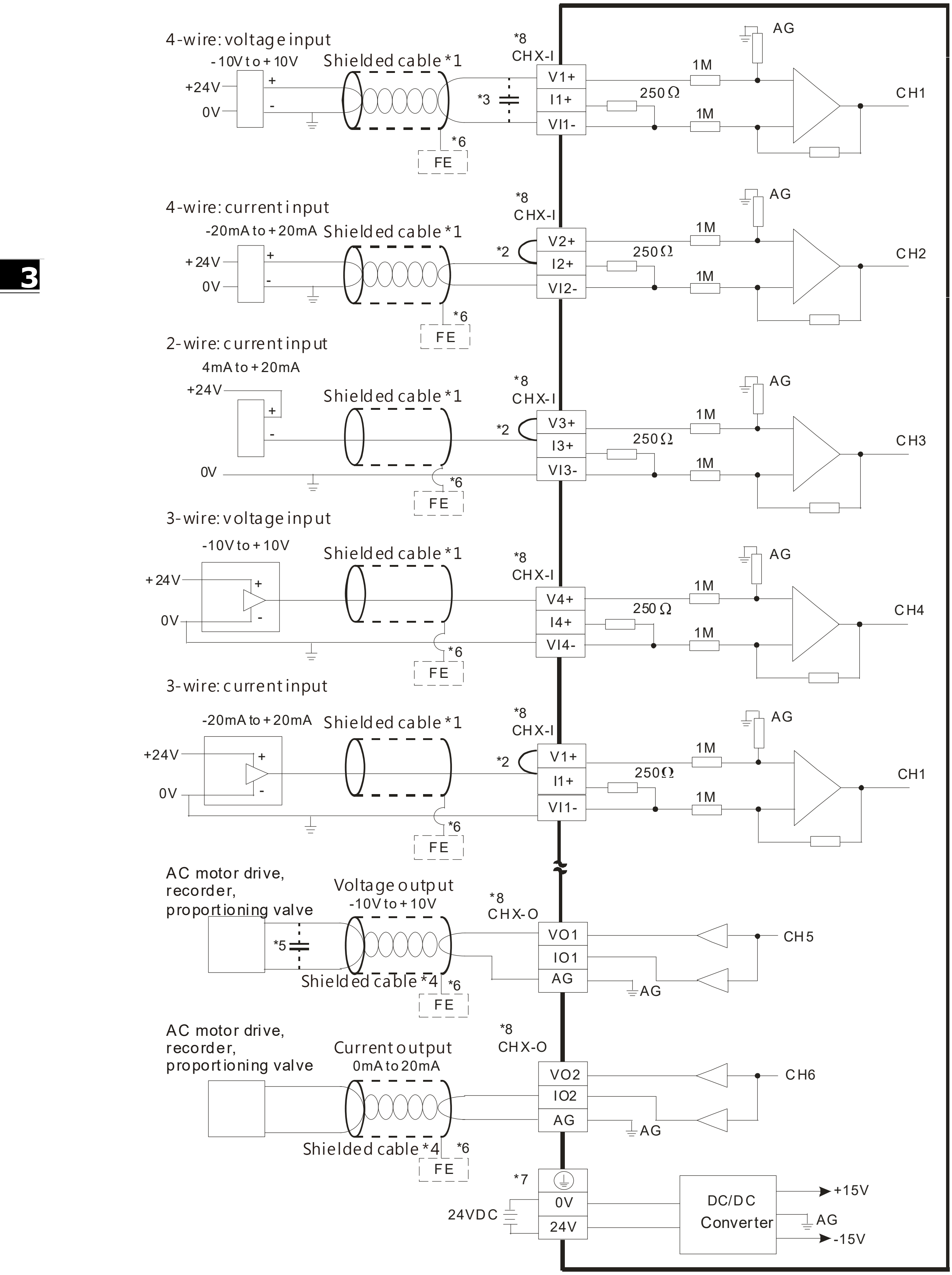
*1. Use shielded cables to isolate the analog input signal cable from other power cables.

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

*3. Connect the terminal ⏚ to ground.

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

3.6.3 Wiring DVP06XA-E2



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

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

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

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

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

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

*7. Connect the terminal ⏚ to ground.

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

3.7 Troubleshooting

When an error occurs in AD, DA, XA modules, an error indicator will start blinking. Once you see the error indicator blinking, you can use the FROM instruction to read the error codes stored in CR#43. Bit 0 to bit 13 indicate the error codes. It is possible to have more than two errors at the same time. 0 indicates *normal* and 1 indicates *error*. Refer to the following table for more details on the causes and the solutions for troubleshooting.

Bit No.	RUN LED	ERROR LED	Description	Solution
bit0	OFF	ON	The external voltage is abnormal.	Check the power supply
bit1	Blinking (0.2 s ON, 0.2 s OFF)	Blinking (0.2 s ON, 0.2 s OFF)	Hardware error	Contact the factory
bit2			Conversion value exceeds the set upper/lower value	Check the upper and lower value
bit3			Channel 1 conversion value is abnormal	Check the Conversion value in Channel 1
bit4			Channel 2 conversion value is abnormal	Check the Conversion value in Channel 2
bit5			Channel 3 conversion value is abnormal	Check the Conversion value in Channel 3
bit6			Channel 4 conversion value is abnormal	Check the Conversion value in Channel 4
bit9			Mode setting error	Check the mode setting
bit10			Average times setting error	Check the average times setting
bit11			Upper/lower value setting error	Check the upper/lower limit setting
bit12			Set value cannot be changed.	Check the value in CR#40 (set value changing prohibited)
bit13			Communication breakdown on next module.	Check the wiring of the modules.

4

Chapter 4 DVP-E Series Temperature Measurement Module

Table of Contents

4.1 General Specifications

4.1.1 DVP04PT-E2/DVP06PT-E2 Specifications

- **Electrical specifications**

Model name	DVP04PT-E2	DVP06PT-E2
Number of inputs	Four	Six
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)	
Connector type	Removable terminal block (terminal pitch: 5 mm)	
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.	
Weight	207 g	176 g

- **Functional specifications**

Digital data format		16-bit two's complement number
Conversion time		200 ms /channel
Overall accuracy		25°C/77°F: The error is ±0.3% of the input within the range. 0 to +55°C / 32 to 131°F: The error is ±0.6% of the input within the range.
Applicable sensor	**04PT**	**2-Wire/3-Wire:** **Pt100**: DIN 43760-1980 JIS C1604-1989, 100 Ω 3850 PPM/°C **Pt1000**: DIN EN60751, 1 kΩ 3850 PPM/°C **Ni100/Ni1000**: DIN 43760 **0 to 300 Ω/0 to 3000 Ω**
	06PT	**2-Wire/3-Wire:** **Pt100**: DIN 43760-1980 JIS C1604-1989, 100Ω 3850 PPM/°C **Pt1000:** DIN EN60751, 1 kΩ 3850 PPM/°C **Ni100/Ni1000**: DIN 43760 **Cu50/Cu100** **JPt100**: JIS C1604-1989 **LG-Ni1000** **0 to 300 Ω/0 to 3000 Ω**
Rated measurement range		Please refer to the table Note*1 below.
Rated analog-to-digital conversion range		Please refer to the table Note*2 below.
Maximum measurable temperature range		Please refer to the table Note*3 below.
Hardware resolution	**Centigrade (°C)**	0.1°C
	Fahrenheit (°F)	0.18°F*4
	Impedance	0.1 Ω
Average function		Setting range: K1 to K100
Self-diagnosis function		Detecting if it exceeds upper and lower limits or if channel disconnection occurs.

Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, and the analog channels are isolated from one another by optocouplers. Isolation between a digital circuit and a ground: 500 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 VAC and a ground: 500 VAC

Note*1. Rated measurement range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Impedance
Pt100	-180°C to 800°C	-292°F to 1,472°F	-
Ni100	-80°C to 170°C	-112°F to 338°F	
Pt1000	-180°C to 800°C	-292°F to 1,472°F	
Ni1000	-80°C to 170°C	-112°F to 338°F	
JPt100	-180°C to 500°C	-292°F to 932°F	
Cu50	-50°C to 150°C	-58°F to 302°F	
Cu100	-50°C to 150°C	-58°F to 302°F	
LG-Ni1000	-50°C to 180°C	-58°F to 356°F	
0~300 Ω	-	-	0 to 300 Ω
0~3000 Ω	-	-	0 to 3000 Ω

Note*2. Rated analog-to-digital conversion range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Impedance
Pt100	K-1,800 to K8,000	K-2,920 to K14,720	-
Ni100	K-800 to K1,700	K-1,120 to K3,380	
Pt1000	K-1,800 to K8,000	K-2,920 to K14,720	
Ni1000	K-800 to K1,700	K-1,120 to K3,380	
JPt100	K-1,800 to K5,000	K-2,920 to K9,320	
Cu50	K-500 to K1,500	K-580 to K3,020	
Cu100	K-500 to K1,500	K-580 to K3,020	
LG-Ni1000	K-500 to K1,800	K-580 to K3,560	
0~300 Ω	-	-	K0 to K3,000
0~3000 Ω	-	-	K0 to K30,000

Note*3. Maximum measurable temperature range

- **DVP04PT-E2**

Sensor	Centigrade (°C)	Fahrenheit (°F)	Impedance
Pt100	-190°C to 810°C	-310°F to 1,490°F	-
Ni100	-90°C to 180°C	-130°F to 356°F	
Pt1000	-190°C to 810°C	-310°F to 1,490°F	
Ni1000	-90°C to 180°C	-130°F to 356°F	
0~300 Ω	-	-	0 to 320 Ω
0~3000 Ω	-	-	0 to 3200 Ω

- **DVP06PT-E2**

Sensor	Centigrade (°C)	Fahrenheit (°F)	Impedance
Pt100	-200°C to 850°C	-328°F to 1,562°F	-
Ni100	-100°C to 180°C	-148°F to 356°F	
Pt1000	-200°C to 850°C	-328°F to 1,562°F	
Ni1000	-100°C to 180°C	-148°F to 356°F	
JPt100	-200°C to 510°C	-328°F to 950°F	
Cu50	-60°C to 160°C	-76°F to 320°F	
Cu100	-60°C to 160°C	-76°F to 320°F	
LG-Ni1000	-60°C to 200°C	-76°F to 392°F	
0~300 Ω	-	-	0 to 320 Ω
0~3000 Ω	-	-	0 to 3200 Ω

Note*4. The temperature unit to be displayed is 0.1 °C and 0.1 °F. If the display mode is Fahrenheit, the number in the second decimal place will not be displayed.

4.1.2 DVP04TC-E2 Specifications

- **Electrical specifications**

Number of inputs	Four
Supply voltage	24 VDC (20.4 VDC to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block (terminal pitch: 5 mm)
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.
Weight	205 g

- **Functional specifications**

Analog input channels		Four
Digital data format		16-bit two's complement number
Conversion time		200 ms /channel
Overall accuracy		25°C/77°F: The allowed error range is ±0.3% of full scale. 0 to +55°C / 32 to 131°F: The allowed error range is ±0.6% of full scale.
Applicable sensor		J-type, K-type, R-type, S-type, T-type, E-type, N-type thermocouple; input voltage: ±80 mV
Rated input range		Please refer to the table Note*1 below.
Analog-to-digital conversion		Please refer to the table Note*2 below.
Hardware	**Centigrade (°C)**	0.1°C

resolution	Fahrenheit (°F)	0.18°F[*3]
	Voltage	0.01 mV
Average function		Yes, CR#8 to CR#11, setting range: K1 to K100
Self-diagnosis function		Detecting if it exceeds upper and lower limits or if channel disconnection occurs.
Isolation		An analog circuit is isolated from a digital circuit by a digital integrated circuit / an optocoupler, and the analog channels are isolated from one another by optocouplers. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC Isolation between analog channels: 120 VAC

Note*1. Rated input temperature range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Voltage
J-type	-100°C to 1,150°C	-148°F to 2,102°F	-
K-type	-100°C to 1,350°C	-148°F to 2,462°F	
R-type	0°C to 1,750°C	32°F to 3,182°F	
S-type	0°C to 1,750°C	32°F to 3,182°F	
T-type	-150°C to 390°C	-238°F to 734°F	
E-type	-150°C to 980°C	-238°F to 1,796°F	
N-type	-150°C to 1,280°C	-238°F to 2,336°F	
±80 mV	-	-	-80 mV to 80 mV

Note*2. Analog-to-digital conversion range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Voltage
J-type	K-1,000 to K11,500	K-1,480 to K21,020	-
K-type	K-1,000 to K13,500	K-1,480 to K24,620	
R-type	K0 to K17,500	K320 to K31,820	
S-type	K0 to K17,500	K320 to K31,820	
T-type	K-1,500 to K3,900	K-2,380 to K7,340	
E-type	K-1,500 to K9,800	K-2,380 to K17,960	
N-type	K-1,500 to K12,800	K-2,380 to K23,360	
±80 mV	-	-	-8000 to 8000

Note*3. The temperature unit to be displayed is 0.1 °C and 0.1 °F. If the display mode is Fahrenheit, the number in the second decimal place will not be displayed.

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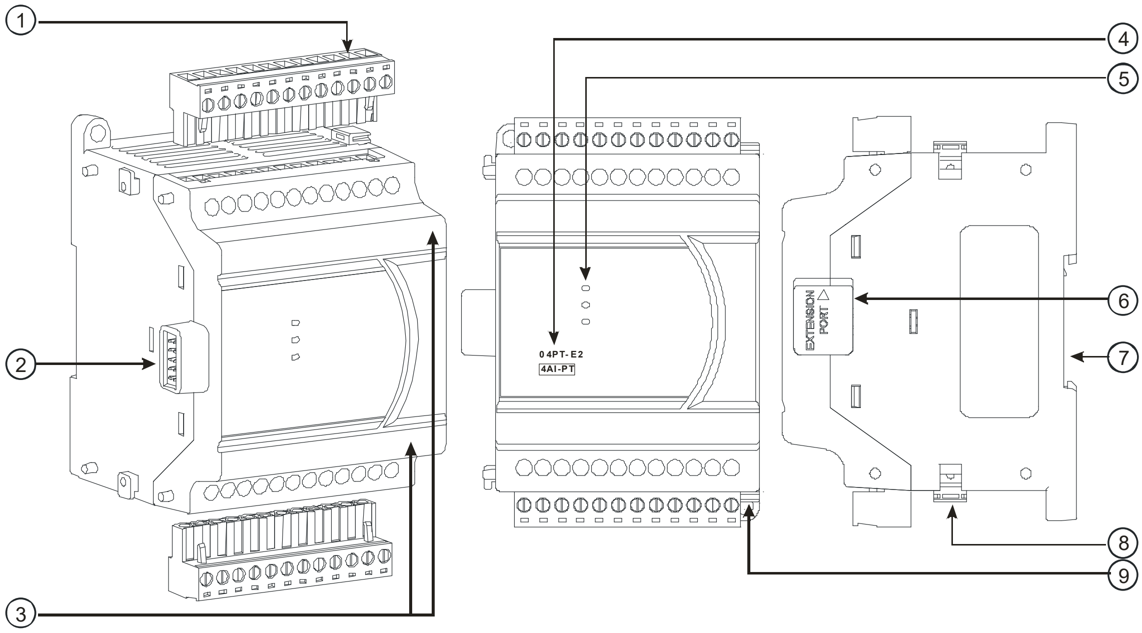
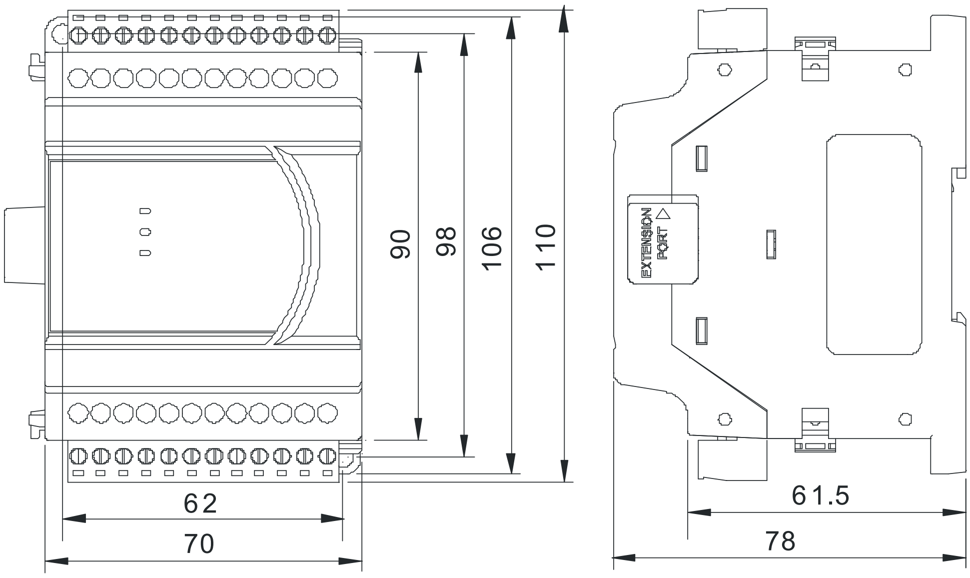
4.2 Module Profiles



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

4.3 Module Dimensions



Unit: mm

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4.4 Module Terminals

- **DVP04PT-E2**

DVP04PT-E2 (4AI)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	O1+	I1+	I1-	FE	O2+	I2+	I2-	FE	O3+	I3+	I3-	FE
Lower	24V	0V	⏚	FE	O4+	I4+	I4-	FE				

- **DVP06PT-E2**

DVP06PT-E2 (6AI)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	O1+	I1+	I1-	O2+	I2+	I2-	O3+	I3+	I3-	O4+	I4+	I4-
Lower	24V	0V	⏚	FE	FE	FE	O5+	I5+	I5-	O6+	I6+	I6-

- **DVP04TC-E2**

DVP04TC-E2 (4AI)

	1	2	3	4	5	6	7	8	9	10	11	12
Upper	I1+	I1-	FE	I2+	I2-	FE	I3+	I3-	FE	I4+	I4-	FE
Lower	24V	0V	⏚	FE	FE	FE	FE	FE				

4.5 Control Registers

4.5.1 DVP04PT-E2/DVP06PT-E2 Control Registers

<table>
<tr><th colspan="2">CR#</th><th colspan="2" rowspan="2">Attrib.</th><th rowspan="2">Registers content</th><th rowspan="2">Description</th></tr>
<tr><th>04PT</th><th>06PT</th></tr>
<tr><td>0</td><td>0</td><td>O</td><td>R</td><td>Model name</td><td>DVP04PT-E2 model code = H’0082
DVP06PT-E2 model code = H’00C2</td></tr>
<tr><td>1</td><td>1</td><td>O</td><td>R</td><td>Firmware version</td><td>Display the current firmware version in hex.</td></tr>
<tr><td>2</td><td>2</td><td>O</td><td>R/W</td><td>CH1 Input mode setting</td><td rowspan="6">Input mode: Default = H’0000
Mode 0 (H’0000): Pt100 (-180°C to 800°C)
Mode1 (H’0001): Ni100 (-80°C to 170°C)
Mode2 (H’0002): Pt1000 (-180°C to 800°C)
Mode3 (H’0003): Ni1000 (-80°C to 170°C)
Mode4 (H’0004): 0 to 300 Ω
Mode5 (H’0005): 0 to 3000 Ω
Mode6 (H’0006): JPt100 (-180°C to 500°C)
Mode7 (H’0007): Cu50 (-50°C to 150°C)
Mode8 (H’0008): Cu100 (-50°C to 150°C)
Mode9 (H’0009): LG-Ni1000 (-50°C to 180°C)
Mode-1 (H’FFFF): Close
Note1: DVP04PT-E2 does NOT support mode 6 to mode 9.
Note2: DVP04PT-E2 mode 5 requires firmware version V1.11 or above.
Note 3: When the input mode for DVP04PT-E2 is set to "Mode-1 (H’FFFF): Close", the measured value is fixed at the maximum positive integer 32767 (H’7FFF).
Note 4: When the input mode for DVP06PT-E2 is set to "Mode-1 (H’FFFF): Close", the measured value is fixed at 0.</td></tr>
<tr><td>3</td><td>3</td><td>O</td><td>R/W</td><td>CH2 Input mode setting</td></tr>
<tr><td>4</td><td>4</td><td>O</td><td>R/W</td><td>CH3 Input mode setting</td></tr>
<tr><td>5</td><td>5</td><td>O</td><td>R/W</td><td>CH4 Input mode setting</td></tr>
<tr><td></td><td>6</td><td>O</td><td>R/W</td><td>CH5 Input mode setting</td></tr>
<tr><td></td><td>7</td><td>O</td><td>R/W</td><td>CH6 Input mode setting</td></tr>
<tr><td>7</td><td></td><td>O</td><td>R/W</td><td>Temperature unit setting</td><td>Select the temperature unit (Celsius °C / Fahrenheit °F).
Default= H’0 (°C)</td></tr>
<tr><td>8</td><td>8</td><td>O</td><td>R/W</td><td>CH1 average times</td><td rowspan="6">Average times setting of channels CH1 to CH6
Setting range: K1 to K100
Default = K10</td></tr>
<tr><td>9</td><td>9</td><td>O</td><td>R/W</td><td>CH2 average times</td></tr>
<tr><td>10</td><td>10</td><td>O</td><td>R/W</td><td>CH3 average times</td></tr>
<tr><td>11</td><td>11</td><td>O</td><td>R/W</td><td>CH4 average times</td></tr>
<tr><td></td><td>12</td><td>O</td><td>R/W</td><td>CH5 average times</td></tr>
<tr><td></td><td>13</td><td>O</td><td>R/W</td><td>CH6 average times</td></tr>
<tr><td>12</td><td>14</td><td>X</td><td>R</td><td>Average temperature measured at CH1</td><td rowspan="5">Average temperature measured.
Setting Temperature Unit:
● DVP04PT-E2: CR#7
● DVP06PT-E2: CR#27</td></tr>
<tr><td>13</td><td>15</td><td>X</td><td>R</td><td>Average temperature measured at CH2</td></tr>
<tr><td>14</td><td>16</td><td>X</td><td>R</td><td>Average temperature measured at CH3</td></tr>
<tr><td>15</td><td>17</td><td>X</td><td>R</td><td>Average temperature measured at CH4</td></tr>
<tr><td></td><td>18</td><td>X</td><td>R</td><td>Average temperature measured at CH5</td></tr>
</table>

CR# 04PT	CR# 06PT	Attrib.		Registers content	Description
	19	X	R	Average temperature measured at CH6	
20	20	X	R	Present temperature measured at CH1	Present temperature measured. Setting Temperature Unit: ● DVP04PT-E2: CR#7 ● DVP06PT-E2: CR#27
21	21	X	R	Present temperature measured at CH2	
22	22	X	R	Present temperature measured at CH3	
23	23	X	R	Present temperature measured at CH4	
	24	X	R	Present temperature measured at CH5	
	25	X	R	Present temperature measured at CH6	
	26	O	R/W	Mode 4: 0 to 300 Ω. Temperature display decimal digit changes	In mode 4 (0 to 300 Ω), temperature display decimal places: 0 = 1 digit after the decimal place, 1 = 2 digits after the decimal place. Default= H0
	27	O	R/W	Temperature unit setting	Select the temperature unit (Celsius °C / Fahrenheit °F). Default = H'0 (°C)
28	28	O	R/W	Adjusted offset value of CH1	Adjusted offset value, range K-1000 to K1000. Default = K0 Measured Value = Original Value – Adjusted Offset Value Unit Setup: ● DVP04PT-E2: CR#7 ● DVP06PT-E2: CR#27
29	29	O	R/W	Adjusted offset value of CH2	
30	30	O	R/W	Adjusted offset value of CH3	
31	31	O	R/W	Adjusted offset value of CH4	
	32	O	R/W	Adjusted offset value of CH5	
	33	O	R/W	Adjusted offset value of CH6	
40	40	O	R/W	Set value changing prohibited	Prohibit set value changing, b0 to b5 corresponds to CH1 to CH6. Default =H'0000
41	41	X	R/W	Save all the set values	Save the values of all retentive parameters. Default =H'0000
43	43	X	R	Error state	Register for storing all error states. See the table of error states for more information.
100	100	O	R/W	Enable/Disable limit detection	Upper and lower bound detection, b0 to b5 corresponds to CH1 to CH6 (0: Disable; 1: Enable). Default= H'0000.
101	101	X	R/W	Upper and lower bound status	Displays the upper and lower bound state (0: Not exceeding the upper or lower bound value; 1: Exceeding the upper or lower bound value), b0 to b5 corresponds to CH1 to CH6 lower bound detection result, b8 to b13 corresponds to CH1 to CH6 upper bound detection result. Default =H'0000
102	102	O	R/W	Set value of CH1 upper bound	Set the upper bound value. Default = K32000.
103	103	O	R/W	Set value of CH2 upper bound	
104	104	O	R/W	Set value of CH3 upper bound	
105	105	O	R/W	Set value of CH4 upper bound	

CR#		Attrib.		Registers content	Description
04PT	06PT				
	106	O	R/W	Set value of CH5 upper bound	
	107	O	R/W	Set value of CH6 upper bound	
108	108	O	R/W	Set value of CH1 lower bound	Set the lower bound value. Default = K-32000.
109	109	O	R/W	Set value of CH2 lower bound	
110	110	O	R/W	Set value of CH3 lower bound	
111	111	O	R/W	Set value of CH4 lower bound	
	112	O	R/W	Set value of CH5 lower bound	
	113	O	R/W	Set value of CH6 lower bound	

Symbols:

O: Retentive CR. When CR#41 is set to H'5678, the values of the retentive CRs will be retained.

X: Non-retentive CR.

R: You can use FROM instruction to read the CR.

W: You can use TO instruction to write data into the CR.

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※ **CR#0 for module reset**

You can use CR#0 to reset all settings by writing H'4352 in CR#0 and waiting for one second before turning the power OFF and then ON again. All parameter settings for this module will be reinitialized. It is suggested to connect only one module for module reset at a time to prevent the initialization process from affecting the normal operation of other modules.

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

Description					
bit0	K1 (H'1)	Power supply error	Bit7	K128 (H'80)	CH5 Conversion error
bit1	K2 (H'2)	Reserved	Bit8	K256 (H'0100)	CH6 Conversion error
bit2	K4 (H'4)	Beyond-upper/lower bound error	bit9	K512 (H'0200)	Mode setting error
bit3	K8 (H'8)	CH1 Conversion error	bit10	K1024 (H'0400)	Average times error
bit4	K16 (H'10)	CH2 Conversion error	bit11	K2048 (H'0800)	Upper / lower bound setting error
bit5	K32 (H'20)	CH3 Conversion error	bit12	K4096 (H'1000)	Set value changing prohibited
bit6	K64 (H'40)	CH4 Conversion error	bit13	K8192 (H'2000)	Communication breakdown on next module

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

※ **PID Control Registers**

PID control function is not available for CH5 and CH6 of DVP06PT-E2.

CR				Attrib.		Register content	Description
CH1	CH2	CH3	CH4				
120	140	160	180	O	R/W	Set temperature value	Please set the temperature value according to the proper range of each sensor type. Default = K0
121	141	161	181	O	R/W	Sampling time (s)	Range: K1 to K30 (s). Default = K2
122	142	162	182	O	R/W	K_P	Proportional control constant. Default = K121
123	143	163	183	O	R/W	K_I	Integral constant. Default = K2,098
124	144	164	184	O	R/W	K_D	Derivative constant. Default = K-29
125	145	165	185	O	R/W	Upper limit of I value	Upper limit of I value. Default = K0
126	146	166	186	O	R/W	Lower limit of I value	Lower limit of I value. Default = K0
127	147	167	187	X	R	I value	Current accumulated offset value
128	148	168	188	O	R/W	Heating/cooling	H’0: Heater; H’1: Cooler. Default = H’0000
129	149	169	189	O	R/W	Upper limit of output	Setting range: K-32,760 to K32,760. Default = K32,000
130	150	170	190	O	R/W	Lower limit of output	Setting range: K-32,760 to K32,760. Default = K0
131	151	171	191	X	R	Output percentage	Range: K0 to K1,000. (Unit: 0.1%)
132	152	172	192	X	R	Output width (ms)	Width of control output. Unit: ms
133	153	173	193	X	R	Output cycle (ms)	Cycle of control output. Unit: ms
134	154	174	194	X	R	Output volume	Output volume
135	155	175	195	X	R/W	PID_RUN/STOP	H’0: STOP; H’1: RUN. Default = K0
136	156	176	196	X	R/W	Auto-tuning	H’0: Disabled; H’1: Auto-tuning. Default = K0

Symbols:
O: Retentive CR.
X: Non-retentive CR.
R: You can use FROM instruction to read the CR.
W: You can use TO instruction to write data into the CR.

※ **Adjust PT Conversion Curve**

You can adjust the conversion curves as needed by changing the Offset value.

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

(Measured Value= Original Value – Adjusted Offset Value)

- **Mode 0 to Mode 3, Mode 6 to Mode 9: input unit 0.1°**

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

Y= Digital output,

X= Measured temperature input

- **Mode 4 to Mode 5: input unit 0.1 Ω**

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

Y= Digital output,

X= Measured impedance input

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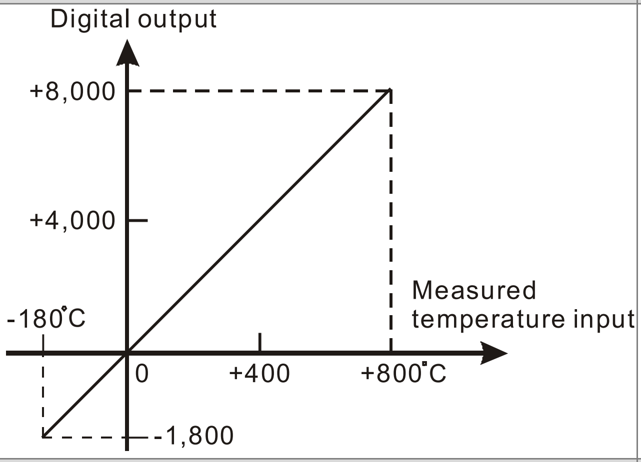
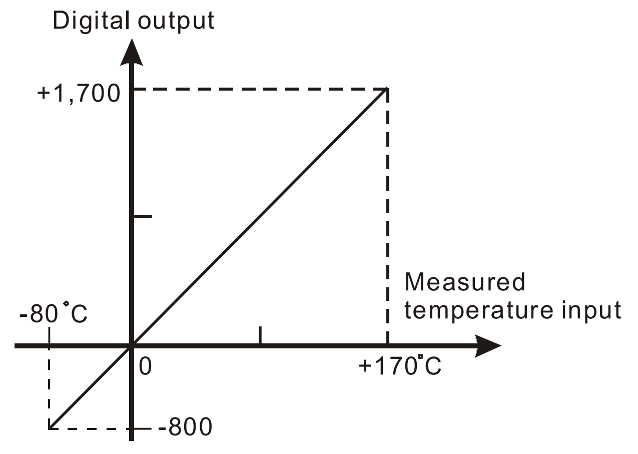
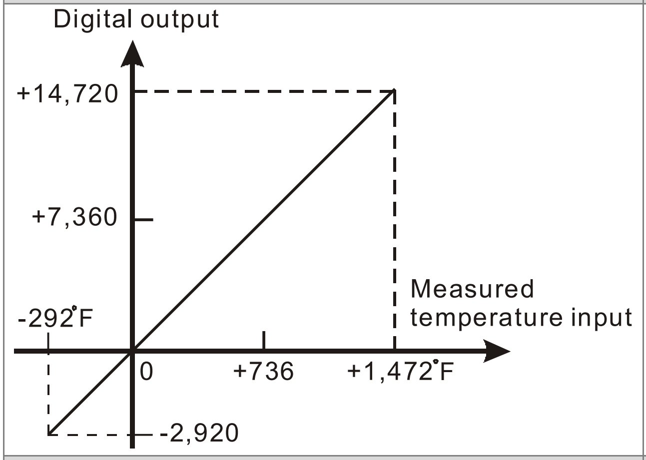
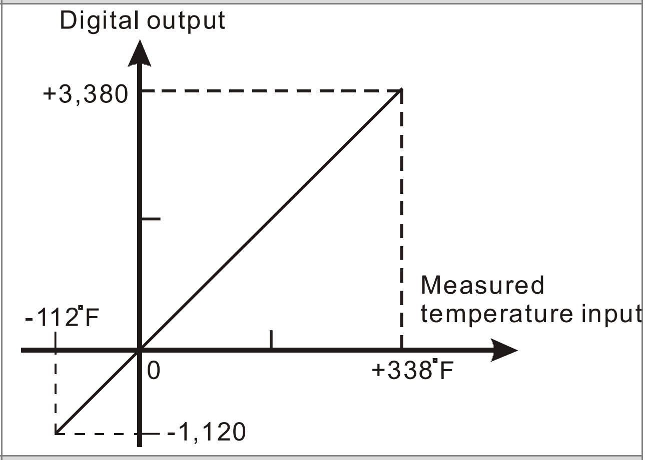
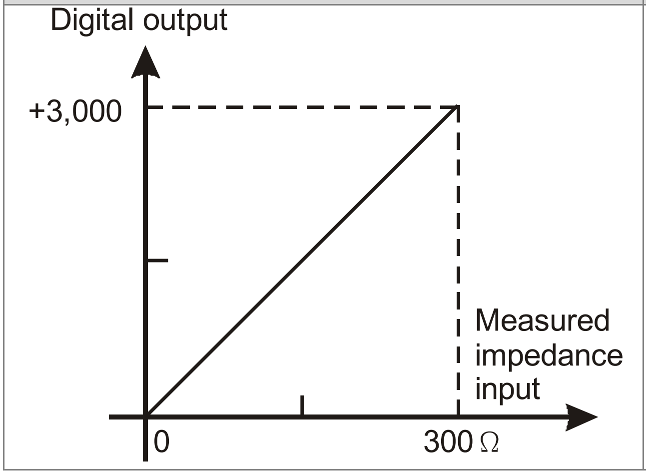
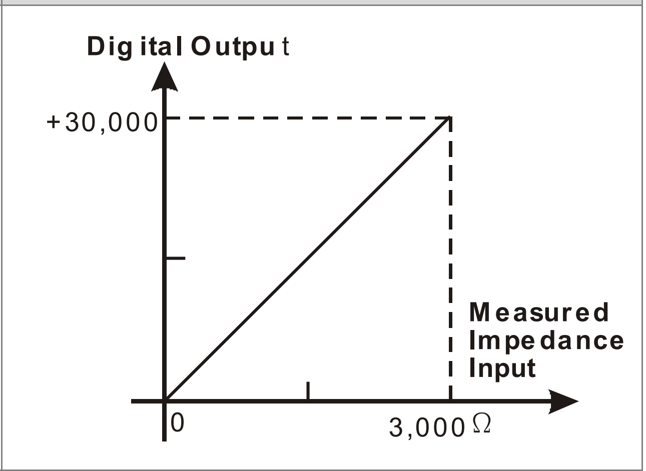
Mode 0	Mode 1
	

Mode 2	Mode 3
	

Mode 4	Mode 5
	

4.5.2 DVP04TC-E2 Control Registers

CR#	Attrib.		Register content	Description
0	O	R	Model name	Set up by the system: DVP04TC-E2 model code = H'0083
1	O	R	Firmware version	Displays the current firmware version in hex.
2	O	R/W	CH1 Input mode setting	Input mode: Default = H'0000. Mode 0 (H'0000): J-type (-100°C to 1,150°C) Mode 1 (H'0001): K-type (-100°C to 1,350°C) Mode 2 (H'0002): R-type (0°C to 1,750°C) Mode 3 (H'0003): S-type (0°C to 1,750°C) Mode 4 (H'0004): T-type (-150°C to 390°C) Mode 5 (H'0005): E-type (-150°C to 980°C) Mode 6 (H'0006): N-type (-150°C to 1,280°C) Mode 7 (H'0007): -80 mV to +80 mV Mode -1(H'FFFF): Close Note: When the input mode for DVP04PT-E2 is set to "Mode -1 (H'FFFF): Close", the measured value is fixed at the maximum positive integer 32767 (H'7FFF) to indicate that the channel is turned off.
3	O	R/W	CH2 Input mode setting	
4	O	R/W	CH3 Input mode setting	
5	O	R/W	CH4 Input mode setting	
7	O	R/W	Temperature unit setting	Select the temperature unit (Celsius °C / Fahrenheit °F). Default = H0 (°C)
8	O	R/W	CH1 average times	Set average times at CH1 to CH4 Range = K1 to K100 Default = K10
9	O	R/W	CH2 average times	
10	O	R/W	CH3 average times	
11	O	R/W	CH4 average times	
12	X	R	Average temperature measured at CH1	Average temperature measured at CH1 to Ch4 Temperature unit: set in CR#7
13	X	R	Average temperature measured at CH2	
14	X	R	Average temperature measured at CH3	
15	X	R	Average temperature measured at CH4	
20	X	R	Present temperature measured at CH1	Present temperature measured at CH1 to CH4 Temperature unit: set in CR#7
21	X	R	Present temperature measured at CH2	
22	X	R	Present temperature measured at CH3	
23	X	R	Present temperature measured at CH4	
28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of Ch1 to Ch4. Default = K0 Range: K-400 to K400 Temperature unit: set in CR#7 (Measured Value= Original Value – Adjusted Offset Value)
29	O	R/W	Adjusted Offset value of CH2	
30	O	R/W	Adjusted Offset value of CH3	
31	O	R/W	Adjusted Offset value of CH4	
40	O	R/W	Set value changing prohibited	Prohibit set value changing in CH1 to CH4. Default =H'0000
41	X	R/W	Save all the set values	Save the values of all retentive parameters. Default =H'0000
43	X	R	Error state	Register for storing all error states. See the table of error states for more information.
100	O	R/W	Function: Enable / Disable limit detection	Upper and lower bound detection, b0 to b3 corresponds to CH1 to CH4 (0: Disable; 1: Enable). Default= H'0000.

CR#	Attrib.		Register content	Description
101	X	R/W	Upper and lower bound state	Displays the upper and lower bound state (0: Not exceeding the upper or lower bound value; 1: Exceeding the upper or lower bound value) b0 to b3 corresponds to CH1 to CH4 lower bound, b8 to b11 corresponds to CH1 to CH4 upper bound.
102	O	R/W	Set value of CH1 upper bound	Set value of CH1 to CH4 upper bound. Default = K32000.
103	O	R/W	Set value of CH2 upper bound	
104	O	R/W	Set value of CH3 upper bound	
105	O	R/W	Set value of CH4 upper bound	
108	O	R/W	Set value of CH1 lower bound	Set value of CH1 to CH4 lower bound. Default = K-32000.
109	O	R/W	Set value of CH2 lower bound	
110	O	R/W	Set value of CH3 lower bound	
111	O	R/W	Set value of CH4 lower bound	
Symbols: O: Retentive CR. When CR#41 is set to H'5678, the values of the retentive CRs will be retained. X: Non-retentive CR. R: You can use FROM instruction to read the CR. W: You can use TO instruction to write data into the CR.				

4

※ **CR#0 for module reset**

You can use CR#0 to reset all settings by writing H'4352 in CR#0 and waiting for one second before turning the power OFF and then ON again. All connected parameter settings for this module will be reinitialized. It is suggested to connect only one module for module reset at a time to prevent the initialization process from affecting the normal operation of other modules. This feature is only available for firmware V1.10 or later.

CR#43 Error state value. See the table below.

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

※ **PID Control Registers**

CR				Attrib.		Register content	Description
CH1	CH2	CH3	CH4				
120	140	160	180	O	R/W	Set temperature value	Please set the temperature value according to the proper range of each sensor type. Default = K0
121	141	161	181	O	R/W	Sampling time (s)	Range: K1 to K30 (s). Default = K2
122	142	162	182	O	R/W	K_P	Proportional control constant. Default = K121

CR				Attrib.		Register content	Description
CH1	CH2	CH3	CH4				
123	143	163	183	O	R/W	K_I	Integral constant. Default = K2,098
124	144	164	184	O	R/W	K_D	Derivative constant. Default = K-29
125	145	165	185	O	R/W	Upper limit of I value	Upper limit of I value. Default = K0
126	146	166	186	O	R/W	Lower limit of I value	Lower limit of I value. Default = K0
127	147	167	187	X	R	I value	Current accumulated offset value
128	148	168	188	O	R/W	Heating/cooling	H’0: Heater; H’1: Cooler. Default = H’0000
129	149	169	189	O	R/W	Upper limit of output	Upper limit of output. Setting range: K-32,760 to K32,760. Default = K32,000
130	150	170	190	O	R/W	Lower limit of output	Lower limit of output. Setting range: K-32,760 to K32,760. Default = K0
131	151	171	191	X	R	Output percentage	Range: K0 to K1,000 (Unit: 0.1%)
132	152	172	192	X	R	Output width (ms)	Width of control output. Unit: ms
133	153	173	193	X	R	Output cycle (ms)	Cycle of control output. Unit: ms
134	154	174	194	X	R	Output volume	Output volume
135	155	175	195	X	R/W	PID_RUN/STOP	H’0: STOP; H’1: RUN. Default = K0
136	156	176	196	X	R/W	Auto-tuning	H’0: Disabled; H’1: Auto-tuning. Default = K0
Symbols: O: Retentive CR. X: Non-retentive CR. R: You can use FROM instruction to read the CR. W: You can use TO instruction to write data into the CR.							

※ **Adjust TC Conversion Curve**

You can adjust the conversion curves as needed by changing the Offset value (CR#28 to CR#31).

Offset: Deviation digital value from the target value. (Measured Value= Original Value – Adjusted Offset Value)

- **Mode0 to Mode6: input unit 0.1°**

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

Y= Digital output,

X= Measured temperature input

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

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

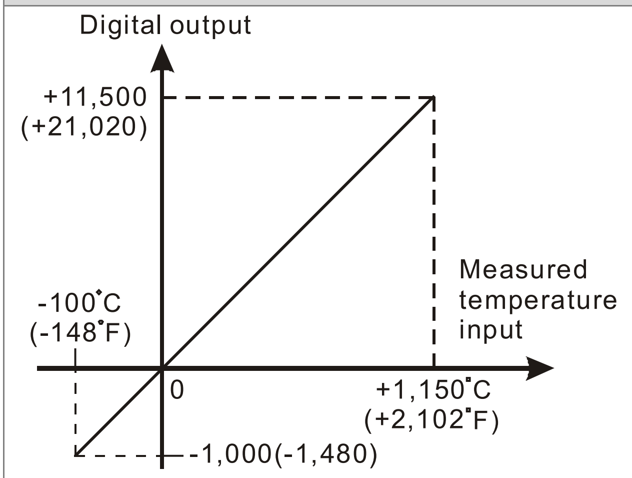
Y= Digital output,

X= Voltage input

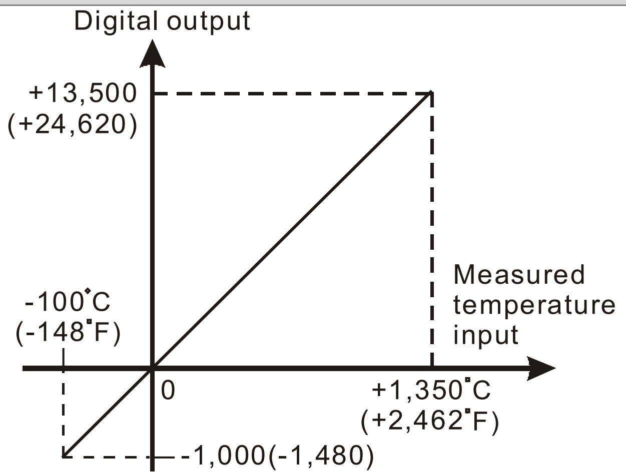
Mode 0 of CR#2 to CR#5	-100°C to 1150°C (-1000 to 11500) -148°F to 2102°F (-1480 to 21020)
Mode 1 of CR#2 to CR#5	-100°C to 1350°C (-1000 to 13500) -148°F to 2462°F (-1480 to 24620)
Mode 2, 3 of CR#2 to CR#5	0°C to 1750°C (0 to 17500) 32°F to 3182°F (320 to 31820)
Mode 4 of CR#2 to CR#5	-150°C to 390°C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

4

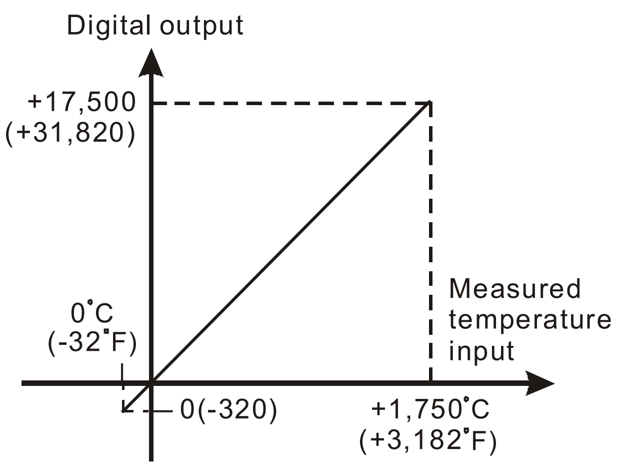
Mode 0: J-type thermocouple



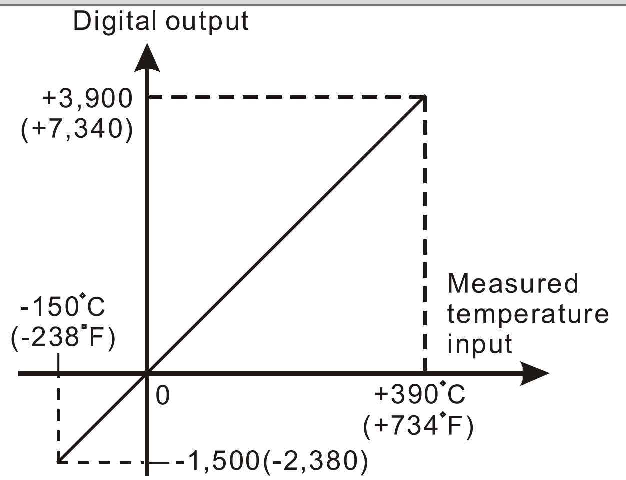
Mode 1: K-type thermocouple

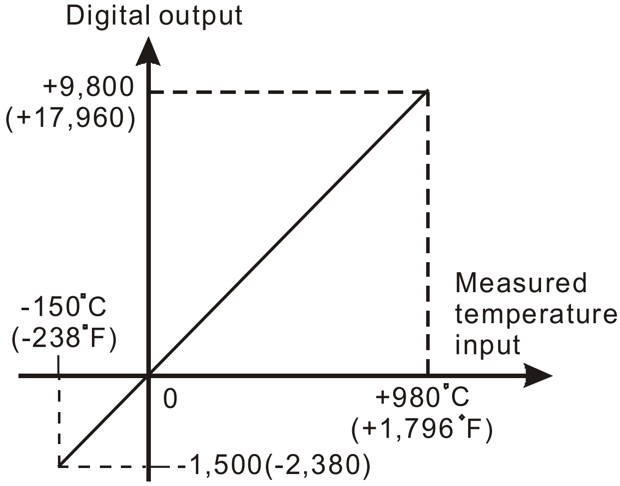
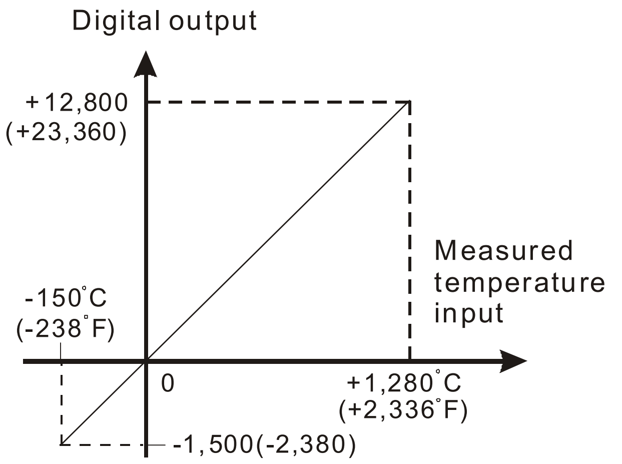


Mode 2: R-type thermocouple
Mode 3: S-type thermocouple



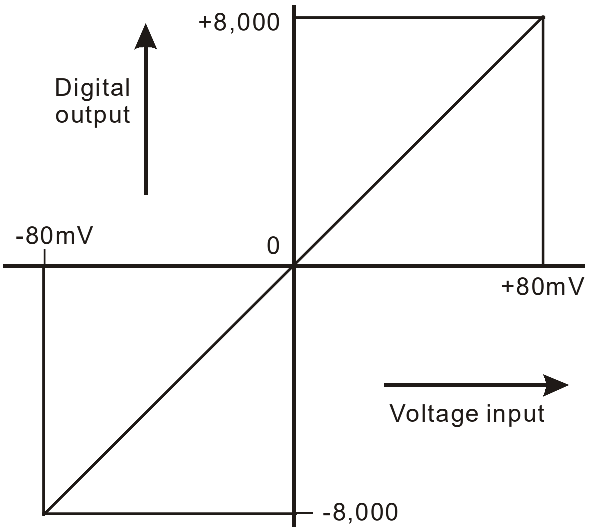
Mode 4: T-type thermocouple



Mode 5: E-type thermocouple	Mode 6: N-type thermocouple
	

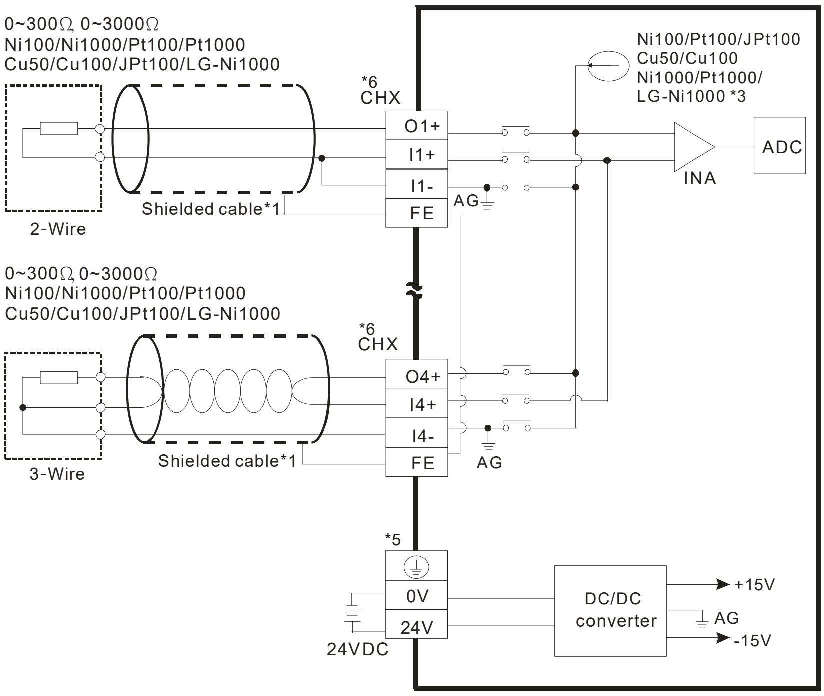
Mode 7 of CR#2 to CR#5	-80 mV to +80 mV (-8000 to 8000)

Mode 7



4.6 Wiring

4.6.1 Wiring DVP04PT-E2/DVP06PT-E2



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

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

*3. Choose a suitable temperature sensor.

- DVP06PT-E2:
  When using temperature sensors, such as Ni100, Pt100, JPt100, Cu50, Cu100 and 0 to 300 Ω impedance sensors, the internal excitation current is 1.0389 mA.

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

- DVP04PT-E2：
  When using temperature sensors such as Ni100, Pt100 and 0 to 300 Ω impedance sensors, the internal excitation current is 1.53 mA.

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

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

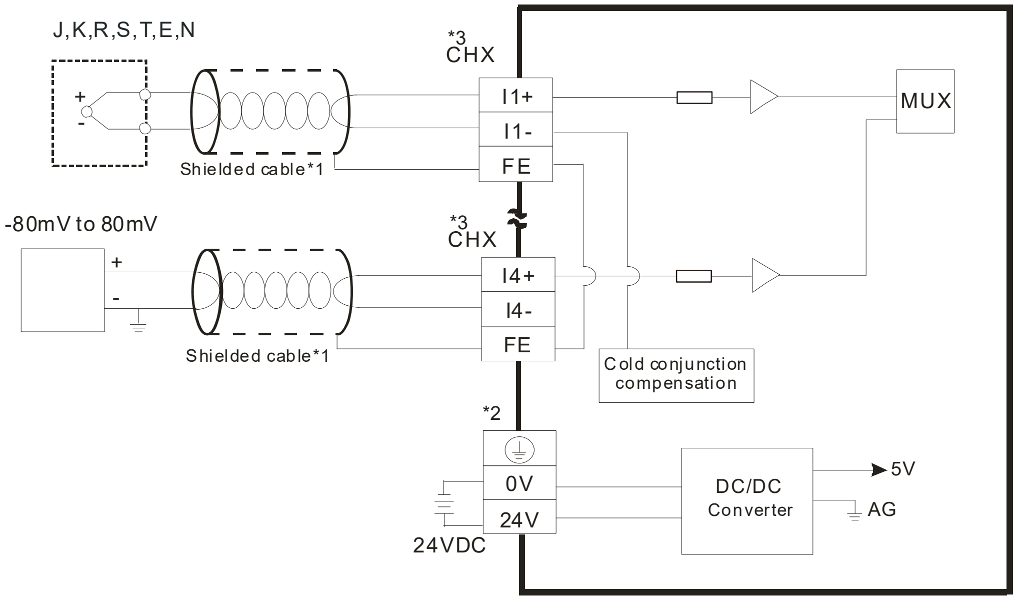
*5. Connect the terminal ⏚ to ground.

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

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

Note 2: Please refer to the functional specifications for the sensor types supported by each model.

4.6.2 Wiring DVP04TC-E2



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

*2. Connect the terminal ⏚ to ground.

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

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

Note 2: TC modules must run for 30 minutes before they start to take any temperature measurement.

4.7 Troubleshooting

When an error occurs in PT/ TC modules, an error indicator will start blinking. Once you see the error indicator blinking, you can use the FROM instruction to read the error codes stored in CR#43. The bit 0 to bit 13 indicates the error codes. It is possible to have more than two errors at the same time. 0 indicates *normal* and 1 indicates *error*. Refer to the following table for more details on the causes and the solutions for troubleshooting.

Bit No.	RUN LED	ERROR LED	Description	Solution
bit0	OFF	ON	The external voltage is abnormal.	Check the power supply.
bit1	Blinking (0.2 s ON and 0.2 s OFF)	Blinking (0.2 s ON and 0.2 s OFF)	Temperature sensor is abnormal.	Contact the factory.
bit2			Conversion value exceeds the set upper/lower limit	Check the upper and lower limits.
bit3			The signal received by channel 1 exceeds the range of analog inputs (temperature).	Check the signal received by channel 1
bit4			The signal received by channel 2 exceeds the range of analog inputs (temperature).	Check the signal received by channel 2
bit5			The signal received by channel 3 exceeds the range of analog inputs (temperature).	Check the signal received by channel 3
bit6			The signal received by channel 4 exceeds the range of analog inputs (temperature).	Check the signal received by channel 4
bit7			The signal received by channel 5 exceeds the range of analog inputs (temperature).	Check the signal received by channel 5
bit8			The signal received by channel 6 exceeds the range of analog inputs (temperature).	Check the signal received by channel 6
bit9			Mode setting error	Check the mode setting
bit10			Average times setting error	Check the average times setting
bit11			Upper/lower limit setting error	Check the upper/lower limit setting
bit12			Set value cannot be changed.	Check the value in CR#40 (set value changing prohibited)
bit13			Communication breakdown on next module	Check the wiring of the modules.

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Chapter 5 DVP-E Series Position Control Module

Table of Contents

5.1 General Specifications

5.1.1 DVP02PU-E2 Specifications

- **Electrical specifications**

Model name	DVP02PU-E2
Number of inputs	High-speed input points: 3; general input points: 5; high-speed output: 4 (2 axes)
Supply voltage	24 VDC from PLC CPU
Connector type	Removable terminal block (terminal pitch: 5 mm)
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.
Weight	180 g

- **Functional specifications – input points**

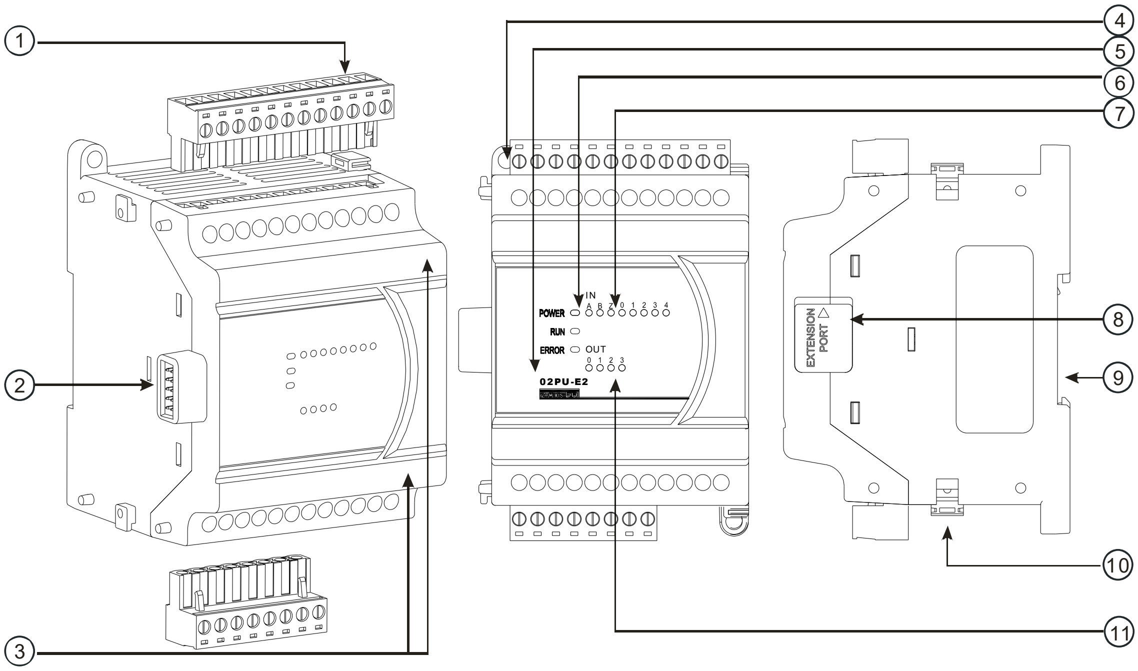
Item \ Model		High-speed Input	General Input
Number of inputs		3 (A+/A-, B+/B-, Z+/Z-)	5 (X0 to X4)
Connector type		Removable terminal block	
Input form		Differential input	Direct current (sinking or sourcing)
Input current		5 to 24 VDC, 5 to 15 mA	24 VDC, 5 mA
Action level	**OFF→ON**	>3 VDC	>15 VDC
	ON→OFF	<1.5 VDC	<5 VDC
Response time		<1.5 us	<0.1 ms
Maximum input frequency		200 kHz (A+/A-, B+/B-) 20 kHz (Z+/Z-)	1 kHz
Input impedance		4.7 kΩ	
Input isolation		500 VAC	
Input display		When the optocoupler is driven, the input LED indicator is ON.	

- **Functional specifications – output points**

Item \ Model		High-speed Output
Number of outputs		Four (2 axes)
Connector type		Removable terminal block
Output form		differential output
Output voltage		5 VDC *1
Leakage current		< 10 uA
Minimum load		1 mA / 5 VDC
Maximum load	**Resistance**	20 mA
	Inductance	N/A
	Bulb	N/A
Maximum output frequency		200 kHz
Maximum Response time	**OFF→ON**	0.15 us
	ON→OFF	0.15 us
Output isolation		500 VAC

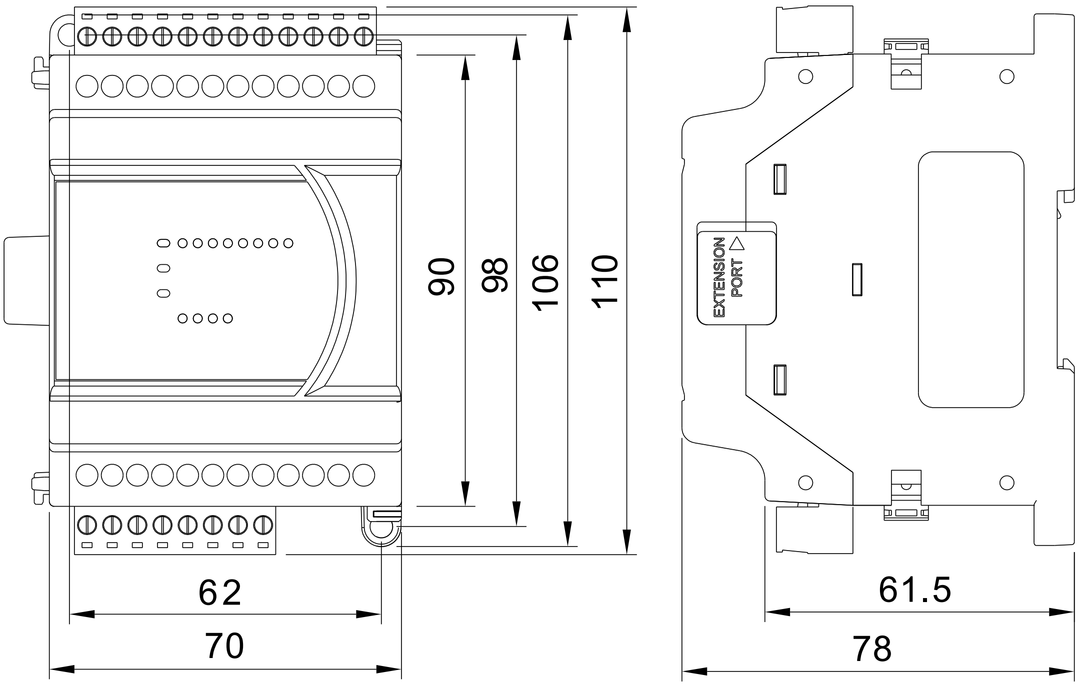
Note*1. Actual output: 4 VDC (No load) to 2.66 VDC (20 mA)

5.2 Module Profiles



No.	Name	Description
1	Removable terminal block	The inputs are connected to sensors or switches. The outputs are connected to loads to be driven.
2	External module connection port	Connects the modules
3	Terminal number	Terminal number
4	Mounting hole	Secures the module on the set.
5	Model name	Model name of the module
6	Power indicator	Indicates the state of the power supply ON: the power is on OFF: no power
	Error indicator	Error state of the module OFF: the module is normal. Blinking: hardware error (e.g. low voltage) occurs in the module.
	Run indicator	Indicates operating state of the module
7	Input LED indicators	ON: Receiving an input signal OFF: Receiving no input signal
8	I/O module connecting port	Connects to the next module
9	DIN rail slot (35 mm)	For the DIN rail
10	I/O module securing clip	Secures the modules
11	Output LED indicators	ON: Sending an output signal OFF: Sending no output signal

5.3 Module Dimensions



Unit: mm

5.4 Module Terminals

DVP02PU-E2

1	2	3	4	5	6	7	8	9	10	11	12
A+	A-	B+	B-	Z+	Z-	S/S	X0	X1	X2	X3	X4

1	2	3	4	5	6	7	8
Y0+	Y0-	Y1+	Y1-	Y2+	Y2-	Y3+	Y3-

5.5 Control Register

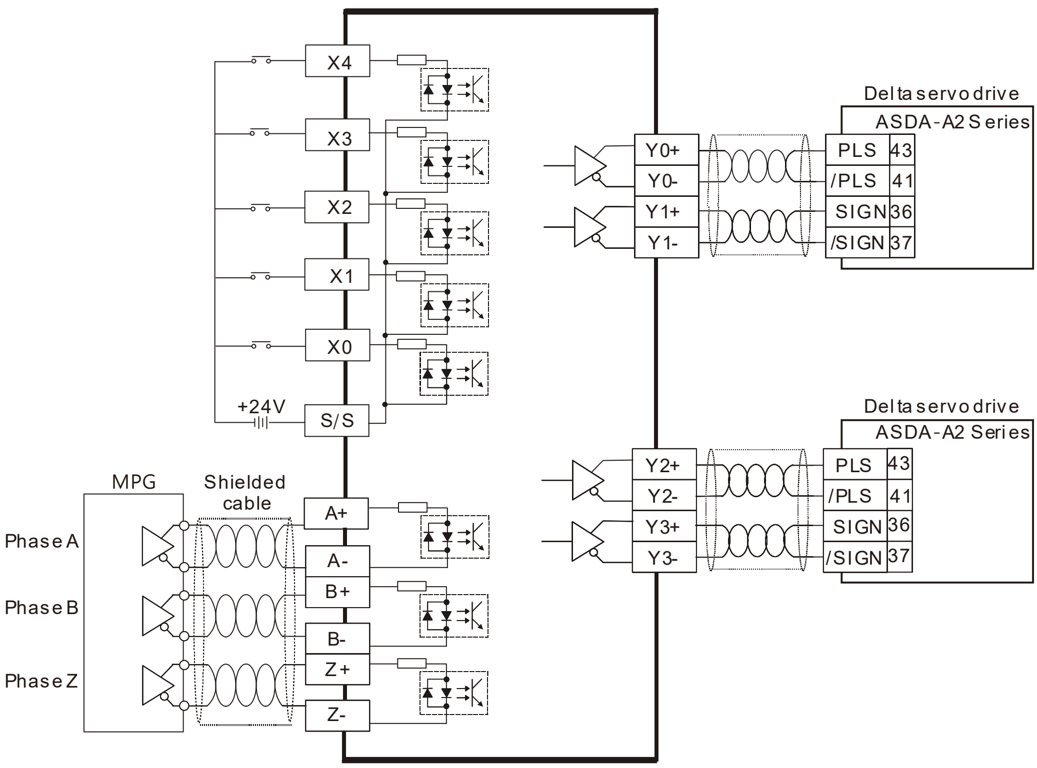
Direct data access to the control registers of the DVP02PU-E2 is not available. You must use the provided API instructions to read from and write to the PU module.

The positioning module functions are as follows:

Setting output control parameters of PU module (API1402 PUCONF), reading PU module output state (API1403 PUSTAT), PU module output pulse without acceleration (API1404 DPUPLS), relative position output of PU module with acceleration and deceleration (API1405 DPUDRI), absolute addressing output of PU module with acceleration and deceleration (API1406 DPUDRA), PU module homing (API 1407 DPUZRN), PU module jog output (API1408 DPUJOG), PU module MPG output (API1409 DPUMPG), and high-speed counter function of PU module (API1410 DPUCNT).

Refer to API14xx Module Instructions from DVP-ES3/EX3/SV3/SX3 Programming Manual for more information on operation.

5.6 Wiring



Note: Refer to Chapter 6 Applied Instructions (Module Instructions API14xx) from DVP-ES3/EX3/SV3/SX3 Series Programming Manual and Delta Servo Drive Manual for more details on output modes.

5.7 Troubleshooting

For error states in the PU module, you can check the status code to identify the cause, but the error LED provides no indication accordingly. Check for the data exchange function of the special extension module through SM228. Refer to Section 2.2.16 Additional Remarks on Special Auxiliary Relays and Special Data Registers in the DVPES3/EX3/SV3/SX3 Series Programming Manual for details.

For detailed operation and application examples regarding the API instructions, please refer to API14xx Module Instructions in DVP-ES3/EX3/SV3/SX3 Series Programming Manual.

- **Error indicator and troubleshooting description**

RUN LED	ERROR LED	Description	Solution
OFF	ON	The power supply from PLC CPU to the module is abnormal.	1. Check if the power supply to the PLC CPU is normal. 2. Check if the PLC CPU and the module are well connected. 3. If the power supply is normal and the connection between the PLC and the module is proper, change the module into a new one.
OFF	Blinking (2 s ON and 2 s OFF)	The previous module firmware update failed.	Please update the module firmware again or contact your local authorized distributor.
No change	Blinking (0.5 s ON and 3 s OFF)	The positive limit is triggered.	1. Check if the software or hardware positive limit is set. 2. Verify that the software positive limit is triggered. 3. Verify that the hardware positive limit is triggered. 4. Leave the positive limit and move towards the negative direction.
No change	Blinking (0.5 s ON/OFF twice and then 3 s OFF)	The negative limit is triggered.	1. Check if the software or hardware negative limit is set. 2. Verify that the software negative limit is triggered. 3. Verify that the hardware negative limit is triggered. 4. Leave the negative limit and move towards the positive direction.
No change	Blinking (0.5 s ON/OFF three times and then 3 s OFF)	Current position value overflow	Incorrect position setting may lead to incorrect movement. Please use the API instruction: PUSTAT to clear the current position.

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6

Chapter 6 DVP-E Series Extension Cable Interface Module

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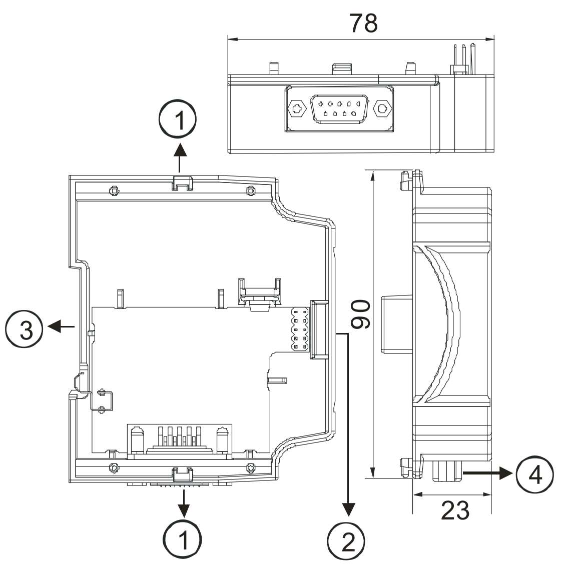
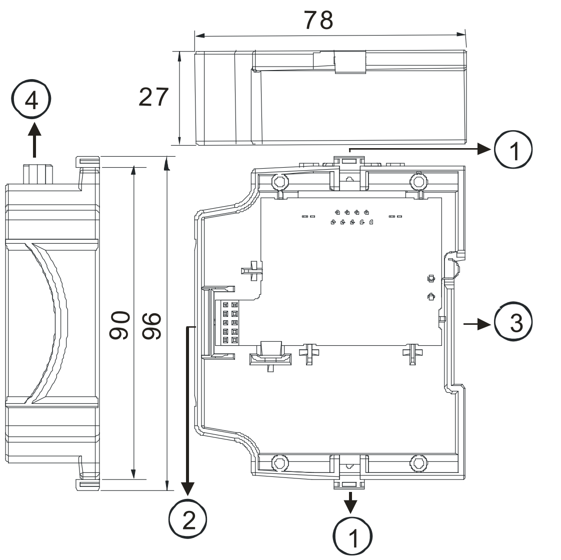
6.1 General Specifications

DVPAEXT01-E2 (DVPAEXT1R-E2 + DVPAEXT1L-E2) is an extension cable interface module. The extension distance available is 0.7 meters. DVPAEXT01-E2 is only applicable to the connection between DVP-E series CPU and the DI/DO or AI/AO extension modules and is excluded from both the digital extension point count and the analog extension module count.

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

6.2 Module Profiles

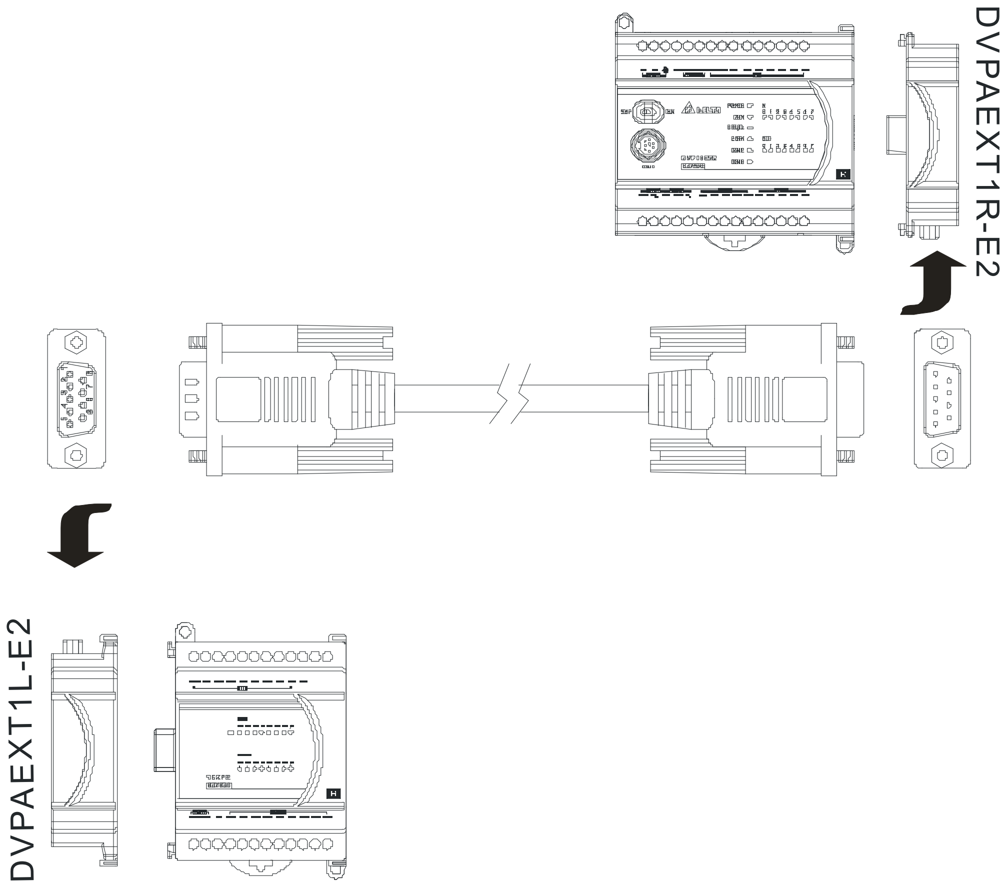
DVPAEXT1R-E2 (right side, previous one)	DVPAEXT1L-E2 (left side, latter one)
	

No.	Name	Description
1	I/O module securing clip	Secures the modules
2	External module connection port	Connects the modules
3	DIN rail slot (35 mm)	For the DIN rail
4	Extension cable port	Connects the extension cable

6.3 Installation and Wiring

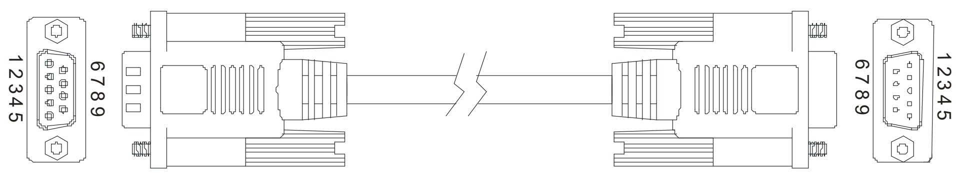
- **Use DVPAEXT01-E2 (DVPAEXT1R-E2 + DVPAEXT1L-E2) to extend the connections**

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



- **Pin Definition**

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



MEMO

7

Chapter 7 DVP-S Series Digital Input/Output Module

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7.1 General Specifications

Item \ Model (DVP)	06SN11R	08SM11N	08SM10N	08SN11R	08SN11T	08SN11TS	08SP11R	08SP11T	08SP11TS	16SM11N
Power supply voltage	24 VDC from PLC CPU									
Weight (g)	113	61	68	82	70	66	80	72	71	70

Item \ Model (DVP)	16SP11R	16SP11T	16SP11TS	16SN11T	16SN11TS	32SM11N	32SN11TN
Power supply voltage	24 VDC from PLC CPU						
Weight (g)	90	72	74	75	74	66	67

- **Electrical specifications for the inputs on digital input/output modules**

Item \ Model (DVP)		08SM11N	16SM11N	08SP11T	08SP11R	08SP11TS	16SP11T	16SP11R	16SP11TS	32SM11N	08SM10N
Number of inputs		8	16	4	4	4	8	8	8	32	8
Connector type		Removable terminal block									
Input type		Digital input									
Input form		DC (sinking or sourcing)									AC
Input voltage		24 VDC, 5 mA									85 to 132 VAC 50 to 60 Hz 9.2 mA 110 VAC / 60 Hz
Action level	**OFF→ON**	> 16.5 VDC									> 79 VAC
	ON→OFF	< 8 VDC									< 30 VAC
Response time	**OFF→ON**	Approximately 10 ms								Approximately 20 ms	< 15 ms
	ON→OFF										< 20 ms
Input impedance		4.7 kΩ									19 kΩ/50 Hz 16 kΩ/60 Hz
Input isolation		500 VAC									
Input display		When the optocoupler is driven, the input LED indicator is ON.									

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

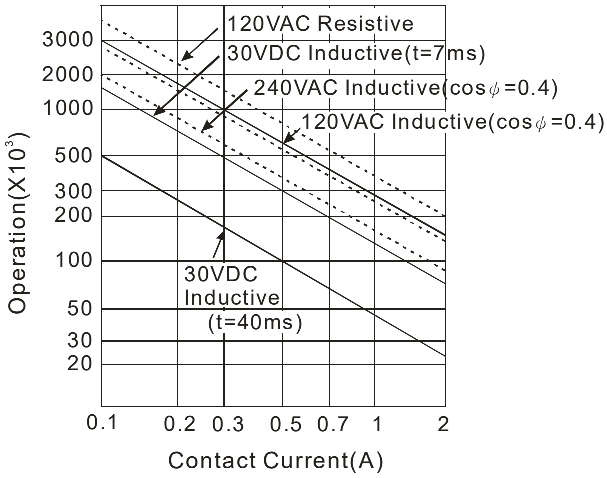
Item \ Model (DVP)		08SP11T	16SP11T	08SN11T	16SN11T	32SN11TN	08SP11TS	16SP11TS	08SN11TS	16SN11TS	08SP11R	16SP11R	08SN11R	06SN11R
Number of outputs		4	8	8	16	32	4	8	8	16	4	8	8	6
Connector type		Removable terminal block												
Output type		Transistor -T (Sinking)					Transistor -T (Sourcing)				Relay-R			
Voltage		5 to 30 VDC				5 to 30 VDC	5 to 30 VDC				10 to 240 VAC, 5 to 30 VDC			
Leakage current		< 10 µA				< 250 µA	<10 µA				–			
Max. load	**Resistance**	0.3 A/output[*2] (1.2 A/COM)				0.1 A / output[*2] (3.2 A/COM)	0.3 A /output[*2] (2 A/COM)				1.5 A/output (5 A/COM)			6 A/output
	Inductance	N/A									Life cycle curve[*3]			Life cycle

Item	Model (DVP)	08SP 11T	16SP 11T	08SN 11T	16SN 11T	32SN 11TN	08SP 11TS	16SP 11TS	08SN 11TS	16SN 11TS	08SP 11R	16SP 11R	08SN11R	06SN 11R
	Bulk	N/A												curve *4
Minimum load		1 mA/5 V												
Output isolation		500 VAC									1500 VAC			
Switching frequency*1		≦100 Hz									≦1 Hz			
Response time	OFF→ON	15 µs				<0.1 ms	15 µs				Approximately 10 ms			
	ON→OFF	25 µs				<0.3 ms	25 µs							

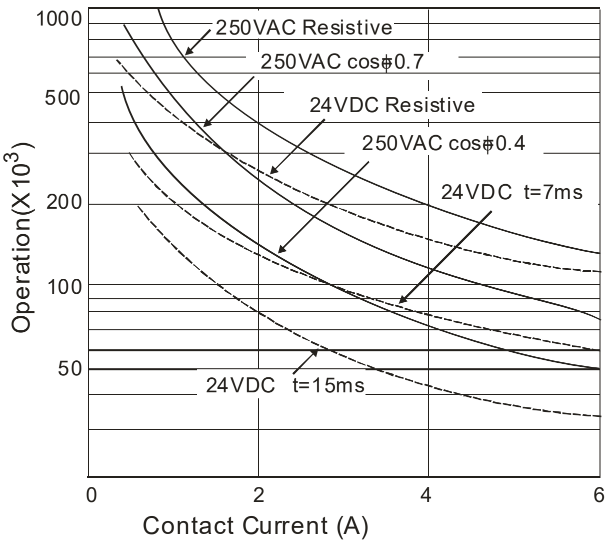
*1. The scan cycle affects the frequency.

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

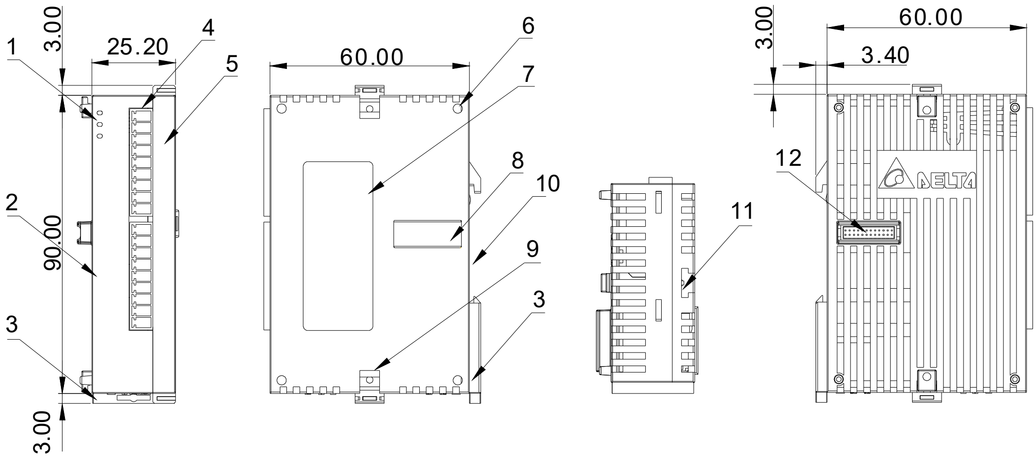
*3. Life cycle curve: The lifetime of a relay terminal varies with the working voltage, the load type (the power factor cosø, the time constant t(L/R)), and the current passing through the terminal. The life cycle curve is shown below.



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



7.2 Module Profiles



Unit: mm

No.	Name	Description
1	Power LED	Indicates the power state of the power supply ON: the power is on OFF: no power
	Low Voltage indicator	Indicates the low voltage state of module ON: low voltage occurs OFF: low voltage resolved
2	Model name	Model name of the module
3	DIN rail securing clip	Secure the modules on the set
4	I/O Terminal	The inputs are connected to sensors. The outputs are connected to loads to be driven.
5	Terminal number	Terminal number
6	Extension unit positioning hole	For positioning between modules.
7	Nameplate	Label of the module
8	Extension module connection port	Connect the modules
9	Extension unit fixing clip	For securing the extension module.
10	Din rail slot (35 mm)	For the DIN rail.
11	Securing module slot	For securing the extension module.
12	Extension module connection port	Connect the PLC or the module.

7.3 Terminals

08SM11N	08SM10N	16SM11N	06SN11R	08SN11R 08SN11T	16SN11T
S/S X0 X1 X2 X3 X4 X5 X6 X7	COM X0 X1 X2 X3 X4 X5 X6 X7	S/S X0 X1 X2 X3 X4 X5 X6 X7 S/S X10 X11 X12 X13 X14 X15 X16 X17	C0 Y0 • C1 Y1 • C2 Y2 • C3 Y3 • C4 Y4 • C5 Y5 •	C0 Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7	UP Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 ZP0 Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 ZP1

08SN11TS	16SN11TS	08SP11R 08SP11T	16SP11R 16SP11T	08SP11TS	16SP11TS
UP Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 ZP	UP0 Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 UP1 Y10 Y11 Y12 Y13 Y14 Y15 Y16 Y17 ZP	S/S X0 X1 X2 X3 • • • • C0 Y0 C1 Y1 C2 Y2 C3 Y3 •	S/S X0 X1 X2 X3 X4 X5 X6 X7 C0 Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7	S/S X0 X1 X2 X3 • • • • UP Y0 Y1 Y2 Y3 • • • • ZP	S/S X0 X1 X2 X3 X4 X5 X6 X7 UP Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 ZP

32SM11N

X0	1	2	X1
X2	3	4	X3
X4	5	6	X5
X6	7	8	X7
X10	9	10	X11
X12	11	12	X13
X14	13	14	X15
X16	15	16	X17
S/S	17	18	S/S
NC	19	20	NC
X20	21	22	X21
X22	23	24	X23
X24	25	26	X25
X26	27	28	X27
X30	29	30	X31
X32	31	32	X33
X34	33	34	X35
X36	35	36	X37
S/S	37	38	S/S
NC	39	40	NC

DVP32SM

32SN11TN

Y0	1	2	Y1
Y2	3	4	Y3
Y4	5	6	Y5
Y6	7	8	Y7
Y10	9	10	Y11
Y12	11	12	Y13
Y14	13	14	Y15
Y16	15	16	Y17
ZP	17	18	ZP
UP	19	20	UP
Y20	21	22	Y21
Y22	23	24	Y23
Y24	25	26	Y25
Y26	27	28	Y27
Y30	29	30	Y31
Y32	31	32	Y33
Y34	33	34	Y35
Y36	35	36	Y37
ZP	37	38	ZP
UP	39	40	UP

DVP32SN

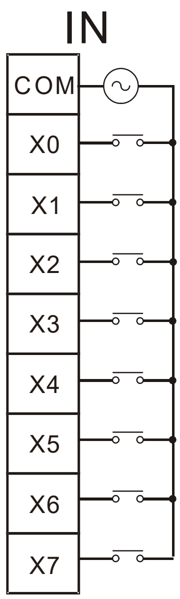
7

7.4 Wiring

This section illustrates how to wire digital input/output modules. The wiring diagrams below also illustrate how the power supplies are connected to S/S, and COM. If you need more information about wiring of digital input/output terminals, refer to Section 7.6 in this manual.

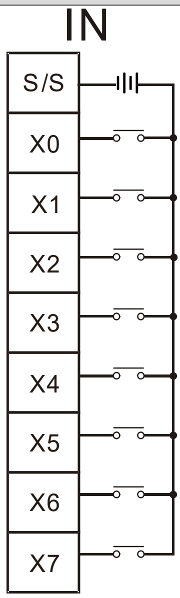
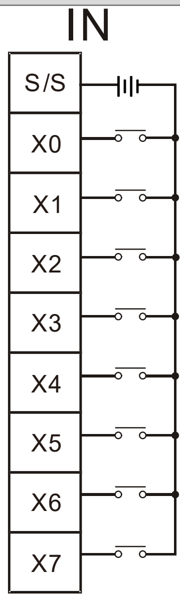
7.4.1 Wiring DVP08SM10N

Input form	AC (Alternating Current)
Voltage specifications	85 to 132 VAC (50 to 60 Hz), 9.2 mA (110 VAC/60 Hz)



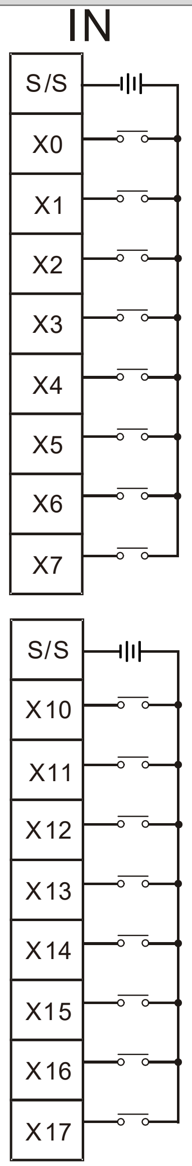
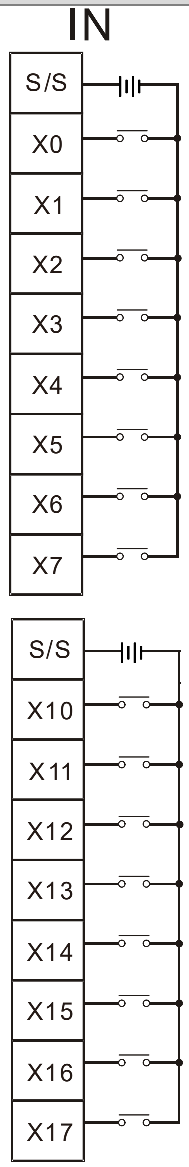
7.4.2 Wiring DVP08SM11N

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

Sinking	Sourcing
	

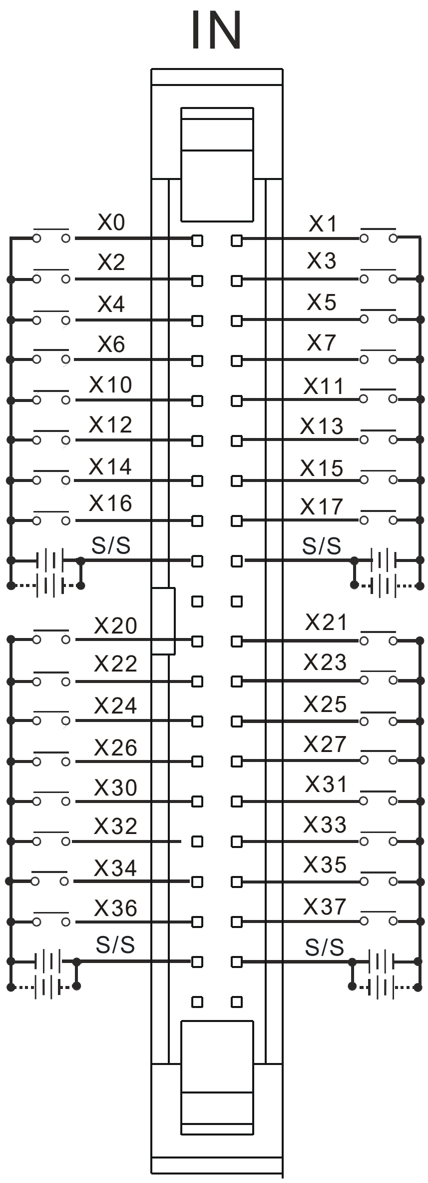
7.4.3 Wiring DVP16SM11N

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

Sinking	Sourcing
	

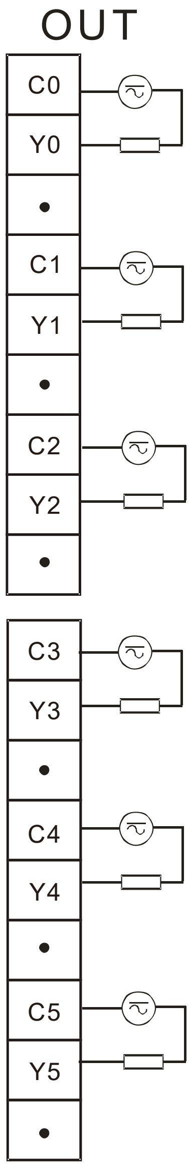
7.4.4 Wiring DVP32SM11N

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



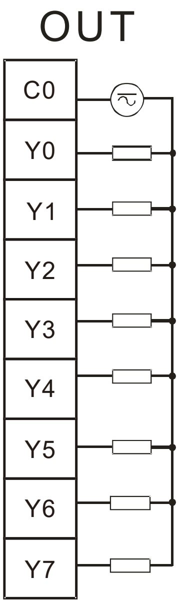
7.4.5 Wiring DVP06SN11R

Output form	Relay
Voltage specifications	10 to 240 VAC, 5 to 30 VDC, 6 A/output



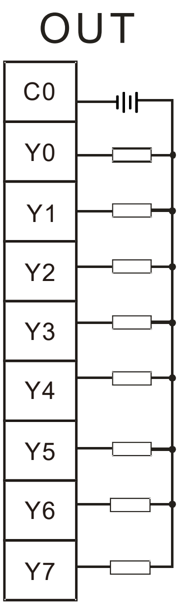
7.4.6 Wiring DVP08SN11R

Output form	Relay
Voltage specifications	10 to 240 VAC, 5 to 30 VDC, 1.5 A/output, 5 A/COM



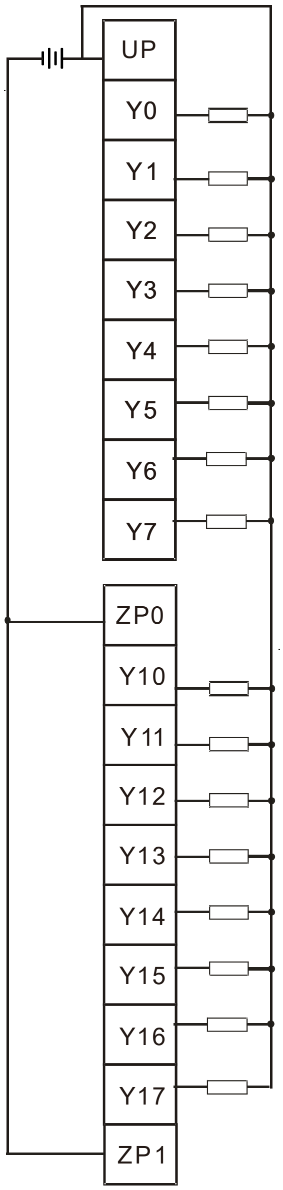
7.4.7 Wiring DVP08SN11T

Output form	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM



7.4.8 Wiring DVP16SN11T

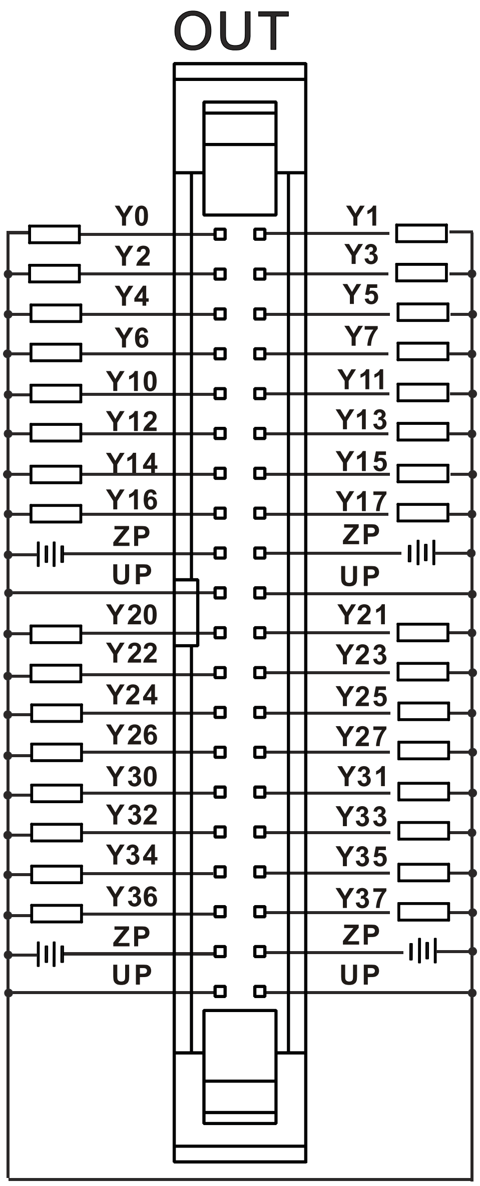
Output form	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM



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

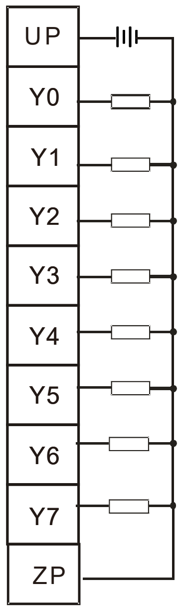
7.4.9 Wiring DVP32SN11TN

Output form	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.1 A/output, 2.2 A/COM



7.4.10 Wiring DVP08SN11TS

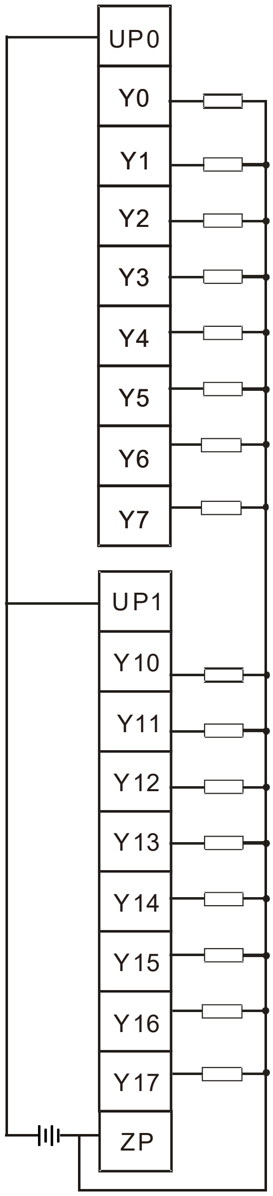
Output form	Transistor-P(sourcing)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 2 A/COM



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

7.4.11 Wiring DVP16SN11TS

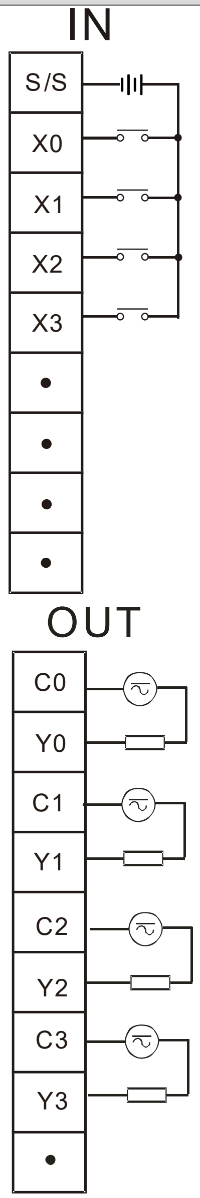
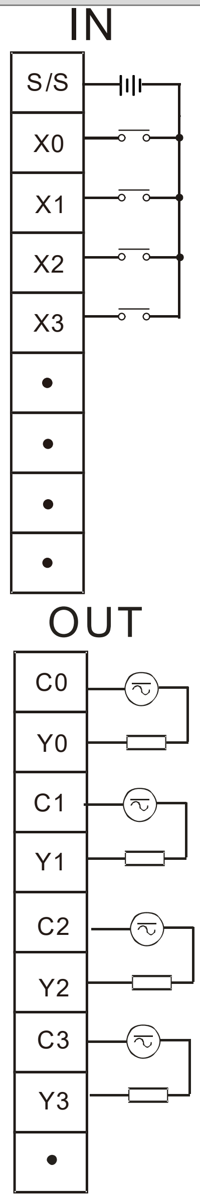
Output form	Transistor-P (sourcing)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 2 A/COM



Note: You need to add external power supply 24 VDC (-15% to +20%) for UP0, UP1 and ZP; power consumption is up to 25 mA.

7.4.12 Wiring DVP08SP11R

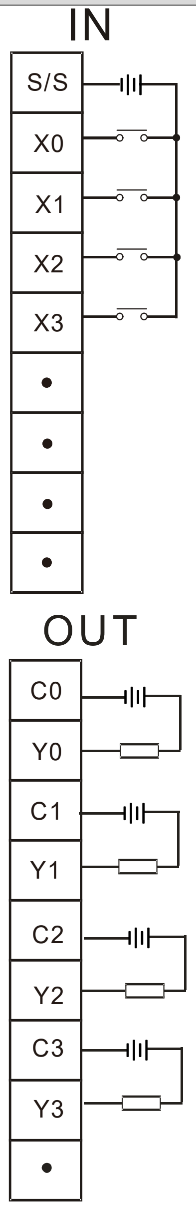
Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output form	Relay
Voltage specifications	10 to 240 VAC, 5 to 30 VDC, 1.5 A/output, 5 A/COM

Sinking input and relay output	Sourcing input and relay output
	

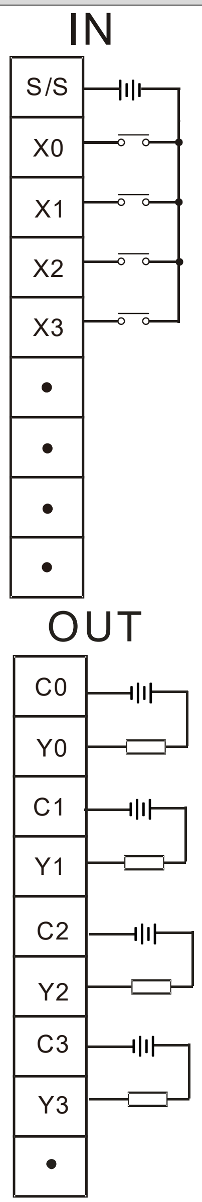
7.4.13 Wiring DVP08SP11T

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output form	Transistor-T (sinking)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 1.2 A/COM

Sinking input and output



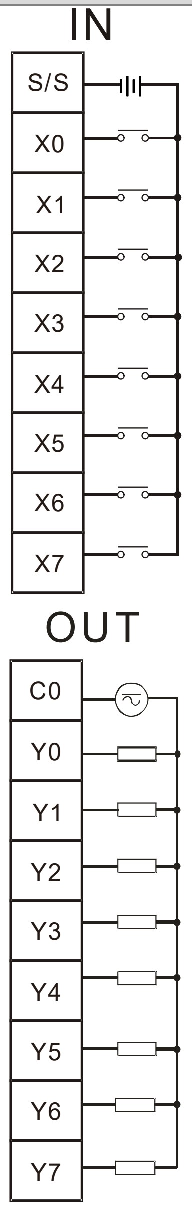
Sourcing input and Sinking output

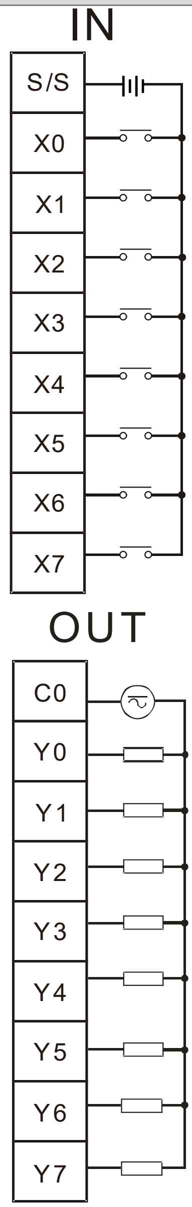


7.4.14 Wiring DVP16SP11R

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output form	Relay
Voltage specifications	10 to 240 VAC, 5 to 30 VDC, 1.5 A/output, 5 A/COM

Sinking input and relay output	Sourcing input and relay output

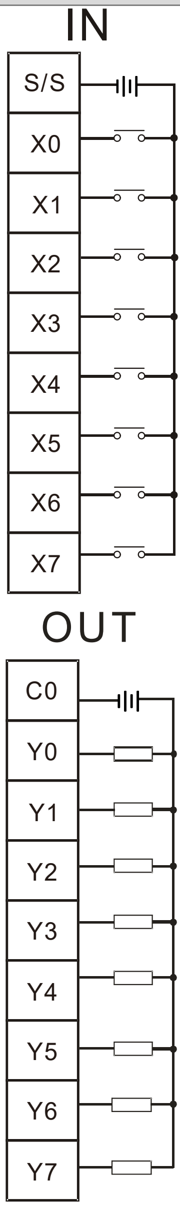
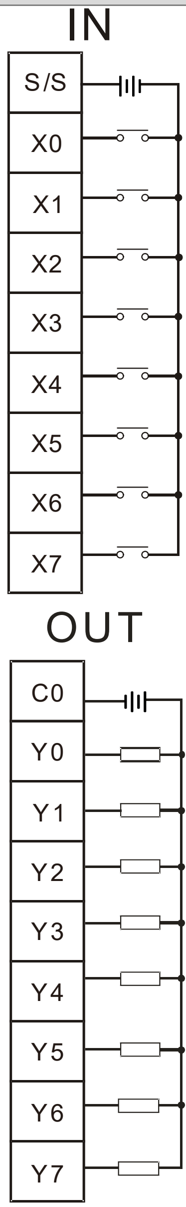




7

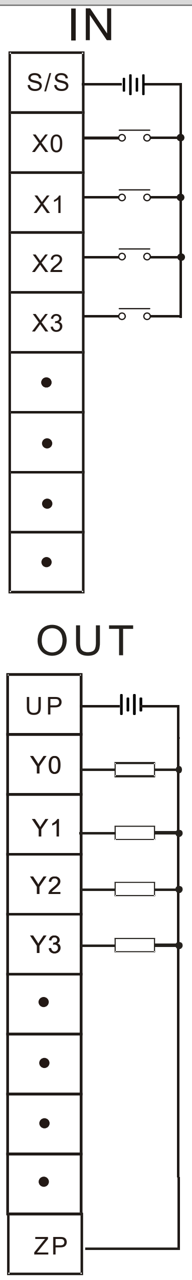
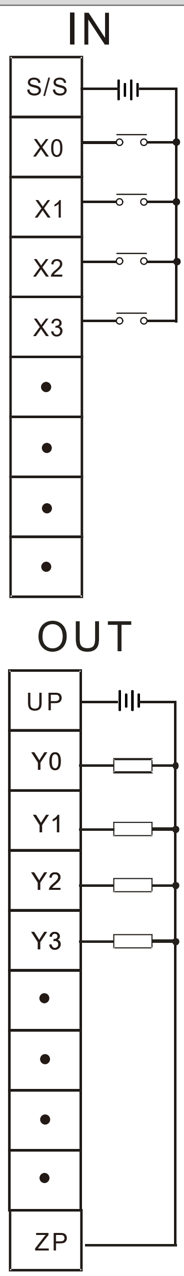
7.4.15 Wiring DVP16SP11T

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output form	Transistor-T (sinking)
Voltage specifications	5 to 30VDC, 0.3 A/output, 1.2 A/COM

Sinking input and output	Sourcing input and Sinking output
	

7.4.16 Wiring DVP08SP11TS

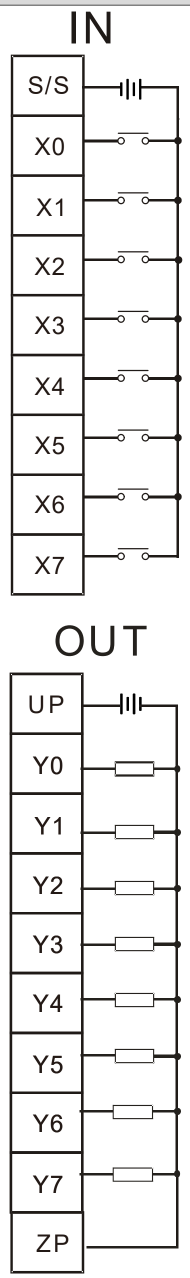
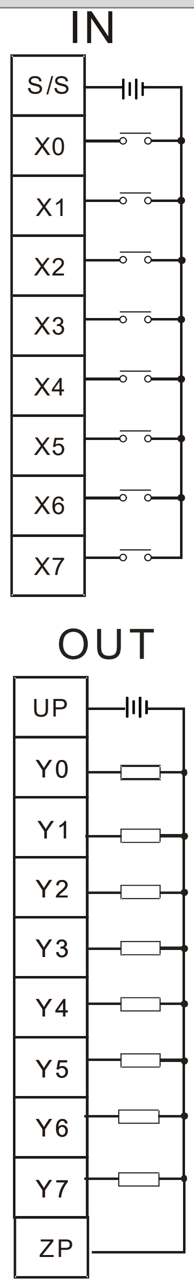
Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output form	Transistor-P (sourcing)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 2 A/COM

Sinking input and Sourcing output	Sourcing input and output
	

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

7.4.17 Wiring DVP16SP11TS

Input form	Direct current (sinking or sourcing)
Voltage specifications	24 VDC, 5 mA
Output form	Transistor-P (sourcing)
Voltage specifications	5 to 30 VDC, 0.3 A/output, 2 A/COM

Sinking input and sourcing output	Sourcing input and output
	

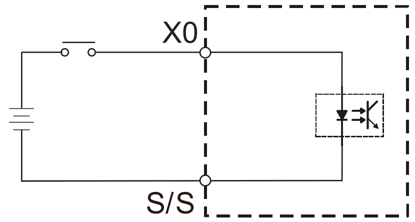
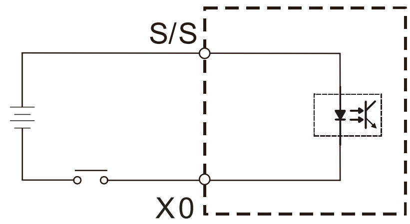
Note: You need to add external power supply 24 VDC (-15% to +20%) for UP and ZP; power consumption is up to 15 mA.

7.5 Digital Input/Output Wiring

7.5.1 Digital Input Wiring

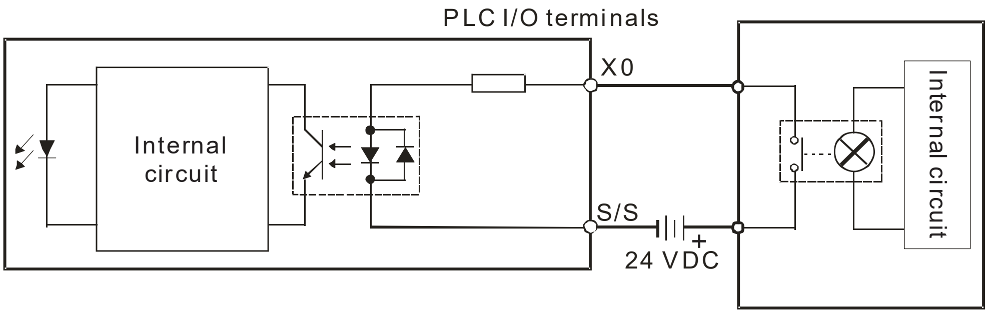
7.5.1.1 Direct Current Power Supply (24 VDC)

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

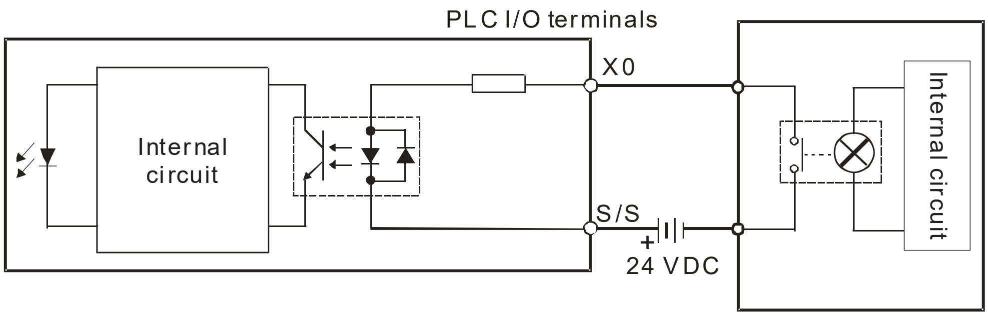
● Sinking  	● Sourcing 

7.5.1.2 Input Wiring and Relay Types

● **Sinking**

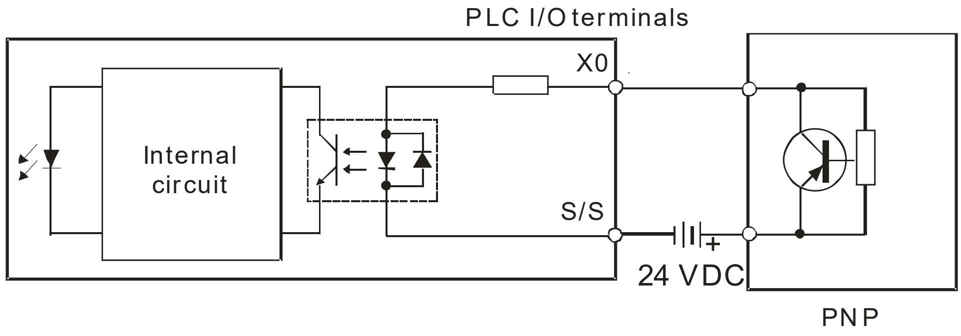


● **Sourcing**

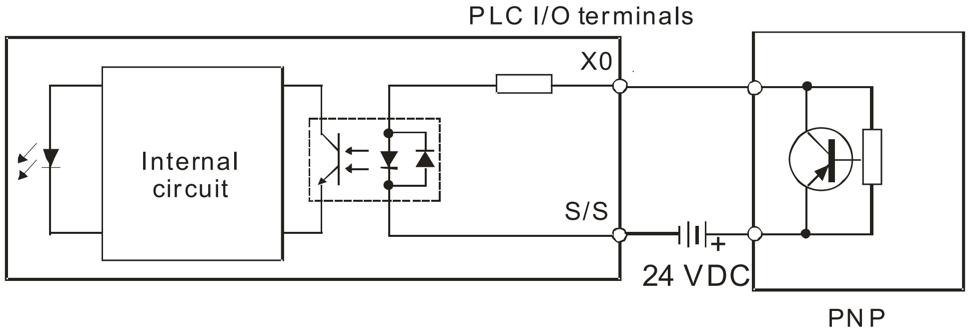


7.5.1.3 Input Wiring and 2-wire Open Collector Transistor

- **Sinking**

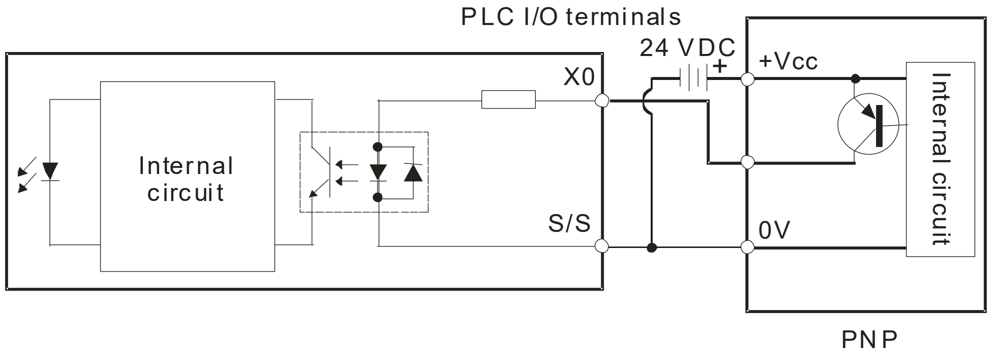


- **Sourcing**

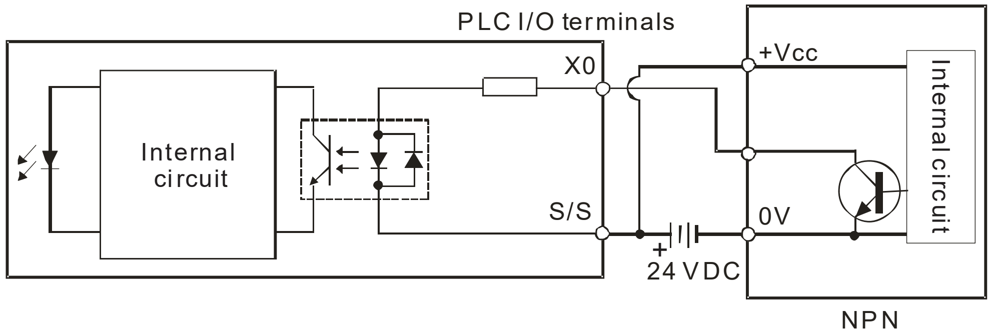


7.5.1.4 Input Wiring and 3-wire Open Collector Transistor

- **Sinking**



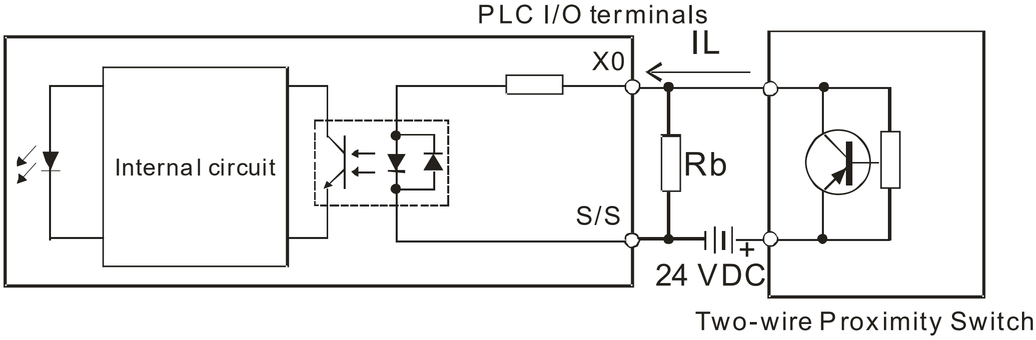
- **Sourcing**



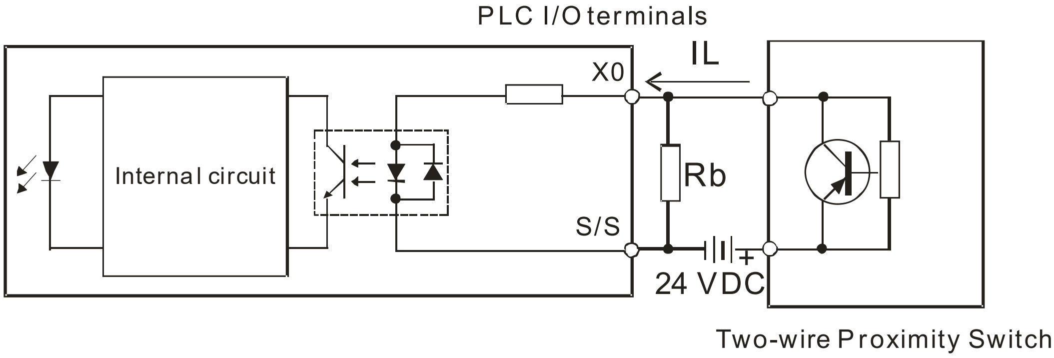
7.5.1.5 Input Wiring and Two-Wire Proximity Switch

When using a 2-wire proximity switch, please ensure the switch has a leakage current (IL) of less than 1 mA when OFF. If the leakage current (IL) is greater than 1 mA, connect a shunt resistor (Rb) as shown in the figure below (it is recommended that the resistor's wattage be at least 1W). $Rb \leq \frac{6}{IL-1}$ (kΩ)

- **Sinking**

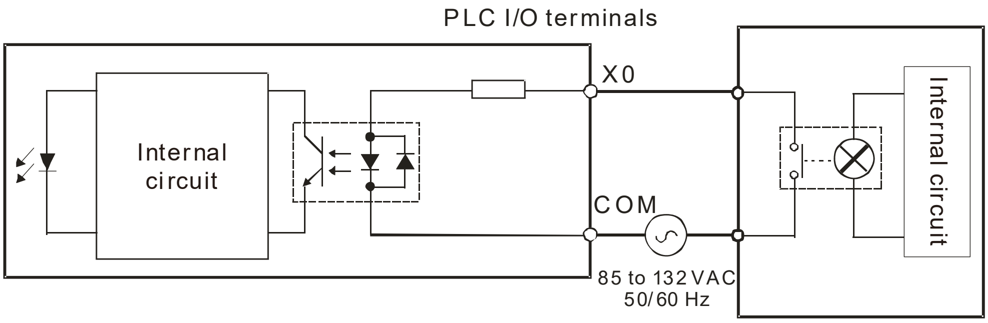


- **Sourcing**



7.5.1.6 AC Type Input Wiring (Applicable to DVP08SM10N)

- **Compatible with Relay (or Solid-State Relay) Output Type**



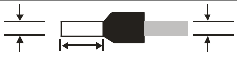
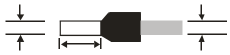
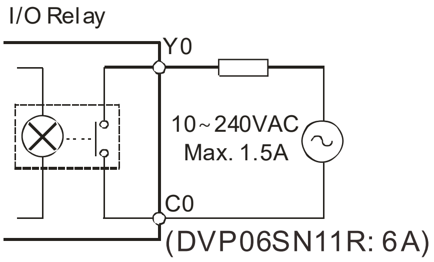
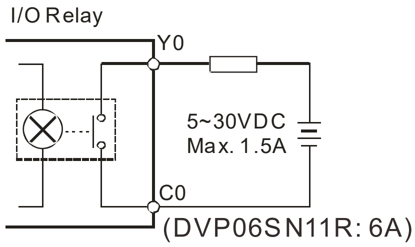
7.5.2 Digital Output Wiring

7.5.2.1 Output Circuits

There are three types of output units: relay outputs and transistor outputs (NPN and PNP).

1. Relay output

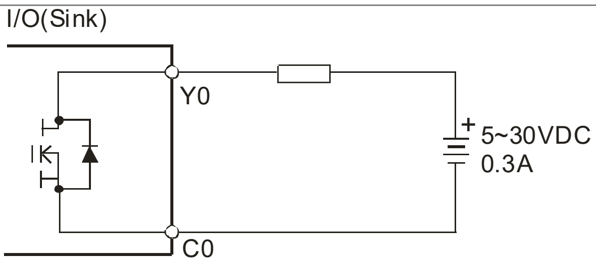
Relay output wiring requires different wire sizes depending on the provided power type, as specified in the diagram. The terminal screw torque at the PLC is 2.0 kgf-cm (1.77 lbf-in). Only copper wires rated for 60/75°C can be used.

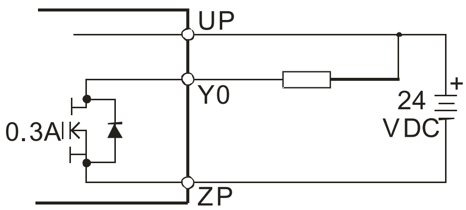
<table>
<tr><th></th><th>AC power supply</th><th>DC power supply</th></tr>
<tr><td>Terminal Specifications</td><td>
< 2 mm 6-8 mm 18-16 AWG</td><td>
< 2 mm 6-8 mm 24-16 AWG</td></tr>
<tr><td>Wiring</td><td></td><td></td></tr>
</table>

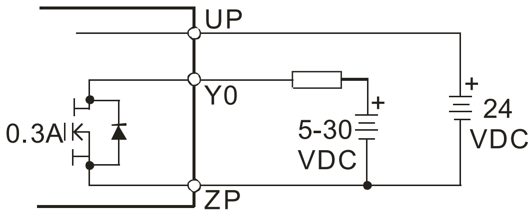
*1. The relay output terminals within the common point COM (those with the same color in the diagram below) should use the same voltage (10 to 240 VAC or 5 to 24 VDC).

C0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7

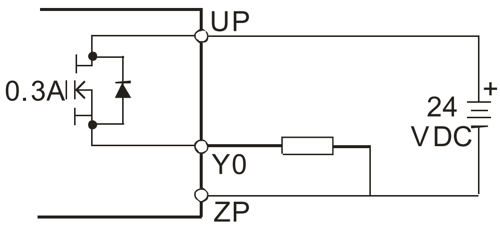
2. NPN Transistor output







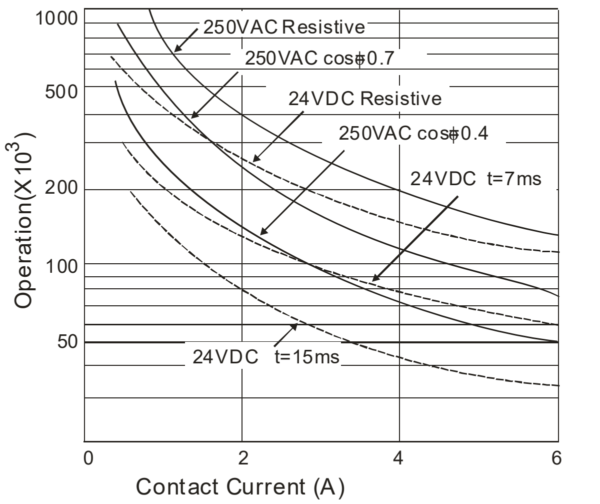
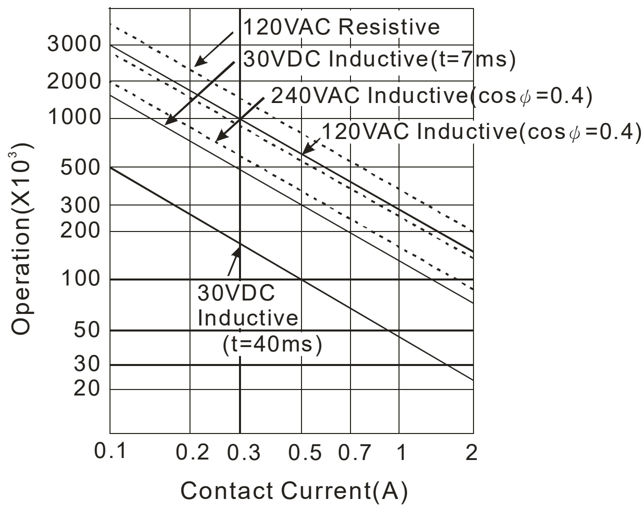
3. PNP Transistor output



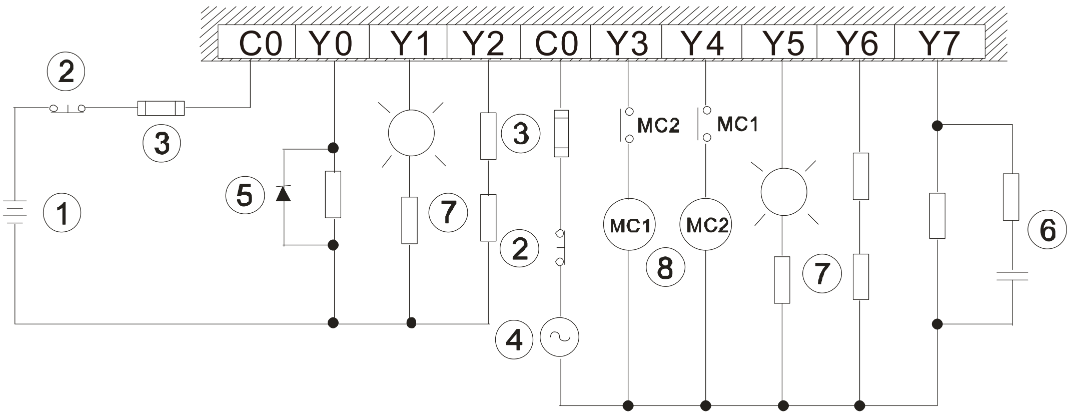
7.5.2.2 Relay Output Circuit

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 of DVP06SN11R is 6 A, same as the maximum current that can pass through common terminal.

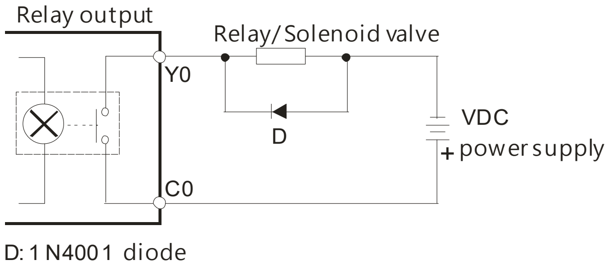
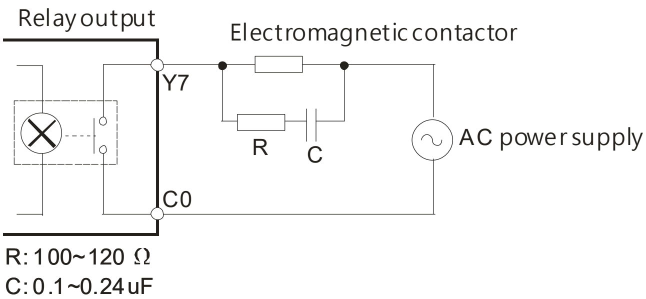
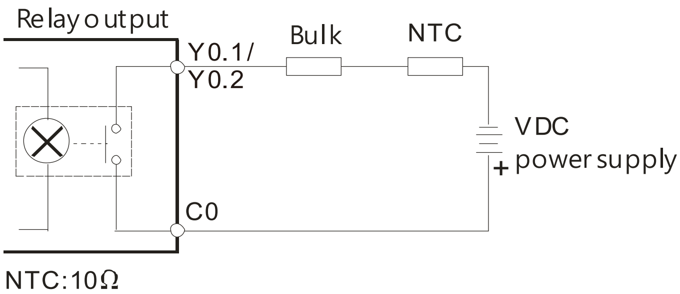
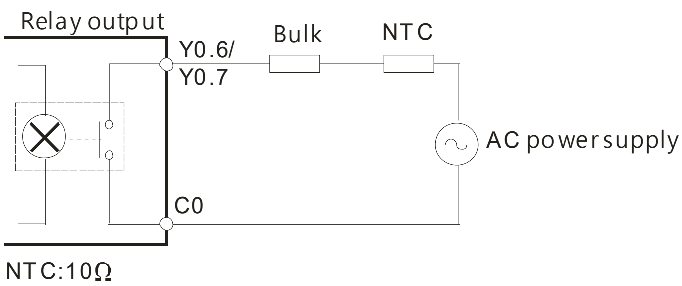
For other models, the maximum current that can pass through every relay terminal is 1.5 A, and the maximum current that can pass through common terminal is 5 A. The lifetime of a relay terminal varies with the working voltage, the load type (the power factor cosψ), and the current passing through the terminal. The relation is shown in the life cycle curve below.

1. Only applicable to DVP06SN11R	2. Applicable to all module models (except DVP06SN11R)
	

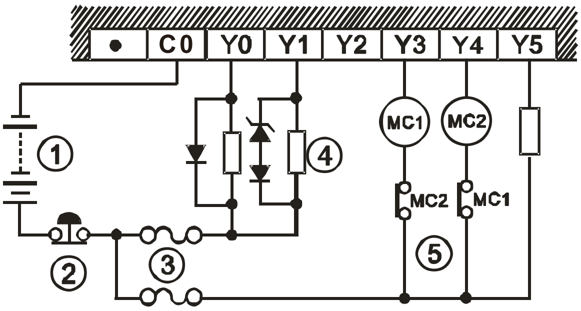
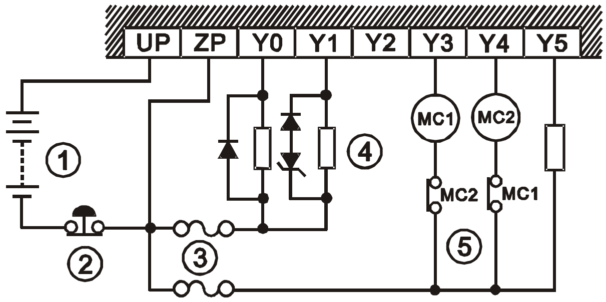
- **Relay output circuit**

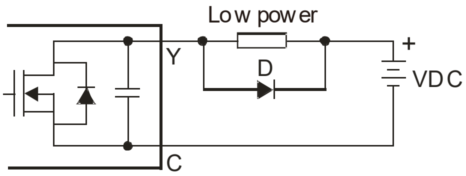


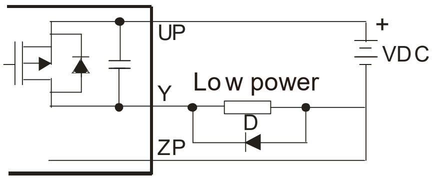
①	Direct-current power supply
②	Emergency stop using an external switch.
③	Fuse: to protect the output circuit, a fuse having a breaking capacity between 5 A to 8 A is connected to the common terminal. (DVP06SN11R utilizes 6 to 9 A.)
④	Alternating-current power supply

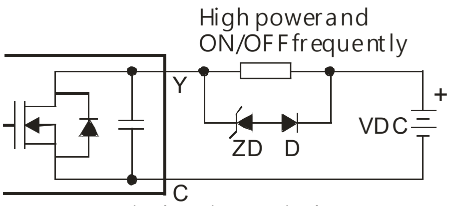
⑤	A relay or a solenoid valve is used as a DC load. A diode is connected in parallel to absorb the surge voltage that occurs when the load is OFF. 
⑥	An electromagnetic contactor is used as an AC load. A resistor and a capacitor are connected in parallel to absorb the surge voltage that occurs when the load is OFF. 
⑦	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.  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. 
⑧	Mutually exclusive output: For example, Y0.3 controls the clockwise rotation of the motor, and Y0.4 controls the counterclockwise rotation of the motor. This interlock circuit and the program in the PLC ensure that there are protective measures if an abnormal condition occurs.

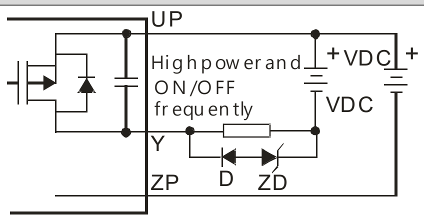
7.5.2.3 Transistor Output Circuit

<table>
<tr><th>NPN</th><th>PNP</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

<table>
<tr><td>①</td><td colspan="2">Direct-current power supply</td></tr>
<tr><td>②</td><td colspan="2">Emergency stop using an external switch.</td></tr>
<tr><td>③</td><td colspan="2">Fuse</td></tr>
<tr><td rowspan="6">④</td><td colspan="2">1. A diode is connected in parallel to absorb the surge voltage: used in low-power situations.</td></tr>
<tr><td>NPN</td><td>PNP</td></tr>
<tr><td>

D: 1N4001 Diode or its equivalent</td><td>

D: 1N4001Diode or its equivalent</td></tr>
<tr><td colspan="2">2. A diode and Zener are connected in parallel to absorb the surge voltage: used in high-power and power-on/off frequently situations.</td></tr>
<tr><td>NPN</td><td>PNP</td></tr>
<tr><td>

D: 1N4001Diode or its equivalent
ZD: 9V Zener, 5W</td><td>

D: 1N4001 Diode or its equivalent
ZD: 9V Zener, 5W</td></tr>
<tr><td>⑤</td><td colspan="2">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.</td></tr>
</table>

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8

Chapter 8 DVP-S Series Analog Input/Output Module

Table of Contents

8.1 General Specifications

8.1.1 DVP04AD-S2/DVP06AD-S/DVP06AD-S2 Specifications

- **Electrical specifications**

Module name	DVP04AD-S2	DVP06AD-S	DVP06AD-S2
Number of inputs	4	6	
Analog input channel	4 channels/each module	6 channels/each module	
Analog-to-digital conversion	Voltage input / current input		
Supply voltage	24 VDC (20.4 VDC to 28.8 VDC) (-15% to +20%)		
Connector type	Removable terminal block		
Conversion time	3 ms/channel		
Connect to DVP PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closes to the PLC CPU is 0.		
Weight	90 g	91 g	88 g

- **Functional specifications**

Analog/digital module	Voltage input				Current input		
Rated input range	±10 V	-6 to 10 V	0 to 10 V	0 to 5 V	±20 mA	-12 to 20 mA	4 to 20 mA
Digital conversion range[*1]	±8,000	±8,000	0 to 8000	0 to 8000	±4,000	±4,000	0 to 4000
Hardware input limit	±10.24 V	-6.19 to 10.19 V	±10.24 V	±5.12 V	±20.48 mA	-12.38 to 20.38 mA	-12.38 to 20.38 mA
Digital conversion limit[*2]	±8,192	±8,192	±8,192	±8,192	±4,096	±4,096	±4,096
Hardware resolution	14 bits	14 bits	14 bits	13 bits	13 bits	13 bits	12 bits
Input impedance – **DVP06AD-S**	200 kΩ				250 Ω		
Input impedance – **DVP04AD-S2 / DVP06AD-S2**	≧1 MΩ				250 Ω		
Absolute input range[*3]	±15 V				±32 mA		
Digital data format	16-bits two's complement number						
Average function	04AD-S2:CR#2 to CR#5; 06AD-S/06AD-S2: CR#2 to CR#4, setting range: K1 to K20						
Self-diagnosis function	Detecting if exceeding upper and lower limits or channel disconnection.						
Overall Accuracy	25° C / 77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C / 32° F to 131° F: The allowed error range is ±1% of full scale.						
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 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. If the input signal exceeds 10% of the digital conversion range, a conversion limit error will appear.

*2. If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit, and a conversion limit error appears. For example, in the voltage input mode (-10 V to +10 V), when the input signal is -10.25 V, exceeding the hardware lower limit, it also exceeds the conversion lower limit. The module uses the lower limit value (-8192) as the input signal and a conversion limit error will appear.

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

8.1.2 DVP02DA-S/DVP02DA-S2/DVP04DA-S2 Specifications

- **Electrical specifications**

Module name	DVP02DA-S	DVP02DA-S2	DVP04DA-S2
Number of outputs	2		4
Analog-to-digital conversion	Voltage output / current output		
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)		
Connector type	Removable terminal block		
Short circuit protection	The module is with short circuit protection, but prolonged short circuit can cause circuit damage. Current output can be open circuit.		
Connect to DVP-PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closes to the PLC CPU is 0.		
Weight	89 g	86 g	94 g

- **Functional specifications**

Analog/digital module	Voltage output				Current output	
Rated output range	0 to 10 V	2 to 10 V	0 to 5 V	1 to 5 V	0 to 20 mA	4 to 20 mA
Digital conversion range	0 to +4,000	0 to +4,000	0 to +4,000	0 to +4,000	0 to +4,000	0 to +4,000
Digital conversion limit	0 to +4,095	0 to +4,095	0 to +4,095	0 to +4,095	0 to +4,095	0 to +4,095
Hardware resolution	12 bits	12 bits	11 bits	11 bits	12 bits	12 bits
Maximum output current	10 mA				-	
Load impedance	≧1 kΩ				≦500 Ω	
Output impedance	≦0.5 Ω				≧1 MΩ	
Overall accuracy	25° C / 77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C / 32° F to 131° F: The allowed error range is ±1% of full scale.					
Response time	3 ms/channel					
Digital data format	16-bits two's complement number					
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit/an optocoupler, but the analog channels are not isolated from one another. Isolation between a digital circuit and a ground: 500 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.					

8.1.3 DVP06XA-S2 specifications

- **Electrical/common specification**

Module name	DVP06XA-S2
Number of inputs/outputs	Input: 4 / output: 2
Analog-to-digital conversion	Voltage input/current input/voltage output/ current output
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Digital data format	16-bits two’s complement number
Response time	3 ms/channel
Overall accuracy	25° C / 77° F: The allowed error range is ±0.5% of full scale. 0° C to 55° C / 32° F to 131° F: The allowed error range is ±1% of full scale.
Connector type	Removable terminal block
Connect to DVP-PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closes to the PLC CPU is 0
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
Weight	91 g

- **A/D Functional specifications**

	Voltage input				Current input		
Analog input channel	4 channel/each module						
Rated input range	±10 V	-6 to 10 V	0 to 10 V	0 to 5 V	±20 mA	-12 to 20 mA	4 to 20mA
Digital conversion range	±2,000	±2,000	0 to 2000	0 to 2000	±1,000	±1,000	0 to 1000
Hardware resolution	12 bits	12 bits	12 bits	11 bits	11 bits	11 bits	10 bits
06XA-S2 input impedance	≧1 MΩ				250 Ω		
Absolute input range*1	±15 V				±32 mA		
Average function	Yes, CR#2 to CR#5, setting range: K1 to K20.						
Self-diagnosis function	Detecting if exceeding upper and lower limits or if channel disconnection occurs.						

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

- **D/A Functional specifications**

Analog/digital module	Voltage output		Current output	
Analog output channel	2 channel/each module			
Rated output range	0 to 10 V	2 to 10 V	0 to 20 mA	4 to 20 mA
Digital conversion range	0 to +4,000	0 to +4,000	0 to +4,000	0 to +4,000
Digital conversion limit	0 to +4,095	0 to +4,095	0 to +4,095	0 to +4,095
Hardware resolution	12 bits	12 bits	12 bits	12 bits
Maximum output current	10 mA		-	
Load impedance	≧1 kΩ		≦500 Ω	
Output impedance	≦0.5 Ω		≧1 MΩ	
Short circuit protection	The module is with short circuit protection, but prolonged short circuit can cause circuit damage. Current output can be open circuit.			

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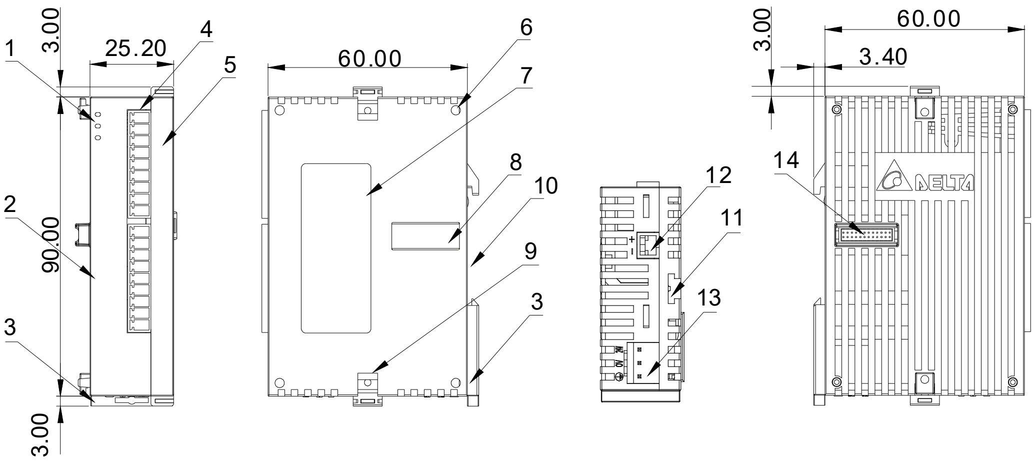
8.2 Module Profiles



Unit: mm

No.	Name	Description
1	Power LED indicator	Indicates the state of the power supply. ON: the power is on OFF: no power
	Run LED indicator	Indicates the operating state of the module.
	ERROR LED indicator	Error state of the module. ON: A serious module error has occurred OFF: the module is normal. Blinking (0.2 seconds ON/OFF): A non-serious module error occurs, can NOT operate normally.
2	Model name	Model name of the module.
3	DIN rail securing clip	Secure the module on the set.
4	I/O Terminals	The inputs are connected to sensors. The outputs are connected to loads to be driven.
5	Terminal number	Terminal number.
6	Extension unit positioning hole	For positioning between modules.
7	Nameplate	Label of the module.
8	Extension module connection port	Connect the modules.
9	Extension unit fixing clip	For securing the extension module.
10	DIN rail slot (35 mm)	For the DIN rail.
11	Securing module slot	For securing the extension module.
12	RS-485communication port	Provide RS-485 communication wiring.
13	Power input port	Expansion unit power input.
14	Extension port	Connect the PLC or the modules.

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8.3 Terminals

04AD-S2	06AD-S	06AD-S2	02DA-S	02DA-S2	04DA-S2	06XA-S2
V1+	V+	V1+	V+	V1+	V1+	V1+
I1+	I+	I1+	I+	I1+	I1+	I1+
COM1	COM	COM1	COM	COM	COM	COM1
FG	V+	V2+	FG	FG	FG	V2+
V2+	I+	I2+	V+	V2+	V2+	I2+
I2+	COM	COM2	I+	I2+	I2+	COM2
COM2	V+	V3+	COM	COM	COM	V3+
FG	I+	I3+	FG	FG	FG	I3+
•	COM	COM3	•	•	•	COM3
V3+	V+	V4+			V3+	V4+
I3+	I+	I4+			I3+	I4+
COM3	COM	COM4			COM	COM4
FG	V+	V5+			FG	V5+
V4+	I+	I5+			V4+	I5+
I4+	COM	COM5			I4+	COM
COM4	V+	V6+			COM	V6+
FG	I+	I6+			FG	I6+
•	COM	COM6			•	COM

8.4 Control Register

8.4.1 DVP04AD-S2 Control Register

<table>
<tr><th rowspan="2">CR#</th><th rowspan="2">RS-485 Parameter address</th><th rowspan="2" colspan="2">Latched</th><th rowspan="2">Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><th colspan="4">Reserved</th><th colspan="3">CH4</th><th colspan="3">CH3</th><th colspan="3">CH2</th><th colspan="3">CH1</th></tr>
<tr><td>0</td><td>H’4000</td><td>○</td><td>R</td><td>Model type</td><td colspan="16">For system use. Data length: 8 bits (b7 to b0)
Model code of DVP04AD-S2: H’90
Users can read the model type through a program to check if the extension module exists.</td></tr>
<tr><td>1</td><td>H’4001</td><td>○</td><td>R/W</td><td>Input mode setting</td><td colspan="16">Input mode setting: The factory setting is H0000.
Mode 0: Voltage input mode (-10 to +10 V)
Mode 1: Voltage input mode (-6 to +10 V)
Mode 2: current input mode (-12 to +20 mA)
Mode 3: current input mode (-20 to +20 mA)
Mode 4: current input mode (4 to +20 mA)
Mode 5: Voltage input mode (0 to +10 V)
Mode 6: Voltage input mode (0 to +5 V)
Mode 7: Close (The reading is fixed to 0.)
(Mode 4 to 6 are available for FW V5.00 or later.)</td></tr>
<tr><td colspan="21">CR#1: used to set 4 internal channels working mode of analog input module. Every channel has four modes that can be set individually. For example: if set CH1 to mode 0 (b2 to b0 = 000), CH2 to mode 1 (b5 to b3 = 001), CH3 to mode 2 (b8 to b6 = 010), CH4 to mode 3 (b11 to b9 = 011). Then CR#1 is set to H’0688 and the upper bits (b12 to b15) will be reserved. The factory setting of CR#1 is H’0000.</td></tr>
<tr><td>2</td><td>H’4002</td><td>○</td><td>R/W</td><td>CH1 average times</td><td colspan="16" rowspan="4">Average times setting of channels CH1 to CH4.
Setting range is K1 to K20, and factory setting is K10.</td></tr>
<tr><td>3</td><td>H’4003</td><td>○</td><td>R/W</td><td>CH2 average times</td></tr>
<tr><td>4</td><td>H’4004</td><td>○</td><td>R/W</td><td>CH3 average times</td></tr>
<tr><td>5</td><td>H’4005</td><td>○</td><td>R/W</td><td>CH4 average times</td></tr>
<tr><td>6</td><td>H’4006</td><td>×</td><td>R</td><td>Average value of CH1 input signal</td><td colspan="16" rowspan="4">Display average value of CH1 to CH4 input signal.
The default value is 10, that is, the average value of the CH1/CH2/CH3/CH4 input signal is calculated every 10 times.</td></tr>
<tr><td>7</td><td>H’4007</td><td>×</td><td>R</td><td>Average value of CH2 input signal</td></tr>
<tr><td>8</td><td>H’4008</td><td>×</td><td>R</td><td>Average value of CH3 input signal</td></tr>
<tr><td>9</td><td>H’4009</td><td>×</td><td>R</td><td>Average value of CH4 input signal</td></tr>
<tr><td>12</td><td>H’400C</td><td>×</td><td>R</td><td>present value of CH1 input signal</td><td colspan="16" rowspan="4">Display present value of CH1 to CH4 input signal.</td></tr>
<tr><td>13</td><td>H’400D</td><td>×</td><td>R</td><td>present value of CH2 input signal</td></tr>
<tr><td>14</td><td>H’400E</td><td>×</td><td>R</td><td>present value of CH3 input signal</td></tr>
<tr><td>15</td><td>H’400F</td><td>×</td><td>R</td><td>present value of CH4 input signal</td></tr>
<tr><td>18</td><td>H’4012</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH1</td><td colspan="16" rowspan="2">Offset setting of CH1 to CH4. Factory setting is K0, and unit is LSB.
Setting range:
Voltage input: K-4,000 to K4,000.</td></tr>
<tr><td>19</td><td>H’4013</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH2</td></tr>
</table>

<table>
<tr><th rowspan="2">CR#</th><th rowspan="2">RS-485 Parameter address</th><th rowspan="2" colspan="2">Latched</th><th rowspan="2">Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><th colspan="4">Reserved</th><th colspan="3">CH4</th><th colspan="3">CH3</th><th colspan="3">CH2</th><th colspan="3">CH1</th></tr>
<tr><td>20</td><td>H’4014</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH3</td><td colspan="16" rowspan="2">Current input: K-4,000 to K4,000.</td></tr>
<tr><td>21</td><td>H’4015</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH4</td></tr>
<tr><td>24</td><td>H’4018</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH1</td><td colspan="16" rowspan="4">GAIN setting of CH1 to CH4.
Factory setting is K4,000 and unit is LSB.
Setting range:
Voltage input: K-3,200 to K16,000.
Current input: K-3,200 to K10,400.</td></tr>
<tr><td>25</td><td>H’4019</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH2</td></tr>
<tr><td>26</td><td>H’401A</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH3</td></tr>
<tr><td>27</td><td>H’401B</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH4</td></tr>
<tr><td colspan="21">CR#18 to CR#27:
Please notice that GAIN value – OFFSET value = +800 LSB to +12,000LSB (voltage) or +800 LSB to +6,400 LSB (current).
If the value difference comes up small (within range), the output signal resolution is then slim, and the variation is definitely larger. On the contrast, if the value difference exceeds the range, the output signal resolution becomes larger, and the variation is definitely smaller.</td></tr>
<tr><td>30</td><td>H’401E</td><td>╳</td><td>R</td><td>Error state</td><td colspan="16">The data register to save all error states. Refer to table of error state for more information.</td></tr>
<tr><td colspan="21">CR#30： Error status value (see the table below)</td></tr>
</table>

Error description	Value	b15 to b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power	K1 (H’1)	Reserved	0	0	0	0	0	0	0	0	0	0	0	1
Mode error	K4 (H’4)		0	0	0	0	0	0	0	0	0	1	0	0
Offset/gain error	K8 (H’8)		0	0	0	0	0	0	0	0	1	0	0	0
Abnormal digital value	K32 (H’20)		0	0	0	0	0	0	1	0	0	0	0	0
Incorrect number of values averaged	K64 (H’40)		0	0	0	0	0	1	0	0	0	0	0	0
Instruction error	K128 (H’80)		0	0	0	0	1	0	0	0	0	0	0	0
The input received by CH1 out of the range	K256 (H’100)		0	0	0	1	0	0	0	0	0	0	0	0
The input received by CH2 out of the range	K512 (H’200)		0	0	1	0	0	0	0	0	0	0	0	0
The input received by CH3 out of the range	K1024 (H’400)		0	1	0	0	0	0	0	0	0	0	0	0
The input received by CH4 out of the range	K2048 (H’800)		1	0	0	0	0	0	0	0	0	0	0	0

Note: Each error code corresponds to a bit (b0 to b11). Two or more error states may occur at the same time.
0 means normal, and 1 means that one or more error states have occurred.

<table>
<tr><td>31</td><td>H’401F</td><td>○</td><td>R/W</td><td>Communication address setting</td><td>Setting RS-485 communication address.
Setting range is 01 to 254 and factory setting is K1.</td></tr>
</table>

8

CR#	RS-485 Parameter address	Latched		Register name	b15 b14 b13 b12 (Reserved) · b11 b10 b9 b8 (CH4) · b7 b6 b5 (CH3) · b4 b3 b2 (CH2) · b1 b0 (CH1)
32	H’4020	○	R/W	Communication format setting	Set the communication format. For baud rate, the settings are 4,800/9,600/19,200/38,400/57,600/115,200 bps. Communication format: DVP04AD-S2 ASCII：7 E 1, 7 O 1, 8 E 1, 8 O 1, 8 N 1, 7 E 2, 7 O 2, 8 E 2, 8 O 2, 8 N 2 RTU：8 E 1, 8 O 1, 8 N 1, 8 E 2, 8 O 2, 8 N 2 Factory default: ASCII, 9600, 7, E, 1 (CR#32=H’0002) Refer to ※CR#32 communication format settings at the end of this table for more information.
33	H’4021	○	R/W	Reset to factory setting and set characteristics adjustable priority	Factory setting is H’0000. Take CH1 setting for example: 1. When b0=0, user can set OFFSET and GAIN value of CH1 (CR#18, CR#24). When b0=1, users are NOT allowed to adjust OFFSET and GAIN value of CH1 (CR#18, CR#24). 2. b1 means if characteristic register is latched. b1=0 (factory setting, latched), b1=1 (not latched). 3. When b2 is set to 1, all settings will be reset to factory setting.
CR#33 is used to set the internal function priority. For example: characteristic register. Output latched function will save output setting in the internal memory before power loss.					
34	H’4022	○	R	Firmware version	Displays the software version In hexadecimal format. For example: H’010A means 1.0A.
35 to 48				For system used.	
Symbols: ○ means latched. ╳ means not latched. R means can read data by using FROM instruction or RS-485. W means can write data by using TO instruction or RS-485. LSB (Least Significant Bits): Voltage input:1_{LSB}=10 V/8,000=1.25 mV Current input:1_{LSB}=20 mA/4,000=5 μA					

※Added the RESET function for 04AD-S2 with firmware V4.16 or later. Connect the module power input to 24 VDC and write H’4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters, are restored to factory defaults.

※ The corresponding parameters address H’4000 to H’4022 of CR#0 to CR#34 are provided for users to read/ write data via RS-485 communication.

※ Function codes: 03’H is for reading data from registers. 06’H is for writing a word data into registers. 10’H is for writing multiple word data into registers.

※ If you want to use Modbus address in decimal format, you can convert a hexadecimal register to decimal format and then add one to have it become a decimal Modbus register address. For example, converting the address “H’4000” of CR#0 from hexadecimal format to decimal format gives the result 16384, and then adding one to it, you have 16385, the Modbus address in decimal format.

※ DVP04AD-S2 CR#32 communication format settings: for modules with firmware V4.14 or previous versions, b11 to b8 data format selection is not available. For ASCII mode, the format is fixed to 7, E, 1 (H’00XX) and for RTU mode, the format is fixed to 8, E, 1 (H’C0xx/H’80xx). For modules with firmware V4.15 or later, refer to the following table for setups. Note that the original code H’C0XX/H’80XX will be seen as RTU, 8, E, 1 for modules with firmware V4.15 or later.

8

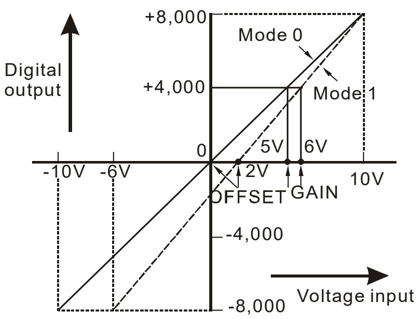
b15 to b12		b11 to b8		b7 to b0	
ASCII/RTU exchange low and high byte of CRC check code		Data format		Baud rate	
Description					
H'0	ASCII	H'0	7, E, 1[*1]	H'01	4800 bps
H'8	RTU, do NOT exchange low and high byte of CRC check code	H'1	8, E, 1	H'02	9600 bps
				H'04	19200 bps
H'C	RTU, exchange low and high byte of CRC check code	H'3	8, N, 1	H'08	38400 bps
		H'4	7, O, 1[*1]	H'10	57600 bps
		H'5	8, O, 1	H'20	115200 bps
		H'6	7, E, 2[*1]		
		H'7	8, E, 2		
		H'8	7, N, 2[*1]		
		H'9	8, N, 2		
		H'A	7, O, 2[*1]		
		H'B	8, O, 2		

Ex: Write H'C310 into CR#32 for a result of RTU, exchange low and high byte of CRC check code, 8,N,1 and baud rate at 57600 bps.

*1. This is only available for ASCII format.

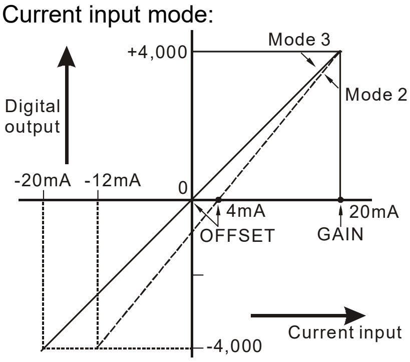
- **Adjust A/D Conversion Characteristic Curves**

Voltage input mode:



Mode 0 of CR#1:	GAIN=5 V (4,000 LSB), OFFSET=0 V (0 LSB).
Mode 1 of CR#1:	GAIN=6 V (4,800 LSB), OFFSET=2 V (1,600 LSB).
Mode 5 of CR#1:	GAIN=5 V (4,000 LSB), OFFSET=0 V (0 LSB).
Mode 6 of CR#1:	GAIN=2.5 V (2,000 LSB), OFFSET=0 V (0 LSB).
GAIN:	Voltage input value when digital output is 4,000 Setting range is -3,200 LSB to +16,000 LSB.
OFFSET:	Voltage input value when digital output is 0 Setting range: -4,000 LSB to +4,000 LSB.
GAIN－OFFSET:	Setting range is +800 LSB to +12,000 LSB.

Current input mode:



Mode 2 of CR#1:	GAIN=20 mA (4,000 LSB), OFFSET=4 mA (800 LSB).
Mode 3 of CR#1:	GAIN=20 mA (4,000 LSB), OFFSET=0 mA (0 LSB).
Mode 4 of CR#1:	GAIN=20 mA (4,000 LSB), OFFSET=4 mA (800 LSB).
GAIN:	Current input value when digital output is +4,000. Setting range is -3,200 LSB to +10,400 LSB.
OFFSET:	Current input value when digital output value is 0. Setting range is -4,000 LSB to +4,000 LSB.
GAIN－OFFSET:	Setting range is +800 LSB to +6,400 LSB.

The chart above is used to adjust the A/D conversion characteristic curve of voltage input mode and current input mode. Users can adjust the conversion characteristic curves by changing OFFSET values (CR#18 to CR#21) and GAIN values (CR#24 to CR#27), depending on the application.

8.4.2 DVP06AD-S/DVP06AD-S2 Control Register

<table>
<tr><th>CR #</th><th>RS-485 parameter address</th><th colspan="2">Latched</th><th>Register content</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H'4000</td><td>○</td><td>R</td><td>Model name</td><td colspan="16">Set by the system. Data length: 8 bits (b7 to b0).
Model code=H'C8.</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H'4001</td><td rowspan="2">○</td><td rowspan="2">R/W</td><td rowspan="2">Input mode setting</td><td colspan="4">Reserved</td><td colspan="2">CH6</td><td colspan="2">CH5</td><td colspan="2">CH4</td><td colspan="2">CH3</td><td colspan="2">CH2</td><td colspan="2">CH1</td></tr>
<tr><td colspan="16">Input mode: Default=H'0000.
Mode 0: Voltage input (-10 V to +10 V)
Mode 1: Voltage input (-6 V to +10 V)
Mode 2: Current input (-12 mA to +20 mA)
Mode 3: Current input (-20 mA to +20 mA)</td></tr>
<tr><td colspan="21">CR#1: The working mode of the 6 channels in the analog input module. There are 4 modes for each channel which can be set up separately. For example, if the user needs to set up CH1: mode 0 (b1 to b0=00) and CH2: mode 1 (b3 to b2=01), CH3: mode 2 (b5 to b4=10), CH4: mode 3 (b7 to b6=11), CH5: mode 0 (b9 to b8=00), CH6: mode 1 (b11 to b10=01), CR#1 has to be set as H'04E4 and the higher bits (b12 to b15) have to be reserved. Default value=H'0000.</td></tr>
<tr><td>#2</td><td>H'4002</td><td>○</td><td>R/W</td><td rowspan="3">CH1 to CH6 Average times setting</td><td colspan="8">CH2</td><td colspan="8">CH1</td></tr>
<tr><td>#3</td><td>H'4003</td><td>○</td><td>R/W</td><td colspan="8">CH4</td><td colspan="8">CH3</td></tr>
<tr><td>#4</td><td>H'4004</td><td>○</td><td>R/W</td><td colspan="8">CH6</td><td colspan="8">CH5</td></tr>
<tr><td colspan="21">CR#2 to CR#4: The settings of average times of the signals at CH1 to CH6.
Range of settings in CH1 to CH6: K1 to K20. For example, if the average time at CH1 is to be set as K10 and CH2 as K18, CR#2 must be set as H'120A. CR#3 to 4 apply the same rule. The default setting of each channel=K10. Default settings of CR#2 to CR#4 are all H'0A0A.</td></tr>
<tr><td>#6</td><td>H'4006</td><td>×</td><td>R</td><td>CH1 input average</td><td colspan="16" rowspan="6">Average of input signals at CH1 to CH6</td></tr>
<tr><td>#7</td><td>H'4007</td><td>×</td><td>R</td><td>CH2 input average</td></tr>
<tr><td>#8</td><td>H'4008</td><td>×</td><td>R</td><td>CH3 input average</td></tr>
<tr><td>#9</td><td>H'4009</td><td>×</td><td>R</td><td>CH4 input average</td></tr>
<tr><td>#10</td><td>H'400A</td><td>×</td><td>R</td><td>CH5 input average</td></tr>
<tr><td>#11</td><td>H'400B</td><td>×</td><td>R</td><td>CH6 input average</td></tr>
<tr><td colspan="21">CR#6 to CR#11: The average of the signals at CH1 to CH6 obtained from the settings in CR#2 to CR#4. For example, if the settings in CR#2 to CR#4 is 10, the content in CR#6 to CR#11 will be the average of the most recent 10 signals at CH1 to CH6.</td></tr>
<tr><td>#12</td><td>H'400C</td><td>×</td><td>R</td><td>CH1 input present value</td><td colspan="16" rowspan="6">Present value of input signals at CH1 to CH6</td></tr>
<tr><td>#13</td><td>H'400D</td><td>×</td><td>R</td><td>CH2 input present value</td></tr>
<tr><td>#14</td><td>H'400E</td><td>×</td><td>R</td><td>CH3 input present value</td></tr>
<tr><td>#15</td><td>H'400F</td><td>×</td><td>R</td><td>CH4 input present value</td></tr>
<tr><td>#16</td><td>H'4010</td><td>×</td><td>R</td><td>CH5 input present value</td></tr>
<tr><td>#17</td><td>H'4011</td><td>×</td><td>R</td><td>CH6 input present value</td></tr>
<tr><td>#18</td><td>H'4012</td><td>○</td><td>R/W</td><td>Adjusted OFFSET value of CH1</td><td colspan="16" rowspan="5">OFFSET settings at CH1 to CH6. Default=K0; Unit: LSB.
When voltage input, range: K-4,000 LSB to K4,000 LSB.
When current input, range: K-4,000 LSB to K4,000 LSB.
Please refer to this instruction sheet when setting OFFSET and GAIN.</td></tr>
<tr><td>#19</td><td>H'4013</td><td>○</td><td>R/W</td><td>Adjusted OFFSET value of CH2</td></tr>
<tr><td>#20</td><td>H'4014</td><td>○</td><td>R/W</td><td>Adjusted OFFSET value of CH3</td></tr>
<tr><td>#21</td><td>H'4015</td><td>○</td><td>R/W</td><td>Adjusted OFFSET value of CH4</td></tr>
<tr><td>#22</td><td>H'4016</td><td>○</td><td>R/W</td><td>Adjusted OFFSET value of CH5</td></tr>
</table>

CR #	RS-485 parameter address	Latched		Register content	b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
#23	H'4017	○	R/W	Adjusted OFFSET value of CH6	
#24	H'4018	○	R/W	Adjusted GAIN value of CH1	GAIN settings at CH1 to CH6. Default=K4,000; Unit: LSB. When voltage input, range: K-3,200 LSB to K16,000 LSB. When current input, range: K-3,200 LSB to K10,400 LSB. Please refer to this instruction sheet when setting OFFSET and GAIN.
#25	H'4019	○	R/W	Adjusted GAIN value of CH2	
#26	H'401A	○	R/W	Adjusted GAIN value of CH3	
#27	H'401B	○	R/W	Adjusted GAIN value of CH4	
#28	H'401C	○	R/W	Adjusted GAIN value of CH5	
#29	H'401D	○	R/W	Adjusted GAIN value of CH6	

CR#18 to CR#29: Please note that: GAIN value – OFFSET value=+800 LSB to +12,000 LSB (voltage) or +800 LSB to +6,400 LSB (current). When GAIN – OFFSET is small (steep oblique), the resolution of input signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of input signal will be rougher and variation on the digital value will be smaller.

CR #	RS-485 parameter address	Latched		Register content	b15 – b0
#30	H'401E	╳	R	Error state	Register for storing all error states. See the table of error state for more information.

CR #30: Error state value (see the table below):

Error status	Content	b15 to b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1 (H'1)	Reserved	0	0	0	0	0	0	0	1
Incorrect mode setting	K4 (H'4)		0	0	0	0	0	1	0	0
Offset/Gain error	K8 (H'8)		0	0	0	0	1	0	0	0
Abnormal digital range	K32 (H'20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64 (H'40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H'80)		1	0	0	0	0	0	0	0

Note: Each error state is determined by the corresponding bits (b0 to b7) and there may be more than 2 errors occurring at the same time. 0=normal; 1=error

CR #	RS-485 parameter address	Latched		Register content	b15 – b0
#31	H'401F	○	R/W	Communication address setting	For setting RS-485 communication address. Range: 01 to 254. Default=K1.
#32	H'4020	○	R/W	Communication format setting	For baud rate, the settings are 4,800/9,600/19,200/38,400/57,600/115,200 bps. Communication format: ASCII: 7,E,1 / 7,O,1 / 8,E,1 / 8,O,1 / 8,N,1 RTU: 8,E,1 / 8,O,1 / 8,N,1 Factory default: ASCII, 9600, 7, E,1 (CR#32=H'0002) Refer to ※CR#32 communication format settings at the end of this table for more information.
#33	H'4021	○	R/W	Return to default setting; OFFSET/GAIN tuning authorization	Return to default | CH6 | CH5 | CH4 | CH3 | CH2 | CH1 Take the setting of CH1 for example: 1. b0: Switch for upper/lower bound alarm on the input value for the channel. 0=disabled; 1=enabled (default). 2. b1: OFFSET/GAIN tuning. 0=forbidden; 1=allowed (default). 3. When b12 to b15=1, all values in CH1 to CH6 will return to default settings. b12 to b15 will return to 0 automatically after the setting is completed.

CR#33 for input mode, setting of average times, OFFSET value and GAIN value will be reset after returning to default settings.

8

CR #	RS-485 parameter address	Latched		Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#34	H'4022	○	R	Firmware version	Displays the current firmware version in hex, e.g. version 1.00 is indicated as H'0100.															
#35 to #48				For system use.																

Symbols: ○: Latched (when written in through RS-485 communication).
╳: Non-latched.
R: Able to read data by FROM instruction or RS-485 communication.
W: Able to write data by TO instruction or RS-485 communication.
LSB (Least Significant Bits): 1. For voltage input: 1 $_{LSB}$=10 V/8,000=1.25 mV.
2. For current input: 1 $_{LSB}$=20 mA/4,000=5 μA.

※ Added the RESET function for modules with firmware V4.12 or later. Connect the module power input to 24 VDC and write H'4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters, are restored to factory defaults.

※ The corresponding parameters address H'4000 to H'4022 of CR#0 to CR#34 are provided for users to read/ write data via RS-485 communication.

※ If you want to use Modbus address in decimal format, you can convert a hexadecimal register to decimal format and then add one to have it become a decimal Modbus register address. For example, converting the address "H'4000" of CR#0 from hexadecimal format to decimal format gives the result 16384, and then adding one to it, you have 16385, the Modbus address in decimal format.

※ Function codes: 03'H is for reading data from registers. 06'H is for writing a word data into registers. 10'H is for writing multiple word data into registers.

※The latched CR must be written through RS-485 communication to have the power-off latching function. If it is written by the host using the TO/DTO command, it will not have the power-off latching function.

※ CR#32 communication format settings: for modules with firmware V4.10 or previous versions, b11 to b8 data format selection is not available. For ASCII mode, the format is fixed to 7, E, 1 (H'00XX) and for RTU mode, the format is fixed to 8, E, 1 (H'C0xx/H'80xx). For modules with firmware V4.11 or later, refer to the following table for setups. Note that the original code H'C0XX/H'80XX will be seen as RTU, 8, E, 1 for modules with firmware V4.11 or later.

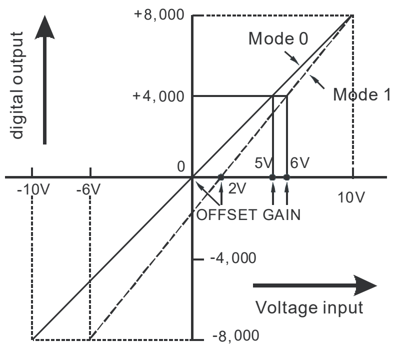
b15 to b12		b11 to b8		b7 to b0	
ASCII/RTU, exchange low and high byte of CRC check code		Data format		Baud rate	
Description					
H'0	ASCII	H'0	7, E, 1*1	H'01	4800 bps
H'8	RTU, do NOT exchange low and high byte of CRC check code	H'1	8, E, 1	H'02	9600 bps
		H'2	reserved	H'04	19200 bps
H'C	RTU, exchange low and high byte of CRC check code	H'3	8, N, 1	H'08	38400 bps
		H'4	7, O, 1*1	H'10	57600 bps
		H'5	8, O, 1	H'20	115200 bps

Note *1: This is only available for ASCII format.

Ex: Write H'C310 into CR#32 for a result of RTU, exchange low and high byte of CRC check code, 8,N,1 and baud rate at 57600 bps.

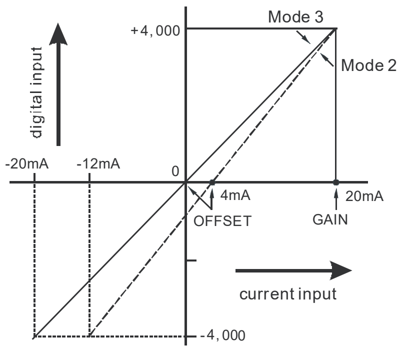
- **Adjusting A/D Conversion Curve**

Voltage input mode:



CR#1 mode 0:	GAIN=5 V (4,000 LSB), OFFSET=0 V (0 LSB).
CR#1 mode 1:	GAIN=6 V (4,800 LSB), OFFSET=2 V (1,600 LSB).
GAIN:	Voltage input value when the digital input value=4,000. Range: -3,200 LSB to +16,000 LSB.
OFFSET:	Voltage input value when the digital output value=0. Range: -4,000 LSB to +4,000 LSB.
GAIN - OFFSET:	Range: +800 LSB to +12,000 LSB

Current input mode:



CR#1 mode 2:	GAIN=20 mA (4,000 LSB), OFFSET=4 mA (800 LSB).
CR#1 mode 3:	GAIN=20 mA (4,000 LSB), OFFSET=0 mA (0 LSB).
GAIN:	Current input value when the digital output value=+4,000. Range: -3,200 LSB to +10,400 LSB.
OFFSET:	Current input value when the digital output value=0. Range: -4,000 LSB to +4,000 LSB.
GAIN - OFFSET:	Range: +800 LSB to +6,400 LSB

The user can adjust the OFFSET/GAIN curves according to the actual needs by changing the OFFSET value (CR#18 to CR#23) and GAIN value (CR#24 to CR#29).

8.4.3 DVP02DA-S/DVP02DA-S2 Control Register

<table>
<tr><th>CR#</th><th>RS-485 parameters address</th><th colspan="2">Latched</th><th>Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#0</td><td>H’4032</td><td>○</td><td>R</td><td>Model type</td><td colspan="16">For system used, data length is 8 bits (b7 to b0).
Model code=H’49.
User can read the data through a program to check if there is extension module.</td></tr>
<tr><td rowspan="2">#1</td><td rowspan="2">H’4033</td><td rowspan="2">○</td><td rowspan="2">R/W</td><td rowspan="2">Output mode setting</td><td colspan="10">Reserved</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Output mode setting: default setting is H’0000.
Mode 0: voltage output mode (0 V to 10 V).
Mode 1: voltage output mode (2 V to 10 V).
Mode 2: current output mode (4 mA to 20 mA).
Mode 3: current output mode (0 mA to 20 mA).
Mode 4: close</td></tr>
<tr><td colspan="21">CR#1: used to set two internal channels working mode of analog output module. Every channel has four modes that can be set individually. For example: if set CH1 to mode 2 (b2 to b0 = 010), CH2 to mode 1 (b5 to b3 = 001). It needs to set CR#1 to H’000A and the upper bits (b6 to b15) will be reserved.</td></tr>
<tr><td>#10</td><td>H’403C</td><td>╳</td><td>R/W</td><td>CH1 output value</td><td colspan="16" rowspan="2">The output value of CH1 to CH2, setting range is K0 to K4,000. Default setting is K0 and unit is LSB.</td></tr>
<tr><td>#11</td><td>H’403D</td><td>╳</td><td>R/W</td><td>CH2 output value</td></tr>
<tr><td>#22</td><td>H’4048</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH1</td><td colspan="16" rowspan="2">It is used to set the OFFSET value of CH1 to CH2.
The setting range is K-2,000 to K2,000.
The default setting is K0 and unit is LSB.</td></tr>
<tr><td>#23</td><td>H’4049</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH2</td></tr>
<tr><td>#28</td><td>H’404E</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH1</td><td colspan="16" rowspan="2">It is used to set the GAIN value of CH1 to CH2.
The setting range is K0 to K4,000.
The default setting is K2,000 and unit is LSB.</td></tr>
<tr><td>#29</td><td>H’404F</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH2</td></tr>
<tr><td colspan="21">CR#22 to CR#29: Please note that GAIN value – OFFSET value=+400 LSB to +6,000 LSB (voltage or current). When this value is within this range, the resolution of the output signal will be thin, and the value variation will be larger. When this value exceeds this range, the resolution of output signal will be thick, and the variation of value will be smaller.</td></tr>
<tr><td>#30</td><td>H’4050</td><td>╳</td><td>R</td><td>Error state</td><td colspan="16">The data register to save all error states. Please refer to error code chart for detail.</td></tr>
<tr><td colspan="21">CR#30 is the error code. Please refer to the following chart.
<table>
<tr><th>Error description</th><th>Content</th><th>b15 to b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>Abnormal power</td><td>K1 (H’1)</td><td rowspan="7">Reserved</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Analog input value error</td><td>K2 (H’2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>Setting mode error</td><td>K4 (H’4)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>Offset/gain error</td><td>K8 (H’8)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Digital range error</td><td>K32 (H’20)</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Average times setting error</td><td>K64 (H’40)</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Instruction error</td><td>K128 (H’80)</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td colspan="11">Note: Each error code will have corresponding bits (b0 to b7). Two or more error states may occur at the same time. 0 means normal, and 1 means that one or more error states have occurred.
EX: if the digital input exceeds 4,000, error (K2) will occur. If the analog output exceeds 10 V, both analog input value error K2 and K32 will occur.</td></tr>
</table></td></tr>
<tr><td>#31</td><td>H’4051</td><td>○</td><td>R/W</td><td>Communication address setting</td><td colspan="16">It is used to set RS-485 communication address. The setting range is from 01 to 254 and the default setting is K1.</td></tr>
</table>

<table>
<tr><th>CR#</th><th>RS-485 parameters address</th><th colspan="2">Latched</th><th>Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>#32</td><td>H’4052</td><td>○</td><td>R/W</td><td>Communication format setting</td><td colspan="16">It is used to set communication format.
For baud rate, the settings are 4,800/9,600/19,200/38,400/57,600/115,200 bps.
Communication format:
ASCII: 7, E, 1 / 7, O, 1 / 8, E, 1 / 8, O, 1 / 8, N, 1
RTU: 8, E, 1 / 8, O, 1 / 8, N, 1
Factory default: ASCII, 9600, 7, E, 1 (CR#32=H’0002)
Refer to ※CR#32 communication format settings at the end of this table for more information.</td></tr>
<tr><td rowspan="2">#33</td><td rowspan="2">H’4053</td><td rowspan="2">○</td><td rowspan="2">R/W</td><td rowspan="2">Reset to default setting and set characteristics adjustable priority</td><td colspan="12">Reserved</td><td colspan="2">CH2</td><td colspan="2">CH1</td></tr>
<tr><td colspan="16">Output latched setting, default setting H’0000.
Give CH1 setting for example:
1. When b0=0, user can set OFFSET and GAIN value of CH1 (CR#22, CR#28). When b1=1, users are NOT allowed to adjust OFFSET and GAIN value of CH1 (CR#22, CR#28).
2. b1 means if characteristic register is latched. b1=0 (default setting, latched), b1=1 (not latched).
3. When b2 is set to 1, all settings will be reset to default setting.</td></tr>
<tr><td colspan="21">CR#33 is used to set the internal function priority. For example: characteristic register. Output latched function will save output setting to the internal memory before power loss.</td></tr>
<tr><td>#34</td><td>H’4054</td><td>○</td><td>R</td><td>Firmware version.</td><td colspan="16">Displays software version in hexadecimal format.
For example: H’010A means 1.0A.</td></tr>
<tr><td colspan="4">#35 to #48</td><td colspan="17">For system used</td></tr>
<tr><td colspan="21">Symbols: ○ means latched.
╳ means not latched.
R means can read data by using FROM instruction via RS-485.
W means can write data by using TO instruction via RS-485.
LSB (Least Significant Bits): 1. Voltage output: 1 $_{LSB}$=10 V/4,000=2.5 mV.
2. Current output: 1 $_{LSB}$=20 mA/4,000=5 μA.</td></tr>
</table>

※ Added the RESET function for modules with firmware V4.06 or later. Connect the module power input to 24 VDC and write H’4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters, are restored to factory defaults.

※ The corresponding parameters address H’4032 to H’4054 of CR#0 to CR#34 are provided for users to read/ write data via RS-485 communication.

※ If you want to use Modbus address in decimal format, you can convert a hexadecimal register to decimal format and then add one to have it become a decimal Modbus register address. For example, converting the address “H’4032” of CR#0 from hexadecimal format to decimal format gives the result 16434, and then adding one to it, you have 16435, the Modbus address in decimal format.

※ Function codes: 03’H is for reading data from registers. 06’H is for writing a word data into registers. 10’H is for writing multiple word data into registers.

※ The output behavior of the module when entering the STOP state is governed by the firmware version:
Firmware Version < 5.00: The output value is automatically set to zero (0).
Firmware Version >=5.00: The output value is set to the configured channel mode's lower limit value (safe state).

※ CR#32 communication format settings: for modules with firmware V4.04 or previous versions, b11 to b8 data format selection is not available. For ASCII mode, the format is fixed to 7, E, 1 (H'00XX) and for RTU mode, the format is fixed to 8, E, 1 (H'C0xx/H'80xx). For modules with firmware V4.05 or later, refer to the following table for setups. Note that the original code H'C0XX/H'80XX will be seen as RTU, 8, E, 1 for modules with firmware V4.05 or later.

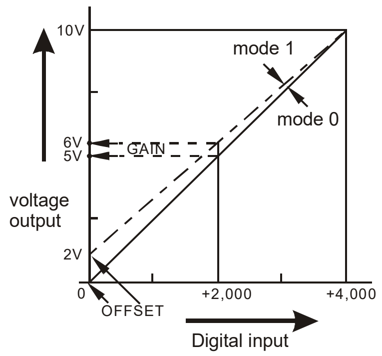
b15 to b12		b11 to b8		b7 to b0	
ASCII/RTU, exchange low and high byte of CRC check code		Data format		Baud rate	
Description					
H'0	ASCII	H'0	7, E, 1*1	H'01	4800 bps
H'8	RTU, do NOT exchange low and high byte of CRC check code	H'1	8, E, 1	H'02	9600 bps
		H'2	reserved	H'04	19200 bps
H'C	RTU, exchange low and high byte of CRC check code	H'3	8, N, 1	H'08	38400 bps
		H'4	7, O, 1*1	H'10	57600 bps
		H'5	8, O, 1	H'20	115200 bps

Note *1: This is only available for ASCII format.

Ex: Write H'C310 into CR#32 for a result of RTU, exchange low and high byte of CRC check code, 8,N,1 and baud rate at 57600 bps.

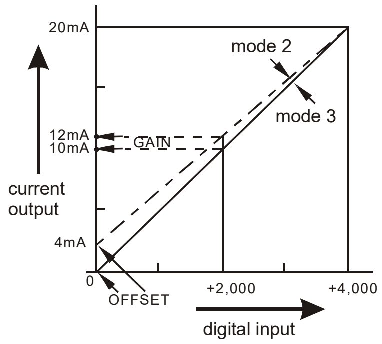
- **Adjust D/A Conversion Curve**

Voltage output mode:



Mode 0 of CR#1:	GAIN=5 V (2,000 LSB), OFFSET=0 V (0 LSB)
Mode 1 of CR#1:	GAIN=6 V (2,400 LSB), OFFSET=2 V (800 LSB)
GAIN:	Voltage output value when digital input is K2,000. Setting range is 0 LSB to +4,000 LSB.
OFFSET:	Voltage output value when digital input is K0. Setting range is -2,000 LSB to +2,000 LSB.
GAIN - OFFSET:	Setting range: +400 LSB to +6,000 LSB

Current output mode:



Mode 2 of CR#1:	GAIN=12 mA (2,400 LSB), OFFSET=4 mA (800 LSB)
Mode 3 of CR#1:	GAIN=10 mA (2,000 LSB), OFFSET=0 mA (0 LSB)
GAIN:	Current output value when digital input is K2,000. Setting range is 0 LSB to +4,000 LSB.
OFFSET:	Current output value when digital input is K0. Setting range is -2,000 LSB to +2,000 LSB.
GAIN - OFFSET:	Setting range: +400 LSB to +6,000 LSB

The charts above are D/A conversion characteristic curve of voltage output mode and current output mode. Users can adjust conversion characteristic curves by changing OFFSET values (CR#14 to CR#15) and GAIN values (CR#18 to CR#19), depending on the application.

8.4.4 DVP04DA-S2 Control Register

<table>
<tr><th>CR#</th><th>RS-485 Parameter address</th><th colspan="2">Latched</th><th>Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><td>0</td><td>H’4032</td><td>○</td><td>R</td><td>Model type</td><td colspan="16">For system use. Data length: 8 bits (b7 to b0)
Model code of DVP04DA-S2: H’91
Users can read the model type through a program to check if the extension module exists.</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">H’4033</td><td rowspan="2">○</td><td rowspan="2">R/W</td><td rowspan="2">Output mode setting</td><td colspan="4">Reserved</td><td colspan="3">CH4</td><td colspan="3">CH3</td><td colspan="3">CH2</td><td colspan="3">CH1</td></tr>
<tr><td colspan="16">Input mode setting: The factory setting is H’0000.
Mode 0: Voltage output mode (0 V to +10 V)
Mode 1: Voltage output mode (2 V to +10 V)
Mode 2: Current output mode (4 mA to +20 mA)
Mode 3: Current output mode (0 mA to +20 mA)
Mode 4: Voltage output mode (0 V to +5 V)
Mode 5: Voltage output mode (1 V to +5 V)
(Mode 4 to 5 are available for FW V5.00 or later.)</td></tr>
<tr><td colspan="21">CR#1: used to set 2 internal channels working mode of analog output module. Every channel has six modes that can be set individually. For example: if set CH1 to mode 2 (b2 to b0 = 010), CH2 to mode 1 (b5 to b3 = 001), CH3 to mode 0 (b8 to b6 = 000), CH4 to mode 0 (b11 to b9 = 000). Then CR#1 is set to H’000A and the upper bits (b12 to b15) will be reserved. The factory setting of CR#1 is H’0000.</td></tr>
<tr><td>6</td><td>H’4038</td><td>×</td><td>R/W</td><td>CH1output value</td><td colspan="16" rowspan="4">The output value of CH1 to CH4, setting range: K0 to K4,000.
The factory setting is K0, unit is LSB.</td></tr>
<tr><td>7</td><td>H’4039</td><td>×</td><td>R/W</td><td>CH2 output value</td></tr>
<tr><td>8</td><td>H’403A</td><td>×</td><td>R/W</td><td>CH3 output value</td></tr>
<tr><td>9</td><td>H’403B</td><td>×</td><td>R/W</td><td>CH4 output value</td></tr>
<tr><td>18</td><td>H’4044</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH1</td><td colspan="16" rowspan="4">Offset setting of CH1 to CH4. Setting range: K-2,000 to K2,000.
Factory setting is K0, and unit is LSB.
Voltage setting range is -2,000 to +2,000.
Current setting range is -2,000 to +2,000.(LSB)</td></tr>
<tr><td>19</td><td>H’4045</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH2</td></tr>
<tr><td>20</td><td>H’4046</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH3</td></tr>
<tr><td>21</td><td>H’4047</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH4</td></tr>
<tr><td>24</td><td>H’404A</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH1</td><td colspan="16" rowspan="4">GAIN setting of CH1 to CH4. Setting range: K0 to K4,000.
Factory setting is K2,000, and unit is LSB.
Voltage setting range is 0 to +4,000.
Current setting range is 0 to +4,000.(LSB)</td></tr>
<tr><td>25</td><td>H’404B</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH2</td></tr>
<tr><td>26</td><td>H’404C</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH3</td></tr>
<tr><td>27</td><td>H’404D</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH4</td></tr>
<tr><td colspan="21">CR#18 to CR#27: Please note that GAIN value – OFFSET value=+400 LSB to +6,000 LSB (voltage or current). If the value difference comes up small (within range), the output signal resolution is then slim, and the variation is definitely larger. On the contrast, if the value difference exceeds the range, the output signal resolution becomes larger, and the variation is definitely smaller.</td></tr>
<tr><td>30</td><td>H’4050</td><td>×</td><td>R</td><td>Error state</td><td colspan="16">Data register to save all error states. Please refer to error code chart for detail.</td></tr>
</table>

CR#	RS-485 Parameter address	Latched	Register name	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

CR#30: Error states value (see the table below)

Error description	Value	b15 to b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power	K1 (H'1)	Reserved	0	0	0	0	0	0	0	1
Scale over error	K2 (H'2)		0	0	0	0	0	0	1	0
Mode error	K4 (H'4)		0	0	0	0	0	1	0	0
Offset/gain error	K8 (H'8)		0	0	0	0	1	0	0	0
Abnormal digital value	K32 (H'20)		0	0	1	0	0	0	0	0
Incorrect number of values averaged	K64 (H'40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H'80)		1	0	0	0	0	0	0	0

Note: *Each error code corresponds to a bits (b0 to b7). Two or more error states may occur at the same time. 0 means normal, and 1 means that one or more error states have occurred.*

Ex: When the digital input exceeds 4000, the scale over (K2) error will be displayed; when the analog output exceeds 10 V, Abnormal digital value (K32) and scale over (K2) error states will be displayed at the same time.

CR#	RS-485 Parameter address	Latched		Register name	Description
31	H'4051	○	R/W	Communication address setting	Setting RS-485 communication address. Setting range is 01 to 254, and factory setting is K1.
32	H'4052	○	R/W	Communication format setting	Used to set communication format. For baud rate, the settings are 4,800/9,600/19,200/38,400/57,600/115,200 bps. Communication format: DVP04DA-S2 ASCII: 7 E 1, 7 O 1, 8 E 1, 8 O 1, 8 N 1, 7 E 2, 7 O 2, 8 E 2, 8 O 2, 8 N 2 RTU: 8 E 1, 8 O 1, 8 N 1, 8 E 2, 8 O 2, 8 N 2 Factory default: ASCII, 9600, 7, E, 1 (CR#32=H'0002) Refer to ※CR#32 communication format settings at the end of this table for more information.
33	H'4053	○	R/W	Reset to factory setting and set characteristics adjustable priority	Reserved | CH4 | CH3 | CH2 | CH1 Factory setting is H'0000. Take CH1 setting for example: 1. When b0=0, user can set OFFSET and GAIN value of CH1 (CR#18, CR#24). When b0=1, users are NOT allowed to adjust OFFSET and GAIN value of CH1 (CR#18, CR#24). 2. b1 means if characteristic register is latched. b1=0 (factory setting, latched), b1=1 (not latched). 3. When b2 is set to 1, all settings will be reset to factory setting.

CR#33 is used to set the internal function priority. For example: characteristic register. Output latched function will save output setting in the internal memory before power loss.

CR#	RS-485 Parameter address	Latched		Register name	Description
34	H'4054	○	R	Firmware version	Displays software version in hexadecimal format. For example: H'010A means 1.0A.
35 to 48				For system used	

Symbols:

○ Means latched.

╳ Means not latched.

R means can read data by using FROM instruction or RS-485.

W means can write data by using TO instruction or RS-485.

LSB (Least Significant Bits):

1. Voltage output: 1 $_{LSB}$ =10 V/4,000=2.5 mV
2. Current output:1 $_{LSB}$ =20 mA/4,000=5 μA

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※ Added the RESET function for 04AD-S2 with firmware V4.16 or later. Connect the module power input to 24 VDC and write H’4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters, are restored to factory defaults.

※ The corresponding parameters address H’4032 to H’4054 of CR#0 to CR#34 are provided for users to read/ write data via RS-485 communication.

※ Function codes: 03’H is for reading data from registers. 06’H is for writing a word data into registers. 10’H is for writing multiple word data into registers

※ If you want to use Modbus address in decimal format, you can convert a hexadecimal register to decimal format and then add one to have it become a decimal Modbus register address. For example, converting the address “H’4032” of CR#0 from hexadecimal format to decimal format, gives the result 16434 and then adding one to it, you have 16435, the Modbus address in decimal format.

※ The output behavior of the module when entering the STOP state is governed by the firmware version:
Firmware Version < 5.00: The output value is automatically set to zero (0).
Firmware Version >=5.00: The output value is set to the configured channel mode's lower limit value (safe state).

※ DVP04DA-S2 CR#32 communication format settings: for modules with firmware V4.14 or previous versions, b11 to b8 data format selection is not available. For ASCII mode, the format is fixed to 7, E, 1 (H’00XX) and for RTU mode, the format is fixed to 8, E, 1 (H’C0xx/H’80xx). For modules with firmware V4.15 or later, refer to the following table for setups. Note that the original code H’C0XX/H’80XX will be seen as RTU, 8, E, 1 for modules with firmware V4.15 or later.

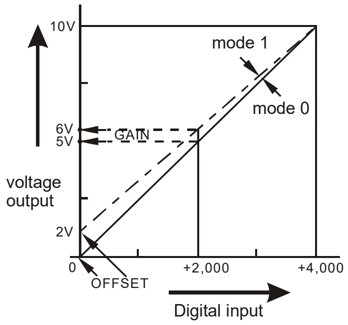
<table>
<tr><th colspan="2">b15 to b12</th><th colspan="2">b11 to b8</th><th colspan="2">b7 to b0</th></tr>
<tr><td colspan="2">ASCII/RTU
exchange low and high byte of CRC check code</td><td colspan="2">Data format</td><td colspan="2">Baud rate</td></tr>
<tr><td colspan="6">Description</td></tr>
<tr><td>H'0</td><td>ASCII</td><td>H'0</td><td>7, E, 1*1</td><td>H'01</td><td>4800 bps</td></tr>
<tr><td rowspan="2">H'8</td><td rowspan="2">RTU,
do NOT exchange low and high byte of CRC check code</td><td rowspan="2">H'1</td><td rowspan="2">8, E, 1</td><td>H'02</td><td>9600 bps</td></tr>
<tr><td>H'04</td><td>19200 bps</td></tr>
<tr><td rowspan="2">H'C</td><td rowspan="2">RTU,
exchange low and high byte of CRC check code</td><td>H'3</td><td>8, N, 1</td><td>H'08</td><td>38400 bps</td></tr>
<tr><td>H'4</td><td>7, O, 1*1</td><td>H'10</td><td>57600 bps</td></tr>
<tr><td rowspan="7"></td><td rowspan="7"></td><td>H'5</td><td>8, O, 1</td><td>H'20</td><td>115200 bps</td></tr>
<tr><td>H'6</td><td>7, E, 2*1</td><td rowspan="6"></td><td rowspan="6"></td></tr>
<tr><td>H'7</td><td>8, E, 2</td></tr>
<tr><td>H'8</td><td>7, N, 2*1</td></tr>
<tr><td>H'9</td><td>8, N, 2</td></tr>
<tr><td>H'A</td><td>7, O, 2*1</td></tr>
<tr><td>H'B</td><td>8, O, 2</td></tr>
</table>

Ex: Write H’C310 into CR#32 for a result of RTU, exchange low and high byte of CRC check code, 8,N,1 and baud rate at 57600 bps.

Note *1: This is only available for ASCII format.

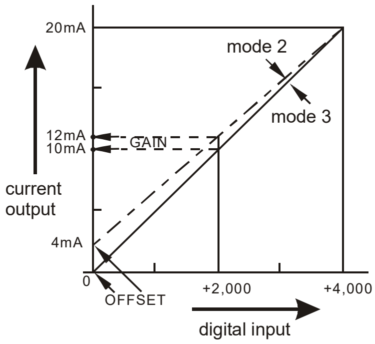
- **Adjusting D/A Conversion Characteristic Curves**

Voltage output mode:



Mode 0 of CR#1:	GAIN=5 V (2,000 LSB), OFFSET=0 V (0 LSB).
Mode 1 of CR#1:	GAIN=6 V (2,400 LSB), OFFSET=2 V (800 LSB).
Mode 4 of CR#1:	GAIN=2.5 V (1,000 LSB), OFFSET=0 V (0 LSB).
Mode 5 of CR#1:	GAIN=3 V (1,200 LSB), OFFSET=1 V (400 LSB).
GAIN:	The setting range of voltage output value when digital input value is K2,000 should be 0 LSB to +4,000 LSB.
OFFSET:	The setting range of voltage output value when digital input value is K0 should be -2,000 LSB to +2,000 LSB.
GAIN – OFFSET:	Setting range: +400 LSB to +6,000 LSB.

Current output mode:



Mode 2 of CR#1:	GAIN=12 mA (2,400 LSB), OFFSET=4 mA (800 LSB).
Mode 3 of CR#1:	GAIN=10 mA (2,000 LSB), OFFSET=0 mA (0 LSB).
GAIN:	The setting range of current output when digital input value is K2,000 should be 0 LSB to +4,000 LSB.
OFFSET:	The setting range of current output when digital input value is K0 should be -2,000 LSB to +2,000 LSB.
GAIN – OFFSET:	Setting range: +400 LSB to +6,000 LSB.

The charts above are D/A conversion characteristic curve of voltage output mode and current output mode. Users can adjust the conversion characteristic curves by changing OFFSET values (CR#18 to CR#21) and GAIN values (CR#24 to CR#27), depending on the application.

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8.4.5 DVP06XA-S2 Control Register

<table>
<tr><th rowspan="2">CR#</th><th rowspan="2">RS-485 parameter address</th><th rowspan="2" colspan="2">Latched</th><th rowspan="2">Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><th colspan="2">CH6</th><th colspan="2">CH5</th><th colspan="3">CH4</th><th colspan="3">CH3</th><th colspan="3">CH2</th><th colspan="3">CH1</th></tr>
<tr><td>#0</td><td>H’40C8</td><td>○</td><td>R</td><td>Model type</td><td colspan="16">For system use. Data length: 8 bits (b7 to b0)
Model code of DVP06XA-S2: H’D4
Users can read the model type through a program to check if the extension module exists.</td></tr>
<tr><td>#1</td><td>H’40C9</td><td>○</td><td>R/W</td><td>Input mode setting</td><td colspan="16">Input mode setting: (CH1 to CH4)
Mode 0: Voltage input mode (-10 V to +10 V)
Mode 1: Voltage input mode (-6 V to +10 V)
Mode 2: Current input mode (-12 mA to +20 mA)
Mode 3: Current input mode (-20 mA to +20 mA)
Mode 4: current input mode (4 to +20 mA)
Mode 5: Voltage input mode (0 to +10 V)
Mode 6: Voltage input mode (0 to +5 V)
(Mode 4 to 6 are available for FW V5.00 or later.)

Output mode setting: (CH5 to CH6)
Mode 0: Voltage output mode (0 V to 10 V)
Mode 1: Voltage output mode (2 V to 10 V)
Mode 2: Current output mode (4 mA to 20 mA)
Mode 3: Current output mode (0 mA to 20 mA)</td></tr>
<tr><td colspan="21">CR#1: b11 to b0 are used to set 4 internal channels working mode of analog input module (AD). b12 to b15 are used to set 2 channels working mode of analog output module (DA). Every channel has four modes that can be set individually. For example: if setting CH1 to mode 0 (b2 to b0=000), CH2 to mode 1 (b5 to b3=001), CH3 to mode 2 (b8 to b6=010), CH4 to mode 3 (b11 to b9=011), b0 to b11 need be set to H’688. If setting CH5 to mode 2 (b13 to b12=10), CH6 to mode 1 (b15 to b14=01), b12 to b15 need be set to H’6. Factory Setting is H’0000.</td></tr>
<tr><td>#2</td><td>H’40CA</td><td>○</td><td>R/W</td><td>CH1 average number</td><td colspan="16" rowspan="4">The number of readings used for “average” on channels CH1 to CH4. Setting range is K1 to K20 and factory setting is K10.
Please note that the average number of writes to CR#2 to CR#5 only needs to be written once. If written continuously, the average value cannot be obtained.</td></tr>
<tr><td>#3</td><td>H’40CB</td><td>○</td><td>R/W</td><td>CH2 average number</td></tr>
<tr><td>#4</td><td>H’40CC</td><td>○</td><td>R/W</td><td>CH3 average number</td></tr>
<tr><td>#5</td><td>H’40CD</td><td>○</td><td>R/W</td><td>CH4 average number</td></tr>
<tr><td>#6</td><td>H’40CE</td><td>×</td><td>R</td><td>Average value of CH1 input signal</td><td colspan="16" rowspan="4">Display average value of CH1 to CH4 input signal.
Assume that the average number of times is set to 10, that is, an average is taken every 10 accumulated input signals from channels CH1 to CH4.</td></tr>
<tr><td>#7</td><td>H’40CF</td><td>×</td><td>R</td><td>Average value of CH2 input signal</td></tr>
<tr><td>#8</td><td>H’40D0</td><td>×</td><td>R</td><td>Average value of CH3 input signal</td></tr>
<tr><td>#9</td><td>H’40D1</td><td>×</td><td>R</td><td>Average value of CH4 input signal</td></tr>
<tr><td>#10</td><td>H’40D2</td><td>×</td><td>R/W</td><td>CH5 output signal value</td><td colspan="16" rowspan="2">Output value of CH5 to CH6, the setting range is K0 to K4,000.
The factory setting is K0 and the unit is LSB.</td></tr>
<tr><td>#11</td><td>H’40D3</td><td>×</td><td>R/W</td><td>CH6 output signal value</td></tr>
<tr><td>#12</td><td>H’40D4</td><td>×</td><td>R</td><td>Present value of CH1 input signal</td><td colspan="16" rowspan="4">Display present value of CH1 to CH4 input signal.</td></tr>
<tr><td>#13</td><td>H’40D5</td><td>×</td><td>R</td><td>Present value of CH2 input signal</td></tr>
<tr><td>#14</td><td>H’40D6</td><td>×</td><td>R</td><td>Present value of CH3 input signal</td></tr>
<tr><td>#15</td><td>H’40D7</td><td>×</td><td>R</td><td>Present value of CH4 input signal</td></tr>
<tr><td>#18</td><td>H’40DA</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH1</td><td colspan="16">Offset setting of CH1 to CH4. Factory setting is K0 and unit is LSB.</td></tr>
</table>

8

<table>
<tr><th rowspan="2">CR#</th><th rowspan="2">RS-485 parameter address</th><th rowspan="2" colspan="2">Latched</th><th rowspan="2">Register name</th><th>b15</th><th>b14</th><th>b13</th><th>b12</th><th>b11</th><th>b10</th><th>b9</th><th>b8</th><th>b7</th><th>b6</th><th>b5</th><th>b4</th><th>b3</th><th>b2</th><th>b1</th><th>b0</th></tr>
<tr><th colspan="2">CH6</th><th colspan="2">CH5</th><th colspan="3">CH4</th><th colspan="3">CH3</th><th colspan="3">CH2</th><th colspan="3">CH1</th></tr>
<tr><td>#19</td><td>H’40DB</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH2</td><td rowspan="3" colspan="16">Voltage input: setting range is K-1,000 LSB to K1,000 LSB.
Current input: setting range is K-1,000 LSB to K1,000 LSB.</td></tr>
<tr><td>#20</td><td>H’40DC</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH3</td></tr>
<tr><td>#21</td><td>H’40DD</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH4</td></tr>
<tr><td>#22</td><td>H’40DE</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH5</td><td rowspan="2" colspan="16">Offset setting of CH5 to CH6. Factory setting is K0, and unit is LSB.
The setting range is K-2,000 LSB to K2,000 LSB.</td></tr>
<tr><td>#23</td><td>H’40DF</td><td>○</td><td>R/W</td><td>To adjust OFFSET value of CH6</td></tr>
<tr><td>#24</td><td>H’40E0</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH1</td><td rowspan="4" colspan="16">GAIN setting of CH1 to CH4. Factory setting is K1,000 and unit is LSB.
Voltage input: setting range is K-800 LSB to K4,000 LSB.
Current input: setting range is K-800 LSB to K2,600 LSB.
Please notice that:
GAIN VALUE – OFFSET VALUE=+200 LSB to +3,000 LSB (voltage) or +200 LSB to +1,600 LSB (current).</td></tr>
<tr><td>#25</td><td>H’40E1</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH2</td></tr>
<tr><td>#26</td><td>H’40E2</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH3</td></tr>
<tr><td>#27</td><td>H’40E3</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH4</td></tr>
<tr><td>#28</td><td>H’40E4</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH5</td><td rowspan="2" colspan="16">GAIN setting of CH5 to CH6. Factory setting is K2,000 and unit is LSB.
The setting range is K0 to K4,000.
Please notice that GAIN value – OFFSET value= +400 LSB to +6,000 LSB (voltage or current).</td></tr>
<tr><td>#29</td><td>H’40E5</td><td>○</td><td>R/W</td><td>To adjust GAIN value of CH6</td></tr>
<tr><td colspan="21">CR#24 to CR#29: If the value difference comes up small (within range), the output signal resolution is then slim, and the variation is definitely larger. On the contrast, if the value difference exceeds the range, the output signal resolution becomes larger, and the variation is definitely smaller.</td></tr>
<tr><td>#30</td><td>H’40E6</td><td>╳</td><td>R</td><td>Error state</td><td colspan="16">Data register stores the error states, see error code chart for details.</td></tr>
<tr><td>#31</td><td>H’40E7</td><td>○</td><td>R/W</td><td>Communication address setting</td><td colspan="16">RS-485 communication address.
Setting range is K1 to K254 and factory setting is K1.</td></tr>
<tr><td>#32</td><td>H’40E8</td><td>○</td><td>R/W</td><td>Communication format setting</td><td colspan="16">For baud rate, the settings are 4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200 bps.
Communication format: For DVP06XA-S2
ASCII: 7,E,1 / 7,O,1 / 8,E,1 / 8,O,1 / 8,N,1 / 7,O,2 / 7,N,2 / 8,E,2 / 8,O,2 / 8,N,2
RTU: 8,E,1 / 8,O,1 / 8,N,1 / 8,E,2 / 8,O,2 / 8,N,2
Factory default: ASCII, 9600, 7, E, 1 (CR#32=H’0002)
Refer to ※CR#32 communication format settings at the end of this table for more information.</td></tr>
<tr><td>#33</td><td>H’40E9</td><td>○</td><td>R/W</td><td>Reset to factory setting and set characteristics adjustable priority</td><td colspan="16">The setting of CH1 to CH4, give CH1 setting for example
1. When b0=0, user can set OFFSET and GAIN value of CH1 (CR#18, CR#24). When b0=1, users are NOT allowed to adjust OFFSET and GAIN value of CH1 (CR#18, CR#24).
2. When b2 set to 1, PLC will be reset to factory settings.

The setting of CH5 to CH6, give CH5 setting for example (b13, b12):
00: can be adjusted, latched.
10: inhibits adjust.
11: reset to factory settings and clear b12, b13 to 0.</td></tr>
<tr><td colspan="21">CR#33 is used to set the internal function priority. For example: characteristic register. Output latched function will save output setting in the internal memory before power loss.</td></tr>
<tr><td>#34</td><td>H’40EA</td><td>○</td><td>R</td><td>Software version</td><td colspan="16">Displays software version in hexadecimal format.
Example: H’010A=version 1.0A.</td></tr>
<tr><td colspan="5">#35 to #48</td><td colspan="16">For system used</td></tr>
</table>

CR#	RS-485 parameter address	Latched	Register name	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
				CH6		CH5		CH4			CH3			CH2			CH1		

Symbols:

◯ means latched.

╳ means non-latched.

R means can read data by using FROM instruction or RS-485.

W means can write data by using TO instruction or RS-485.

LSB (Least Significant Bits):

1. Voltage input: 1 $_{LSB}$=10 V/2,000=5 mV.   2. Current input: 1 $_{LSB}$=20 mA/1,000=20 μA.
1. Voltage output: 1 $_{LSB}$=10 V/4,000=2.5 mV.   2. Current output: 1 $_{LSB}$=20 mA/4,000=5 μA.

※ Added the RESET function for 06XA-S2 with firmware V4.16 or later. Connect the module power input to 24 VDC and write H’4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters, are restored to factory defaults.

※ The corresponding parameters address H’40C8 to H’40EA of CR#0 to CR#34 allow user to read/write data via RS-485 communication.

※ Function codes: 03’H is for reading data from registers. 06’H is for writing a word data into registers. 10’H is for writing multiple word data into registers.

CR#30 is the error code. Please refer to the chart below.

Error Description	Value	b15 to b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power	K1 (H’1)	Reserved	0	0	0	0	0	0	0	0	0	0	0	1
The D/A output exceeds the range.	K2 (H’2)		0	0	0	0	0	0	0	0	0	0	1	0
Mode error	K4 (H’4)		0	0	0	0	0	0	0	0	0	1	0	0
Offset/gain error	K8 (H’8)		0	0	0	0	0	0	0	0	1	0	0	0
Hardware malfunction	K16 (H’10)		0	0	0	0	0	0	0	1	0	0	0	0
Abnormal digital value	K32 (H’20)		0	0	0	0	0	0	1	0	0	0	0	0
Incorrect number of values averaged	K64 (H’40)		0	0	0	0	0	1	0	0	0	0	0	0
Instruction error	K128 (H’80)		0	0	0	0	1	0	0	0	0	0	0	0
The input received by CH1 is out of the range.	K256 (H’100)		0	0	0	1	0	0	0	0	0	0	0	0
The input received by CH2 is out of the range.	K512 (H’200)		0	0	1	0	0	0	0	0	0	0	0	0
The input received by CH3 is out of the range.	K1024 (H’400)		0	1	0	0	0	0	0	0	0	0	0	0
The input received by CH4 is out of the range.	K2048 (H’800)		1	0	0	0	0	0	0	0	0	0	0	0

Note: Each error code corresponds to a bits (b0 to b11). Two or more error states may occur at the same time.
0 means normal, and 1 means that one or more error states have occurred.

Example: If the digital input exceeds 4,000, the error K2 will occur.
If the analog output exceeds 10 V, the errors K2 and K32 will occur.
(A/D does not support displaying the error K2.)

※ If you want to use Modbus address in decimal format, you can convert a hexadecimal register to decimal format and then add one to have it become a decimal Modbus register address. For example, converting the address “H’40C8” of CR#0 from hexadecimal format to decimal format gives the result 16584, and then adding one to it, you have 16585, the Modbus address in decimal format.

※ The output behavior of the module when entering the STOP state is governed by the firmware version:
Firmware Version < 5.00: The output value is automatically set to zero (0).
Firmware Version >=5.00: The output value is set to the configured channel mode's lower limit value (safe state).

※ DVP06XA-S2 CR#32 communication format settings: for modules with firmware V4.14 or previous versions, b11 to b8 data format selection is not available. For ASCII mode, the format is fixed to 7, E, 1 (H'00XX) and for RTU mode, the format is fixed to 8, E, 1 (H'C0xx/H'80xx). For modules with firmware V4.15 or later, refer to the following table for setups. Note that the original code H'C0XX/H'80XX will be seen as RTU, 8, E, 1 for modules with firmware V4.15 or later.

b15 to b12		b11 to b8		b7 to b0	
ASCII/RTU exchange low and high byte of CRC check code		Data format		Baud rate	
Description					
H'0	ASCII	H'0	7, E, 1*1	H'01	4800 bps
H'8	RTU, do NOT exchange low and high byte of CRC check code	H'1	8, E, 1	H'02	9600 bps
				H'04	19200 bps
H'C	RTU, exchange low and high byte of CRC check code	H'3	8, N, 1	H'08	38400 bps
		H'4	7, O, 1*1	H'10	57600 bps
		H'5	8, O, 1	H'20	115200 bps
		H'6	7, E, 2*1		
		H'7	8, E, 2		
		H'8	7, N, 2*1		
		H'9	8, N, 2		
		H'A	7, O, 2*1		
		H'B	8, O, 2		

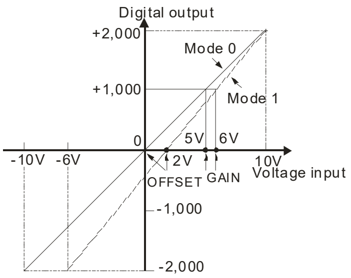
Note *1: This is only available for ASCII format.

Ex: Write H'C310 into CR#32 for a result of RTU, exchange low and high byte of CRC check code, 8, N, 1 and baud rate at 57600 bps.

- **Analog/Digital Curves**

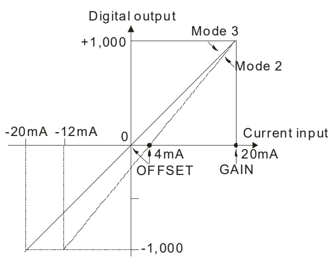
▪ **Adjusting the A/D Conversion Curves of CH1 to Ch4**

Voltage input mode:



Mode 0 of CR#1:	GAIN=5 V (1,000 LSB), OFFSET=0 V (0 LSB).
Mode 1 of CR#1:	GAIN=6 V (1,200 LSB), OFFSET=2 V (400 LSB).
Mode 5 of CR#1:	GAIN=5 V (1,000 LSB), OFFSET=0 V (0 LSB).
Mode 6 of CR#1:	GAIN=2.5 V (500 LSB), OFFSET=0 V (0 LSB).
GAIN:	Voltage input value when digital output is 1,000. Setting range is -800 LSB to +4,000 LSB.
OFFSET:	Voltage input value when digital output is 0. Setting range is -1,000 LSB to +1,000 LSB
GAIN - OFFSET:	Setting range is +200 LSB to +3,000 LSB

Current input mode:

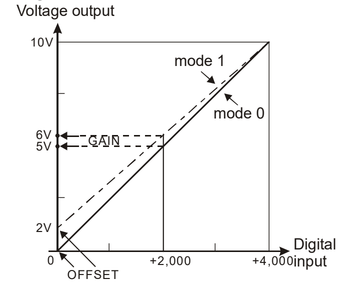


Mode 2 of CR#1:	GAIN=20 mA (1,000 LSB), OFFSET=4 mA (200 LSB).
Mode 3 of CR#1:	GAIN=20 mA (1,000 LSB), OFFSET=0 mA (0 LSB).
Mode 4 of CR#1:	GAIN=20 mA (1,000 LSB), OFFSET=4 mA (200 LSB).
GAIN:	Current input value when digital output is +1,000. Setting range is -800 LSB to +2,600 LSB
OFFSET:	Current input value when digital output value is 0. Setting range is -1,000 LSB to +1,000 LSB
GAIN – OFFSET:	Setting range is +200 LSB to +1,600 LSB

Use the chart above to adjust A/D conversion characteristic curve of voltage input mode and current input mode. Users can adjust conversion characteristic curves by changing OFFSET values (CR#18 to CR#21) and GAIN values (CR#24 to CR#27), depending on the application.

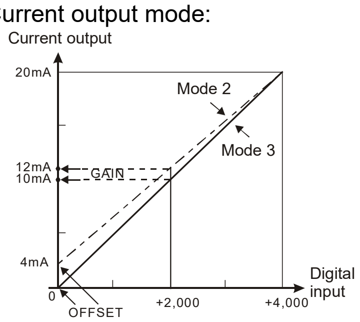
■ **Adjust the D/A Conversion Curves of CH5 to CH6**

Voltage output mode:



Mode 0 of CR#1:	GAIN=5 V (2,000 LSB), OFFSET=0 V (0 LSB).
Mode 1 of CR#1:	GAIN=6 V (2,400 LSB), OFFSET=2 V (800 LSB).
GAIN:	Voltage output value when digital input value is K2,000. Setting range is 0 LSB to +4,000 LSB.
OFFSET:	Voltage output value when digital input is K0. Setting range is -2,000 LSB to +2,000 LSB.
GAIN-OFFSET:	Setting range is +400 LSB to +6,000 LSB

Current output mode:



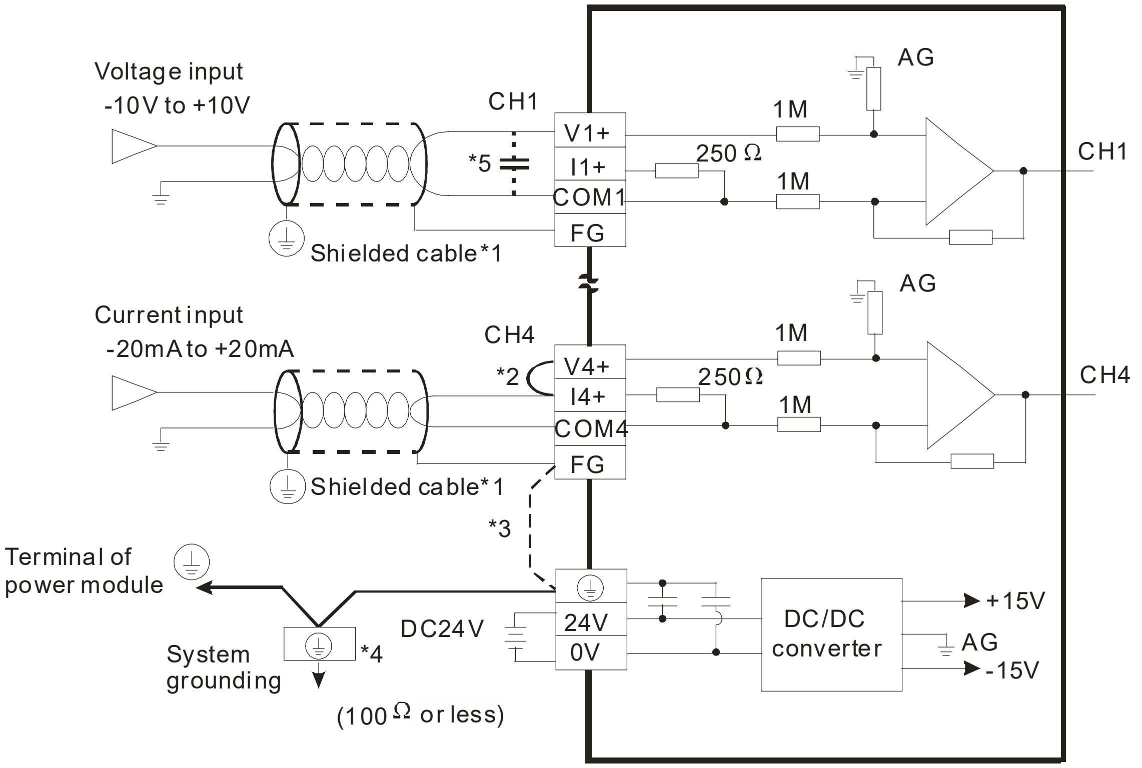
Mode 2 of CR#1:	GAIN=12 mA (2,400 LSB), OFFSET=4 mA (800 LSB).
Mode 3 of CR#1:	GAIN=10 mA (2,000 LSB), OFFSET=0 mA (0 LSB).
GAIN:	Current output value when digital input value is K2,000. Setting range is 0 LSB to +4,000 LSB.
OFFSET:	Current output value when digital input is K0. Setting range is -2,000 LSB to +2,000 LSB.
GAIN-OFFSET:	Setting range is +400 LSB to +6,000 LSB

Use the chart above to adjust D/A conversion characteristic curve of voltage output mode and current output mode. Users can adjust the conversion characteristic curves by changing OFFSET values (CR#14 to CR#15) and GAIN values (CR#18 to CR#19), depending on the application.

8

8.5 Wiring

8.5.1 Wiring DVP04AD-S2



*1: When performing analog input, please isolate other power wirings.

*2: When connecting to current signals, please make sure to short-circuit “V+” and “I+” (V4+ and I4+) terminals.

*3: If the noise is too loud, please connect the FG and ground terminals.

*4: Please connect the ⏚ terminal on both the power module and DVP04AD-S2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

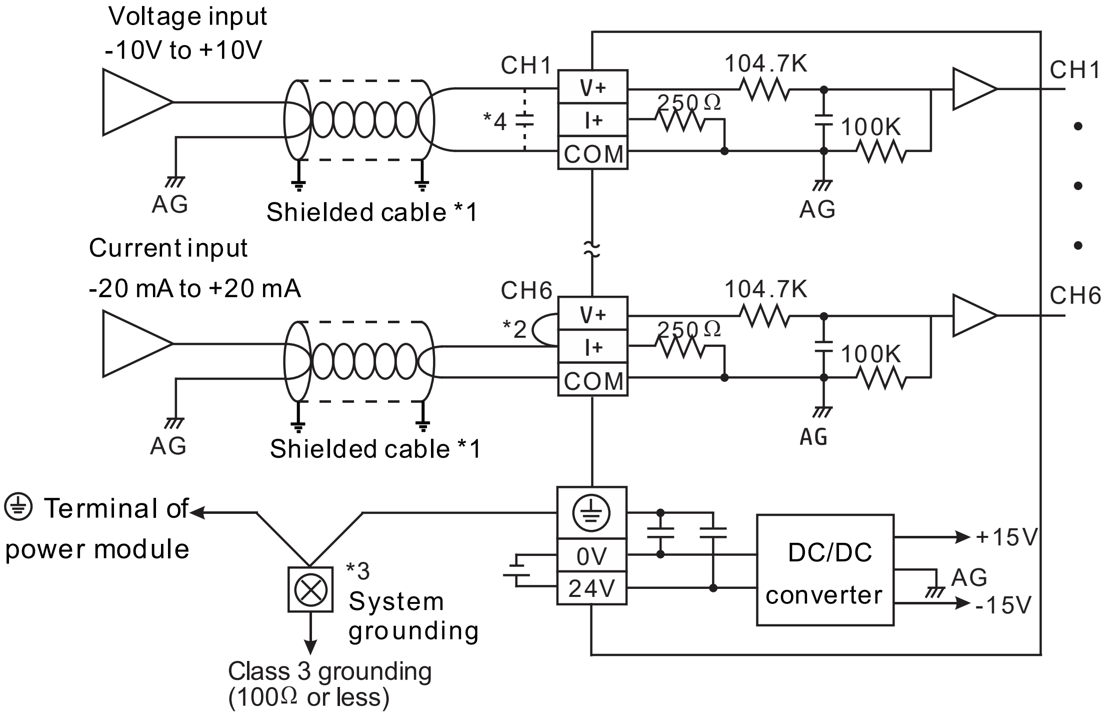
*5: If the ripple voltage of the input terminal of the connected load is large, and results in interference with the wiring, please connect a 0.1 to 0.47 μF, 25 V capacitor.

※ DO NOT wire empty terminals (●).

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

8

8.5.2 Wiring DVP06AD-S



*1: When performing analog input, please isolate other power wirings.

*2: When connecting to current signals, please make sure to short-circuit "V+" and "I+" terminals.

*3: Please connect the ⏚ terminal on both the power module and DVP06AD-S to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

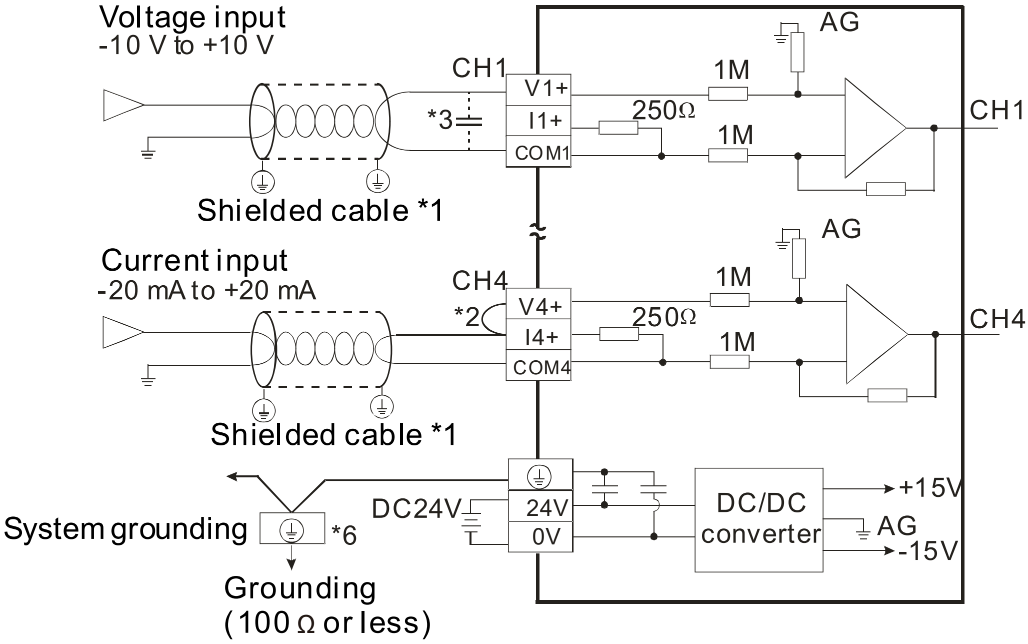
*4: If the ripple voltage of the input terminal of the connected load is large, and results in interference with the wiring, please connect a 0.1 to 0.47 μF, 25 V capacitor.

※ DO NOT wire empty terminals (●).

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

8

8.5.3 Wiring DVP06AD-S2



*1: When performing analog input, please isolate other power wirings.

*2: When connecting to current signals, please make sure to short-circuit “V+” and “I+” terminals as well as “V6+” and “I6+” terminals.

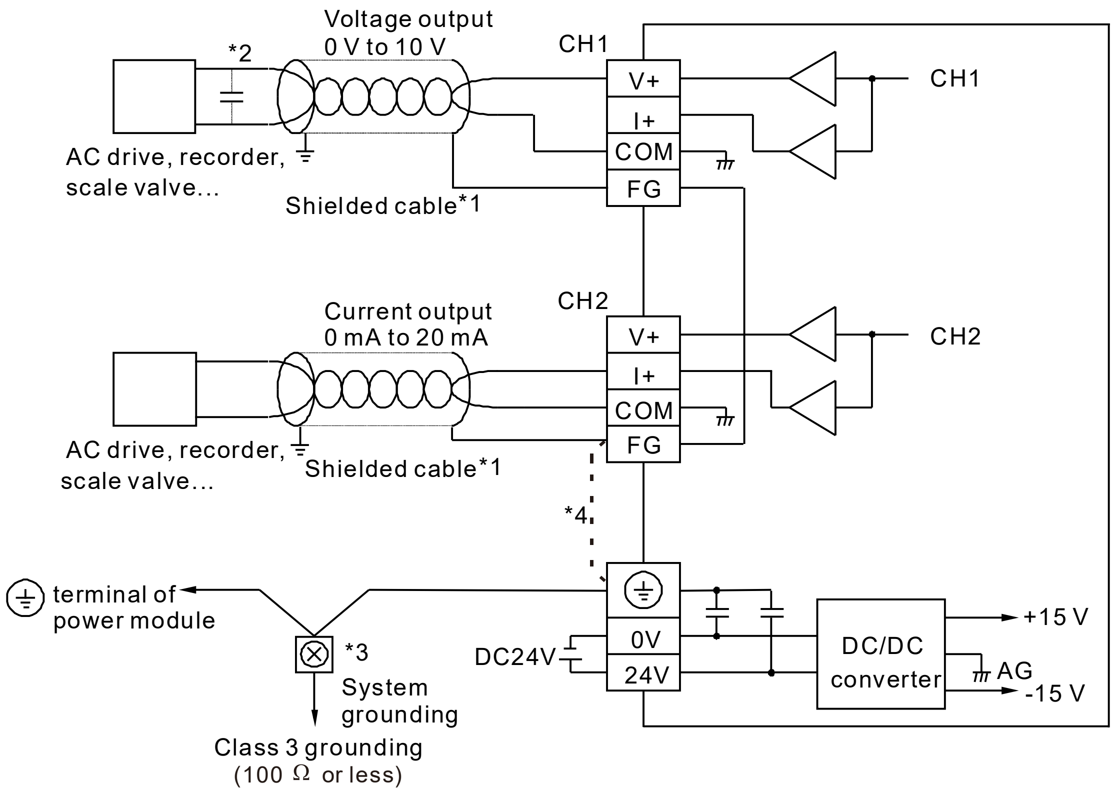
*3: Please connect the ⏚ terminal on both the power module and DVP06AD-S2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

*4: If the ripple voltage of the input terminal of the connected load is large, and results in interference with the wiring, please connect a 0.1 to 0.47 μF, 25 V capacitor.

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

8

8.5.4 Wiring DVP02DA-S



Note 1: When performing analog output, please isolate other power wirings.

Note 2: If noise interferes from loaded input wiring terminal is significant, please connect a capacitor with 0.1 to 0.47 μF, 25 V for noise filtering.

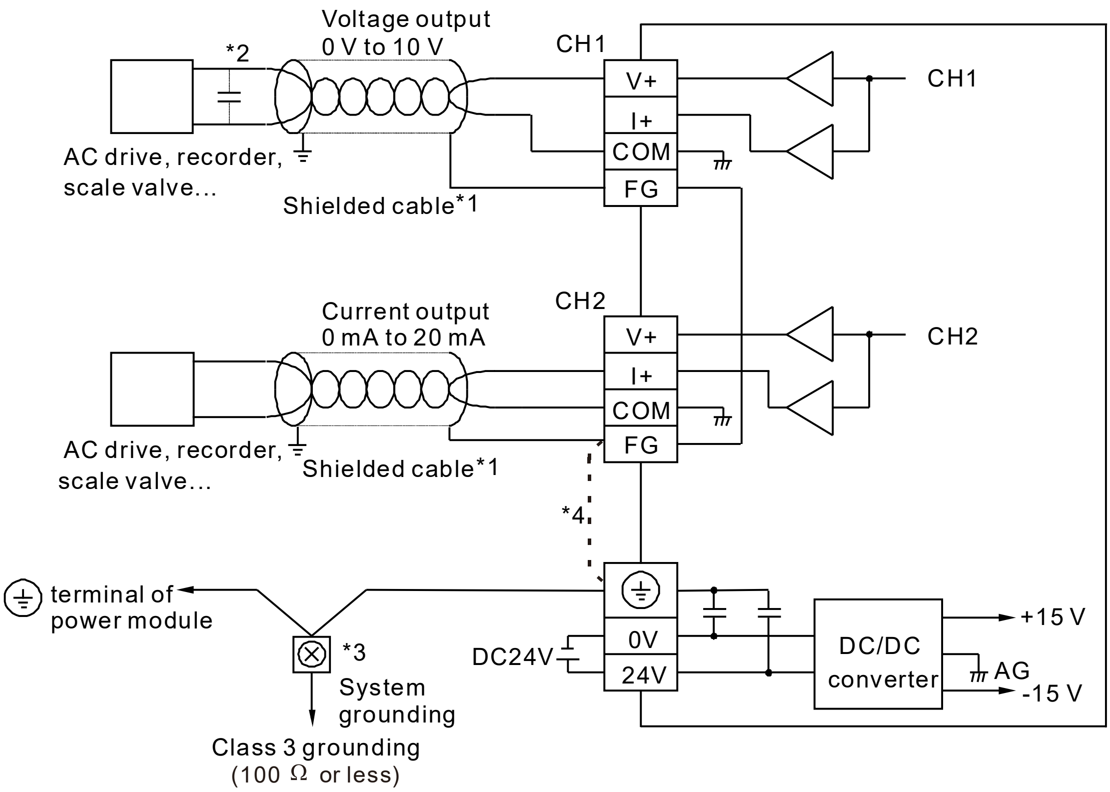
Note 3: Please connect the ⏚ terminal on both the power module and DVP02DA-S to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

Note 4: If there is much noise, please connect the terminal FG to the ground terminal.

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

※ DO NOT wire empty terminals.

8.5.5 Wiring DVP02DA-S2



Note 1: When performing analog output, please isolate other power wirings.

Note 2: If noise interferes from loaded input wiring terminal is significant, please connect a capacitor with 0.1 to 0.47 μF, 25 V for noise filtering.

Note 3: Please connect the ⏚ terminal on both the power module and DVP02DA-S2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

Note 4: If there is much noise, please connect the terminal FG to the ground terminal.

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

※ DO NOT wire empty terminals.

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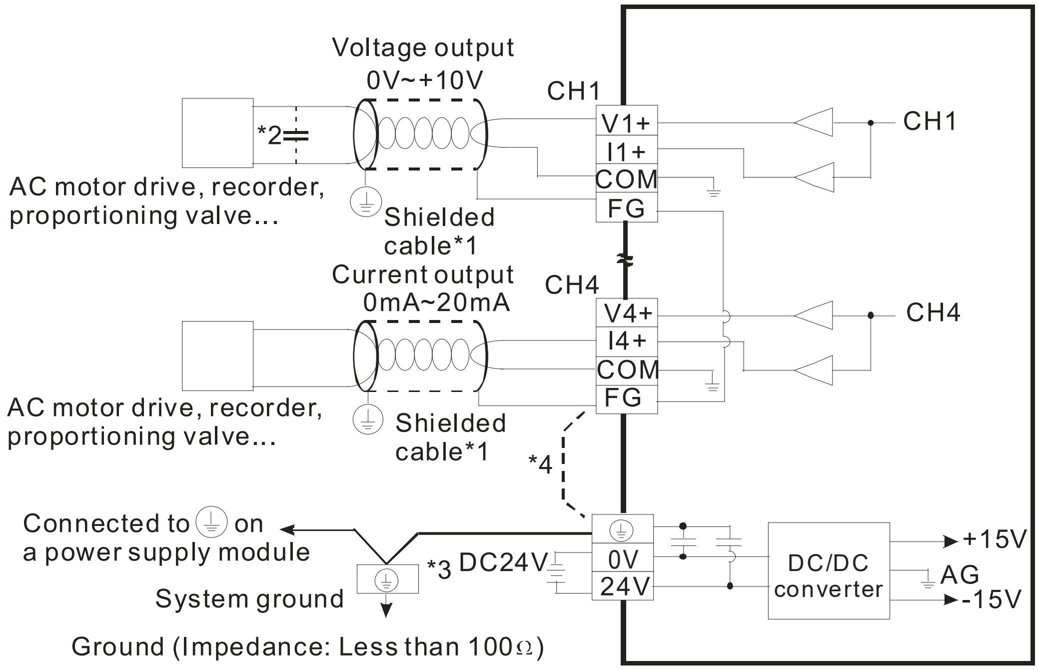
8.5.6 Wiring DVP04DA-S2



Note 1: When performing analog output, please isolate other power wirings

Note 2: If noise interferes with the wiring and makes the ripple voltage of the input terminal of the connected load high, please connect a 0.1 to 0.47 μF, 25 V capacitor.

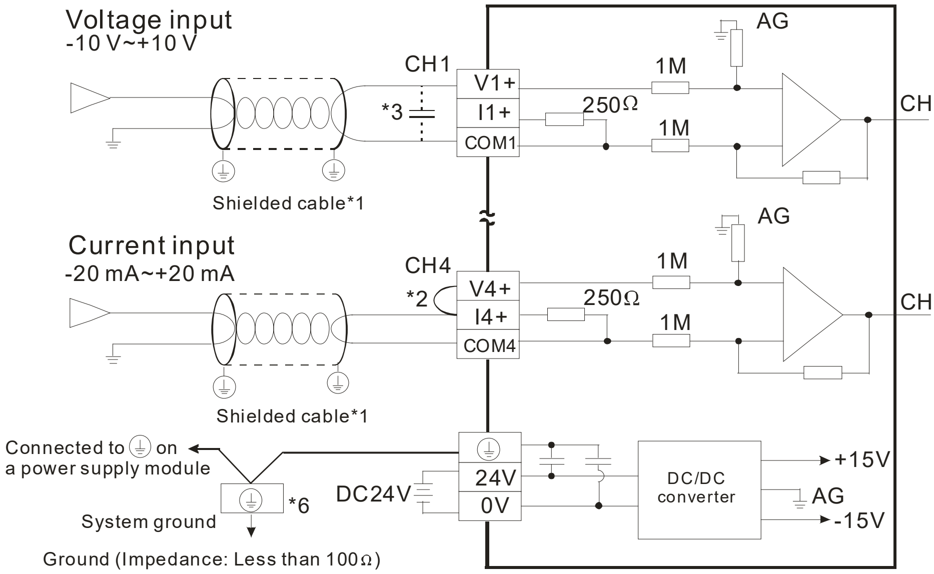
Note 3: Please connect the ⏚ terminal on both the power module and DVP04DA-S2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

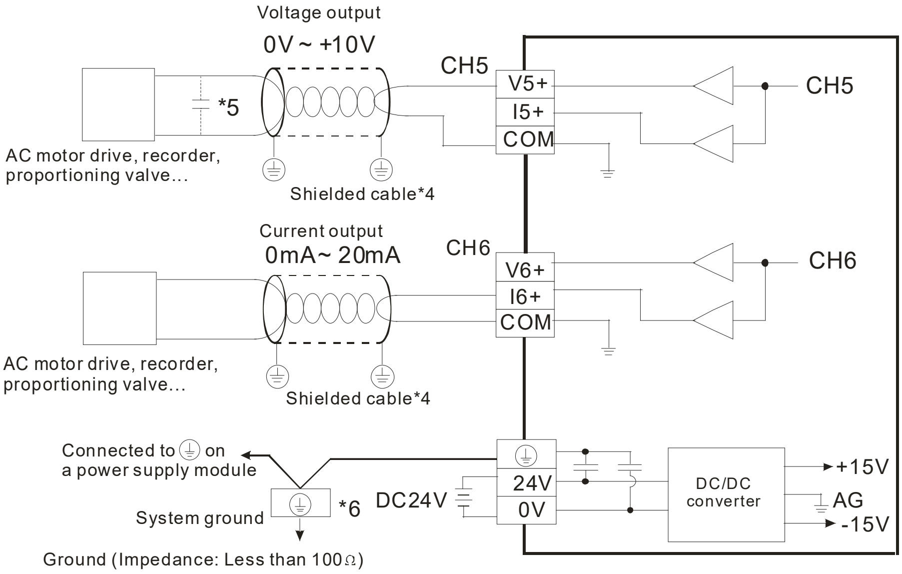
Note 4: If the noise is too loud, please connect the FG and ground terminals.

※ DO NOT wire to the empty terminal (●).

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

8.5.7 Wiring DVP06XA-S2





Note 1: When performing analog input, please isolate other power wirings

Note 2: When connecting to current signals, please make sure to short-circuit “V+” and “I+” (V4+ and I4+) terminals.

Note 3: If ripple voltage results in interference with the wiring, please connect a 0.1 to 0.47 μF, 25 V capacitor.

Note 4: When performing analog output, please isolate other power wirings.

Note 5: If noise interferes with the wiring and makes the ripple voltage of the output terminal of the connected load high, please connect a 0.1 to 0.47 μF, 25 V capacitor.

Note 6: Please connect the ⏚ terminal on both the power module and DVP06XA-S2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.

※ Use cables with the same length (less than 200 m) and wire resistance of less than 100 ohm.

8.6 Troubleshooting

When an error occurs in AD, DA, XA modules, the error indicator will start blinking. Once you see error indicator starts blinking, you can use the FROM instruction to read the error codes stored in CR#30. The bits 0 to bits 15 indicates the corresponding error codes. It is possible to have two errors at the same time. 0 indicates normal and 1 indicates error. Refer to the following table for more the causes and the solutions for troubleshooting

Bit No.	RUN LED	ERROR LED	Description	Solution
Bit 0	OFF	ON	The external voltage is abnormal.	Check the power supply.
Bit 1	Blinking	Blinking	Input value exceeds the set upper/lower bound	Check the input signal.
Bit 2	Blinking	OFF	Communication address setting error	Check whether the value written in the communication address is correct and rewrite it.
Bit 3	Blinking	OFF	OFFSET/GAIN error	Check if the written value of OFFSET and GAIN are correct and rewrite them.
Bit 4	Blinking	OFF	Analog measuring sensor is abnormal	Contact the factory.
Bit 5	Blinking	Blinking	Input value exceeds the set upper/lower bound	Check the input signal.
Bit 6	Blinking	OFF	Average time setting error	Check the average time setting.
Bit 7	Blinking	OFF	FROM/TO instruction error	Check whether the instruction reads or writes from incorrect CR. Check whether the module is properly connected.
Bit 8	Blinking	Blinking	The signal received by channel 1 exceeds the range of analog inputs	Check the signal received by channel 1.
Bit 9	Blinking	Blinking	The signal received by channel 2 exceeds the range of analog inputs	Check the signal received by channel 2.
Bit 10	Blinking	Blinking	The signal received by channel 3 exceeds the range of analog inputs	Check the signal received by channel 3.
Bit 11	Blinking	Blinking	The signal received by channel 4 exceeds the range of analog inputs	Check the signal received by channel 4.

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Chapter 9 DVP-S Series Temperature Measurement Module

Table of Contents

9.1 General Specification

9.1.1 DVP04PT-S/DVP06PT-S Specification

- **Electrical Specifications**

Model name	DVP04PT-S	DVP06PT-S
Number of inputs	4	6
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)	
Connector type	Removable terminal block	
Connect to DVP-PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.	
Weight	91.5 g	84.5 g

- **Functional Specifications**

Digital data format		16-bit two's complement number
Response time		DVP04PT-S: 200 ms/channel; DVP06PT-S: 160 ms/channel
Overall accuracy		0°C to 55°C / 32°F to 131°F: The allowed error range is ±6% of full scale.
Applicable sensors		**2-wire/3-wire:** **Pt100:** DIN 43760-1980 JIS C1604-1989, 100 Ω 3850 PPM/°C **Pt1000:** DIN EN60751, 1 kΩ 3850 PPM/°C **Ni100/Ni1000:** DIN 43760 **Cu50/Cu100** **LG-Ni1000** **0 to 300 Ω / 0 to 3000 Ω**
Rated measurement range		Please refer to the table Note*1 below.
Digital analog-to-digital conversion range		Please refer to the table Note*2 below.
Maximum measurable temperature range		Please refer to the table Note*3 below.
Resolution	**Centigrade (°C)**	0.1°C
	Fahrenheit (°F)	0.18°F[*4]
	Input impedance	0 to 300 Ω: 0.01 Ω 0 to 3000 Ω: 0.1 Ω
Average function		Yes (DVP04PT-S: CR#2 to CR#5; DVP06PT-S: CR#2) Setting range: K1 to K20
Self-diagnosis function		Detecting if exceeding upper and lower limits or channel disconnection.
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

Note*1. Rated measurement range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Input impedance
Pt100	-180°C to 800°C	-292°F to 1,472°F	
Ni100	-80°C to 170°C	-112°F to 338°F	
Pt1000	-180°C to 800°C	-292°F to 1,472°F	
Ni1000	-80°C to 170°C	-112°F to 338°F	
Cu50	-50°C to 150°C	-58°F to 302°F	
Cu100	-50°C to 150°C	-58°F to 302°F	
LG-Ni1000	-60°C to 200°C	-76°F to 392°F	
0 to 300 Ω	-	-	0 to 300 Ω
0 to 3000 Ω	-	-	0 to 3000 Ω

Note*2. Rated analog-to-digital conversion range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Input impedance
Pt100	K-1,800 to K8,000	K-2,920 to K14,720	
Ni100	K-800 to K1,700	K-1,120 to K3,380	
Pt1000	K-1,800 to K8,000	K-2,920 to K14,720	
Ni1000	K-800 to K1,700	K-1,120 to K3,380	
Cu50	K-500 to K1,500	K-580 to K3,020	
Cu100	K-500 to K1,500	K-580 to K3,020	
LG-Ni1000	K-600 to K2,000	K-760 to K3,920	
0 to 300 Ω	-	-	K0 to K30,000
0 to 3000 Ω	-	-	K0 to K30,000

Note*3. Maximum measurable temperature range

Sensor	Centigrade (°C)	Fahrenheit (°F)	Input impedance
Pt100	-200°C to 800°C	-328°F to 1,472°F	
Ni100	-90°C to 180°C	-130°F to 356°F	
Pt1000	-200°C to 800°C	-328°F to 1,472°F	
Ni1000	-90°C to 180°C	-130°F to 356°F	
Cu50	-50°C to 150°C	-58°F to 302°F	
Cu100	-50°C to 150°C	-58°F to 302°F	
LG-Ni1000	-60°C to 250°C	-76°F to 482°F	
0 to 300 Ω	-	-	0 to 320 Ω
0 to 3000 Ω	-	-	0 to 3200 Ω

Note*4. The temperature unit to be displayed is 0.1 °C and 0.1 °F. If the display mode is Fahrenheit, the number in the second decimal place will not be displayed.

9.1.2 DVP04TC-S Specifications

- **Electrical Specifications**

Number of inputs	4
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block
Connect to DVP-PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.
Weight	78.7 g

- **Functional specifications**

Analog input channel		4 channels/each module
Digital conversion range		16 bits two’s complement number
Response time		200 ms/channel
Overall accuracy		25°C/77°F: The allowed error range is ±0.5% of full scale. 0 to +55°C / 32 to 131°F: The allowed error range is ±1% of full scale.
Applicable sensors		J-type, K-type, R-type, S-type, T-type thermocouple
Rated input range		Please refer to the table Note*1 below.
Analog-to-digital conversion		Please refer to the table Note*2 below.
Hardware resolution	**Centigrade (°C)**	0.1°C
	Fahrenheit (°F)	0.18°F*3
Average function		Yes, CR#2 to CR#5, setting range: K1 to K20
Self-diagnosis function		Detecting if exceeding upper and lower limits or channel disconnection.
Isolation		An analog circuit is isolated from a digital circuit by a digital integrated circuit / an optocoupler, and the analog channels are isolated from one another by optocouplers. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and a digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC Isolation between analog channels: 120 VAC

Note*1. Rated input range

Sensor	Centigrade (°C)	Fahrenheit (°F)
J-type	-100°C to 700°C	-148°F to 1,292°F
K-type	-100°C to 1,000°C	-148°F to 1,832°F
R-type	-10°C to 1,700°C	-14°F to 3,092°F
S-type	-10°C to 1,700°C	-14°F to 3,092°F
T-type	-100°C to 350°C	-148°F to 662°F

Note*2. **Analog-to-digital conversion**

Sensor	Centigrade (°C)	Fahrenheit (°F)
J-type	K-1,000 to K7,000	K-3,280 to K12,920
K-type	K-1,000 to K10,000	K-1,480 to K18,320
R-type	K-100 to K17,000	K-140 to K30,920
S-type	K-100 to K17,000	K-140 to K30,920
T-type	K-1,000 to K3,500	K-1,480 to K6,620

Note*3. **The temperature unit to be displayed is 0.1 °C and 0.1 °F. If the display mode is Fahrenheit, the number in the second decimal place will not be displayed**

9.1.3 DVP08NTC-S Specifications

- **Electrical specifications**

Number of inputs	8
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block
Connect to DVP-PLC CPU	Up to 8 modules can be connected and no digital I/O will be taken. Numbering is from 0 to 7 in a consecutive order; the one closest to the PLC CPU is 0.
Weight	70 g

- **Functional specifications**

Analog input channel	8 channels/each module
Digital data format	16 bits two's complement number
Response time	200 ms/channel
Overall accuracy	25°C/77°F: The allowed error range is ±0.5% of full scale. 0 to +55°C / 32 to 131°F: The allowed error range is ±1% of full scale.
Applicable sensors	Pt1000: DIN 43760 Ni1000: DIN EN60751 LG-Ni1000 NTC 10K B25 B85 3977K NTC 100K B25 B85 4260K NTC 20K B25 B85 4200 NTC 30K B25 B50 4200 PT-42H 10K B25 B85 3435K PT-43 10.74K B25 B85 3480K PT-51F 49.12K B25 B85 3992K PT-25E2 98..63K B25 B85 4066K PT-312 231.4K B25 B85 4240K KTY81 110 120 KTY81 121 KTY81 122 KTY81 210 220 KTY81 221 KTY81 222
Drive current	213.33 µA (RTD)/109.17 µA (NTC)/1.009 mA (KTY81 Series)
Rated input range	Please refer to the table Note*1 below.
Analog-to-digital conversion	Please refer to the table Note*2 below.

Hardware resolution	**Centigrade (°C)**	0.1°C
	Fahrenheit (°F)	0.1°F
Average function		Yes, CR#6, setting range:K1 to K100
Self-diagnosis function		Detecting if exceeding upper and lower limits or channel disconnection.
Isolation		There is no isolation between channels.t Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC

Note*1. **Rated input range**

Sensor	Centigrade (°C)	Fahrenheit (°F)
Pt1000	-180°C to 800°C	-292°F to 1,472°F
Ni1000	-100°C to 180°C	-148°F to 356°F
LG-Ni1000	-60°C to 200°C	-76°F to 392°F
NTC 10K B25 B85 3977K	-40 to 110°C	-40°F to 230°F
NTC 100K B25 B85 4260K	-20°C to 150°C	-4°F to 302°F
NTC 20K B25 B85 4200	-40°C to 125°C	-40°F to 257°F
NTC 30K B25 B50 4200	-30°C to 130°C	-22°F to 266°F
PT-42H 10K B25 B85 3435K	-50°C to 130°C	-58°F to 266°F
PT-43 10.74K B25 B85 3480K	-50°C to 130°C	-58°F to 266°F
PT-51F 49.12K B25 B85 3992K	-25°C to 180°C	-13°F to 356°F
PT-25E2 98..63K B25 B85 4066K	-25°C to 210°C	-13°F to 410°F
PT-312 231.4K B25 B85 4240K	0°C to 240°C	32°F to 464°F
KTY81 110 120	-55°C to 150°C	-67°F to 302°F
KTY81 121	-55°C to 150°C	-67°F to 302°F
KTY81 122	-55°C to 150°C	-67°F to 302°F
KTY81 210 220	-55°C to 150°C	-67°F to 302°F
KTY81 221	-55°C to 150°C	-67°F to 302°F
KTY81 222	-55°C to 150°C	-67°F to 302°F

Note*2. Analog-to-digital conversion

Sensor	Centigrade (°C)	Fahrenheit (°F)
Pt1000	K-1,800 to K8,000	K-2,920 to K14,720
Ni1000	K-1,000 to K1,800	K-1,480 to K3,560
LG-Ni1000	K-600 to K2,000	K-760 to K3,920
NTC 10K B25 B85 3977K	K-400 to K1,100	K-400 to K2,300
NTC 100K B25 B85 4260K	K-200 to K1,500	K-40 to K3,020
NTC 20K B25 B85 4200	K-400 to K1,250	K-400 to K2,570
NTC 30K B25 B50 4200	K-300 to K1,300	K-220 to K2,660
PT-42H 10K B25 B85 3435K	K-500 to K1,300	K-580 to K2,660
PT-43 10.74K B25 B85 3480K	K-500 to K1,300	K-580 to K2,660
PT-51F 49.12K B25 B85 3992K	K-250 to K1,800	K-130 to K3,560
PT-25E2 98..63K B25 B85 4066K	K-250 to K2,100	K-130 to K4,100
PT-312 231.4K B25 B85 4240K	K 0 to K2,400	K-320 to K4,640
KTY81 110 120	K-550 to K1,500	K-670 to K3,020
KTY81 121	K-550 to K1,500	K-670 to K3,020
KTY81 122	K-550 to K1,500	K-670 to K3,020
KTY81 210 220	K-550 to K1,500	K-670 to K3,020
KTY81 221	K-550 to K1,500	K-670 to K3,020
KTY81 222	K-550 to K1,500	K-670 to K3,020

9.1.4 DVP02TUN-S/DVP02TUR-S/DVP02TUL-S/DVP02TKN-S/ DVP02TKR-S/DVP02TKL-S Specifications

- **Electrical specifications**

Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block
Hardware resolution	16 bits
Distance	100 meters
Input disconnection detection	Temperature input supports disconnection detection
Isolation	An analog circuit is isolated from a digital circuit by a digital integrated circuit. There is no isolation between channels. Isolation between a digital circuit and a ground: 500 VDC Isolation between an analog circuit and a ground: 500 VDC Isolation between an analog circuit and digital circuit: 500 VDC Isolation between the 24 VDC and a ground: 500 VDC
Connect to DVP-PLC CPU	The modules are numbered from 0 to 7 automatically by their distance from DVP-PLC. Max. 8 modules are allowed to connect to DVP-PLC and will not occupy any digital I/O points.
Weight	70 g

- **Analog input function specification**

Models	DVP02TUN-S/DVP02TUR-S/DVP02TUL-S DVP02TKN-S/DVP02TKR-S/DVP02TKL-S		
Analog	**Voltage input**	**Current input**	**Temperature input**
Rated input range	0 to 10 V 0 to 5 V 0 to +50 mV -100 to +100 mV	0 to 20 mA 4 to 20 mA	Thermocouple*1 Thermistor*2
Overall accuracy (normal temperature)	±0.5%		±0.4%
Overall accuracy (full temperature range)	±1%		±0.8%
Hardware resolution	16 bits		24 bits
Input impedance	650 kΩ	2 MΩ	2 MΩ

*1. Thermocouple: J, K, R, S, T, E, N, B, U, L, TXK (L), C, PL II

*2. Thermistor: Pt100, JPt100, Pt1000, Ni100, Ni120, Ni1000, Cu50, Cu100, LG-Ni1000

- **Analog sampling time (by channel)**

Model	DVP02TUN-S/DVP02TUR-S/DVP02TUL-S DVP02TKN-S/DVP02TKR-S/DVP02TKL-S				
Analog input type	**AI**	**Thermocouple**	**Thermistor**	**Quick AI (0 to 10 V) *2**	**Quick AI (4 to 20 mA) *2**
Setting time (ms)	80	80	160	3	3
Conversion time (ms)	50	50	100	2	2
Response time (ms)	130	130	260	5	5

Response time = setting time + conversion time

*1. Compared to the response time of the thermocouple temperature, it needs two times of time for the thermistor temperature to respond, since the thermistor channels require a temperature compensation.

*2. Since there is only one channel used, the time to stabilize the circuit is not required.

- **Analog output function specification**

Model	DVP02TUL-S/DVP02TKL-S	
Analog	**Voltage output**	**Current output**
Rated output range	0 to 10 V	0 to 20 mA 4 to 20 mA
Overall accuracy (normal temperature)	±0.5%	
Overall accuracy (full temperature range)	±1%	
Hardware resolution	12 bits	
Allowable load impedance	1 kΩ to 2 MΩ at 0 V to 10 V	≦550 Ω
Setting time (μs)	100	250
Conversion time (μs)	500	500
Response time (μs)	600	750

Response time = setting time + conversion time

- **Digital output Function Specification**

Item		DVP02TUR-S DVP02TKR-S	DVP02TUN-S DVP02TKN-S
Number of outputs		4	4
Connector type		Removable terminal block	
Output point type		Relay-R	Transistor-T (NPN)
Voltage specification		Below 250 VAC, 30 VDC	12 to 30 VDC
Maximum load	**Resistive**	2 A/point (3 A/COM)*1	0.3 A/point (0.6 A/COM)*1
	Inductive	Life cycle curves *2, *4	7.2 W (24 VDC)*3
	Bulb	20 W (24 VDC) 100 W (230 VAC)	2 W (24 VDC)
Maximum output frequency	**Resistive**	1 Hz	100 Hz
	Inductive	0.5 Hz	0.5 Hz
	Bulk	1 Hz	10 Hz
Maximum response time	**OFF→ON**	10 ms	0.5 ms
	ON→OFF		

*1. Complied with UL61010-2-201 & IEC61131-2 (AC or DC resistance)

*2. Complied with UL61010-2-201 & IEC61131-2 (AC/DC general-use)

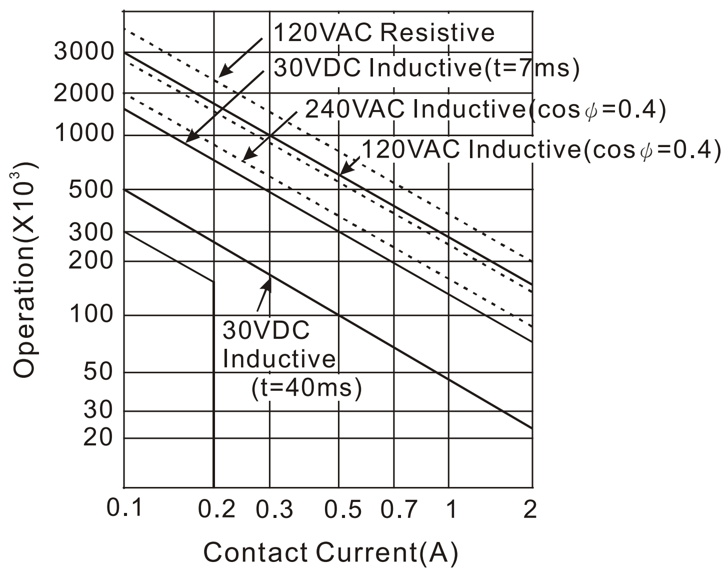
AC pilot duty: Rated making capacity: 7.5 A; rated breaking capacity: 0.75 A; 2.5 A thermal continuous at 240 VAC

DC pilot duty: rated making capacity: 0.22 A; rated breaking capacity: 0.22 A; 1 A thermal continuous at 30 VDC

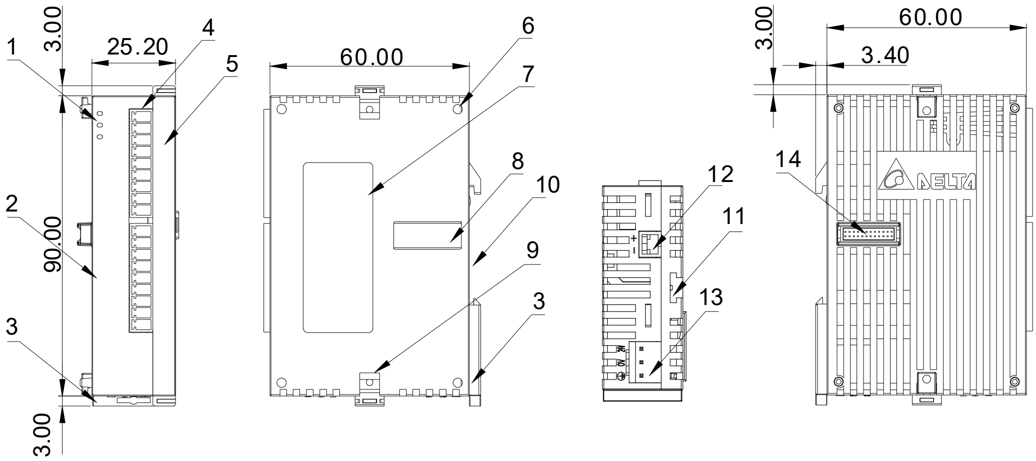
*3. Complied with IEC/UL61010-2-201 (DC general-use)

Disconnect power before servicing to avoid the risk of electric shock.

*4. Life cycle curves



9.2 Module Profiles and Dimensions



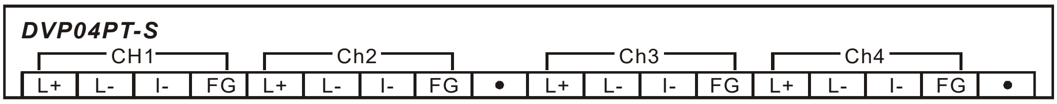
Unit: mm

No.	Name	Description
1	POWER LED indicator	Indicates the state of the power supply. ON: the power is on OFF: no power
	Run LED indicator	Indicates the operating state of the module.
	ERROR LED indicator	Error state of the module. ON: A serious module error has occurred OFF: the module is normal. Blinking (0.2 seconds ON/OFF): A non-serious module error occurs, can NOT operate normally.
2	Model name	Model name of the module.
3	DIN rail securing clip	Secures the module on the set.
4	I/O terminals	The inputs are connected to sensors. The outputs are connected to loads to be driven.
5	Terminal numbers	Terminal numbers
6	Extension unit positioning hole	For positioning between modules.
7	Nameplate	Label of the module
8	Extension module connection port	Connects the modules.
9	Extension unit fixing clip	For securing the extension module.
10	DIN rail slot (35 mm)	For the DIN rail.
11	Securing module slot	For securing the extension module.
12	RS-485communication port	For RS-485 communication wiring.
13	Power input port	Expansion unit power input.
14	Extension port	Connects the PLC or the modules.

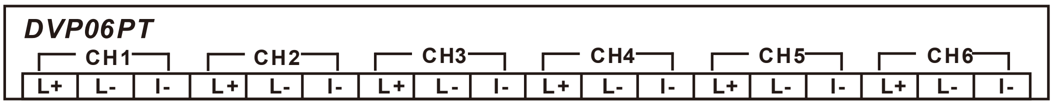
9

9.3 Terminals

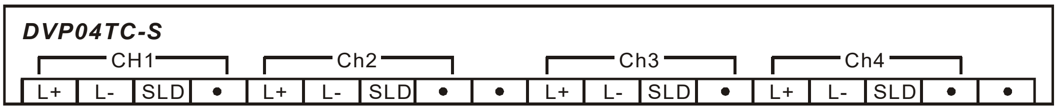
DVP04PT-S



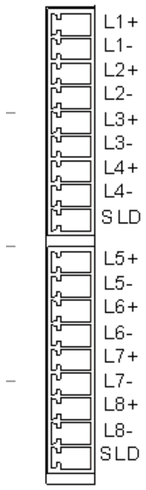
DVP06PT-S



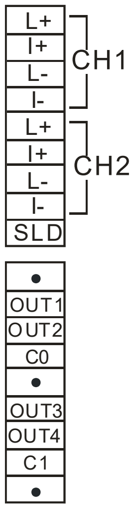
DVP04TC-S



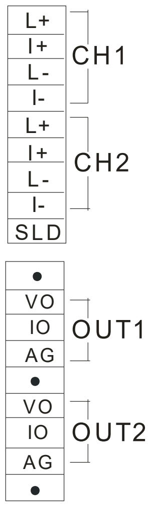
DVP08NTC-S



DVP02TUR-S/DVP02TUN-S
DVP02TKR-S/DVP02TKN-S



DVP02TUL-S
DVP02TKL-S



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9.4 DVP04PT-S/DVP06PT-S/DVP04TC-S/DVP08NTC-S Control Register

9.4.1 DVP04PT-S/DVP06PT-S Control Register

<table>
<tr><th>CR#</th><th>Address</th><th>Latched</th><th>Attribute</th><th>Register content</th><th>Description</th></tr>
<tr><td>#0</td><td>H’4064</td><td>O</td><td>R</td><td>Model name
(Set up by the system)</td><td>DVP04PT-S model code= H’8A
DVP06PT-S model code = H’CA</td></tr>
<tr><td>#1</td><td>H’4065</td><td>X</td><td>R/W</td><td>CH1-CH4 Mode setting</td><td><table><tr><td>b15 to 12</td><td>b11 to 8</td><td>b7 to 4</td><td>b3 to 0</td></tr><tr><td>CH4</td><td>CH3</td><td>CH2</td><td>CH1</td></tr></table>Take CH1 mode (b3,b2,b1,b0) for example.
1. (0,0,0,0): Pt100 (default)
2. (0,0,0,1): Ni100
3. (0,0,1,0): Pt1000
4. (0,0,1,1): Ni1000
5. (0,1,0,0): LG-Ni1000
6. (0,1,0,1): Cu100
7. (0,1,1,0): Cu50
8. (0,1,1,1): 0 to 300 Ω
9. (1,0,0,0): 0 to 3000 Ω
10. (1,1,1,1)The channel is disabled.

Note 1: Modes 8 and 9 are only available for DVP04PT-S V4.16, DVP06PT-S V4.12 and later.
Note 2: When the input mode of DVP04PT-S is configured to "1, 1, 1, 1: Disabled", the measured value will be fixed and displayed as the maximum positive integer, 32767 (H'7FFF).
Note 3: Set up the CH5 and CH6 mode in CR#31 for DVP06PT-S.</td></tr>
<tr><td rowspan="2">#2</td><td>H’4066</td><td rowspan="2">O</td><td rowspan="2">R/W</td><td>DVP04PT-S:
CH1 average number</td><td>Number of readings used for the calculation of “average” temperature on CH1.
Setting range: K1 to K20.
Default setting is K10.</td></tr>
<tr><td>--</td><td>DVP06PT-S:
CH1-CH6 average number</td><td>Number of readings used for the calculation of “average” temperature on CH1 to CH6.
Setting range: K1 to K20.
Default setting is K10.</td></tr>
<tr><td>#3</td><td>H’4067</td><td>O</td><td>R/W</td><td>DVP04PT-S:
CH2 average number</td><td>Number of readings used for the calculation of “average” temperature on CH2.
Setting range: K1 to K20.
Default setting is K10.</td></tr>
<tr><td>#4</td><td>H’4068</td><td>O</td><td>R/W</td><td>DVP04PT-S:
CH3 average number</td><td>Number of readings used for the calculation of “average” temperature on CH3.
Setting range: K1 to K20.
Default setting is K10.</td></tr>
<tr><td>#5</td><td>H’4069</td><td>O</td><td>R/W</td><td>DVP04PT-S:
CH4 average number</td><td>Number of readings used for the calculation of “average” temperature on CH4.
Setting range: K1 to K20.
Default setting is K10.</td></tr>
<tr><td>#6</td><td>H’406A</td><td>X</td><td>R</td><td>CH1 average degrees</td><td rowspan="2">DVP04PT-S:
Average Celsius degrees for CH1 to CH4</td></tr>
<tr><td>#7</td><td>H’406B</td><td>X</td><td>R</td><td>CH2 average degrees</td></tr>
</table>

CR#	Address	Latched	Attribute	Register content	Description
#8	H'406C	X	R	CH3 average degrees	DVP06PT-S: Average Celsius degrees for CH1 to CH6 Unit: 0.1°C/ 0.01 Ω (0 to 300 Ω)/ 0.1 Ω (0 to 3000 Ω)
#9	H'406D	X	R	CH4 average degrees	
#10	--	X	R	CH5 average degrees	
#11	--	X	R	CH6 average degrees	
#12	H'4070	X	R	CH1 average degrees	DVP04PT-S: Average Fahrenheit degrees for CH1 to CH4 DVP06PT-S: Average Fahrenheit degrees for CH1 to CH6 Unit: 0.1°F/ 0.01 Ω (0 to 300 Ω)/ 0.1 Ω (0 to 3000 Ω)
#13	H'4071	X	R	CH2 average degrees	
#14	H'4072	X	R	CH3 average degrees	
#15	H'4073	X	R	CH4 average degrees	
#16	--	X	R	CH5 average degrees	
#17	--	X	R	CH6 average degrees	
#18	H'4076	X	R	Present temp. of CH1	DVP04PT-S: Present Celsius temperature of CH1 to CH 4 DVP06PT-S: Present Celsius temperature of CH1 to CH6 Unit: 0.1°C/ 0.01 Ω (0 to 300 Ω)/ 0.1 Ω (0 to 3000 Ω)
#19	H'4077	X	R	Present temp. of CH2	
#20	H'4078	X	R	Present temp. of CH3	
#21	H'4079	X	R	Present temp. of CH4	
#22	--	X	R	Present temp. of CH5	
#23	--	X	R	Present temp. of CH6	
#24	H'407C	X	R	Present temp. of CH1	DVP04PT-S: Present Fahrenheit temperature of CH1 to CH4 DVP06PT-S: Present Fahrenheit temperature of CH1 to CH6 Unit: 0.1°F/ 0.01 Ω (0 to 300 Ω)/ 0.1 Ω (0 to 3000 Ω)
#25	H'407D	X	R	Present temp. of CH2	
#26	H'407E	X	R	Present temp. of CH3	
#27	H'407F	X	R	Present temp. of CH4	
#28	--	X	R	Present temp. of CH5	
#29	--	X	R	Present temp. of CH6	
#29	H'4081	X	R/W	DVP04PT-S: PID mode setup	Set H'5678 as PID mode and other values as normal mode Default value is H'0000.
#30	H'4082	X	R	Error status	Data register stores the error state. Refer to the error code chart for details.
#31	H'4083	O	R/W	DVP04PT-S: Communication address setup	Set up the RS-485 communication address; setting range: 01 to 254. Default: K1
	--	X	R/W	DVP06PT-S: CH5-CH6 Mode setting	CH5 mode: b0 to b3 CH6 mode: b4 to b7 See CR#1 for reference
32	H'4084	O	R/W	DVP04PT-S: Communication format setting	For baud rate, the settings are 4,800/9,600/19,200/38,400/57,600/115,200 bps. Communication format: ASCII: 7, E, 1 / 7 ,O, 1 / 8 ,E, 1 / 8, O, 1 / 8, N, 1 RTU: 8, E, 1 / 8, O, 1 / 8, N, 1 Factory default : ASCII, 9600, 7, E, 1 (CR#32=H'0002) Refer to ※CR#32 communication format settings at the end of this table for more information.
	--	X	R/W	DVP06PT-S: CH5 to CH6 Error LED indicator setting	b15 to b12: ERR LED; b11 to b9, b8 to b6: reserved; b5 to b3: CH6; b2 to b0: CH5 b12 to b13 respectively correspond to CH5 to CH6 error display enable/disable. When the bit is ON, channel error occurs, and the Error LED indicator flashes. OFF: disabled.

<table>
<tr><th>CR#</th><th>Address</th><th>Latched</th><th>Attribute</th><th>Register content</th><th>Description</th></tr>
<tr><td rowspan="2">#33</td><td>H’4085</td><td>O</td><td>R/W</td><td>DVP04PT-S:
CH1 to CH4
Reset to default setting and Error LED indicator setting</td><td rowspan="2"><table><tr><td>b15 to b12</td><td>b11 to b9</td><td>b8 to b6</td><td>b5 to b3</td><td>b2 to b0</td></tr><tr><td>ERR LED</td><td>CH4</td><td>CH3</td><td>CH2</td><td>CH1</td></tr></table>If b2 to b0 are set to 100, all the setting values of CH1 will be reset to the defaults. To reset all channels to defaults, set b11 to 0 to H’924 (DVP04PT-S supports single and all channels reset; DVP06PT-S supports all channels reset only).
b12 to b15 respectively correspond to CH1 to CH4 error display enable/disable. When the bit is ON, channel error occurs, and the Error LED indicator flashes. OFF: disabled.</td></tr>
<tr><td>--</td><td>X</td><td>R/W</td><td>DVP06PT-S:
All channels reset to default setting and CH1 to CH4 Error LED indicator setting</td></tr>
<tr><td>#34</td><td>H’4086</td><td>O</td><td>R</td><td>Firmware version</td><td>Displays the firmware version in hexadecimal format.
For example, H’010A = version 1.0A</td></tr>
<tr><td colspan="4">#35 to #48</td><td colspan="2">For system use</td></tr>
<tr><td colspan="6">Symbols:
O: means latched. (Supported with RS485; but NOT supported when connecting to CPUs.)
X: means not latched.
R: able to read data by using FROM instruction or RS-485.
W: able to write data by using TO instruction or RS-485.</td></tr>
</table>

1. Added the RESET function is only for 04PT-S modules with firmware V4.16 or later and not available for 06PT-S. Connect the module power input to 24 VDC and write H’4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters are restored to factory defaults.

2. If you want to use a Modbus address in decimal format, convert a hexadecimal register address to decimal format and then add one to have it become a decimal Modbus register address. For example, by converting the address “H’4064” of CR#0 in hexadecimal format to decimal format, you have the result 16484, and then by adding one to it, you have 16485, the Modbus address in decimal format.

3. CR#32 communication format settings: for DVP04PT-S firmware V4.14 or previous versions, the b11 to b8 data format option is not open for selection. For ASCII mode, the format is fixed to 7, E, 1 (H’00XX), and for RTU mode, the format is fixed to 8, E, 1 (H’C0xx/H’80xx). For DVP04PT-S firmware V4.15 or later, refer to the following table for setups. Note that the original code H’C0XX/H’80XX will be seen as RTU, 8, E, 1 for firmware V4.15 or later.

<table>
<tr><th colspan="2">b15 to b12</th><th colspan="2">b11 to b8</th><th colspan="2">b7 to b0</th></tr>
<tr><td colspan="2">ASCII/RTU,
exchange low and high bytes of CRC check code</td><td colspan="2">Data format</td><td colspan="2">Baud rate</td></tr>
<tr><th colspan="6">Description</th></tr>
<tr><td>H'0</td><td>ASCII</td><td>H'0</td><td>7, E, 1 *1</td><td>H'01</td><td>4800 bps</td></tr>
<tr><td rowspan="2">H'8</td><td rowspan="2">RTU,
do not exchange low and high bytes of CRC check code</td><td>H'1</td><td>8, E, 1</td><td>H'02</td><td>9600 bps</td></tr>
<tr><td>H'2</td><td>Reserved</td><td>H'04</td><td>19200 bps</td></tr>
<tr><td rowspan="3">H'C</td><td rowspan="2">RTU,
exchange low and high bytes of CRC check code</td><td>H'3</td><td>8, N, 1</td><td>H'08</td><td>38400 bps</td></tr>
<tr><td>H'4</td><td>7, O, 1 *1</td><td>H'10</td><td>57600 bps</td></tr>
<tr><td></td><td>H'5</td><td>8, O, 1</td><td>H'20</td><td>115200 bps</td></tr>
</table>

Example: Write H’C310 into CR#32 to achieve the setup of “RTU (exchanging low and high bytes of the CRC check code), 8, N, 1 and baud rate: 57600 bps”.

Note *1: This is only available for ASCII format.

4. RS-485 function codes: 03’H is for reading data from registers. 06’H is for writing one single word of data to registers. 10’H is for writing multiple words of data to registers.

5. Description of errors in CR#30:
   Note: Each error has a corresponding bit, and the error code should be converted to a 16-bit binary number (bit0 to bit15). When one of the bits is ON, it means that an error state has occurred. Therefore, when error occurs, there may be more than 2 bits showing ON. For example: bit1=ON, bit8=ON, which means that there is an open connection on the channel contact, and it is CH1. Refer to the table below:

Bit number	0	1	2	3
Description	Power source abnormal	The contact is not connected to anything.	Reserved	Reserved
Bit number	4	5	6	7
Description	Reserved	Reserved	Average number error	PLC instruction error
Bit number	8	9	10	11
Description	CH1 Abnormal conversion	CH2 Abnormal conversion	CH3 Abnormal conversion	CH4 Abnormal conversion
Bit number	12	13	14	15
Description	CH5 Abnormal conversion	CH6 Abnormal conversion	Reserved	Reserved

6. When CR#29 is set to H’5678, CR#0 to CR#34 can be used for PID settings with DVP04PT-S version V3.08 and above.

<table>
<tr><th colspan="8">PID Mode description</th></tr>
<tr><td>CR#</td><td>Keep</td><td>R/W</td><td></td><td>CR#</td><td>Keep</td><td>R/W</td><td></td></tr>
<tr><td>#0</td><td>O</td><td>R</td><td>Model name</td><td>#24</td><td>O</td><td>R/W</td><td>CH1 K_D</td></tr>
<tr><td>#1</td><td>X</td><td>R/W</td><td>CH1 to CH4 mode setting</td><td>#25</td><td>O</td><td>R/W</td><td>CH2 K_D</td></tr>
<tr><td>#2</td><td>X</td><td>R</td><td>PID Output % at CH1</td><td>#26</td><td>O</td><td>R/W</td><td>CH3 K_D</td></tr>
<tr><td>#3</td><td>X</td><td>R</td><td>PID Output % at CH2</td><td>#27</td><td>O</td><td>R/W</td><td>CH4 K_D</td></tr>
<tr><td>#4</td><td>X</td><td>R</td><td>PID Output % at CH3</td><td rowspan="12">#28</td><td rowspan="12">X</td><td rowspan="12">R/W</td><td rowspan="12">Run/Stop and Auto tuning

Bit0: CH1 PID Run/Stop
Bit1: CH2 PID Run/Stop
Bit2: CH3 PID Run/Stop
Bit3: CH4 PID Run/Stop
0=PID Stop, 1=PID Run

Bit4: CH1 Auto tuning
Bit5: CH2 Auto tuning
Bit6: CH3 Auto tuning
Bit7: CH4 Auto tuning
1: The auto tuning function is enabled. After the auto tuning action completed, the value becomes 0.</td></tr>
<tr><td>#5</td><td>X</td><td>R</td><td>PID Output % at CH4</td></tr>
<tr><td colspan="4">CR#2 to CR#5: 0 to 1000; Unit: 0.1%</td></tr>
<tr><td>#6</td><td>X</td><td>R</td><td>Average temperature (ºC) at CH1</td></tr>
<tr><td>#7</td><td>X</td><td>R</td><td>Average temperature (ºC) at CH2</td></tr>
<tr><td>#8</td><td>X</td><td>R</td><td>Average temperature (ºC) at CH3</td></tr>
<tr><td>#9</td><td>X</td><td>R</td><td>Average temperature (ºC) at CH4</td></tr>
<tr><td colspan="4">CR#6 to CR#9: Unit: 0.1%</td></tr>
<tr><td>#10</td><td>O</td><td>R/W</td><td>Set temperature at CH1</td></tr>
<tr><td>#11</td><td>O</td><td>R/W</td><td>Set temperature at CH2</td></tr>
<tr><td>#12</td><td>O</td><td>R/W</td><td>Set temperature at CH3</td></tr>
<tr><td>#13</td><td>O</td><td>R/W</td><td>Set temperature at CH4</td></tr>
<tr><td colspan="4">CR#10 to CR#13: Set the PID target value (SV)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>#14</td><td>O</td><td>R/W</td><td>CH1 K_P</td><td rowspan="2">#29</td><td rowspan="2">X</td><td rowspan="2">R/W</td><td rowspan="2">Enter PID mode (H’5678)
K0: Exit the PID mode</td></tr>
<tr><td>#15</td><td>O</td><td>R/W</td><td>CH2 K_P</td></tr>
<tr><td>#16</td><td>O</td><td>R/W</td><td>CH3 K_P</td><td>#30</td><td>X</td><td>R</td><td>Error code</td></tr>
<tr><td>#17</td><td>O</td><td>R/W</td><td>CH4 K_P</td><td>#31</td><td>O</td><td>R/W</td><td>CH1 Sampling time</td></tr>
<tr><td>#19</td><td>O</td><td>R/W</td><td>CH1 K_I</td><td>#32</td><td>O</td><td>R/W</td><td>CH2 Sampling time</td></tr>
<tr><td>#20</td><td>O</td><td>R/W</td><td>CH2 K_I</td><td>#33</td><td>O</td><td>R/W</td><td>CH3 Sampling time</td></tr>
<tr><td>#21</td><td>O</td><td>R/W</td><td>CH3 K_I</td><td>#34</td><td>O</td><td>R/W</td><td>CH4 Sampling time</td></tr>
<tr><td>#22</td><td>O</td><td>R/W</td><td>CH4 K_I</td><td colspan="4">CR#31 to CR#34: 1 to 30; Unit: 1 s</td></tr>
<tr><td colspan="8">Note: CR#29 must be set to H’5678 to enter the PID mode before configuring settings on other control registers.</td></tr>
</table>

9.4.2 DVP04TC-S Control Register

<table>
<tr><th>CR#</th><th>Address</th><th>Latched</th><th>Attribute</th><th>Register content</th><th>Description</th></tr>
<tr><td>#0</td><td>H’4096</td><td>O</td><td>R</td><td>Model name</td><td>Set up by the system:
DVP04TC-S model code=H’8B</td></tr>
<tr><td>#1</td><td>H’4097</td><td>O</td><td>R/W</td><td>Thermocouple type</td><td><table><tr><td>b15 to b12</td><td>b11 to b9</td><td>b8 to b6</td><td>b5 to b3</td><td>b2 to b0</td></tr><tr><td>Reserved</td><td>CH4</td><td>CH3</td><td>CH2</td><td>CH1</td></tr></table>Example: setting of CH1
1. (b2, b1, b0) set to (0, 0, 0), use J-type.
2. (b2, b1, b0) set to (0, 0, 1), use K-type.
3. (b2, b1, b0) set to (0, 1, 0), use R-type.
4. (b2, b1, b0) set to (0, 1, 1), use S-type.
5. (b2, b1, b0) set to (1, 0, 0), use T-type.
Note: With version V4.20 and above, you can disable a certain channel. And the reading will be fixed to 0. For example, set (b2, b1, b0) to (1, 1, 0) and CH1 would be disabled.</td></tr>
<tr><td colspan="6">CR#1: Used to set the working mode of four channels. There are 5 modes (J-type, K-type, R-type, S-type, and T-type) for each channel and can be set individually. For example, if you want to set CH1 to CH4 as following: CH1: J-type (b2 to b0=000), CH2: K-type (b5 to b3=001), CH3: J-type (b8 to b6=000) and CH4: K-type (b11 to b9=001), you should set CR#1 to H’0208. The higher bits (b12 to b15) will be reserved, and the default setting is H’0000.</td></tr>
<tr><td>#2</td><td>H’4098</td><td>O</td><td>R/W</td><td>CH1 average number</td><td rowspan="4">Average times setting of channels CH1 to CH4.
Setting range:
For versions prior to V3.04: K1 to K4,095.
For versions after V3.05: K1 to K20.
Default setting is K10.</td></tr>
<tr><td>#3</td><td>H’4099</td><td>O</td><td>R/W</td><td>CH2 average number</td></tr>
<tr><td>#4</td><td>H’409A</td><td>O</td><td>R/W</td><td>CH3 average number</td></tr>
<tr><td>#5</td><td>H’409B</td><td>O</td><td>R/W</td><td>CH4 average number</td></tr>
<tr><td colspan="6">CR#2 to CR#5: Please note that when setting average times via TO/DTO instructions, you should use the rising-edge/falling-edge detection instruction (such as LDP and LDF) to get a correct average value of input signals.</td></tr>
<tr><td>#6</td><td>H’409C</td><td>X</td><td>R</td><td>CH1 average degrees</td><td rowspan="4">Average Celsius degrees for channels CH1 to CH4. (Unit: 0.1°C).</td></tr>
<tr><td>#7</td><td>H’409D</td><td>X</td><td>R</td><td>CH2 average degrees</td></tr>
<tr><td>#8</td><td>H’409E</td><td>X</td><td>R</td><td>CH3 average degrees</td></tr>
<tr><td>#9</td><td>H’409F</td><td>X</td><td>R</td><td>CH4 average degrees</td></tr>
<tr><td>#10</td><td>H’40A0</td><td>X</td><td>R</td><td>CH1 average degrees</td><td rowspan="4">Average Fahrenheit degrees for channels CH1 to CH4. (Unit: 0.1°F).</td></tr>
<tr><td>#11</td><td>H’40A1</td><td>X</td><td>R</td><td>CH2 average degrees</td></tr>
<tr><td>#12</td><td>H’40A2</td><td>X</td><td>R</td><td>CH3 average degrees</td></tr>
<tr><td>#13</td><td>H’40A3</td><td>X</td><td>R</td><td>CH4 average degrees</td></tr>
<tr><td>#14</td><td>H’40A4</td><td>X</td><td>R</td><td>Present temp. of CH1</td><td rowspan="4">Present Celsius temperature of channels CH1 to CH4. (Unit: 0.1°C).</td></tr>
<tr><td>#15</td><td>H’40A5</td><td>X</td><td>R</td><td>Present temp. of CH2</td></tr>
<tr><td>#16</td><td>H’40A6</td><td>X</td><td>R</td><td>Present temp. of CH3</td></tr>
<tr><td>#17</td><td>H’40A7</td><td>X</td><td>R</td><td>Present temp. of CH4</td></tr>
</table>

<table>
<tr><th>CR#</th><th>Address</th><th>Latched</th><th>Attribute</th><th>Register content</th><th colspan="5">Description</th></tr>
<tr><td>#19</td><td>H’40A9</td><td>X</td><td>R</td><td>Present temp. of CH1</td><td colspan="5" rowspan="2">Present Fahrenheit temperature of channels CH1 to CH2. (Unit: 0.1°F).</td></tr>
<tr><td>#20</td><td>H’40AA</td><td>X</td><td>R</td><td>Present temp. of CH2</td></tr>
<tr><td>#21</td><td>H’40AB</td><td>X</td><td>R</td><td>Present temp. of CH3</td><td colspan="5" rowspan="2">Present Fahrenheit temperature of channels CH3 to CH4. (Unit: 0.1°F).</td></tr>
<tr><td>#22</td><td>H’40AC</td><td>X</td><td>R</td><td>Present temp. of CH4</td></tr>
<tr><td>#24</td><td>H’40AE</td><td>O</td><td>R/W</td><td>CH1 OFFSET Value</td><td colspan="5" rowspan="4">Adjust offset values of channels CH1 to CH4.
The range is -1,000 to +1,000 and default setting is K0. (Unit: 0.1°C). OFFSET = module measured temperature - OFFSET value = actual displayed temperature</td></tr>
<tr><td>#25</td><td>H’40AF</td><td>O</td><td>R/W</td><td>CH2 OFFSET Value</td></tr>
<tr><td>#26</td><td>H’40B0</td><td>O</td><td>R/W</td><td>CH3 OFFSET Value</td></tr>
<tr><td>#27</td><td>H’40B1</td><td>O</td><td>R/W</td><td>CH4 OFFSET Value</td></tr>
<tr><td>#29</td><td>H’40B3</td><td>X</td><td>R/W</td><td>PID mode setting</td><td colspan="5">Set H'5678 to enable PID mode, all other settings are normal mode. Default: H’0000.</td></tr>
<tr><td>#30</td><td>H’40B4</td><td>X</td><td>R</td><td>Error state</td><td colspan="5">The data register stores the error state.
Refer to the error code table for details.</td></tr>
<tr><td>#31</td><td>H’40B5</td><td>O</td><td>R/W</td><td>Communication address setting</td><td colspan="5">RS-485 communication address. Setting range is 1 to 254 and default setting is K1.</td></tr>
<tr><td>#32</td><td>H’40B6</td><td>O</td><td>R/W</td><td>Communication format setting</td><td colspan="5">It is used to set communication format.
For baud rate, the settings are 4,800/9,600/19,200/38,400/57,600/115,200 bps.
Communication format:
ASCII: 7, E, 1 / 7, O, 1 / 8, E, 1 / 8, O, 1 / 8, N, 1
RTU: 8, E, 1 / 8, O, 1 / 8, N, 1
Factory default: ASCII, 9600, 7, E, 1 (CR#32=H’0002)
Refer to ※CR#32 communication format settings at the end of this table for more information.</td></tr>
<tr><td rowspan="3">#33</td><td rowspan="3">H’40B7</td><td rowspan="3">O</td><td rowspan="3">R/W</td><td rowspan="3">Reset to default setting</td><td>b15 to b12</td><td>b11 to b9</td><td>b8 to b6</td><td>b5 to b3</td><td>b2 to b0</td></tr>
<tr><td>ERR LED</td><td>CH4</td><td>CH3</td><td>CH2</td><td>CH1</td></tr>
<tr><td colspan="5">Example: Setting of CH1
1. b0 to b1: Reserved.
2. b2: Set to 1 and PLC will be reset to default settings.
Definitions of ERR LED: b12 to b15=1111 (default settings)
1. b12 corresponds to CH1: when b12=1, the range is exceeded, and ERR LED flashes.
2. b13 corresponds to CH2: when b13=1, the range is exceeded, and ERR LED flashes.
3. b14 corresponds to CH3: when b14=1, the range is exceeded, and ERR LED flashes.
4. b15 corresponds to CH4: when b15=1, the range is exceeded, and ERR LED flashes.</td></tr>
<tr><td>#34</td><td>H’40B8</td><td>O</td><td>R</td><td>Software version</td><td colspan="5">Displays the software version in hexadecimal format.
Example: H’010A = version 1.0A</td></tr>
<tr><td colspan="4">#35 to #48</td><td colspan="6">For System used</td></tr>
<tr><td colspan="10">Symbols:
O: means latched. (Supported with RS485, but NOT supported when connecting to CPUs.)
X: means not latched.
R: able to read data by using FROM instruction or RS-485.
W: able to write data by using TO instruction or RS-485.</td></tr>
</table>

1. Added the RESET function for the modules with firmware V4.14 or later. Connect the module power input to 24 VDC and write H’4352 into CR#0 and then turn the power off and on again; all parameters in modules, including communication parameters, are restored to factory defaults.
2. If you want to use Modbus address in decimal format, you can convert a hexadecimal register address to decimal format and then add one to have it become a decimal Modbus register address. For example, by converting the

address “H’4096” of CR#0 in hexadecimal format to decimal format, you have the result 16534 and then by adding one to it, you have 16535, the Modbus address in decimal format.

3. CR#32 communication format settings: for modules with firmware V4.12 or previous versions, b11 to b8 data format selection is not available. For ASCII mode, the format is fixed to 7, E, 1 (H’00XX) and for RTU mode, the format is fixed to 8, E, 1 (H’C0xx/H’80xx). For modules with firmware V4.13 or later, refer to the following table for setups. Note that the original code H’C0XX/H’80XX will be seen as RTU, 8, E, 1 for modules with firmware V4.13 or later.

b15 to b12		b11 to b8		b7 to b0	
ASCII/RTU, exchange low and high byte of CRC check code		Data format		Baud rate	
Description					
H'0	ASCII	H'0	7, E, 1*1	H'01	4800 bps
H'8	RTU, do not exchange low and high byte of CRC check code	H'1	8, E, 1	H'02	9600 bps
		H'2	reserved	H'04	19200 bps
H'C	RTU, exchange low and high byte of CRC check code	H'3	8, N, 1	H'08	38400 bps
		H'4	7, O, 1*1	H'10	57600 bps
		H'5	8, O, 1	H'20	115200 bps

Note *1: This is only available for ASCII format.

Example: Write H’C310 into CR#32 to achieve the setup of RTU (exchanging low and high bytes of CRC check code), 8, N, 1 and baud rate: 57600 bps.

4. Function codes: 03’H is for reading data from registers. 06’H is for writing one word data into registers. 10’H is for writing multiple word data into registers.

5. CR#30 is the error state register. Refer to the table below:

Error description	Content	b15 to b8	b7	b6	b5	b4	b3	b2	b1	b0
Power source abnormal	K1 (H’1)	Reserved	0	0	0	0	0	0	0	1
Wiring to empty external contact	K2 (H’2)		0	0	0	0	0	0	1	0
Setting mode error	K4 (H’4)		0	0	0	0	0	1	0	0
Offset/Gain error	K8 (H’8)		0	0	0	0	1	0	0	0
Temperature sensor error	K16 (H’10)		0	0	0	1	0	0	0	0
Digital range error	K32 (H’20)		0	0	1	0	0	0	0	0
Average times setting error	K64 (H’40)		0	1	0	0	0	0	0	0
Instruction error	K128 (H’80)		1	0	0	0	0	0	0	0
Note: Each error state is determined by corresponding bits (b0 to b7). Two or more errors may happen at the same time. 0 means normal and 1 means having error.										

6. When CR#29 is set to H’5678, CR#0 to CR#34 can be used for PID settings in DVP04TC-S V3.08 and later.

PID Mode description							
CR#	Keep	R/W		CR#	Keep	R/W	
#0	O	R	Model name	#24	O	R/W	CH1 K_D
#1	X	R/W	Thermocouple type	#25	O	R/W	CH2 K_D
#2	X	R	PID Output % at CH1	#26	O	R/W	CH3 K_D
#3	X	R	PID Output % at CH2	#27	O	R/W	CH4 K_D
#4	X	R	PID Output % at CH3	#28	X	R/W	Run/Stop and Auto tuning Bit0: CH1 PID Run/Stop Bit1: CH2 PID Run/Stop
#5	X	R	PID Output % at CH4				
CR#2 to CR#5: 0 to 1000; Unit: 0.1%							
#6	X	R	Average temperature (°C) at CH1				

PID Mode description							
#7	X	R	Average temperature (ºC) at CH2				Bit2: CH3 PID Run/Stop Bit3: CH4 PID Run/Stop 0=PID Stop, 1=PID Run Bit4: CH1 Auto tuning Bit5: CH2 Auto tuning Bit6: CH3 Auto tuning Bit7: CH4 Auto tuning 1: The auto tuning function is enabled. After the auto tuning is completed, the value becomes 0.
#8	X	R	Average temperature (ºC) at CH3				
#9	X	R	Average temperature (ºC) at CH4				
CR#6 to CR#9: Unit: 0.1%							
#10	O	R/W	Set temperature at CH1				
#11	O	R/W	Set temperature at CH2				
#12	O	R/W	Set temperature at CH3				
#13	O	R/W	Set temperature at CH4				
CR#10 to CR#13: Set the PID target value (SV)							
#14	O	R/W	CH1 K_P	#29	X	R/W	Enter PID mode (H'5678) K0: Exit the PID mode
#15	O	R/W	CH2 K_P				
#16	O	R/W	CH3 K_P	#30	X	R	Error code
#17	O	R/W	CH4 K_P	#31	O	R/W	CH1 Sampling time
#19	O	R/W	CH1 K_I	#32	O	R/W	CH2 Sampling time
#20	O	R/W	CH2 K_I	#33	O	R/W	CH3 Sampling time
#21	O	R/W	CH3 K_I	#34	O	R/W	CH4 Sampling time
#22	O	R/W	CH4 K_I	CR#31 to CR#34: 1 to 30; Unit: 1 s			
Note: Users must enter the PID mode (CR#29=H'5678) before setting other control registers.							

9.4.3 DVP08NTC-S Control Register

CR#	MODBUS Address	Latched	Attribute	Register content	Description
#0	H4000	O	R	Model name	H010D
#1	H4001	O	R/W	CH1 and CH2 Mode setting	Please refer to the content description - Sensor Settings (CR#1 to CR#4)
#2	H4002	O	R/W	CH3 and CH4 Mode setting	
#3	H4003	O	R/W	CH5 and CH6 Mode setting	
#4	H4004	O	R/W	CH7 and CH8 Mode setting	
#5	H4005	O	R/W	Temperature scales setting	K0: Celsius (°C) (Default) K1: Fahrenheit (°F)
#6	H4006	O	R/W	Moving average	Setting range: 1 to 100. Default: 3
#7	H4007	X	R	CH1 average degrees	Average degrees, unit: 0.1 degree
#8	H4008	X	R	CH2 average degrees	
#9	H4009	X	R	CH3 average degrees	
#10	H400A	X	R	CH4 average degrees	
#11	H400B	X	R	CH5 average degrees	
#12	H400C	X	R	CH6 average degrees	
#13	H400D	X	R	CH7 average degrees	
#14	H400E	X	R	CH8 average degrees	
#15	H400F	X	R	Error code register	Please refer to the content description – Error code register
#16	H4010	O	R/W	RS-485 station setting	Setting range:1 to 254. Default: 1
#17	H4011	O	R/W	Communication format Setting	Please refer to the content description – communication format setting

CR#	MODBUS Address	Latched	Attribute	Register content	Description	
#18	H4012	X	R	CH1 ADC Raw Data	Low word	Raw conversion data
#19	H4013				High word	
#20	H4014	X	R	CH2 ADC Raw Data	Low word	
#21	H4015				High word	
#22	H4016	X	R	CH3 ADC Raw Data	Low word	
#23	H4017				High word	
#24	H4018	X	R	CH4 ADC Raw Data	Low word	
#25	H4019				High word	
#26	H401A	X	R	CH5 ADC Raw Data	Low word	
#27	H401B				High word	
#28	H401C	X	R	CH6 ADC Raw Data	Low word	
#29	H401D				High word	
#30	H401E	X	R	CH7 ADC Raw Data	Low word	
#31	H401F				High word	
#32	H4020	X	R	CH8 ADC Raw Data	Low word	
#33	H4021				High word	
#34	H4022	O	R	Firmware version	Example: H0123 represents V1.23	
#35	H4023	X	R/W	Instruction	Please refer to the content description - Instruction	
#36 to #49	For system use					

Symbols:
O means latched.
X means not latched (Power-off latching command must be issued to maintain power-off state.)
R means can read data by using FROM instruction or RS-485.
W means can write data by using TO instruction or RS-485.

1. Sensors setting (CR#1 to CR#4)

The contents and allocations of registers are shown below:

CR#	MODBUS Address	Register Name	Register Content Allocation	
			High byte (b15 to b8)	Low byte (b7 to b0)
#1	H4001	CH1 and CH2 Sensors setting	CH2 Setting value	CH1 Setting value
#2	H4002	CH3 and CH4 Sensors setting	CH4 Setting value	CH3 Setting value
#3	H4003	CH5 and CH6 Sensors setting	CH6 Setting value	CH5 Setting value
#4	H4004	CH7 and CH8 Sensors setting	CH8 Setting value	CH7 Setting value

The corresponding sensor types are as follows:

Value		Sensor Type
Decimal	Hexadecimal	
K0	H00	Pt1000
K1	H01	Ni1000
K2	H02	LG-Ni1000
K3	H03	NTC 10K B25 B85 3977K
K4	H04	NTC 100K B25 B85 4260K
K5	H05	NTC 20K B25 B85 4200
K6	H06	NTC 30K B25 B50 4200

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Value		Sensor Type
Decimal	Hexadecimal	
K7	H07	PT-42H 10K B25 B85 3435K
K8	H08	PT-43 10.74K B25 B85 3480K
K9	H09	PT-51F 49.12K B25 B85 3992K
K10	H0A	PT-25E2 98..63K B25 B85 4066K
K11	H0B	PT-312 231.4K B25 B85 4240K
K12	H0C	KTY81-110/120
K13	H0D	KTY81-121
K14	H0E	KTY81-122
K15	H0F	KTY81-210/220
K16	H10	KTY81-221
K17	H11	KTY81-222
K18	H12	Self-defined temperature/resistance table 1
K19	H13	Self-defined temperature/resistance table 2
K20	H14	Self-defined temperature/resistance table 3
K21	H15	Self-defined temperature/resistance table 4
K22	H16	Self-defined temperature/resistance table 5
K23	H17	Self-defined temperature/resistance table 6
K24	H18	Self-defined temperature/resistance table 7
K25	H19	Self-defined temperature/resistance table 8
K255	HFF	Channel disabled (Default) And the reading will be fixed to 0.

Example:

- To set CH1 to use Pt1000 (H00) and CH2 to use NTC 30K (H06), write H0600 to CR#1.
- To set CH5 to use self-defined table 8 (H19) and close CH6 channel (HFF), write HFF19 to CR#3.

2. Error Code Register (CR#15)

Error State	Value	b15 to b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
CH1 Invalid measured value or sensor connection failure	K1 (H1)	Reserved	0	0	0	0	0	0	0	0	0	1
CH2 Invalid measured value or sensor connection failure	K2 (H2)		0	0	0	0	0	0	0	0	1	0
CH3 Invalid measured value or sensor connection failure	K4 (H4)		0	0	0	0	0	0	0	1	0	0
CH4 Invalid measured value or sensor connection failure	K8 (H8)		0	0	0	0	0	0	1	0	0	0
CH5 Invalid measured value or sensor connection failure	K16 (H10)		0	0	0	0	0	1	0	0	0	0
CH6 Invalid measured value or sensor connection failure	K32 (H20)		0	0	0	0	1	0	0	0	0	0
CH7 Invalid measured value or sensor connection failure	K64 (H40)		0	0	0	1	0	0	0	0	0	0
CH8 Invalid measured value or sensor connection failure	K128 (H'80)		0	0	1	0	0	0	0	0	0	0
Power source abnormal	K256 (H100)		0	1	0	0	0	0	0	0	0	0
Hardware malfunction	K512 (H200)		1	0	0	0	0	0	0	0	0	0

Error State	Value	b15 to b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Note: Each error state is determined by the corresponding bit (b0 to b9). Two or more errors may occur at the same time. 0 means normal, 1 mans an error has occurred.												

3. Communication format setting (CR#17)

b15 to b12		b11 to b8		b7 to b0	
ASCII/RTU		Data format		Baud rate	
H0	ASCII (Default)	H'0	7, E, 1 (Only for ASCII) (Default)	H02	9600 (Default)
HC	RTU	H1	8, E, 1	H04	19200
		H2	7, N, 1 (Only for ASCII)	H08	38400
		H3	8, N, 1	H10	57600
		H4	7, O, 1 (Only for ASCII)	H20	115200
		H5	8, O, 1		
		H6	7, E, 2 (Only for ASCII)		
		H7	8, E, 2		
		H8	7, N, 2 (Only for ASCII)		
		H9	8, N, 2		
		HA	7, O, 2 (Only for ASCII)		
		HB	8, O, 2		

4. Instruction (CR#35)

Instruction	Description
H6001	Retains values after power loss.
H5AA5	Restores to factory settings. Self-defined table will not be reset.
H5AA6	Clears all self-defined tables.

After writing is done, CR#35 can be read once, where a reading of 1 indicates a successful write command, and a reading of 0 indicates a failed write command. After reading is done, the value will reset to 0.

9.5 DVP02TUN-S/DVP02TUR-S/DVP02TUL-S/ DVP02TKN-S/DVP02TKR-S/DVP02TKL-S Control Registers

9.5.1 Control Registers

9.5.1.1 MODBUS Address List for DVP02TK-S Series

TK MODBUS Address	Description
H0000	TK CR#0: starting address
H1000	The 1st module on the right side of TK series, CR#0: starting address
H2000	The 2nd module on the right side of TK series, CR#0: starting address
H3000	The 3rd module on the right side of TK series, CR#0: starting address
H4000	The 4th module on the right side of TK series, CR#0: starting address
H5000	The 5 th module on the right side of TK series, CR#0: starting address
H6000	The 6 th module on the right side of TK series, CR#0: starting address
H7000	The 7 th module on the right side of TK series, CR#0: starting address
H8000	The 8 th module on the right side of TK series, CR#0: starting address

Note: Modbus addresses are required while using Modbus-TK to read/write registers over a RS-485 network.

9.5.1.2 MODBUS Hex Address List for DVP02TK-S Series

Address (Hex)	Attribute		Name	Description	Default
0F00	R	X	Number of connected extension modules	Detecting number of the extension modules connected to the right side of the TK series	--
0F01	R	X	Code of the 1st module	Code of the 1st module on the right side of TK series	--
0F02	R	X	Code of the 2nd module	Code of the 2nd module on the right side of TK series	--
0F03	R	X	Code of the 3rd module	Code of the 3rd module on the right side of TK series	--
0F04	R	X	Code of the 4th module	Code of the 4th module on the right side of TK series	--
0F05	R	X	Code of the 5th module	Code of the 5th module on the right side of TK series	--
0F06	R	X	Code of the 6th module	Code of the 6th module on the right side of TK series	--
0F07	R	X	Code of the 7th module	Code of the 7th module on the right side of TK series	--
0F08	R	X	Code of the 8th module	Code of the 8th module on the right side of TK series	--
0F09	R/W	O	RS-485 communication setup	Refer to sections for setting up the RS-485 communication mode	K0
0F0A	R/W	X	Reserved		
0F0B	R/W	O	RS-485 communication format	0: ASCII; 1: RTU	K0
0F0C	R/W	O	TK station number	TK station number setup	K1

Address (Hex)	Attribute		Name	Description	Default
0F0D	R/W	X	TK operation	0: Stop; 1: Run	--

9.5.1.3 List of the Control Registers

TU CR#	TK Add. (Hex)	Attribute		Name	Description	Default
#0	000	R	O	Model	By default, you can see the model's name in the program and determine whether there is any extension module. DVP02TUL-S: H014F DVP02TUN-S: H024F DVP02TUR-S: H034F DVP02TKL-S: H044F DVP02TKN-S: H054F DVP02TKR-S: H064F	--
#1	001	R	O	Firmware version	Hexadecimal, displaying the current firmware version, for example the current firmware is 1.02 and it will display H'0102.	--
#2	002	R	O	CH1 PV	Channel current value	--
#3	003	R	O	CH2 PV		
#4	004	R/W	O	CH1 SV setups	Channel target value	K0
#5	005	R/W	O	CH2 SV setups		
#6	006	R/W	X	CH1 setups to run/stop an operation	K0: stop K1: run K2: pause (programmable)	K0
#7	007	R/W	X	CH2 setups to run/stop an operation		
#8	008	R/W	X	CH1 Auto tuning	K0: Auto-control mode K1: Auto-adjust mode, after adjusting it will switch to the auto-control mode and input the most suitable parameters, e.g., Kc_Kp, Ti_Ki, Td_Kd and Tf. K2: Auto-adjust mode (enhanced), recommended when the change in temperature reaches 2 degrees /second. Another channel would be turned off automatically while adjusting, then revert to the original channel setting once completed.	K0
#9	009	R/W	X	CH2 Auto tuning		

TU CR#	TK Add. (Hex)	Attribute		Name	Description	Default
#10	00A	R/W	X	Setups to switch pages	CR#11 to CR#42: Definitions may vary according to different setups on the specific page. K0: Basic setup page for CH1 K1: PID setup page for CH1 K2: Program control setup page for CH1 K3: Pattern 0, 1 setup page for CH1 K4: Pattern 2, 3 setup page for CH1 K5: Pattern 4, 5 setup page for CH1 K6: Pattern 6, 7 setup page for CH1 K7: Automatic PID calculation setup page for CH1 K10: Basic setup page for CH2 K11: PID setup page for CH2 K12: Program control setup page for CH2 K13: Pattern 0, 1 setup page for CH2 K14: Pattern 2, 3 setup page for CH2 K15: Pattern 4, 5 setup page for CH2 K16: Pattern 6, 7 setup page for CH2 K17: Automatic PID calculation setup page for CH2	K0
#11 to #42	--	R/W	X	According to each setup page	Please refer to each setup page.	K0
--	00B	R/W	--	Page0	Basic setup page for CH1	--
--	02B	R/W	--	Page1	PID setup page for CH1	--
--	04B	R/W	--	Page2	Program control setup page for CH1	--
--	06B	R/W	O	Page3	Pattern 0, 1 setup page for CH1	--
--	08B	R/W	O	Page4	Pattern 2, 3 setup page for CH1	--
--	0AB	R/W	O	Page5	Pattern 4, 5 setup page for CH1	--
--	0CB	R/W	O	Page6	Pattern 6, 7 setup page for CH1	--
--	291	R/W	O	Page7	Automatic PID calculation setup page for CH1	--
--	0EB	R/W	O	Page10	Basic setup page for CH2	--
--	10B	R/W	O	Page11	PID setup page for CH2	--
--	12B	R/W	O	Page12	Program control setup page for CH2	--
--	14B	R/W	O	Page13	Pattern 0, 1 setup page for CH2	--
--	16B	R/W	O	Page14	Pattern 2, 3 setup page for CH2	--
--	18B	R/W	O	Page15	Pattern 4, 5 setup page for CH2	--
--	1AB	R/W	O	Page16	Pattern 6, 7 setup page for CH2	--
--	2B1	R/W	O	Page17	Automatic PID calculation setup page for CH2	--
#43	24B		X	Error code	Please refer to error code descriptions.	K0

TU CR#	TK Add. (Hex)	Attribute		Name	Description	Default
#45	24D	R/W	X	User-defined	0x0501: Restore to defaults 0x0502: Settings written on flash 0x0504: RS-485 mode and latched (parameter/mode/station number) 0x51CC: Manually output 0x51DD: Auto output (the PID will be invalid after switching to manually output mode.) CR control can be set up by the analog output of DVP02TUL-S/DVP02TKL-S and the digital output of /DVP02TUN-S/DVP02TKR-S/DVP02TKN-S. DVP02TUL-S/DVP02TKL-S: CR#4: CH1 analog output value range K0 to K4000 CR#5: CH2 analog output value range K0 to K4000 DVP02TUR-S/DVP02TUN-S/DVP02TKR-S/DVP02TKN-S: CR#4 (bit0/bit1): CH1 digital output Y0/Y1 CR#5 (bit0/bit1): CH2 digital output Y2/Y3	K0
#46	24E	R	O	CH1 display value	The display value is the measured value after being rounded off or the value set to be displayed for the channels.	
#47	24F	R	O	CH2 display value		

Symbols:
O: Latched.
X: Non-latched.
R: Able to read data by FROM instruction.
W: Able to write data by TO instruction.

- CR#43 Error code descriptions

Error Code		1	0
Bit0	Power supply abnormal	Abnormal	Normal
Bit1	Hardware abnormal	Abnormal	Normal
Bit2	CH1 conversion error	Abnormal	Normal
Bit3	CH2 conversion error	Abnormal	Normal
Bit4	CH1 circuit control abnormal	Abnormal	Normal
Bit5	CH2 circuit control abnormal	Abnormal	Normal
Bit6	Manually / Auto Output	Manually Output	Auto Output
Bit7-15	Reserved		

9.5.1.4 Basic Setup Page

TU CR#	TK CH1 Page0 Add. (Hex)	TK CH2 Page10 Add. (Hex)	Attribute		Name	Description	Default
#11	00B	0EB	R/W	O	Sensor type	K-255: Channel disabled K0: 0 to 5 V K1: 0 to 10 V K2: 0 to 20 mA K3: 4 to 20 mA K4: 0 to 50 mV K5: Pt100 K6: JPt100 K7: Pt1000 K8: J K9: K K10: R K11: S K12: T K13: E K14: N K15: B K16: L K17: U K18: TXK K19: C K20: PL II K21: Cu50 K22: Cu100 K23: Ni100 K24: Ni1000 K25: LGNi1000 K26: 0to10V (Quick AI) K27: Ni120 K28: -100 mV to 100 mV K29: 4 mA to 20 mA (Quick AI) When the channel is disabled (K255), the reading is fixed to 0.	K0
#12	00C	0EC	R/W	O	Unit of temperature	K0: ºC K1: ºF	K0
#13	00D	0ED	R/W	O	Offset temperature error	K-999 to K999	K0

TU CR#	TK CH1 Page0 Add. (Hex)	TK CH2 Page10 Add. (Hex)	Attribute		Name	Description	Default
#14	00E	0EE	R/W	O	Temperature filter range	Temperature filter ranges from K10 to K10000. When the input value is within ±10 of the last input value, the system will apply filtering measurement. Therefore, when the noise interference is greater, the filter range setting should also be increased too.	K10
#15	00F	0EF	R/W	O	Filtering factor	Ranging K0 to K50. Operational formula: value = (last value*n + this measurement) / (n+1) When the set value is smaller, the PV will be closer to this measured value. When the set value is larger, the filtering factor will increase, and the PV will become more stable.	K1
#16	010	0F0	R/W	O	Control type	K0: PID Auto K1: PID Manual K2: PID program control K3: ON/OFF (for DVP02TUR-S/DVP02TUN-S/ DVP02TKR-S/DVP02TKN-S)	K0
#17	011	0F1	R/W	O	Output 1 control	K0: Heating K1: Cooling K2: Alarm (for DVP02TUR-S /DVP02TUN-S/ DVP02TKR-S /DVP02TKN-S) K3: Proportion (for DVP02TUL-S/ DVP02TKL-S)	K0
#18	012	0F2	R/W	O	Output 2 control	K0: Heating K1: Cooling K2: Alarm Note: not available for DVP02TUL-S/ DVP02TKL-S	K0
#21	015	0F5	R/W	O	Output setup	K0: cyclic output K1: immediately output DVP02TUN-S/ DVP02TKN-S: K0 (default) DVP02TUR-S/ DVP02TKR-S: K0 (default) Note: not available for DVP02TUL-S/DVP02TKL-S	K0

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TU CR#	TK CH1 Page0 Add. (Hex)	TK CH2 Page10 Add. (Hex)	Attribute		Name	Description	Default
#23	017	0F7	R/W	O	Output 1: heating/cooling control cycle setup	DVP02TUN-S/ DVP02TKN-S: K1 to K990 at 0.1 per second, default: K10. DVP02TUR-S/ DVP02TKR-S: K30 to K990 at 0.1 per second (default), default: K200. Note: not available for DVP02TUL-S/DVP02TKL-S.	K10 /K200
#24	018	0F8	R/W	O	Output 2: heating/cooling control cycle setup		
#25	019	0F9	R/W	O	Alarm 1 output	K0 to K12; please refer to section 9.5.4.2 Alarm Features. Note: not available for DVP02TUL-S/DVP02TKL-S.	K0
#26	01A	0FA	R/W	O	Alarm 2 output		
#27	01B	0FB	R/W	O	Alarm output 1 upper-limit setup		
#28	01C	0FC	R/W	O	Alarm output 1 lower-limit setup		
#29	01D	0FD	R/W	O	Alarm output 2 upper-limit setup		
#30	01E	0FE	R/W	O	Alarm output 2 lower-limit setup		
#32	020	100	R/W	O	PV upper-limit setup for a corresponding output	For DVP02TUL-S series, when the input value varies, the corresponding output will vary accordingly. Take 4 to 20 mA as an example, and set the upper-limit to K1000, set the lower-limit to K0; when the reading is K0, the output will be 4 mA and when the reading is K1000, the output will be 20 mA. You can also set it to a negative slope by setting the range to K0 to K1000; when the reading is K0, the output will be 20 mA, and when the reading is K1000, the output will be 4 mA.	K4000
#33	021	101	R/W	O	PV lower-limit setup for a corresponding output		K0
#34	Reserved for system use						
#35	023	103	R/W	O	Heating hysteresis setup	ON-OFF (For DVP02TUN-S / DVP02TUR-S / DVP02TKN-S / DVP02TKR-S)	K10
#36	024	104	R/W	O	Cooling hysteresis setup		K10

TU CR#	TK CH1 Page0 Add. (Hex)	TK CH2 Page10 Add. (Hex)	Attribute		Name	Description	Default
#37	025	105	R/W	O	Analog output mode	For DVP02TUL-S / DVP02TKL-S K0: 0 to 10 V K1: 0 to 20 mA K2: 4 to 20 mA	K0
#38	026	106	R/W	O	Out of the LED setting range	K0=LED blinking K1=LED not blinking	K0
#39	027	107	R/W	O	Dead band setup for dual outputs	Setting range: K-32768 to K32767 Note: not available for DVP02TUL-S / DVP02TKL-S	K10
#40	028	108	R	X	Outputting	DVP02TUL-S / DVP02TKL-S: analog output value K0 to K4000 DVP02TUN-S/DVP02TUR-S/DVP02TKN-S/DVP02TKR-S: Bit0: Digital output point, OUT1 Bit1: Digital output point, OUT2	--
#41	029	109	R	O	Set up the display value for the channel.	If the preset value (PV) is bigger than the display value, set the PV to be the same as the display value, ranging from K0 to K100.	K2
Symbols: O: Latched. X: Non-latched. R: Able to read data by FROM instruction. W: Able to write data by TO instruction.							

9.5.1.5 PID Setup Page

TU CR#	TK CH1 Page1 Add. (Hex)	TK CH2 Page11 Add. (Hex)	Attribute		Name	Description	Default
#11	02B	10B	R/W	O	MOUT_AUTO	K0: Normal, the value of MOUT won't be changed with the value of MV. K1: Auto, the value of MOUT will be changed with the value of MV.	K0
#12	02C	10C	R/W	O	MOUT	When set to PID Manual, the MV value will be outputted as the manually set MOUNT value, between MV_MAX and MV_MIN.	K0
#13	02D	10D	R/W	O	α value	The smaller the value of integral delay parameter, the slower the accumulation of integral coefficients would start. Setup range is from K0 to K100.	K65
#14-#17	Reserved						
#18	032	112	R/W	O	PID_EQ	PID formula types K0: Independent Formula K1: Dependent Formula	K1
#19	033	113	R/W	O	PID_DE	The calculation of the PID derivative error K0: Using the variations in the error (E) to calculate the control value of the derivative (Derivative of the error). K1: Using the variations in the PV to calculate the control value of the derivative (Derivative of the PV).	K0

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TU CR#	TK CH1 Page1 Add. (Hex)	TK CH2 Page11 Add. (Hex)	Attribute		Name	Description	Default
#20	034	114	R/W	O	ERR_DBW	Error dead bandwidth: Range within which an error (E) is 0. An error (E) is equal to SV−PV or PV-SV. If the setting value is 0, the function will not be enabled; otherwise, the CPU module will check whether the present error is less than the absolute value of ERR_DBW, and check whether the present error meets the cross-status condition. If the present error is less than the absolute value of ERR_DBW, and meets the cross-status condition, the present error will be count as 0, and the PID algorithm will be implemented, otherwise the present error will be brought into the PID algorithm according to the normal processing.	K0
#21	035	115	R/W	O	BIAS	Feedforward output value, used for the PID feedforward.	K0
#22	036	116	R/W	X	MV	The MV output value is K0 to K1000 and the unit is 0.1.	--
#23	037	117	R/W	X	I_MV (Low word)	Accumulated integral value temporarily stored. This value is usually used for reference only. Users can clear or modify it according to their needs. When the MV is greater than the MV_MAX, or less than the MV_MIN, the accumulated integral value in I_MV will no longer be altered.	--
#24	038	118	R/W	X	I_MV (High word)		--
#25	039	119	R/W	O	AUTO Tuning (PID hysteresis)	PID working: SV - PID Range < PV < SV + PID Range	K1
#26	03A	11A	R/W	O	β value	K0 to K100, and the unit is 0.01.	K65
#27	03B	11B	R/W	O	Kc_Kp floating point format (Lo word)	Calculated proportional coefficient (Kc or Kp) If the P coefficient is less than 0, the Kc_Kp will be 0. Independently, if Kc_Kp is 0, it will not be controlled by P.	1.0
#28	03C	11C	R/W	O	Kc_Kp floating point format (Hi word)		

TU CR#	TK CH1 Page1 Add. (Hex)	TK CH2 Page11 Add. (Hex)	Attribute		Name	Description	Default
#29	03D	11D	R/W	O	Ti_Ki floating point format (Lo word)	Integral coefficient (Ti or Ki) If the calculated coefficient I is less than 0, Ti_Ki will be 0. If Ti_Ki is 0, it will not be controlled by I.	1.0
#30	03E	11E	R/W	O	Ti_Ki floating point format (Hi word)		
#31	03F	11F	R/W	O	Td_Kd floating point format (Lo word)	Derivative coefficient (Td or Kd) If the calculated coefficient D is less than 0, Td_Kd will be 0. If Ti_Ki is 0, it will not be controlled by D.	0.1
#32	040	120	R/W	O	Td_Kd floating point format (Hi word)		
#33	041	121	R/W	O	Tf floating point format (Lo word)	The derivation parameter is used to suppress variations. It can filter derivatives, with higher parameter values providing stronger filtering effects. Generally, it is recommended to use the value obtained from auto tuning.	0.0
#34	042	122	R/W	O	Tf floating point format (Hi word)		
#35	043	123	R/W	O	Default integral coefficient	K0 to K10000 (The unit is 0.01)	K0
#36	044	124	R/W	O	Max. value of MV	K0 to K1000 (The unit is 0.1%)	K1000
#37	045	125	R/W	O	Min. value of MV	K0 to K1000 (The unit is 0.1%)	K0

Symbols:

O: Latched.

X: Non-latched.

R: Able to read data by FROM instruction.

W: Able to write data by TO instruction.

9.5.1.6 Program Control Setup Page

TU CR#	TK CH1 Page2 Address (Hex)	TK CH2 Page12 Address (Hex)	Attribute		Name	Description	Default
#11	04B	12B	R/W	O	Pattern number to start running	K0 to K7	K0
#12	04C	12C	R/W	O	Step number to start running	K0 to K7	K0
#13	04D	12D	R/W	O	The Cycle index of the Pattern numbers 0 to 7 to repeat running	K0 to K99, indicates the number of times the Pattern runs, with values ranging from 1 to 100. K9999: running continuously	K0
#14	04E	12E	R	X	Read the current running pattern number	K0 to K8 (8 indicates ending)	K0
#15	04F	12F	R	X	Read the current running step number	K0 to K7	K0
#16	050	130	R	X	Read the step running time left	Unit: seconds	K0
#17	051	131	R/W	O	Pattern0_set up for the max. step number to run	K0 to K7	K0
#18	052	132	R/W	O	Pattern1_ set up for the max. step number to run		
#19	053	133	R/W	O	Pattern2_ set up for the max. step number to run		
#20	054	134	R/W	O	Pattern3_ set up for the max. step number to run		
#21	055	135	R/W	O	Pattern4_ set up for the max. step number to run		
#22	056	136	R/W	O	Pattern5_ set up for the max. step number to run		
#23	057	137	R/W	O	Pattern6_ set up for the max. step number to run		
#24	058	138	R/W	O	Pattern7_ set up for the max. step number to run		
#25	059	139	R	X	The current cycle index number of the Pattern number 0to7 to repeat running		
#26	05A	13A	R/W	O	Temperature hold function setup	K0 to K999 (unit: 0.1 degree) K9999: disable	K0
#27	05B	13B	R/W	O	Go back to the pattern number that is currently running	K0 to K7	K0

TU CR#	TK CH1 Page2 Address (Hex)	TK CH2 Page12 Address (Hex)	Attribute		Name	Description	Default
#28	05C	13C	R/W	O	Go back to the step number that is currently running		
#29	05D	13D	R/W	O	Time unit of program control	K0: The unit is 1 min. K1: The unit is 0.1 sec.	K0

9.5.1.7 Patterns 0, 1 Setup Page

TU CR#	TK CH1 Page3 Address (Hex)	TK CH2 Page13 Address (Hex)	Attribute		Name	Description	Default
#11	06B	14B	R/W	O	Pattern 0-0 Target temperature	Range: K -32768 to K32767	K0
#12	06C	14C	R/W	O	Pattern 0-1 Target temperature		
#13	06D	14D	R/W	O	Pattern 0-2 Target temperature		
#14	06E	14E	R/W	O	Pattern 0-3 Target temperature		
#15	06F	14F	R/W	O	Pattern 0-4 Target temperature		
#16	070	150	R/W	O	Pattern 0-5 Target temperature		
#17	071	151	R/W	O	Pattern 0-6 Target temperature		
#18	072	152	R/W	O	Pattern 0-7 Target temperature		
#19	073	153	R/W	O	Pattern 0-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#20	074	154	R/W	O	Pattern 0-1 Running time		
#21	075	155	R/W	O	Pattern 0-2 Running time		
#22	076	156	R/W	O	Pattern 0-3 Running time		
#23	077	157	R/W	O	Pattern 0-4 Running time		
#24	078	158	R/W	O	Pattern 0-5 Running time		
#25	079	159	R/W	O	Pattern 0-6 Running time		
#26	07A	15A	R/W	O	Pattern 0-7 Running time		
#27	07B	15B	R/W	O	Pattern 1-0 Target temperature	Range: K-32768 to K32767	K0
#28	07C	15C	R/W	O	Pattern 1-1 Target temperature		
#29	07D	15D	R/W	O	Pattern 1-2 Target temperature		
#30	07E	15E	R/W	O	Pattern 1-3 Target temperature		
#31	07F	15F	R/W	O	Pattern 1-4 Target temperature		
#32	080	160	R/W	O	Pattern 1-5 Target temperature		
#33	081	161	R/W	O	Pattern 1-6 Target temperature		
#34	082	162	R/W	O	Pattern 1-7 Target temperature		
#35	083	163	R/W	O	Pattern 1-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#36	084	164	R/W	O	Pattern 1-1 Running time		

TU CR#	TK CH1 Page3 Address (Hex)	TK CH2 Page13 Address (Hex)	Attribute		Name	Description	Default
#37	085	165	R/W	O	Pattern 1-2 Running time		
#38	086	166	R/W	O	Pattern 1-3 Running time		
#39	087	167	R/W	O	Pattern 1-4 Running time		
#40	088	168	R/W	O	Pattern 1-5 Running time		
#41	089	169	R/W	O	Pattern 1-6 Running time		
#42	08A	16A	R/W	O	Pattern 1-7 Running time		

9.5.1.8 Patterns 2, 3 Setup Page

TU CR#	TK CH1 Page4 Address (Hex)	TK CH2 Page14 Address (Hex)	Attribute		Name	Description	Default
#11	08B	16B	R/W	O	Pattern 2-0 Target temperature	Range: K-32768 to K32767	K0
#12	08C	16C	R/W	O	Pattern 2-1 Target temperature		
#13	08D	16D	R/W	O	Pattern 2-2 Target temperature		
#14	08E	16E	R/W	O	Pattern 2-3 Target temperature		
#15	08F	16F	R/W	O	Pattern 2-4 Target temperature		
#16	090	170	R/W	O	Pattern 2-5 Target temperature		
#17	091	171	R/W	O	Pattern 2-6 Target temperature		
#18	092	172	R/W	O	Pattern 2-7 Target temperature		
#19	093	173	R/W	O	Pattern 2-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#20	094	174	R/W	O	Pattern 2-1 Running time		
#21	095	175	R/W	O	Pattern 2-2 Running time		
#22	096	176	R/W	O	Pattern 2-3 Running time		
#23	097	177	R/W	O	Pattern 2-4 Running time		
#24	098	178	R/W	O	Pattern 2-5 Running time		
#25	099	179	R/W	O	Pattern 2-6 Running time		
#26	09A	17A	R/W	O	Pattern 2-7 Running time		
#27	09B	17B	R/W	O	Pattern 3-0 Target temperature	Range: -32768 to 32767	K0
#28	09C	17C	R/W	O	Pattern 3-1 Target temperature		
#29	09D	17D	R/W	O	Pattern 3-2 Target temperature		
#30	09E	17E	R/W	O	Pattern 3-3 Target temperature		
#31	09F	17F	R/W	O	Pattern 3-4 Target temperature		
#32	0A0	180	R/W	O	Pattern 3-5 Target temperature		
#33	0A1	181	R/W	O	Pattern 3-6 Target temperature		
#34	0A2	182	R/W	O	Pattern 3-7 Target temperature		
#35	0A3	183	R/W	O	Pattern 3-0 Running time	Range: K0 to K900	K0

TU CR#	TK CH1 Page4 Address (Hex)	TK CH2 Page14 Address (Hex)	Attribute		Name	Description	Default
#36	0A4	184	R/W	O	Pattern 3-1 Running time	(Unit: minutes)	
#37	0A5	185	R/W	O	Pattern 3-2 Running time		
#38	0A6	186	R/W	O	Pattern 3-3 Running time		
#39	0A7	187	R/W	O	Pattern 3-4 Running time		
#40	0A8	188	R/W	O	Pattern 3-5 Running time		
#41	0A9	189	R/W	O	Pattern 3-6 Running time		
#42	0AA	18A	R/W	O	Pattern 3-7 Running time		

9.5.1.9 Patterns 4, 5 Setup Page

TU CR#	TK CH1 Page5 Address (Hex)	TK CH2 Page15 Address (Hex)	Attribute		Name	Description	Default
#11	0AB	18B	R/W	O	Pattern 4-0 Target temperature	Range: K-32768 to K32767	K0
#12	0AC	18C	R/W	O	Pattern 4-1 Target temperature		
#13	0AD	18D	R/W	O	Pattern 4-2 Target temperature		
#14	0AE	18E	R/W	O	Pattern 4-3 Target temperature		
#15	0AF	18F	R/W	O	Pattern 4-4 Target temperature		
#16	0B0	190	R/W	O	Pattern 4-5 Target temperature		
#17	0B1	191	R/W	O	Pattern 4-6 Target temperature		
#18	0B2	192	R/W	O	Pattern 4-7 Target temperature		
#19	0B3	193	R/W	O	Pattern 4-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#20	0B4	194	R/W	O	Pattern 4-1 Running time		
#21	0B5	195	R/W	O	Pattern 4-2 Running time		
#22	0B6	196	R/W	O	Pattern 4-3 Running time		
#23	0B7	197	R/W	O	Pattern 4-4 Running time		
#24	0B8	198	R/W	O	Pattern 4-5 Running time		
#25	0B9	199	R/W	O	Pattern 4-6 Running time		
#26	0BA	19A	R/W	O	Pattern 4-7 Running time		
#27	0BB	19B	R/W	O	Pattern 5-0 Target temperature	Range: K-32768 to K32767	K0
#28	0BC	19C	R/W	O	Pattern 5-1 Target temperature		
#29	0BD	19D	R/W	O	Pattern 5-2 Target temperature		
#30	0BE	19E	R/W	O	Pattern 5-3 Target temperature		
#31	0BF	19F	R/W	O	Pattern 5-4 Target temperature		
#32	0C0	1A0	R/W	O	Pattern 5-5 Target temperature		
#33	0C1	1A1	R/W	O	Pattern 5-6 Target temperature		
#34	0C2	1A2	R/W	O	Pattern 5-7 Target temperature		

TU CR#	TK CH1 Page5 Address (Hex)	TK CH2 Page15 Address (Hex)	Attribute		Name	Description	Default
#35	0C3	1A3	R/W	O	Pattern 5-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#36	0C4	1A4	R/W	O	Pattern 5-1 Running time		
#37	0C5	1A5	R/W	O	Pattern 5-2 Running time		
#38	0C6	1A6	R/W	O	Pattern 5-3 Running time		
#39	0C7	1A7	R/W	O	Pattern 5-4 Running time		
#40	0C8	1A8	R/W	O	Pattern 5-5 Running time		
#41	0C9	1A9	R/W	O	Pattern 5-6 Running time		
#42	0CA	1AA	R/W	O	Pattern 5-7 Running time		

9.5.1.10 Patterns 6, 7 Setup Page

TU CR#	TK CH1 Page6 Address (Hex)	TK CH2 Page16 Address (Hex)	Attribute		Name	Description	Default
#11	0CB	1AB	R/W	O	Pattern 6-0 Target temperature	Range: K-32768 to K32767	K0
#12	0CC	1AC	R/W	O	Pattern 6-1 Target temperature		
#13	0CD	1AD	R/W	O	Pattern 6-2 Target temperature		
#14	0CE	1AE	R/W	O	Pattern 6-3 Target temperature		
#15	0CF	1AF	R/W	O	Pattern 6-4 Target temperature		
#16	0D0	1B0	R/W	O	Pattern 6-5 Target temperature		
#17	0D1	1B1	R/W	O	Pattern 6-6 Target temperature		
#18	0D2	1B2	R/W	O	Pattern 6-7 Target temperature		
#19	0D3	1B3	R/W	O	Pattern 6-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#20	0D4	1B4	R/W	O	Pattern 6-1 Running time		
#21	0D5	1B5	R/W	O	Pattern 6-2 Running time		
#22	0D6	1B6	R/W	O	Pattern 6-3 Running time		
#23	0D7	1B7	R/W	O	Pattern 6-4 Running time		
#24	0D8	1B8	R/W	O	Pattern 6-5 Running time		
#25	0D9	1B9	R/W	O	Pattern 6-6 Running time		
#26	0DA	1BA	R/W	O	Pattern 6-7 Running time		
#27	0DB	1BB	R/W	O	Pattern 7-0 Target temperature	Range: K-32768 to K32767	K0
#28	0DC	1BC	R/W	O	Pattern 7-1 Target temperature		
#29	0DD	1BD	R/W	O	Pattern 7-2 Target temperature		
#30	0DE	1BE	R/W	O	Pattern 7-3 Target temperature		
#31	0DF	1BF	R/W	O	Pattern 7-4 Target temperature		
#32	0E0	1C0	R/W	O	Pattern 7-5 Target temperature		

TU CR#	TK CH1 Page6 Address (Hex)	TK CH2 Page16 Address (Hex)	Attribute		Name	Description	Default
#33	0E1	1C1	R/W	O	Pattern 7-6 Target temperature		
#34	0E2	1C2	R/W	O	Pattern 7-7 Target temperature		
#35	0E3	1C3	R/W	O	Pattern 7-0 Running time	Range: K0 to K900 (Unit: minutes)	K0
#36	0E4	1C4	R/W	O	Pattern 7-1 Running time		
#37	0E5	1C5	R/W	O	Pattern 7-2 Running time		
#38	0E6	1C6	R/W	O	Pattern 7-3 Running time		
#39	0E7	1C7	R/W	O	Pattern 7-4 Running time		
#40	0E8	1C8	R/W	O	Pattern 7-5 Running time		
#41	0E9	1C9	R/W	O	Pattern 7-6 Running time		
#42	0EA	1CA	R/W	O	Pattern 7-7 Running time		
Symbols: O: Latched. X: Non-latched. R: Able to read data by FROM instruction. W: Able to write data by TO instruction.							

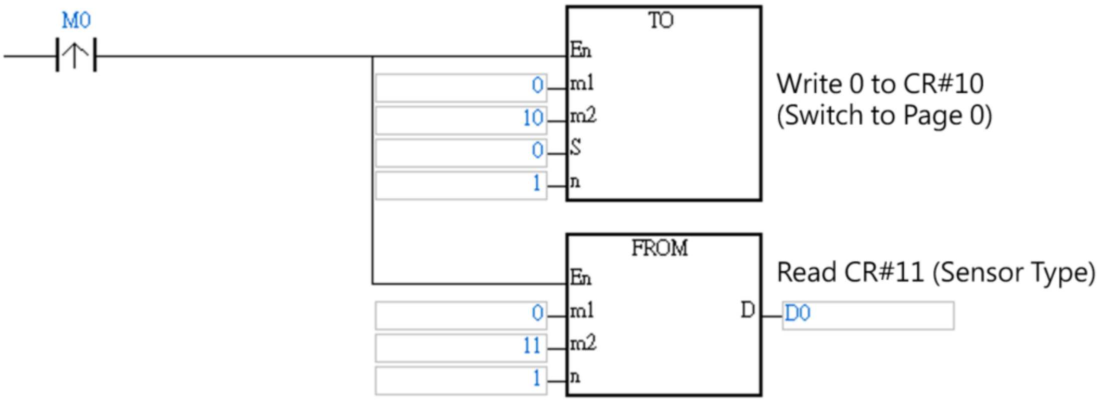
9.5.1.11 Automatic PID Calculation Setup Page

TU CR#	TK CH1 Page7 Address (Hex)	TK CH2 Page17 Address (Hex)	Attribute		Name	Description	Default
#11	291	2B1	R/W	X	The set point currently being adjusted	Set the point that you intend to adjust with the setting value K1 and K2. When the adjustment finished, the value would change to another set point automatically.	K0
#12	292	2B2	R/W	O	Switch for auto-calculation	K1: Turn ON K0: Turn OFF After successfully adjusting both points, the auto-calculation feature would be switch ON.	K0
#13 to #19	293 to 299	2B3 to 2B9	R/W	O	For internal calculation.		
#20	29A	2BA	R/W	O	The first set point SV	Value of the first set point SV.	K0
#21 to #26	29B to 2A0	2BB to 2C0	R/W	O	For internal calculation.		
#27	2A1	2C1	R/W	O	The second set point SV	Value of the second set point SV.	K0
#28 to #33	2A2 to 2A7	2C2 to 2C7	R/W	O	For internal calculation.		

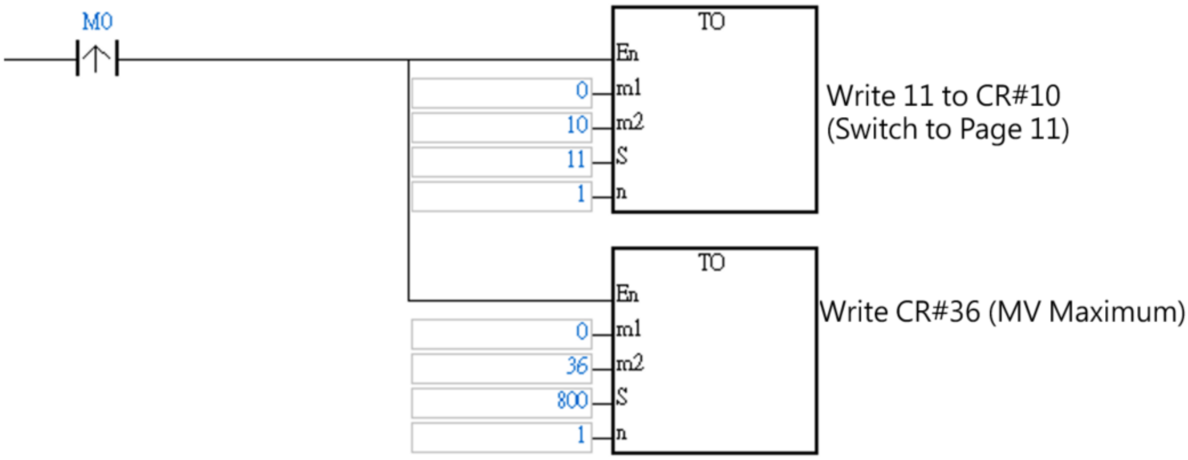
9.5.2 Examples of Setting a Control Register

Since CR#11 to CR#42 are defined differently from page to page, the register module features switching pages on the screen. CR#10 is the register for page control, which should be written to with the value of the corresponding page before you read/write CR#11 to CR#42. The programming example is shown as follows:

1. Read the sensor type of channel1. (Page0, CR#11)



2. Set the maximum MV value of channel2. (Page11, CR#36)



9.5.3 Analog Input Description

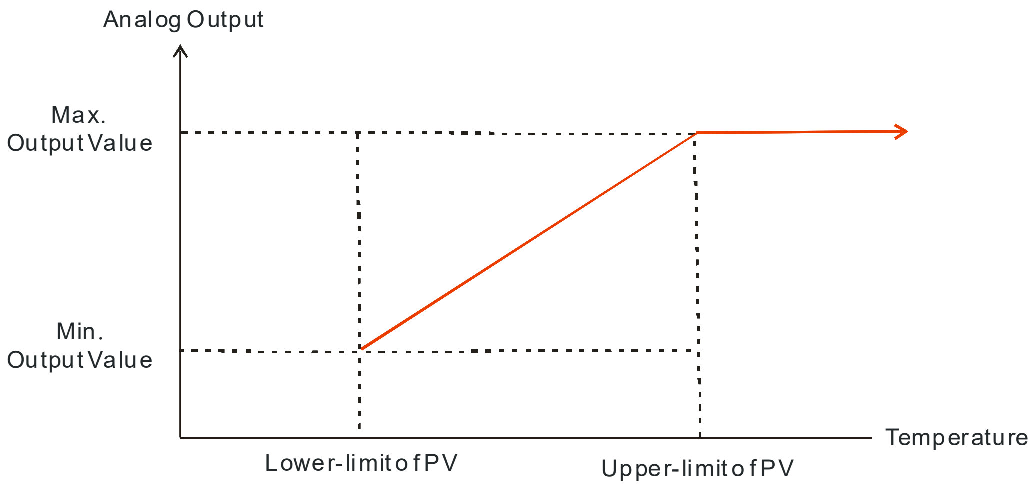
The analog input value of CH1 is shown at CR#2, and the value of CH2 is shown at CR#3. Please refer to the following table to set the input sensor type register. The temperature of the platinum and thermocouple can be set in Celsius or Fahrenheit, unit 0.1 degree. Users can use offset to edit the settings.

Mode			Analog Range	Digital Range
Current / Voltage	-1	Channel disabled	X	X
	0	0 to 5 V	0 to 5 V	K0 to K32000
	1	0 to 10 V	0 to 10 V	
	2	0 to 20 mA	0 to 20 mA	
	3	4 to 20 mA	4 to 20 mA	
	4	0 to 50 mV	0 to 50 mV	
	26	0 to 10 V (Quick AI)	0 to 10 V	
	28	-100 mV to 100 mV	-100 mV to 100 mV	K-32000 to K32000
	29	4 to 20 mA (Quick AI)	4 to 20 mA	K0 to K32000
Platinum	5	Pt100	-200 to 600°C	K-2000 to K6000
	6	JPt100	-20 to 400°C	K-200 to K4000
	7	Pt1000	-200 to 600°C	K-2000 to K6000
Thermocouple	8	J	-100 to 1200°C	K-1000 to K12000
	9	K	-200 to 1300°C	K-2000 to K13000
	10	R	0 to 1700°C	K0 to K17000
	11	S	0 to 1700°C	K0 to K17000
	12	T	-200 to 400°C	K-2000 to K4000
	13	E	0 to 600°C	K0 to K6000
	14	N	-200 to 1300°C	K-2000 to K13000
	15	B	100 to 1800°C	K1000 to K18000
	16	L	-200 to 850°C	K-2000 to K8500
	17	U	-200 to 500°C	K-2000 to K5000
	18	TXK	-200 to 800°C	K-2000 to K8000
	19	C	0 to 1800°C	K0 to K18000
	20	PL II	-100 to 1370°C	K-1000 to K13700
Copper thermal resistance	21	Cu50	-50 to 150°C	K-500 to K1500
	22	Cu100	-50 to 150°C	K-500 to K1500
Nickel thermal resistance	23	Ni100	-100 to 180°C	K-1000 to K1800
	24	Ni1000	-100 to 180°C	K-1000 to K1800
	25	LGNi1000	-60 to 200°C	K-600 to K2000
	27	Ni120	-80 to 260°C	K-800 to K2600

9.5.4 Outputs

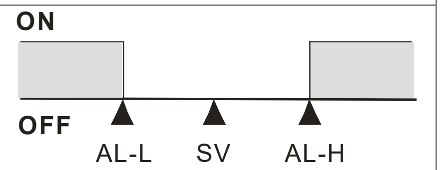
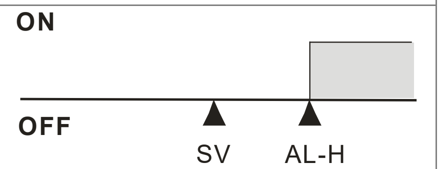
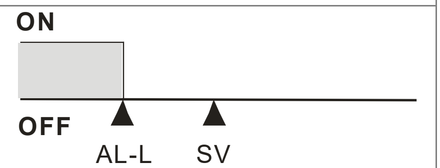
9.5.4.1 The output value varies with the PV value

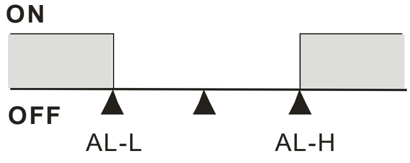
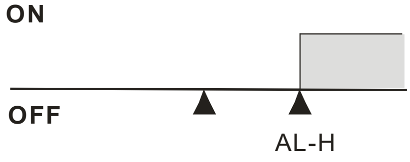
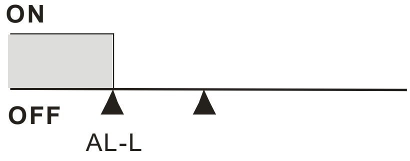
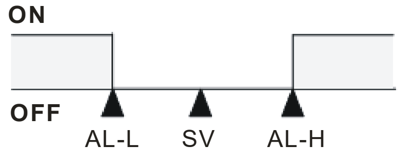
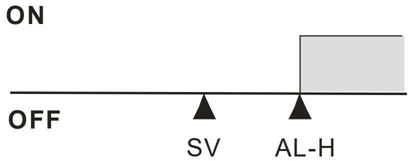
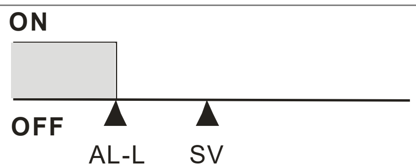
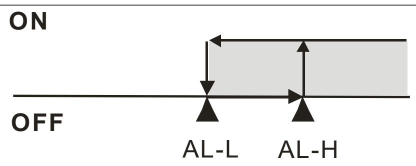
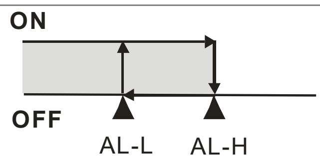
This functionality is only available for DVP02TUL-S/DVP02TKL-S series. When the PV varies, the corresponding output will vary accordingly. Take 4 to 20 mA as an example, set the upper-limit to 1000, and set the lower-limit to 0; when PV is 0, the output will be 4 mA and when PV is 1000, the output will be 20 mA. When you can also set it to a negative slope by setting the range to 0 to 1000; when the PV is 0, the output will be 20 mA, and when the PV is 1000, the output will be 4 mA. As the linear graph shown below, the analog output will vary according to the PV value.



9.5.4.2 Alarm Outputs

The alarm output is only available for DVP02TUN-S, DVP02TUR-S, DVP02TKN-S and DVP02TKR-S series, not for DVP02TUL-S and DVP02TKL-S series. Alarm function is to set the input value to trigger the outputs to do corresponding actions. There are 12 modes available for setups. The alarm output operations are shown below.

Setting Value	Alarm Type	Alarm Output Operation
0	Alarm function disabled.	None
1	Deviation upper-limit and lower-limit: This alarm output operates when the PV is higher than the setting value SV+AL-H or lower than the setting value SV-AL-L.	
2	Deviation upper-limit: This alarm output operates when the PV is higher than the setting value SV+AL-H.	
3	Deviation lower-limit: This alarm output operates when the PV is lower than the setting value SV-AL-L.	

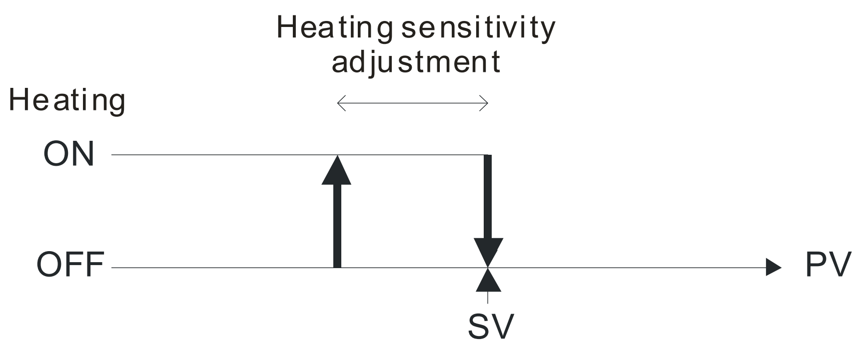
Setting Value	Alarm Type	Alarm Output Operation
4	Upper and lower alarm reverse action: This alarm output operates when the PV is between SV+AL-H and SV- AL_L.	
5	Absolute value upper-limit and lower-limit: This alarm output operates when the PV is higher than the setting value AL-H or lower than the setting value AL-L.	
6	Absolute value upper-limit: This alarm output operates when the PV is higher than the setting value AL-H.	
7	Absolute value lower-limit: This alarm output operates when the PV is lower than the setting value AL-L.	
8	Standby alarm value upper-limit and lower-limit: This alarm output operates when the PV is at the set value and the temperature is higher than the setting value SV+AL-H or lower than the setting value SV- AL_L.	
9	Standby alarm value upper-limit: This alarm output operates when the PV is at the set value and the temperature is higher than the setting value SV+AL-H.	
10	Standby alarm value lower-limit: This alarm output operates when the PV is at the set value and the temperature is lower than the setting value SV- AL_L.	
11	Hysteresis upper-limit alarm output: This alarm output operates if the PV value is higher than the setting value SV+AL-H. This alarm output is OFF when the PV is lower than the setting value SV+AL-L.	
12	Hysteresis lower-limit alarm output: This alarm output operates if PV value is lower than the setting value SV-AL-H. This alarm output is OFF when the PV is higher than the setting value SV-AL-L.	

9.5.5 ON/OFF Control Mode

For DVP02TUR/DVP02TUN-S/DVP02TKR/DVP02TKN-S series, every channel has 2 digital outputs. Outputs control the ON/OFF mode.

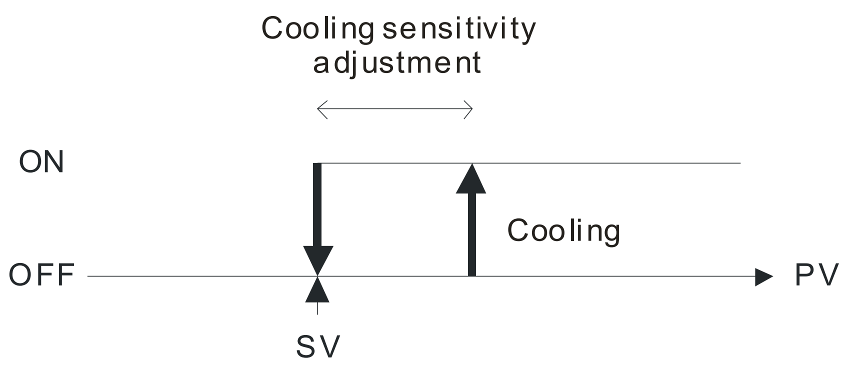
- **Actions for the heating output:**

The output is OFF when the input is greater than the setting value. Output is ON when the input is smaller than the total value of the setting value + adjustment sensitivity setting value. For example, set the setting value of SV to 100 degrees and the heating sensitivity adjustment to 10 degrees. When the temperature reaches 100 degrees, the digital output switches to OFF. When the temperature is 90 degrees, it will heat up to 100 degrees, and then the digital output will switch to OFF.

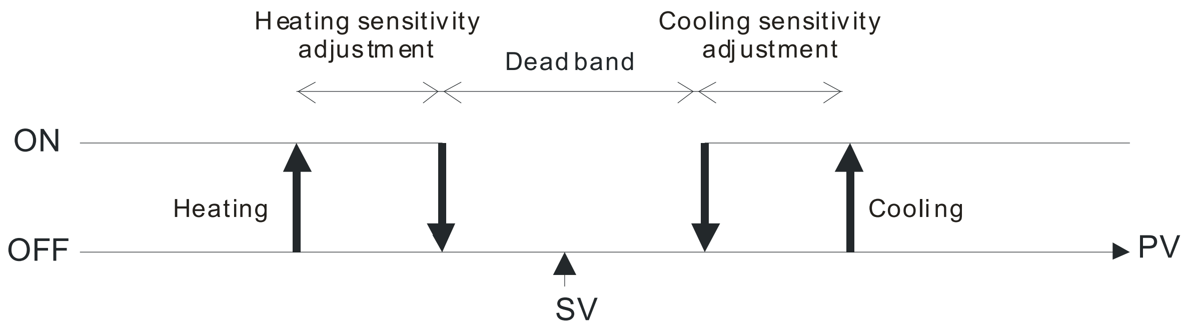


- **Actions for the cooling output:**

The output is ON when the input is greater than the total value of the setting value + adjustment sensitivity setting value. Output is OFF when the input is smaller than the setting value. For example, set the setting value of SV to 10 degrees and the cooling sensitivity adjustment to 5 degrees; when the temperature reached 10 degrees, the digital output switches to OFF. When the temperature is 15, it will cool down to 10 degrees, and then the digital output will switch to OFF.



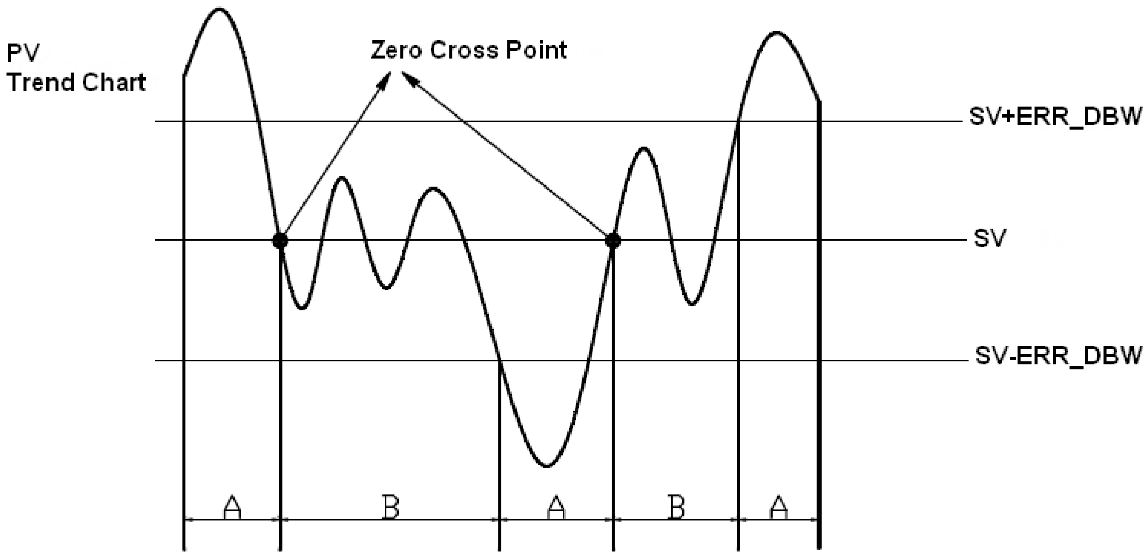
- **Actions for dual outputs:**



When setting one output for heating and the other for cooling, a non-action zone (dead band) can be set as the figure above. For example, set the setting value of SV to 100 degrees, heating sensitivity adjustment to 10 degrees, cooling sensitivity adjustment to 5 degree and dead band to 20 degrees. When the temperature is 90 to 110 degrees, the outputs will be OFF. Heating up the temperature to 90 degrees, the output will switch to OFF. When the temperature is below 80 degrees, the heating up will be started. Cooling down the temperature to 110 degrees, the output will switch to OFF. When the temperature is over 115 degrees, the cooling will be started.

9.5.6 Control Mode

When the PV is in the range of ERR_DBW, the PLC will run the PID operation according to the E value. When the PV is over the SV, the cross status will be established, and the E value will be seen as 0 while running the PID operation until the PV goes over the range of ERR_DBW. If PID_DE is True, the PLC will run the derivative of PV. When the cross status is established, the Delta PV will be seen as 0 while running the derivative of PID operation. As the example shown below, the PLC will run the PID operation in the section A and will see the values of E and Delta PV as 0 while running the PID operation.



PID Formula:

- **Independent Formula & Derivative of E (PID_EQ**=False and **PID_DE**=False)

$$CV = K_p E + K_i \int_0^t E dt + K_d \frac{dE}{dt} + BIAS$$

$$E = SV - PV \quad or \quad E = PV - SV$$

- **Independent Formula & Derivative of PV (PID_EQ**=False and **PID_DE**=True)

$$CV = K_p E + K_i \int_0^t E dt - K_d \frac{dPV}{dt} + BIAS$$

$$E = SV - PV$$

$$or$$

$$CV = K_p E + K_i \int_0^t E dt + K_d \frac{dPV}{dt} + BIAS$$

$$E = PV - SV$$

- **Dependent Formula & Derivative of E (PID_EQ**=True and **PID_DE**=False)

$$CV = K_c\left[E + \frac{1}{T_i}\int_0^t Edt + T_d\frac{dE}{dt}\right] + BIAS$$

$$E = SV - PV \quad or \quad E = PV - SV$$

- **Dependent Formula & Derivative of PV (PID_EQ**=True and **PID_DE**=True)

$$CV = K_c\left[E + \frac{1}{T_i}\int_0^t Edt - T_d\frac{dPV}{dt}\right] + BIAS$$

$$E = SV - PV$$

$$or$$

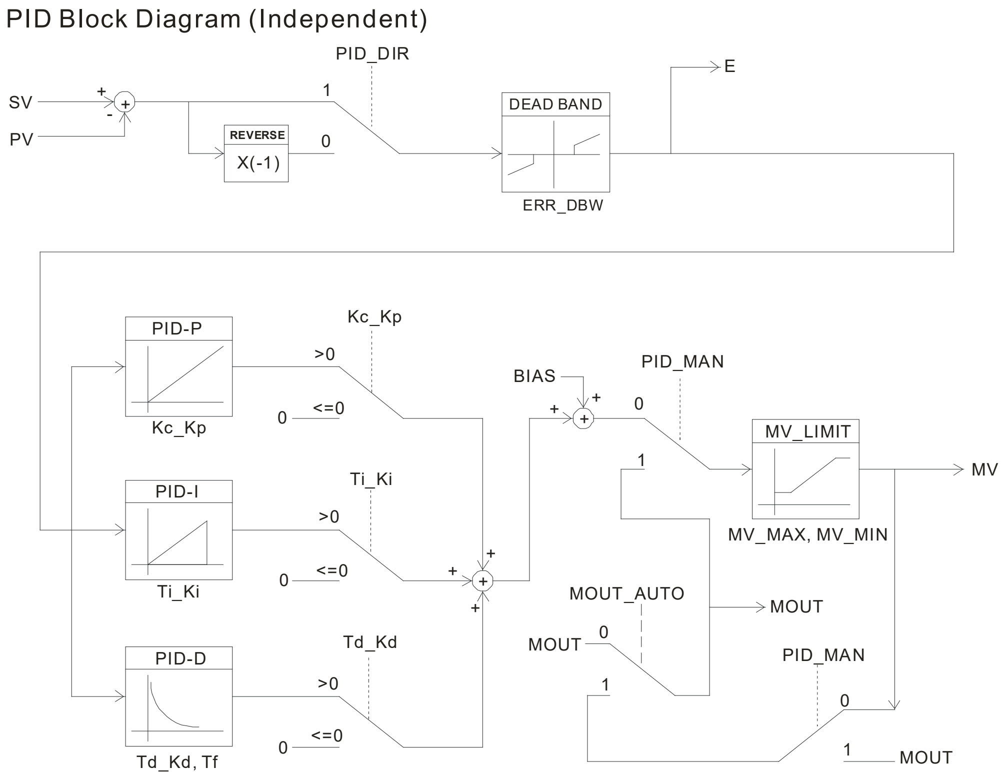
$$CV = K_c\left[E + \frac{1}{T_i}\int_0^t Edt + T_d\frac{dPV}{dt}\right] + BIAS$$

$$E = PV - SV$$

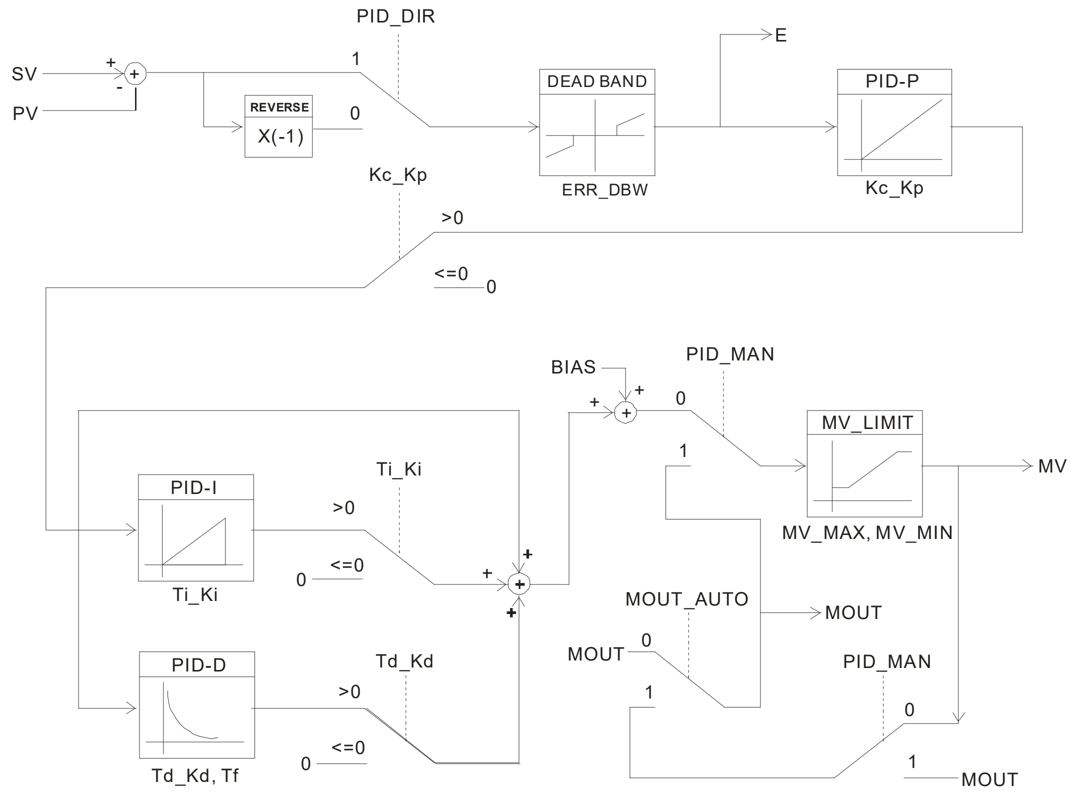
※All the **CVs** stated above are the **MVs** in the formula.

Auto tuning mode: When auto tuning is done, the value will become 0 and switch to the auto tuning mode automatically.

PID Control Block Diagram:



PID Block Diagram (Dependent)



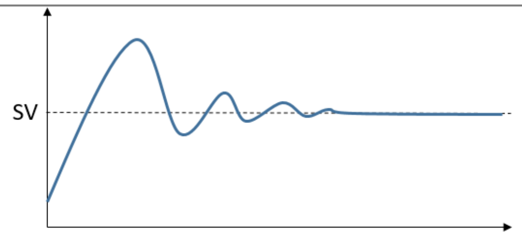
Note:

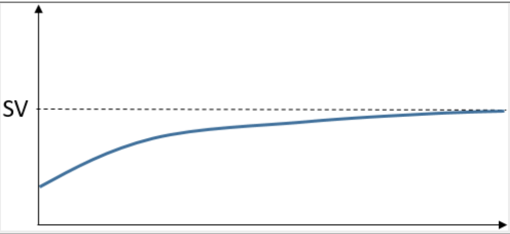
1. When tuning these 3 parameters, Kc_Kp, Ti_Ki and Td_Kd, set the Kc_Kp value first (according to their experiences), and set the Ti_Ki and Td_Kd value to 0. When it can be controlled, users can increase the values of Ti_Ki and Td_Kd. When the value of Kc_Kp is 1, it means that the proportional gain is 100%. That is, the error is increased by a factor of one. When the proportional gain is less than 100%, the error is decreased. When th proportional gain is greater than 100%, the error is increased.

   The parameters which have been tuned automatically are not necessarily suitable for every controlled environment. Therefore, users can further modify the automatically tuned parameters. However, it is suggested to modify the values of Ti_Ki or Td_Kd only.

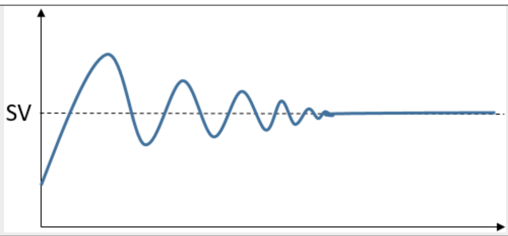
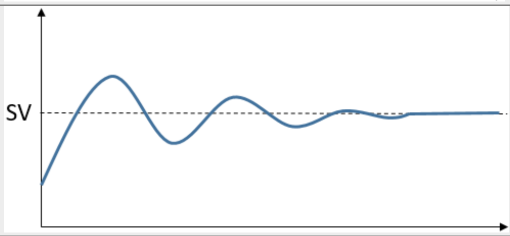
PID Tuning Guide:

P gain

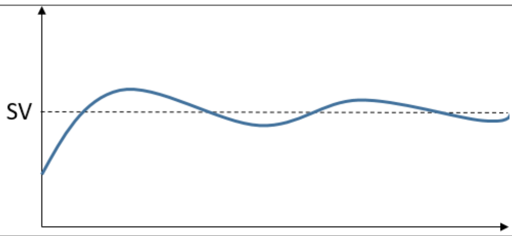
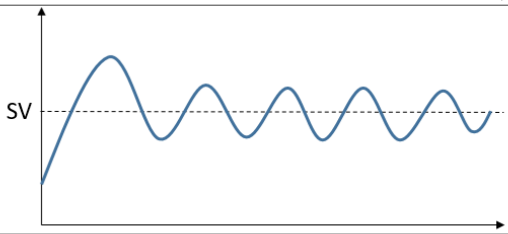
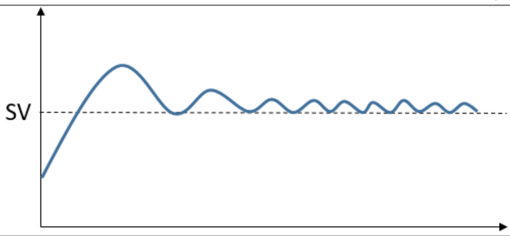
Increase P gain		Achieve the target temperature more quickly with a faster convergence speed, while Overshoot being increased.

Reduce P gain		Prevent overshooting, which would cause longer time to achieve the target temperature with a slower convergence speed.

I gain

Increase I gain (Decreasing integral time Ti)		As increasing Overshoot, oscillation amplitude would be increased as well, to reach the target temperature with a faster convergence speed.
Decrease I gain (Increasing integral time Ti)		The convergence speed would be slower to minimize overshoot and oscillations.

D gain

Increase D gain		Changes in temperature would be eased.
Decrease D gain		Changes in temperature would become rapid.
Special case		To improve the situation that temperature constantly oscillates over the SV, decrease D gain or simply control with PI.

9.5.7 Programmable SV Control Mode

The temperature setting value is not fixed but a setting curve defined by users according to their requirements. By PID control, the temperature input rises along with the defined temperature curve. The device provides 8 patterns and each pattern with 8 steps, a linking parameter, a loop parameter, and a number of execution steps respectively. Each step has 2 parameters (temperature setting value and time). After setting these parameters up, each temperature controller will have its own set of initial pattern and step for creating its own temperature setting curve. Some of the terms are explained as follows:

1. Initial pattern: set the program to start running at a sequential number of patterns.
2. Initial Step: set the program to start running at a sequential number of steps.
3. Running time: set the temperature duration time, if not necessary, it can be set to 0.
4. Step: includes 2 parameter settings: a setting point X and a Running time T, indicating the setting value (SV) to rise to X degree after the time T. If the setting point X is identical to the previous setting, this process is called a Soak, otherwise it is called a Ramp; therefore, this control procedure is also called a Ramp Soak control. The first running procedure is preset as a Soak control, to set the temperature control to setting point X degree in advanced and keep the temperature at X degree, at a duration time of T.
5. Number of loops: Extra loops to be carried out for the pattern. If set to 1, the pattern will be carried out 2 times.
6. Executing step: Number of steps executed for each pattern
7. Execution: Before execution, users need to set up all the parameters. If the setting control is in the running mode, the program will start running from the initial pattern and initial step, carrying out commands one by one by their set orders. When the setting control is in the ending mode, the SV will stop at the final setting. When the setting control is in the stop mode and the temperature will be at the value before the stop, by re-selecting to run, the program will start running from the initial pattern and initial step. When the setting control is in the pause mode and the temperature is at the value before the pause, by re-selecting to run, the program will start running from the step where the program was paused, carrying out the remaining parts. During execution, the SV cannot be set up.

9.5.8 ERROR LED Indicator

When the channel detects the analog input is out of range, the error code will show up and the error LED will also be blinking. Users can disable this functionality to inactivate the error LED blinking, but the error code will still show up.

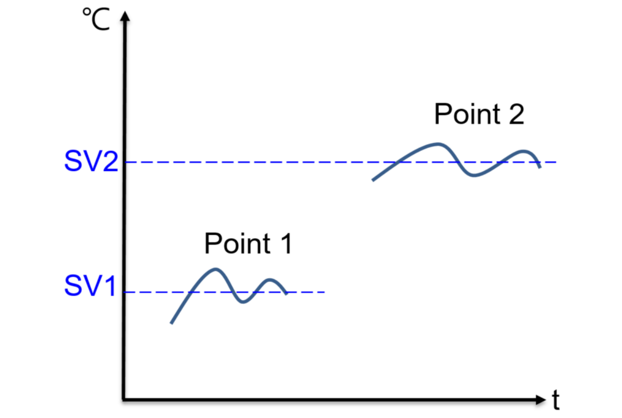
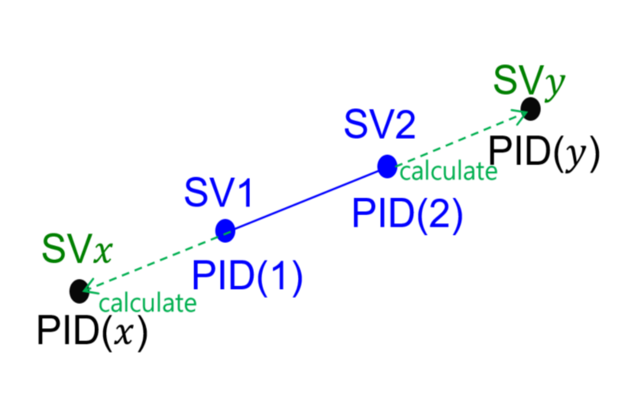
Parameter:

Page	CR	Description	Setting Value
Basic Setup Page	38	Error LED setting when input is out of range	K0=LED blinking (default) K1=LED not blinking

9.5.9 Automatic PID Calculation Feature (Supports TK V1.06/TU V4.18 and Later)

9.5.9.1 Feature Description

As the set value (SV) being changed, the PID parameters would be calculated automatically based on the relation between two set points after performed auto-tuning twice.

1. After auto-tuning two set points, the SV slope of a linear function would be calculated based on the changes of the waveform parameters between two points.	2. When the SVs being changed, the corresponding PID parameters would be calculated according to the calculated slope.
	

9.5.9.2 Setup Instructions

Follow the below steps to set up (take channel 1 for example):

Step 1: Set the first set value (SV) to adjust.

CR Page	CR#	Description	Setting Value
All pages	4	The target value	User-defined

Step 2: Set the current point for auto-tuning.

CR Page	CR#	Description	Setting Value
Automatic PID Calculation Setup Page (Page7)	11	The current set point for auto-tuning.	K1

Step 3: Start auto-tuning.

CR Page	CR#	Description	Setting Value
All pages	8	Auto-tuning	K1 or K2
	6	Setups to run/stop an operation	K1

After auto-tuning is finished, the current set point (Step2 CR) would be changed to the second point (K2) automatically.

Step 4: After both set points being tuned (notice if CR#8 changes back to 0), set the second set value (SV) to adjust (same as step1).

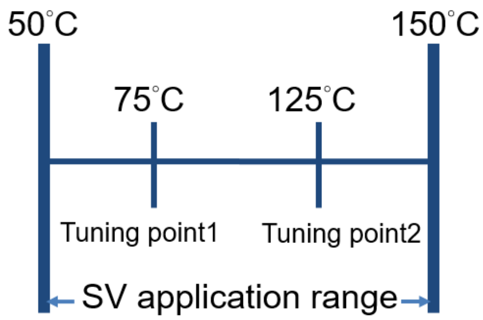
Step 5: Start auto-tuning (same as step3).

Step 6: When the setting is completed, the auto-calculation feature would be switched to ON automatically. And the PID parameters would be output differently according to each SV

9.5.9.3 Additional Instructions

1. Choosing tuning points

   It's suggested that you set the tuning points at 25% and 75% of the SV application range



2. Copying parameters

   Under the same environment, CR#12 to CR#33 on automatic PID calculation page can be copied to the same position of other modules (including internal calculation parameters) to achieve the same calculation result.

3. Adjusting tuning point

   In case that you want to reset a specific tuning point, simply reset the SV and the current tuning point, then perform auto-tuning again.

9.5.10 RS-485 Communication Setup for DVP02TK-S

9.5.10.1 MODBUS Communication Protocol

For DVP02TK-S series, MODBUS supports formats: RTU and ASCII. When RTU is selected, the data length is 8 and the following function codes are supported.

Function code03: read multiple words, up to 32 words can be read.

Function code06: write a single word.

Function code10: write multiple words, up to 32 words can be written.

9.5.10.2 Restore to Factory Settings

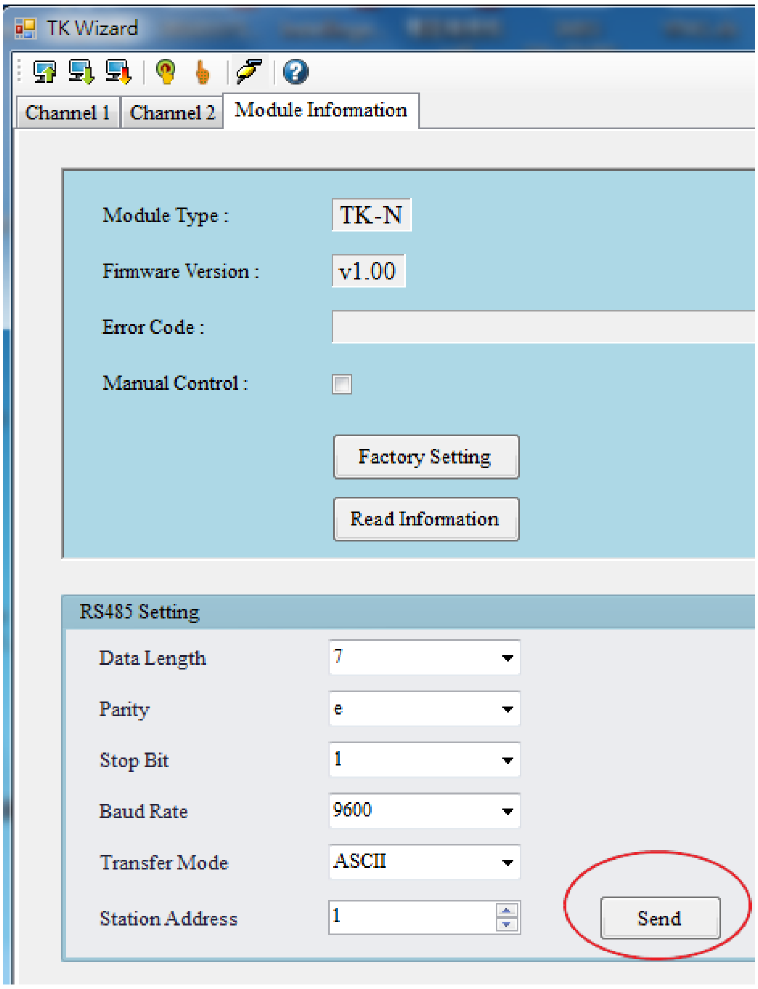
Users can restore the RS-485 communication settings to defaults (9600/7/1/E, station number 1) by switching RUN to STOP and then STOP to RUN after turning on the device within 5 seconds.

9.5.10.3 RS-485 Communication Setup

There are 2 methods to set up RS-485 communication: via TK Wizard or setting the MODBUS address.

- TK Wizard (TKSoft):

  Click the Module Information and set up the baud rate, transfer mode, etc., and then click “Send” to save the settings



- MODBUS address setup:

  Write the value 0x00XY (refer to the following list for X and Y setups) in MODBUS address (0x0F09).

  Example: the value 0x0000 (X=0/Y=0) indicates the baud rate is 9600, data length is 7, stop bits is 1 and the parity is Even.

<table>
<tr><th colspan="5">RS-485 Communication Setting Address = 0x0F09, written value is (0x00XY)</th></tr>
<tr><td rowspan="5">X</td><td rowspan="5">Bit7 to Bit4</td><td rowspan="5">Baud Rate (bps)</td><td>Value</td><td>Description</td></tr>
<tr><td>0</td><td>9600 (default)</td></tr>
<tr><td>1</td><td>19200</td></tr>
<tr><td>2</td><td>38400</td></tr>
<tr><td>3</td><td>57600</td></tr>
</table>

RS-485 Communication Setting Address = 0x0F09, written value is (0x00XY)				
			4	115200
			5 to 16	Reserved
Y	Bit3	Data Length	0	7 (default)
			1	8
	Bit2	Stop Bits	0	1-bit (default)
			1	2-bit
	Bit1 to Bit0	Parity	0	Even (default)
			1	Odd
			2	None
			3	Reserved

	Data Length	Stop Bits	Parity				
Y Value	bit3	bit2	bit1	bit0	Data Bits	Stop Bits	Parity
	(0: 7; 1: 8)	(0: 1-bit; 1: 2-bit)	(0: Even; 1: Odd; 2: None; 3: Reserved)				
0	0	0	0	0	7	1	even
1	0	0	0	1	7	1	odd
2	0	0	1	0	7	1	none
3	0	0	1	1	7	1	even
4	0	1	0	0	7	2	even
5	0	1	0	1	7	2	odd
6	0	1	1	0	7	2	none
7	0	1	1	1	7	2	even
8	1	0	0	0	8	1	even
9	1	0	0	1	8	1	odd
A	1	0	1	0	8	1	none
B	1	0	1	1	8	1	even
C	1	1	0	0	8	2	even
D	1	1	0	1	8	2	odd
E	1	1	1	0	8	2	none
F	1	1	1	1	8	2	even

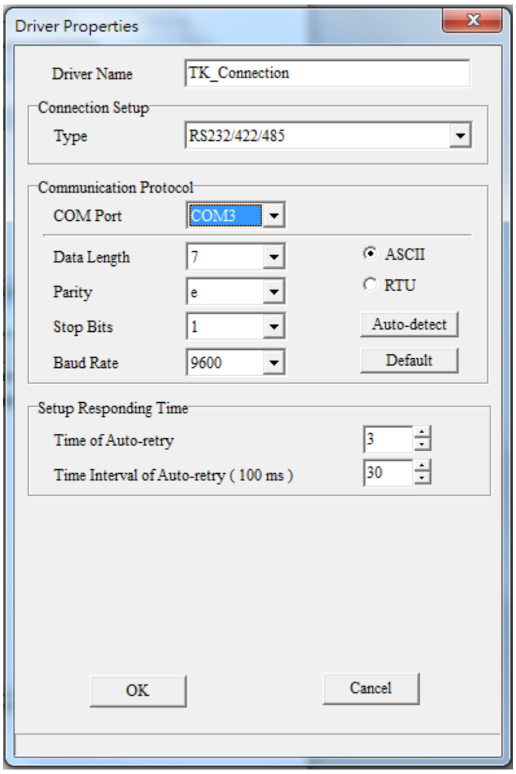
9.5.11 TK Wizard-Connection Setup

9.5.11.1 Restore to Factory Settings for DVP02TK-S

Refer to section 9.5.9.2 for more information on restoring the RS-485 communication settings to defaults (9600/7/1/E, station number 1).

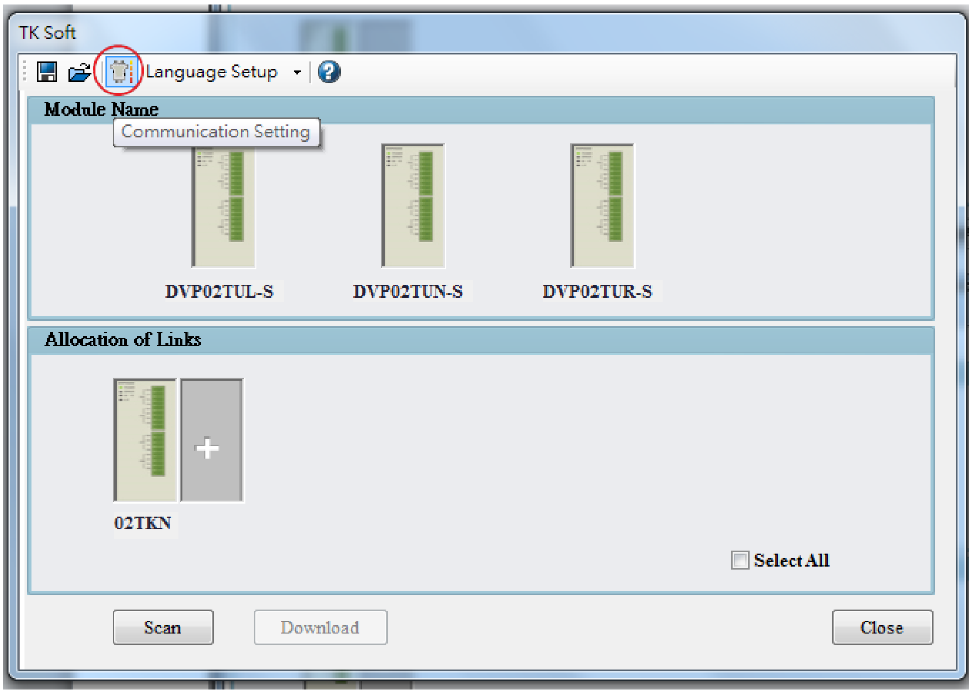
9.5.11.2 COMMGR Setup

Input the communication setting values to create a TK connection in COMMGR. After setting the values, click the Auto-detect button to check if the connection is successfully established. Click OK to confirm the settings.

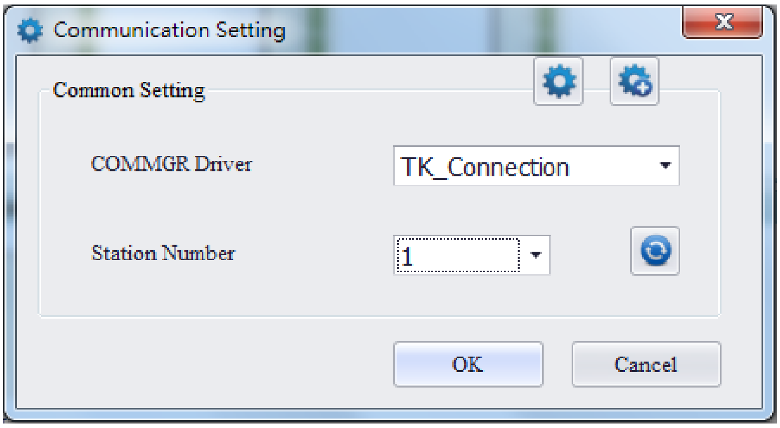


9.5.11.3 Settings in TKSoft

Click the icon Communication Setting in TKSoft to set up the communication.



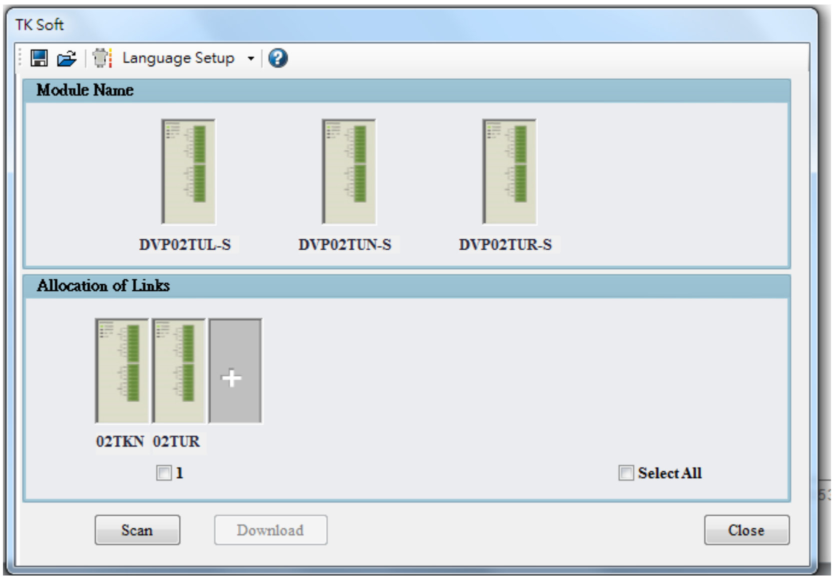
Select the COMMGR driver and the station number.



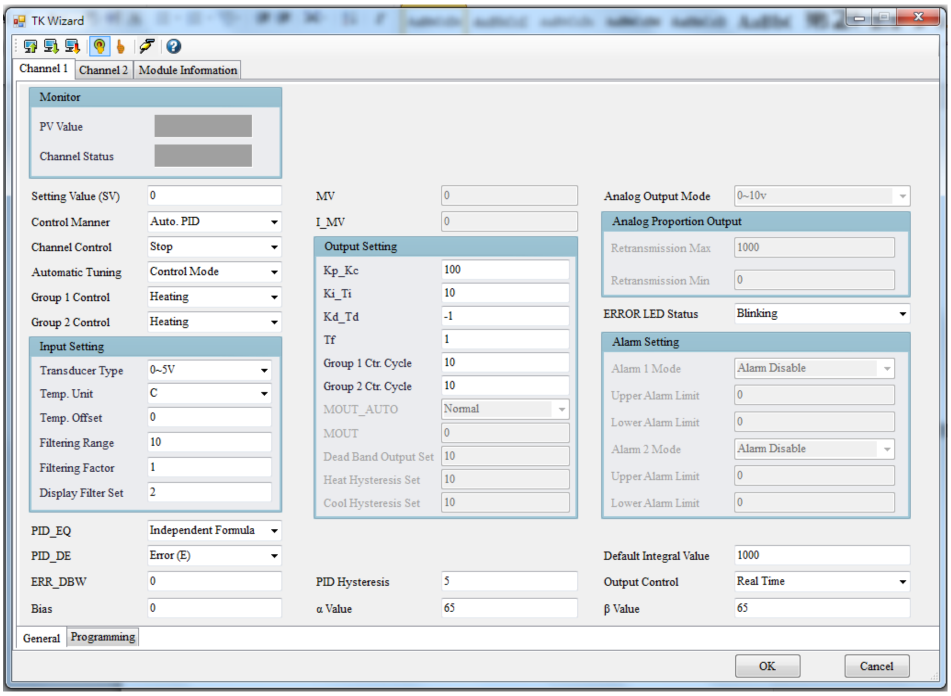
9

9.5.11.4 TKSoft-Scan the Connected Device

Once the setup is completed, click the Scan button to have the system detect the connected modules DVP02TK-S series and DVP02TU-S series on the right side.

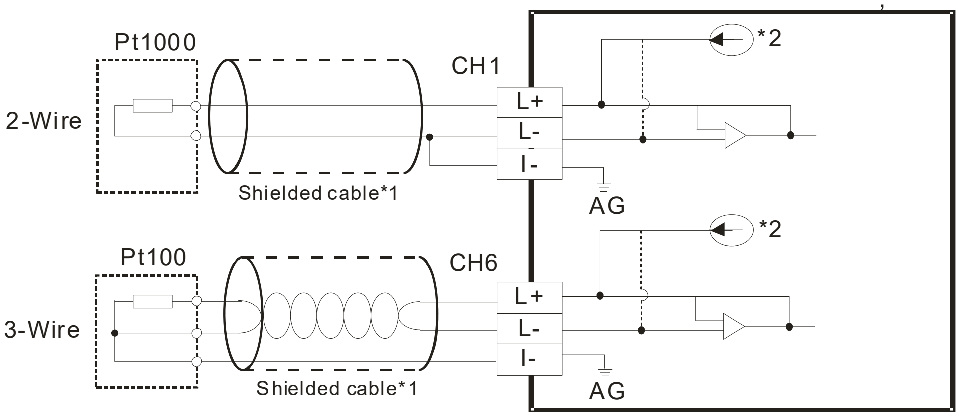


Double-click the DVP02TK-S / DVP02TU-S icon to open the setting page for module parameters.



9.6 Wiring

9.6.1 Wiring DVP04PT-S/DVP06PT-S



Note1: Use only the wires that are packed with the temperature sensor for analog input and separate from other power lines or any wire that may cause noise.

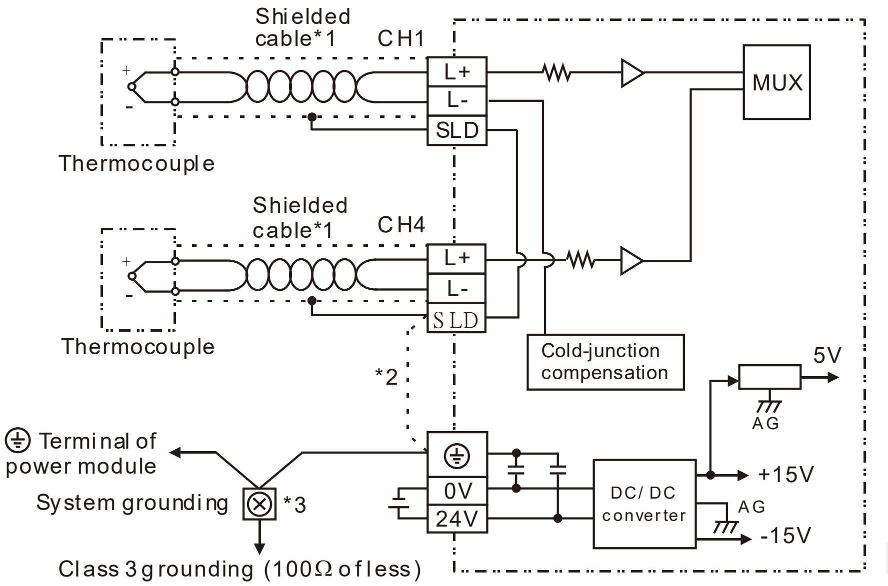
Note2: 3-wire RTD sensor provides a compensation loop that can be used to subtract the wire resistance while the 2-wire RTD sensor has no mechanism to compensate. Use cables (3-wired) with the same length (less than 200 m) and wire resistance of less than 20 ohm.

Note3: If there is noise, please connect the shielded cables to the system earth point, and then ground the system earth point or connect it to the distribution box.

Note4: Please keep wires as short as possible when connecting the module to a device whose temperature is going to be measured, and keep the power cable used as far away from the cable connected to a load as possible to prevent noise interference.

Note5: Please connect ⏚ on the power supply module and ⏚ on the temperature module to a system ground first, and then ground the system ground or connect the system ground to a distribution box.

9.6.2 Wiring DVP04TC-S



Note1: Use only the wires that are supplied with J, K, R, S or T thermocouple sensor. Tighten PLC terminal screws to a torque of 1.95 kg-cm (1.7 in-lbs).

Note2: Terminal SLD is a grounding location for noise suppression.

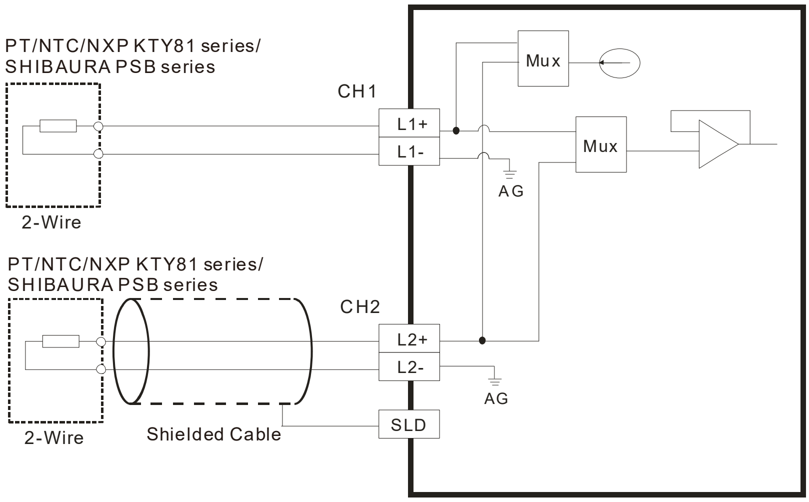
Note3: Please connect ⏚ the power supply module terminal and ⏚ DVP04TC-S temperature measurement module terminal to the system earth ground.

Warning1: Do NOT wire empty terminals.

Warning2: Only use copper conducting wires with a temperature rating of 60/75°C and the length must be less than 50 m.

Warning3: TC modules must run for 30 minutes before they start to take any temperature measurement.

9.6.3 Wiring DVP08NTC-S



Note1: Use only the wires that are packed with the temperature sensor for analog input and separate from other power lines or any wire that may cause noise.

Note2: DVP08NTC-S only supports the 2-wire RTD sensor, which has no mechanism to compensate.

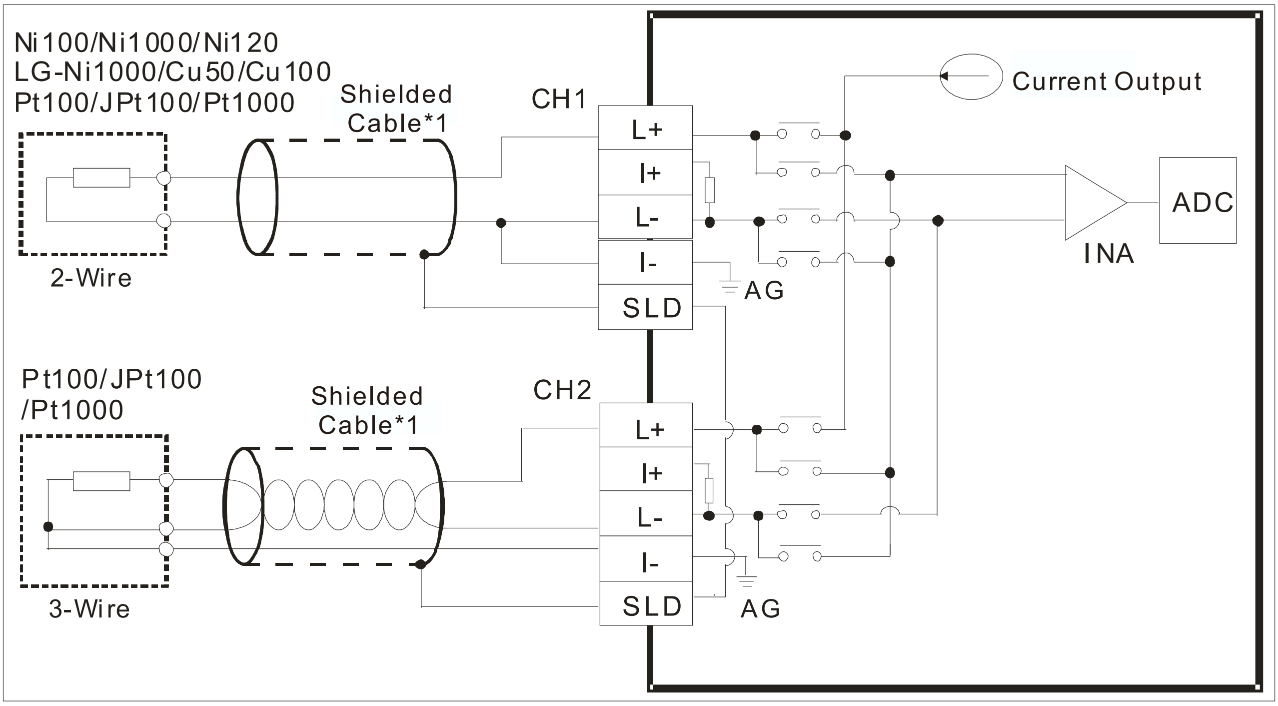
Note3: If there is noise, please connect the shielded cables to the system earth point, and then ground the system earth point or connect it to the distribution box.

Note4: Please keep wires as short as possible when connecting the module to a device whose temperature is going to be measured, and keep the power cable used as far away from the cable connected to a load as possible to prevent noise interference.

Note5: Please connect ⏚ on the power supply module and ⏚ on the temperature module to a system ground, and then ground the system ground or connect the system ground to a distribution box.

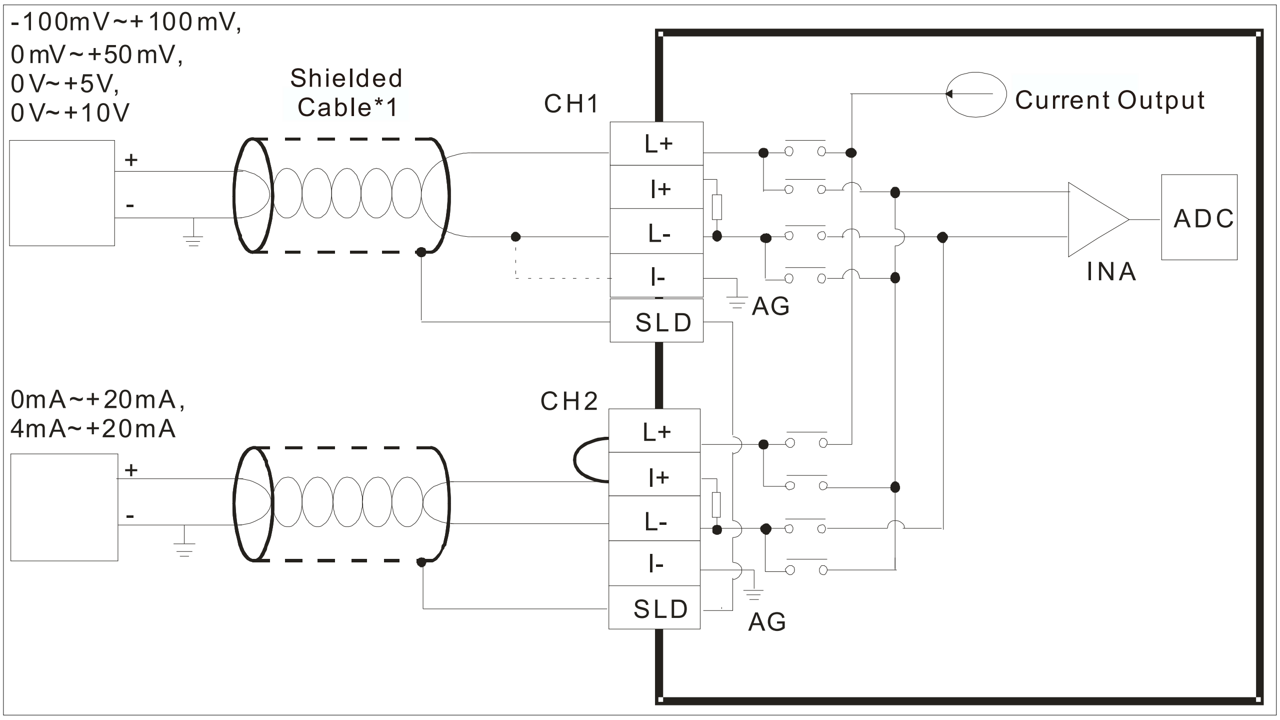
9.6.4 Wiring DVP02TUN-S/DVP02TUR-S/DVP02TUL-S/ DVP02TKN-S/ DVP02TKR-S/DVP02TKL-S

- **Sensor input wiring**



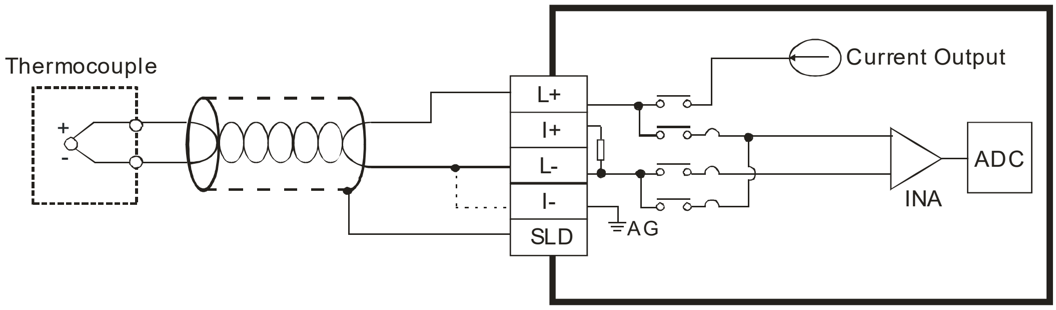
*1. Please isolate it from other power cables.

- **Voltage/Current input wiring**

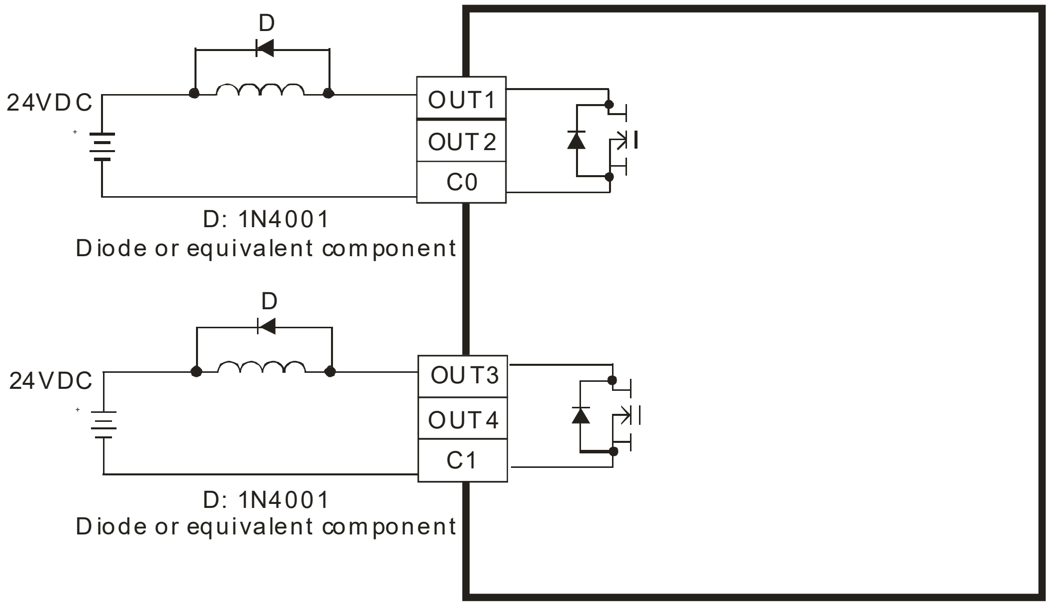


*1. Please isolate it from other power cables.

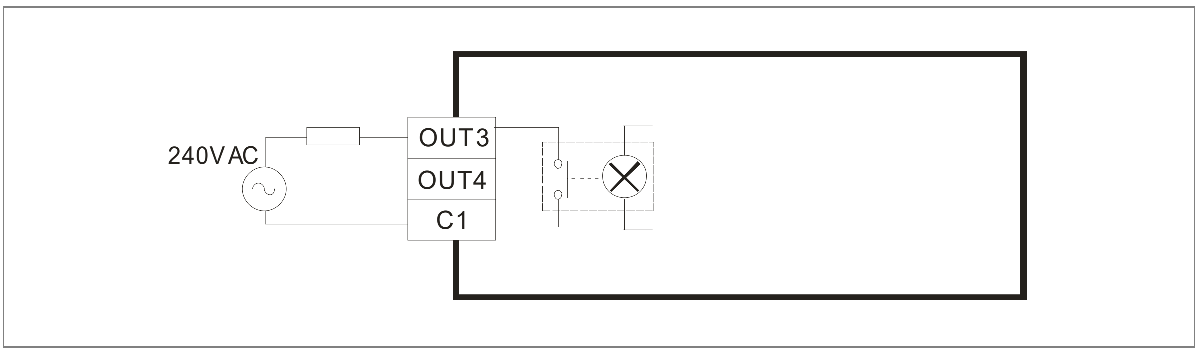
- **Thermocouple input wiring**

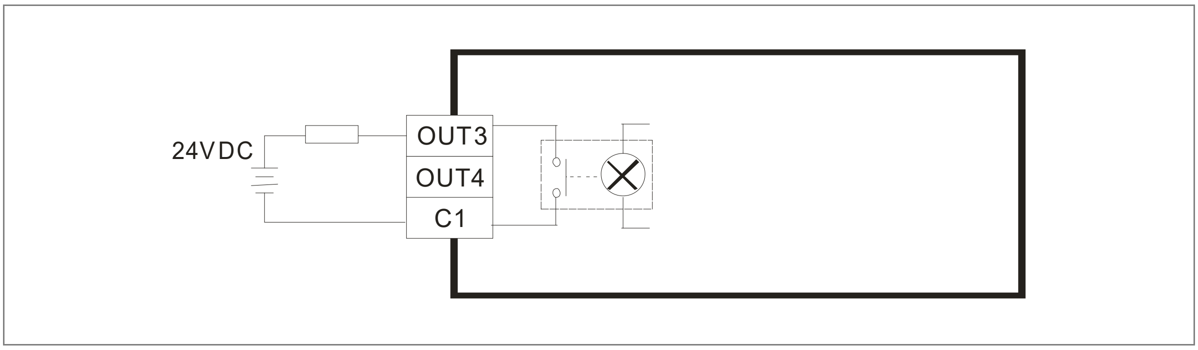


- **DVP02TUN-S/DVP02TKN-S output points wiring**



- **DVP02TUR-S/DVP02TKR-S output points wiring**

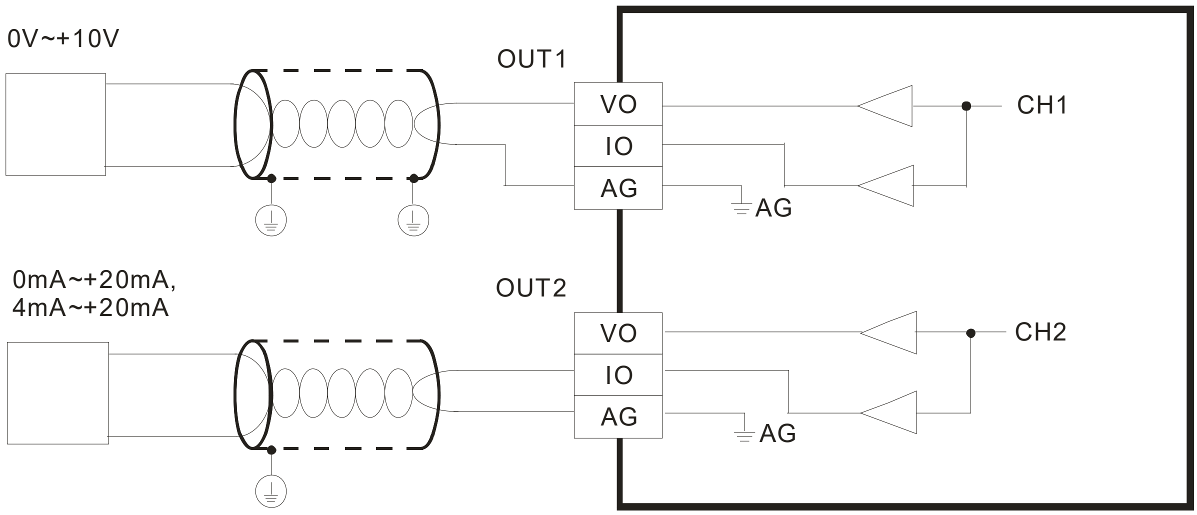




Warning: Electric shock!

Digital relay output points are connected to hazardous locations.

- **DVP02TUL-S/DVP02TKL-S output points wiring**



9.7 Troubleshooting

When an error occurs in PT and TC modules, an error indicator will start blinking. Once you see an error indicator blinking, you can use the FROM instruction to read the error state data stored in CR#30. Bits 0 to 15 of CR#30 determine each error state. It is possible to have two errors at the same time. 0 indicates normal and 1 indicates error. Refer to the following table for more regarding the causes and the solutions for troubleshooting.

<table>
<tr><th>Bit No.</th><th>RUN LED</th><th>ERROR LED</th><th>Description</th><th>Solution</th></tr>
<tr><td>Bit 0</td><td>OFF</td><td>ON</td><td>The external voltage is abnormal.</td><td>Check the power supply.</td></tr>
<tr><td>Bit 1</td><td>Blinking</td><td>Blinking</td><td>The input value exceeds the set upper/lower bound.</td><td>Check the input signal.</td></tr>
<tr><td>Bit 2</td><td rowspan="3">Blinking</td><td rowspan="3">OFF</td><td>Communication address setting error</td><td>Check whether the value written in the communication address is correct and rewrite it</td></tr>
<tr><td>Bit 3</td><td>OFFSET/GAIN error</td><td>Check if the written values of OFFSET and GAIN are correct and rewrite them.</td></tr>
<tr><td>Bit 4</td><td>Temperature sensor abnormal</td><td>Contact the factory.</td></tr>
<tr><td>Bit 5</td><td>Blinking</td><td>Blinking</td><td>The input value is out of range.</td><td>Check the input signal.</td></tr>
<tr><td>Bit 6</td><td rowspan="2">Blinking</td><td rowspan="2">OFF</td><td>Average time setting error</td><td>Check the average time setting.</td></tr>
<tr><td>Bit 7</td><td>FROM/TO instruction error</td><td>Check whether the instruction reads/ writes from/to an incorrect CR.
Check whether the module is properly connected.</td></tr>
<tr><td>Bit 8</td><td rowspan="4">Blinking</td><td rowspan="4">Blinking</td><td>The signal received by channel 1 exceeds the range of analog inputs</td><td>Check the signal received by channel 1</td></tr>
<tr><td>Bit 9</td><td>The signal received by channel 2 exceeds the range of analog inputs</td><td>Check the signal received by channel 2</td></tr>
<tr><td>Bit 10</td><td>The signal received by channel 3 exceeds the range of analog inputs</td><td>Check the signal received by channel 3</td></tr>
<tr><td>Bit 11</td><td>The signal received by channel 4 exceeds the range of analog inputs</td><td>Check the signal received by channel 4</td></tr>
</table>

MEMO

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10

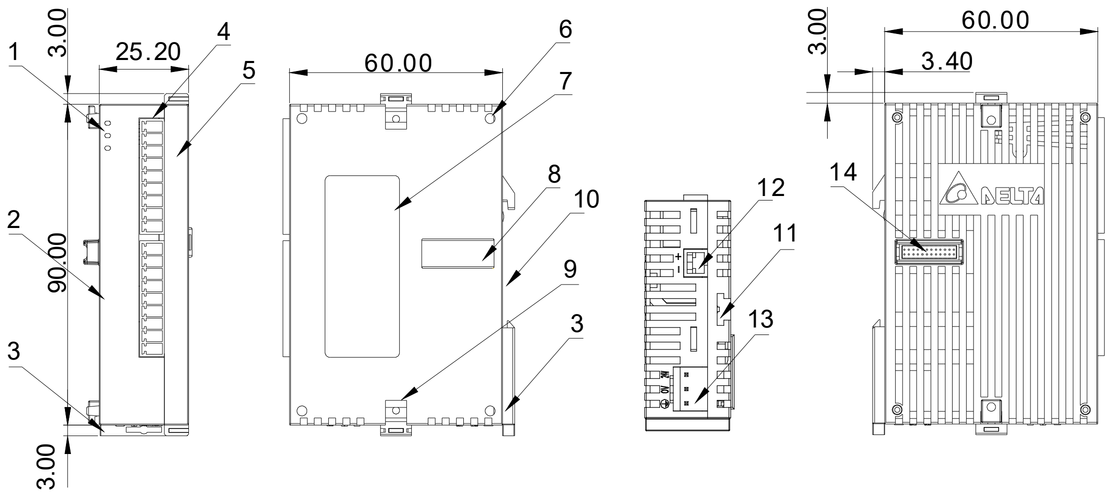
Chapter 10 DVP-S Series Position Control Module

Table of Contents

10.1 DVP01PU-S Specification

Item	Description
Power supply	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Distance instruction	The distance value is set by CR. 1. Setting range: -2,147,483,648 to +2,147,483,647 2. Selectable unit: um, mdeg, 10^{-4} inch, Pulse 3. Selectable rate: 100, 101, 102, 103 4. Selectable position: absolute and relative position instructions.
Speed instruction	The speed value is set by CR. 1. Setting range: -2,147,483,648 to +2,147,483,647 (conversion value of 10 to 200 kPPS) 2. Selectable unit: pulse/s, cm/min, 10 deg/min, inch/min
External output	The photo coupler is adopted for insulation and there are LED indications for all output/input signals. Outputs: FP and RP (line driver output 5 V) Output: CLR is the type of NPN open collector transistor output (5 to 24V DC, less than 20 mA)
External input	The photo coupler is adopted for insulation and there are LED indications for all output/input signals. Input point: START, STOP, LSP, LSN, DOG (contact or open collector transistor, 24 V DC±10%, 5±1 mA) Inputs: ΦA, ΦB (line driver or open collector transistor, 5 to 24 VDC, 6 to 15 mA) Input: PG0 (line driver or open collector transistor, 5 to 24 VDC, 6 to 15 mA)
Pulse output format	Three selectable modes: Pulse/Dir, FP (CW) /RP (CCW), A/B (all modes are line driver output.)
Position program & data transmission	CR data can be read/written via FROM/TO intruction of PLC CPU. The 32-bit data is composed of values of 2 consecutive CR numbers. The 16-bit CR area in the position module is CR#0 to CR#48.
Connect to DVP-PLC	Modules are numbered, starting from 0 to 7, with 0 closest and 7 farthest to the CPU. Up to 8 modules can be connected without occupying any digital I/O.

10.2 Module Profiles and Dimensions



Unit: mm

No.	Name	Description
1	POWER LED indicator	Indicates the state of the power supply ON: the power is on OFF: no power
	Low Voltage indicator	Indicates the low voltage state of the module. ON: the external input power is lower than 19.5 V. OFF: the power supply is normal.
	ERROR indicator	Error state of the module OFF: the module operates normally. Blink: the value in CR#39 is not 0.
2	Model name	Model name of the module
3	DIN rail clip	Secures the module on the set
4	Terminals	The inputs are connected to sensors or switches. The outputs are connected to loads to be driven.
5	Terminal indicator	Terminal number.
6	Mounting hole	For positioning between modules.
7	Nameplate	Label of the module.
8	Extension module connection port	Connects the modules.
9	Extension unit fixing clip	For securing the extension module.
10	DIN rail slot (35 mm)	For the DIN rail.
11	Securing module slot	For securing the extension module.
12	communication port	Provides RS-485 communication wiring.
13	Power input port	Expansion unit power input.
14	Extension port	Connects the PLC or the modules.

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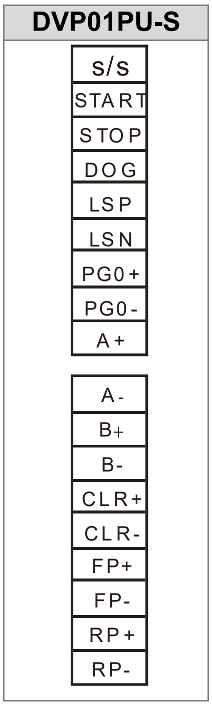
10.2.1 LED Display

POWER	: Power indicator, +5 V internal power
LV	: Low voltage indicator, lit when external input power is lower than 19.5 V
ERROR	: Error indicator (ON/OFF blinking). It will blink when CR#39 is not 0.
LSP	: Right limit input indicator
LSN	: Left limit input indicator
PG0	: Zero signal input indicator
START	: Start input
STOP	: Stop input
DOG	: DOG (near point signal) input
FP	: CW pulse output
RP	: CCW pulse output
ΦA	: A-phase input of manual pulse generator
ΦB	: B-phase input of manual pulse generator
CLR	: Output clear signal

10.3 Terminals



10.3.1 Input/Output Terminal

Description	Terminal	Content	Response
Power supply	+24 V/ 0 V	Power input, 24 VDC (-15 to +20%); Current consumption 70±10 mA; Startup peak current 1.3 A	-
Input	START	Start input terminal	4 ms/12 ms
	STOP	Stop input terminal	4 ms
	LSP/LSN	Limit Stroke of right/left limit	1 ms
	ΦA+/ΦA-	A-phase terminal (+, -) of manual pulse generator input (line driver input)	200 kHz
	ΦB+/ΦB-	B-phase terminal (+, -) of manual pulse generator input (line driver input)	200 kHz
	PG0+/ PG0-	Zero signal input terminal +, - (line driver input)	4 ms
	DOG	Offers two different functions depending on operation mode. (1) It is near-point signal in zero return mode. (2) It is the starting signal for interrupt 1st-speed mode or interrupt 2nd-speed mode.	1 ms
	S/S	Signal common terminal of Inputs (START, STOP, DOG, LSP, LSN)	-
Output	CLR+/ CLR-	Clear signal (clear signal of internal error counter for Servo drive)	4 ms
	FP+/FP-	FP/RP mode: CW pulse output; I/O mode: pulse output; AB-phase mode: A-phase output	200 kHz
	RP+/RP-	FP/RP mode: CCW pulse output; I/O mode: direction output; AB-phase mode: B-phase output	200 kHz

10.4 Control Registers

CR No.					Content	Setting Range
HM	LW	Address	Latched	Attribute		
	#0	H’4190	○	R	Model No.	System setting, Read-only (For the model code, please refer to the model list H’0110.)
#2	#1	H’4191	○	R/W	Pulse rate (A)	Range: 1 to +2,147,483,647 PPS/REV; Initial value: 2,000 pulses/revolution (PLS/REV)
#4	#3	H’4193	○	R/W	Feed rate (B)	Range: 1 to +2,147,483,647 units/REV, Initial value: 1,000 (units*1/REV)
	#5	H’4195	○	R/W	Parameter setting; Initial value: H’0000	b15: STOP input polarity b14: START input polarity b13: START response time b12: Acceleration curve options b11: DOG polarity b10: DOG trigger time b9: Pulse direction b8: Zero return direction b7: LSN input polarity b6: LSP input polarity b5: Pulse output format b4: Position rate setting b3 b2 b1 b0: Unit setting
#7	#6	H’4196	○	R/W	Maximum speed V_{max}	Range: 0 to +2,147,483,647 units*1 (10 to 200 kPPS) *2 Initial value: 200,000 units*1
#9	#8	H’4198	○	R/W	Bias speed V_{bias}	Range: 0 to +2,147,483,647 units*1 (0 to 200 kPPS pulse transfer value)*2; Initial value: 0 unit*1
#11	#10	H’419A	○	R/W	JOG speed V_{JOG}	Range: 0 to +2,147,483,647 units*1 (10 to 200 kPPS pulse transfer value) *2; Initial value: 5,000 units*1
#13	#12	H’419C	○	R/W	Zero return speed V_{RT}	Range: 0 to +2,147,483,647 unit*1 (10 to 200 kPPS pulse transfer value) *2; Initial value: 50,000 units*1
#15	#14	H’419E	○	R/W	Zero return deceleration speed V_{CR}	Range: 0 to +2,147,483,647 units*1 (10 to 200 kPPS pulse transfer value) *2; Initial value: 1,000 units*1
	#16	H’41A0	○	R/W	The number of PG0 in zero return mode N	Range: 0 to +32,767 PLS Initial value: 0 PLS
	#17	H’41A1	○	R/W	The number of pulse in zero return mode P	Range: -32,768 to +32,767 PLS Initial value: 0 PLS
	#18	H’41A2	○	R/W	Zero return mode H Mode	b0: zero return mode, b1: detect DOG falling-edge in zero return mode
#20	#19	H’41A3	○	R/W	Zero point setting (HP)	Range: 0 to ±999,999 units*1 Initial value: 0 unit*1
	#21	H’41A5	○	R/W	Acceleration time T_{acc}	Range: 10 to +32,767 ms Initial value: 100 ms
	#22	H’41A6	○	R/W	Deceleration time T_{dec}	Range: 10 to +32,767 ms; Initial value: 100 ms
#24	#23	H’41A7	×	R/W	Target position (I) P(I)	Range: -2,147,483,648 to +2,147,483,647 units*1 (-2,147,483,648 to +2,147,483,647 pulse transfer value) *2; Initial value: 0 unit*1
#26	#25	H’41A9	×	R/W	Running speed (I) V(I)	Range: -2,147,483,648 to +2,147,483,647 units*1 (10 to 200 kPPS pulse transfer value) *2; Initial value: 1,000 units*1
#28	#27	H’41AB	×	R/W	Target position (II) P(II)	Range: -2,147,483,648 to +2,147,483,647 units*1 (-2,147,483,648 to +2,147,483,647 pulse transfer value) *2; Initial value: 0 unit*1
#30	#29	H’41AD	×	R/W	Running speed (II) V(II)	Range: 0 to +2,147,483,647 units*1 (10 to 200 kPPS pulse transfer value) *2; Initial value: 2,000 unit*1

CR No.					Content	Setting Range
HM	LW	Address	Latched	Attribute		
	#31	H'41AF	×	R/W	Running instruction; Initial value: H'0000	b15: - b14: - b13: CLR output (On/Off) b12: CLR signal output mode b11: - b10: Current position = 0 b9: - b8: Software START b7: ABS/REL Coordinate b6: Zero return start b5: JOG- b4: JOG+ b3: CCW pulse STOP b2: CW pulse STOP b1: Software STOP b0: Error reset
	#32	H'41B0	×	R/W	Work mode; Initial value: H'0001	b15: - b14: - b13: Current position: CR34, 33; current speed: CR36, 35; display unit: 0 → pulse, 1 → unit b12: Return to Initial value b11-b9: MASK setting b8: LSP/LSN stop mode b7: Manual pulse generator range limitation b6: STOP mode b5: Manual pulse generator input operation b4: Variable speed operation mode start b3: Interrupt 2nd-speed position mode start b2: 2nd-speed position mode start b1: Interrupt 1st-speed position mode start b0: 1st-speed position mode start
#34	#33	H'41B1	×	R/W	Current position CP (PLS)	Range display: -2,147,483,648 to +2,147,483,647 PLS Initial value: 0 PLS
#36	#35	H'41B3	×	R	Current speed CS (PPS)	Range display: 0 to +2,147,483,647 PPS Initial value: 0 PPS
	#37	H'41B5	×	R/W	Communication address and Baud rate setting	RS-485 communication address setting: setting range 01 to 254 Initial value: K1. Baud rate setting: 4,800, 9,600, 19,200, 38,400, 57,600, and 115,200 bps. ASCII mode data format is 7 data bits, even parity and 1 stop bit (7 E 1). RTU mode data format is 8 data bits, even parity and 1 stop bit (8 E 1) b0: 4,800 bps (bit/sec.), b1: 9,600 bps (bit/sec.) (Initial value) b2: 19,200 bps (bit/sec.), b3: 38,400 bps (bit/sec.) b4: 57,600 bps (bit/sec.), b5: 115,200 bps (bit/sec.) b6: reserved, b7: 0 for RTU, 1 for ASCII mode, b8 to b15: communication address
	#38	H'41B6	○	R/W	Execution status Initial value: H'XXXX	b15: - b14: - b13: - b12: - b11: - b10: MPG input downward b9: MPG input upward b8: - b7: Route paused indication b6: Position completed indication b5: Error occurred flag b4: CP value overflow b3: Zero return is done b2: CCW pulse is outputting b1: CW pulse is outputting b0: Status indication

<table>
<tr><th colspan="5">CR No.</th><th rowspan="2">Content</th><th rowspan="2" colspan="3">Setting Range</th></tr>
<tr><th>HM</th><th>LW</th><th>Address</th><th>Latched</th><th>Attribute</th></tr>
<tr><td></td><td>#39</td><td>H'41B7</td><td>×</td><td>R</td><td>Error code</td><td colspan="3">Please refer to the following note*3 explanation.
Initial value: H'0000</td></tr>
<tr><td></td><td>#40</td><td>H'41B8</td><td>×</td><td>R/W</td><td>Electronic gearing number of MPG input</td><td colspan="3">Please refer to the following note*4 explanation.
Initial value: H'1</td></tr>
<tr><td></td><td>#41</td><td>H'41B9</td><td>×</td><td>R/W</td><td>Electronic gearing denominator of MPG input</td><td colspan="3">Please refer to the following note*4 explanation.
Initial value: H'1</td></tr>
<tr><td>#43</td><td>#42</td><td>H'41BA</td><td>×</td><td>R/W</td><td>Input frequency of manual pulse generator</td><td colspan="3">The input frequency of manual pulse generator
Initial value: 0</td></tr>
<tr><td>#45</td><td>#44</td><td>H'41BC</td><td>×</td><td>R/W</td><td>Accumulated pulse input no. of manual pulse generator</td><td colspan="3">The count value of CW manual pulse input is " +" symbol, on the contrary, the CCW manual pulse input is "-" symbol. And the count value is nothing to do with the ratio setting of manual electronic gearing (CR#40, #41). Initial value: 0.</td></tr>
<tr><td rowspan="6"></td><td rowspan="6">#46</td><td rowspan="6">H'41BE</td><td rowspan="6">×</td><td rowspan="6">R/W</td><td rowspan="6">Response speed of manual pulse generator</td><th>Value</th><th>Response speed</th><td rowspan="6">When the response speed setting is faster, the instructions of pulse output and manual pulse generator input will achieve better synchronization.
When the response speed setting is slower, the instruction of pulse output is slower than the instruction of manual pulse generator input.
Initial value: 5</td></tr>
<tr><td>≧5</td><td>4 ms (Initial value)</td></tr>
<tr><td>4</td><td>32 ms</td></tr>
<tr><td>3</td><td>108 ms</td></tr>
<tr><td>2</td><td>256 ms</td></tr>
<tr><td>1 or 0</td><td>500 ms</td></tr>
<tr><td rowspan="10"></td><td rowspan="10">#47</td><td rowspan="10">H'41BF</td><td rowspan="10">×</td><td rowspan="10">R</td><td rowspan="10">Terminal status</td><th>bit #</th><th>Status</th><th>Description</th></tr>
<tr><td>b0</td><td>START input</td><td>When START input is On, b0 is On.</td></tr>
<tr><td>b1</td><td>STOP input</td><td>When STOP input is On, b1 is On.</td></tr>
<tr><td>b2</td><td>DOG input</td><td>When DOG input is On, b2 is On.</td></tr>
<tr><td>b3</td><td>PG0 input</td><td>When PG0 input is On, b3 is On.</td></tr>
<tr><td>b4</td><td>LSP input</td><td>When LSP input is On, b4 is On.</td></tr>
<tr><td>b5</td><td>LSN input</td><td>When LSN input is On, b5 is On.</td></tr>
<tr><td>b6</td><td>A phase input</td><td>When A phase input is On,
b6 is On.</td></tr>
<tr><td>b7</td><td>B phase input</td><td>When B phase input is On,
b7 is On.</td></tr>
<tr><td>b8</td><td>CLR output</td><td>When CLR output is On, b8 is On.</td></tr>
<tr><td></td><td>#48</td><td>H'41C0</td><td>○</td><td>R</td><td>System version</td><td colspan="3">System version is in hexadecimal. e.g. software V1.00 is for H'0100.</td></tr>
</table>

*1: Unit setting varies based on b0 and b1 setting of CR#5.

*2: Use max. pulse output if the upper limit is exceeded. Use min. pulse output if the lower limit is exceeded.

*3. When ERROR LED is on, it indicates DVP01PU-S hardware malfunction or incorrect parameter setting when the error LED flashes. ERR code is recorded in CR#39.

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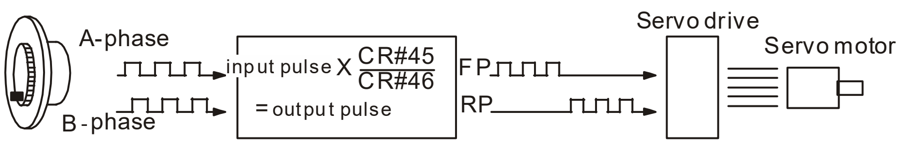
Error code	Description	Error code	Description
H’0000	No error	H’0014	JOG speed (V_{JOG}) setting error
H’0001	Target position (I) setting error	H’0020	CW pulse is forbidden
H’0002	Target address (II) setting error	H’0021	CCW pulse is forbidden
H’0010	Running speed (I) setting error	H’0030	Low voltage
H’0011	Running speed (II) setting error	H’0080	Hardware error in internal memory
H’0012	Zero return deceleration (V_{CR}) setting error	H’0081	Data writing error in internal memory
H’0013	Zero return (V_{RT}) setting error		

*4. When the working mode CR#32 b5 is set to On, it means that the manual pulse generator input working mode is started.

A. Manual pulse generator provides A/B phase pulses to ΦA and ΦB inputs. The relationship between the FP/RP output and the input pulse is as shown in the figure below:



B. During operation, if LSP or LSN is started, the output will stop immediately. If LSP is started, CW pulse is prohibited, and CCW pulse is allowed. If LSN is started, CCW pulse is prohibited, and CW pulse is allowed.

C. Default for Positioning completed is CR#38 b6=Off. When positioning is completed, positioning completion indication will become **CR#38 b6=On**.

D. Output operating speed is proportional to the input frequency of manual pulse generator and electronic gears (CR#40, CR#41).

※ CR#0 to CR48: you can use the corresponding addresses H’4190 to 41C0 to read/write data via RS-485 communication.

1. Baud rate supportive: 4,800, 9,600, 38,400, 57,600, and 115,200 bps.
2. Modbus ASCII/RTU: ASCII mode is 7 bits, even bit and 1 stop bit (7, E, 1). RTU mode is 8 bits, even bit and 1 stop bit (8, E, 1).
3. Function code: 03’H for reading data from CRs; 06’H for writing one word in CRs; 10’H for writing many words in CRs.

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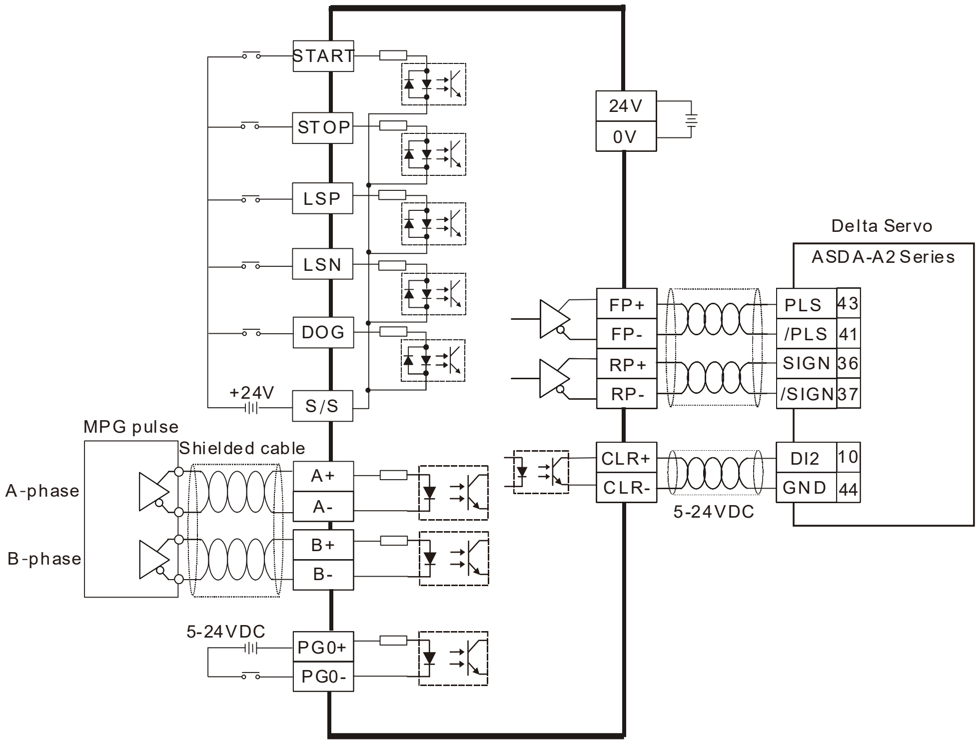
10.5 Wiring



1. Please use 22-16AWG (1.5 mm) wiring (either single or multiple core) for I/O wiring terminals. PLC terminal screws should be tightened to 1.90kg-cm (1.65 lb-in). Use copper conductors only, 60/75oC.
2. DO NOT arrange the wiring of I/O signal wires or power supply in the same wiring duct.
3. Make sure the terminals ⏚ of the power module and DVP01PU-S are properly grounded or connected to the cover of a power distribution cabinet.
4. DO NOT wire to the null terminal ●.
5. Use only 60/75°C copper conductors.

10.6 Troubleshooting

When the DVP01PU-S module encounters an error, the ERROR indicator will be illuminated. Use the FROM instructions to read the error status data register (CR#39). Refer to the table below to identify the error and execute the corresponding solutions.

No.	ERROR LED	Description	Solution
H’0000	OFF	Normal	
H’0001	Blinking	Target position (I) setting error	1. Target position (I) cannot be 0. 2. If at the positive limit, the target position (I) should not be a positive value. 3. If at the negative limit, the target position (I) should not be a negative value.
H’0002	Blinking	Target position (II) setting error	Target position (II) cannot be 0.
H’0010	Blinking	Operating speed (I) setting error	Check if the speed setting is within this range: VMAX>V (I) >VBIAS
H’0011	Blinking	Operating speed (II) setting error	Check if the speed setting is within this range: VMAX>V (II) >VBIAS
H’0012	Blinking	Zero return deceleration (V_{CR}) setting error	Check if the speed setting is within this range: VRT>VCR
H’0013	Blinking	Zero return (V_{RT}) setting error	Check if the speed setting is within this range: VMAX>VRT>VBIAS
H’0014	Blinking	JOG speed (V_{JOG}) setting error	Check if the JOG speed exceeds the maximum speed VMAX.
H’0020	Blinking	CW pulse is forbidden	Check if the running instruction CR#31 bit2 is set correctly and verify whether the executed instruction runs in the clockwise direction.
H’0021	Blinking	CCW pulse is forbidden	Check if the running instruction CR#31 bit3 is set correctly and verify whether the executed instruction runs in the clockwise direction.
H’0030	Blinking	Low voltage signal	Check whether the module input voltage is correct.
H’0080	Blinking	Hardware error in internal memory	Reset the module
H’0081	Blinking	Data writing error in internal memory	Reset the module

MEMO

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Chapter 11 DVP-S Series Left-Side High-Speed Analog Input/Output Module

Table of Contents

11.1 General Specifications

11.1.1 DVP04AD-SL Specifications

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- **Electrical Specifications**

Model name	DVP04AD-SL
Number of inputs	4
Analog-to-digital conversion	Voltage input/current input
Power supply	24 VDC (20.4 VDC to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block
Response time	250 μs/channel
Connect to DVP-PLC CPU	Connect to the left side of CPU, numbered from 100 to 107, according to the position of module from the closest to farthest to CPU.
Weight	106.5 g

- **Functional specifications**

Analog/digital module	Voltage input				Current input		
Analog input channels	4 channels per module						
Range of analog input	±10 V	±5 V	0 to 5 V	1 to 5 V	±20 mA	0 to 20 mA	4 to 20 mA
Range of digital conversion	±32,000	±32,000	0 to 32,000	0 to 32,000	±32,000	0 to 32,000	0 to 32,000
Hardware input limit*1	±10.12V	±5.06 V	-0.06 to 5.06 V	0.952 to 5.048 V	±20.24 mA	-0.24 to 20.24 mA	3.808 to 20.192 mA
Digital conversion limit*2	±32,384	±32,384	-384 to 32,384	-384 to 32,384	±32,384	-384 to 32,384	-384 to 32,384
Hardware resolution	16 bits	16 bits	15 bits	15 bits	16 bits	15 bits	15 bits
Input impedance	≧1 MΩ				250 Ω		
Absolute input range*3	± 15 V				± 32 mA		
Digital data format	16-bit two’s complement number, 15 significant bits						
Average function	Yes, CR#8 to CR#11, with setting range: K1 to K20.						
Self-diagnosis function	Detecting if upper and lower limits are exceeded or channel disconnection occurs.						
Overall Accuracy	25° C / 77° F: The allowed error range is ±0.3% of full scale. 0° C to 55° C / 32° F to 131° F: The allowed error range is ±0.5% of full scale.						
Response time	250 μs/channel						
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. If the input signal exceeds the hardware input limit, the module only shows the maximum value. If the input signal is below the lower limit, it only shows the minimum value.

*2. If the input signal exceeds the hardware input limit, it also exceeds the digital conversion limit, and a conversion limit error appears. For example, in the voltage input mode (-10 V to +10 V), when the input signal is -10.25 V, exceeding the hardware lower limit, it also exceeds the conversion lower limit. The module uses the lower limit value (-32384) as the input signal and a conversion limit error appears.

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

11.1.2 DVP04DA-SL Specifications

- **Electrical specifications**

Module name	DVP04DA-SL
Number of outputs	4
Digital-to-analog conversion	Voltage output/ Current output
Supply voltage	24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Connector type	Removable terminal block
Short circuit protection	The module is with short circuit protection, but if the duration of a short circuit is too long, it can cause circuit damage. Current output can be open circuit.
Connect to DVP-PLC CPU	Connect to the left side of CPU, numbered from 100 to 107, according to the position of module from the closest to farthest to CPU.
Weight	107 g

- **Functional specifications**

Digital/analog module	Voltage output		Current output	
Analog output channels	4 channels per module			
Rated output range	±10 V	0 to 10 V	0 to 20 mA	4 to 20 mA
Digital conversion range	±32,000	0 to 32,000	0 to 32,000	0 to 32,000
Digital conversion limit	±32,000	0 to 32,000	0 to 32,000	0 to 32,000
Hardware resolution	16 bits	15 bits	15 bits	15 bits
Maximum output current	10 mA		-	
Load impedance	≧1 kΩ		≦500 Ω	
Output impedance	≦0.5 Ω		≧1 MΩ	
Overall accuracy	25° C / 77° F: The allowed error range is ±0.3% of full scale. 0° C to 55° C / 32° F to 131° F: The allowed error range is ±0.5% of full scale.			
Response time	250 μs/channel			
Digital data format	16-bit two's complement number, 15 significant bits.			
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			

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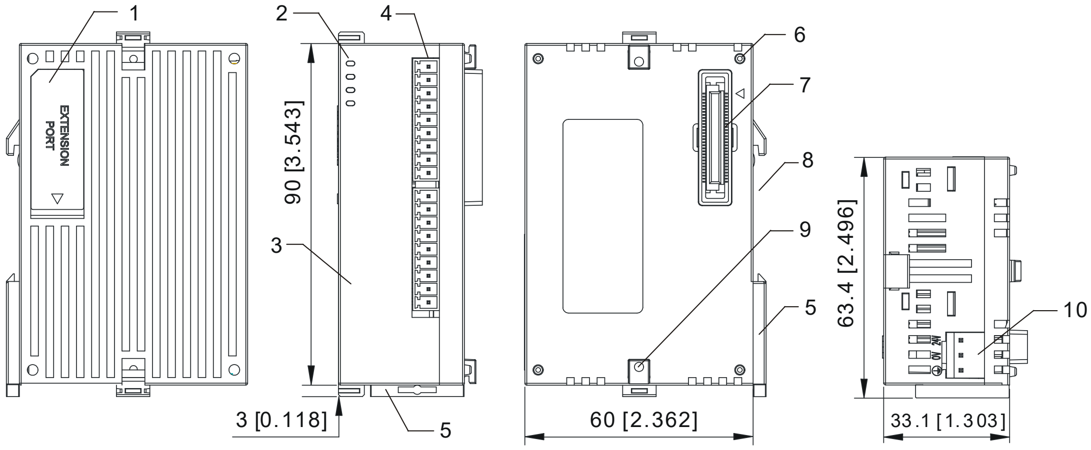
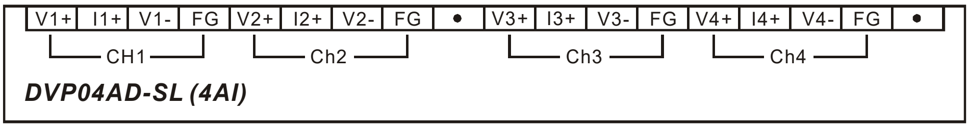
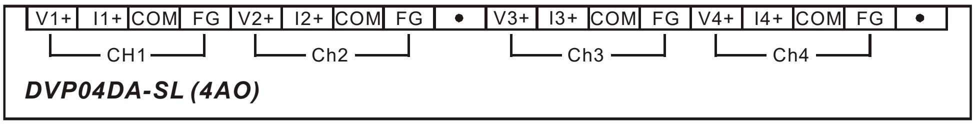
11.2 Module Profiles and Dimensions



Unit: mm

No.	Name	Description
1	Extension module connection port	Connect the modules.
2	POWER LED indicator	Indicates the state of the power supply ON: the power is on OFF: no power
	ERROR LED indicator	Error state of the module. ON: A serious module error has occurred OFF: the module is normal. Blinking (0.2 seconds ON/OFF): A non-serious module error occurs, can NOT operate normally
	Run LED indicator	Indicates the operating state of the module.
3	Model name	Model name of the module.
4	I/O Terminals	The inputs are connected to sensors. The outputs are connected to loads to be driven.
5	DIN rail securing clip	Secure the module on the set.
6	Extension unit positioning hole	For positioning between modules.
7	Extension port	Connect the PLC or the modules.
8	DIN rail slot (35 mm)	For the DIN rail.
9	Extension unit fixing clip	For securing the extension module.
10	Power input port	Expansion unit power input.

11.3 Terminals

DVP04AD-SL	
DVP04DA-SL	

11.4 Control Registers

11.4.1 DVP04AD-SL Control Registers

CR#	Attrib.		Register name	Explanation
#0	O	R	Model name	Set up by the system: DVP04AD-SL model code = H’4400
#1	O	R	Firmware version	Displays the current firmware version in hex.
#2	X	R/W	CH1 input mode setting	Input mode: Default = H’0000. Take CH1 for example: Mode 0 (H’0000): Voltage input (±10 V) Mode 1 (H’0001): Current input (±20 mA) Mode 2 (H’0002): Current input (0 to +20 mA) Mode 3 (H’0003): Current input (+4 to +20 mA) Mode 4 (H’0004): Voltage input (±5 V) Mode 5 (H’0005): Voltage input (0 V to +5 V) Mode 6 (H’0006): Voltage input (1 V to +5 V) Mode -1 (H’FFFF): Channel unavailable Note: When the input mode is configured to "Mode-1 (H'FFFF): Disabled", the measured value will be fixed and displayed as the maximum positive integer, 32767 (H'7FFF).
#3	X	R/W	CH2 input mode setting	
#4	X	R/W	CH3 input mode setting	
#5	X	R/W	CH4 input mode setting	
#8	X	R/W	CH1 sampling range	Set sampling range in CH1 to CH4: Range = K1 to K20 Default = K10
#9	X	R/W	CH2 sampling range	
#10	X	R/W	CH3 sampling range	
#11	X	R/W	CH4 sampling range	
#12	X	R	CH1 average input value	Average value of input signals at CH1 to CH4
#13	X	R	CH2 average input value	
#14	X	R	CH3 average input value	
#15	X	R	CH4 average input value	
#16	X	R	CH1 present input value	Present value of input signals at CH1 to CH4
#17	X	R	CH2 present input value	
#18	X	R	CH3 present input value	
#19	X	R	CH4 present input value	
#20	X	R/W	Set value of CH1 upper bound	Set the value of CH1 to CH4 upper bound. Default = K32767.
#21	X	R/W	Set value of CH2 upper bound	
#22	X	R/W	Set value of CH3 upper bound	
#23	X	R/W	Set value of CH4 upper bound	
#24	X	R/W	Set value of CH1 lower bound	Set the value of CH1 to CH4 lower bound.

CR#	Attrib.		Register name	Explanation
#25	X	R/W	Set value of CH2 lower bound	Default = K-32768.
#26	X	R/W	Set value of CH3 lower bound	
#27	X	R/W	Set value of CH4 lower bound	
#28	X	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 to CH4. Default = K0, unit= LSB.
#29	X	R/W	Adjusted Offset value of CH2	
#30	X	R/W	Adjusted Offset value of CH3	
#31	X	R/W	Adjusted Offset value of CH4	
#34	X	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value in CH1 to CH4. Default = K16,000, unit= LSB.
#35	X	R/W	Adjusted Gain value of CH2	
#36	X	R/W	Adjusted Gain value of CH3	
#37	X	R/W	Adjusted Gain value of CH4	
※ Input Mode 2 (0 mA to 20 mA), Mode 3 (4 mA to 20 mA), Mode 5 (0 V to 5 V), and Mode 6 (1 V to 5 V) do not support adjusted OFFSET and GAIN value. ※ When input mode changes, the adjusted OFFSET and GAIN value automatically resets.				
#42	X	R/W	Function: Return to default setting	b0 to b3: corresponding to CH1 to CH4 b4 to b15: reserved Default = H’0000. Give CH1 setting for example: When b0 is set to 1, all settings are reset to default settings.
#43	X	R	Error state	Register for storing all error state. Refer to the table of error states for more information. Default = H’0000.
Symbols: O means latched. X means not latched. R means the CR can be read by using FROM instruction. W means the CR can be written data by using TO instruction. LSB (Least Significant Bit): 1. Voltage input: 1_{LSB}=10 V/32,000=312.5 μV 2. Current input: 1_{LSB}=20 mA/32,000=625 nA				

※ CR#43 Error state value. See the table below.

Bit	Error State	Content Value	Bit	Error State	Content Value
b0	K1 (H’0001)	Power supply error	b1	K2 (H’0002)	Hardware error
b2	K4 (H’0004)	Mode setting error	b3	K8 (H’0008)	Reserved
b4	K16 (H’0010)	CH1 Upper / lower bound error	b5	K32 (H’0020)	CH2 Upper / lower bound error
b6	K64 (H’0040)	CH3 Upper / lower bound error	b7	K128 (H’0080)	CH4 Upper / lower bound error
b8	K256 (H’0100)	CH1 Conversion error	b9	K512 (H’0200)	CH2 Conversion error
b10	K1024 (H’0400)	CH3 Conversion error	b11	K2048 (H’0800)	CH4 Conversion error
b12	K4096 (H’1000)	Reserved	b13	K8192 (H’2000)	Hardware error
b14	K16384 (H’4000)	Default setting error	b15	K32768 (H’8000)	Reserved
Note: Each error state is determined by a corresponding bit and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error.					

※ **Adjust A/D Conversion Curve**

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

※ Input Mode 2(0 mA to 20 mA), Mode 3 (4 mA to 20 mA), Mode 5 (0 V to 5 V), Mode 6 (1 V to 5 V) do not support adjusted OFFSET and GAIN value.

- Equation for voltage input Mode 0

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

Y=Digital output, X=Voltage input
Resolution: 0.3125 mV=20 V/64,000

- Equation for voltage input Mode 4/ Mode 5

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

Y=Digital output, X=Voltage input
Resolution: 0.15625 mV=10 V/64,000=5 V/32,000

- Equation for current input Mode 1/ Mode 2

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

Y=Digital output, X=Current input
Resolution: 0.625 μA=40 mA/64,000=20 mA/32,000

Gain: The Gain value is got by dividing the corresponding voltage/current input value of the digital output value 16,000 by the resolution for a mode.

Offset: The Offset value is got by dividing the corresponding voltage/current input value of the digital output value 0 by the resolution for a mode.

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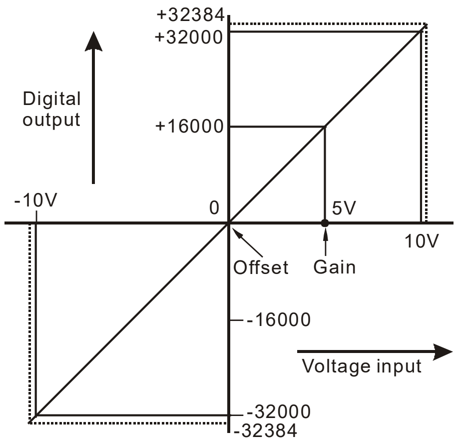
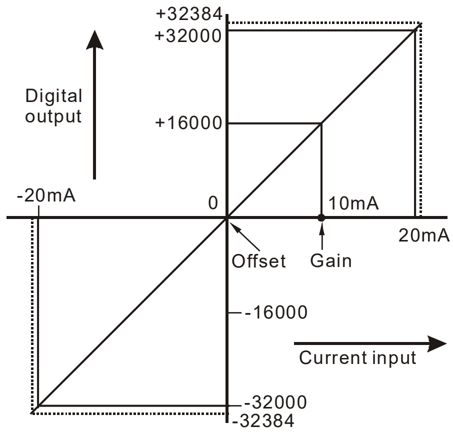
※ A/D Conversion Curve

Mode 0	-10 to +10 V, Gain=16,000 (=$5\ \mathrm{V}/312.5\ \mathrm{uV}$), Offset=0
Mode 1	-20 to +20 mA, Gain=16,000 (=$10\ mA/625\ nA$), Offset=0
Range of digital data	-32,000 LSB to +32,000 LSB
Max./Min. range of digital data	-32,384 LSB to +32,384 LSB

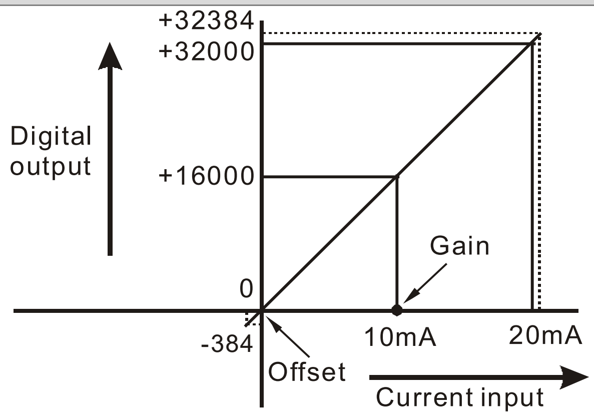
Mode 0 | **Mode 1**

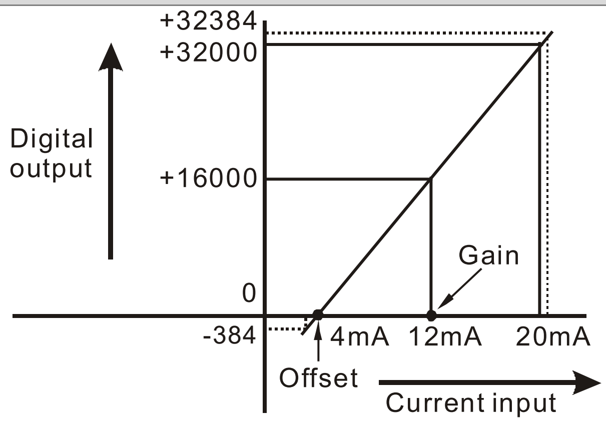




Mode 2	0 to +20 mA, Gain=16,000 (=$10\ mA/625\ nA$), Offset=0
Mode 3	4 to +20 mA, Gain=19,200 (=$12\ mA/625\ nA$), Offset=6,400 (=$4\ mA/625\ nA$)
Range of digital data	0 LSB to +32,000 LSB
Max./Min. range of digital data	-384 LSB to +32,384 LSB

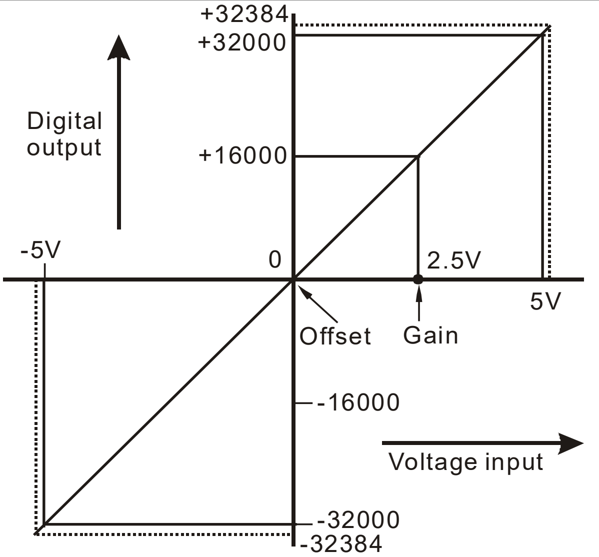
Mode 2 | **Mode 3**





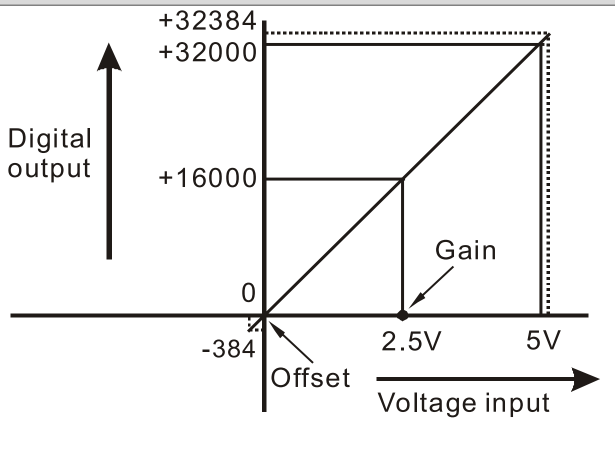
Mode 4	-5 to +5 V, Gain=16,000 (=$2.5\ V/156.25\ uV$), Offset=0
Range of digital data	-32,000 $_{\text{LSB}}$ to +32,000 $_{\text{LSB}}$
Max./Min. range of digital data	-32,384 $_{\text{LSB}}$ to +32,384 $_{\text{LSB}}$

Mode 4

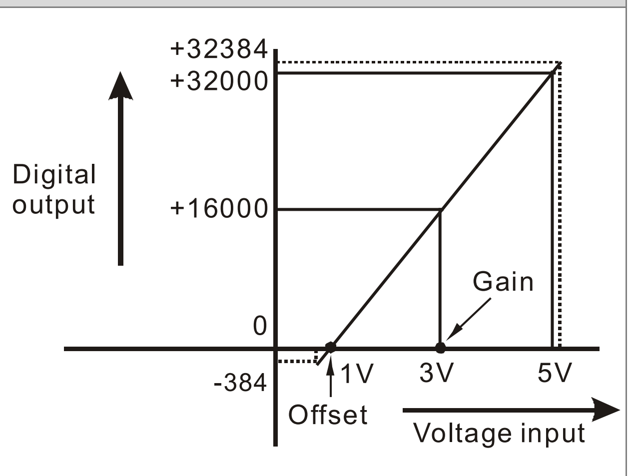


Mode 5	0 to +5 V, Gain=16,000 (=$2.5\ V/156.25\ uV$), Offset=0
Mode 6	1 to +5 V, Gain=19,200 (=$2.5\ V/156.25\ uV$), Offset=6,400 (=$1\ V/156.25\ uV$)
Range of digital data	0 $_{\text{LSB}}$ to +32,000 $_{\text{LSB}}$
Max./Min. range of digital data	-384 $_{\text{LSB}}$ to +32,384 $_{\text{LSB}}$

Mode 5



Mode6



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11.4.2 DVP04DA-SL Control Registers

CR#	Attrib.		Register name	Explanation
#0	O	R	Model name	System used; data length is 8 bits (b7 to b0). Model code = H'4401. User can read the data from program to check if there is I/O module.
#1	O	R	Firmware version	Displays the current firmware version in hex. For example: 1.0A means CR#1 = H'010A.
#2	X	R/W	CH1 output mode setting	Output mode: Default = H'0000. Take CH1 for example: Mode 0 (H'0000): Voltage output (±10 V) Mode 1 (H'0001): Current output (0 to +20 mA) Mode 2 (H'0002): Current output (+4 to +20 mA) Mode 3 (H'0003): Voltage output (0 V to 10 V) Mode -1 (H'FFFF): All channels are unavailable
#3	X	R/W	CH2 output mode setting	
#4	X	R/W	CH3 output mode setting	
#5	X	R/W	CH4 output mode setting	
#6	X	R/W	The enabling function of table output	Please refer to the table of CR#6 below for detail. Default = H'0000
#7	X	R/W	Enable table output function	Bit 0 to bit 3 activate the table output function on CH1 to CH4. Modifying the parameters in output table during table output process is not allowed. 0: Stop, 1: Run, Default = H'0000.
#8	X	R/W	Curves of table output function	Please refer to the table of CR#8 for details. Default = H'0000
#16	X	R/W	CH1 output signal value	Voltage output range: K-32,000 to K32,000 Current output range: K0 to K32,000 Default: K0
#17	X	R/W	CH2 output signal value	
#18	X	R/W	CH3 output signal value	
#19	X	R/W	CH4 output signal value	
#20	X	R	CH1 output value in the current table	Default = K32767
#21	X	R	CH2 output value in the current table	
#22	X	R	CH3 output value in the current table	
#23	X	R	CH4 output value in the current table	
#24	X	R	Current CH1 transition point in the table	Default = K0
#25	X	R	Current CH2 transition point in the table	
#26	X	R	Current CH3 transition point in the table	
#27	X	R	Current CH4 transition point in the table	
#28	X	R/W	Adjusted OFFSET value of CH1	Set the adjusted OFFSET value of CH1 to CH4. Default = K0
#29	X	R/W	Adjusted OFFSET value of CH2	
#30	X	R/W	Adjusted OFFSET value of CH3	
#31	X	R/W	Adjusted OFFSET value of CH4	
#34	X	R/W	Adjusted GAIN value of CH1	Set the adjusted GAIN value of CH1 to CH4. Default = K16,000.
#35	X	R/W	Adjusted GAIN value of CH2	
#36	X	R/W	Adjusted GAIN value of CH3	
#37	X	R/W	Adjusted GAIN value of CH4	
※ Output Mode 2 (4 mA to 20 mA) and Mode 3 (0 V to 10 V) do not support adjusted OFFSET and GAIN value. ※ When output mode changes, the adjusted OFFSET and GAIN value automatically reset.				
#43	X	R	Error state	Register for storing all error state. Refer to table of error state for more information. Default setting: H'0000.
#44	X	R	State of table output	Used when output mode=1

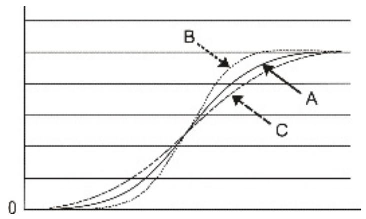
CR#	Attrib.		Register name	Explanation
				b0 to b3: Displays the output completed state of CH1 to CH4. Display value = 1 indicates the end of output. b4 to b7: Displays the CH1 to CH4 output table parameter error state. Display value = 1 indicates parameter error. b8 to b15: Reserved.
#100	X	R/W	Number of transition points for CH1 table output	range: K0 to K10 Default = K0 (Refer to the transition point table below for more information on the channel table outputs.)
#125	X	R/W	Number of transition points for CH2 table output	
#150	X	R/W	Number of transition points for CH3 table output	
#175	X	R/W	Number of transition points for CH4 table output	
Symbols: O means latched. X means not latched. R means the CR can be read by using FROM instruction. W means the CR can be written data by using TO instruction. LSB (Least Significant Bit):1. Voltage output: 1_{LSB} = 10 V/32,000 = 312.5 μV. 2. Current output: 1_{LSB} = 20 mA/32,000 = 625 nA				

※ CR#6: The Enabling Function of Table Output. See the table below.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1
K0: Disable (Default)			
K1: Acyclic Table Output			
K2: Cyclic Table Output			
Note: 1. Table output function is enabled when the table output mode is not set as 0. 2. When table output function is enabled, the value set in CR#16 to CR#19 is invalid. CR#20 to CR#23 stores the present table output value for users to read. CR#24 to CR#27 indicates the present transition point of table output in each channel.			

※ CR#8: Curves of Table Output Function. See the table below.

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH4	CH3	CH2	CH1
K0: Linearity (Default)			
K1: S carve (A)			
K2: S carve (B)			
K3: S carve (C)			



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

Bit	Error Status	Content Value
b0	K1 (H’0001)	Power source abnormal
b1	K2 (H’0002)	Hardware malfunction
b2	K4 (H’0004)	Setting mode error
Note: Each error status is determined by a corresponding bit (b0 to b15) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error. b3 to b15: reserved.		

11

※ CR#100 to CR#200: Transition points for table output. See the table below:

CR#	Description	Value
CR#100	Transition points of CH1 table output	Max. = 10
CR#101	Output value of point 1 in CH1	D1
CR#102	Duration between point 1 and point 2 in CH1	T1
CR#103	Output value of point 2 in CH1	D2
CR#104	Duration between point 2 and point 3 in CH1	T2
CR#105	Output value of point 3 in CH1	D3
CR#106	Duration between point 3 and point 4 in CH1	T3
CR#107	Output value of point 4 in CH1	D4
CR#108	Duration between point 4 and point 5 in CH1	T4
CR#109	Output value of point 5 in CH1	D5
CR#110	Duration between point 5 and point 6 in CH1	T5
CR#111	Output value of point 6 in CH1	D6
CR#112	Duration between point 6 and point 7 in CH1	T6
CR#113	Output value of point 7 in CH1	D7
CR#114	Duration between point 7 and point 8 in CH1	T7
CR#115	Output value of point 8 in CH1	D8
CR#116	Duration between point 8 and point 9 in CH1	T8
CR#117	Output value of point 9 in CH1	D9
CR#118	Duration between point 9 and point 10 in CH1	T9
CR#119	Output value of point 10 in CH1	D10
CR#120 to CR#124	Reserved	-

Note: Duration between points. Set range: K1 to K100 (Unit: 10 ms)

Note: CR#100 to CR#200 are CRs for transition point setting in CH1 to CH4.
Take CH1 for example, CR#100 sets the total transition points. Max. 10 points (CR#101 to CR#119: D1 to D10) can be allocated in the output waveform. Duration between points can be specified by T1 to T9. CR#120 to CR#124 are reserved. Same CR function applies on CH2 to CH4.

※ D/A Conversion Curve

Users can adjust the conversion curves according to the actual needs by changing the OFFSET value (CR#28 to CR#31) and GAIN value (CR#34 to CR#37).

Output Mode 2 (4 mA to 20 mA), Mode 3 (0 V to 10 V) do not support adjusted OFFSET and GAIN value.

- Equation for Voltage output Mode 0 adjustment

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

Y=Voltage output, X=Digital input

Resolution: 0.3125 mV=20 V/64,000

- Equation for Current output Mode 1 adjustment

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

Y=Current output, X=Digital input

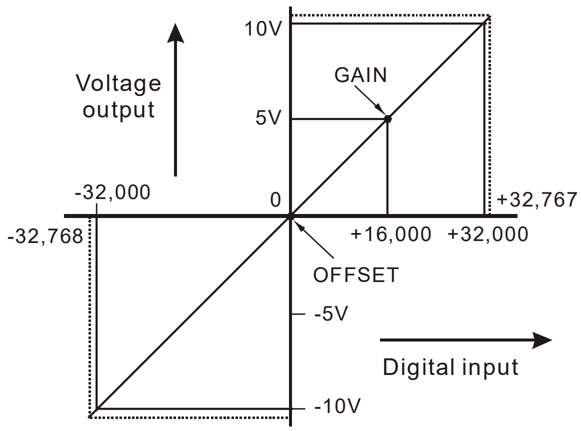
Resolution: 0.625 μA=20 mA/32,000

GAIN= The corresponding voltage/current output value of the digital output value 16,000 ÷. Resolution

OFFSET= The corresponding voltage/current output value of the digital output value 0. ÷ Resolution

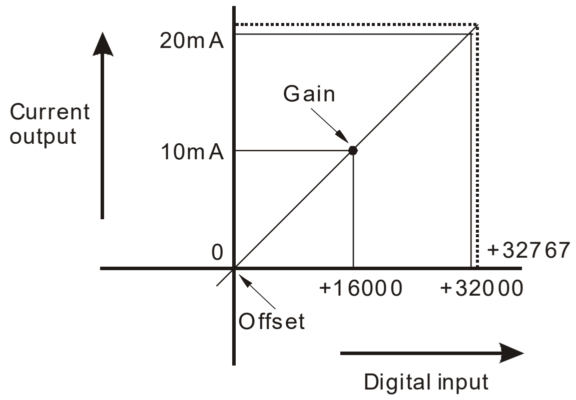
Mode 0	-10 to +10 V, GAIN=16,000 (=5 $V/312.5\ uV$), OFFSET=0
Range of digital data	-32,000 LSB to +32,000 LSB
Max./Min. range of digital data	-32,768 LSB to +32,767 LSB

Mode 0



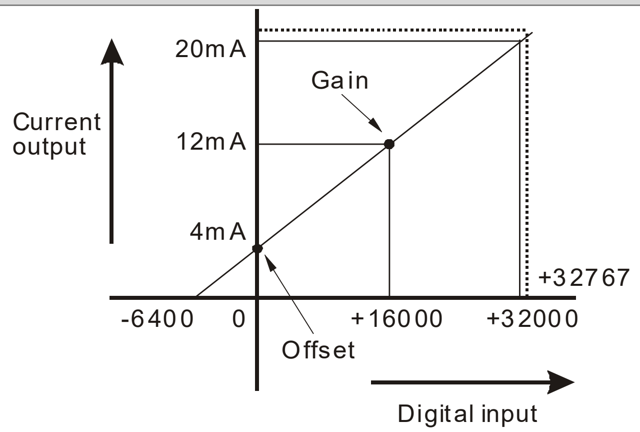
Mode 1	0 to +20 mA, GAIN=16,000 (=$10\ mA/625\ nA$), OFFSET=0
Range of digital data	0 LSB to +32,000 LSB
Max./Min. range of digital data	0 LSB to +32,767 LSB

Mode 1



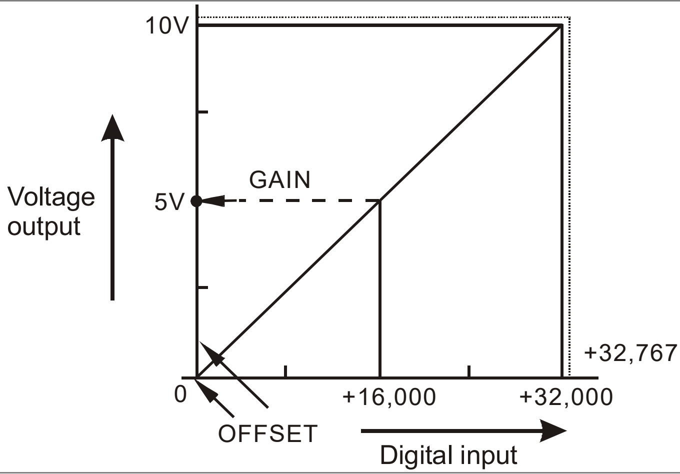
Mode 2	+4 to +20 mA, GAIN=19,200 (=$12\ mA/625\ nA$), OFFSET=6,400 (=$4\ mA/625\ nA$)
Range of digital data	0 LSB to +32,000 LSB
Max./Min. range of digital data	-6400 LSB to +32,767 LSB

Mode 2



Mode 3	0 to +10 V, GAIN=16,000 (=$5\ V/312.5\ uV$), OFFSET=0
Range of digital data	0 LSB to +32,000 LSB
Max./Min. range of digital data	0 LSB to +32,767 LSB

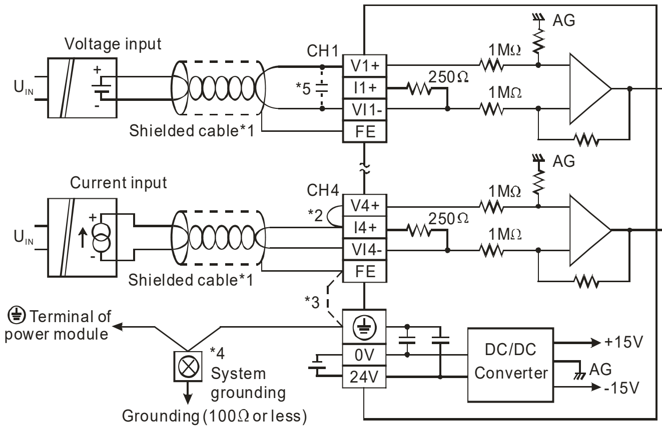
Mode 3



11.5 Wiring

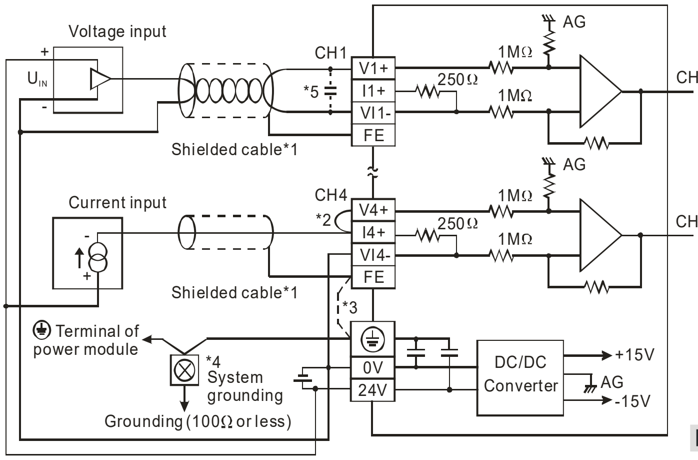
11.5.1 Wiring DVP04AD-SL

- Active type



[Figure 2]

- Passive type



[Figure 3]

Note 1: When performing analog input, please isolate other power wirings.

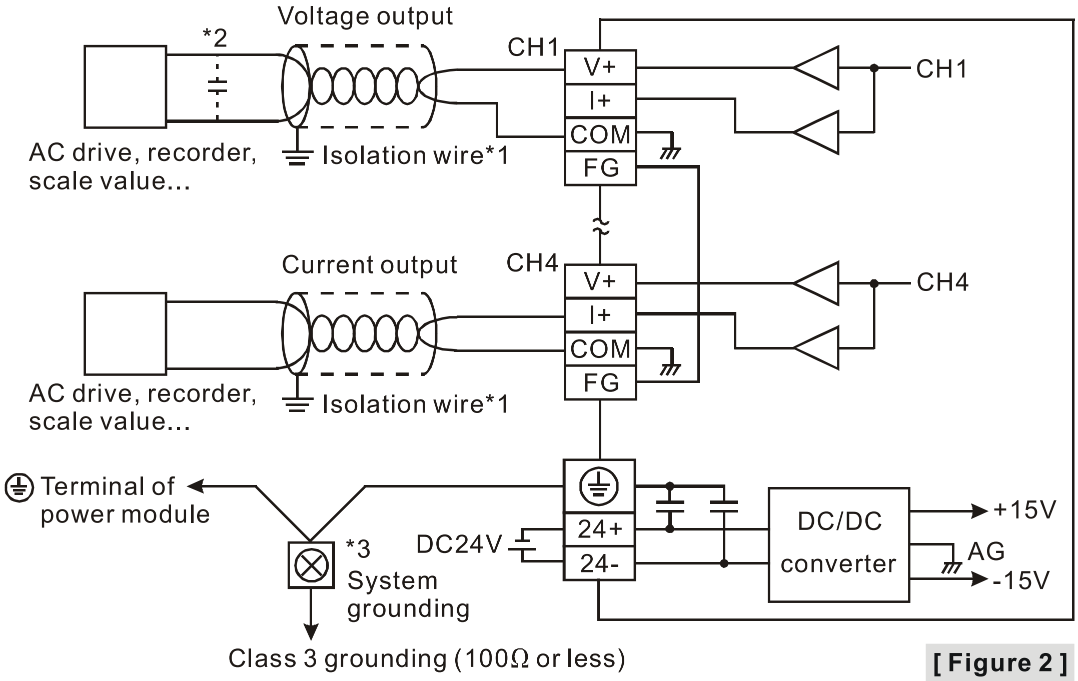
Note 2: When the A/D module is connected to current signals, make sure you short-circuit “V+” and “I+” terminals.

Note 3: If the noise is too significant, please connect FE to the grounding terminal.

Note 4: Please connect the ⏚ terminals on both the power module and DVP04AD module to the system earth point, and then ground the system earth contact or connect it to the cover of a power distribution cabinet.

Note 5: If the ripples of the input voltage are so significant that causes noise interference on the wiring, connect the wiring to a 0.1 to 0.47μF 25 V capacitor.

11.5.2 Wiring DVP04DA-SL



[Figure 2]

Note 1: Please isolate analog outputs from other power wiring.

Note 2: If noise interference from the loaded input terminals is significant, please connect a capacitor with 0.1 to 0.47μF 25 V.

Note 3: Please connect the ⏚ terminals on both the power module and DVP04DA-SL module to the system earth point, and then ground the system earth point or connect it to the cover of a power distributor cabinet.

11.6 Troubleshooting

When an error occurs in the left-side high-speed analog (AD/DA) modules (DVP04AD-SL/DVP04DA-SL), an error indicator will start blinking. Once you see an error indicator blinking, you can use the FROM instruction to read the error codes stored in CR#43. Each of bit 0 to bit 15 determines an error state. It is possible to have two errors at the same time. 0 indicates normal and 1 indicates error. Refer to the following table for more regarding causes and solutions for troubleshooting

<table>
<tr><th>Bit No.</th><th>RUN LED</th><th>ERROR LED</th><th>LV LED</th><th>Description</th><th>Solution</th></tr>
<tr><td>Bit 0</td><td>OFF</td><td>OFF</td><td>ON</td><td>The external voltage is abnormal.</td><td>Check the power supply.</td></tr>
<tr><td>Bit 1</td><td rowspan="14">RUN: Blinking

STOP: OFF</td><td>-</td><td>-</td><td>NA</td><td>-</td></tr>
<tr><td>Bit 2</td><td>Blinking</td><td>OFF</td><td>Channel mode setting is out of range</td><td>Check the mode setting</td></tr>
<tr><td>Bit 3</td><td>-</td><td>-</td><td>NA</td><td>-</td></tr>
<tr><td>Bit 4</td><td>Blinking</td><td>OFF</td><td>Input signal exceeds the set upper/lower bound of CH1</td><td>Upon restoring the input signal within the set upper/lower limits, this error state will be automatically cleared.</td></tr>
<tr><td>Bit 5</td><td>Blinking</td><td>OFF</td><td>Input signal exceeds the set upper/lower bound of CH2</td><td>Upon restoring the input signal within the set upper/lower limits, this error state will be automatically cleared.</td></tr>
<tr><td>Bit 6</td><td>Blinking</td><td>OFF</td><td>Input signal exceeds the set upper/lower bound of CH3</td><td>Upon restoring the input signal within the set upper/lower limits, this error state will be automatically cleared.</td></tr>
<tr><td>Bit 7</td><td>Blinking</td><td>OFF</td><td>Input signal exceeds the set upper/lower bound of CH4</td><td>Upon restoring the input signal within the set upper/lower limits, this error state will be automatically cleared.</td></tr>
<tr><td>Bit 8</td><td>Blinking</td><td>OFF</td><td>The signal received by channel 1 exceeds the range of analog inputs</td><td>Check the signal received by channel 1</td></tr>
<tr><td>Bit 9</td><td>Blinking</td><td>OFF</td><td>The signal received by channel 2 exceeds the range of analog inputs</td><td>Check the signal received by channel 2</td></tr>
<tr><td>Bit 10</td><td>Blinking</td><td>OFF</td><td>The signal received by channel 3 exceeds the range of analog inputs</td><td>Check the signal received by channel 3</td></tr>
<tr><td>Bit 11</td><td>Blinking</td><td>OFF</td><td>The signal received by channel 4 exceeds the range of analog inputs</td><td>Check the signal received by channel 4</td></tr>
<tr><td>Bit 12</td><td>-</td><td>-</td><td>NA</td><td>-</td></tr>
<tr><td>Bit 13</td><td>ON</td><td>OFF</td><td>Internal memory error</td><td>Contact the factory</td></tr>
<tr><td>Bit 14</td><td>ON</td><td>OFF</td><td>Abnormal factory calibration values</td><td>Contact the factory</td></tr>
</table>

12

Chapter 12 DVP-S Series Left-Side High-Speed Load Cell Module

Table of Contents

12.1 Principle of Load Cell

If a metallic material undergoes tension or strain, it will become thin, and its electrical impedance will increase. If a metallic material is compressed, its electrical impedance will become small. A strain gauge adopting this principle is called a load cell. Such a sensing device is able to convert physical pressure into electrical signals, and therefore it is widely used on occasions on which loads, tension and pressure need to be converted into electrical signals.

12.2 Introduction of Load Cell

A load cell module provides 4-wire or 6-wire load cells with various eigenvalues. Therefore, its response time can be adjusted according to users' requirements. On this basis, the requirements of load application markets can be easily met. Besides, a DVP series PLC* can read data in a load cell module or write data to a load cell module by means of the instruction FROM/TO.

*: DVP-SV series PLCs, DVP-EH2-L series PLCs, DVP-SA2 series PLCs, and DVP-SX2 series PLCs support left-side extension modules.

12.3 General Specification

12.3.1 DVP01LC-SL/DVP02LC-SL Specification

Module name		DVP01LC-SL/DVP02LC-SL
Supply voltage		24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Power consumption		3 W
Maximum current consumption		125 mA
Input signal range		±40m VDC
Sensibility		+5 VDC +/-10%
Resolution		Hardware (ADC): 20 bits Data output: 16 bits
Communication interface		RS-232/RS-485
Applicable sensor type		4-wire or 6-wire load cell
Expanding a temperature coefficient		≤ ± 50 ppm/K v. E
Reducing a temperature coefficient to zero		≤ ± 0.4 μV/K
Linearity error		≤ 0.02%
Response time		2, 10, 20, 40, 80, 200, 380 ms × channels
Eigenvalue applicable to a load cell		0 to 1, 0 to 2, 0 to 4, 0 to 6 mV/V
Maximum distance for connecting a load cell		100 meters
Maximum output current		5 VDC * 300 mA
Allowable load		40 to 4,010 Ω
Common-mode rejection ratio (CMRR@50/60 Hz)		≥ 100 dB
Dynamic value filter		DVP01LC-SL: Setting range: K1 to K9 DVP02LC-SL: Setting range: K1 to K5
Average value filter		Setting range: K1 to K100
Isolation		Between a digital circuit and the ground: 500 VAC Between an analog circuit and the ground: 500 VAC Between an analog circuit and a digital circuit: 500 VAC
Series connection to DVP-PLC CPU		Connectable to the left side of CPU, numbered from 100 to 107 according to the position of module from the closest to farthest to the CPU.
Weight	**DVP01LC-SL**	122 g

Module name		DVP01LC-SL/DVP02LC-SL
	DVP02LC-SL	132 g

- Complying with DIN1319-1, the tolerance of measured value should be ≤ 0.05% under 20°C + 10K temperature range.
- When the corrected ambient temperature and the actual temperature have a difference of more than 10°C, it is suggested that you re-correct it.

12.3.2 DVP201LC-SL/DVP202LC-SL/DVP211LC-SL Specification

Module name		DVP201LC-SL/DVP202LC-SL/DVP211LC-SL
Rated supply voltage		24 VDC (20.4 to 28.8 VDC) (-15% to +20%)
Power consumption		5 W
Minimum/maximum static voltage		20.4 V/28.8 VDC
Minimum/maximum dynamic voltage		18.5 V/30.2 VDC
Maximum current consumption		150 mA
Input signal range		±200m VDC
Sensibility		+5 VDC +/-5%
Resolution		Hardware (ADC): 24 bits Data output: 32 bits
Highest precision		0.04%
Communication interface		RS-232, RS-485
Applicable sensor type		4-wire or 6-wire load cell
Expanding a temperature coefficient		≤ ± 20 ppm/K v. E
Reducing a temperature coefficient to zero		≤ ± 0.1 μV/K
Linearity error		≤ 0.015%
Response time		2.5, 10, 16, 20, 50, 60, 100, 200, and 400ms
Eigenvalue applicable to a load cell		0 to 1, 0 to 2, 0 to 4, 0 to 6, 0 to 20, 0 to 40, and 0 to 80 mV/V
Maximum distance for connecting a load cell		100 meters
Maximum output current		5 VDC * 300 mA
Allowable load		40 to 4,010 Ω
Filtering		Extrema/ Average/ Low-pass filtering
Common-mode rejection ratio (CMRR @50/60 Hz)		≥100 dB
Isolation		Between a digital circuit and the ground: 500 VAC Between an analog circuit and the ground: 500 VAC Between an analog circuit and a digital circuit: 500 VAC
Series connection to DVP-PLC MPU		Connectable to the left side of MPU, numbered from 100 to 107 according to the position of module from the closest to farthest to MPU.
Weight	**DVP201LC-SL**	122 g
	DVP202LC-SL	132 g
	DVP211LC-SL	

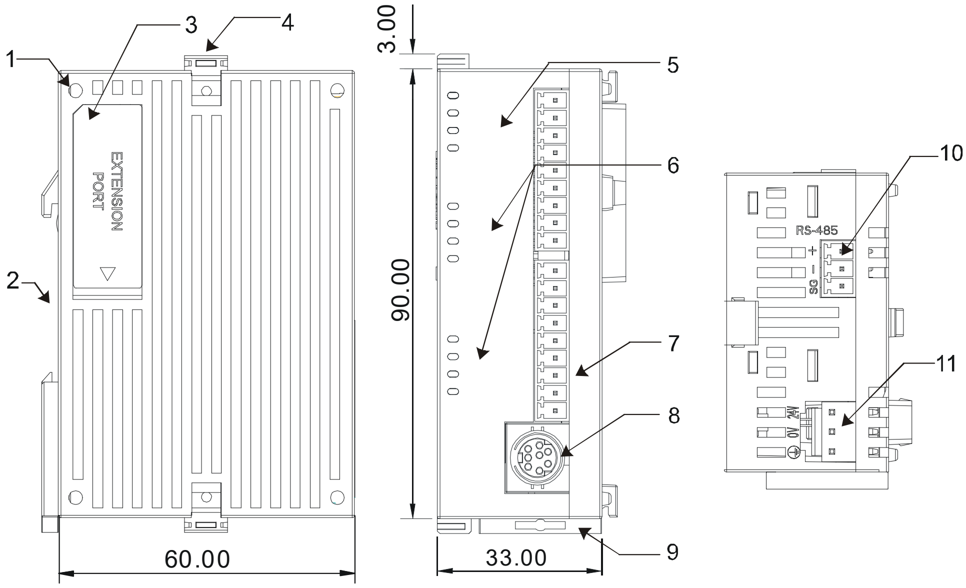
		DVP211LC-SL	
		Electrical specifications for input terminals	Electrical specifications for output terminals
Input/Output terminal		X0, X1	Y0, Y1, Y2, Y3
Type		Digital input	Transistor
Form		DC (sinking or sourcing)	--
Specifications		Input current: 24 VDC, 5 mA	Voltage specifications: 5 to 30 VDC*1
Input impedance		4.7 KΩ	--
Maximum switch frequency		10 kHz	1 kHz
Action level	**OFF→ON**	>15 VDC	--
	ON→OFF	<5 VDC	--
Response time	**OFF→ON**	<20 μs	<100 μs
	ON→OFF	<50 μs	<150 μs
Maximum load	**Resistive load**	--	0.5 A/1 output (4 A/COM)*2
	Inductive load	--	15 W (30 VDC)
	Bulb	--	2.5 W (30 VDC)

Note: In order to meet DIN 1319-1, an error needs to be less than or equal to 0.05% at 20 °C + 10 K.

#1: UP and ZP should be connected to a 24 V DC power supply. The current that an output terminal consumes is approximately 1 mA.

#2: In NPN mode, ZP is used. In PNP mode, UP is used.

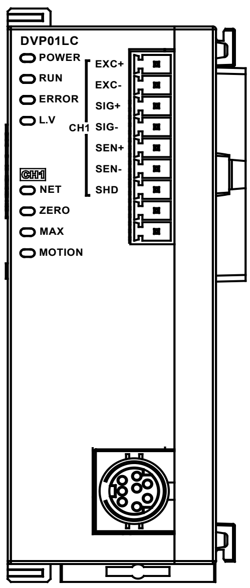
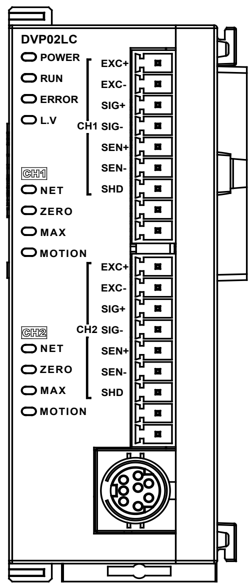
12.4 Module Profiles and Dimensions



Unit: mm

No.	Name	Description
1	Extension unit positioning hole	For positioning between modules.
2	DIN rail slot (35 mm)	For the DIN rail.
3	Extension module connection port	Connects the modules.
4	Extension unit fixing clip	For securing the extension module.
5	POWER indicator	Indicates the state of the power supply ON: the power is on OFF: no power
	Run indicator	Indicates the operating state of the module
	ERROR indicator	Error state of the module. ON: A serious module error has occurred OFF: the module is normal. Blinking (0.2 seconds ON/OFF): A non-serious module error occurs.
	Low voltage LED indicator	Indicates the low voltage state of the module ON: module voltage is too low OFF: module voltage is normal
6	Functional state indicator	DVP01/02LC: Channel Net Weight, Zero Point, Maximum Value, Stability State Indicator DVP201/202LC: Weight Display, Zero Weight, Weight Upper Limit, Stability State Indicator DVP211LC: Stability Function, Loop Control, Digital Input/Output State Indicator
7	Terminals	The inputs are connected to sensors. The outputs are connected to loads to be driven.
8	RS-232 port	For wiring RS-232 communication
9	DIN rail securing clip	Secures the module on the set.
10	RS-485 port	For wiring RS-485 communication.
11	Power input port	Expansion unit power input.

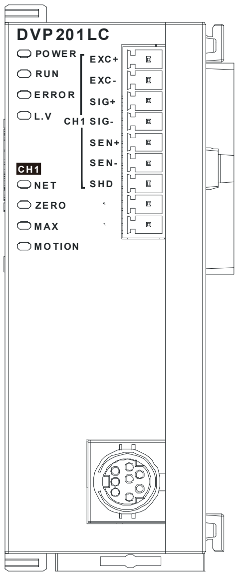
12.4.1 Indicators of DVP01LC-SL/DVP02LC-SL

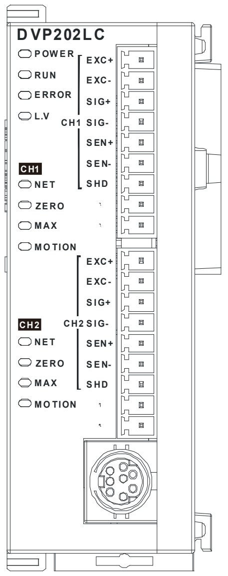
<table>
<tr><th>DVP01LC-SL</th><th>DVP02LC-SL</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

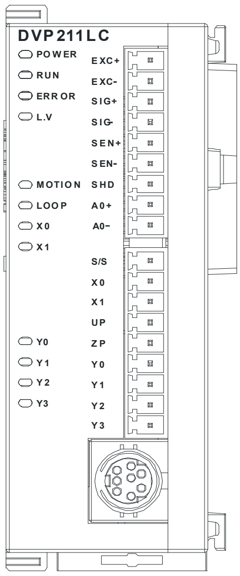
Name	Color	Function
POWER indicator	Green	Displaying power
RUN indicator	Green	Displaying the state of the module
ERROR indicator	Red	Displaying an error
L.V indicator	Red	Showing that the voltage of an external power is low
Net indicator	Orange	Net/Gross weight indicator
Zero indicator	Orange	Once the weight value is in the zero point range, this indicator is ON.
Max indicator	Orange	Maximum weight indicator
Motion indicator	Orange	Showing that measurement is stable

12.4.2 Indicators of DVP201LC-SL/DVP202LC-SL/DVP211LC-SL

DVP201LC-SL	DVP202LC-SL	DVP211LC-SL

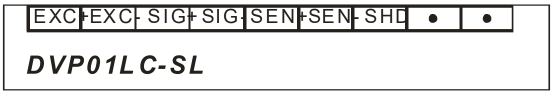
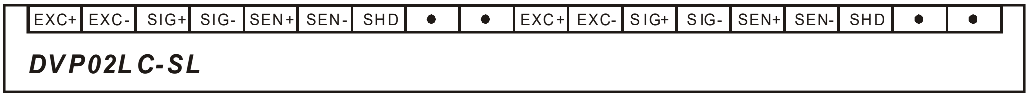
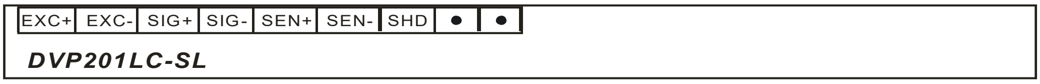
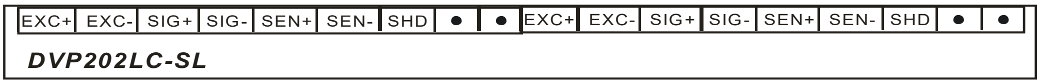
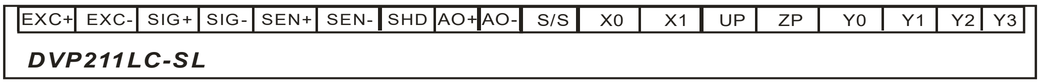






Name	Color	Function
POWER indicator	Green	Displaying power
RUN indicator	Green	Displaying the state of the module
ERROR indicator	Red	Displaying an error
L.V indicator	Red	Showing that the voltage of an external power is low
LOOP indicator	Green	LOOP control
MOTION indicator	Orange	Showing that measurement is stable
X0/X1	Red	Showing that X0/X1 is On/Off
Y0 to Y3	Red	Showing that Y0/Y1/Y2/Y3 is On/Off
NET indicator	Orange	Net/Gross weight indicator
ZERO indicator	Orange	Once the weight value is in the zero point range, this indicator is ON.
MAX indicator	Orange	Maximum weight indicator

12.5 Terminals

DVP01LC-SL	
DVP02LC-SL	
DVP201LC-SL	
DVP202LC-SL	
DVP211LC-SL	

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12.6 DVP01LC-SL/DVP02LC-SL Control Registers

12.6.1 DVP01LC-SL Control Register

CR#	Add.	Attrib.		Register name	Explanation
#0	H1000	O	R	Model name	Set up by the system: DVP01LC-SL model code = H'4106
#1	H1001	O	R	Firmware version	Displaying the current firmware version in hex.
#2	H1002	O	R/W	Eigenvalue	Mode 0 (H'0000): 1 mV/V Mode 1 (H'0001): 2 mV/V, default Mode 2 (H'0002): 4 mV/V Mode 3 (H'0003): 6 mV/V
#3	H1003	O	R/W	Reaction time for measurement	Mode 0 (H'0000): 2 ms Mode 1 (H'0001): 10 ms Mode 2 (H'0002): 20 ms Mode 3 (H'0003): 40 ms Mode 4 (H'0004): 80 ms, default Mode 5 (H'0005): 200 ms Mode 6 (H'0006): 380 ms
#6	H1006	X	R/W	Tare gotten from CH1	Reading the present average value as tare. bit0: CH1
#7	H1007	O	R/W	Gross/Net weight	Taking the present weight as the gross weight (K0) or the net weight (K1).
#8	H1008	O	R/W	Gross weight from CH1 (Low word)	Users can input the value or use the instruction to read the gross weight. Default: 0
#9	H1009	O	R/W	Gross weight from CH1 (High word)	
#10	H100A	O	R/W	Average number of times gotten from CH1	Default: K10; Range: K1 to K100 If the setting value exceeds the range, it will be automatically changed to K1 or K100.
#12	H100C	X	R	Weight gotten from CH1 (Low word)	Displaying the weight. Default: K0
#13	H100D	X	R	Weight gotten from CH1 (High word)	Displaying the weight. Default: K0
#16	H1010	O	R/W	Number of times the stability of the values gotten from CH1 is checked	Default: K5; Range: K1 to K500
#18	H1012	O	R/W	Range within which the stability of the values gotten from CH1 is checked	Default: K10; Range: K1 to K10,000
#20	H1014	O	R/W	Number of decimal places gotten from CH1	Default: K2; Range: K0 to K4
#22	H1016	O	R/W	Unit of measurement for weight gotten from CH1	Four ASCII words at most
#23	H1017	O	R/W	Unit of measurement for weight gotten from CH1	
#26	H101A	X	R/W	Weight calibration command	For correcting the weight Default: H'0000 H'0001: Reset the weight gotten from CH1 to zero H'0002: The weight of the weights gotten from CH1 (Please use CR#41 to make the calibration parameter retentive after finishing correcting the weight.)
#33	H1021	O	R/W	Weight of the weights gotten from CH1	The default in CR#33 and CR#34 is K1000.

CR#	Add.	Attrib.		Register name	Explanation
					Range: K-32,768 to K32,767 Steps for the calibration: 1: Place no weights on the load cell 2: Write H'000 into CR#26. 3: Place standard weights on the load cell. 4: Write the weight of the weights on the plate into CR#33. 5: Write H'0002 into CR#26.
#35	H1023	O	R	Maximum weight gotten from CH1 (Low word)	The user can set the maximum weight. If the weight gotten is larger than the maximum weight set by the user, the error code will be recorded.
#36	H1024	O	R	Maximum weight gotten from CH1 (High word)	
#37	H1025	O	R/W	Upper limit for taking the weight gotten from CH1 as zero	For judging the zero status If the weight is within this range, the status code will be a zero bit, indicating that there are no weights. Default: K10 Range: K-32,768 to K32,767
#39	H1027	O	R/W	Lower limit for taking the weight gotten from CH1 as zero	For judging the zero state If the weight is within this range, the status code will be a zero bit, indicating that there is no weight. Default: K-10 Range: K-32,768 to K32,767
#41	H1029	X	R/W	Storing the setting value (H'5678)	The present setting value is stored. All setting values are written into the internal flash memory so that they can be used next time DVP01LC-SL is turned on. H0: No action (default) H'FFFF: The value is stored successfully. H'5678: All setting values are written into the internal flash memory. After H'5678 is written into the register, all setting values will be stored in the flash memory. After the values are stored, the value in CR#41 becomes H'FFFF. If the value written into the register is not H'5678, the value will automatically return to H0. For example, if K1 is written into the register, K1 will return to K0.
#42	H102A	X	R/W	Restoring DVP01LC-SL to its factory settings	After H'1A2B is written to CR#42, DVP01LC-SL will be restored to its factory settings.
#43	H102B	X	R/W	Setting the percentage of signals filtered for CH1	Default: K2 Range: K1 to K9 (Unit: 10%)
#50	H1032	X	R	State code	b0 (H'0001): The weight gotten from CH1 is zero. (No load) b2 (H'0004): The weight gotten from CH1 exceeds the maximum weight. (Overload) b4 (H'0010): The measured value gotten from CH1 is stable. b6 to b15: Reserved
#51	H1033	X	R	Error code	All error states are stored in the register. See "Error Code Table" below.

CR#	Add.	Attrib.		Register name	Explanation
					Default: H'0000
#52	H1034	O	R/W	RS-232 station address	The default in CR#52 and CR#54 is K1. Range: K1 to K255
#53	H1035	O	R/W	RS-232 communication format	
#54	H1036	O	R/W	RS-485 station address	The default in both CR#53 and CR#55 is H'0000; Range: ASCII, 9600, 7, E, 1.
#55	H1037	O	R/W	RS-485 communication format	See "Communication Format Table" below.
Symbols: O indicates that the register is latched. X indicates that the register is not latched. R indicates that the data can be read. W indicates that the data can be written.					

※ Error Code Table for CR#51:

bit	Value	Error	bit	Value	Error
b0	K1 (H'0001)	The power supply is abnormal.	b1	K2 (H'0002)	The hardware breaks down.
b2	K4 (H'0004)	The conversion gotten from CH1 is incorrect.	b3	K8 (H'0008)	The voltage of SEN in CH1 is incorrect.
B4 to b15		Reserved			
Note: Every error state depends on its corresponding bit. There may be more than two error states occurring at the same time. 0 indicates that there is no error. 1 indicates that an error occurs.					

※ Communication Format Table for CR#53, CR#55:

bit15	bit14 to bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
ASCII/RTU	Reserved	Serial transmission speed				Data length	Stop bit	Parity bit	

Description					
bit15	ASCII/RTU	0	ASCII	1	RTU
bit7 to bit4	Serial transmission speed	0	9,600 bps	1	19,200 bps
		2	38,400 bps	3	57,600 bps
		4	115,200 bps	5	Reserved
bit3	Data length (RTU = 8 bits)	0	7	1	8
bit2	Stop bit	0	1 bit	1	2 bits
bit1 to bit0	Parity bit	0	Even	1	Odd
		2	Reserved	3	Reserved

12.6.2 DVP02LC-SL Control Register

CR#	Add.	Attrib.		Register name	Explanation
#0	H1000	O	R	Model name	Set up by the system: DVP02LC-SL model code = H'4206
#1	H1001	O	R	Firmware version	Display the current firmware version in hex.
#2	H1002	O	R/W	Characteristic value (eigenvalue)	Mode 0 (H'0000): 1 mV/V Mode 1 (H'0001): 2 mV/V, default Mode 2 (H'0002): 4 mV/V Mode 3 (H'0003): 6 mV/V
#3	H1003	O	R/W	Reaction time for measurement	Mode 0 (H'0000): 2 ms Mode 1 (H'0001): 10 ms Mode 2 (H'0002): 20 ms Mode 3 (H'0003): 40 ms Mode 4 (H'0004): 80 ms, default Mode 5 (H'0005): 200 ms Mode 6 (H'0006): 380 ms
#4	H1004	O	R	Average value of all channels	Sum up CH1 average value and CH2 average value and average them. Equation: (CH1 average value + CH2 average value)/2
#6	H1006	X	R/W	CH1 to CH2 read tare weight	Reads the present average value as the tare weight value bit0: CH1; bit1: CH2; bit2 to bit15: reserved
#7	H1007	O	R/W	CH1 to CH2 gross/net weight	Displays the present weight as Gross (K0) or Net (K1). bit0 to bit3: CH1; bit4 to bit7: CH2; bit8 to bit15: reserved. Take CH1 for example: bit3 to bit0 = 0000, gross; bit3 to bit0 = 0001, net; bit3 to bit0 = 1111, channel disabled.
#8	H1008	O	R/W	CH1 tare weight	The user can write in the weight or read it by commands. Default: K0; Range: -K32,768 to K32,767.
#9	H1009	O	R/W	CH2 tare weight	
#10	H100A	O	R/W	CH1 average times	Default: K10; Range: K1 to K100. When the set value exceeds the range, it will automatically be changed to K1 or K100.
#11	H100B	O	R/W	CH2 average times	
#12	H100C	X	R	CH1 average weight	Displays the average weight.
#13	H100D	X	R	CH2 average weight	
#14	H100E	X	R	CH1 present weight	Displays the present weight.
#15	H100F	X	R	CH2 present weight	
#16	H1010	O	R/W	CH1 standstill times	Default: K5 Range: K1 to K500
#17	H1011	O	R/W	CH2 standstill times	
#18	H1012	O	R/W	CH1 standstill range	Default: K10 Range: K1 to K10,000
#19	H1013	O	R/W	CH2 standstill range	
#20	H1014	O	R/W	CH1 decimal place	Default: K2 Range: K0 to K4
#21	H1015	O	R/W	CH2 decimal place	
#22	H1016	O	R/W	CH1 unit of measurement	Enter max. 4 ASCII words.
#23	H1017	O	R/W	CH1 unit of measurement	
#24	H1018	O	R/W	CH2 unit of measurement	
#25	H1019	O	R/W	CH2 unit of measurement	
#26	H101A	X	R/W	Weight calibration command	For the user to correct the weight. Default: H'0000 H'0001: CH1 Calibration command

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CR#	Add.	Attrib.		Register name	Explanation
					H'0002: CH1 Weight base point command H'0003: CH2 Calibration command H'0004: CH2 Weight base point command (Please use CR#41 to make the calibration parameter retentive after finishing correcting the weight.)
#33	H1021	O	R/W	CH1 weight base point	For CR#33 to CR#34 default = K1,000; Range: K-32,768 to K32,767 Steps for calibration: Take CH1 for example 1: Place no weights on the load cell 2: Set up CR#26 command = "H'0001" 3: Place standard weights on the load cell 4: Write the weight of the weights on the plate into CR#33. 5: Set up CR#26 command = "H'0002"
#34	H1022	O	R/W	CH2 weight base point	
#35	H1023	O	R	CH1 max. weight	Set up the max. weight. When the measured value exceeds the set value, error codes will be recorded.
#36	H1024	O	R	CH2 max. weight	
#37	H1025	O	R/W	Upper limit for CH1 zero point check	Reference for reset to zero. When the weight is within this range, the status code will be set to "zero bit", indicating the current zero weight status. Default: K10 Range: K-32,768 to K32,767
#38	H1026	O	R/W	Upper limit for CH2 zero point check	
#39	H1027	O	R/W	Lower limit for CH1 zero point check	Reference for reset to zero. When the weight is within this range, the status code will be set to "zero bit", indicating the current zero weight status. Default: K-10 Range: K-32,768 to K32,767
#40	H1028	O	R/W	Lower limit for CH2 zero point check	
#41	H1029	X	R/W	Saving set value (H'5678)	Saves the present set value and write all the set values into the internal Flash for use next time DVP02LC-SL is switched on. H0: No action, Default H'FFFF: Saving is successful H'5678: Write to internal Flash When H'5678 is written in, all set values will be saved in Flash. When the saving is completed, CR#41 will become H'FFFF. If the value written in is not H'5678, it will automatically return to H0, e.g. write K1 into CR# to return to K0.
#42	H102A	X	R/W	Restoring DVP02LC-SL to its factory settings	After H'1A2B is written to CR#42, DVP02LC-SL will be restored to its factory settings.
#43	H102B	X	R/W	CH1 filter percentage	Default: K2 Range: K1 to K5 (Unit: 10%)
#44	H102C	X	R/W	CH2 filter percentage	
#45	H102D	X	R/W	CH1 filter average value	Displays average weight after filtering. Condition to enable the filter: average time ≥ 30
#46	H102E	X	R/W	CH2 filter average value	
#50	H1032	X	R	Status code	b0 (H'0001): CH1 zero weight (empty) b1 (H'0002): CH2 zero weight (empty) b2 (H'0004): CH1 exceeds max. weight (overload) b3 (H'0008): CH2 exceeds max. weight (overload) b4 (H'0010): CH1 stable measured value b5 (H'0020): CH2 stable measured value

CR#	Add.	Attrib.		Register name	Explanation
					b6 to b15: Reserved
#51	H1033	X	R	Error code	Stores all the error statuses. See "Error Code Table" below. Default: H'0000
#52	H1034	O	R/W	RS-232 node address	For CR#52, CR#54 default = 1 Range: K1 to K255 For CR#53, CR#55 default = H'0000; Range: ASCII, 9600, 7, E, 1. See "Communication Format Table" below.
#53	H1035	O	R/W	RS-232 communication setting	
#54	H1036	O	R/W	RS-485 node address	
#55	H1037	O	R/W	RS-485 communication setting	
Symbols: O means latched. X means not latched. R means read. W means write.					

※ Error Code Table for CR#51:

bit	Content	Error	bit	Content	Error
b0	K1 (H'0001)	Power supply abnormality	b1	K2 (H'0002)	Hardware abnormality
b2	K4 (H'0004)	CH1 conversion error	b3	K8 (H'0008)	CH1 SEN voltage error
b4	K16 (H'0010)	CH2 conversion error	b5	K32 (H'0020)	CH2 SEN voltage error
b6 to b15	K64 (H'0040)	Reserved			
Note: Every error state is decided by its corresponding bit, so there might be more than 2 error states occurring at the same time. 0 refers to no error; 1 refers to error occurring.					

※ Communication Format Table for CR#53 and CR#55:

bit15	bit14 to bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
ASCII/RTU	Reserved	Baud rate				Data length	Stop bit	Parity	

Description					
bit15	ASCII/RTU	0	ASCII	1	RTU
bit7 to bit4	Baud rate	0	9,600 bps	1	19,200 bps
		2	38,400 bps	3	57,600 bps
		4	115,200 bps	5	Reserved (unit: bps)
bit3	Data length (RTU = 8 bits)	0	7	1	8
bit2	Stop bit	0	1 bit	1	2 bits
bit1 to bit0	Parity	0	Even	1	Odd
		2	Reserved	3	Reserved

12.6.3 Functions Description

12.6.3.1 Measuring Net Weight

You can choose to measure the net weight or the gross weight of an object. A net weight is the weight of a product, that is, the actual weight of a product without its package. The weight of a package is a tare. A gross weight is a total weight, namely a net weight plus a tare.

- Tare: A tare is the weight of a package.
- Net Weight: A net weight is the weight of a product, that is, the actual weight of a product without its package.
- Gross Weight: A gross weight is a total weight, namely the weight of a product itself (a net weight) plus the weight of a package (a tare).
- Gross weight=Net weight + Tare

  Example: A product weighs 10 kilograms, and the carton in which the product is packed weighs 0.2 kilograms. The total weight gotten is 10.2 kilograms.

  Net weight=10 kg

  Tare=0.2 kg

  Gross weight=10.2 kg

- Relevant control registers
  - CR#6: Read Tare
  - CR#7: Gross /Net
  - CR#8 to 9: Tare Weight
- Example

Display net weight using CH1 measurement values and disable CH2. (If the weight of the packaging material is known, the tare reading step can be skipped.)

1. Read tare weight:

   Step1: Write H’0000 to CR#7.

   Step2: Place the packaging material on CH1 Load Cell.

   Step3: Write H’0001 to CR#6 to set the current weight of the packaging material as the tare weight.

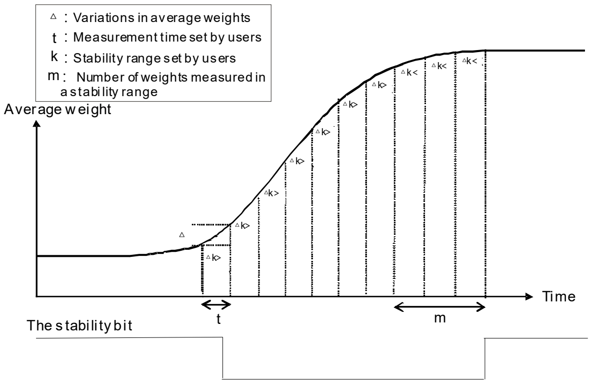
2. Set CR#7=H’00F1.

12.6.3.2 Stability Check

When an object is put on a load cell, users can utilize this function to check whether the current measurement weight has stabilized.

- If a weight measured is in a stability range specified by users (CR#18/CR#19), the stability bit in CR#50 will be set to 1.
- If a weight measured exceeds a range specified by users, the stability bit in CR#50 will be set to 0. It remains 0 until the stability check count (CR#16, CR#17) is within the stability range again. Once the stability check count is within the range, the stability bit of CR#50 will be set to 1.

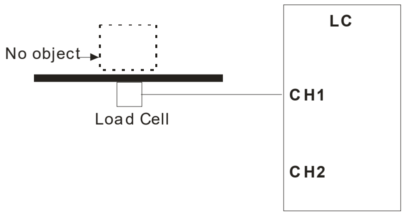
Example: The measurement time set is 10 milliseconds, the number of weights measured in a stability range is 10, and the stability range set is 1000 grams. If a variation exceeds 1000 grams, the stability bit in CR#50 will be set to 0. If the variations in 100 milliseconds (10×10 ms) are within 1000 grams, the stability bit in CR#50 will be set to 1. (It is recommended that users check whether the present weight measured is in the stability range before performing control.)

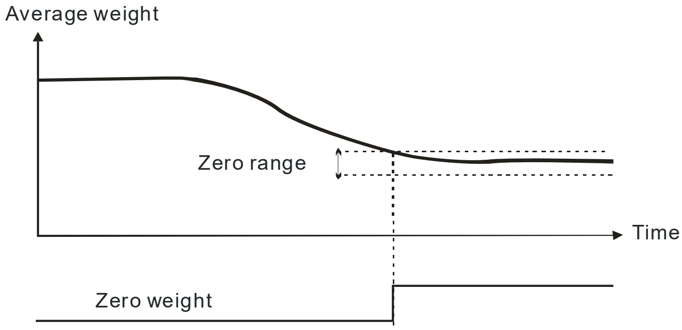


- Relevant control registers
  1. DVP01LC-SL
     - CR#16: Number of weights measured in a stability range
     - CR#18: Stability check range
  2. DVP02LC-SL
     - CR#16, CR#17: Number of weights measured in a stability range
     - CR#18, CR#19: Stability check range

12.6.3.3 Determining Zero

Users can utilize this function to determine when an item has been completely removed from the Load Cell. When the user observes that the stability bit for the measurement value is 1 and the zero point weight bit is also 1, it indicates that the item has been successfully removed from the Load Cell. At this point, users can perform the next control step. (The zero point weight bit is 1 within the zero point detection range.)

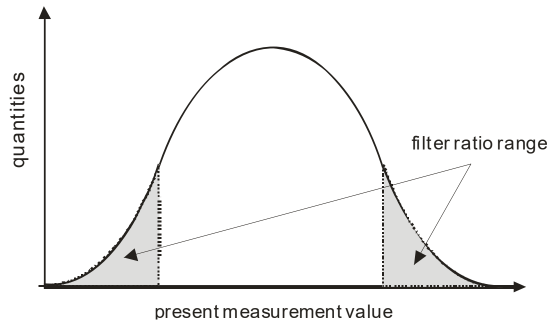




- Relevant control registers
  - CR#37 to CR#40: Range for determining whether a weight measured is 0 grams

12.6.3.4 Filtering out Weights

The averaging function involves summing up the read values to obtain a smoothed result, but in real-world environments, unavoidable external forces can lead to drastic spikes in the readings. This can cause significant fluctuations in the calculated average. The filtering function is designed to exclude abrupt spike values from the summation average, ensuring that the filtered average is not heavily influenced by these sudden spikes. The filtering operation is triggered when the averaging count is equal to or greater than 30, and the filtering ratio is within the range of 10% to 50%. This helps mitigate the impact of abrupt spikes on the averaged values.



- Relevant control registers:
  1. DVP01LC-SL
     - CR#43: Filter ratio setting
  2. DVP02LC-SL
     - CR#43, CR#44: Filter ratio setting
     - CR#45, CR#46: Filtered average

12.7 DVP201LC-SL/DVP202LC-SL/DVP211LC-SL Control Register

12.7.1 Control Register

CR#	Address	Attribute		Register name	Explanation	
#0	H1000	O	R	Model name	The model code of a load cell module is defined by the module's system. DVP201LC-SL's model code=H'5106 DVP202LC-SL's model code=H'5206 DVP211LC-SL's model code=H'5906	
#1	H1001	O	R	Firmware version	Hexadecimal value The current firmware version of a load cell module is displayed.	
#2	H1002	O	R/W	Characteristic value (eigenvalue)	CH1: Bit 0 to bit 7; CH2: Bit 8 to bit 15 Mode 0: 1 mV/V; Mode 4: 20 mV/V Mode 1: 2 mV/V; Mode 5: 40 mV/V Mode 2: 4 mV/V; Mode 6: 80 mV/V Mode 3: 6 mV/V	
#3	H1003	O	R/W	Reaction time for measurement	CH1: bit0 to bit7; CH2: bit8 to bit15 Mode 0: 2.5 ms; Mode 5: 60 ms Mode 1: 10 ms; Mode 6: 100 ms Mode 2: 16 ms; Mode 7: 200 ms Mode 3: 20 ms; Mode 8: 400 ms Mode 4: 50 ms (factory setting)	
#6	H1006	X	R/W	Returning to zero/ Subtracting a tare	K1: Subtracting the tare measured by CH1 K2: Not subtracting the tare measured by CH1 K3: Restoring the weight measured by CH1 to 0	K4: Subtracting the tare measured by CH2 K5: Not subtracting the tare measured by CH2 K6: Restoring the weight measured by CH2 to 0
#7	H1007	O	R/W	Displaying a gross weight/net weight	CH1: Bit 0 to bit 7; CH2: Bit 8 to bit 15 K0: Displaying a gross weight K1: Displaying a net weight DVP202LC-SL can be configured to disable a channel (HFF).	
#8	H1008	X	R/W	Tare measured by CH1 (Low word)	Displaying a tare	
#9	H1009	X	R/W	Tare measured by CH1 (High word)		
#10	H100A	X	R/W	Tare measured by CH2 (Low word)		
#11	H100B	X	R/W	Tare measured by CH2 (High word)		
#12	H100C	X	R	Weight measured by CH1 (Low word)	Displaying a weight	
#13	H100D	X	R	Weight measured by CH1 (High word)		
#14	H100E	X	R	Weight measured by C2 (Low word)		

CR#	Address	Attribute		Register name	Explanation
#15	H100F	X	R	Weight measured by C2 (High word)	
#16	H1010	O	R/W	Number of weights measured by CH1 in a stability range	Setting range: K1 to K500 (Factory setting: K5)
#17	H1011	O	R/W	Number of weights measured by CH2 in a stability range	Setting range: K1 to K500 (Factory setting: K5)
#18	H1012	O	R/W	Stability range for CH1	Setting range: K1 to K10000 (Factory setting: K10)
#19	H1013	O	R/W	Stability range for CH2	Setting range: K1 to K10000 (Factory setting: K10)
#20	H1014	O	R/W	Lower limit of the zero return for CH1	Provide a judgment of whether the weight value is zero. When the weight value is within this range, the status code's empty load bit will be set, indicating that the current weight value is in the empty load state. The factory default value is K-10, and the set value range is K-1 to K-32768.
#21	H1015	O	R/W	Lower limit of the zero return for CH2	
#25	H1019	O	R/W	Total number of points which need to be calibrated	Setting range: K2 to K20 (Factory setting: K2)
#26	H101A	X	R/W	Calibration command	CH1: K1 to K20 CH2: K21 to K40
#27	H101B	O	R/W	Selecting a calibration point for CH1	K1 to K19
#28	H101C	O	R/W	Selecting a calibration point for CH2	K1 to K19
#29	H101D	O	R/W	Raw data given to a calibration point for CH1 (Low word)	The firmware will load the relevant raw data automatically while calibrating. You can get a similar result of measurement curves by copying the raw data of calibrated points and settings associated to the measurement to other modules, which use the same model of sensors, without calibration. Please note that the above acts may cause unpredictable errors and deviation in the result of measurement curves because of different features between sensors and environment.
#30	H101E	O	R/W	Raw data given to a calibration point for CH1 (High word)	
#31	H101F	O	R/W	Raw data given to a calibration point for CH2 (Low word)	
#32	H1020	O	R/W	Raw data given to a calibration point for CH2 (High word)	
#33	H1021	O	R/W	Digital value given to a calibration point for CH1 (Low word)	Digital values (weight values) correspond to calibration points 1 to 19. E.g. To calibrate a 100 g weight to be shown as 1000 on the LC display, you'll have to write 1000 to CR#33 before calibration. Please refer to section 12.10 for more details.
#34	H1022	O	R/W	Digital value given to a calibration point for CH1 (High word)	
#35	H1023	O	R/W	Digital value given to a calibration point for CH2 (Low word)	
#36	H1024	O	R/W	Digital value given to a calibration point for CH2 (High word)	
#37	H1025	O	R/W	Maximum which can be measured by CH1 (Low word)	Specify the maximum weight which can be measured by CH1/CH2. If a weight measured exceeds the maximum weight, an error code (CR#51) will be stored.
#38	H1026	O	R/W	Maximum which can be measured by CH1 (High word)	
#39	H1027	O	R/W	Maximum which can be measured by CH2 (Low word)	

CR#	Address	Attribute		Register name	Explanation
#40	H1028	O	R/W	Maximum which can be measured by CH2 (High word)	
#41	H1029	X	R/W	Storing all setting values (H’5678)	Storing all setting values, and writing them to the flash memory in the load cell module used Others: No action (factory setting) H’5678: Writing all setting values to the flash memory in the load cell module used
#42	H102A	X	R/W	Restoring all settings to factory settings	Restoring all settings to factory settings (H’55AA)
#43	H102B	X	R/W	Way in which weights measured by CH1 are filtered out	K0: Not filtering weights (factory setting) K1: Extrema filtering K2: Average filtering K3: LPF 5 Hz K4: LPF 10 Hz K5: LPF 20 Hz K6: LPF 50/60 Hz Note: When you set it to K3-K6 (Only supported by FW V1.14 and above), the transfer time would be set to 10 ms, which is mandatory.
#44	H102C	X	R/W	Way in which weights measured by CH2 are filtered out	
#45	H102D	X	R/W	Filter parameter for CH1	Extrema filtering: K0 to K8 Average filtering: The number of weights which need to be averaged should be in the range of K1 to K100.(Supported only by FW V1.12 and above) Low-pass filtering (LPF): Invalid
#46	H102E	X	R/W	Filter parameter for CH1	
#48	H1030	O	R/W	Upper limit for determining whether the digital value corresponding to a weight measured by CH1 is 0 grams	Provides a judgment of whether the weight value is zero. When the weight value is within this range, the status code's empty load bit will be set, indicating that the current weight value is in the empty load state. The factory default value is K10, and the set value range is K0 to K32767.
#49	H1031	O	R/W	Upper limit for determining whether the digital value corresponding to a weight measured by CH2 is 0 grams	
#51	H1033	X	R/W	State code	The status of the load cell module used is stored in this register. Please refer to the status table below for more information. Factory setting: H’0000
#52	H1034	O	R/W	RS-232 station address	The default value in CR#52/CR#54 is K1. The setting values in CR#52 and CR#54 should be in the range of K1 to K255. The default value in CR#53/CR#55 is H’0000 (ASCII, 9600 bps, 7 data bits, even parity bit, one stop bit). Please refer to the communication format table below for more information.
#53	H1035	O	R/W	RS-232 communication format	
#54	H1036	O	R/W	RS-485 station address	
#55	H1037	O	R/W	RS-485 communication format	
#95	H105F	O	R/W	Zero point tracking range of CH1	Setting range: 0 to 30000; when you set the value to 0, it indicates zero point tracking is disabled.
#96	H1060	O	R/W	Zero point tracking time of CH1	Setting range: 5 to 1000; unit: 0.1 s
#97	H1061	O	R/W	Zero point tracking range of CH2	Setting range: 0 to 30000; when you set the value to 0, it indicates zero point tracking is disabled.
#98	H1062	O	R/W	Zero point tracking time of CH2	Setting range: 5 to 1000; unit: 0.1 s

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CR#	Address	Attribute		Register name	Explanation
#100	H1064	O	R/W	Current output	Setting range: K0 to K4000
#101	H1065	X	R	Digital input terminal	Bit 0: X0; Bit 1: X1
#102	H1066	X	R/W	Digital output terminal	Bit 0: Y0; Bit 1: Y1; Bit 2: Y2; Bit 3: Y3
#103	H1067	O	R/W	Way of outputting a current	K0: Digital value (CR#100) corresponding to a current output in the range of 0 mA to 20 mA (factory setting) K1: Digital value (CR#100) corresponding to a current output in the range of 4 mA to 20 mA K2: Weight corresponding to a current output in the range of 0 mA to 20 mA K3: Weight corresponding to a current output in the range of 4 mA to 20 mA
#104	H1068	O	R/W	Way in which a digital input terminal operates	X0: Bit 0 to bit 7; X1: Bit 8 to bit 15 H0: General digital input terminal (factory setting) H1: If a digital input terminal is ON, a weight will be restored to zero. H2: If a digital input terminal is ON, a tare will be measured. H3: If a digital input terminal is ON, a tare will be subtracted. H4: If a digital input terminal is OFF, a net weight will be measured. H6: If a digital input terminal is ON, zero will be adjusted. H7: If a digital input terminal is ON, the first point will be adjusted. H8: rising edge triggered: Y0 to Y3 open outputs; falling edge triggered: Y0 to Y3 close outputs H9: rising edge triggered: Y0 to Y3 close outputs; falling edge triggered: Y0 to Y3 open outputs HA: rising edge triggered: Y0 to Y3 hold outputs; falling edge triggered: Y0 to Y3 open outputs HB: rising edge triggered: Y0 to Y3 open outputs; falling edge triggered: Y0 to Y3 hold outputs H'8 to H'B: ● Hold state: State remains Hold while changing Y0 to Y3 and CR#109 = 2 (HOLD state). ● When the output is in the active state: the modified state of Y0 to Y3 will be output.

<table>
<tr><td>#105</td><td>H1069</td><td>O</td><td>R/W</td><td>Way in which a digital output terminal operates</td><td><table><tr><th>Bit 15 to bit 12</th><th>Bit 11 to bit 8</th><th>Bit 7 to bit 4</th><th>Bit 3 to bit 0</th></tr><tr><th>Y3</th><th>Y2</th><th>Y1</th><th>Y0</th></tr></table>H0: General digital output terminal (factory setting)
H1: If no weight is measured, a digital output terminal will be ON.
H2: If no weight is measured, a digital output terminal will be OFF.
H3: If a weight measured is greater than the maximum weight specified, a digital output terminal will be ON.
H4: If a weight measured is greater than the maximum weight specified, a digital output terminal will be OFF.
H5: If an excitation voltage is abnormal, a digital output terminal will be ON.
H6: If an excitation voltage is abnormal, a digital output terminal will be OFF.
H7: If a weight measured is in the stability range specified, a digital output terminal will be ON.
H8: If a weight measured is in the stability range specified, a digital output terminal will be OFF.
H9: If a weight measured is greater than the weight value that is set to output, a digital output terminal will be ON.
HA: If a weight measured is greater than t the weight value that is set to output, a digital output terminal will be OFF.</td></tr>
<tr><td>#106</td><td>H106A</td><td>O</td><td>R/W</td><td>Weight changing of CH1</td><td>Default: K0; setting range: K0 to K32767</td></tr>
<tr><td>#107</td><td>H106B</td><td>O</td><td>R/W</td><td>Weight changing of CH2</td><td>Default: K0; setting range: K0 to K32767</td></tr>
<tr><td>#109</td><td>H106D</td><td>X</td><td>R/W</td><td>Status of Y point</td><td>Work with CR#104 and Y points
0: Y point outputs enabled (default)
1: Y point outputs disabled (the state of Y0-Y3 is OFF)
2: Y point outputs hold (the state of Y0-Y3 cannot be changed)</td></tr>
<tr><td>#110</td><td>H106E</td><td>O</td><td>R/W</td><td>Y0 weight output setting value (Low word)</td><td rowspan="5">When the weight is greater than the weight value that is set to output, you can set the Y point outputs to ON or OFF.</td></tr>
<tr><td>#111</td><td>H106F</td><td>O</td><td>R/W</td><td>Y0 weight output setting value (High word)</td></tr>
<tr><td>#112</td><td>H1070</td><td>O</td><td>R/W</td><td>Y1 weight output setting value (Low word)</td></tr>
<tr><td>#113</td><td>H1071</td><td>O</td><td>R/W</td><td>Y1 weight output setting value (High word)</td></tr>
<tr><td>#114</td><td>H1072</td><td>O</td><td>R/W</td><td>Y2 weight output setting value (Low word)</td></tr>
</table>

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#115	H1073	O	R/W	Y2 weight output setting value (High word)	
#116	H1074	O	R/W	Y3 weight output setting value (Low word)	
#117	H1075	O	R/W	Y3 weight output setting value (High word)	
#118	H1076	O	R/W	Y0 delay output time	Default: 0; setting range: 0 to 300; unit: 10 ms
#119	H1077	O	R/W	Y1 delay output time	
#120	H1078	O	R/W	Y2 delay output time	
#121	H1079	O	R/W	Y3 delay output time	
Symbols: O indicates that the register is latched. X indicates that the register is not latched. R indicates that the data can be read. W indicates that the data can be written.					

※Function Code: 03H: Read data from the register; 06H: Write one word of data to the register; 10H: Write multiple words of data to the register

※ CR#51: State code

bit	Content	Description	bit	Content	Description
b0	K1 (H'0001)	Abnormal power	b1	K2 (H'0002)	Hardware failure
b2	K4 (H'0004)	The weight measured by CH1 exceeds the maximum weight which can be measured, or the voltage of SEN is incorrect.	b3	K8 (H'0008)	CH1 is adjusted incorrectly.
b4	K16 (H'0010)	The weight measured by CH1 exceeds the maximum weight which can be measured.	b5	K32 (H'0020)	No weight is measured by CH1.
b6	K64 (H'0040)	A weight measured by CH1 is in the stability range specified.	b7	K128 (H'0080)	The conversion of a weight measured by CH2 into a digital value is incorrect, or the voltage of SEN is incorrect.
b8	K256 (H'0100)	CH2 is adjusted incorrectly.	b9	K512 (H'0200)	The weight measured by CH2 exceeds the maximum weight which can be measured.
b10	K1024 (H'0400)	No weight is measured by CH2.	b11	K2048 (H'0800)	A weight measured by CH2 is in the stability range specified.
b12 to b15	Reserved				
Note: Each state is determined by a corresponding bit, and it is possible to generate two or more states at the same time. 0 represents normal, while 1 indicates that an error occurs.					

※ CR#53 and CR#55 communication format:

Bit 15	Bit 14 to Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ASCII/RTU	Reserved	Serial transmission speed				Data length	Stop bit	Parity bit	

Description

Bit 15	ASCII/RTU	0	ASCII	1	RTU
Bit 7 to bit 4	Serial transmission speed	0	9,600 bps	1	19,200 bps
		2	38,400 bps	3	57,600 bps
		4	115,200 bps	5	Reserved
Bit 3	Data length (RTU=8 bits)	0	7	1	8
Bit 2	Stop bit	0	1 bit	1	2 bits
Bit 1 to bit 0	Parity bit	0	Even	1	Odd
		2	Reserved	3	Reserved

12.7.2 Functions Descriptions

12.7.2.1 Measuring Net Weight

Users can choose to measure the net weight or the gross weight of an object. A net weight is the weight of a product, that is, the actual weight of a product without its package. The weight of a package is a tare. A gross weight is a total weight, namely a net weight plus a tare

- Tare: A tare is the weight of a package.
- Net Weight: A net weight is the weight of a product, that is, the actual weight of a product without its package.
- Gross Weight: A gross weight is a total weight, namely the weight of a product itself (a net weight) plus the weight of a package (a tare).
- Gross weight=Net weight + Tare

  Example: A product weighs 10 kilograms, and the carton in which the product is packed weighs 0.2 kilograms. The total weight gotten is 10.2 kilograms.

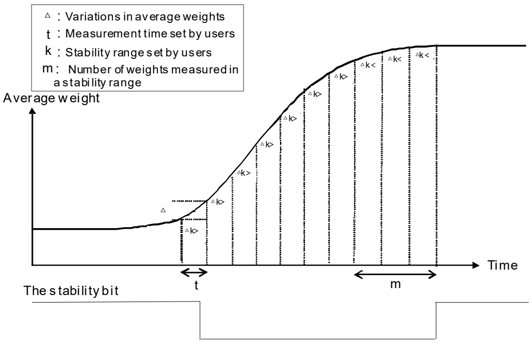
  Net weight=10 KG, Tare=0.2 KG, Gross weight=10.2 KG
- Relevant control registers
  - CR#6: Returning to zero/Subtracting a tare
  - CR#7: Displaying a gross weight/net weight
  - CR#8 to CR#9: Measured tare

12.7.2.2 Stability Check

When an object is put on a load cell, users can utilize this function to check whether the current measurement weight has stabilized.

- If a weight measured is in a stability range specified by users (CR#18/CR#19), the stability bit in CR#51 will be set to 1.
- If a weight measured exceeds a range specified by users, the bit in CR#51 will be set to 0. It remains 0 until the stability check count (CR#16, CR#17) is within the stability range again. Once the stability check count is within the range, the bit of CR#51 will be set to 1.

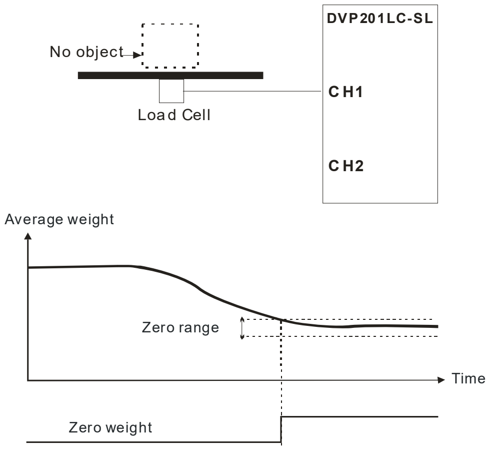
Example: The measurement time set is 10 milliseconds, the number of weights measured in a stability range is 10, and the stability range set is 1000 grams. If a variation exceeds 1000 grams, the bit in CR#51 will be set to 0. If the variations in 100 milliseconds (10×10 ms) are within 1000 grams, the bit in CR#51 will be set to 1. (Users should judge whether the present weight measured is in the stability range set before they perform control.)



- Relevant control registers
  - CR#16, CR#17: Number of weights measured in a stability range
  - CR#18, CR#19: Stability check range

12.7.2.3 Determining Zero

Users can utilize this function to determine when an item has been completely removed from the Load Cell. When the user observes that the stability bit for the measurement value is 1 and the zero point weight bit is also 1, it indicates that the item has been successfully removed from the Load Cell. At this point, users can perform the next control step. (The zero point weight bit is 1 within the zero point detection range.)



- Relevant control registers
  - CR#20/CR#21/CR#48/CR#49: Range for determining whether a weight measured is 0 grams.

12.7.2.4 Filtering out Weight

There are three ways to filter out weights

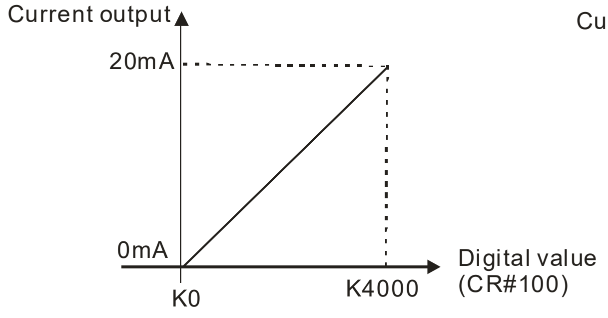
- Filtering out the maximum/minimum weight measured: If there is a maximum weight or a minimum weight, CR#45 can be used to filter out the maximum weight or the minimum weight. If the value in CR#45 is bigger, more weights will be filtered out. Setting range: K0 to K8

  For example, set the value to 8, then the current filtered weight = (current input value x10%) + (previous filtered value x90%).

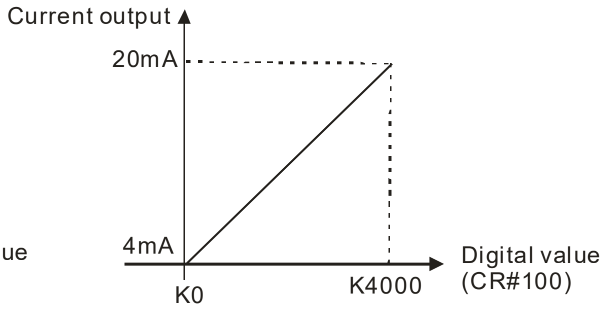
- Averaging weights: The values read are averaged so that a steady value is obtained. There may be peak values due to unavoidable external factors, and the average value obtained changes accordingly. The maximum number of values which can be averaged are 100.
- Low-pass filters (LPF) with different cutoff frequencies are provided. (Supported by firmware V1.14 and above.)

12.7.2.5 Correspondence between Current Outputs and Weights

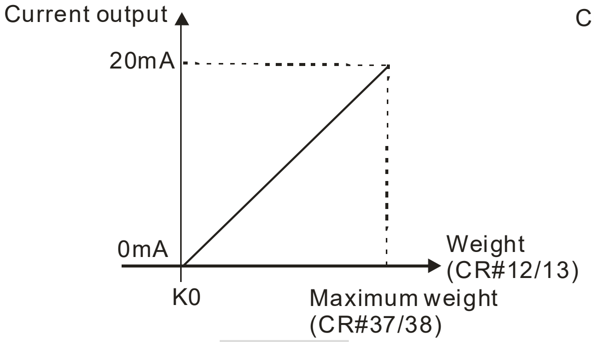
Current outputs directly correspond to weights. Currents vary with weights. Users can set a current output mode by means of CR#103.



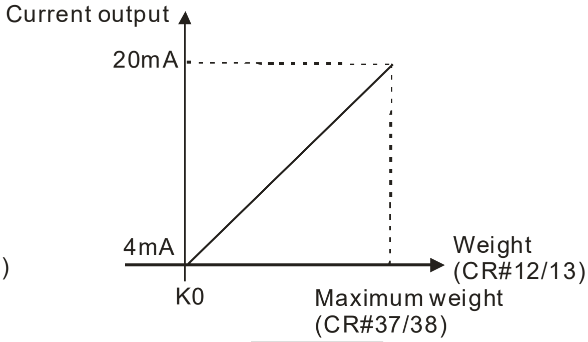
(Mode 0)



(Mode 1)

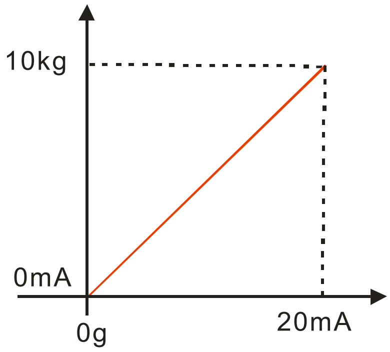


(Mode 2)

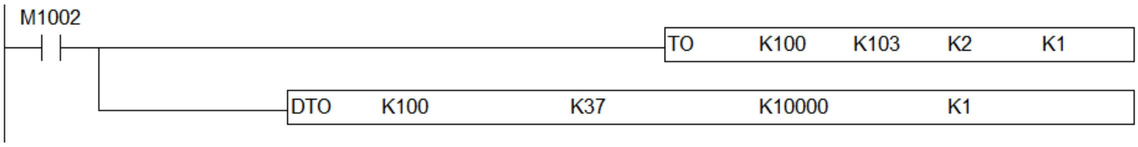


(Mode 3)

Example: 10 kg correspond to 20 mA.

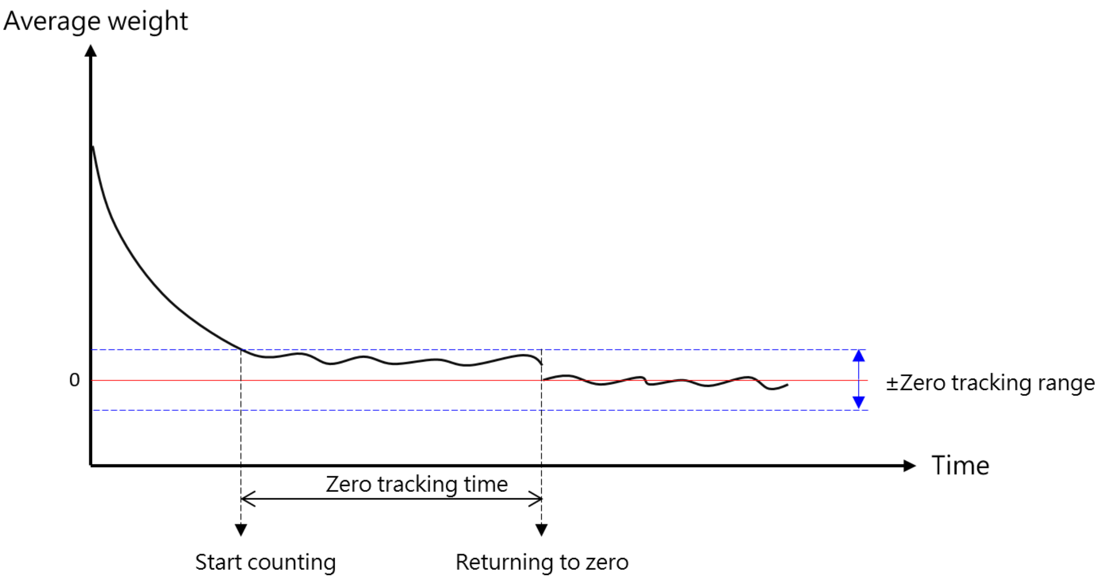


A load cell module is directly connected to the left side of a DVP series PLC. The instruction TO is used to set parameters. CR#103 is set to K2, and CR#37/CR#38 is set to K10000. Please see the WPLSoft program shown below.



12.7.2.6 Zero Tracking

That is Auto-zero function. The sensor may lose flexibility and accuracy after being used for a long time. In this case, you can set up a range for time and weight that zero tracking is attempted. Please refer to CR#95 to CR#98 for relevant information of settings.

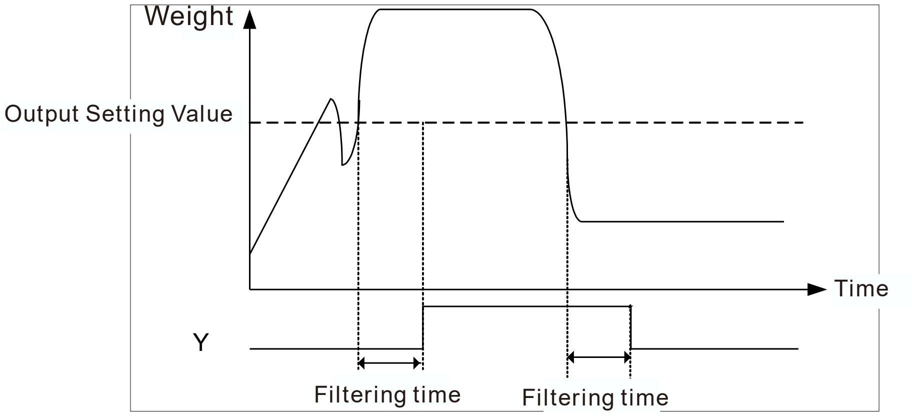


12.7.2.7 Weight Updates

Weight values would be updated in real time while using control registers. Meanwhile, you are allowed to configure the settings of changes in weight values in CR#106 to CR#107 and the weight value would only be updated when the changes are greater than the setting value.

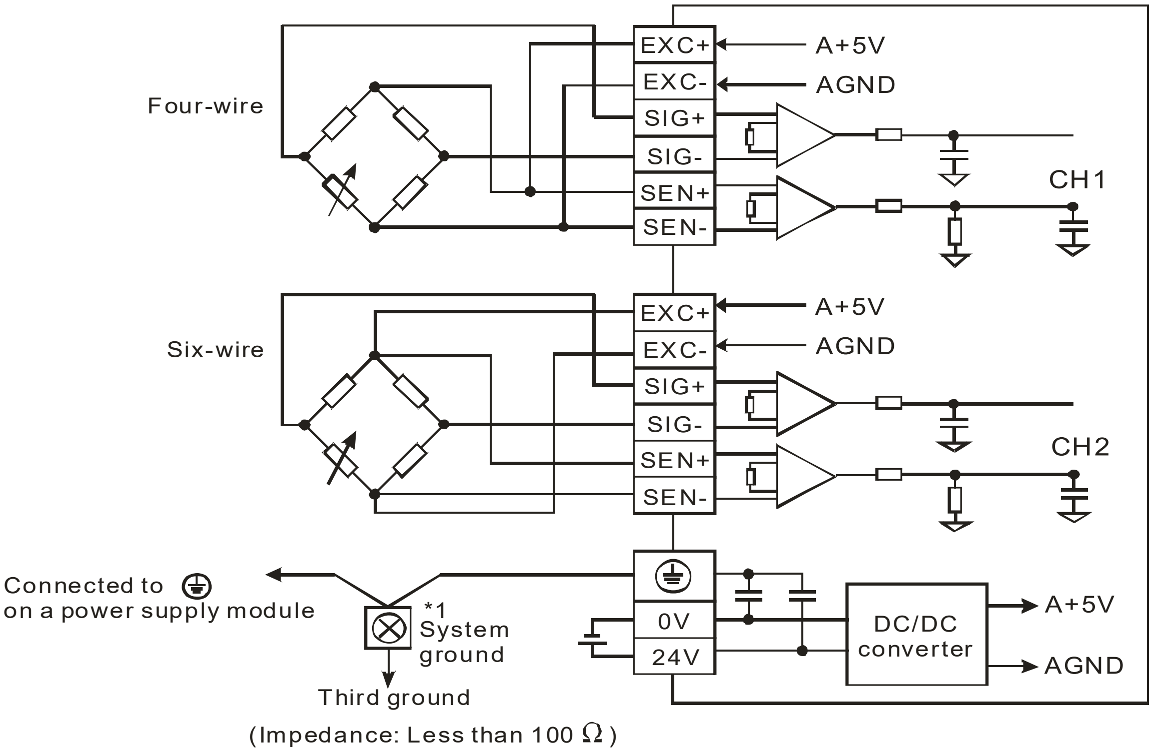
12.7.2.8 Output Values Set for Y Points

When the weight is greater than the weight value that is set to output, you can set the Y point output to ON or OFF. With delay output time, you can prevent multiple Y points from being enabled at the same time. Please refer to CR#110 to CR#121 for details of the related settings.



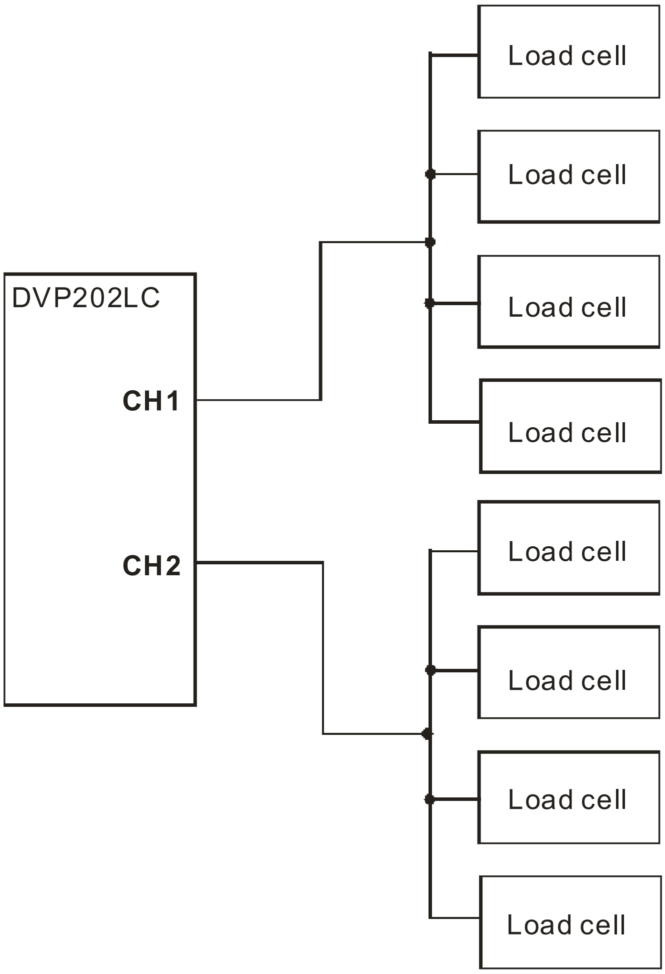
12.8 Wiring

12.8.1 DVP01LC-SL/DVP02LC-SL/DVP201LC-SL/DVP202LC-SL/ DVP211LC-SL Wiring



Note 1: Please connect both ⏚ on a power supply module and ⏚ on the load cell module to a system ground, and then ground the system ground or connect the system ground to a distribution box.

- Multiple load cells connected in parallel are connected to a single load cell module. Take DVP202LC-SL for example.



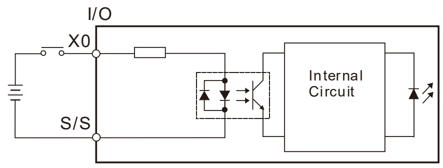
Note 1: Please connect both ⏚ on a power supply module and ⏚ on the load cell module to a system ground, and then ground the system ground or connect the system ground to a distribution box.

Note 2: If multiple load cells are connected in parallel, the total impedance should be greater than 40 Ω.

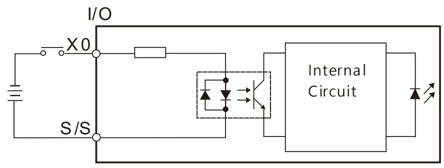
12.8.2 DVP211LC-SL Digital Input Wiring

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

- Sinking

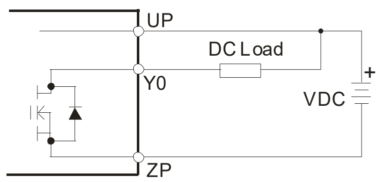


- Sourcing

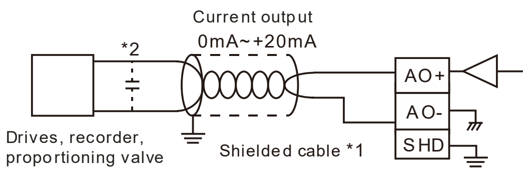


12.8.3 DVP211LC-SL Output Wiring

- NPN Transistor output



- Analog output



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

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

12.9 Software Interface Instructions

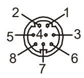
The following content takes the DVP01LC-SL model as an example.

12.9.1 Initial Settings

1. Connect DVP01LC-SL module to the PC, as illustrated below:

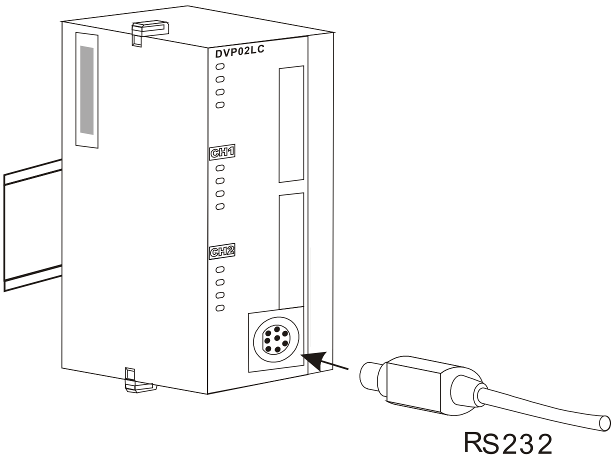
   - Please follow the PIN definitions for the wiring.

PC COM Port 9 PIN D-SUB female		↔	DVP01LC COM Port 8 PIN MINI DIN	
Rx	2	↔	5	Tx
Tx	3	↔	4	Rx
GND	5	↔	8	GND
⌐	7		1, 2	5V
└	8			
⌐	1			
├	4			
└	6			

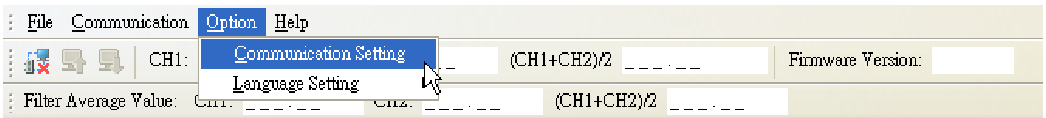


   - There are 2 communication interfaces in DVP01LC-SL available for the communication with the PC and other devices. COM1 is the RS-232 port, and COM2 is the RS-485 port. Both ports comply with standard Modbus protocol. The PC can communicate directly with DVP01LC-SL through COM1.

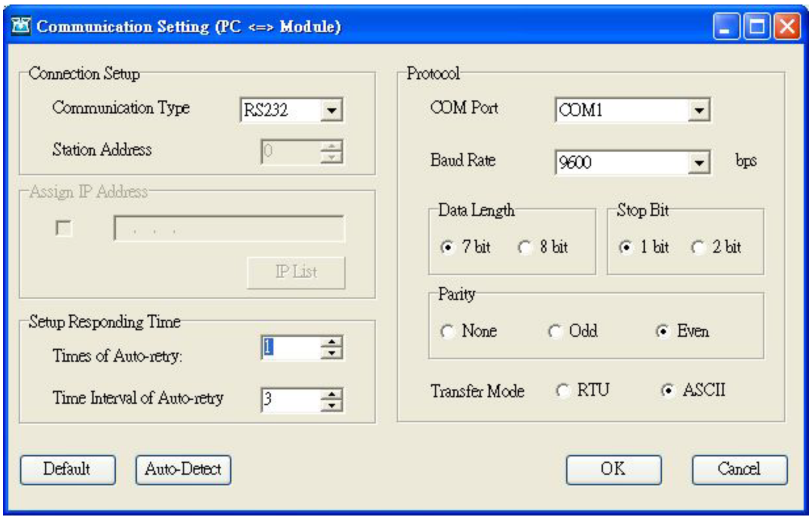
   - We recommend you use Delta's power supply module for DVP01LC-SL.



2. Open the software. Select "Option" -> "Communication Setting".



3. Set up the communication parameters according to the settings below.



- **Setting up responding time**

  Times of auto-retry: Default = 1, range: 0 to 50

  Time interval of auto-retry: Default = 3, range: 1 to 20

- **Setting up COM port**

  COM port: Select the communication port to be connected with the CPU.

  Baud rate: 9600, 19200, 38400, 57600 or 115200

  Data length: 7 bits or 8 bits. When the transmission mode is set to RTU, it will automatically be set to "8 bit".

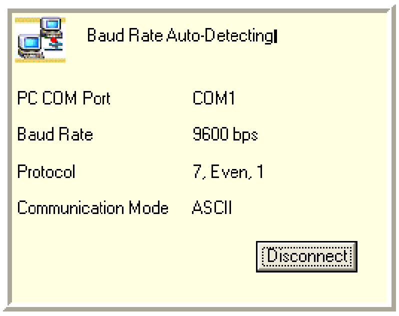
  Stop bit: 1 bit or 2 bits

  Parity: None, Odd or Even

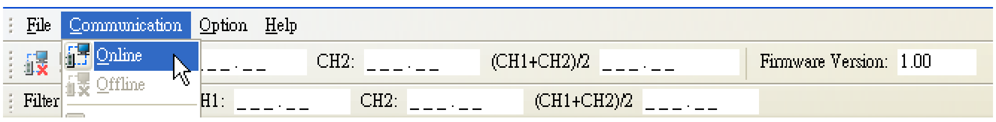
  Transfer (transmission) mode: RTU or ASCII

- **Auto-detection**

  Click the "Auto-Detect" button, and all the connections will be auto-detected in the current transmission mode.



4. After the communication settings are completed, click the icon on the toolbar, or select "Communication" -> "Online" to establish the connection between the software and DVP01LC-SL.

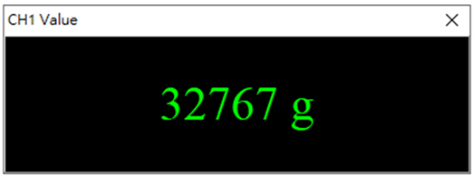


5. When you click “online”, a window for uploading module information will appear, asking whether to upload the module data to the PC. If you select "Yes", the module's configuration values will be uploaded to the software and overwrite the previous software settings.

6. Once you enter the online status, the screen will show the real-time data of DVP01LC-SL, including its current firmware version and the average values of CH1. You can click a value, and a window displaying enlarged characters will appear.

   - **The average values**

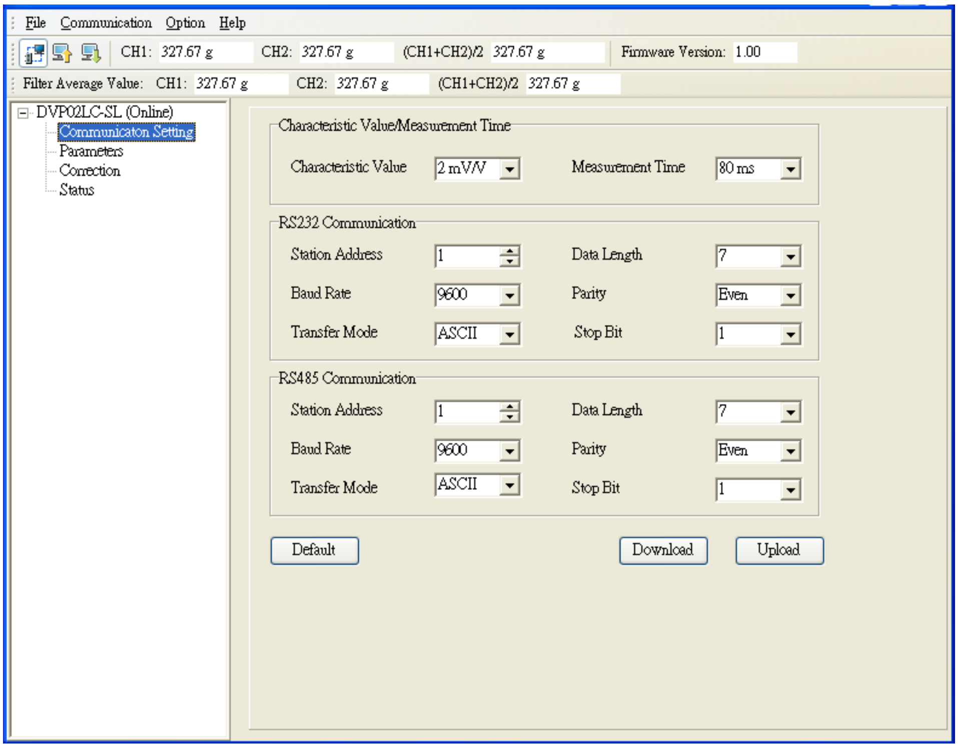
Click on a value, and the enlarged characters of the value will appear.



7. In the connection, if you would like to upload the data in DVP01LC-SL to software, click the icon . Or click the icon  if you would like to download all the parameters set in the software to the module.

12.9.2 Communication Settings

The communication setting window allows you to set up the communication formats for RS-232 and RS-485, the characteristic value (eigenvalue) and measuring time. When all the settings are done, click the icon  to download the parameters to DVP01LC-SL, or click “Upload” to display the parameters of DVP01LC-SL in the software. Click “Default” and all the parameters set will return to the default settings.



(For illustration purpose only)

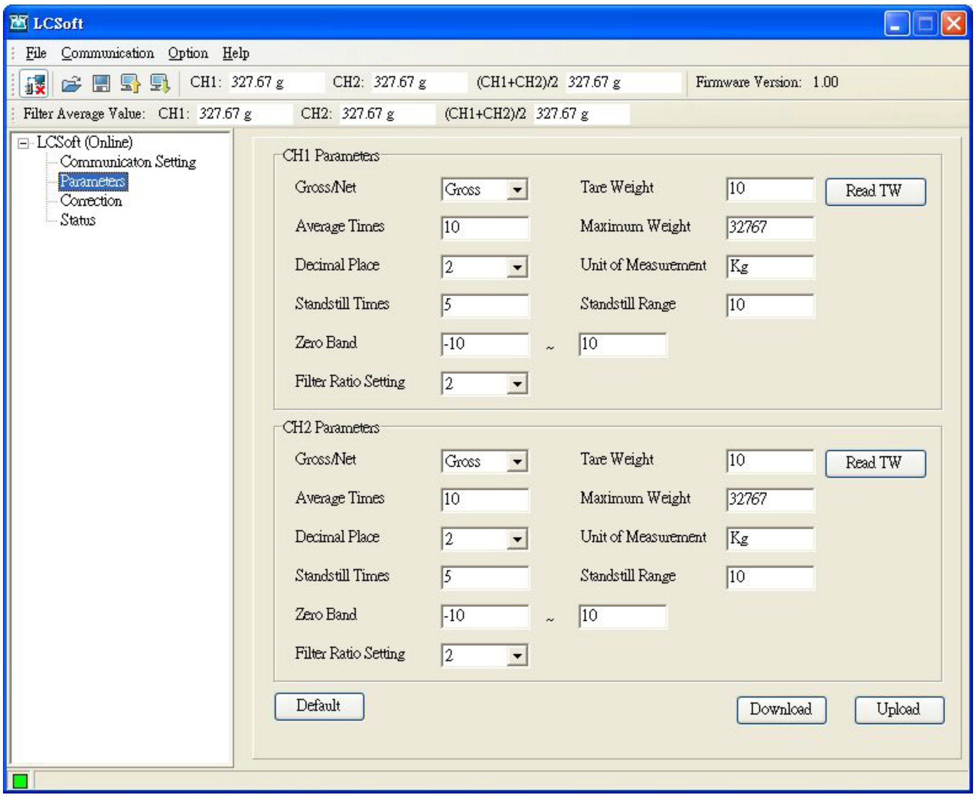
- **Characteristic Value/Measurement time**
  - Characteristic value: The eigenvalue, corresponding to the value set in CR#2. Scroll down to select 1 mV/V, 2 mV/V, 4 mV/V or 6 mV/V. The default setting is 2 mV/V.
  - Measurement time: Corresponds to the value set in CR#3. Scroll down to select 2 ms, 10 ms, 20 ms, 40 ms or 80 ms. The default setting is 80 ms.

- **RS-232 Communication**
  - Station address: The node address, corresponding to the value set in CR#52. Click to set the station address, the range is 1 to 255, and the default setting is 1.
  - Baud rate: Corresponds to bit4 to bit7 of CR#53. Scroll down to select 9600, 19200, 38400, 57600 or 115200. The default setting is 9600.
  - Transfer mode: The transmission mode, corresponding to bit15 of CR#53. Scroll down to select RTU or ASCII. The default setting is ASCII.
  - Data length: Corresponds to bit3 of CR#53. Scroll down to select 7 or 8. The default setting is 7. When the transmission mode is set to RTU, the data length will be automatically set to 8.
  - Parity: Corresponds to bit0 to bit1 of CR#53. Scroll down to select none, odd or even. The default setting is even.
  - Stop bit: Corresponds to bit2 of CR#53. Scroll down to select 0 or 1. The default setting is 1.

- **RS-485 Communication**
  - Station address: The node address, corresponding to the value set in CR#54. Click to set the station address, the range is 1 to 255, and the default setting is 1.
  - Baud rate: Corresponds to bit4 to bit7 of CR#55. Scroll down to select 9600, 19200, 38400, 57600 or 115200. The default setting is 9600.
  - Transfer mode: The transmission mode, corresponding to bit15 of CR#55. Scroll down to select RTU or ASCII. The default setting is ASCII.
  - Data length: Corresponds to bit3 of CR#55. Scroll down to select 7 or 8. The default setting is 7. When the transmission mode is set to RTU, the data length will be automatically set to 8.
  - Parity: Corresponds to bit0 to bit1 of CR#55. Scroll down to select none, odd or even. The default setting is even.
  - Stop bit: Corresponds to bit2 of CR#55. Scroll down to select 0 or 1. The default setting is 1.

12.9.3 Parameter Settings

The parameter setting window allows you to set up parameters for CH1 and CH2, including displaying the net weight or gross weight, the tare weight, average times, maximum weights, units for measurements, the decimal place, range and times for standstill checks, zero point checks and filter percentages. When all the settings are done, click “download” to download the parameters to DVP01LC-SL, or click “Upload” to display the parameters of DVP01LC-SL in the software.



(For illustration purpose only)

- **Gross/Net**

  Corresponds to the value in CR#7. Scroll down to select displaying the gross weight or net weight.

- **Tare Weight**

  Enter the weight value for tare weight settings here or click "Tare" to set it. The range is -32768 to 32767, with a default software value of 0.

- **Maximum Weight**

  When the measured value exceeds the maximum weight, an error will be displayed in the state.

  The range is -32768 to 32767, with a default software value of 32767.

- **Unit of Measurement**

  The weight measurement unit for CH1 corresponds to CR#22 and CR#23. Enter a weight unit here, with a maximum of 4 characters. The default software value is "Kg"

- **Standstill Times**

  The times of standstill checks, corresponding to the value in CR#16. Enter the times here. The range is 1 to 500, and the default setting is 5.

- **Standstill Range**

The stability check range for CH1 corresponds to CR#18. Enter the value here to set the stability check range, ranging from 1 to 10000. The default software value is 10.

- **Zero Band**

  The upper limit of the zero band detection for CH1 corresponds to CR#37, and the lower limit corresponds to CR#39. This range is used for zero-state detection reference. When the weight value is within this range, the status code is set to the zero bit, indicating an empty state. Enter values here to set the upper and lower limits of the zero-point check range, with a range of -32768 to 32767. The default software value is -10 to 10.

- **Average Times**

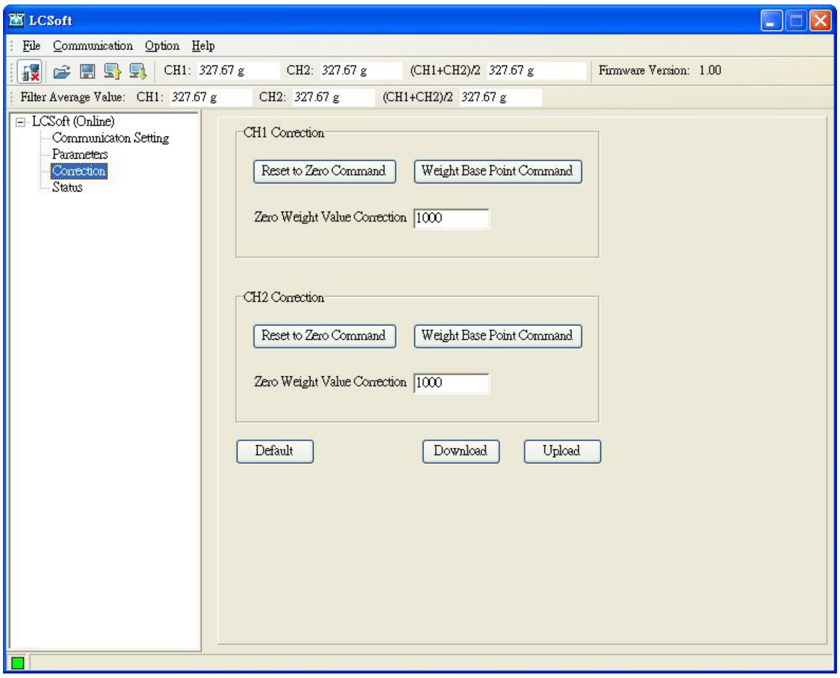
  The range is 1 to 100, and the default setting is 10.

- **Filter Ratio Setting**

  The filter ratio setting for CH1 corresponds to CR#43. This is used to configure the filter ratio for the dynamic filtering function, with a setting range of 1 to 9. The weighted average of the weight after dynamic filtering is displayed in the CH1 filter average value on the toolbar or can be viewed in CR#45 filter average value. The default software value is 2.

12.9.4 Calibration Setting

Here we introduce parameters and corresponding control registers related to calibration in the software. Parameters include reset to zero point commands, weight base point commands and weight calibration commands. When all the settings are done, click “download” to download the parameters to DVP01LC-SL, or click “Upload” to display the parameters of DVP01LC-SL in the software.



(For illustration purpose only)

- **Zero weight value calibration**

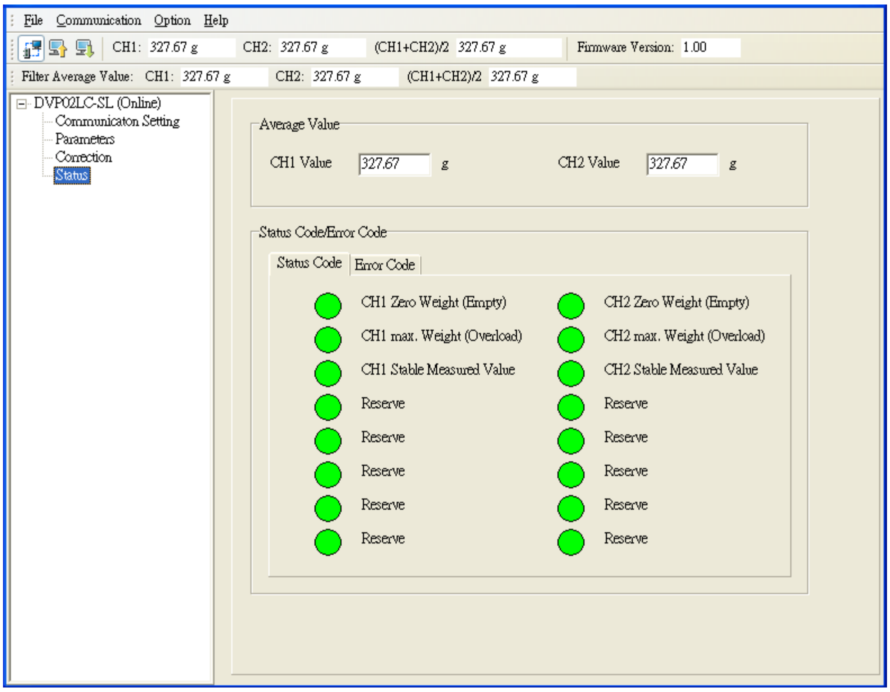
  Corresponds to CR#33 and CR#34. Enter the weight base value here. The default setting is 1,000.

- **Relative Digital Values**

  Digital values corresponding to the actual weight of the calibration weight.

12.9.5 Status Settings

In the status setting window, you can view the measuring results and the operation status of DVP01LC-SL, including the present average value in CH1, the unit of measurement, status codes and error codes.



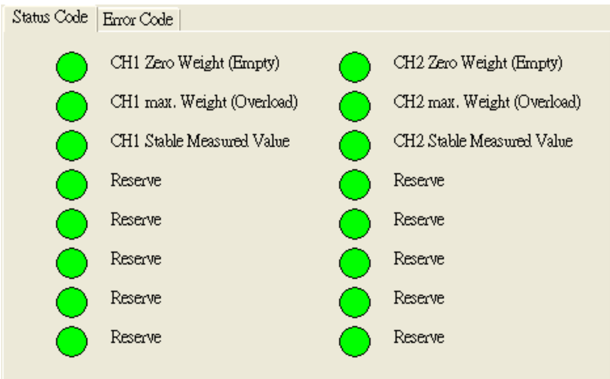
(For illustration purpose only)

- **Weight value**

  The current measured weight value, displayed in the unit previously set for weight measurement.

- **Status code**

  Corresponds to the value set in CR#50, indicating the measuring statuses at CH1 and CH2, including the empty load, overload and whether the measured values are stable.

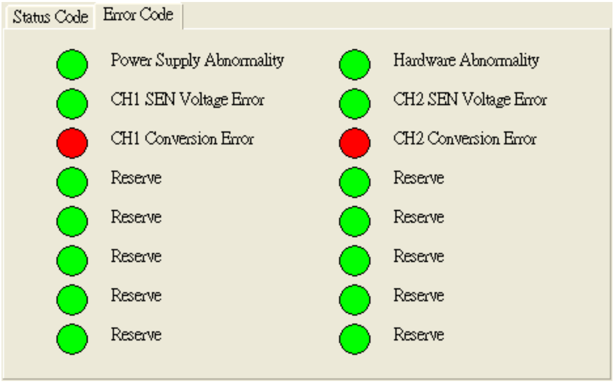


(For illustration purpose only)

- CH1 zero weight (empty): Corresponds to bit0 of CR#50. When the value measured at CH1 equals 0, the indicator will turn red.
- CH1 max. weight (overload): Corresponds to bit2 of CR#50. When the value measured at CH1 exceeds the maximum weight set, the indicator will turn red.
- CH1 stable measured value: Corresponds to bit4 of CR#50. When the value measured at CH1 is stable, the indicator will turn red.

- **Error code**

Corresponds to the value in CR#51, displaying the operation status, including power supply abnormality, hardware abnormality, SEN voltage errors and conversion errors.



(For illustration purpose only)

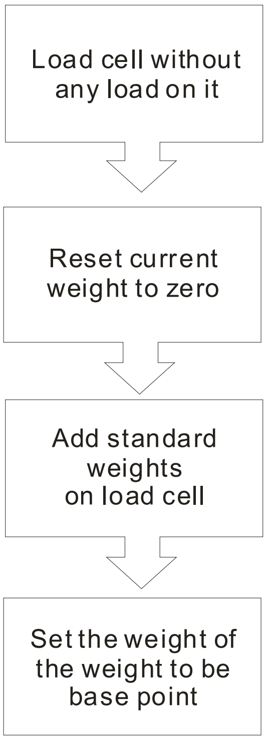
- Power supply abnormality: Corresponds to bit0 of CR#51. When the power supply encounters abnormality, the indicator will turn red.
- Hardware abnormality: Corresponds to bit1 of CR#51. When the hardware encounters abnormality, the indicator will turn red.
- CH1 SEN voltage error: Corresponds to bit3 of CR#51. When the SEN signal input at CH1 encounters error, i.e. abnormal load cell signal occurs, the indicator will turn red.
- CH1 conversion error: Corresponds to bit4 of CR#51. When the conversion of the measured signal at CH1 encounters an error, the indicator will turn red.

12.10 Calibration

12.10.1 DVP01LC-SL/DVP02LC-SL Calibration

The following content uses the DVP01LC-SL model as an example.

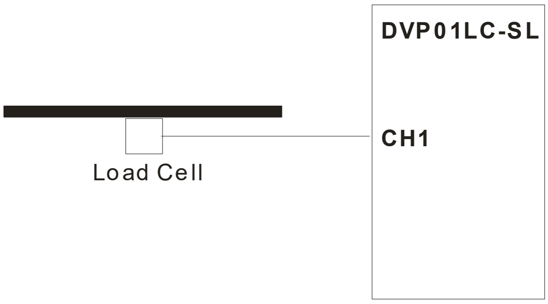
Calibration is performed to align the module with the weight values of the Load Cell and allows for the adjustment of the curve as desired. The calibration steps are illustrated in the diagram below. Calibration can be divided into PLC calibration and software calibration. PLC calibration involves connecting the DVP PLC CPU to the DVP01LC-SL module and using TO/FROM instructions to carry out the calibration steps. Software calibration, on the other hand, requires the PC to connect to the DVP01LC-SL module using an RS-232 communication cable. The module calibration steps are then performed in the software, without the need for sending control commands through the DVP PLC. The following will introduce the PLC calibration and software calibration steps separately.



12.10.1.1 Calibration by the PLC

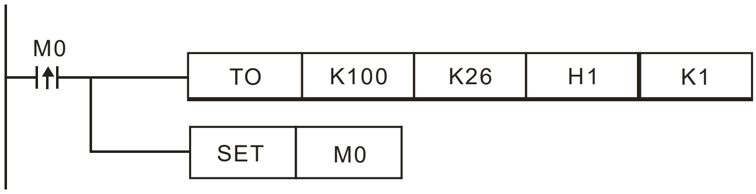
In this example, we connect DVP02LC-SL to a DVP series PLC CPU and correct CH1 by TO instruction.

1. Connect the DVP01LC-SL module to the left side of the CPU and provide power supply to them individually according to the requirements.
2. Connect the Load Cell to module CH1, as illustrated in the diagram below. Please refer to section 12.8 for the wiring details.

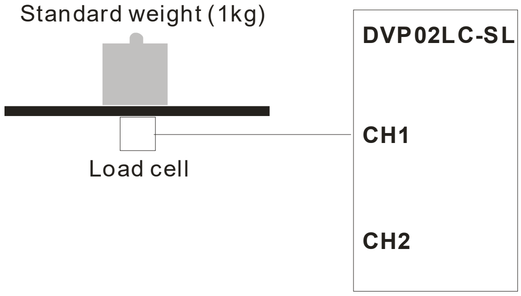


3. Set up every parameter and eigenvalue according to the actual measuring requirements and specifications of the load cell. In this example, we use the initial settings of all parameters.

4. Execute the Reset-to-Zero command by writing H’0001 into CR#26, as the WPLSoft program below.

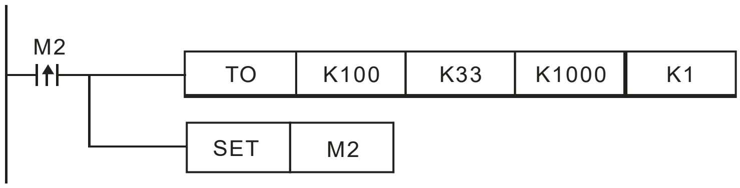


5. Add a 1 kg weight on the load cell. Please be aware of the maximum weight the load cell can take.



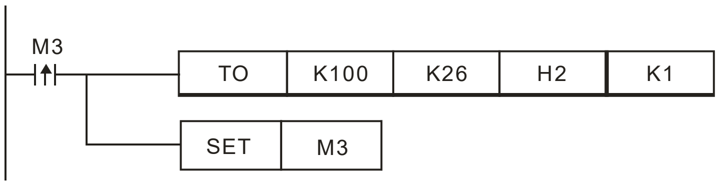
(For illustration purpose only)

6. Write the corresponding digital value for the 1kg calibration weight (in this example, 1 kg corresponds to K1000) into CR#33 and CR#34 (CH1 calibration weight baseline), as shown in the WPLSoft program in the following diagram.

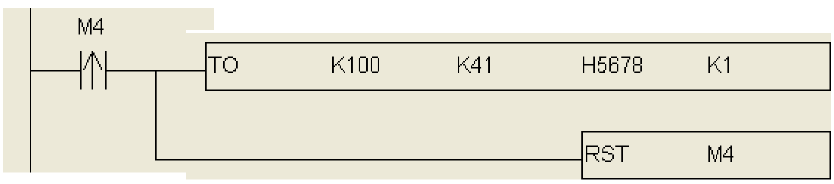


Note: Users can set arbitrary values, and the corresponding curve graph will also differ. Please refer to section 12.10.1.3 for guidance.

7. Execute the weight base point command by writing H’0002 into CR#26, as the WPLSoft program below.



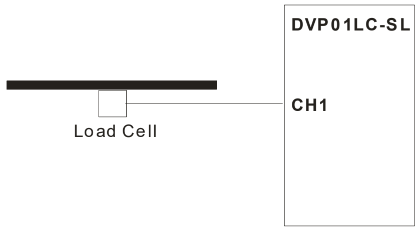
8. Save the calibration results for future use upon the next power-up. Write H'5678 into CR#41, as illustrated in the WPLSoft program shown below.



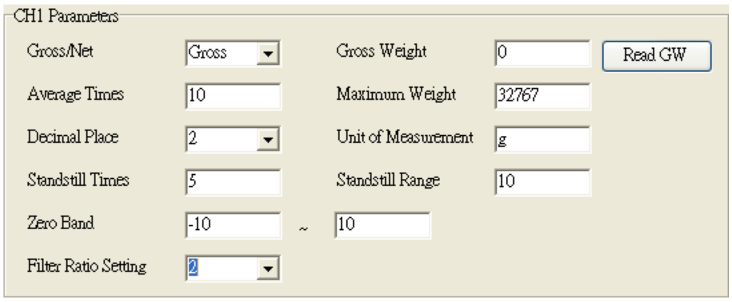
12.10.1.2 Calibration by Software

In this example, we will demonstrate how to correct CH1 on DVP01LC-SL by the software.

1. Install the communication connection cable. Connect the PC to the DVP01LC-SL module using an RS-232 communication cable and provide power supply according to the requirements.
2. Connect the Load Cell to the module's CH1, as illustrated in the diagram below. Please refer to section 12.8 for the wiring details.

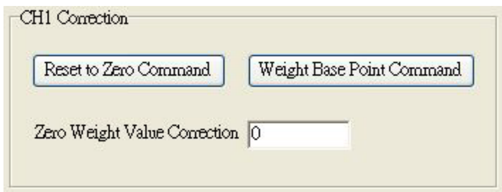


3. Open the software and see 12.9.1 for how to set up the connection between the software and DVP01LC-SL.
4. Click "Parameters" on the left-hand side column to start setting up the parameters. Set up every parameter and eigenvalue according to the actual measuring requirements and specifications of the load cell. After the parameter setups are done, click "Download".



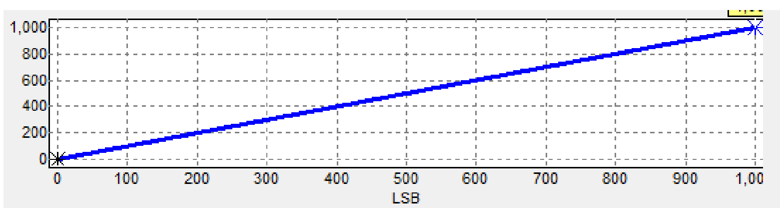
(For illustration purpose only)

5. Click on "Calibration" in the left window. Begin by entering the actual weight of the calibration weight as 1000 and inputting the corresponding digital value as 1000 (in this example, 1 kg corresponds to K1000). Click on the next step command to start the calibration.

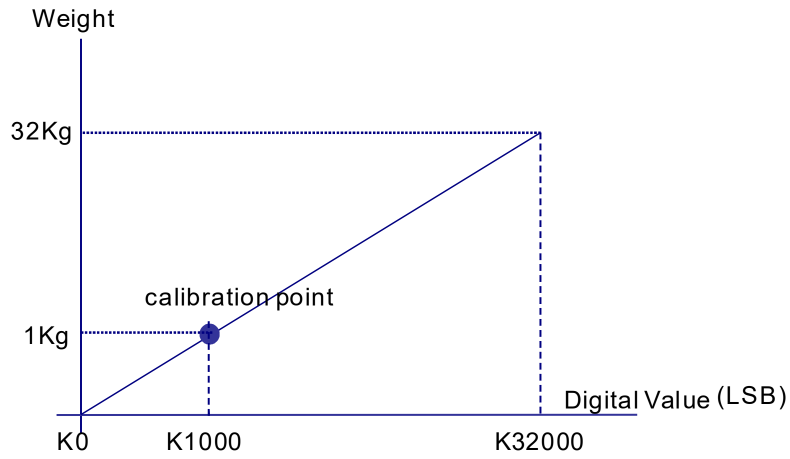


(For illustration purpose only)

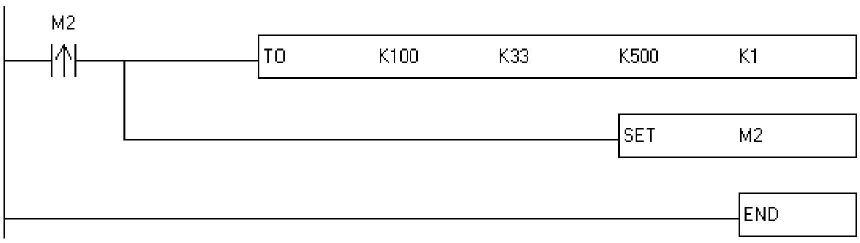
6. In the state where no items are placed on the Load Cell, the CH1 weight display is equal to 0 g. Click on the next step command.
7. Place a standard 1 kg calibration weight on the Load Cell. Note: Please refer to the maximum weight that the Load Cell can bear at the time. Click on the next step command.
8. Calibration completed. The diagram below displays the relationship between the digital values and corresponding weight values.



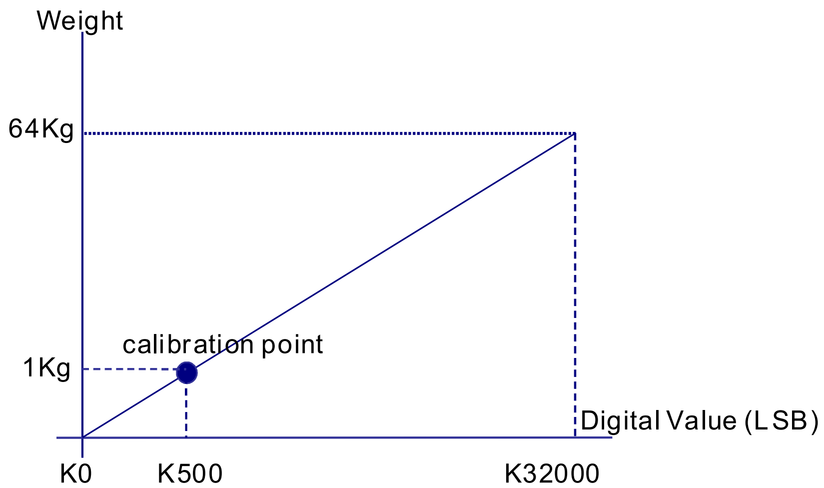
12.10.1.3 Example Curve Graph After Calibration



The digital values corresponding to the calibration weight can be written arbitrarily by the user, and the generated curve graph will also differ. For example, if you modify the 1 kg calibration weight from corresponding to K1000 to corresponding to K500, write it into CR#33 (CH1 calibration weight baseline), as shown in the WPLSoft program in the following diagram.

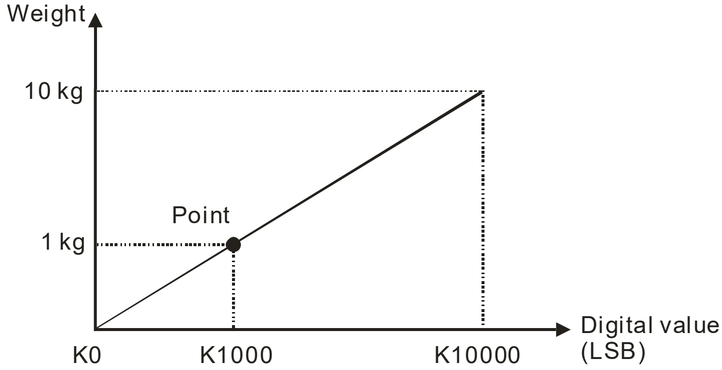


After calibration, the curve graph is as follows:



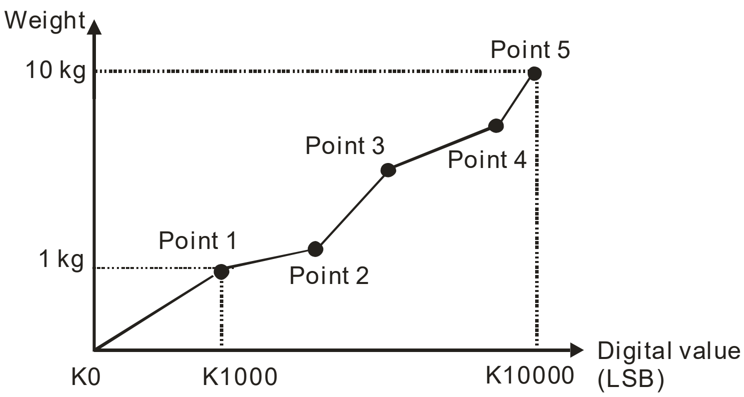
12.10.2 DVP201LC-SL/DVP202LC-SL/DVP211LC-SL Calibration

The purpose of making adjustment is to make the weight measured on a load cell correspond to the digital value displayed in a load cell module. Generally, two points are adjusted. After a system is set up, users can put no load on the scale. The weight measured is 0 grams when no load is put on the scale. The users can put a given weight on the scale and set a digital value corresponding to the weight. The two points are adjusted. For example, if a load cell sensor which can measure a maximum weight of 10 kg is used, and 1 kg correspond to K1000, the curve presented will be like the one shown below.



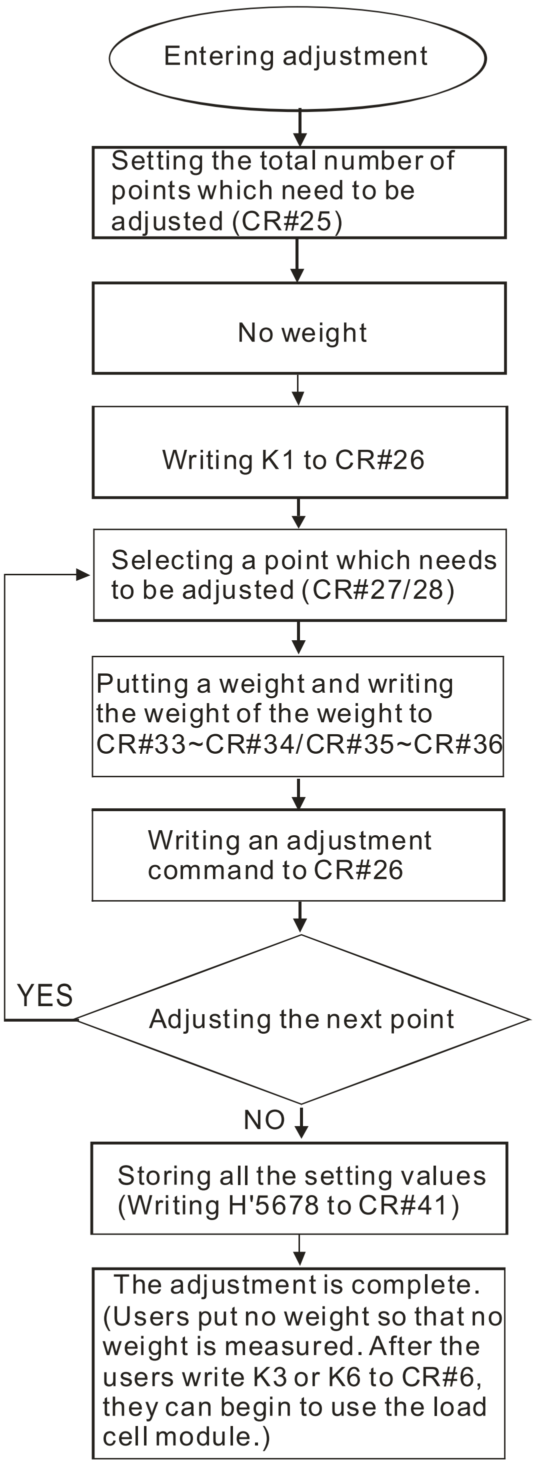
Adjusting two points

In addition to the adjustment of two points, a load cell supports the adjustment of multiple points (20 points at most). A characteristic curve is shown below.



Adjusting multiple points

12.10.2.1 Steps in calibration



12.10.2.2 Example 1

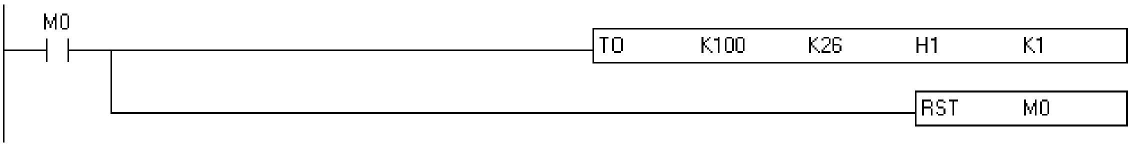
Example: One point is adjusted. (A weight which weighs 1 kg corresponds to 1000 LSB.)

A load cell module is directly connected to the left side of a DVP series PLC. The instruction TO is used to make adjustment. The steps in making adjustment are as follows.

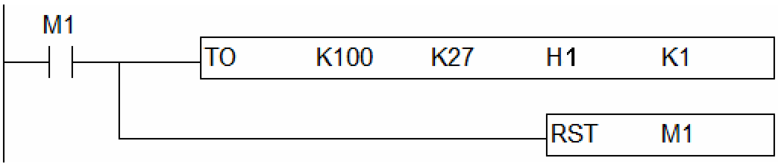
Step 1: Write K2 to CR#25. Please see the WPLSoft program shown below.

Step 2: Connect a load cell to a module and put no load on the load cell.

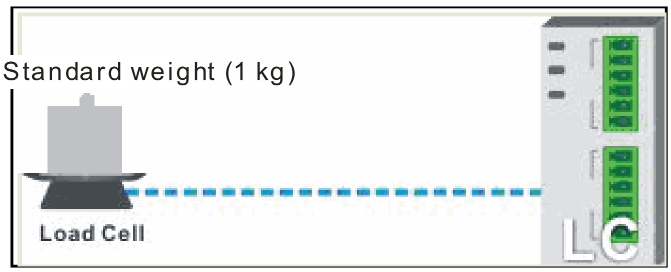
Step 3: Write H'0001 to CR#26.



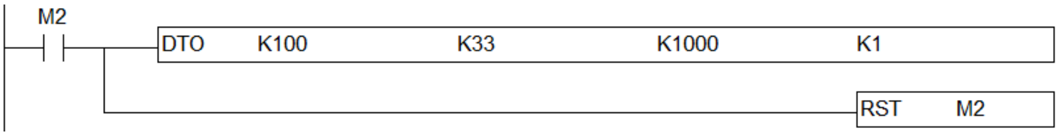
Step4: Select point 1 (default setting) and write H1 to CR#27.



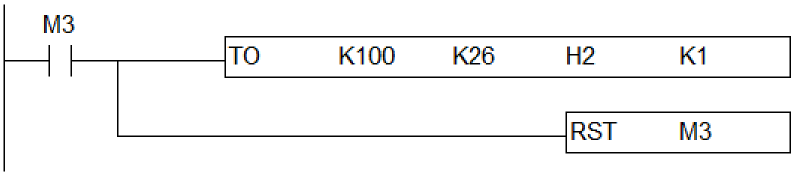
Step5: Put a standard weight which weighs 1000 g on the load cell.



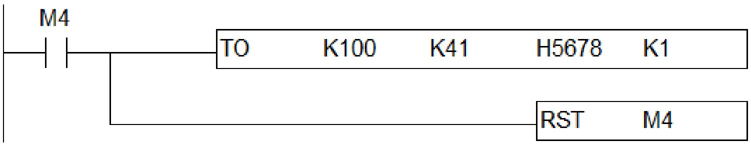
Step 6: Write K1000 (1000 g) to CR#33.



Step 7: Write H2 to CR#26.



Step 8: Make sure that the value displayed is correct, and make the adjusted settings retentive by writing H’5678 to CR#41.



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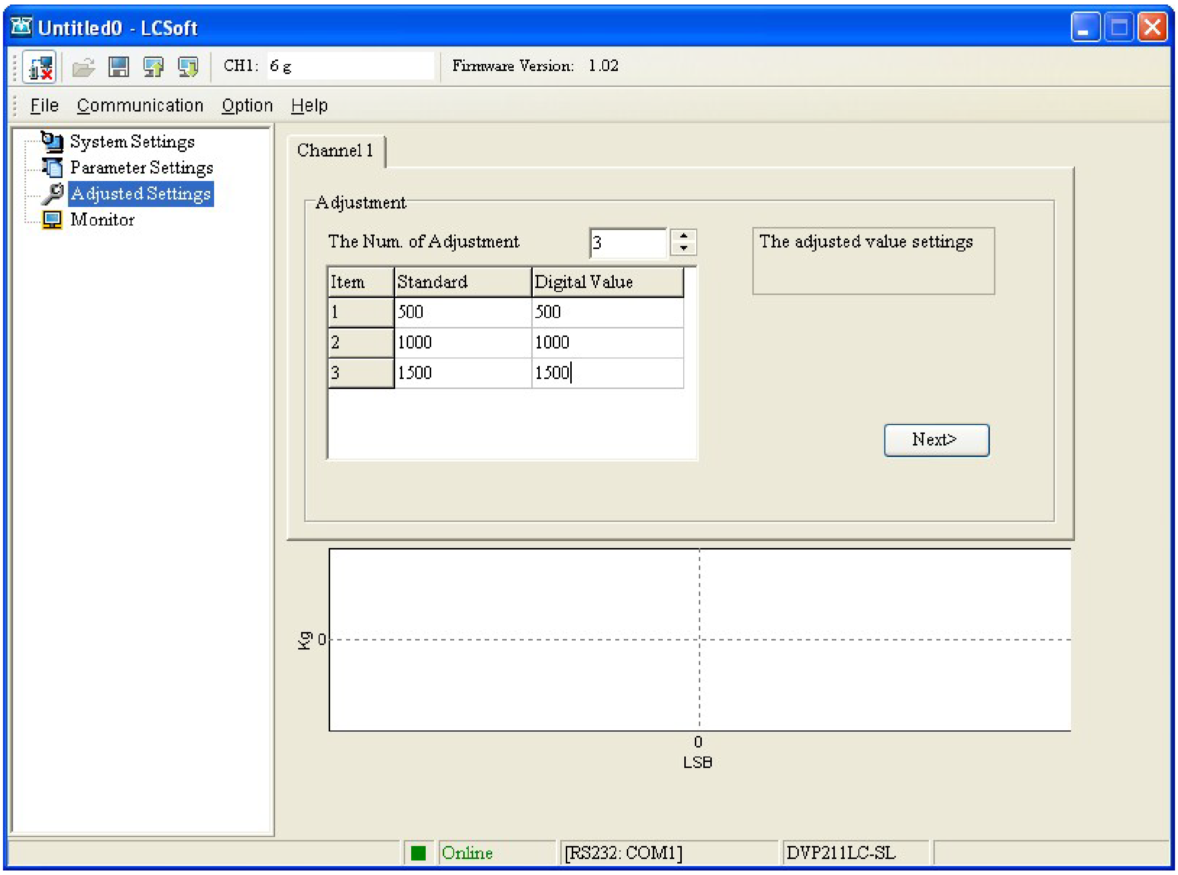
12.10.2.3 Example 2

Example: Three points are adjusted.

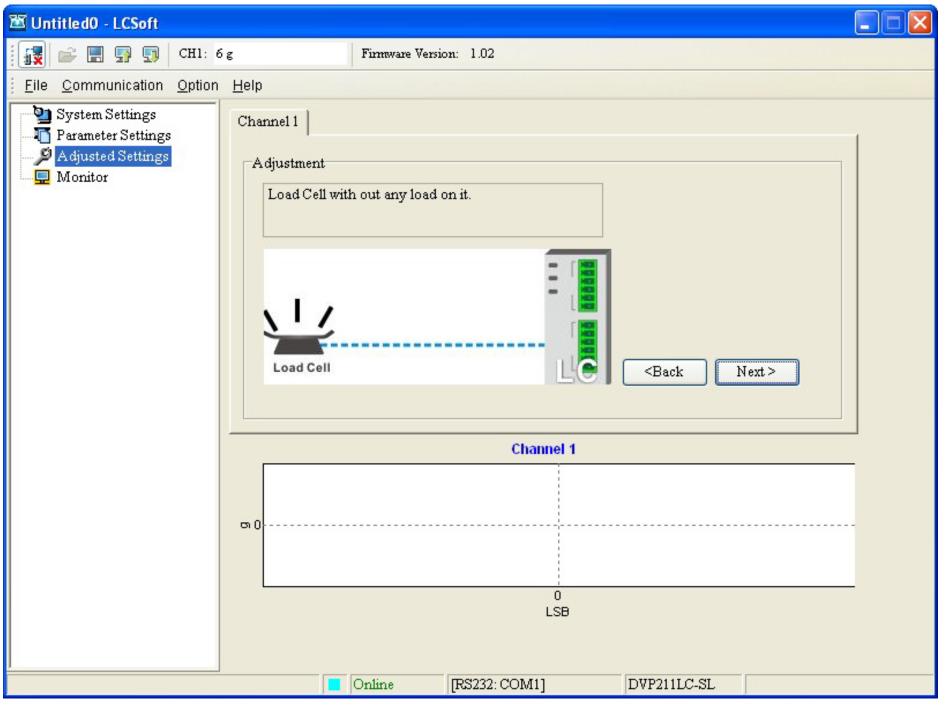
Note: the "Decimal Point Setting" and "Weight Measurement Unit" on LCSoft are for software display purposes only and will not affect the digital values of the module itself.

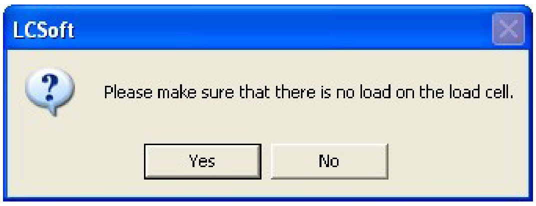
A load cell module is used independently. The steps in making adjustment are as follows.

Step 1: Select **3** in **The Num. of Adjustment** box. The weight of the first weight is 500 g. It corresponds to 500 LSB. The weight of the second weight is 1000 g. It corresponds to 1000 LSB. The weight of the third weight is 1500 g. It corresponds to 1500 LSB. Please see the figure below.

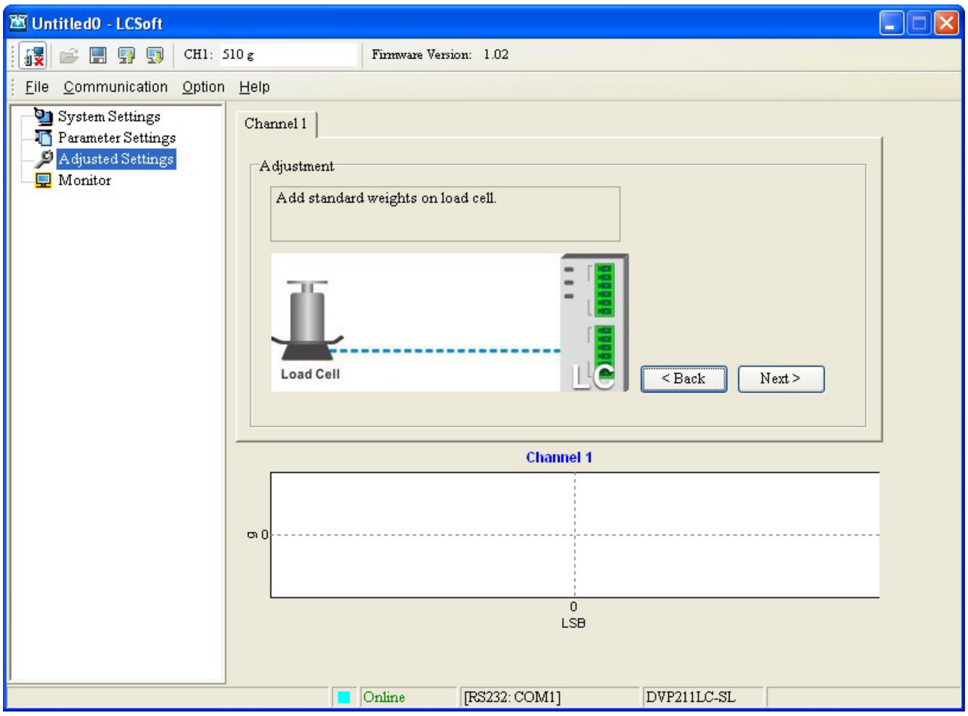


Step 2: Put no load on the load cell used. Click “Next.”

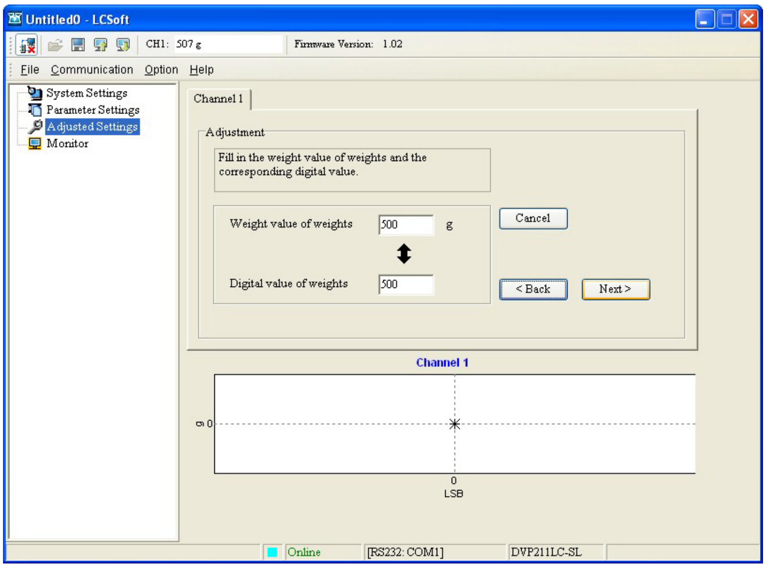


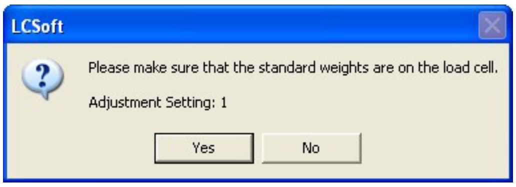


Step 3: Put a standard weight which weighs 500 g on the load cell used and click **Next**.

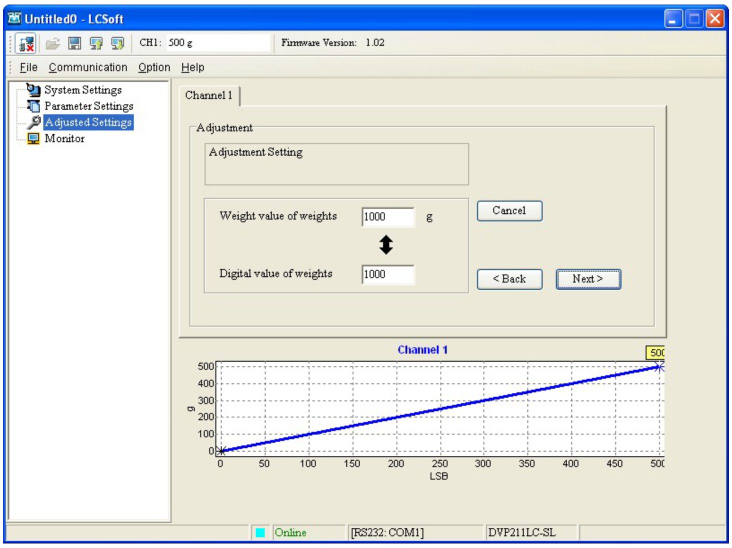


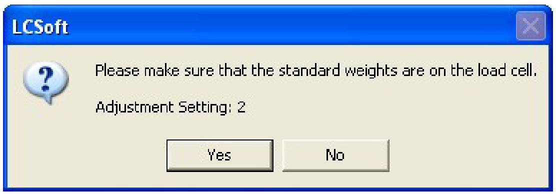
Step 4: Type “500” in the **Weight value of weights** box, type “500” in the **Digital value of weights** box, and click **Next**.



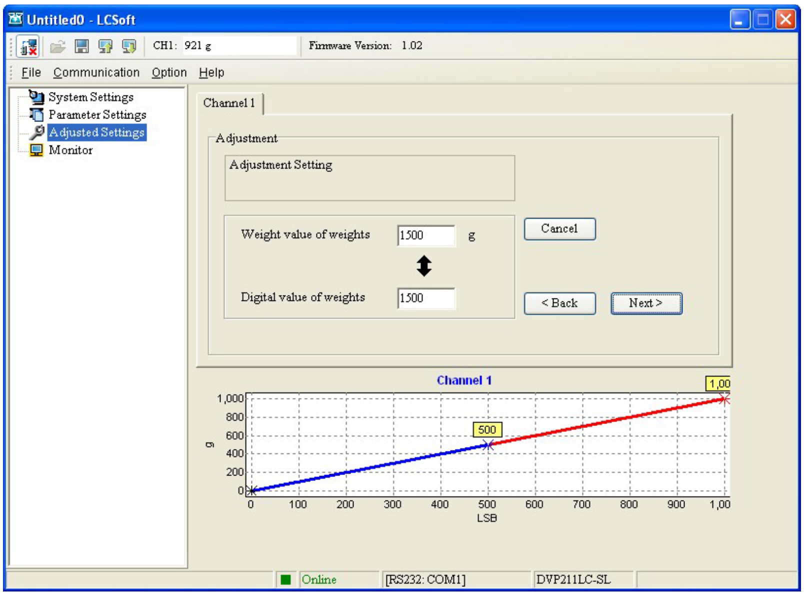


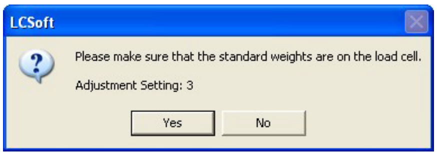
Step 5: Put a standard weight which weighs 1000 g on the load cell used. Type “1000” in the **Weight value of weights** box, type “1000” in the **Digital value of weights** box, and click **Next**.



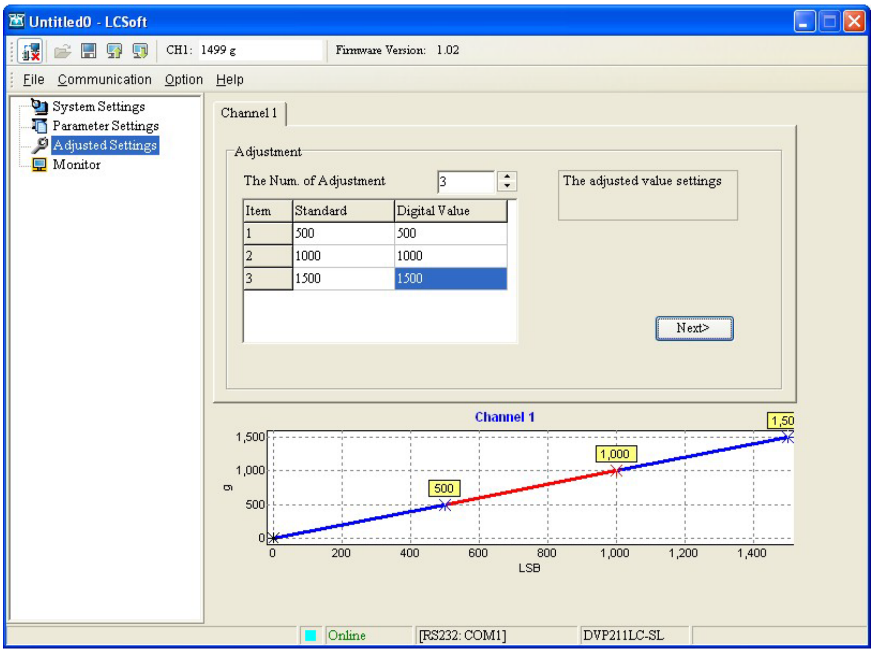


Step 6: Put a standard weight which weighs 1500 g on the load cell used. Type “1500” in the **Weight value of weights** box, type “1500” in the **Digital value of weights** box, and click **Next**.





Step 7: The adjustment made is complete, and a curve is displayed.



12.11 Troubleshooting

When an error occurs in the left-side high-speed weighing (LC) module, an error indicator will start blinking. Once you see an error indicator blinking, you can use the FROM instruction to read the error codes stored in CR#51. Each of bit 0 to bit 15 determines an error state. It is possible to have two errors at the same time. 0 indicates normal and 1 indicates error. Refer to the following table for more regarding causes and solutions for troubleshooting.

12.11.1 DVP01LC-SL/DVP02LC-SL

Bit No.	RUN LED	ERROR LED	Description	Solution
Bit 0	OFF	Blinking	The external voltage is abnormal	Check the power supply.
Bit 1	No change	Blinking	Hardware malfunction	Contact the factory.
Bit 2	No change	Blinking	CH1 conversion error	Check the input signal of CH1
Bit 3	No change	Blinking	CH1 SEN voltage error	Check the wiring of CH1.
Bit 4	No change	Blinking	CH2 conversion error	Check the input signal of CH2
Bit 5	No change	Blinking	CH2 SEN voltage error	Check the wiring of CH2.

12.11.2 DVP201LC-SL/DVP202LC-SL/DVP211LC-SL

Bit No.	RUN LED	ERROR LED	Description	Solution
Bit 0	OFF	ON	The external voltage is abnormal	Check the power supply.
Bit 1	No change	ON	Hardware malfunction	Contact the factory
Bit 2	No change	Blinking	CH1 input exceeds measurement range or SEN voltage error	Check the wiring of CH1
Bit 3	No change	Blinking	CH1 calibration error	Make recalibration for CH1; the calibration curve cannot be turned.
Bit 4	No change	Blinking	CH1 exceeds the upper weight limit	Check if the input signal of CH2 exceeds the upper weight limit.
Bit 5	No change	Blinking	CH1 no load	State flag, non-error
Bit 6	No change	Blinking	CH1 measurement value is stable	State flag, non-error
Bit 7	No change	Blinking	CH2 input exceeds measurement range or SEN voltage error	Check the wiring of CH2
Bit 8	No change	Blinking	CH2 calibration error	Make recalibration for CH2; the calibration curve cannot be turned.
Bit 9	No change	Blinking	CH2 exceeds the upper weight limit	Check if the input signal of CH2 exceeds the upper weight limit.
Bit 10	No change	Blinking	CH2 no load	State flag, non-error
Bit 11	No change	Blinking	CH2measurement value is stable	State flag, non-error

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Chapter 13 DVP-S Series Left-Side High-Speed Communication Module

Table of Contents

13.1 DVPEN01-SL

13.1.1 Introduction

DVPEN01-SL is an Ethernet communication module for remote setting and communication through DVP-CPU project editing software. DVPEN01-SL features functions such as sending E-mail, automatic network correction for RTC in PLC, data exchange, etc. It supports MODBUS TCP communication protocol and can conduct remote monitoring by using SCADA (Supervisor Control and Data Acquisition) software or HMI (Human Machine Interfaces). DVPEN01-SL can be the master of MODBUS TCP, sending out MODBUS TCP instructions and controlling the peripheral equipment. In addition, under MDI/MDI-X auto-detection, it does not need to use a crossover cable. See below for more details on DVPEN01-SL module.

13.1.1.1 Features

- Auto-detects 10/100 Mbps transmission rate
- MDI/MDI-X auto-detection
- Supports MODBUS TCP protocol (supports Master and Slave modes simultaneously)
- Able to send out E-mails (Does not support TLS/SSL certificates)
- Auto-corrects the RTC in PLC through the Internet time correction function
- Supports point-to-point data exchange (Max. data exchange length: 200 bytes)
- Firmware version V2.18 and above (inclusive) support DVP-SV3 and DVP-SX3 PLC CPUs.

13.1.1.2 Specifications

- Internet interface

Item	Specifications
Interface	RJ-45 with Auto MDI/MDIX
Number of ports	RS-232 1 Port
Transmission method	IEEE802.3, IEEE802.3u
Transmission cable	Category 5e, UC-PRG030-20A (3 M)
Transmission rate	10/100 Mbps (Auto-Detect)
Network protocol*1	DHCP, SMTP, SNMP, NTP, MC Protocol, MODBUS TCP

*1. When installed on the left side of DVP-SV3 and DVP-SX3 PLC CPUs, SMTP, SNMP, and MC Protocol are not supported.

Item		Specification
MODBUS TCP	**Client: Maximum number of connections**	24 (data exchange table) 2 (CR data exchange function)
	Server: Maximum number of connections	16
	Maximum data length for a single connection	100 words
MC Protocol	**Communication type**	UDP
	Client: Maximum number of connections	10
	Server: Maximum number of connections	8
	Maximum data length for a single connection	100 words
RTU-EN01	**Maximum connection count***2	4
IP filter function	**Number of entries in the whitelist.**	8
SNMP	**Version**	SNMPv2
	Number of communities	2
	Permissions	GET, GET/SET
SMTP Email function	**Number of E-mails**	4

*2. The RTU-EN01 mapping feature does not consume any additional MODBUS TCP connections

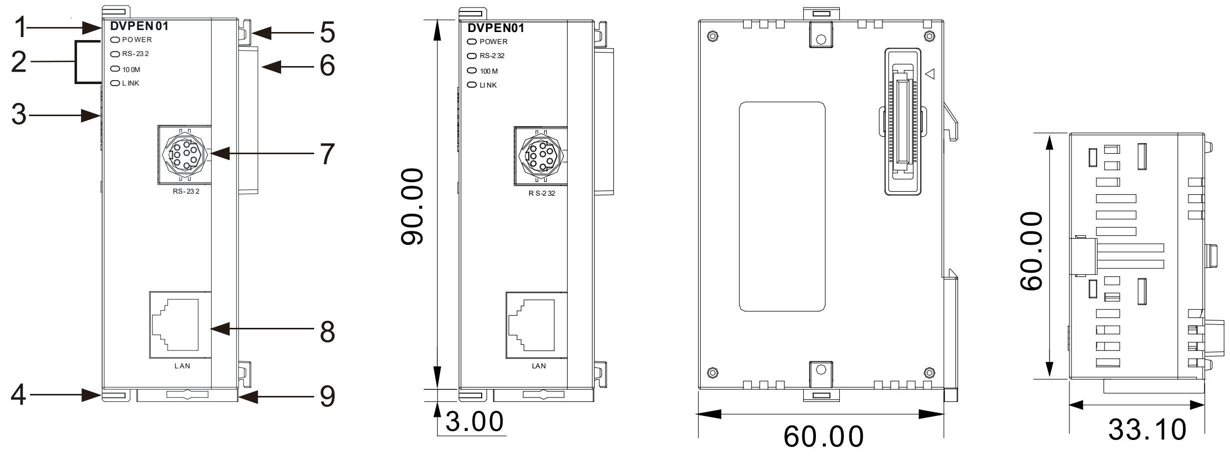
- **Serial communication interface**

Item	Specification
Interface	RS-232
Number of ports	1 port
Function	Supports only parameter settings.
Transmission cable	UC-MS030-01A (3 M), UC-MS010-02A (1 M), UC-PRG020-12A (2 M)

- **Electrical specifications**

Item	Specification
Power supply voltage	24 VDC (-15 to 20%) (Power is supplied by the internal bus of the CPU.)
Power consumption	1.5 W
Insulation voltage	500 V
Weight (g)	92

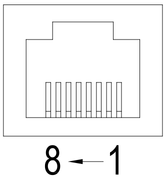
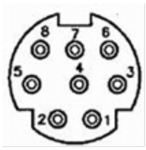
13.1.2 Module Profiles and Dimension



Unit: mm

No.	Name	Description
1	Model name	Module model number.
2	POWER LED indicator(Green)	Indicates the power status of the power supply ON: the power is on. OFF: no power
	LINK indicator(Green)	ON: Network connection normal Blinking: Network in operation OFF: Not connected to the network
	RS-232 indicator(Red)	Blinking: Data transmission in progress OFF: No data transmission
	100M indicator(Orange)	ON: Ethernet transmission rate is 100 Mbps. OFF: Ethernet transmission rate is 10 Mbps.
3	Extension module connection port	Connect the modules.
4	Extension unit fixing clip	For securing the extension module.
5	Extension unit positioning hole	For positioning between modules.
6	Extension module connection port	Connect the PLC or the module.
7	RS-232communication port	For wiring RS-232 communication.
8	Ethernet communication port	For connecting Ethernet network.
9	DIN rail securing clip	Secure the modules on the set

13.1.3 Terminals

Ethernet (RJ-45) Pin Definition				
	Pin no.	Definition	Pin no.	Definition
	1	TX+	5	N/C
	2	TX-	6	RX-
	3	RX+	7	N/C
	4	N/C	8	N/C
RS-232 Pin Definition				
	Pin no.	Definition	Pin no.	Definition
	1	N/C	5	TX
	2	N/C	6	N/C
	3	N/C	7	N/C
	4	RX	8	GND

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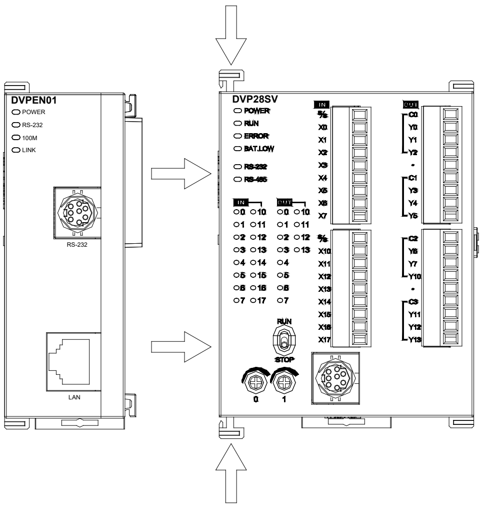
13.1.4 Installation and Wiring

13.1.4.1 Installation

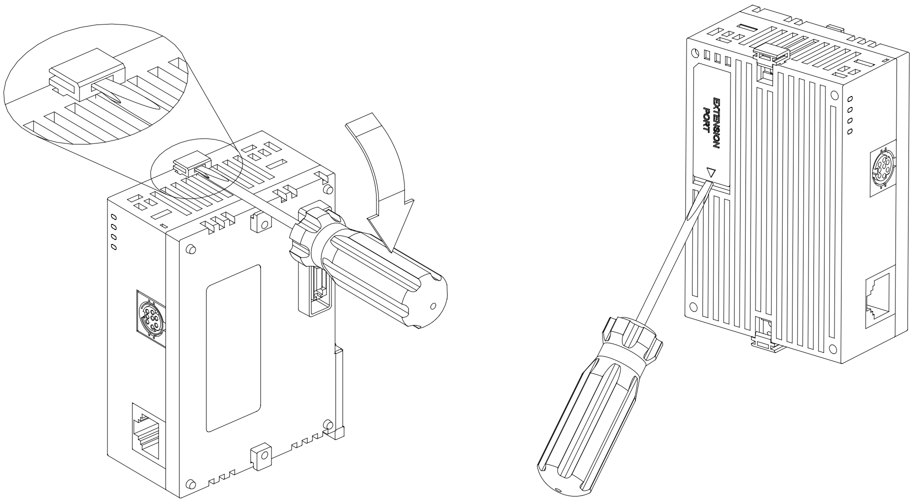
1. Connecting DVPEN01-SL to the PLC CPU:

- Adjust the I/O module clip on the left side of the PLC CPU.
- Align the corresponding connectors on the DVPEN01-SL and the PLC CPU, then securely connect them as illustrated.
- Fasten the DVPEN01-SL clip onto the left side of the PLC CPU.



2. Connecting DVPEN01SL to other I/O modules:

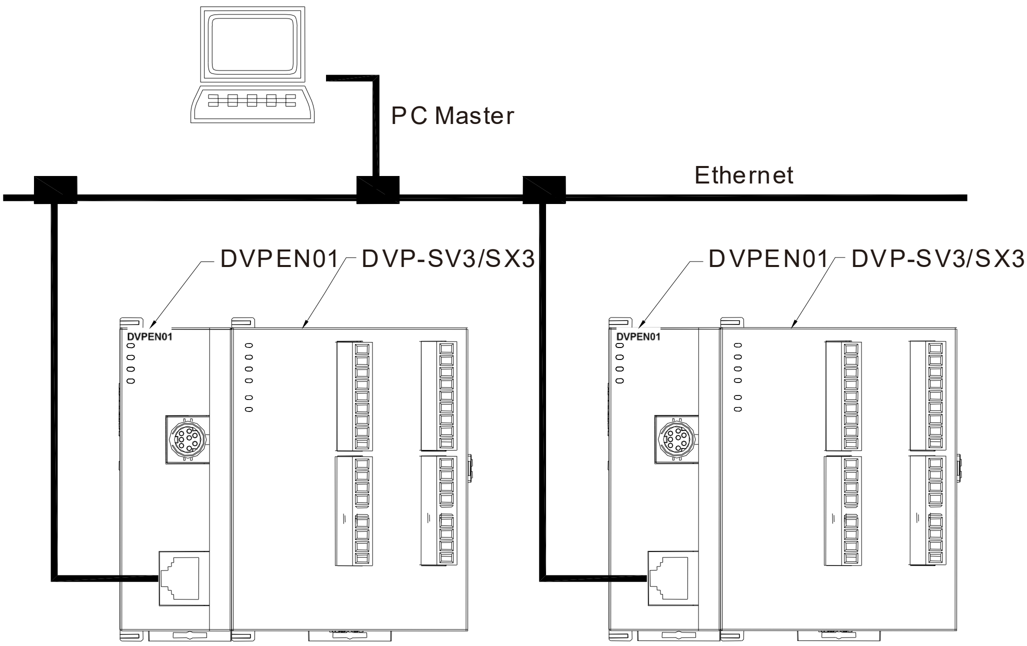
To connect the DVPEN01-SL to other I/O modules, use a screwdriver to lift the extension clip on the I/O module and open the side cover. Then, align the connectors of the DVPEN02-SL and the I/O module and connect them securely.



13.1.4.2 Wiring

Use a CAT-5e twisted-pair cable to establish a connection between the DVPEN01-SL and the Ethernet switch. Due to the DVPEN01-SL's built-in Auto MDI/MDIX feature, a standard straight-through CAT-5e cable can be used for connection without the need for a crossover cable.

The following diagram illustrates the network cable connection between the computer and the DVPEN01-SL module.



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13.1.5 Control Register

CR# HW	CR# LW	Type	Content	Explanation			
	#0	R	Model name	Read only; The model code of DVPEN01-SL = 0x4050			
	#1	R	Firmware version	Displaying the current firmware version in hex, e.g. V1.00 is indicated as 0x0100.			
	#2	R	Communication mode	0: Disabled; 1: Enabled			
				b0	Setting for MODBUS TCP mode		
				b1	Setting for data exchange mode		
	#3	W	Trigger E-Mail Event 1	Trigger email sending			
	#4	W	Trigger E-Mail Event 2				
	#5	W	Trigger E-Mail Event 3				
	#6	W	Trigger E-Mail Event 4				
	#7	R	Status of E-Mails 1, 2	b0 to b7	Status of E-Mail 2	b8 to b15	Status of E-Mail 1
	#8	R	Status of E-Mails 3, 4	b0 to b7	Status of E-Mail 4	b8 to b15	Status of E-Mail 3

CR#3 to CR#6: After the E-Mail is sent, the CR will automatically be set to 0.
Please use differential commands to trigger CR#3 to CR#6 to avoid continual sending of e-mails.

CR#7 to CR#8: E-Mail Status. See the table below.

CR value	E-Mail status	CR value	E-Mail status
0	Not being sent	11	Incorrect e-mail address of recipient
1	Processing	12	SMTP server communication error
2	Successfully sent	13	No available TCP connections
10	Unable to connect to SMTP server		

CR# HW	CR# LW	Type	Content	Explanation
	#9	R/W	Code after title of E-Mail 1	Filled in by the user. The subject of the email will be included and sent along with the email.
	#10	R/W	Code after title of E-Mail 2	
	#11	R/W	Code after title of E-Mail 3	
	#12	R/W	Code after title of E-Mail 4	
	#13	R/W	Data exchange enabled flag	0: Disabled 1: Trigger the CR data exchange function once 2: Continuously execute the data exchange table 3: Execute the data exchange mode table once.

CR#13:

CR content	Description
0	Disabled
1	Trigger the CR data exchange function once
2	Use when the software setting startup condition is 'Program Start'. After writing, continue executing data exchange until CR#13 is set to 0 to stop.
3	Use when the software setting startup condition is 'Program Start'. After writing, perform one data exchange. When execution finished, automatically set CR#13 to 0. Supported in version V2.06 and later.

CR# HW	CR# LW	Type	Content	Explanation
	#14	R	Data exchange status register.	Displays the status of CR data exchange function: 0: Data not received 1: Data exchange in progress 2: Data exchange successful 3: Data exchange failed

CR# HW	CR# LW	Type	Content	Explanation
CR#14: 0 => data not received; 1 => data exchange being processed; 2 => data exchange successful; 3 => data exchange fails.				
	#15	R/W	RTU mapping enabled flag	1: Enabled; 0: Disabled (default) Supported in firmware versions V2.0 and later.
	#16	R/W	Connection status for RTU-EN01 mapping function.	b0: Connection status of RTU slave 1 b1: Connection status of RTU slave 2 b2: Connection status of RTU slave 3 b3: Connection status of RTU slave 4
	#17	R/W	Data exchange cycle time	The communication minimum update period (ms) for configuring the data exchange mode table can be set. The default value is 0, indicating that the next record is sent immediately upon receipt without waiting for a period.
#19	#18	R	Communication error status for the data exchange table.	CR#19 b0 to b15: Error in data exchange tables 1 to 16 CR#18 b0 to b7: Error in data exchange tables 17 to 24 1: Error occurs
#21	#20	R/W	Initiate control for the data exchange item.	CR#21 b0-b15: Activation status of data exchange tables 1-16. CR#20 b0-b7: Activation status of data exchange tables 17-24. The status of 1 indicates that it is activated.

CR#18 to CR#21：

Corresponding to the data exchange table numbers as follows:

CR#19 & CR#21																
bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
NO.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
CR#18 & CR#20																
bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	bit	b5	b4	b3	b2	b1	b0
NO.	Reserved								24	23	22	21	20	19	18	17

CR# HW	CR# LW	Type	Content	Explanation
	22	R/W	TCP/IP RT (Retransmission Timeout) Setting	The TCP retransmission timeout can be adjusted. When a TCP packet exceeds this time, it will be automatically retransmitted. If the response time from the slave is longer, this parameter can be increased in order to reduce the number of retransmitted packets. Unit: ms, Range: 20 to 3000 ms, Default value: 20 ms.
#26	#25	R/W	Remote IP address for CR data exchange function.	Configure the IP address of the slave device for CR data exchange.
CR#25 to CR#26: Before setting up the destination IP address, set CR#28 to 0. E.g. If the user wants to set the destination IP address to 192.168.0.2, write H'0002 to CR#25 and H'C0A8 to CR#26. (K192 = H'C0, K168 = H'A8, K0 = H'00, K2 = H'02)				
	#27	R/W	Data exchange tabl synchronous read/write function.	Configure the MODBUS TCP function code used by the data exchange table.
CR#27: The default value is 0. When both read and write are configured, use function code 0x17 for data exchange. When set to 1, use function code 0x03 for reading, function code 0x06 for single write, and function code 0x10 for multiple writes				
	#28	R/W	Selection of CR data exchange II list.	Select the slave IP address for CR data exchange from the data exchange table.

<table>
<tr><th colspan="2">CR#</th><th rowspan="2">Type</th><th rowspan="2">Content</th><th rowspan="2">Explanation</th></tr>
<tr><th>HW</th><th>LW</th></tr>
<tr><td colspan="5">CR#28:
The default value is 0, using the values of CR#25 and CR#26 as the slave IP address.
When set to the slave station number in the data exchange table (i.e., K1 to K255), it will search the IP address corresponding to that station number in the data exchange table list.</td></tr>
<tr><td colspan="2">#29 to #48</td><td>R/W</td><td>Transmission buffer for CR dat exchange.</td><td>Starting address of the storage area for transmitting data in the CR data exchange function.</td></tr>
<tr><td colspan="2">#49 to #68</td><td>R</td><td>Reception buffer for CR dat exchange.</td><td>Starting address of the storage area for receiving data in the CR data exchange function.</td></tr>
<tr><td></td><td>#81</td><td>R/W</td><td>Read address for CR data exchange.</td><td>Starting address of the buffer for transmitting data from the slave in the CR data exchange function</td></tr>
<tr><td></td><td>#82</td><td>R/W</td><td>Read data length for CR data exchange</td><td>Configure the number of registers for reading data in the CR data exchange function (range: K1 to K100).</td></tr>
<tr><td></td><td>#83</td><td>R/W</td><td>Received address for CR data exchange</td><td>Starting address of the buffer for receiving data at the master station in the CR data exchange function.</td></tr>
<tr><td></td><td>#84</td><td>R/W</td><td>Written address for CR data exchange</td><td>Starting address of the buffer for receiving data from the slave in the CR data exchange function.</td></tr>
<tr><td></td><td>#85</td><td>R/W</td><td>Written data length for CR data exchange</td><td>Configure the number of registers for transmitting data in the CR data exchange function (range: K1 to K100).</td></tr>
<tr><td></td><td>#86</td><td>R/W</td><td>Sent address for CR data exchange</td><td>Starting address of the buffer for transmitting data at the master station in the CR data exchange function.</td></tr>
<tr><td colspan="5">CR#81 to CR #86:
Configure the MODBUS address for the local (master station) CR data exchange function's transmission buffer. Unless there are specific requirements, it is not recommended to use this method.
For example, write H1000 (D0) to CR#81, write K1 to CR#82, fill in H1064 (D100) to CR#83; when the data exchange is successful, the value of slave’s D0 will be written to the CPU’s D100. Write H1002 (D2) to CR#84, write K4 to CR#85, fill in H1008 (D8) to CR#86; when the data exchange is successful, the values of local (master’s) D8 to D11 will be written to slave’s D2 to D5. It is enabled to simultaneously perform both transmit and receive functions.
If both CR#82 and CR#85 are 0, the CR data exchange transmission buffer (CR#29 to CR#68) and the default number of registers (K20) will be used.</td></tr>
<tr><td></td><td>#87</td><td>R/W</td><td>Mode of setting IP address</td><td>0: Static IP address; 1: DHCP</td></tr>
<tr><td>#89</td><td>#88</td><td>R/W</td><td>IP address</td><td>Reading or setting an IP address
If an IP address is 192.168.1.5, set the value in CR#88 to H0105, and the value in CR#89 to HC0A8.</td></tr>
<tr><td>#91</td><td>#90</td><td>R/W</td><td>Netmask</td><td>Reading or setting a netmask
If a netmask is 255.255.255.0, set the value in CR#90 to HFF00, and the value in CR#91 to HFFFF.</td></tr>
<tr><td>#93</td><td>#92</td><td>R/W</td><td>Gateway IP address</td><td>Reading or setting a gateway IP address
If a gateway IP address is 192.168.1.5, set the value in CR#92 be H0105, and the value in CR#93 be HC0A8.</td></tr>
<tr><td></td><td>#94</td><td>R/W</td><td>Enabling the setting of an IP address</td><td>Executing the setting of an IP address.
When set to 1, execute the IP configuration function.
After configuration is complete, the CR value is automatically set back to 0.</td></tr>
<tr><td></td><td>#95</td><td>R</td><td>Status of setting an IP address</td><td>Showing the status of setting an IP address
0: Not executed.
1: In progress
2: IP configuration completed
Please verify the legality of the IP address and ensure that the IP address and default gateway are on the same subnet.</td></tr>
</table>

<table>
<tr><th colspan="2">CR#</th><th rowspan="2">Type</th><th rowspan="2">Content</th><th rowspan="2">Explanation</th></tr>
<tr><th>HW</th><th>LW</th></tr>
<tr><td></td><td>#102</td><td>R/W</td><td>MC Protocol UDP port</td><td>UDP communication port number for the MC Protocol data exchange slave device, default value is 1025.</td></tr>
<tr><td>#105</td><td>#104</td><td>R</td><td rowspan="2">MAC Address</td><td rowspan="2">Assuming the MAC address is 00 18 23 AA BB CC, set CR#104=H0018, CR#105=H23AA, and CR#106=HBBCC.</td></tr>
<tr><td></td><td>#106</td><td>R</td></tr>
<tr><td></td><td>#111</td><td>R/W</td><td>bit processing mode</td><td>Configure the MODBUS TCP command transmission function bit mode:
0: Use 16-bit mode (default)
1: Use 8-bit mode</td></tr>
<tr><td></td><td>#112</td><td>R/W</td><td>MODBUS TCP keep-alive timeout</td><td>Unit: second
Range: 0 to 65535, setting it to 0 is equivalent to 65535.
The default value is 30 s. If the connection is idle for more than the connection keep-alive time, the idle connection will be terminated.</td></tr>
<tr><td></td><td>#113</td><td>R</td><td>Status of MODBUS TCP connection</td><td>Displays the current TCP connection status for MODBUS TCP:
0: The current TCP connection is closed.
1: TCP connection has been established.</td></tr>
<tr><td></td><td>#114</td><td>R/W</td><td>MODBUS TCP communication timeout</td><td>Set the communication timeout period (ms) for the MODBUS TCP command transmission function.</td></tr>
<tr><td></td><td>#115</td><td>R/W</td><td>Sending MODBUS TCP command</td><td>Set the data transmission mode for the MODBUS TCP command transmission function.</td></tr>
<tr><td colspan="5">CR#115:
When set to 1, activate the data transmission for the MODBUS TCP command transmission function. After data transmission is complete, the CR value is automatically set back to 0. Use rising or falling edge contacts to trigger.
When set to 2, activate the data transmission for the MODBUS TCP command transmission function. After data transmission is complete, the TCP connection will be maintained, awaiting the next transmission.
When set to 3, it will terminate the current TCP connection.</td></tr>
<tr><td></td><td>#116</td><td>R/W</td><td>MODBUS TCP status</td><td>Current status of the MODBUS TCP mode
0: Data not received
1: Data exchange in progress
2: Data exchange successful
3: Data exchange failed</td></tr>
<tr><td>#118</td><td>#117</td><td>R/W</td><td>Destination IP in MODBUS TCP mode</td><td>Configure the IP address of the remote communication device for the MODBUS TCP command transmission function. Refer to the explanation for CR#25 and CR#26 for the configuration method.</td></tr>
<tr><td></td><td>#119</td><td>R/W</td><td>Data length in MODBUS TCP mode</td><td>Configure the length of data in the communication in MODBUS TCP mode
In 8-bit mode, it ranges from K1 to K100
in 16-bit mode, it ranges from K1 to K200.</td></tr>
<tr><td colspan="2">#120 to #219</td><td>R/W</td><td>Buffers for data transmission in MODBUS TCP mode</td><td>Buffers for sent/received data in MODBUS TCP mode</td></tr>
<tr><td></td><td>#222</td><td>R</td><td>Number of MODBUS TCP Server connections</td><td>Maximum: 16</td></tr>
<tr><td></td><td>#223</td><td>R</td><td>Number of MODBUS TCP Client connections</td><td>Maximum: 26</td></tr>
<tr><td colspan="5">CR#222 to 223:
● Supported in firmware version V2.18 and above.
● MODBUS TCP Client and Server quantities are counted separately.</td></tr>
</table>

CR# HW	CR# LW	Type	Content	Explanation
● The number of MODBUS TCP Server connections includes connections used by project software monitoring.				
	#229	R	Number of RTU corresponding function client connections	Maximum: 4
	#230	R	Number of TCP connections	Maximum:88
CR#229 to 230: ● Supported in firmware version V2.18 and above. ● RTU corresponding function connections and MODBUS TCP connections are counted separately. ● TCP connection count includes all connections using the TCP protocol (including but not limited to MODBUS TCP, RTU), totaling both Client and Server connections**.**				
	#231	R/W	TCP/IP Reset	The default value is 0. When set to 0x1013, reset the TCP/IP function.
CR#231: ● Supported in firmware version V2.18 and above. ● Users must clear the value of CR#231 on their own. ● It will interrupt all existing communication. Please use it with caution.				
	#251	R	Error code	Each bit represents a specific error condition.

CR#251:

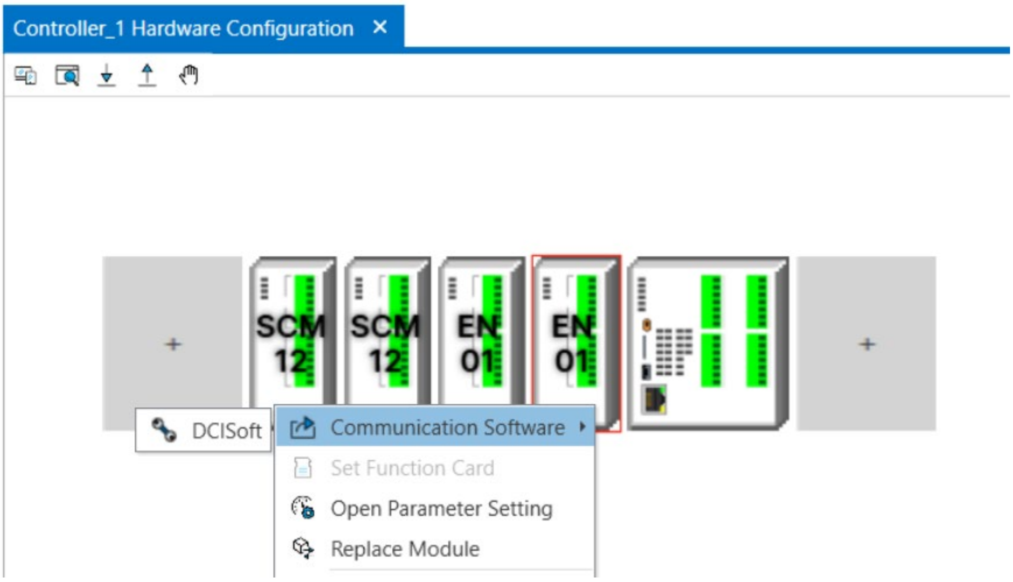
Bit	Error status
0	No network connected.
1	IP setting error
2	CR#13 is configured for data transmission, but data exchange is disabled.
3	CR#13 is configured for data transmission, but data exchange mode is not activated.
4	NTP-Server connection failed.
7	SMTP-Server connection failed.
8	DHCP did not obtain correct network parameters.

Symbols:
R: Able to read data through the use of FROM instruction; W: Able to write data through the use of TO instruction
The No. range for left-side high-speed I/O modules: 100 to 107 (m1 = 100 to 107)

13.1.6 Software Setting

This section gives instructions on how to set DVPEN01-SL by DCISoft and explanations on each setup page. Before you start a setup page, you have to select Ethernet in the Communication Setting window. Next, you can search by IP address or use Auto-Search. You also can open the setup page for DVPEN01-SL by RS-232. DVPEN01-SL is set by UDP port 20006; therefore, you have to be aware of the relevant settings of the firewall.

When installed on the left side of the DVP-SV3/SX3 CPU module, you can also right-click on the module icon on the hardware configuration page of DIADesigner and open DCISoft.



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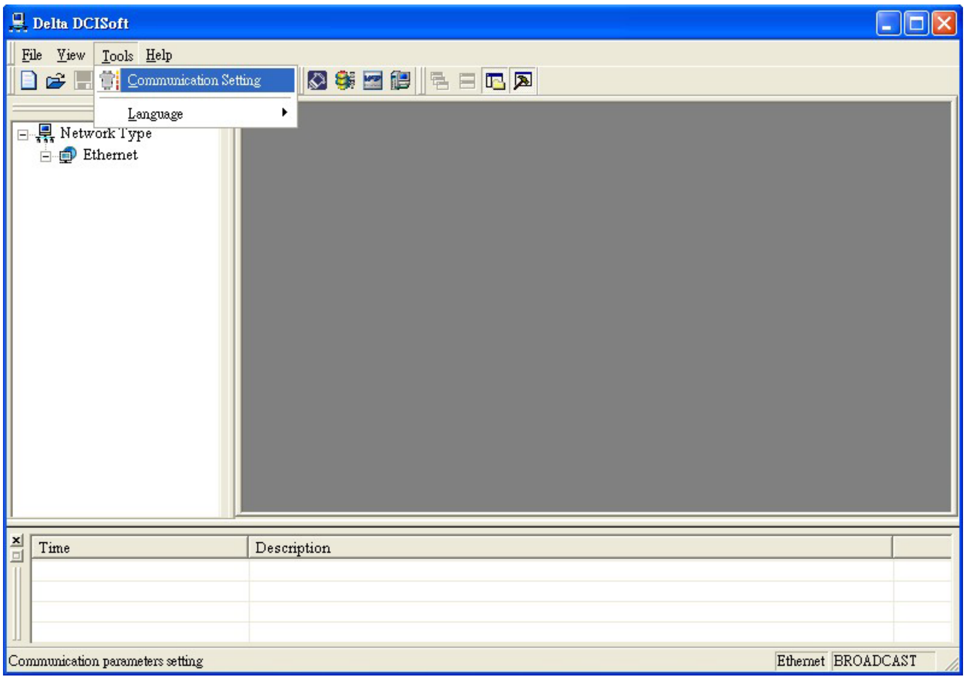
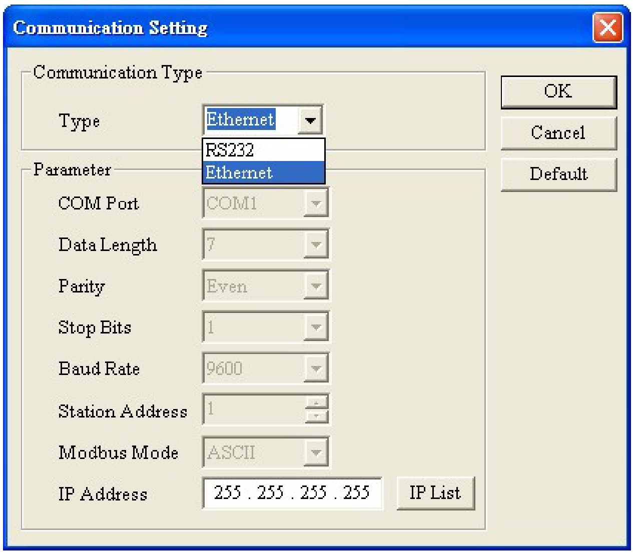
13.1.6.1 Communication & Modules Searching Setting

- **Communication settings**

1. Open DCISoft in your PC and click on **Communication Setting**.



2. Select **Ethernet** as the transmission type.



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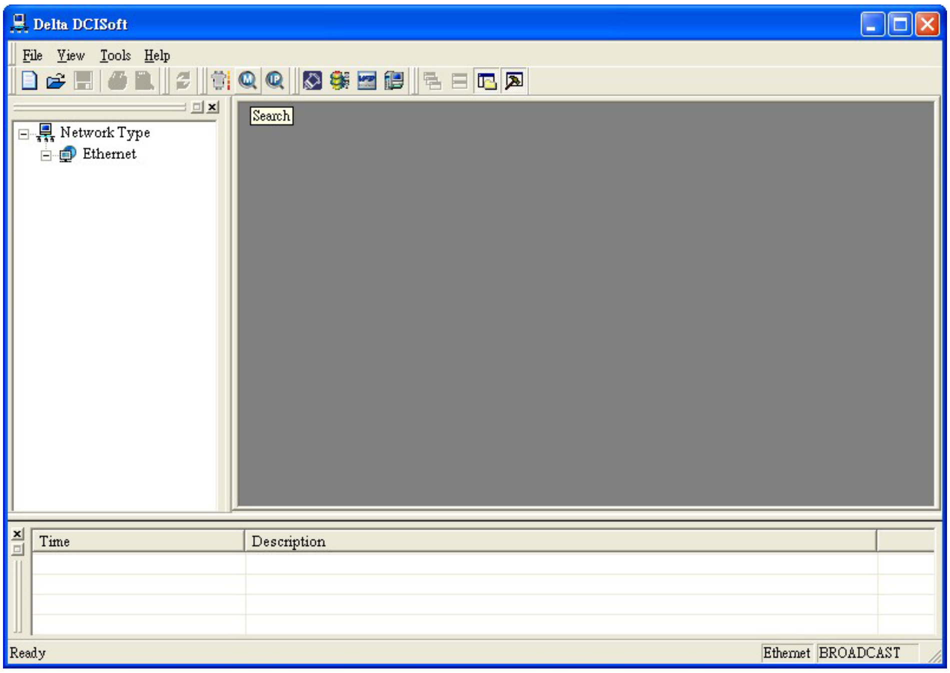
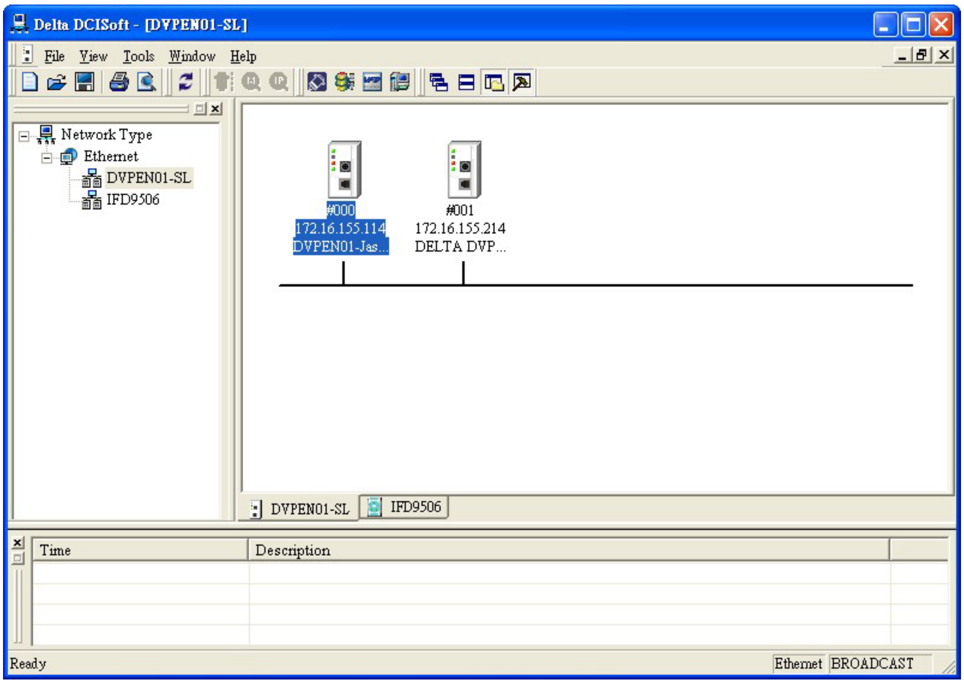
- **Broadcast search**

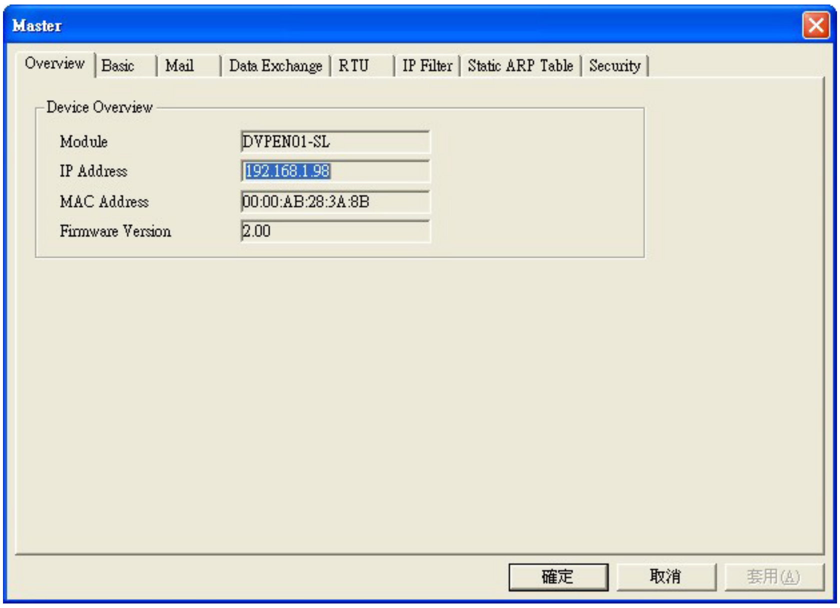
1. Click Search in DCISoft to search for all Delta Ethernet products on the network. The window on the left-hand side shows the models found, and the window on the right-hand side displays the device list of all models.



2. Click a model on the left-hand side, and you will see the device list of the model selected on the right-hand side. Click the device to be set to enter the setup page.



3. You will see the basic setup page as follows.



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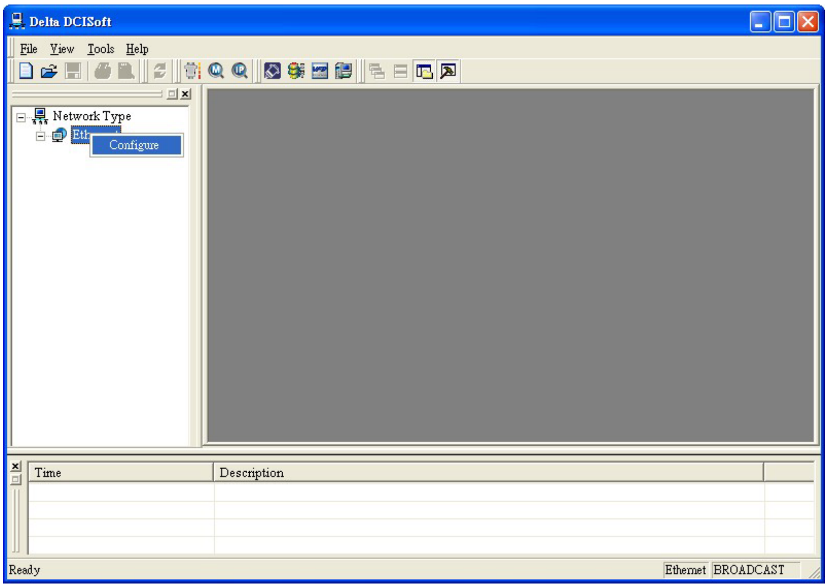
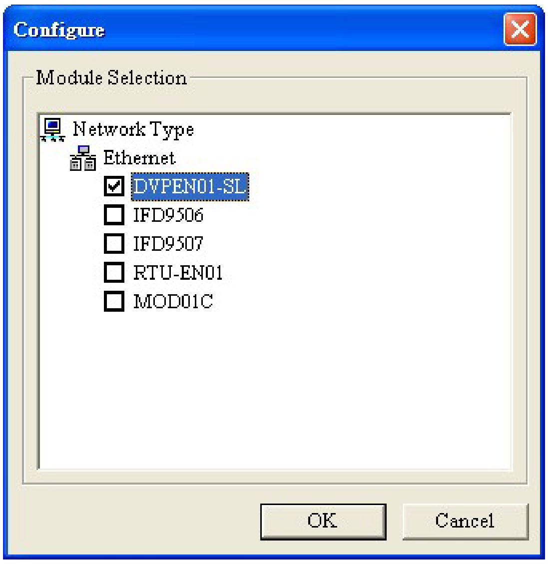
- Designating a model to search

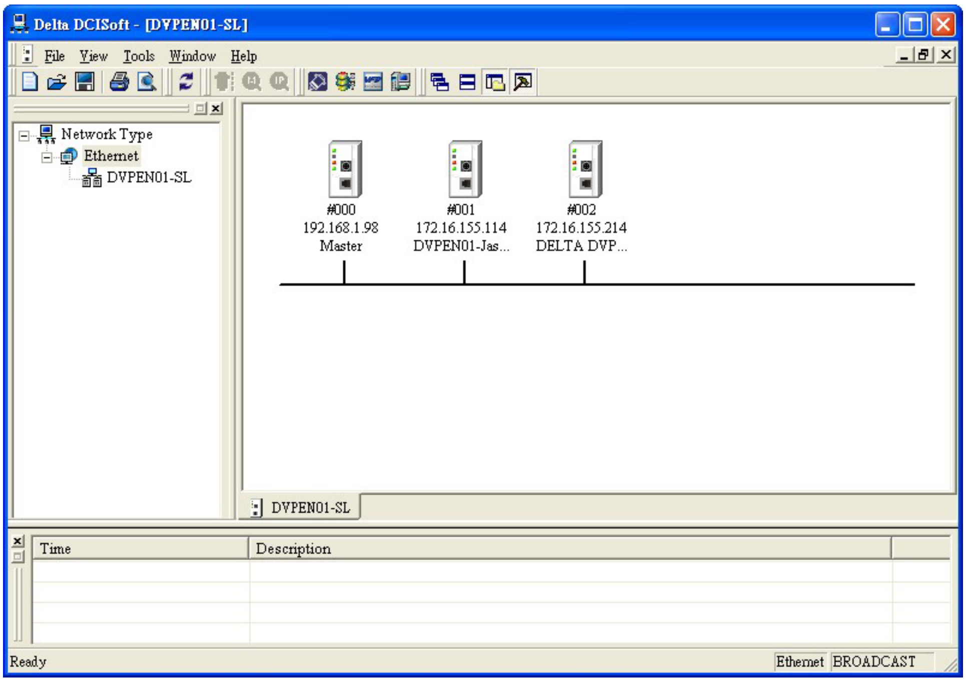
1. Right click **Ethernet** on the left-hand side window and click **Configure** to designate a model to search for.



2. After configuring a model, select the DVPEN01-SL checkbox and click OK to auto-search for DVPEN01-SL modules on the network.

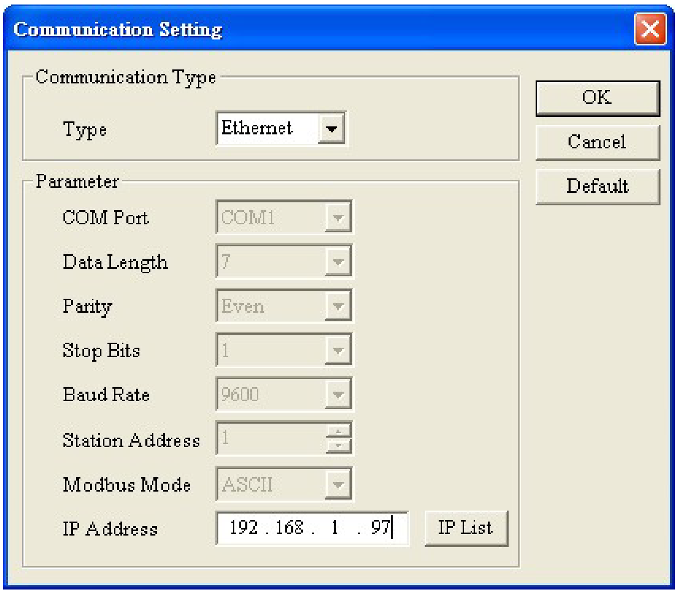


3. List of the current DVPEN01-SL modules

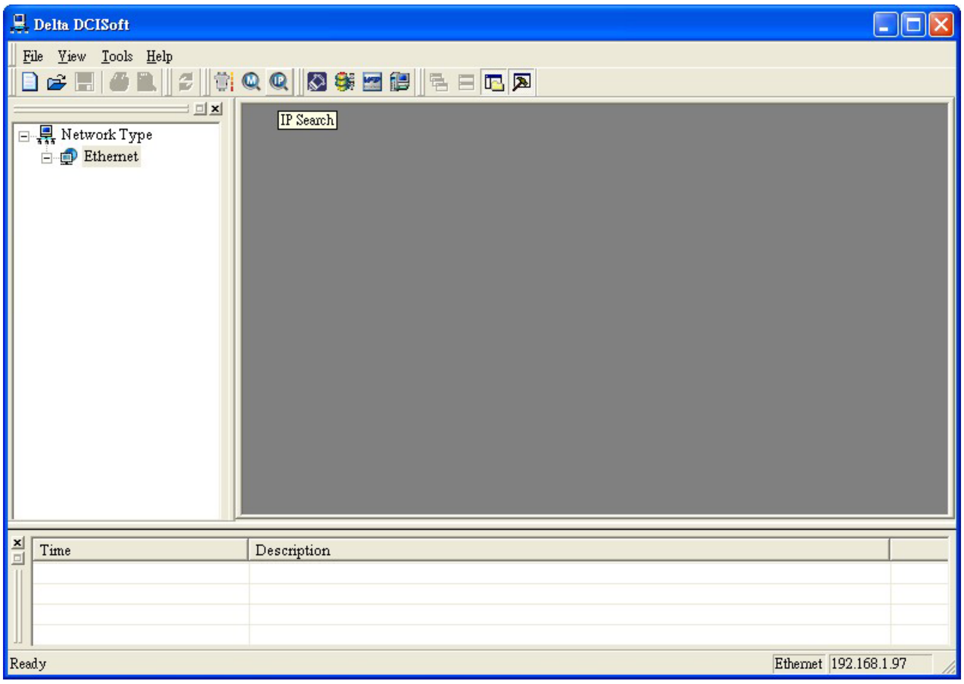


- Searching by IP address

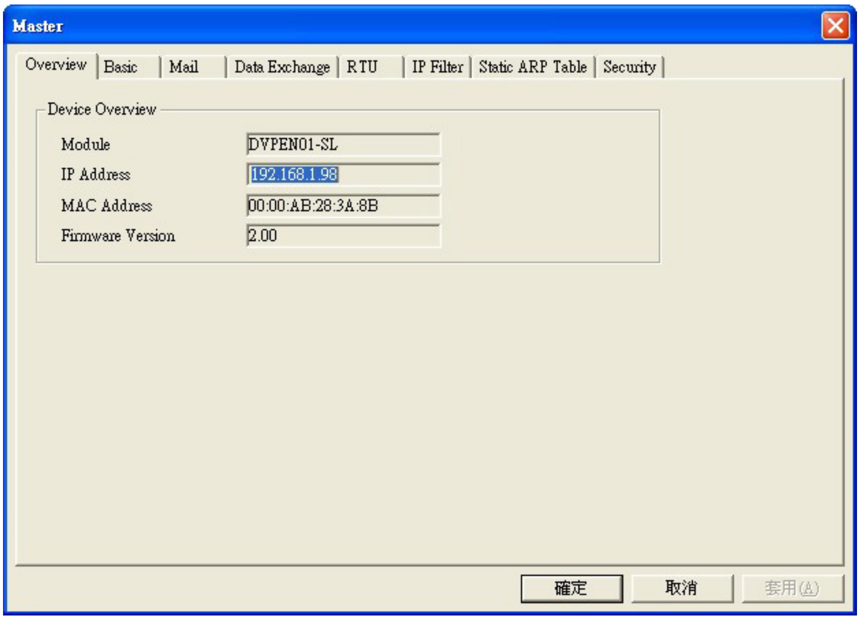
1. Select Ethernet in the Communication Type section and enter the IP address. Click OK.



2. Click **IP Search** to start searching for the designated IP address.

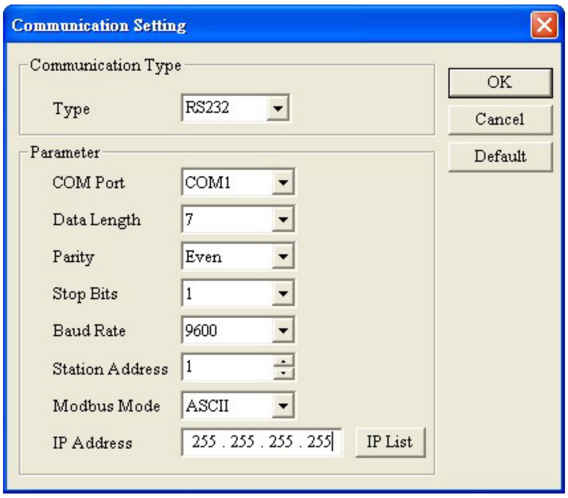


3. The DVPEN01-SL module found will be displayed in the right-hand side window. Double-click the module to enter the setup page.



- **Opening the DVPEN01-SL setup page by RS-232**

1. Select RS232 as the transmission type in the Communication Setting window. You will have to designate a communication port. When DVPEN01-SL is searched by RS-232, you do not need to set the parameters (i.e. data length, parity, stop bits and baud rate)



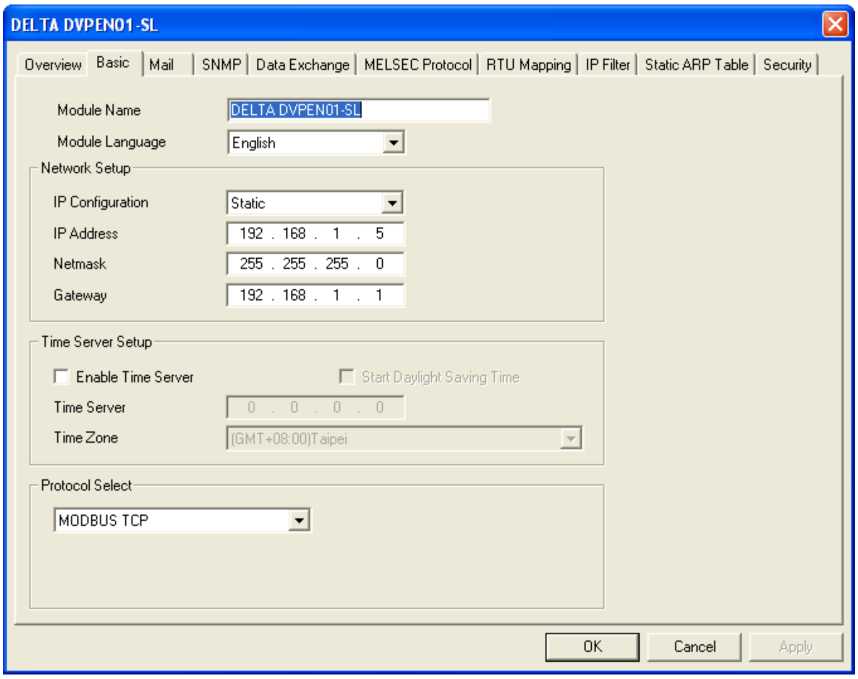
2. After setting the communication port, click Search. If the searching is successful, the setup page for DVPEN01-SL will open automatically.

13

13.1.6.2 Basic Settings

The basic settings include parameters as module name, language, enabling MODBUS TCP and time correction.

- Basic settings



1. **Module Name**

   There can be many DVPEN01-SL modules in the network. Thus, you can set a module name for each module to identify the module when you need to use them.

2. **Module Language**

   You can select a language for each module name, and the windows will be displayed in the selected language.

3. **Enable** MODBUS **TCP**

   To enable or disable MODBUS TCP. When MODBUS TCP is disabled, WPLSoft will not be able to upload or download.

4. **Enable Time Server**

   DVPEN01-SL adopts NTP (Network Time protocol), which means it can acquire correct time automatically from the time server in the network and correct the RTC in the CPU every fixed period of time to ensure correct time in the CPU. The **Enable Time Server** is unselected by default.

5. **Start Daylight Saving Time**

   Daylight Saving Time; also known as summer time is a conventional local time adopted by many countries in the world on a seasonal basis. Most commonly DST is obtained by adjusting the official local time forward, by one hour, for the spring, summer, and early autumn periods. Daylight Saving Time is not implemented in Taiwan; therefore, you do not need to check this item.

6. **Time Server**

   IP address of the time server. You can acquire correct time from the time server to correct the time in the CPU.

7. **Time Zone**

A time zone is a region of the Earth that has adopted the same standard time, usually referred to as the local time. Most adjacent time zones are exactly one hour apart, and by convention compute their local time as an offset from Greenwich Mean Time (see also UTC). Standard time zones can be defined by geometrically subdividing the Earth's spheroid into 24 lunes (wedge-shaped sections), bordered by meridians each 15° of longitude apart. The local time in neighboring zones is then exactly one hour different. However, political and geographical practicalities can result in irregularly shaped zones that follow political boundaries or that change their time seasonally (as with daylight saving time), as well as being subject to occasional redefinition as political conditions change. You should choose the Time zone that you are in.

8. **Protocol Select**

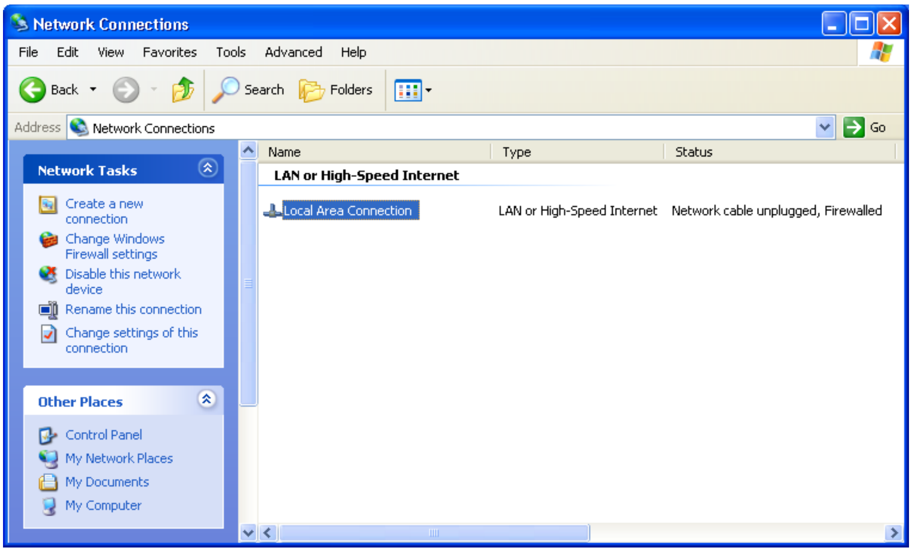
DVPEN01-SL supports MODBUS TCP and the Mitsubishi MELSEC protocol in a UDP mode. The default setting is MODBUS TCP.

13.1.6.3 Network Settings

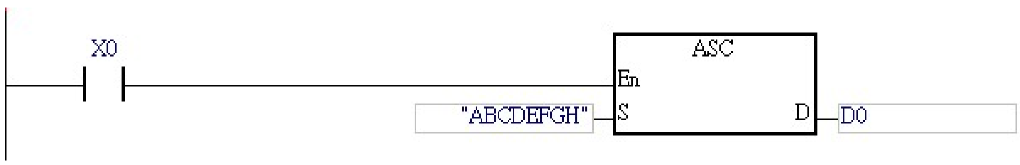
The first step for all the network devices to connect to the network is to have own IP addresses (Internet Protocol). The IP address is like a number for every network device to be identified in the network

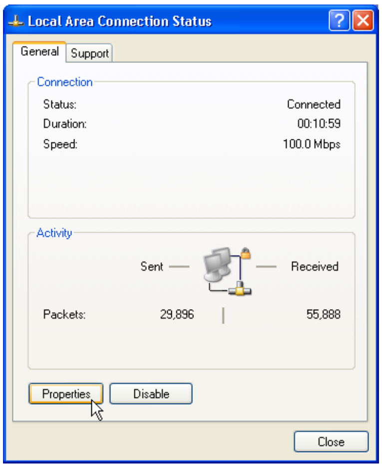
- **Setting the static IP address of the PC**

1. Enter the Control Panel window→ Enter the Network Connections window. Click on Local Area Connection.

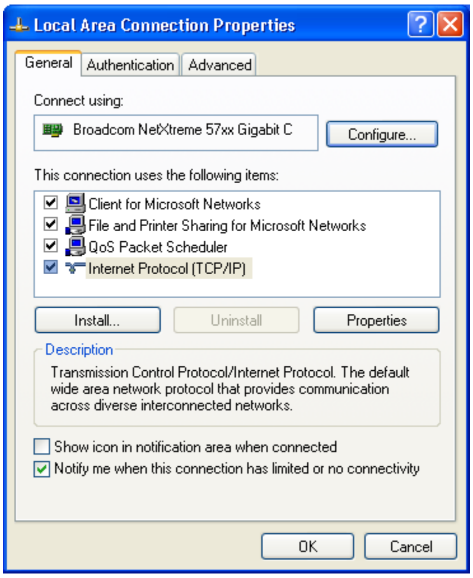


2. You will see the Local Area Connection Status window. Click on Properties.

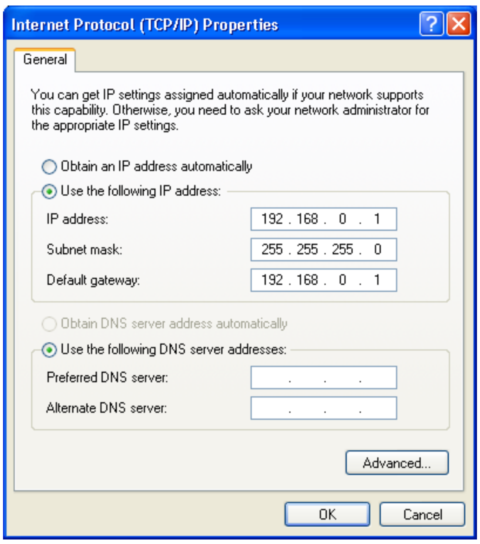




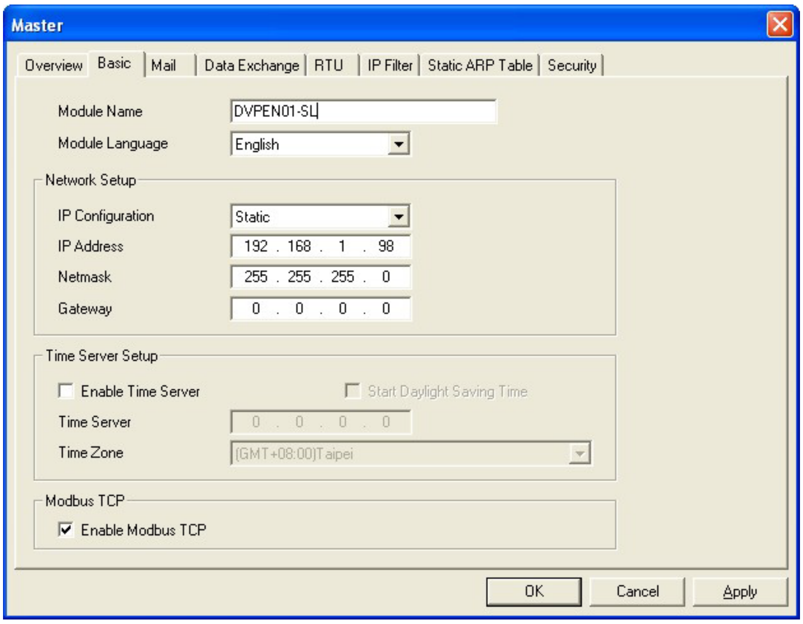
3. Click on Internet Protocol (TCP/IP).



4. Enter 192.168.0.1 into the IP address box. Click on OK to complete the IP address setting of the PC.



- **Setting the DVPEN01-SL network**



1. IP Configuration:

   There are two types of IP address, static IP addresses and DHCP.

   Static IP address: Preset or manually modified by the user.

   DHCP: Automatically updated by the server. There has to be a server in the LAN.

IP	Explanation
Static	Enter the IP address, subnet mask and gateway.
DHCP	DHCP server offers the IP address, subnet mask and gateway.

2. IP Address:

   IP address is the location of the device in the network. Every device connected to the network has to have an IP address. Incorrect IP address will result in connection failure on the device or even other devices. Ask your ISP for IP address setup. The default IP address for DVPEN01-SL is 192.168.1.5.

3. Netmask:

   Subnet mask is an important parameter for setting the subnet, used for checking if the destination IP address and the local device are in the same subnet. If not, the device will send the packet to the gateway, and the gateway will send the packet to another subnet. Incorrect setting may cause the destination device unable to communicate with DVPEN01-SL. To check whether the setting is correct, conducting a bitwise AND operation on one's own IP and the destination device's IP with their respective subnet masks. If the two values are identical, they are within the same subnet. The default subnet mask (Netmask) of DVPEN01-SL is 255.255.255.0.

4. Gateway:

   Gateway is the gate for two different subnets, allowing the two ends in different subnets to communicate. For example, if the LAN has to be connected to WAN, it will need a gateway to bridge the communication. The IP address of the gateway has to be in the same subnet as DVPEN01-SL. The default gateway IP address of DVPEN01-SL is 192.168.1.1.

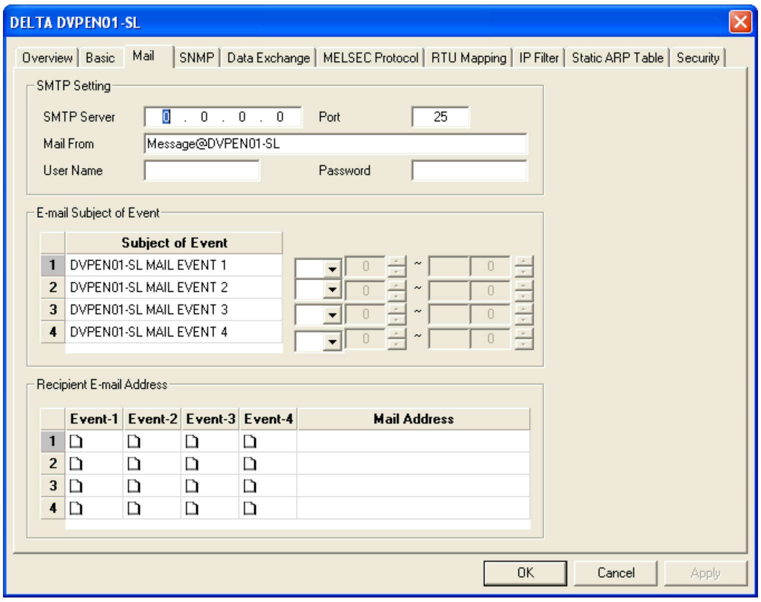
13.1.6.4 Emails Setting

DVPEN01-SL has E-mail functions for the user to pre-save a segment of text messages, which can be a descriptive message or error message, into the subject of the E-mail. When the E-mail is triggered, DVPEN01-SL will send the messages to the user by E-mail.

DVPEN01-SL does not support TLS/SSL encrypted communication. Please ensure to verify the communication specifications of your email server before use.

Provide four sets of E-Mail current value information. Users can define the registers or bit information they want to read. When a trigger occurs, DVPEN01-SL will retrieve the current values set for the specified registers or bits and add them to the E-Mail. Each set provides a maximum of 100 consecutive register data. The introduction is as follows:

- **Mails Setting**



1. **SMTP Setting**

The E-mail will first be sent to SMTP server, and SMTP server will send it to the designated address. For example, assume there is an E-mail to be sent to test@delta.com.tw, and the SMTP server is 172.16.144.122. The E-mail will be sent to SMTP server first, and the server will further send it to the recipient test@delta.com.tw.

The setting boxes are described below.

A. SMTP Server: Setting the IP address of the SMTP server.

B. Port: Entering the port of the SMTP server (The default value is 25.)

C. Mail From: Setting the mail address used to send E-mails (63 characters at most can be entered.)

D. Username: Account used to log in to the SMTP server.

E. Password: Password used to log in to the SMTP server.

2. **E-mail Subject of Event**

You can enter text messages in the column, and the message will be placed in the subject of the E-mail and sent to the recipient. DVPEN01-SL is able to contain 1 to 4 E-mail subjects (max. 63 English characters are allowed).

You can select additional information for the E-mail. Every E-mail is able to contain the present values in 100 consecutive registers.

3. **Recipient E-mail Address**

   You can enter 4 E-mail addresses. One mail can be sent to 4 addresses (max. 63 English characters are allowed).

4. **Selecting recipients**

   After you have set all the parameters for the E-mail, you will need to select recipients. The E-mail will be sent to the designated recipients when the E-mail is triggered. The triggering condition is set when control registers (CR#3 to CR#6) are configured to 1.

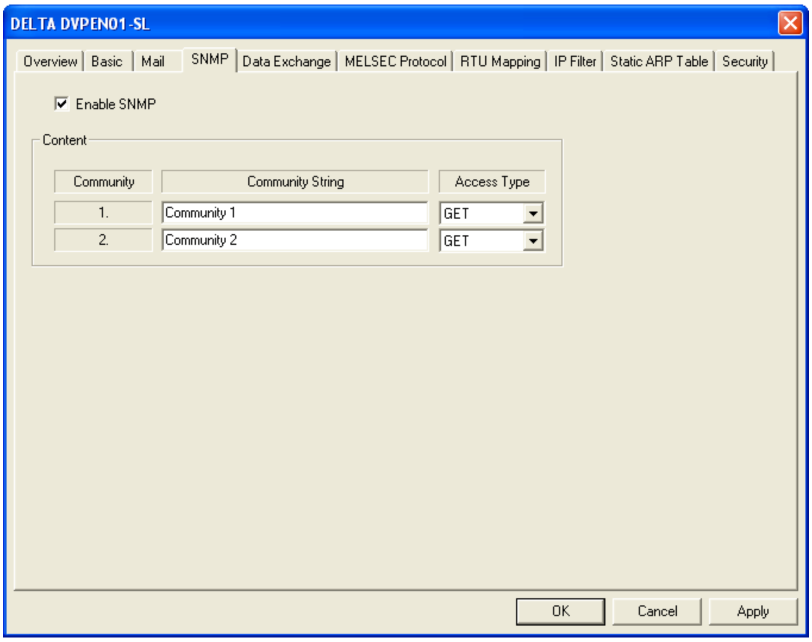
5. See section 13.1.7.7 for more details and examples.

Note: To correctly send out E-mails, there has to be a SMTP server in the network. When we send out an E-mail, the mail will be sent to SMTP server first, and the server will further send the mail to the designated address.

13.1.6.5 SNMP

SNMP is a simple network management function. Users can read and control the registers in PLC by means of a SNMP network management tool. (DVPEN01-SL version 2.06 and above support this function.

- SNMP Setting



1. **Enable SNMP**: Disable/enable the SNMP function.

2. **Community**

   Users can set two communities. The relevant setting boxes are described below.

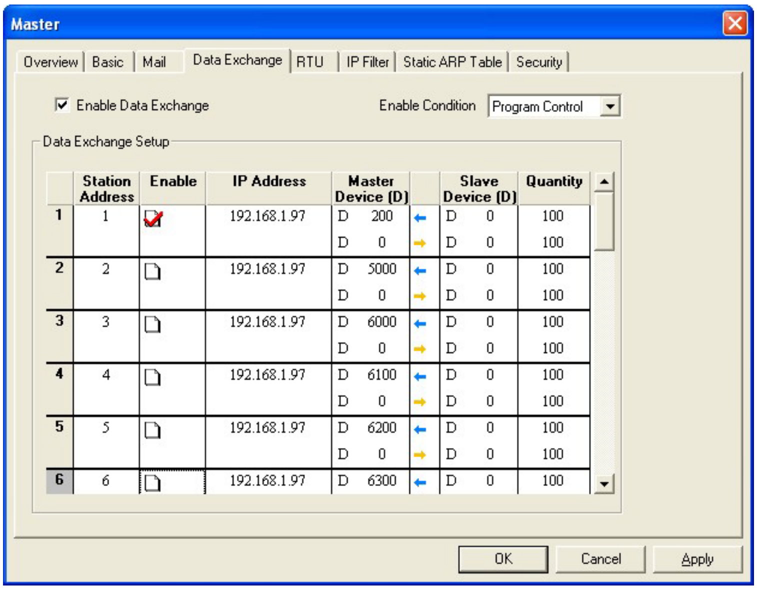
   - Community String: Name given to the community which is connected (63 English characters at most can be entered.)

   - Access Type: Select GET (reading) or GET/SET (reading/writing).

13.1.6.6 Data Exchange

DVPEN01-SL is able to designate a data exchange area for CPUs to exchange and synchronize their data.

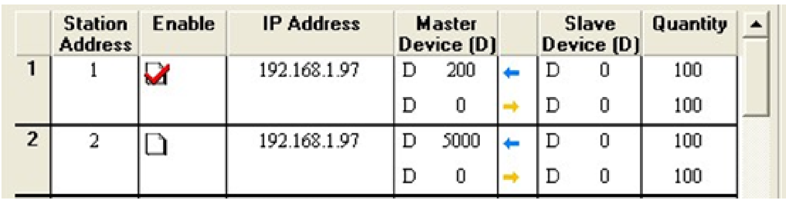
- **Data exchange setting**



	Station Address	Enable	IP Address	Master Device (D)		Slave Device (D)	Quantity
1	1	☑	192.168.1.97	D 200	←	D 0	100
				D 0	→	D 0	100
2	2	☐	192.168.1.97	D 5000	←	D 0	100
				D 0	→	D 0	100
3	3	☐	192.168.1.97	D 6000	←	D 0	100
				D 0	→	D 0	100
4	4	☐	192.168.1.97	D 6100	←	D 0	100
				D 0	→	D 0	100
5	5	☐	192.168.1.97	D 6200	←	D 0	100
				D 0	→	D 0	100
6	6	☐	192.168.1.97	D 6300	←	D 0	100

1. **Enable Data Exchange**

   Check/uncheck the station addresses to enable/disable data exchange. The station address can be selected individually. For example, check Station Address 1 to enable the data exchange and uncheck the Station Address 2 to disable the data exchange as the image shown below. This can also be achieved by setting up CR#20 to 21. Please refer to section 13.1.5 in this manual for more information.



	Station Address	Enable	IP Address	Master Device (D)		Slave Device (D)	Quantity
1	1	☑	192.168.1.97	D 200	←	D 0	100
				D 0	→	D 0	100
2	2	☐	192.168.1.97	D 5000	←	D 0	100
				D 0	→	D 0	100

2. **Enable Condition**

   You can select “Always Enable” or “Program Control”. If Always Enable is selected, DVPEN01-SL will execute data exchange continuously until the setting in DCISoft is changed. If Program Control is selected, DVPEN01-SL will execute data exchange according to the program setting (CR#13=2: Executing data exchange; CR#13=0: Stopping executing data exchange.)

3. **Station Address and IP Address**

   You have to enter the IP address of DVPEN01-SL at the other end. For example, if you would like DVPEN01-SL to exchange data with 192.168.0.1, set No. 1 as 192.168.0.1. When the data are being exchanged, if the value in CR#28 is H’0001, the data will be exchanged with 192.168.0.1.

4. Master Device: The D register in PLC. For firmware version V2.18 and above, DVP-SV3 and SX3 are supported.

5. Slave Device: Can be configured as a D register or 16-bit MODBUS communication address (Hex).
   When set as D register, the remote device must be a Delta Series PLC. For firmware version V2.20 and above, DVP-SV3, SX3, ES3 and EX3 are supported.
   For PLCs of other series (e.g., AS, AX, and AH Series) or other brands, you need to input the HEX address.

6. Quantity: A slave can send and receive the data in 100 consecutive registers at the same time.
7. Reading (←): Start address of the master's receiving register←Start address of the slave's sending register
8. Writing (→): Start address of the master's sending register→Start address of the slave's receiving register
9. When data exchange is executed, DVPEN01-SL executes the writing (→) first before the reading (←)

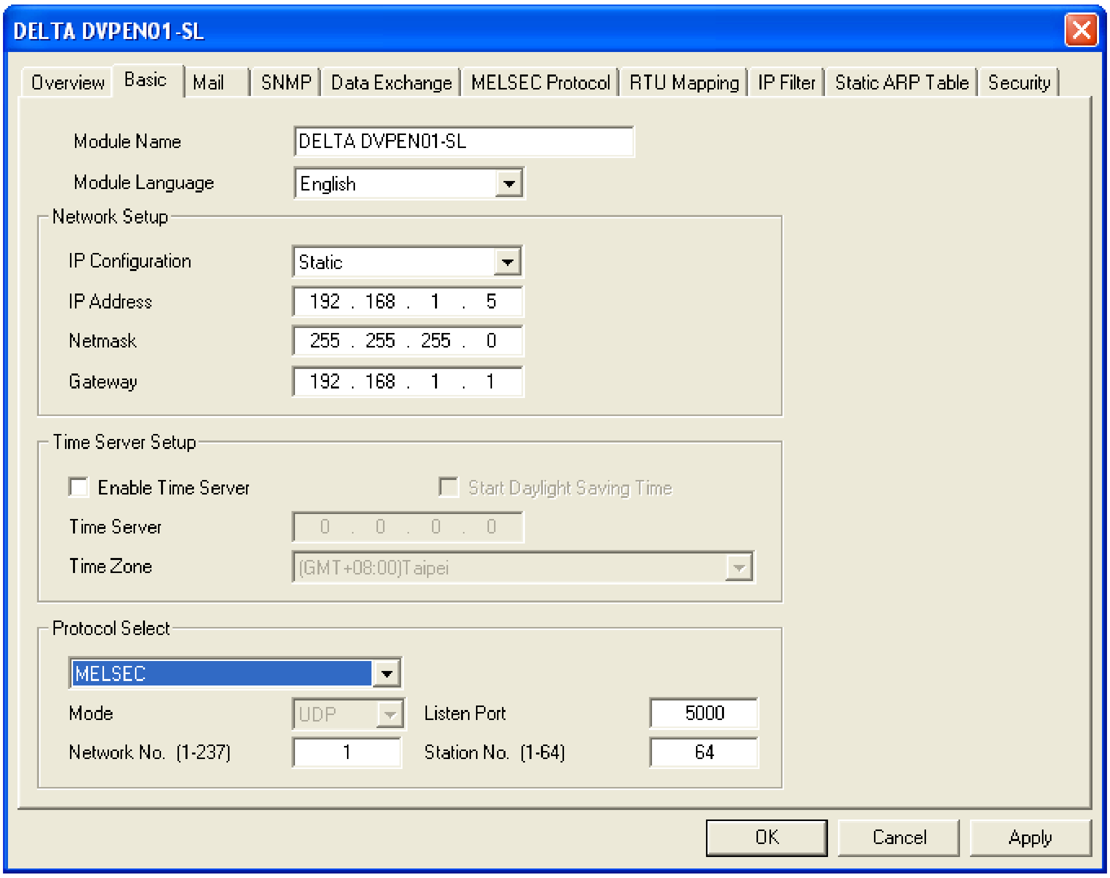
※ For data exchange, D register is parted into 2 sections, D0000 to D4095 and D4096 to D9999. Please DO NOT use different sections for the consecutive sent and received data (start address + number of data).

10. See section 13.1.7.9 to section13.1.7.11 for more details and examples.

13.1.6.7 MELSEC Protocol

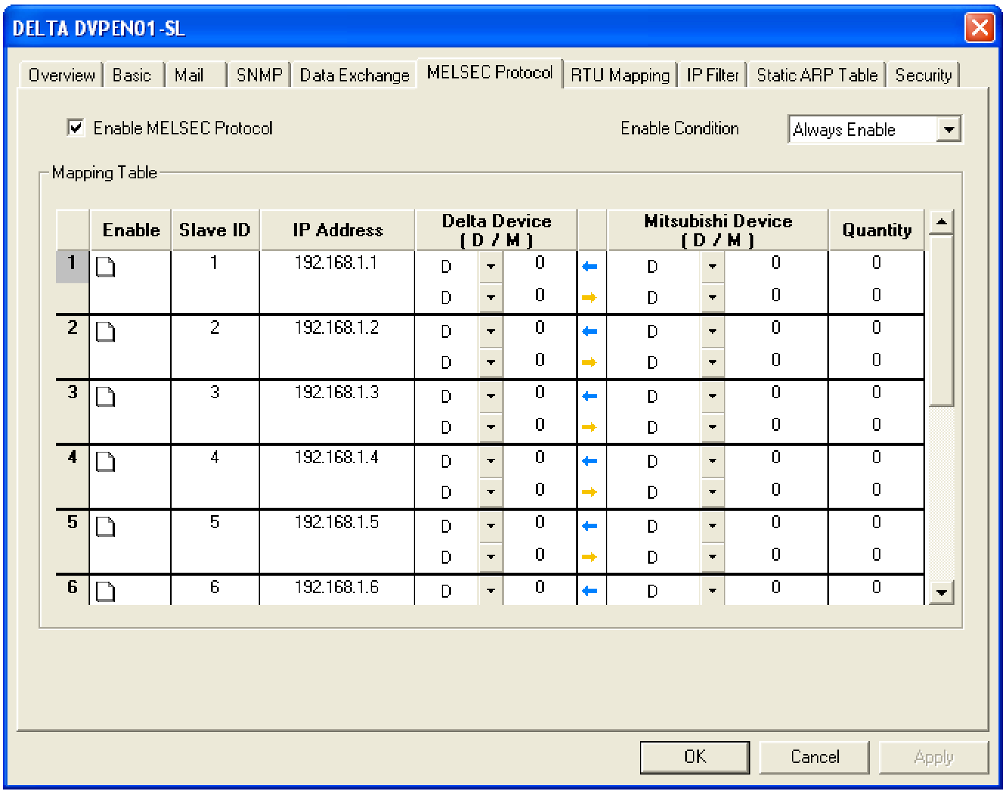
DVPEN01-SL can communicate with Mitsubishi devices by means of the MELSEC protocol. It supports the communication with a master and the communication with slaves simultaneously. Only UDP communication is allowed. (DVPEN01-SL version 2.10 and above support this function.)

- MELSEC Protocol mode setting



1. **Protocol Select**: Setting the MELSEC function.
2. **Listen Port**: Setting the communication port of the MELSEC protocol slave.
3. **Network No./Station No.:** Setting the network number and the station number of the MELSEC protocol device.

- **MELSEC Protocol data exchange setting**



1. **Enable MELSEC Protocol**

Users can disable/enable the MELSEC protocol. After the MELSEC protocol is enabled, data exchange will be carried out according to the data which has been set.

2. **Enable Condition**

Users can select **Always Enable** or **Program Control**. If **Always Enable** is selected, DVPEN01-SL will execute data exchange continuously until the setting in DCISoft is changed. If **Program Control** is selected, DVPEN01-SL will execute data exchange according to the program setting (CR#13=2: Executing data exchange; CR#13=0: Stopping executing data exchange).

3. **Slave ID** and **IP address**

Users need to type the IP address and the slave ID of a Mitsubishi device which supports the MELSEC protocol. For example, users can type the slave ID 1 and the IP address 192.168.0.1. If data exchange is executed, DVPEN01-SL will exchange data with the device whose slave ID is 1 and IP address is 192.168.0.1 by means of the MELSEC communication.

4. **Delta Device**, **Mitsubishi Device**, and **Quantity**

Reading (←): Start address of the Delta device's receiving register←Start address of the Mitsubishi device's sending register

Writing (→): Start address of the Delta device's sending register→Start address of the Mitsubishi device's receiving register

When data exchange is executed, DVPEN01-SL executes the writing (→) first before the reading (←).

Quantity: A slave is able to send and receive the data in up to 100 consecutive registers at the same time.

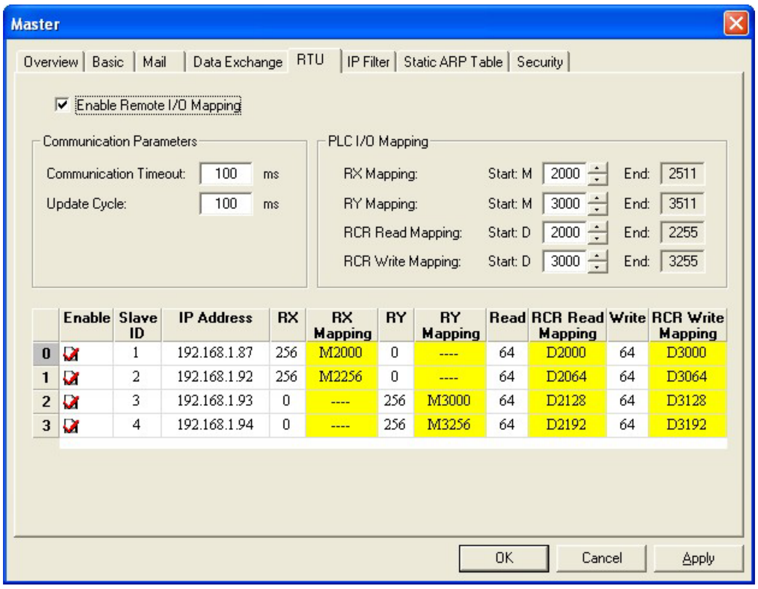
Please refer to section 13.1.7.15 for more information.

13.1.6.8 RTU

Use the RTU function to conduct mapping between Delta's network modules DVPEN01-SL and RTU-EN01. Set the mapping data first, then users will be able to use WPLSoft in DVPEN01-SL to save and retrieve the mapped bit (M) and register (D) in order to operate the remote RTU-EN01.

Only the DVPEN01-SL with firmware V2.20 or above supports this function. Please contact Delta technical support team or the distributors if a firmware upgrade is needed.

- **RTU Setting**



1. **Enable Remote I/O Mapping**

   Users can select the **Enable Remote I/O Mapping** checkbox. After the checkbox is selected, the network module used will be mapped onto RTU-EN01 according to the data set.

2. **Communication Parameters**

   Users can enter a time interval in the **Communication Timeout** box, and a cycle in the **Update Cycle** box.

3. **PLC I/O Mapping**

   Users can set the bit devices which correspond to digital inputs(X) and digital outputs(Y), and analog registers (RCR) on RTU-EN01. The bit devices set start from M2000. The registers used for the reading of data start from D2000, and the registers used for the writing of data start from D3000. The software automatically calculates end addresses according to the numbers set.

4. **Remote Device Mapping Setting**

   After users check **Enable** cell, users have to enter the station address of RTU-EN01, IP address, the number of digital inputs (RX), the number of digital outputs (RY), the number of registers used for the reading of data(Read), and the number of registers used for the writing of data(Write).

   DVPEN01-SL can be mapped onto four slaves. The maximum number of digital inputs used for mapping, the maximum number of digital outputs used for mapping, the maximum number of registers used for mapping are described below:

   Digital I/O (RX+RY): 256

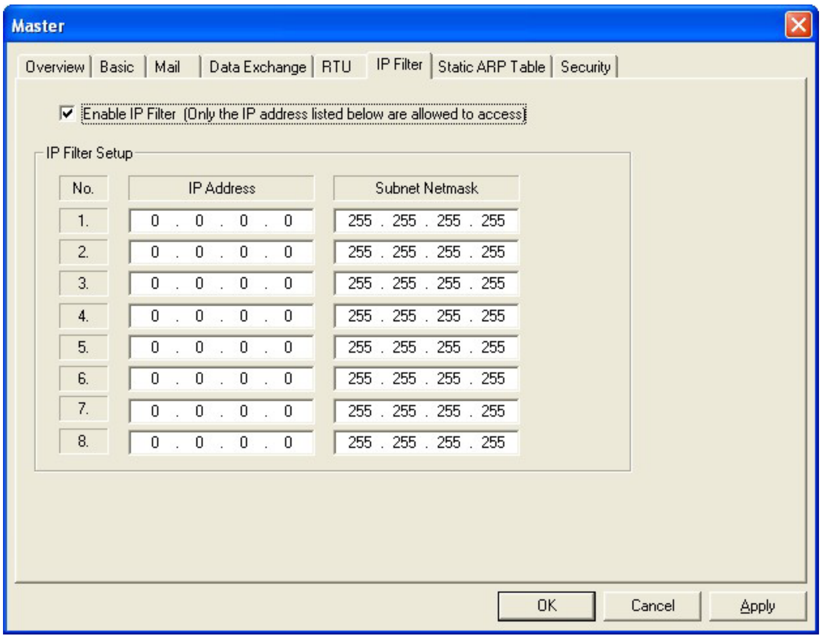
   Analog (Read) register:64

   Analog (Write) register:64

13.1.6.9 IP Filter

IP filter is used for restricting the connection of the network in case some uncertain IP addresses will cause errors. Only the IP addresses set within a certain range can establish a connection. Other IP addresses will be rejected.

- **IP Filter Setting**



1. **Enable IP Filter**

   Check the box to enable IP filter.

2. **IP Address**

   IP addresses that are allowed to establish connections. Maximum 8 IP addresses are allowed.

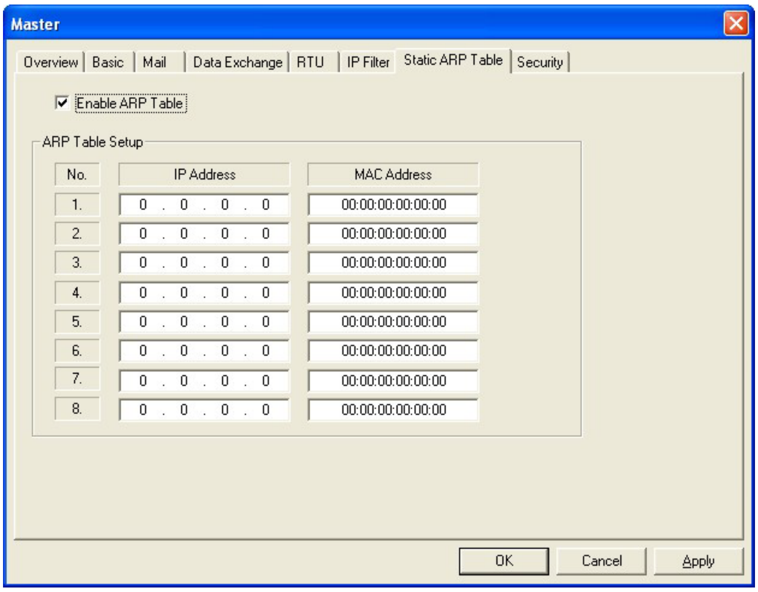
3. **Subnet Netmask**

   The subnet of the IP address is allowed to establish a connection. To see whether the destination IP address is allowed, conduct bitwise AND operations between the allowed IP address and subnet mask and destination IP address and subnet mask. If the two values obtained are the same, the destination IP address is allowed by the IP filter. For example, assuming the IP address is 192.168.0.1 and subnet mask 255.255.255.255, the only one IP address allowed to establish a connection is 192.168.0.1. If the subnet mask is 255.255.255.0, the IP addresses allowed to establish connections will become 192.168.0.0 to 192.168.0.255.

13.1.6.10 Static ARP Table

ARP (Address Resolution Protocol) is used for obtaining the MAC address corresponding to the IP address in data transmission. For example, there is a datum to be sent to 172.16.155.250, but you do not know the corresponding MAC address. You can use ARP to look up the MAC address by IP address, and the corresponding MAC address will be saved, so you do not need to look it up again when sending the next datum. Therefore, if you do not know the MAC address, you will have to spend some time looking up the MAC address. If you want to enhance the transmission efficiency, use the static ARP table to save time. For example, assume the IP address is 192.168.0.1 and MAC is 00:14:22:56:0F:7F. As long as there are data sent to 192.168.0.1, you will get the MAC address from the table.

- **Static ARP Table Setting**



1. **IP Address**

   Destination IP address in data transmission.

2. **MAC Address**

   The MAC addresses corresponding to the IP address.

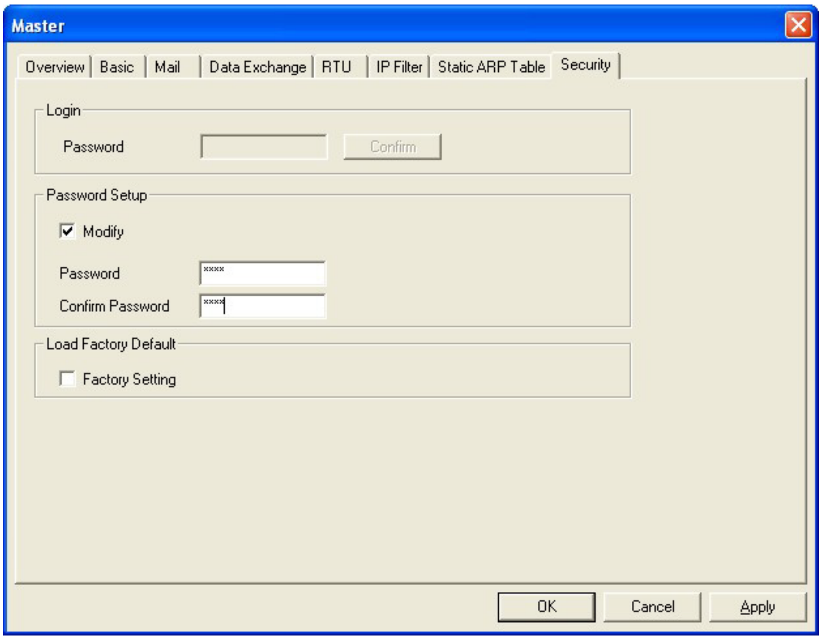
Note: Incorrect settings may result in connection failure. Therefore, DO NOT include MAC addresses of devices outside the network in the list.

13

13.1.6.11 Password Setting

To prevent the set values in DVPEN01-SL from being modified, you can set a password to lock the settings in DVPEN01-SL.

- **Password Setting**



1. **Modify**

   Check the box to modify the password.

2. **New password**

   Maximum 4 characters are allowed. Leave the column blank to disable the password protection function.

3. **Confirm Password**

   Enter the new password again.

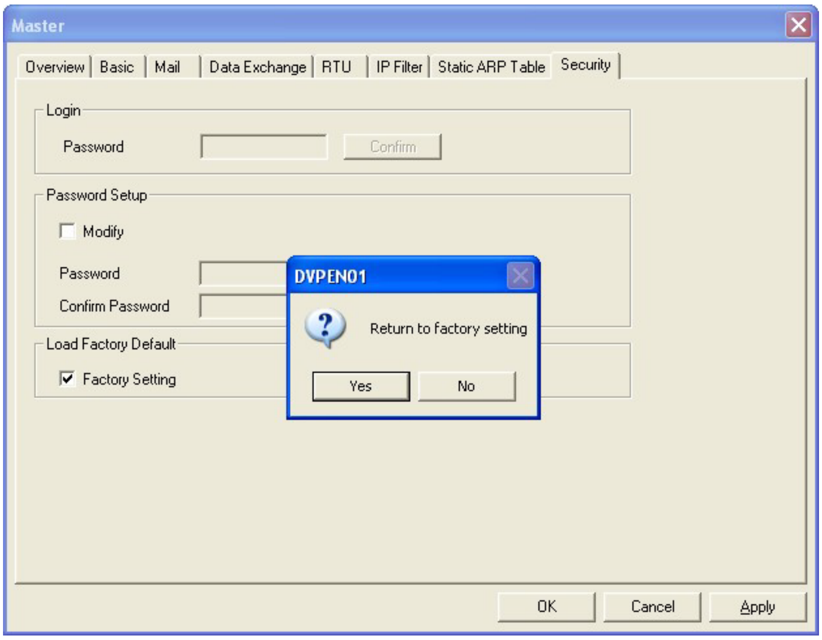
4. See section 13.1.7.4 for more details.

Note: After the password is locked, all the pages cannot be set unless you unlock the password. However, if you set DVPEN01-SL by RS-232, you can return the setting to default setting whether the password is locked or not. For example, if you have locked DVPEN01-SL but forget the password, you have to return DVPEN01-SL to factory default setting by RS-232, and all the settings will return to default ones.

13.1.6.12 Return to Default Setting

If you need to clear all the settings after many modifications on the settings and return the settings to default ones, select the **Factory Setting** checkbox.

- **Return to Default Settings**



Select the **Factory Setting** checkbox, and click on **Yes**.

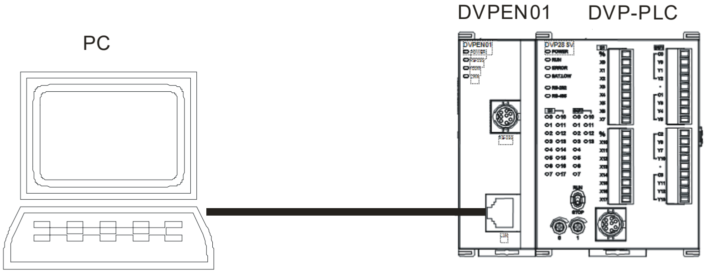
Note: If you set DVPEN01-SL by RS-232, you can return the setting to default setting whether the password is locked or not. It takes approximately 10 seconds to return to default setting, so DO NOT switch off the power within the 10 seconds.

13.1.7 Application Examples

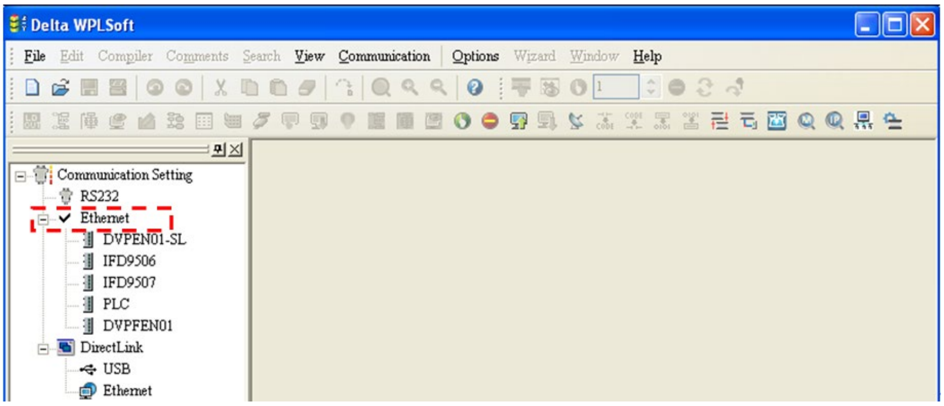
13.1.7.1 Setting IP Address and Communication through WPLSoft

Application	Setting the network parameters of DVPEN01-SL directly on the PC.
Network environment	(1) IP address of the PC executing WPLSoft: 192.168.0.3 (2) Subnet mask: 255.255.255.0; Gateway: 192.168.0.1 (3) IP address of DVPEN01-SL: 192.168.0.4 (4) Connect the PC and DVPEN01-SL by RJ-45 cable. Note: Both PC and DVPEN01-SL have to adopt static IP addresses.

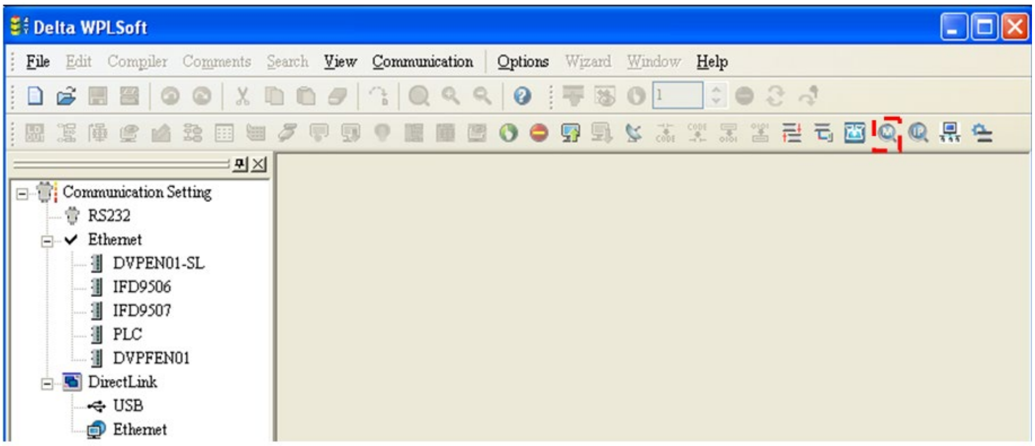
1. The connection illustration



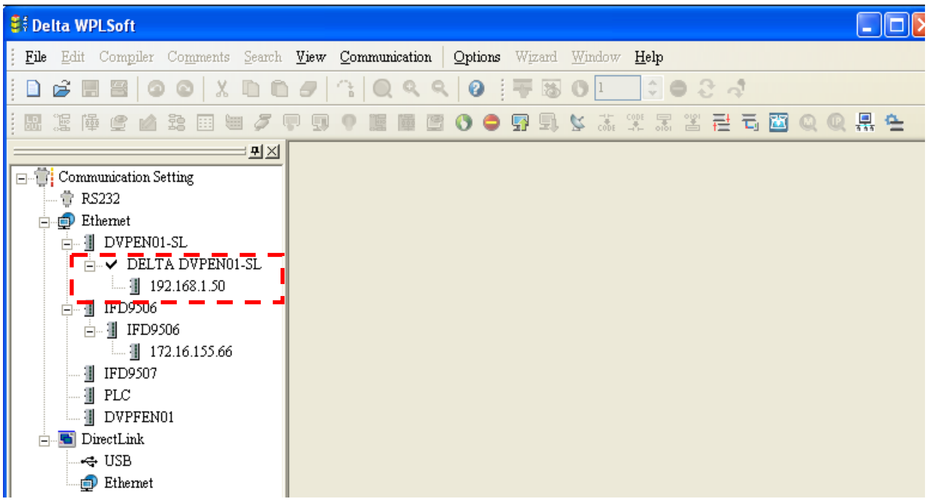
2. Start WPLSoft and click **Ethernet** in the **Communication Setting** section.



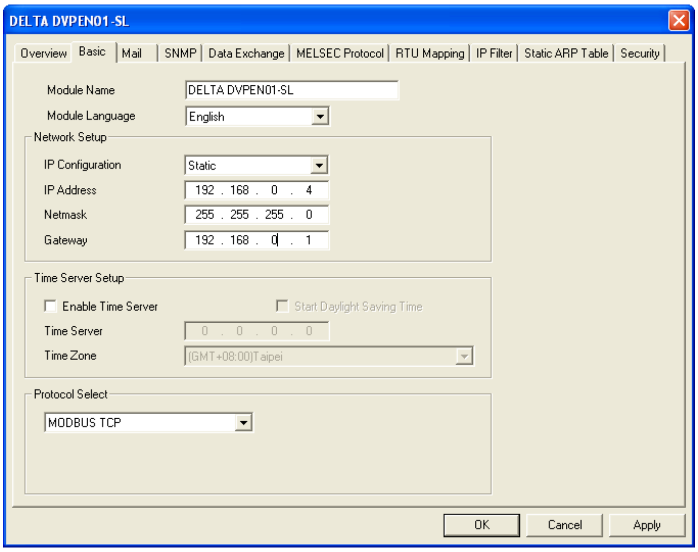
3. Click **Auto-Search Ethernet Module** to search for all the Ethernet modules on the network.



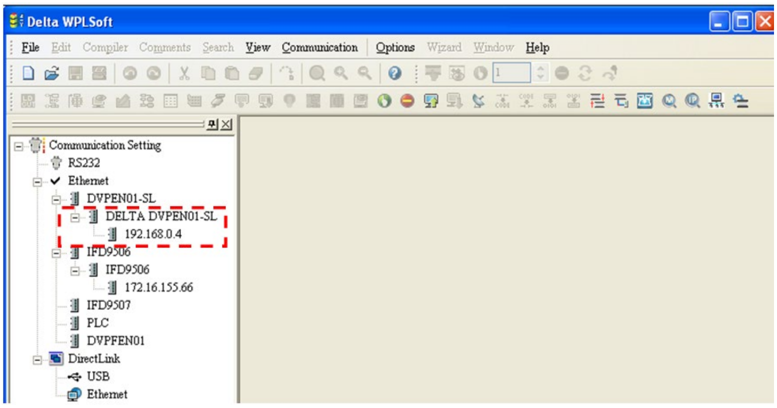
4. All the devices connected to the network are shown in the **Ethernet** section. After **DELTA DVPEN01-SL** is clicked, WPLSoft can communicate with the CPU by means of DVPEN01-SL.



5. Double-click **DELTA DVPEN01-SL** in the **Ethernet** section, and DCISoft will be started. Please refer to section 13.1.6.3 for more information about setting IP address.



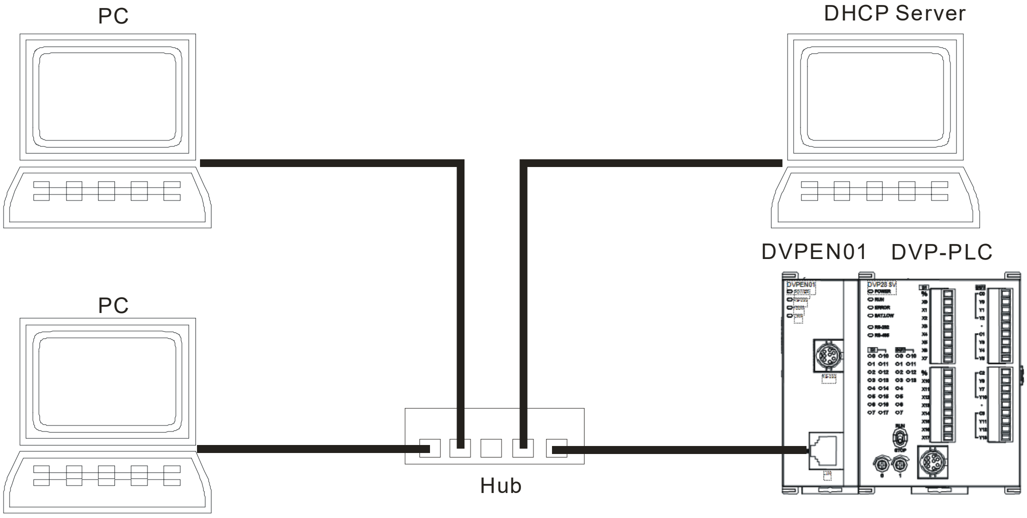
6. After the IP address setting is complete, repeat step 2 to step 4 to use the modified IP address for communication.



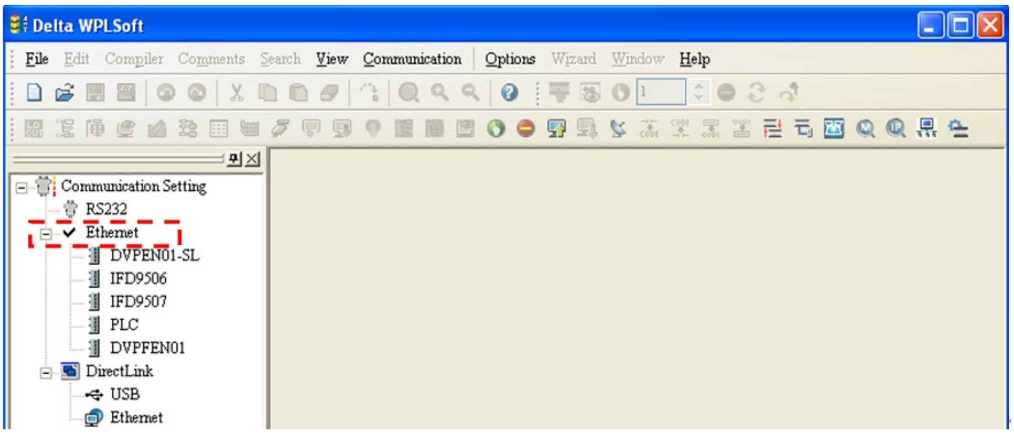
13.1.7.2 Connecting the PC with DVPEN01-SL through LAN

Application	Setting the network parameters of DVPEN01-SL by WPLSoft through LAN.
Network environment	(1) Connect the PC and DVPEN01-SL by using DHCP server through LAN. (2) DVPEN01-SL obtains its IP address through DHCP mode. Note: DVPEN01-SL can use a RJ-45 cable with/without a jump wire.

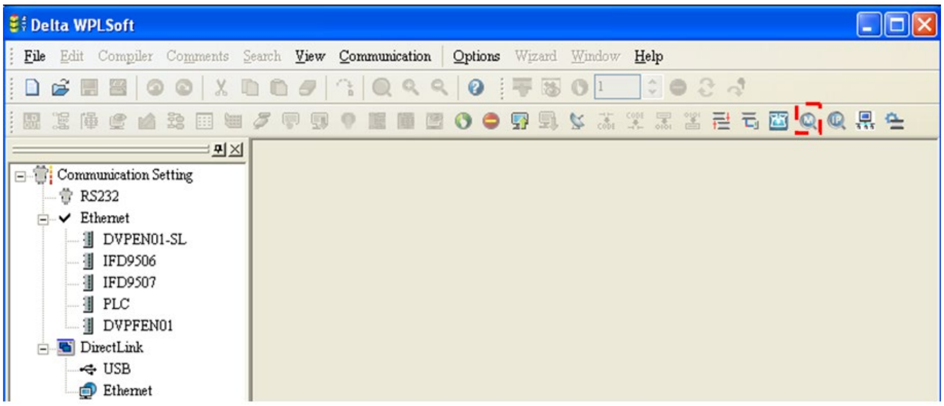
1. The connection illustration



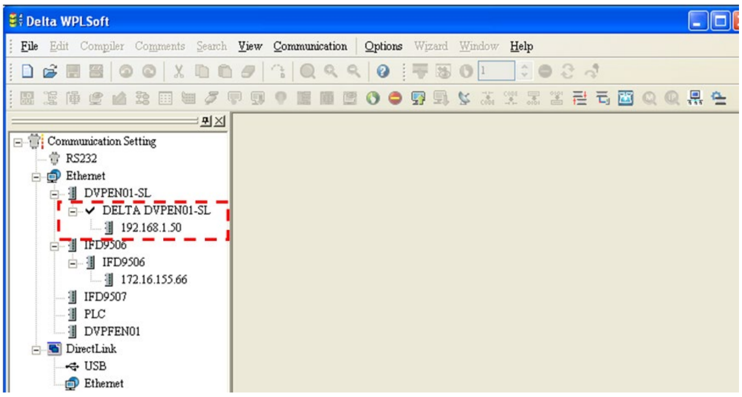
2. Start WPLSoft and click **Ethernet** in the **Communication Setting** section.



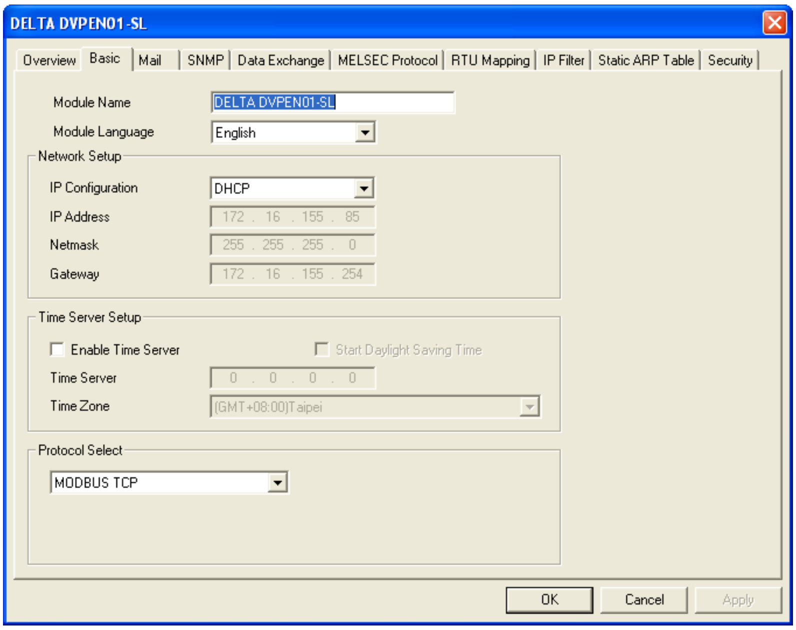
3. Click **Auto-Search Ethernet Module** to search for all the Ethernet modules on the network.



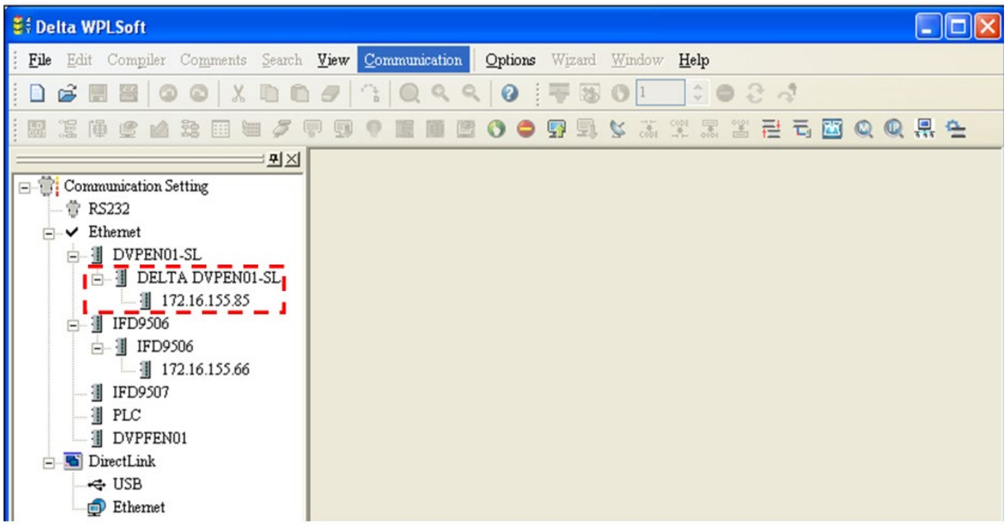
4. All the devices connected to the network are shown in the **Ethernet** section. After **DELTA DVPEN01-SL** is clicked, WPLSoft can communicate with the CPU by means of DVPEN01-SL.



5. Double-click **DELTA DVPEN01-SL** in the **Ethernet** section, and DCISoft will be started. Please refer to section 13.1.6.3 for more information about setting IP address.



6. After the IP address setting is complete, repeat step 2 to step 4 to use the modified IP address for communication.

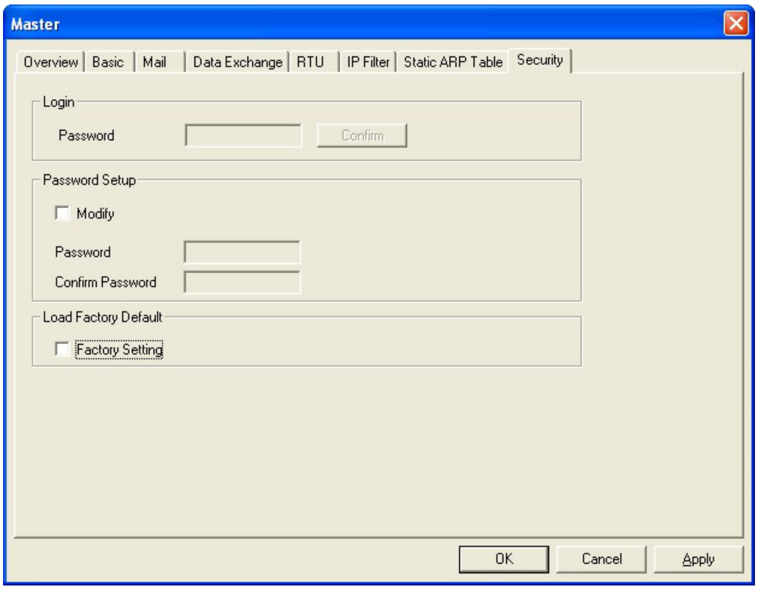


13.1.7.3 Password Setting and Removal

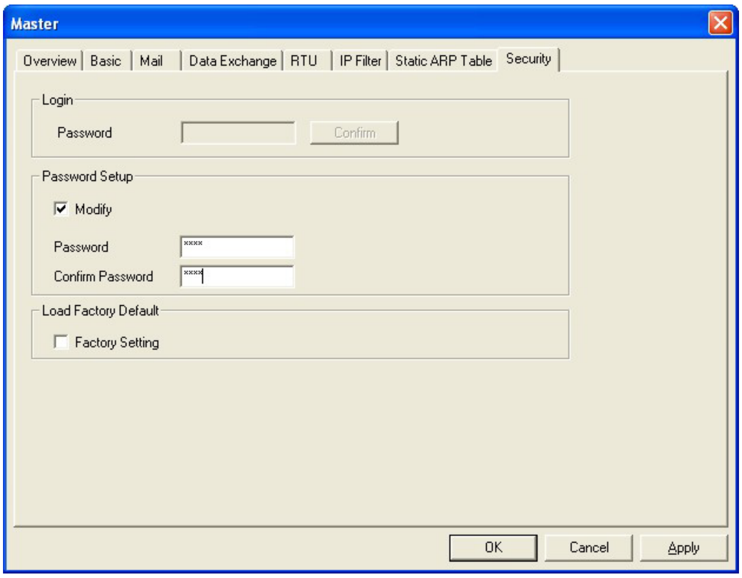
Application	Setting and clearing a password by WPLSoft
Network environment	(1) Set the password for DVPEN01-SL (2) Unlock DVPEN01-SL (3) Clear the password in DVPEN01-SL

1. Please refer to section 13.1.7.1 for the connection and how to set the communication.

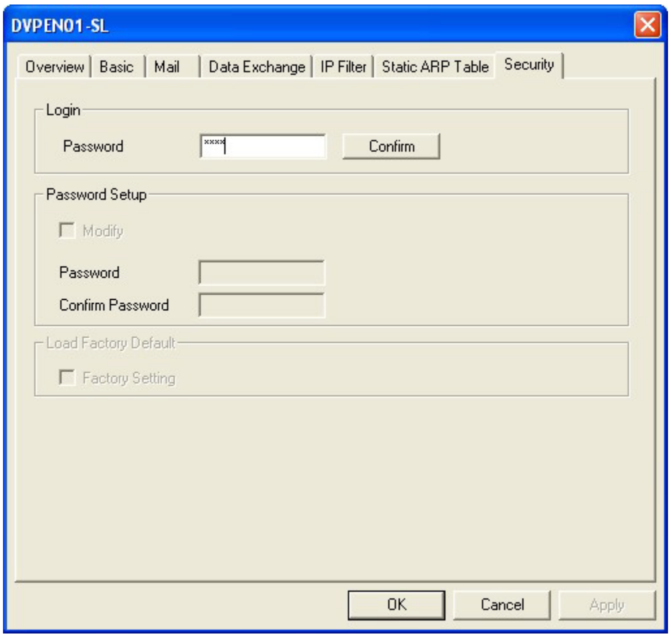
2. Open the setup page and switch to the **Security** page.



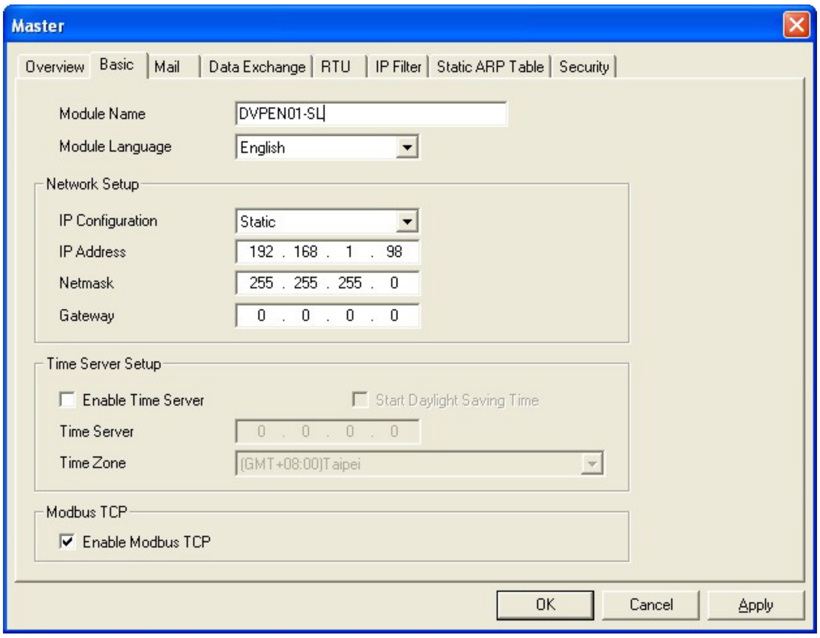
3. Select the **Modify** checkbox and enter “aabb” in the **Password** box and the **Confirm Password** box. Click on **OK** to save the password.



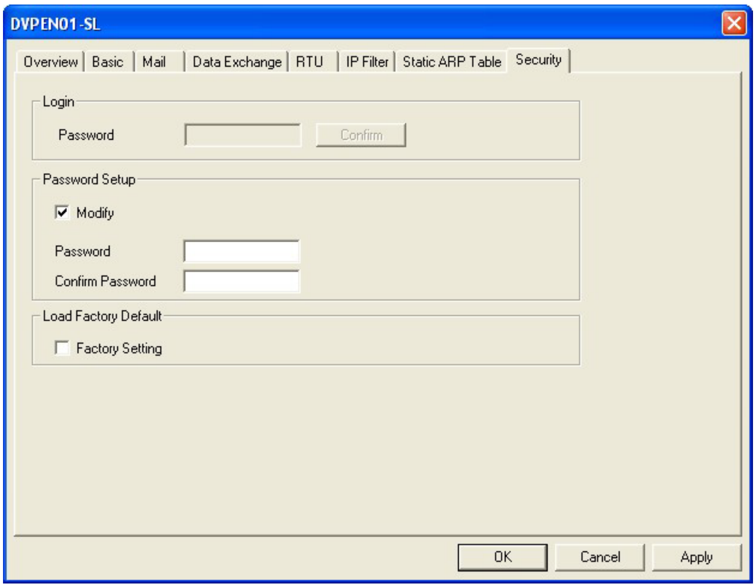
4. Open the setup page again, and DVPEN01-SL is now locked by the password. You cannot open any of the setting tabs now. Click on **Confirm** after entering the password in the Password field.



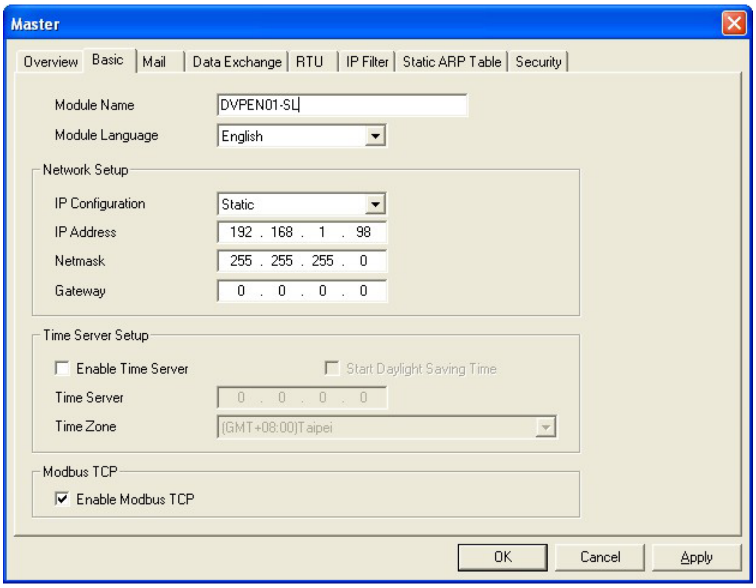
5. Enter the password to temporarily unlock the protection and modify the parameters. If you close the setup page, the locking will automatically be recovered.



6. To clear the password, simply leave the password fields blank. Click on **Apply** to clear the password.



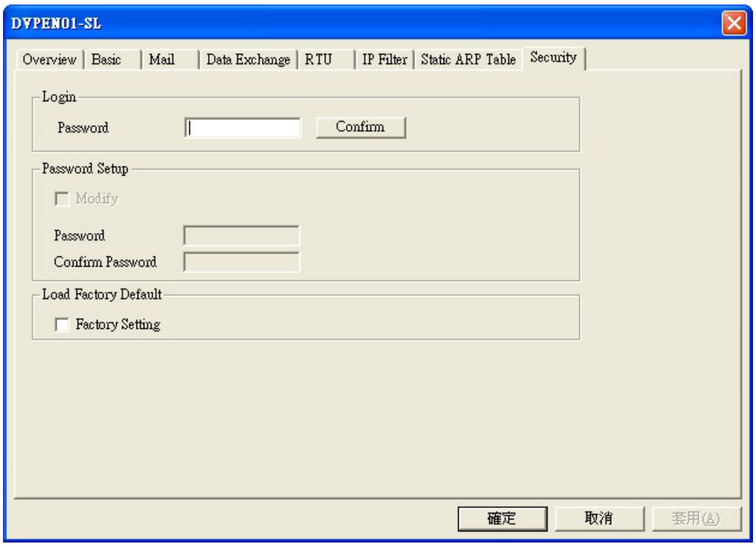
7. After the password is cleared, you can modify the parameters.



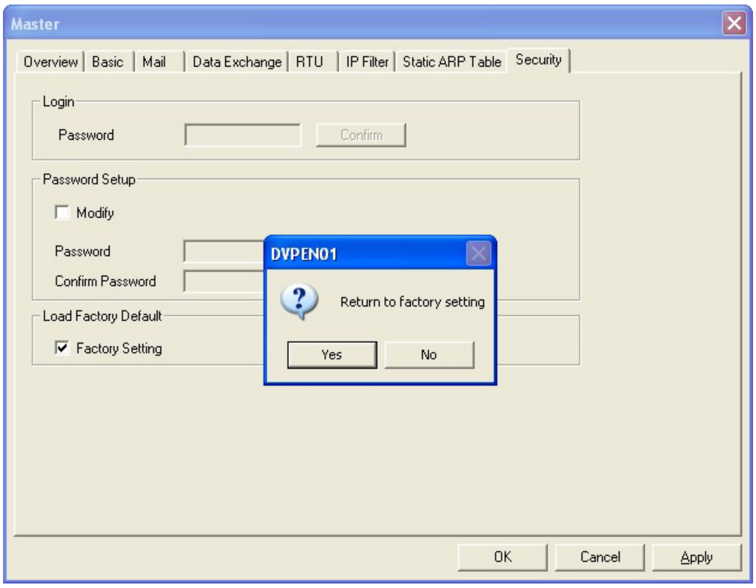
13.1.7.4 When the Password is Lost (Return to Default Setting by RS-232)

Application	Return to default setting by RS-232
Network environment	(1) DVPEN01-SL is set with a password. (2) The password is forgotten. Users can return to default setting by RS-232.

1. Use UC-PRG020-12A cable to connect the PC and DVPEN01-SL, and open the setup page. The **Security** page opens.



2. After the **Factory Setting** box is selected, a confirmation window will appear. Click on **Yes** to return to default settings (in approx. 5 to 10 seconds), and the password will be cleared as well.



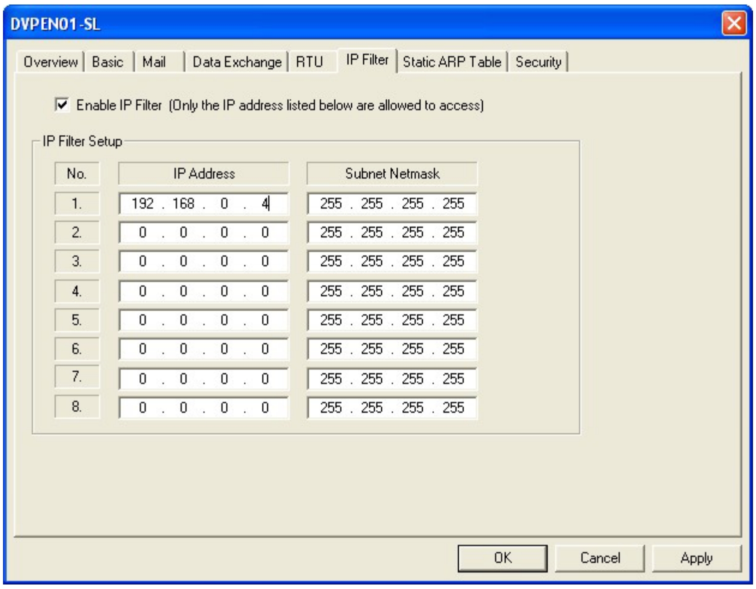
3. After the searching, all the parameters have already returned to their default settings.

13.1.7.5 IP Filter Protection

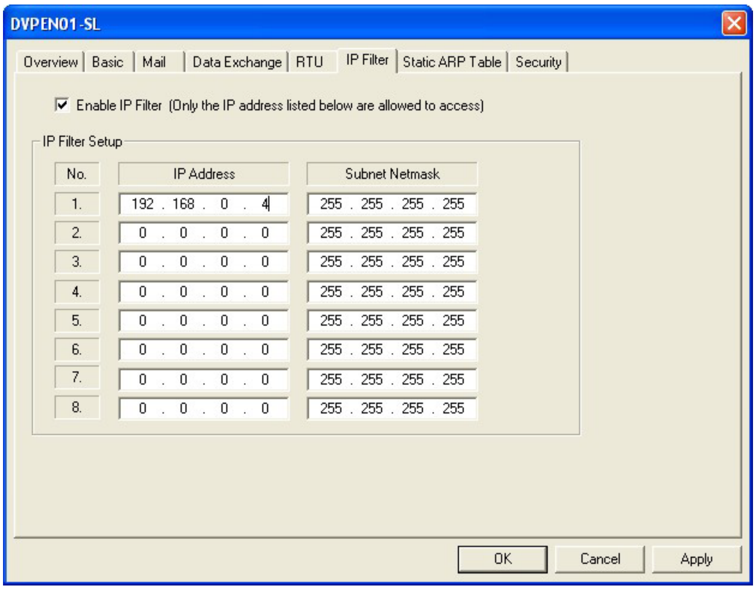
Application	Setting the IP filter protection
Network environment	(1) IP address of DVPEN01-SL: 192.168.0.4 (2) Only connections to 192.168.0.7 and 172.16.0.1 to 172.16.0.255 are allowed.

1. Please refer to section 13.1.7.1 for the connection and how to set the communication.

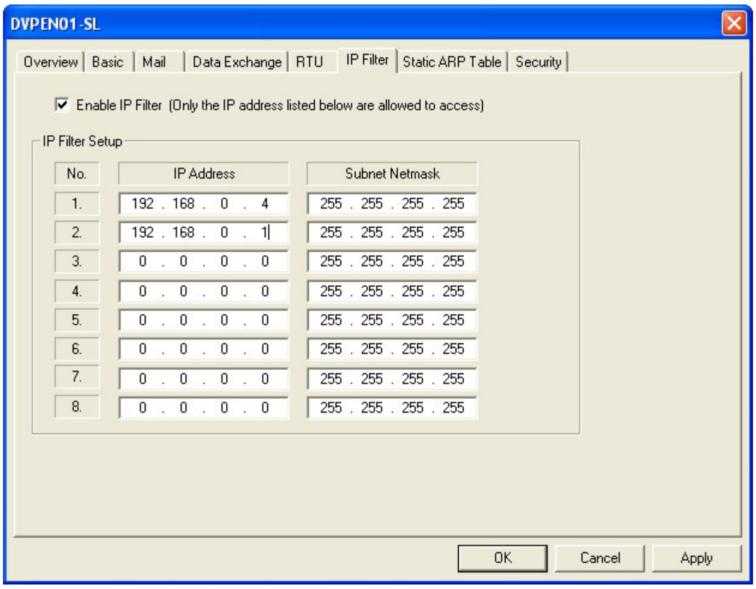
2. Open the setup page and switch to the **IP Filter** page



3. Select the **Enable IP Filter** checkbox. Enter “192.168.0.4” in the **No. 1 IP Address** box and “255.255.255.255” in the **No. 1 Subnet Netmask** box.



4. Enter “192.168.0.1” in the **No. 2 IP Address** box and “255.255.255.0” in the No. 2 **Subnet Netmask** box. Click on **OK** to complete the setting. Only the device within the IP address range can be connected.



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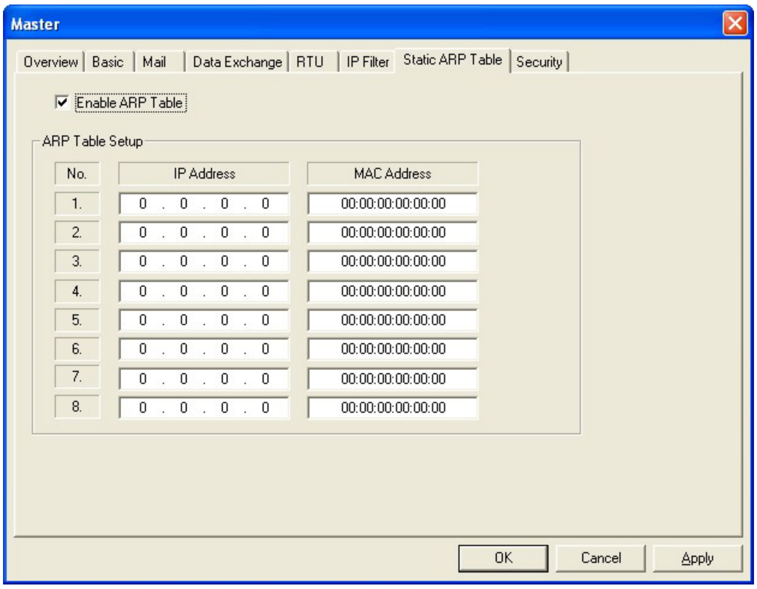
13.1.7.6 Static ARP Table Setting

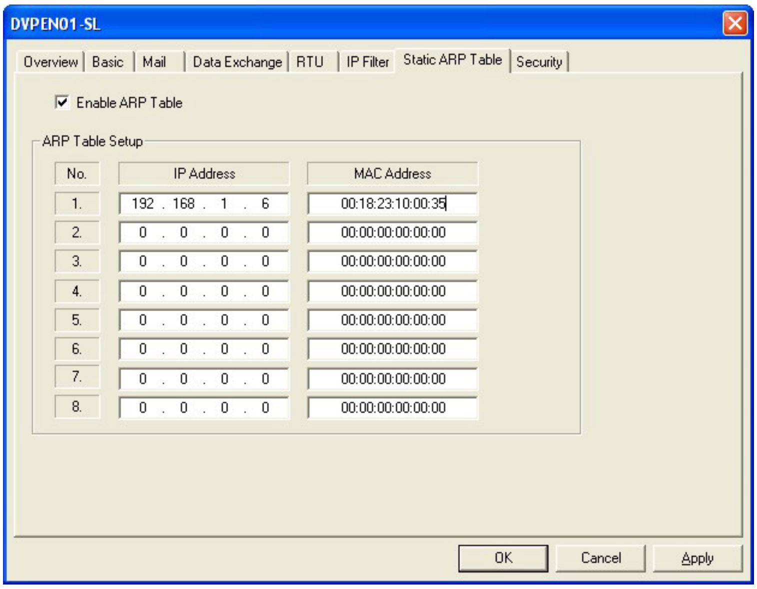
Application	Setting the static ARP table
Network environment	(1) MAC address of equipment 192.168.1.6 is 00 : 18 : 23 : 10 : 00 : 35 (2) MAC address of equipment 192.168.1.1 is 00 : 18 : 23 : 10 : 00 : 04

1. Please refer to section 13.1.7.1 for the connection and how to set the communication.

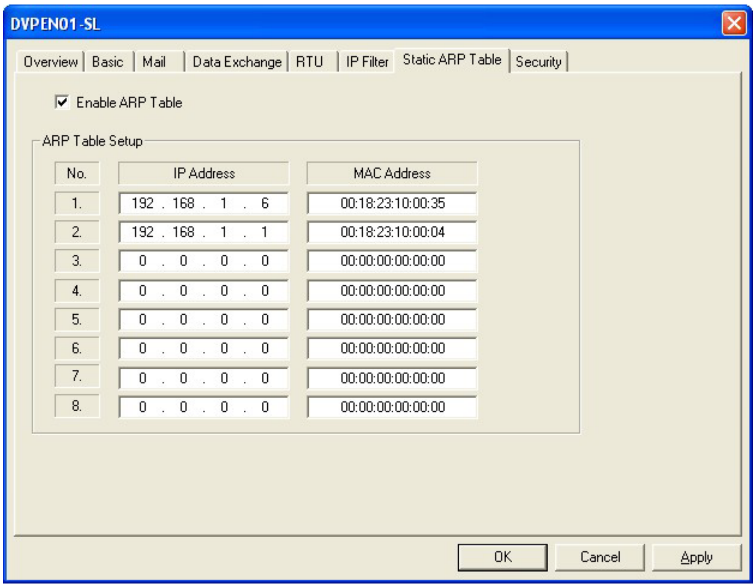
2. Open the setup page and switch to the **Static ARP Table** page.



3. Select the **Enable ARP Table** checkbox. Enter “192.168.1.6” in the **No. 1 IP Address** box, and its corresponding MAC address is “00:18:23:10:00:35”.



4. Enter “192.168.1.1” in **No.2 IP Address** box, and its MAC address is “00:18:23:10:00:04”. Click on **OK** to complete the setting. Only the device within the IP address range can be connected.



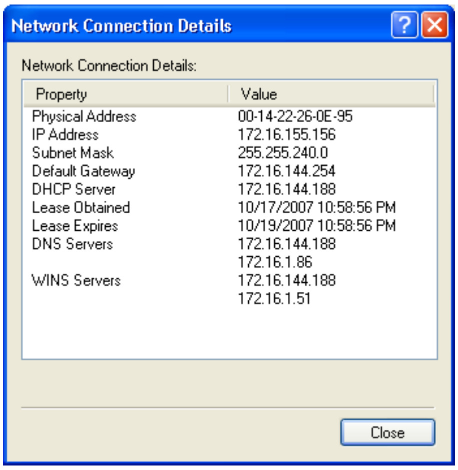
Note:

The MAC address of DVPEN01-SL can be obtained from WPLSoft or the MAC address sticker on the device.

The MAC address of PC can be found in the **Network Connection Details** window (see below).

MAC address

001823100022



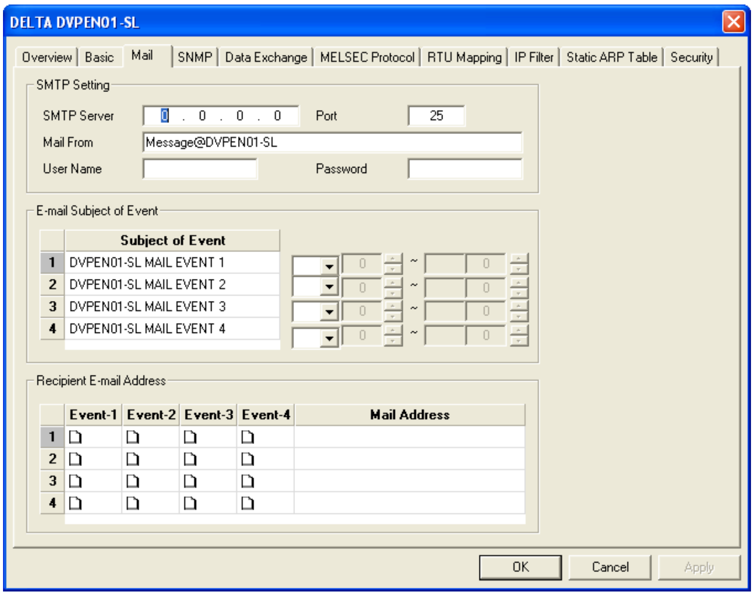
13.1.7.7 E-Mail Application

Application	Sending an E-mail to notify the administrator when the current status of X0 and Y0 is changed.
Network application	(1) IP address of the SMTP server: 172.16.144.121 (2) E-mail address of administrator: test@sample.com (3) An E-mail message will be generated when the status of X0 and Y0 is changed.

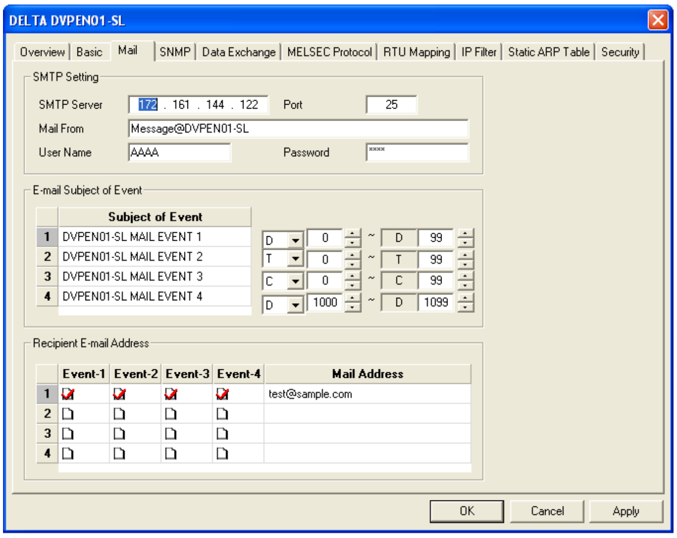
1. Please refer to section 13.1.7.1 for the connection and how to set the communication.

2. DVPEN01-SL does not support TLS/SSL encrypted communication. Please verify the communication specifications of the mail server before use.

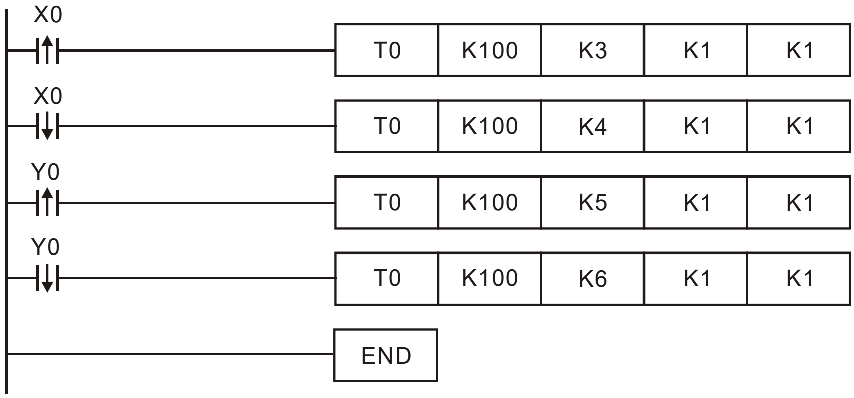
3. Open the setup page and switch to the **Mail** page.



4. Set E-mails and select events. Enter the address of the SMTP server, the subjects of the E-mails, username/password, the E-mail addresses of the recipients, the present values in the registers (D devices, T devices, and C devices) attached to the E-mails, and the number of values. Check the Event cells for recipient 1. Click **Apply** to complete the setting of E-mails.



5. After all the settings in DVPEN01-SL are completed, compile the ladder diagram in the CPU and download it to the CPU. See below for the program design:



Explanations:

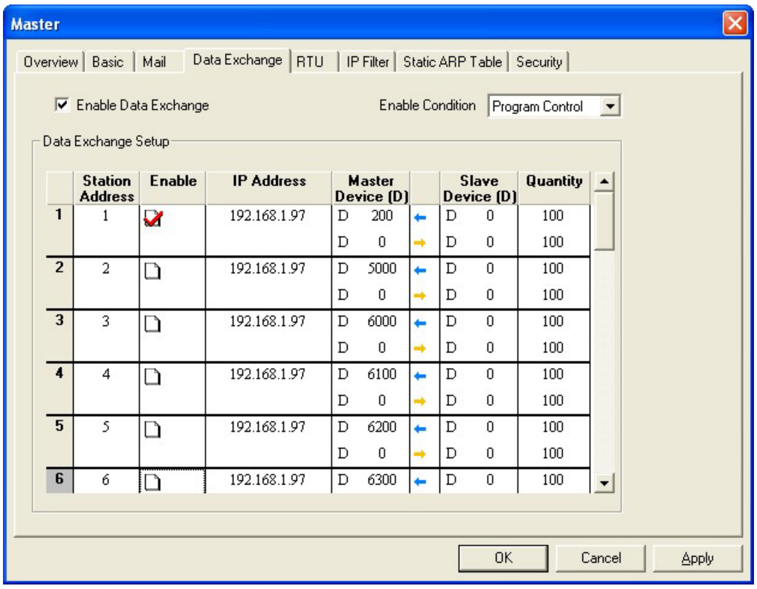
- If the rising-edge of X0 is triggered, X0 will go from Off to On. Write “1” into CR#3 of DVPEN01-SL, and the first E-mail will be sent out.
- If the falling-edge of X0 is triggered, X0 will go from On to Off. Write “1” into CR#4 of DVPEN01-SL, and the second E-mail will be sent out.
- If the rising-edge of Y0 is triggered, Y0 will go from Off to On. Write “1” into CR#5 of DVPEN01-SL, and the third E-mail will be sent out.
- If the falling-edge of Y0 is triggered, Y0 will go from On to Off. Write “1” into CR#6 of DVPEN01-SL, and the fourth E-mail will be sent out.

13.1.7.8 Data Exchange Application (1)

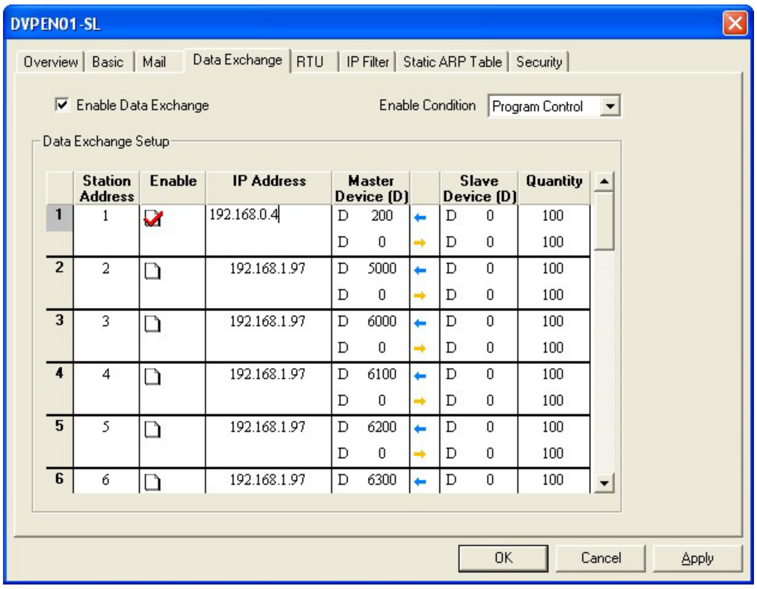
Application	Writing the time in RTC in PLC_B into D0 to D6 of PLC_A
Network environment	(1) Adopt a static IP address. (2) IP address of PLC_A: 192.168.0.4 (3) IP address of PLC_B: 192.168.0.5 (4) Update from PLC_B to PLC_A.

1. Please refer to section 13.1.7.1 for the connection and how to set the communication.

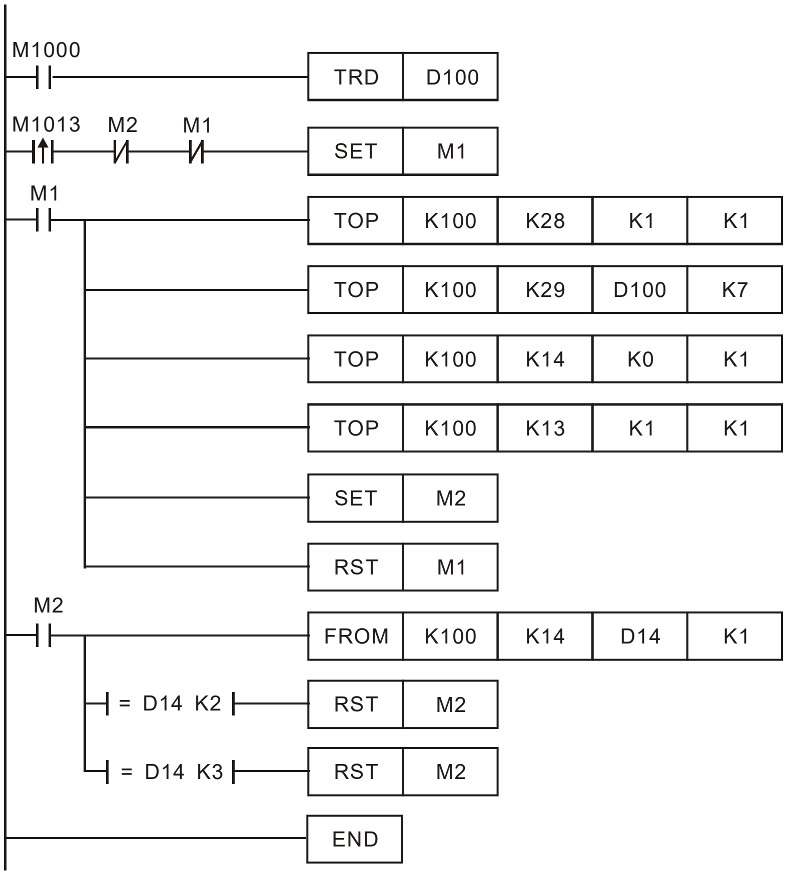
2. Open the setup page of PLC_B and switch to the **Data Exchange** page.



3. Select the **Enable Data Exchange** checkbox. Select Program Control in the **Enable Condition** drop-down list box. Enter the IP address of PLC_A “192.168.0.4” in the **IP Address** cell corresponding to station address 1. Click on **Apply** to complete the setting.



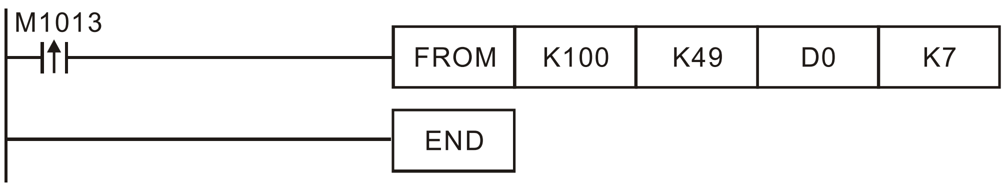
4. After all the settings in PLC_B are completed, compile the ladder diagram in the CPU and download it to PLC_B. The program designed is like the one shown below:



Explanations:

- The data exchange will be executed every one second.
- Write the communication address of the destination PLC in CR#28, and DVPEN01-SL will automatically detect by the previous setting that No. 1 IP address is “192.168.0.4".
- Write the data in RTC into CR#29 to CR#35.
- Write “1” into CR#13 to start the data exchange.
- CR#14=2 refers to successful exchange. CR#14=3 refers to failed exchange.

5. Compile the ladder diagram for PLC_A and download it to PLC_A.



Explanations:

- The received data are stored in CR#49 to CR#55.
- The data received every one second are written into D0 to D6.

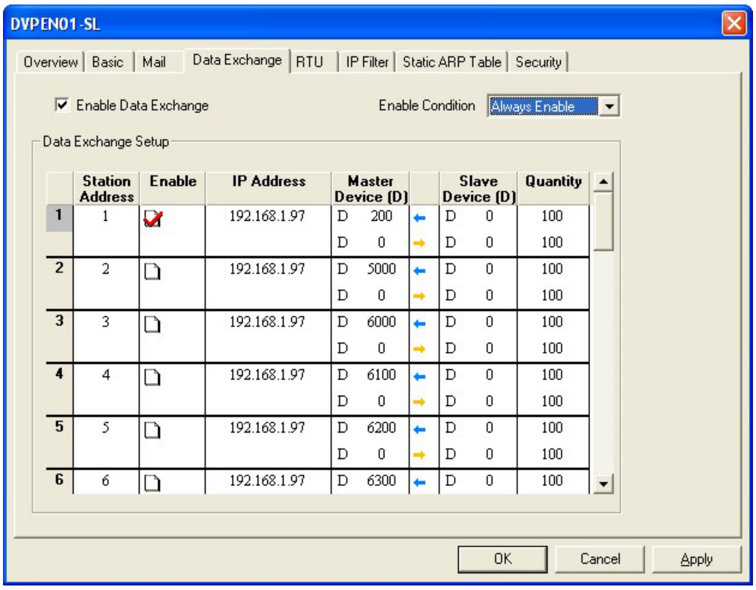
13

13.1.7.9 Data Exchange Application (2)

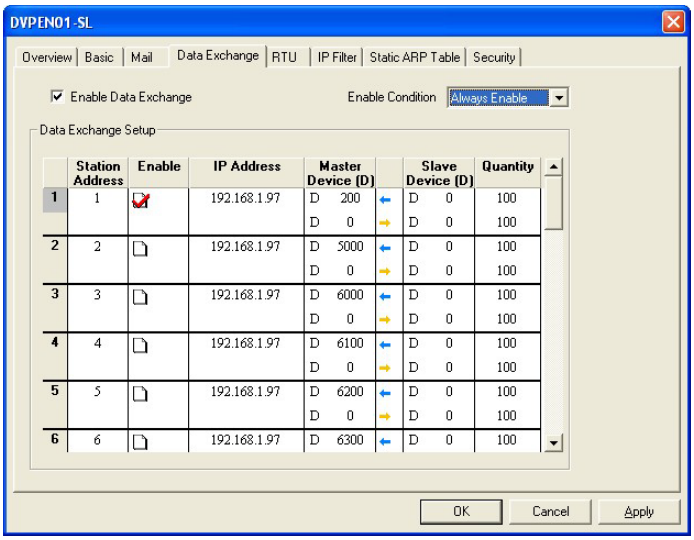
Application	Select Always Enable in the Enable Condition drop-down list box. Enable a timer and write the timer values into D0 to D99. Continuously write the present values in D0 to D99 of PLC_A into D0 to D99 of PLC_B, and write the values in D0 to D99 of PLC-B into D200 to D299 of PLC_A.
Network environment	(1) Adopt a static IP address. (2) IP address of PLC_A: 192.168.1.99 (3) IP address of PLC_B: 192.168.1.97 (4) Update from PLC_A to PLC_B and PLC_B to PLC_A.

※ Firmware version 2.0 and above support this function.

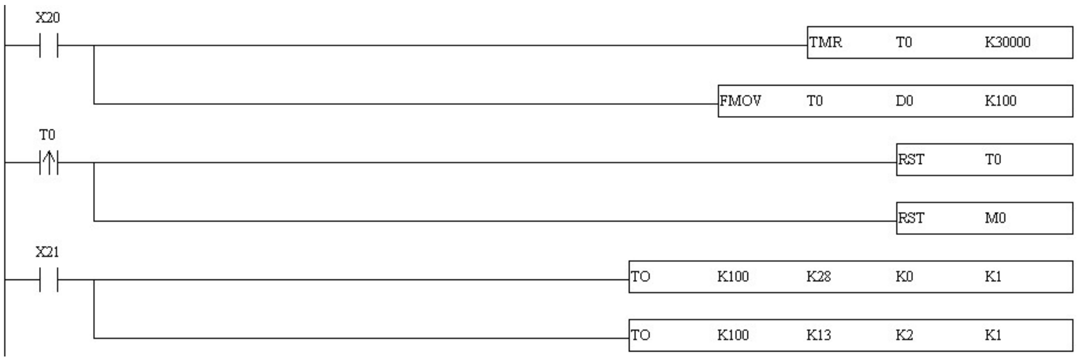
1. Please refer to section 13.1.7.1 for the connection and how to set the communication.
2. Open the setup page of PLC_A and switch to the **Data Exchange** page.



3. Check **'Enable Data Exchange'**, and select '**Always Enable**' as the execution mode. Check the '**Enable'** option for the first data exchange group, enter PLC_B IP as '192.168.1.97' in the first IP address of the group. Set D200←D0 and D0→D0, both with a quantity of 100 records.



4. After all the settings in PLC_A are completed, you have to write a ladder diagram for the CPU and download it to PLC_B. The program designed is like the one shown below:



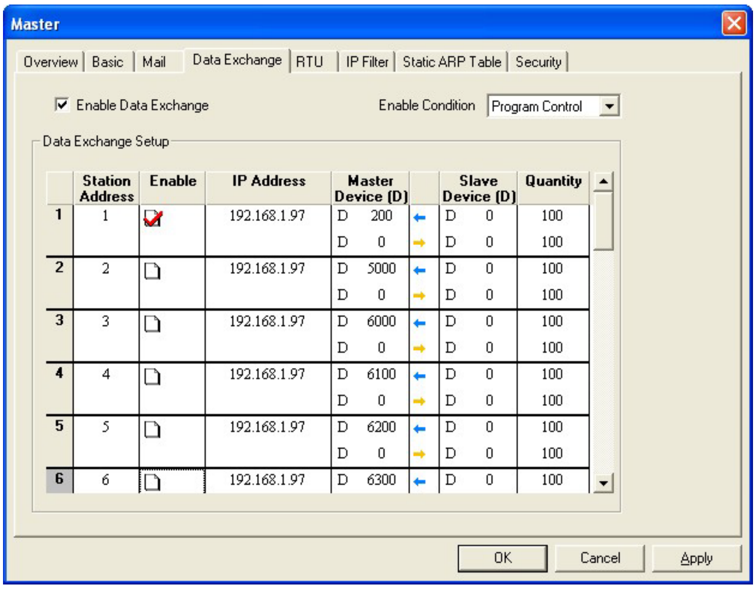
13.1.7.10 Data Exchange Application (3)

Application	Enable a timer (X20) and write the timer values into D0 to D99. Control the program (X21) and write the present values in D0 to D99 of PLC_A into D0 to D99 of PLC_B and write the values in D0 to D99 of PLC-B into D200 to D299 of PLC_A. Control the program (X21) to stop the execution.
Network environment	(1) Adopt a static IP address. (2) IP address of PLC_A: 192.168.1.99 (3) IP address of PLC_B: 192.168.1.97 (4) Update from PLC_A to PLC_B and PLC_B to PLC_A.

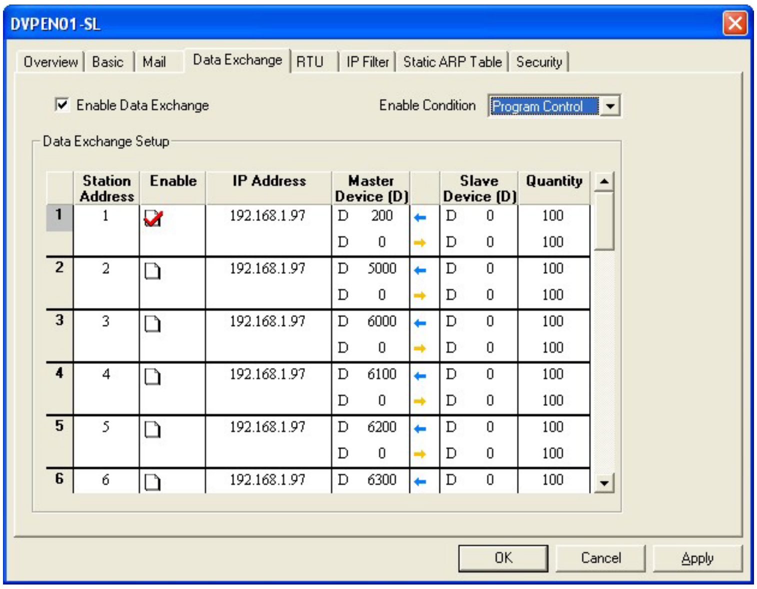
※ Firmware version 2.0 and above support this function.

1. Please refer to section 13.1.7.1 for the connection and how to set the communication.

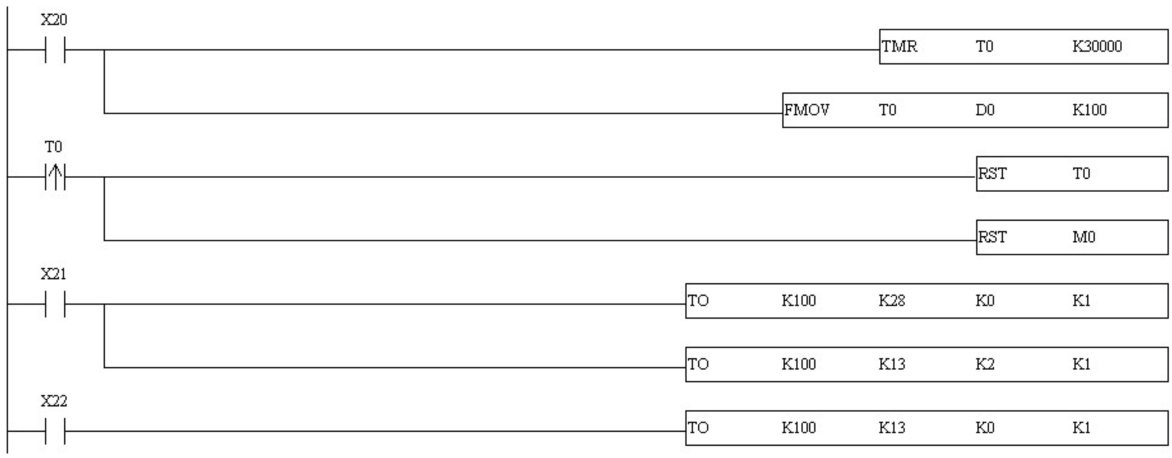
2. Open the setup page of PLC_A and switch to the **Data Exchange** page.



3. Check ‘**Enable Data Exchange**,’ select the execution mode as '**Program Control**.' Check the ‘**Enable’** option for the first data exchange group, enter PLC_B IP as '192.168.1.97' in the first IP address of the group. Set D200←D0 and D0→D0, both with a quantity of 100 records.



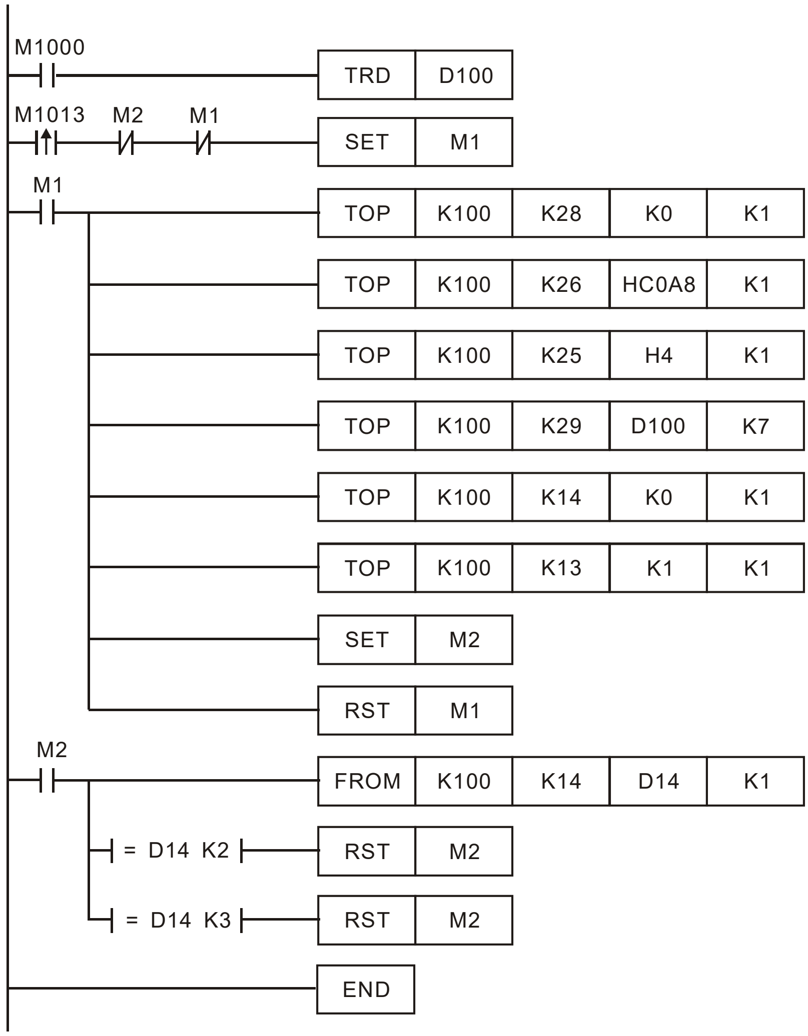
4. After all the settings in PLC_A are completed, you have to write a ladder diagram for the CPU and download it to PLC_B. The program designed is like the one shown below.



13.1.7.11 Data Exchange Application (4)

Application	Writing the time of the RTC in PLC_B into D0 to D6 of PLC_A, using a ladder diagram to designate an IP address.
Network environment	(1) Adopt a static IP address. (2) IP address of PLC_A: 192.168.0.4 (3) IP address of PLC_B: 192.168.0.5 (4) Update from PLC_B to PLC_A

1. Please refer to section 13.1.7.1 for how to set the communication. Compile the ladder diagram in the CPU and download it to PLC_B. The program designed is like the one shown below.

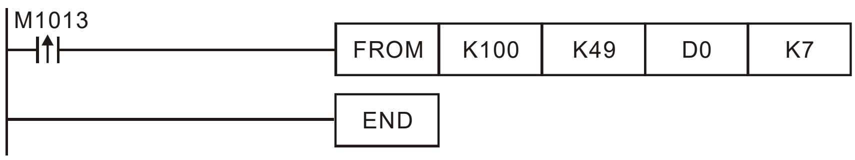


Explanations:

- The data exchange will be executed every one second.
- Write “0” into CR#28, and PLC_B will use CR#25 to CR#26 as the IP address of the destination PLC.
- Write the IP address of PLC_A into CR#25 and CR#26. The first two IP codes (192.168=H’C0A8) should be written into CR#26, and the last two IP codes (0.4=H’0004) into CR#25.
- Write the data in RTC into CR#29 to CR#35.
- Write “1” into CR#13 to start the data exchange.

  CR#14=2 refers to successful execution. CR#14=3 refers to failed execution.

2. Compile the ladder diagram for PLC_A and download it to PLC_A.



Explanations:

The received data are stored in CR#49 to CR#55.

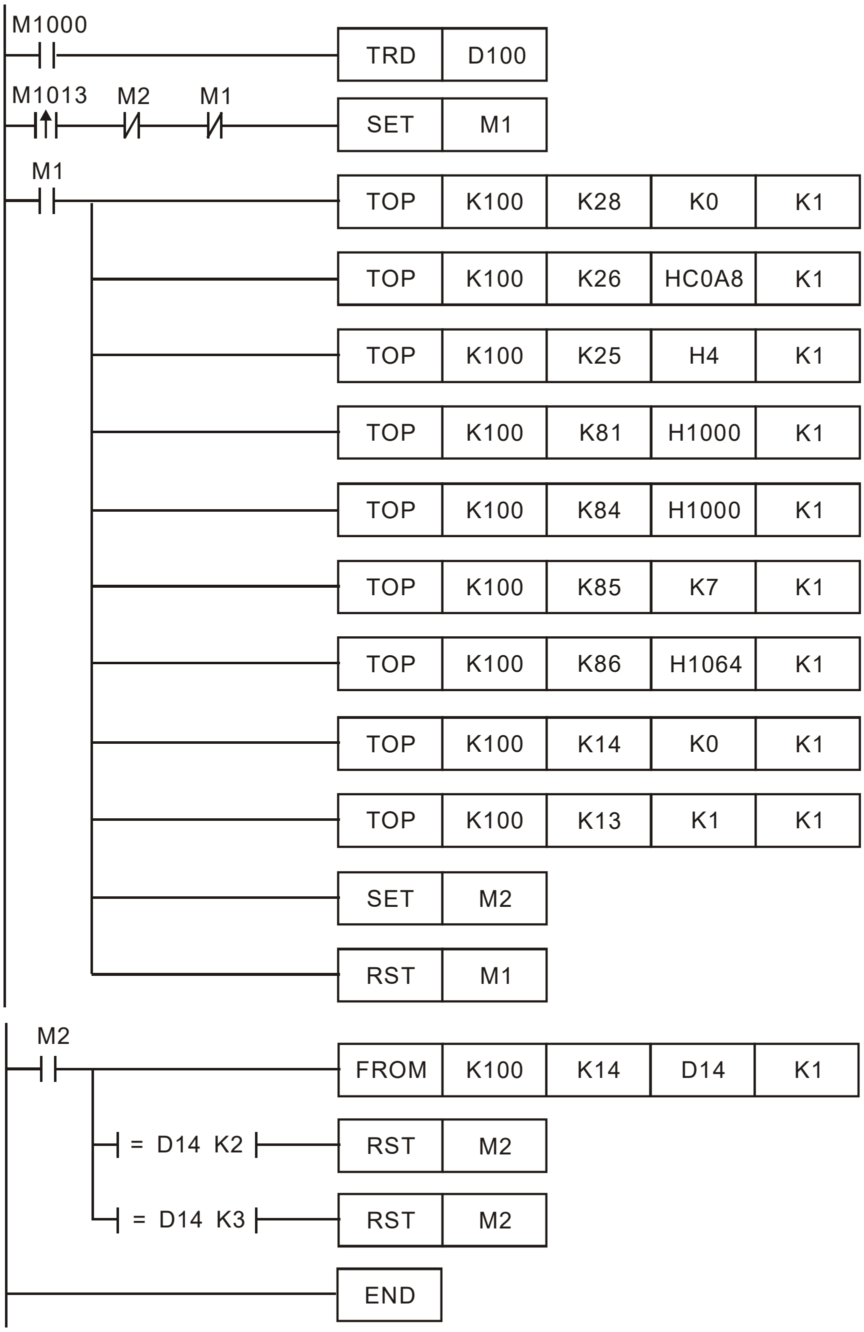
The data received every one second are written into D0 to D6.

13.1.7.12 Data Exchange Application (5)

Application	Writing the time in RTC in PLC_B directly into D0 to D6 of PLC_A without writing the ladder diagram into PLC_A.
Network environment	(1) Adopt a static IP address. (2) IP address of PLC_A: 192.168.0.4 (3) IP address of PLC_B: 192.168.0.5 (4) Update from PLC_B to PLC_A.

1. Please refer to section 13.1.7.1 for how to set the communication.

2. Compile the ladder diagram in the CPU and download it to PLC_B. Do NOT need to write any corresponding ladder diagram into PLC_A.



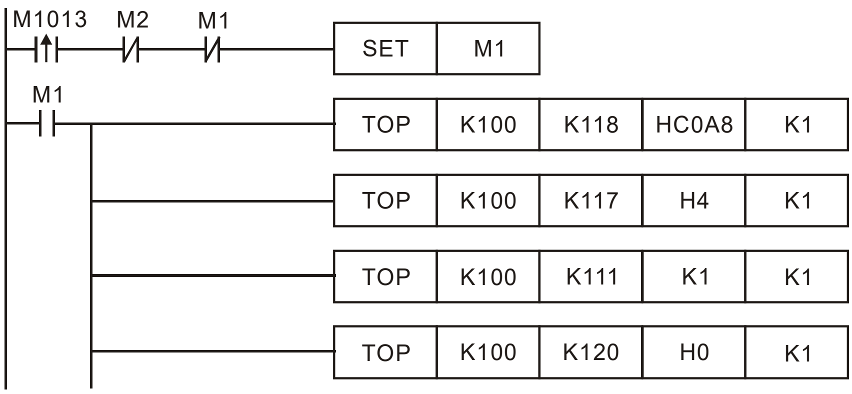
Explanations:

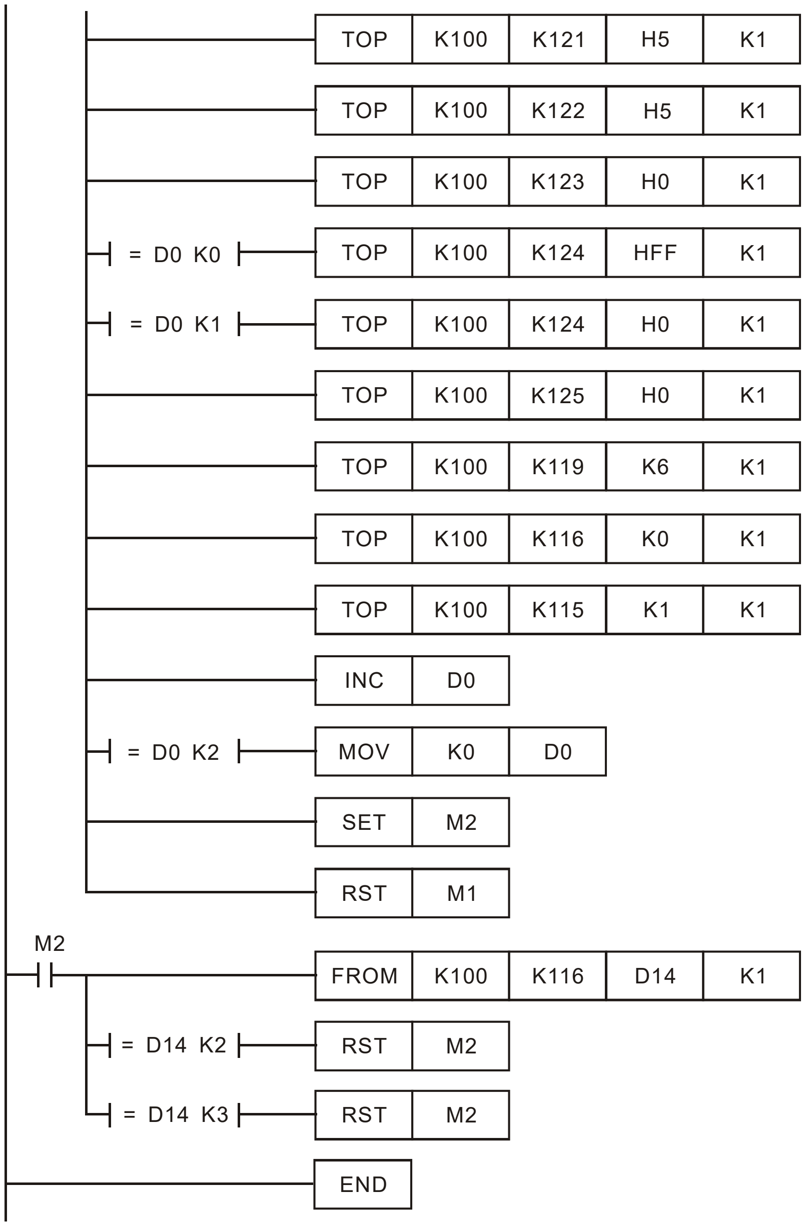
- The data exchange will be executed every one second.
- Write “0” into CR#28, and PLC_B will use CR#25 to CR#26 as the IP address of the destination PLC.
- Write the IP address of PLC_A into CR#25 and CR#26. The first two IP codes (192.168=H’C0A8) should be written into CR#26, and the last two IP codes (0.4=H’0004) into CR#25.
- Write the MODBUS address of D0 (H’1000) in PLC_A into CR#81 and CR#84.
- Write the MODBUS address of D100 (register of RTC) (H’1064) into CR#86.
- Write the number of registers K7 into CR#85.
- Write “1” into CR#13 to start the data exchange.
- CR#14=2 refers to successful execution. CR#14=3 refers to failed execution.
- Once the data exchange is successful, the values in D1313 to D1318 in PLC_B will be written into D0 to D6 of PLC_A.

13.1.7.13 MODBUS TCP Master Application

Application	Compiling MODBUS instruction by PLC_B, making Y0 of PLC_A flashing
Network environment	(1) Adopt a static IP address. (2) IP address of PLC_A: 192.168.0.4 (3) IP address of PLC_B: 192.168.0.5 (4) Update from PLC_B to PLC_A (5) Use MODBUS instruction 050500FF00 to set “On” Y0. (6) Use MODBUS instruction 0505000000 to set “Off” Y0. (7) Y0 goes between On/Off once every one second.

1. Please refer to section 13.1.7.1 for how to set the communication
2. Compile the ladder diagram in the CPU and download it to PLC_B. See below for the program design. Do NOT need to write any corresponding ladder diagram into PLC_A.





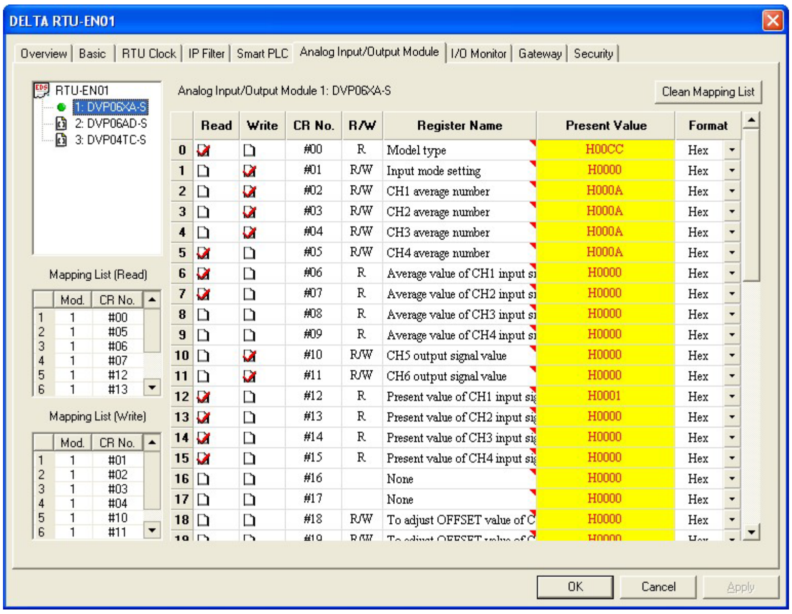
Explanations:

- The data exchange will be executed every one second.
- Write the IP address of PLC_A into CR#117 and CR#118. The first two IP codes (192.168=H'C0A8) should be written into CR#118, and the last two IP codes (0.4=H'0004) into CR#117.
- Set CR#111 as "1" to enable the 8-bit mode. The MODBUS instruction is stored in the low byte of CR#120 to CR#247.
- Write MODBUS instruction into CR#120 to CR#125. CR#120 is the MODBUS address.
- Write the length of the instruction into CR#119.
- Write "1" into CR#115 to start the execution of MODBUS TCP instruction.
- CR#116=2 refers to successful execution. CR#116=3 refers to failed execution.
- If the execution is successful, Y0 on PLC_A will go between On and Off every one second.

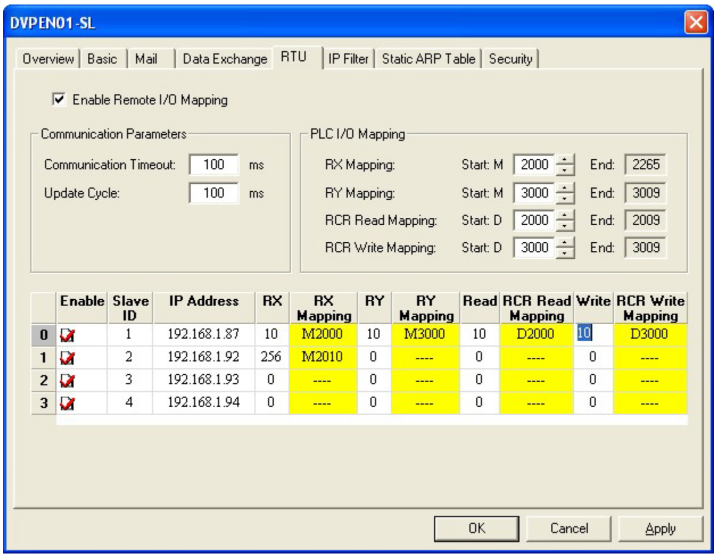
13.1.7.14 RTU Mapping

Application	Using RTU mapping to read/write the remote digital I/O and analog I/O registers. DVP28SV+DVPEN01-SL→RTU-EN01+DVP06XA+DVP16SP.
Network environment	Adopt static IP address. IP address of DVPEN01-SL: 192.168.1.90 IP address of RTU-EN01: 92.168.1.91 Use DCISoft for RTU-EN01and check 10 mapping data for read and 10 mapping data for write. Set the mapping start address and number of data for RX, RY, RCR (read) and RCR (write) at DVPEN01-SL. Enable the mapping function in DVP-SV PLC at DVPEN01-SL. Use M2000 and D2000 in DVP-SV to read and M3000 and D3000 to write the value in the remote RTU-EN01.

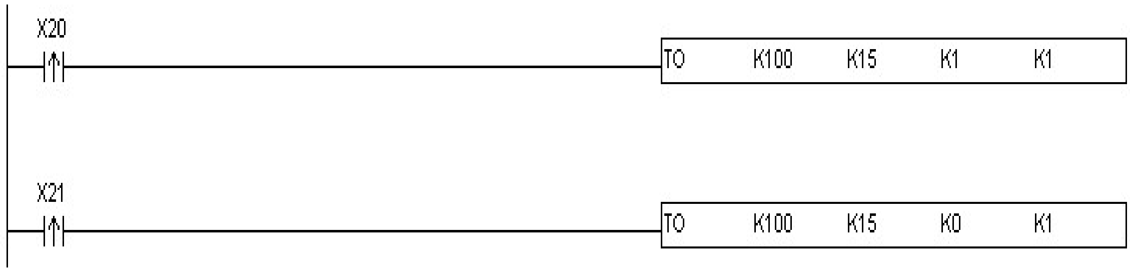
1. Please refer to section 13.1.7.1 for more information about setting communication
2. Use DCISoft for RTU-EN01 to set mapping control registers used for reading/writing.



3. Use DCISoft for DVPEN01-SL to set start addresses and numbers. (RX: M2000 to M2009; RY: M3000 to M3009; RCR (Reading): D2000 to D2009; RCR (Writing): D3000 to D3009)



4. Edit a ladder diagram, and download it to DVPEN01-SL. The program edited is like the one shown below.



Explanations:

1. Enabling mapping: CR15=1
2. Disabling mapping: CR15=0
3. After CR#15 is enabled, M2000 to M2009 and D2000 to D2009 will be used to read data, and present values will be read before M3000 to M3009 and D3000 to D3009 are used to write data.
4. During the execution of mapping, other devices cannot be used to modify the values in mapping registers.

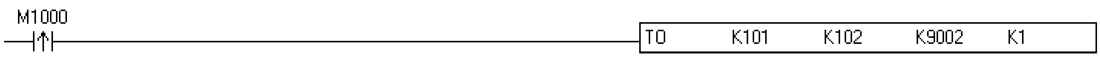
13.1.7.15 MELSEC Protocol Application

Application	Using **Always Enable** in the **Enable Condition** drop-down list box to read/write registers in a Mitsubishi PLC. DVP28SV+DVPEN01-SL→Mitsubishi PLC
Network environment	(1) Use a static IP address. (2) The IP address of DVPEN01-SL is 192.168.1.5, and the sending communication port is 9002. (3) The IP address of RTU-EN01 is 192.168.1.39, and the receiving communication port is 9002. (4) Data mapping: D100 to D199 in DVP28SV are mapped onto D100 to D199 in the Mitsubishi PLC, and D0 to D99 in the Mitsubishi PLC are mapped onto D0 to D99 in DVP28SV.

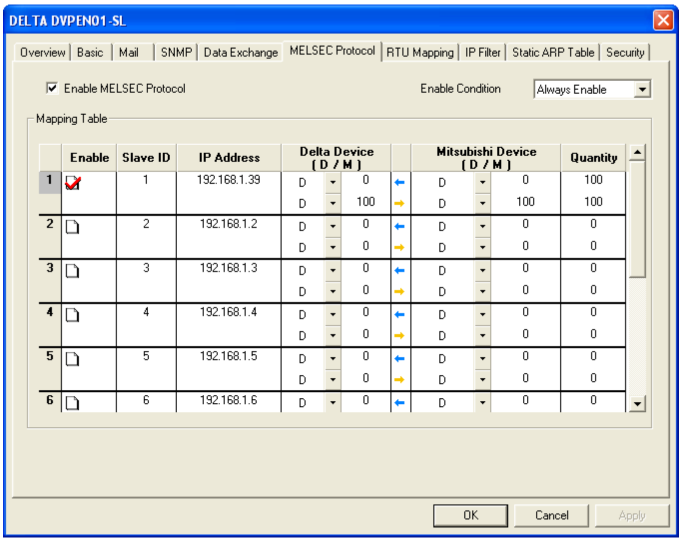
※ Firmware version 2.10 and above support this function.

※ Please visit the Mitsubishi website for more information about the Mitsubishi PLC models which support the MELSEC communication protocol.

1. Please refer to section 13.1.7.1 for more information about setting communication.
2. Use the Mitsubishi software to set the IP address of the Mitsubishi PLC and the communication parameters.
   - Communication protocol: MC protocol
   - Communication mode: UDP
   - Communication port: 9002
3. Write a program for the CPU, and download it to DVPEN01-SL. The program designed is like the one shown below



4. Use DCISoft to set data exchange for DVPEN01-SL.



※ After the settings are downloaded, DVPEN01-SL will read the data in D0 to D99 in the Mitsubishi PLC into D0 to D99 in DVP28SV, and write the data in D100 to D199 in DVP28SV into D100 to D199 in the Mitsubishi PLC.

13.1.8 LED Indictor and Troubleshooting

13.1.8.1 LED Indication

LED	LED Status	Indication	How to correct
POWER (green)	Constantly ON	Power supply is normal.	--
	Constantly OFF	No power supply	Check whether the CPU module supplies power normally, and DVPEN01-SL is connected tightly.
RS-232 (red)	Flashing	There are data being transmitted in the serial port	--
	Constantly OFF	No data transmission	Check whether the RS-232 cable is connected to the COM port on DVPEN01-S when in RS-232 communication.
100M (orange)	Constantly ON	Connected to Ethernet at 100 Mbps	--
	Constantly OFF	Connected to Ethernet at 10 Mbps	Check whether the network cable is connected correctly, the transmission rate is 100 Mbps, and the RJ45 connector is connected normally.
LINK (green)	Constantly ON	The network connection is normal.	--
	Flashing	Network in operation	--
	Constantly OFF	The network is not connected	Check whether the network cable is connected correctly, and the RJ45 connector is connected normally.

13.1.8.2 Troubleshooting

Abnormality	Cause	Solution
DCISoft search or page opening abnormality	DVPEN01-SL is not connected to a network.	Check whether DVPEN01-SL is correctly connected to a network.
	Blocked by network firewall or router.	If the computer and DVPEN01-SL are in different network segments or separated by two or more switches, please use the specified IP for detection or utilize RS-232 for relevant configurations.
	Network interference.	If occasionally experiencing situations where searches are successful while at other times unsuccessful, it may be due to network congestion, causing packets to be unable to transmit in real time. Please simplify the network and proceed with the configuration again or utilize RS-232 for relevant settings.
Able to open DVPEN01-SL setup page but fail to upload /download program and monitor by WPLSoft	The network setting for DVPEN01-SL is incorrect.	Check whether the network setting for DVPEN01-SL is correct. Consult the IT staff if you are using the Intranet in the company or refer to the network setting instructions provided by your ISP.
Unable to send emails	The network setting for DVPEN01-SL is incorrect.	Check whether the network setting for DVPEN01-SL is correct.
	Incorrect CR settings	Check whether the CR is used correctly.
	Incorrect settings for e-mail server	Confirm the IP address of the SMTP server.
	The mail server does not support TLS/SSL	Please use email server that supports TLS/SSL.

13.2 DVPDNET-SL

13.2.1 Introduction

DVPDNET-SL running on the left side of PLC can serve as the DeviceNet master or slave with the PLC together.

1. When used as a master station, it has the following functions:
   - Automatically exchanges data with the PLC CPU. Users can monitor the slave station by manipulating specific registers on the PLC CPU.
   - Supports client functionality for Explicit messages.
   - Supports various IO connections with slave stations: Polled, Bit-Strobed, Change of State, Cyclic.
   - Serves as an interface for DeviceNet Builder configuration software and DeviceNet network connection. The configuration software can directly configure the network through the DNET module.
   - Supports sending the Explicit message to read/write slave station data through PLC ladder diagram.
   - Maximum data length for both input and output is 380 bytes.
2. When used as a slave station, it has the following functions:
   - Automatically exchanges data with the PLC CPU. Users only need to program the PLC's D registers, eliminating the need for FROM/TO instructions.
   - Supports server functionality for Explicit messages and supports **Group 2 only server** connection mode.
   - Supports polled connection.
   - Maximum data length for both input and output is 255 bytes.

13.2.1.1 Features

- Serves as DeviceNet master by connecting to the PLC and supports standard DeviceNet protocol.
- DeviceNet Builder provides the convenient graphic configuration interface; automatically scans and recognizes all slaves on the DeviceNet network.
- Supports DeviceNet Master and Slave modes.
- Supports eight baud rates: 10 Kbps, 20 Kbps, 50 Kbps, 125 Kbps, 250 Kbps, 500 Kbps, 800Kbps and 1 Mbps.

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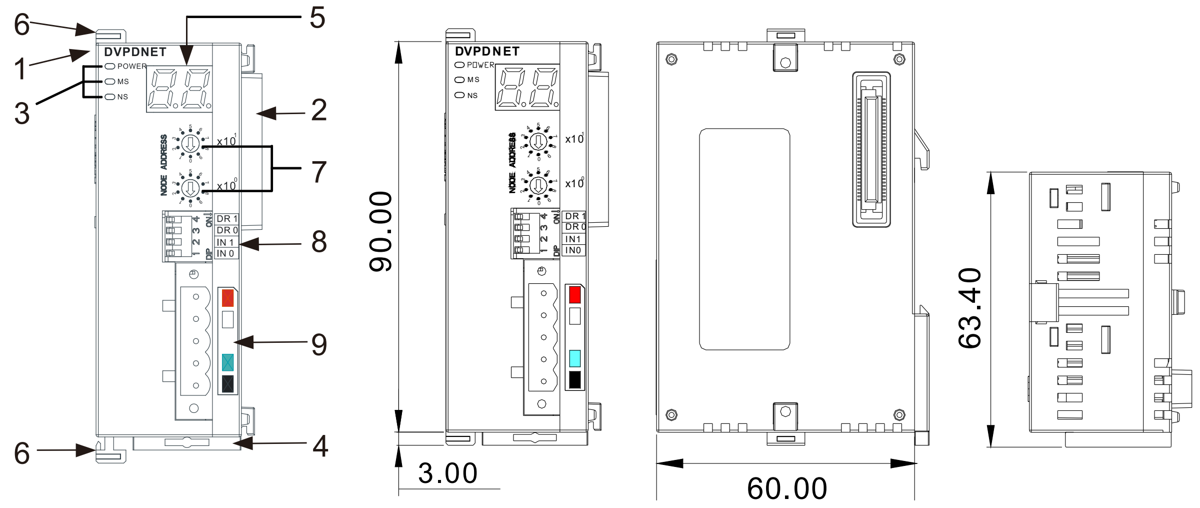
13.2.1.2 Specification

Module name	DVPDENT-SL
Supply voltage	Provided by PLC CPU
DeviceNet connector	Removable connector (5.08 mm)
Transmission method	CAN
Transmission cable	TAP-CB01 cable and TAP-CB02 cable are recommended. (The shielded wire must be grounded, and the cable should be away from the power line)
Message type	Explicit connection, IO polled connection, bit-strobe connection, COS/CC connection
Baud rate	Standard mode: 125 K, 250 K, 500 Kbps Extended mode:10 K, 20 K, 50 K, 125 K, 250 K, 500 K, 800 K, 1 Mbps
Product code	Master mode: 64 Slave mode: 82
Product type	12
Manufacturer ID	799 (Delta Electronics Inc.)
Connect to DVP-PLC CPU	Connect to the left side of CPU, numbered from 100 to 107 according to the position of module from the closest to farthest to CPU
Weight	115 g

13.2.2 Module Profiles and Dimension



Unit: mm

No.	Name	Description
1	Model name	Model name of the module
2	Extension port	Connect the PLC or the modules.
3	POWER LED indicator	Indicates the status of the power supply ON: the power is on OFF: no power
	MS indicator	OFF: no power Green light blinking: Module not configured Green light ON: Input/output data is normal Red light blinking: DNET as master: Abnormal operation of slave tasks in the scan list DNET as slave: Configuration issue Red light ON: internal module error
	NS indicator	OFF: No power/Failed to establish duplicate ID check procedure Green light blinking: Online but not connected to the DeviceNet network Green light ON: Online and connected to the DeviceNet network Red light blinking: Communication error Red light ON: Network failure, duplicate node address, no network power, or network bus interruption (BUS-OFF)
4	DIN rail clip	Secure the module on the set
5	Digital indicator	The digital indicator is used to show the node address, error information, and error messages from the slave station of the DVPDNET-SL module
6	Extension clip	For securing the extension module
7	Address switch	DeviceNet communication address setting
8	Function switch	Communication speed and I/O data action settings.
9	DeviceNet connection port	Connect to DeviceNet

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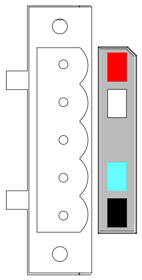
13.2.3 Terminals

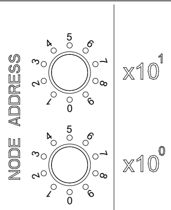
DeviceNet Pin Definition



Pin	Signal	Color	Function
1	V-	Black	0 VDC
2	CAN_L	Blue	Signal-
3	Drain	-	Shield
4	CAN_H	White	Signal+
5	V+	Red	24 VDC

Note: Either end of the communication cable should be connected with a terminal resistor of 121 Ω, and the resistors should be connected between "Signal+" and "Signal-".

Address Switch



Switch setting	Content
0 … 63	Valid DeviceNet node address
Others	Invalid DeviceNet MAC ID address setting

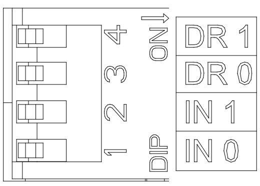
Example:

If you need to set the node address of DVPDNET-SL to 26, simply switch the corresponding switch of x101 to 2 and the corresponding switch of x100 to 6.

Note:

- Please set up the node address when the power is switched off. After the setup is completed, re-power DVPDNET-SL.
- Use the slotted screwdriver to rotate the switch carefully in case you scratch the switch.

Function Switch



DR1	DR0	Baud rate
OFF	OFF	125 Kbps
OFF	ON	250 Kbps
ON	OFF	500 Kbps
ON	ON	Entering the mode of extended baud rate

IN0:
ON– When the slave is offline, the I/O data in the buffer area will be held.
OFF– When the slave is offline, the I/O data in the buffer area will be cleared.
IN1: reserved.

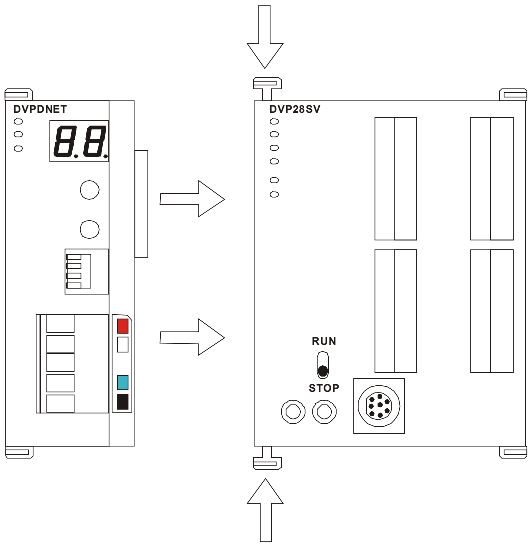
Note:

- After setting up the function switch, re-power DVPDNET-SL and then the setting is effective.
- Use the slotted screwdriver to adjust the DIP switch carefully in case you scratch the switch.

13.2.4 Installation

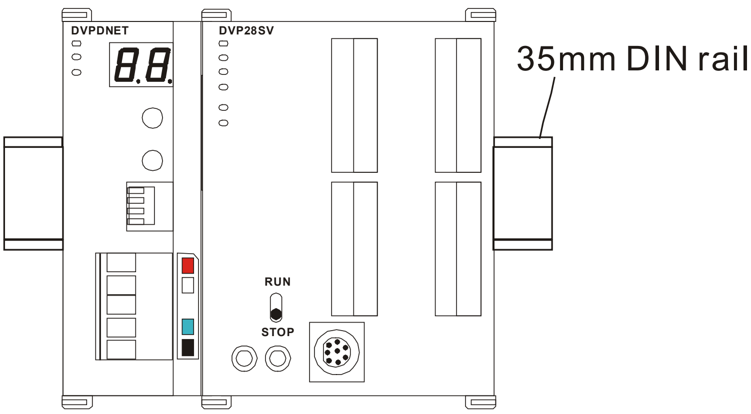
1. Connecting DVPDNET-SL to PLC

- Adjust the extension clips on the left side of the PLC.
- Meet the extension port of the PLC with DVPDNET-SL as shown in the figure below.
- Fasten the extension clips.



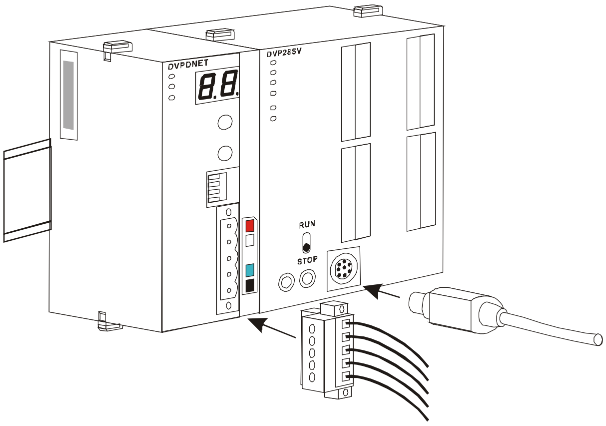
2. Install DVPDNET-SL and PLC on DIN Rail

- Use 35 mm DIN rail.
- Open the DIN rail clip on the PLC and DVPDNET-SL. Insert the PLC and DVPDNET-SL onto the DIN rail.
- Clip up the DIN rail clips on the PLC and DVPDNET-SL to fix the PLC and DVPDNET-SL on the DIN rail, as shown below.



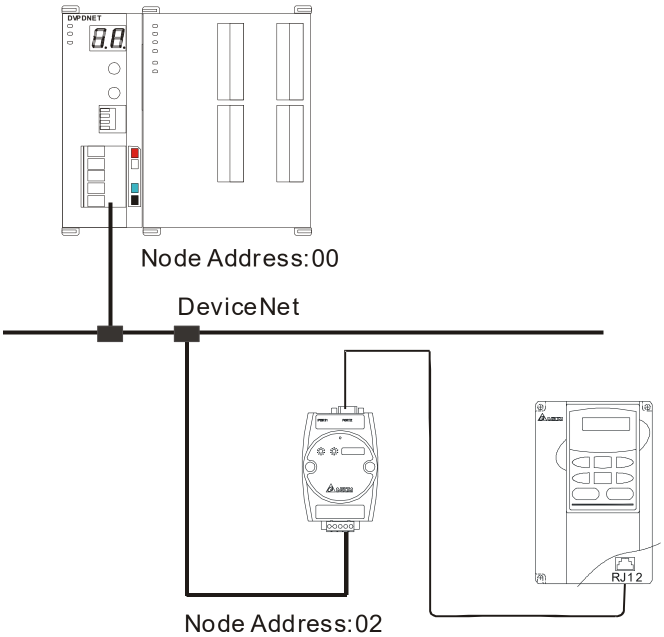
3. Connect to DeviceNet Connection Port

- The colors on the PINs on the DeviceNet connection port match the colors of the connection cables. Make sure you connect the cable to the right PIN.
- We recommend you also apply Delta's power module in the connection.



13.2.5 Connect to DeviceNet

Please wire according to the pin definitions of the communication connector and connect it to the DeviceNet network.



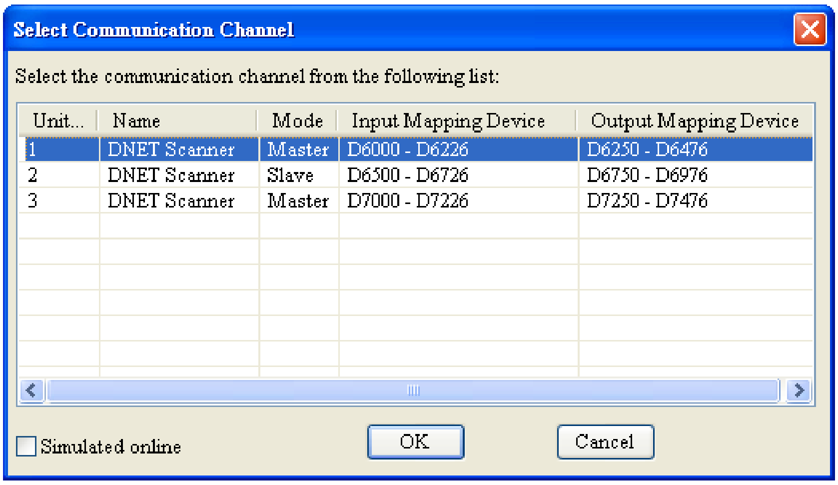
13.2.6 Software Introduction

Before DVPDNET-SL starts to work, it must be configured through DeviceNet Builder software.

Note: Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

13.2.6.1 Communication Channel Selection

Max. 8 DVPDNET-SL modules can be connected to the left side of the PLC and every DVPDNET-SL is a communication channel. When there are three DVPDNET-SL modules connected to PLC's left side and DeviceNet Builder software is online, the following dialog box will pop up for you to select the current channel.



Parameter	Explanation
Unit No.	The unit No. of the first DVPDNET-SL (DNET Scanner) on the left side of PLC is 1. PLC's left side can be connected with max 8 DVPDNET_SL. The further DVPDNET-S is from the PLC, the larger its unit No is.
Name	DVPDNET-SL's name in software.
Code	For displaying the current mode of DVPDNET-SL: master mode or slave mode.
Input Mapping Device	The register areas which PLC CPU distributes to DVPDNET-SL. The areas are mainly used to receive the message from DeviceNet Slaves and the data from slaves on the bus will be automatically updated to these registers.
Output Mapping Device	The register areas which the PLC has assigned to DVPDNET-SL. The areas are mainly used to control DeviceNet slaves and the control data in these registers will be automatically sent to DeviceNet slaves on the bus. Slaves will take some action accordingly after receiving the data.

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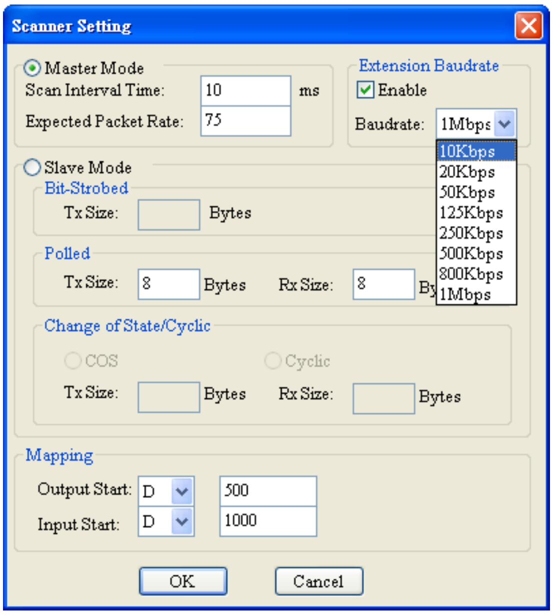
13.2.6.2 Scan Module Setup

The following dialog is for setting DVPDNET-SL's current mode: master mode or slave mode.

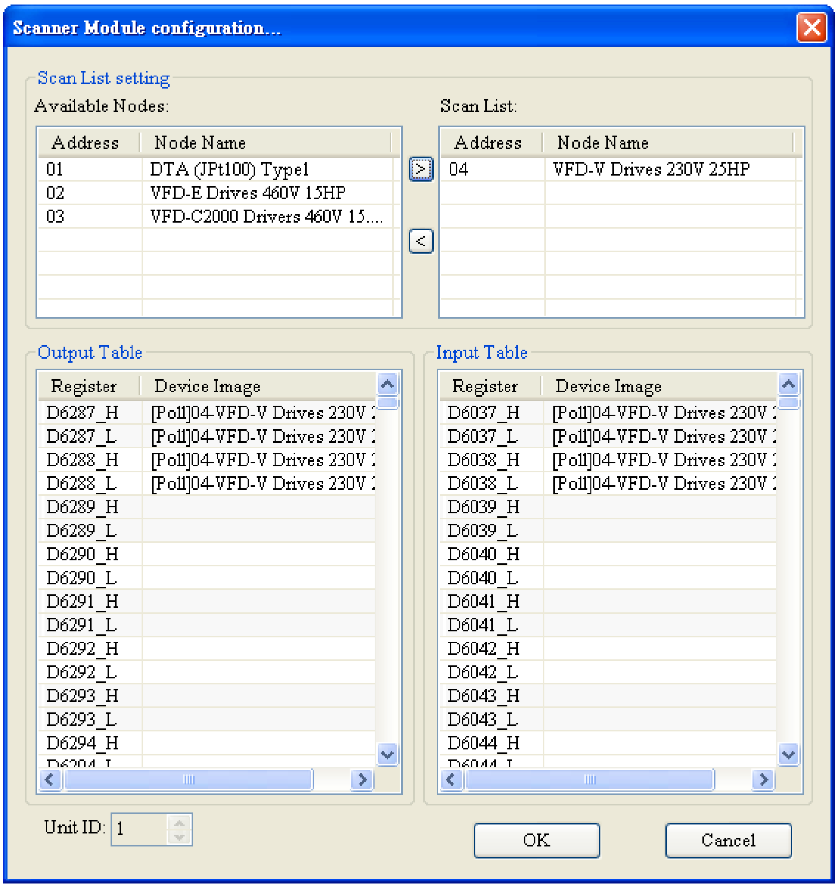


Parameter	Explanation
Master mode	For setting DVPDNET-SL as master.
Scan interval time	The cycle time for master to send and receive the real-time data after real-time data connection is successful.
Expected Packet Rate	The result value of the parameter multiplied by 4 is the timeout time. (Unit: ms) Master assumes that the slave is offline if it receives no response from slave after the timeout time has elapsed.
Extension baud rate	The parameter is effective only when DVPDNET is in master mode. Selecting "Enable" activates the function. Select an appropriate baud rate according to actual demand.
Slave mode	For setting DVPDNET-SL as slave
Bit-strobed	Reserved; no actual purpose now.
Polled	The parameter is effective only when DVPDNET is in slave mode. The filled byte numbers correspond to the data length of outputs and inputs as DVPDNET-S is in slave mode. "TxSize" corresponds to "Output length" and "RxSize" corresponds to "Input length".
Change of State/Cyclic	Reserved; no actual purpose now.
Mapping	Available for AH models only; no actual purpose now.

Note: These parameters and the configuration data are downloaded to DVPDNET-SL together.

13.2.6.3 Scan List Setup

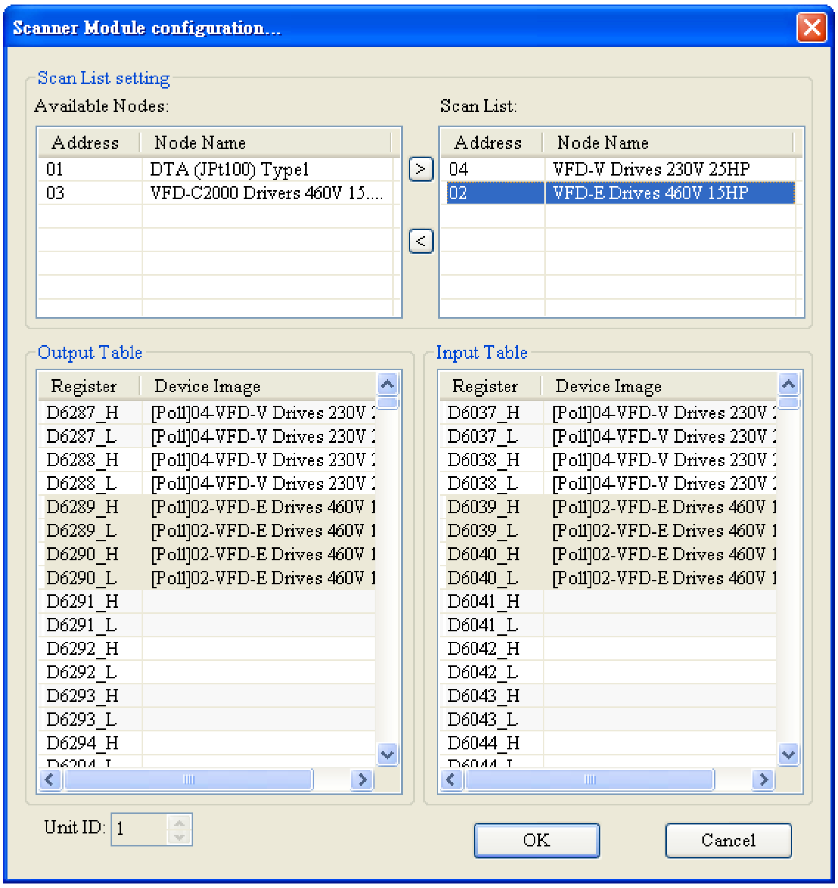
Double-click the existing icon of DVPDNET-SL in the DeviceNet Builder interface and then the following dialog box appears for configuring the scan module.



Parameter	Explanation
Available nodes	All already scanned slaves appear in “Available list”. After the configuration data is downloaded to DVPDNET-SL, the slave in “Available nodes” will not conduct the real-time data exchange with DVPDNET-SL.
Scan list	After the configuration data is downloaded to DVPDNET-SL, the slave in “Scan list” will conduct the real-time data exchange with DVPDNET-SL.
Address	The station No. for the slave on the DeviceNet bus.
Node name	The node name that the node address corresponds to.

13.2.6.4 Input Table and Output Table

Select the device in “Scan list” and then the data lengths of input and output of the device will be displayed respectively in the lower part of the following dialog box.



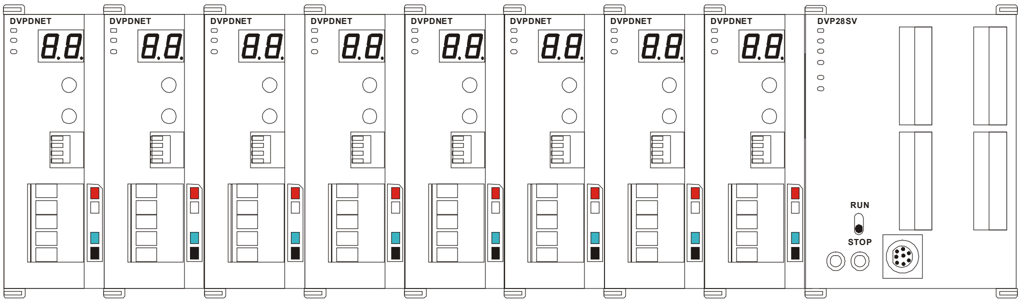
Parameter	Explanation
Output Table	PLC’s registers and the corresponding output data are shown in “Output table”. The values in PLC’s registers will be sent to slave in real time as the control data of the slave.
Input Table	PLC’s registers and the corresponding input data are shown in “input table”. The data that slave sends to master will be updated in PLC’s registers in real time.
Register	The number of the registers in PLC; “D6289_H” indicates the high byte of register D6289; “D6289_L” indicates the low byte of register D6289.
Device image	For displaying the data type and the name of current slave; “Poll” means the polled data.

13.2.7 Input and Output Mapping Areas

13.2.7.1 Data Mapping Areas

The input and output data mapping introduced here is the data mapping between the PLC and DVPDNET-SL. The mapping relation keeps unchanged, and users are not allowed to revise the areas.

Maximum 8 units of DVPDNET-SL modules can be connected on PLC's left side. For DVP-SE2, maximum 6 units of DVPDNET-SL modules can be connected on the left side. After all, DVPDNET-SL modules are connected to the PLC, the PLC will assign data mapping areas to each DVPDNET-SL.



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1. When DVPDNET-SL is used with different PLC, the input and output mapping areas for it are different. The details are as follows:

- When the PLC is DVP-SV3 or DVP-SX3, registers D16000 to D19999 are occupied. The number of the first DVPDNET-SL on the left side of the PLC is 1 and the number of the DVPDNET-SL module close to the left side of the first DVPDNET-SL is 2, and subsequent DVPDNET-SL modules are No. 3, No. 4 and so on.

Unit No.	Mapping devices	
	Output mapping	Input mapping
1	D16250 to D16497	D16000 to D16247
2	D16750 to D16997	D16500 to D16747
3	D17250 to D17497	D17000 to D17247
4	D17750 to D17997	D17500 to D17747
5	D18250 to D18497	D18000 to D18247
6	D18750 to D18997	D18500 to D18747
7	D19250 to D19497	D19000 to D19247
8	D19750 to D19997	D19500 to D19747

- When the PLC is another model in the DVP series (that is, not DVP-SV3 or DVP-SX3), registers D6000–D9999 are occupied. The number of the first DVPDNET-SL on the left side of the PLC is 1 and the number of the DVPDNET-SL module close to the left side of the first DVPDNET-SL is 2, and subsequent DVPDNET-SL modules are No. 3, No. 4 and so on.

Unit No.	Mapping devices	
	Output mapping	Input mapping
1	D6250 to D6497	D6000 to D6247
2	D6750 to D6997	D6500 to D6747
3	D7250 to D7497	D7000 to D7247
4	D7750 to D7997	D7500 to D7747
5	D8250 to D8497	D8000 to D8247
6	D8750 to D8997	D8500 to D8747

Unit No.	Mapping devices	
	Output mapping	Input mapping
7	D9250 to D9497	D9000 to D9247
8	D9750 to D9997	D9500 to D9747

13.2.7.2 I/O Mapping Area Assignment (in Master Mode)

- When the PLC is DVP-SV3 and DVP-SX3, and the DVPDNET-SL of number 1 is in master mode, the data mapping areas are assigned as shown in the following table.

Input mapping area			Output mapping area		
Devices in PLC	Function	Data length	Devices in PLC	Function	Data length
D16000–D16031	Explicit response message program	32 words	D16250–D16281	Explicit request message program	32 words
D16032–D16035	Status of nodes in the scan list	4 words	D16282–D16285	Bit-strobe command	4 words
D16036	DVPDNET-SL status	1 word	D16286	Reserved	1 word
D16037–D16226	DeviceNet input data	190 words	D16287–D16476	DeviceNet output data	190 words
D16227–D16247	Reserved	21 words	D16477–D16497	Reserved	21 words

- When the PLC is another model in the DVP series (that is, not DVP-SV3 or DVP-SX3), and the DVPDNET-SL of number 1 is in master mode, the data mapping areas are assigned as shown in the following table.

Input mapping area			Output mapping area		
Devices in PLC	Function	Data length	Register No. in PLC	Function	Data length
D6000 to D6031	Explicit response message program	32 words	D6250 to D6281	Explicit request message program	32 words
D6032 to D6035	Status of nodes in the scan list	4 words	D6282 to D6285	Bit-strobe command	4 words
D6036	DVPDNET-SL status	1 word	D6286	Reserved	1 word
D6037 to D6226	DeviceNet input data	190 words	D6287 to D6476	DeviceNet output data	190 words
D6227 to D6247	Reserved	21 words	D6477 to D6497	Reserved	21 words

Note:

If the number of the DVPDNET-SL is 2, the numbers of the registers in the two tables above will all be added by 500 respectively; if the number of the DVPDNET-SL is 3, the numbers of the registers in the two tables above will all be added by 1000 respectively; if the number of the DVPDNET-SL is 4, the numbers of the registers in the two tables above will all be added by 1500 respectively and so on.

13.2.7.3 I/O Mapping Area Assignment (in Slave Mode)

- When the PLC is DVP-SV3 or DVP-SX3, and the DVPDNET-SL is in slave mode, the data mapping areas are assigned as shown in the following table and these devices are for the real-time data exchange.

Unit No	Input mapping area		Output mapping area	
	Initial device	Max data length (bytes)	Initial device	Max data length (bytes)
1	D16000	255	D16250	255
2	D16500	255	D16750	255
3	D17000	255	D17250	255
4	D17500	255	D17750	255
5	D18000	255	D18250	255
6	D18500	255	D18750	255
7	D19000	255	D19250	255
8	D19500	255	D19750	255

When the unit No. of the DVPDNET_SL is 1, the control data which DeviceNet master sends out will be updated in real time in PLC's devices among which D16000 is the initial device. In the meanwhile, the values in PLC's devices among which D16250 is the initial device will be automatically sent back to DeviceNet master. In this way, the real-time data exchange is realized.

- When the PLC is another model in the DVP series (that is, not DVP-SV3 or DVP-SX3) and the DVPDNET-SL is in slave mode, the data mapping areas are assigned as shown in the following table and these devices are for the real-time data exchange.

Unit No	Input mapping area		Output mapping area	
	Initial device	Max data length (bytes)	Initial device	Max data length (bytes)
1	D6000	255	D6250	255
2	D6500	255	D6750	255
3	D7000	255	D7250	255
4	D7500	255	D7750	255
5	D8000	255	D8250	255
6	D8500	255	D8750	255
7	D9000	255	D9250	255
8	D9500	255	D9750	255

When the unit No. of the DVPDNET_SL is 1, the control data which DeviceNet master sends out will be updated in real time in PLC's devices among which D6000 is the initial device. In the meanwhile, the values in PLC's devices among which D6250 is the initial device will be automatically sent back to DeviceNet master. In this way, the real-time data exchange is realized.

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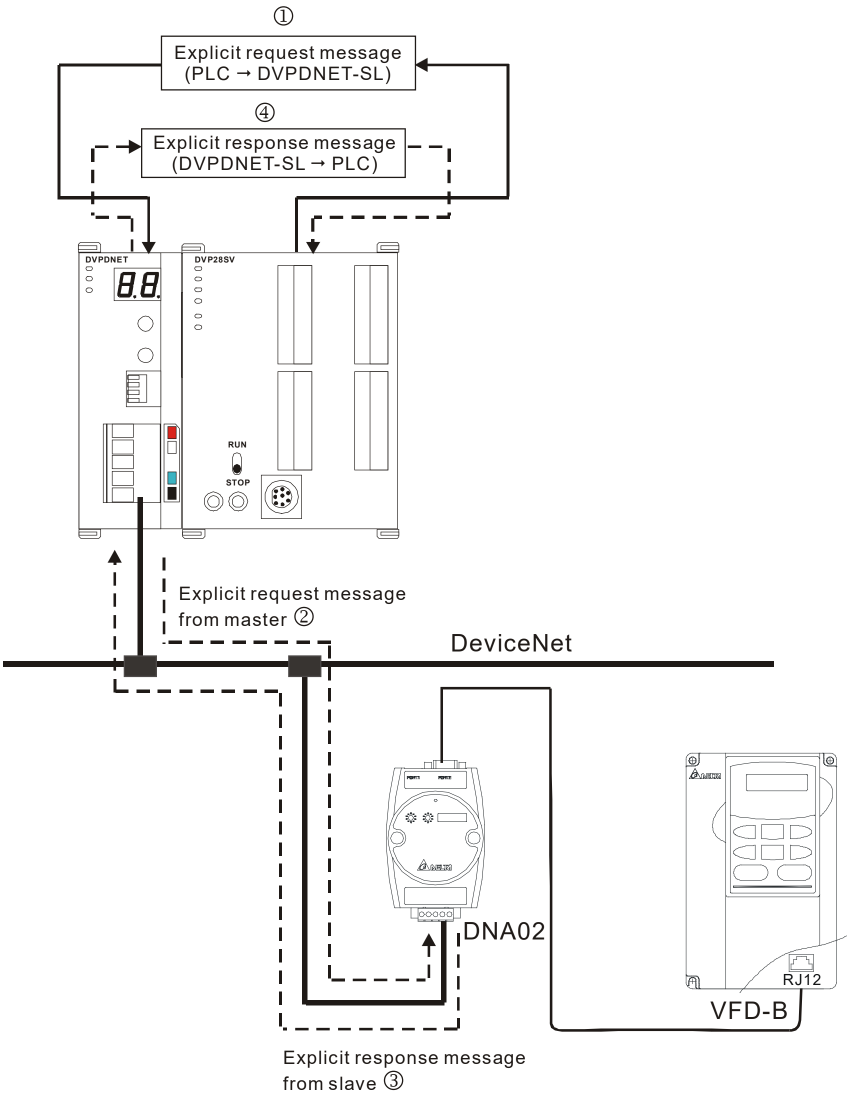
13.2.8 Sending Explicit Message from Ladder Diagram

DVPDNET-SL supports the sending of explicit messages through WPL programs.

Note: Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas for DVPDNET-SL. We take DVP-SV as the PLC for description below.

13.2.8.1 Principle of Explicit Message Sending



①: The PLC sends the explicit request message based on WPL program to DVPDNET-SL.

②: Then DVPDNET-SL transfers the request message to the target equipment.

③: The target equipment processes the request message and replies with a response message to DVPDNET-SL.

④: The PLC stores the response message from DVPDNET-SL to D registers to finish one explicit message transmission.

13.2.8.2 Structure of Explicit Message

You can edit explicit messages in "explicit request message editing area" and "explicit response message editing area". See the table below for the corresponding relation between the two areas and PLC devices. If you send the requested message to D6250 – D6281, DVPDNET-SL will write the response message data to D6000 – D6031.

PLC device	Mapping area	Mapping length
D6000 to D6031	Explicit response message editing area	64 bytes
D6250 to D6281	Explicit request message editing area	64 bytes

1. Structure of request message. See the table below:

<table>
<tr><th rowspan="2">PLC device</th><th colspan="17">Requested message</th></tr>
<tr><th></th><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>D6250</td><td rowspan="3">Message Header</td><td colspan="8">ReqID</td><td colspan="8">Command</td></tr>
<tr><td>D6251</td><td colspan="8">Port</td><td colspan="8">Size</td></tr>
<tr><td>D6252</td><td colspan="8">Service code</td><td colspan="8">MAC ID</td></tr>
<tr><td>D6253</td><td rowspan="3">Message Data</td><td colspan="8">High byte of Class ID</td><td colspan="8">Low byte of Class ID</td></tr>
<tr><td>D6254</td><td colspan="8">High byte of Instance ID</td><td colspan="8">Low byte of Instance ID</td></tr>
<tr><td>D6255</td><td colspan="8">reserved</td><td colspan="8">Attribute ID (optional)</td></tr>
<tr><td>D6256 to D6281</td><td></td><td colspan="16">Service data</td></tr>
</table>

- Command: Fixed to "01Hex".
- ReqID: The request ID. Whenever an explicit message is sent out, the message will be given a ReqID for DVPDNET-SL to identify every message. For the next explicit message to be sent out, you have to change the ID. ReqID = 0 indicates that DVPDNET-SL will not send out any explicit message. Range of ReqID: 00Hex to FFHex.
- Size: The length of the message, starting from D6253. The high byte of D6255 is reserved, and when the data length is calculated, D6255 is counted as 1 byte. The maximum data length is 58 bytes. Error will occur when the length is greater than 58 bytes. Unit: byte.
- Port: The communication port. Fixed to "00Hex".
- MAC ID: The node address of the target equipment on DeviceNet.
- Service Code: The service code of the explicit message. See the meanings of the codes in the table below:

Service Code	Explanation
01Hex	Read all attributes (Get_Attribute_All)
02Hex	Set all attributes (Set_Attribute_All)
0EHex	Read a single attribute (Get_Attribute_Single)
10Hex	Set a single attribute (Set_Attribute_Single)

2. Structure of response message. See the table below:

PLC device	Response Message		
		15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
D6000	Message Header	ReqID	Status
D6001		Port	Size
D6002		Service Code	MAC ID
D6003 – D6031	Message Data	Service Response Data	

- The definitions of ReqID, Port, Service Code and MAC ID are the same as their definitions in the request message.
- Size: The length of the message, starting from D6003. Max. 58 bytes. Error will occur when the length is greater than 58 bytes. Unit: byte.

3. See the table below for the meanings of Status (status codes):

Status code	Explanation
0	No explicit message is sent out.
1	The communication of explicit message is successful.
2	The explicit message is being sent out.
3	Error: No response from the target equipment.
4	Error: Command is invalid.
5	Error: Size of request message is invalid.
6	Error: Size of response message is invalid.
7	Error: Failing to establish a connection to the target equipment.
8 to 255	Reserved

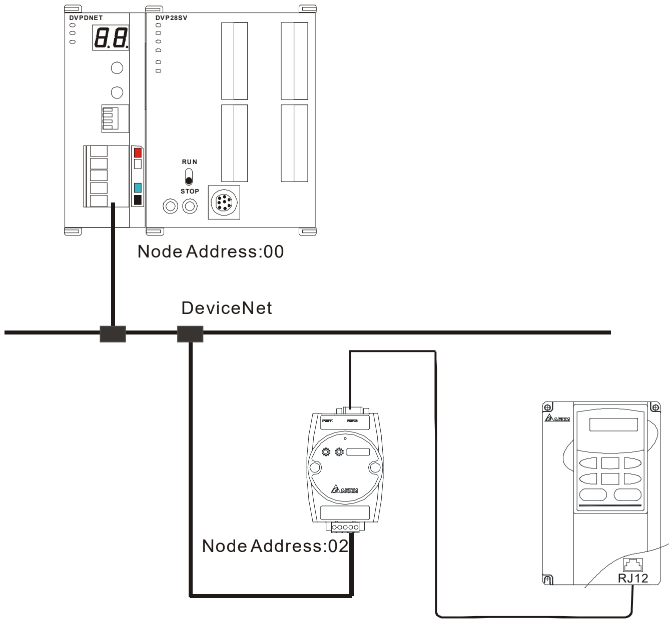
Notes:

- DVPDNET-SL can only send out one explicit message at a time.
- Before sending the explicit message by using WPL program, we suggest you clear the request message editing area and response message editing area.
- If the slave responds with a standard error code, and DVPDNET-SL consider the communication successful, “The communication of the explicit message is successful.” indicates that the communication has been completed successfully.

4. Application example (I)

Control requirement	When M0 = On, read Class 1>>Instance 1>>Attribute 1 of IDF9502

A. Connection Figure



Note:

Delta DeviceNet slave module, IFD9502 can connect VFD AC motor drive to the DeviceNet network.

B. Parameters setting and devices explanation

- Setting of DVPDNET-SL

Parameter	Setting value	Explanation
Node address	00	Set the node address of the DVPDNET-SL to “00”.
Baud rate	500 Kbps	Set the communication speed of the DVPDNET-SL and the bus to “500 Kbps”.

- Setting of IFD9502

Parameter	Setting value	Explanation
Node address	02	Set the node address of the IFD9502 to “02".
Baud rate	500 Kbps	Set the communication speed of the IFD9502 and the bus to “500 Kbps”.

- Settings of VFD-B

Parameter	Setting value	Explanation
02-00	04	The main frequency is operated on RS-485 interface.
02-01	03	The operation commands are operated on the communication interface. Operation by keys is valid.
09-00	01	Communication address of the VFD-B: 01
09-01	03	Baud rate: 38,400
09-04	03	Modbus RTU mode; data format <8, N, 2>

- Explanations on devices

PLC device		Content	Explanation	
			15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
Request message editing area	D6250	0101 Hex	ReqID= 01 Hex	Command= 01 Hex
	D6251	0005 Hex	Port= 00 Hex	Size= 05 Hex
	D6252	0E02 Hex	Service Code= 0E Hex	MAC ID= 02 Hex
	D6253	0001 Hex	High bye of Class ID=00 Hex	Low byte of Class ID= 01 Hex
	D6254	0001 Hex	High byte of Instance ID= 00Hex	Low byte of Instance ID= 01 Hex
	D6255	0001 Hex	N/A	Attribute ID= 01 Hex
Response message editing area	D6000	0101 Hex	ReqID= 01 Hex	Status= 01 Hex
	D6001	0002 Hex	Port= 00 Hex	Size= 02 Hex
	D6002	8E02 Hex	Service Code= 8E Hex	MAC ID= 02 Hex
	D6003	031F Hex	High byte of Service Data= 03 Hex	Low byte of Service Data= 1F Hex

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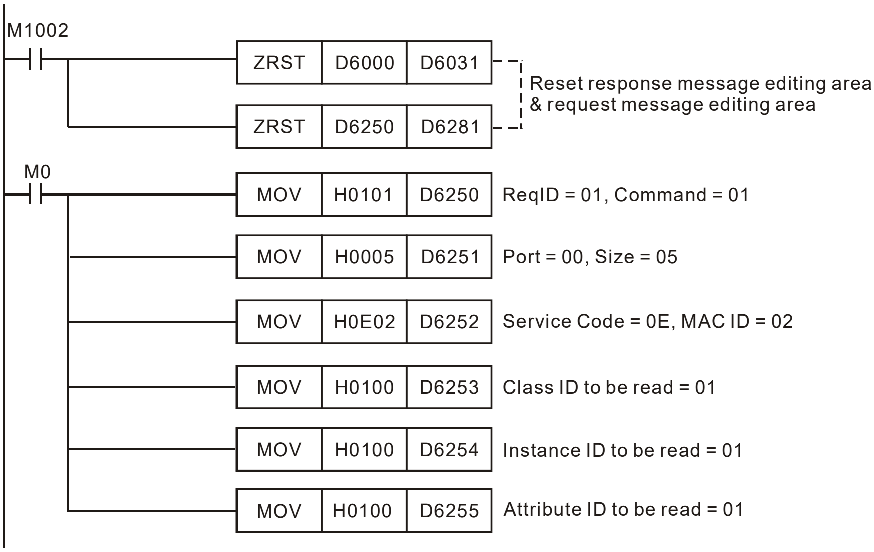
C. PLC program



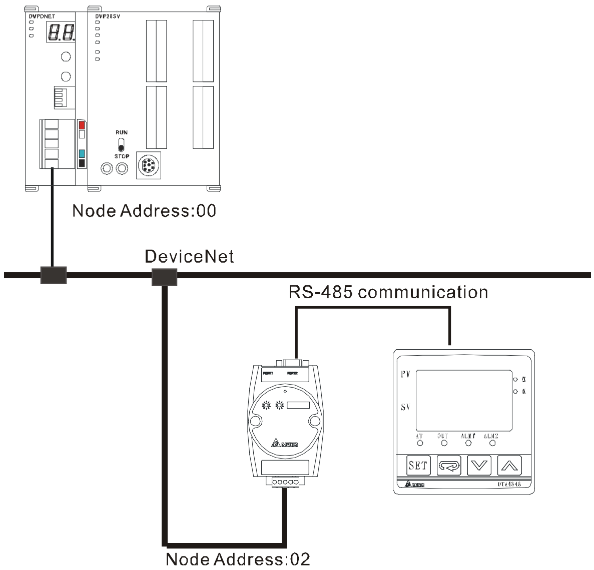
D. Program explanation

- In the beginning of the program, clear the contents in the response message editing area and request message editing area to 0.
- When M0 is On, DVPDNET-SL sends out the request message to read Class 1>>Instance 1>> Attribute 1 of the target equipment (node address: 02). If the communication of the explicit message is successful, the slave will send back a response message.
- When M0 is On, DVPDNET-SL only sends out the request message once. To send out the request message again, you will have to change the value of ReqID.
- The reading is successful and the data back from the target equipment are stored in D6000 – D6003.
- If the reading is successful, the contents of Class 1 > > Instance 1 > > Attribute 1 of IFD9502 will be stored in D6003. In this example, the content in D6003 should be 031F Hex.

5. Application example (II)

Control requirement	M1 = On, set 0x99>>Instance 1>>Attribute 2 of IFD9502 to "0004Hex".

A. Connection Figure



Note:

Delta DeviceNet slave module, IFD9502 can connect the temperature controller to the DeviceNet network.

B. Parameters setting and devices explanation

- Setting of DVPDNET-SL

Parameter	Setting value	Explanation
Node address	00	Set the node address of the DVPDNET-SL to "00".
Baud rate	500 Kbps	Set the communication speed of the DVPDNET-SL and bus to "500 Kbps".

- Setting of IFD9502

Parameter	Setting value	Explanation
Node address	02	Set the node address of the IFD9502 to "02".
Baud rate	500 Kbps	Set the communication speed of the IFD9502 and the bus to "500 Kbps".

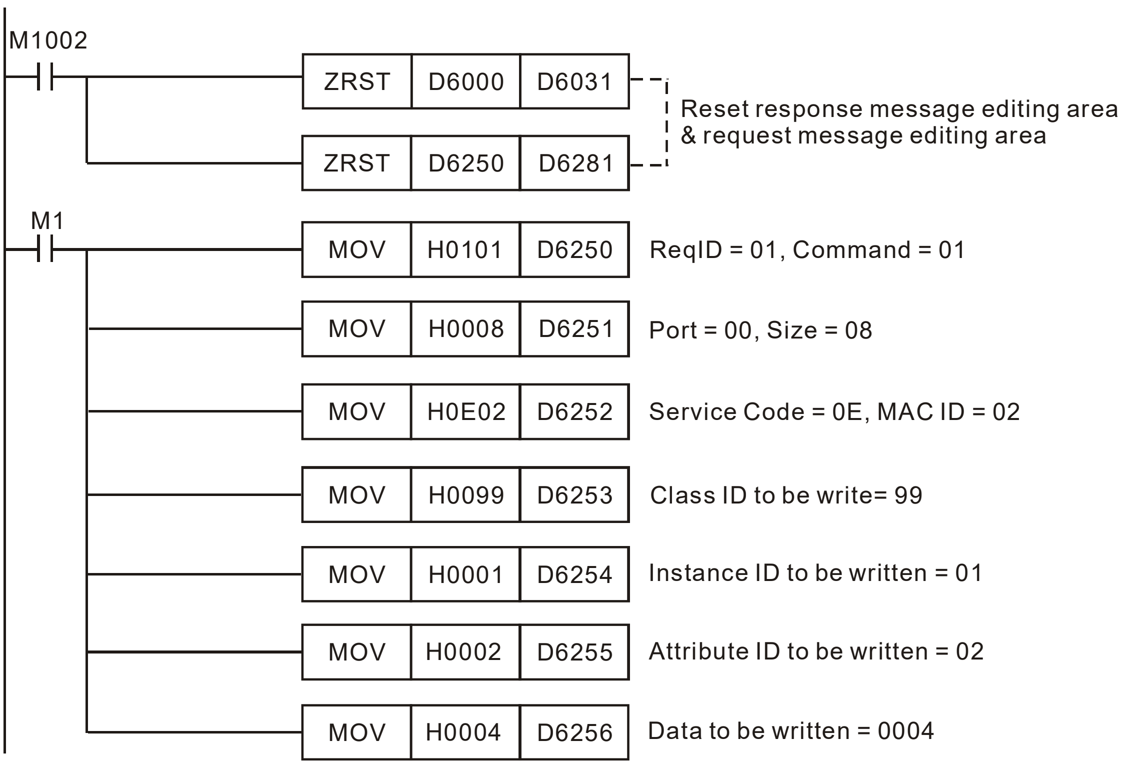
- Setting of VFD-B

Parameter	Setting value	Explanation
02-00	04	The main frequency is operated on RS-485 interface.
02-01	03	The operation commands are operated on the communication interface. Operation by keys is valid.
09-00	01	Communication address of the VFD-B: 01
09-01	03	Baud rate: 38,400
09-04	03	Modbus RTU mode; data format <8, N, 2>

- Explanations on devices

PLC device		Content	Explanation	
			15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
Request message editing area	D6250	0101 Hex	ReqID= 01 Hex	Command= 01 Hex
	D6251	0005 Hex	Port= 00 Hex	Size= 07 Hex
	D6252	0E02 Hex	Service Code= 10 Hex	MAC ID= 02 Hex
	D6253	0099 Hex	High byte of Class ID= 00 Hex	Low byte of Class ID= 99 Hex
	D6254	0001 Hex	High byte of Instance ID= 00 Hex	Low byte of Instance ID= 01 Hex
	D6255	0002 Hex	N/A	Attribute ID= 02 Hex
	D6256	0004 Hex	High byte of data= 00 Hex	Low byte of data= 04 Hex
Response message editing area	D6000	0101 Hex	ReqID = 01 Hex	Status= 01 Hex
	D6001	0002 Hex	Port = 00Hex	Size= 02 Hex
	D6002	9002 Hex	Service Code = 90E Hex	MAC ID= 02Hex
	D6003	0004 Hex	High byte of Service Data= 00 Hex	Low byte of Service Data= 04 Hex

C. PLC program



D. Program explanation

- In the beginning of the program, clear the contents in the response message editing area and request message editing area to 0.
- When M1 is On, DVPDNET-SL sends out the request message. Write 0004 Hex into Class 99 >> Instance 1 >> Attribute 2 of the target equipment (node address: 02). If the communication of the explicit message is successful, the slave will send back a response message.
- When M1 is On, DVPDNET-SL only sends out the request message once. To send out the request message again, you will have to change the value of ReqID.
- If the writing is successful, the message back from the target equipment will be stored between D6000 and D6003.

13.2.9 Bit-Strobe Command

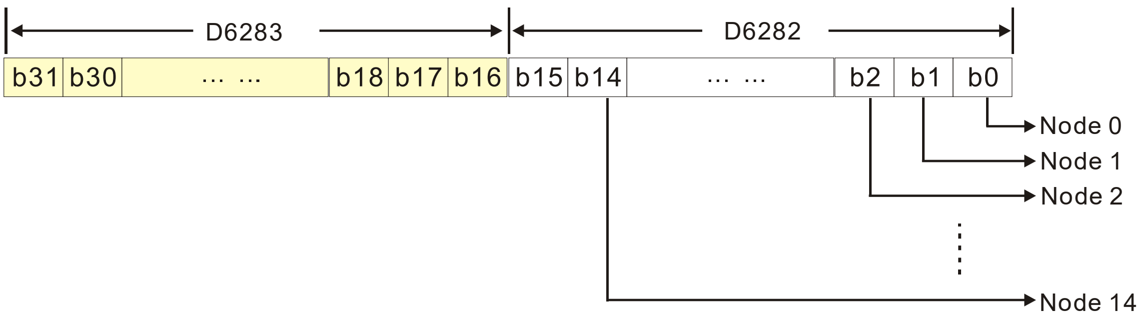
Bit-strobe is one of the standard I/O transmission methods for DeviceNet. The size of the command is fixed to 8 bytes (i.e. 64 bits), and every bit corresponds to a slave.

Note: Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

PLC device	Corresponding nodes on the network					
	b15	b14	b13	…	b1	b0
D6282	Node 15	Node 14	Node 13	…	Node 1	Node 0
D6283	Node 31	Node 30	Node 29	…	Node 17	Node 16
D6284	Node 47	Node 46	Node 45	…	Node 33	Node 32
D6285	Node 63	Node 62	Node 61	…	Node 49	Node 48

When b0 of D6282 is 0, node 0 is selected, and it needs to respond with a message to the master.

When both b0 and b1 of D6282 are 0, node 0 and node 1 are selected and they need to send back the response message to the master.



In the bit-strobe mode, the master will not send control data to slave nodes.

However, when its corresponding bit is set to 0, the slave node will have to respond with I/O data to the master.

When its corresponding bit is set to 1, the slave node will not have to respond with I/O data to the master.

13.2.10 Display of Node Status on Network

13.2.10.1 Display of Status of Nodes in Scan List

This function is available for monitoring whether some DeviceNet slave is offline or not. DVPDNET-SL can conduct the real-time monitoring of the nodes in the scan list and map the status of every node to a bit. Different PLC on the right of the DVPDNET-SL module corresponds to different devices. The details are as follows.

- When the PLC is DVP-SV3 or DVP-SX3 on the right of the DVPDNET-SL module, you can acquire the status of nodes by monitoring D16032–D16035.

  See the table below for the corresponding relation between PLC devices and the nodes on the network:

PLC device	Corresponding nodes on the network					
	b15	b14	b13	… …	b1	b0
D16032	Node 15	Node 14	Node 13	… …	Node 1	Node 0
D16033	Node 31	Node 30	Node 29	… …	Node 17	Node 16
D16034	Node 47	Node 46	Node 45	… …	Node 33	Node 32
D16035	Node 63	Node 62	Node 61	… …	Node 49	Node 48

- When the PLC on the right side of DVPDNET-SL module is another model in the DVP series, you can acquire the status of nodes by monitoring D6032 – D6035.

  See the table below for the corresponding relation between PLC devices and the nodes on the network.

PLC device	Corresponding nodes on the network					
	b15	b14	b13	…	b1	b0
D6032	Node 15	Node 14	Node 13	…	Node 1	Node 0
D6033	Node 31	Node 30	Node 29	…	Node 17	Node 16
D6034	Node 47	Node 46	Node 45	…	Node 33	Node 32
D6035	Node 63	Node 62	Node 61	…	Node 49	Node 48

When the node in the scan list is normal, the corresponding bit is OFF. If the node occurs with abnormality, its corresponding bit will become ON.

13.2.10.2 Status of DVPDNET-SL

You can acquire the real-time status of DVPDNET-SL by monitoring D6036/D16036. When DVPDNET-SL runs normally, the content in D6036/D16036 is 0. While DVPDNET-SL is being initialized, the value in the high byte of D6036/D16036 is 1 and the low byte is 0. When an error occurs in DVPDNET-SL, the value in the high byte of D6036/D16036 is 2 and the low byte contains an error code. For detains on error codes, please refer to Digital Display Diagnosis.

Note: Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

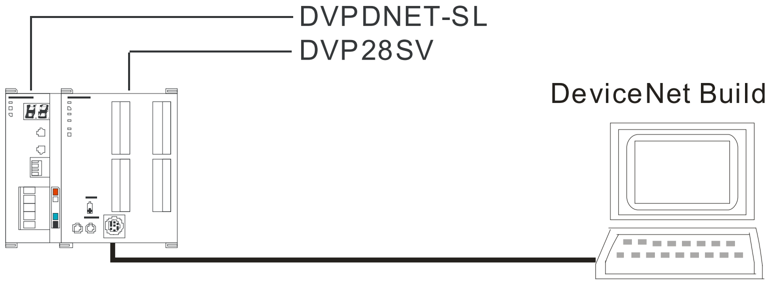
PLC device	Explanation															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
D6036	Status of DVPDNET-SL (0: normal, 1: initializing, 2: in error)								Error codes of DVPDNET-SL (Refer to Digital Display Diagnosis)							

13.2.11 Setup of Slave Mode

DVPDNET-SL can serve as slave through modifying the mode in the software. As DVPDNET-SL serves as slave, the default input / output data length is 8 bytes and max input / output data length is 255 bytes.

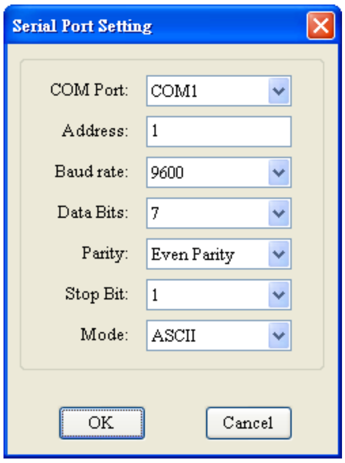
DVPDNET-SL can work in slave mode by using the following method.

1. Connect the devices according to the figure below. The PC accesses the PLC via RS232 or RS485.



Note: Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

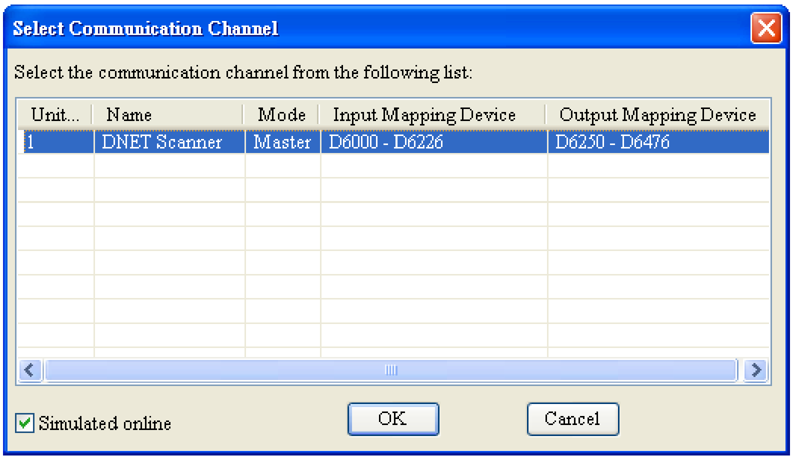
2. Open DeviceNet Builder software, select “Setup” => “Communication Setting” => “System Channel”, and the “Serial Port Setting” dialog box will appear as below.



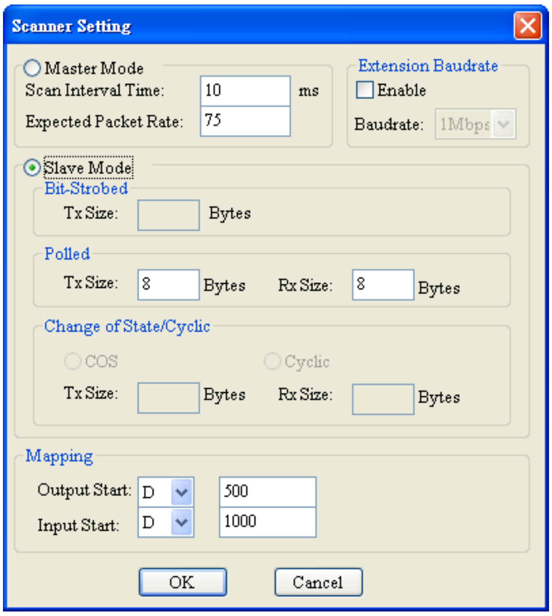
3. Set up the communication parameters for the PC and DVP-SV, e.g. the communication port, address, baud rate and communication format. Click on “OK” after the configuration is finished.

Item	Function	Default
COM Port	COM port on the PC to be used to communicate with DVP-SV	COM1
Address	Communication address of DVP-SV	01
Baud rate	Communication speed between the PC and DVP-SV	9,600 (bps)
Data Bits	Communication protocol between the PC and DVP-SV	7
Parity		Even Parity
Stop Bit		1
Mode	Communication mode between the PC and DVP-SV	ASCII

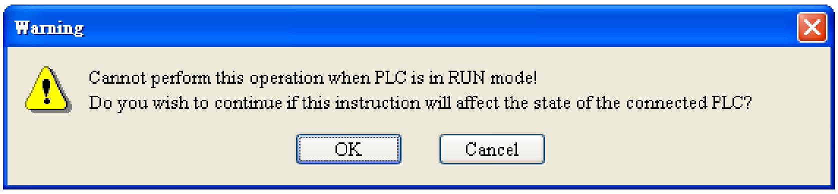
4. Select “Network” => "Online” and the “Select Communication Channel” dialog box will appear. Click on “OK” to start scanning the DeviceNet network after selecting “analog online” in the following window.



5. Select “Network” >> “Scan module” and then “Scan module setting” dialog box appears. After “Slave mode” is selected there, fill the appropriate slave data length. Finally, click on “OK” to finish the setting.



6. Select “Network” >> “Download” and then a dialog box appears below. Click on “OK” to download the configuration data to DVPDNET-SL.

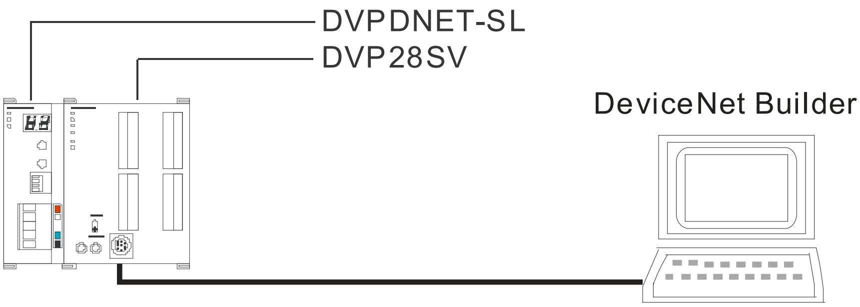


7. After download is finished, power the PLC off and then repower it. Then, DVPDNET-SL has been set as slave mode.

13.2.12 Extended Baud Rate Setup

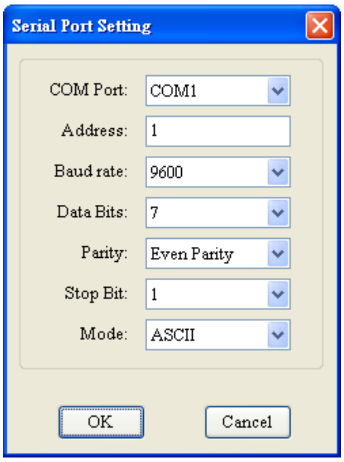
13.2.12.1 Extended Baud Rate Setup (in Master Mode)

1. Connect the device to the DeviceNet network according to the following figure. The PC accesses the PLC via RS232 or RS485.



Note: Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

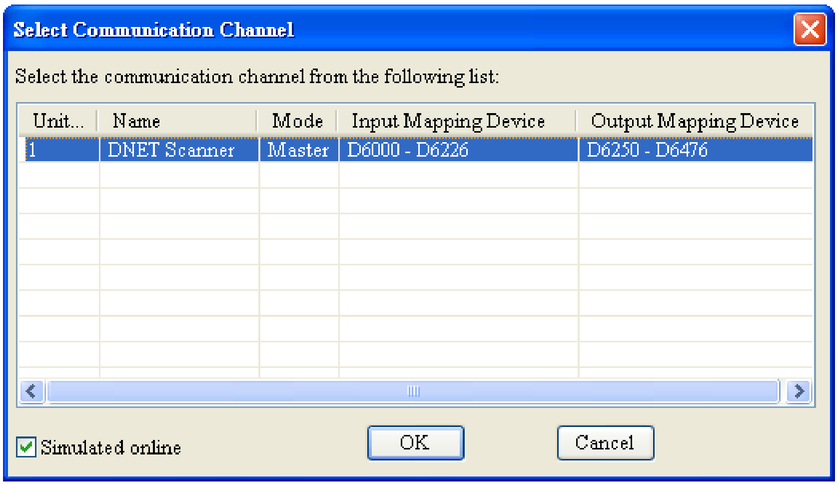
2. Open DeviceNet Builder software and select “Setup” => “Communication Setting” => “System Channel”. And then the following dialog box appears.



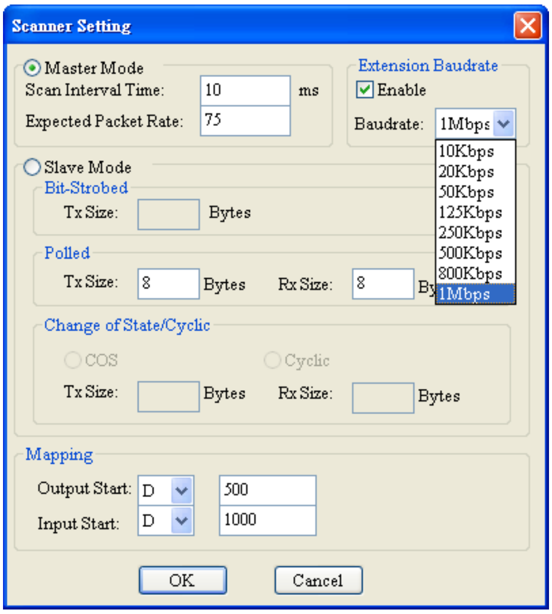
3. Set up the communication parameters for the PC and DVP-SV, e.g. the communication port, address, baud rate and communication format. Click on “OK” after the configuration is finished.

Item	Function	Default
COM Port	COM port on the PC to be used to communicate with DVP-SV	COM1
Address	Communication address of DVP-SV	01
Baud rate	Communication speed between the PC and DVP-SV	9,600 (bps)
Data Bits	Communication protocol between the PC and DVP-SV	7
Parity		Even Parity
Stop Bit		1
Mode	Communication mode between the PC and DVP-SV	ASCII

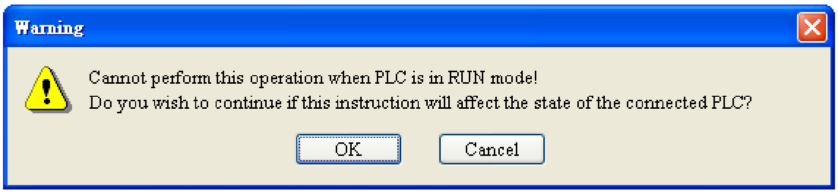
4. Select “Network” => "Online” and the following “Select Communication Channel” dialog box will appear. Click on “OK”.



5. Select “Network” => "Setup of scan module” and the following "Setup of scan module” dialog box appears. Select “Master mode” and “Startup” to activate the function of extended baud rate. In the meanwhile, select the appropriate baud rate according to the actual demand. Click “OK” to finish setting.



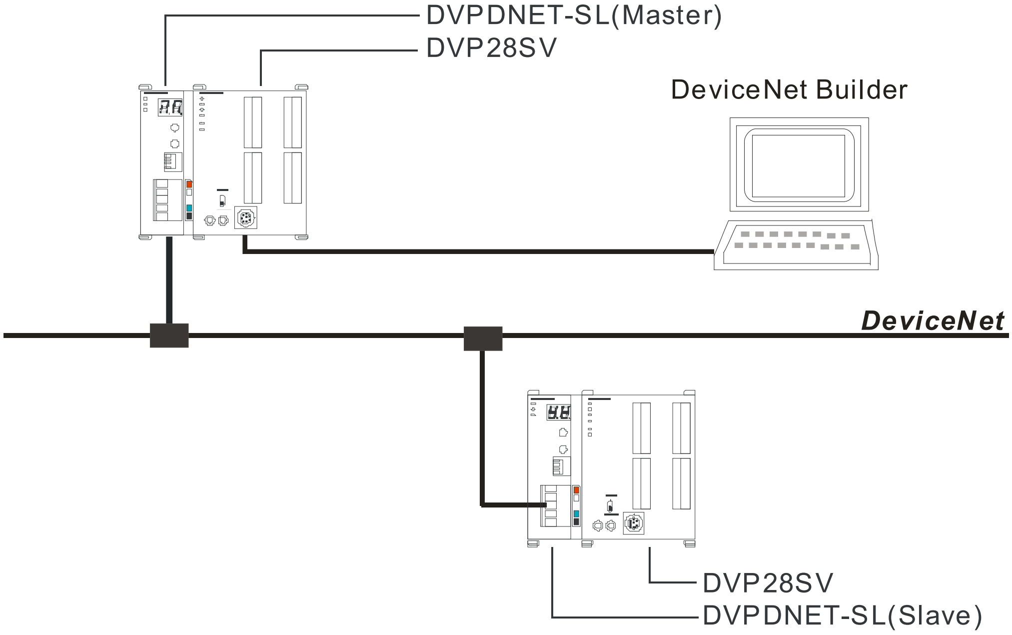
6. Select “Network” => “Download” and the following dialog box appears. Click “OK” to download the configuration data to DVPDNET-SL.



7. After download is completed, set DVPDNET-SL’s function switch DR0 and DR1 as ON and then repower PLC to finish the setting of the extended baud rate.

13.2.12.2 Extended Baud Rate Setup (in Slave Mode)

1. Connect relevant devices to the DeviceNet network according to the following figure.



Note:

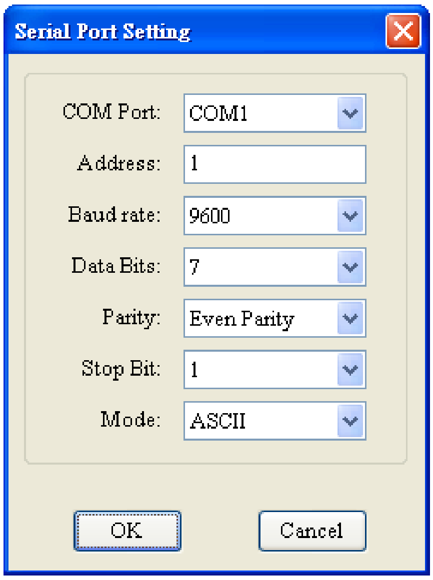
The DVPDNET-SL at the bottom of the figure above has been set to work in slave mode. (See section 13.2.11).

The node addresses of the two DVPDNET-SLs must not be identical.

The baud rates of the two DVPDNET-SLs are both 500 Kbps.

Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

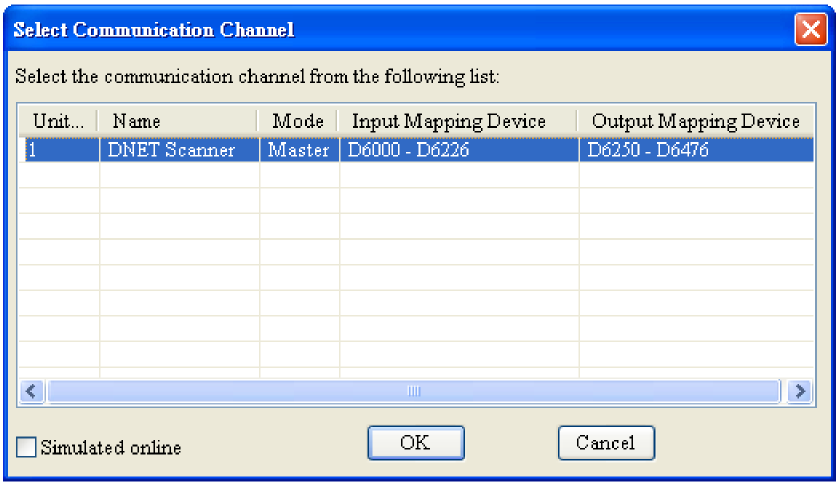
2. Open DeviceNet Builder software and select “Setup” => “Communication Setting” => “System Channel” to see the following dialog box.

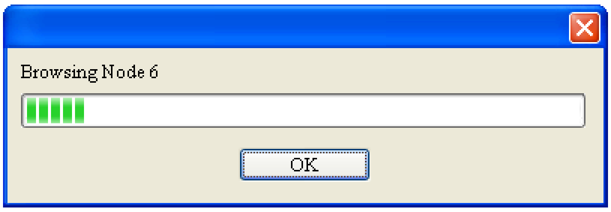


3. Set up the communication parameters for the PC and DVP-SV, e.g. the communication port, address, baud rate and communication format. Click on "OK" after the configuration is finished.

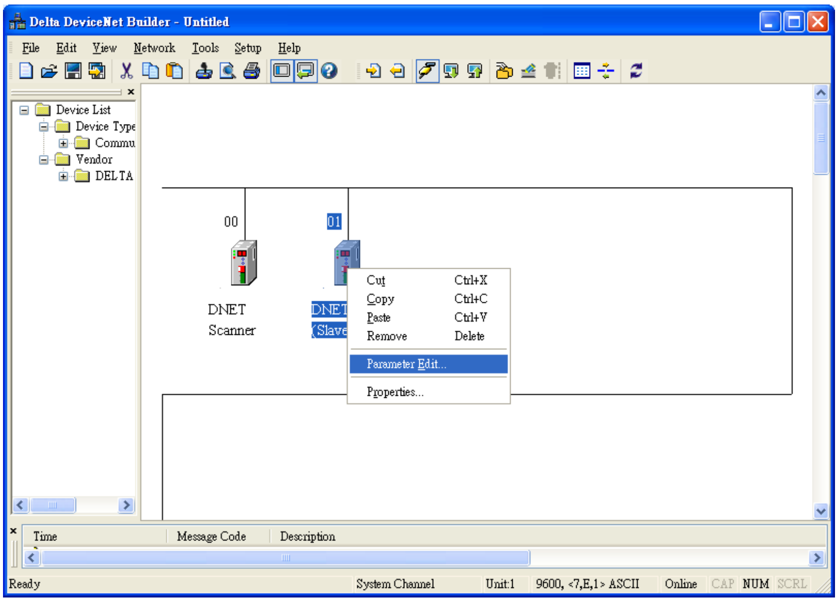
Item	Function	Default
COM Port	COM port on the PC to be used to communicate with DVP-SV	COM1
Address	Communication address of DVP-SV	01
Baud rate	Communication speed between the PC and DVP-SV	9,600 (bps)
Data Bits	Communication protocol between the PC and DVP-SV	7
Parity		Even Parity
Stop Bit		1
Mode	Communication mode between the PC and DVP-SV	ASCII

4. Select "Network" => "Online" and the "Select Communication Channel" dialog box will appear. Click on "OK" to start scanning the entire DeviceNet network.

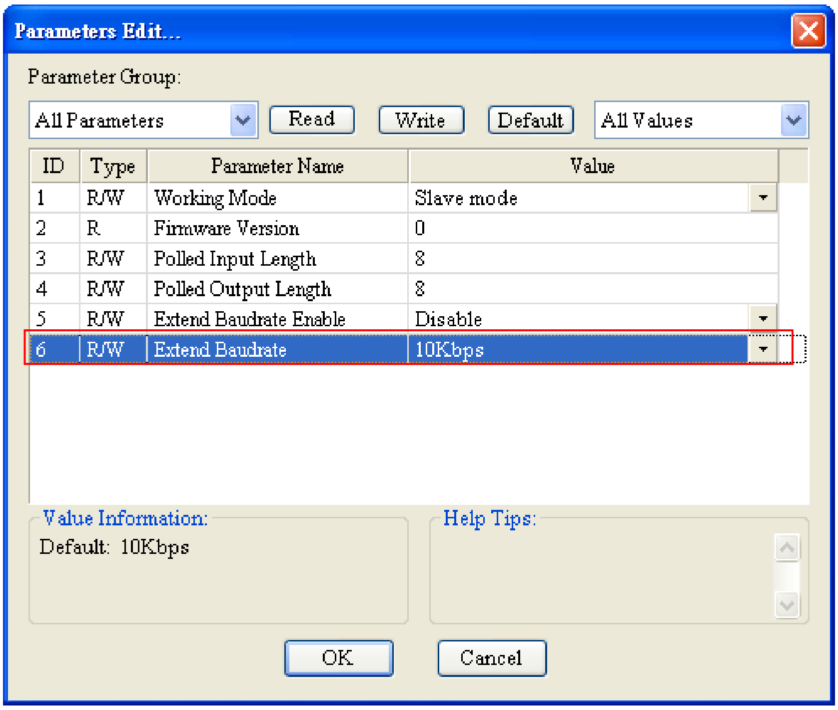




5. After scanning is successful, right-click DNET (Slave) to select “Parameter Edit”.



6. Set parameter 5 as “Enable” and select a baud rate in parameter 6 in the following page. Click on “Download” to download the newly set parameter value to DVPDNET-SL (Slave).



7. After the download is completed, set DVPDNET-SL (Slave)’s function switch: DR0 and DR1 as ON. And then repower PLC to finish the setting of the extended baud rate.

13.2.13 Application Example

This section provides an example on how to construct and configure a DeviceNet network.

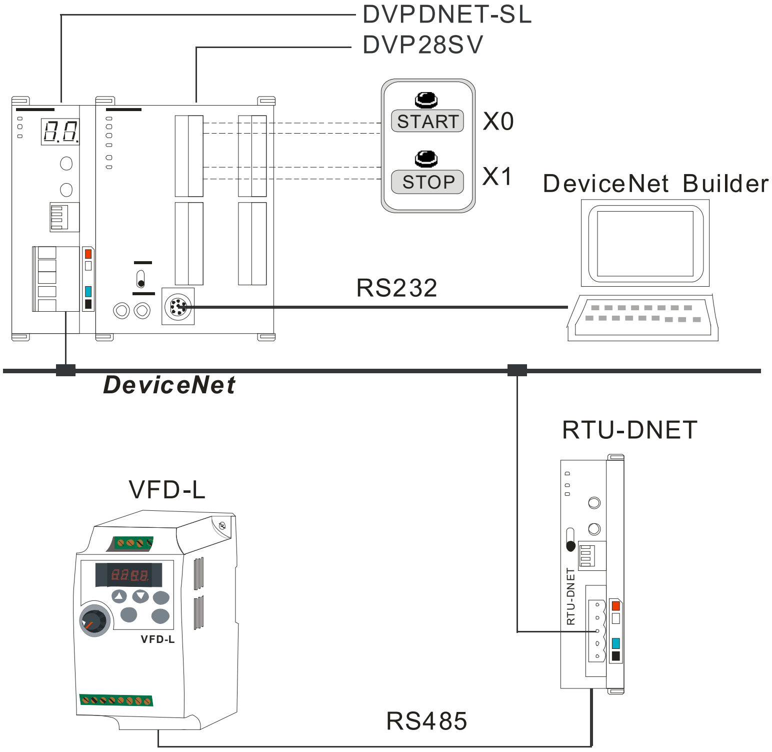
Control requirement	Using X points of DVP28SV to control RUN/STOP of the remote AC motor drive VFD-L.

Note:

Different PLC corresponds to different device addresses. For details, please refer to Input and Output Mapping Areas. We take DVP-SV as the PLC for description below.

13.2.13.1 Construct DeviceNet Network

1. Connection Figure



Note:

Delta DeviceNet remote IO communication module, RTU-DNET supports the MODBUS communication function.

2. Set up DVPDNET-SL, RTU-DNET and VFD-L according to the table below.

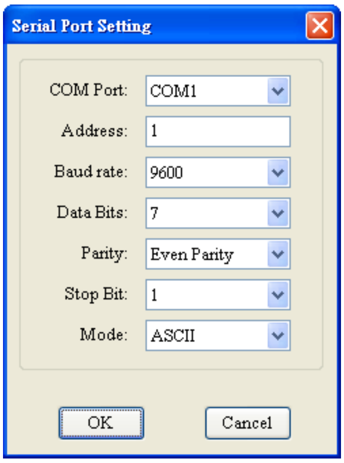
DeviceNet Module	Node address	Baud rate
DVPDNET-SL	01	500 Kbps
RTU-DNET	02	500 Kbps

VFD-L parameter	Setting	Description
02-00	4	Transmit the frequency of VFD-L via RS485.
02-01	3	Control the operation of VFD-L via RS485.
09-00	1	Set the node address of VFD-L in Modbus to 1.
09-01	1	Set the baud rate of VFD-L in Modbus to 9600
09-04	1	Set the communication format of VFD-L in Modbus to 7, E, 1, ASCII.

13.2.13.2 Configure DeviceNet Network

- Configuring DeviceNet slave

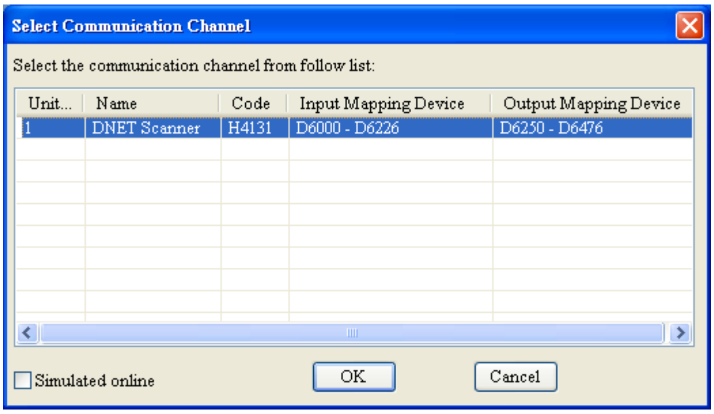
1. Open DeviceNet Builder software and select “Setup” => “Communication Setting” => “System Channel”, and then the “Serial Port Setting” dialog box will appear as below.

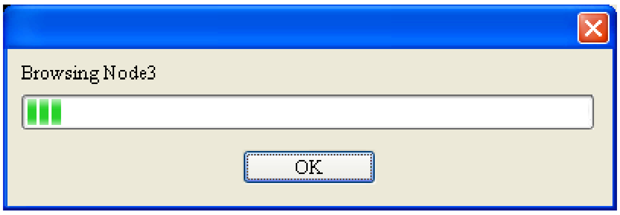


2. Set up the communication parameters for the PC and DVP-SV, e.g. the communication port, address, baud rate and communication format. Click on “OK” after the configuration is finished.

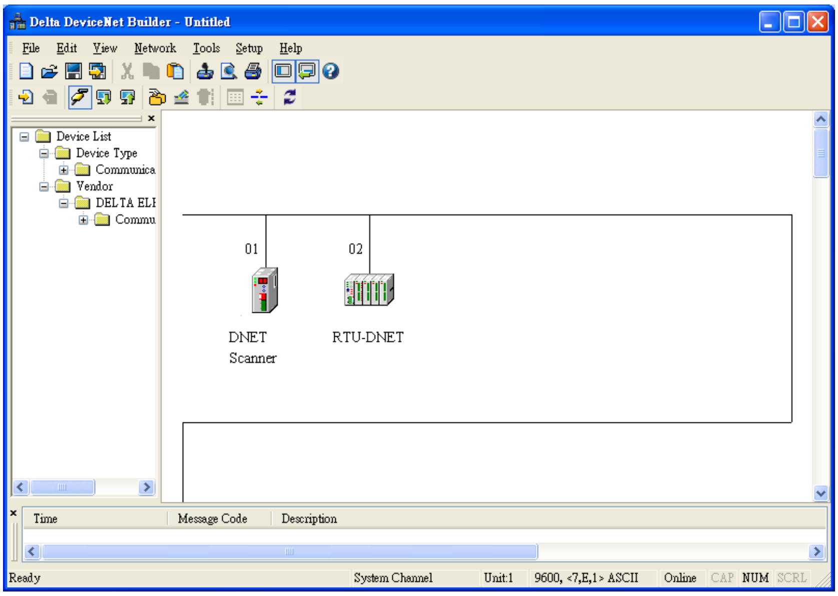
Item	Function	Default
COM Port	COM port on the PC to be used to communicate with DVP-SV	COM1
Address	Communication address of DVP-SV	01
Baud rate	Communication speed between the PC and DVP-SV	9,600 (bps)
Data Bits		7
Parity	Communication protocol between the PC and DVP-SV	Even Parity
Stop Bit		1
Mode	Communication mode between the PC and DVP-SV	ASCII

3. Select “Network” => "Online”, and the “Select Communication Channel” dialog box will appear. Click on “OK” to start scanning the DeviceNet network.

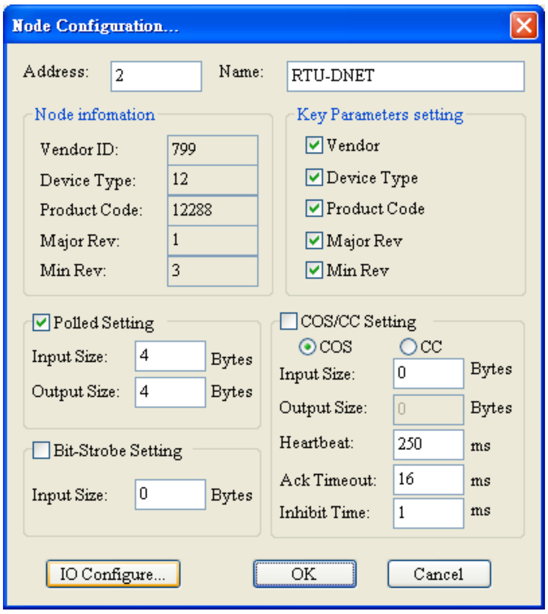




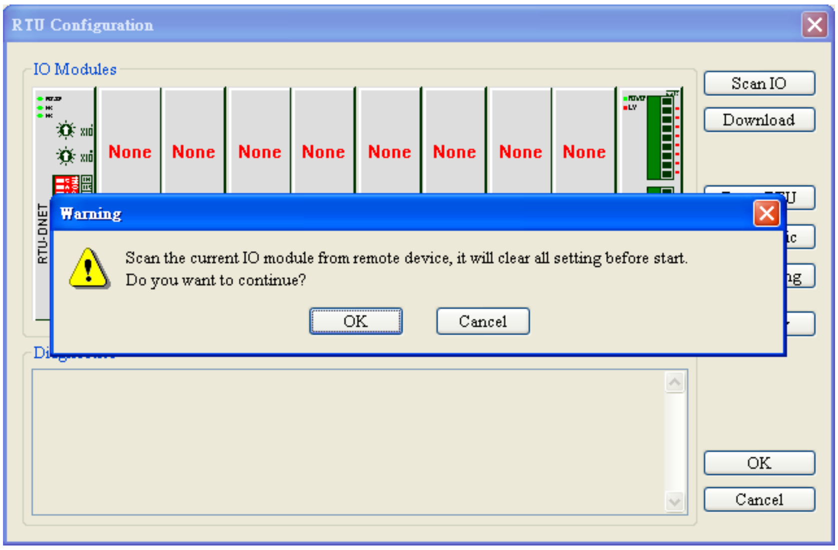
4. If there is no progress in the bar on the dialog box, it means the connection between the PC and DVP-SV is abnormal, or there are other programs also using the COM port on the PC. After the scan is completed, the dialog box will tell you that the scan is completed, and the icons and device names of all the nodes scanned on the network will be shown on the screen. See the figure below, in which the node addresses of DVPDNET-SL and RTU-DNET are 01 and 02 respectively.



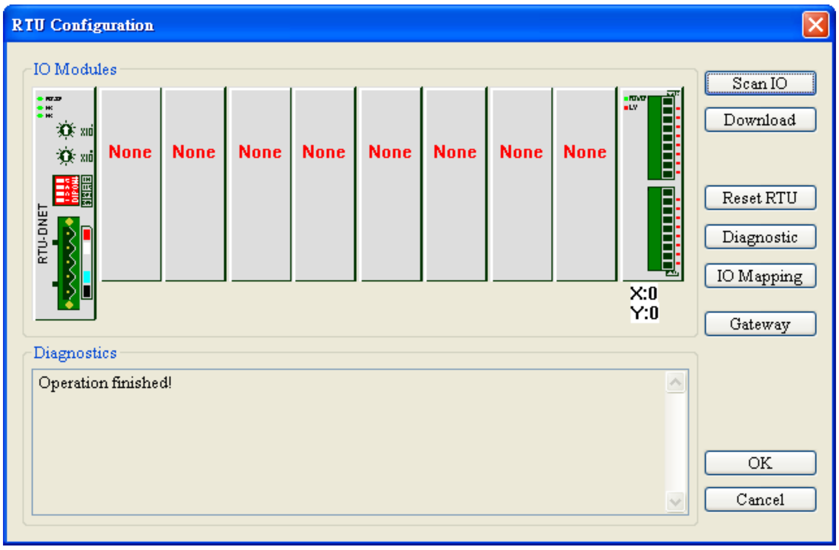
5. Double-click on RTU-DNET (node 02), and the "Node Configuration…" dialog box will appear.



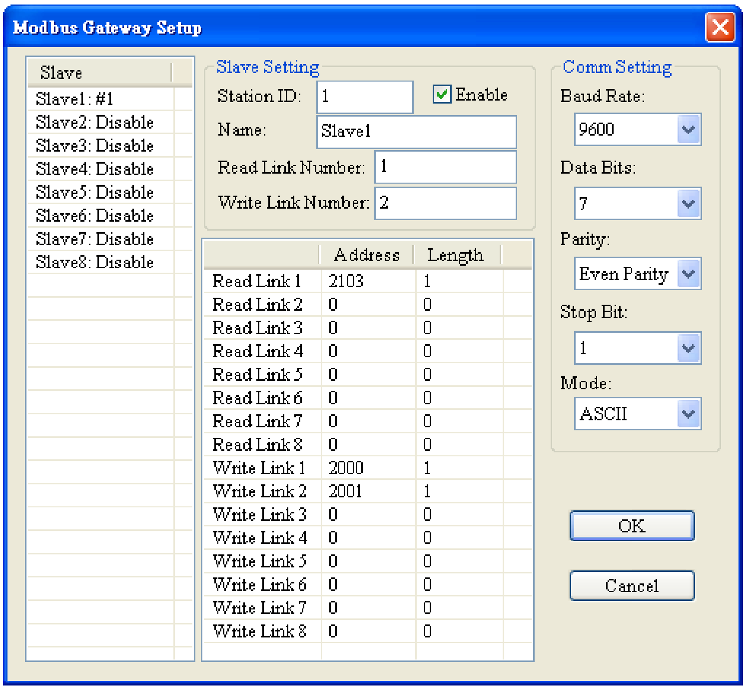
6. Clicking on “IO Configure…” button in “Node Configuration” dialog box, you will see “RTU Configuration” page where you click on “Scan IO” button and “Warning” dialog box will appear. With a click on “OK”, DeviceNet Builder will detect the devices connected to RTU-DNET as below.



7. Because no special module is connected to the right side of RTU-DNET, “None” words will show up in the locations of the special modules in the following window. The numbers of X and Y digital points are 0. Then, click on “Gateway”.

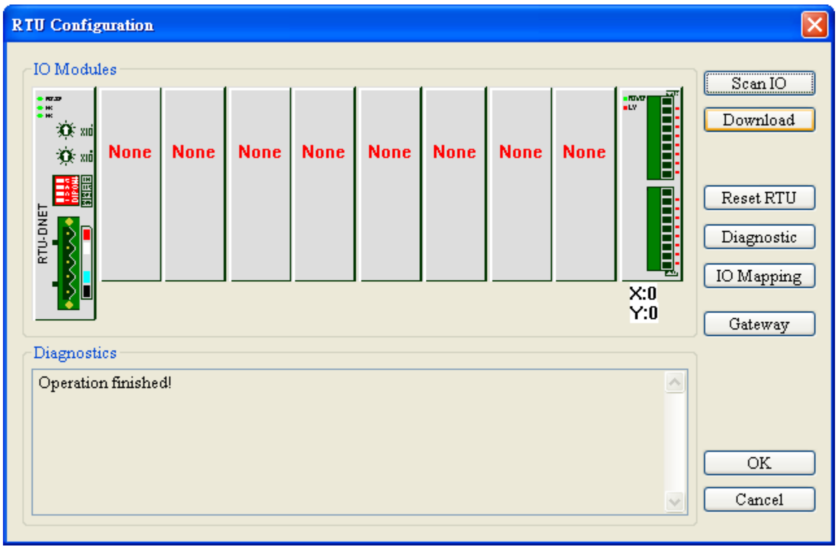


8. In the interface of “Modbus gateway setting”, use the parameters of one slave and fill in relevant values there. You can refer to the user manual of RTU-DNET.



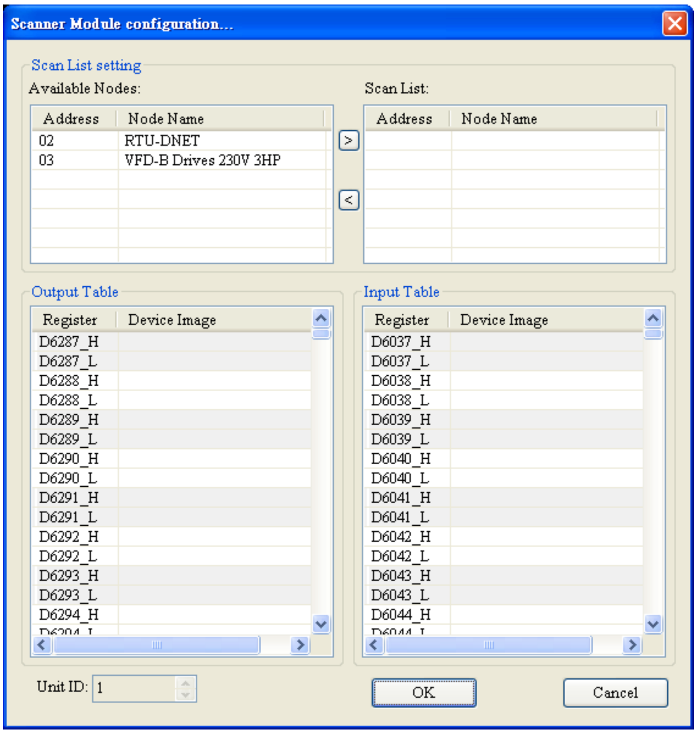
Note: The slave mentioned here is the slave on the Modbus network and has nothing directly to do with the DeviceNet network.

9. Click on “OK” in the window above and then click on “Download” in the following window to download the configuration data to RTU-DNET. After the download is finished, the configuration of RTU-DNET is finished.

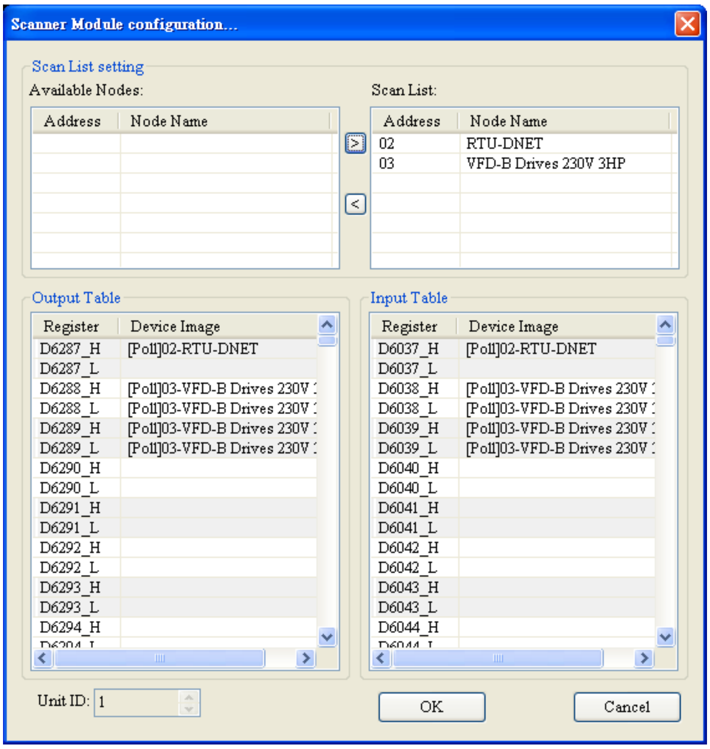


- Configuration of DeviceNet Master

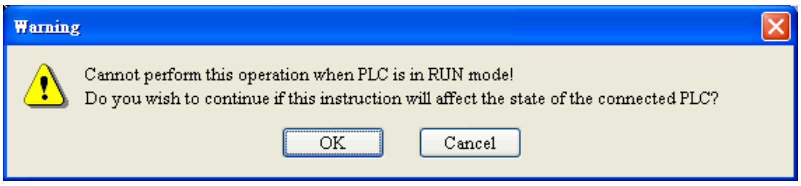
1. Double-click on DNET Scanner (node 01), and the “Scan Module Configuration..." dialog box will pop up. You can find the currently available nodes, RTU-DNET and VFD-B Drives 230V 3HP, in the list on the left side. On the right side, there is an empty “Scan List”.



2. Move the DeviceNet slave devices in the "Available Nodes” list on the left side to the "Scan List” on the right side. Select one node and click on. In this way, move all the nodes to the scan list.



3. Confirm all the settings and click on “OK”. Next, download the configuration to DVPDNET-SL. If DVP-SV is in RUN mode while you are downloading the configuration, a “Warning” dialog box will appear.



4. Click on “OK” to continue the download. Make sure DVP-SV is in RUN mode.

- Configure the DeviceNet network in the steps above. The mapping relation between DVPDNET-SL and slave device is shown as below.

DVP28SV → DVPDNET-SL → slave device

DVP28SV	DVPDNET-SL	RTU-DNET & VFD-L
D6287	⇨	Control word of VFD-L (2000H)
D6288		Control frequency of VFD-L (2001H)

DVP28SV ← DVPDNET-SL ← slave device

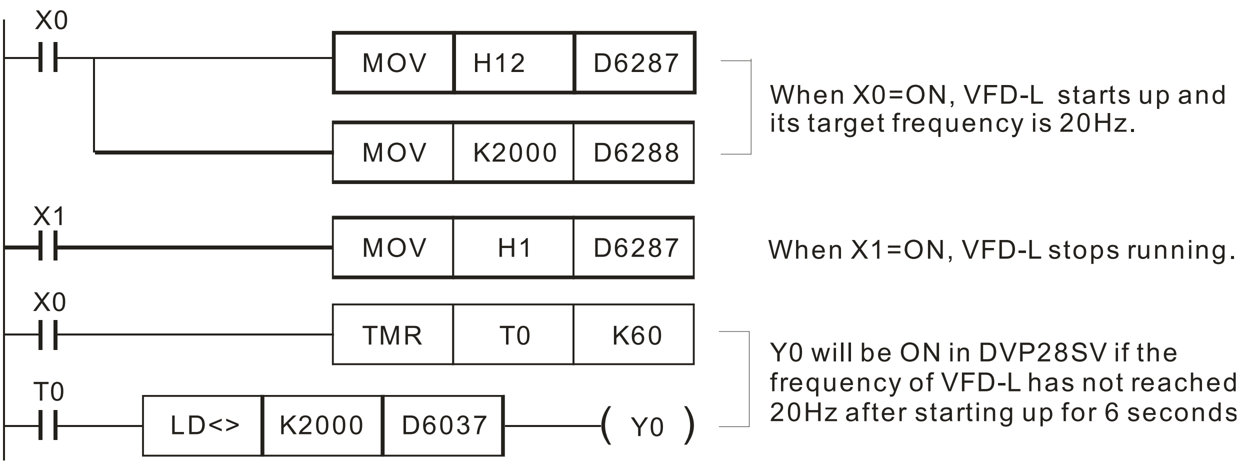
DVP28SV	DVPDNET-SL	RTU-DNET & VFD-L
D6037	⇦	Output frequency of VFD-L (2103H)

13.2.13.3 Ladder Diagram Program

This section introduces how to edit the ladder diagram program to meet the requirement of controlling the DeviceNet network.

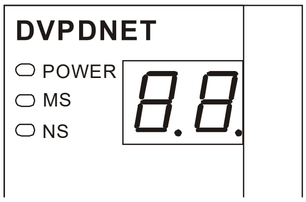
Control requirement	When X0=ON, VFD-L AC motor drive runs; When X1=ON, VFD-L AC motor drive stops; After VFD-L has been operating for 6 seconds, Y0 of DVP28SV is ON if the specified frequency of VFD-L is not reached yet.

Explanation of PLC Program



13.2.14 Error Diagnosis & Troubleshooting

DVPDNET-SL supports two diagnostic methods: indicator diagnosis and digital display diagnosis.



13.2.14.1 LED Indicator Diagnosis

13

- **Power LED**

LED status	Indication	How to correct
Off	The power supply is abnormal.	Make sure that the power supply to DVPDNET-SL is normal.
Green light on	The power supply is normal.	--

- **NS LED**

LED status	Indication	How to correct
Off	No power; or duplicated ID checking has not completed	1. Make sure that the power supply and connection to DVPDNET-SL is fine. 2. Make sure that there is at least 1 node that is able to communicate on the network.
Green light blinking	No communication	No correction is needed; refer to the digital display diagnosis and eliminate the error.
Green light on	Normal operation	--
Red light blinking	Error in communication	Refer to the digital display diagnosis and eliminate the error.
Red light on	Network error; duplicated ID; bus-off or no power supply	1. Make sure that all the devices have a unique node address. 2. Check the network connection is proper. 3. Check if the node address of RTU-DNET is valid. 4. Check if the network power is normal.

- **MS LED**

LED status	Indication	How to correct
Off	No power	Make sure that the power supply and connection to DVPDNET-SL is fine.
Green light blinking	The master is not configured.	Configure the scan list and re-download it to DVPDNET-SL.
Green light on	Normal operation	--
Red light blinking	DNET as the master: Abnormal operation of slave tasks in the scan list. DNET as the slave: Configuration issues.	Check the digital indicator and make sure the configuration data of the salve in the scan list is consistent with the salve actually connected.
Red light on	Internal error	1. Check if the configuration is valid. 2. Re-power it. If the error still exists, contact your local distributors.

- **MS LED & NS LED**

LED status		Indication	How to correct
NS LED	MS LED		
OFF	OFF	No power	Make sure that the power supply to DVPDNET-SL is normal.
OFF	Green light ON	Duplicated ID check has not completed.	Make sure that there is at least one node which can communicate with DVPDNET-SL normally, at the same baud rate as DVPDNET-SL on the network.
Red light ON	Green light on	MAC ID detection failure or bus-off	1. Ensure that the node address of DVPDNET-SL is unique. 2. Re-power DVPDNET-SL.
Red light ON	Red light blinking	No 24V DC power from DeviceNet network	1. Check if the network cable is correctly connected to DVPDNET-SL. 2. Check the 24V DC network power.
Red light ON	Red light ON	Hardware error	Contact your local distributors.

13.2.14.2 Digital Display Diagnosis

Code	Indication	How to correct
0 – 63	Node address of DVPDNET-SL (in normal operation)	--
80	DVPDNET-SL is in STOP status.	Turn the PLC to RUN to start I/O data exchange.
F0	Duplicated MAC ID check failure	1. Ensure that the node address of DVPDNET-SL is unique. 2. Re-power DVPDNET-SL.
F1	No slave device in the scan list.	Configure the scan list and download it to DVPDNET-SL.
F2	Low voltage is detected.	Check if the power supply to the DVPDNET-SL and PLC is normal.
F3	Entering test mode	Change IN1of the function switch from On to Off and re-power the DVPDNET-SL.
F4	Bus-off	1. Check if the network cable connection is proper. 2. Check if the baud rates of the nodes on the network are consistent. 3. Re-power DVPDNET-SL.
F5	No network power	1. Make sure that the cable is correctly connected. 2. Ensure that the power supply to the network is normal.
F6	Internal error; Flash or RAM check error	If the error still exists after re-power it, contact your local distributors.
F7	Internal error; GPIO check error	If the error still exists after re-power it, contact your local distributors.
F8	Error produced in factory manufacturing	If the error still exists after re-power it, contact your local distributors.
F9	Internal error; EEPROM access failure	If the error still exists after re-power it, contact your local distributors.
FA	Invalid configuration data	1. Configure the network correctly and re-download it to DVPDNET-SL. 2. Check if the node address of the slave in the scan list is the same as the node address of DVPDNET-SL.
E0	Device key parameter does not match the scan list table.	Make sure that the device parameter in the scan list matches the desired key parameter, including vendor ID, product code, device type and version.

Code	Indication	How to correct
E1	Data size returned does not match the scan list.	Re-configure the scan list using correct data size.
E2	Slave device in the scan list does not exist or is offline.	1. Check if there is any change for the node address of the slave. 2. Check if the communication cable is disconnected or connected loosely.
E3	DVPDNET-SL fails to transmit a message.	Make sure that the connection is valid and check if the baud rate is correct.
E4	Error detected in sequence of fragmented I/O messages from device	Check if the slave is operating normally.
E5	Slave device returns error when DVPDNET-SL attempts to communicate with it.	Check if the slave is operating normally.
E6	Data size returned is bigger than expected.	Ensure that the size of the IO data of the slave is the same as that configured in the scan list.
E7	DVPDNET-SL is checking MAC ID.	If the code is displayed long, do the troubleshooting according to the following steps. 1. Make sure that at least two nodes work normally on the network. 2. Check if both ends of the network are each connected with a 121 Ω terminal resistor. 3. Check if the baud rates of the node devices on the network are identical. 4. Check if the communication cable is normal so as to avoid that the cable is disconnected or connected loosely. 5. Re-power the DVPDNET-SL module.

13.3 DVPCOPM-SL

13.3.1 Introduction

DVPCOPM-SL is a CAN module operating on the left side of the PLC. The PLC can have a maximum of 8 DVPCOPM-SL modules connected to its left side. For DVP-SE2, up to 6 units of DVPCOPM-SL modules can be connected on the left side. DVPCOPM-SL supports both CANopen and SAE J1939 modes. In CANopen mode, it supports master/slave modes, as well as the CANRS instruction. DVPCOPM-SL can use J1939 communication instructions to operate in SAE J1939 mode. The DVPCOPM-SL master module is responsible for the data exchange between the PLC and other slaves on the bus when the PLC is connected to the CANopen network via DVPCOPM-SL. To achieve data exchange, DVPCOPM-SL master module is used for transmitting the data in the PLC to slaves on the bus and meanwhile returns the data in slaves to the PLC.

The PLC connected to the right side of DVPCOPM-SL includes DVP-28SV, DVP-SX2, DVP-EH2-L, DVP-SV3, DVP-SX3 and DVP-SE2.

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13.3.1.1 Features

DVPCOPM-SL can be used as the master in CANopen network, as well as the slave for other masters.

1. As a master, DVPCOPM-SL features:

- Complying with CANopen standard protocol DS301 V4.02
- Supporting NMT Master Service
- Error control: Supporting Heartbeat/Node Guarding Protocol
- Supporting PDO Service:

Max. 200 RxPDOs and 390 bytes of data

Max. 200 TxPDOs and 390 bytes of data

Each slave can be configured with a maximum of 8 TxPDOs and 8 RxPDOs.

PDO transmission type: Supporting event trigger, time trigger, synchronous cycle, and synchronous non-cycle.

PDO mapping: Every PDO can be configured with a maximum of 32 parameters.

Type of mapping data supported:

Storage space	Data type
1 bit	BOOL
8 bits	SINT USINT BYTE
16 bits	INT UINT WORD
32 bits	DINT UDINT REAL DWORD
64 bits	LINT ULINT LREAL LWORD

- Supporting SDO Service

Number of Server: 0

Number of Client: 3

Supporting standard expedited SDO transfer.

Supporting Auto SDO function. Able to execute up to 20 Auto SDOs to each slave.

Supporting reading/writing of data in slaves by using SDO Service in the ladder diagram in PLC.

- Supporting Emergency Protocol：

  Able to store 5 latest Emergency messages for each slave.

  Able to indicate Emergency messages in a slave through a digital display.

  Able to read Emergency messages through the ladder diagram in PLC.

- SYNC producer, range: 0 to 65,535 ms.
- As the interface between Delta CANopen Builder software and CANopen network. The software can configure the network directly through DVPCOPM-SL.
- Automatically exchanges data with the PLC. Users only need to edit a program for D registers mapped in the PLC without using FROM and TO instructions when programming. When DVPCOPM-SL is connected to the PLC which is DVP-SV3 or DVP-SX3, the registers D16000 to D19999 are occupied. When DVPCOPM-SL is connected to other DVP series PLC which is not DVP-SV3 or DVP-SX3, the registers D6000 to D9999 are occupied.

2. As a slave, DVPCOPM-SL features:

- Complying with CANopen standard protocol DS301 V4.02
- Supporting NMT Slave Service
- Error control: Supporting Heartbeat Protocol
- Supporting PDO Service: Each slave can be configured with a maximum of 8 TxPDOs and 8 RxPDOs.
- PDO transmission type: Supporting event trigger, time trigger, synchronous cycle, synchronous non-cycle.
- Supporting SDO Service.

  Number of Server: 1

  Number of Client: 0

  Supporting standard expedited SDO transfer.

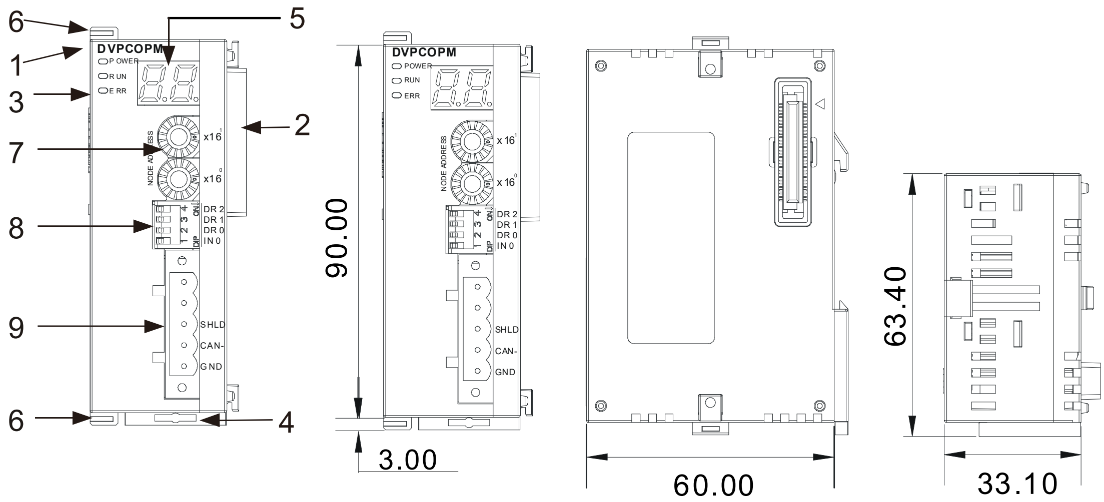
- Supporting Emergency Protocol.

  Able to indicate Emergency event in the slave through a digital display.

13.3.1.2 Specification

Model name	DVPCOPM-SL
Power supply	Supplied by the internal bus from the CPU
Power consumption	1.7 W
CANopen connector	Removable connector (5.08 mm)
Transmission method	CAN
Transmission cable	Contains two communication wires, one shielded wire and one ground wire
Message type	PDO, SDO, SYNC (synchronous object), Emergency (Emergency object), NMT
Baud rate	10k, 20k, 50k, 125k, 250k, 500k, 800k, 1M bps (bits/sec)
Product code	82
Device type	0 (Non-Profile)
Manufacturer ID	477 (Delta Electronics Inc.)
Connect to DVP PLC CPU	Connectable to the left side of CPU, numbered from 100 to 107 according to the location of modules from the one closest to the CPU
Weight	115 g

13.3.2 Module Profiles and Dimension



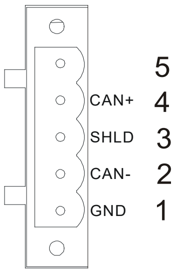
Unit: mm

No.	Name	Description
1	Model name	Model number
2	Extension port	Connect the PLC or the modules
3	POWER LED indicator	Indicates the status of the power supply ON: the power is on OFF: no power
	RUNLED indicator	OFF: No power supply Green light flashing once: DVPCOPM-SL is in stopped state Green light flashing: DVPCOPM-SL is in a pre-operation state Red light ON: DVPCOPM-SL is in a normal state
	ERRORLED indicator	OFF: Normal Red light flashing once: Bus error exceeds the warning level Red light flashing twice: Slave station disconnected Red light steady on: Bus off
4	DIN rail clip	Secure the module on the set.
5	Digital display	Displaying Node Address of DVPCOPM-SL Module Displaying Error Information from Slave Station
6	Fixing clip for I/O module	For securing the extension module.
7	Address switch	CANopen communication address setting
8	Function switch	Baud rate and I/O data action settings
9	CANopen port	Connect CANopen network.

13.3.3 Terminals

13.3.3.1 CANopen Port

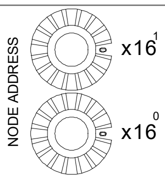
The port is used for the connection to CANopen network. Wire by using the connector enclosed with DVPCOPM-SL.



PIN	Signal	Content
1	GND	GND
2	CAN_L	Signal-
3	Shield	Shield
4	CAN_H	Signal+
5	-	reserved

13.3.3.2 Address Switch

The switch is used for setting up the node address of DVPCOPM-SL on CANopen network. Range: 1 to 7F (0, 88 to FF are forbidden).



Switch setting	Content
1 to 7F	Valid CANopen node address
0, 80 to FF	Invalid CANopen node address

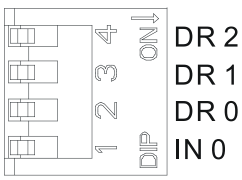
Example: If you need to set the node address of DVPCOPM-SL to 26 (1AH), simply switch the corresponding switch of $x16^1$ to 1 and the corresponding switch of $x16^0$ to A.

Note:

1. Use a slotted screwdriver to rotate the switch carefully in case you scratch the switch.
2. Set up the node address when the power is switched off. After the setup is completed, repower DVPCOPM-SL.

13.3.3.3 Function Switch

The switch is used for setting up the baud rate for the communication between DVPCOPM-SL and CANopen network (DR0 to DR2). See the table below for the baud rates and maximum communication distances.



DR2	DR1	DR0	IN0	Baud rate
OFF	OFF	OFF	reserved	10 Kbps
OFF	OFF	ON		20 Kbps
OFF	ON	OFF		50 Kbps
OFF	ON	ON		125 Kbps
ON	OFF	OFF		250 Kbps
ON	OFF	ON		500 Kbps
ON	ON	OFF		800 Kbps
ON	ON	ON		1 Mbps

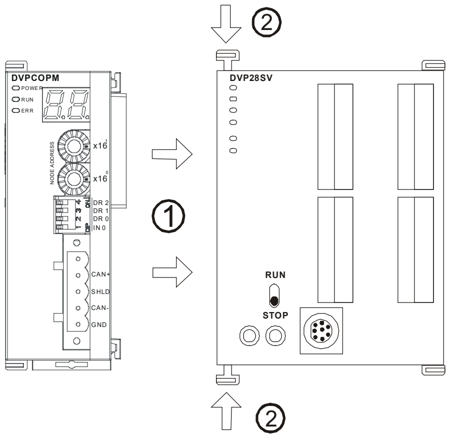
Note:

- Please use a slotted screwdriver to turn the DIP switch carefully.
- Please set up the function switch when the module is powered off. After setting is over, power on the module again.

13.3.4 Installation

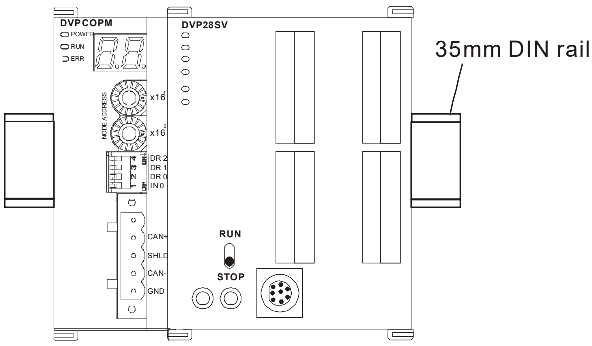
1. Connecting DVPCOPM-SL to PLC

- Open the fixing clip on top and bottom of PLC. Meet the extension port of DVPCOPM-SL with PLC, as shown in number①.
- Press the fixing clips on top and bottom of PLC and check if the connection is fine, as shown in number②.



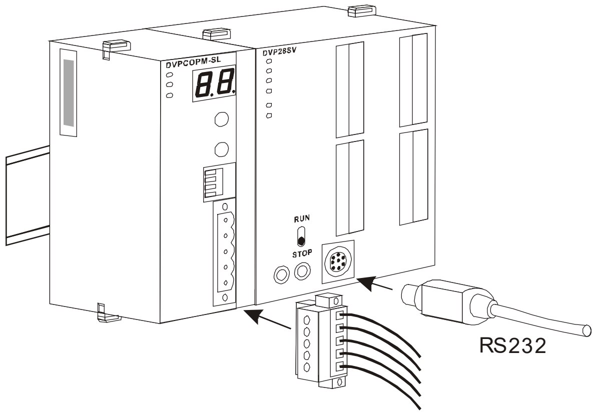
2. Installing DVPCOPM-SL and PLC on DIN Rail.

- Use 35 mm DIN rail.
- Open the DIN rail clip on PLC and DVPCOPM-SL. Insert PLC and DVPCOPM-SL onto the DIN rail.
- Clip up the DIN rail clips on PLC and DVPCOPM-SL to fix PLC and DVPCOPM-SL on the DIN rail, as shown below.



3. Connecting to CANopen Port

- Please wire according to the PIN definition of the connection port.
- Plug the communication connector to the CANopen port of DVPCOPM-SL as follows.



13.3.5 CANopen Mode

13.3.5.1 Construct a CANopen Network

In this section, we will introduce how to build a complete CANopen network by using DVPCOPM-SL and other slaves.

Before constructing a network, you have to first know clearly what the network is for and start a preliminary planning for the data to be exchanged. The plan shall include the slaves to be used, type of transmission and the data to be exchanged, total length of data to be exchanged, requirement on the response time for data exchange, and so on. The information will decide whether the network you build is a sensible one, or whether it satisfies your needs, and even affects the later-on network sustainability and flexibility of network capacity upgrade.

In the example below, we will illustrate how to control RUN/STOP and speed of a Delta ASD-B servo drive by a Delta digital I/O module DVP-08ST.

13.3.5.1.1 Construct a CANopen Network

Equipment and software required:

Equipment & software	Function
DVP-PS02	24 V power supply module, supplying power to CANopen.
DVP-PS01	24 V power supply module, supplying power to remote I/O DVP-08ST and DVP-SA PLC.
DVP-28SV	DVP-SV PLC
DVPCOPM-SL	CANopen master
DVP-12SA	DVP-SA PLC
DVP-08ST	Digital I/O module
IFD9503	CANopen bus adapter
ASD-B	Delta B series servo drive
WPLSoft	DVP series PLC programming software
Delta CANopen Builder	CANopen configuration software for DVPCOM-SL master

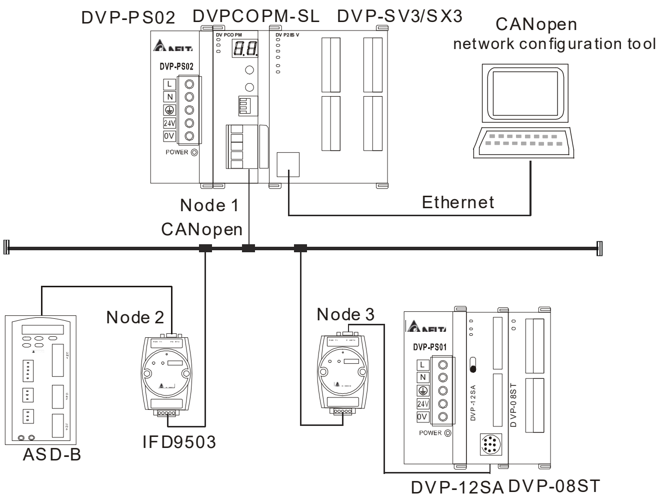
Set up DVPCOPM-SL and IFD9503 according to the table below. For how to operate IFD9503, please refer to the operation manual of IFD9503.

Module	Node address	Transmission rate (bps)
DVPCOPM-SL	01	1M
IFD9503	02 (connected to the servo)	1M
IFD9503	03 (connected to the SA PLC)	1M

Set up ASD-B as follows:

Parameter	Setting value	Explanation
P1-01	02	Control mode: speed mode
P1-09	100 (rpm)	Internal speed command 1 (SP1)
P1-10	300 (rpm)	Internal speed command 2 (SP2)
P1-11	500 (rpm)	Internal speed command 3 (SP3)
P2-10	101	Function of DI1: Servo on
P2-11	114	Function of DI2: SPD0
P2-12	115	Function of DI3: SPD1
P2-18	102	Function of DO1: Output when servo on
P3-00	1	Modbus communication address
P3-01	5 (115,200 bps)	Modbus baud rate
P3-02	1 (7,E,1)	Modbus data format
P3-06	3F	DI1 to DI6 controlled by communication

Constructing a CANopen network following the figure below:



For the connection between IFD9503 and PLC, IFD9503 and ASD-B, or IFD9503 and other equipment, please refer to IFD9503 operation manual. For the electrical specifications and wiring of ASD-B, please refer to ASD-B operation manual.

13.3.5.1.2 Data Mapping in a CANopen Network

- Data mapping in DVP-12SA

DVP-08ST provides 8 channels of digital inputs and 1 byte of input data in total. In this example, we will use X0 of DVP-08ST to run/stop ASD-B and use X1 and X2 to select a speed for the servo drive. Y0 is for the output signal of ASD-B status. See the table below for details.

Digital input/output point	Function
X0	Controlling RUN/STOP of ASD-B
X1, X2	Selecting the speed of ASD-B: X1 = 0, X2 = 1, selecting SP1 X1 = 1, X2 = 0, selecting SP2 X1 = 1, X2 = 1, selecting SP3
Y0	Status of ASD-B: ON: RUN OFF: STOP

When IFD9503 is connected to DVP-12SA, the default length of input data is 8 bytes and output data is 8 bytes for the data exchange with DVPCOPM-SL master. D256 in DVP-12SA is the start device for input data, and D0 is the start device for output data. To realize the control function of X0, X1 and X2, we place the statuses of X0 to X2 to bit 0 to bit 2 of D256. That is, when X0 = On, bit 0 of D256 will become 1. When X1 = On, bit 1 of D256 will become 1. In this way, we can realize the control of RUN, STOP and speed of ASD-B by the changes in D256 through WPLSoft. The status word data in ASD-B will then be sent to D0. That is, when bit 0 of D0 becomes 1, there will be signals at Y0.

Mapping between DVPCOPM-SL master and DVP-12SA (SA PLC):

Mapping register in Master	Transmission direction	Mapping register in Slave
D6032	←	D256
D6033		D257
D6034		D258
D6035		D259
D6282	→	D0
D6283		D1
D6284		D2
D6285		D3

- Data mapping in ASD-B

In this example, IFD9503 is the interface for the connection between ASD-B and CANopen network. In default setting, IFD9503 provides 1 word of input data and 1 word of output data to exchange with DVPCOPM-SL master.

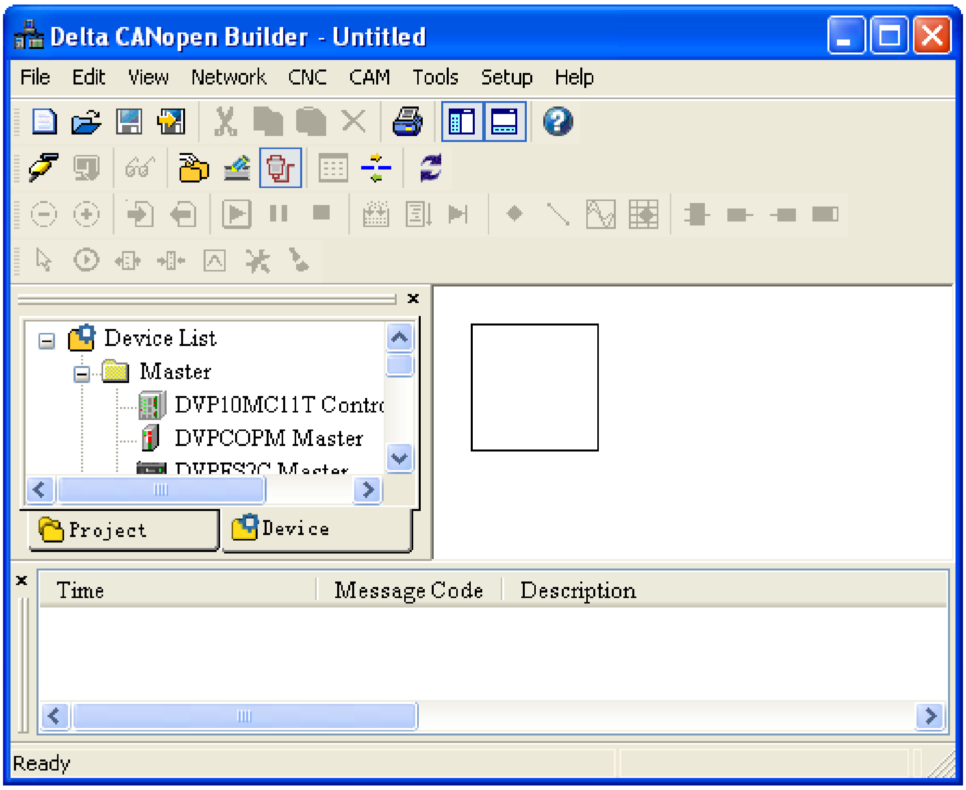
Mapping between DVPCOPM-SL master and ASD-B:

Mapping register in Master	Transmission direction	Mapping parameter in Slave
D6036	←	P4-09 (Digital output status)
D6286	→	P4-07 (Multi-function digital input)

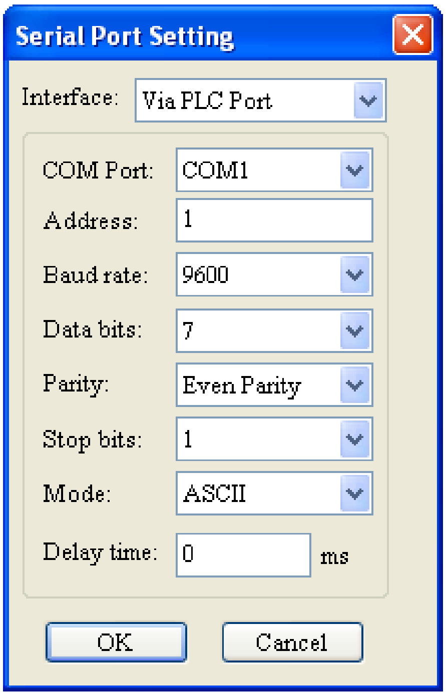
13.3.5.1.3 Configure Network by Delta CANopen Builder Software

- Using CANopen Builder to scan the network

1. Open the CANopen Builder software by clicking Delta Industrial Automation > CANopen Builder from the Start menu in Windows.



2. Select “Setup” => “Communication Setting” => “System Channel”, and the "Serial Port Setting” dialog box will appear.



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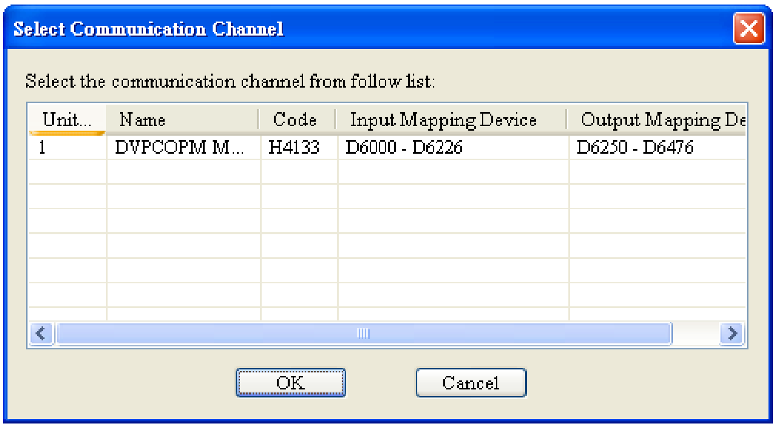
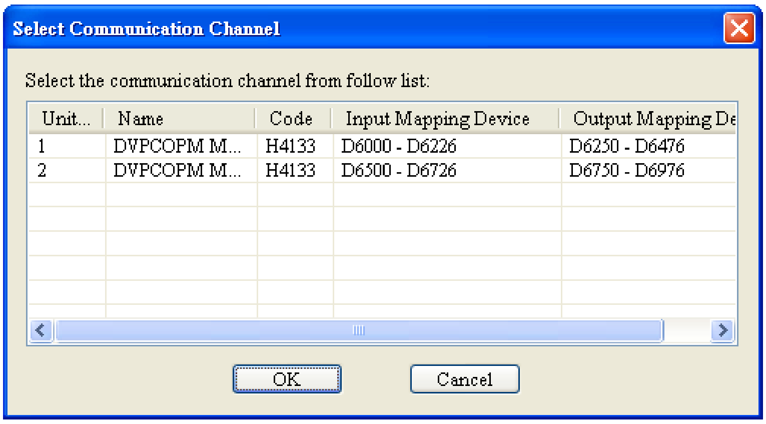
3. Set up the parameters for communication between the PC and DVP-SV, e.g. the communication port, address, baud rate and communication format.

Item	Function	Default
COM Port	COM port on the PC to be used to communicate with DVP-SV	COM1
Address	Communication address of DVP-SV	01
Baud rate	Communication speed between the PC and DVP-SV	9,600 (bps)
Data Bits		7
Parity	Communication protocol between the PC and DVP-SV	Even Parity
Stop Bit		1
Mode	Communication mode between the PC and DVP-SV	ASCII

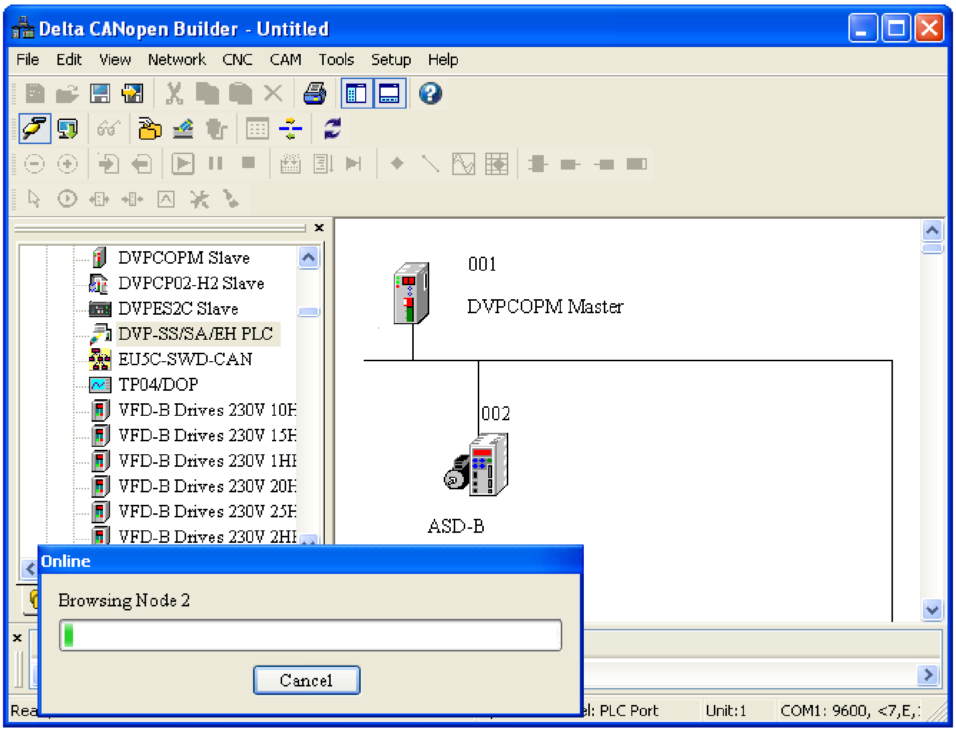
4. Select "Network" => "Online", and the "Select Communication Channel" dialog box will appear. In this example, if the connection with DVP-SV is in normal status, you will see the screen as below.



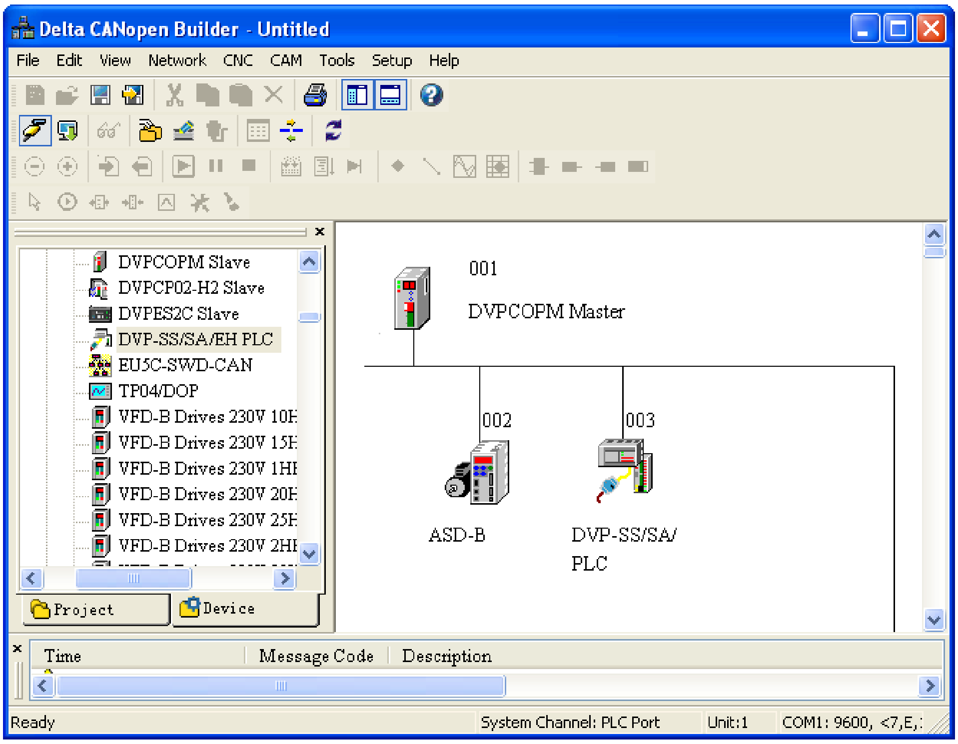
If there are more than one DVPCOPM-SL module (less than 8) connected to the left side of DVP-SV and suppose there are two connected in this example, you will see the screen as below after clicking on "Online". The DVPCOPM-SL which is closest to DVP-SV is regarded as the first module, and so on.



Select the DVPCOPM-SL which needs to establish the communication. Click on “OK” and start to scan all the slaves in the network. If the network installation and power supply are normal, you will see the screen as below.

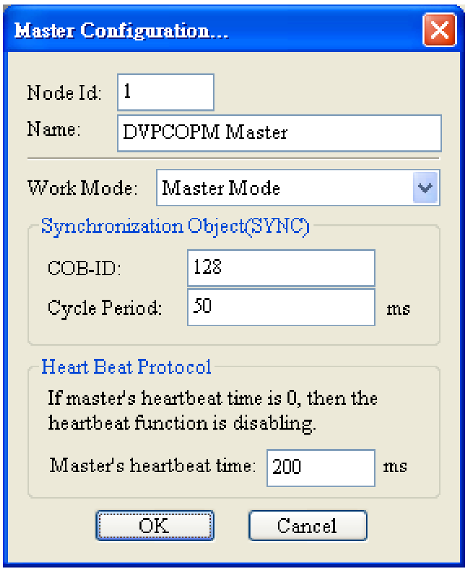


5. In normal condition, after the scan is over, you will find the master and all the slaves displayed in CANopen network, as below.



- Setting up parameters in CANopen master

Select “Network” => ”Master Parameter”, and you will see the dialog box as below.



Work Mode: The work mode of DVPCOPM-SL. You can select either “Master Mode” or “Slave Mode”.

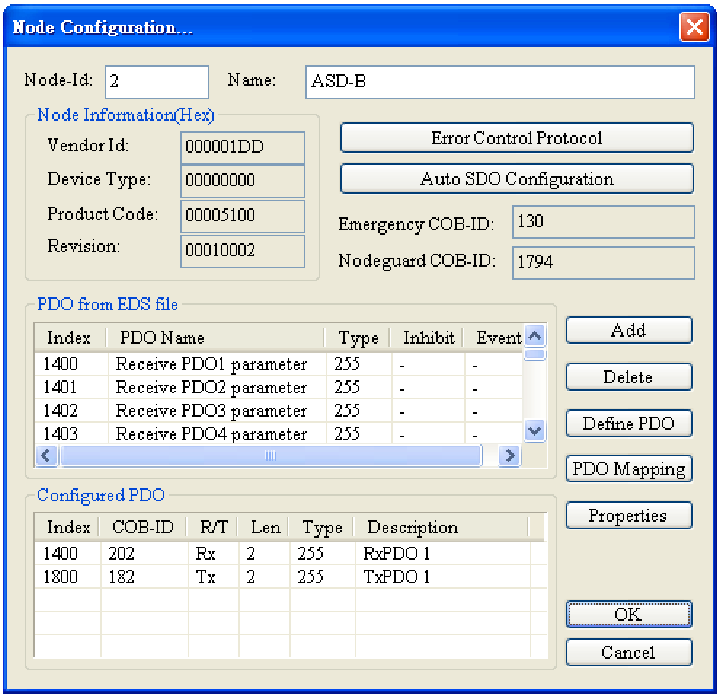
Cycle Period: The regular interval at which synchronous messages are sent

Master’s heartbeat time: The cycle time for DVPCOPM-SL to send out the heartbeat message.

After all the parameters are set up, click on “OK".

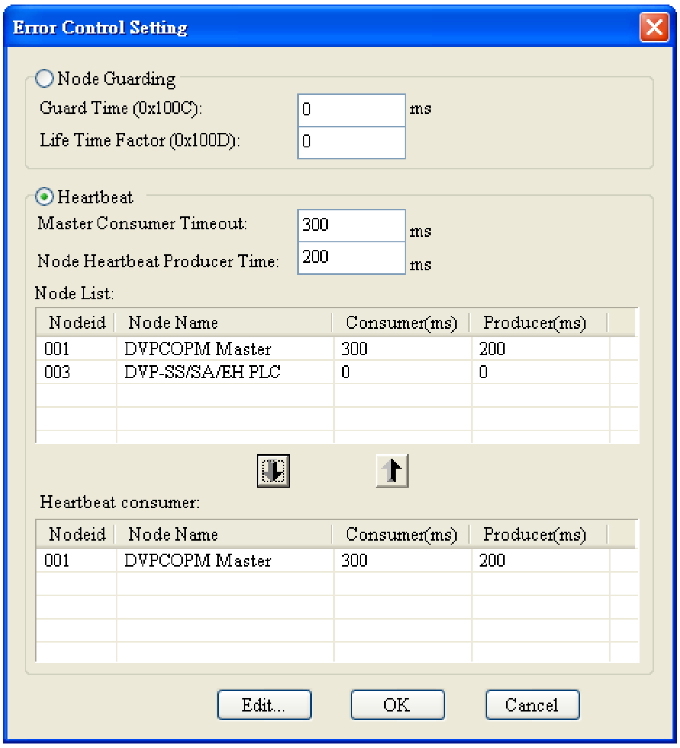
- Setting up parameters in CANopen slave, take the parameter settings in ASD-B for example.

1. Double-click on ASD-B, and you will see the dialog box as below.

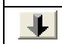


2. Relevant parameter settings

- **Error Control Protocol:** In the "Node Configuration…" page, click on "Error Control Protocol", and you will see the dialog box appearing as below.



Explanation of the parameters above:

Parameter Name		Explanation	Remark
Node Guarding	Guard time	The master sends the guard message to the slave based on the time interval specified by "Guard Time".	When "Heartbeat" is selected, "Node Guarding" cannot be selected.
	Life Time Factor	Life time=Guard Time x Life Time Factor. The slave does not respond to the polling from the master within the period of Life Time and then master assumes the slave is offline.	
Heartbeat	Node heartbeat producer time	The slave sends the heartbeat message to the master within the cycle of "Node heartbeat producer time"	The time for "Master consumer timeout" should be longer than that for "slave heartbeat producer time".
	Master consumer time-out	If the master failed to receive the heartbeat message from the slave within the period of "master consumer timeout", the master would assume the slave is offline.	
Node list		All nodes configured in CANopen network are all displayed in the node list.	--
Heartbeat consumer		The node configured with "error control setting" can monitor whether the nodes in the window of "Heartbeat consumer" are offline.	Only one node can be configured in "Heartbeat consumer".
 Icon		Select some node in "Node list" and add it to	--

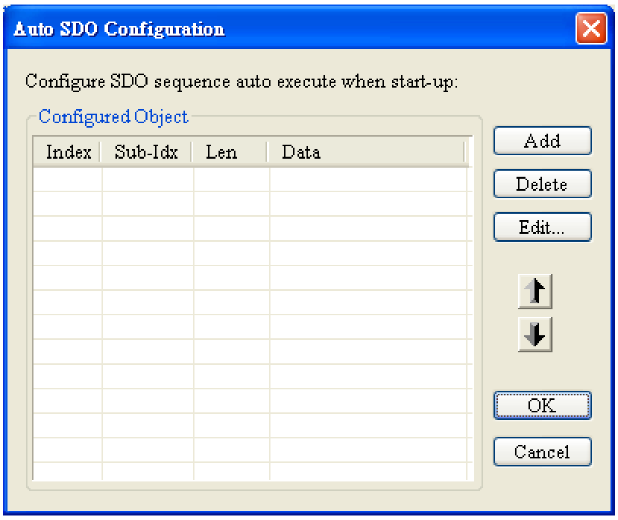
Parameter Name	Explanation	Remark
	the window of "heartbeat monitoring" by clicking the icon .	
Icon	Select one node in "Heartbeat" and then delete the selected node by clicking the icon .	--
"Edit" Button	Select one node in "Heartbeat monitoring" and revise the monitoring time clicking "Edit…"	--
"OK" Button	By clicking "OK" return to the dialogue box of "Node configuration" and the parameters set in "Error control setting" are saved	--
"Cancel" Button	By clicking "Cancel" return to the dialogue box of "Node configuration" and the parameters set in "Error control setting" are invalid.	--

- **Auto SDO Configuration**

In the "Node Configuration" page, click on "Auto SDO Configuration", and you will see the page as below.

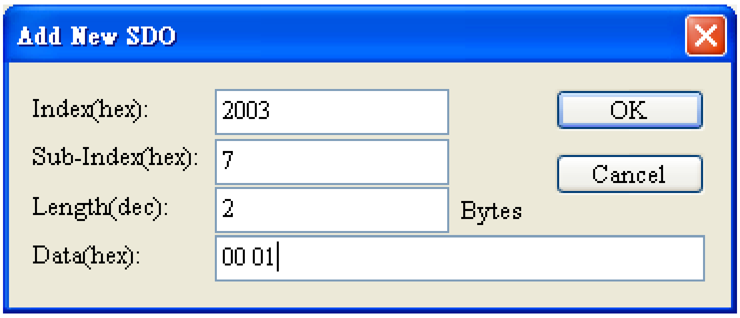
Click on "Add" to edit an auto SDO. Click on "Edit" to modify the selected auto SDO. Each slave can be configured with 20 auto SDOs at most.

The auto SDO can only be used for writing parameter values, rather than reading parameters and can only write to a slave once before the slave enters the operational state from the pre-operational state.



The following window pops up by clicking on "Add" button in the window above. "Index (hex)" and "Sub-Index (hex)" are the index and sub-index of the parameters to be accessed; "Length (dec)" is determined by the data type of the parameter to be accessed with the unit: byte.

The value in “Length (dec)” is 2 for the word-type parameter. “Data (hex)” is the data in hex format to be written into the parameter, the low byte in the left, high byte in the right and space between two bytes. For data type: double words, the low word is in the left and high word is in the right.

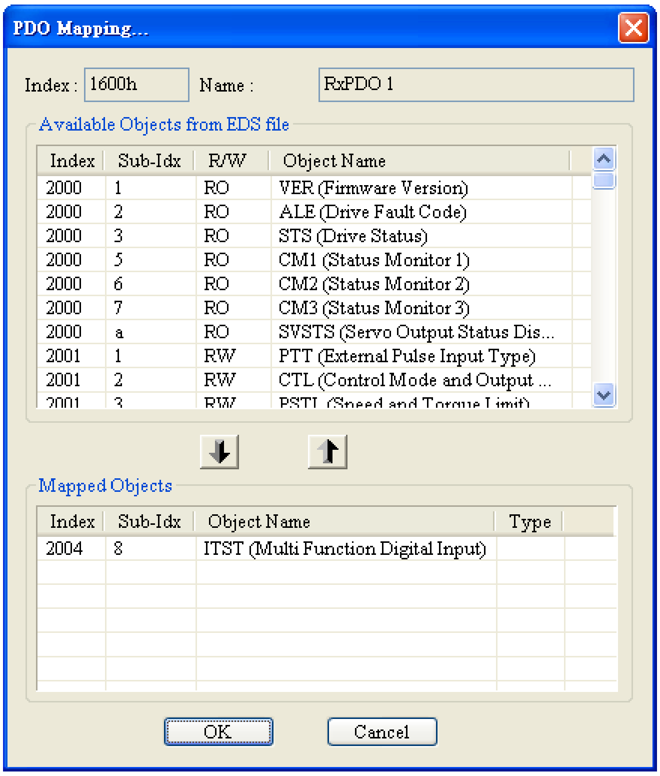


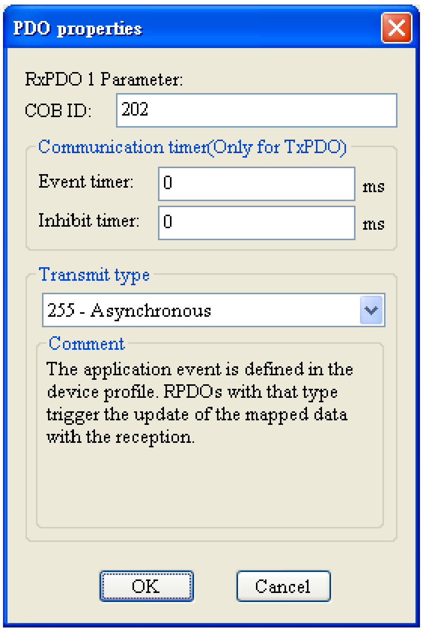
- **PDO mapping**

In the “Node Configuration…” page, select a TxPDO or RxPDO in “Configured PDO” and click on “PDO Mapping”, and you will come to the “PDO Mapping…” page as below. You can add the parameters in “Available Objects from EDS file” into “Mapped Objects”. The total length of the parameters added in each PDO CAN’T exceed 8 bytes. After the configuration is completed, click on “OK”.

In the “Node Configuration…” page, click on “Properties” to enter the "PDO Properties” page and modify COB-ID and Transmit type. After the configuration is completed, click on “OK”. In the “Node Configuration…” page, click on “Define PDO” to define RxPDO or TxPDO.

In this example, we adopt the default configuration. Finally, click “OK” in the “Node Configuration…” page.





PDO COB-ID setting rule is as follows.

RxPDO Number	COB-ID (HEX)	TxPDO Number	COB-ID (HEX)
RxPDO1	200 + slave node address	TxPDO1	180 + slave node address
RxPDO2	300 + slave node address	TxPDO2	280 + slave node address
RxPDO3	400 + slave node address	TxPDO3	380 + slave node address
RxPDO4	500 + slave node address	TxPDO4	480 + slave node address

Note:

The COB-IDs of RxPDO5 to RxPDO8 and TxPDO5 to TxPDO8 can be those of RxPDO1 to RxPDO4 and TxPDO1 to TxPDO4 of slaves which have not been used on the network yet. COB-ID of every PDO must NOT be identical.

PDO transmission types are listed as below.

Transmission Type		Description	Remark
0	RxPDO	Master transmits a SYNCH message to slave every SYNCH cycle. When there is a change for RxPDO data, RxPDO data is transmitted to slave and the data that slave receives is valid after receiving the next SYNCH message. When there is no change in RxPDO data, master does not transmit RxPDO data to slave.	SYNCH non-cycle
	TxPDO	Master transmits a SYNCH message to slave every SYNCH cycle. When TxPDO data changes, slave sends the TxPDO data to master after receiving SYNCH message, TxPDO data that master receives is valid immediately. When there is no change in TxPDO data, slave does not transmit TxPDO data to master.	
1	RxPDO	Master transmits a SYNCH message to slave every SYNCH cycle. Master sends out RxPDO data to slave once every SYNCH cycle. RxPDO data that slave receives from master is valid after slave receives the next SYNCH message.	SYNCH Cycle

Transmission Type		Description	Remark
	TxPDO	Master transmits a SYNCH message to slave every SYNCH cycle. Slave sends out TXPDO data to master once after receiving one SYNCH message. And then the TxPDO data master receives is valid immediately.	
2	RxPDO	Master transmits a SYNCH message to slave every SYNCH cycle. Master transmits RxPDO data to slave every two SYNCH cycles. The RxPDO data slave receives will be valid after slave receives the next SYNCH message.	SYNCH Cycle
	TxPDO	Master transmits a SYNCH message to slave every SYNCH cycle. Slave sends out TxPDO data to master once after receiving 2 SYNCH messages. And the TxPDO data master receives is valid immediately.	
3 to 240	RxPDO	Deduce from the transmission types: 1 and 2.	SYNCH Cycle
	TxPDO	Deduce from the transmission types: 1 and 2.	
254	RxPDO	When there is any change in RxPDO, RxPDO data is transmitted to slave and the PxPDO that slave receives is valid immediately. When there is no change in RxPDO, master does not send RxPDO data to slave.	ASYNCH
	TxPDO	When Event timer and inhibit timer are both 0, TxPDO data is transmitted to master after TXPDO data changes and the data that master receives will be valid immediately; when TxPDO data does not change, slave does not send out TxPDO data to master. When neither of Event timer nor inhibit timer are 0, slave sends out TxPDO data to master once every a period of Event timer. After TxPDO data is sent out, no TxPDO data is allowed to be sent out again within the period of inhibit timer and when TxPDO data changes, TxPDO data is transmitted to master at once and the data that master receives will be valid immediately.	
255	RxPDO	Same as the transmission type: 254	ASYNCH
	TxPDO	Same as the transmission type: 254	

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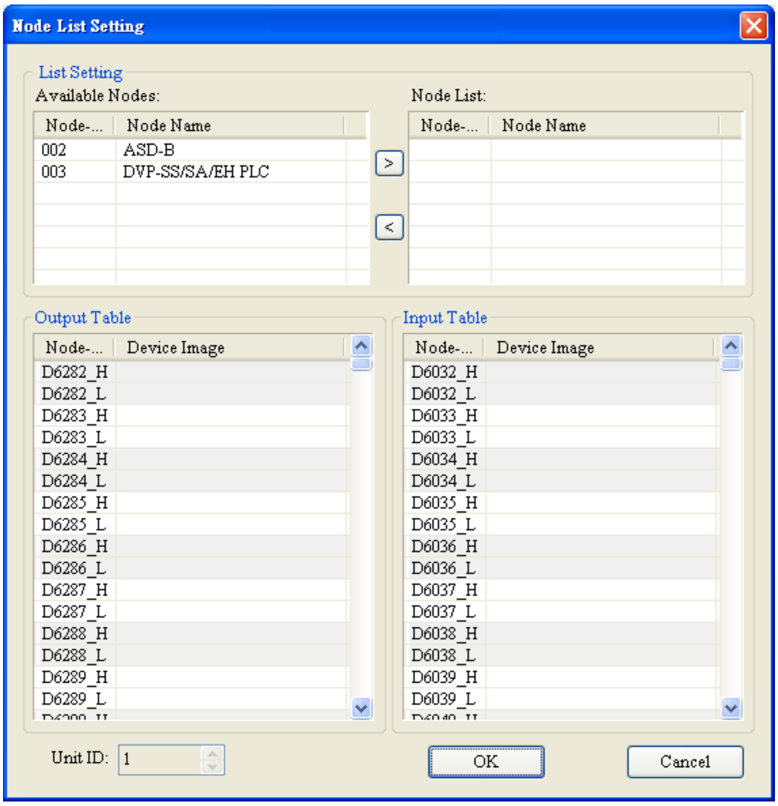
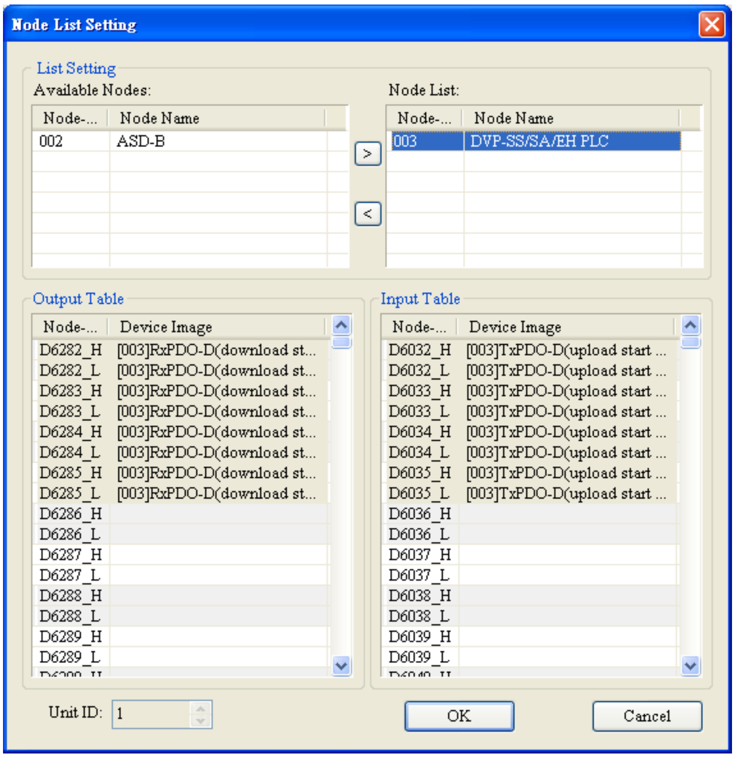
- Node List Setting

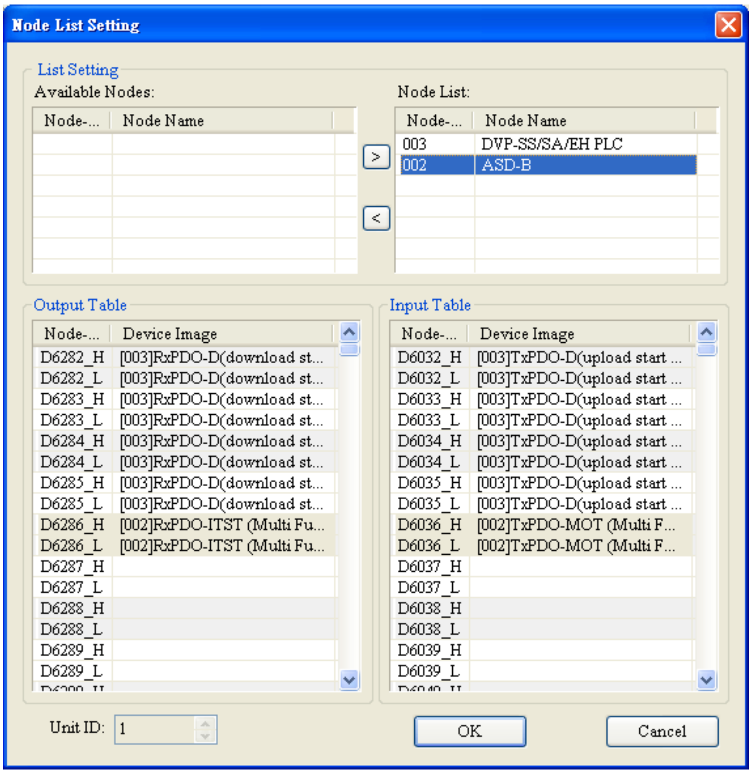
1. Double click on "DVPCOPM Master" icon, and you will see the "Node List Setting" dialog box as below.



2. In this example, first select DVP-SS/SA/EH PLC of Node 003 and click on [>] to add this node into the node list. After that, select Node 003 in the node list, and you will be able to see how the I/O data correspond to D registers in DVP-SV from the Output Table and Input Table below.

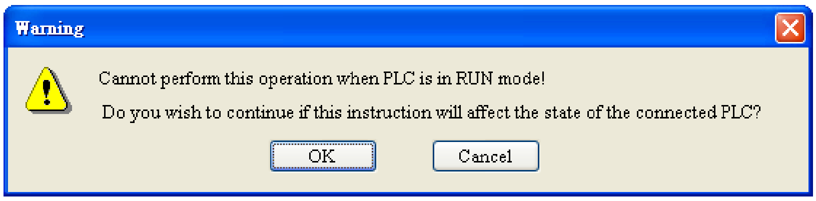


3. Add Node 002 into the node list in the same way, and you will be able to see how the I/O data correspond to D registers in DVP-SV from the Output Table and Input Table below. Click on "OK" to complete setting up the node list.

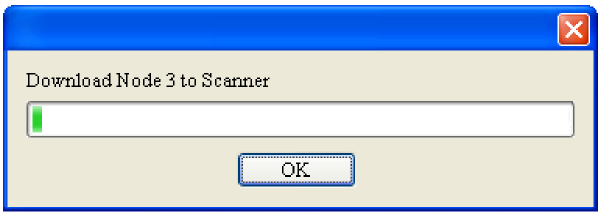


- Download data to the master

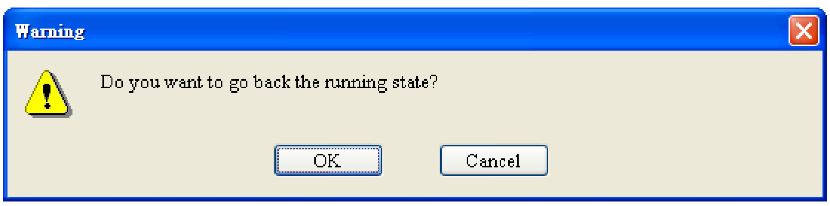
1. Select "Network" => "Download" to download the configuration data to DVPCOPM-SL master. If the PLC is in RUN status at this moment, you will be given a warning saying that you have to stop the operation before the download.



2. Click on "OK" to stop the PLC and start to download the data to the master.



3. After the download is completed, you will be given another warning, asking you if you would like to run the PLC again. Click on "OK" to restart the PLC program, or click on "Cancel" to stop the PLC.



13.3.5.1.4 Save Configuration Data

Select “File” => "Save” to save current configuration data.

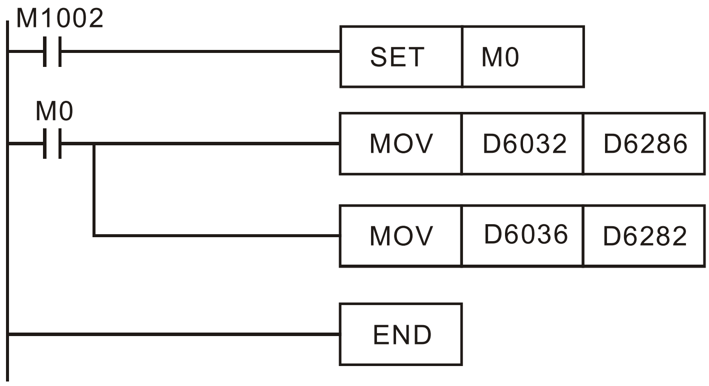
13.3.5.1.5 CANopen Network Control

In this section, we will introduce how to write WPL program to satisfy the requirement of the control over CANopen network.

1. Target

- When SW0 on Slave 3 is closed, the servo drive on Slave 2 will start to run.
- When SW0 on Slave 3 is open, the servo drive on Slave 2 will stop.
- When the status of SW1 and SW2 on Slave 3 is switched, the running speed of servo drive on Slave 2 can be modified.
- When the servo drive is running, the signal LED of Slave 2 will be On.
- When the servo drive stops, the signal LED of Slave 2 will be Off.

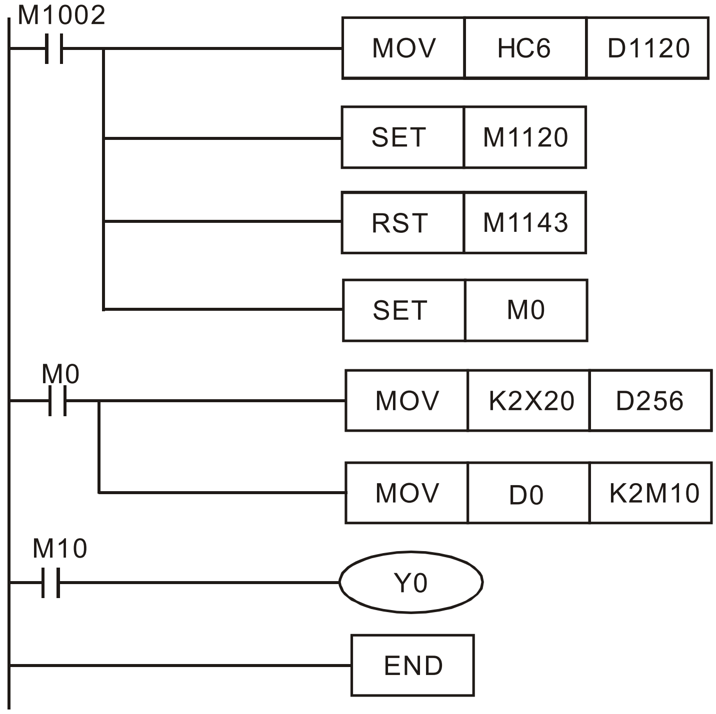
2. The program in DVP-SV CPU (master)



Program explanations:

- The 2nd row of the program indicates sending the content of D256 in DVP-SA (mapped in D6032 of DVP-SV) to the control word (mapped in D6286 of DVP-SV) of the servo drive.
- The 3rd row of the program indicates sending the output status of the servo drive (mapped in D6036 of DVP-SV) to D0 in DVP-SA (mapped in D6282 of DVP-SV).

The program in DVP-SA CPU (slave):



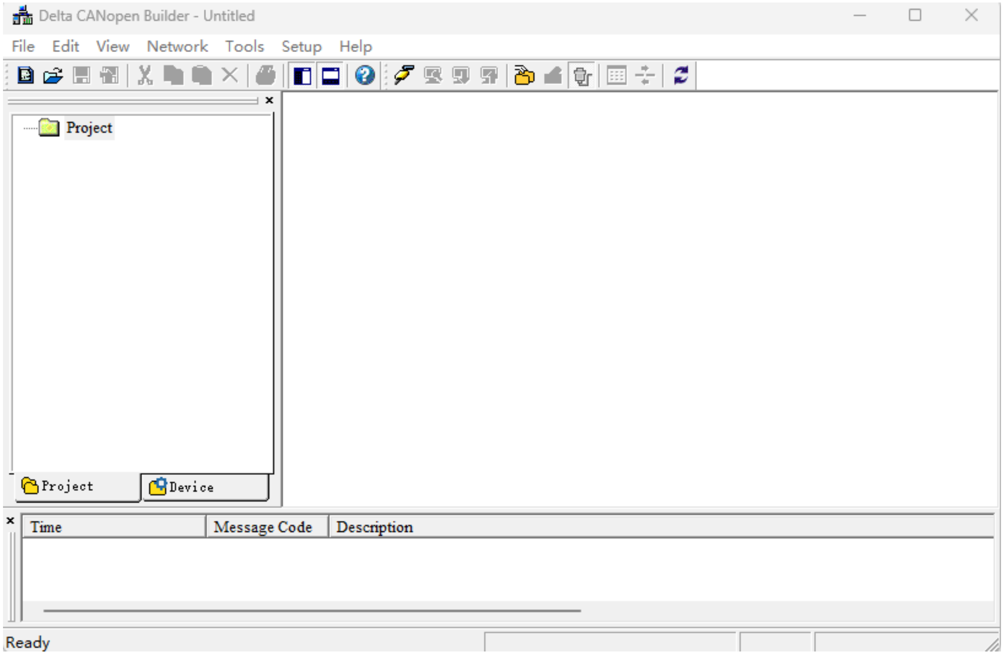
Program explanations:

- The first 3 rows of the program set up the communication format between DVP-SA and IFD9503, which is 115,200bps, 7E1-ASCII, and COM2 communication port.
- When M0 = On, send the input status of X20 to X27 of DVP-08ST to D256, and send the data in b0 to b15 of D0 to M10 to M25.
- When D0 = 1, M10 will be On, and Y0 of DVP-SA will output.

13.3.5.1.6 Upload CANopen Configuration

This section introduces how to upload the CANopen configuration from the DVPCOPM-SL via Delta CANopen Builder software.

1. Open the CANopen Builder software by double-clicking the CANopen Builder.exe file located within the ISPSoft installation directory, C:\Program Files (x86)\Delta Industrial Automation\ISPSoft 3.20\CANopenBuilder.
   (This function is supported by ISPSoft V3.20 and DVPCOPM-SL firmware V1.40 or later.)



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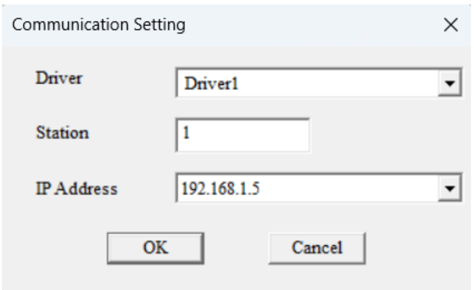
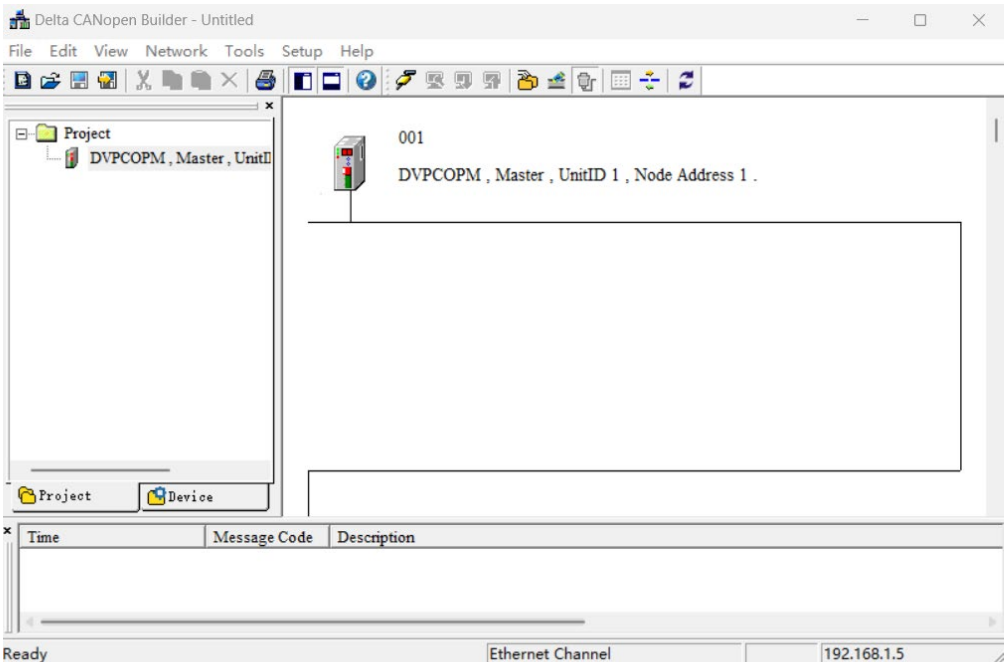
2. Click the menu **Setup** > **Communication Setting** to set communication.

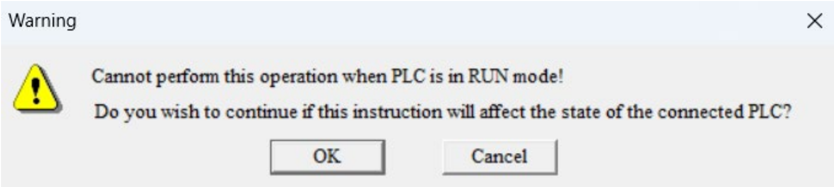


3. Click the menu **Network** > **Online** to establish communication with DVPCOPM-SL. If the communication is made successfully, the DVPCOPM-SL module will be displayed in the window.



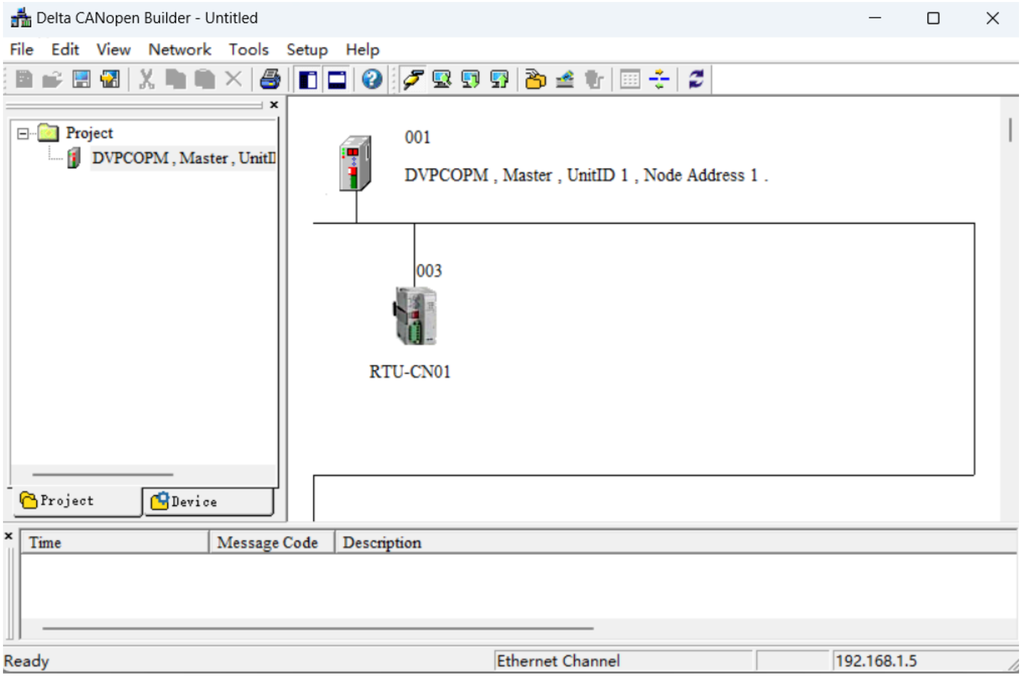
4. Click the menu **Network** > **Upload** or click the upload icon .

When the PLC is in the RUN state, a warning prompt box will pop up if you perform the upload operation. Click **OK** to set the PLC to the Stop state, and then the upload starts; click **Cancel** to cancel the upload operation.



After the upload is completed, the software will prompt whether to return the PLC to the RUN state. Click **OK** so that the PLC will return to the Run state; clicking **Cancel**, the PLC will remain in the Stop state.

After the upload is completed, the DVPCOPM-SL module and its saved CANopen configuration will be shown in the window.



13.3.5.2 Input and Output Mapping Areas

1. When DVPCOPM-SL serves as the CANopen master, the input and output mapping areas are described as below.

- When the PLC is DVP-SV3 or DVP-SX3, the input and output mapping areas for different positions on the left side of the PLC are shown in the table below. The position of the first one on the left of the PLC is 1, the second one is 2, and so on.

Mapping Area / Position	Output Mapping Area	Input Mapping Area
1	D16250 to D16476	D16000 to D16226
2	D16750 to D16976	D16500 to D16726
3	D17250 to D17476	D17000 to D17226
4	D17750 to D17976	D17500 to D17726
5	D18250 to D18476	D18000 to D18226
6	D18750 to D18976	D18500 to D18726
7	D19250 to D19476	D19000 to D19226
8	D19750 to D19976	D19500 to D19726

- When the PLC is another model in the DVP series (i.e., not DVP-SV3 or DVP-SX3), the input and output mapping areas for different positions on the left side of the PLC are shown in the table below. The position of the first one on the left of the PLC is 1, the second one is 2, and so on.

Mapping Area / Position	Output Mapping Area	Input Mapping Area
1	D6250 to D6476	D6000 to D6226
2	D6750 to D6976	D6500 to D6726
3	D7250 to D7476	D7000 to D7226
4	D7750 to D7976	D7500 to D7726
5	D8250 to D8476	D8000 to D8226
6	D8750 to D8976	D8500 to D8726
7	D9250 to D9476	D9000 to D9226
8	D9750 to D9976	D9500 to D9726

2. When DVPCOPM-SL serves as CANopen master, the request message areas and response message areas of SDO, NMT and Emergency, and PDO mapping areas are described as below.

- When the PLC is DVP-SV3 and DVP-SX3, the request message areas and response message areas of SDO, NMT and Emergency, and PDO mapping areas for different positions on the left side of the PLC are shown in the table below. The position of the first one on the left of the PLC is 1, the second one is 2, and so on.

Mapping area / Position	Request Message Area of SDO, NMT, Emergency	Response Message Area of SDO, NMT, Emergency	RxPDO Mapping Area	TxPDO Mapping Area
1	D16250 to D16281	D16000 to D16031	D16282 to D16476	D16032 to D16226
2	D16750 to D16781	D16500 to D16531	D16782 to D16976	D16532 to D16726
3	D17250 to D17281	D17000 to D17031	D17282 to D17476	D17032 to D17226
4	D17750 to D17781	D17500 to D17531	D17782 to D17976	D17532 to D17726
5	D18250 to D18281	D18000 to D18031	D18282 to D18476	D18032 to D18226
6	D18750 to D18781	D18500 to D18531	D18782 to D18976	D18532 to D18726
7	D19250 to D19281	D19000 to D19031	D19282 to D19476	D19032 to D19226
8	D19750 to D19781	D19500 to D19531	D19782 to D19976	D19532 to D19726

- When the PLC is another model in the DVP series (i.e., not DVP-SV3 or DVP-SX3), the request message areas and response message areas of SDO, NMT and Emergency, and PDO mapping areas for different positions on the left side of the PLC are shown in the table below. The position of the first one on the left of the PLC is 1, the second one is 2, and so on.

Mapping area / Position	Request Message Area of SDO, NMT, Emergency	Response Message Area of SDO, NMT, Emergency	RxPDO Mapping Area	TxPDO Mapping Area
1	D6250 to D6281	D6000 to D6031	D6282 to D6476	D6032 to D6226
2	D6750 to D6781	D6500 to D6531	D6782 to D6976	D6532 to D6726
3	D7250 to D7281	D7000 to D7031	D7282 to D7476	D7032 to D7226
4	D7750 to D7781	D7500 to D7531	D7782 to D7976	D7532 to D7726
5	D8250 to D8281	D8000 to D8031	D8282 to D8476	D8032 to D8226
6	D8750 to D8781	D8500 to D8531	D8782 to D8976	D8532 to D8726
7	D9250 to D9281	D9000 to D9031	D9282 to D9476	D9032 to D9226
8	D9750 to D9781	D9500 to D9531	D9782 to D9976	D9532 to D9726

3. When DVPCOPM-SL serves as CANopen slave, the input and output mapping areas for different positions of the left side of the PLC are as below.

- When the PLC is DVP-SV3 and DVP-SX3, the input and output mapping areas for different positions on the left side of the PLC are shown in the table below. The position of the first one on the left of the PLC is 1, the second one is 2, and so on.

Mapping area / Position	Output Mapping Area	Input Mapping Area
1	D16282 to D16476	D16032 to D16226
2	D16782 to D16976	D16532 to D16726
3	D17282 to D17476	D17032 to D17226
4	D17782 to D17976	D17532 to D17726
5	D18282 to D18476	D18032 to D18226
6	D18782 to D18976	D18532 to D18726
7	D19282 to D19476	D19032 to D19226
8	D19782 to D19976	D19532 to D19726

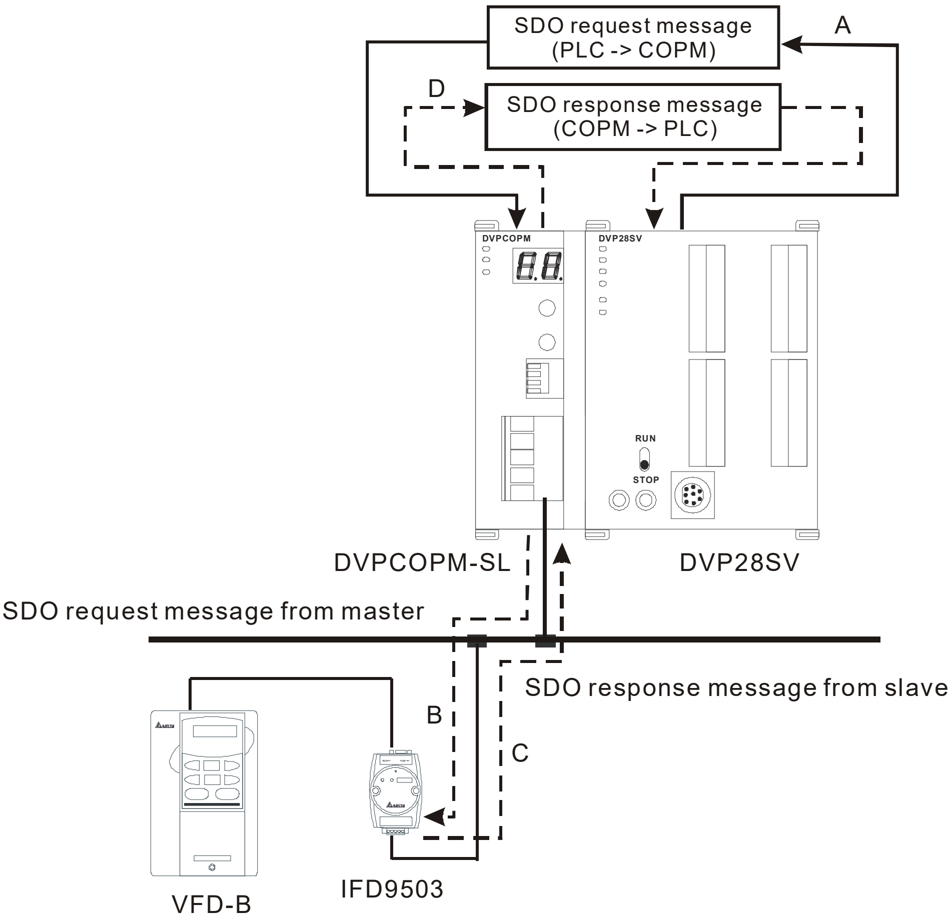
- When the PLC is another model in the DVP series (i.e., not DVP-SV3 or DVP-SX3), the input and output mapping areas for different positions on the left side of the PLC are shown in the table below. The position of the first one on the left of the PLC is 1, the second one is 2, and so on.

Mapping area / Position	Output Mapping Area	Input Mapping Area
1	D6282 to D6476	D6032 to D6226
2	D6782 to D6976	D6532 to D6726
3	D7282 to D7476	D7032 to D7226
4	D7782 to D7976	D7532 to D7726
5	D8282 to D8476	D8032 to D8226
6	D8782 to D8976	D8532 to D8726
7	D9282 to D9476	D9032 to D9226
8	D9782 to D9976	D9532 to D9726

13.3.5.3 Send SDO, NMT and Read Emergency by Ladder Diagram

13.3.5.3.1 Principle

See the chart below for sending SDO by WPL program:



A: PLC sends out the request message to DVPCOPM-SL (master).

B: DVPCOPM-SL (master) sends out the request message to the target equipment.

C: The target equipment processes the request message and sends the response message to DVPCOPM-SL.

D: PLC receives SDO, NMT and Emergency data.

Note: The corresponding device addresses are different for DVPCOPM-SL with different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. In this case, the PLC is exemplified by DVP-28SV.

13.3.5.3.2 Structures of SDO Request and Response Message

You can edit SDO, NMT and Emergency in "request message editing area". Take the first DVPCOPM-SL master placed on the left-hand side of DVP-SV for example. See the table below for the corresponding relation between "request message editing area" and "response message editing area" and the devices in PLC.

PLC device	Mapping area	Data length
D6000 to D6031	SDO response message and Emergency response message	64 bytes
D6250 to D6281	SDO request message, NMT service message and Emergency request message	64 bytes

1. Structure of SDO request message:

<table>
<tr><th rowspan="2">PLC device</th><th colspan="17">Request Message</th></tr>
<tr><th></th><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>D6250</td><td rowspan="3">Message Header</td><td colspan="8">ReqID</td><td colspan="8">Command</td></tr>
<tr><td>D6251</td><td colspan="8">Reserved</td><td colspan="8">Size</td></tr>
<tr><td>D6252</td><td colspan="8">Type</td><td colspan="8">MAC ID</td></tr>
<tr><td>D6253</td><td rowspan="5">Message Data</td><td colspan="8">Index high byte</td><td colspan="8">Index low byte</td></tr>
<tr><td>D6254</td><td colspan="8">Reserved</td><td colspan="8">Sub-index</td></tr>
<tr><td>D6255</td><td colspan="8">Datum 1</td><td colspan="8">Datum 0</td></tr>
<tr><td>D6256</td><td colspan="8">Datum 3</td><td colspan="8">Datum 2</td></tr>
<tr><td>D6257 to D6281</td><td colspan="16">Reserved</td></tr>
</table>

- Command: Fixed to "01Hex".
- ReqID: Request ID. Whenever an SDO request message is sent out, the message will be given a ReqID for CANopen master to identify. For the next request message to be sent out, you have to change the ID number. Range of ReqID: 00Hex to FFHex.
- Size: Data length of the message. Max. 8 bytes. Unit: byte.
- MAC ID: Node address of the target equipment on the CANopen network.
- Type: In SDO request message, 01Hex refers to SDO data read service; 02Hex refers to SDO data write service; In the SDO response messages, 43Hex indicates reading 4 bytes of data, and 4BHex indicates reading 2 bytes of data. 4FHex means to read 1 byte of data; 60Hex means to write 1/2/4 byte(s) of data; 80Hex means to end SDO command. For example, if the type is 02Hex in SDO request message, the type is 60Hex in the SDO response message when writing data is successful.

2. Structure of SDO response message:

PLC device	Response message																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
D6000	Message header	ReqID								Status							
D6001		Reserved								Size							
D6002		Type								MAC ID							
D6003	Message data	Index high byte								Index low byte							
D6004		Reserved								Sub-index							
D6005		Datum 1								Datum 0							
D6006		Datum 3								Datum 2							
D6007 to D6031		Reserved															

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- Status code:

Status code	Explanation
0	No data transmission request
1	The SDO message transmission is successful.
2	The SDO message is being transmitted.
3	Error: SDO transmission timeout
4	Error: Illegal command
5	Error: Size of the request message is illegal.
6	Error: Size of the response message is illegal.
7	Error: Equipment to be sent messages is busy.
8	Error: Illegal type
9	Error: Incorrect node address
0A	Error information (See the error code for SDO response message)
0B to FF	Reserved

- ReqID: Normally, the same as the ReqID in the request message.
- Size: Data length of the message, the maximum length is 20. Unit: Bytes
- MAC ID: Node address of the target equipment on the CANopen network.
- Type: In the SDO response message, 43Hex means that 4-byte data are read; 4BHex means that 2-byte data are read; 4FHex means that 1-byte data are read; 60Hex means that 1/2/4 byte (s) of data are written, 80Hex means ending the SDO command. E.g., if the type is 02Hex in the SDO request message, the type in the SDO response message is 60Hex when writing data is successful.

13.3.5.3.3 Structure of NMT Service Message

You can send the NMT request message to D6250 to D6281, and the slave will not respond with a message.

Note: The corresponding device addresses are different for DVPCOPM-SL with different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. Here the PLC is DVP-28SV.

PLC device	Request Message																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
D6250	Message Header	ReqID								Command							
D6251		Reserved								Size (fixed to 04Hex)							
D6252		Type (fixed to 03Hex)								MAC ID							
D6253	Message Data	Reserved								NMT service code							
D6254		Reserved								MAC ID							

- Command: Fixed to “01Hex”.
- ReqID: Request ID. Whenever a NMT request message is sent out, the message will be given a ReqID for the CANopen master to identify. For the next NMT request message to be sent out, you have to change the ID number. Range of ReqID: 00Hex to FFHex.
- MAC ID: Node address of the target equipment on the CANopen network.
- NMT service code:

  01Hex: Enable remote node; 02Hex: Disable remote node; 80Hex: Enter pre-operational status; 81Hex: Reset application; 82Hex: Reset communication.

Example: If you want to stop node 03 equipment on the CANopen network, you have to set NMT service code to “02Hex” and MAC ID to “03".

13.3.5.3.4 Structures of Emergency Request and Response Messages

The corresponding device addresses are different for DVPCOPM-SL with different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. The PLC here is DVP-28SV.

1. See the table below for the format of Emergency request message:

PLC device	Request Message																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
D6250	Message Header	ReqID								Command							
D6251		Reserved								Size (fixed to 0)							
D6252		Type (fixed to 04Hex)								MAC ID							
D6253 to D6281	Message Data	Reserved															

2. See the table below for the format of Emergency response message:

<table>
<tr><th rowspan="2">PLC device</th><th colspan="17">Response Message</th></tr>
<tr><th></th><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>D6000</td><td rowspan="3">Message Header</td><td colspan="8">ReqID</td><td colspan="8">Status</td></tr>
<tr><td>D6001</td><td colspan="8">Reserved</td><td colspan="8">Size (2A Hex)</td></tr>
<tr><td>D6002</td><td colspan="8">Type (04Hex)</td><td colspan="8">MAC ID</td></tr>
<tr><td>D6003</td><td rowspan="6">Message Data</td><td colspan="8">Total number of data</td><td colspan="8">Number of data stored</td></tr>
<tr><td>D6004</td><td colspan="8">Datum 1</td><td colspan="8">Datum 0</td></tr>
<tr><td>D6005</td><td colspan="8">Datum 3</td><td colspan="8">Datum 2</td></tr>
<tr><td>D6006</td><td colspan="8">Datum 5</td><td colspan="8">Datum 4</td></tr>
<tr><td>D6007</td><td colspan="8">Datum 7</td><td colspan="8">Datum 6</td></tr>
<tr><td>D6008 to D6011</td><td colspan="16">Emergency2</td></tr>
<tr><td>D6012 to D6015</td><td rowspan="4">Message Data</td><td colspan="16">Emergency3</td></tr>
<tr><td>D6016 to D6019</td><td colspan="16">Emergency4</td></tr>
<tr><td>D6020 to D6023</td><td colspan="16">Emergency5</td></tr>
<tr><td>D6024 to D6031</td><td colspan="16">Reserved</td></tr>
</table>

- Command: Fixed to “01Hex”.
- ReqID: Request ID. Whenever an Emergency message is sent out, the message will be given a ReqID for the CANopen master to identify. For the next Emergency message to be sent out, you have to change the ID number. Range of ReqID: 00Hex to FFHex.
- MAC ID: Node address of the target equipment on CANopen network.
- Total number of data: Total number of Emergency messages CANopen master receives.
- Number of data stored: The latest number of Emergency messages CANopen master receives. (Every slave gives less than 5 Emergency messages.)

Note:

- CANopen master can only send out one SDO, NMT or Emergency request message to one piece of equipment every time.
- When you use WPL program to send out SDO, NMT or Emergency request messages, we recommend you clear the “request message editing area” and “response message editing area” to 0.

13.3.5.3.5 Application Examples

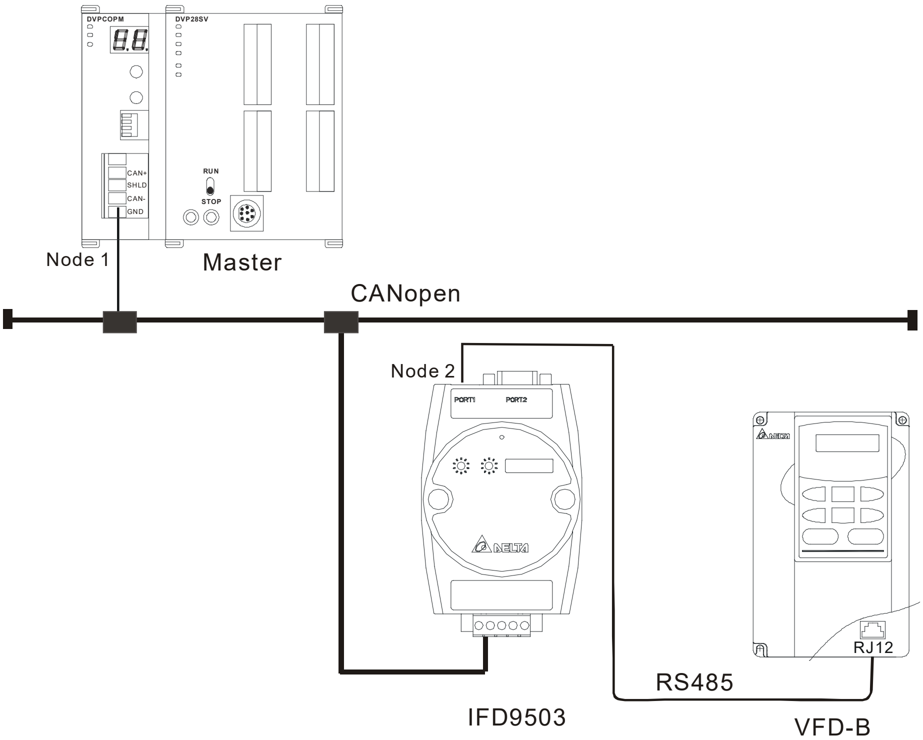
In this section, we will illustrate how to write a WPL program to send out SDO and NMT messages or read Emergency request messages.

(Note: the PLC is DVP-28SV here.)

1. Example I

- Control requirement:

When M0 turns ON, the actual output frequency of the AC motor drive is read via SDO. The corresponding index/ sub-index of the actual output frequency of the AC motor drive is 2021/4.



- Required settings in DVPCOPM-SL:

Parameter	Setting	Explanation
Node address	01	Set the node address of DVPCOPM-SL to “01”.
Baud rate	1 Mbps	Set the communication speed between DVPCOPM-SL and bus to “1 Mbps”.

- Required settings in IFD9503:

Parameter	Setting	Explanation
Node address	02	Set the node address of IFD9503 to “02”.
Baud rate	1 Mbps	Set the communication speed between IFD9503 and bus to “1 Mbps”.

- Required settings in VFD-B AC motor drive

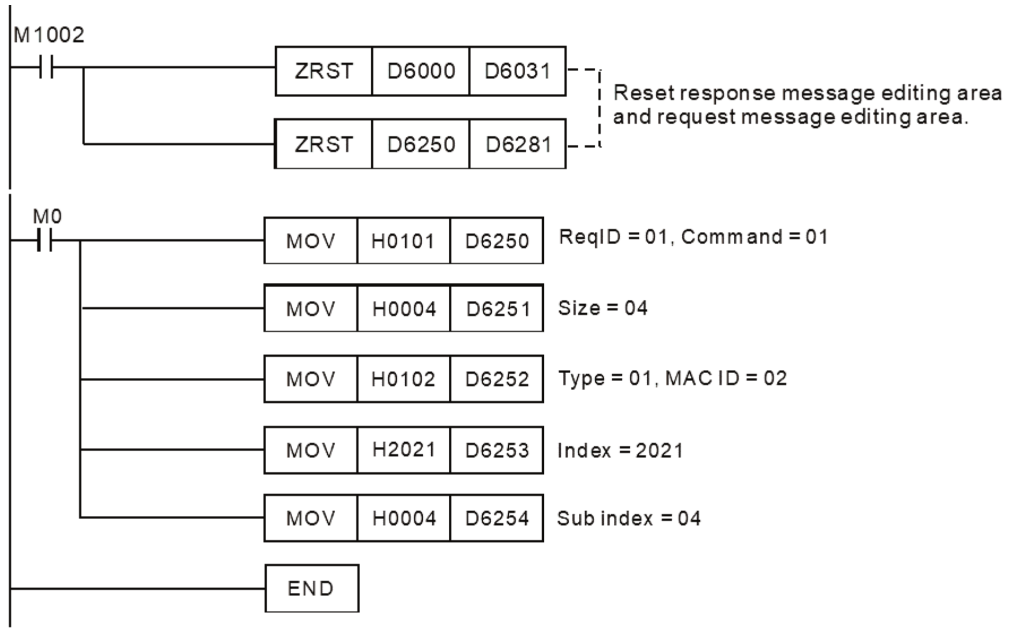
Parameter	Setting	Explanation
02-00	04	The main frequency is operated by RS-485 interface.
02-01	03	The running command is operated by communication interface. Operation by keys is valid.
09-00	01	Communication address of VFD-B: 01
09-01	03	Baud rate: 38,400 bps
09-04	03	Modbus RTU mode, format <8, N, 2>

- Devices in the PLC:

<table>
<tr><th colspan="2" rowspan="2">PLC device</th><th rowspan="2">Content</th><th colspan="16">Explanation</th></tr>
<tr><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td rowspan="5">SDO request message editing area</td><td>D6250</td><td>0101Hex</td><td colspan="8">ReqID = 01Hex</td><td colspan="8">Command = 01Hex</td></tr>
<tr><td>D6251</td><td>0004Hex</td><td colspan="8">Reserved</td><td colspan="8">Size = 04Hex</td></tr>
<tr><td>D6252</td><td>0102Hex</td><td colspan="8">Type = 01Hex</td><td colspan="8">MAC ID = 02Hex</td></tr>
<tr><td>D6253</td><td>2021Hex</td><td colspan="8">High byte of index = 20Hex</td><td colspan="8">Low byte of index = 21Hex</td></tr>
<tr><td>D6254</td><td>0004Hex</td><td colspan="8">Reserved</td><td colspan="8">Sub index = 04Hex</td></tr>
<tr><td rowspan="6">SDO response message editing area</td><td>D6000</td><td>0101Hex</td><td colspan="8">ReqID = 01Hex</td><td colspan="8">Status = 01Hex</td></tr>
<tr><td>D6001</td><td>0006Hex</td><td colspan="8">Reserved</td><td colspan="8">Size = 06Hex</td></tr>
<tr><td>D6002</td><td>4B02Hex</td><td colspan="8">Type = 4BHex</td><td colspan="8">MAC ID = 02Hex</td></tr>
<tr><td>D6003</td><td>2021Hex</td><td colspan="8">High byte of index = 20Hex</td><td colspan="8">Low byte of index = 21Hex</td></tr>
<tr><td>D6004</td><td>0004Hex</td><td colspan="8">Reserved</td><td colspan="8">Sub index = 04Hex</td></tr>
<tr><td>D6005</td><td>0100Hex</td><td colspan="8">Datum 1= 01Hex</td><td colspan="8">Datum 0 = 00Hex</td></tr>
</table>

The value 0100Hex in D6005 indicates that the actual output frequency of the AC motor drive is 2.56 Hz.

- PLC program



Program explanation

1) At the beginning of the program, the SDO request information mapping area and the SDO response information mapping area are first cleared to zero.

2) When M0 = On, CANopen master will send out a SDO request message to read the contents in index 2021 and subindex 4 of the target equipment (at node address 02). If the communication is successful, the slave will return a response message.

3) When M0 = On, CANopen master will send out the request message only once. If you would like it to send out one more request message, you will have to change the ReqID.

4) Upon successful reading, the data returned from the target equipment are stored in D6000 to D6005.

2. Example II

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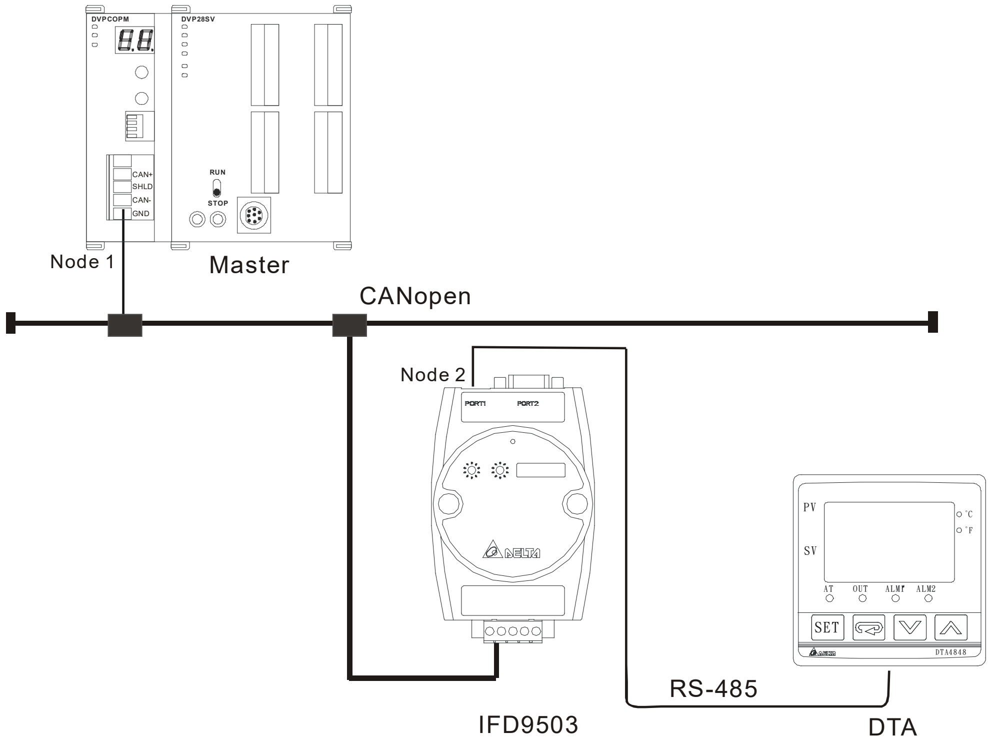
- Control requirement:

When M0 turns ON, the target temperature of the DTA temperature controller is set to 26.0℃ via SDO. The corresponding index/ sub-index of the target temperature of the DTA is 2047/2.



- Required settings in DVPCOPM-SL

Parameter	Setting	Explanation
Node address	01	Set the node address of DVPCOPM-SL to “01”.
Baud rate	1 Mbps	Set the communication speed between DVPCOPM-SL and the bus to “1 Mbps”.

- Required settings in IFD9503

Parameter	Setting	Explanation
Node address	02	Set the node address of IFD9503 to “02”.
Baud rate	1 Mbps	Set the communication speed between IFD9503 and the bus to “1 Mbps”.

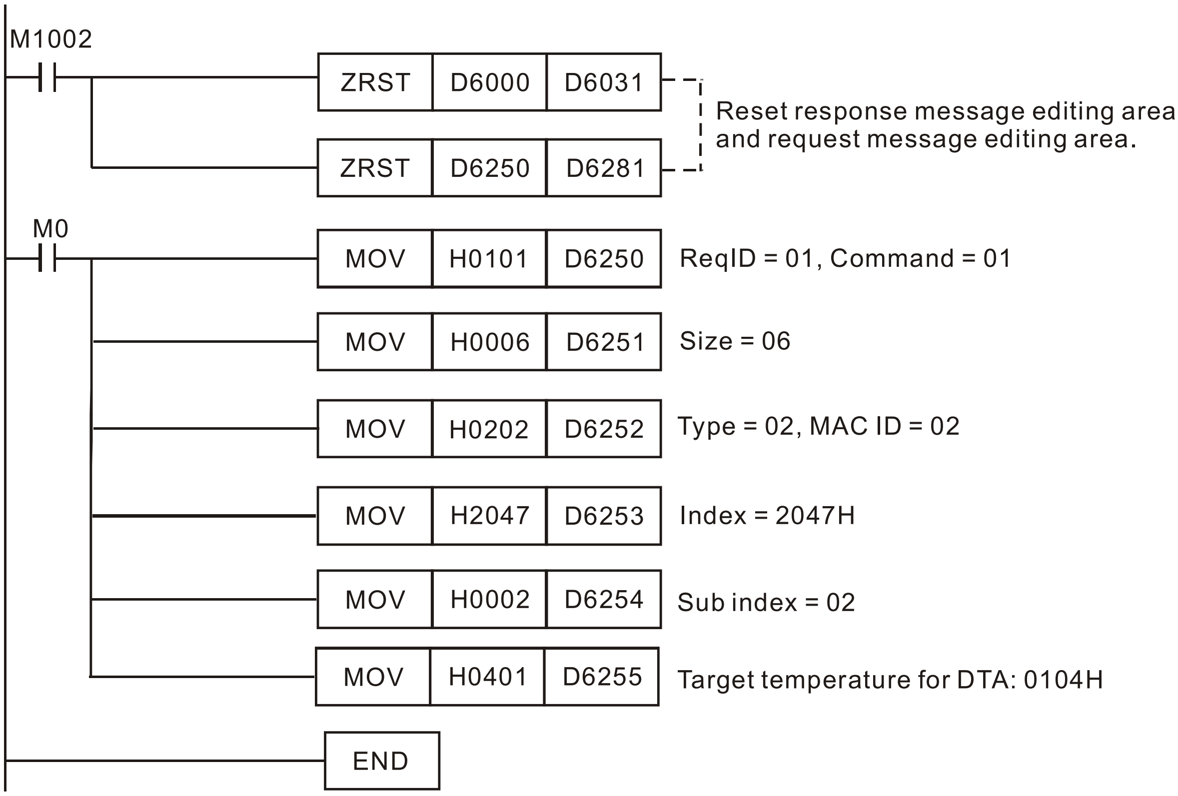
- Required settings in DTA temperature controller

Parameter	Setting	Explanation
CoSH	On	C WE: Enable/disable communication write-in
C-SL	ASCII	C-SL: Select ASCII or RTU format
C-no	1	C NO: Set up communication address
bPS	38400	BPS: Set up communication speed
LEn	7	LENGTH: Set up data length
PrtY	E	PARITY: Set up parity bit
StoP	1	STOP BIT: Set up stop bit
tPUn	℃	UNIT: Select temperature unit, °C or °F

- Devices in PLC

<table>
<tr><th colspan="2" rowspan="2">PLC Device</th><th rowspan="2">Content</th><th colspan="16">Explanation</th></tr>
<tr><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td rowspan="6">SDO request message editing area</td><td>D6250</td><td>0101Hex</td><td colspan="8">ReqID = 01Hex</td><td colspan="8">Command = 01Hex</td></tr>
<tr><td>D6251</td><td>0006Hex</td><td colspan="8">Reserved</td><td colspan="8">Size = 06Hex</td></tr>
<tr><td>D6252</td><td>0202Hex</td><td colspan="8">Type = 02Hex</td><td colspan="8">MAC ID = 02Hex</td></tr>
<tr><td>D6253</td><td>2047Hex</td><td colspan="8">High byte of index = 20Hex</td><td colspan="8">Low byte of index = 47Hex</td></tr>
<tr><td>D6254</td><td>0002Hex</td><td colspan="8">Reserved</td><td colspan="8">Sub index = 02Hex</td></tr>
<tr><td>D6255</td><td>0401 Hex</td><td colspan="8">Datum 1= 04Hex</td><td colspan="8">Datum 0= 01Hex</td></tr>
<tr><td rowspan="5">SDO response message editing area</td><td>D6000</td><td>0101Hex</td><td colspan="8">ReqID = 01Hex</td><td colspan="8">Status = 01Hex</td></tr>
<tr><td>D6001</td><td>0004Hex</td><td colspan="8">Reserved</td><td colspan="8">Size = 04Hex</td></tr>
<tr><td>D6002</td><td>6002Hex</td><td colspan="8">Type = 60Hex</td><td colspan="8">MAC ID = 02Hex</td></tr>
<tr><td>D6003</td><td>2047Hex</td><td colspan="8">High byte of index = 20Hex</td><td colspan="8">Low byte of index = 47Hex</td></tr>
<tr><td>D6004</td><td>0002Hex</td><td colspan="8">Reserved</td><td colspan="8">Sub index = 02Hex</td></tr>
</table>

- PLC program



Program explanation:

1. At the beginning of the program, the SDO request message editing area and SDO response message editing area are first cleared to zero.
2. When M0= On, CANopen master will send out a SDO request message to write 0104Hex into index 2047, sub index 2 of the target equipment (at node address 02). If the communication is successful, the slave will return a response message.
3. When M0 = On, CANopen master will send out the request message only once. If you would like it to send out one more message, you will have to change the ReqID.
4. Upon successful reading, the messages returned from the target equipment are stored in D6000 to D6004.

13.3.5.4 Network Node Status Display

The state of all slaves on the CANopen network can be read through reading 5002/1 (index/subindex) value by sending SDO messages via the ladder diagram; the master state of the CANopen network can be read through reading 5003/1 (index/subindex) value by sending SDO messages via the ladder diagram; the CANopen network state can be read through reading 5004/1 (index/subindex) value by sending SDO messages via the ladder diagram.

13.3.5.4.1 Slave State of CANopen Network

Users can read the content value in H’5002>>H’01 (index>>subindex) to acquire the status of the slaves on the CANopen network by sending SDO.

Index	Subindex	Object Name	Data Type	Attribute	Default
H’5002	H’00	Entry	Unsigned 16 bits	Read-only	---
	H’01	Status word of node 1 to node 127	Unsigned 128 bits	Read-only	---

The corresponding relations between index H”5002>> subindex H’01 and network nodes are as follows.

H’5002>>H’01	Corresponding Network Node					
	b15	b14	b13	… …	b1	b0
Word 0	Node 15	Node 14	Node 13	… …	Node 1	Reserved
Word 1	Node 31	Node 30	Node 29	… …	Node 17	Node 16
Word 2	Node 47	Node 46	Node 45	… …	Node 33	Node 32
Word 3	Node 63	Node 62	Node 61	… …	Node 49	Node 48
Word 4	Node 79	Node 78	Node 77	… …	Node 65	Node 64
Word 5	Node 95	Node 94	Node 93	… …	Node 81	Node 80
Word 6	Node 111	Node 110	Node 109	… …	Node 97	Node 96
Word 7	Node 127	Node 126	Node 125	… …	Node 113	Node 112

The corresponding bits are in OFF status when the nodes in the node list of the master module are normal; the corresponding bits are in ON status when the nodes in the node list of the master module are abnormal, e.g. Initializing fails, or other abnormality causes slave offline.

13.3.5.4.2 Master Status of CANopen Network

Users can read the content value in H’5003>>H’01 to acquire the master module status on the CANopen network by sending SDO messages. When the master module is at normal work, the content value in H’5003>>H’01 is 0; when there is any error in the master module, the content value in H’5003>>H’01 is the corresponding error code.

Index	Subindex	Object Name	Data Type	Attribute	Default
H’5003	H’00	Entry	Unsigned 16 bits	Read-only	---
	H’01	Status of the master module	Unsigned 16 bits	Read-only	---

Explanation of the Content value for H’5003>>H’01.

Content Value	Explanation	Actions
F1	No slave has been added to the node list of CANopen Builder.	Add the slave to the node list and redownload configuration to DVPCOPM-SL
F2	In process of downloading configuration to DVPCOPM-SL.	Wait till the configuration download is finished.
F3	DVPCOPM-SL in error status	Redownload configuration. Replace it with a new DVPCOPM-SL if the error still exists.
F4	Bus-off is detected	Check the wiring for all cables of CANopen network is proper; ensure all nodes on the network work at same baud rate and finally repower DVPCOPM-SL.
F5	The setting for DVPCOPM-SL node address is incorrect	The DVPCOPM-SL node address should be set in the range of 1 to 127.
F9	Low-voltage detection error	Check and ensure the work power for DVPCOPM-SL is normal.
FA	The inner firmware of DVPCOPM-SL is in error state.	Repower DVPCOPM-SL.
FB	The storage space sending data in DVPCOPM-SL is full.	Check and ensure bus cable connection is normal and then repower DVPCOPM-SL.
FC	The storage space receiving data in DVPCOPM-SL is full.	Check and ensure bus cable connection is normal and then repower DVPCOPM-SL.
0	The master is in normal status	--

13.3.5.4.3 CANopen Network Status

Users can read the content value in H’5004>>H’01 to acquire CANopen network status by editing ladder diagram to send SDO. When all nodes on the CANopen network are all at normal work, the content value in H’5004>>H’01 is 0; when any node of CANopen network is abnormal or initializing fails, the content value in H’5004>>H’01 is 1.

Index	Subindex	Object Name	Data Type	Attribute	Default
H’5004	H’00	Entry	Unsigned 16 bits	Read-only	---
	H’01	CANopen network status	Unsigned 16 bits	Read-only	---

13.3.5.4.4 Data Structures of SDO Request and Response Messages

Here, the SDO request message structure is for 5002/1 (index/ subindex), 5003/1 (index/ subindex), 5004/1 (index/ subindex) only and can be realized by editing the request message mapping area. Take DVPCOPM-SL, the first master module on the left of PLC as an example, the table below shows the corresponding relations between request and response message mapping areas, and PLC devices.

Note: The corresponding device addresses are different for DVPCOPM-SL with different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. The PLC here is DVP-28SV.

PLC Device	Mapping Area	Mapping Length
D6000 to D6031	SDO response message area	64 bytes
D6250 to D6281	SDO request message area	64 bytes

Structure of SDO Request Message

PLC Device	Request Message		
		15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
D6250	Message header	Request ID	Command code
D6251		Reserved	Data length
D6252		Type	MAC ID
D6253	Message data	Main index high byte	Main index low byte
D6254		Reserved	Subindex
D6255		Data1	Data 0
D6256		Data 3	Data 2
D6257 to D6281		Reserved	

- Command code: Fixed to 01 (Hex)
- Request ID: Every SDO request message to be sent out should be given a request ID. CANopen master identifies every request message via "Request ID" which must be changed for the next communication after current communication is finished. The value range for Request ID is 00 (Hex) to FF (Hex).
- Data length: Data length of the message is fixed to 4 bits.
- MAC ID: Node address of CANopen network master.
- Type: Fixed to 1 in SDO request message which indicates SDO data reading service.

Structure of SDO Response Message

PLC Device	Response Message		
		15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0
D6000	Message Header	Response ID	Status code
D6001		Reserved	Data Length
D6002		Type	MAC ID
D6003	Message Data	Main index high byte	Main index low byte
D6004		Reserved	Subindex
D6005		Data 1	Data 0
D6006		Data 3	Data 2
D6007		Data 5	Data 4
D6008		Data 7	Data 6
D6009		Data 9	Data 8
D6010		Data 11	Data 10
D6011		Data 13	Data 12
D6012		Data 15	Data 14
D6013 to D6031		Reserved	

- Status Code

Status Code	Explanation
0	No data transmission request
1	SDO message transmission succeeds.
2	SDO message is being transmitted.
3	Error – SDO message transmitting is time-out.
4	Error – Command code is invalid.
5	Error – The transmitted data length is invalid.
6	Error – Response data length is invalid.
7	Error – The device which is to be used for transmission is busy.
8	Error – Type code is invalid.
9	Error – Node address is wrong.
0A	Error information (refer to the error code in SDO response message)
0B to FF	Reserved

- Response ID: Normally, the same as Request ID in a request message; in abnormal status, Response ID is 0.
- Data length: Data length of message data; maximum value: 32; Unit: byte.
- MAC ID: Node address of CANopen network master.
- Type: In SDO response message, 43 (Hex) represents that data of 4 bytes are read; 4B (Hex) represents that data of 2 bytes are read; 4F (Hex) represents that data of 1 byte are read and 42 (Hex) represents data longer than 4 bytes are read.

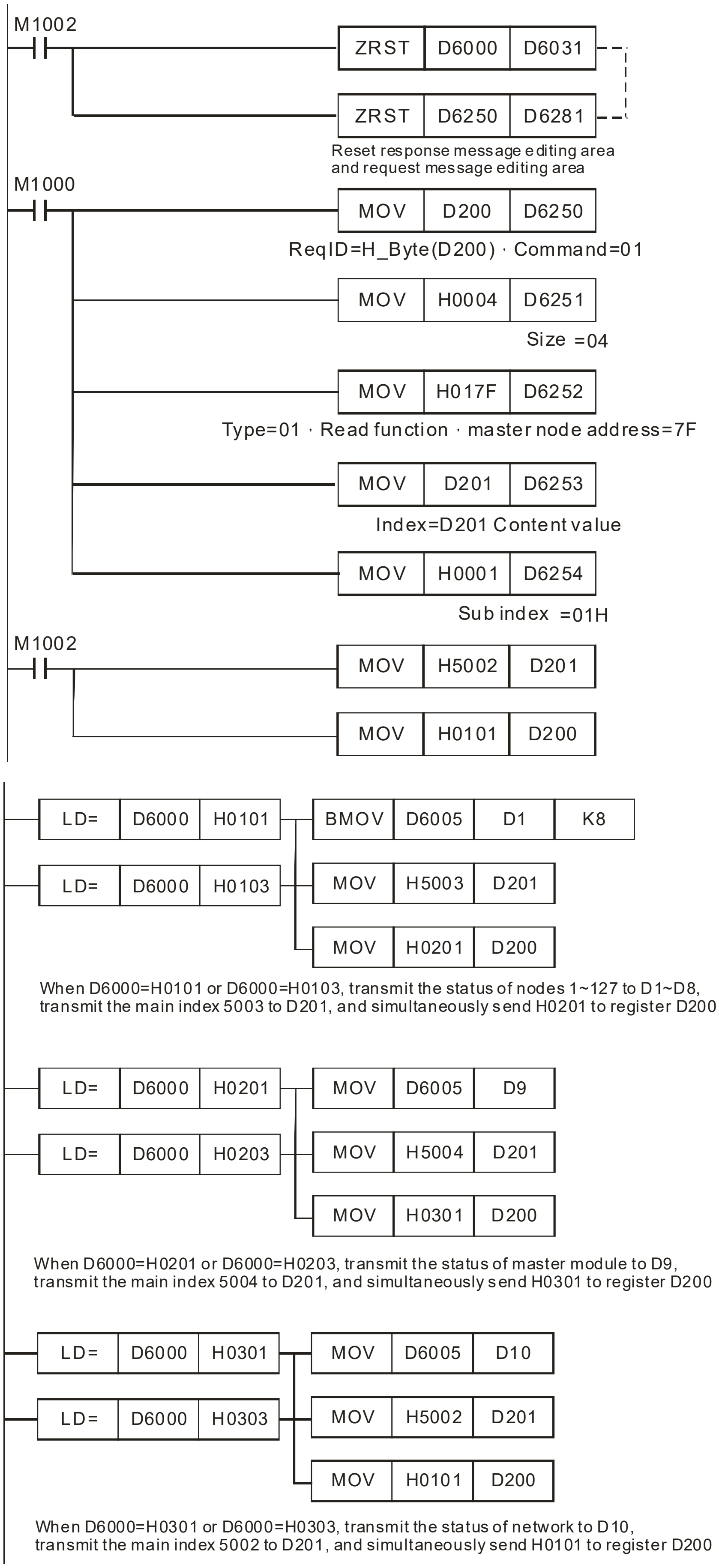
13.3.5.4.5 Application Examples

Control Requirement

Edit a ladder diagram to achieve the monitor function on a CANopen network as follows.

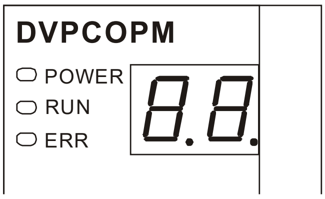
- Real-time monitoring of the state of the slaves in the node list of the master module;
- Real-time monitoring of the state of the master module;
- Real-time monitoring of the state of the CANopen network.

Note: The corresponding device addresses are different for DVPCOPM-SL with a different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. Here the PLC is DVP-28SV


M1002
ZRST D6000 D6031
ZRST D6250 D6281
Reset response message editing area
and request message editing area
M1000
MOV D200 D6250
ReqID=H_Byte(D200) · Command=01
MOV H0004 D6251
Size =04
MOV H017F D6252
Type=01 · Read function · master node address=7F
MOV D201 D6253
Index=D201 Content value
MOV H0001 D6254
Sub index =01H
M1002
MOV H5002 D201
MOV H0101 D200
LD= D6000 H0101
LD= D6000 H0103
BMOV D6005 D1 K8
MOV H5003 D201
MOV H0201 D200
When D6000=H0101 or D6000=H0103, transmit the status of nodes 1~127 to D1~D8,
transmit the main index 5003 to D201, and simultaneously send H0201 to register D200
LD= D6000 H0201
LD= D6000 H0203
MOV D6005 D9
MOV H5004 D201
MOV H0301 D200
When D6000=H0201 or D6000=H0203, transmit the status of master module to D9,
transmit the main index 5004 to D201, and simultaneously send H0301 to register D200
LD= D6000 H0301
LD= D6000 H0303
MOV D6005 D10
MOV H5002 D201
MOV H0101 D200
When D6000=H0301 or D6000=H0303, transmit the status of network to D10,
transmit the main index 5002 to D201, and simultaneously send H0101 to register D200

13.3.5.5 LED Indicator and Troubleshooting

DVPCOPM-SL has three LED indicators and a digital display on it. POWER LED indicates whether the power supply to DVPCOPM-SL is normal. RUN LED and ERR LED indicate the current status. The digital display shows the node address of DVPCOPM-SL and error information from the slave.



13.3.5.5.1 LED Indicator

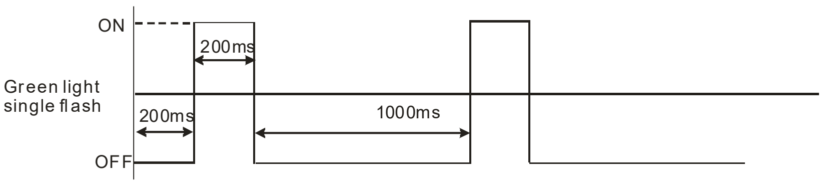
- **POWER LED**

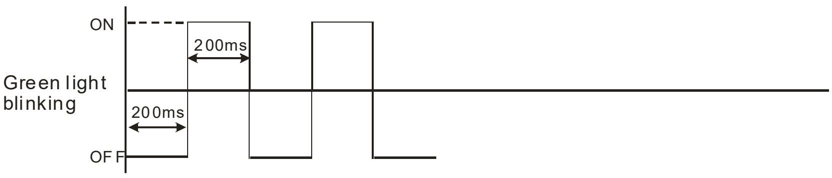
LED status	Indication	Solution
OFF	Power supply is abnormal.	Ensure that the power supply to DVPCOPM-SL is normal.
Green light On	Power supply is normal.	--

- **RUN LED**

LED status	Indication	Solution
Green light single flash	DVPCOPM-SL in STOP status	Upper computer is downloading network configuration and DVPCOPM-SL is waiting till the download is finished.
Green light blinking	DVPCOPM-SL in pre-operational status	1. Ensure that the bus cables wiring on the CANopen network is proper. 2. Ensure that the baud rates of the master and other slaves are identical. 3. Check if the configured slave has been connected to the network. 4. Check if the slave is offline.
Green light On	DVPCOPM-SL is in operational status	--

RUN LED green light single flash versus blinking:





- **ERR LED**

LED status	Indication	Solution
Off	Normal	--
Red light double flash	Slave is offline.	1. Check if CANopen bus is the standard cable. 2. Check if both terminals of CANopen bus are connected with a terminal resistor separately.
Red light single flash	Bus error exceeds the warning level.	1. Check if CANopen bus is the standard cable. 2. Check if both terminals of CANopen bus are connected with a terminal resistor separately. 3. Check if the interference around CANopen bus is too strong.
Red light steady on	Bus-off	1. Check if connection for CANopen network bus cables is proper. 2. Check if DVPCOPM-S and other slaves are identical in baud rate.

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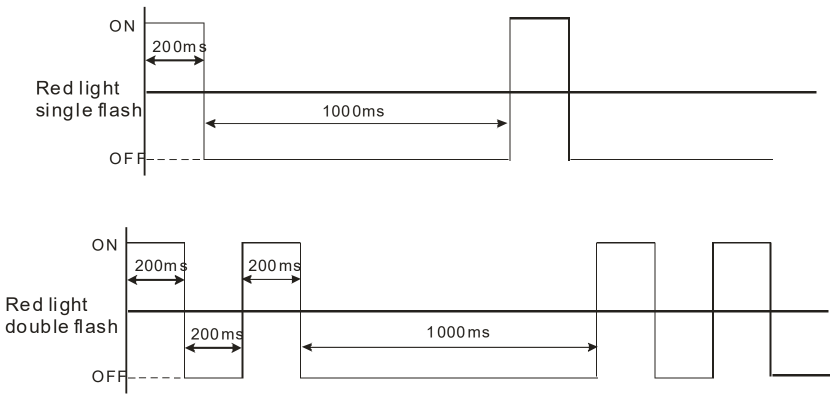
Error LED red light single flash versus double flashes:



13.3.5.5.2 Codes in Digital Display

- DVPCOPM-SL as master

Code	Indication	How to correct
1 to 7F	The node address of DVPCOPM-SL when in normal operation.	--
F1	The slave has not been added to the node list of CANopen builder software.	Add the slave into the node list and then redownload it to DVPCOPM-SL.
F2	The data are being downloaded to DVPCOPM-SL.	Wait till configuration download is finished
F3	DVPCOPM-SL in error status	Redownload parameter configuration and change into a new DVPCOPM-SL if the error still exists.
F4	Bus-off is detected.	Check if CANopen network bus cables are properly connected.
F5	Incorrect DVPCOPM-SL's node address setting.	The node address for DVPCOPM-SL should be set in the range of 1 to 127.
F6	Internal error: manufacturing process	Repower DVPCOPM-SL. If the error still exists, change to a new DVPCOPM-SL.
F7	Internal error: GPIO check	

Code	Indication	How to correct
F8	Internal error: memory check	
F9	Low voltage is detected.	Check and make sure the power of DVPCOPM-SL works normally.
FA	The firmware of DVPCOPM-SL is in error status.	Repower DVPCOPM-SL.
FB	The sending buffer in DVPCOPM-SL is full.	Check and ensure CANopen network bus cables are properly connected and then repower DVPCOPM-SL
FC	The receiving buffer in DVPCOPM-SL is full.	Check and ensure CANopen network bus cables are properly connected and then repower DVPCOPM-SL.
E0	DVPCOPM-SL receives the Emergency message sent by the slave.	Read relevant information through PLC or Delta CANopen Builder software.
E1	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 DVPCOPM-SL.
E2	PDO message from the slave has not been received.	Check and make sure the setting is correct.
E3	Auto SDO download failed.	Check and make sure auto SDO is correct.
E4	PDO parameter setting has failed.	Make sure the PDO parameters setting is legal.
E5	Error in key parameters setting.	Make sure all the slaves connected are consistent with the slaves configured.
E6	Slave is offline.	Make sure the power supply to the slave works normally and the CANopen network is connected properly.
E7	Slave error control timeout.	
E8	Master / slave node address repeated.	Reset the node address and make sure the new address is not a repeated one.

- DVPCOPM-SL as slave

Code	Indication	How to correct
1 to 7F	The node address of DVPCOPM-SL when in normal operation.	--
A0	The parameters in DVPCOPM-SL are being initialized.	Wait till initializing is finished.
A1	DVPCOPM-SL is in pre-operational status.	Check if the bus cables in CANopen network are connected properly.
A3	The configuration data are being downloaded to DVPCOPM-SL.	Wait till configuration is finished downloading.
B0	Heartbeat message timeout	Check if the bus cables in CANopen network are connected properly.
B1	PDO length returned from the slave is inconsistent with that set in the node list.	Reset the PDO data length in the slave and download the new setting to DVPCOPM-SL.
F4	Bus-off is detected	Check if the bus cables in CANopen network are connected properly; ensure all the nodes in the network work are at the same baud rate. Repower DVPCOPM-SL.

Code	Indication	How to correct
FB	The sending buffer in DVPCOPM-SL is full.	Make sure the bus works normally and repower DVPCOPM-SL.
FC	The receiving buffer in DVPCOPM-SL is full.	Check if the bus cables in CANopen network are connected properly and repower DVPCOPM-SL.

13.3.5.6 Indexes and Sub-indexes for DVPCOPM-SL Working as CANopen Slave

When DVPCOPM-SL serves as CANopen slave, the indexes/sub-indexes for different positions of the module on the left side of the PLC correspond to the registers in the PLC as shown in the following table. The position of the first one on the left of the PLC is 1, the position of the second one is 2, and so on.

Note: The corresponding device addresses are different for DVPCOPM-SL with different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. Here the PLC is DVP-28SV.

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Correspond to / Position	Index	Sub-index range	Input/output mapping area	Register in the PLC
1	H'2000	H'01 to H'20	Output mapping area	D6282 to D6313
	H'2001	H'01 to H'20	Input mapping area	D6032 to D6063
2	H'2000	H'01 to H'20	Output mapping area	D6782 to D6813
	H'2001	H'01 to H'20	Input mapping area	D6532 to D6563
3	H'2000	H'01 to H'20	Output mapping area	D7282 to D7313
	H'2001	H'01 to H'20	Input mapping area	D7032 to D7063
4	H'2000	H'01 to H'20	Output mapping area	D7782 to D7813
	H'2001	H'01 to H'20	Input mapping area	D7532 to D7563
5	H'2000	H'01 to H'20	Output mapping area	D8282 to D8313
	H'2001	H'01 to H'20	Input mapping area	D8032 to D8063
6	H'2000	H'01 to H'20	Output mapping area	D8782 to D8813
	H'2001	H'01 to H'20	Input mapping area	D8532 to D8563
7	H'2000	H'01 to H'20	Output mapping area	D9282 to D9313
	H'2001	H'01 to H'20	Input mapping area	D9032 to D9063
8	H'2000	H'01 to H'20	Output mapping area	D9782 to D9813
	H'2001	H'01 to H'20	Input mapping area	D9532 to D9563

Take the first one on the left side of the PLC for example. When DVPCOPM-SL serves as CANopen slave, its indexes and sub-indexes, and attributes correspond to the registers in the PLC as shown in the following table.

- Output mapping area

Index	Sub-index	Object name	Data type	Attribute	Register in the PLC (Output mapping area)
H’2000	H’01	Data_in [0]	Signed 16-bit	Write-only	D6282
	H’02	Data_in [1]	Signed 16-bit	Write-only	D6283
	H’03	Data_in [2]	Signed 16-bit	Write-only	D6284
	H’04	Data_in [3]	Signed 16-bit	Write-only	D6285
	H’05	Data_in [4]	Signed 16-bit	Write-only	D6286
	H’06	Data_in [5]	Signed 16-bit	Write-only	D6287
	H’07	Data_in [6]	Signed 16-bit	Write-only	D6288
	H’08	Data_in [7]	Signed 16-bit	Write-only	D6289
	H’09	Data_in [8]	Signed 16-bit	Write-only	D6290
	H’0A	Data_in [9]	Signed 16-bit	Write-only	D6291
	H’0B	Data_in [10]	Signed 16-bit	Write-only	D6292
	H’0C	Data_in [11]	Signed 16-bit	Write-only	D6293
	H’0D	Data_in [12]	Signed 16-bit	Write-only	D6294
H’2000	H’0E	Data_in [13]	Signed 16-bit	Write-only	D6295
	H’0F	Data_in [14]	Signed 16-bit	Write-only	D6296
	H’10	Data_in [15]	Signed 16-bit	Write-only	D6297
	H’11	Data_in [16]	Signed 16-bit	Write-only	D6298
	H’12	Data_in [17]	Signed 16-bit	Write-only	D6299
	H’13	Data_in [18]	Signed 16-bit	Write-only	D6300
	H’14	Data_in [19]	Signed 16-bit	Write-only	D6301
	H’15	Data_in [20]	Signed 16-bit	Write-only	D6302
	H’16	Data_in [21]	Signed 16-bit	Write-only	D6303
	H’17	Data_in [22]	Signed 16-bit	Write-only	D6304
	H’18	Data_in [23]	Signed 16-bit	Write-only	D6305
	H’19	Data_in [24]	Signed 16-bit	Write-only	D6306
	H’1A	Data_in [25]	Signed 16-bit	Write-only	D6307
	H’1B	Data_in [26]	Signed 16-bit	Write-only	D6308
	H’1C	Data_in [27]	Signed 16-bit	Write-only	D6309
	H’1D	Data_in [28]	Signed 16-bit	Write-only	D6310
	H’1E	Data_in [29]	Signed 16-bit	Write-only	D6311
	H’1F	Data_in [30]	Signed 16-bit	Write-only	D6312
	H’20	Data_in [31]	Signed 16-bit	Write-only	D6313

- Input mapping area

Index	Sub-index	Object name	Data type	Attribute	Register in the PLC (Input mapping area)
H'2001	H'01	Data_out[0]	Signed 16-bit	Read-only	D6032
	H'02	Data_out[1]	Signed 16-bit	Read-only	D6033
	H'03	Data_out[2]	Signed 16-bit	Read-only	D6034
	H'04	Data_out [3]	Signed 16-bit	Read-only	D6035
	H'05	Data_out [4]	Signed 16-bit	Read-only	D6036
	H'06	Data_out [5]	Signed 16-bit	Read-only	D6037
	H'07	Data_out [6]	Signed 16-bit	Read-only	D6038
	H'08	Data_out [7]	Signed 16-bit	Read-only	D6039
	H'09	Data_out [8]	Signed 16-bit	Read-only	D6040
	H'0A	Data_out [9]	Signed 16-bit	Read-only	D6041
	H'0B	Data_out [10]	Signed 16-bit	Read-only	D6042
	H'0C	Data_out [11]	Signed 16-bit	Read-only	D6043
	H'0D	Data_out [12]	Signed 16-bit	Read-only	D6044
	H'0E	Data[_out 13]	Signed 16-bit	Read-only	D6045
	H'0F	Data_out [14]	Signed 16-bit	Read-only	D6046
	H'10	Data_out [15]	Signed 16-bit	Read-only	D6047
	H'11	Data_out [16]	Signed 16-bit	Read-only	D6048
H'2001	H'12	Data_out [17]	Signed 16-bit	Read-only	D6049
	H'13	Data_out [18]	Signed 16-bit	Read-only	D6050
	H'14	Data_out [19]	Signed 16-bit	Read-only	D6051
	H'15	Data_out [20]	Signed 16-bit	Read-only	D6052
	H'16	Data_out [21]	Signed 16-bit	Read-only	D6053
	H'17	Data_out [22]	Signed 16-bit	Read-only	D6054
	H'18	Data_out [23]	Signed 16-bit	Read-only	D6055
	H'19	Data_out [24]	Signed 16-bit	Read-only	D6056
	H'1A	Data_out [25]	Signed 16-bit	Read-only	D6057
	H'1B	Data_out [26]	Signed 16-bit	Read-only	D6058
	H'1C	Data_out [27]	Signed 16-bit	Read-only	D6059
	H'1D	Data_out [28]	Signed 16-bit	Read-only	D6060
	H'1E	Data_out [29]	Signed 16-bit	Read-only	D6061
	H'1F	Data_out [30]	Signed 16-bit	Read-only	D6062
	H'20	Data_out [31]	Signed 16-bit	Read-only	D6063

13.3.6 SAE J1939 Mode

13.3.6.1 Features

The DVPCOPM-SL module enables the DVP series PLC on its right-side to be applied to the SAE J1939 bus by utilizing special J1939 communication instructions so as to allow the PLC to communicate with other devices on the J1939 bus.

The following are supported functions:

- Node address setting
- Broadcast: Synchronously or asynchronously broadcasts PGN (Parameter Group Number) data to the bus.
- Request: Sends the request to the global address or to a particular destination address to get the PGN data.
- Receive: Receives PGN broadcast or command messages from a destination address.

SAE J1939 instructions for DVPCOPM-SL, CANopen communication instructions and the CANRS instruction are mutually exclusive, and using them together is forbidden. Do NOT use CANopen communication instructions while using any J1939 function. When the SAE J1939 instructions are used, the digital display on DVPCOPM-SL should show F1 or F5, and the baud rate for communication is set to 250 Kbps with the function switch (DR0-DR2).

13.3.6.2 Input and Output Mapping Areas

The input and output mapping areas for SAE J1939 instructions are the same as those in CANopen mode. For more details, please refer to section 13.3.5.2.

13.3.6.3 J1939 Communication Instructions

13.3.6.3.1 J1939_Status (Initial Setting and Current Working Status)

J1939_Status	
En	Eno
Enable	Address
SID	Ready
Name	Error
Output_Mapping	ErrCode
Input_Mapping	

- **Input parameters**

Name	Content	Data type	Setting Range
Enable	Enable	BOOL	TRUE: Enable FALSE: Disable
SID	Communication port number	WORD	100 to 107
Name	Name	ARRAY[4] OF WORD	No limit
Output_Mapping	Start address of output mapping area	WORD	Specified address
Input_Mapping	Start address of input mapping area	WORD	Specified address

- **Output parameters**

Name	Content	Data type	Setting Range
Address	ECU address	WORD	0 to 253

Name	Content	Data type	Setting Range
Ready	ECU status	BOOL	TRUE: Initialization completed FALSE: Initialization not completed
Error	Error flag	BOOL	TRUE: Error occurs FALSE: No error
ErrCode	Error code	WORD	Refer to the description of error codes

- **Function**

1. The J1939_Status instruction initializes the DVPCOPM-SL module to leave it in the J1939 state and displays its current working status. When the output parameter **Ready** is TRUE, it indicates that the initialization is complete, and then other instructions can be executed.

2. **Enable** enables this instruction so that DVPCOPM-SL enters the J1939 mode.

3. **SID** specifies a communication port number. For the first DVPCOPM-SL module, which is closest to the left side of the CPU module, its port number is K100; for the second DVPCOPM-SL module on the left side of the CPU module, its port number is K101, and so on.

4. **Name** is for setting the ECU (Electronic Control Unit) name of DVPCOPM-SL. You can find the rule for ECU name definition in the SAE1939-81 document. The ECU name is used for arbitration in applying for an address for DVPCOPM-SL. Regardless of how you set the ECU name, the firmware ensures that the arbitration bit in the name field is 1, i.e. the highest bit of Name[3] must be 1.

   Name data transmission: If Name[0]=16#1234, Name[1]=16#5678, Name[2]=16#9ABC, Name[3]=16#DEF0, on the CAN bus, the name data is sent in this order: 0x34 0x12 0x78 0x56 0x74 0x9A 0xF0 0xDE.

   Please make sure that the names of all ECUs connected to the bus are unique. When **Name** is set to zero, the DVPCOPM-SL module will automatically generate a unique name to ensure proper functioning. Once this instruction is enabled, the ECU name cannot be changed unless the device is repowered on.

5. **Output_Mapping** is the start address of the output mapping area, which is determined together by the CPU model and the location of the DVPCOPM-SL modules on the left of the CPU. For details on input and output mapping areas, refer to section 13.3.5.2 in the DVP Series Module Manual. For example, if DVPCOPM-SL is the first one on the left side of the CPU, DVP12SA2, the start address of the output mapping area should be set to 6282.

6. **Input_Mapping** is the start address of the input mapping area. When this instruction is executed, all device values in the input mapping area will be set to 0xFF until the data is received. For example, DVPCOPM-SL is the first one on the left side of the CPU DVP12SA2, the start address of the input mapping area should be 6032. When this instruction is executed, the values in D6032 to D6249 will become 0xFF if no data is received.

7. **Address** is the address of an ECU. The node address which is set with the knob switch on DVPCOPM-SL is prioritized for arbitration use. If the arbitration fails, the firmware will automatically assign an address to the ECU. The actual address of the ECU is subject to the **Address** output of this instruction.

   Note: The SAE bus has assigned some of the addresses to specific modules (e.g. address 0 is assigned to the engine controller), so please ensure you avoid address conflicts with other ECUs.

8. **Ready** indicates the initialization state of an ECU. When Ready is TRUE, the initialization is complete. Other instructions can only be executed after the initialization is completed.

9. **Error** and **ErrCode** indicate whether there is an error with the current working status of the ECU. If the **Error** parameter of any other instruction is TRUE, the **Error** of the J1939_Status instruction will become TRUE simultaneously, and **ErrCode** will display a corresponding error code.

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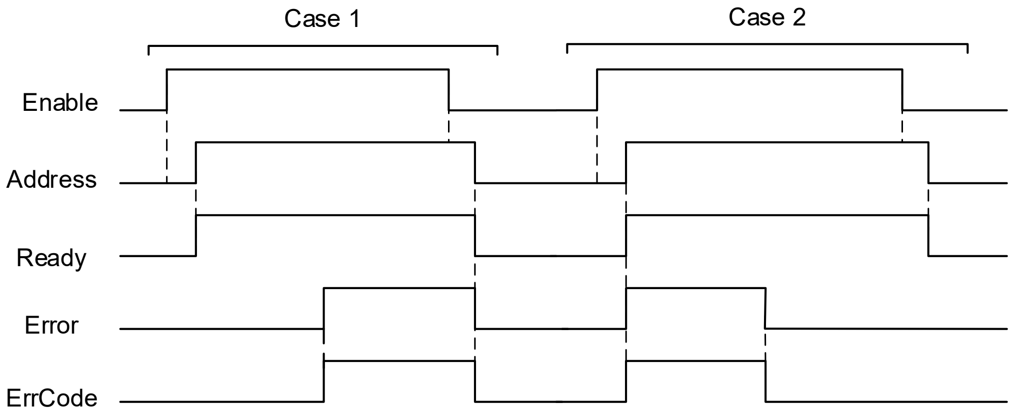
- **Output update timing diagram**



Case 1: *Enable* changes from FALSE to TRUE. A few periods later, the actual address is output and *Ready* changes to TRUE. When an error occurs, *Error* changes to TRUE and *ErrCode* displays a corresponding error code. *Enable* changes from TRUE to FALSE, and a few periods later, all outputs are cleared to zero.

Case 2: There is an error on the bus when *Enable* changes from FALSE to TRUE. A few periods later, the actual address is output, *Ready* changes to TRUE, *Error* changes to TRUE and *ErrCode* shows a corresponding error code. After the bus error is fixed, *Error* and *ErrCode* are cleared to zero. *Enable* changes from TRUE to FALSE, and a few periods later, all outputs are cleared to zero.

13.3.6.3.2 J1939_Broadcast (Sending Broadcast Messages)

J1939_Broadcast	
En	Eno
Enable	Busy
SID	Error
No	
PGN	
Length	
Aim_Address	
Send_Buffer	
Period_Time	
Inhibit_Time	

- **Input parameters**

Name	Description	Data Type	Range
Enable	Enable	BOOL	TRUE: Enable FALSE: Disable
SID	Communication port number	WORD	100-107
No	Instruction number	WORD	0-10
PGN	Parameter group number	WORD	No limit
Length	PGN data length (Unit: byte)	WORD	No limit
Aim_Address	Destination address	WORD	0-253, 255
Send_Buffer	Start address of the buffer for storing broadcast data	WORD	Within the output mapping area
Period_Time	Cycle time (Unit: ms)	WORD	No limit
Inhibit_Time	Inhibit time (Unit: ms)	WORD	No limit

- **Output parameters**

Name	Description	Data Type	Range
Busy	Broadcasting flag	BOOL	TRUE: Data is being broadcast FALSE: No broadcasting
Error	Error flag	BOOL	TRUE: Error occurs. FALSE: No error.

- **Function**

1. The J1939_Broadcast instruction is used to broadcast PGN data to the destination address or all ECUs according to the cycle time setting or once any data change occurs.
2. **Enable** enables this instruction to activate the broadcast function.
3. **SID** specifies a communication port number. For the first DVPCOPM-SL module, which is closest to the left side of the CPU module, its port number is K100. For the second DVPCOPM-SL module on the left side of the CPU module, its port number is K101, and so on.
4. **No** indicates an instruction number, ranging from 0 to 10. Up to eleven same instructions can be executed simultaneously, and their instruction No. must be different from each other.
5. **PGN** (Parameter Group Number) is a 24-bit value, composed of reserved bits, data page bits, PF (PDU Format) bits, and PS (PDU Specific) bits. For further details on the PGN definition rule, see the SAE1939-21 document. In this instruction, only the lower 16 bits of the PGN are taken, and its higher 8 bits are 0.
6. **Length** represents the length of PGN data in bytes. When the length of the PGN data exceeds 8 bytes, DVPCOM-SL will automatically send data by following the communication protocol stipulated in SAEJ1939-21.
7. **Aim_Address** is for specifying a destination address. If the parameter is set to 255, it means to broadcast data to all ECUs. When the PGN refers to a parameter group for global messages and its data length is less than or equal to 8 bytes, messages will be sent to all ECUs, and the setting of **Aim_Address** is invalid in this case.
8. **Send_Buffer** is the start address of the buffer for temporarily storing broadcast data, all addresses for broadcast data must be within the range of the output mapping area.
9. **Period_Time** is the message transmission cycle. When **Period_Time** is set to 0, it indicates the asynchronous mode is activated, which means that the broadcast data in the buffer is sent as long as any change to broadcast data occurs.
10. **Inhibit_Time** is the inhibit time only for the asynchronous mode, that is, the shortest time interval between message transmissions. Setting this parameter can prevent too fast data changes resulting in high CAN bus load. This parameter is valid only when **Period_Time** is set to 0.
11. If the settings for this instruction are successful, **Busy** will change to TRUE to start broadcasting data.
12. When an error occurs in input parameters of this instruction, **Error** will change to TRUE and the error code will be displayed in **ErrCode** of the J1939_Status instruction.

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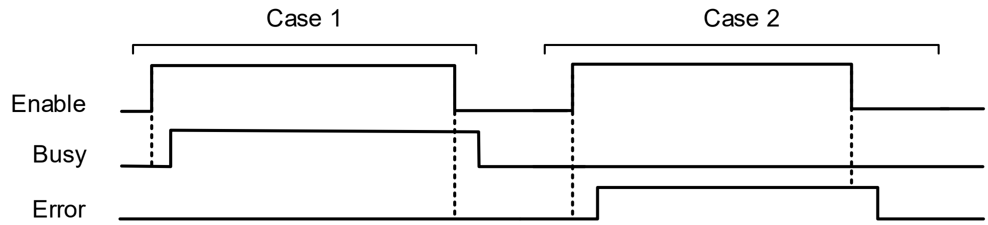
- **Output update timing diagram**



Case 1: *Enable* changes from FALSE to TRUE. A few periods later, *Busy* changes to TRUE. *Enable* changes from TRUE to FALSE, and a few periods later, the output of *Busy* is cleared to zero.

Case 2: When *Enable* changes from FALSE to TRUE, an input parameter error occurs. A few periods later, *Error* changes to TRUE, and the corresponding error code is displayed in *ErrCode* of the J1939_Status instruction. *Enable* changes from TRUE to FALSE. A few periods later, the output of *Error* is cleared to zero.

13.3.6.3.3 J1939_Receive (Receiving Broadcast Messages or Commands)

J1939_Receive	
En	Eno
Enable	Busy
SID	Error
No	
PGN	
Length	
Aim_Address	
Receive_Buffer	

- **Input parameters**

Name	Description	Data Type	Range
Enable	Enable	BOOL	TRUE: Enable FALSE: Disable
SID	Communication port number	WORD	100-107
No	Instruction number	WORD	0-10
PGN	Parameter group number	WORD	No limit
Length	PGN data length (Unit: byte)	WORD	No limit
Aim_Address	Destination address	WORD	0-253, 255
Receive_Buffer	Start address of the buffer for receiving data	WORD	Within the input mapping area

- **Output parameters**

Name	Description	Data Type	Range
Busy	Receiving flag	BOOL	TRUE: Receiving in progress FALSE: No receiving
Error	Error flag	BOOL	TRUE: Error occurs. FALSE: No error.

- **Function**

1. The J1939_Receive instruction is used to cyclically receive broadcast PGN data and commands from the destination address or all ECUs.
2. **Enable** enables this instruction to activate the receive function.
3. **SID** specifies a communication port number. For the first DVPCOPM-SL module, which is closest to the left side of the CPU module, its port number is K100. For the second DVPCOPM-SL module on the left side of the CPU module, its port number is K101, and so on.
4. **No** indicates an instruction number, ranging from 0 to 10. Up to eleven J1939_Receive instructions can be executed simultaneously, and their instruction No. must be different from each other.
5. **PGN** (Parameter Group Number) is a 24-bit value, composed of reserved bits, data page bits, PF (PDU Format) bits, and PS (PDU Specific) bits. For further details on the PGN definition rule, see the SAE1939-21 document. In this instruction, only the lower 16 bits of the PGN are taken, and its higher 8 bits are set to 0.
6. **Length** represents the length of PGN data, with the unit: byte.
7. **Aim_Address** is for specifying a destination address. If the parameter is set to 255, it means to receive messages from all ECUs.
8. **Receive_Buffer** is the start address of the buffer for receiving data, and all addresses for receiving data must be within the range of the input mapping area. The received data will be placed in the reception buffer in the way described in the following **Reception Rule 1**. You need to plan the buffer for receiving data to avoid any conflict with other instructions. When **Enable** is FALSE, each device data in the reception buffer for this instruction will be restored to the default value 0xFF.

Reception Rule 1:

When **Aim_Address** is set to 255, two messages from source addresses 0x53 and 0x54 are received, which are respectively the content: 0x12 0x34 0x56 0x78 0x9A 0xBC 0xDE 0xF0 with the identifier 0x18F12353 and length 8, and the content: 0x44 0x45 0x4C 0x54 0x41 0x00 0x00 0x00 with the identifier 0x18F12354 and length 8. The firmware will store the data according to the following table.

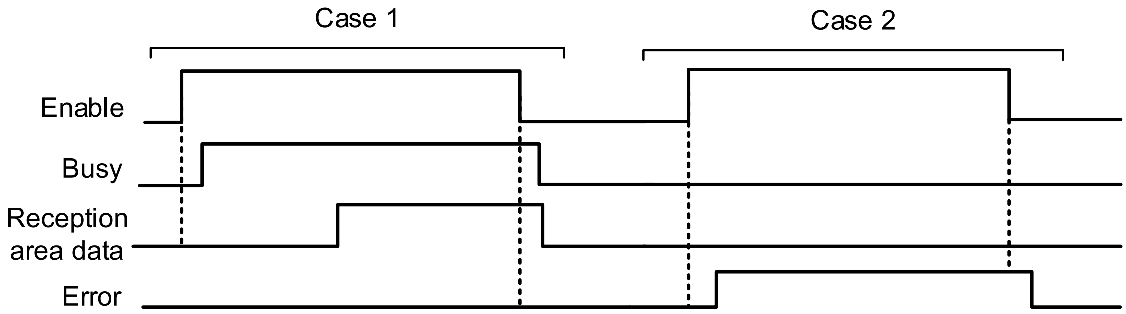
Device No.	Content (Hex.)	Description
D6032	XX53	XX: message sequence number*1 53: Source address
D6033	3412	Received data content
D6034	7856	Received data content
D6035	BC9A	Received data content
D6036	F0DE	Received data content
D6037	XX54	XX: message sequence number 54: Source address
D6038	4544	Received data content
D6039	544C	Received data content
D6040	0041	Received data content
D6041	0000	Received data content
D6042	FFFF	Unused input mapping area

*1: XX represents a message sequence number. Each time a new message is received (whether it is the same as the previous one or not), XX will be incremented by 1. Through the message sequence number, you can determine whether a new message is received. If the data from the same source address is received again, the previous data will be overwritten, and no more space will be occupied.

9. If the settings for this instruction are successful, **Busy** will change to TRUE to start receiving data.

10. When an error occurs in input parameters of this instruction, **Error** will change to TRUE and the error code will be displayed in **ErrCode** of the J1939_Status instruction.

- **Output update timing diagram**



Case 1: *Enable* changes from FALSE to TRUE. A few periods later, *Busy* changes to TRUE. When data is received, the data in the reception area change accordingly. *Enable* changes from TRUE to FALSE. A few periods later, the output of *Busy* is cleared to zero, and the data in the reception area is restored to default values.

Case 2: When *Enable* changes from FALSE to TRUE, an input parameter error occurs, or the input mapping area of this J1939_Receive instruction conflicts with that of other J1939_Receive instructions. A few periods later, *Error* changes to TRUE, and the error code is displayed in *ErrCode* of the J1939_Status instruction. *Enable* changes from TRUE to FALSE. A few periods later, the output of *Error* is cleared to zero.

13.3.6.3.4 J1939_Request (Requesting Data and Receiving Responses)

J1939_Request	
En	Eno
Enable	Done
SID	Error
PGN	
Length	
Aim_Address	
Receive_Buffer	

- **Input parameters**

Name	Description	Data Type	Range
Enable	Enable	BOOL	TRUE: Enable FALSE: Disable
SID	Communication port number	WORD	100-107
PGN	Parameter group number	WORD	-
Length	PGN data length (Unit: byte)	WORD	Within the mapping area for TxPDO
Aim_Address	Destination address where a request is received	WORD	0-253, 255
Receive_Buffer	Start address of the buffer for receiving data	WORD	Within the input mapping area

- **Output parameters**

Name	Description	Data Type	Range
Done	Completion flag	BOOL	TRUE: Data request success. FALSE: Data request in progress.
Error	Error flag	BOOL	TRUE: Data request failed. FALSE: No error.

- **Function**

1. The J1939_Request instruction is used to request the PGN data from a destination address or all ECUs. Only one J1939_Request instruction in the program is executed every time, which means the ENs of other J1939_Request instructions cannot be TRUE in the program during execution.
2. **Enable** enables this instruction to activate the request function.
3. **SID** specifies a communication port number. For the first DVPCOPM-SL module, which is closest to the left side of the CPU module, its port number is K100. For the second DVPCOPM-SL module on the left side of the CPU module, its port number is K101, and so on.
4. **PGN** (Parameter Group Number) is a 24-bit value, composed of reserved bits, data page bits, PF (PDU Format) bits, and PS (PDU Specific) bits. For further details on the PGN definition rule, see the SAE1939-21 document. In this instruction, only the lower 16 bits of the PGN are taken, and its higher 8 bits are 0.
5. **Length** represents the length of PGN data, with the unit: byte.
6. **Aim_Address** is for specifying a destination address. If the parameter is set to 255, it means to send the request to all ECUs.
7. **Receive_Buffer** is the start address of the buffer for receiving data, and all addresses for receiving data must be within the range of the input mapping area. The received data will be placed in the reception buffer in the way described in the following **Reception Rule 2**. You need to plan the buffer for receiving data to avoid any conflict with other instructions. When **Enable** is FALSE, the device data in the reception buffer will be restored to the default value 0xFF.

   Reception Rule 2:

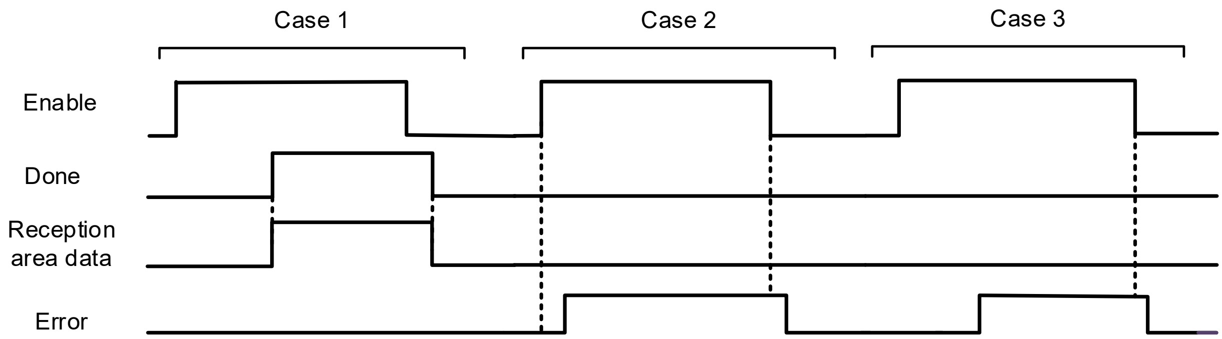
   When **Aim_Address** is set to 255 for requesting the PGN data from all ECUs, two messages from source addresses 0x53 and 0x54 are received, which are respectively the content: 0x12 0x34 0x56 0x78 0x9A 0xBC 0xDE 0xF0 with the identifier 0x18F12353 and length 8, and the content: 0x44 0x45 0x4C 0x54 0x41 0x00 0x00 0x00 with the identifier 0x18F12354 and length 8. The firmware will store the data according to the following table.

Device	Content (Hex.)	Description
D6032	XX53	XX: Reserved 53: Source address
D6033	3412	Received data content
D6034	7856	Received data content
D6035	BC9A	Received data content
D6036	F0DE	Received data content
D6037	0054	00: Reserved 54: Source address
D6038	4544	Received data content

Device	Content (Hex.)	Description
D6039	544C	Received data content
D6040	0041	Received data content
D6041	0000	Received data content
D6042	FFFF	Unused input mapping area

8. After this request instruction successfully receives the PGN data from the address where the request is received, **Done** will change to TRUE. If you want to request PGN data again after receiving is complete, please set **Enable** to FALSE and then wait until **Done** shifts to FALSE before re-enabling the J1939_Request instruction.
9. When an error occurs, **Error** will change to TRUE and the error code will be displayed in **ErrCode** of the J1939_Status instruction. To request PGN data again after an error occurs, you must set **Enable** to FALSE and then wait until **Error** shifts to FALSE before re-enabling the J1939_Request instruction.

- **Output update timing diagram**



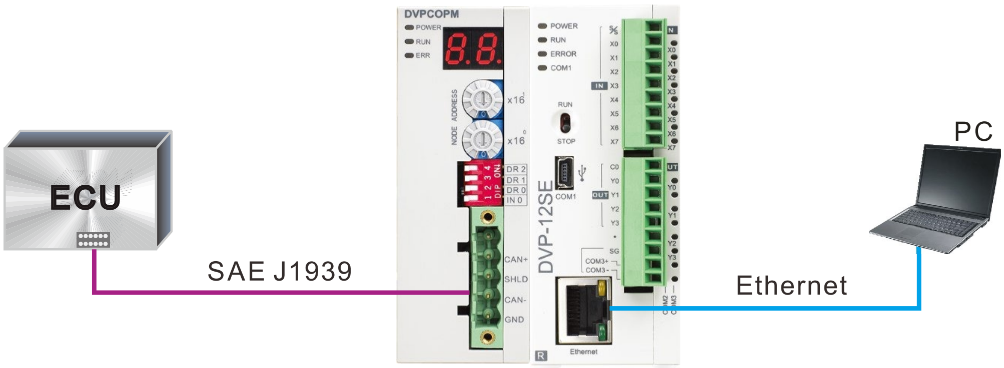
Case 1: When *Enable* changes from FALSE to TRUE, this instruction starts to request data. After the response data is received from another ECU device, *Done* changes to TRUE and the data in the reception area change accordingly. *Enable* changes from TRUE to FALSE, and a few periods later, the output of *Done* is cleared to zero. And meanwhile the data in the reception area is restored to default values.

Case 2: When *Enable* changes from FALSE to TRUE, an input parameter error occurs. A few periods later, *Error* changes to TRUE, and the error code is displayed in *ErrCode* of the J1939_Status. *Enable* changes from TRUE to FALSE, and a few periods later, the output of *Error* is cleared to zero.

Case 3: After *Enable* changes from FALSE to TRUE, *Error* changes to TRUE when an error occurs during data receiving and the error code is displayed in *ErrCode* of the J1939_Status. *Enable* changes from TRUE to FALSE, and a few periods later, all outputs are cleared to zero.

13.3.6.4 Application Examples

- **Network structure**



- **Control requirement:**

Install one DVPCOPM-SL module on the left side of the DVP-12SE CPU and connect it to another ECU. Then write a ladder diagram program in ISPSoft so as to implement the following operations.

1. Set the name for the DVPCOPM-SL module and start addresses of its input and output mapping areas, and then leave the device in the J1939 state.
2. With the cycle time (Period_Time) set to 1000 ms, DVPCOPM-SL broadcasts the PGN 61444 data of 8 bytes (length) to all ECUs.
3. DVPCOPM-SL receives the broadcast data of PGN 65265 from the ECU with its destination address 0.
4. DVPCOPM-SL sends the request to the ECU with its destination address 0 for its PGN 65265 data.

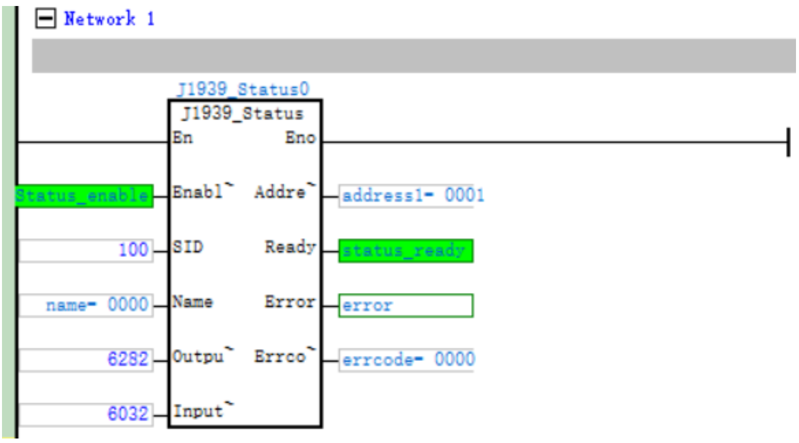
Note: Different PLCs have different device addresses for DVPCOPM-SL. For details, please refer to Input and Output Mapping Areas for DVPCOPM-SL.

5. Settings for DVPCOPM-SL:

Parameter	Setting Value	Description
Node address	01	Set the node address of DVPCOPM-SL to 01.
Transmission rate	250 Kbps	Set the transmission rate for DVPCOPM-SL to communicate with the bus to 250 Kbps.

- **PLC program**

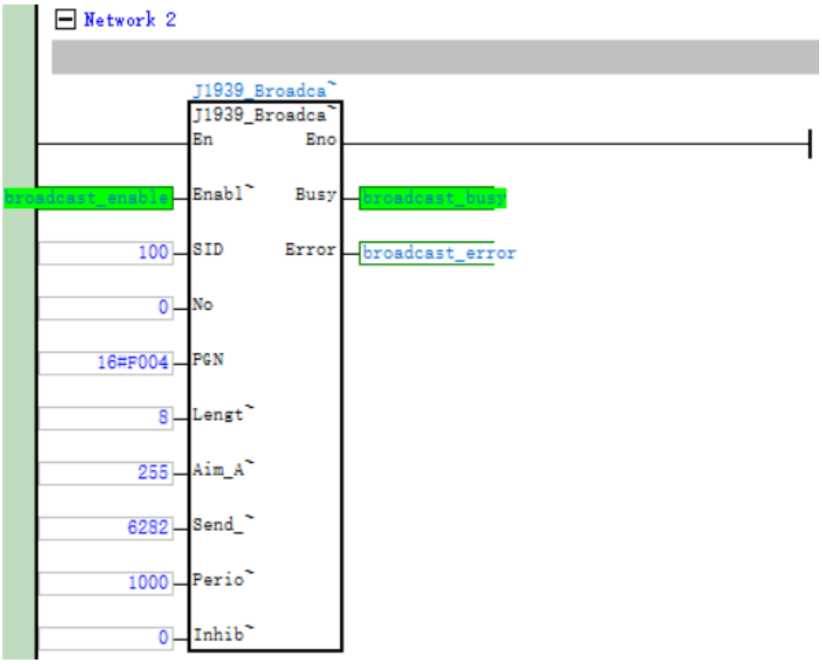
Network 1:



Program description:

Of J1939_Status, the input parameter SID is set to 100, Name is set to 0, Input_Mapping (the start address of the input mapping area) is set to 6032 and Output_Mapping (the start address of the output mapping area) is 6282. Set the variable Status_enable of J1939_Status to TRUE to execute this instruction. Then, the DVPCOPM-SL module with its node address set to 01 will automatically be given an ECU name and start initializing to enter the SAE J1939 state.

Network 2:



Program description:

Set the variable **broadcast_enable** of J1939_Broadcast to TRUE to execute this instruction. Then DVPCOPM-SL will cyclically broadcast the data in D6282 to D6285 with the cycle time (Period_Time) set to 1000 ms.

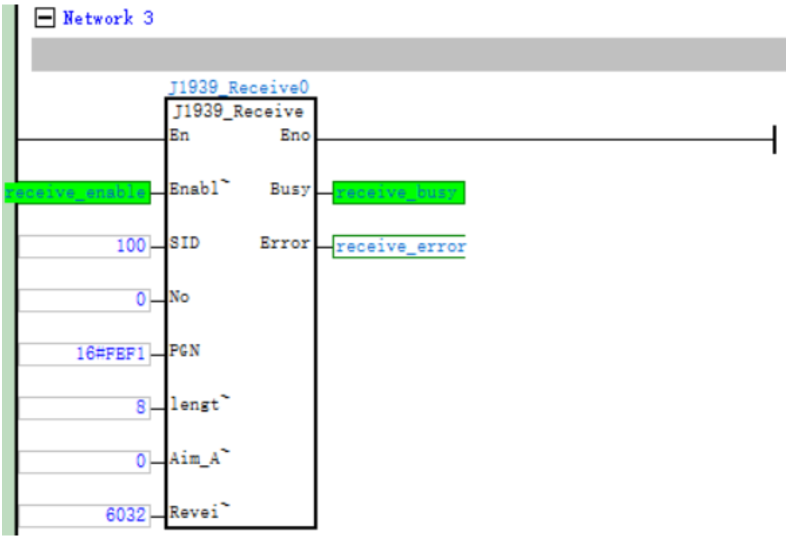
See the setting values in the devices as follows:

Device	D6282	D6283	D6284	D6285
Setting value	16#0102	16#0304	16#0506	16#0708

Bus data:

PGN	Length	Data
61444	8	02 01 04 03 06 05 08 07

Network 3:



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Program description:

Set the variable receive_enable of J1939_Receive to TRUE. Then, DVPCOPM-SL will receive the data of PGN 65265 (16#FEF1) from the ECU with its address 0, and store the data in D6032 to D6036.

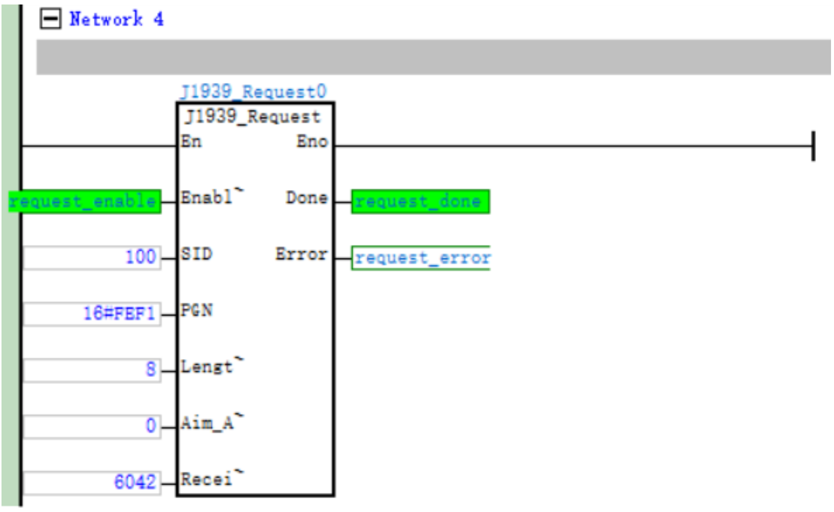
See the data stored in D6032 to D6036 in the following table.

No.	Device	Data	Description
1	D6032	16#XX00	XX: The quantity of data. 00: ECU address.
2	D6033	0	
3	D6034	16#0049	
4	D6035	0	
5	D6036	0	

Bus data:

PGN	Length	Data
65265	8	00 00 49 00 00 00 00 00

Network 4



Program description:

Set the variable request_enable of J1939_Request to TRUE. Then, DVPCOPM-SL will request the data of PGN 65265 (16#FEF1) from the ECU with its destination address (Aim_Address) 0, and store the response data in D6042 to D6046. See the data in D6042 to D6046 in the following table.

No.	Device	Data	Description
1	D6042	16#XX00	XX: Reserved. 00: ECU address.
2	D6043	0	-
3	D6044	16#0049	-
4	D6045	0	-
5	D6046	0	-

Bus data:

PGN	Length	Data
65265	8	00 00 49 00 00 00 00 00

13.3.6.5 LED Indicators and Troubleshooting

13.3.6.5.1 LED Indicator

- **POWER LED**

LED status	Indication	Solution
OFF	Power supply is abnormal	Ensure that the power supply of DVPCOPM-SL is normal.
Green light ON	Power supply is normal	--

- **RUN LED**

LED status	Indication	Solution
Green light blinking	Module error has occurred.	Check the J1939_Status instruction or the error code on digital display. Then refer to the digital display diagnosis to identify and resolve the error.
Green light ON	Normal	--

- **ERR LED**

LED status	Indication	Solution
OFF	Normal	--
Red light blinking	Module error has occurred	Check the J1939_Status instruction or the error code on digital display. Then refer to the digital display diagnosis to identify and resolve the error.
Red light ON	Bus error has occurred	1. Check that all the network bus cables are properly connected. 2. Check if DVPCOPM-SL and other slaves are identical in baud rate. 3. Check whether there are other ECU devices on the bus. 4. Check if each of both ends of the SAE J1939 bus is connected with a terminal resistor. 5. Check if there is excessive interference around the SAE J1939 bus cables.

13.3.6.5.1 Error Codes

Error codes are displayed in the **ErrorID** output of the J1939_Status instruction, and also shown every 500 ms in the digital display on DVPCOPM-SL.

Code	Indication	How to correct
0 to FD	A valid address has been applied for successfully and DVPCOPM-SL is running normally.	--
FF01	DVPCOPM-SL is applying for an address.	DVPCOPM-SL is waiting for its own ECU to apply for a valid address.
FF02	Unable to apply for a valid address	Modify the address of the ECU, and then repower DVPCOPM-SL.
FF03	When J1939_Status is executed to initialize DVPCOPM-SL into the J1939 state, the input and output mapping areas overlap.	Modify the start addresses of the input and output mapping areas to ensure that the start address of the output mapping is greater than the start address of the input mapping area plus 195.
FF11	Instruction or firmware internal error	Check the program and power DVPCOPM-SL on again.

Code	Indication	How to correct
FF21	A conflict in J1939_Request: a new request is sent when the response to the previous request has not been received.	Disable the current request instruction, and execute the instruction again.
FF22	The reception registers for J1939_Request conflict with devices for other instructions, the input mapping area range is exceeded, or the PGN length error occurs.	Disable the current request instruction, modify the reception register addresses, and re-execute the instruction.
FF23	No response is received to the request sent by J1939_Request.	Make sure that the PGN is supported or the slave exists, and re-execute the instruction.
FF31	The input parameter No of J1939_Broadcast or J1939_Receive exceeds the range, or there are same-type instructions with the same No.	Disable the current request instruction and the J1939_Status instruction, adjust parameters, and re-execute both the instructions currently reporting an error and the J1939_Status instruction.
FF32	The value of Aim_Address in an instruction exceeds the allowed range.	Disable the instruction with an error, modify its parameter, and re-execute it.
FF41	CAN bus error	Ensure that the CAN bus wiring is correct, baud rate settings are consistent, terminal resistors are set properly, and there are other CAN nodes on the bus.
FF51	Reception registers for J1939_Receive conflict with devices for other instructions, the input mapping area range is exceeded, or the PGN length error occurs.	Disable the instruction with an error, modify its reception register addresses, and then re-execute it .
FF61	The transmission register addresses for J1939_Broadcast exceed the output mapping area range or the PGN length error occurs.	Disable the broadcast instruction, modify its transmission register addresses, and then re-execute the instruction .

13.4 DVPPF02-SL

13.4.1 Introduction

DVPPF02-SL is a PROFIBUS DP slave communication module, used for connecting Delta DVP-SV, DVP-SX2, DVP-SV3, DVP-SX3 series PLC to the PROFIBUS DP network. DVPPF02-SL is a left-side extension module, and no external power supply is required when using it. Its power is supplied by the PLC CPU.

13.4.1.1 Features

- Supports the loop data transmission between the PROFIBUS DP master and multiple slaves.
- Auto-detects the baud rate, max. 12 Mbps.
- Self-diagnosis
- The PLC CPU is extendable to up to 8 DVPPF02-SL modules on its left-hand side.
- Supports max. 100 words of I/O output and 100 words of I/O input.

13.4.1.2 Specification

- PROFIBUS DP Port

Interface	DB9 connector
Transmission method	High-speed RS-485
Transmission cable	Shielded twisted pair cable
Electrical isolation	500 VDC

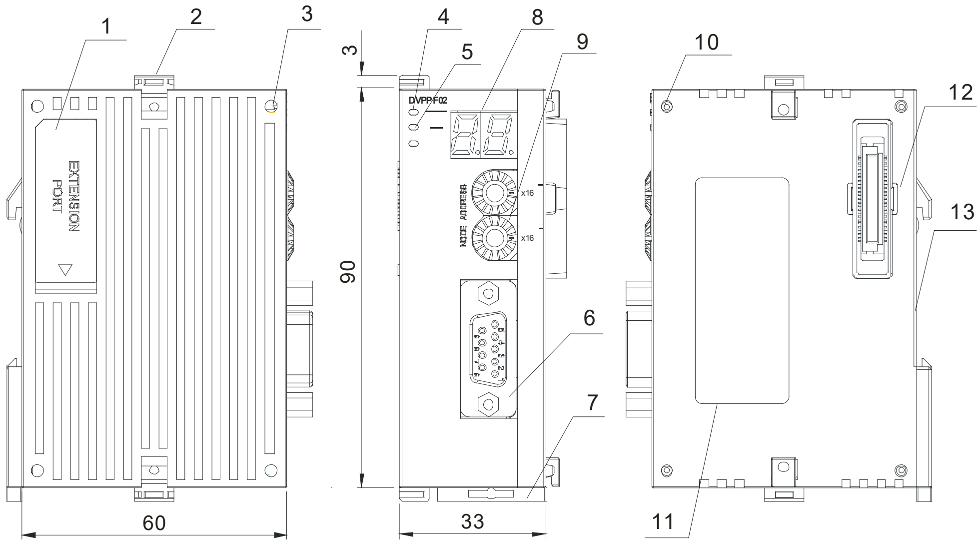
- Communication

Data type	Cyclic data exchange
Module name	DVPPF02-SL
GSD document	DELA0AFE.GSD
Product ID	0AFE
Serial baud rate (auto-detection)	9.6k, 19.2k, 93.75k, 187.5k, 500k, 1.5M, 3M, 6M, 12M (Unit: bps)

- Electrical Specification

Power supply voltage	Supplied by the PLC CPU
Insulation voltage	500 VDC
Power consumption	2 W
Weight	118 g

13.4.2 Module Profiles and Dimensions



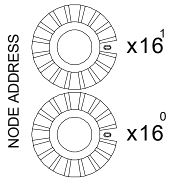
Unit: mm

No.	Name	Description
1	Extension module connection port	Connect the modules
2	Extension unit fixing clip	For securing the extension module
3	Mounting hole	For positioning between modules
4	POWER LED indicator	Indicates the status of the power supply ON: the power is on OFF: no power
5	NET indicator	Green Light ON: connection established between the master and slave stations. Red Light ON: DVPPF02-SL not connected to the master station.
6	PROFIBUS DP communication connector	Connect to the PROFIBUS DP network
7	DIN rail clip	Secure the module on the set
8	Digital display	Display the status code of DVPPF02-SL
9	Address switch	Set the node address
10	Mounting hole	For positioning between modules
11	Nameplate	Indicate product information such as model, product serial number, etc.
12	Extension module connection port	Connect the PLC or the modules
13	DIN rail slot (35 mm)	For the DIN rail

13.4.3 Terminals

13.4.3.1 Address Switch

The address switches on DVPPF02-SL are used for setting up the node address of DVPPF02-SL on the PROFIBUS DP network. The switches are two rotary switches x16^0 and x16^1. Range for each switch: 0 to F. See the table below for the setup range for the switches.



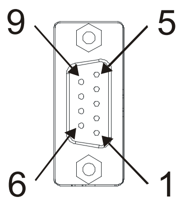
Address	Definition
1 to 7D	Valid PROFIBUS address
0, 7E to FF	Invalid PROFIBUS address

Example: If you are to set the node address of DVPPF02-SL to 26 (decimal), simply switch x16^1 to 1 and x16^0 to A. 26 (decimal) = 1A (hex) = 1×16^1 + A×16^0.

Note:

- Set up the address of DVPPF02-SL when the power is off. Re-power the module after you finish setting up the address.
- Changing the setting of address when DVPPF02-SL is operating is regarded invalid.
- Use slotted screwdriver carefully to adjust the address in case you scratch the switch.

13.4.3.2 PROFIBUS DP Connector

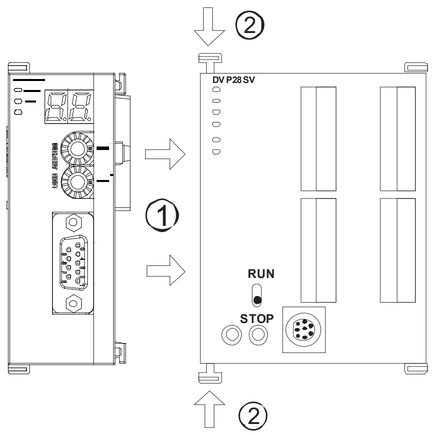


Pin	Definition	Pin	Definition
1	-	6	VP
2	-	7	-
3	Rxd/Txd-P	8	Rxd/Txd-N
4	-	9	-
5	DGND		

13.4.4 Installation

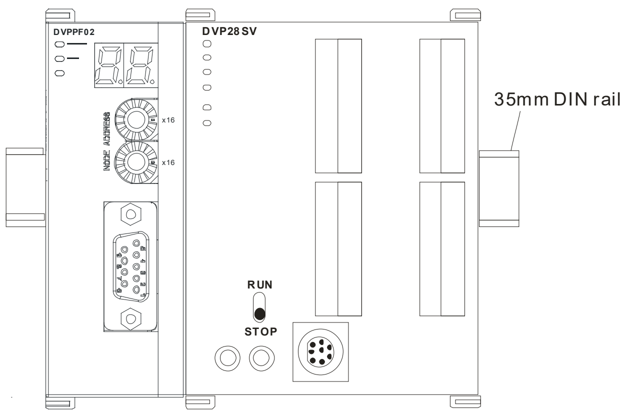
1. Connect DVPPF02-SL to PLC CPU

- Open the fastening ports for the I/O module on the left-hand side of the PLC CPU and insert the DVPPF02-SL alongside the fastening clips, as ①.
- Press the clips to make sure the connection is tight, as ②.



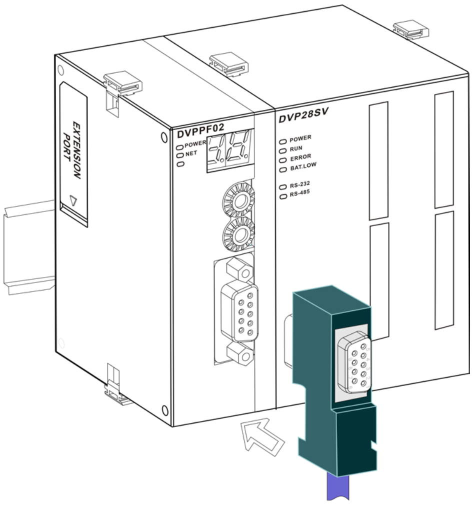
2. Install DVPPF02-SL and PLC CPU on DIN Rail

- Use 35 mm DIN rail.
- Open the DIN rail clips on DVPPF02-SL and the PLC CPU. Insert DVPPF02-SL and the PLC CPU onto the DIN rail.
- Clip up the DIN rail clip on DVPPF02-SL and the PLC CPU to fix them on the DIN rail.



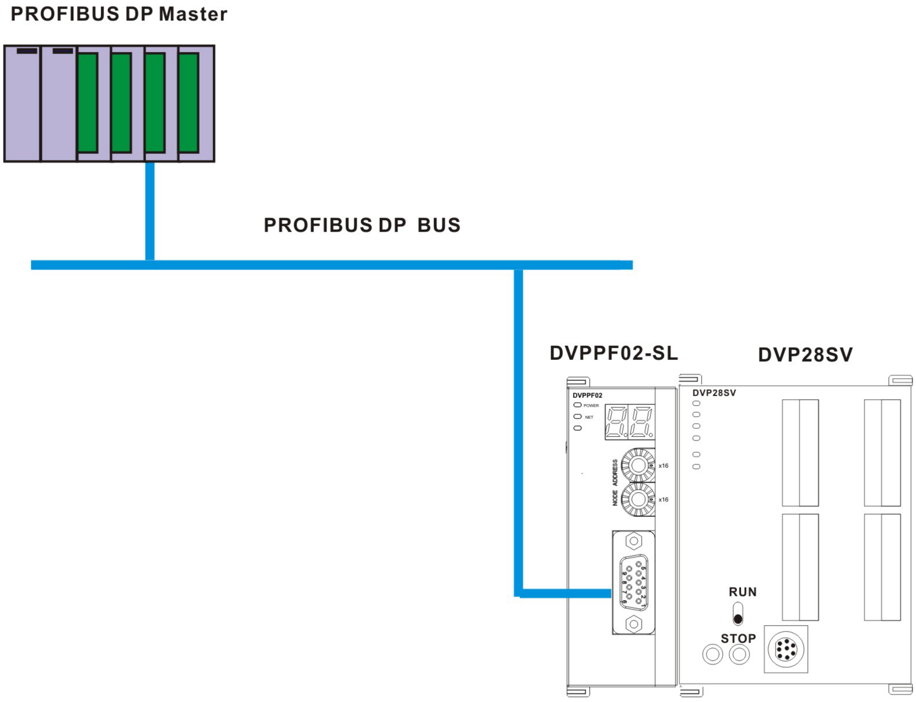
3. Connect to PROFIBUS DP Port

Insert the PROFIBUS DP bus connector into the PROFIBUS DP port on DVPF02-SL. Screw it tight to ensure DVPF02-SL and the PROFIBUS DP bus are properly connected.



13.4.5 Establish PROFIBUS DP Network

DVPPF02-SL is used for connecting SX2/SV/SV3/SX3 series PLC to the PROFIBUS DP network.



13.4.6 Transmission Distance and Baud Rate

The baud rate for PROFIBUS DP communication ranges from 9.6 kbps to12 Mbps. The max. cable length is limited by the transmission rate. The transmission distance can be from 100 to 1,200 meters. See the table below for the baud rates DVPPF02-SL support and their corresponding transmission distances.

Baud rate (bps)	9.6 K	19.2 K	93.75 K	187.5 K	500 K	1.5 M	3 M	6 M	12 M
Distance (m)	1200	1200	1200	1000	400	200	100	100	100

13.4.7 GSD File

GSD file is a text file, used for identifying the PROFIBUS DP device (master or slave). A GSD file includes data required for configuring a slave on the PROFIBUS DP master, supplier information, baud rates supported and applicable I/O. When using DVPPF02-SL, first import the GSD file to the software for configuring the PROFIBUS DP master, then DVPPF02-SL and items to be configured will be displayed in the software. You can download the GSD file for DVPPF02-SL from Delta's website: http://www.deltaww.com.

13.4.8 Mapping Areas and Status Registers

When the PLC is DVP-SV3 or DVP-SX3, see the table below for the I/O mapping and status registers of DVPPF02-SL at different locations. The number of the first DVPDNET-SL on the left side of the PLC is 1 and the number of the DVPDNET-SL module close to the left side of the first DVPDNET-SL is 2, and subsequent DVPDNET-SL modules are No. 3, No. 4 and so on.

Direction / Location	Output mapping Slave → Master	Input mapping Master → Slave	DVPPF02-SL Status register
1	D16250 to D16349	D16000 to D16099	D16100
2	D16750 to D16849	D16500 to D16599	D16600
3	D17250 to D17349	D17000 to D17099	D17100
4	D17750 to D17849	D17500 to D17599	D17600
5	D18250 to D18349	D18000 to D18099	D18100
6	D18750 to D18849	D18500 to D18599	D18600
7	D19250 to D19349	D19000 to D19099	D19100
8	D19750 to D19849	D19500 to D19599	D19600

When the PLC is another model in the DVP series (that is, not DVP-SV3 or DVP-SX3), see the table below for the I/O mapping and status registers of DVPPF02-SL at different locations. The number of the first DVPDNET-SL on the left side of the PLC is 1 and the number of the DVPDNET-SL module close to the left side of the first DVPDNET-SL is 2, and subsequent DVPDNET-SL modules are No. 3, No. 4 and so on.

Direction / Location	Output mapping Slave → Master	Input mapping Master → Slave	DVPPF02-SL Status register
1	D6250 to D6349	D6000 to D6099	D6100
2	D6750 to D6849	D6500 to D6599	D6600
3	D7250 to D7349	D7000 to D7099	D7100
4	D7750 to D7849	D7500 to D7599	D7600
5	D8250 to D8349	D8000 to D8099	D8100

Direction / Location	Output mapping Slave → Master	Input mapping Master → Slave	DVPPF02-SL Status register
6	D8750 to D8849	D8500 to D8599	D8600
7	D9250 to D9349	D9000 to D9099	D9100
8	D9750 to D9849	D9500 to D9599	D9600

Explanations on status registers for DVPPF02-SL:

High byte		Low byte	
Code	Definition	Code	Definition
0	Normal status	0	No error
1	Initializing	F1	DVPPF02-SL is initializing.
2	Error	F0	The node address of DVPPF02-SL is out of range.
		F2	Error in low voltage detection
		F3	DVPPF02-SL enters factory test mode.
		F4	DVPPF02-SL is disconnected from the master.
		F5	Error in parameter
		F7	Hardware error
		F9	Configuration error

13.4.9 Configure DVPPF02-SL

13.4.9.1 Configure DVPPF02-SL

Please refer to Chapter 10 of the SYCON.net software manual for detailed setup instructions.

13.4.9.2 I/O Configuration of DVPPF02-SL

When DVPPF02-SL is configured in the software for the PROFIBUS DP master, it offers many choices for configuration, satisfying all kinds of data length demands. See the table below. The output configuration means the data is sent from the master to the salve; the input configuration means from the salve to the master.

Output configuration	Input configuration	I/O configuration
1 Word Out	1 Word Out	1 Word Out 1 Word In
2 Word Out	2 Word Out	2 Word Out 1 Word In
4 Word Out	4 Word Out	4 Word Out 1 Word In
8 Word Out	8 Word Out	8 Word Out 1 Word In
16 Word Out	16 Word Out	16 Word Out 1 Word In
32 Word Out	32 Word Out	32 Word Out 1 Word In
64 Word Out	64 Word Out	64 Word Out 1 Word In

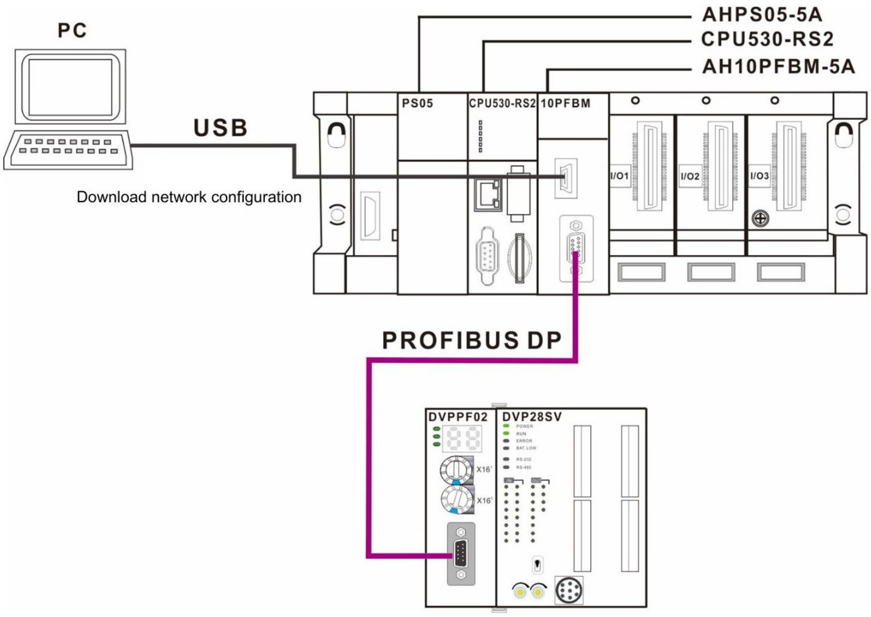
13.4.10 Application Example

13.4.10.1 Control Requirement

Exchange data between the master AH10PFBM-5A and the slave DVPPF02-SL through the PROFIBUS DP network.

13.4.10.2 Connect DVPPF02-SL to the PROFIBUS DP Network

1. The AH10PFBM-5A PLC is the PROFIBUS DP master and DVPPF02-SL the slave. See figure below for the network structure.



2. Set the PROFIBUS address of DVPPF02-SL to “2”.
3. Connect a DVP-SV PLC on the right side of DVPPF02-SL and check if the connection is proper.

Note: The corresponding device addresses are different for DVPCOPM-SL with different PLC. Please refer to Input and Output Mapping Areas for DVPCOPM-SL for details. Here the PLC is DVP-28SV.

13.4.10.3 Software Instructions

1. ISPSoft software is Delta's PLC programming software, and it can be downloaded from Delta's official website: http://www.deltaww.com/.
2. In this example, we take AH10PFBM-5A as PROFIBUS DP master and illustrate with SYCON.net software.

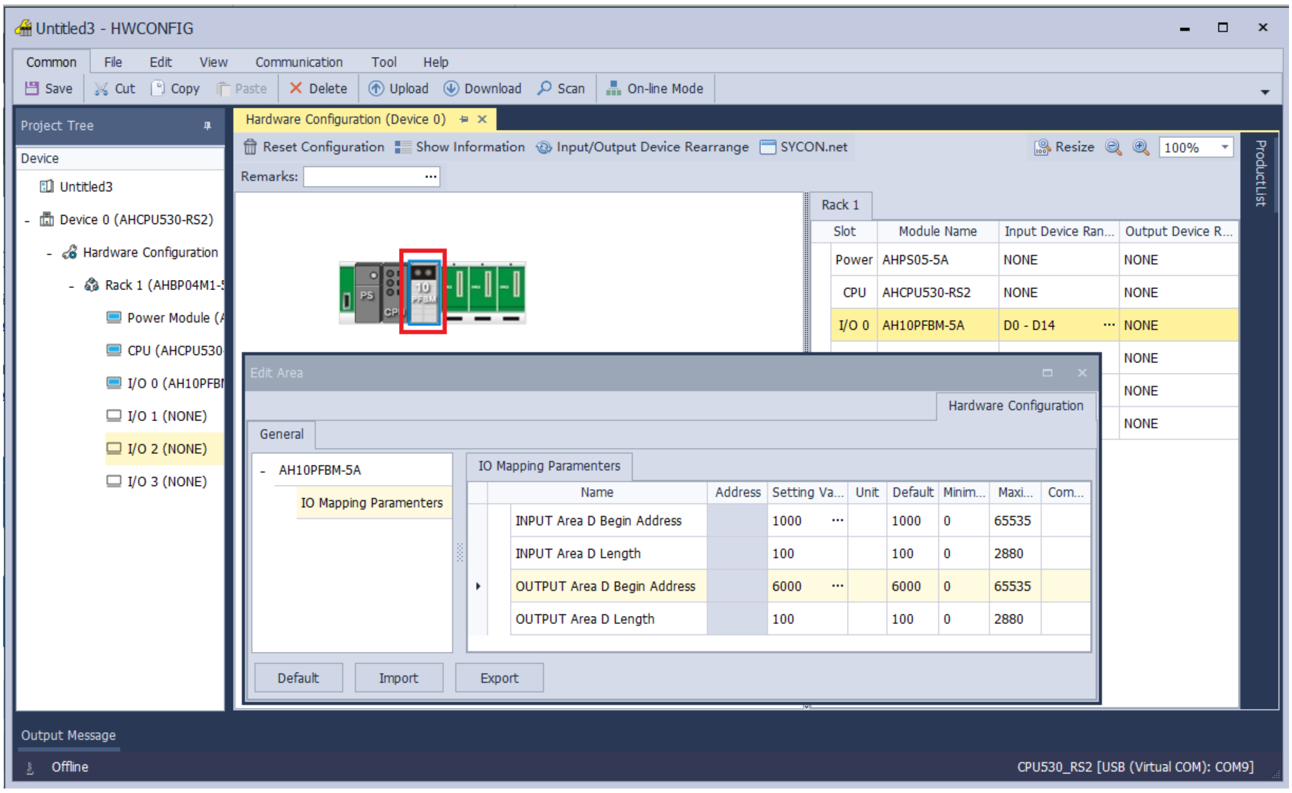
13.4.10.4 Master Station Configuration

Please refer to Chapter 10 of the SYCON.net software manual for details.

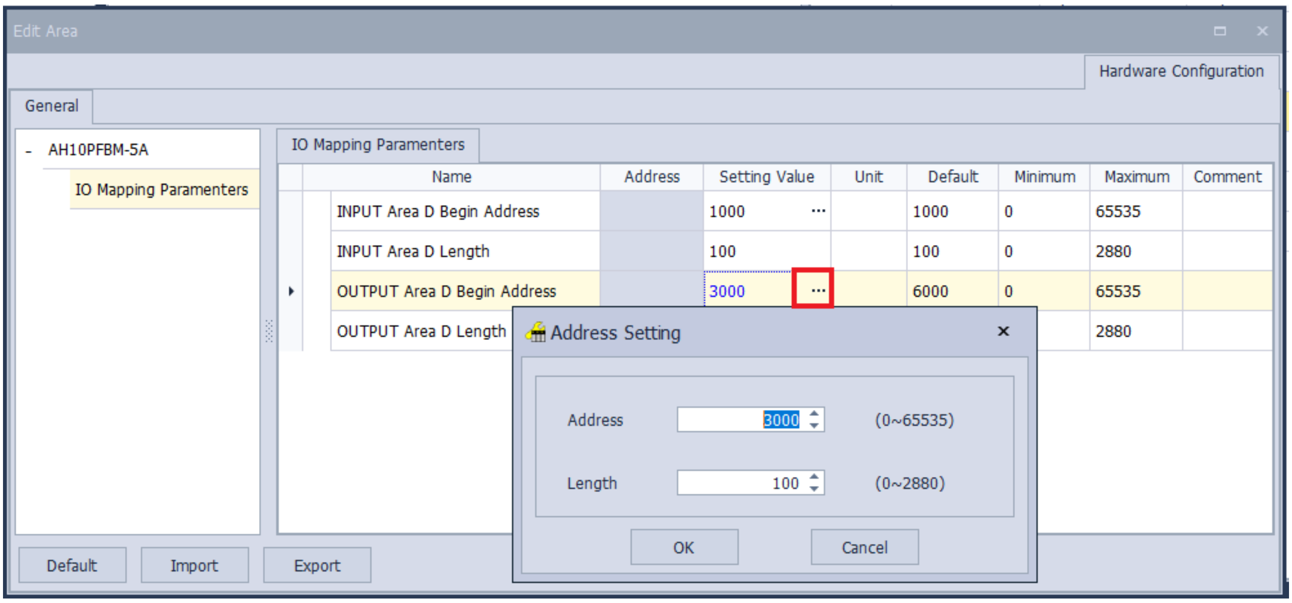
13.4.10.5 I/O Mapping Relationship between Master PLC and Slave PLC

The input and output areas assigned by the master module for the AH master PLC are shown in the diagram below.

(For detailed setup instructions, please refer to section 15.1 of the SYCON.net software manual.)



The diagram below illustrates the starting addresses and lengths of the OUTPUT and INPUT areas assigned by the master module for the master PLC. Data from the OUTPUT area is transmitted to the slave, while the INPUT area receives data sent from the slave.



The diagram below illustrates the mapping addresses allocated by the master station for the slave configuration module parameters. By the upper and lower diagrams, it can be observed that the slave configuration module corresponds to the starting register numbers of the master PLC's OUTPUT and INPUT areas.

Offset Address: Corresponding to the offset of the starting addresses of the INPUT and OUTPUT areas allocated by the AH master station PLC, unit: Byte

Calculation method for the starting D registers of the slave configuration module corresponding to the master station PLC:

Starting register number of OUTPUT area D registers corresponding to the slave configuration module = Starting address of OUTPUT area + (offset address / 2).

Starting register number of INPUT area D registers corresponding to the slave configuration module = Starting address of INPUT area + (offset address / 2).

The above explains the connection between the master and the DVPPF02-SL slave. The mapping relationship between the master PLC's D registers and the slave configuration module is related to the master station parameter settings. For detailed setup instructions, please refer to Section 10.3.2 of the SYCON.net software manual.

In this example, the starting addresses assigned by the AH master PLC for the INPUT and OUTPUT areas are D1000 and D3000, respectively.

The mapping relationship between the master PLC and the configuration options of the DVPPF02-SL slave is as follows:

Master PLC Register		DVPPF02-SL configuration	Offset
D3000	⇨	1 Word In	0
D3001		1 Word In, 1 Word Out	2
D1000	⇦	1 Word Out	0
D1001		1 Word In, 1 Word Out	2

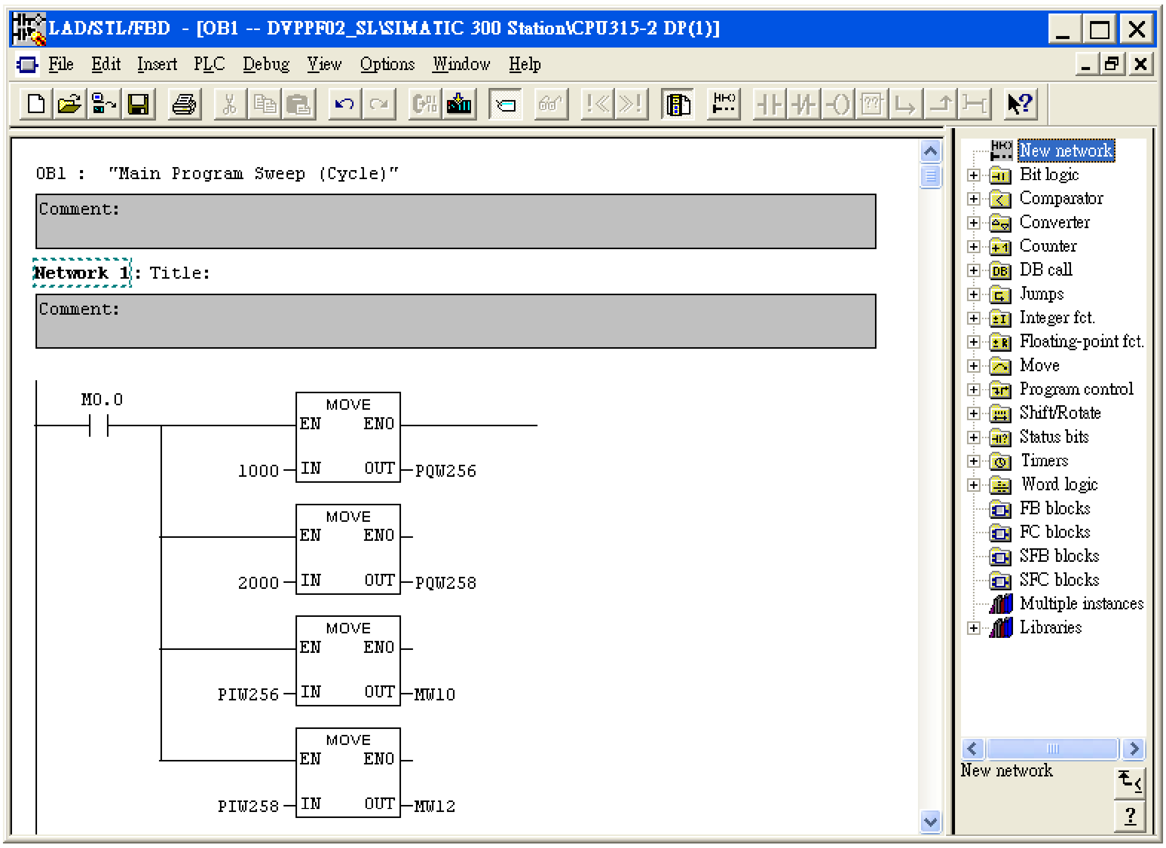
The corresponding registers for data exchange between the master and the slave are shown in the following table:

Registers for AH PLC of AH10PFBM-5A master	Direction of data transmission in PROFIBUS DP network	Registers for SV PLC of DVPPF02-SL slave
D3000	⇨	D6000
D3001		D6001
D1000	⇦	D6250
D1001		D6251

13.4.10.6 PLC Programming

- **The program for master PLC**

Using ISPSoft software to write the program for the master PLC, when the master PLC is running and M0 is ON, it controls the configuration options of the DVPPF02-SL. When M1 is ON, the master PLC reads the corresponding values of the DVPPF02-SL configuration options.



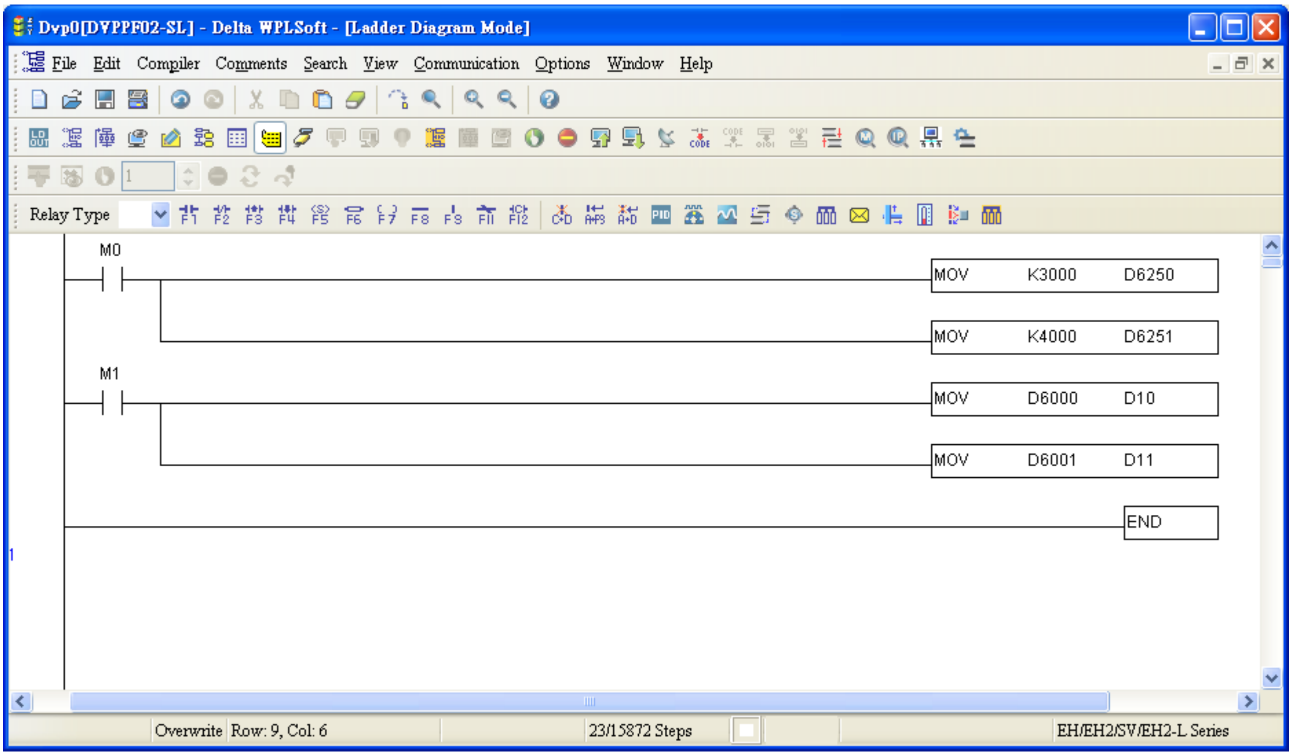
(For illustration purposes only)

- Program introduction of Master PLC:

1. The master program is written in sections 2 and 3.
2. When M0 is ON, write 1000 to D3000 and 2000 to D3001. The master station will transmit the data of D3000 and D3001 through the PROFIBUS DP bus to the slave's D6000 and D6001.
3. When M1 is ON, write the data of D1000 to D100 and the data of D1001 to D110. The data of D1000 and D1001 are transmitted from the slave's D6250 and D6251 to the master through the PROFIBUS DP bus.

- The program for slave PLC

Using the WPL software to write the program for the slave PLC, when the slave PLC is running and M0 is ON, it controls the configuration options of the DVPPF02-SL. When M1 is ON, the slave PLC reads the corresponding values of the DVPPF02-SL configuration options.



(For illustration purposes only)

■ Program introduction of Slave PLC

1. Delta PLC programs can be designed by the Delta WPLSoft software. For details on programming methods, please refer to the software manual.

2. When M0 is ON, write 3000 to D6250 and 4000 to D6251. The DVPPF02-SL will transmit the data of D6250 and D6251 through the PROFIBUS DP bus to the master's D1000 and D1001.

3. When M1 is ON, write the value of D6000 to D10 and the value of D6001 to D11. The data of D6000 and D6001 are transmitted from the master (D3000 and D3001) to the DVPPF02-SL through the PROFIBUS DP bus.

13.4.11 LED Indicator and Troubleshooting

13.4.11.1 LED Indicator

- **POWER LED**

LED status	Indication	How to correct
Green light ON	The power supply is normal.	--
OFF	No power supply	1. Check if the connection between DVPPF02-SL and the PLC CPU is normal. 2. Check if the power supply from the PLC CPU is normal.

- **NET LED**

LED status	Indication	How to correct
Green light ON	A connection is established between the master and slave.	--
Red light ON	DVPPF02-SL has not established a connection with the master.	1. Check if DVPPF02-SL is connected with the PROFIBUS DP bus. 2. Check if the communication cable between DVPPF02-SL and the PROFIBUS DP master is well connected. 3. Check if the actual address of DVPPF02-SL is consistent with the address configured in the software. 4. Check if the GSD file is used correctly.

13.4.11.2 Digital Display

Code	Indication	How to correct
1 to 7D	The node address of DVPPF02-SL when it is operating normally.	--
F0	The node address of DVPPF02-SL is out of range.	Set the node address of DVPPF02-SL to 1 to 125.
F1	DVPPF02-SL is initializing.	--
F2	Error in low voltage detection	1. Check if the connection between DVPPF02-SL and the PLC CPU is normal. 2. Check if the power supply from the PLC CPU is normal.
F3	DVPPF02-SL enters factory test mode.	When PLC is SV and SX2, write 0 to D6350 When PLC is SV3 and SX3, write 0 to D16350
F4	DVPPF02-SL is disconnected from the master.	Check if the communication cable between DVPPF02-SL and the PROFIBUS DP master is well connected.
F5	Error in parameter	Check if the GSD file is used correctly.
F7	Hardware error	Contact your local distributors.
F9	Configuration error	Check if the GSD file is used correctly.
80	The PLC CPU connected to DVPPF02-SL is in STOP status.	Switch the PLC CPU to RUN.

Operation of Digital Display

1. When DVPPF02-SL is in normal operation status and the PLC CPU is in RUN status, the digital display will only show its node address.
2. When DVPPF02-SL is in normal operation status and the PLC CPU is in STOP status, the digital display will show its node address and the STOP status code alternately.
3. When DVPPF02-SL is initializing or in error status and the PLC CPU is in RUN status, the digital display will show its node address, initialization code or error code alternately.
4. When DVPPF02-SL is initializing or in error status and the PLC CPU is in STOP status, the digital display will show its node address, initialization or error code and STOP status code alternately.

13.5 DVPSCM12-SL/DVPSCM52-SL

13.5.1 Introduction

DVPSCM, serial communication modules, support MODBUS UD Link (user-defined format of RS-485). Besides, they can be used as a RS-422 or RS-485 communication port of the PLC CPU, and programming, uploading, downloading, and monitoring can be carried out by Delta PLC software. SCMSoft, the setting software of DVPSCM12/52-SL, is built in Delta communication software DCISoft. Please download DCISoft software from Delta website.

DVPSCM52-SL is a slave communication module using a building automation control network communication protocol, BACnet MS/TP. It is equipped with all the functions of DVPSCM12-SL and supports the BACnet MS/TP slave communication protocol. It can read/write the BV values or AV values from/into a BACnet MS/TP master. SCMSoft, the setting software of DVPSCM52-SL, is built in Delta communication software, DCISoft. Please download DCISoft V1.08 or above from Delta website.

13.5.1.1 Features

- It provides RS-422 and RS-485 communication ports (COM1 & COM2).
- RS-422/RS-485 communication and the power supply are isolated from each other.
- There are two built-in 120 Ω terminal resistors and switches.
- Each communication port can connect to at most 32 devices.
- It has the MODBUS data exchange functions (MODBUS Advance).
- It has the user-defined communication protocol, and the process planning function (UD Link).
- DVPSCM52-SL supports the BACnet MS/TP slave functions and can connect to a superior device.
- The CPUs supports: DVP-SA2 (V1.0), DVP-SX2 (V1.2), DVP-SV (V2.2), DVP-SE (V1.0), EH2-L (V2.20), and EH3-L (V1.00) series.
- Firmware version V1.10 and above support DVP-SV3 and DVP-SX3 PLC.

13.5.1.2 Specifications

- RS-485/RS-422 interface

Item	Specifications
Terminal	European terminal blocks with spring plugs
Transmission rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 230400, and 460800 (Unit: bps)
Communication format	Stop bit: 1, 2; Parity bit: None, Odd, Even; Data bit: 7, 8
Communication protocol	MODBUS ASCII/RTU, UD Link, and BACnet MS/TP slave (supported by DVPSCM52-SL)

- Electrical Specifications

Item	Specifications
Supply voltage	24 VDC (Power is supplied by the internal bus through the CPU)
Power consumption	1.5 W
Insulation voltage	2500 VDC
Weight	95 g

- BACnet Protocol Implementation Statement

1. Introduction of the standard BACnet device

Model	Introduction
DVPSCM52-SL	BACnet Application Specific Controller (B-ASC)

2. Supported BIBBs

Model	BIBBs	BIBB Name
DVPSCM52-SL	DS-RP-B	Data Sharing-ReadProperty-B
	DS-WP-B	Data Sharing-WriteProperty-B
	DM-DDB-B	Device Management-DynamicDeviceBinding-B
	DM-DOB-B	Device Management-DynamicObjectBinding-B
	DM-DCC-B	Device Management-DeviceCommunicationControl-B
	DS-RPM-B	Data Sharing-ReadPropertyMultiple-B
	DS-WPM-B	Data Sharing-WritePropertyMultiple-B

3. Supported objects

Model	Object	Creation	Deletion
DVPSCM52-SL	Analog value	Not supported	Not supported
	Binary value	Not supported	Not supported
	Device	Not supported	Not supported

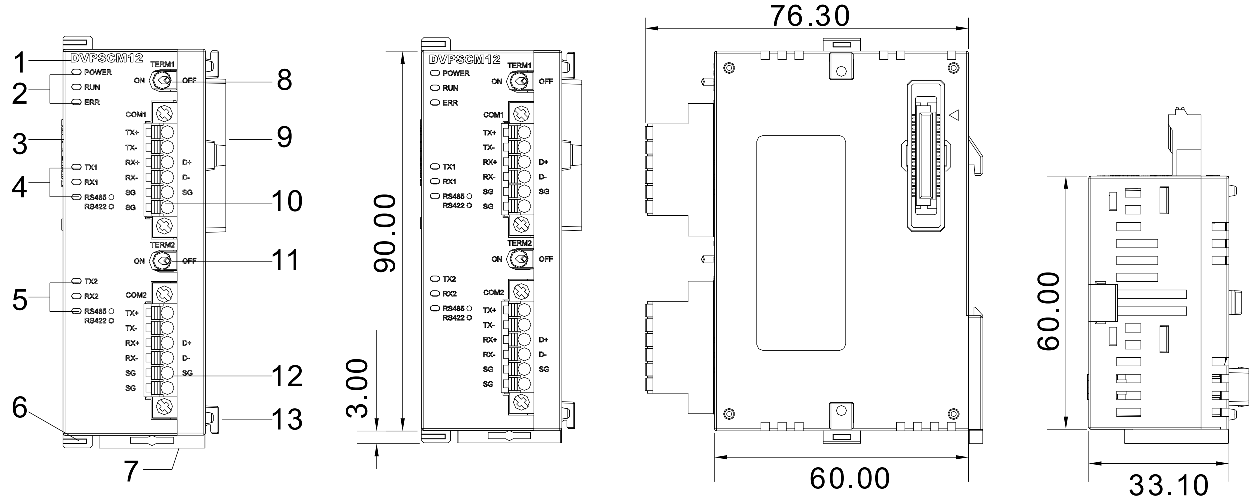
4. Data Link Layer Options

Model	Data Link	Supported Baud Rate
DVPSCM52-SL	MS/TP Slave	9600/1920/38400/76800

5. Supported character set

Model	Character set
DVPSCM52-SL	ANSI X3.4

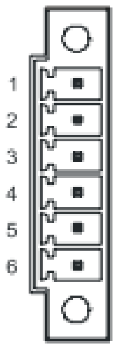
13.5.2 Module Profiles and Dimensions



Unit: mm

No.	Name	Description
1	Model name	Model name of the module
2	POWER LED indicator	Indicates the status of the power supply ON: the power is on OFF: no power
	RUN LED indicator	ON: SCM module status is RUN OFF: SCM module status is STOP
2	ERROR LED indicator	ON: hardware error has occurred OFF: no error Blinking (0.2 seconds ON/OFF): system configuration or communication error.
3	Extension module connection port	Connect the modules.
4	TX1, RX1, RS-485/RS-422 indicators	OFF: RS-485/RS-422 no transmission/reception Blinking: RS-485/RS-422 transmission/reception in progress
5	TX2, RX2, RS-485/RS-422 indicators	OFF: RS-485/RS-422 no transmission/reception Blinking: RS-485/RS-422 transmission/reception in progress
6	Extension unit fixing clip	For securing the extension module
7	DIN rail securing clip	Secure the module on the set
8	Terminal resistor 1 switch	120 Ω termination resistor enhances the system's anti-interference capability
9	Extension port	Connect the PLC or the modules
10	RS-485/RS-422communication port 1	Used for communication wiring
11	Terminal resistor 2 switch	120 Ω termination resistor enhances the system's anti-interference capability
12	RS-485/RS-422 communication port 2	Used for communication wiring
13	Extension unit positioning hole	For positioning between modules

13.5.3 Terminals

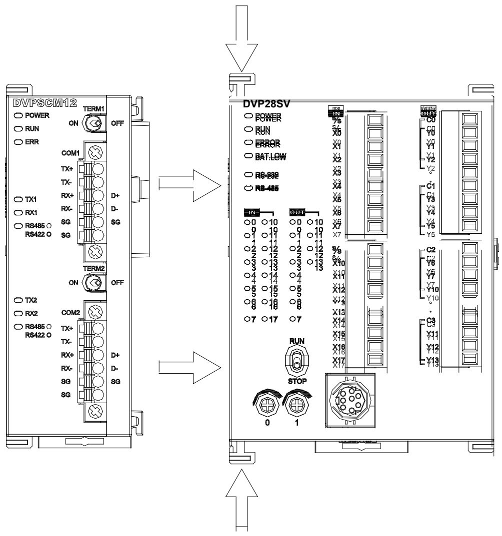
RS-485/RS-422 communication port definitions			
	Terminal no.	RS-485	RS-422
	1	-	TX+
	2	-	TX-
	3	D+	RX+
	4	D-	RX-
	5	SG	SG
	6	-	SG

13

13.5.4 Installation and Wiring

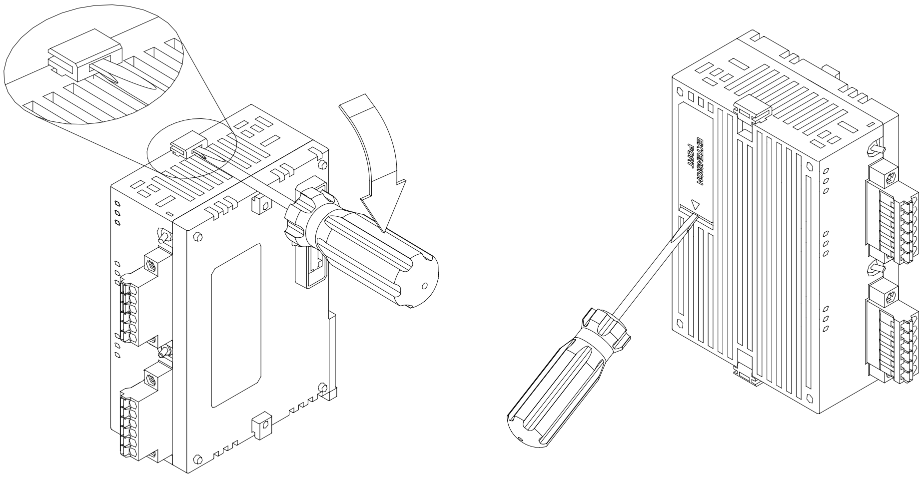
13.5.4.1 Installation

1. The PLC connects to the SCM module.
   - Adjust the clips connecting to the left-side module on the CPU.
   - Direct the I/O module to the interface on the CPU; combine the I/O module with the CPU as shown in the figure below.
   - Tighten the clips connecting to the left-side module on the CPU.



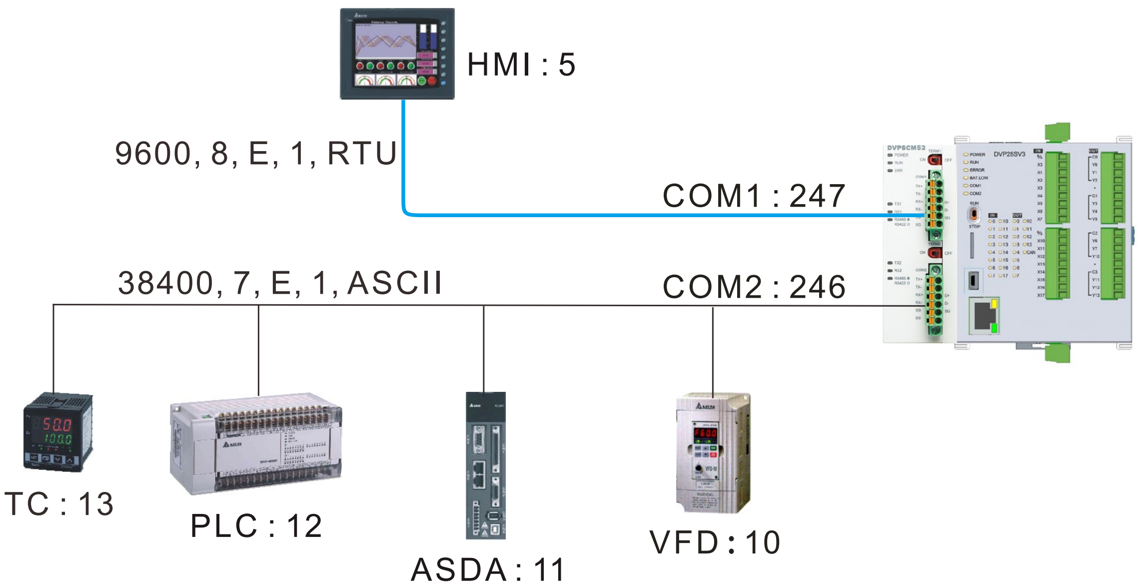
2. SCM module connects to other I/O modules

To connect the SCM module to other I/O modules, use a screwdriver to lift the extension clip on the I/O module and open the side cover. Then, align the connectors of the SCM module and the I/O module, and connect them securely.



13.5.4.2 Wiring

SCM module can be connected to other Delta industrial products via standard MODBUS communication, including Touch Panel HMI, Text Panel HMI, programmable logic controllers, inverters and servo motors. The connection example is as follows:



13.5.5 Control Register

CR#	Attribute	Name of the register	Description
0	R	Model code	The code is set up by the system. Model code of DVPSCM12-SL=H'4041 Model code of DVPSCM52-SL=H'4042
1	R	Firmware version	The firmware version is displayed in a hexadecimal value. For example, H'0100 indicates that the firmware version is V1.00.
2	Reserved		
3	R/W	Group number triggered by COM1 UD Link	The group number triggered by COM1 UD Link
4	R/W	Reference address of the data sent through COM1 in UD Link	It is used when COM1 UD Link chooses "Base+Offset". "Reference data register+Offset" defines the actual source device for the data sending.
5	R/W	Reference address of the data received through COM1 in UD Link	It is used when COM1 UD Link chooses "Base+Offset". "Reference data register+Offset" defines the actual source device for the data receiving.
6	Reserved		
7	R/W	Group number triggered by COM2 UD Link	The Group number triggered by COM2 UD Link
8	R/W	Reference address of the data sent through COM2 in UD Link	It is used when COM2 UD Link chooses "Base+Offset". "Reference data register+Offset" defines the actual source device for the data sending.
9	R/W	Reference address of the data received through COM2 in UD Link	It is used when COM2 UD Link chooses "Base+Offset". "Reference data register+Offset" defines the actual source device for the data receiving.
10	R	Module status	RUN or STOP
11 to 19	R	Error Flag	The flag for an error in the module; please refer to the following explanation.
20 to 27	R	UD Link status	The execution status of UD Link
28 to 29	Reserved		
30	R/W	Triggering the UD Link sequence	0: Not triggered, 1 to 254: Number of times the UD Link sequence is triggered 255: Always triggered
31	R/W	Triggering the data exchange through COM1 to read bits or words	High byte: bit; Low byte: word 0: Not triggered; 1: Triggered once; 2: Always triggered
32	R/W	Triggering the data exchange through COM2 to read bits or words.	High byte: bit; Low byte: word 0: Not triggered; 1: Triggered once; 2: Always triggered
33	R/W	Triggering the data exchange through COM1 to write bits or words.	High byte: bit; Low byte: word 0: Not triggered; 1: Triggered once; 2: Always triggered
34	R/W	Triggering the data exchange through COM2 to write bits or words.	High byte: bit; Low byte: word 0: Not triggered; 1: Triggered once; 2: Always triggered
35 to 36	R/W	Selecting the "reading bits through COM1" checkbox	Bit = 0: Disabling the function of reading bits through COM1. Bit = 1: Enabling the function of reading bits through COM1.

CR#	Attribute	Name of the register	Description
37 to 38	R/W	Selecting the "reading words through COM1" checkbox	Bit = 0: Disabling the function of reading words through COM1. Bit = 1: Enabling the function of reading words through COM1.
39 to 40	R/W	Selecting the "reading bits through COM2" checkbox	Bit = 0: Disabling the function of reading bits through COM2. Bit = 1: Enabling the function of reading bits through COM2.
41 to 42	R/W	Selecting the "reading words through COM2" checkbox	Bit = 0: Disabling the function of reading words through COM2. Bit = 1: Enabling the function of reading words through COM1.
43 to 44	R/W	Selecting the "writing bits through COM1" checkbox	Bit = 0: Disabling the function of writing bits through COM1. Bit = 1: Enabling the function of writing bits through COM1.
45 to 46	R/W	Selecting the "writing words through COM1" checkbox	Bit = 0: Disabling the function of writing words through COM1. Bit = 1: Enabling the function of writing words through COM1.
47 to 48	R/W	Selecting the "writing bits through COM2" checkbox	Bit = 0: Disabling the function of writing bits through COM2. Bit = 1: Enabling the function of writing bits through COM2.
49 to 50	R/W	Selecting the "writing words through COM2" checkbox	Bit = 0: Disabling the function of writing words through COM2. Bit = 1: Enabling the function of writing words through COM2.
51	R/W	COM1 station number	Range: 1 to 247
52	R/W	COM1 baud rate	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 76800 8: 115200 9: 230400 10: 460800
53	R/W	COM1 format (Data Length, Parity, Stop Bits)	0: 7, Even, 1 1: 7, Even, 2 2: 7, Odd, 1 3: 7, Odd, 2 4: 7, None, 1 5: 7, None, 2 6: 8, Even, 1 7: 8, Even, 2 8: 8, Odd, 1 9: 8, Odd, 2 10: 8, None, 1 11: 8, None, 2
54	R/W	COM1protocol and interface	High byte: communication protocol (0: MODBUS; 1: UD Link; 2: BACnet MS/TP slave) Low byte: communication interface (0: RS-485; 1: RS-422) DVPSCM12-SL | Interface

13

<table>
<tr><th>CR#</th><th>Attribute</th><th>Name of the register</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th colspan="2"></th><th>RS-485</th><th>RS-422</th></tr>
<tr><td rowspan="2">Protocol</td><td>MODBUS</td><td>16#0000</td><td>16#0001</td></tr>
<tr><td>UD Link</td><td>16#0100</td><td>16#0101</td></tr>
</table>
<table>
<tr><th colspan="2" rowspan="2">DVPSCM52-SL</th><th colspan="2">interface</th></tr>
<tr><th>RS-485</th><th>RS-422</th></tr>
<tr><td rowspan="3">Protocol</td><td>MODBUS</td><td>16#0000</td><td>16#0001</td></tr>
<tr><td>UD Link</td><td>16#0100</td><td>16#0101</td></tr>
<tr><td>BACnet MS/TP slave</td><td>16#0200</td><td>16#0201</td></tr>
</table>
</td></tr>
<tr><td>55</td><td>R/W</td><td>COM1 communication timeout</td><td>1 to 65535 ms (65535 indicates no timeout).</td></tr>
<tr><td>56</td><td>R/W</td><td>COM1 transmission delay</td><td>0 to 65535 ms</td></tr>
<tr><td>57</td><td>R/W</td><td>COM1 transmission mode</td><td>0: ASCII; 1: RTU</td></tr>
<tr><td>58</td><td>R/W</td><td>Number of COM1 communication retry</td><td>0 to 255</td></tr>
<tr><td>59 to 60</td><td colspan="3">Reserved</td></tr>
<tr><td>61</td><td>R/W</td><td>COM2 station number</td><td>Range: 1 to 247</td></tr>
<tr><td>62</td><td>R/W</td><td>COM2 baud rate</td><td>0: 1200
1: 2400
2: 4800
3: 9600
4: 19200
5: 38400
6: 57600
7: 76800
8: 115200
9: 230400
10: 460800</td></tr>
<tr><td>63</td><td>R/W</td><td>COM2 format (Data Length, Parity, Stop Bits)</td><td>0: 7, Even, 1
1: 7, Even, 2
2: 7, Odd, 1
3: 7, Odd, 2
4: 7, None, 1
5: 7, None, 2
6: 8, Even, 1
7: 8, Even, 2
8: 8, Odd, 1
9: 8, Odd, 2
10: 8, None, 1
11：8, None, 2</td></tr>
<tr><td>64</td><td>R/W</td><td>COM2 protocol and interface</td><td>High byte: communication protocol
(0: MODBUS; 1: UD Link; 2: BACnet MS/TP slave)
Low byte: interface (0: RS-485; 1: RS-422)</td></tr>
</table>

<table>
<tr><th>CR#</th><th>Attribute</th><th>Name of the register</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td colspan="2" rowspan="2">DVPSCM12-SL</td><td colspan="2">interface</td></tr>
<tr><td>RS-485</td><td>RS-422</td></tr>
<tr><td rowspan="2">protocol</td><td>MODBUS</td><td>16#0000</td><td>16#0001</td></tr>
<tr><td>UD Link</td><td>16#0100</td><td>16#0101</td></tr>
</table>
<table>
<tr><td colspan="2" rowspan="2">DVPSCM52-SL</td><td colspan="2">interface</td></tr>
<tr><td>RS-485</td><td>RS-422</td></tr>
<tr><td rowspan="3">protocol</td><td>MODBUS</td><td>16#0000</td><td>16#0001</td></tr>
<tr><td>UD Link</td><td>16#0100</td><td>16#0101</td></tr>
<tr><td>BACnet MS/TP slave</td><td>16#0200</td><td>16#0201</td></tr>
</table>
</td></tr>
<tr><td>65</td><td>R/W</td><td>COM2 communication timeout</td><td>1 to 65535 ms (65535 indicates no timeout)</td></tr>
<tr><td>66</td><td>R/W</td><td>COM2 transmission delay</td><td>0 to 65535 ms</td></tr>
<tr><td>67</td><td>R/W</td><td>COM2 transmission mode</td><td>0: ASCII; 1: RTU</td></tr>
<tr><td>68</td><td>R/W</td><td>Numbers of COM2 communication retry</td><td>0 to 255</td></tr>
<tr><td>69 to 70</td><td colspan="3">reserved</td></tr>
<tr><td>71</td><td>R/W</td><td>COM ON/OFF setting</td><td>High byte: COM1, low byte: COM2
<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">COM2</td></tr>
<tr><td>OFF</td><td>ON and Latched *2</td><td>ON and non-latched *1</td></tr>
<tr><td rowspan="3">COM1</td><td>OFF</td><td>16#0000</td><td>16#0011</td><td>16#0022</td></tr>
<tr><td>ON and latched</td><td>16#1100</td><td>16#1111</td><td>16#1122</td></tr>
<tr><td>ON and non-latched</td><td>16#2200</td><td>16#2211</td><td>16#2222</td></tr>
</table>
0x00: OFF
0x11: setting ON and latched
0x22: setting ON and non-latched
When the CR value is set to the above values, executing the COM1/2 configuration function. CR value will automatically set back to 16#0000 after the configuration trigger.
*1: it is recommended to apply non-latched setting to prevent frequent writing operations from affecting the lifespan of the product’s internal materials.
*2: Please note that if a power outage occurs during latched data restoration, there is a risk of data loss.</td></tr>
<tr><td>72</td><td>R</td><td>COM status setting</td><td>High byte: COM1; Low byte: COM2.
Display the execution status of COM1 and COM2 settings. Code explained below:
0x00: Not configured
0x01: Configuration successful
0x02: Configuration in progress
0x03: Error - Station number setting out of range
0x04: Error - Baud rate setting out of range</td></tr>
</table>

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CR#	Attribute	Name of the register	Description
			0x05: Error - Format setting out of range 0x06: Error - Communication interface setting out of range 0x07: Error - Communication timeout setting out of range 0x08: Error - Transmission mode setting out of range 0x09: Error - Communication retry count setting out of range 0x0A: Error - Configuration ON/OFF setting out of range
73	R/W	Restore to factory settings	16#55AA: Restore to factory settings. After the setting is triggered, the CR value is automatically set back to 16#0000.
74	R	Restore to factory default status	16#0000: Not configured 16#0001: Configuration successful 16#0002: Configuration in progress
75 to 115	reserved		
116	R/W	Sending the MODBUS command	1: Enabling the sending After the sending of the MODBUS command is complete, CR#116 is reset to 0.
117	R/W	Processing status of the MODBUS command	0: Not yet received; 1: Processing; 2: Received; 3: Reception failure
118	R/W	Destination of the MODBUS command	1: COM1, 2: COM2
119	R/W	Length of the MODBUS command	Setting the length of the MODBUS command
120 to 249	R/W	Contents of the MODBUS command	The space for storing the MODBUS command which is sent/received
Symbol: R: data can be read using the FROM instruction; W: data can be written using the TO instruction. The left-side high-speed special module codes are used in the range from K100 to K107.			

※ **Additional remarks**

1. CR#11: Error code

Error code	Description
0x0001	Hardware error
0x0002	UD Link error
0x0004	There is a communication error in the communication port.
0x0008	MODBUS communication error
0x0010	Restore to factory setting

2. CR#12: Hardware error flag

Bit	15 to 4	3	2	1	0
Description	Reserved	LV occurs.	SRAM is damaged.	GPIO is damaged.	FLASH is damaged.

3. CR#13：COM1 UD Link error flag

   CR#14：COM2 UD Link error flag

Bit	Description	Bit	Description
0	Group number is not found.	8	UD Link data check error
1	Command number is not found.	9	Unknown processing procedure
2	Packet editing error	10	Unknown Rx packet segment format
3	There is a comparison error in the data received.	11	Unknown Rx packet segment format
4	Checksum error	12	The length read from the register is out of range
5	reserved	13	The length written into the register is out of range
6	The data received is not sufficient for comparing	14	reserved
7	The data received is beyond expectation.	15	reserved

4. CR#15：COM1 MODBUS error flag
   CR#16：COM2 MODBUS error flag

Error code	Name	Description
0x0001	Illegal function	Unsupported function code
0x0002	Illegal data address	Unsupported address
0x0003	Illegal data value	Unsupported data value
0x0004	Slave device failure	The slave fails.
0x0005	Transform failure	Value conversion error

5. CR#17: COM1 communication error flag
   CR#18: COM2 communication error flag
   CR#19: internal communication error flag

Bit	Description	Bit	Description
0	Sending format error	8	Reserved
1	Parity check error	9	Reserved
2	Too late to receive the data.	10	Reserved
3	Communication timeout error	11	Reserved
4	Checksum error	12	Reserved
5	Internal communication timeout	13	Buffer for the sending is full.
6	Internal communication error	14	Buffer for the receiving is full.
7	Reserved	15	Reserved

6. The modification of communication parameters through CR#51-CR#74 requires firmware version V1.10 or above.

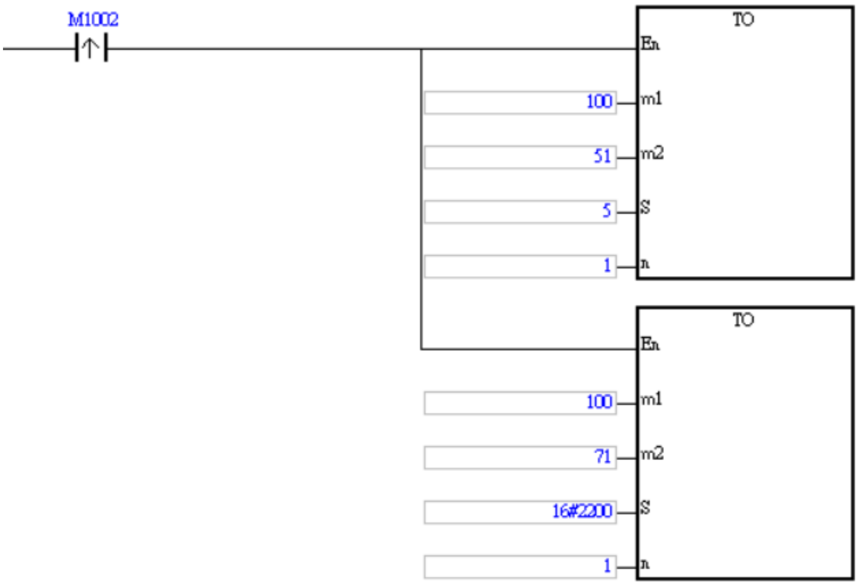
   The following example demonstrates the modification of the station number for COM1:

   (1) Write 5 to CR#51 to set the station number for COM1 to 5.

   (2) Write 16#2200 to CR#71, indicating the writing of COM1 parameters with non-latched function.

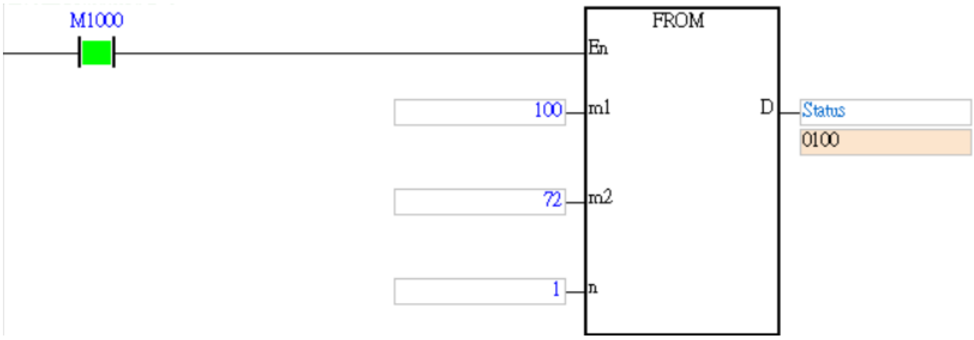
   - If setting COM2, write the configuration value to the low byte, such as 16#0022.
   - Note: When executing the writing operation with latched function, you must use the rising edge to execute

TO instruction (or TOP instruction) to prevent affecting the lifespan of the product’s internal materials.



(3) Confirm the setting status

- CR#72 = 16#0100:COM1 is configured correctly.
- If COM2 is configured, the low byte will display the status of COM2.



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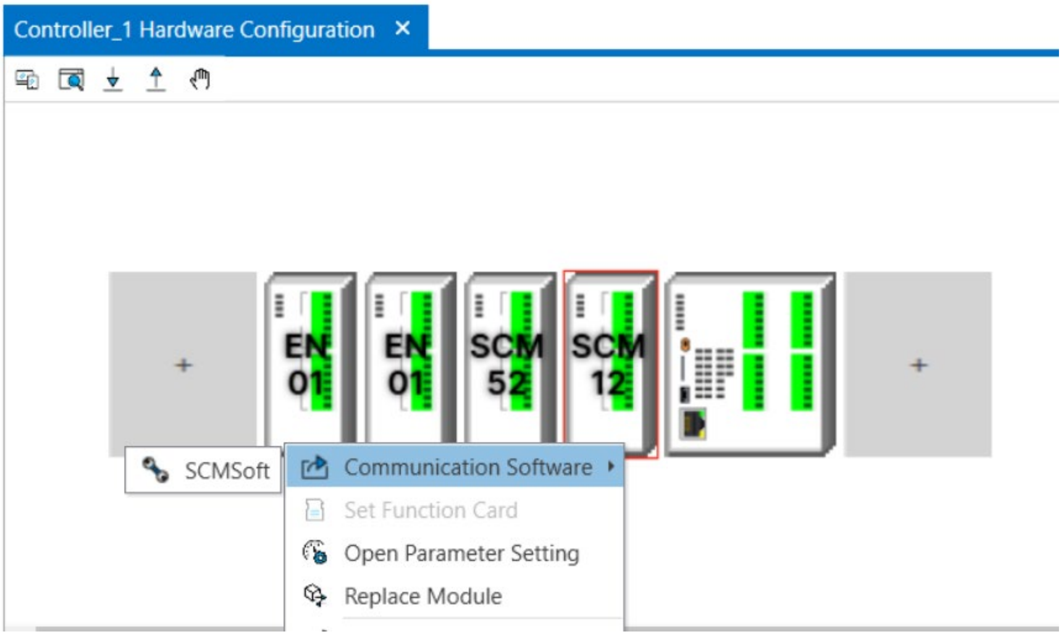
13.5.6 Rapid Start

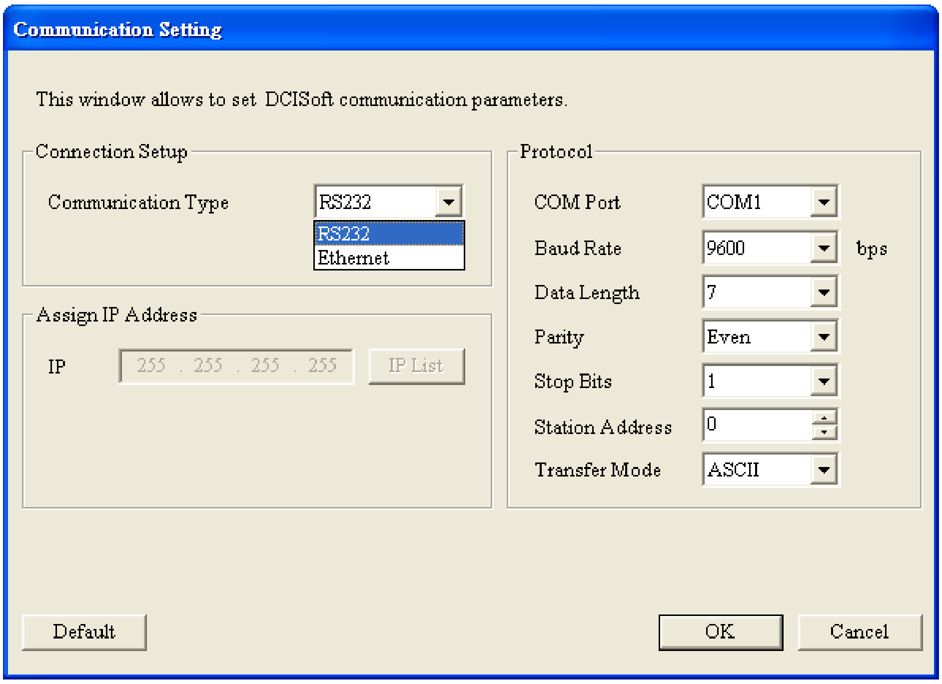
This section introduces how to execute MODBUS RS-485/RS-422 communication through the communications ports on the SCM module.

When installed on the left side of the DVP-SV3/SX3 PLC, you can also right-click on the module icon on the DIADesigner hardware configuration page to open SCMSoft.



- **Communication setting**

Open DCISoft, click “Tools” >“Communication Setting”. You can choose the communication port, and set the information related to RS-232. If an Ethernet module (DVPEN01-SL) is used with the SCM module, select “Ethernet” in “Communication Type” box to upload/download the program.

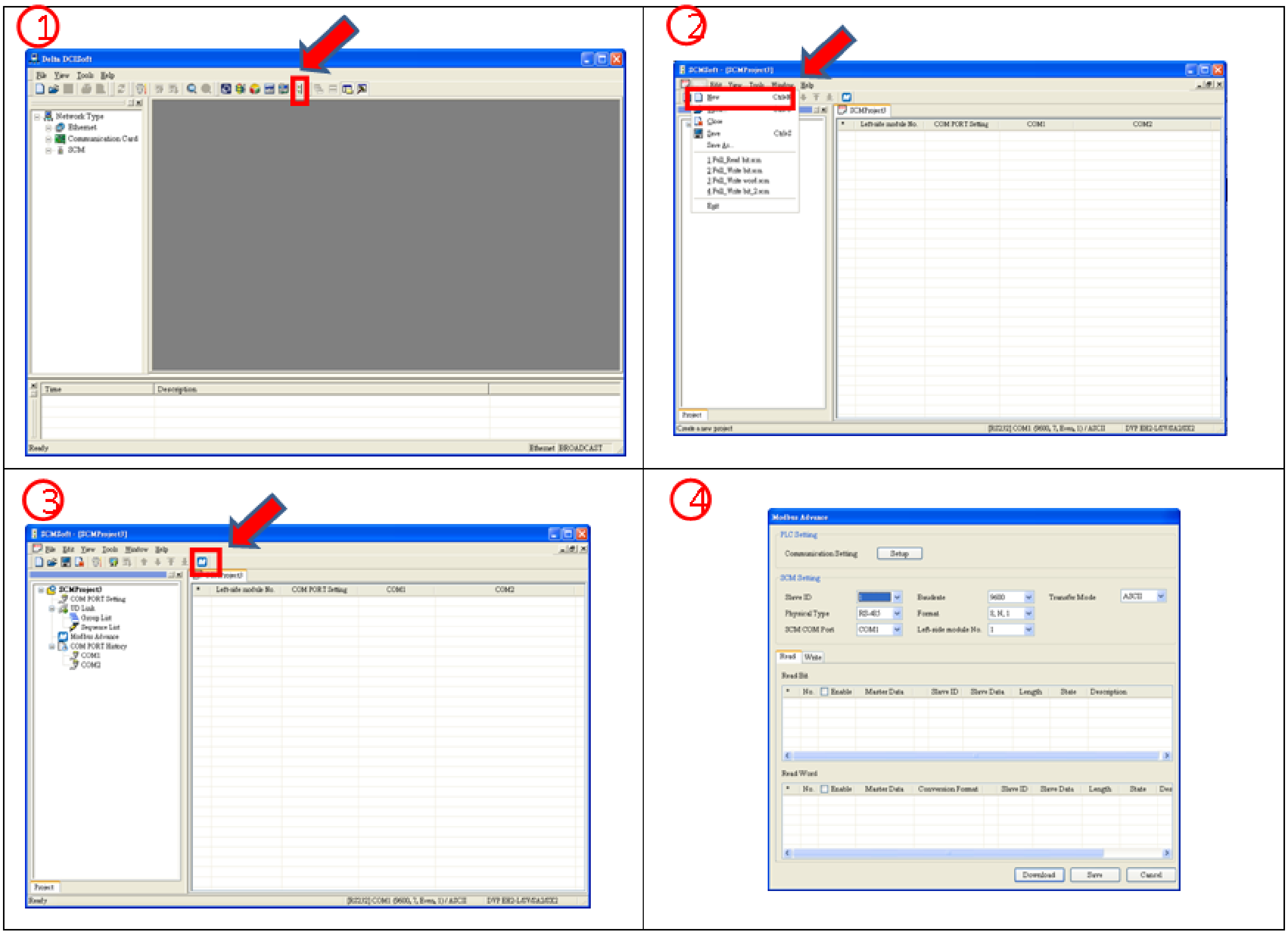


- **Opening a SCM project and MODBUS Advance**

① Click “SCMSoft” in DCISoft to open the setting page.

② Click “New Project” in SCMSoft to establish a SCM project.

③ Finally, click “MODBUS Advance Wizard” to open the setting page for the reading/writing.



- **Setting MODBUS Advance**

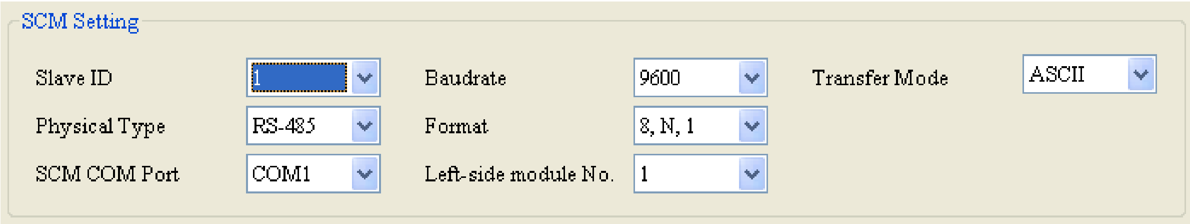
In order to expedite the communication using MODBUS, SCMSoft provides “MODBUS Advance Wizard”. The user only needs to designate the registers for the data sending and receiving, or the absolute positions. The settings will be downloaded to the SCM module through the communication port chosen by the user. After the flag is enabled, the designated reading and writing are complete. The following are the steps of setting the wizard.

1. MODBUS Advance－PLC Setting

   Click “Setup” to set the communication between the PLC and SCMSoft. If the setting has been completed at **Communication setting**, the user does not have to set the communication here again.

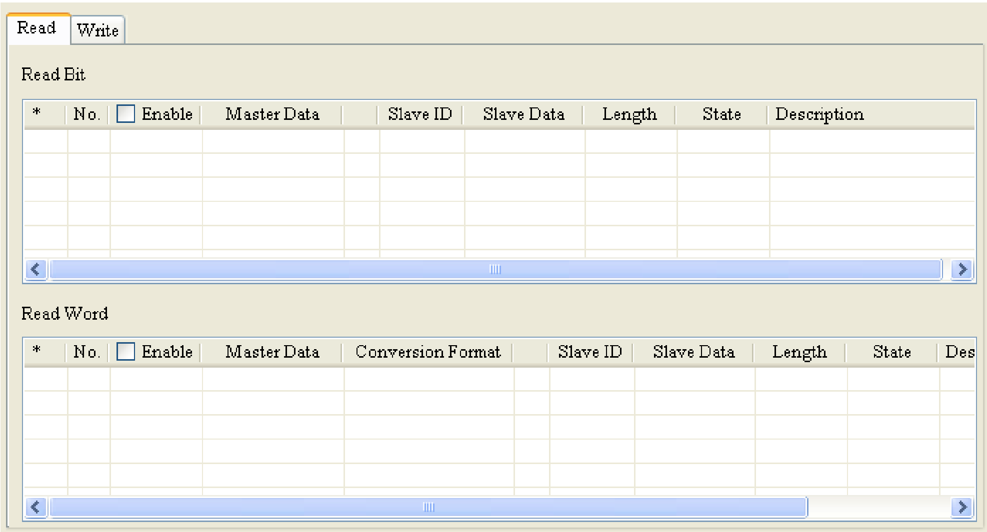
2. SCM Setting

   When setting the communication format of the communication port on the SCM module, the user can designate the left-side module number, and the communication port, and set the station address, the baud rate, the physical type, the transfer mode, and the format.

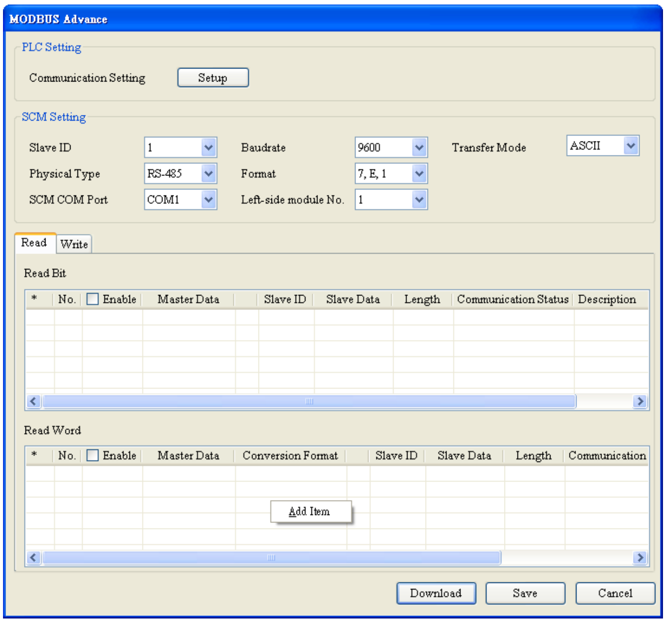


3. MODBUS Advance－Reading/Writing

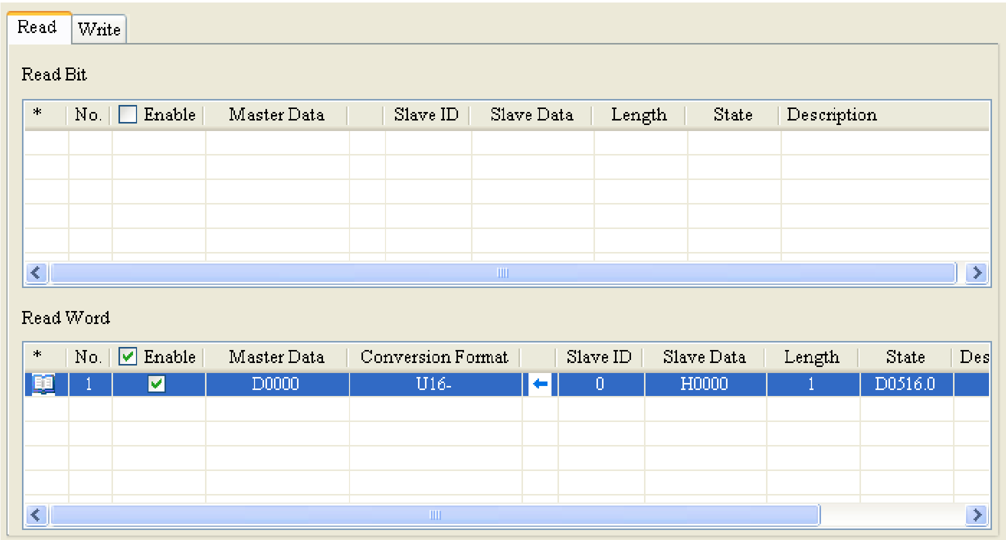
   Set “Read Bit”/“Read Word” and “Write Bit”/ “Write Word”.

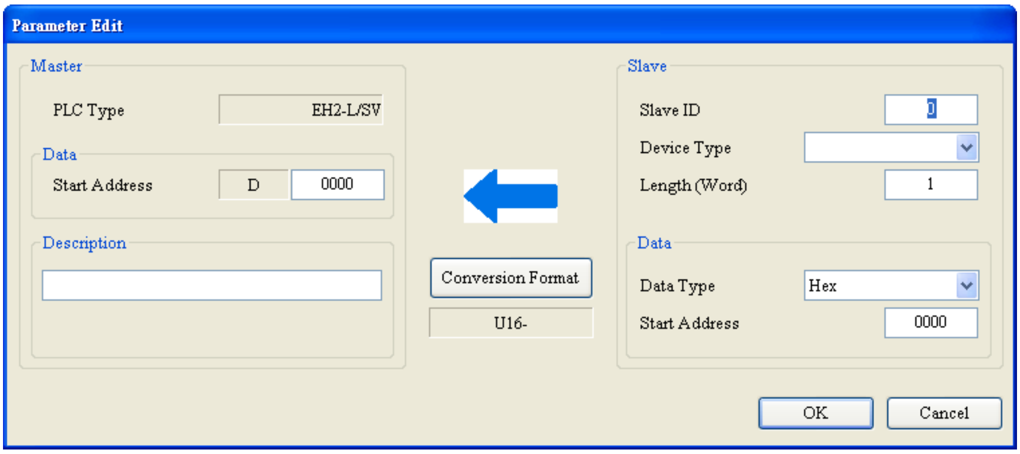


Right-click “Add Item” to increase bits and words. The bits are listed in the upper column, and the words are listed in the lower column.



Double-click the added item to edit the parameter.





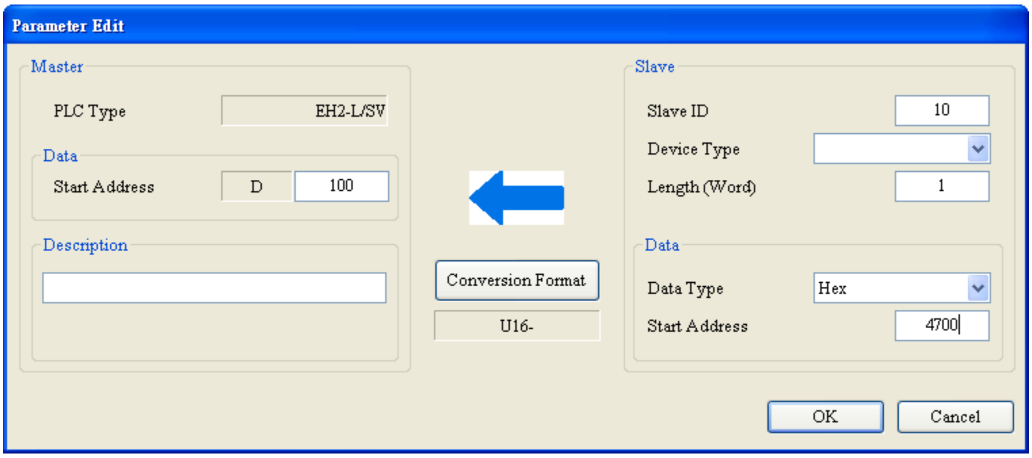
Master

PLC Type:	It displays the PLC type. You can click “Tools” in SCMSoft to change the PLC type.
Data:	Enter the address of the data register D in the PLC to store the value read from the slave.
Description:	Enter the description of the device. The maximum length is 30 bytes.

Slave

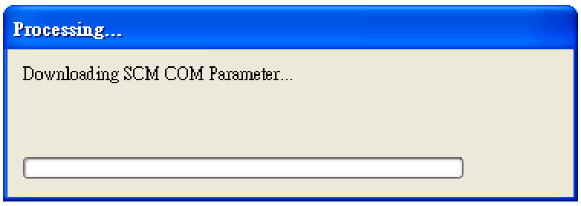
Slave ID:	The number of the salve device from which the data is read
Device Type:	You can choose the Delta PLC type. If PLC used is not a Delta PLC, please leave the column blank.
Length (bit):	Indicates the length of the data being read. The maximum length is 100 bits.
Data Type:	You can choose either “Hex” or “Modbus 6 Digit”. “Hex” represents 6 hexadecimal digits, and “Modbus 6 Digit” represents 6 decimal digits. If the device type is a Delta PLC type, the data type in this column will automatically become the data register D.
Start Address:	The start address of the data.

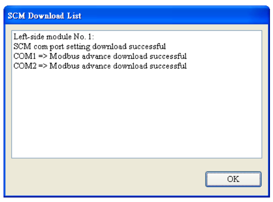
If the absolute position of the present value of the Delta DTA temperature controller is the hexadecimal value, 4700 (H’4700), and the station address is 10, the present value can be read and stored in D100 in the PLC through COM1 on the SCM module. The settings are as follows:



● **Download**

After the setting is complete, check whether the other parameter settings conform to the slave setting. Then, click “Download”.





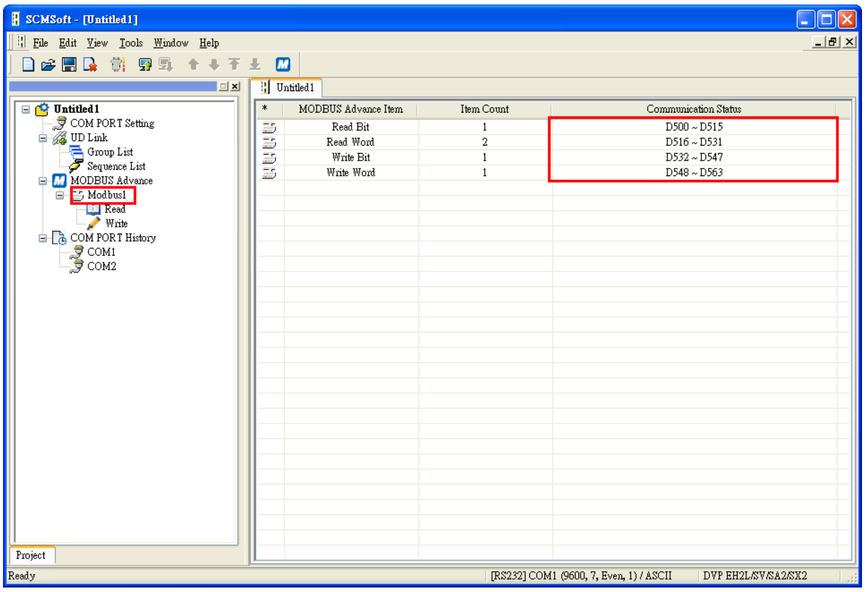
- **Communication status**

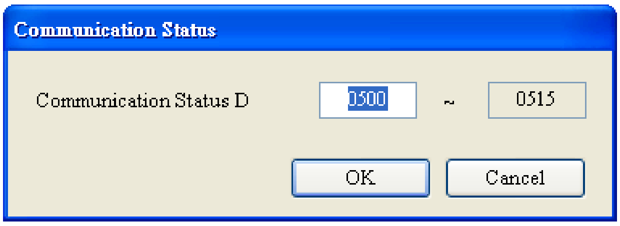
The SCM module provides the communication state of MODBUS Advance. There are four sections — Read Bit, Read Word, Write Bit, and Write Word. The execution status in each line is stored in the bits in the data registers. If D100 is entered into No.1, the execution status of the data exchange in No.1 will be displayed in the first bit (b0) in D100, and by analogy, the execution status of the data exchange in No.2 will be displayed in the second bit (b1) if D100 is entered into N0.2.

Dn																
Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

D (n+1)																
Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The default address is D500. You can change the start address in MODBUS Advance.





- **Enable**

Control the data exchange through the instruction TO in WPLSoft to read bits/read words/write bits/write words (CR#31 to CR#34).

CR#	Attribute	Name of the register	Description
31	R/W	Triggering the data exchange through COM1 to read bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered
32	R/W	Triggering the data exchange through COM2 to read bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered
33	R/W	Triggering the data exchange through COM1 to write bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered
34	R/W	Triggering the data exchange through COM2 to write bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered

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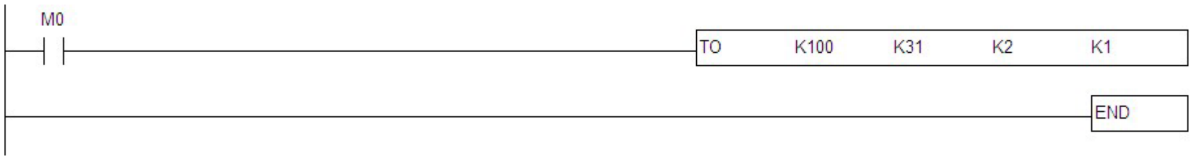
If you want to keep executing the word-reading, enter K2 into CR#31. If you want to execute the word-reading once, enter K1 into CR#31.



After M0 is triggered, COM1 on the SCM module will keep reading the present value which will be stored in D100, and the status value of bit0 in D0 is 1.

Device Name	Comment	Status	T/C Set Value	Present Value (16 bits)	Present Value (32 bits)	Floating Point	Format	T/C Set Value Reference
D100				K286	K286	F4.007E-43	Signed Decimal	
D0				K1	K1	F1.401E-45	Signed Decimal	

13.5.7 SCMSoft Introduction

This section will introduce the setting software of the SCM module — SCMSoft.

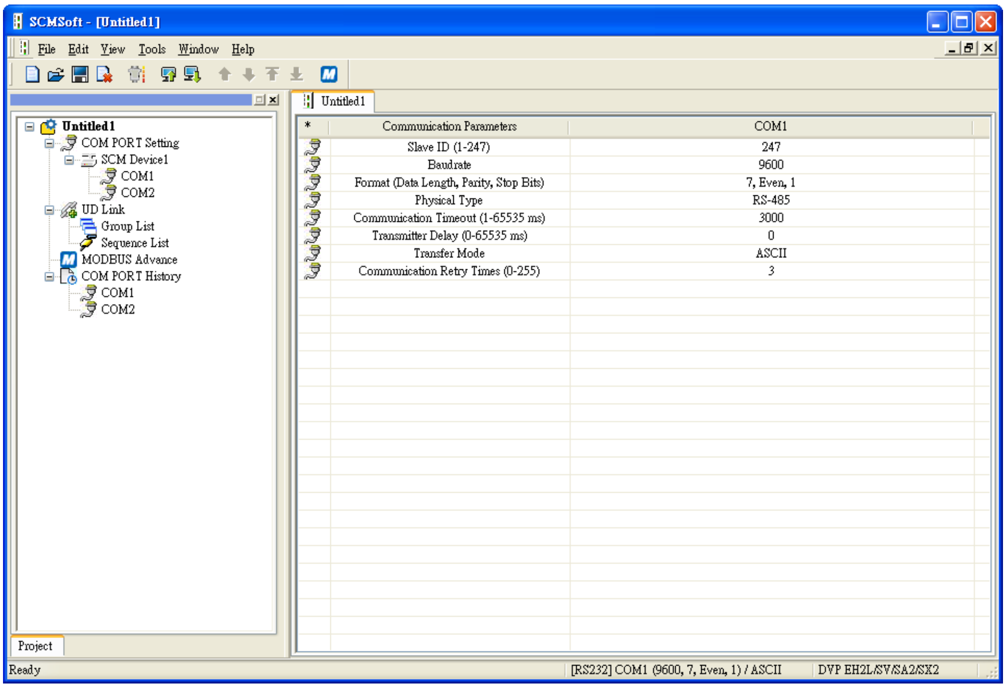
13.5.7.1 SCM Project

By establishing an SCM project, the SCM module makes the execution plan for COM1 and COM2. The SCM project includes four parts — COM PORT Setting, UD Link, MODBUS Advance, and COM port history.

COM PORT Setting	Set the communication formats and the parameters that COM1 and COM2 execute on the SCM module. (Section 13.5.7.2).
UD Link	Define the contents of the RS-485/RS-422 packets. (Section 13.5.7.3).
MODBUS Advance	Connect to the standard MODBUS RS-485/422 device. If other Delta automation products and other standard MODBUS communication devices are used, you can use this function. (Section 13.5.7.4).
COM port history	Set whether to record the history of the communication port on the SCM module. (Section 13.5.7.5).

13.5.7.2 COM PORT Setting

Setting the serial communication format:



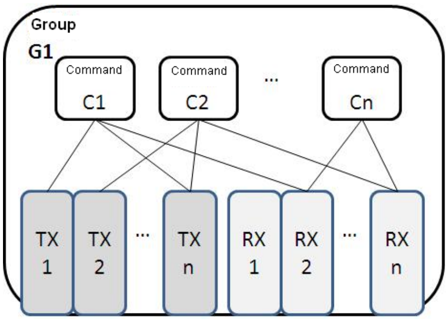
Protocol:	If the standard MODBUS is used, select MODBUS. If the user-defined RS-485/RS-422 format is used, select UD Link.
Slave ID:	Set the slave IDs of COM1 and COM2. The superior device connects to the SCM module through the slave ID. The default slave ID of COM1 is 247, and that of COM2 is 246.
Baud rate:	It supports communication rates 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 230400 and 460800 bps.
Physical Type:	RS-485 or RS-422

Communication Timeout:	If there has been no response for a certain period of time after the instruction is transmitted through the communication port, that period of time is called the communication timeout. The default communication timeout is 3000 ms.
Transmitter Delay:	The default time interval between the instructions is 0 ms, that is, the next instruction is transmitted immediately after the reply is received.
Transfer Mode:	ASCII or RTU
Communication Retry Times:	It means the number of times the communication has been retried after the communication fails. If there is still no response, the communication stops.

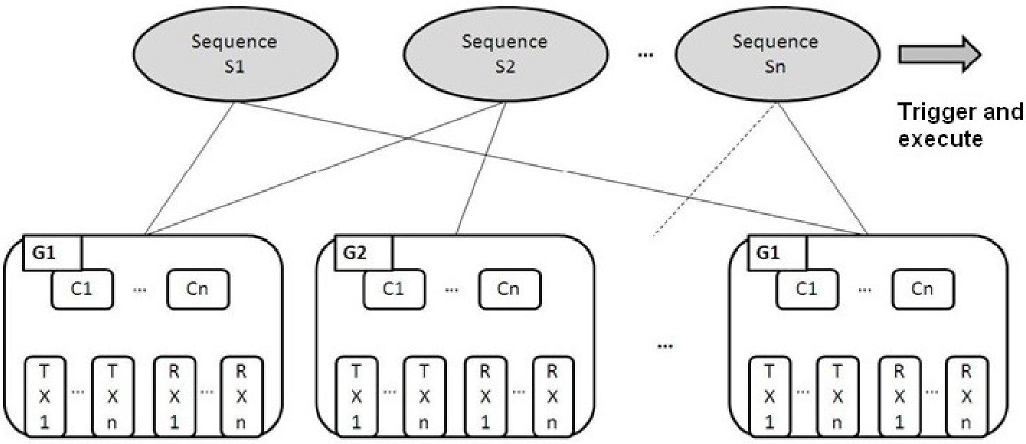
13.5.7.3 UD Link (User-defined Link)

UD Link provides non-Modbus RS-485/RS-422 link function. The packets can be edited according to the communication formats. The steps of establishing UD Link are as follows:

1. Create a group→ Edit TX packets and RX packets→ Create commands→ Trigger and execute the instructions as a group



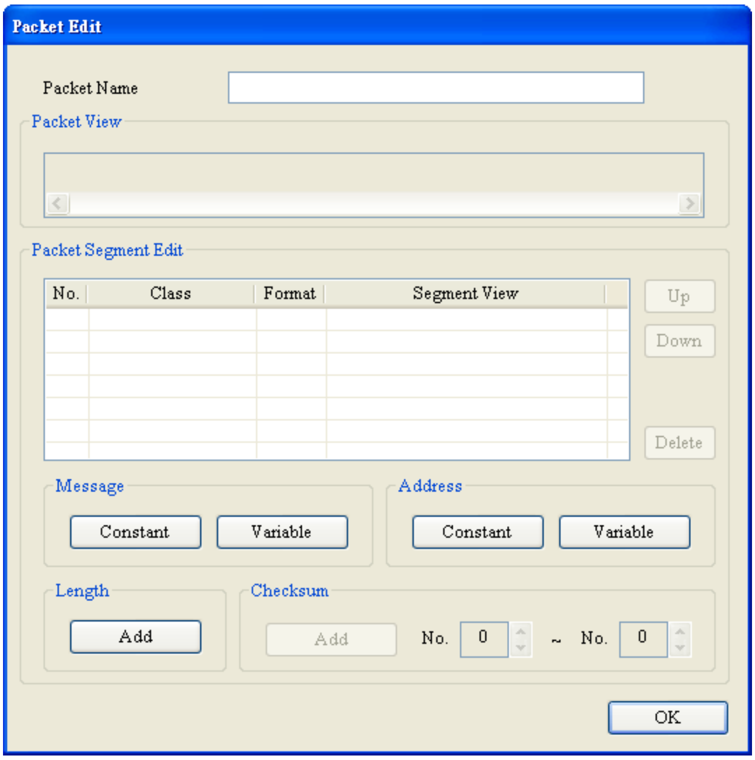
2. Create a group → Edit TX packets and RX packets → Create commands→ Create other groups→ Create sequences→ Trigger and execute the instructions as sequences.



First of all, establish the transmission instructions (TXs) and the reception instructions (RXs) in the group. Then, set the execution sequence and the number of times for TXs and RXs through the commands. Finally, trigger and execute the instructions as a group. In addition, if various groups of group packets are required in a large system, the user can create the groups in the sequences and set the execution sequence.

13.5.7.3.1 TX Packet and RX Packet

Create various TX packets and RX packets in a group. The contents of TX packets and RX packets may include several messages, one address, one length, and one checksum.



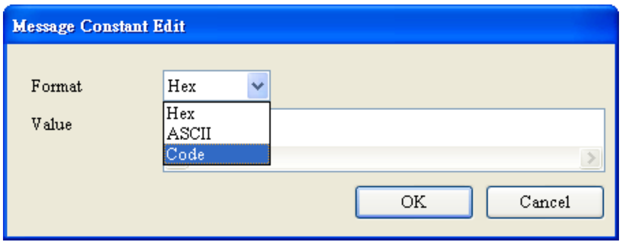
- Packet Name: Edit the name of the packet.
- Packet View: It displays the contents of the packet.
- Packet Segment Edit: Adjust the sequence of the packet segment and add/delete the packet segment.

  No.: It is the packet segment number. You can edit at most 64 segments in a packet.

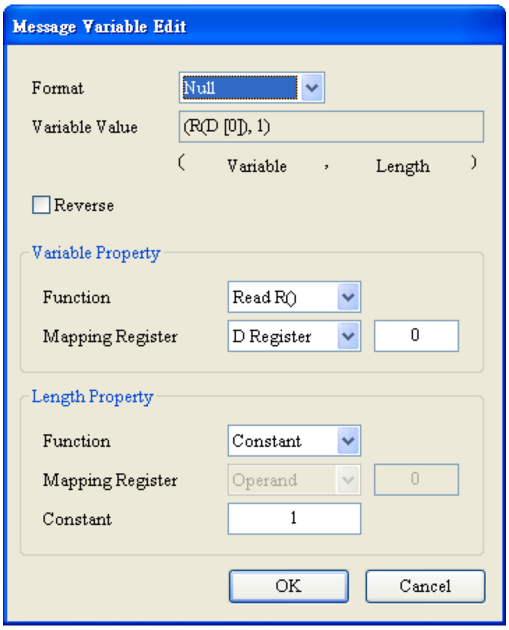
  Class: The class of the segment includes the message, the address, the length and the checksum.

  Format: The format of the segment includes Hex, ASCII, Code, and etc.

  Segment View: The description of the segment.
- Message: Edit the constant message and the variable message. Both the constant message and the variable message can be used with a packet head, a start bit, an end bit, or a data segment. One packet can include many messages.
- Address: Edit either the constant address or the variable address. One packet includes only one address segment.
- Length: Edit the length of the packet. One packet includes only one length segment.
- Checksum: Edit the checksum. One packet includes only one checksum segment.



- Constant: The data is a fixed value.
- Format: The format of the data can be Hex, ASCII, or Code. When the format of the data is Code, it indicates that the data uses the control code.
- Value: Enter the constant value.



- Variable: The data is a variable which mapping register can be the internal register in the SCM module or the register in the PLC.
- Format: Set the format of the data.

Null: Does NOT make any change to the format of the data.

Hex: The ASCII data can be converted into the hexadecimal value. The words which cannot be converted will become zeros.

ASCII: The hexadecimal value can be converted into the ASCII data. The words which cannot be converted will become zeros.

- Variable Property

Function: The variable functions include “Read R ()”, “Write W ()”, and no action “*”. For TX packets, you can choose “Read R ()”. For RX packets, you can choose “Read R ()”, “Write W ()”, or no action “*”.

Mapping register: You can choose the internal register in the SCM module or the register in the PLC. The internal registers in the SCM module include I1, I2, O1, and O2. The registers in the PLC include the data registers and “Base+Offset”.

Register	Definition	Register	Definition
D	Internal D register in the PLC	Base+Offset	Used with the control register.
I1	Used to receive/send the data through COM1.	O1	Used to send the data through COM1.
I2	Used to receive/send the data through COM2.	O2	Used to send the data through COM2.

- Length

Class: The length segment can be either 1 byte or 2 bytes.

Format: The format of the length segment can be the hexadecimal value or the ASCII data.

Value: The user can enter the length value according to the format setting.

- Checksum

Class: The user can choose the class of the checksum segment.

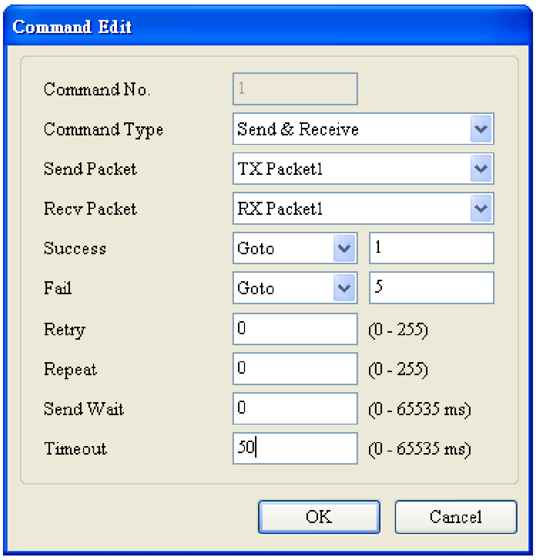
Format: The user can choose the format of the checksum segment.

Initial Value: The user can set the initial value of the checksum.

Reverse: Reverse the checksum (word) in bytes.

13.5.7.3.2 Command

After creating many TX packets and RX packets, you can choose the packets to be sent and received through creating the commands and plan the sequence of executing the commands.



Command No.: Each command has its own number. You can designate the sequence of executing the commands through these numbers.

Command Type: Choose “Send”, “Receive”, or “Send & Receive”.

Send Packet: Choose the group name which has been created in the groups.

Receive Packet: Choose the group name which has been created in the groups.

Success: Designate the action following the execution of a command. Choose “Next”, ”Goto”, or “End”.

Next: Execute the next command. If the number of the command being executed is one, the number of the next command will be executed is two.

Goto: Directly designate the command whose number is much larger.

End: The execution of commands comes to an end.

Fail: Designate the action following the execution of a command. Choose “Next”, ”Goto”, or “End”.

Next: Execute the next command. If the number of the command being executed is one, the number of the next command will be executed is two.

Goto: Directly designate the command whose number is much larger.

End: The execution of commands comes to an end.

Retry: The number of times the sending of a command has been retried after the sending fails.

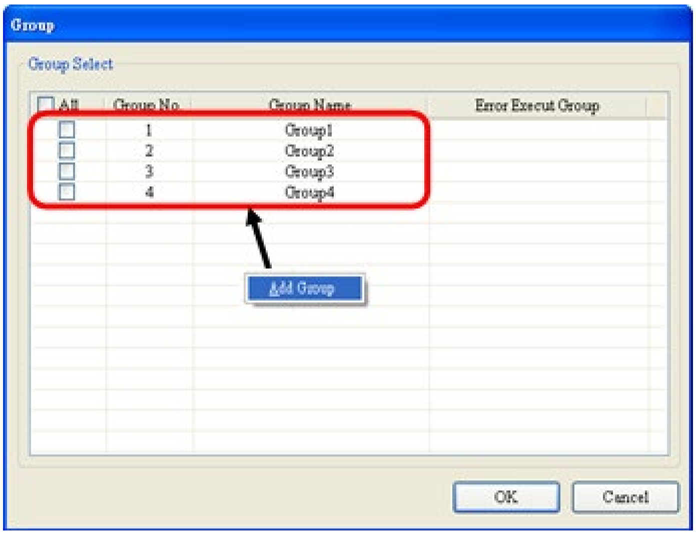
Repeat: The number of times the sending of a command has been repeated after the command has been executed successfully.

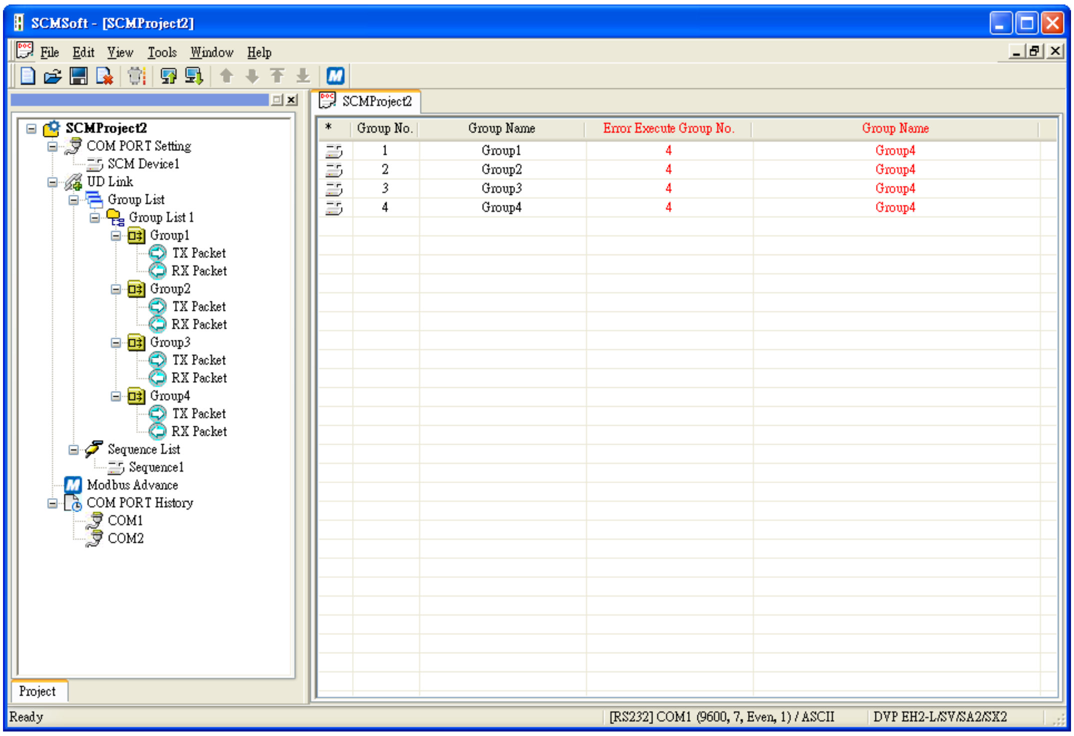
Send Wait: The default time interval between the instructions is 0 ms, that is, the next instruction is transmitted immediately after the reply is received.

Timeout: If there has been no response for a certain period of time after the instruction is transmitted through the communication port, that period of time is called the communication timeout. The default communication timeout is 50 ms.

13.5.7.3.3 Sequence

Click "Add Group" by right-clicking in Sequence to check the groups which will be executed. These groups will be downloaded as a sequence and executed through the serial port. In addition, you can click "Error Execute Group No." twice to set the group which will be executed when an error occurs. When there is an error in executing a group, the group which is set in "Error Execute Group No." will be executed.





13

13.5.7.4 MODBUS Advance

Please refer to section 13.5.6 for more related introduction.

13.5.7.5 COM PORT History

The function of the COM PORT historical data is to record all packets during the SCM communication process in the buffer within SCM, providing users with debugging capabilities. The buffer, shared for both transmission and reception, has a size of approximately 2 Kbytes and only retains the latest communication data, discarding older information. Additionally, the buffer is non-latched, meaning that data will be lost if there is a power outage. The SCMSoft allows users to activate, deactivate, or upload the buffer data within SCM.

In the COM PORT historical data, three options are available through right-clicking. The functionalities are described as follows: "Start COM PORT Historical Data": Initiates the recording of the communication process for all COM ports in SCM. "Stop COM PORT Historical Data": Halts the recording of the communication process for all COM ports in SCM. "Upload COM PORT Historical Data": Uploads all communication data recorded internally in SCM to SCMSoft. Please note that recording of all SCM communication data will automatically cease before uploading. To resume recording, it is necessary to reselect "Start COM PORT Historical Data.”

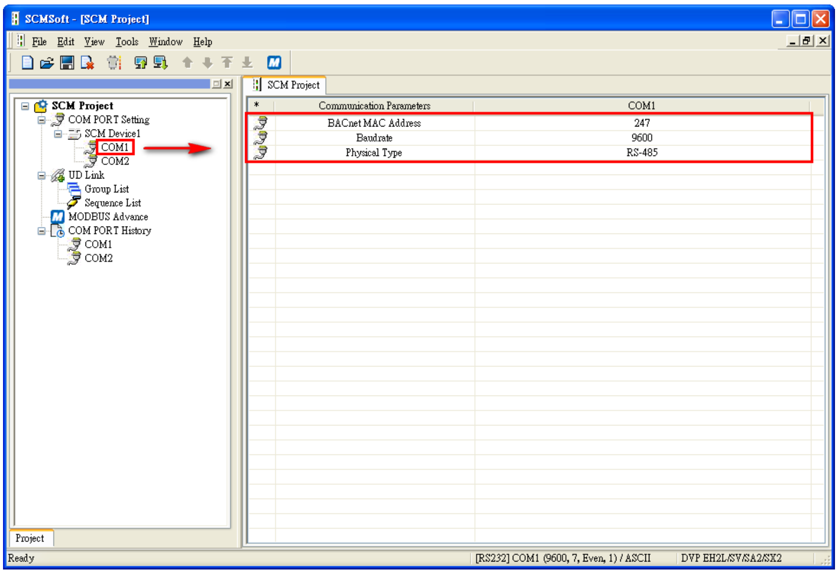
13.5.7.6 BACnet MS/TP Slave Function (Supported by DVPSCM52-SL)

If you want to connect an SCM module to a BACnet CPU, you have to set the BACnet parameters and the BACnet object for the SCM module.

For firmware versions V1.08 and below, the PLC CPU needs to write to AV or BV before being able to read them. For versions V1.10 and above, the PLC CPU can directly read AV and BV values without the need for prior write operations.

13.5.7.6.1 BACnet Parameters

The BACnet parameters include the BACnet MAC address, the baud rate, and the physical type.



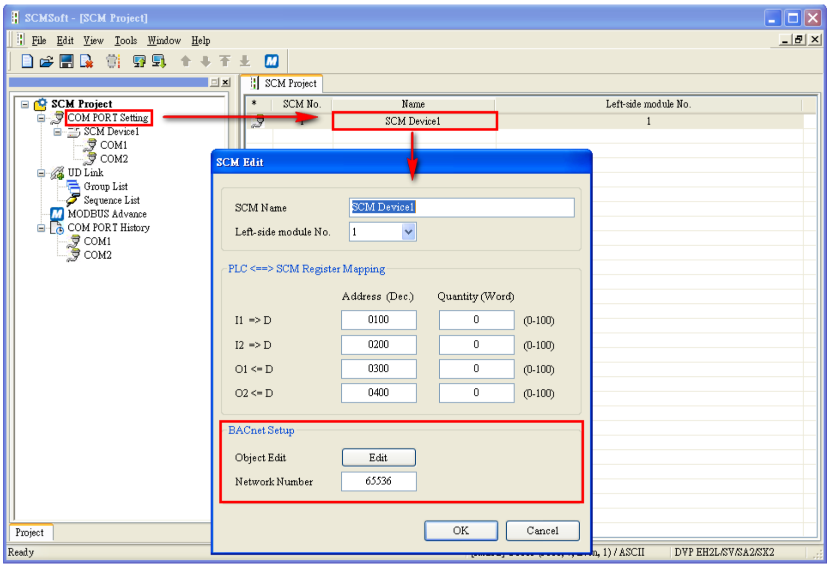
BACnet MAC address: 1 to 247 (Default: 247), Please note that the maximum MAC address that some masters support is 127.

Baud rates supported by BACnet: 9600 (default), 19200, 38400, and 76800 bps

Physical type: options are RS-485 or RS-422.

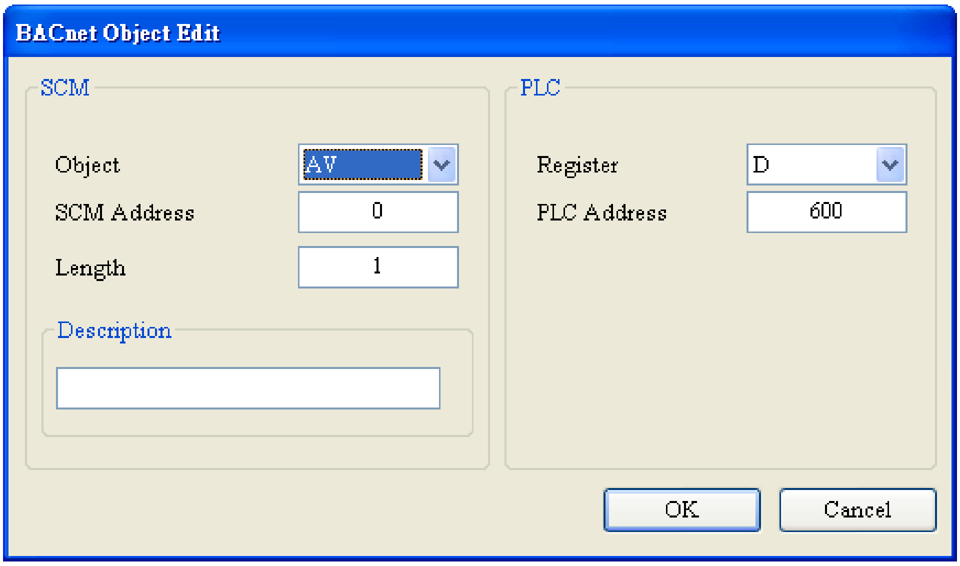
13.5.7.6.2 BACnet Object

Network Number: The network number on the BACnet network is unique. It cannot be used repeatedly. (Default: 65536).



BACnet object edit: Editing the AV and BV values which correspond to the data registers and coils in the Delta PLC master connecting to the SCM module

The lenghth of tha AV value corresponds to two data registers in the Delta PLC, and the lenghth of the BV value corresponds to one coil in the Delta PLC.



Object: You can select “AV” or “BV”. “AV” corresponds to the data registers in the PLC, and “BV” corresponds the coil in the PLC.

SCM address: Set the address of the AV, or the BV. The setting range is 0 to 383.

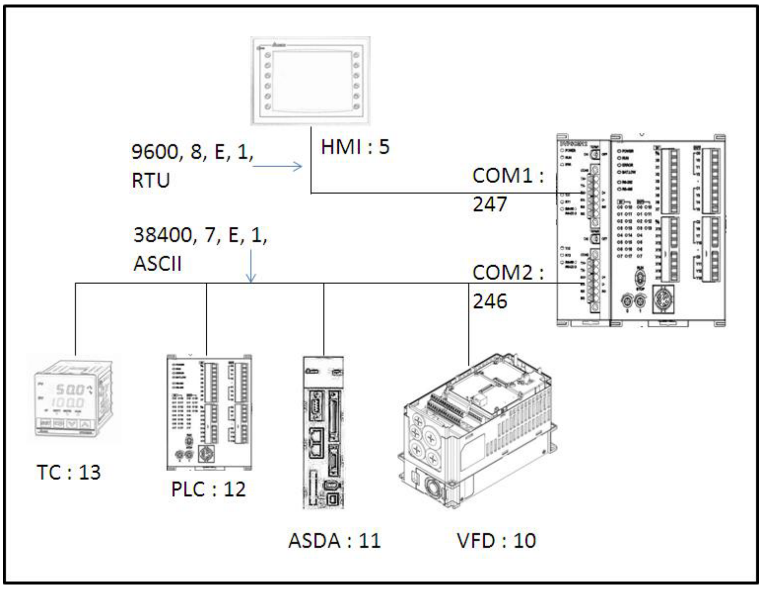
Length: A unit is a double word.

PLC: The start address in the Delta PLC.

13.5.8 Application

13.5.8.1 MODBUS

This section introduces how the SCM module connects to other Delta industrial products such as the human-machine interfaces, the text panels, the PLCs, the motor drives, and the servo motors through the standard MODBUS. The connection diagram is as below:

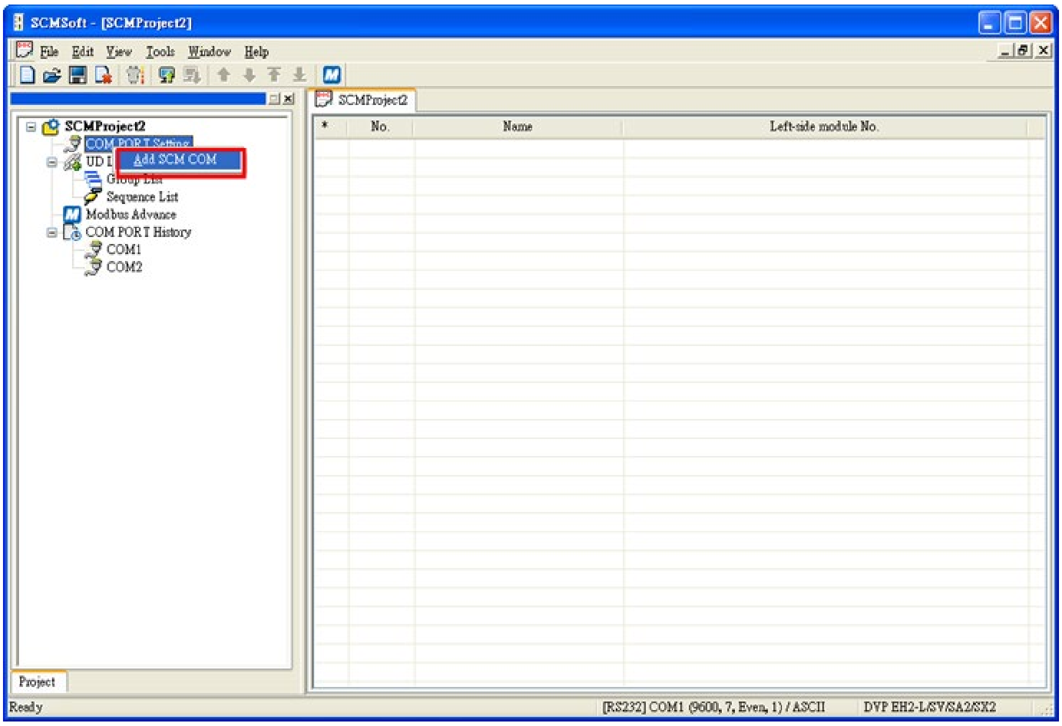


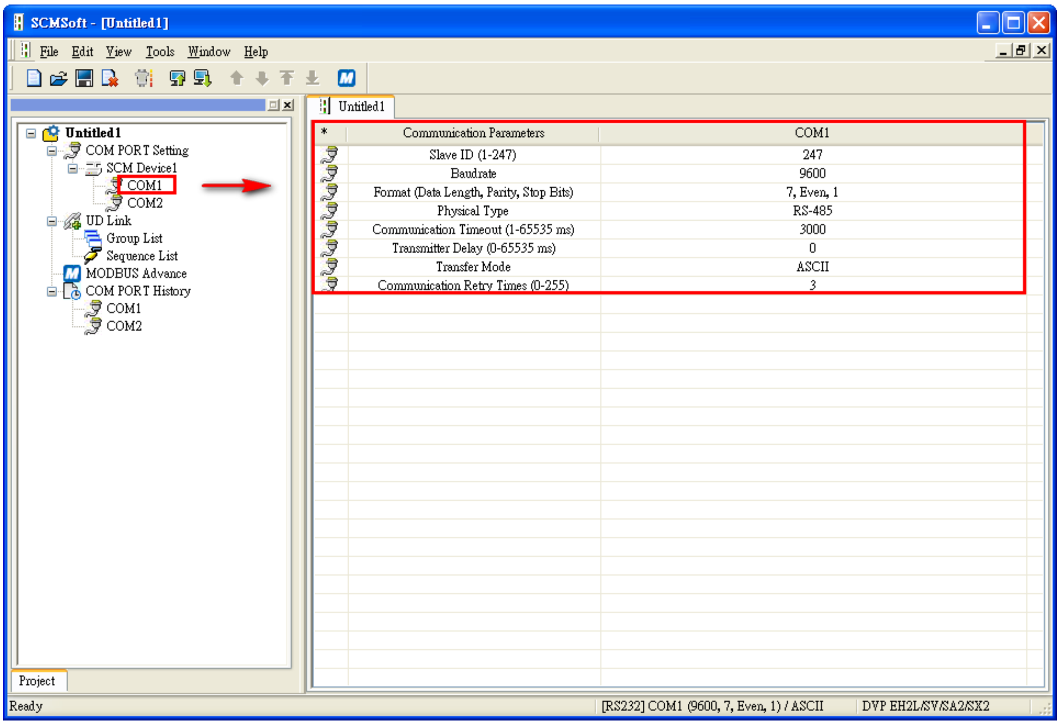
Product	Station address	Communication protocol	Address from which the data is read	Register in the CPU	Address into which the data is written	Register in the CPU
HMI	5	9600, RTU, 8, E, 1	-		-	
VFD	10	38400, ASCII, 7, E, 1	2103H	D100	2000H 2001H	D150 to D151
ASDA	11	38400, ASCII, 7, E, 1	0101H 020AH	D200, D201	0101H 020AH	D250, D251
PLC	12	38400, ASCII, 7, E, 1	D100 to D109	D300 to D309	D200 to D204	D350 to D354
TC	13	38400, ASCII, 7, E, 1	1000H (PV)	D400	1001H (SV)	D451

13.5.8.1.1 Connection between the MODBUS Slave and the Delta Product

For SCM as the MODBUS slave, you only have to set the parameters such as the station address and the baud rate to allow the connection with the master.

Open **SCMSoft** → 『**New Project**』 → **COM PORT setting**: 『Add SCM COM』 → Set the communication parameters.





Set the communication parameters of COM1: station address 247 (default), Modbus RTU, 9600, 8, Even, 1.

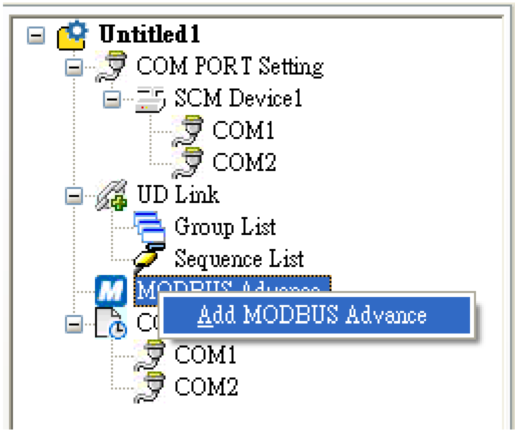
*	Communication Parameters	COM1
	Slave ID (1-247)	247
	Baudrate	9600
	Format (Data Length, Parity, Stop Bits)	8, Even, 1
	Physical Type	RS-485
	Communication Timeout (1-65535 ms)	3000
	Transmitter Delay (0-65535 ms)	0
	Transfer Mode	RTU
	Communication Retry Times (0-255)	3

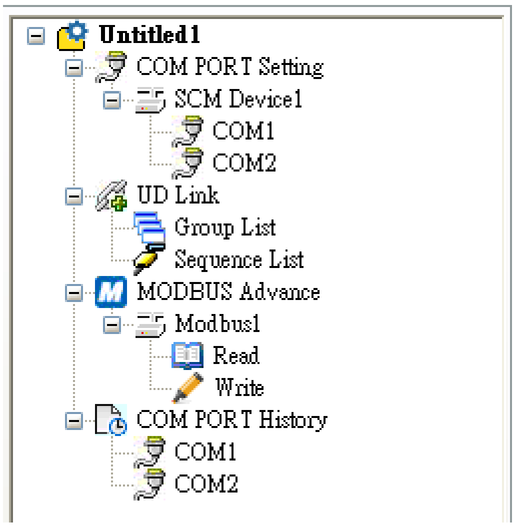
13.5.8.1.2 Connection between the MODBUS Master and the Delta Product

1. Set the communication parameters of COM2: station address 246 (default), Modbus ASCII, 38400, 7, Even, 1.

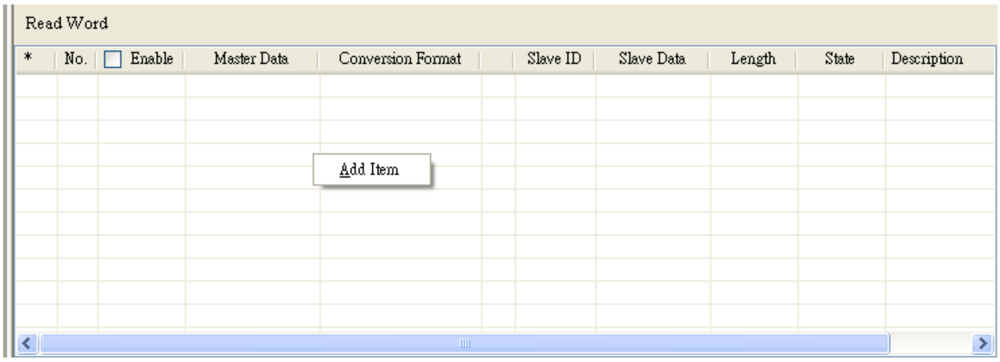
*	Communication Parameters	COM2
	Slave ID (1-247)	246
	Baudrate	38400
	Format (Data Length, Parity, Stop Bits)	7, Even, 1
	Physical Type	RS-485
	Communication Timeout (1-65535 ms)	3000
	Transmitter Delay (0-65535 ms)	0
	Transfer Mode	ASCII
	Communication Retry Times (0-255)	3

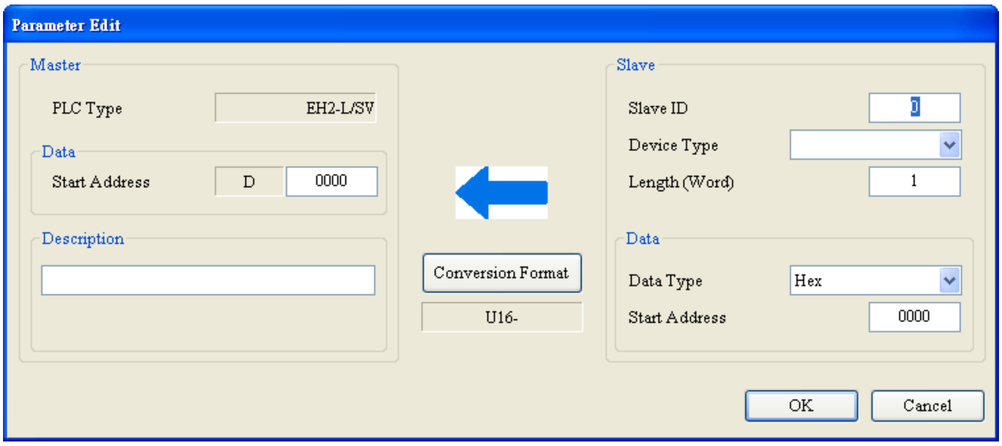
2. Add MODBUS Advance.



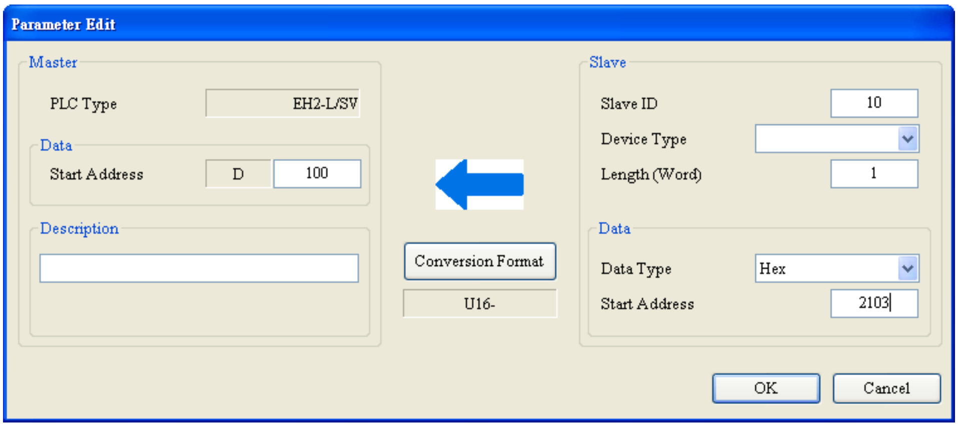


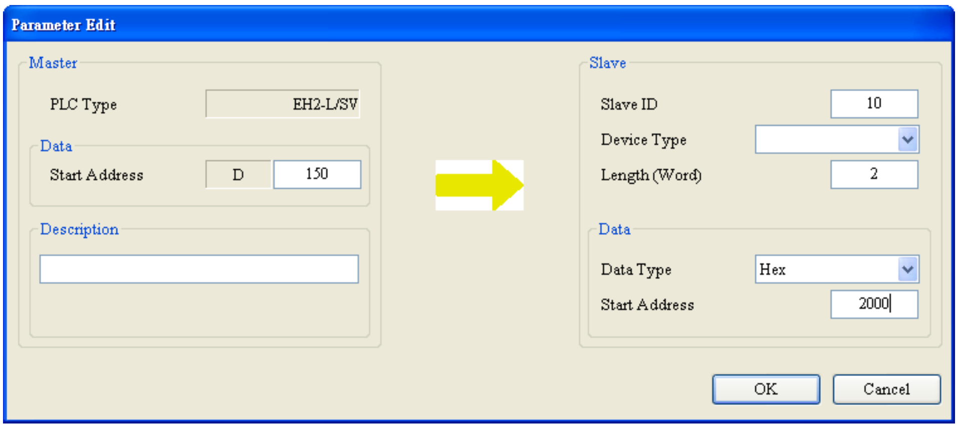
3. Set the data exchange in the slave: Add Item → double-click the added item to set the reading/writing information in the slave.



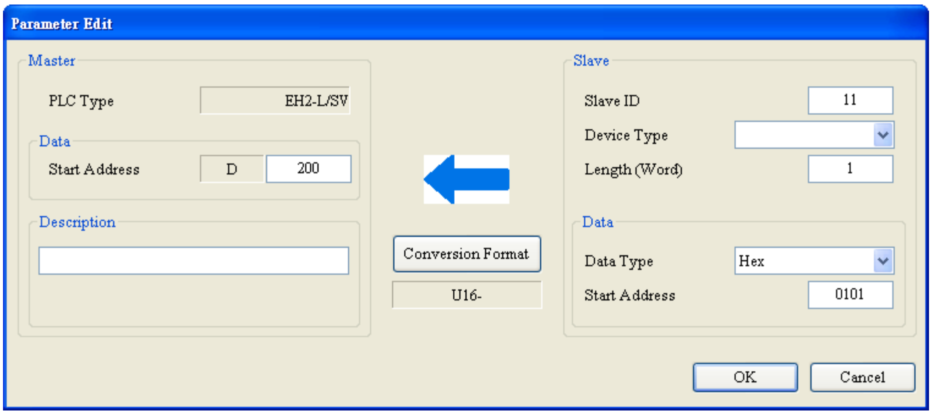


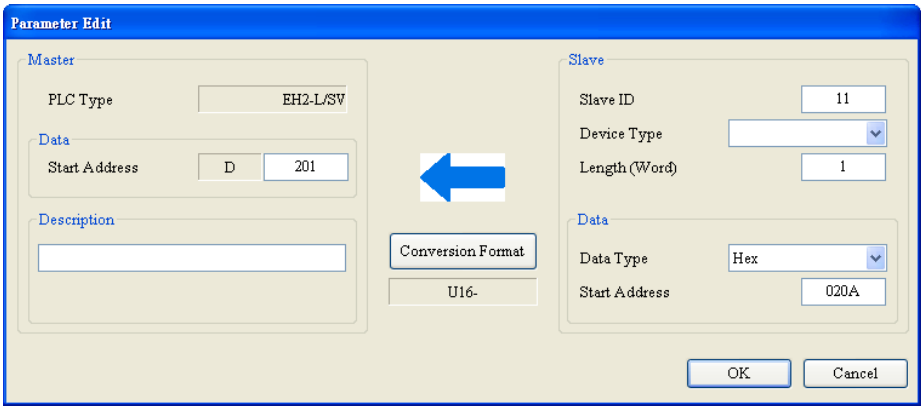
VFD (D100←2103H), (D150, D151→H2000, H2001)



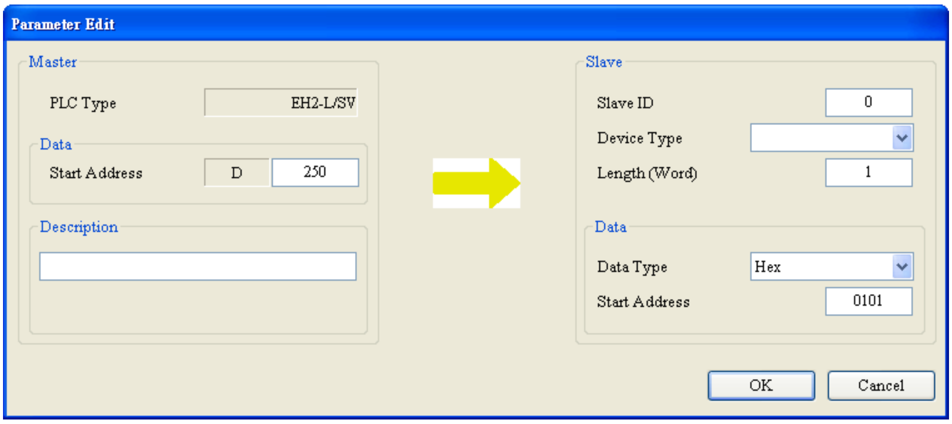


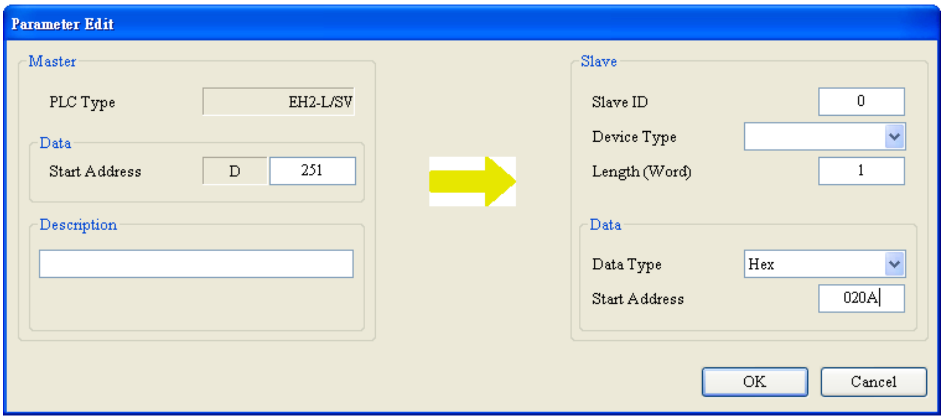
ASDA (D200←0101H, D201←020AH)



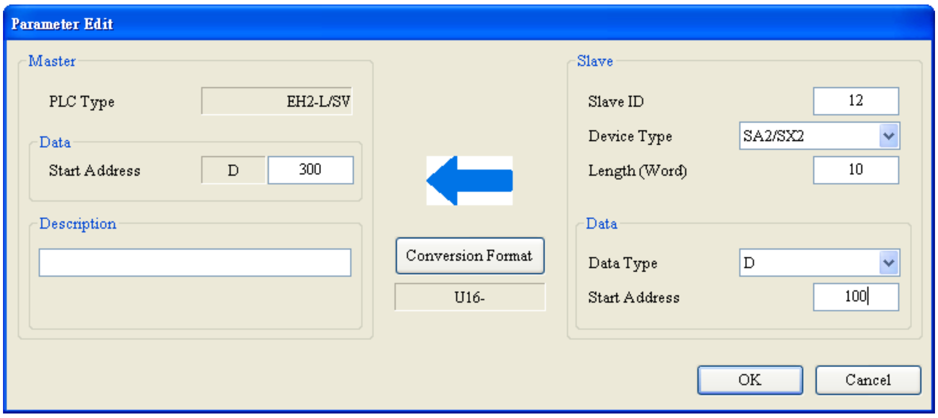


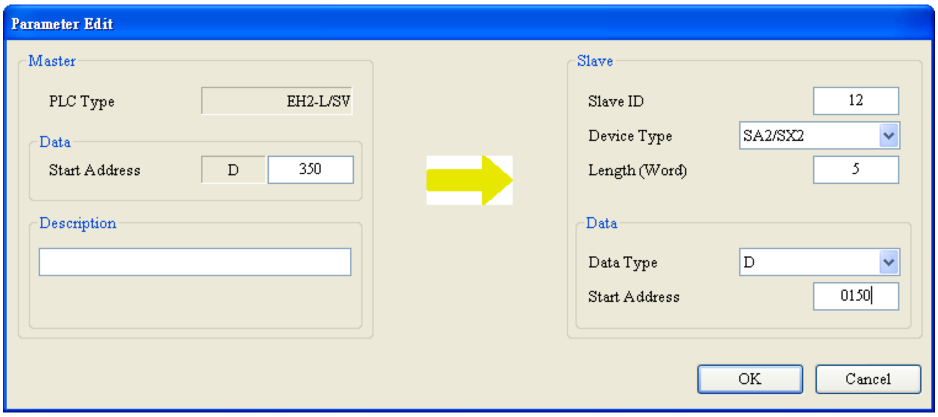
(D250→0101H, D251→020AH)



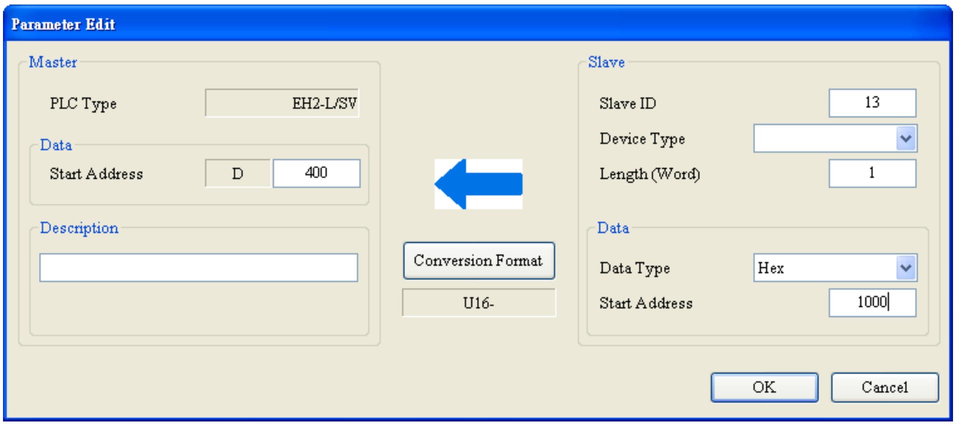


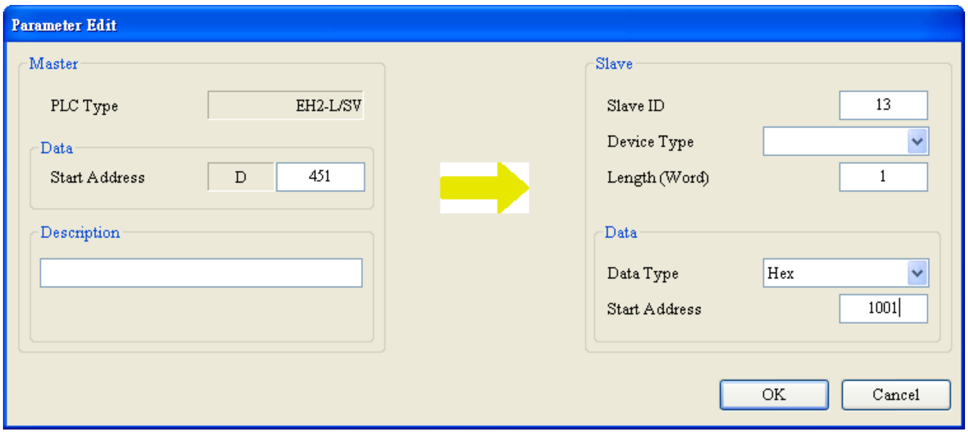
PLC (D300 to D309 in the master←D100 to D109 in the slave), (D350 to D354 in the master→D150 to D154 in the slave)



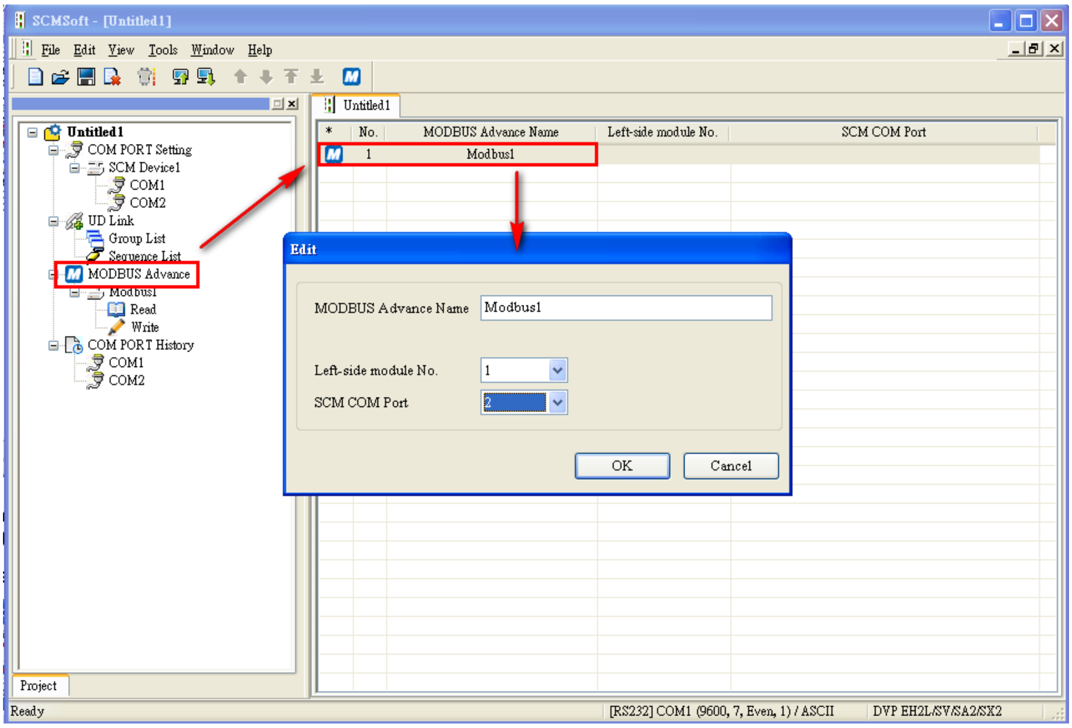


TC (D400←1000H), (D451→1001H)

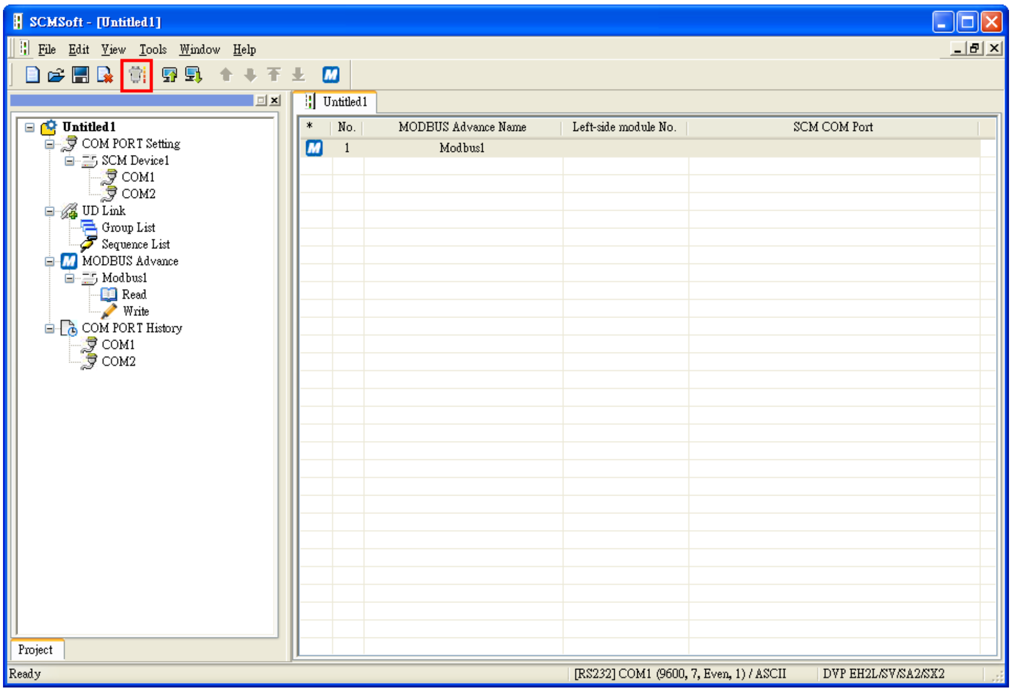


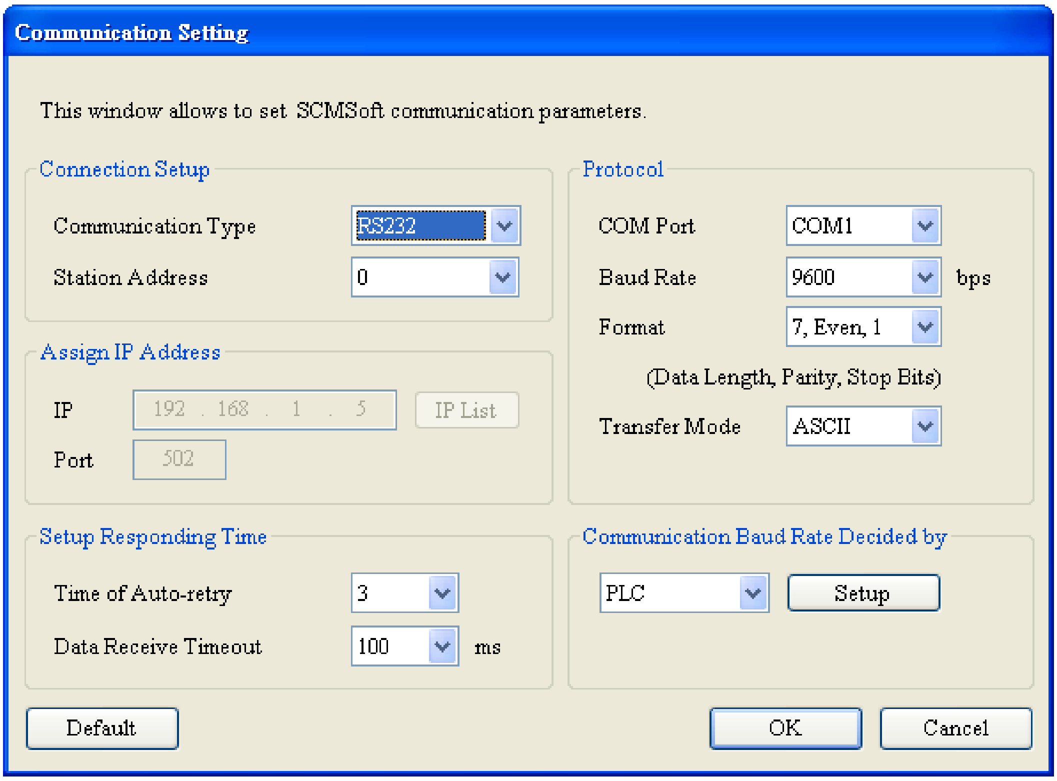


After the setting is complete, the user can designate the communication port using MODBUS Advance — COM port 2 on the first left-side module.

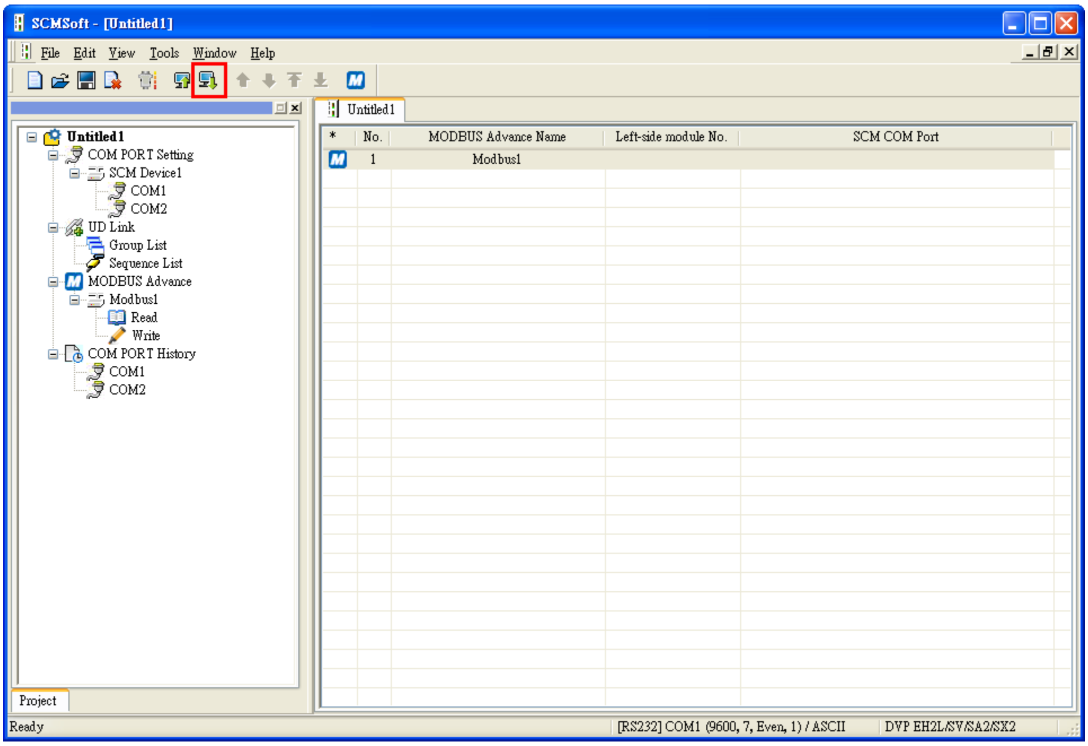


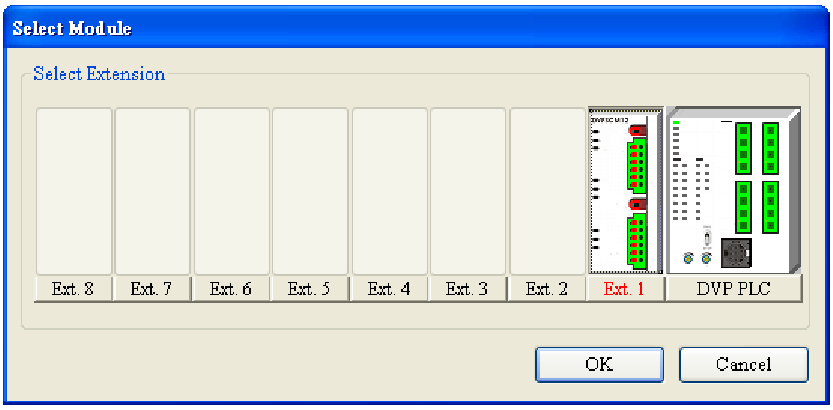
4. Download the parameters: Set the communication. After the setting is complete, click “OK” to exit from the communication setting, and the parameters are set.

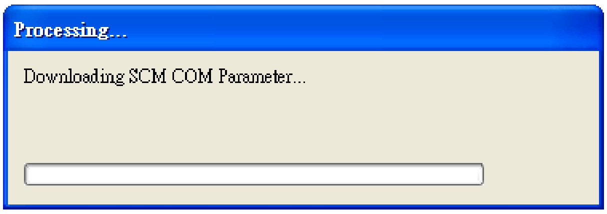


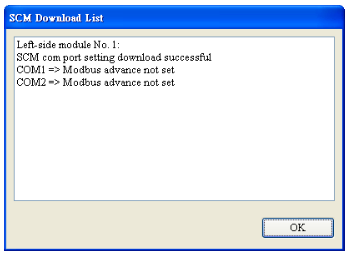


Click “Download”, choose the left-side module which will be downloaded, and click “OK”. If only one device is connected, click “OK” directly.







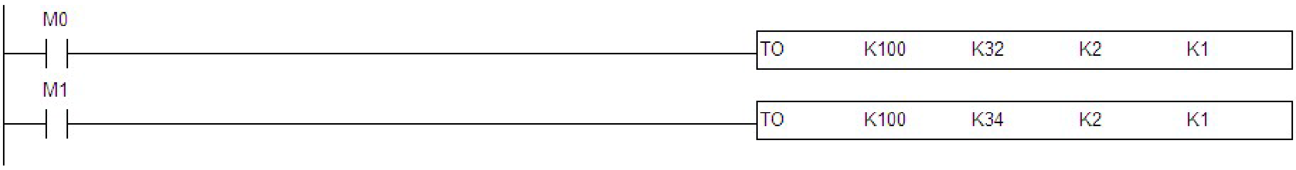


5. Enable the data exchange function: Control the data exchange through the instruction TO in WPLSoft to read bits/read words/write bits/write words (CR#31 to CR#34).

31	R/W	Triggering the data exchange through COM1 to read bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered
32	R/W	Triggering the data exchange through COM2 to read bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered
33	R/W	Triggering the data exchange through COM1 to write bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered
34	R/W	Triggering the data exchange through COM2 to write bits or words.	High byte: bit; Low byte: word 0: Not triggered, 1: Triggered once, 2: Always triggered

If you want to keep executing the word-reading, enter K2 into CR#32. To execute the word-reading once, enter K1 into CR#32.

If you want to keep executing the word-writing, enter K2 into CR#34. To execute the word-writing once, enter K1 into CR#34.



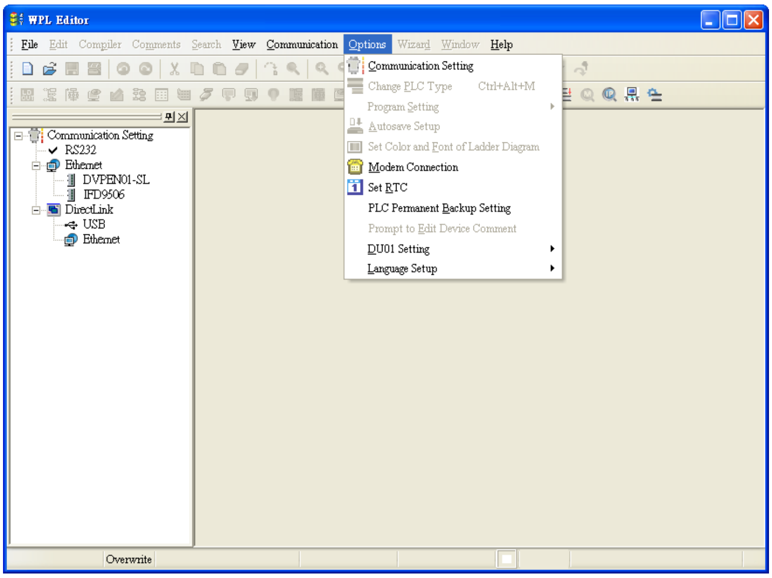
After M0 is triggered, the data will be read from the salve address which has been set through COM2 on the SCM module.

After M1 is triggered, the data will be written into the slave address which has been set through COM2 on the SCM module.

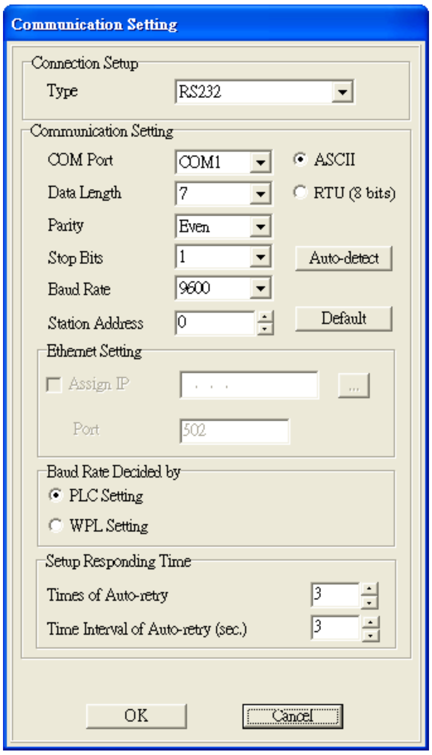
13.5.8.2 Connect to WPLSoft

The SCM module can be used as the additional communication port of the PLC master. When RS-485 communication of the PLC master is executed, you can use WPLSoft to monitor the master through the SCM module. The default communication format of COM1 on the SCM module is 9600, 7, Even, 1, and the station address is 247.

1. Set WPLSoft: Open WPLSoft. Click “Options” and choose “Communication Setting”.



2. Choose RS-232 in Communication Setting, designate “COMP Port”, and enter the communication parameters. The communication parameters here should conform to the default setting of COM1 on the SCM module. If other communication parameters are used, they need to be modified in COM PORT Setting of the SCM module. In addition, the setting of “Station Address” should conform to COM1 on the SCM module rather than the station address of the CPU of the PLC.



3. Click “OK” to upload/download WPLSoft program from/to the CPU of the PLC.

13.5.8.3 RS-485

This section introduces how SCM connects to other Delta industrial products through RS-485 (the non-standard MODBUS).

13.5.8.3.1 Connect to Electricity Meter

There are two common modes of connecting to the electricity meter. One is through the standard MODBUS, the other is through RS-485. This section introduces how the SCM module connects to the electricity meter through RS-485 in UD Link.

1. The record type

   Set the station address of the electricity meter to 5. The electricity meter includes three record types — abbreviated, control and full record types.

(Abbreviated)

Word number	Content	Description
1	10h	Start bit
2	0 … FAh, FFh	Device address (IA)
3		Function code (FF)
4		Checksum (CS) (IA+FF)
5	16h	End marker

(Full)

Word number	Content	Description
1	68h	Start bit
2		Length
3		Length (repeat)
4	68h	Start bit (repeat)
5	0 … FAh, FFh	Device address (IA)
6		Function code (FF)
7		Parameter index (PI)
…		n word, data block
Length+5		Checksum (CS) (Add from IA to the previous item.)
Length+6	16h	End marker

(Control)

Word number	Content	Description
1	68h	Start bit
2	03h	Length
3	03h	Length (repeat)
4	68h	Start bit (repeat)
5	0 … FAh, FFh	Device address (IA)
6		Function code (FF)
7		Parameter index (PI)
8		Checksum (CS) (Add from IA to PI.)
9	16h	End marker

2. The usage

There are nine types of usage in which the SCM module communicates with the electricity meter through the combination of three record types.

Type	Instruction to the electricity meter	Response (through the record type)
1	Reset Abbreviated record	N/A
2	Query about the status of the device: abbreviated record	Abbreviated record
3	Measured value and error (cyclic data) Abbreviated record	Full record
4	Event data analyzed erroneously Abbreviated record	Full record
5	Measured value Control record	Full record
6	Output parameter: control record	Full record
7	Status: control record	Full record
8	Device specifications: control record	Full record
9	Real-time timing data: control record	Full record

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3. Edit the UD Link

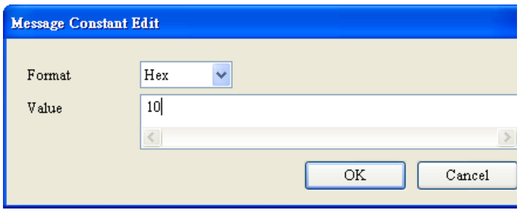
Type 1

Only send the abbreviated record (abbreviated record) :

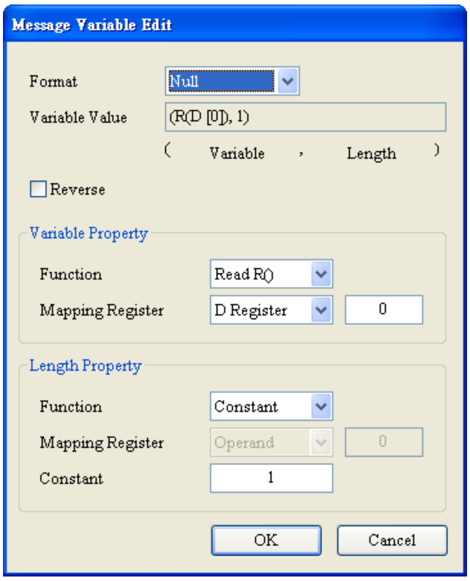
『Start word』 + 『device address (IA)』 + 『Function code (FF)』 + 『Checksum (CS)』 + 『End marker』

→ 10h + D0 + 09h + (IA+FF) + 16h

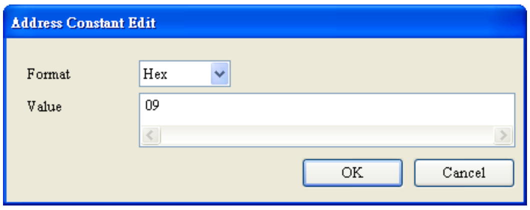
- Start word: 10h



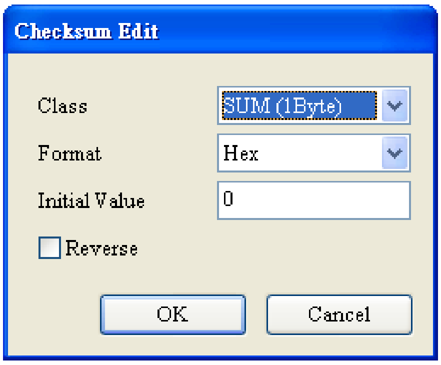
- Read the device address from D0 (IA).

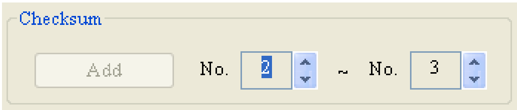


- Function code (FF): 09h

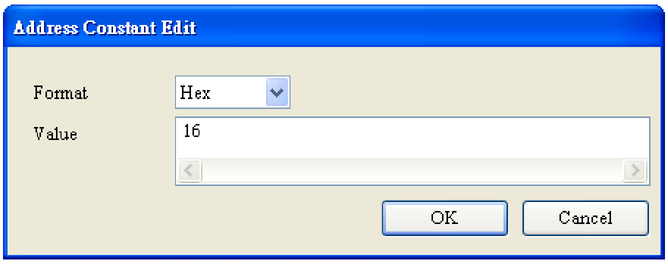


- Checksum (1byte; adding the previous two items up):

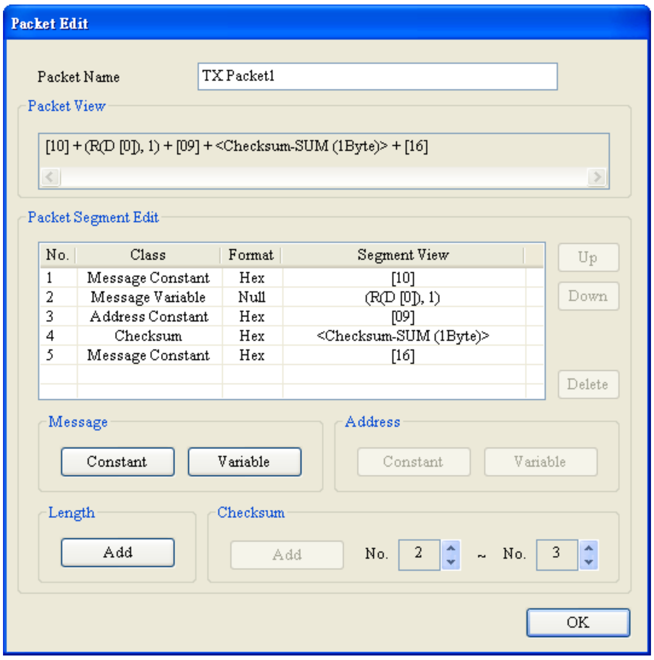




- End word: 16h

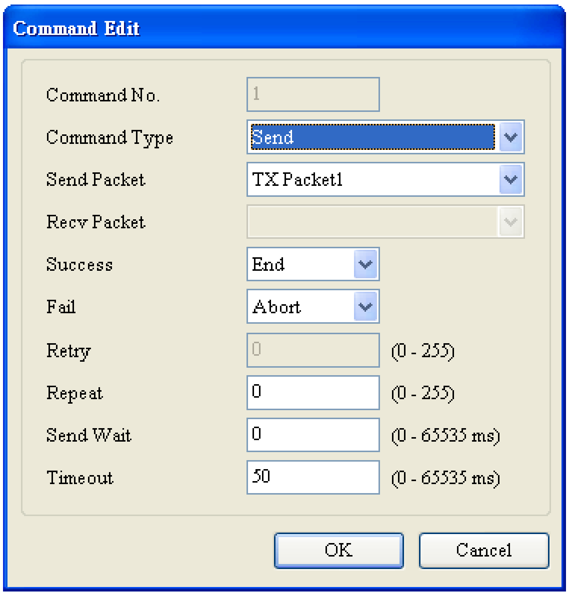


- The editing is complete:



There is no response address for type 1, so do NOT need to edit the function code of the response (Rx).

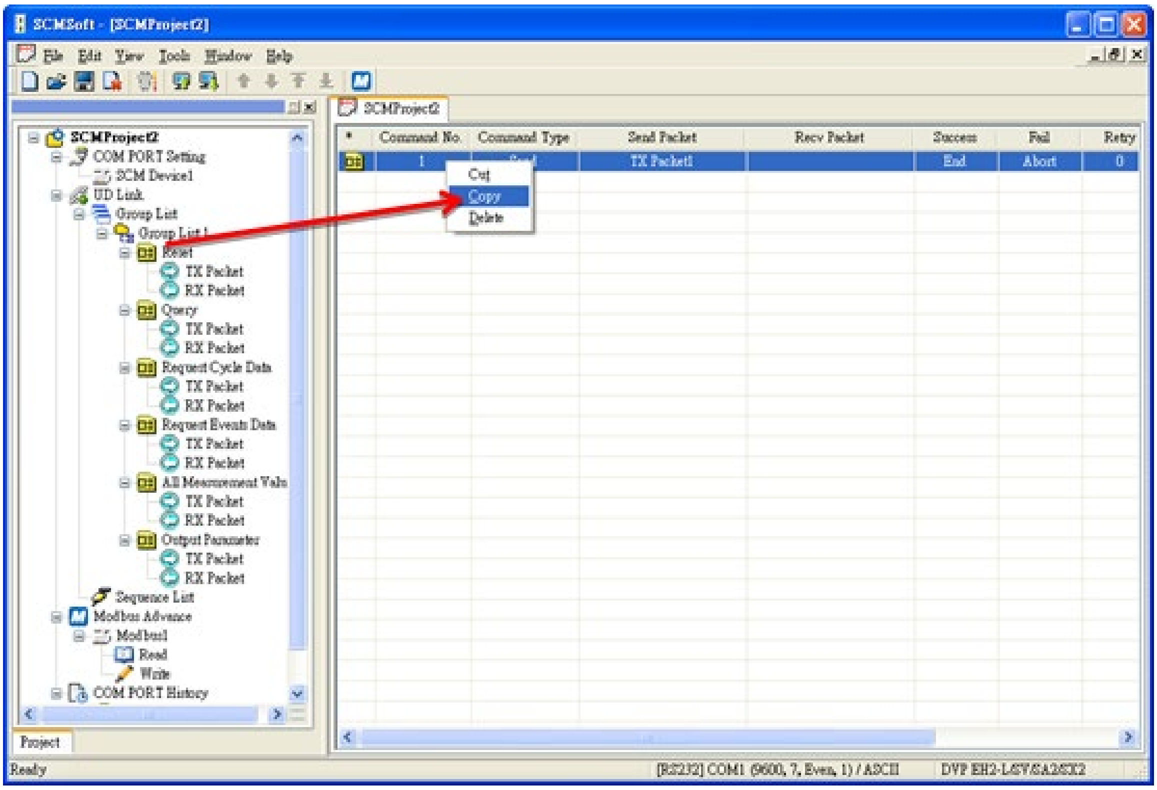
Edit the SCM command: Sending Tx Packet1; no response address.



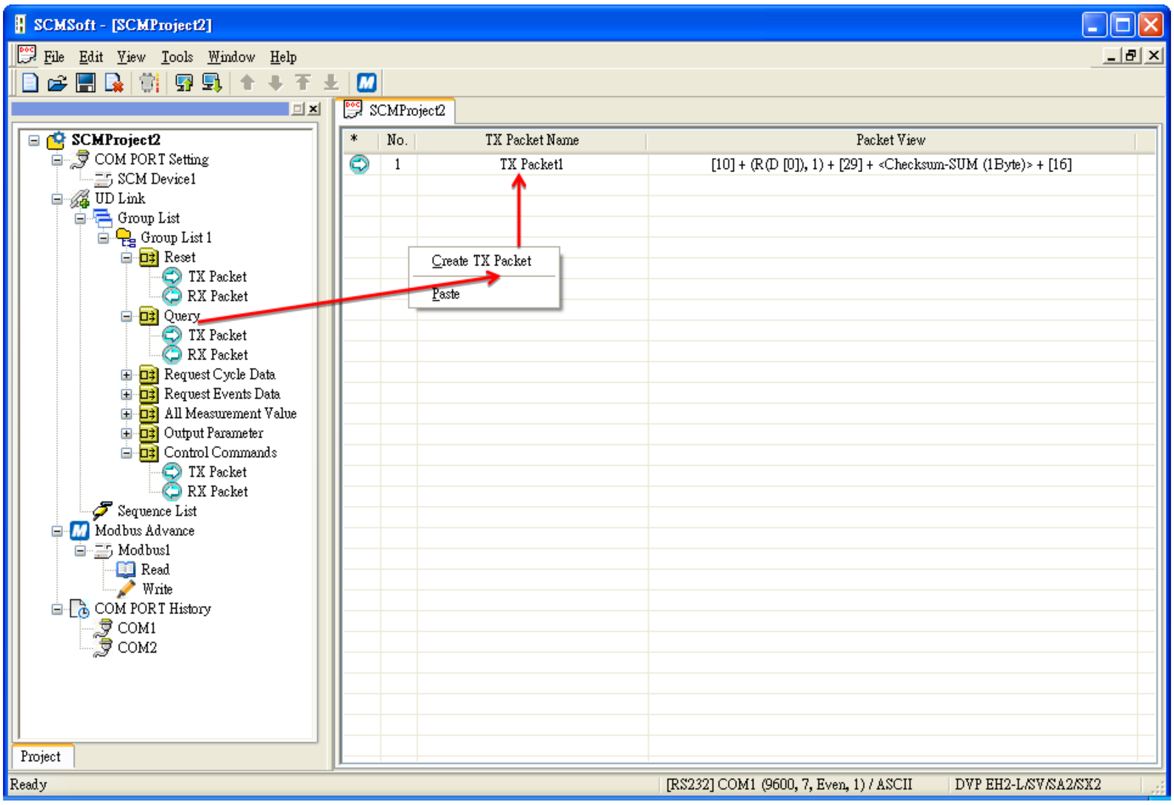
Type 2

Send the abbreviated record and respond with the abbreviated record. The setting of the sending is as that in type 1. You can copy the setting directly. Note that the function code is 29h.

- Copy the setting in Reset group.



■ Paste the setting to TX Packet in Query group.

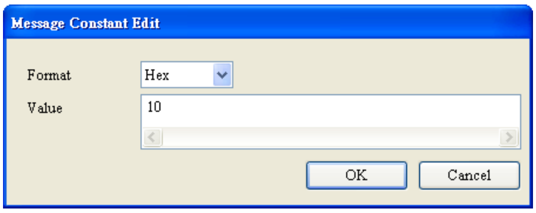


Respond with the abbreviated record.

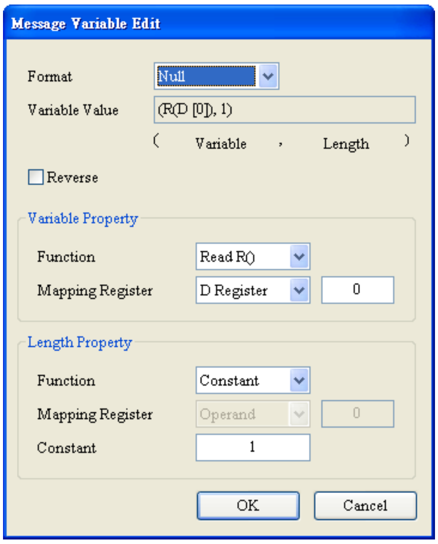
『Start word』+『Device address (IA)』+『Function code (FF)』+『Checksum (CS)』+『End marker』

→ 10h + D0 + 09h + (IA+FF) + 16h

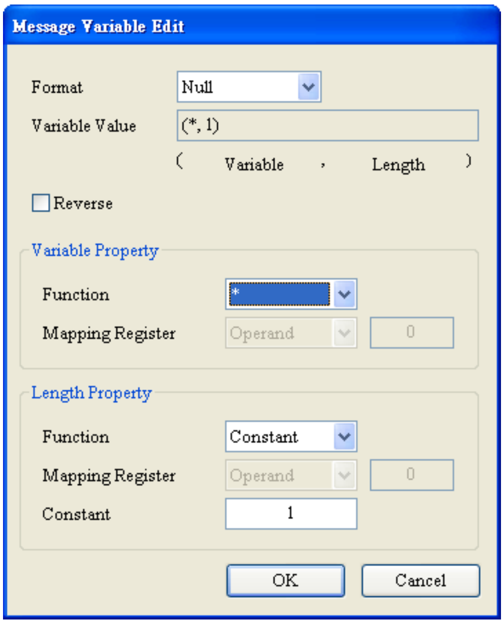
■ Start word: 10h



■ Check whether the response address and the device address previously read from D0 (IA) are the same.

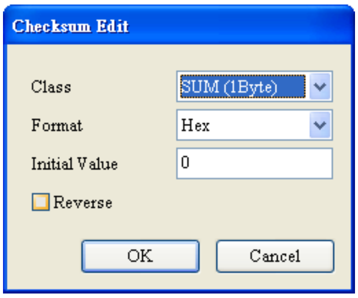


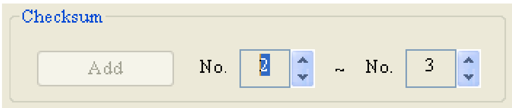
- Ignore the function code (FF) of the response: (*, 1): Ignore the word whose length is 1. If you want to store the function code, refer to the setting of the device address (IA) to store the function code in the D register.



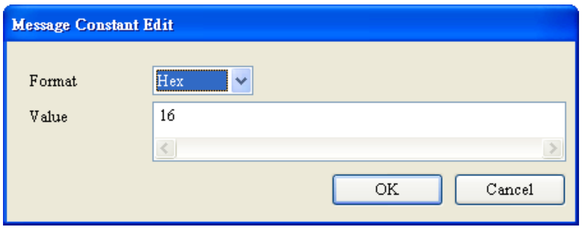
- Checksum

(1 byte, adding the previous two items up):

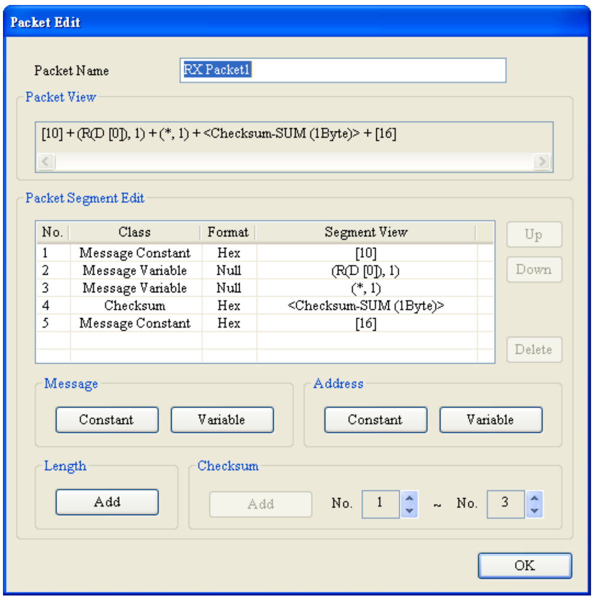




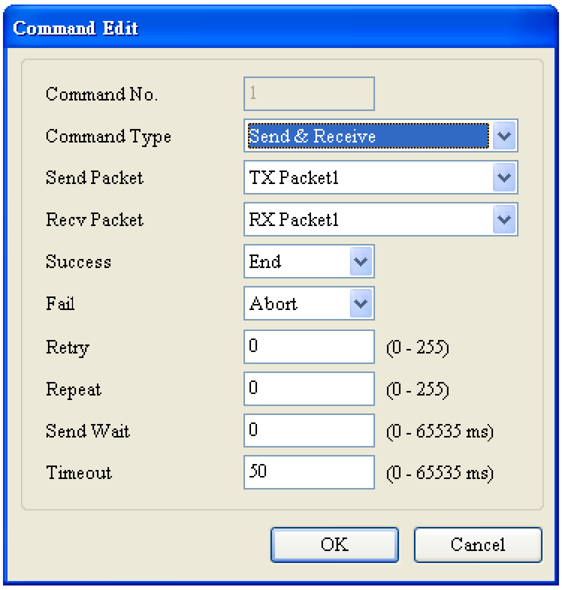
- End word: 16h



- The editing is complete:



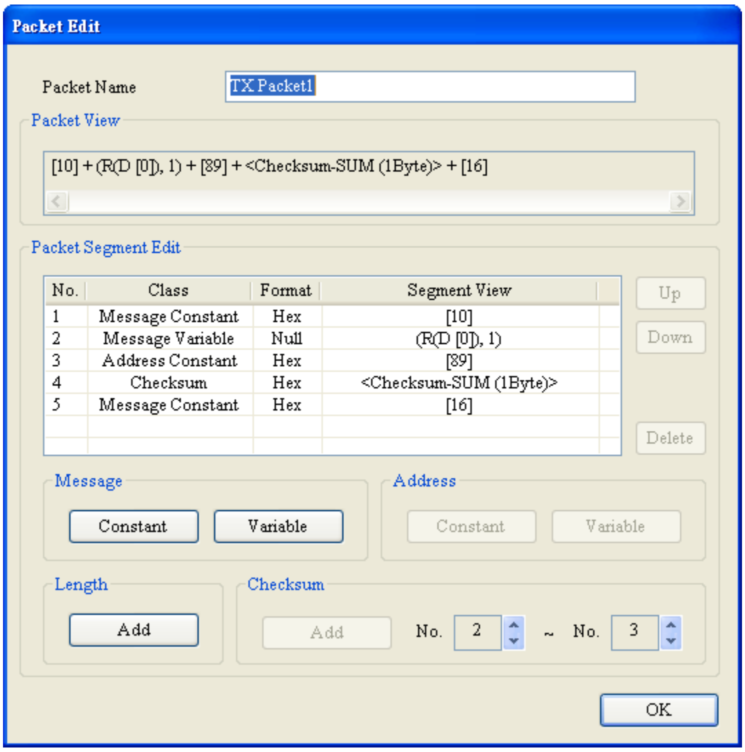
Edit the SCM command: Sending Tx Packet1 and receiving Rx Packet1.



Type3

Send the abbreviated record and respond with the full record.

For the sending of the abbreviated record, you can copy or refer to those in type 1 and type 2. Note that the function code (FF) is 89h.



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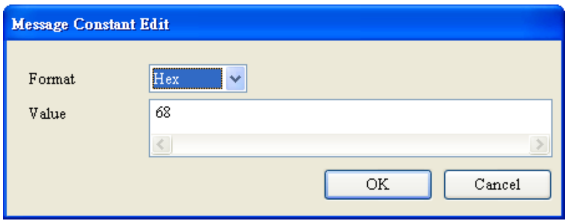
Respond with the full record.

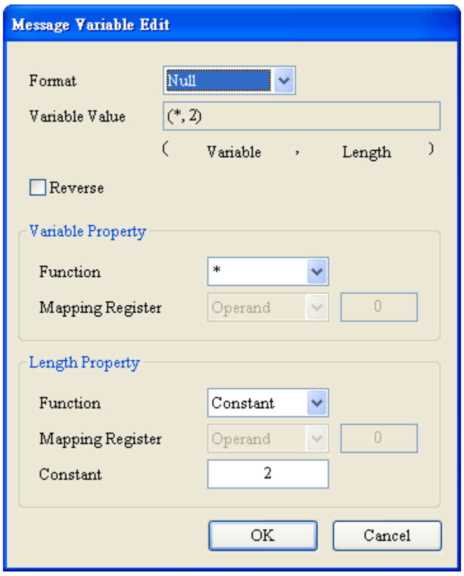
『Start word』+『Length』+『Length (repeat)』+『Start word』+『Device address (IA)』+『Function code (FF)』+『Parameter index (PI)』+『Data block (DB)』+『Checksum (CS)』+『End marker』

→ 68h + (Null) + (Null) + 68h + D0 + (Null) + D100

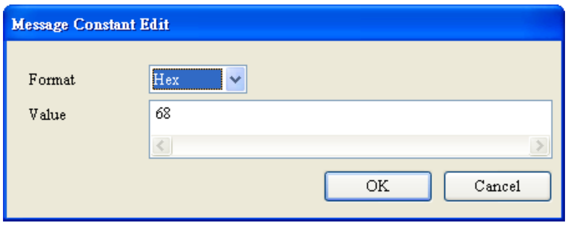
■ Start word: 68h



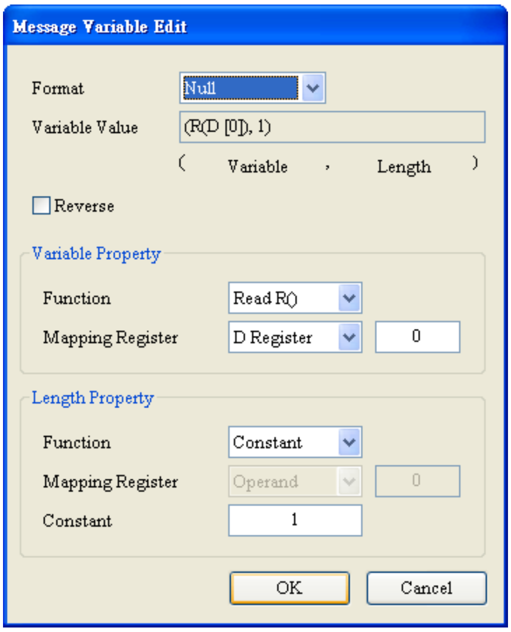
■ Length + Length (repeat): Ignore these two words. They can be ignored or stored.



■ Start word: 68h

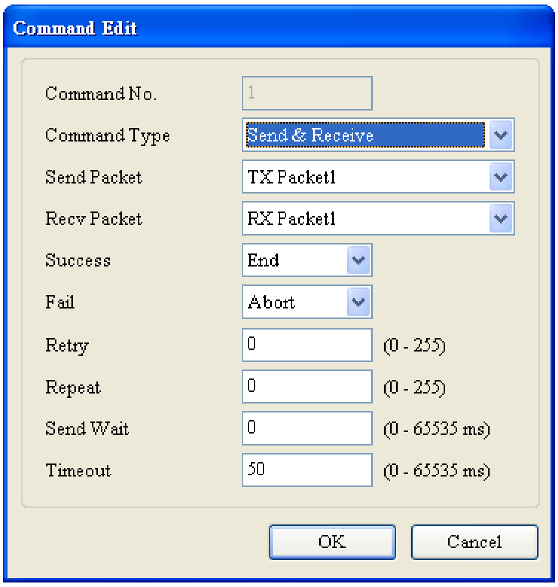


■ Device address (IA): Check whether the response address and the device address previously read from D0 (IA) are the same.



Note: Some unimportant words can be ignored. You can just store the data which is needed in the registers (Dx), and the data whose length of the response code is unknown can be stored in the registers by means of this method.

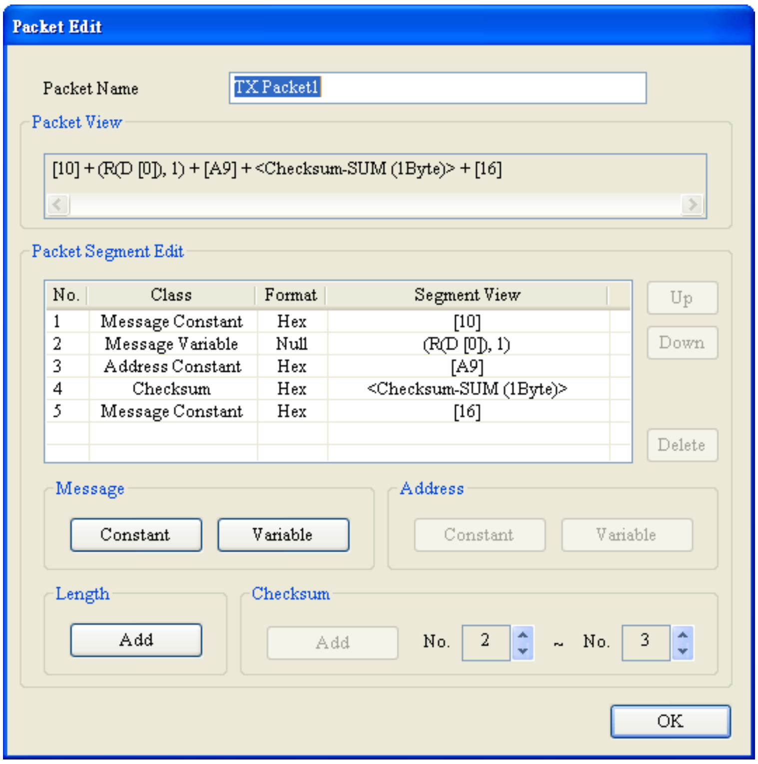
Edit the SCM command: Sending Tx Packet1 and receiving Rx Packet1.



Type4

Send the abbreviated record and respond with the full record.

For the sending of the abbreviated record, you can copy or refer to those in type 1 and type 2. Note that the function code (FF) is A9h.

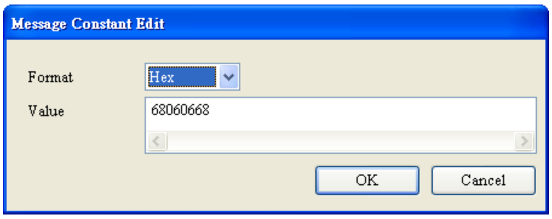


Respond with the full record.

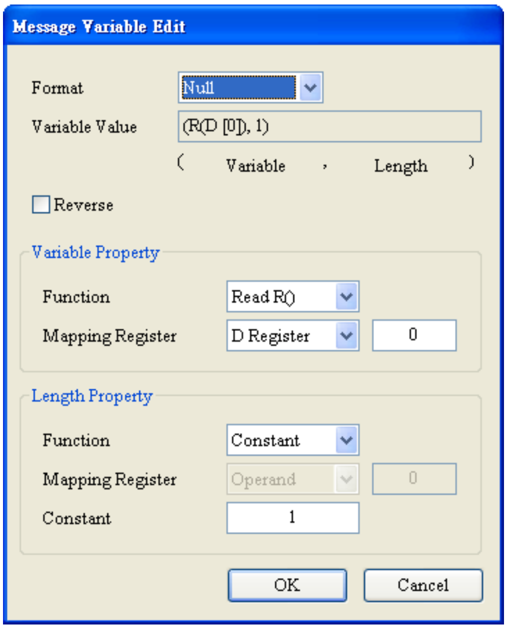
『Start word』 + 『Length』 + 『Length (repeat)』 + 『Start word』 + 『Device address (IA)』 + 『Function code (FF)』 + 『Parameter index (PI)』 + 『Data block (DB)』 + 『Checksum (CS)』 + 『End marker』

→ <u>68h + 06h + 06h + 68h + D0 + (1 word) + (3 words) + (the content gotten from adding from IA to the end) + 16h</u>

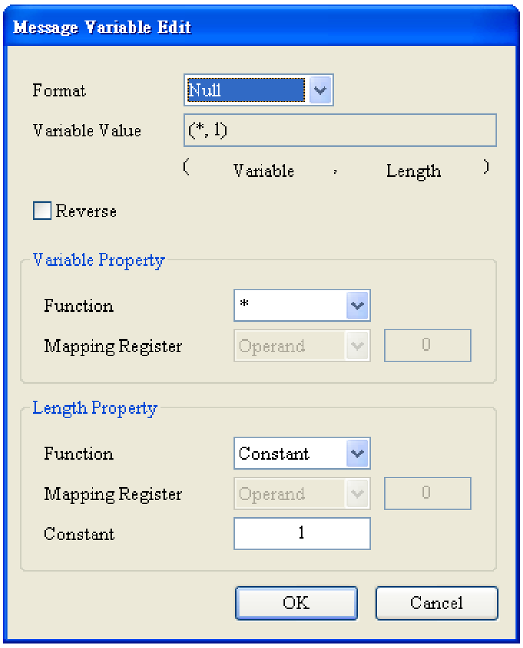
- Start word-Length-Length-Start word



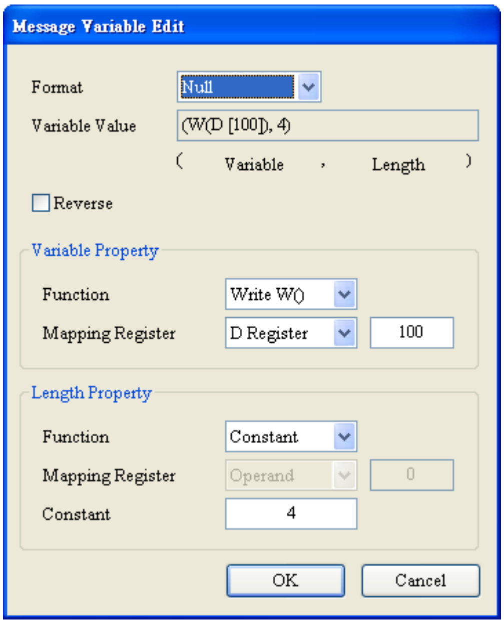
- Check whether the response address and the device address previously read from D0 (IA) are the same.



- FF : Ignore the function code.



- Store PI+DB in D100.



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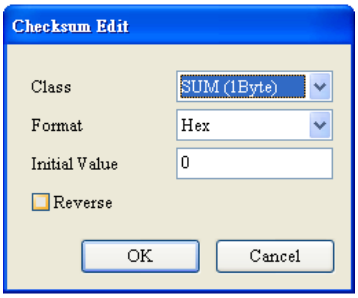
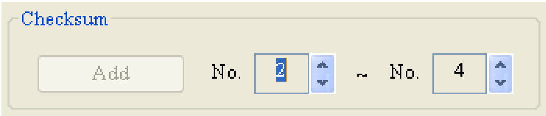
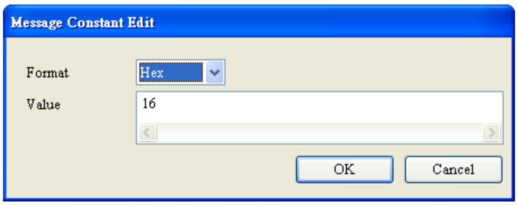
- Checksum:

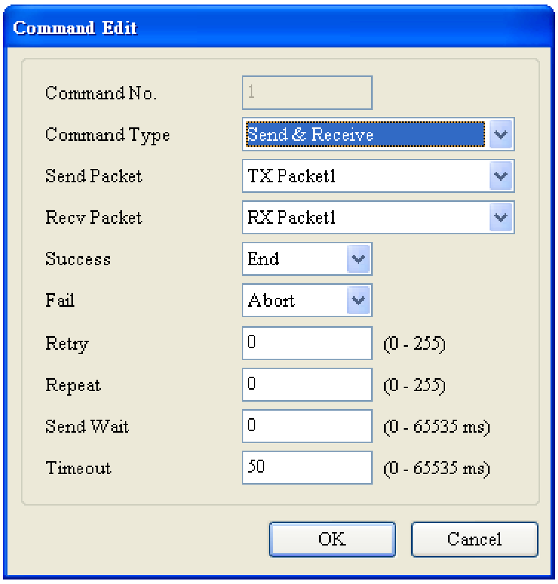




- End word:



Edit the SCM command: Sending Tx Packet1, and receiving Rx Packet1



Type 5

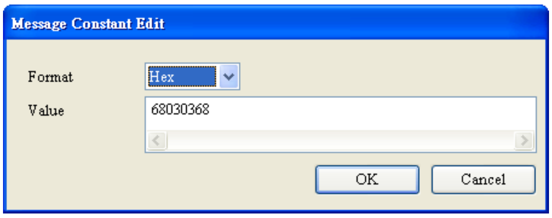
Send the Control record and respond with the full record.

When the control record is sent, the function code (FF) is 89h.

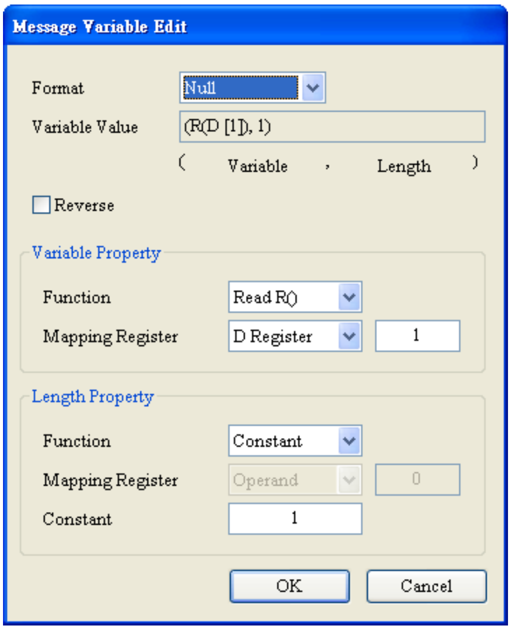
『Start word』+『Length』+『Length (repeat)』+『Start word』+『Device address (IA)』+『Function code (FF)』+『Parameter index (PI)』 + 『Checksum (CS)』 + 『End marker』

→ 68h + 03h + 03h + 68h + D0 + 89h + D1 + (the content gotten from adding from IA to the end) + 16h.

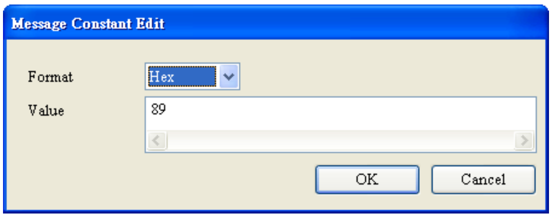
- Start word-Length-Length-Start word



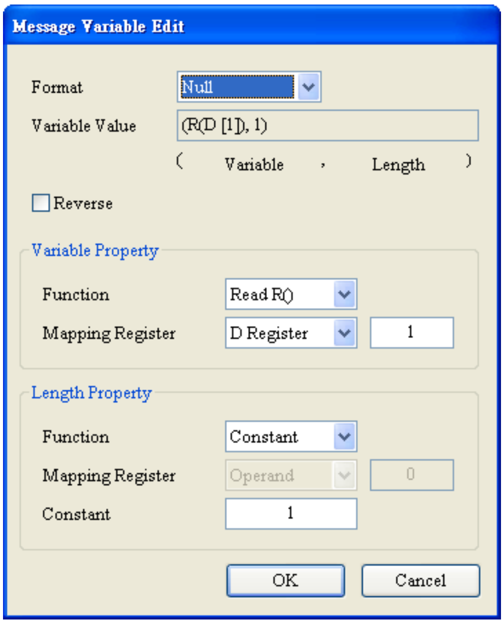
- The device address is read from D0.



- Function code: 89h



- The parameter index is read from D1.

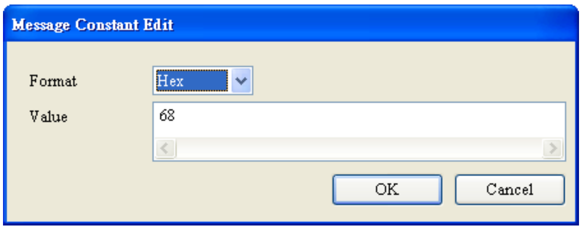


Respond with the full record.

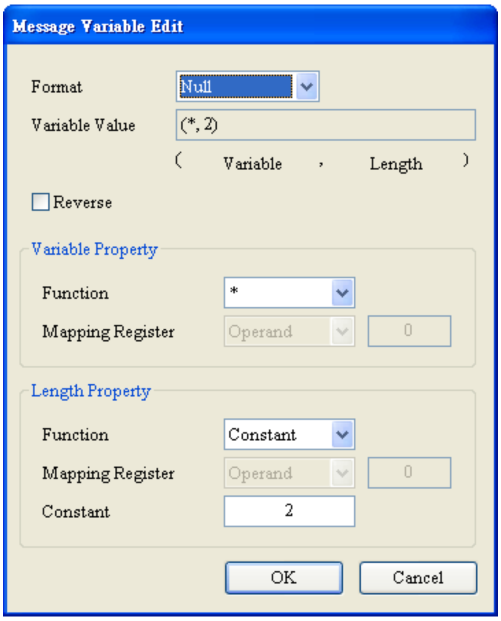
『Start word』+『Length』+『Length (repeat)』+『Start word』+『Device address (IA)』+『Function code (FF)』+『Parameter index (PI)』+『Data block (DB)』+『Checksum (CS)』+『End marker』

→ 68h + (Null) + (Null) + 68h + D0 + (Null) + D1 + D100 + (the content gotten from adding from IA to the end) + 16h

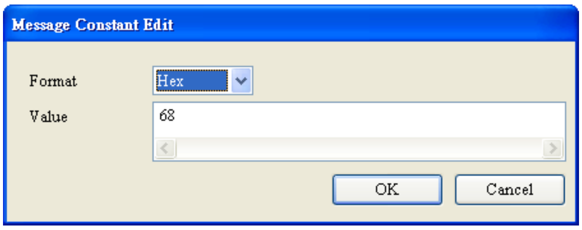
- Start word:



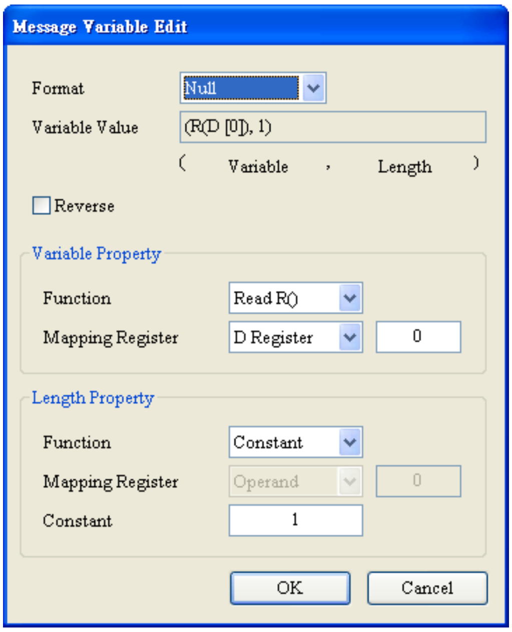
- Length-Length (two words): Ignore the two words.



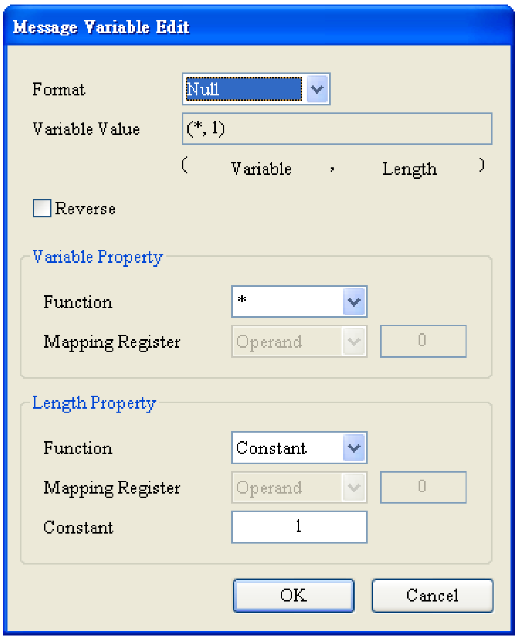
- Start word: 68h



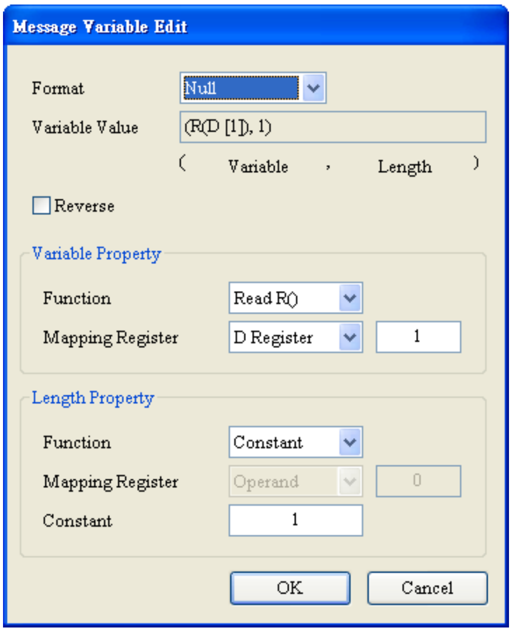
- Check whether the response address and the device address previously read from D0 (IA) are the same.



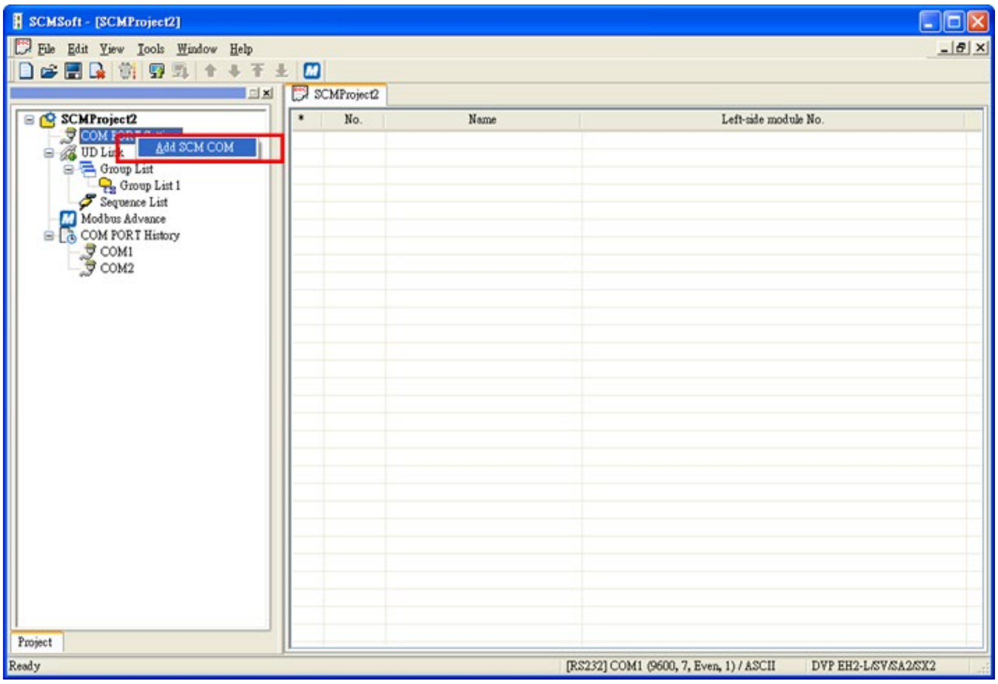
- Function code

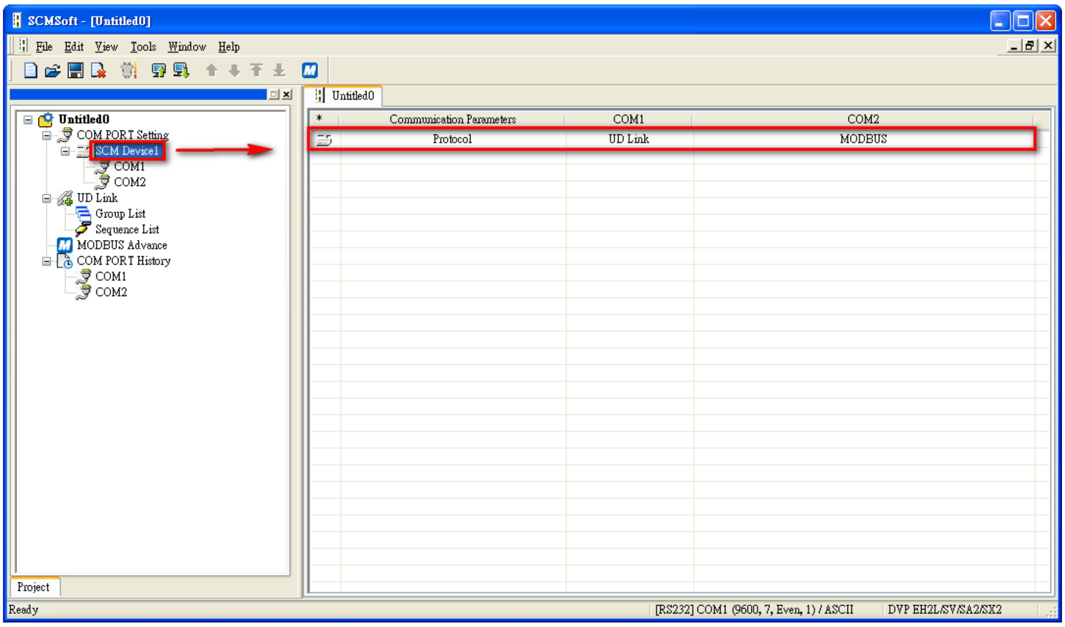


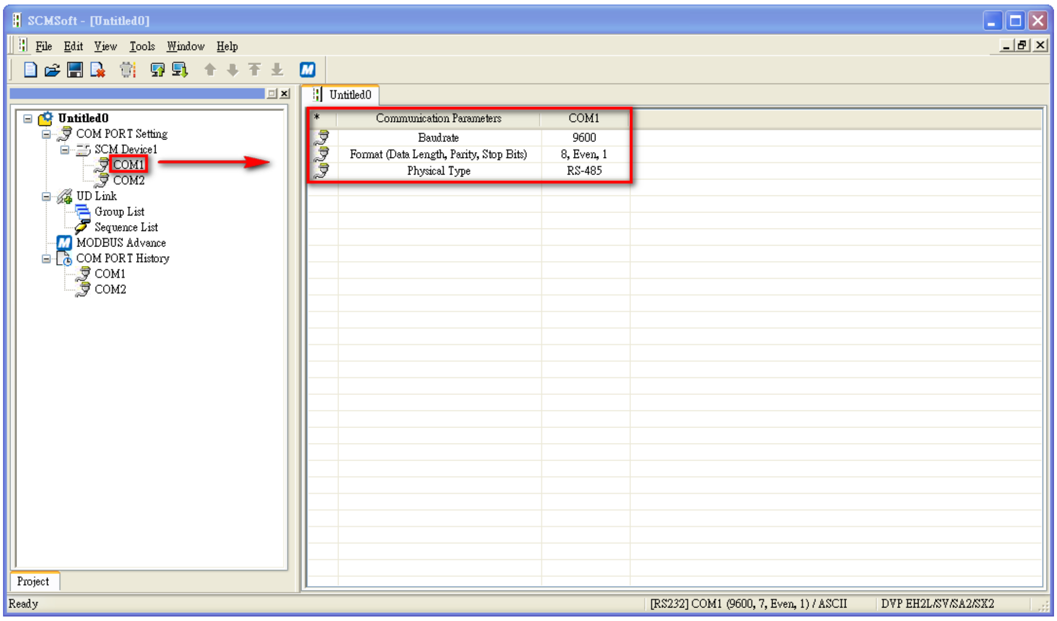
- Check whether the parameter index of the receiving and that of the sending are the same.



4. Download: After setting all types, download the UD Link to the SCM module. Open SCMSoft → 『New Project』 → COM PORT Setting: 『Add SCM COM』 → Set the communication parameters.







Set the communication parameters of COM1: Station address 247 (default), UD Link, 9600, 8, Even, 1.

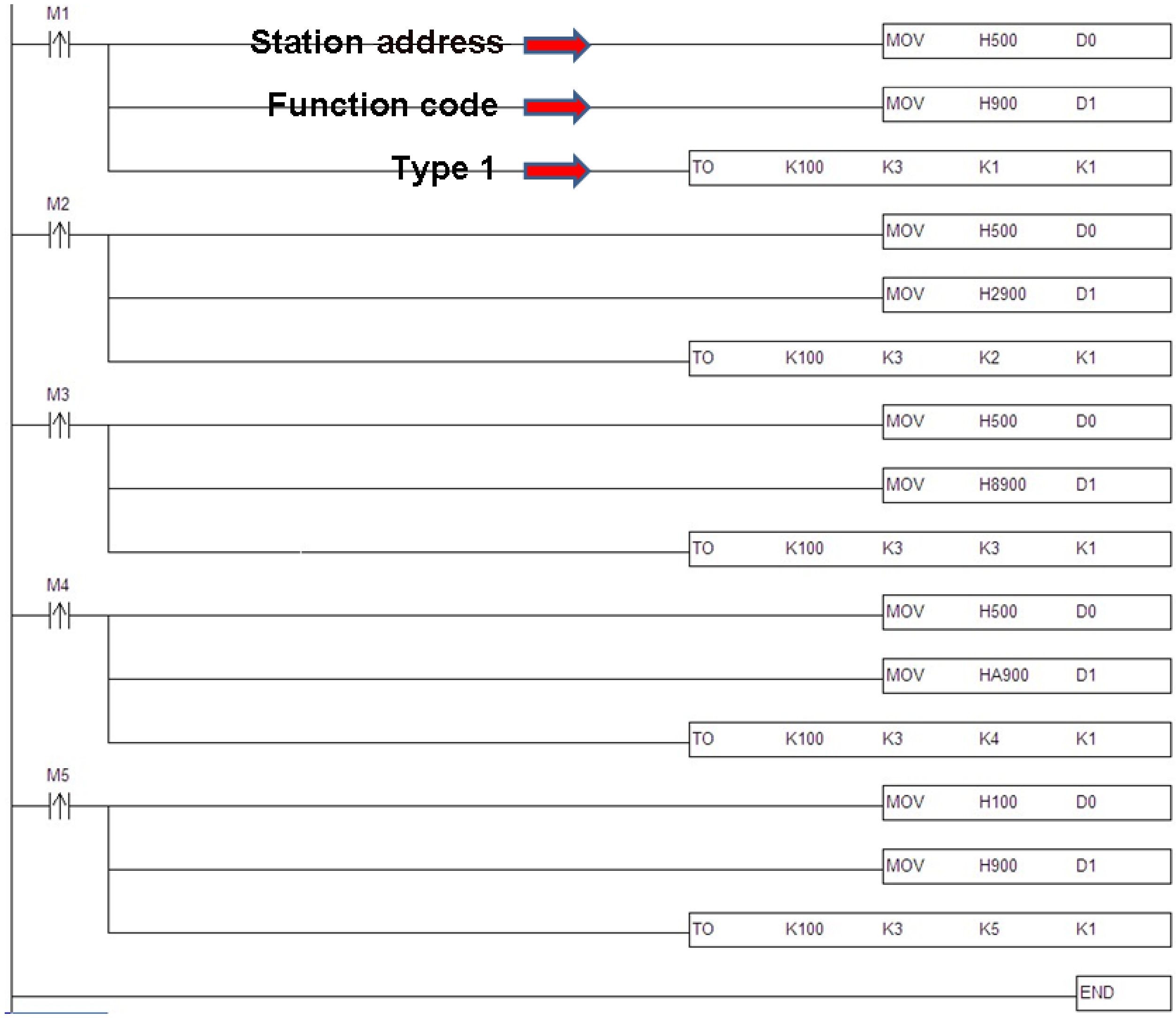
*	Communication Parameters	COM1
	Baudrate	9600
	Format (Data Length, Parity, Stop Bits)	8, Even, 1
	Physical Type	RS-485

5. WPLSoft triggers UD Link

The group number set in each type is triggered by “To instruction” in WPLSoft which triggers the execution of UD Link. K1 is written into CR#3 if the group number is 1 and by analogy, K2 is written into CR3 if the group number is 2.

CR#	Attribute	Name of the register	Description
3	R/W	Group number triggered by COM1 UD Link	The Group number triggered by COM1 UD Link

The sending of type 1 to 5 is controlled by M1 to M5. Each triggering includes writing the station address of the electricity meter and the function code into D0 and D1 respectively. When the data is written into the registers, the higher bit precedes the lower bit. For example, the user has to enter H’0555 when the station address is 5, and the same applies to the reading of the response address from D100.

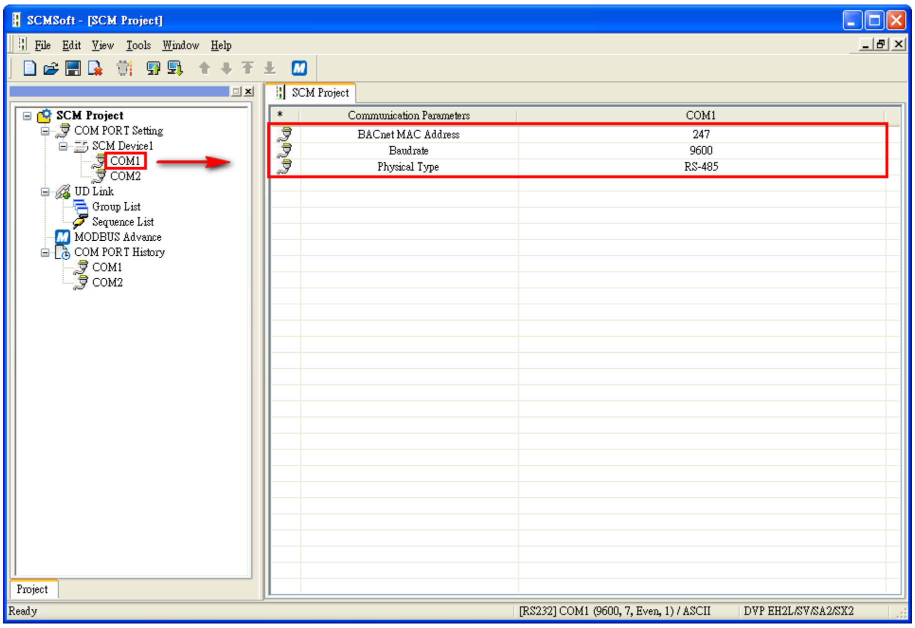


13.5.8.4 BACnet MS/TP Slave Function (Supported by DVPSCM52-SL)

Set the BACnet parameters and the BACnet object for the SCM module, and then download them to the SCM module to connect to the BACnet MS/TP module.

For firmware versions V1.08 and below, the PLC CPU needs to write to AV or BV before being able to read them. For versions V1.10 and above, the PLC CPU can directly read AV and BV values without the need for prior write operations.

BACnet parameters



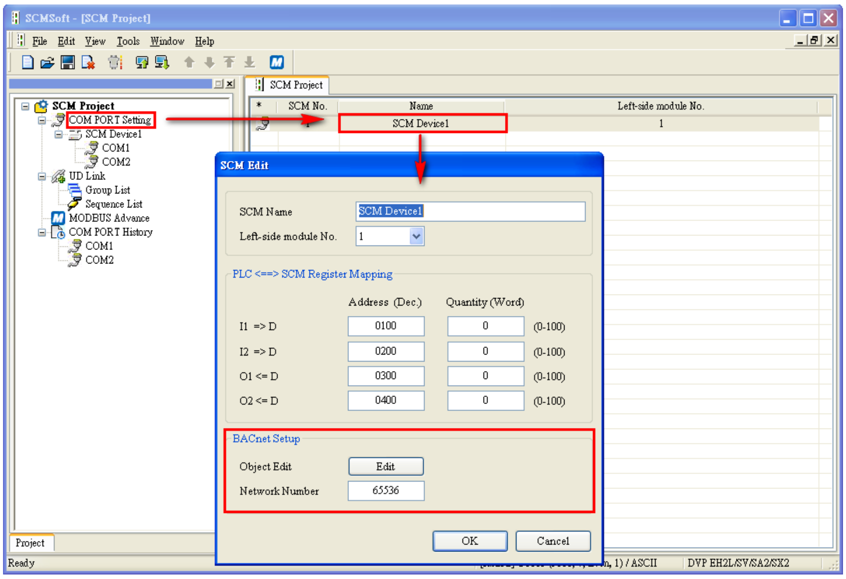
BACnet MAC address: 1 to 247 (Default: 247). It can NOT be the same as the addresses of other devices on the BACnet network.

Baud rate: 1200 bps to 460800 bps (Default: 9600). It MUST be the same as the setting for the BACnet MS/TP CPU.

Physical Type: options are RS-485 or RS-422.

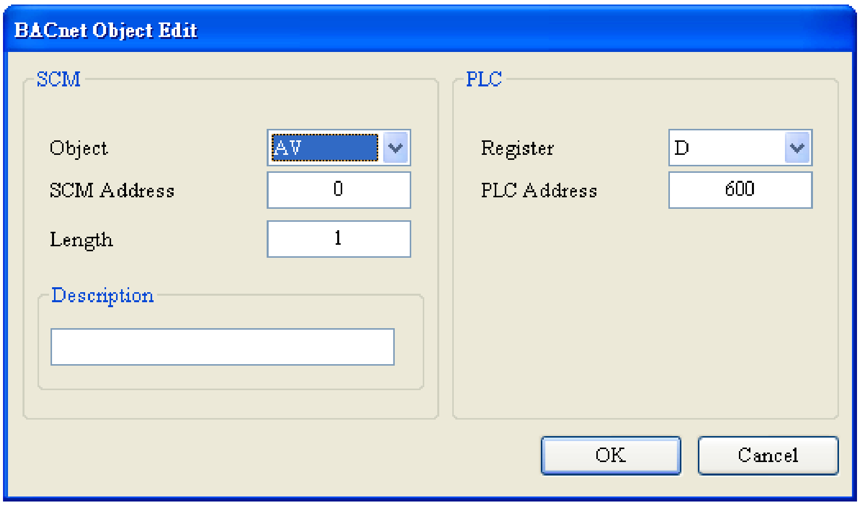
BACnet object

Network Number: The network number on the BACnet network is unique. It CAN'T be used repeatedly. (Default: 65536)



BACnet object edit: Editing the AV and BV values which correspond to the data registers and coils in the Delta PLC connecting to the SCM module

The lenghth of tha AV value corresponds to two data registers in the Delta PLC, and the lenghth of the BV value corresponds to one coil in the Delta PLC.



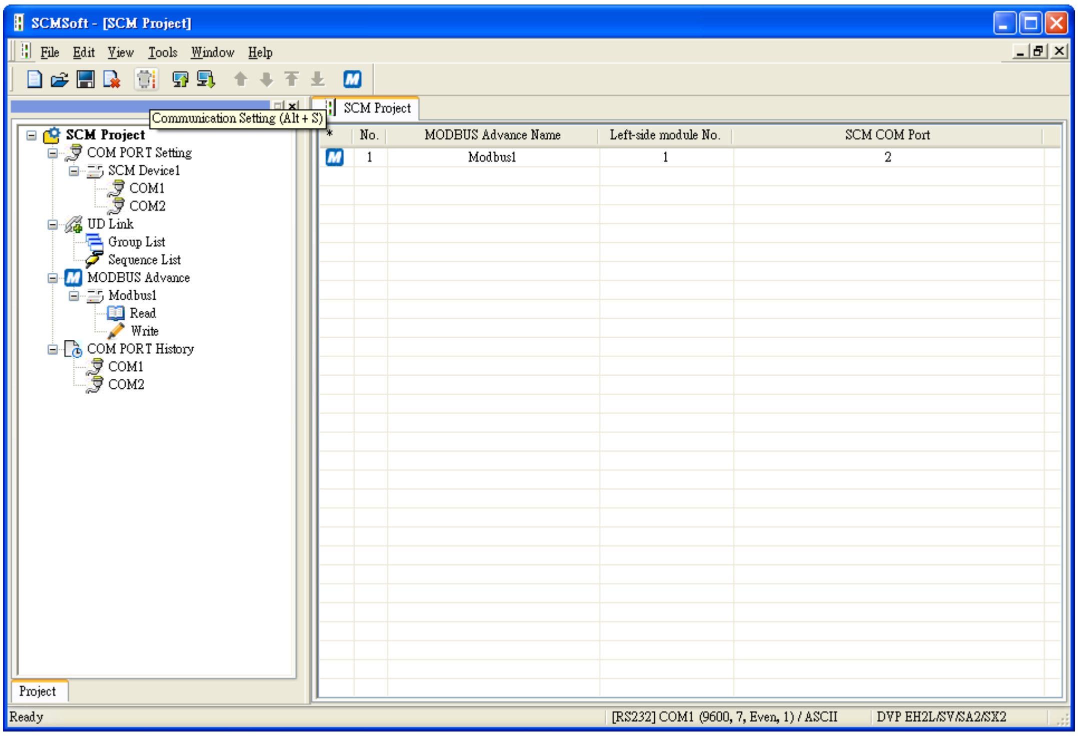
Object: The user can select “AV” or “BV”. “AV” corresponds to data the registers in the PLC, and “BV” corresponds the coil in the PLC.

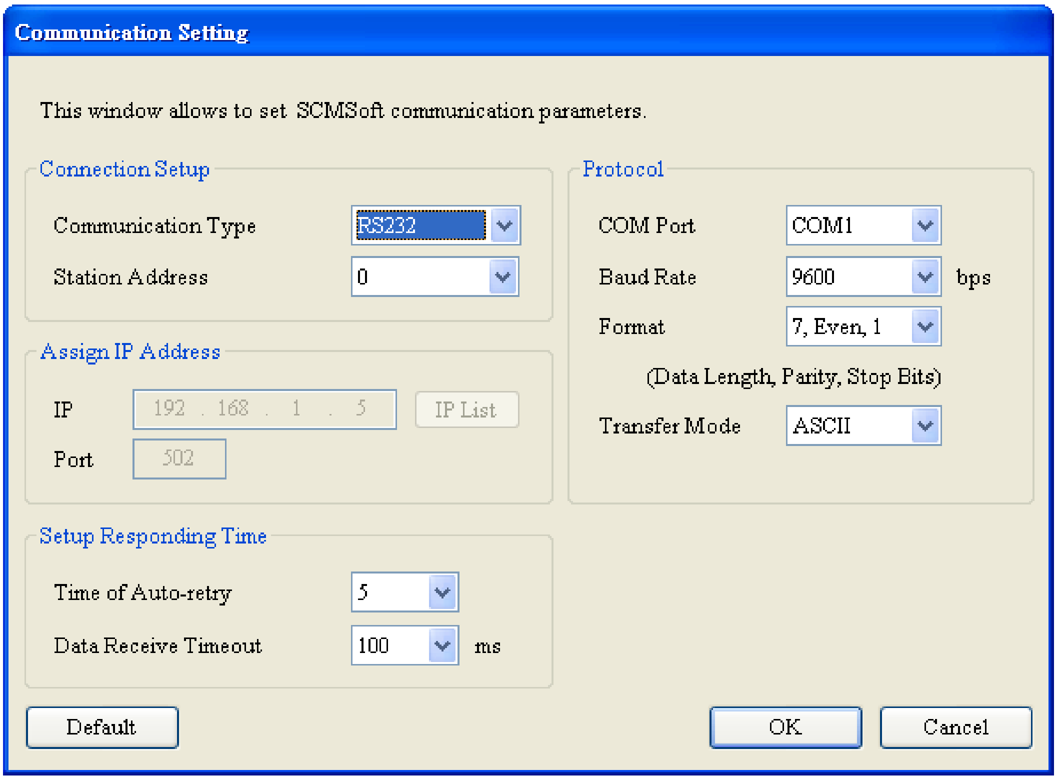
SCM address: The user can set the address of the AV, or the address of the BV. The setting range is 0 to 383.

Length: A unit is a double word.

PLC: The start address in the Delta PLC.

Download





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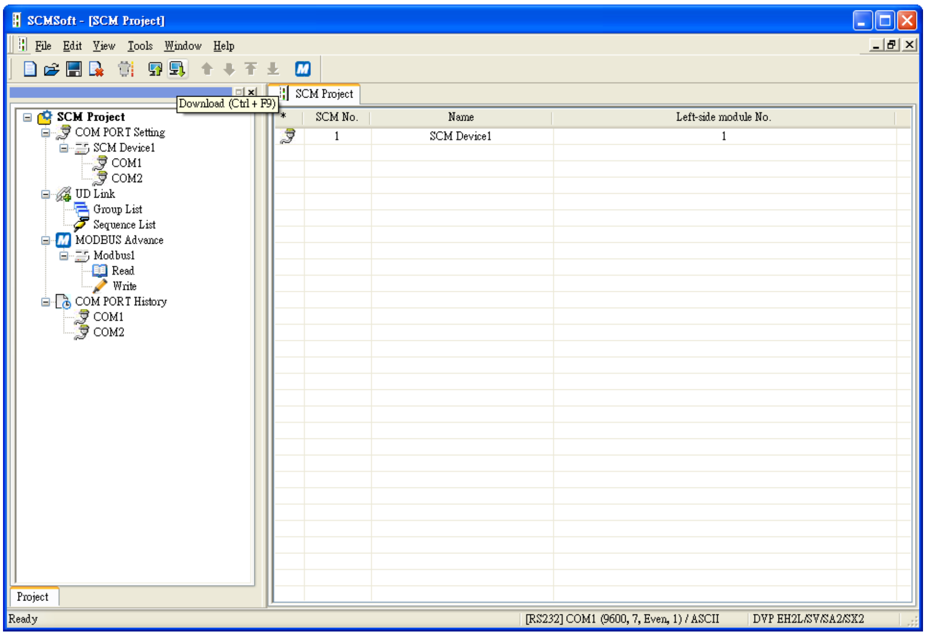
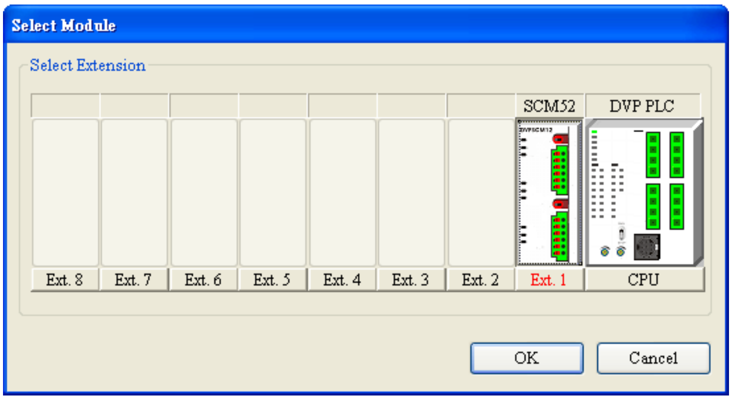
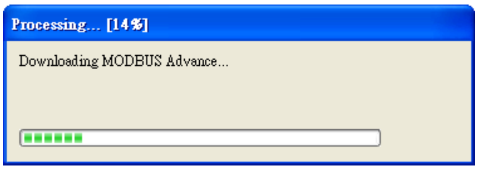
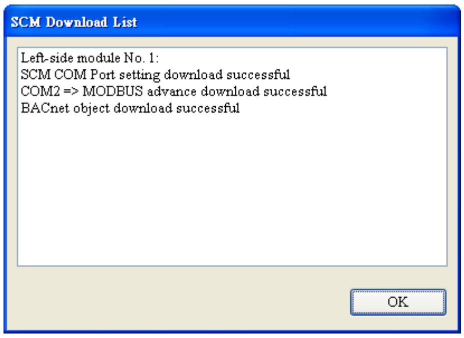
Click “Download”, choose the left-side module which will be downloaded, and click “OK”. If only one device is connected, click “OK” directly.









After the parameters are downloaded, the AV and BV values in the software correspond to the registers and bit in the PLC connected to the SCM module.

13.5.9 LED Indicator and Troubleshooting

13.5.9.1 LED Indicator

LED	Status		Indication	How to correct
POWER	Green light	On	Power supply is normal	--
		Off	No power supply	Check if the power is on.
RUN	Green light	On	DVPSCM52-SL in RUN status	--
		Off	DVPSCM52-SL in STOP status	--
ERR	Red light	On	Hardware error	Contact your local distributors.
		Flashes	1. Errors in system settings or communication 2. Returning to Factory Setting	Reset to default values.
		Off	No errors	--
TX1/TX2	Orange light	Flashes	RS-485/RS-422 in transmission	--
		Off	No RS-485/RS-422 transmission	--
RX1/RX2	Orange light	Flashes	RS-485/RS-422 in reception	--
		Off	No RS-485/RS-422 reception	--
RS-485/ RS-422	Green light	On	RS-485 mode	--
		Off	RS-422 mode	--

13.5.9.2 Troubleshooting

Abnormality	Cause	Solution
POWER LED OFF	PLC CPU not powered	Check the power supply for the PLC CPU.
	DVPSCM52-SL not connected with the PLC CPU	Check if DVPSCM52-SL is tightly connected with the PLC CPU.
As MODBUS master, no response from the slave	Wiring error	Ensure the use of shielded twisted pair RS-485 communication cables and correct connections.
	Slave communication function error	Please check the TX indicator; if it is flashing normally, confirm whether the communication functionality of the slave device is normal.
	The MODBUS advanced settings were not downloaded, or there is an error in the CR configuration.	Please check the TX indicator; if it is not flashing, re-download the advanced parameters for MODBUS and ensure that CR triggers data exchange correctly.
As MODBUS slave, no response to the master	Wiring error	Ensure the use of shielded twisted pair RS-485 communication cables and correct connections.
	Parameters setting error	Please check the RX indicator; if it is flashing normally, confirm whether the historical data and communication format are correct.
UD Link communication error	Wiring error	Ensure the use of shielded twisted pair RS-485 communication cables and correct connections
	The received packet length is set incorrectly	Verify that the length setting for receiving packet variable messages is correct. If there are no specific requirements, it is recommended to set the length attribute function to ' * ' to allow the device to determine it autonomously.
	The variable attributes for receiving packets are set incorrectly.	Confirm that the functionality setting for the variable attributes of receiving packets is 'Write W()', so that the device will write the received variable data into the registers.

13.6 DVPEN02-SL

13.6.1 Introduction

DVPEN02-SL is an Ethernet communication module for remote setting and communication through project editing software. Its features include sending E-mail, automatic network correction for RTC in PLC, data exchange, etc. It supports MODBUS TCP communication protocol. You can conduct remote monitoring by using SCADA (Supervisor Control and Data Acquisition) software or HMI (Human Machine Interfaces). DVPEN02-SL can act as the master of MODBUS TCP, sending out MODBUS TCP instructions and controlling its peripheral equipment. In addition, under MDI/MDI-X auto-detection, it does not need to use a crossing cable. See below for more details on the DVPEN02-SL module.

13.6.1.1 Features

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- Supports DVP Series 2nd generation PLCs (FW V1.00 or above): DVP12SA2, DVP20SX2 (V1.2 or above), DVP12SE (V2.0 or above), and DVP28SE2, DVP24SV2, and DVP28SV2, working with editing software DCISoft V1.27 and above.
- Supports DVP Series 3rd generation PLCs (FW V1.02 or above): DVP-SV3 (V1.10 or above), DVP-SX3 (V1.10 or above), working with editing software DIADesigner V1.11 and above.
- Auto-detects 10/100 Mbps transmission rate; MDI/MDI-X auto-detection
- Supports MODBUS TCP protocol (Client and Server modes simultaneously)
- Supports SNMP: Agent (v1, v2c), and instructions GET and SET.
- Supports sending E-mails with TLS/SSL certificates
- Auto-corrects the RTC in PLC through the Internet time correction function
- Supports firmware updates and network diagnostics on the web page

Differences between DVPEN02-SL and DVPEN01-SL:

- **Added Ethernet communication port**
- **Increased maximum number of MODBUS TCP Server connections**
- **Added SMTP with TLS&DNS**
- **Added Web page**
- **Added the following features for use with 3rd generation PLCs (V1.02 and above):**
  - **Added EIP Adapter**
  - **Added MQTT Client**
  - **Increased the maximum number of MODBUS TCP Client connections**

Item	DVPEN01-SL	DVPEN02-SL (works with DVP 2nd generation PLCs)	DVPEN02-SL (works with DVP 3rd generation PLCs)
Number of Ethernet ports	1	2	
Number of RS-232 ports	1	0	
Number of MODBUS TCP Server connections	16	32	
Email	SMTP (no secure)	SMTPS (Supports TLS/SSL and DNS)	SMTPS (Supports TLS/SSL and DNS)

Item	DVPEN01-SL	DVPEN02-SL (works with DVP 2nd generation PLCs)	DVPEN02-SL (works with DVP 3rd generation PLCs)
			Supports MSEND instructions
Web page	X	Supports firmware updates, network diagnostics	
Number of MODBUS TCP Client connections	24		32
Max. number of EIP Adapter connections	X		8
Max. number of MQTT Client connections	X		1

13.6.1.2 Specifications

- **Internet interface**

Item	Specifications
Interface	RJ-45 with Auto MDI/MDIX
Number of ports	RS-45 x2 Ports
Transmission method	IEEE802.3, IEEE802.3u
Transmission cable	Category 5e,
Transmission rate	10/100 Mbps (Auto-Detect)

Item		Specification: Works with DVP 2nd generation PLCs	Specification: Works with DVP 3rd generation PLCs
MODBUS TCP[*1]	**Client: Max. number of connections**	24 (data exchange table) 1 (ETHRW instruction)	32/64 (data exchange table)[*4] 1 (ETHRW instruction)
	Server: Max. number of connections[*2]	32	
	Max. data length for a single connection	100 words	
MELSEC 3E	**Communication type**	UDP	
	Client: Max. number of connections	10	
	Server: Max. number of connections	8	
	Max. data length for a single connection	100 words	
RTU-EN01	**Max. connection count[*3]**	4	
IP filter function	**Number of entries in the whitelist**	8	
SNMP	**Version**	V1, v2c	
	Number of communities	2	
	Permissions	GET, GET/SET	
SMTP Email function	**Number of E-mails**	4	
	Number of recipient email addresses that can be stored	4	

<table>
<tr><th colspan="2" rowspan="2">Item</th><th colspan="2">Specification</th></tr>
<tr><th>Works with DVP 2nd generation PLCs</th><th>Works with DVP 3rd generation PLCs</th></tr>
<tr><td rowspan="2"></td><td>Number of trigger methods that can be stored</td><td colspan="2">4</td></tr>
<tr><td>Additional information</td><td colspan="2">Registers of 100 consecutive addresses</td></tr>
<tr><td rowspan="2">Web page</td><td>Max. number of connections</td><td colspan="2">8</td></tr>
<tr><td>Features</td><td colspan="2">Device information viewing,
Permission management,
Firmware update</td></tr>
<tr><td>EIP Adapter</td><td>Number of connections</td><td>X</td><td>8</td></tr>
<tr><td rowspan="2">MQTT Client</td><td>Max. number of connections</td><td rowspan="2">X</td><td>1</td></tr>
<tr><td>Max. number of simultaneous subscriptions</td><td>5</td></tr>
</table>

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*1. The number of MODBUS TCP Client and Server connections are calculated separately.

*2. The number of MODBUS TCP Server connections includes ones used by program editing software for monitoring.

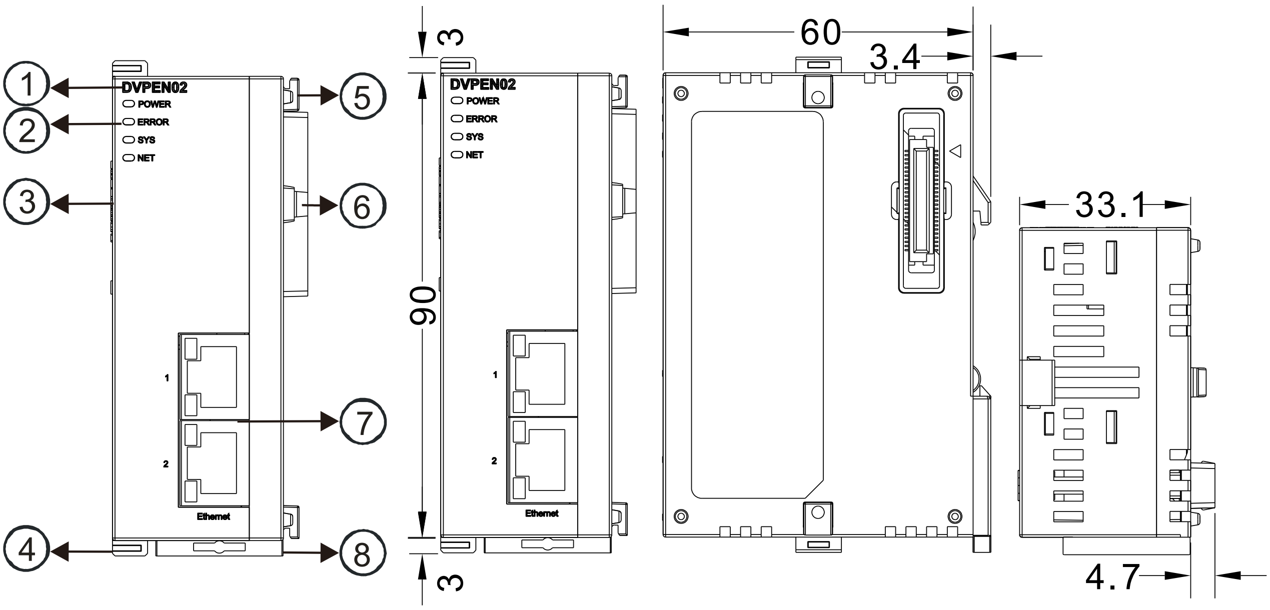
*3. The RTU-EN01 mapping feature does not consume any additional MODBUS TCP connections

*4: 32/64 respectively indicates 32 Modbus TCP connections and 64 data exchange mapping instructions.

- **Electrical specifications**

Item	Specification
Power supply voltage	24 VDC (-15 to 20%) (Power is supplied by the internal bus of the CPU.)
Power consumption	1.3 W
Insulation voltage	500 VAC
Weight (g)	101

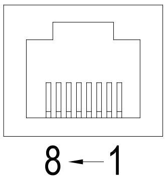
13.6.2 Module Profiles and Dimension



Unit: mm

No.	Name	Description
1	Model name	Module model number.
2	POWER LED (Green)	Indicates the power state of the power supply ON: the power is on. OFF: no power
	ERROR LED (Red)	Indicates the error state ON: hardware error OFF: normal Blinking: system error or communication error
	SYS LED (Green)	Indicates the SYS communication state ON: system works normally. OFF: no communication error Blinking: hardware error, system error (ERROR LED ON)
	NET LED (Green)	Indicates the NET communication state ON: communication works normally OFF: being initialized Blinking: communication error (ERROR LED ON)
3	Extension module connection port	Connect the modules.
4	Extension unit fixing clip	For securing the extension module.
5	Extension unit positioning hole	For positioning between modules.
6	Extension module connection port	Connect the PLC or the module.
7	Ethernet communication port	For connecting Ethernet network.
8	DIN rail securing clip	Secure the modules on the set

13.6.3 Terminals

Ethernet (RJ-45) Pin Definition				
	Pin no.	Definition	Pin no.	Definition
	1	TX+	5	N/C
	2	TX-	6	RX-
	3	RX+	7	N/C
	4	N/C	8	N/C

13.6.4 Installation and Wiring

13.6.4.1 Installation

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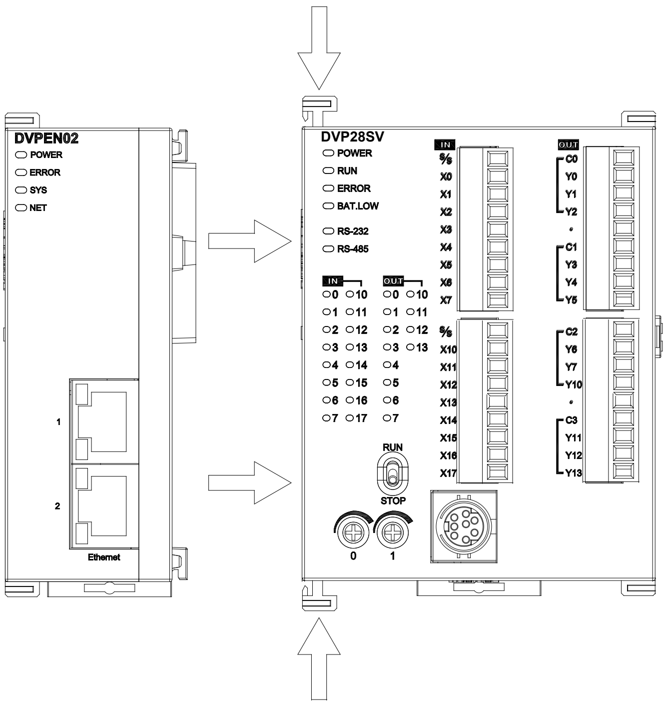
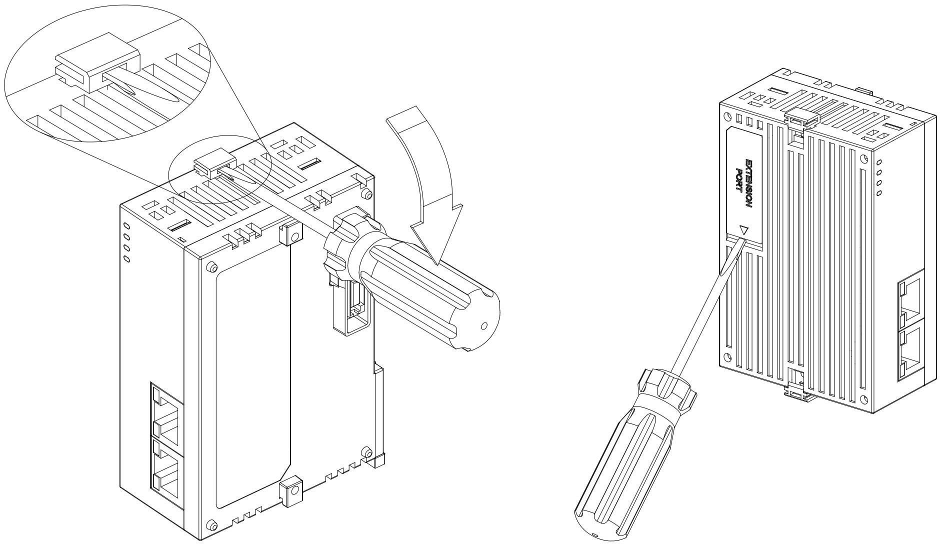
1. Connecting DVPEN02-SL to the PLC CPU:

- Adjust the I/O module clips on the left side of the PLC CPU.
- Align DVPEN02-SL and the corresponding connection port of the PLC CPU, and then securely connect them as illustrated.
- Fasten the clips on the left side of the PLC CPU.



2. Connecting DVPEN02SL to another I/O module:

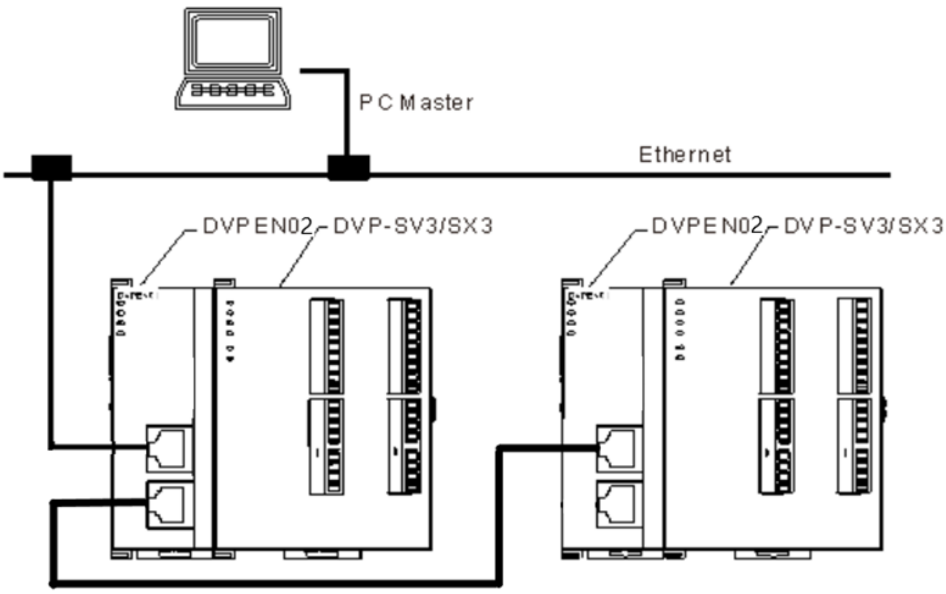
To connect the DVPEN02-SL to another I/O module, use a screwdriver to lift the extension clips on the I/O module and open the side cover. Then, align the DVPEN02-SL and the I/O module, and connect them securely.



13.6.4.2 Wiring

Using a CAT-5e twisted-pair cable to establish a connection between the DVPEN02-SL and the Ethernet switch. Due to the DVPEN02-SL's built-in Auto MDI/MDIX feature, a standard straight-through CAT-5e cable can be used for connection without the need for a crossover cable.

The following diagram illustrates the network cable connection between the computer and the DVPEN02-SL module.



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13.6.5 Control Register

CR#	Attribute	Register name	Description	Corresponding DVPEN01-SL's CR#
0	R	Model code	Read only; the model code of DVPEN02-SL=0x4051	0
1	R	Firmware version	Displaying the current firmware version in hex, e.g. V1.00 is indicated as 0x0100	1
2 to 4	R	MAC Address	Assuming the MAC address is 00 18 23 AA BB CC CR#2=H0018 CR#3=H23AA CR#4=HBBCC	104 to 106
5	R/W	Communication mode	Bit 0: switching communication protocols 0: MODBUS TCP 1: MELSEC Bit 1: enable or disable the data exchange table 0: Disabled 1: Enabled	2
6	R/W	Mode of setting IP address	0: Static IP address 1: DHCP	87
7 to 8	R/W	IP Address	The IP address is displayed when the module powers on. After modification, triggering CR#13 saves the modified parameters. If an IP address is 192.168.1.5, set the value in CR#7 to H0105, and the value in CR#8 to HC0A8.	88 to 89
9 to 10	R/W	Subnet mask	The subnet mask is displayed when the module powers on. After modification, triggering CR#13 saves the modified parameters. This parameter has a latched function. If the subnet mask is 255.255.255.0, set CR#9 to HFF00 and CR#10 to HFFFF.	90 to 91
11 to 12	R/W	Gateway IP address	The gateway IP address is displayed when the module powers on. After modification, triggering CR#13 saves the modified parameters. This parameter has a latched function. If the gateway IP address is 192.168.1.5, set CR#11 to H0105 and CR#12 to HC0A8.	92 to 93
13	R/W	Enabling the setting of an IP address	When set to 1, the IP configuration is executed. After the configuration is complete, the CR value is automatically reset to 0 and remains latched, meaning it is retained even after a power outage.	94

CR#	Attribute	Register name	Description	Corresponding DVPEN01-SL's CR#
14	R	Status of setting an IP address	0: Default value 1: Setting completed 2: IP setting In progress 3: IP setting error 4: Subnet mask error 5: IP and subnet mask mismatch 6: Gateway error If an error occurs, all settings will be reset to the current legal value. If the IP address is invalid or not in the same subnet as the default gateway, the settings will not be applied. CR#7 to 12 will be reset to the current legal value, while CR#13 will be reset to 0.	95
15	R/W	TCP keep-alive time-out	Range: 5 to 65,535 seconds. The default value is 30 s. This parameter has a latched function.	--
16	R/W	IP address conflict detection function	0: Disabled 1: Enabled (default) This parameter has a latched function.	--
17 to 18	--	Reserved		
19	R/W	Trigger E-Mail Event 1	Set to 1 to activate email sending. After the email is sent, the value in CR# is automatically reset to 0. Please use the rising/falling edge trigger switch to avoid continuous sending of E-mails.	3
20	R/W	Trigger E-Mail Event 2		4
21	R/W	Trigger E-Mail Event 3		5
22	R/W	Trigger E-Mail Event 4		6

<table>
<tr><th>CR#</th><th>Attribute</th><th>Register name</th><th>Description</th><th>Corresponding DVPEN01-SL's CR#</th></tr>
<tr><td>23 to 24</td><td>R</td><td>Register of E-Mail status</td><td>
<table>
<tr><td rowspan="2">CR#23</td><td>High byte</td><td>Status of E-Mail 1</td></tr>
<tr><td>Low byte</td><td>Status of E-Mail 2</td></tr>
<tr><td rowspan="2">CR#24</td><td>High byte</td><td>Status of E-Mail 3</td></tr>
<tr><td>Low byte</td><td>Status of E-Mail 4</td></tr>
</table>
<table>
<tr><th>Value</th><th>E-Mail Status</th></tr>
<tr><td>0</td><td>Not being sent</td></tr>
<tr><td>1</td><td>Processing</td></tr>
<tr><td>2</td><td>Successfully sent</td></tr>
<tr><td>10</td><td>Unable to connect to SMTP-Server</td></tr>
<tr><td>11</td><td>Incorrect E-Mail address of recipient</td></tr>
<tr><td>12</td><td>SMTP server communication error</td></tr>
<tr><td>13</td><td>Exceeding the maximum number of TCP connections</td></tr>
<tr><td>14</td><td>Unknown error</td></tr>
<tr><td>15</td><td>Insufficient memory space</td></tr>
<tr><td>16</td><td>Internal communication error</td></tr>
</table>
</td><td>7 to 8</td></tr>
<tr><td>25</td><td>R/W</td><td>Code after title of E-Mail 1</td><td rowspan="4">The code filled in by the user, which will be present in the subject of the e-mail and sent together with the e-mail.</td><td>9</td></tr>
<tr><td>26</td><td>R/W</td><td>Code after title of E-Mail 2</td><td>10</td></tr>
<tr><td>27</td><td>R/W</td><td>Code after title of E-Mail 3</td><td>11</td></tr>
<tr><td>28</td><td>R/W</td><td>Code after title of E-Mail 4</td><td>12</td></tr>
<tr><td>29 to 30</td><td>--</td><td colspan="3">Reserved</td></tr>
<tr><td>31</td><td>R/W</td><td>Enabled flag for RTU-EN01 mapping</td><td>0: Disabled (default)
1: Enabled</td><td>15</td></tr>
<tr><td>32</td><td>R/W</td><td>Connection status for RTU-EN01 mapping function</td><td>bit0: Connection status of RTU slave 1
bit1: Connection status of RTU slave 2
bit2: Connection status of RTU slave 3
bit3: Connection status of RTU slave 4</td><td>16</td></tr>
<tr><td>33 to 38</td><td>--</td><td colspan="3">Reserved</td></tr>
<tr><td>39</td><td>R/W</td><td>Daylight Saving Time function</td><td>0: Disabled
1: Enabled</td><td>--</td></tr>
<tr><td>40 to 41</td><td>--</td><td colspan="3">Reserved</td></tr>
<tr><td>42</td><td>R/W</td><td>Program control for MELSEC data exchange table</td><td>0: Disabled
1: Continuously execute the data exchange table
2: Execute the data exchange function once (After completing one cycle, the CR value is automatically set back to 0.)</td><td>--</td></tr>
</table>

CR#	Attribute	Register name	Description	Corresponding DVPEN01-SL's CR#
43	R/W	MELSEC data exchange cycle time	Set the minimum update period (in milliseconds) for the MELSEC data exchange table. If the duration for completing the data exchange is shorter than the cycle time, the module will wait until the end of the cycle time before executing the next round of communication. Setting range: 10 to 60000 Default: 50	--
44	R/W	MELSEC communication time-out setting	Set the communication timeout period for data exchange table. Unit: ms Setting range: 50 to 60000 Default: 1000	--
45	R/W	MELSEC remote UDP port number	In MELSEC data exchange, when the device acts as a Client, this CR indicates the remote Server's UDP port number. The default value is 1025.	102
46	R/W	MELSEC local UDP port number	In MELSEC data exchange, when the device acts as a Server, this CR indicates the local UDP port number. The default value is 8192.	--
47	R/W	Enabled flag for MELSEC data exchange table	CR#47 bit 0 to bit 9: item 1 to 10 0: Disabled 1: Enabled	--
48 to 49	R	Communication error state for the MELSEC data exchange table	CR#48 bit 0 to bit 3: item 9 to 10 CR#49 bit 0 to bit 15: item 1 to 8 Each item uses 2 bits. 00: Data exchange has not been executed 01: UDP error 10: MELSEC error 11: Data exchange was successful	--
50 to 94	--	Reserved		
95	R/W	MODBUS TCP Server Communication port	Modify the communication port for the local device. The default value is the standard port number 502. Using 0 or other reserved port number will cause a communication error and display error codes.	--
96	R/W	Program control for MODBUS TCP Data exchange	0: Disabled 1: Continuously execute the data exchange table 2: Execute the data exchange function once (After completing one cycle, the CR value is automatically set back to 0.) *Note: This feature is only available for 2nd generation PLCs. For 3rd generation PLCs, please configure the settings in DIADesigner.	13

CR#	Attribute	Register name	Description	Corresponding DVPEN01-SL's CR#
97	R/W	The synchronous read and write function for MODBUS TCP data exchange table	Configure the MODBUS TCP function code used by the data exchange table. 0: Use function code 0x17 (default) 1: Do not use function code 0x17 *Note: This feature is only available for 2nd generation PLCs. For 3rd generation PLCs, please configure the settings in DIADesigner.	27
98	R/W	MODBUS TCP data exchange cycle time	Set the minimum update period (in milliseconds) for the MODBUS TCP data exchange table. If the duration for completing the data exchange is shorter than the cycle time, the module will wait until the end of the cycle time before executing the next round of communication. Setting range: 10 to 60000 Default: 50 *Note: This feature is only available for 2nd generation PLCs. For 3rd generation PLCs, please configure the settings in DIADesigner.	17
99 to 100	--	Reserved		
101 to 102	R/W	Enabled flag for MODBUS TCP data exchange table	CR#102 bit0 to bit15: item 1 to 16 CR#101 bit0 to bit7: item 17 to 24 CR#101 bit8 to bit15: item 25 to 32 (only available for 3rd generation PLCs) 0: Disabled 1: Enabled *For 3rd generation PLCs, each bit represents a connection number (item number), and its ON/OFF state corresponds to whether the connection is enabled in the DIADesigner checkbox field.	20 to 21
103 to 107	--	Reserved		
108 to 110	R	Communication error state for the MODBUS TCP data exchange table	CR#108 bit0 to bit15: item 17 to 24 CR#109 bit0 to bit15: item 9 to 16 CR#110 bit0 to bit15: item 1 to 8 00: Data exchange has not been executed 01: TCP error 10: MODBUS error 11: Data exchange was successful *Note: This feature is only available for 2nd generation PLCs. For 3rd generation PLCs, please configure the settings in DIADesigner.	18 to 19
111	R/W	MODBUS TCP remote device port number	For ETHRW instruction The default value is the standard port number 502.	--
112 to 113	--	Reserved		

CR#	Attribute	Register name	Description	Corresponding DVPEN01-SL's CR#
114	R/W	MODBUS TCP communication time-out setting	Set the communication timeout period for data exchange table and ETHRW instructions for 2nd generation PLCs. Unit: ms Setting range: 50 to 60000 Default: 1000	114
115 to 221	--	Reserved		
222	R	Number of MODBUS TCP Server connections	Maximum: 32	222
223	R	Number of MODBUS TCP Client connections	Maximum: 24	223
224 to 228	--	Reserved		
229	R	The number of RTU-EN01 connections	Maximum: 4	229
230 to 250	--	Reserved		
251	R	Error code	Refer to troubleshooting table	251
Symbols: R: Able to read data using the FROM instruction; W: Able to write data using the TO instruction; The No. for left-side high-speed I/O modules: 100 to 107 (m1=100 to 107).				

13.6.6 Configure DVPEN02-SL with 2nd Generation PLCs

DVPEN02-SL supports DVP12SA2, DVP20SX2 (V1.2 or above), DVP12SE (V2.0 or above), and DVP28SE2, DVP24SV2, and DVP28SV2.

Please use Delta software DCISoft V1.27 or above for configuration.

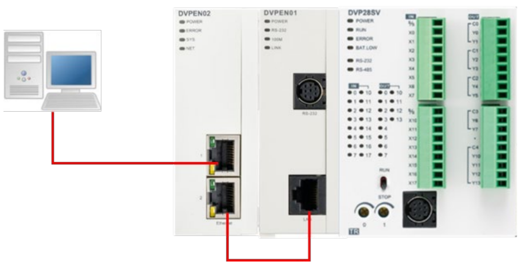
This section introduces the features and configuration of DVPEN02-SL. For application examples, please refer to section 13.1.7, Application Examples of DVPEN01-SL.

13.6.6.1 Replace DVPEN01-SL

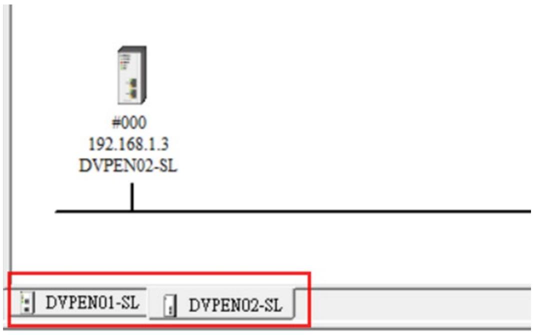
This section introduces the steps for replacing DVPEN01-SL with DVPEN02-SL.

1. Power off, connect DVPEN02-SL on the left of the PLC, and then power on again.

2. Connect both the DVPEN01-SL and DVPEN02-SL to the computer simultaneously.



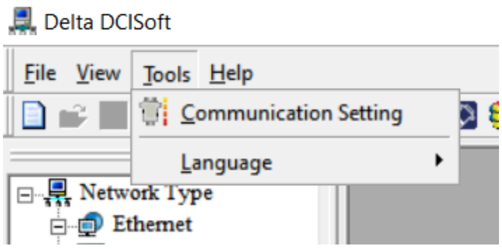
3. Open DCISoft, and you will see DVPEN01-SL and DVPEN02-SL displayed below.

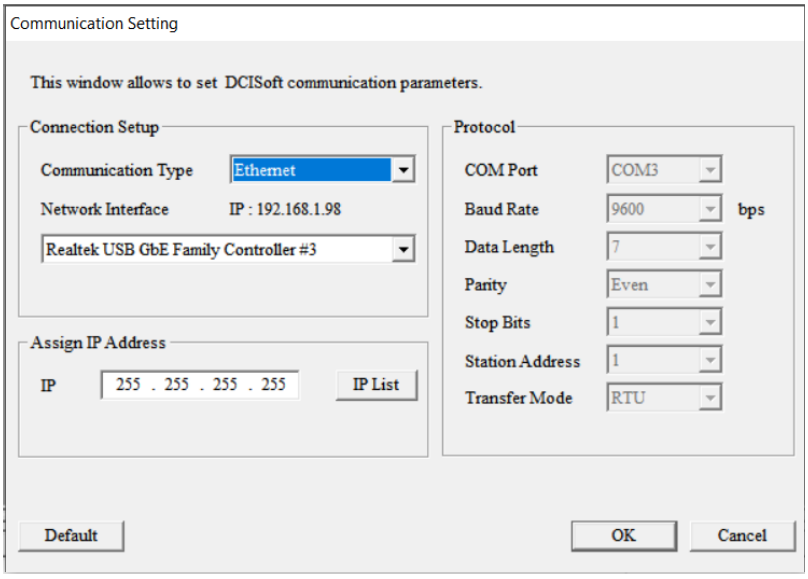


4. Copy the required parameters (including IP address) from DVPEN01-SL to DVPEN02-SL.
5. The data exchange table for MODBUS TCP and MELSEC can be exported as DSV files and then imported into DVPEN02-SL on the configuration page. Please refer to sections 13.6.6.8 and 13.6.6.9.
6. If you use the control registers of DVPEN01-SL, please modify the corresponding CR# of DVPEN02-SL in DCISoft according to the table in section 13.6.5.

13.6.6.2 Communication Settings

Select Ethernet as the communication type in DCISoft.



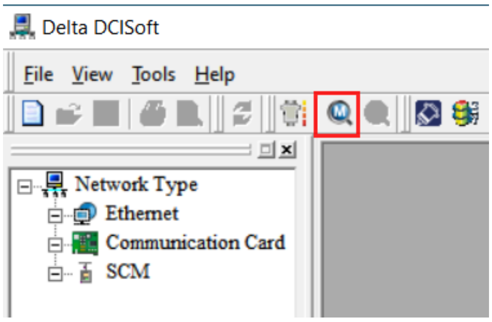


After completing the settings, you can search for models via broadcast search or designate an IP address for search. DVPEN02-SL is configured using UDP port 20006, so you need to be aware of the relevant firewall settings.

13.6.6.3 Search for Modules

- Broadcast search

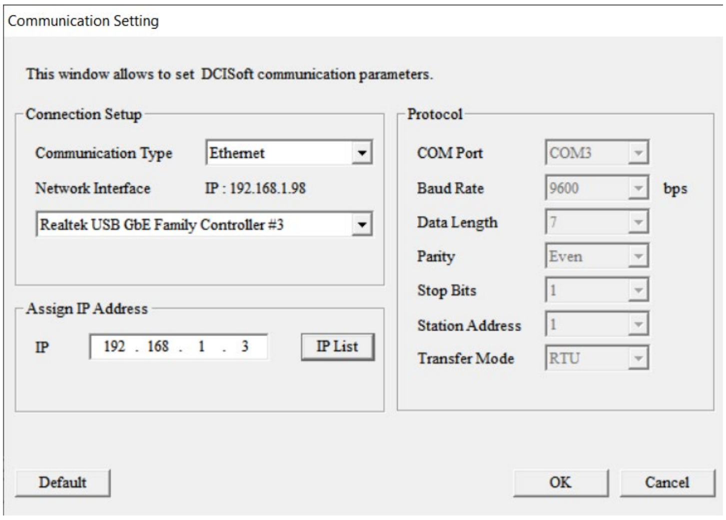
1. Click Search in DCISoft to search for all Delta Ethernet products on the network.



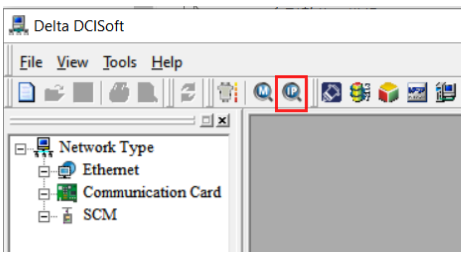
2. Since routers and switches block broadcast packets, cross-subnet searches or packets passing through more than two switches are not supported.

- Searching by an IP address

1. Select Ethernet in the Communication Type section and enter the IP address. Click OK.

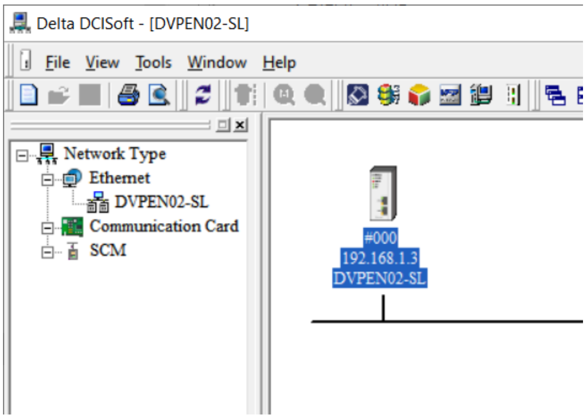


2. Click IP Search to start searching for the designated IP address.



3. Searching by designated IP address enables cross-subnet search and device connection in large networks.

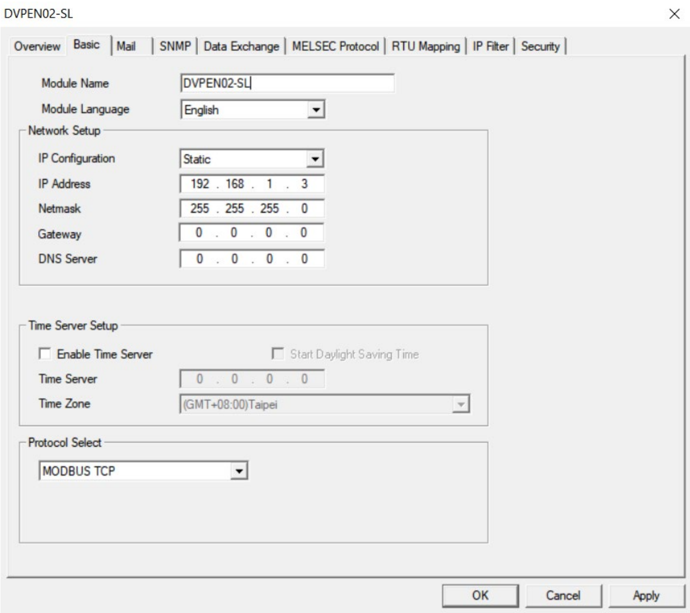
4. Click the scanned device icon to open its setting page.



13

13.6.6.4 Basic Settings

The basic settings include module name, module language, protocol selection, and time correction.



1. **Module Name**

   There may be multiple DVPEN02-SL modules on the network. Therefore, you can assign each module a unique name for easy identification.

2. **Module Language:**

   You can select a display language for each module. The user interface will appear in the selected language.

3. **Network Setup**

   Please refer to Section 13.6.6.5 for details.

4. **Enable Time Server**

DVPEN01-SL adopts NTP (Network Time Protocol), allowing it to automatically obtain the correct time from the network time server and periodically update the RTC in the CPU to ensure accurate time. The Enable Time Server is disabled by default.

5. **Start Daylight Saving Time**

   Daylight Saving Time, also known as summer time, is a conventional local time adjustment adopted by many countries on a seasonal basis. Most commonly, DST is implemented by setting the official local time forward, by one hour, for the spring, summer, and the early autumn periods. The enabling of this option depends on whether your country observes Daylight Saving Time.

6. **Time Server**

   The IP address of Time Server, you can obtain the correct time from the network time server and periodically update the RTC in the CPU to ensure accurate time.

7. **Time Zone**

   A time zone is a region of the Earth that has adopted the same standard time, usually referred to as the local time. Most adjacent time zones are exactly one hour apart, and by convention compute their local time as an offset from Greenwich Mean Time (see also UTC). Standard time zones can be defined by geometrically subdividing the Earth's spheroid into 24 lunes (wedge-shaped sections), bordered by meridians each 15° of longitude apart. The local time in neighboring zones is then exactly one hour different. However, political and geographical practicalities can result in irregularly shaped zones that follow political boundaries or that change their time seasonally (as with daylight saving time), as well as being subject to occasional redefinition as political conditions change. Please select your local time zone.

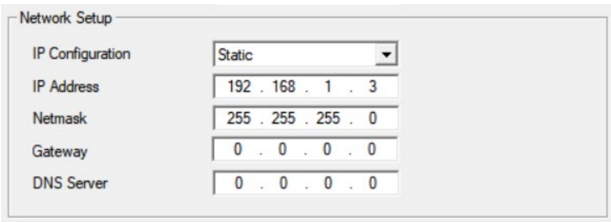
8. **Protocol Select**

   DVPEN02-SL supports MODBUS TCP and the Mitsubishi MELSEC 3E protocol in a UDP mode. The default setting is MODBUS TCP.

   When MODBUS TCP is selected, both Client and Server functions for MELSEC will be disabled. When MELSEC is selected, only the MODBUS TCP Client function will be disabled, while the Server function remains enabled.

13.6.6.5 Network Settings

The first step for all network equipment to connect to a network is to have own IP addresses (Internet Protocol address). The IP address acts as a unique identifier for each piece of network equipment within the network.



1. **IP Configuration**

   There are two types of IP addresses, static IP and DHCP.

IP	Explanation
Static	The user enters the IP address, subnet mask and gateway
DHCP	DHCP server offers the IP address, subnet mask and gateway.

2. **IP Address**

An IP address identifies a device's location within a network. Every device connected to the network must have a unique IP address. Incorrect IP address configuration may cause connection failures for the device or even other devices on the network. Ask your ISP (Internet Service Provider) for any assistance you need about IP address setup. The default IP address for DVPEN02-SL is 192.168.1.3.

3. **Subnet Mask and Gateway**

Subnet mask is an important parameter for subnet configuration. It determines whether the destination IP address and the local device are in the same subnet. Incorrect configuration may prevent communication with DVPEN02-SL. To verify your configuration, perform bitwise AND operation between your IP address and subnet mask, then repeat the same operation with the destination IP address. If the results match, both IP addresses are in the same subnet.

If they do not match, the device will send the packet to the gateway for routing to another subnet. For DVPEN02-SL, the default subnet mask is 255.255.255.0, and the default gateway is 0.0.0.0.

The gateway IP address must be in the same subnet as DVPEN02-SL. It should be provided by your ISP or DHCP Server. If cross-subnet communication is not required, keep the default gateway as 0.0.0.0.

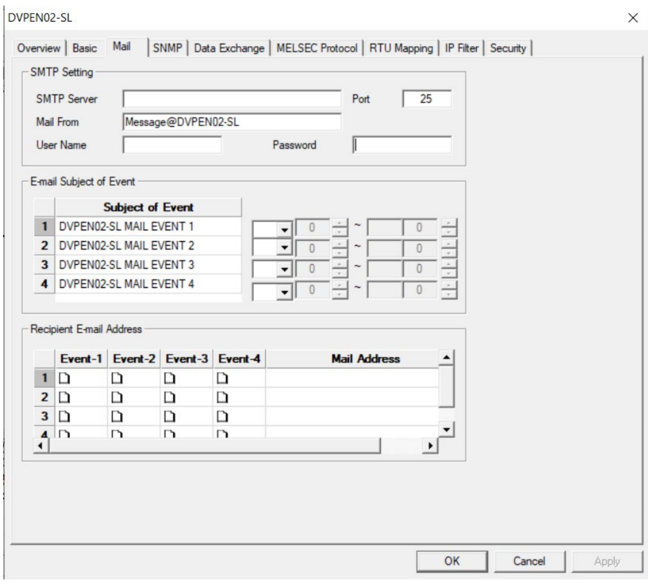
4. **DNS Server**

DNS (Domain Name System) translates domain names into IP addresses, allowing applications to access Internet resources without memorizing complex IP addresses.

DVPEN02-SL converts the SMTP server URL through the DNS servers. The DNS server address should be provided by your ISP or DHCP server, or you can use a public DNS server address available on the internet.

13.6.6.6 Emails Setting

E-Mail, short for Electronic Mail, is a way of delivering messages via the Internet. DVPEN02-SL has E-Mail function, using SMTP (Simple Mail Transfer Protocol). Users can pre-save text messages, which can be about the status or error information into the email subjects. Once the condition for triggering the email is met, DVPEN02-SL will send a user-set message to the SMTP server, requesting the SMTP server to send the email to the user. Therefore, to correctly send out emails, there has to be a SMTP server in the network.



DVPEN02-SL supports TLS/SSL communication, which is encrypted, using the domain name (characters) for SMTP server and providing four sets of E-Mail current value information. Users can define the register or bit information they want to read. When an event occurs, DVPEN02-SL will retrieve the current values of the specified registers or bits and add them to the E-Mail. Each provides a maximum of 100 consecutive register data.

Here is the detailed introduction:

1. **SMTP Server**: Setting the domain name of the outgoing SMTP mail server.
2. **Port**: Entering the communication port of the outgoing SMTP mail server.
   - 587 (TLS/STARTTLS; default)
   - 465 (SSL)
   - 25 (Not encrypted)
3. **Mail From**: Setting the mail address used to send emails (63 characters at most can be entered.)
4. **User Name**: Account used to log in to the outgoing SMTP mail server (24 characters at most can be entered.)
5. **Password**: Password used to log in to the outgoing SMTP mail server
6. **Email Subject of** Event

   You can enter text messages in the column, which will be placed in the subjects of emails and sent to the recipients. DVPEN02-SL can have 1 to 4 email subjects (up to 63 characters are allowed).

   You can select additional information for emails. Each email is able to contain the present values in 100 consecutive registers.
7. **Recipient E-mail** Address

   The recipient of an email, that is, the address to which an email is sent.

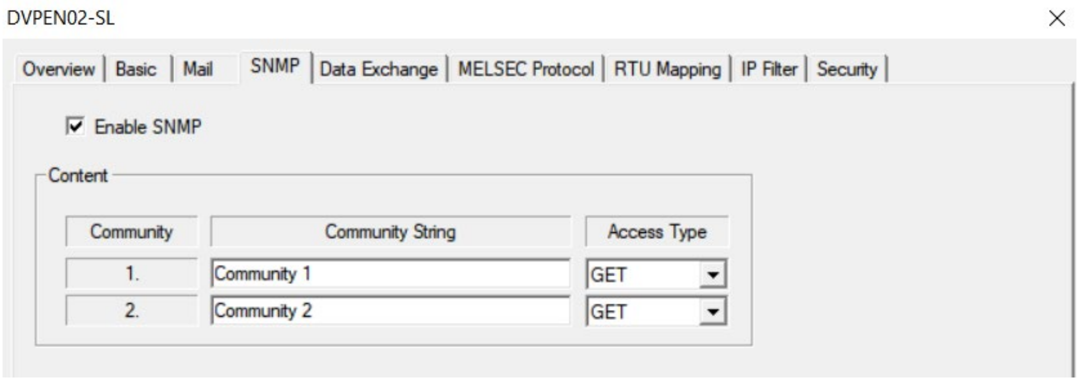
   You can enter 4 E-mail addresses. One email can be sent to 4 addresses (Up to 63 English characters are allowed).
8. **Selecting the** recipients

   When you have set all DVPEN02-SL's email parameters, you'll need to select recipients. When the email is triggered, the email will be sent to the selected recipients. The triggering condition is that the control registers (CR#19-CR#22) are set to 1.

13.6.6.7 SNMP

SNMP (Simple Network Management Protocol) is a standardized protocol used for managing and monitoring devices in the network. There are three main components in an SNMP framework: SNMP Manager, SNMP Agent, and Management Information Base (MIB). The SNMP manager is responsible for communicating with agents, and agents running on devices collect and provide device information. MIB defines the structure of manageable objects for handy reading and writing of data.

DCISoft allows you to do relevant SNMP settings. Please download the MIB file for SNMP communication from Delta official website. The SNMP agent on DVPEN02-SL only supports SNMP V1 and V2C, not supporting the Trap function. You need to prepare your own SNMP manager to read and write data. Through the SNMP manager, you can send requests to obtain the system and status of the device, as well as read and write to the registers in the PLC. Please choose an appropriate SNMP manager in accordance with your need to achieve efficient monitoring and management of devices.



Name	Description
Enable SNMP	Disable/enable the SNMP function.
Community String	When the SNMP manager initiates a request, a correct name need be given to the community.
Access Type	Set the access permission. GET (reading) is a default option.

An OID (Object Identifier) is a unique identifier used in SNMP to identify manageable variables. OIDs are organized in a tree structure, and each OID is a string of numbers indicating different positions in the hierarchy.

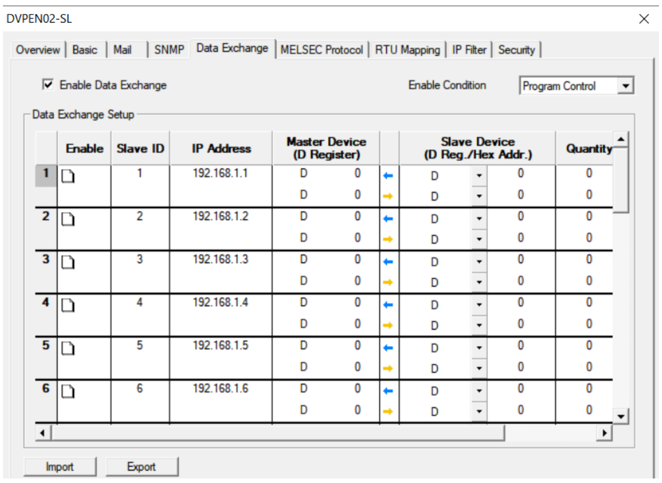
Example: For the **OID=1.3.6.1.4.1.6785.501.2.1.2.X**, its **1.3.6.1.4.1** represents enterprise level, **6785.501.2.1** indicates Delta/IABG/PLC/DVP series and 2 stands for the DVPEN02-SL product. The following is the content classification of **X**.

For more details on OIDs, refer to content description in the MIB file.

X	Description
1	System information
2	Network information
3	Register data

13.6.6.8 MODBUS TCP Data Exchange

Through the data exchange function of DVPEN02-SL, the data exchange between PLCs is carried out within the designated data exchange area to achieve the data synchronization.



1. **Enable Data Exchange**

   Check/uncheck the checkbox of “Enable Data Exchange” to enable/disable data exchange. After the data exchange function is enabled, data exchange will be executed according to the configuration data.

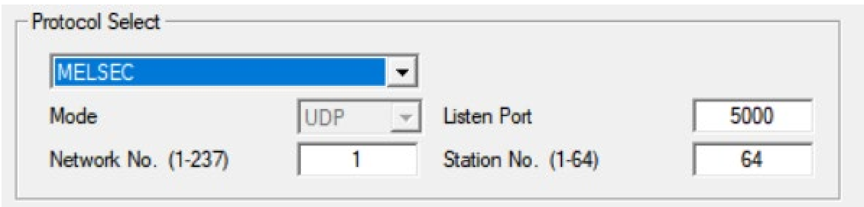
2. **Enable Condition**

   Select “Always Enable” or “Program Control”. If “Always Enable” is selected, DVPEN02-SL will execute data exchange continuously until the setting in DCISoft is changed. If “Program Control” is selected, DVPEN02-SL will execute data exchange according to the PLC program (CR#96.)

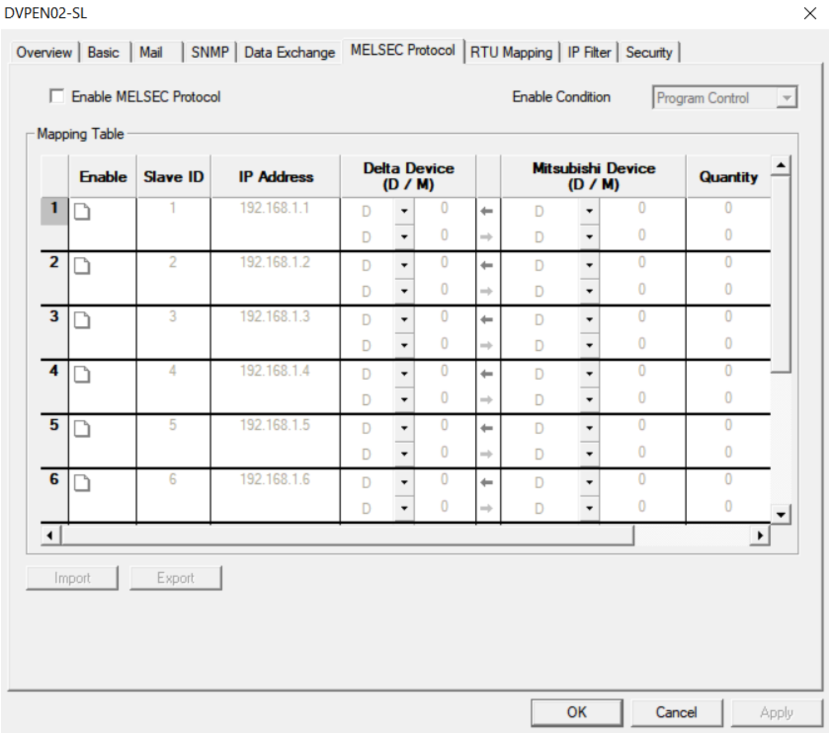
3. **Data Exchange Setup**
   - **Enable**: Enable or disable the single-data exchange, which can also be achieved by CR#101 to CR#102.
   - **Slave ID**: The ID field in the MODBUS TCP command. If the slave ID is not to be judged, this parameter can be set arbitrarily.
   - **IP Address**: The IP addresses of remote devices.
   - **Master Device (D Register)**: The D registers in the PLC CPU.
   - **Slave Device (D Reg / Hex Addr.)**: You can set the column as D registers (D) or MODBUS absolute addresses (Hex). When using D registers, the remote devices must be Delta DVP series PLCs. For the PLCs of other series or other brands, they must use hex addresses.
   - **Quantity**: For the same slave, the data in 100 consecutive registers can be sent and the data in 100 consecutive registers can be received at most simultaneously.
4. **Import and Export**
   Export settings into a CSV file for storage on your computer, or import a CSV file from your computer, to back up and restore the data exchange table. The data exchange tables of DVPEN02-SL and DVPEN01-SL are compatible.
5. The D registers for the data exchange function come into two sections: D0000-D4095 and D4096-D9999. For consecutive sent and received data (start address + quantity of data), do NOT use two different sections.
6. During data exchange, the writing (→) is executed first before the reading (←). If writing data fails for a specific item in the table, the read operation will not be executed for the item. If a read failure occurs, it is suggested to first check for any errors in writing data.
7. The following are the functions of other CRs. For detailed description, please refer to section 13.6.5.
   - CR#97: Set whether to use MODBUS TCP function code 0x17.
   - CR#98: Set the minimum update cycle time (ms) for the MODBUS TCP data exchange table.
   - CR#108 to CR#110: Indicate the communication error status of the MODBUS TCP data exchange table.
   - CR#114: Set the communication timeout time.

13.6.6.9 MELSEC Data Exchange

DVPEN02-SL can communicate with Mitsubishi devices by using the MELSEC protocol which is set on the Basic page. It supports both master and slave communication modes simultaneously. However, only UDP communication is allowed.



1. **Listen Port**: Setting the communication port of the local device.
2. **Network No.**: The number used to identify a network. In a factory or facility, there may be multiple independent networks, each with a unique network number, which ensures that data is transmitted within the correct network without getting mixed up with other networks.
3. **Station No.**: The number used to identify a device in the network. Each device in the network has a unique station number, which ensures that data is correctly sent to the target device and data is received from the correct device.



1. **Enable MELSEC Protocol**

   Disable/enable the MELSEC protocol. After the MELSEC protocol is enabled, data exchange will be carried out according to the data which has been set.

2. **Enable Condition**

   Select "Always Enable" or "Program Control". If "Always Enable" is selected, DVPEN02-SL will execute data exchange continuously until the setting in DCISoft is changed. If "Program Control" is selected, DVPEN02-SL will execute data exchange according to the PLC program (CR#42).

3. **Mapping Table**

   Refer to MODBUS TCP Data Exchange for more.

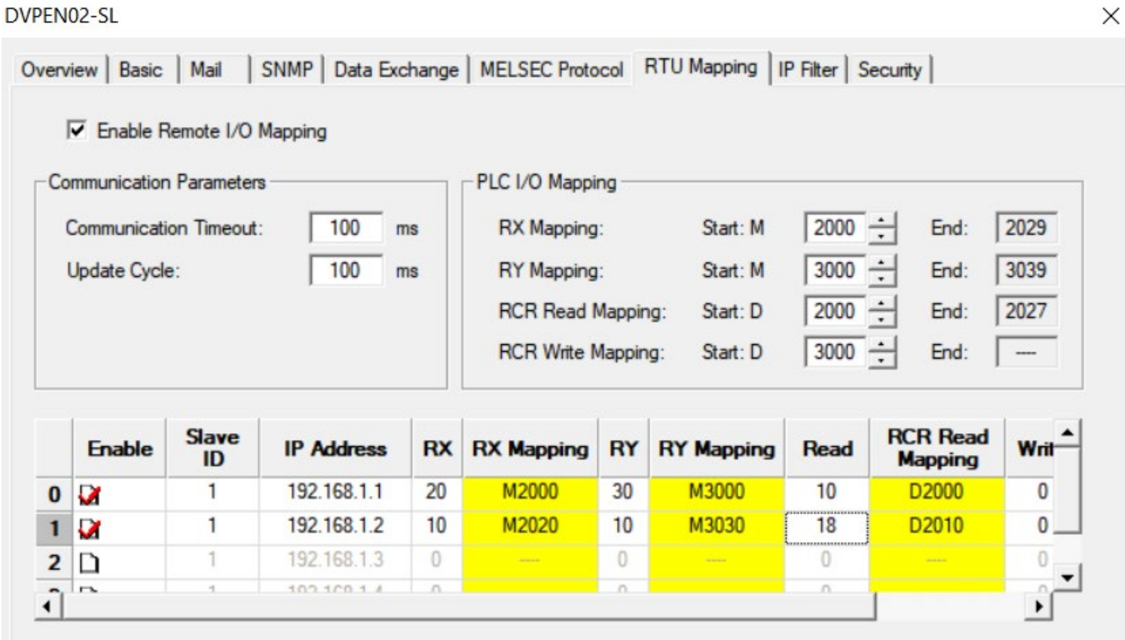
   - **Slave ID**: The ID of the MELSEC slave.
   - **IP Address**: The IP address of the remote device.
   - **Delta Device (D / M)**: The D registers (Word) or M registers (Bit) in the PLC.
   - **Mitsubishi Device (D / M)**: The D registers (Word) or M registers (Bit) in the Mitsubishi device, which must be the same in type as those in the master.
   - **Quantity**: For the same slave, the data in 100 consecutive registers can be sent and data in 100 consecutive registers can be received at most simultaneously.

4. Before communication, write the communication port number of the remote device into CR#45. The default value is 1025. Refer to the operation manual of the remote device.

   ※ For Mitsubishi devices that support the MELSEC 3E communication protocol, please check them out from the Mitsubishi website.

13.6.6.10 RTU-EN01 Mapping

DVPEN02-SL provides the convenient function of mapping with the RTU-EN01. After the configuration setting is over, you can directly read data from and write data into M (bits) and D registers in the PLC program so as to operate the remote RTU-EN01 devices.



1. **Enable Remote I/O Mapping**

   Check/uncheck the “Enable Remote I/O Mapping” checkbox to enable/disable the Remote I/O Mapping function. Once the function is enabled, DVPEN02-SL will execute the mapping with the remote RTU-EN01 according to the configuration data.

2. **Communication Parameters**

   Set the communication timeout time (ms) and update cycle time (ms) during the connection with the remote RTU-EN01.

3. **PLC I/O Mapping**

   Set the start addresses for mapping data of the I/O modules on the right side of the remote RTU-EN01, and data lengths are set in the remote device mapping table at the bottom of the figure above.

   - RX: Inputs for digital modules, starting from M2000.
   - RY: Outputs for digital modules, starting from M3000.
   - RCR: Control registers for analog modules, starting from D2000 for the read operation and starting from D3000 for the write operation

4. **Remote Device Mapping**

   After you check "Enable", enter the slave ID, the IP address, the number of digital inputs (RX), the number of digital outputs (RY), the number of read registers (Read), and the number of write registers (Write) for the remote RTU-EN01. The data quantities are set and confirmed on the RTU-EN01 page from DCISoft.

   DVPEN02-SL can be mapped onto four slaves.

   The maximum numbers of digital I/O and analog registers for mapping for each slave are:

   Digital I/O (RX+RY): 256

   Analog registers (read): 64.

   Analog registers (write): 64.

13.6.6.11 IP Filter

IP filter is used for restricting the connection of the network in case some uncertain IP addresses will cause errors. Only the IP addresses within the specified range can establish a connection. Other IP addresses will be rejected. For IP filter setting, refer to section 13.1.6.9. If you forget the IP filter setup, please contact your distributors.

13.6.6.12 Password Setting

To prevent the setting values in DVPEN02-SL from being modified incorrectly, you can set a password to lock the settings in DVPEN02-SL. For password setting, see section 13.1.6.11. If you forget the password, you will need to use DCISoft to restore the device to its factory settings.

13.6.6.13 Return to Factory Settings

To clear all current settings and return them to factory settings, you can select the checkbox of "Factory Setting" on the Security page. After the factory setting is done, repower the device. For details on operation, please refer to section 13.1.6.12.

13.6.7 Configure DVPEN02-SL with 3rd Generation PLCs

DVPEN02-SL supports DVP-SV3/DVP-SX3 (V1.0 or above).

Please use Delta software DIADesigner V1.11 or above for configuration.

This section introduces the features and configuration of DVPEN02-SL. For application examples, please refer to section 13.1.7, Application Examples of DVPEN01-SL.

13.6.7.1 Replace DVPEN01-SL

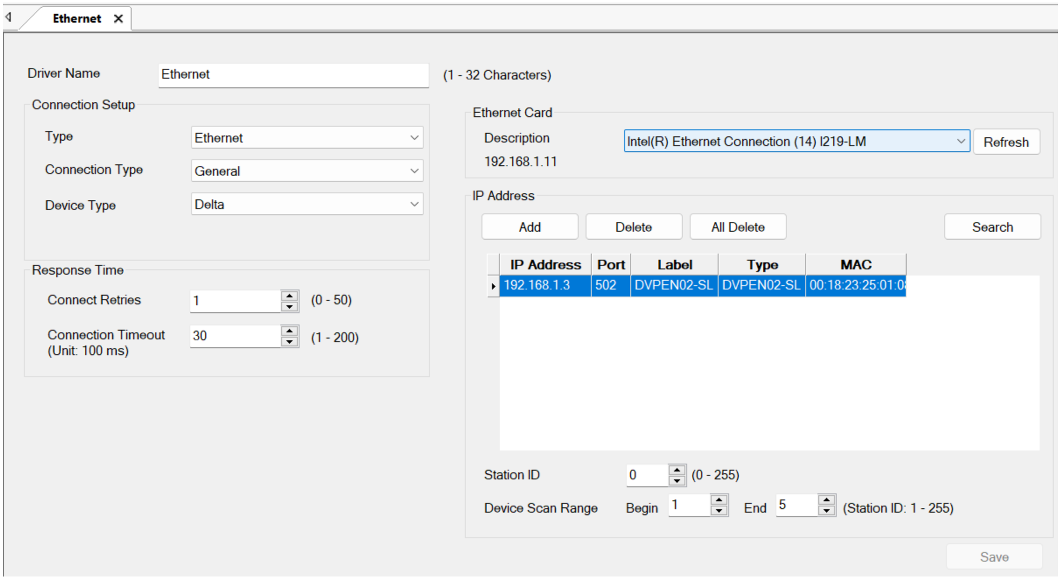
From **DVPEN01-SL** with 2nd/3rd generation PLCs to **DVPEN02-SL** with 3rd generation PLCs:

- DVPEN01-SL works with DVP series 2nd generation PLCs: The data exchange table cannot be transferred. Other features need to be configured manually. Please refer to section 13.6.6.1.
- DVPEN01-SL works with DVP series 3rd generation PLCs: Parameters cannot be directly transferred to DVPEN02-SL. This is because DVPEN01-SL only supports the data exchange table feature, while DVPEN02-SL provides multiple features and an upgraded data exchange table.

13.6.7.2 Search for Modules

- Broadcast search

1. Set Ethernet as the communication type in COMMGR to search for all Delta Ethernet products on the network.

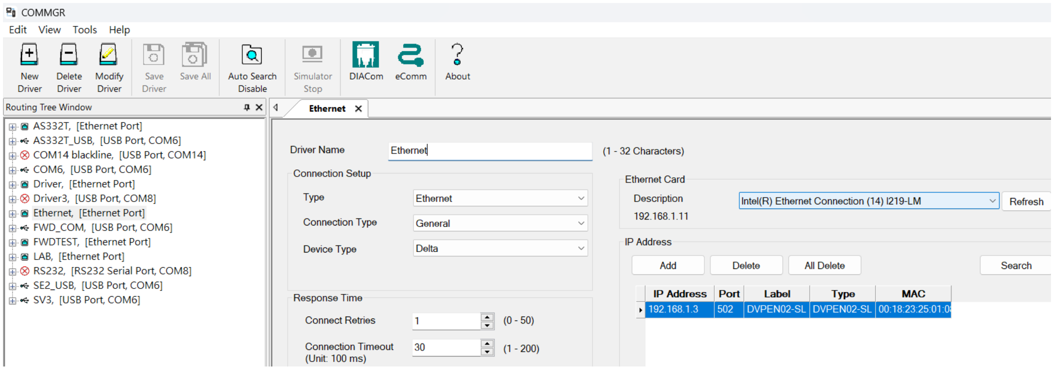


2. Since routers and switches block broadcast packets, cross-subnet searches or packets passing through more than two switches are not supported.

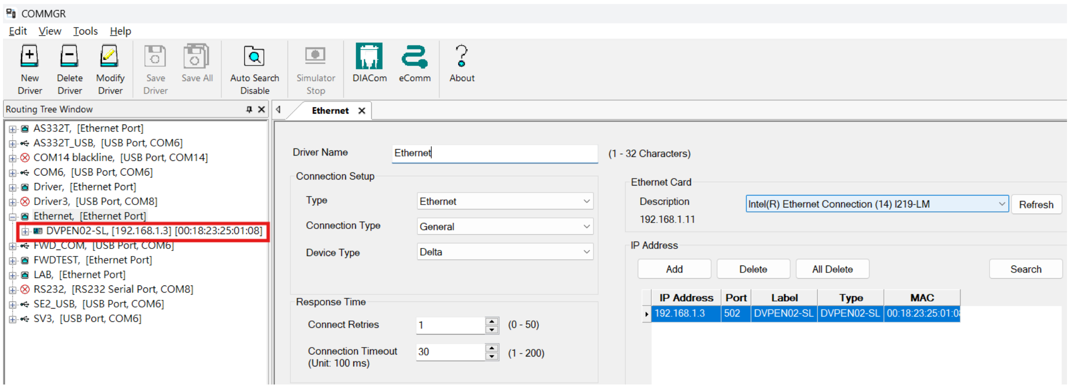
13.6.7.3 Forwarding Setting in DIADesigner

In DIADesigner with COMMGR V2.11 or later, you can upload/download the SV3/SX3 project via DVPEN02-SL as follows:

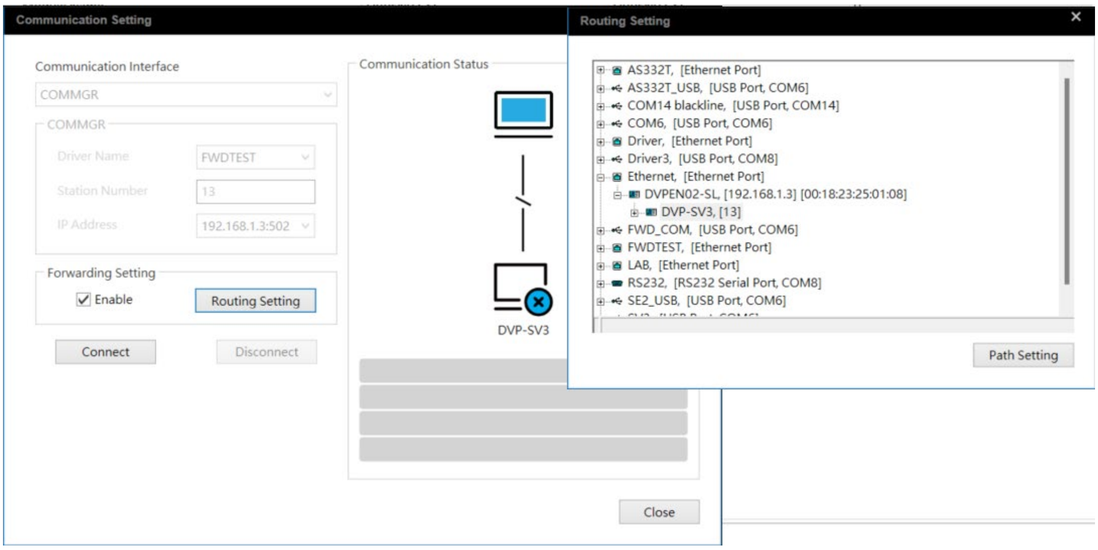
1. Search DVPEN02-SL in COMMGR.



2. Click the scanned DVPEN02-SL on the left side of COMMGR, and the connected SV3/SX3 will be displayed.

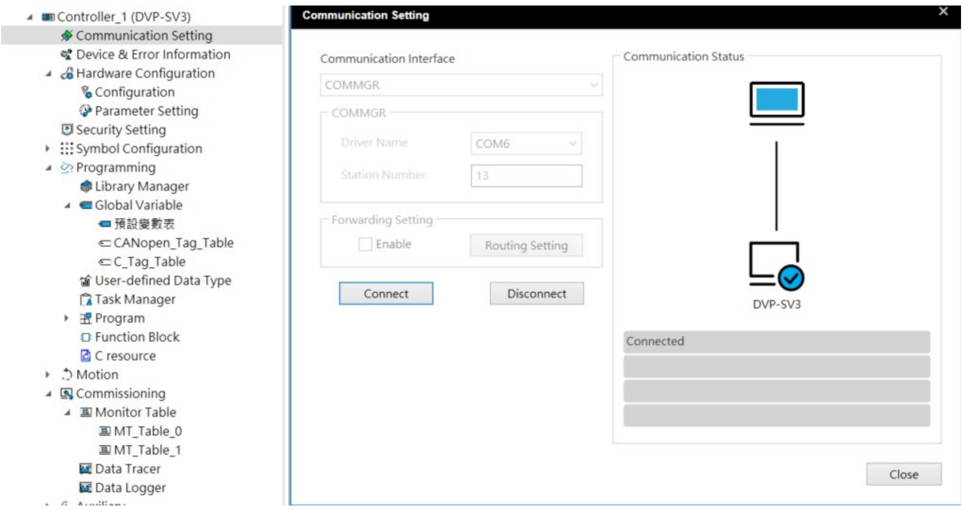


3. In DIADesigner Communication Setting, enable the **Forwarding Setting** and select the corresponding SV3/SX3 under DVPEN02-SL in the Routing Setting to establish the connection.

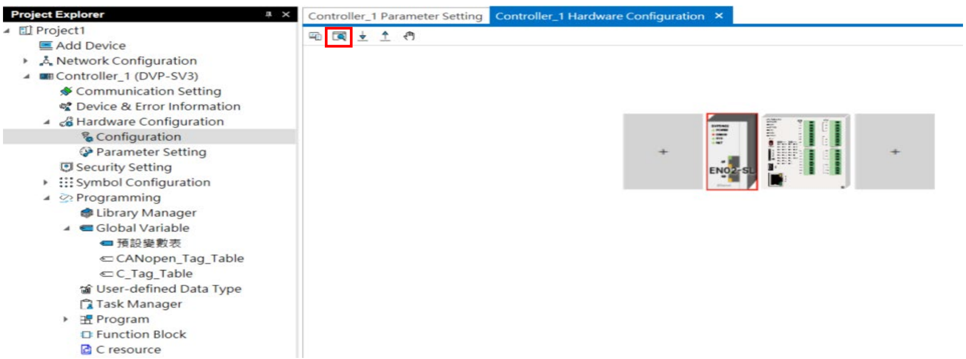


13.6.7.4 Device Overview

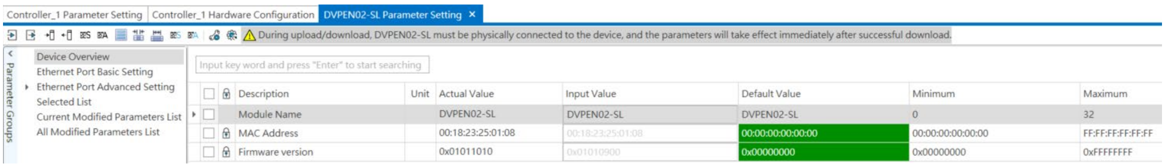
1. Connect the PLC in DIADesigner.



2. Select ***Hardware Configuration*** -> ***Configuration***, then click the I/O scan icon. The DVPEN02-SL connected to the left of SV3/SX3 will be displayed.



3. Double-click the DVPEN02-SL module to open the **Parameter Setting.** You can modify the module name and view the MAC Address and Firmware version in **Device Overview**.



13.6.7.5 Basic Settings

The basic settings include Network Settings, Web Server Enable/Disable, and IP Address Duplicate Detection Enable/Disable.

1. Network Settings

   Please refer to section 13.6.7.6

2. Web Server Enable/Disable

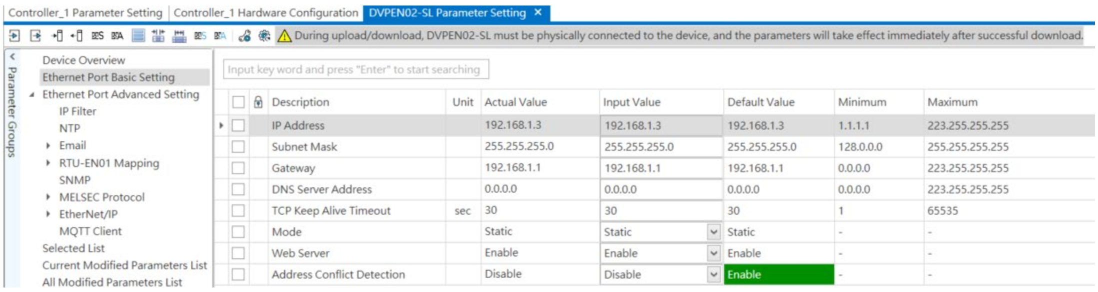
   You can enable or disable the Web feature. If disabled, DVPEN02-SL information cannot be obtained via web browser.

3. IP Address Duplicate Detection Enable/Disable

   You can enable or disable the IP conflict detection feature. The detection runs every 120 seconds. Error code 0x1810 will be displayed if an IP conflict is detected.

13.6.7.6 Network Settings

The first step for all network equipment to connect to a network is to have own IP addresses (Internet Protocol address). The IP address acts as a unique identifier for each piece of network equipment within the network.



1. IP Configuration

There are two types of IP addresses, static IP and DHCP.

IP	Explanation
Static	The user enters the IP address, subnet mask, and gateway.
DHCP	DHCP server offers the IP address, subnet mask and gateway.

2. IP Address

An IP address identifies a device's location within a network. Every device connected to the network must have a unique IP address. Incorrect IP address configuration may cause connection failures for the device or even other devices on the network. Ask your ISP (Internet Service Provider) for any assistance you need about IP address setup. The default IP address for DVPEN02-SL is 192.168.1.3.

3. Subnet Mask and Gateway

Subnet mask is an important parameter for subnet configuration. It determines whether the destination IP address and the local device are in the same subnet. Incorrect configuration may prevent communication with DVPEN02-SL. To verify your configuration, perform bitwise AND operation between your IP address and subnet mask, then repeat the same operation with the destination IP address. If the results match, both IP addresses are in the same subnet.

If they do not match, the device will send the packet to the gateway for routing to another subnet. For DVPEN02-SL, the default subnet mask is 255.255.255.0, and the default gateway is 0.0.0.0.

The gateway IP address must be in the same subnet as DVPEN02-SL. It should be provided by your ISP or DHCP Server. If cross-subnet communication is not required, keep the default gateway as 0.0.0.0.

4. DNS Server

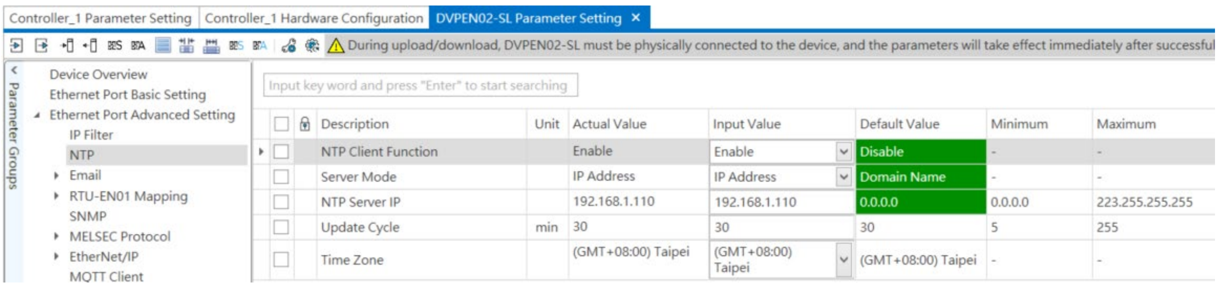
DNS (Domain Name System) translates domain names into IP addresses, allowing applications to access Internet resources without memorizing complex IP addresses.

DVPEN02-SL converts the SMTP server URL through the DNS servers. The DNS server address should be provided by your ISP or DHCP server, or you can use a public DNS server address available on the internet.

5. TCP Keep-Alive Time

The duration to keep the connections for HTTP Server, Modbus Server, and EIP Adapter. Setting range: 5 to 65535 seconds.

13.6.7.7 NTP Settings



1. NTP Client Function: DVPEN02-SL supports the NTP (Network Time Protocol) to automatically synchronize with network time servers and calibrate the PLC's real-time clock. This feature is disabled by default.

   Note: When disabled, DVPEN02-SL will synchronize its time with the PLC every hour.

2. Server Mode: DVPEN02-SL supports configuring the NTP server using either an IP address or domain name. The selected mode determines the type of input required for the next parameter.

3. NTP Server IP / NTP Server Domain Name: This field displays either IP address or domain name based on the selected Server Mode. Enter the correct NTP server address accordingly.

4. Update Cycle: The update interval for NTP Server synchronization. When NTP synchronization fails, DVPEN02-SL will synchronize its time with the PLC instead.

5. Time Zone: Time zones are based on Greenwich Mean Time (GMT) as the standard reference. Select the time zone for your device by either choosing a city or specifying the UTC (Coordinated Universal Time) offset.

Note: DVPEN02-SL will use the Daylight Saving Time settings from the SV3/SX3.

13.6.7.7.1 Configure NTP Parameters via DTM Instruction

DVPEN02-SL with SV3/SX3 supports configuring NTP parameters via the DTM instruction. When using this method, the NTP client service will be enabled and the settings will be saved permanently.

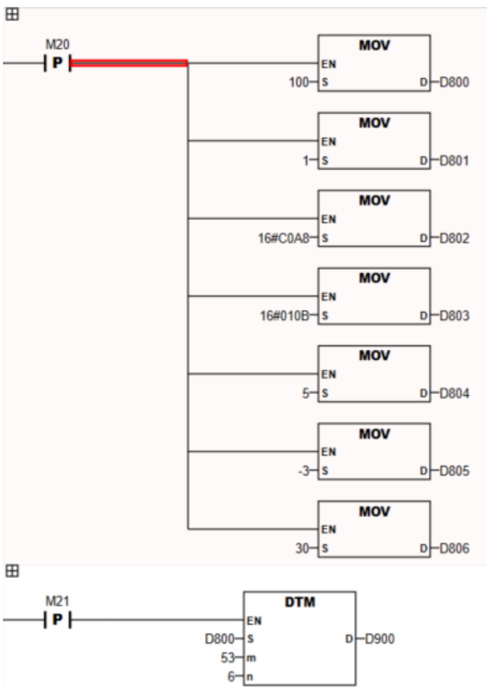
DTM	DVPEN02-SL
m	K53
n	Enter the value as S1+ “n”
S1+0	The connected modules are numbered K100 to K107, where K100 is the module nearest to the PLC (1st module) and K107 is the 8th module.
S1+1 to S1+n	Defined in the table on the right
D+0	0: Execution successful 1: Execution in progress 2: Execution failed
D+1	Refer to the error code table below

Operand	NTP Parameter
n	6
S1+1	1
S1+2	NTP Server IP (upper 16 bits)
S1+3	NTP Server IP (lower 16 bits)
S1+4	NTP update cycle (minute) Minimum value is 5
S1+5	NTP Time zone (hour)
S1+6	NTP Time zone (minute)

13

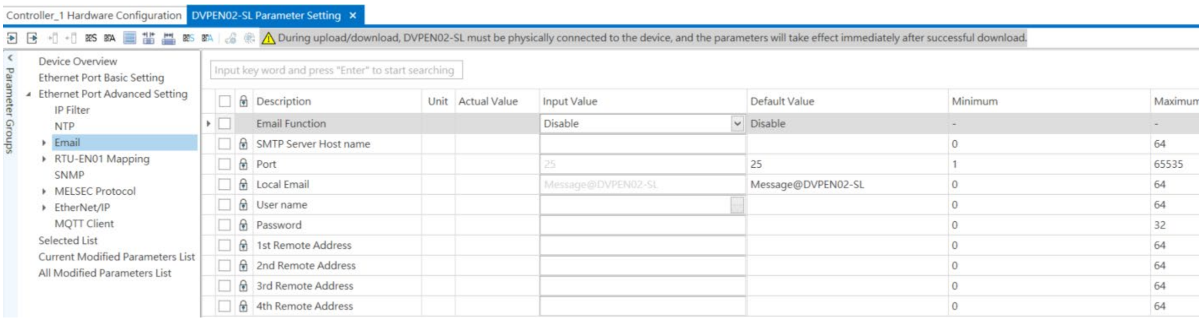
D+1	Definition
0	Correct
1	Length Error
2	Module is busy. Please try again later
3	Module Communication Timeout
4	Module Custom Function Code Error (unknown S1+1)
5	Invalid NTP IP Address
6	Invalid Time Zone

For example: NTP server IP: 192.168.1.11, update cycle: 5 minutes, time zone: UTC-3:30.



13.6.7.8 Emails Setting

E-Mail, short for Electronic Mail, is a way of delivering messages via the Internet. DVPEN02-SL has E-Mail function, using SMTP (Simple Mail Transfer Protocol). Users can pre-save text messages, which can be about the status or error information into the email subjects. Once the condition for triggering the email is met, DVPEN02-SL will send a user-set message to the SMTP server, requesting the SMTP server to send the email to the user. Therefore, to correctly send out emails, there has to be a SMTP server in the network.



DVPEN02-SL supports TLS/SSL communication, which is encrypted, using the domain name (characters) for SMTP server and providing four sets of E-Mail current value information. You can define the register or bit information you want to read. When an event occurs, DVPEN02-SL will retrieve the current values of the specified registers or bits and add them to the E-Mail. Each provides a maximum of 100 consecutive register data.

Here is the detailed introduction:

1. **SMTP Server Host Name**: Setting the domain name of the outgoing SMTP mail server.

2. **Port**: Entering the communication port of the outgoing SMTP mail server.

   - 587 (TLS/STARTTLS; default)
   - 465 (SSL)
   - 25 (Not encrypted)

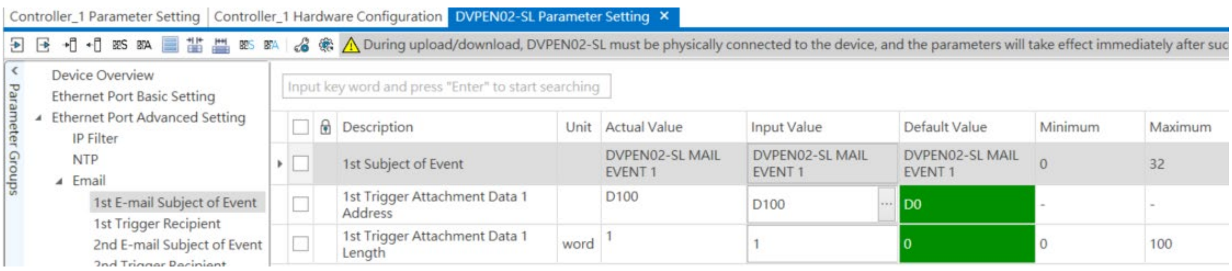
3. **Local Email**: Setting the mail address used to send emails (63 characters at most can be entered.)

4. **User Name**: Account used to log in to the outgoing SMTP mail server (24 characters at most can be entered.)

5. **Password**: Password used to log in to the outgoing SMTP mail server

6. **Remote Address:** The recipient of an email, that is, the address to which an email is sent.

   You can enter 4 E-mail addresses. One email can be sent to 4 addresses (Up to 63 English characters are allowed).



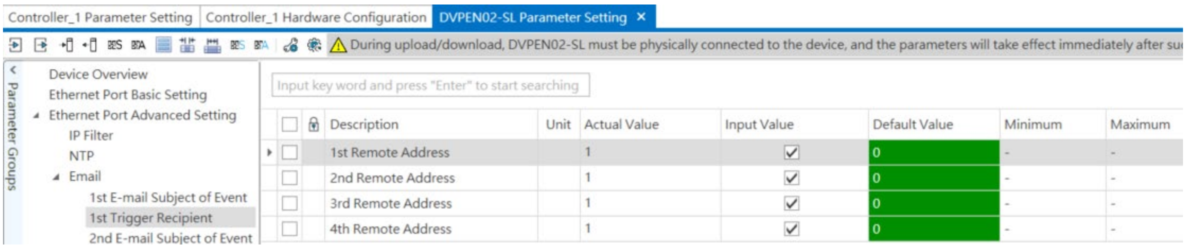
7. **Subject of Event**

   You can enter text messages in the column, which will be placed in the subjects of emails and sent to the recipients. DVPEN02-SL can have 1 to 4 email subjects (up to 63 characters are allowed).

   You can select additional information for emails. Each email is able to contain the present values in 100 consecutive registers.

8. **Device Address:** Select the type and starting address of the registers for the E-Mail content.

9. **Length:** Enter the register length for the E-Mail content.



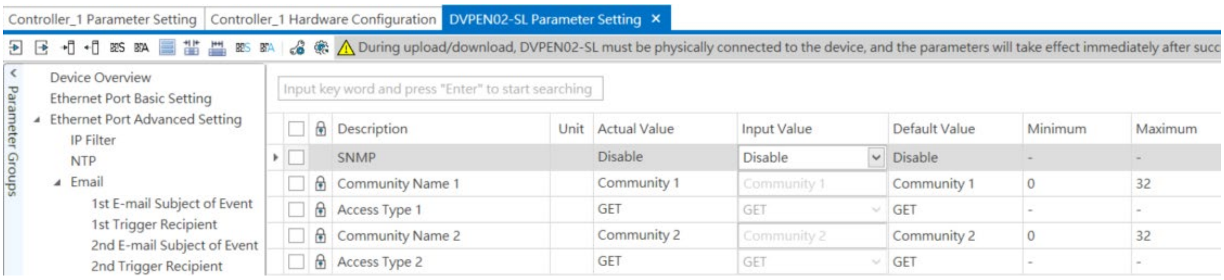
10. **Selecting the recipients**

When you have set all DVPEN02-SL's email parameters, you'll need to select recipients. When the email is triggered, the email will be sent to the selected recipients. The triggering condition is that the control registers (CR#19–CR#22) are set to 1.

13.6.7.9 SNMP

SNMP (Simple Network Management Protocol) is a standardized protocol for managing and monitoring devices in the network. There are three main components in an SNMP framework: SNMP Manager, SNMP Agent, and Management Information Base (MIB). The SNMP manager is responsible for communicating with agents, and agents running on devices collect and provide device information. MIB defines the structure of manageable objects for handy reading and writing of data.

DIADesigner allows you to do relevant SNMP settings. Please download the MIB file for SNMP communication from Delta official website. The SNMP agent on DVPEN02-SL only supports SNMP V1 and V2C, not supporting the Trap function. You need to prepare your own SNMP manager to read and write data. Through the SNMP manager, you can send requests to obtain the system and status of the device, as well as read from and write to the registers in the PLC. Please choose an appropriate SNMP manager in accordance with your need to achieve efficient monitoring and management of devices.



Name	Description
Enable SNMP	Disable/enable the SNMP function.
Community String	When the SNMP manager initiates a request, a correct name need be given to the community.
Access Type	Set the access permission. GET (reading) is a default option.

An OID (Object Identifier) is a unique identifier used in SNMP to identify manageable variables. OIDs are organized in a tree structure, and each OID is a string of numbers indicating different positions in the hierarchy.

Example: For the **OID=1.3.6.1.4.1.6785.501.2.1.2.X**, its **1.3.6.1.4.1** represents enterprise level, **6785.501.2.1** indicates Delta/IABG/PLC/DVP series and **2** stands for the DVPEN02-SL product.

The following is the content classification of **X**. For more details on OIDs, refer to content description in the MIB file.

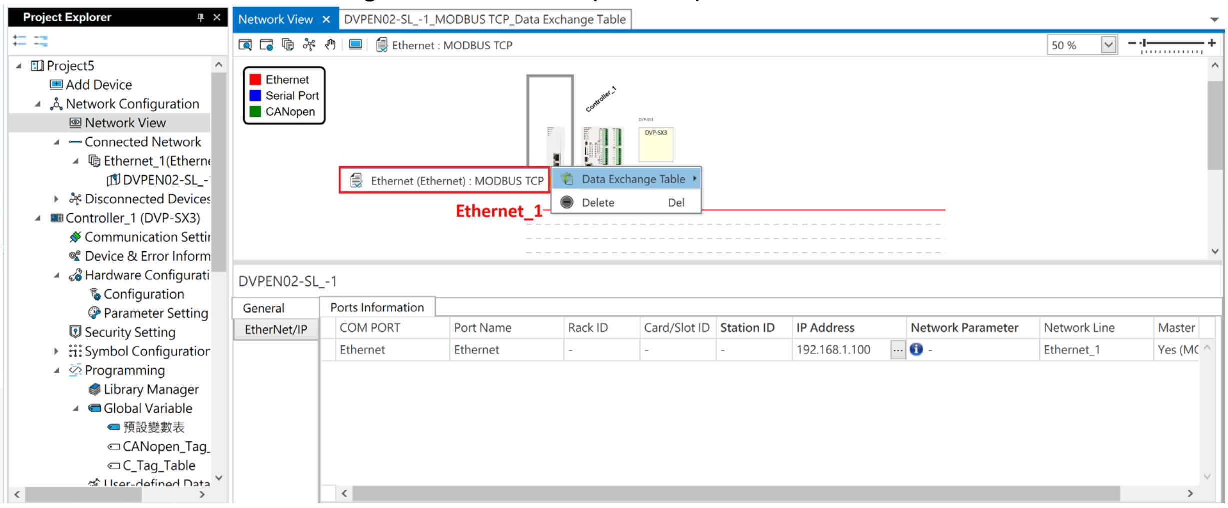
X	Description
1	System information
2	Network information
3	Register data

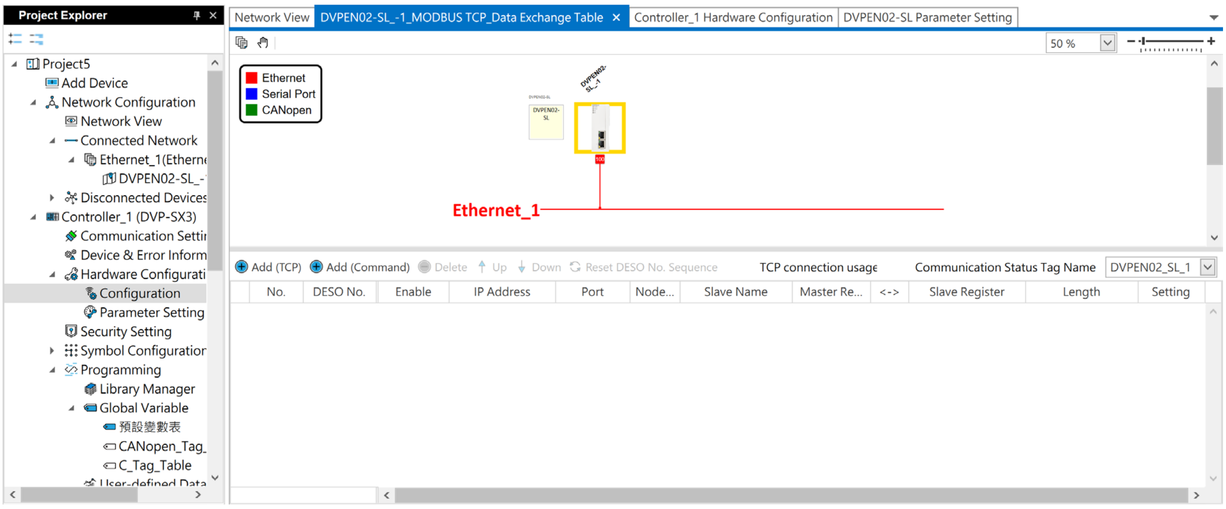
13.6.7.10 MODBUS TCP Data Exchange

Through the data exchange function of DVPEN02-SL, the data exchange between PLCs is carried out within the designated data exchange area to achieve the data synchronization.

1. **Open Data Exchange Table**

   In DIADesigner, click **Network View** under **Project**, after configuring the Ethernet topology, right-click the DVPEN02-SL icon and select **Data Exchange Table** > **Ethernet (Ethernet): MODBUS TCP**.

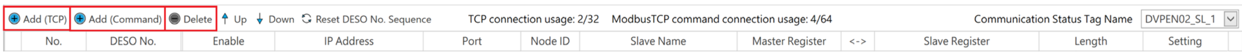




2. **Edit Data Exchange Table**

   DVPEN02-SL can establish up to 32 MODBUS TCP connections and configure up to 64 data exchange mapping commands. Each TCP connection requires at least one command connection. The total number of commands across all TCP connections cannot exceed 64.

To configure a new Data Exchange Table, click **Add (TCP)** to create a TCP connection first, then use **Add (Command)** or **Delete** to manage connections.

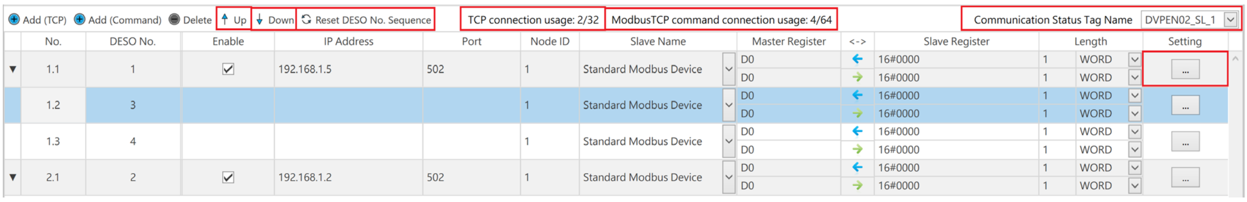


The **TCP Connection number** and **Command Connection number** are automatically assigned by the software and cannot be modified. All other parameters can be modified directly, and advanced parameters require clicking the **Settings** button. The **Up** and **Down** buttons can be used to change the polling sequence of commands within the same TCP connection. **Reset DESO No. Sequence** button will reassign DESO numbers to Commands from top to bottom.

TCP connection usage displays the number of connections currently in use out of 32 total TCP connections.

Modbus TCP command connection usage displays the number of commands currently in use out of 64 total Command connections.

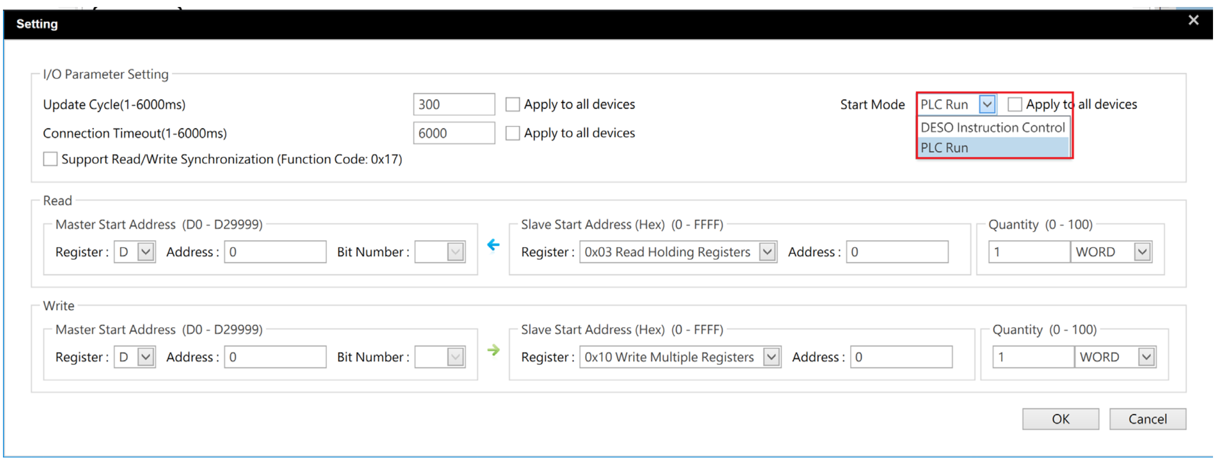
Communication Status Tag Name allows you to monitor the connection status of all Commands in real-time via the preset variable DVPEN02_SL_X in the monitoring table. (where X is determined by the hardware configuration location.)



3. **Start Mode**

Click the **Setting** button of an existing Command connection. In the **Start Mode** field, select "**DESO Instruction Control**" or "**PLC Run**". When **Start Mode** is set to "**PLC Run**", if the **Enable** field is checked and the PLC is in RUN state, DVPEN02-SL will continuously execute data exchange until the PLC switches to STOP. DVPEN02-SL then closes all connections and stops data exchange.

When **Start Mode** is set to "**DESO Instruction Control**", data exchange is performed according to the DESO instruction. DESO will execute the appointed command number of the data exchange table once. Each time DESO is triggered, DVPEN02-SL establishes a new MODBUS TCP Connection, performs the data exchange, and closes the connection upon completion. For more details on DESO instruction (API1821), please refer to section 6.19 of DVP-ES3/EX3/SV3/SX3 Programming Manual.



4. **Data Exchange Setup**

- **Update Cycle:** Specifies the interval between each data exchange instruction. You can adjust the update cycle to an appropriate value based on **Average refresh cycle** under **MODBUS TCP Data Exchange Diagnostic** in **DIADesigner Parameter Setting.** Proper settings improve communication quality, shorten the response times, stabilize the connections, and prevent DVPEN02-SL from being overwhelmed by incoming packets.

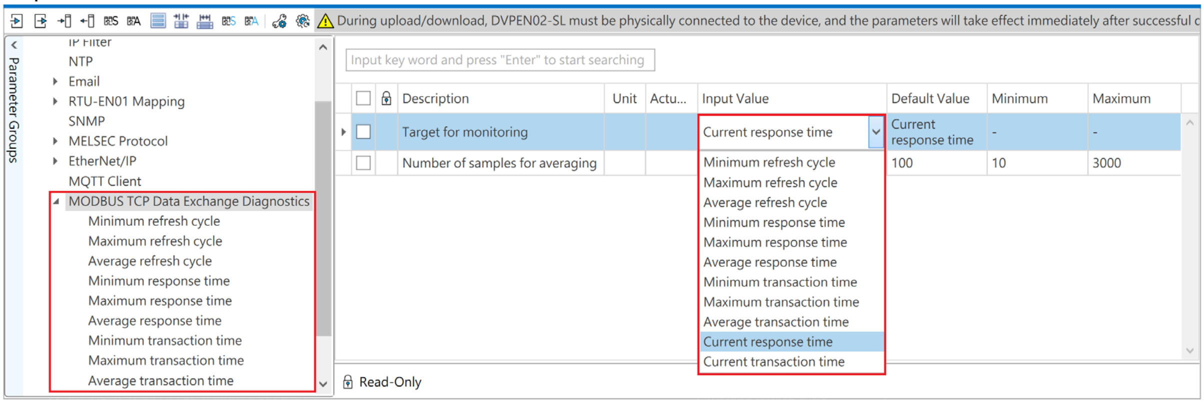
- **Connection Timeout**: Sets the device response timeout period. When timeout alarms occur frequently, increase this value. It is recommended to start with the maximum value of 6000 ms. For fine-tuning, refer to **Maximum response time** under **MODBUS TCP Data Exchange Diagnostic** in **DIADesigner Parameter Setting**.

- **Support Read/Write Synchronization (Function Code: 0x17)**: Disabled by default. The feature can improve communication efficiency. Ensure the remote device supports this feature before enabling.

5. **MODBUS TCP Data Exchange Diagnostic**

DVPEN02-SL Parameter Setting provides **MODBUS TCP Data Exchange Diagnostic** information**.** By selecting different options in **Target for monitoring,** you can change what the **resp_time** field represents in the preset variable **DVPEN02_SL_X** (Communication Status Tag Name).

Example: When **Target for monitoring** is set to **Current Response Time**, **resp_time** dynamically shows the current response time for all Command connections.

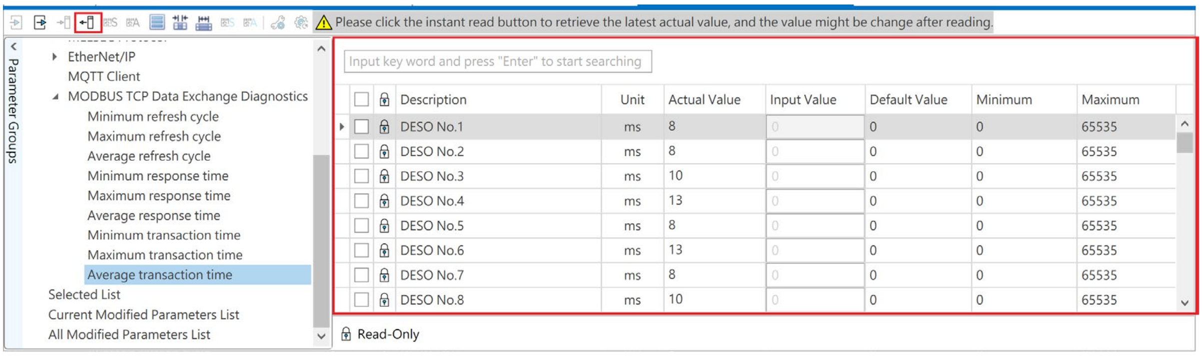


Number of samples for averaging is used to calculate **Average refresh cycle, Average response time, and Average transaction time.**

A larger sample size produces results that better reflect actual conditions, but requires longer calculation time.

Example: if **Update Cycle** is 300 ms, and **Number of samples for averaging** is 100, each average calculation requires at least 30 seconds (300 ms x 100 = 30,000 ms).

Each Command connection is calculated separately. Click the **Instant Read** button to retrieve the latest actual value.

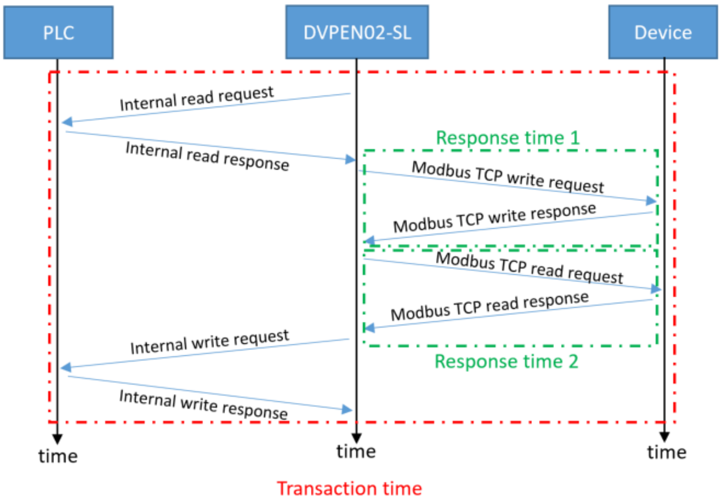


6. **Response Time and Transaction Time**

Response Time: The communication time measured from when DVPEN02-SL sends a Modbus TCP Request packet until it receives the response from the remote device.

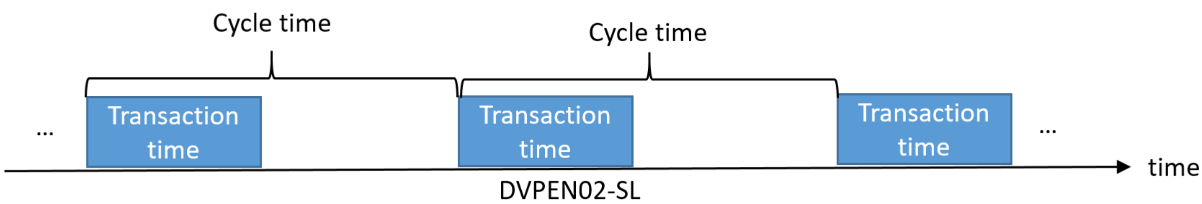
Transaction Time: The total time required to complete one data exchange command. This includes the time for DVPEN02-SL to read/write PLC registers as well as the time to read/write the remote device.

The following flowchart uses asynchronous and synchronous read/write scenarios to illustrate the difference:



7. **Cycle Time**

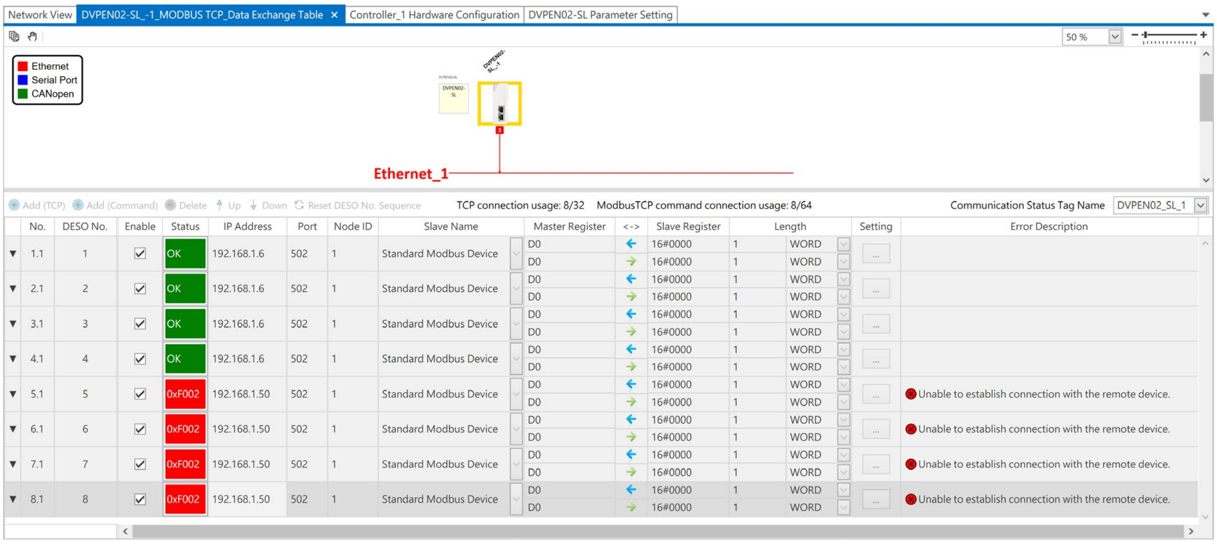
The fixed interval measured from when a transaction starts until when the next transaction begins within the same Command connection.



The Cycle Time must be greater than the transition time required for the command connection; otherwise, the setting will be ineffective.

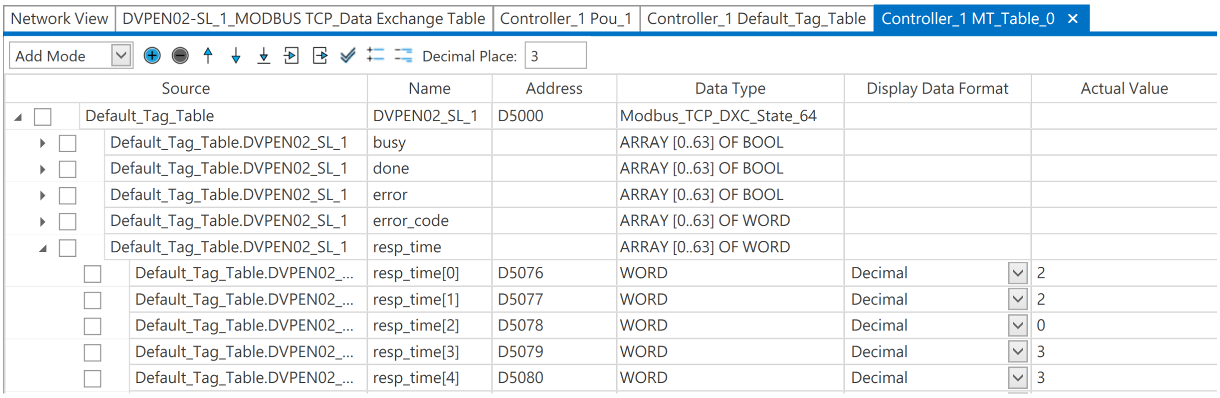
8. **Communication Status Online Monitoring**

When DIADesigner is in online monitoring mode, the data exchange table will dynamically update the connection status. When the connection is normally operating, the status will display OK in green; when the connection is abnormal, the status will display the error code in red, with further explanation in the error description field. Please refer to section 13.6.9.6 for the complete list of error codes.



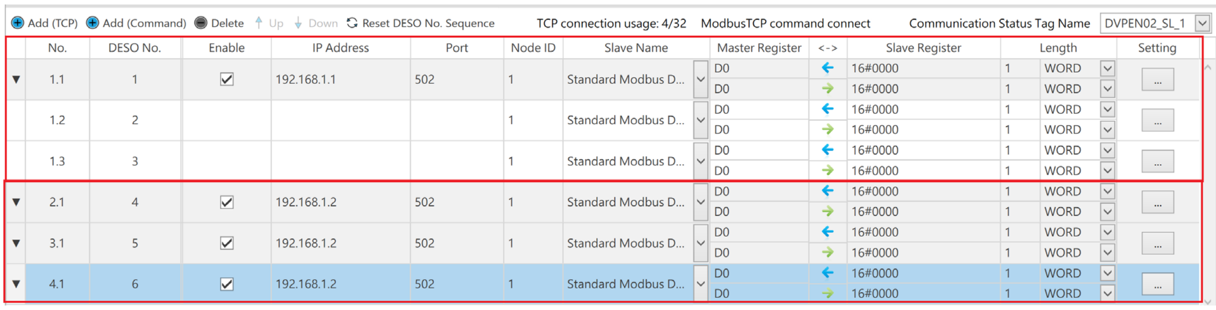
9. **Communication Status Preset Variable**

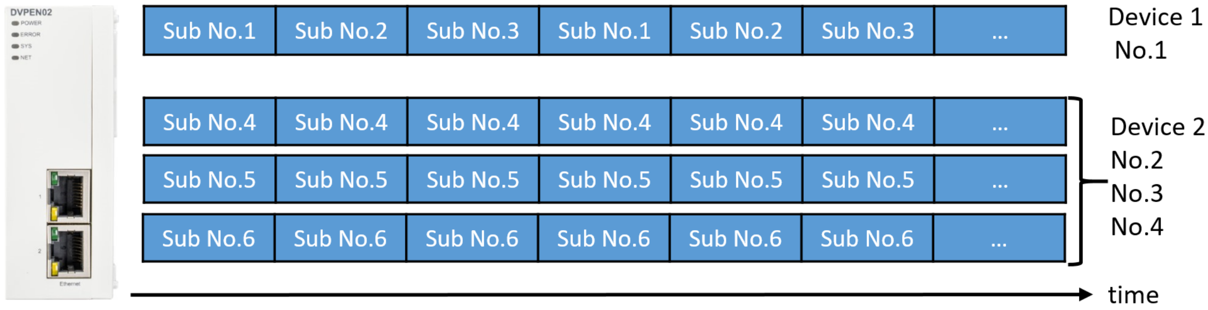
The Default Tag Table automatically generates the variable **DVPEN02_SL_X** for monitoring the communication status of the Data Exchange Table. This provides greater flexibility in PLC programming.



10. **Execution Sequence of TCP Connections and Command Connections**

The following example illustrates the timing difference in execution sequence when **Start Mode** is set to **PLC Run**. The two MODBUS TCP Servers each have 3 Command connections configured: Device 1 (IP 192.168.1.1) uses one TCP connection, while Device 2 (IP 192.168.1.2) uses three TCP connections.





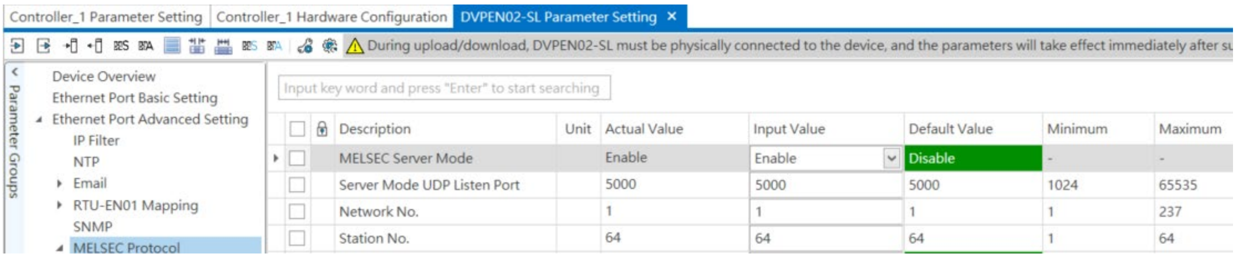
When multiple Command connections share the same TCP connection, the polling method can effectively increase the number of devices that can be connected. However, as the number of Command connections within the same TCP connection increases, the actual Update Cycle for all Command connections will be extended proportionally.

11. During data exchange, the writing (→) is executed first before the reading (←). If writing data fails for a specific item in the table, the read operation will not be executed for the item. If a read failure occurs, it is suggested to first check for any errors in writing data.

13.6.7.11 MELSEC Data Exchange

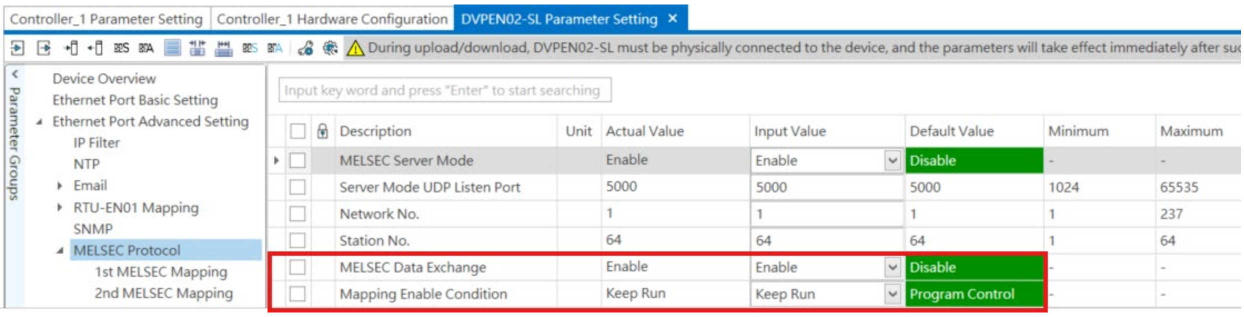
DVPEN02-SL can communicate with Mitsubishi devices by using the MELSEC protocol which is set on the Basic page. It supports both master and slave communication modes simultaneously. However, only UDP communication is allowed.

- **MELSEC Protocol**



1. **Server Mode UDP Listen Port**: Setting the communication port of the local device.
2. **Network No.**: The number used to identify a network. In a factory or facility, there may be multiple independent networks, each with a unique network number, which ensures that data is transmitted within the correct network without being mixed with other networks.
3. **Station No.**: The number used to identify a device in the network. Each device in the network has a unique station number, which ensures that data is correctly sent to the target device and received from the correct device.

- **MELSEC Data Exchange**

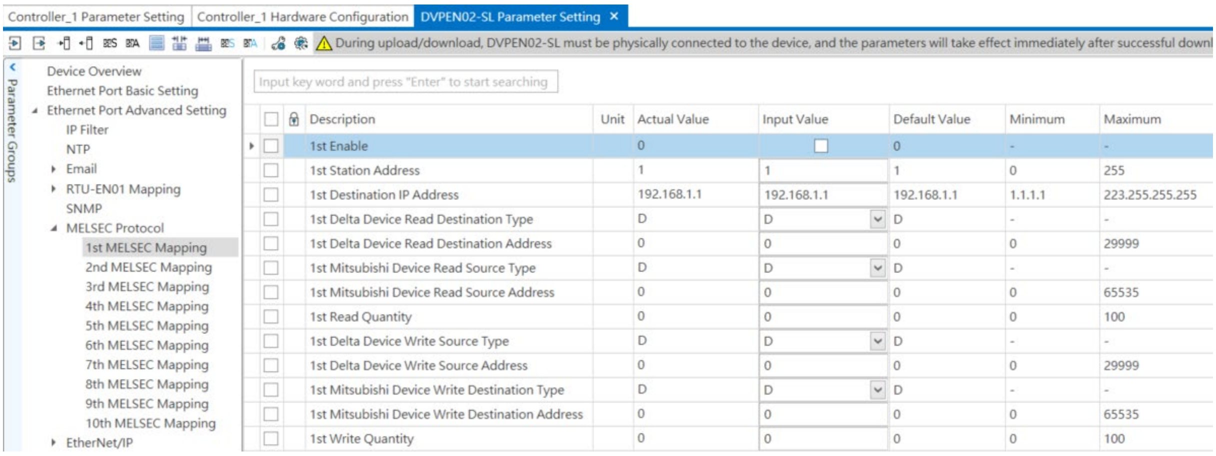


1. **MELSEC Data Exchange**

   Disable/enable the MELSEC protocol. After the MELSEC protocol is enabled, data exchange will be carried out according to the configuration.

2. **Enable Condition**

   Select "**Keep Run**" or "**Program Control**". If "**Keep Run**" is selected, DVPEN02-SL will execute data exchange continuously until the setting in DIADesigner is changed. If "**Program Control**" is selected, DVPEN02-SL will execute data exchange according to the PLC program (CR#42).



3. **Data Exchange Procedure**

First, data is written from **Delta Device Write Source** to **Mitsubishi Device Write Destination.** Then, data is read from **Mitsubishi Device Read Source** to **Delta Device Read Destination**.

4. **Mapping Table Description**

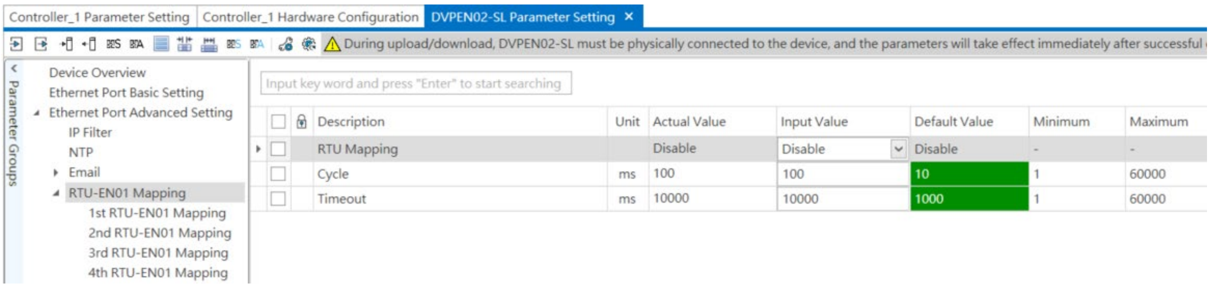
- **Enable**: Enable/disable the data exchange
- **Station Address**: The ID of the MELSEC slave.
- **IP Address**: The IP address of the remote device.
- **Delta Device (Read/Write):**
  - Type: D registers (Word) or M registers (Bit) in the PLC.
  - Address: Starting address of the local register (Refer to the DVP-ES3/EX3/SV3/SX3 Series Hardware and Operation Manual for the maximum corresponding range).
- **Mitsubishi Device (Read/Write)**:
  - Type: D registers (Word) or M registers (Bit) in the Mitsubishi device, which must be the same type as the master.
  - Address: Starting address of the remote register (Refer to the Mitsubishi Manual for the maximum corresponding range).
- **Quantity**: For the same slave device, up to 100 consecutive registers can be sent and up to 100 consecutive registers can be received simultaneously.

5. Before communication, write the communication port number of the remote device into CR#45. The default value is 1025. Refer to the operation manual of the remote device.

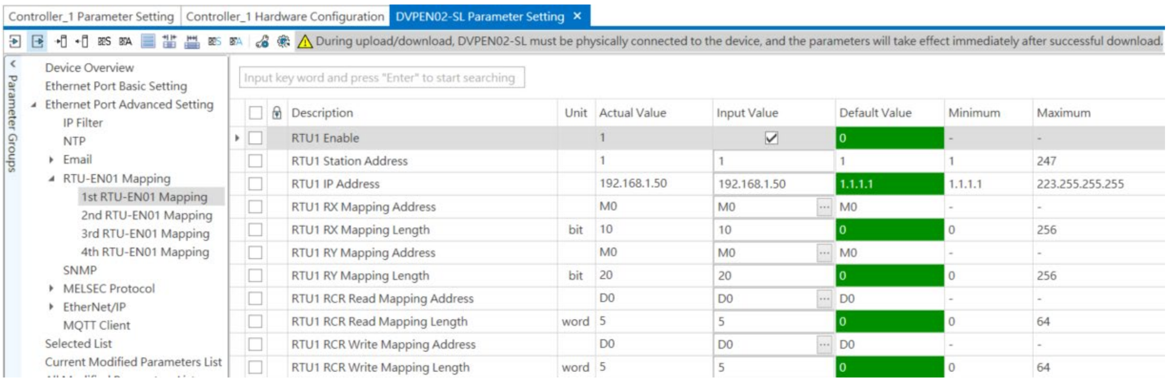
※ For Mitsubishi devices that support the MELSEC 3E communication protocol, please check them out from the Mitsubishi website.

13.6.7.12 RTU-EN01 Mapping

DVPEN02-SL provides the convenient function of mapping with the RTU-EN01. After the configuration is completed, you can directly read data from and write data into M (bits) and D registers in the PLC program so as to operate the remote RTU-EN01 devices.



1. **RTU Mapping:** Enable/disable the RTU Mapping. Once the function is enabled, DVPEN02-SL will execute the mapping with the remote RTU-EN01 according to the configuration data.
2. **Cycle:** Set the update cycle time (ms) during the connection with the remote RTU-EN01.
3. **Timeout:** Set the communication timeout time (ms) during the connection with the remote RTU-EN01.



4. **RTU Enable:** Enable/disable this RTU-EN01 connection.
5. **RTU Station Address:** Set the station address of the remote RTU-EN01.
6. **RTU IP Address:** Set the IP address of the remote RTU-EN01.
7. **RX Mapping Parameters:** Inputs for digital modules
   - RX Mapping Address: Starting address of M or X registers in the PLC.
   - RX Mapping Length: Required mapping data length
8. **RY Mapping Parameters:** Outputs for digital modules
   - RY Mapping Address: Starting address of M or Y registers in the PLC.
   - RY Mapping Length: Required mapping data length
9. **RCR Read Mapping Parameters:** Read the control registers for analog modules
   - RCR Read Mapping Address: Starting address of D or SR registers in the PLC.
   - RCR Read Mapping Length: Required mapping data length
10. **RCR Write Mapping Parameters:** Write the control registers for analog modules
    - RCR Write Mapping Address: Starting address of D or SR registers in the PLC.

- RCR Write Mapping Length: Required mapping data length

11. **Remote Device Mapping Setting**

After you check "Enable", enter the slave ID, the IP address, the number of digital inputs (RX), the number of digital outputs (RY), the number of read registers (Read), and the number of write registers (Write) for the remote RTU-EN01. The data quantities are set and confirmed on the RTU-EN01 page from DCISoft.

DVPEN02-SL can be mapped onto four slaves.

The maximum numbers of digital I/O and analog registers for mapping for each slave are:

Digital I/O (RX+RY): 256

Analog registers (read): 64.

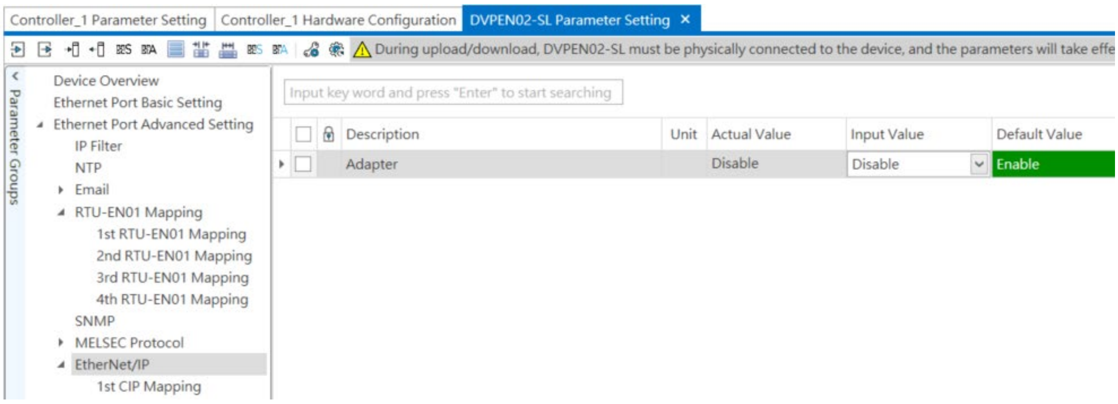
Analog registers (write): 64.

13.6.7.13 EtherNet/IP–Slave

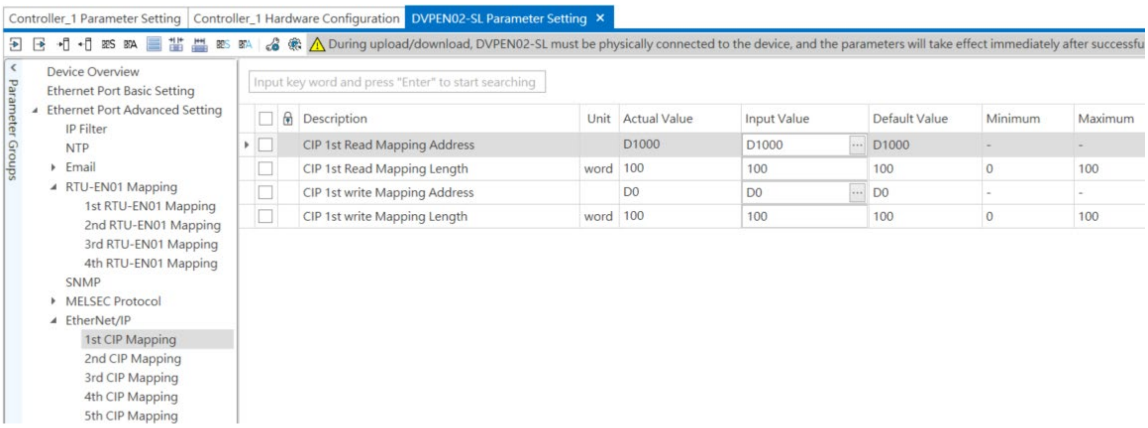
DVPEN02-SL works with SV3/SX3 supports EtherNet/IP Adapter, allowing up to 8 simultaneous TCP and CIP connections. First, configure the starting register address and maximum data length for DVPEN02-SL in DIADesigner, then configure the CIP connection settings on the Master device.

13.6.7.13.1 EtherNet/IP Parameter Setting

Configure the starting address and maximum data length for remote device access. DVPEN02-SL will reject any connection request that exceeds the configured maximum data length.



1. Adapter: Enable/disable EIP Adapter function.

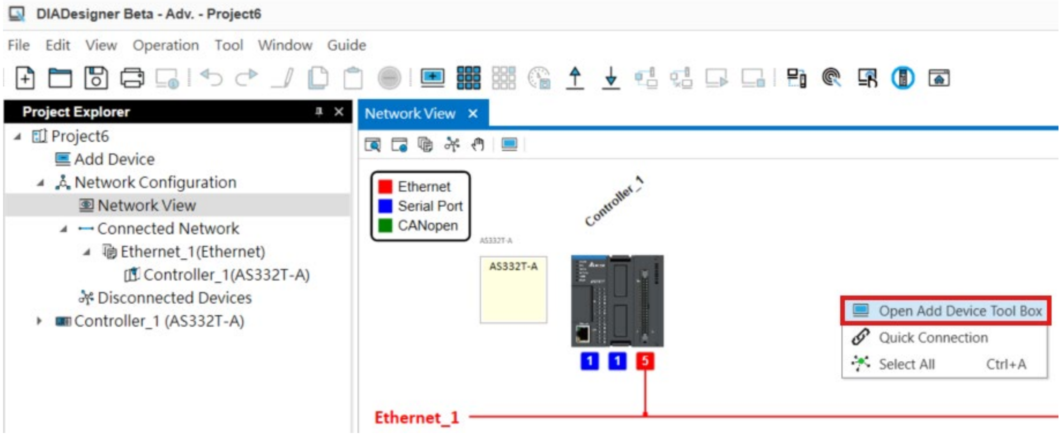


2. CIP Read Mapping (DVPEN02-SL -> Remote Device)
   - Address: The starting address of the register.
   - Length: Maximum data length that can be read when a connection is established. (unit: Word)
3. CIP Write Mapping (Remote Device -> DVPEN02-SL)
   - Address: The starting address of the register.
   - Length: Maximum data length that can be written when a connection is established. (unit: Word)

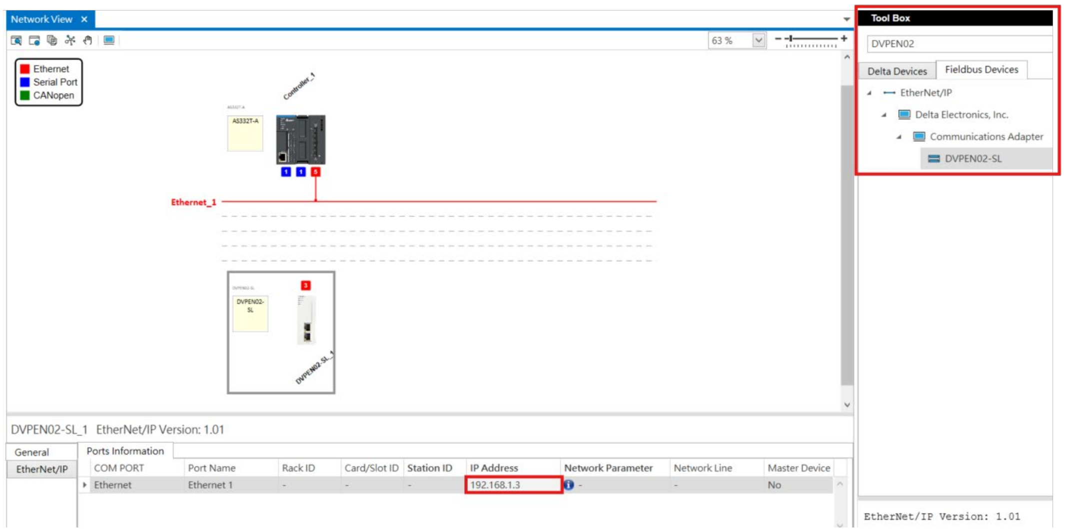
13.6.7.13.2 EtherNet/IP Slave Example

DVPEN02-SL can function as an EtherNet/IP Adapter when installed on the left side of an SV3/SX3 PLC.
The operation steps are as follows:

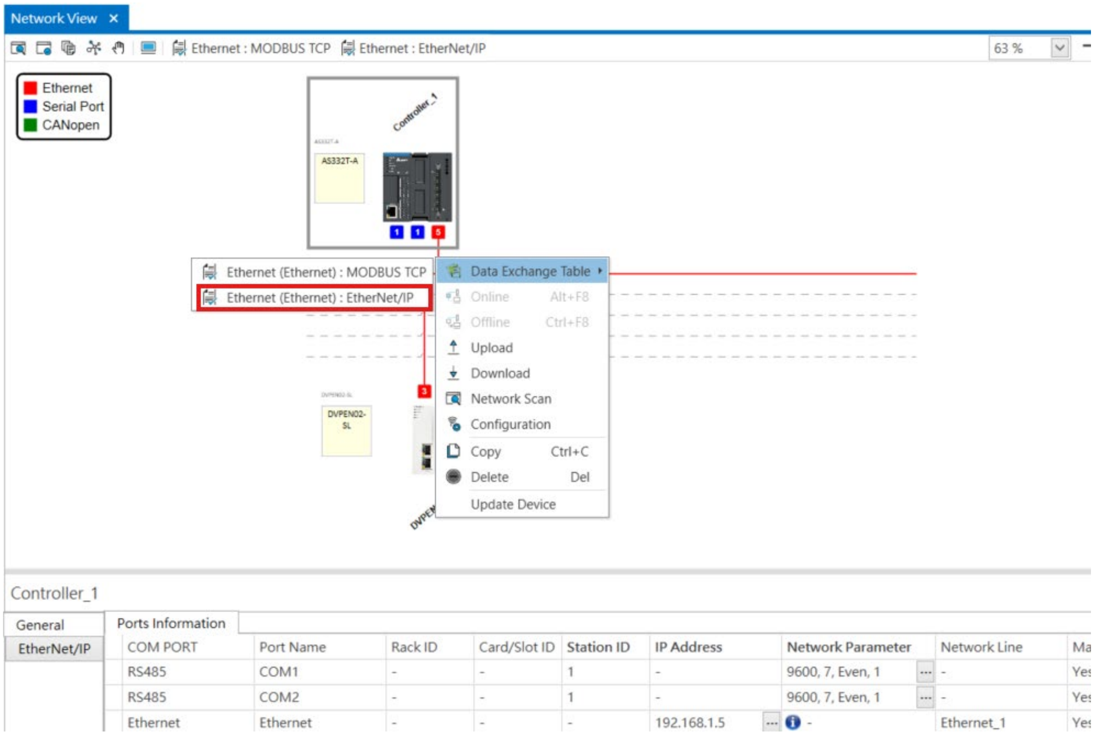
1. First, configure the starting register address and the maximum data length as described in section 13.6.7.13.1 Parameter Setting.
2. In DIADesigner, click **Network Configuration** in the Project Explorer -> double-click **Network View** -> right-click in the **Network View** window -> select **Open Add Device Tool Box**.



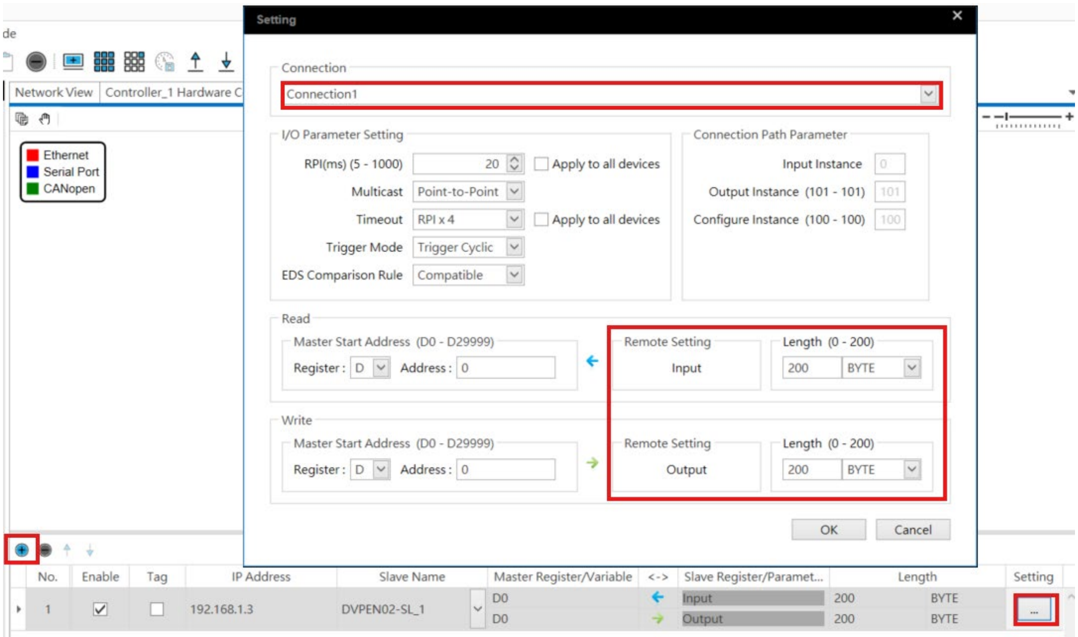
3. Search for DVPEN02-SL in the Tool Box, add it to the Network View, and configure its IP address.



4. Right-click the master station, select **Data Exchange Table** -> **Ethernet (Ethernet): EtherNet/IP.**



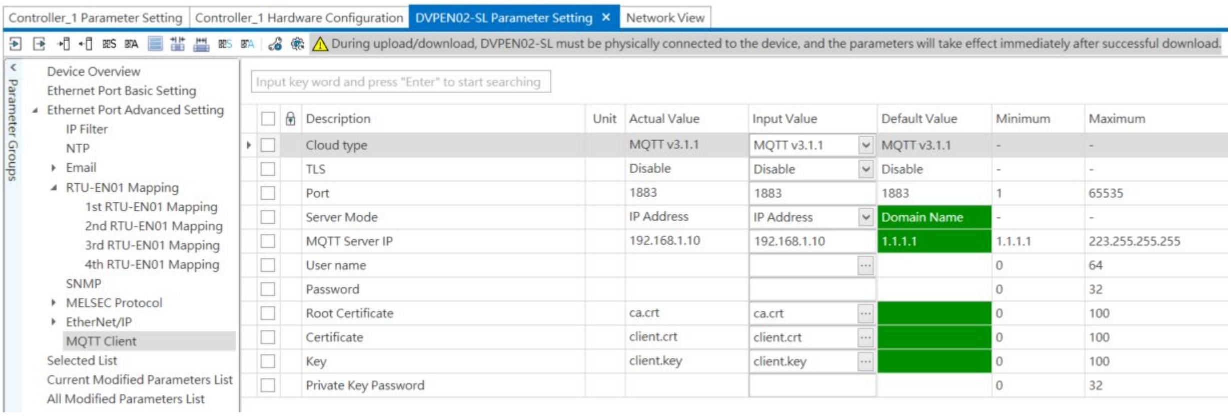
5. Click **Setting** to configure the connection settings. After completing the configuration, click **OK,** then download the project to start data exchange.



13.6.7.14 MQTT Client

DVPEN02-SL with SV3/SX3 supports MQTT Client function. You can use the **Publish** function to send messages or update PLC register status to a specified **Topic** on the MQTT Server. Using the **Subscribe** function, you can subscribe to up to 5 Topics simultaneously and receive messages or register status updates published by other users to those Topics.

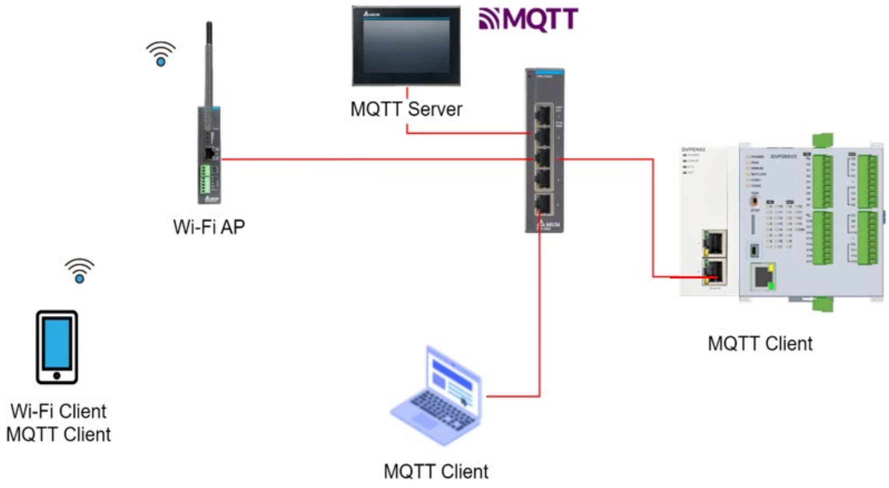
13.6.7.14.1 MQTT Parameter Setting



1. Cloud type: Currently only MQTT standard version 3.1.1 is supported.
2. TLS: Enable/disable TLS v1.2 protocol.
3. Port: Broker communication port.
4. Server Mode: Specify whether the MQTT Server uses an IP Address or a Domain Name for connection.
5. MQTT Server IP: The MQTT server IP address or domain name.
6. User Name: Account configured on MQTT Server.
7. Password: Password configured on MQTT Server.
8. Root Certificate: The trusted Root CA Certificate (required if TLS is enabled).
9. Certificate: The client certificate.
10. Key: Private key for the certificate.
11. Private Key Password: Password for the private key (optional).

13.6.7.14.2 MQTT Structure

The following demonstrates MQTT standard version 3.1.1 configuration using DOP-100 as the MQTT Server. See the DOP-100 Manual for supported models and versions.

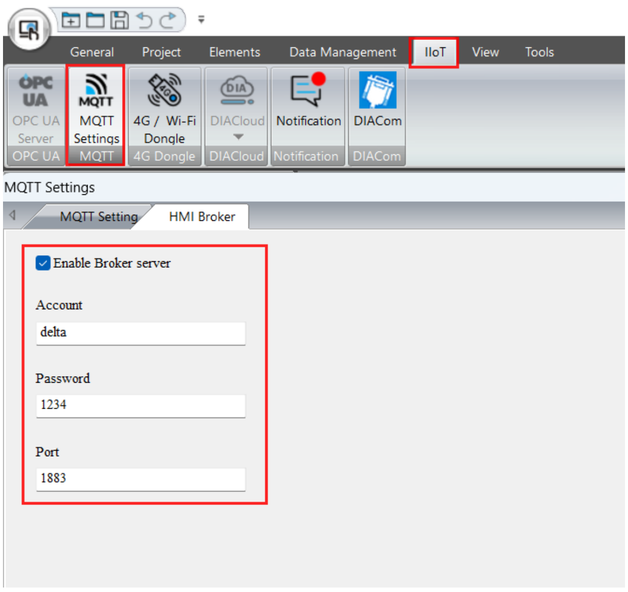


1. Communication Structure Description

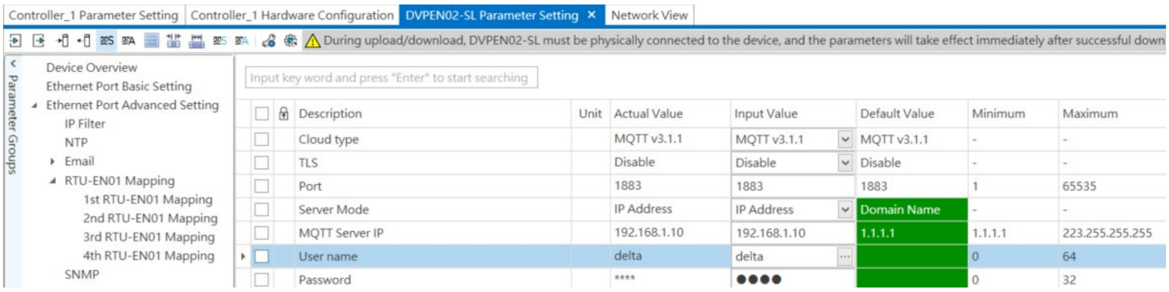
- MQTT Client: PLCs, computers, and mobile phones can communicate with MQTT Server via MQTT protocol to publish and subscribe, using wired or wireless network connection,.
- MQTT Server: HMI acts as the core of the communication structure, receiving and distributing messages from MQTT Client.
- Wi-Fi AP: Provides wireless network access for mobile phones to connect.
- Wi-Fi Client: Mobile devices such as phones connect to the Wi-Fi AP as MQTT Client, and communicate with MQTT Server.

The following steps describes only the PLC and HMI connection parameter settings.

2. Configure MQTT Setting on the IIoT page in DIAScreen. Enter the account, password, and port number on HMI Broker page, then download the configuration to the HMI.



3. In MQTT Parameter Setting, enter the HMI IP address, disable TLS, and enter the communication port, account, and password configured in the previous step.



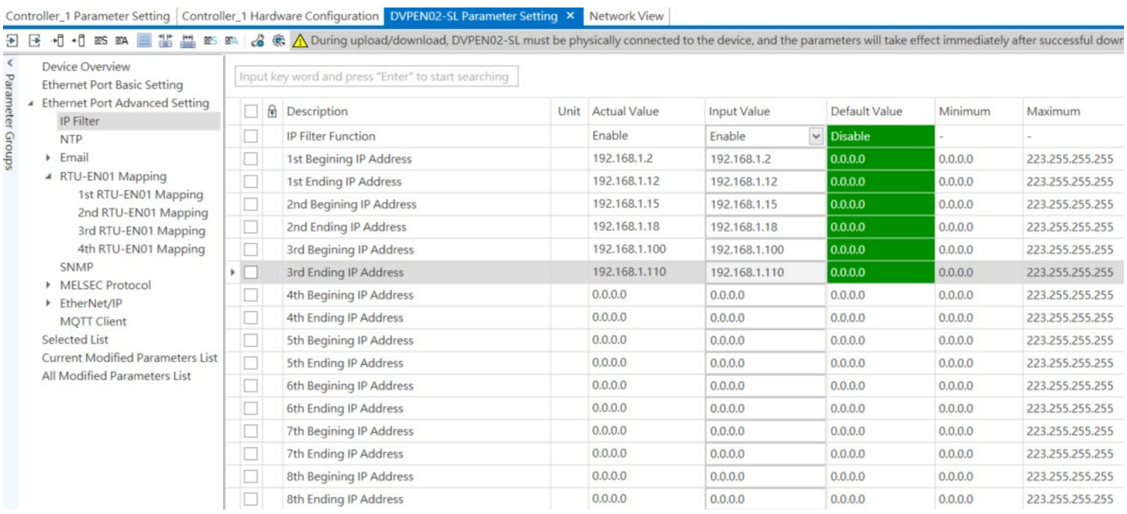
4. After completing the configuration, you can establish or disconnect the connection using PLC API2214 MQTT_Connect.

5. After connection is established, use API2215 MQTT_Publish, API2216 MQTT_Subscribe to publish messages and subscribe to/unsubscribe from topics.

6. Refer to the DVP-ES3/EX3/SV3/SX3 Series Programming Manual for detailed operation and application examples of these API instructions.

13.6.7.15 IP Filter

IP filter is used for restricting the connection of the network in case some uncertain IP addresses will cause errors. Only the IP addresses within the specified range can establish a connection. Other IP addresses will be rejected. If you forget the IP filter setup, please contact your distributors.



1. **IP Filter Function**: Enable/disable the IP filter function. When enabled, only connections from configured IP addresses will be allowed.

2. **IP Address Filter Settings**: Configure allowed IP addresses for incoming connections. Up to 8 IP addresses can be configured..

3. **Configuration Example**: As shown in the figure above, only packets from the configured IP addresses will be accepted.

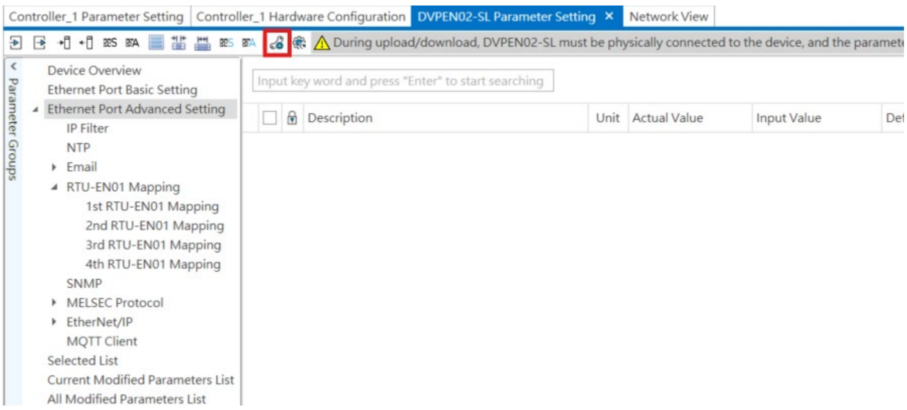
- 192.168.1.2 to 192.168.1.12
- 192.168.1.15 to 192.168.1.18
- 192.168.1.100 to 192.168.1.110

13.6.7.16 Password Setting

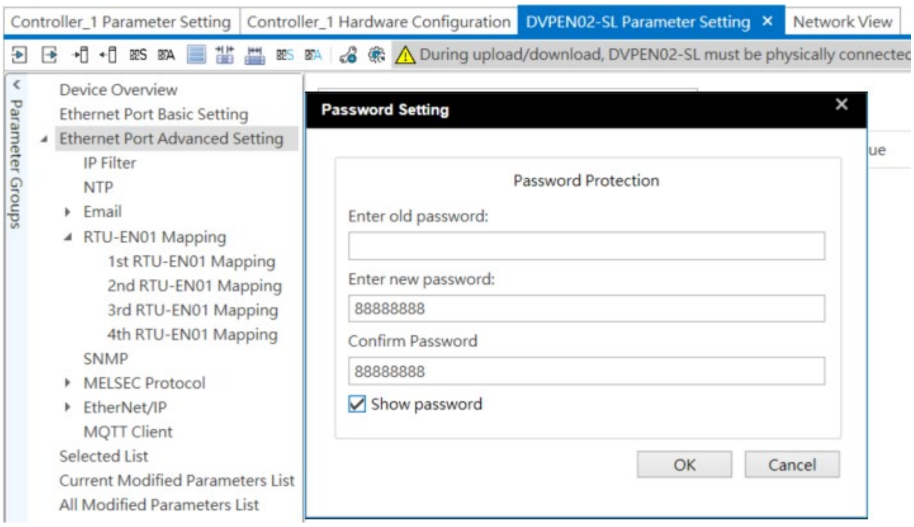
To prevent the setting values in DVPEN02-SL from being modified incorrectly, you can set a password to lock the settings in DVPEN02-SL. After configuring the password, you must power cycle the device for the changes to take effect. If you forget the password, use DIADesigner to restore the device to its factory settings.

The configuration is as follows:

1. Open DVPEN02-SL Parameter Setting, and select “Password Setting” icon.

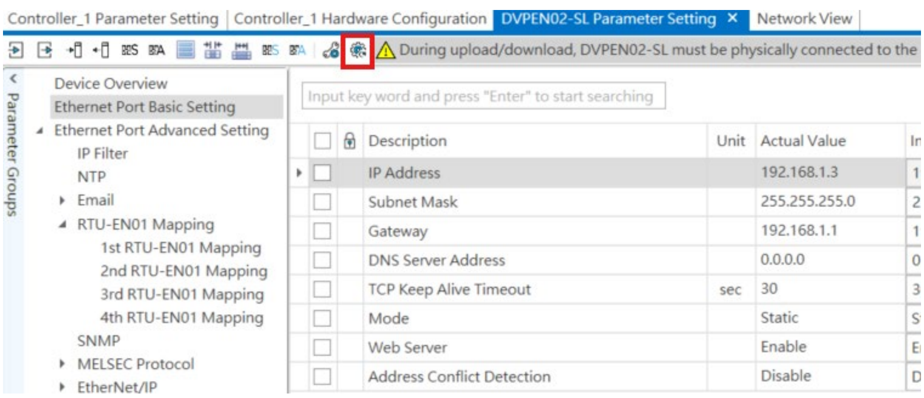


2. Enter the desired password and click **OK**. Then power cycle the device to apply the password.



13.6.7.17 Return to Factory Settings

To clear all current settings and restore factory defaults, select the “Factory Setting” icon on the DVPEN02-SL Parameter Setting page to reset all parameters.



13.6.8 Website Features Overview

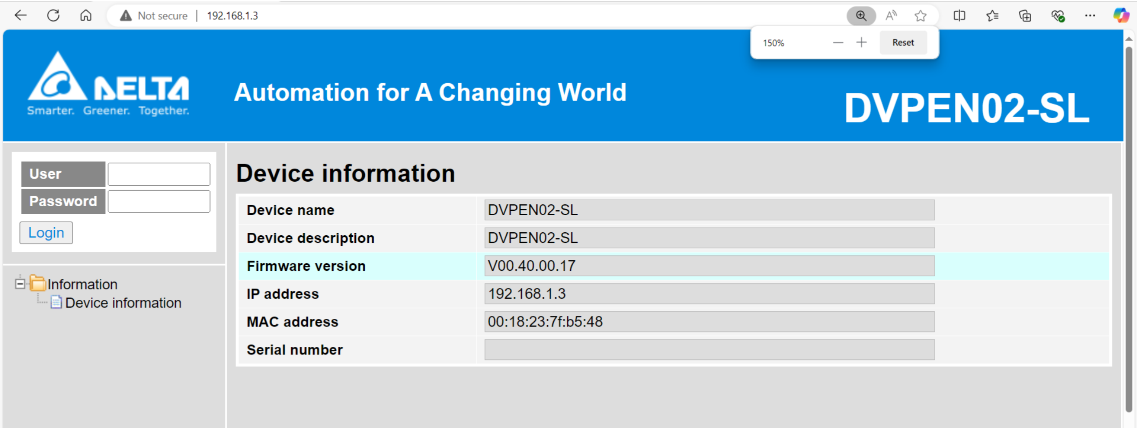
13.6.8.1 Open Web Page

List of browsers that support IABG Web Solution:

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

- **Operation Steps**

a. Open your browser, enter PLC IP address in the search bar to connect to the PLC.



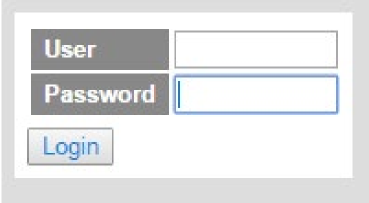
b. After the webpage appears, enter “Admin” in the User section and without entering any password, click Login. You can set up the password in Account Management page after login.

13.6.8.2 Login

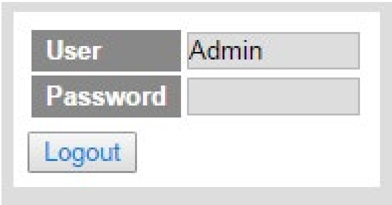
You need to login to your account to set up.

- **Operation Steps**

  a. In the login area, enter your username and password, then click the "Login" button.



  b. Once logged in, the user field will display your account name (read-only). You can click "Logout" to exit this page.



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

13.6.8.3 Menu

Users with different login permissions will see different pages on the Menu page.

The menu displays different options based on the user's access level.

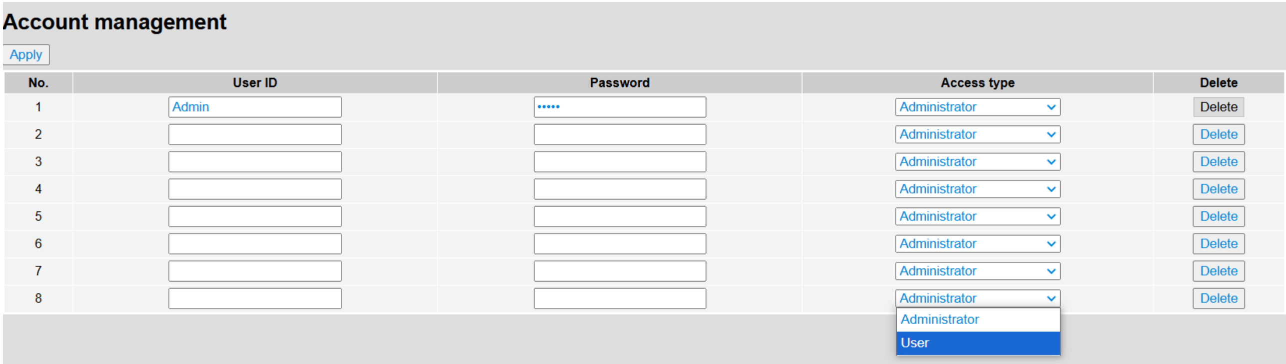
Options	Access Level	
	Administrator	**User**
Information	V	V
Diagnostic	V	V
Network configuration	V	
Save	V	
System	V	

13.6.8.4 Account Management

On the Account Management user settings page, you can configure up to 8 user accounts. There are 2 different access permission levels. User number 1 cannot be deleted and has fixed Administrator privileges.

The default account and password: Admin / Admin. Upon first use, be sure to change the account password to ensure network security.

Users with IDs from 2 to 8 can configure their own access rights. Users with "User" permission can only read the website's Information and Diagnostic information.



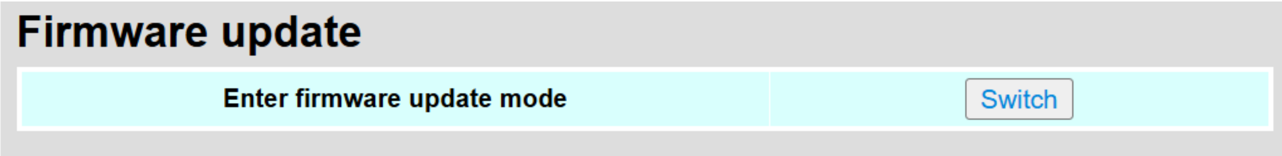
13.6.8.5 Diagnostic

- System diagnostic: Here provides information about the status of various functions. If any function is not in the 'Running' state, it is recommended to power cycle the device.
- Network diagnostic: Here displays network-related diagnostic information.
- Protocol diagnostic: Here displays protocol-related diagnostic information.

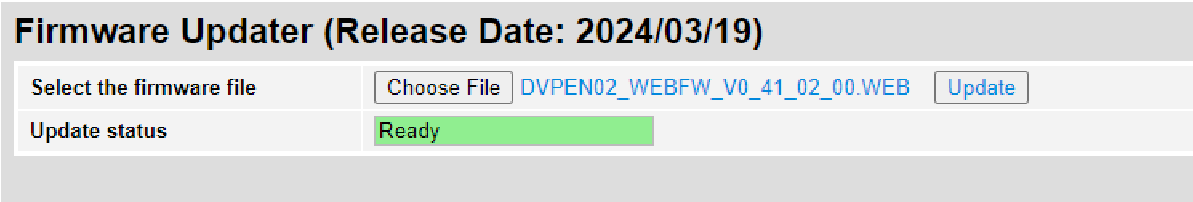
13.6.8.6 Firmware Update

Firmware update page is where you can update the firmware.

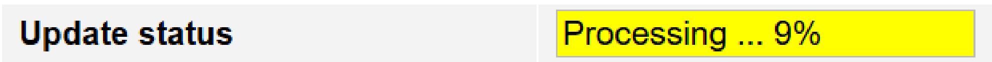
Clicking the Switch button will redirect you to the firmware update page. When this happens, all the indicator lights will illuminate and stay on.



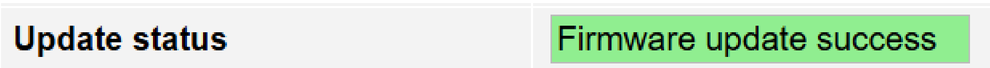
To update the firmware, go to the firmware update page and load the update file. You can get the update file from your distributor or the manufacturer.



The update status will display "Firmware update success" when the process is finished. Do not close the browser or turn off the device while the update is in progress.



When the update is complete, the screen will show "Firmware update success." Turn the DVPEN02-SL off and on again to complete the process.



After power cycling the module, manually reset the parameters to factory defaults using the software to prevent potential parameter errors caused by newly added functions.

13.6.9 Troubleshooting

13.6.9.1 Basic Inspection

This section provides information on the potential causes of equipment malfunctions during operation, as well as the appropriate corrective actions.

- Check the LED indicators for errors.
- Read the error codes in the control register CR#251 through the PLC program to diagnose the cause of malfunctions.

13.6.9.2 Network Functions Inspection

Abnormality	Cause	Solution
DCISoft search or page opening abnormality	DVPEN02-SL is not connected to a network.	Check whether DVPEN02-SL is correctly connected to a network.
	Blocked by network firewall or router.	If the computer and DVPEN02-SL are in different network segments or separated by two or more switches, please use the specified IP for a search.
	Network interference.	If occasionally experiencing situations where searches are successful while at other times unsuccessful, it may be due to network congestion, causing packets to be unable to transmit in real time. Please simplify the network and then proceed with the configuration again.
Able to open DVPEN02-SL setup page but fail to upload /download program and monitor devices by ISPSoft	The network setting for DVPEN02-SL is incorrect.	Check whether the network setting for DVPEN02-SL is correct. Consult the IT staff if you are using the Intranet in the company. Refer to the network setting instructions provided by your ISP if you are using a private network.
Communication based on the MODBUS TCP data exchange table fails.	Remote device communication timeout occurs.	Modify the value in CR#114 to increase the data exchange timeout time.
	Function code not supported.	• Set CR#97 to 1 to disable the function code 0x17 • Set the data length for Write operation to 0 for testing. If the communication is normal, it indicates that the server does not support writing data into the MODBUS TCP address.
Unable to send emails	The network setting for DVPEN02-SL is incorrect.	Check whether the network setting for DVPEN02-SL is correct.
	The DNS server address has not been set.	This abnormality usually occurs in static IP mode. Please fill in a correct DNS server address. If you don't know the address, please use a public DNS server name on the network.
	Incorrect CR settings.	Check whether the CR#19-CR#22 are triggered correctly.
	Incorrect settings for the e-mail server.	Check the address (domain name) and port number of the e-mail server and ensure it can be pinged to.
	Incorrect account or password for the e-mail server.	Make sure to use the correct account and password. Refer to the operating instructions of the e-mail server for details.

Abnormality	Cause	Solution
RTU-EN01 mapping fails	Incorrect CR settings.	Check whether CR #31 is enabled correctly.
The SNMP manager fails to read data.	Incorrect community name setting.	• Ensure that the community's name setting is correct. • Make sure to fill in the OIDs as described in the MIB file

13.6.9.3 LED Indicators (ERROR, SYS and NET) Inspection

LED Blinking Type	Definition	Error Type
Fast blinking	ON: 0.25 s OFF: 0.25 s	General error
General blinking	ON: 0.5 s OFF: 0.5 s	General warning
Slow blinking	ON: 1 s OFF: 1 s	Minor warning

ERROR	SYS	NET	Cause
Constantly ON	Constantly ON	Constantly ON	Firmware update in progress or firmware update failure
	General blinking	Constantly OFF	Hardware error
Fast blinking	Constantly ON	Constantly ON	Model mismatch
	General blinking	-	Low voltage
General blinking	General blinking	-	Internal communication failure or parameter abnormality
	-	General blinking	Network parameter error
Slow blinking	-	-	Some functions cannot get connected to the remote device

Note: - indicates that the fault is irrelevant to the LED indicator.

13.6.9.4 Error Information

Error Code	ERROR	SYS	NET	Cause and Solution
0x1610	Fast blinking	General blinking	-	• The 24 VDC power supply is not stable, and the device is in the low-voltage state. • Check the power supply module.
0x1611	Constantly ON	General blinking	Constantly OFF	• Network hardware error. • Restore to factory settings. • If the issue persists, please contact your local distributors.
0x1612 0x1613	Constantly ON	General blinking	Constantly OFF	• Memory damage. • Restore to factory settings. • If the issue persists, please contact your local distributors.

Error Code	ERROR	SYS	NET	Cause and Solution
0x1614 0x1615	Constantly ON	General blinking	Constantly OFF	• Internal communication error. • Repower the device. • If the issue persists, please contact your local distributors.
0x1616	Fast blinking	Constantly ON	Constantly ON	• This error occurs when switching from 2nd to 3rd generation PLCs, or vice versa. • Confirm whether you intend to change the PLC CPU. • If the PLC CPU has been changed, reset the module to factory defaults using the software.

Note: - indicates that the error is irrelevant to the LED indicator.

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13.6.9.5 Warning Information

Warning Code	ERROR	SYS	NET	Cause and Solution
0x1800	General blinking	General blinking	-	• The device is restoring to factory settings. • The warning will stop automatically 5 seconds later.
0x1810	General blinking	Constantly OFF	General blinking	• An IP address conflict occurs. • Remove the network cable from DVPEN02-SL and use the PING command on the computer to search for the devices with the same IP address and modify their IP addresses.
0x1811	General blinking	Constantly OFF	General blinking	• Fail to obtain an IP address in DHCP mode. • Check the state of the DHCP server or use the IP setting tool in COMMGR to assign an IP address to the device.
0x1820	General blinking	General blinking	Constantly OFF	• Fail to synchronize with the time of the CPU. • Check whether an error occurs in the CPU. • Wait for the next synchronization attempt. If the issue persists, repower the device.
0x1821	General blinking	General blinking	Constantly OFF	• MODBUS TCP data exchange table error. • Please contact your local distributors.
0x1830	General blinking	General blinking	Constantly OFF	• DNS resolution failure. • Verify that the DNS server is functioning properly.
0x1831	General blinking	General blinking	Constantly OFF	• The function of MELSEC data exchange table is disabled. • Check whether the CR control is accidentally triggered while the MELSEC data exchange table is disabled.
0x1832	General blinking	General blinking	Constantly OFF	• The function of MODBUS TCP data exchange table is disabled. • Verify whether the CR control is accidentally triggered when the MODBUS data exchange table is disabled.
0x1833	General blinking	General blinking	Constantly OFF	• MODBUS TCP data exchange table error. • Please contact your local distributors.

Warning Code	ERROR	SYS	NET	Cause and Solution
0x1834	General blinking	General blinking	Constantly OFF	• MQTT DNS resolution failure. • Verify that the MQTT server address exists. • Verify that the DNS Server is correct.
0x1840	Slow blinking	Constantly OFF	Slow blinking	• Unable to connect to the SMTP server.
0x1841	Slow blinking	Constantly OFF	Slow blinking	• Unable to connect to the NTP server.
0x1842	Slow blinking	Constantly OFF	Slow blinking	• Unable to connect to the MODBUS TCP server.
0x1843	Slow blinking	Constantly OFF	Slow blinking	• Unable to connect to the RTU-EN01 module.
0x1860	-	-	-	• The number of connections with the MODBUS TCP server has reached the upper limit. • No more new connections can be established. If normal connections are affected, you can try reducing the connection-alive time for DVPEN02-SL, or limit the number of MODBUS TCP connections from the client(s) to meet the specifications for DVPEN02-SL.
0x1861	-	-	-	• The number of connections with the MELSEC server has reached the upper limit. • No more new connections can be established. If normal connections are affected, you can try reducing the connection-alive time for DVPEN02-SL, or limit the number of MELSEC connections from the client (s) to meet the specifications for DVPEN02-SL.
0x1862	-	-	-	• The number of EIP Adapter connections has reached the upper limit.
0x1868	-	-	-	• Incorrect MODBUS TCP server port • Modify the value in CR#95 for MODBUS server port No.
0x1869	-	-	-	• Incorrect MELSEC Server port • Modify the MELSEC Server listening port in Parameter Setting
0x186A	-	-	-	• Incorrect MELSEC data exchange local port • Modify the value in CR#46 for MELSEC data exchange local port
0x1871	-	-	-	• Incorrect MELSEC command received • Check the communication settings or packet content for the client.
0x1872	-	-	-	• PLC responded with exception code in CIP data exchange. • Check the parameters configured in the upper device.

Note: - indicates that the warning is irrelevant to the LED indicator.

13.6.9.6 MODBUS TCP Data Exchange Table Error Codes

Available for hardware configuration when connected to an SV3/SX3 PLC.

Error code	Description	Solution
0x00XX	Remote device responded with exception code	• XX is the MODBUS TCP exception code • Refer to the remote device operation manual • Verify the MODBUS TCP Server device specification

Error code	Description	Solution
0xF001	Remote device communication timeout	• Verify whether the average respond time is too close to the communication timeout setting value. • Increase the communication timeout setting value. • Capture network packets for analysis.
0xF002	Unable to establish connection with remote device	• Verify that the IP address and communication port in the data exchange table match the device settings • Verify that the remote device Server mode is enabled and has not reached the maximum connection limit. • Ensure the network cable is properly connected. • Capture network packets for analysis.
0xF003	Insufficient network resources	• Increase the update cycle and communication timeout values to reduce the frequency of disconnections and reconnections. • Reduce the load on all active network features. • Switch the PLC status to STOP, wait 2 minutes, then switch back to RUN.
0xF004	Incorrect function code received from remote device	• Capture network packets for analysis.
0xF005	Access to an invalid register in the PLC CPU	• If the issue persists, please contact your local distributors.
0xF006	Data Exchange Table operation status is abnormal	• If the issue persists, please contact your local distributors.
0xF007	Incorrect Protocol Identifier in the Header of the received MODBUS TCP packet	• Capture network packets for analysis.
0xF008	Incorrect Transaction Identifier in the Header of the received MODBUS TCP packet	• Capture network packets for analysis.
0xF009	Incorrect Length in the Header of the received MODBUS TCP packet	• Capture network packets for analysis.
0xF00A	Insufficient MODBUS TCP packet length received	• Capture network packets for analysis.
0xF00B	Remote device actively disconnected	• Check remote device settings.
0xF00C	Parameter error in data exchange table	• Confirm that the software parameters in the firmware version match the hardware configuration. • If the issue persists, please contact your local distributors.
0xF00D	Read and write data lengths are both 0	• The read and write data lengths cannot be set to 0 simultaneously.
0xF00E	Module memory access error	• If the issue persists, please contact your local distributors.
0xF00F	Internal communication error occurred in the PLC	• If the issue persists, please contact your local distributors.
0xF010	Module queue access error	• If the issue persists, please contact your local distributors.

13.6.10 Cyber Security

13.6.10.1 User Access Control Settings

- This product webpage allows you to manage account and password permissions. We recommend changing the default account name and password when you first use it.
- Passwords must be 8–16 characters long and include at least three of the following:
  uppercase letters (A–Z), lowercase letters (a–z), digits (0–9), and special symbols.
- It is recommended to change your password regularly and avoid using recently used passwords.

13.6.10.2 Ethernet Security

- For optimal security, use this product within a closed, firewalled local network to prevent unauthorized access and ensure proper operation
- It is recommended to configure IP filtering so that connections can only be established within the specified IP range
- When connecting to a switch, it is recommended to disable unnecessary ports to reduce the potential attack surface, and to ensure that the cabinet is locked to prevent unauthorized individuals from tampering with network ports or capturing packets.
- When connecting to a switch, it is recommended to disable unnecessary ports to reduce the potential attack surface, and to ensure that the cabinet is locked to prevent unauthorized individuals from tampering with network ports or capturing packets.

13.6.11 Open Source Declaration

lwIP TCP/IP stack

FreeRTOS

This product includes FreeRTOS, a real-time operating system kernel developed by Amazon Web Services, Inc.
License: MIT License
Source: https://www.freertos.org

Mbed TLS

This product includes Mbed TLS, a cryptographic library developed by Arm Limited.
License: Apache License 2.0
Source: https://github.com/Mbed-TLS/mbedtls

13.7 DVPPN02-SL

13.7.1 Introduction

1. Thank you for choosing Delta DVPPN02-SL module. To ensure correct installation and operation of the product, please read this operation manual carefully before use.
2. This operation manual only provides introductory information on DVPPN02-SL. For more detailed information on the PROFINET protocol, please refer to relevant references or literatures.
3. DVPPN02-SL can serve as a PROFINET slave to communicate with a PROFINET master. Before the communication with the PROFINET master starts, the GSDML (General Station Description Markup Language) file of DVPPN02-SL must have been installed. Please download the latest version of the file from Delta official website.

13.7.1.1 Features

- Installed on the left side of DVP series PLC, works as a PROFINET slave to connect to a PROFINET network.
- Supports the data exchange of up to 16 pieces and setting the starting D register for each piece.
- Supports the data length for each piece: 1, 2, 4, 8, 16, 32 or 64, and data type: Word.
- For data lengths, input (Input), output (Output), or input plus output (In- and Output) can be selected.
- Maximum data lengths for input and output supported are both 128 Words, IOPS and IOCS excluded.

13.7.1.2 Specifications

■ **Supported CPU modules**

Item	Specification
Model name	Left-side scalable CPU modules: DVP-SA2, DVP-SX2, DVP12SE, DVP-SE2, DVP-SV3, DVP-SX3, etc.

■ **Communication specifications**

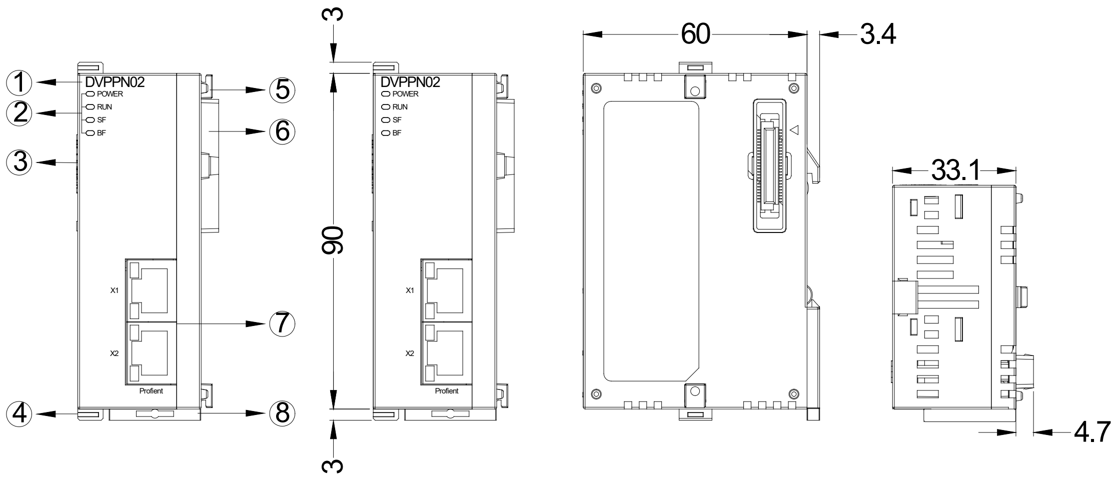
Item	Specification
Communication protocol	PROFINET RT
EtherNet interface	100 Mbps / 2 x RJ45
Transmission cable	Category 5e or later
Max. transmission distance	100 meters
Topology type	Linear and star
Max. number of PN slots	16
Minimum cycle time for data exchange	10 ms

■ **Electrical specifications**

Item	Specification
Power supply voltage	24 VDC (-15% to 20%) (Provided by the internal bus of the CPU)
Power consumption	1.5 W
Isolation voltage	500 V
Weight	About 103 g

13.7.2 Module Profile and Parts

13.7.2.1 Profile and Dimensions

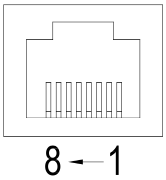


Unit: mm

No.	Name	Description
1	Model name	Model name of the module
2	Power indicator (Green light)	Indicates the state of the power supply ON: The power is on. OFF: No power supply.
	RUN indicator (Green light)	Indicates the initialization state of the module ON: Initialization success. OFF: Initialization failure or the power supply is NOT normal.
	SF (System Fault) indicator (Red light)	Indicates the system state of the module ON: 1. Being initialized; 2. Low voltage occurs. Rapid blinking (ON: 0.5 s; OFF: 0.5 s): Data error in the latched area. Slow blinking (ON: 2 s; OFF: 2 s): GPIO initialization failure. OFF: The system is operating fine.
	BF (Bus Fault) indicator (Red light)	Indicates the connection state of the module. ON: No connection at the PROFINET port. Blinking: The connection is fine but the communication with PN-Controller is NOT normal. OFF: The communication with PN-Controller is normal.
3	Extension port	Connect the module
4	Extension unit fixing clip	Secure the extension module
5	Extension unit positioning hole	For positioning between modules
6	Extension port	Connect the PLC or the module
7	PROFINET port	For PROFINET network connection
8	DIN rail clip	Secure the module onto the DIN rail

13.7.3 Terminals

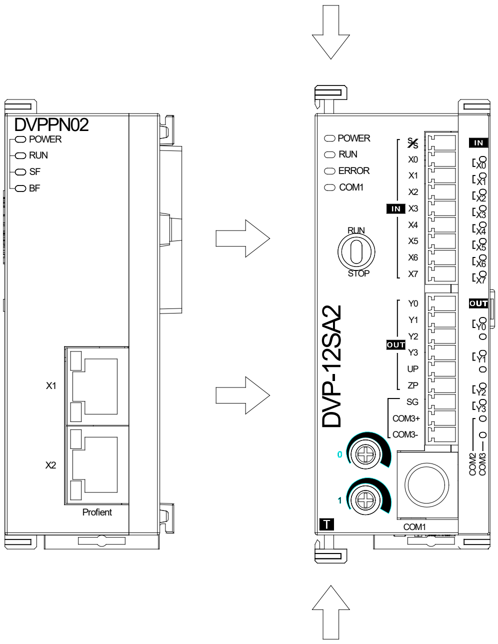
The two RJ-45 Ports, X1 and X2 are used for the connection to a PROFINET network.

PROFINET port (RJ-45)				
	Pin No.	Definition	Pin No.	Definition
	1	TX+	5	N/C
	2	TX-	6	RX-
	3	RX+	7	N/C
	4	N/C	8	N/C

13.7.4 Installation

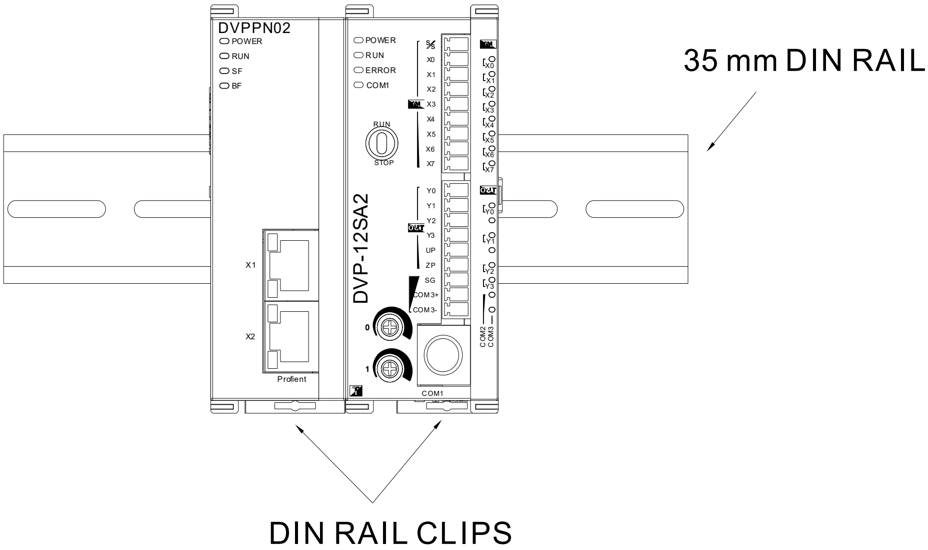
13.7.4.1 Connecting DVPPN02-SL to the PLC CPU

1. Open the top and bottom fixing clips on the left side of the PLC CPU.
2. Insert the DVPPN02-SL onto the CPU by aiming at the connection interface, as shown in the figure below.
3. Press both clips on the left side of the CPU to get DVPPN02-SL and the CPU connected tightly.



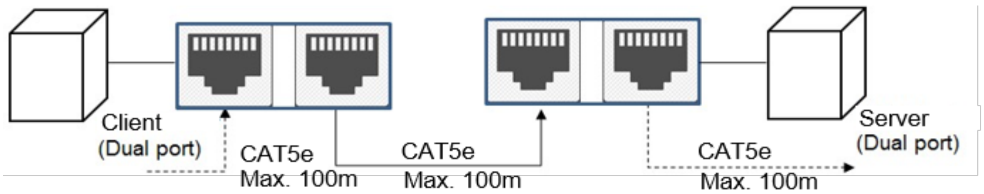
13.7.4.2 Installing the DVPPN02-SL and PLC CPU on a DIN Rail

1. Use a standard 35 mm DIN rail.
2. Open the DIN rail clips on both DVPPN02-SL and the CPU and then insert them onto the DIN rail.
3. Press DIN rail clips back to secure DVPPN02-SL and the CPU onto the DIN rail.

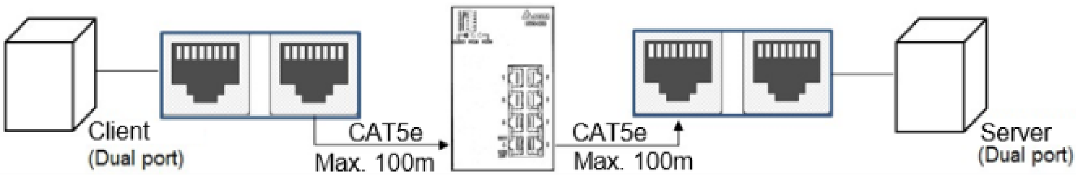


13.7.4.3 Connecting to the PROFINET Network

- **Linear topology**



- **Star topology**



13.7.5 Configuring DVPPN02-SL

13.7.5.1 Firmware Requirement

DVPPN02-SL with the DVP series CPU serves as a PROFINET slave.

Here are the lists of DVP series CPU modules and their firmware versions for your reference:

DVP Series CPU	SA2	SX2	SE	SE2	SV2	SV3	SX3
Firmware version	V3.06	V3.06	Not supported for now		Not supported	V1.08.03	V1.08.03

13.7.5.2 Data Exchange

The DVPPN02-SL module is installed on the left side of the DVP series CPU module. There are up to eight DVPPN02-SL modules connectable on the left side of one PLC.

- **Modules**

There are 21 types of modules like 32 word in- and output, available for data exchange by combining different data length with different data type in the following table. That the I/O modules correspond to D registers (D6000-D19999) in the DVP PLC can be set up in the upper device software. Refer to Application Example for detailed operation in the next section.

Data Length (word)	1, 2, 4, 8, 16, 32, 64
Data Type	Input, Output, In- and Output

- **Different CPU modules and corresponding D register ranges**

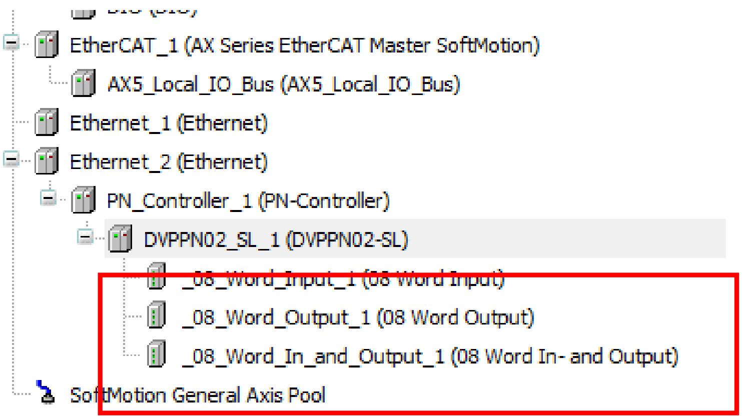
CPU module	Range of D registers
2nd-generation CPU (DVP-SA2, DVP-SX2, etc)	D6000-D9999 (The system will automatically change it to D9999 if you set a starting D register address which exceeds D9999.)
3rd-generation CPU (DVP-SV3, DVP-SX3, etc)	D6000-D19999

- **Example**

By DVPPN02-SL, the values of PLC's registers D6000-D6007 and D7000-D7007 are sent to the PROFINET master, and meanwhile the data from the PROFINET master is stored into PLC's registers D6100-D6107 and D7100-D7107.

Here are steps for configuration settings:

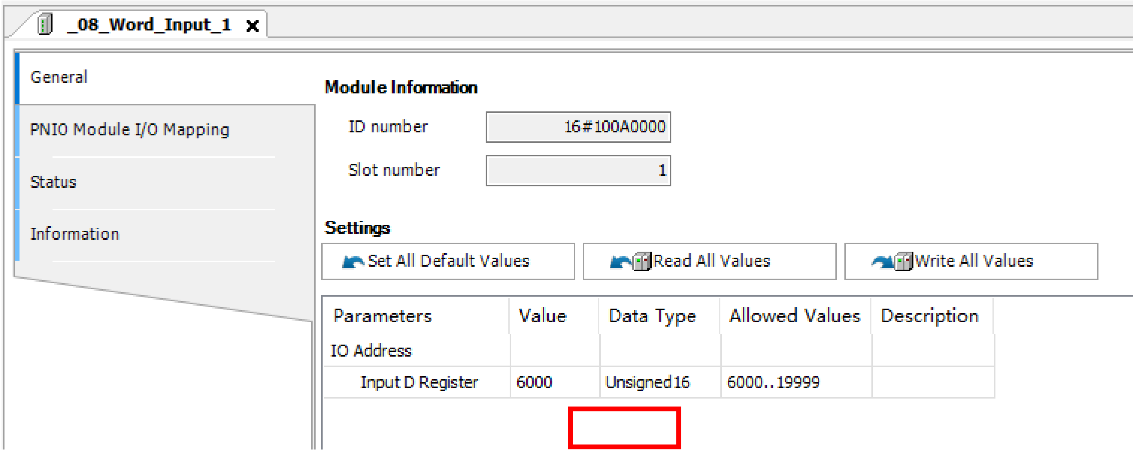
1. Connect DVPPN02-SL on the left of the DVP-12SA2 CPU to the PROFINET master (AX564 CPU) through the PROFINET port. Assign "08 Word Input," "08 Word Output," and "08 Word In- and Output" modules to slots 1 through 3 of the DVPPN02-SL respectively as shown in the following configuration page of the DIA-AX software:



2. Set up the starting D registers for PN input/output modules for data mapping as follows.

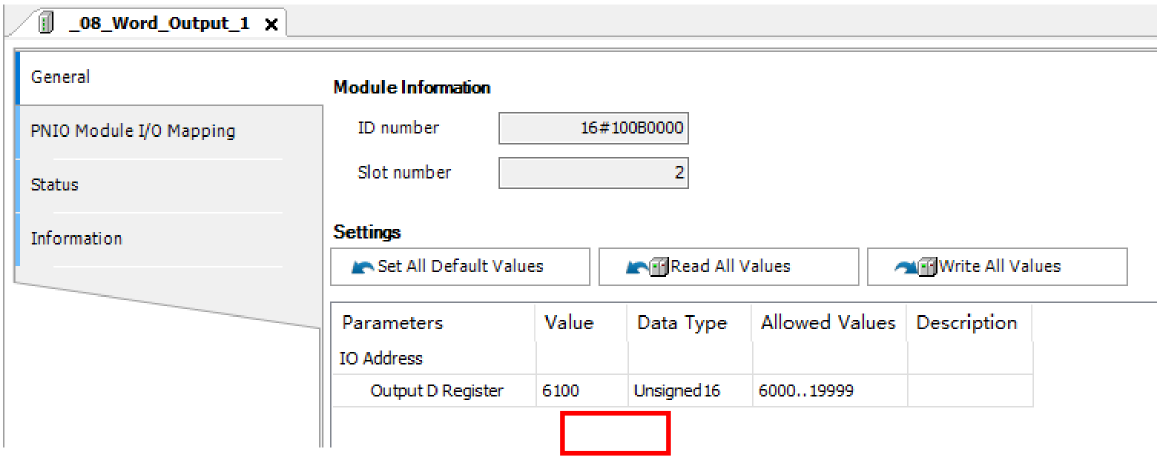
PN Slot	Module Name	Type	Starting Register
Slot 1	08 Word Input	Input	D6000
Slot 2	08 Word Output	Output	D6100
Slot 3	08 Word In- and Output	Input	D7000
		Output	D7100

■ The configuration window for the "**08 Word Input**" module at Slot 1:



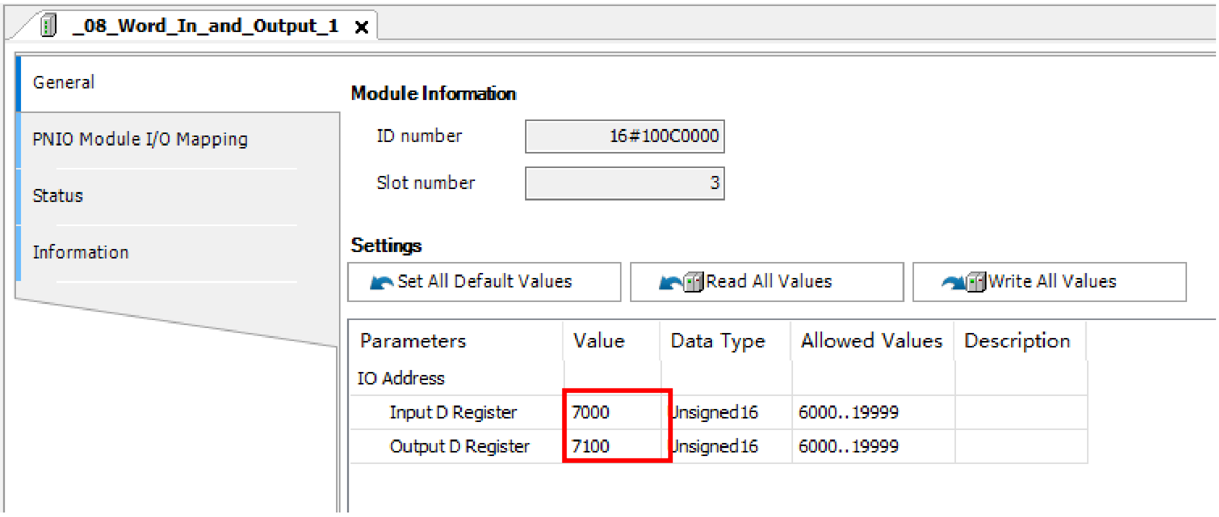
The "**Input D Register**" parameter corresponds the starting one of the D registers where the data will be sent to the PROFINET master, and for the data length, you can get to know it from the name of a PN module. The value of the "Input D Register" parameter in the figure above is 6000, so the values in registers D6000-D6007 will be sent to AX564 through DVPPN02-SL.

■ The configuration page for the "08 Word Output" module at Slot 2:



The "**Output D Register**" parameter corresponds to the starting one of the D registers where the data from the PROFINET master is stored by DVPPN02-SL. The value of the "**Output D Register**" parameter in the figure above is 6100, so the data sent by the PROFINET master to DVPPN02-SL will be stored in the registers D6100-D6107.

■ The configuration page for “08 Word In- and Output” at Slot 3:



3. Download the configuration data to the PROFINET master (refer to section 13.7.5 for more).
See the mapping between the PROFINET master and the DVP-12SA2 CUP as shown in the following table.

PROFINET Master	DVPPN02-SL	DVP-12SA2
Input devices in PN master	←	D6000-D6007
		D7000-D7007
Output devices in PN master	→	D6100-D6107
		D7100-D7107

When on the left side of the PLC are the extension modules: DVPPN02-SL, DVPCOPM-SL, DVPDNET-SL, etc., do NOT use the D registers in the mapping areas for DVPCOPM-SL and DVPDNET-SL as the D registers for PN modules for data mapping. (For details on mapping areas for DVPCOPM-SL and DVPDNET-SL, please refer to sections 13.2.7 and 13.3.6).

For example, from left to right, there are DVPCOPM-SL, DVPPN02-SL and DVPDNET-SL on the left side of DVP-28SV3. The data exchange area for DVPCOPM-SL occupies D16000-D16476, and the data exchange area for DVPDNET-SL is D16500-D16997. Therefore, you should select the mapping D registers in the ranges of D6000-D15999 and D17000-D19999 for PN modules.

- **Total data length**

The total data size is related to the number of modules used. The total data length is the data length plus the length of I/O Provider State (IOPS) and IO Consumption State (IOCS) of modules as shown in the following table.

PN Module Type		Additional Input Data Length (byte)	Additional Output Data Length (byte)
PN slot 0	Status Register	4	0
	Device Access Point (DAP)	4	0
Input module		1	0
Output module		1	1
I/O module		2	1

DAP (Device Access Point) and Status Register should be counted in the total data length of input and output.

For example, in the table below, the lengths of Production Status (IOPS) and IO Consumption Status (IOCS) for modules are also counted.

PN Slot	PN Module	In (byte)			Out (byte)		
		Data Size	IOPS / IOCS	Total	Data Size	IOPS / IOCS	Total
0	Status Register	4	0	4	0	0	0
	DVPPN02-SL (DAP)	0	4	4	0	0	0
1	64 Word In- and Output	128	2	130	128	1	129
2	16 Word In- and Output_1	32	2	34	32	1	33
3	16 Word In- and Output_2	32	2	34	32	1	33
4	08 Word In- and Output	16	2	18	16	1	17
5	04 Word Output	0	1	1	8	1	9
Total Size				225			221

If the total size specification of 284 bytes for input or 284 bytes for output is exceeded, the PLC editing software will prompt you with an error message while compiling.

- **Types of Status Register**

Status Register comes into Module Status and DVPPLC Status. Module Status is for you to check the system state of DVPPN02-SL.

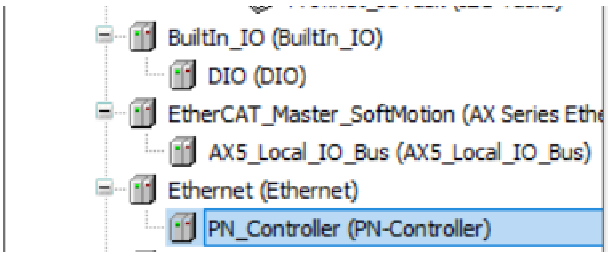
Value in Module Status	Description	Solution
16#F010	DVPPN02-SL GPIO initialization failed	Repower it on. If the problem persists, contact your local authorized distributors.
16#F011	Data in the latched area for DVPPN02-SL is NOT normal.	

From the value of DVPPLC Status, you can check the state of the DVP PLC working with DVPPN02-SL. While the DVP PLC is in Run, the value of DVPPLC Status is 1, and DVPPLC Status is 0 while the DVP PLC is in Stop.

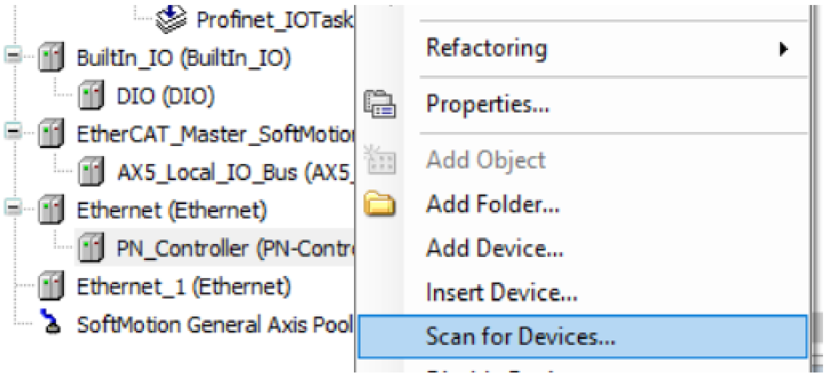
13.7.6 Application Example

This section introduces the operation steps for the data exchange between the AX564 CPU and the slave DVPPN02-SL through the DIADesigner-AX software.

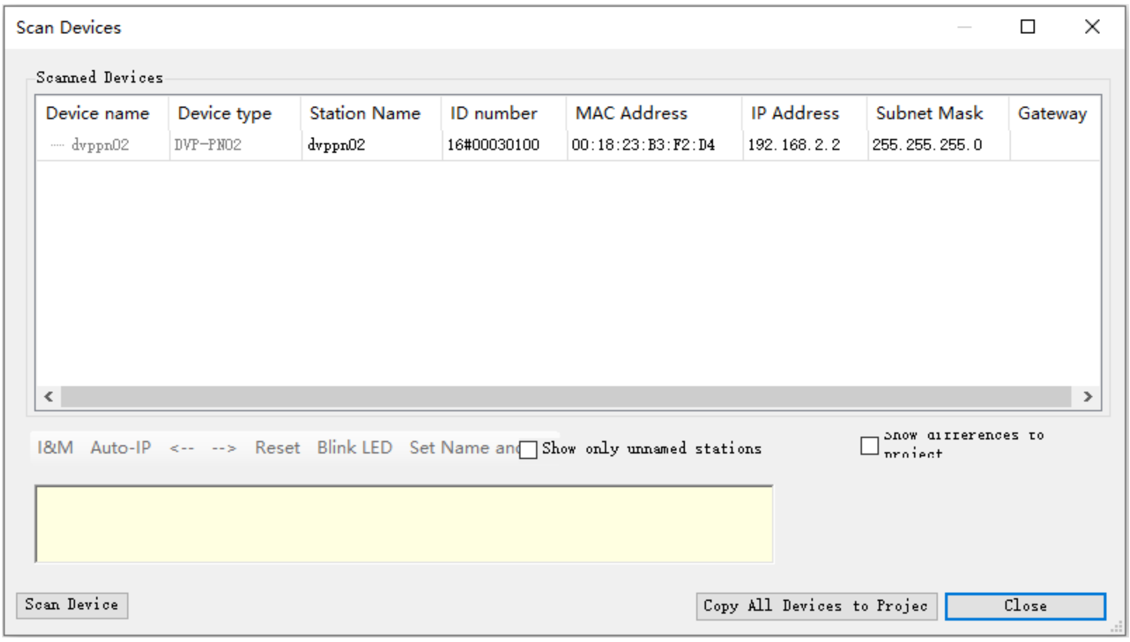
1. Install DVPPN02-SL on the left side of DVP12SA2 and then power them on.
2. Add the PN_Controller device under **Ethernet (Ethernet)** for AX-5 CPU in DIADesigner-AX.



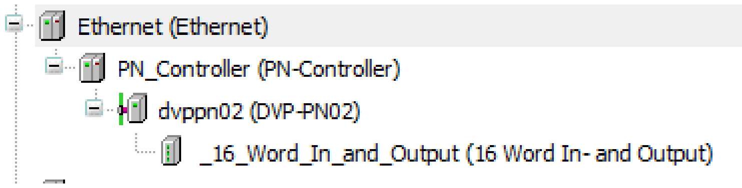
3. Right-click on **PN_Controller** and then click **Scan for Devices…** from the context menu.



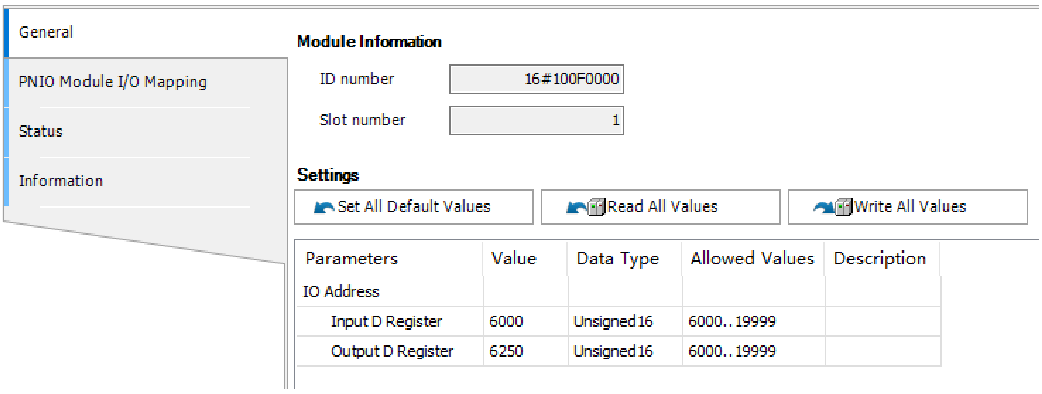
4. Select the model DVPPN02 for data exchange to add the slave device.



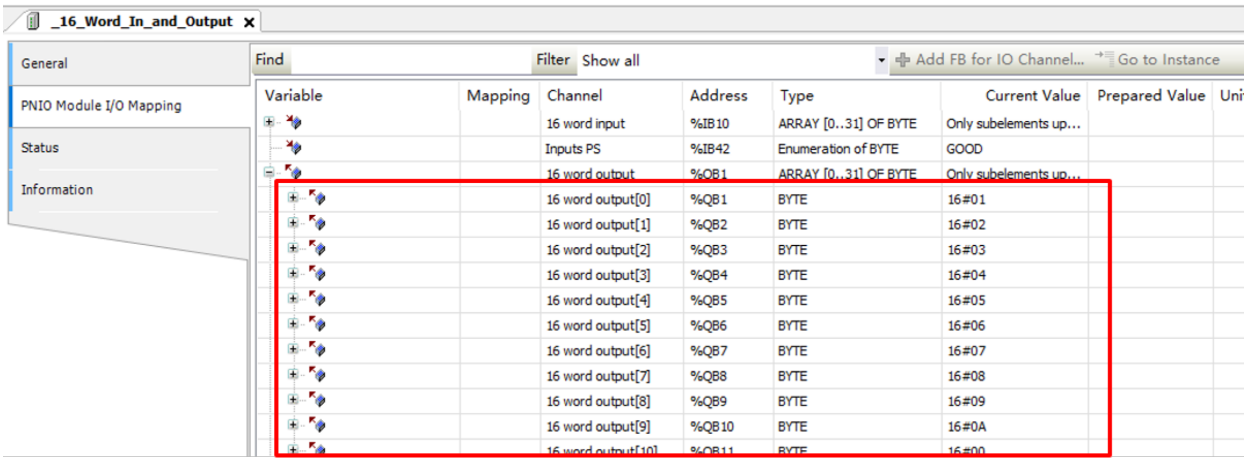
5. After that, right-click on the slave device and click **Add Device…** from the context menu to add a PN module (e.g. **16 Word In- and Output).**



6. Double-click on the **16 Word In- and Output** module to open the module setup page, where you can set the starting D registers in the DVP series CPU for communication from the **General** tab.



7. Click **Login** to download the project to the AX-5 CPU after the setting is over.
8. Then the mapping data for 16 word output of AX-5 is sent to D6250-D6265 in the DVP CPU respectively.
   - DVPPN02-SL I/O mapping page:



- DVP PLC monitoring page:

Device Name	Comment	Status	T/C Set Value	Present Value (16 bi	Present Value (32 bi	Floating Point	Format	T/C S
D6250				H201	H4030201	F0.000	Hexadecimal	
D6251				H403	H6050403	F0.000	Hexadecimal	
D6252				H605	H8070605	F0.000	Hexadecimal	
D6253				H807	HA090807	F0.000	Hexadecimal	
D6254				HA09	HA09	F0.000	Hexadecimal	
D6255				K0	K0	F0.000	Signed Decimal	

9. The data from D6000-D6015 in DVP PLC is stored in the mapping area for 16 word input of the AX-5 CPU.

- DVP PLC monitoring page:

Device Name	Comment	Status	T/C Set Value	Present Value (16 bits)	Present Value (32 bi	Floating Point	Format
D6000				H2211	H44332211	F716.532	Hexadecimal
D6001				H4433	H66554433	F251780528596385	Hexadecimal
D6002				H6655	H88776655	F-0.000	Hexadecimal
D6003				H8877	HAA998877	F-0.000	Hexadecimal
D6004				HAA99	HAA99	F0.000	Hexadecimal
D6005				H0	H0	F0.000	Hexadecimal

- DVPPN02-SL I/O mapping page:

_16_Word_In_and_Output

General

PNIO Module I/O Mapping

Status

Information

Find Filter Show all Add FB for IO Channel... Go

Variable	Mapping	Channel	Address	Type	Current Value	Prepar
		16 word input	%IB10	ARRAY [0..31] OF BYTE	Only subelements up...	
		16 word input[0]	%IB10	BYTE	16#11	
		16 word input[1]	%IB11	BYTE	16#22	
		16 word input[2]	%IB12	BYTE	16#33	
		16 word input[3]	%IB13	BYTE	16#44	
		16 word input[4]	%IB14	BYTE	16#55	
		16 word input[5]	%IB15	BYTE	16#66	
		16 word input[6]	%IB16	BYTE	16#77	
		16 word input[7]	%IB17	BYTE	16#88	
		16 word input[8]	%IB18	BYTE	16#99	
		16 word input[9]	%IB19	BYTE	16#AA	
		16 word input[10]	%IB20	BYTE	16#00	
		16 word input[11]	%IB21	BYTE	16#00	

13.7.7 Error Diagnosis and Troubleshooting

13.7.7.1 LED Indicator Diagnosis

- **POWER LED**

The POWER LED indicates the status of the power supply for DVPPN02-SL.

LED status	Indication	How to correct
OFF	No power supply	1. Check if the connection between DVPPN02-SL and the PLC is proper. 2. Check if the power supply from the PLC is normal.
Green light ON	The power supply is normal.	--

- **RUN LED**

The RUN LED indicates whether the initialization of DVPPN02-SL is completed.

LED status	Indication	How to correct
OFF	Abnormal power supply or initialization failure	1. Check if the power supply from the PLC is normal. 2. If the problem persists after re-power on, contact your local authorized distributors.
Green light ON	Initialization success	--

- **SF LED**

The SF (System Fault) LED indicates the system error of DVPPN02-SL.

LED status	Indication	How to correct
OFF	The module is working normally.	--
Red light blinking rapidly (ON: 0.5 s; OFF: 0.5 s)	Data error in the latched area	If the problem persists after re-power on, contact your local authorized distributors.
Red light blinking slowly (ON: 2 s; OFF: 2 s)	GPIO initialization failure	If the problem persists after re-power on, contact your local authorized distributors.
Red light ON	The initialization is in progress	No correction. The indicator will automatically turn off after initialization is done.
	Low voltage	Check the voltage of the module is normal.

- **BF LED**

The BF (Bus Fault) LED indicates the connection status of DVPPN02-SL on the bus.

LED status	Indication	How to correct
OFF	The communication with the PN controller is normal.	--

Red light blinking	The network cable is connected properly, but the communication with PN-controller is abnormal.	Check the PN configuration and download the correct configuration to the PN-controller.
Red light ON	COM port not wired	Make sure that the cable and the COM port are well connected.

13.7.7.2 Status Register Diagnosis

- **Module Status Register**

The status register, Module Status, displays the system state of DVPPN02-SL.

Register value	Indication	How to correct
16#F010	DVPPN02-SL's GPIO initialization failure.	If the problem persists after re-power on, contact your local authorized distributors.
16#F011	Data in the latched area for DVPPN02-SL is NOT normal.	

- **DVPPLC Status Register**

The status register, DVPPLC Status, displays the state of the PLC.

Register value	Indication	How to correct
0	The PLC is in Stop.	--
1	The PLC is in Run.	--
Others	The PLC is in Error.	Refer to Troubleshooting for CPU Modules in the hardware and operation manual of DVP PLC.

14

Chapter 14 DVP-S Series Left-Side Positioning Module

Table of Contents

14.1 Specification

- **Electrical specification**

Module name	DVP02PU-SL
Number of inputs	High-speed inputs: 3; general inputs 5; high-speed outputs: 4 (2 axes)
Supply voltage	24 VDC (1.5 W) from PLC CPU
Connector type	Removable terminal block (terminal pitch: 3.5 mm)
Connect to DVP PLC CPU	Modules are connected to the left-side of the CPU and automatically numbered 100-107 starting from the nearest.
Weight	105 g

- **Functional specifications – Inputs**

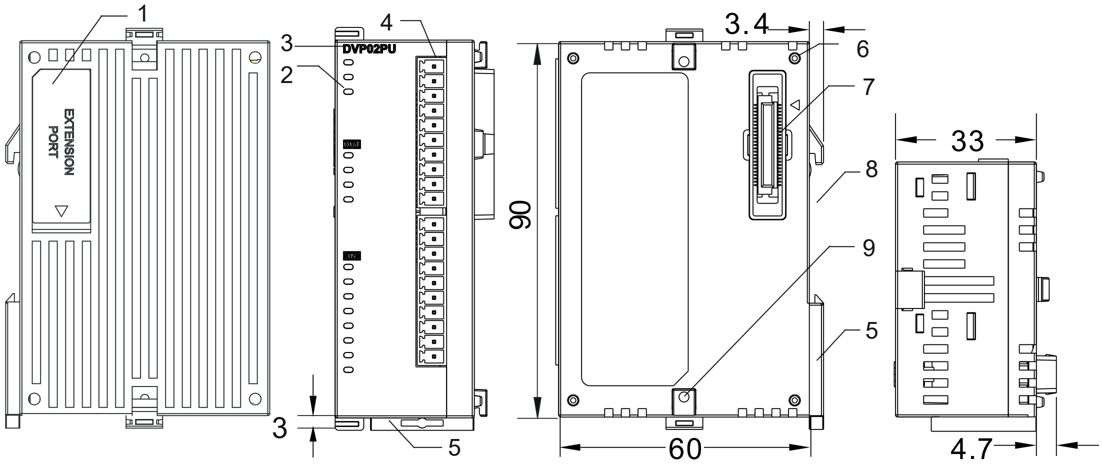
Item \ Model		High-speed Input	Normal Input
Number of inputs		3 (A+/A-, B+/B-, Z+/Z-)	5 (X0 to X4)
Connector type		Removable terminal block	
Input form		Differential input	Direct current (sinking or sourcing)
Input current		5 to 24 VDC, 5 to 15 mA	24 VDC, 5 mA
Action level	**OFF→ON**	>3 VDC	>15 VDC
	ON→OFF	<1.5 VDC	<5 VDC
Response time		<1.5 μs	<0.1 ms
Maximum input frequency		200 kHz (A+/A-, B+/B-) 20 kHz (Z+/Z-)	1 kHz
Input impedance		4.7 kΩ	
Input isolation		500 VAC	
Input display		Upon optocoupler activation, the input LED illuminates.	

- **Functional specifications – Output Points**

Item \ Model		High-speed Output
Number of outputs		Four (2 axes)
Connector type		Removable terminal block
Output form		differential output
Output voltage		5 VDC *1
Leakage current		< 10 μA
Minimum load		1 mA / 5 VDC
Maximum load	**Resistance**	20 mA
	Inductance	N/A
	Bulb	N/A
Maximum output frequency		200 kHz
Maximum Response time	**OFF→ON**	0.15 μs
	ON→OFF	0.15 μs
Output isolation		500 VAC

Note*1: Actual output: 4 VDC (No load) to 2.66 VDC (20 mA

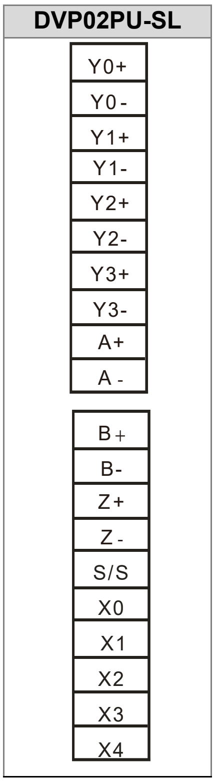
14.2 Module Profiles and Dimensions



Unit: mm

No.	Name	Description
1	Extension module port	Connects the extension module.
2	POWER LED indicator	Indicates the state of the power supply ON: the power is on OFF: no power
	Error LED indicator (Red)	Error state of the module OFF: the module is normal. Blinking (0.2 seconds ON/OFF): The module has encountered a fault or is experiencing a low voltage condition.
	Run LED indicator	Operating state of the module
	Input LED indicator	ON: Receives an input signal OFF: Receives no input signal
3	Model name	Model name of the module
4	Terminals	Input: Connect switches or sensors to the terminals via wiring. Output: Terminal connection for driving the load (contactor, solenoid valve, etc.).
5	DIN rail clip	Secures the module onto the DIN rail.
6	Extension module positioning holes	Positions the modules.
7	Extension module port	Connects the CPU or the extension module.
8	DIN rail slot (35 mm)	For mounting the module onto the DIN rail
9	Extension module clip	Secures the extension module.

14.3 Terminals



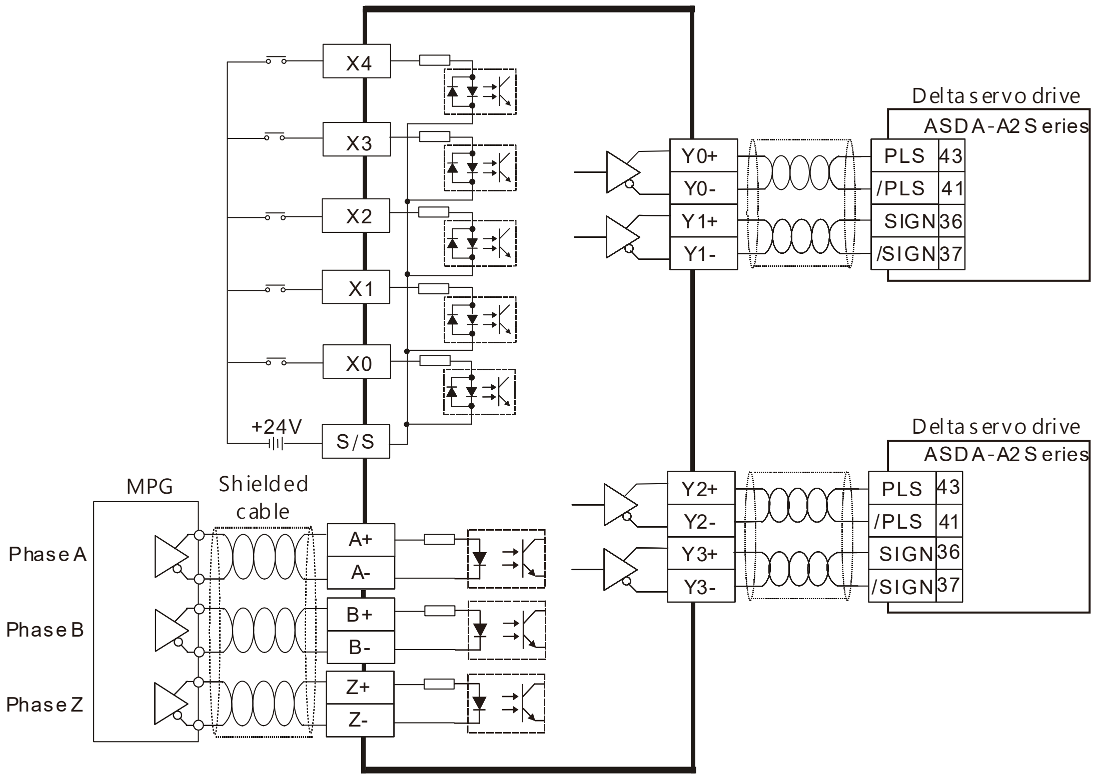
14.3.1 Installation Precautions

- The power supply device shall be compliance with UL 62368-1/UL60950 LPS (Limited Power Source), or UL61010-1 / UL61010-2-201 LE (Limited Energy).
- Le dispositif d'alimentation doit être conforme à la norme UL 62368-1/UL60950 LPS (Source d'alimentation limitée) ou UL61010-1 / UL61010-2-201 LE (Énergie limitée).
- Please be sure to use certified power supply with SELV output or certified power supply providing double insulation evaluated by UL60950, or UL61010-1 and UL61010-2-201 standards.
- Veuillez-vous assurer d'utiliser une alimentation électrique certifiée avec une sortie SELV (Safety Extra Low Voltage) ou une alimentation certifiée fournissant une double isolation évaluée selon les normes UL60950, ou UL61010-1 et UL61010-2-201.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection fournie par l'équipement pourrait être compromise.
- The installation that the safety of any system incorporating the equipment is the responsibility of the assembler of the system.
- L'installateur du système est responsable de la sécurité de tout système intégrant l'équipement.
- Clean by dry cloth only.
- Nettoyer uniquement avec un chiffon sec.

14.4 Control Register

Since this module does NOT use control registers to read/write data, you need to use API to perform data reading and writing. You can use API to execute DVP positioning module features, including setting output control parameters of PU module (API1402 PUCONF), reading PU module output state (API1403 PUSTAT), PU module output pulse without acceleration (API1404 DPUPLS), Relative position output of PU module with acceleration and deceleration (API1405 DPUDRI), Absolute addressing output of PU module with acceleration and deceleration (API1406 DPUDRA), PU module homing (API 1407 DPUZRN), PU module jog output (API1408 DPUJOG), PU module MPG output (API1409 DPUMPG), and High-speed counter function of PU module (API1410 DPUCNT). Refer to API14 Module Instruction in the DVP-ES3/EX3/SV3/SX3 Programming Manual for more information on operation.

14.5 Wiring



Note:

Refer to Chapter 6 Applied Instruction (Module Instructions API14xx) in DVP-ES3/EX3/SV3/SX3 Series Programming Manual and Delta Servo Drive Manual for more details on output modes.

14.6 Troubleshooting

When an error occurs in PU modules, you can check the status code to identify the causes, but the error LED indicator will not be illuminated. Please refer to special extension module exchange function for more information. (SM228, you can find more detailed information in section 2.2.16 ‘Additional Remarks on SM/SR’ in the DVP-ES3/EX3/SV3/SX3 Series Programming Manual).

For detailed operation and application examples regarding the API instructions, please refer to ‘API14 Module Instructions’ in DVP-ES3/EX3/SV3/SX3 Series Programming Manual.

- **Error indicator and troubleshooting description**

<table>
<tr><th>RUN LED</th><th>ERROR LED</th><th>Description</th><th>Solution</th></tr>
<tr><td>OFF</td><td>ON</td><td>The power supply from PLC CPU to the module is abnormal.</td><td>1. Check if the power supply of PLC CPU is normal.
2. Check if the connection between PLC CPU and the module is well-connected.
3. If the above points are TRUE, change your module.</td></tr>
<tr><td>OFF</td><td>Blinking
(2-second ON, 2-second OFF)</td><td>The previous firmware update is abnormal.</td><td>The previous firmware update failed. Contact your local authorized distributors for another firmware update for the module.</td></tr>
<tr><td>Unchanged</td><td>Blinking
The LED is lit for 0.5 seconds and then off for 3 seconds.</td><td>The positive limit is triggered.</td><td rowspan="2">1. Check if the positive and negative limits are set.
2. Check if the positive limit set in the software is triggered.
3. Check if the negative limit set in the hardware is trigger.
4. Move towards the negative direction, away from the limit.</td></tr>
<tr><td>Unchanged</td><td>Blinking
The LED blinks two times (0.5-second ON, 0.5-second OFF per blink), and then remains off for 3 seconds.</td><td>The negative limit is triggered.</td></tr>
<tr><td>Unchanged</td><td>Blinking
The LED blinks three times (0.5-second ON, 0.5-second OFF per blink), and then remains off for 3 seconds.</td><td>Current position overflow</td><td>Use PUSTAT instruction to clear the current position. Incorrect position setting may lead to incorrect movement.</td></tr>
</table>

15

Chapter 15 DVP-S Series Remote I/O Communication Module

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15.1 RTU-485 Module

15.1.1 Introduction

- The RTU-485 module provides Modbus remote I/O communication, allowing Delta PLCs to control DVP Slim series I/O modules remotely.
- The RTU-485 module is a Modbus slave device, designed for interoperability with standard Modbus master units.

15.1.1.1 Features

- Auto-detects I/O modules
- The maximum number of special input/output modules that can be connected is 8, and the maximum expansion for digital module points is 128 input points and 128 output points.

15.1.1.2 Specifications

- **RTU-485 Connector**

Item	Specification
Connector	Removable connector (3 Pin)
Communication protocol	RS-485
Transmission cable	2-wire twisted shielded cable

- **Communication**

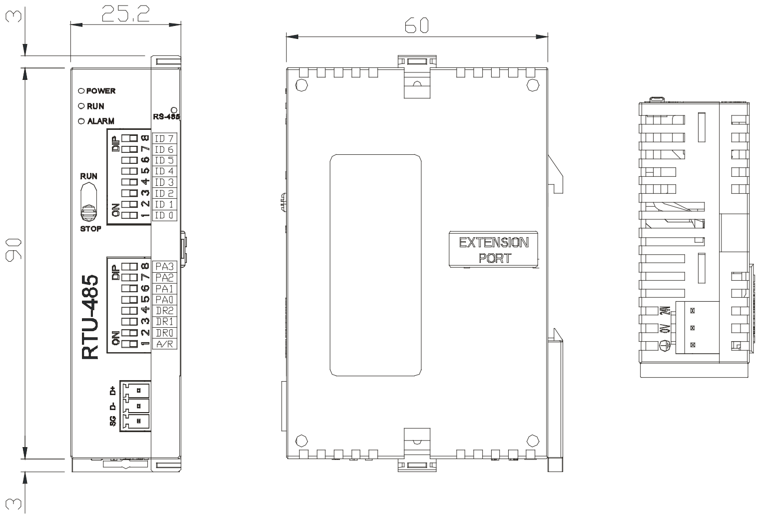
<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Communication address range</td><td colspan="5">Hexadecimal: 1 to F0 (decimal : 1 to 240)</td></tr>
<tr><td>Serial transmission rate</td><td colspan="5">1,200; 2,400; 4,800; 9,600; 19,200; 38,400; 57,600; 115,200 (unit: bps)</td></tr>
<tr><td rowspan="4">Communication format</td><td rowspan="3">ASCII</td><td>7, E, 1</td><td>7, O, 2</td><td colspan="2">8, O, 1</td></tr>
<tr><td>7, O, 1</td><td>7, N, 2</td><td colspan="2">8, N, 1</td></tr>
<tr><td>7, E, 2</td><td>8, E, 1</td><td colspan="2">8, N, 2</td></tr>
<tr><td>RTU</td><td>8, E, 1</td><td>8, O, 1</td><td>8, N, 1</td><td>8, N, 2</td></tr>
</table>

- **Electrical specification**

Item	Specification
Power supply	24 VDC (-15% to 20%) (with DC input polarity reverse protection)
Insulation voltage	500 VAC
Power consumption	1.5 W
Weight	70 g

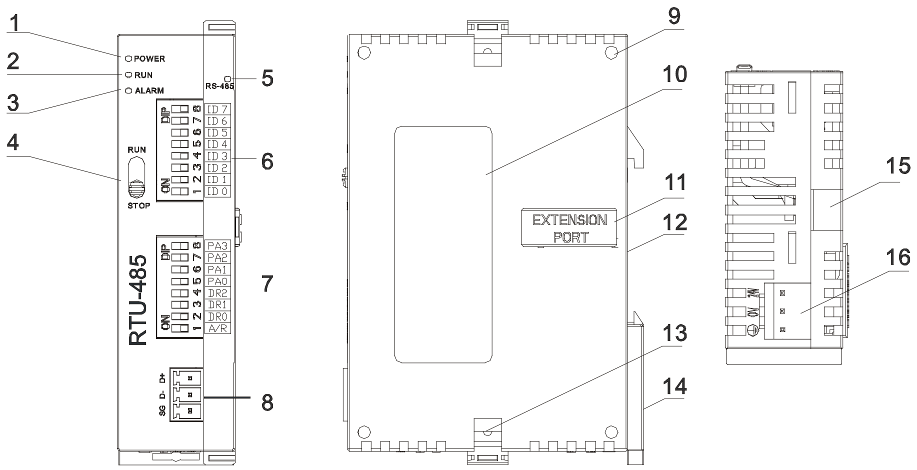
15.1.2 Dimensions and Parts

- **Dimensions**



Unit: mm

- **Parts**

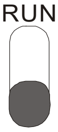


No.	Name	Description
1	POWER LED indicator (Green)	Indicates the power status of the module ON: The module is supplied with power. OFF: Not supplied with power.
2	RUN indicator (Green)	ON: RTU-485 is in RUN mode. OFF: RTU-485 is in STOP mode.
3	ALARM indicator (Red)	ON: RTU-485 transmission error OFF: Low operating voltage
4	RUN/STOP switch	RUN: Start user program execution STOP: Stop user program execution
5	Communication indicator (Red)	OFF: RTU-485 is not in communication with the master device. Blinking: RTU-485 is in normal communication with the master device.
6	Address setting switch	RTU-485 communication address setting

No.	Name	Description
7	Communication format switch	Communication format setting
8	RS-485 communication port	For RS-485 communication
9	I/O module alignment holes	For module-to-module alignment
10	Nameplate	Label plate
11	I/O module port	For connecting I/O modules
12	DIN rail slot (35 mm)	For mounting the DIN rail
13	I/O module clip	For securing I/O modules
14	DIN rail clip	For securing the device itself
15	I/O mounting slots	For mounting I/O modules
16	Power supply input	For supplying power to I/O modules

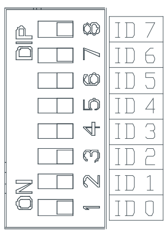
15.1.3 Arrangement of Terminals

15.1.3.1 RUN/STOP Switch

	Mode Setting	Description
RUN  STOP	RUN	The I/O module is in RUN mode.
	RUN→STOP	1. The I/O module's state is changed from RUN to STOP. 2. All output points of the digital I/O module are set to OFF
	STOP	1. The special I/O module is in STOP mode. 2. Special I/O modules cannot be controlled by communication. 3. Digital I/O modules cannot be controlled by communication.
	STOP→RUN	1. The special input/output module’s state is changed from STOP to RUN. 2. Redetects the DIO point count and the quantity of special I/O modules.

15.1.3.2 Address Setting Switch

This is for setting the communication address for the RTU-485 module. Setting range: H'01 to H'F0 (decimal: 1 to 240).

	Setting	Description
	H’01 to H’F0	Valid communication addresses; ID0 to ID7 are defined sequentially as 2^0, 2^1, 2^2, to 2^7.
	H’00, H’F1 to H’FF	Invalid communication addresses.

Example: Setting the RTU-485 address to 26 (decimal) requires ID4, ID3, and ID1 switches set to ON.

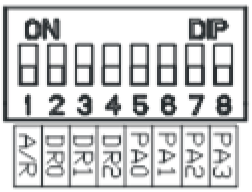
Important:

- Set the communication address with the power off. Power on the RTU-485 module only after setting the address.
- Changes to the communication address during operation are ignored.
- Adjust the rotary switch carefully with a flathead screwdriver to avoid scratches.

15.1.3.3 Communication Setting Switch

The communication setting switches provide users with the following functions:

- Setting the communication format (PA0 to PA3 and A/R)
- Setting the seria transmission rate (DR0 to DR2)



Switch					Communication format
PA3	PA2	PA1	PA0	A/R	
OFF	OFF	OFF	OFF	ON	7, E, 1, ASCII
OFF	OFF	OFF	ON	ON	7, O, 1, ASCII
OFF	OFF	ON	OFF	ON	7, E, 2, ASCII
OFF	OFF	ON	ON	ON	7, O, 2, ASCII
OFF	ON	OFF	OFF	ON	7, N, 2, ASCII
OFF	ON	OFF	ON	ON	8, E, 1, ASCII
OFF	ON	ON	OFF	ON	8, O, 1, ASCII
OFF	ON	ON	ON	ON	8, N, 1, ASCII
ON	OFF	OFF	OFF	ON	8, N, 2, ASCII
OFF	ON	OFF	ON	OFF	8, E, 1, RTU
OFF	ON	ON	OFF	OFF	8, O, 1, RTU
OFF	ON	ON	ON	OFF	8, N, 1, RTU
ON	OFF	OFF	OFF	OFF	8, N, 2, RTU

Switch			Serial transmission rate
DR2	DR1	DR0	
OFF	OFF	OFF	1,200 bps
OFF	OFF	ON	2,400 bps
OFF	ON	OFF	4,800 bps
OFF	ON	ON	9,600 bps
ON	OFF	OFF	19,200 bps
ON	OFF	ON	38,400 bps
ON	ON	OFF	57,600 bps
ON	ON	ON	115,200 bps

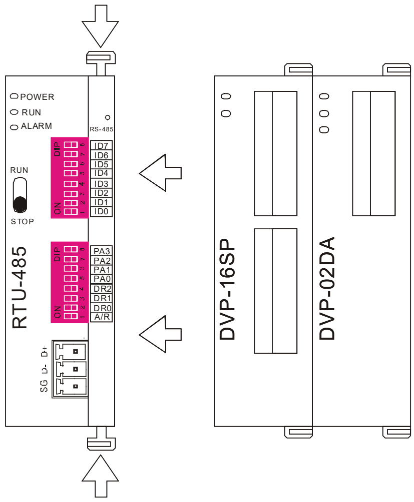
Important:

- Set the communication address with the power off. Power on the RTU-485 module only after setting the address.
- Changes to the communication address during operation are ignored.
- Adjust the rotary switch carefully with a flathead screwdriver to avoid scratches.

15.1.4 Installation

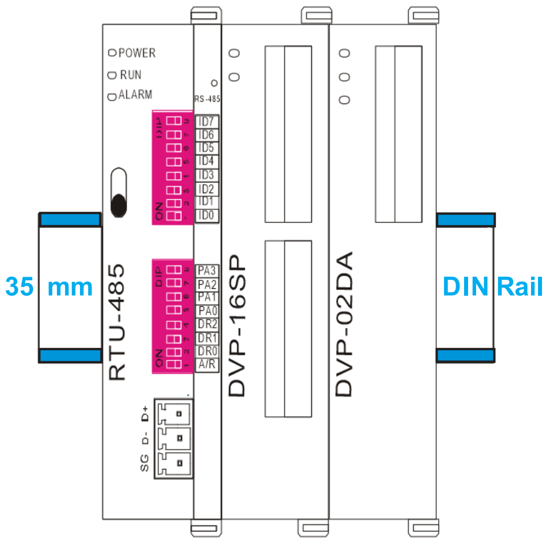
1. Connecting the RTU-485 with the DVP-S Series I/O Modules

- Open the mounting clips on the upper and lower sides of the RTU-485's right side. Then, align the I/O module with the connection port in the direction of the left arrow as shown in the diagram, and connect them.
- Press the mounting clips on the upper and lower sides of the RTU-485 towards the module to secure the I/O modules and ensure good contact.



2. Mounting the RTU-485 and DVP-S Series I/O Modules on the DIN rail

- Use a 35 mm standard DIN rail.
- Open the DIN rail mounting clips of the RTU-485 and its I/O modules. Then, mount the RTU-485 and the I/O modules onto the DIN rail.
- Press the DIN rail mounting clips of the RTU-485 and its I/O modules towards the modules to secure them onto the DIN rail, as shown in the diagram below.



15.1.5 Addresses of Functional Areas

15.1.5.1 Addresses of Functional Areas in Digital I/O Module

Communication address	Devices	Attribute	Data type	Length
H’0400 to H’047F	X000 to X177 (Octal)	R	bit	128 points
H’0500 to H’057F	Y000 to Y177 (Octal)	R/W	bit	128 points

15.1.5.2 Addresses of Functional Areas in Special I/O Module

<table>
<tr><th>Communication address</th><th>Control register</th><th>Attribute</th><th>Data type</th><th>Length</th></tr>
<tr><td>H’1600 to H’1630</td><td>1st special I/O module: CR0 to CR48</td><td rowspan="8">Refer to the CR attributes of the applicable special I/O modules.</td><td>word</td><td>49</td></tr>
<tr><td>H’1640 to H’1670</td><td>2nd special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
<tr><td>H’1680 to H’16B0</td><td>3rd special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
<tr><td>H’16C0 to H’16F0</td><td>4th special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
<tr><td>H’1700 to H’1730</td><td>5th special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
<tr><td>H’1740 to H’1770</td><td>6th special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
<tr><td>H’1780 to H’17B0</td><td>7th special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
<tr><td>H’17C0 to H’17F0</td><td>8th special I/O module: CR0 to CR48</td><td>word</td><td>49</td></tr>
</table>

Note: The RTU-485 can connect up to 8 special I/O modules. The module closest to the right side of the RTU-485 is considered the first module in the sequence, the next one is the second module, and so on.

15.1.5.3 Addresses of Special Functional Areas

Communication address	Attribute	Content	Explanation
H’0000	R	Model name	Set up by the system. Model code of RTU-485 = H’0200.
H’0001	R	Firmware version	The current firmware version is displayed in hexadecimal, e.g. V0.1 is indicated as H’0010.
H’0002	R	Firmware issue date	The issue data of the firmware is displayed in hexadecimal, e.g. H’1FD0 = K8150 indicates that the firmware is issued on the morning of August 15.
H’0003	R/W	RUN/STOP RTU-485	H’0003 = K1, RTU-485: RUN; H’0003 = K0, RTU-485: STOP.
H’0004	R	Communication format	Display the communication format of RTU-485.
H’0005	R	Baud rate	Display the transmission rate of RTU-485.
H’0006	R	Communication address	Display the communication address of RTU-485.
H’0007	R	Number of DI/DO points	High byte stores the number of input points. Low byte stores the number of output points.

Communication address	Attribute	Content	Explanation
H’0008	R	Error code	The current error log value. Refer to section 15.1.5.4 for the error code descriptions.
H’0009	R	Error code log	The number of errors; Range: 0 to 32
H’0017	R	Number of special I/O modules	Number of special I/O modules detected by RTU-485.
H’0018	R	Model code of the 1st special I/O module	The model code of the 1st special I/O module connected to RTU-485.
H’0019	R	Model code of the 2nd special I/O module	The model code of the 2nd special I/O module connected to RTU-485.
H’001A	R	Model code of the 3rd special I/O module	The model code of the 3rd special I/O module connected to RTU-485.
H’001B	R	Model code of the 4th special I/O module	The model code of the 4th special I/O module connected to RTU-485.
H’001C	R	Model code of the 5th special I/O module	The model code of the 5th special I/O module connected to RTU-485.
H’001D	R	Model code of the 6th special I/O module	The model code of the 6th special I/O module connected to RTU-485.
H’001E	R	Model code of the 7th special I/O module	The model code of the 7th special I/O module connected to RTU-485.
H’001F	R	Model code of the 8th special I/O module	The model code of the 8th special I/O module connected to RTU-485.

15.1.5.4 Error Codes

Code	Indication	Explanation
0001	Incorrect function code	RTU-485 does not support this function code.
0002	Incorrect operand address	The device address range is exceeded, or a data writing error occurs during reading/writing a device.
0003	Incorrect data	The data read/written exceed the maximum length.
0004	RTU-485 STOP	RTU-485 is in STOP mode.
000B	Incorrect communication format	The length of data received by RTU-485 is too short.
000C	Incorrect communication format	The length of data received by RTU-485 is too long.

15.1.6 Function Codes RTU-485 Module Supports

RTU-485 complies with the standard Modbus protocol, supporting 7 function codes, which are H’01, H’02, H’03, H’05, H’06, H’0F and H’10. Refer to the standard Modbus protocol for the specific data format of each function code.

Code	Function	Data type	Applicable address
H’01	Read the output status of bit devices.	bit	DO area: H’0500 to H’057F
H’02	Read the input status of bit devices	bit	DI area: H’0400 to H’047F
H’03	Read registers	word	Area for special functions: H’0000 to H’001F
			CRs for the 1st special I/O module: H’1600 to H’1630
			CRs for the 2nd special I/O module: H’1640 to H’1670
			CRs for the 3rd special I/O module: H’1680 to H’16B0
			CRs for the 4th special I/O module: H’16C0 to H’16F0
			CRs for the 5th special I/O module: H’1700 to H’1730
			CRs for the 6th special I/O module: H’1740 to H’1670
			CRs for the 7th special I/O module: H’1780 to H’16B0
			CRs for the 8th special I/O module: H’17C0 to H’17F0
H’05	Write a single value to a bit device	bit	DO area: H’0500 to H’057F
H’06	Write a single value to a register	word	RTU-485 RUN/STOP mode: H’0003
			Applicable to CRs with R/W attribute in the 1st to 8th special I/O modules.
H’0F	Write values to multiple bit devices	bit	DO area: H’0500 to H’057F
H’10	Write values to multiple registers	word	Applicable to CRs with R/W attribute in the 1st to 8th special I/O modules.

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15.1.6.1 Function Code 01

Function code 01 allows you to read the status of coils.

Example 1: In Modbus ASCII mode, read the status of Y0 to Y5 of RTU-485 module (slave station 1).
A master sends “: 01 01 0500 0006 F3 CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“1”	31H	
“0”	30H	High byte of the starting address to be read
“5”	35H	
“0”	30H	Low byte of the starting address to be read
“0”	30H	
“0”	30H	High byte of the number of bit devices to be read
“0”	30H	
“0”	30H	Low byte of the number of bit devices to be read
“6”	36H	
“F”	46H	LRC checksum
“3”	33H	
CR	0DH	End character
LF	0AH	

A slave replies with “: 01 01 01 35 C8 CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“1”	31H	
“0”	30H	Number of bit devices to read (expressed in bytes, where 1 byte = 8 bits). If the number of bits to read is not a multiple of 8, it is rounded up to the nearest byte.
“1”	31H	
“3”	33H	The data content (status of Y0 to Y5): 35H indicates Y0, Y2, Y4, and Y5 are ON; Y1 and Y3 are OFF.
“5”	35H	
“C”	43H	LRC checksum
“8”	38H	
CR	0DH	End character
LF	0AH	

Example 2: In Modbus RTU mode, reading the status of Y0-Y5 on RTU-485 module (slave station 1).
A master sends 01 01 0500 0006 BCC4.

Message (sent)	Description
01H	Slave address
01H	Function code
05H	High byte of the starting address to be read
00H	Low byte of the starting address to be read
00H	High byte of the number of bit devices to be read
06H	Low byte of the number of bit devices to be read
BCH	Low byte of the CRC checksum
C4H	High byte of the CRC checksum

A slave replies with 01 01 01 35 919F.

Message (replied)	Description
01H	Slave address
01H	Function code
01H	Number of bit devices to read (expressed in bytes, where 1 byte = 8 bits). If the number of bits to read is not a multiple of 8, it is rounded up to the nearest byte.
35H	The data content (status of Y0 to Y5): 35H indicates Y0, Y2, Y4, and Y5 are ON; Y1 and Y3 are OFF.
91H	Low byte of the CRC checksum
9FH	High byte of the CRC checksum

15.1.6.2 Function Code 02

Function code 02 allows you to read the status of input devices.

Example 1: In Modbus ASCII mode, read the status of X2 to X34 of RTU-485 module (slave station 1).
A master sends ": 01 02 0402 001B DC CR LF".

Message (sent)		Description
ASCII	Hex.	
" : "	3AH	Start character
"0"	30H	Slave address
"1"	31H	
"0"	30H	Function code
"2"	32H	
"0"	30H	High byte of the starting address to be read
"4"	34H	
"0"	30H	Low byte of the starting address to be read
"2"	32H	
"0"	30H	High byte of the number of bit devices to be read
"0"	30H	
"1"	31H	Low byte of the number of bit devices to be read
"B"	42H	
"D"	44H	LRC checksum
"C"	43H	
CR	0DH	End character
LF	0AH	

A slave replies with ": 01 02 04 CD 55 AA 07 26 CR LF".

Message (replied)		Description
" : "	3AH	Start character
"0"	30H	Slave address
"1"	31H	
"0"	30H	Function code
"2"	32H	
"0"	30H	Number of bit devices to read (expressed in bytes, where 1 byte = 8 bits). If the number of bits to read is not a multiple of 8, it is rounded up to the nearest byte.
"4"	34H	
"C"	43H	The data content (status of X2 to X11): CDH indicates X2, X4, X5, X10 and X11 are ON; X3, X6 and X7 are OFF.
"D"	44H	
"5"	35H	The data content (status of X12 to X21): 55H indicates X12, X14, X16, and X20 are ON; X13,

Message (replied)		Description
“5”	35H	X15, X17 and X21 are OFF.
“A”	41H	The data content (status of X22 to X31): AAH indicates X23, X25, X27, and X31 are ON; X22, X24, X26 and X30 are OFF.
“A”	41H	
“0”	30H	The data content (status of X32 to X34): 07H indicates X32, X33, and X34 are ON.
“7”	37H	
“2”	32H	LRC checksum
“6”	36H	
CR	0DH	End character
LF	0AH	

Example 2: In Modbus RTU mode, reading the status of X2 to X34 on RTU-485 module (slave station 1).
A master sends 01 02 0402 001B 98F1.

Message (sent)	Description
01H	Slave address
02H	Function code
04H	High byte of the starting address to be read
02H	Low byte of the starting address to be read
00H	High byte of the number of bit devices to be read
1BH	Low byte of the number of bit devices to be read
98H	Low byte of the CRC checksum
F1H	High byte of the CRC checksum

A slave replies with 01 02 04 CD 55 AA 07 EA3C.

Message (replied)	Description
01H	Slave address
02H	Function code
04H	Number of byte devices to read (expressed in bytes, where 1 byte = 8 bits). If the number of bytes to read is not a multiple of 8, it is rounded up to the nearest byte.
CDH	The data content (status of X2 to X11): CDH indicates X2, X4, X5, X10 and X11 are ON; X3, X6 and X7 are OFF.
55H	The data content (status of X12 to X21): 55H indicates X12, X14, X16, and X20 are ON; X13, X15, X17 and X21 are OFF.
AAH	The data content (status of X22 to X31): AAH indicates X23, X25, X27, and X31 are ON; X22, X24, X26 and X30 are OFF.
07H	The data content (status of X32 to X34): 07H indicates X32, X33, and X34 are ON.
EAH	Low byte of the CRC checksum
3CH	High byte of the CRC checksum

15.1.6.3 Function Code 03

Function code 03 allows you to read the content of retainable registers (word devices).

Example 1: In Modbus ASCII mode, read the content of RTU-485 address H'0000 (RTU-485 device code) of slave station 1.

A master sends “: 01 03 0000 0001 FB CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“3”	33H	
“0”	30H	High byte of the starting address to be read
“0”	30H	
“0”	30H	Low byte of the starting address to be read
“0”	30H	
“0”	30H	High byte of the number of word devices to be read
“0”	30H	
“0”	30H	Low byte of the number of word devices to be read
“1”	31H	
“F”	46H	LRC checksum
“B”	42H	
CR	0DH	End character
LF	0AH	

A slave replies with “: 01 03 02 0200 F6 CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“3”	33H	
“0”	30H	Number of word devices to read (expressed in bytes, where 1 word = 2 bytes).
“2”	34H	
“0”	30H	The data content (the content of RTU-485 address H'0000): RTU-485 device code is H’0200.
“2”	32H	
“0”	30H	
“0”	30H	
“F”	46H	LRC checksum
“8”	38H	
CR	0DH	End character
LF	0AH	

Example 2: In Modbus RTU mode, reading the content of RTU-485 address H'0000 (RTU-485 device code) of slave station 1.

A master sends 01 03 0000 0001 840A.

Message (sent)	Description
01H	Slave address
03H	Function code
00H	High byte of the starting address to be read
00H	Low byte of the starting address to be read
00H	High byte of the number of word devices to be read
01H	Low byte of the number of word devices to be read
84H	Low byte of the CRC checksum
0AH	High byte of the CRC checksum

A slave replies with 01 03 02 0200 B924.

Message (replied)	Description
01H	Slave address
03H	Function code
02H	Number of word devices to read (expressed in bytes, where 1 word = 2 bytes).
02H	The data content (the content of RTU-485 address H'0000): RTU-485 device code is H’0200.
00H	
B9H	Low byte of the CRC checksum
24H	High byte of the CRC checksum

Example 3: In Modbus RTU mode, reading the contents of RTU-485 addresses H’1600 to H’1602 of slave station 1.

A master sends “: 01 03 1600 0003 E3 CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“3”	33H	
“1”	31H	High byte of the starting address to be read
“6”	36H	
“0”	30H	Low byte of the starting address to be read
“0”	30H	
“0”	30H	High byte of the number of word devices to be read
“0”	30H	
“0”	30H	Low byte of the number of word devices to be read
“3”	33H	
“E”	45H	LRC checksum
“3”	33H	
CR	0DH	End character
LF	0AH	

A slave replies with “: 01 03 06 0001 0002 0003 F0 CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“3”	33H	
“0”	30H	Number of word devices to read (expressed in bytes, where 1 word = 2 bytes).
“6”	36H	
“0”	30H	The data content (the content of RTU-485 address H'1600): H’0001.
“0”	30H	
“0”	30H	
“1”	31H	
“0”	30H	The data content (the content of RTU-485 address H'1601): H’0002.
“0”	30H	
“0”	30H	
“2”	32H	
“0”	30H	The data content (the content of RTU-485 address H'1602): H’0003.
“0”	30H	
“0”	30H	
“3”	33H	
“F”	46H	LRC checksum
“0”	30H	
CR	0DH	End character
LF	0AH	

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Example 4: In Modbus RTU mode, reading the content of RTU-485 addresses H’1600 to H’1602 of slave station 1.

A master sends 01 03 1600 0003 0183.

Message (sent)	Description
01H	Slave address
03H	Function code
16H	High byte of the starting address to be read
00H	Low byte of the starting address to be read
00H	High byte of the number of word devices to be read
03H	Low byte of the number of word devices to be read
01H	Low byte of the CRC checksum
83H	High byte of the CRC checksum

A slave replies with 01 03 06 0001 0002 0003 FD74.

Message (replied)	Description
01H	Slave address
03H	Function code
06H	Number of word devices to read (expressed in bytes, where 1 word = 2 bytes).
00H	The data content (the content of RTU-485 address H'1600): H’0001.
01H	
00H	The data content (the content of RTU-485 address H'1601): H’0002.
02H	
00H	The data content (the content of RTU-485 address H'1602): H’0003.
03H	
FDH	Low byte of the CRC checksum
74H	High byte of the CRC checksum

15.1.6.4 Function Code 05

Function code 05 allows you to write a single value to a bit device.

Example 1: In Modbus ASCII mode, set the Y2 of RTU-485 module (slave station 1) to ON.

A master sends “: 01 05 0502 FF00 F4 CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“5”	35H	
“0”	30H	High byte of the address to be written
“5”	35H	
“0”	30H	Low byte of the address to be written
“2”	32H	
“F”	46H	The written data is H’FF00.
“F”	46H	
“0”	30H	
“0”	30H	
“F”	46H	LRC checksum
“4”	34H	
CR	0DH	End character
LF	0AH	

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A slave replies with “: 01 05 0502 FF00 F4 CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“5”	35H	
“0”	30H	High byte of the address to be written
“5”	35H	
“0”	30H	Low byte of the address to be written
“2”	32H	
“F”	46H	The written data is H’FF00.
“F”	46H	
“0”	30H	
“0”	30H	
“F”	46H	LRC checksum
“4”	34H	
CR	0DH	End character
LF	0AH	

15.1.6.5 Function Code 06

Function code 06 allows you to write a single value to a register (word device).

Example 1: In Modbus ASCII mode, set the content of RTU-485 address H'1601 of slave station 1 to K4.

A master sends “: 01 06 1601 0004 DE CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“6”	36H	
“1”	31H	High byte of the address to be written
“6”	36H	
“0”	30H	Low byte of the address to be written
“1”	31H	
“0”	30H	The written data is H’0004.
“0”	30H	
“0”	30H	
“4”	34H	
“D”	44H	LRC checksum
“E”	45H	
CR	0DH	End character
LF	0AH	

A slave replies with “: 01 06 1601 0004 DE CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“6”	36H	
“1”	31H	High byte of the address to be written
“6”	36H	
“0”	30H	Low byte of the address to be written
“1”	31H	

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Message (replied)		Description
ASCII	Hex.	
"0"	30H	The written data is H'0004.
"0"	30H	
"0"	30H	
"4"	34H	
"D"	44H	LRC checksum
"E"	45H	
CR	0DH	End character
LF	0AH	

Example 2: In Modbus RTU mode, set the content of RTU-485 address H'1601 of slave station 1 to K4.

A master sends 01 06 1601 0004 DD81.

Message (sent)	Description
01H	Slave address
06H	Function code
16H	High byte of the address to be written
01H	Low byte of the address to be written
00H	The written data is H'0004.
04H	
DDH	Low byte of the CRC checksum
81H	High byte of the CRC checksum

A slave replies with 01 06 1601 0004 DD81.

Message (replied)	Description
01H	Slave address
06H	Function code
16H	High byte of the address to be written
01H	Low byte of the address to be written
00H	The written data is H'0004.
04H	
DDH	Low byte of the CRC checksum
81H	High byte of the CRC checksum

15.1.6.6 Function Code 15

Function code 15 allows you to write data to multiple bit devices.

Example 1: In Modbus ASCII mode, set the status of Y0 to Y17 of RTU-485 module (slave station 1).

Device	Y17	Y16	Y15	Y14	Y13	Y12	Y11	Y10	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	ON	ON	OFF	ON

A master sends “: 01 0F 0500 000A 02 CD01 11 CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“F”	46H	
“0”	30H	High byte of the starting address of the bit devices to be written
“5”	35H	
“0”	30H	Low byte of the starting address of the bit devices to be written
“0”	30H	
“0”	30H	High byte of the number of bit devices to be written
“0”	30H	
“0”	30H	Low byte of the number of bit devices to be written
“A”	41H	
“0”	30H	Number of bit devices to write (expressed in bytes, where 1 byte = 8 bits). If the number of bits to write is not a multiple of 8, it is rounded up to the nearest byte.
“2”	32H	
“C”	43H	The data content (status of Y0 to Y7) to be written: CDH indicates Y0, Y2, Y3, Y6, and Y7 are ON; Y1, Y4, and Y5 are OFF.
“D”	44H	
“0”	30H	The data content (status of Y10 to Y11) to be written: 01H indicates Y10 is ON; Y11 is OFF.
“1”	31H	
“1”	31H	LRC checksum
“1”	31H	
CR	0DH	End character
LF	0AH	

A slave replies with “: 01 0F 0500 000A E1 CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“0”	30H	Function code
“F”	46H	
“0”	30H	High byte of the starting address of the bit devices to be written
“5”	35H	
“0”	30H	Low byte of the starting address of the bit devices to be written
“0”	30H	
“0”	30H	High byte of the number of bit devices to be written
“0”	30H	
“0”	30H	Low byte of the number of bit devices to be written
“A”	41H	
“E”	45H	LRC checksum
“1”	31H	
CR	0DH	End character
LF	0AH	

Example 2: In Modbus RTU mode, set the status of Y0 to Y17 of RTU-485 module (slave station 1).

Device	Y17	Y16	Y15	Y14	Y13	Y12	Y11	Y10	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	ON	ON	OFF	ON

A master sends 01 0F 0500 000A 02 CD 01 2568.

Message (sent)	Description
01H	Slave address
0FH	Function code
05H	High byte of the starting address to be written
00H	Low byte of the starting address to be written
00H	High byte of the number of bit devices to be written
0AH	Low byte of the number of bit devices to be written
02H	Number of bit devices to write (expressed in bytes, where 1 byte = 8 bits). If the number of bits to write is not a multiple of 8, it is rounded up to the nearest byte.
CDH	The data content (status of Y0 to Y7) to be written: CDH indicates Y0, Y2, Y3, Y6, and Y7 are ON; Y1, Y4, and Y5 are OFF.

Message (sent)	Description
01H	The data content (status of Y10 to Y11) to be written: 01H indicates Y10 is ON; Y11 is OFF.
25H	Low byte of the CRC checksum
68H	High byte of the CRC checksum

A slave replies with 01 0F 05 00 00 0A D500.

Message (replied)	Description
01H	Slave address
0FH	Function code
05H	High byte of the starting address to be written
00H	Low byte of the starting address to be written
00H	High byte of the number of bit devices to be written
0AH	Low byte of the number of bit devices to be written
D5H	Low byte of the CRC checksum
00H	High byte of the CRC checksum

15.1.6.7 Function Code 16

Function code 16 allows you to write data to multiple word devices.

Example 1: In Modbus ASCII mode, set the content of RTU-485 address H'1618 of slave station 1 to K500 (01F4H), H’1619 to K1000 (03E8H, and H’161A to K2000 (07D0H).

A master sends “: 01 10 1618 0003 06 01F4 03E8 07D0 01 CR LF”.

Message (sent)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“1”	31H	Function code
“0”	30H	
“1”	31H	High byte of the starting address of the word devices to be written.
“6”	36H	
“1”	31H	Low byte of the starting address of the word devices to be written.
“8”	38H	
“0”	30H	High byte of the number of word devices to be written.
“0”	30H	
“0”	30H	Low byte of the number of word devices to be written.
“3”	33H	
“0”	30H	Number of word devices to write (expressed in bytes, where 1 word = 2 bytes).
“6”	36H	
“0”	30H	The first written data is H’01F4.
“1”	31H	
“F”	46H	
“4”	34H	
“0”	30H	The second written data is H’03E8.
“3”	33H	
“E”	45H	
“8”	38H	
“0”	30H	The third written data is H’07D0.
“7”	37H	
“D”	44H	
“0”	30H	
“0”	30H	LRC checksum
“1”	31H	
CR	0DH	End character
LF	0AH	

A slave replies with “: 01 10 1618 0003 BE CR LF”.

Message (replied)		Description
ASCII	Hex.	
“ : ”	3AH	Start character
“0”	30H	Slave address
“1”	31H	
“1”	31H	Function code
“0”	30H	
“1”	31H	High byte of the starting address of the word devices to be written.
“6”	36H	
“1”	31H	Low byte of the starting address of the word devices to be written.
“8”	38H	

Message (replied)		Description
ASCII	Hex.	
"0"	30H	High byte of the number of word devices to be written.
"0"	30H	
"0"	30H	Low byte of the number of word devices to be written.
"3"	33H	
"B"	42H	LRC checksum
"E"	45H	
CR	0DH	End character
LF	0AH	

Example 2: In Modbus RTU mode, set the content of RTU-485 address H'1618 of slave station 1 to K500 (01F4H), H'1619 to K1000 (03E8H, and H'161A to K2000 (07D0H).

A master sends 01 10 1618 0003 06 01F4 03E8 07D0 1F6F.

Message (sent)	Description
01H	Slave address
10H	Function code
16H	High byte of the starting address of the word devices to be written.
18H	Low byte of the starting address of the word devices to be written.
00H	High byte of the number of word devices to be written.
03H	Low byte of the number of word devices to be written.
06H	Number of word devices to write (expressed in bytes, where 1 word = 2 bytes).
01H	The first written data is H'01F4.
F4H	
03H	The second written data is H'03E8.
E8H	
07H	The third written data is H'07D0.
D0H	
1FH	Low byte of the CRC checksum
6FH	High byte of the CRC checksum

A slave replies with 01 10 1618 0003 0447.

Message (replied)	Description
01H	Slave address
10H	Function code
16H	High byte of the starting address to be written
18H	Low byte of the starting address to be written
00H	High byte of the number of word devices to be written.
03H	Low byte of the number of word devices to be written.
04H	Low byte of the CRC checksum
47H	High byte of the CRC checksum

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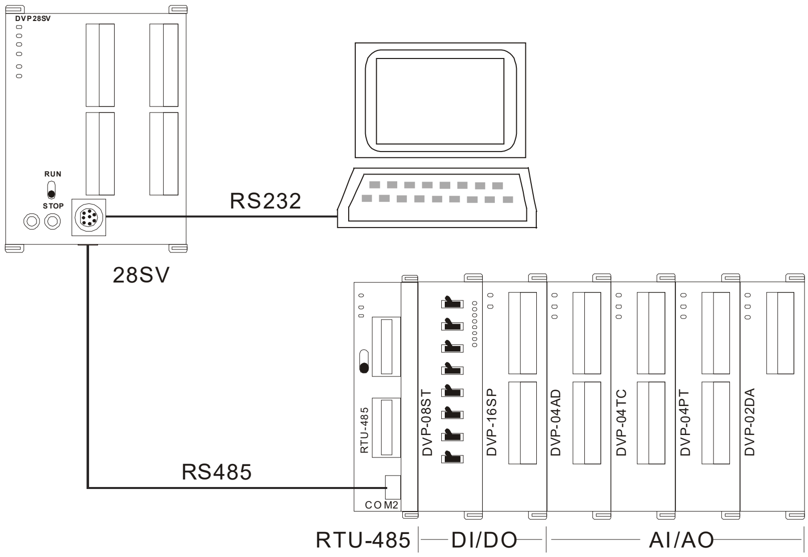
15.1.7 Application Examples

The RTU-485 functions as a standard Modbus slave, ensuring compatibility with other Modbus-compliant Programmable Logic Controllers (PLCs). In this setup, a DVP28SV PLC acts as the master. A PC downloads the ladder diagram to the DVP28SV through its RS-232 port (COM1). Subsequently, the DVP28SV executes the ladder diagram and controls the remote IO of the RTU-485 module by sending Modbus commands via its RS-485 port (COM2).

As a Modbus remote I/O communication module, the RTU-485 allows Delta PLCs to remotely control DVP-S series I/O modules. An example follows to illustrate this.

15.1.7.1 In ASCII Mode, PLC Sends Data to the Right-Side AIO Modules of RTU-485

- **Network connection diagram**



- **Requirements**
  - If M0 is ON, read the content of CR#0 from the 1st special input/output module (DVP04AD-S) located on the right of the RTU-485.
  - If M1 is ON, set CR#2=H'0001 from the 1st special input/output module (DVP04AD-S) located on the right of the RTU-485.
  - If M2 is ON, read the content of CR#0 from the 2nd special input/output module (DVP04TC-S) located on the right of the RTU-485.
  - If M3 is ON, set CR#2=H'0002 from the 2nd special input/output module (DVP04TC-S) located on the right of the RTU-485.

- **RTU-485 Configurations**

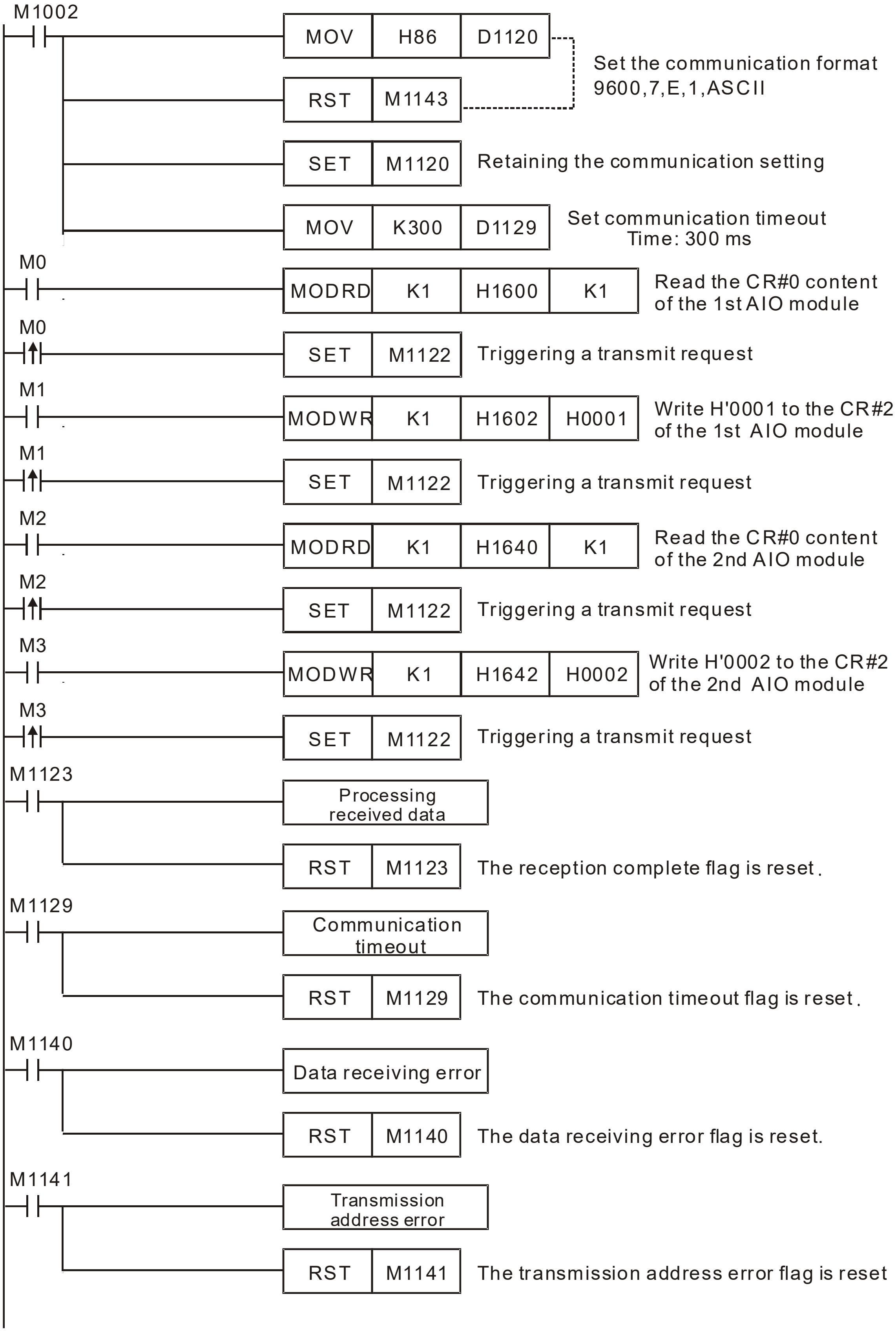
Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus ASCII; <7, E, 1>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus ASCII, 7, E, 1. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	9600 bps	RTU-485 module supports various transmission rates. In this example, the transmission rate is set to 9600 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

Modbus address	Corresponding register	Description
H’1600	CR#0 from the 1st special input/output module (DVP04AD-S)	To read CR#0 of the 1st special input/output module (DVP04AD-S), you need to access the Modbus address H'1600 on the RTU-485 module, as this address maps to that register.
H’1602	CR#2 from the 1st special input/output module (DVP04AD-S)	To set CR#2 of the 1st special input/output module (DVP04AD-S), you need to access the Modbus address H'1602 on the RTU-485 module, as this address maps to that register.
H’1640	CR#0 from the 2nd special input/output module (DVP04TC-S)	To read CR#0 of the 2nd special input/output module (DVP04TC-S), you need to access the Modbus address H'1640 on the RTU-485 module, as this address maps to that register.
H’1642	CR#2 from the 2nd special input/output module (DVP04TC-S)	To set CR#2 of the 2nd special input/output module (DVP04TC-S), you need to access the Modbus address H'1642 on the RTU-485 module, as this address maps to that register.

Note: Refer to section 15.1.5.2, “Addresses of Functional Areas in Special I/O Module” for the mapping relationship between the CR registers of the modules on the right and the RTU-485 addresses.

- **The program**


M1002
MOV H86 D1120
RST M1143
Set the communication format 9600,7,E,1,ASCII
SET M1120
Retaining the communication setting
MOV K300 D1129
Set communication timeout Time: 300 ms
M0
MODRD K1 H1600 K1
Read the CR#0 content of the 1st AIO module
M0
SET M1122
Triggering a transmit request
M1
MODWR K1 H1602 H0001
Write H'0001 to the CR#2 of the 1st AIO module
M1
SET M1122
Triggering a transmit request
M2
MODRD K1 H1640 K1
Read the CR#0 content of the 2nd AIO module
M2
SET M1122
Triggering a transmit request
M3
MODWR K1 H1642 H0002
Write H'0002 to the CR#2 of the 2nd AIO module
M3
SET M1122
Triggering a transmit request
M1123
Processing received data
RST M1123
The reception complete flag is reset.
M1129
Communication timeout
RST M1129
The communication timeout flag is reset.
M1140
Data receiving error
RST M1140
The data receiving error flag is reset.
M1141
Transmission address error
RST M1141
The transmission address error flag is reset

- **Program explanations**
  - Set the communication format. Master and slave must use the same format, which is configured here as 9600 (baud rate), 7, Even parity, 1 stop bit, ASCII mode.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the MODRD instruction. At the same time, the master PLC sends the request message ": 01 03 1600 0001 E5 0x0D 0x0A" to the RTU-485 module to read the CR#0 content of the 1st special input/output module (DVP04AD-S) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the MODWR instruction. At the same time, the master PLC sends the request message ": 01 06 1602 0001 E0 0x0D 0x0A" to the RTU-485 module to write H'0001 to the CR#2 of the 1st special input/output module (DVP04AD-S) on the RTU-485 module's right.
  - When M2 is ON, triggering a transmit request, execute the MODRD instruction. At the same time, the master PLC sends the request message ": 01 03 1640 0001 A5 0x0D 0x0A" to the RTU-485 module to read CR#0 content of the 2nd special input/output module (DVP04TC-S) on the RTU-485 module's right.
  - When M3 is ON, triggering a transmit request, execute the MODWR instruction. At the same time, the master PLC sends the request message ": 01 06 1642 0002 9F 0x0D 0x0A" to the RTU-485 module to write H'0002 to the CR#2 of the 2nd special input/output module (DVP04TC-S) on the RTU-485 module's right.

15.1.7.2 In RTU Mode, PLC Sends Data to the Right-Side AIO Modules of RTU-485

- **Network connection diagram**

  Refer to section 15.1.7.1 “Network connection diagram”.

- **Requirements**
  - If M0 is ON, read the content of CR#0 from the 1st special input/output module (DVP04AD-S) located on the right of the RTU-485.
  - If M1 is ON, set CR#2=H’0001 from the 1st special input/output module (DVP04AD-S) located on the right of the RTU-485.
  - If M2 is ON, read the content of CR#0 from the 2nd special input/output module (DVP04TC-S) located on the right of the RTU-485.
  - If M3 is ON, set CR#2=H’0002 from the 2nd special input/output module (DVP04TC-S) located on the right of the RTU-485.

- **RTU-485 Configurations**

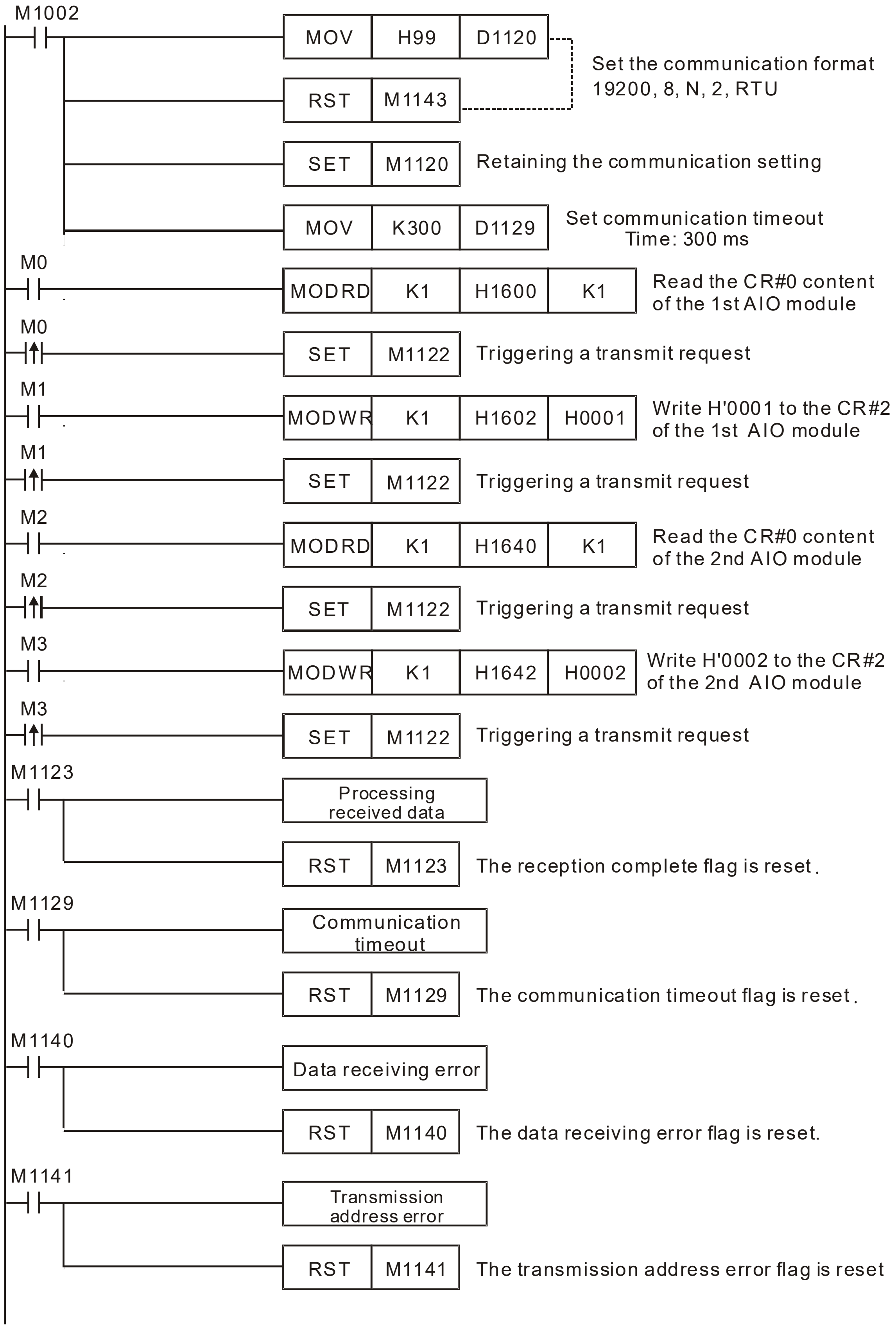
Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus RTU; <8, N, 2>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus RTU, <8, N, 2>. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	19200 bps	RTU-485 module supports various transmission rates. In this example, the transmission is set to 19200 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

Modbus address	Corresponding register	Description
H’1600	CR#0 from the 1st special input/output module (DVP04AD-S)	To read CR#0 of the 1st special input/output module (DVP04AD-S), you need to access the Modbus address H'1600 on the RTU-485 module, as this address maps to that register.
H’1602	CR#2 from the 1st special input/output module (DVP04AD-S)	To set CR#2 of the 1st special input/output module (DVP04AD-S), you need to access the Modbus address H'1602 on the RTU-485 module, as this address maps to that register.
H’1640	CR#0 from the 2nd special input/output module (DVP04TC-S)	To read CR#0 of the 2nd special input/output module (DVP04TC-S), you need to access the Modbus address H'1640 on the RTU-485 module, as this address maps to that register.
H’1642	CR#2 from the 2nd special input/output module (DVP04TC-S)	To set CR#2 of the 2nd special input/output module (DVP04TC-S), you need to access the Modbus address H'1642 on the RTU-485 module, as this address maps to that register.

Note: Refer to section 15.1.5.2, “Addresses of Functional Areas in Special I/O Module” for the mapping relationship between the CR registers of the modules on the right and the RTU-485 addresses.

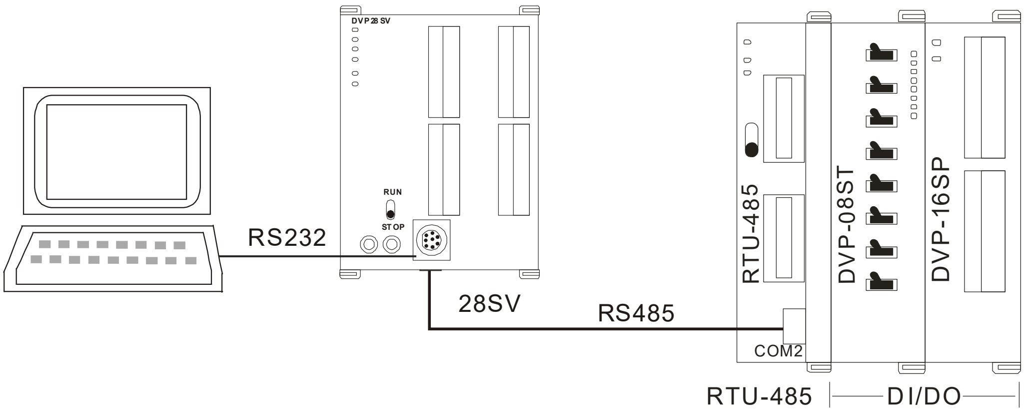
- **The program**


M1002
MOV H99 D1120
RST M1143
Set the communication format
19200, 8, N, 2, RTU
SET M1120
Retaining the communication setting
MOV K300 D1129
Set communication timeout
Time: 300 ms
M0
MODRD K1 H1600 K1
Read the CR#0 content
of the 1st AIO module
M0
SET M1122
Triggering a transmit request
M1
MODWR K1 H1602 H0001
Write H'0001 to the CR#2
of the 1st AIO module
M1
SET M1122
Triggering a transmit request
M2
MODRD K1 H1640 K1
Read the CR#0 content
of the 2nd AIO module
M2
SET M1122
Triggering a transmit request
M3
MODWR K1 H1642 H0002
Write H'0002 to the CR#2
of the 2nd AIO module
M3
SET M1122
Triggering a transmit request
M1123
Processing
received data
RST M1123
The reception complete flag is reset.
M1129
Communication
timeout
RST M1129
The communication timeout flag is reset.
M1140
Data receiving error
RST M1140
The data receiving error flag is reset.
M1141
Transmission
address error
RST M1141
The transmission address error flag is reset

- **Program explanations**
  - Set the communication format. Master and slave must use the same format, which is configured here as 19200 (baud rate), 8 data bits, no parity, 2 stop bits, RTU mode.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the MODRD instruction. At the same time, the master PLC sends the request message “01 03 1600 0001 80 42” to the RTU-485 module to read the CR#0 content of the 1st special input/output module (DVP04AD-S) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the MODWR instruction. At the same time, the master PLC sends the request message “01 06 1602 0001 ED 82” to the RTU-485 module to write H’0001 to the CR#2 of the 1st special input/output module (DVP04AD-S) on the RTU-485 module's right.
  - When M2 is ON, triggering a transmit request, execute the MODRD instruction. At the same time, the master PLC sends the request message “01 03 1640 0001 81 96” to the RTU-485 module to read CR#0 content of the 2nd special input/output module (DVP04TC-S) on the RTU-485 module's right.
  - When M3 is ON, triggering a transmit request, execute the MODWR instruction. At the same time, the master PLC sends the request message “01 06 1642 0002 AC 57” to the RTU-485 module to write H’0002 to the CR#2 of the 2nd special input/output module (DVP04TC-S) on the RTU-485 module's right.

15.1.7.3 In ASCII Mode, PLC Reads Input Signals from the Right-Side DIO Modules of RTU-485

- **Network connection diagram**



- **Requirements**
  - If M0 is ON, read the contents of X0 to X2 from the 1st DIO module (DVP08ST) located on the right of the RTU-485.
  - If M1 is ON, read the contents of X0 to X7 from the 2nd DIO module (DVP16SP) located on the right of the RTU-485.

- **RTU-485 Configurations**

Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus ASCII; <7, E, 1>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus ASCII, 7, E, 1. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	9600 bps	RTU-485 module supports various transmission rates. In this example, the transmission rate is set to 9600 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

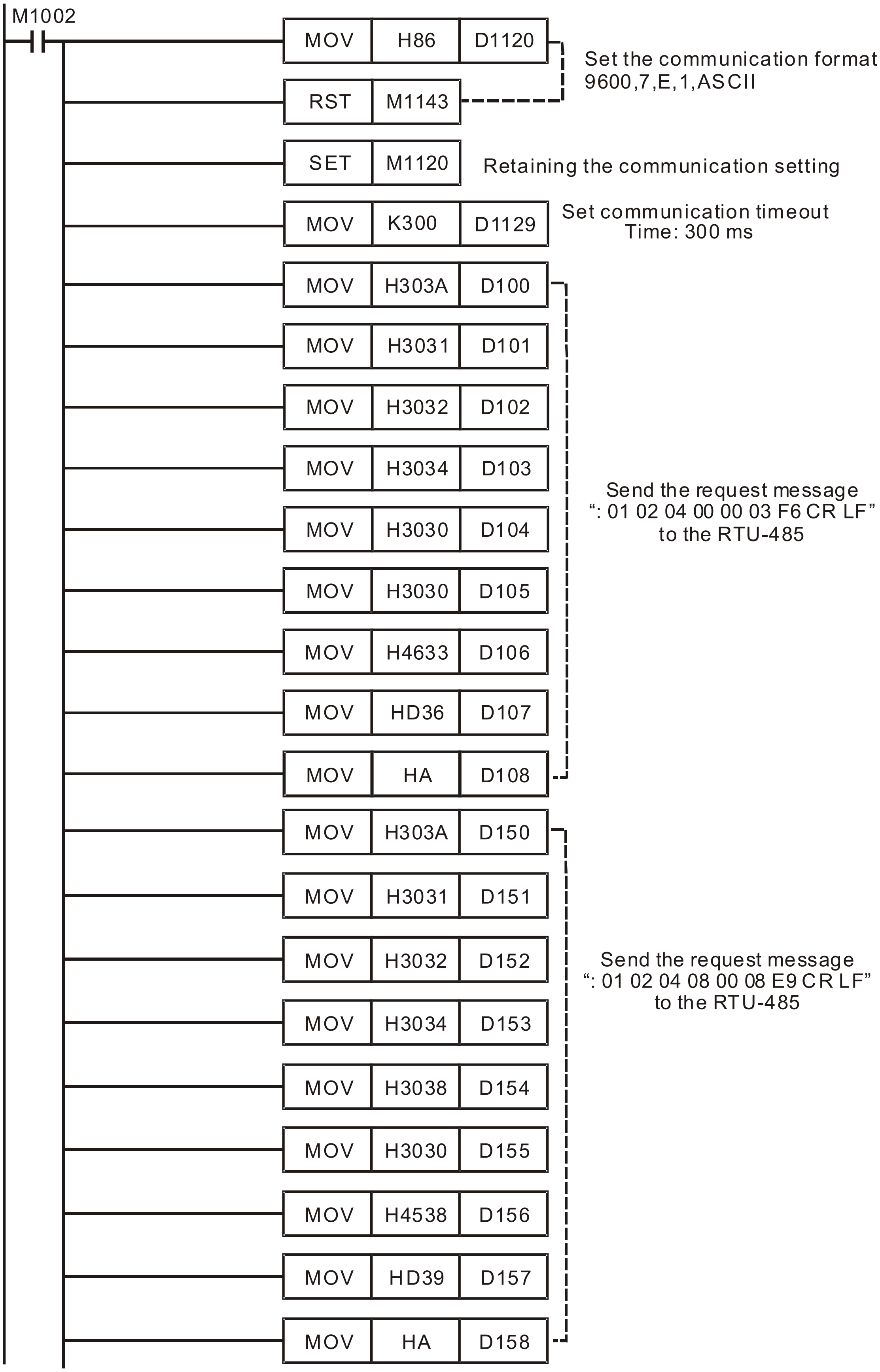
Inputs X0-X177 on the DIO module correspond to Modbus addresses H'0400-H'047F on the RTU-485 module.

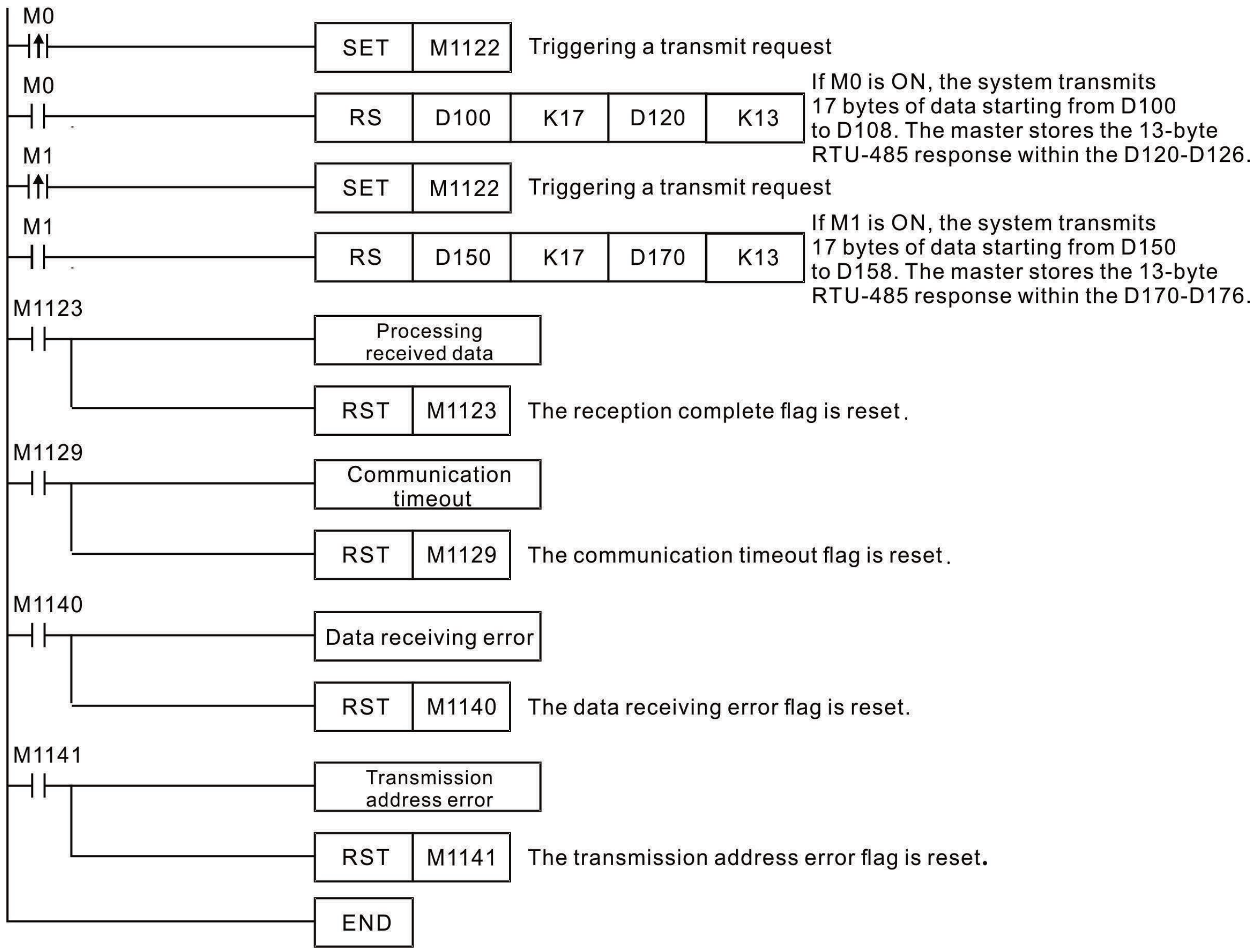
Here is the breakdown of which input on the DIO module is mapped to which Modbus address on the RTU-485 module.

Module	Input	Modbus Address	Description
DVP08ST	X0	H'0400	X0 on the DVP08ST is mapped to H'0400 on the RTU-485 module. A read operation on H'0400 is required to read the DVP08ST's X0.
	X1	H'0401	X1 on the DVP08ST is mapped to H'0401 on the RTU-485 module. A read operation on H'0401 is required to read the DVP08ST's X1.
	X2	H'0402	X2 on the DVP08ST is mapped to H'0402 on the RTU-485 module. A read operation on H'0402 is required to read the DVP08ST's X2.
	X3	H'0403	X3 on the DVP08ST is mapped to H'0403 on the RTU-485 module. A read operation on H'0403 is required to read the DVP08ST's X3.
	X4	H'0404	X4 on the DVP08ST is mapped to H'0404 on the RTU-485 module. A read operation on H'0404 is required to read the DVP08ST's X4.
	X5	H'0405	X5 on the DVP08ST is mapped to H'0405 on the RTU-485 module. A read operation on H'0405 is required to read the DVP08ST's X5.
	X6	H'0406	X6 on the DVP08ST is mapped to H'0406 on the RTU-485 module. A read operation on H'0406 is required to read the DVP08ST's X6.
	X7	H'0407	X7 on the DVP08ST is mapped to H'0407 on the RTU-485 module. A read operation on H'0407 is required to read the DVP08ST's X7.
DVP16SP	X0	H'0408	X0 on the DVP16SP is mapped to H'0408 on the RTU-485 module. A read operation on H'0408 is required to read the DVP16SP's X0.
	X1	H'0409	X1 on the DVP16SP is mapped to H'0409 on the RTU-485 module. A read operation on H'0409 is required to read the DVP16SP's X1.
	X2	H'040A	X2 on the DVP16SP is mapped to H'040A on the RTU-485 module. A read operation on H'040A is required to read the DVP16SP's X2.
	X3	H'040B	X3 on the DVP16SP is mapped to H'040B on the RTU-485 module. A read operation on H'040B is required to read the DVP16SP's X3.
	X4	H'040C	X4 on the DVP16SP is mapped to H'040C on the RTU-485 module. A read operation on H'040C is required to read the DVP16SP's X4.
	X5	H'040D	X5 on the DVP16SP is mapped to H'040D on the RTU-485 module. A read operation on H'040D is required to read the DVP16SP's X5.
	X6	H'040E	X6 on the DVP16SP is mapped to H'040E on the RTU-485 module. A read operation on H'040E is required to read the DVP16SP's X6.
	X7	H'040F	X7 on the DVP16SP is mapped to H'040F on the RTU-485 module. A read operation on H'040F is required to read the DVP16SP's X7.

Note: Refer to section 15.1.5.1, "Addresses of Functional Areas in Digital I/O Module" for the mapping relationship between X0 to X177 of the module on the right and the RTU-485 addresses.

- **The program**


M1002
MOV H86 D1120
RST M1143
Set the communication format
9600,7,E,1,ASCII
SET M1120
Retaining the communication setting
MOV K300 D1129
Set communication timeout
Time: 300 ms
MOV H303A D100
MOV H3031 D101
MOV H3032 D102
MOV H3034 D103
MOV H3030 D104
MOV H3030 D105
MOV H4633 D106
MOV HD36 D107
MOV HA D108
Send the request message
“: 01 02 04 00 00 03 F6 CR LF”
to the RTU-485
MOV H303A D150
MOV H3031 D151
MOV H3032 D152
MOV H3034 D153
MOV H3038 D154
MOV H3030 D155
MOV H4538 D156
MOV HD39 D157
MOV HA D158
Send the request message
“: 01 02 04 08 00 08 E9 CR LF”
to the RTU-485



- **Program explanations**
  - Set the communication format. Master and slave must use the same format, which is configured here as 9600, 7, Even parity, 1 stop bit, ASCII.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message ": 01 02 0400 0003 F6 0x0D 0x0A" to the RTU-485 module to read the X0 to X2 states of the 1st module (DVP08ST) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message ": 01 02 0408 0008 E9 0x0D 0x0A" to the RTU-485 module to read the X0 to X7 states of the 2nd module (DVP16SP) on the RTU-485 module's right.

15.1.7.4 In RTU Mode, PLC Reads Input Signals from the Right-Side DIO Modules of RTU-485

- **Network connection diagram**

  Refer to section 15.1.7.3 “Network connection diagram”.

- **Requirements**

  - If M0 is ON, read the contents of X0 to X2 from the 1st DIO module (DVP08ST) located on the right of the RTU-485.
  - If M1 is ON, read the contents of X0 to X7 from the 2nd DIO module (DVP16SP) located on the right of the RTU-485.

- **RTU-485 Configurations**

Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus RTU; <8, N, 2>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus RTU, 8, N, 2. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	19200 bps	RTU-485 module supports various transmission rates. In this example, the transmission is set to 19200 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

Inputs X0-X177 on the DIO module correspond to Modbus addresses H'0400-H'047F on the RTU-485 module.

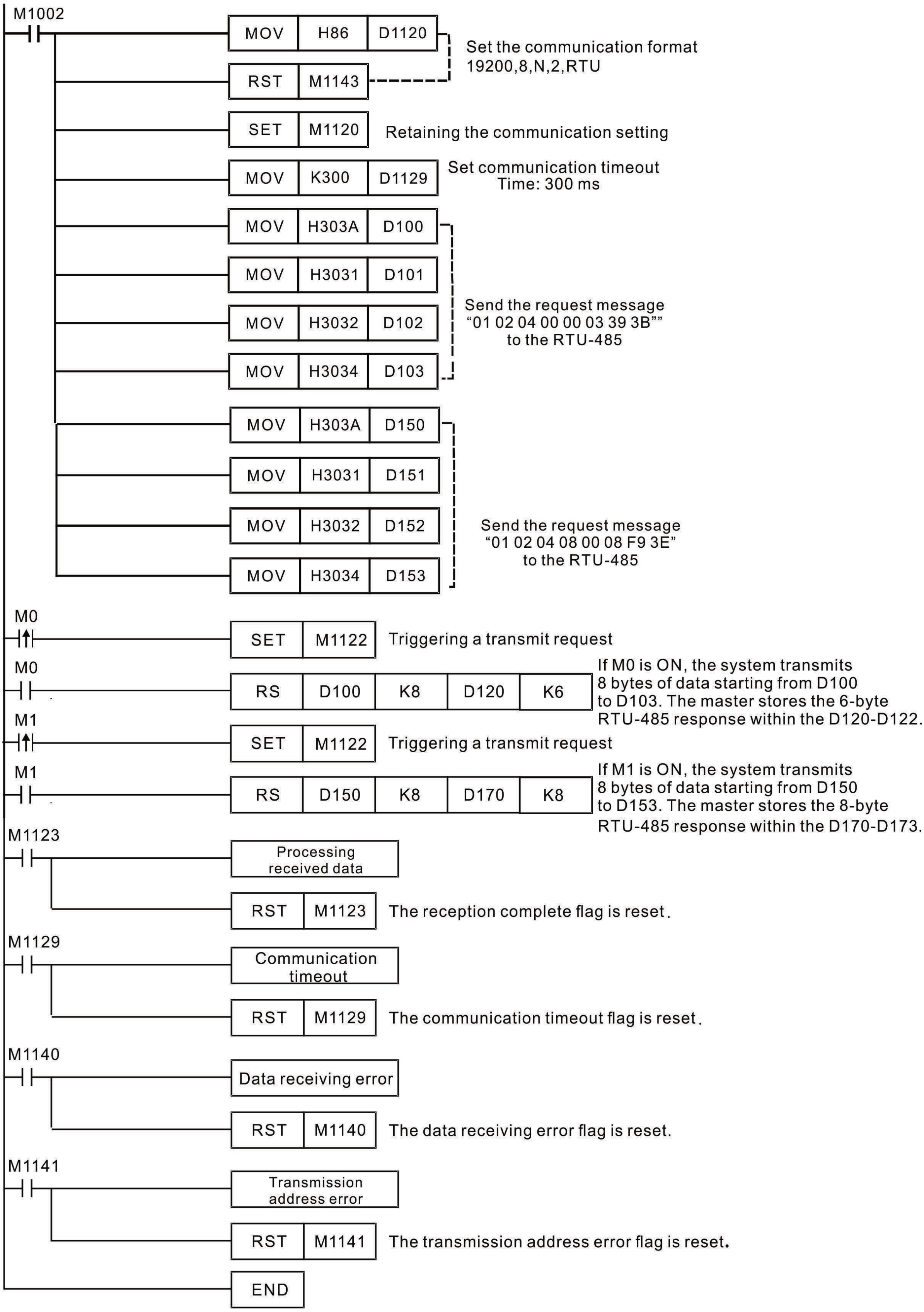
Here is the breakdown of which input on the DIO module is mapped to which Modbus address on the RTU-485 module.

Module	Input	Modbus Address	Description
DVP08ST	X0	H’0400	X0 on the DVP08ST is mapped to H'0400 on the RTU-485 module. A read operation on H'0400 is required to read the DVP08ST's X0.
	X1	H’0401	X1 on the DVP08ST is mapped to H'0401 on the RTU-485 module. A read operation on H'0401 is required to read the DVP08ST's X1.
	X2	H’0402	X2 on the DVP08ST is mapped to H'0402 on the RTU-485 module. A read operation on H'0402 is required to read the DVP08ST's X2.
	X3	H’0403	X3 on the DVP08ST is mapped to H'0403 on the RTU-485 module. A read operation on H'0403 is required to read the DVP08ST's X3.
	X4	H’0404	X4 on the DVP08ST is mapped to H'0404 on the RTU-485 module. A read operation on H'0404 is required to read the DVP08ST's X4.
	X5	H’0405	X5 on the DVP08ST is mapped to H'0405 on the RTU-485 module. A read operation on H'0405 is required to read the DVP08ST's X5.

Module	Input	Modbus Address	Description
	X6	H’0406	X6 on the DVP08ST is mapped to H'0406 on the RTU-485 module. A read operation on H'0406 is required to read the DVP08ST's X6.
	X7	H’0407	X7 on the DVP08ST is mapped to H'0407 on the RTU-485 module. A read operation on H'0407 is required to read the DVP08ST's X7.
DVP16SP	X0	H’0408	X0 on the DVP16SP is mapped to H'0408 on the RTU-485 module. A read operation on H'0408 is required to read the DVP16SP's X0.
	X1	H’0409	X1 on the DVP16SP is mapped to H'0409 on the RTU-485 module. A read operation on H'0409 is required to read the DVP16SP's X1.
	X2	H’040A	X2 on the DVP16SP is mapped to H'040A on the RTU-485 module. A read operation on H'040A is required to read the DVP16SP's X2.
	X3	H’040B	X3 on the DVP16SP is mapped to H'040B on the RTU-485 module. A read operation on H'040B is required to read the DVP16SP's X3.
	X4	H’040C	X4 on the DVP16SP is mapped to H'040C on the RTU-485 module. A read operation on H'040C is required to read the DVP16SP's X4.
	X5	H’040D	X5 on the DVP16SP is mapped to H'040D on the RTU-485 module. A read operation on H'040D is required to read the DVP16SP's X5.
	X6	H’040E	X6 on the DVP16SP is mapped to H'040E on the RTU-485 module. A read operation on H'040E is required to read the DVP16SP's X6.
	X7	H’040F	X7 on the DVP16SP is mapped to H'040F on the RTU-485 module. A read operation on H'040F is required to read the DVP16SP's X7.

Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between X0 to X177 of the module on the right and the RTU-485 addresses.

- **The program**



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- **Program explanations**
  - Set the communication format. Master and slave must use the same format, which is configured here as 19200 (baud rate), 8 data bits, no parity, 2 stop bits, RTU mode.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message "01 02 0400 0003 393B" to the RTU-485 module to read the X0 to X2 states of the 1st module (DVP08ST) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message "01 02 0408 0008 F93E" to the RTU-485 module to read the X0 to X7 states of the 2nd module (DVP16SP) on the RTU-485 module's right.

15.1.7.5 In ASCII Mode, PLC Sets Output Devices on the Right-Side DIO Module of RTU-485

- **Network connection diagram**

  Refer to section 15.1.7.3 “Network connection diagram”.

- **Requirements**

  - If M0 is ON, set Y0=ON on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.
  - If M0 is ON, set Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.

- **RTU-485 Configurations**

Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus ASCII; <7, E, 1>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus ASCII, 7, E, 1. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	9600 bps	RTU-485 module supports various transmission rates. In this example, the transmission rate is set to 9600 bps. Refer to section 15.1.3.3 for more details.

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- **Explanations**

Outputs Y0-Y177 on the DIO module correspond to Modbus addresses H'0500-H'057F on the RTU-485 module.

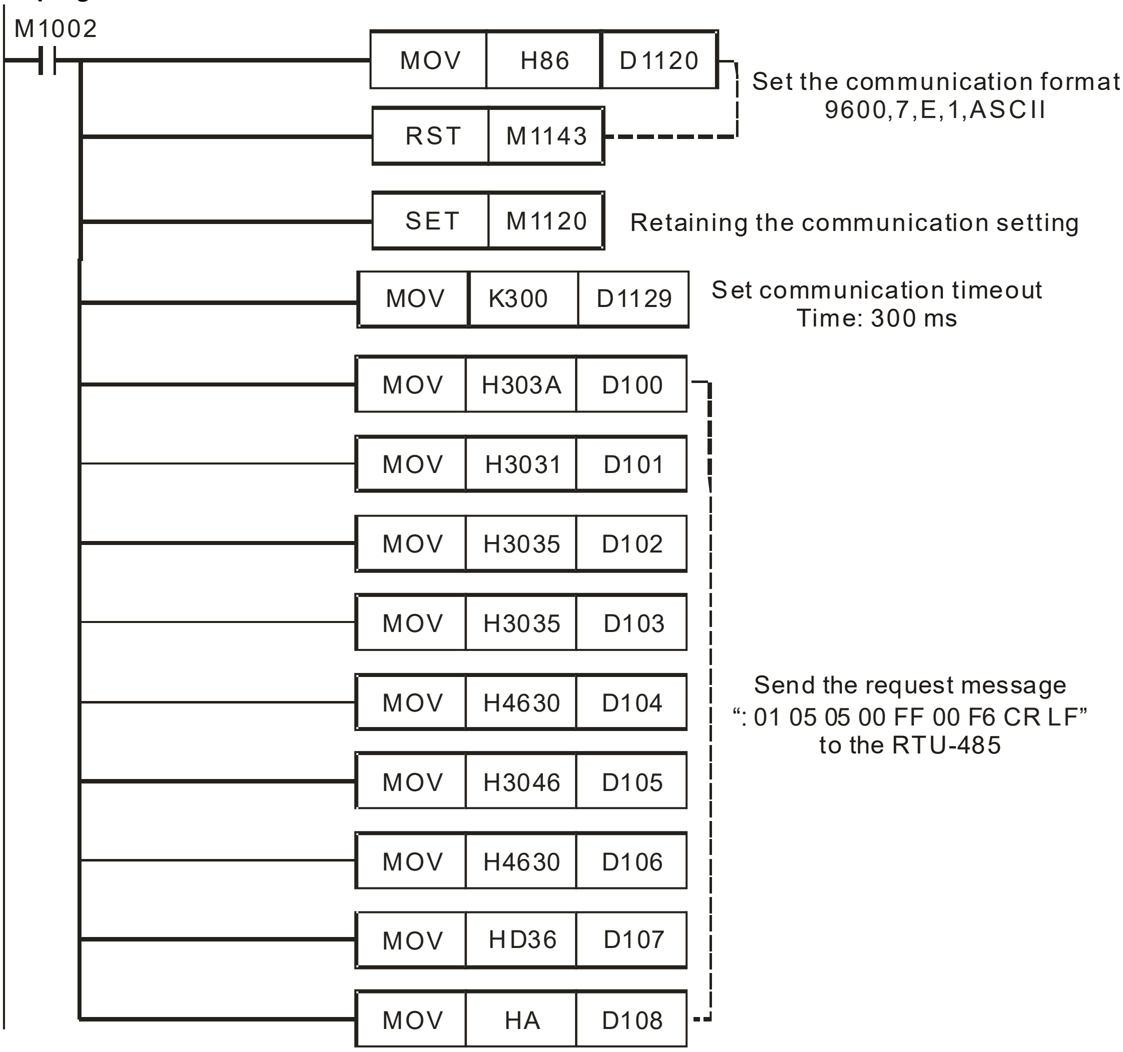
Here is the breakdown of which output on the DIO module is mapped to which Modbus address on the RTU-485 module.

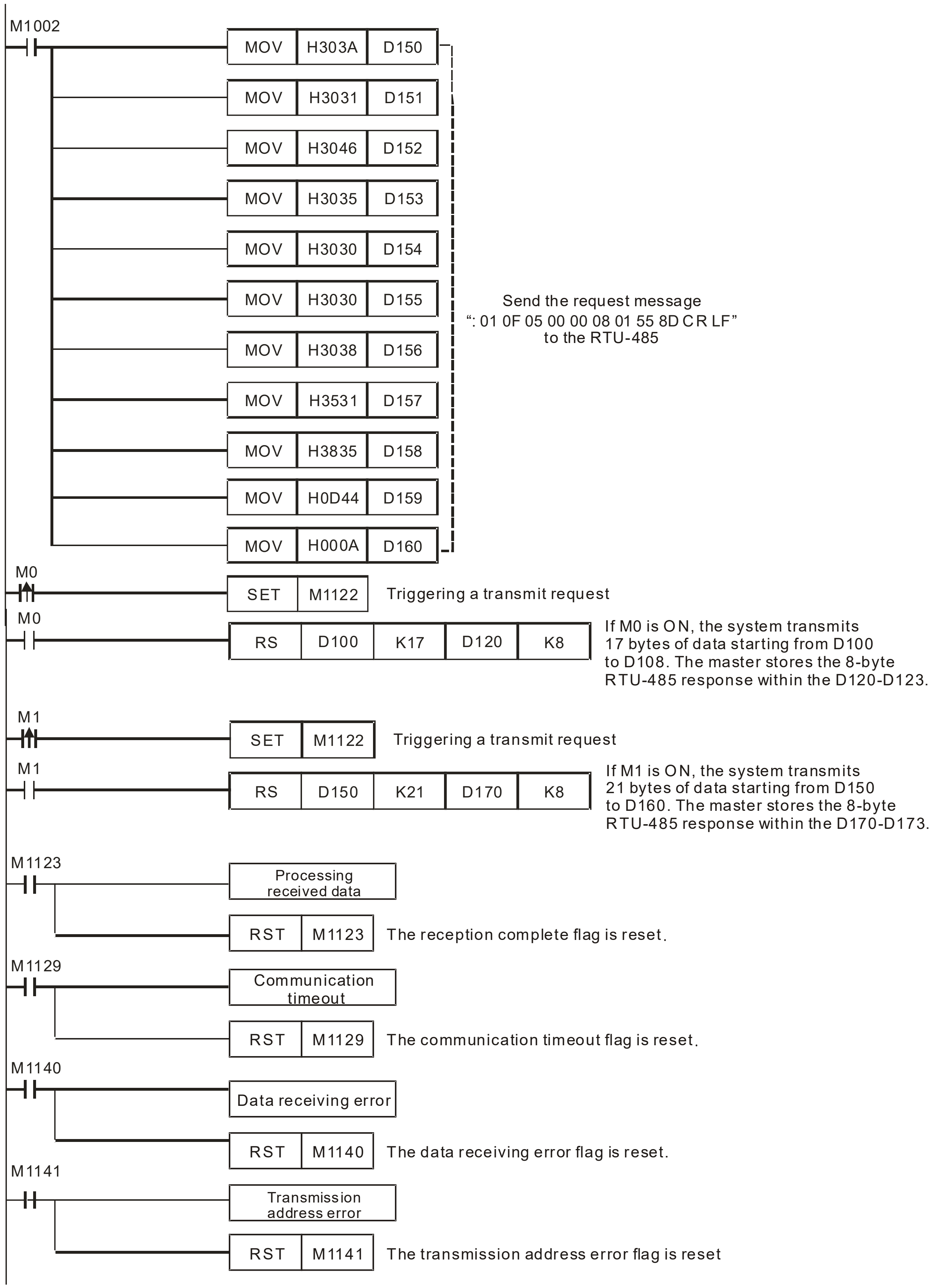
Module	Output	Modbus Address	Description
DVP16SP	Y0	H’0500	Y0 on the DVP16SP is mapped to H'0500 on the RTU-485 module. A write operation on H'0500 is required to write the DVP16SP's Y0.
	Y1	H’0501	Y1 on the DVP16SP is mapped to H'0501 on the RTU-485 module. A write operation on H'0501 is required to write the DVP16SP's Y1.
	Y2	H’0502	Y2 on the DVP16SP is mapped to H'0502 on the RTU-485 module. A write operation on H'0502 is required to write the DVP16SP's Y2.
	Y3	H’0503	Y03 on the DVP16SP is mapped to H'0503 on the RTU-485 module. A write operation on H'0503 is required to write the DVP16SP's Y3.
	Y4	H’0504	Y4 on the DVP16SP is mapped to H'0504 on the RTU-485 module. A write operation on H'0504 is required to write the DVP16SP's Y4.
	Y5	H’0505	Y5 on the DVP16SP is mapped to H'0505 on the RTU-485 module. A write operation on H'0505 is required to write the DVP16SP's Y5.

Module	Output	Modbus Address	Description
	Y6	H’0506	Y6 on the DVP16SP is mapped to H'0506 on the RTU-485 module. A write operation on H'0506 is required to write the DVP16SP's Y6.
	Y7	H’0507	Y7 on the DVP16SP is mapped to H'0507 on the RTU-485 module. A write operation on H'0507 is required to write the DVP16SP's Y7.

Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between Y0 to Y177 of the modules on the right and the RTU-485 addresses.

- **The program**




M1002
MOV H303A D150
MOV H3031 D151
MOV H3046 D152
MOV H3035 D153
MOV H3030 D154
MOV H3030 D155
MOV H3038 D156
MOV H3531 D157
MOV H3835 D158
MOV H0D44 D159
MOV H000A D160
Send the request message
“: 01 0F 05 00 00 08 01 55 8D CR LF”
to the RTU-485
M0
SET M1122
Triggering a transmit request
M0
RS D100 K17 D120 K8
If M0 is ON, the system transmits 17 bytes of data starting from D100 to D108. The master stores the 8-byte RTU-485 response within the D120-D123.
M1
SET M1122
Triggering a transmit request
M1
RS D150 K21 D170 K8
If M1 is ON, the system transmits 21 bytes of data starting from D150 to D160. The master stores the 8-byte RTU-485 response within the D170-D173.
M1123
Processing received data
RST M1123
The reception complete flag is reset.
M1129
Communication timeout
RST M1129
The communication timeout flag is reset.
M1140
Data receiving error
RST M1140
The data receiving error flag is reset.
M1141
Transmission address error
RST M1141
The transmission address error flag is reset

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- **Program explanations**
  - Set the communication format. Master and slave must use the same format, which is configured here as 9600, 7, Even parity, 1 stop bit, ASCII.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message ": 01 05 0500 FF00 F6 0x0D 0x0A" to the RTU-485 module to set the Y0=ON of the 2nd module (DVP16SP) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message ": 01 0F 0500 0008 01 55 8D 0x0D 0x0A" to the RTU-485 module to set the Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF of the 2nd module (DVP16SP) on the RTU-485 module's right.

15.1.7.6 In RTU Mode, PLC Sets Output Devices on the Right-Side DIO Module of RTU-485

- **Network connection diagram**

  Refer to section 15.1.7.3 “Network connection diagram”.

- **Requirements**

  - If M0 is ON, set Y0=ON on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.
  - If M0 is ON, set Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.

- **RTU-485 Configurations**

Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus RTU; <8, N, 2>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus RTU, 8, N, 2. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	19200 bps	RTU-485 module supports various transmission rates. In this example, the transmission is set to 19200 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

Outputs Y0-Y177 on the DIO module correspond to Modbus addresses H'0500-H'057F on the RTU-485 module.

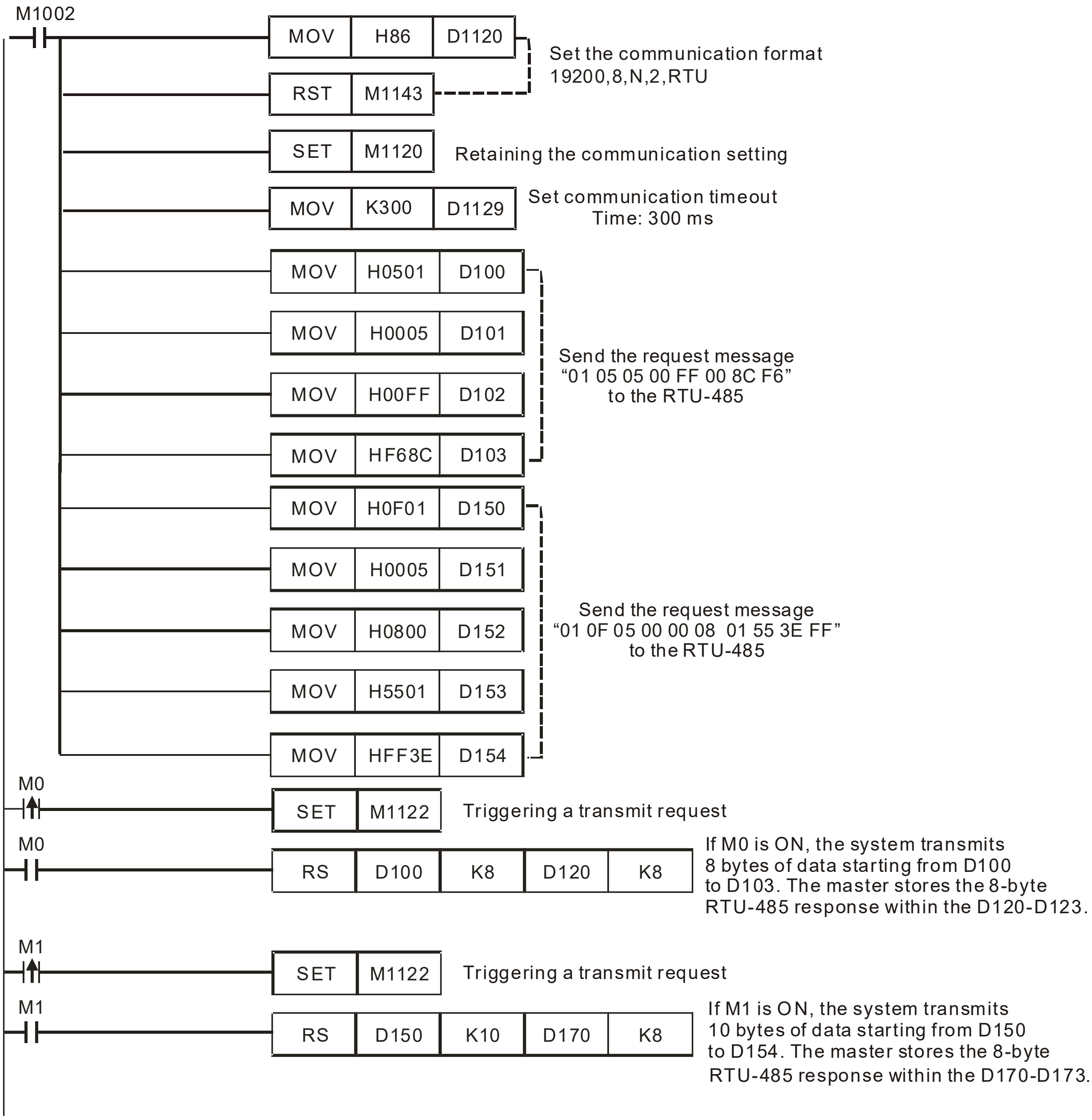
Here is the breakdown of which output on the DIO module is mapped to which Modbus address on the RTU-485 module.

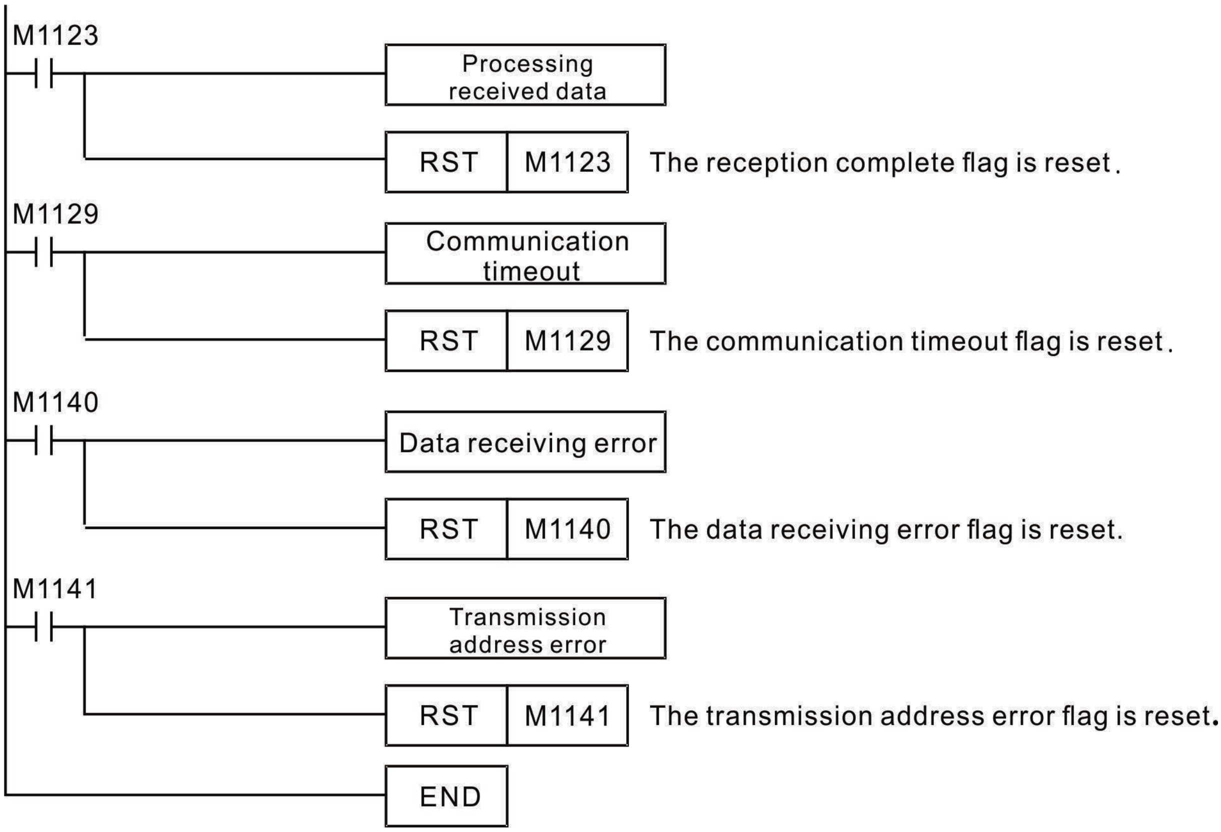
Module	Output	Modbus Address	Description
DVP16SP	Y0	H’0500	Y0 on the DVP16SP is mapped to H'0500 on the RTU-485 module. A write operation on H'0500 is required to write the DVP16SP's Y0.
	Y1	H’0501	Y1 on the DVP16SP is mapped to H'0501 on the RTU-485 module. A write operation on H'0501 is required to write the DVP16SP's Y1.
	Y2	H’0502	Y2 on the DVP16SP is mapped to H'0502 on the RTU-485 module. A write operation on H'0502 is required to write the DVP16SP's Y2.
	Y3	H’0503	Y03 on the DVP16SP is mapped to H'0503 on the RTU-485 module. A write operation on H'0503 is required to write the DVP16SP's Y3.
	Y4	H’0504	Y4 on the DVP16SP is mapped to H'0504 on the RTU-485 module. A write operation on H'0504 is required to write the DVP16SP's Y4.

Module	Output	Modbus Address	Description
	Y5	H’0505	Y5 on the DVP16SP is mapped to H'0505 on the RTU-485 module. A write operation on H'0505 is required to write the DVP16SP's Y5.
	Y6	H’0506	Y6 on the DVP16SP is mapped to H'0506 on the RTU-485 module. A write operation on H'0506 is required to write the DVP16SP's Y6.
	Y7	H’0507	Y7 on the DVP16SP is mapped to H'0507 on the RTU-485 module. A write operation on H'0507 is required to write the DVP16SP's Y7.

Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between Y0 to Y177 of the modules on the right and the RTU-485 addresses.

- **The program**





- **Program explanations**
  - Set the communication format. Master and slave must use the same format, which is configured here as 19200 (baud rate), 8 data bits, no parity, 2 stop bits, RTU mode.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “01 05 0500 FF00 8CF6” to the RTU-485 module to set the Y0=ON of the 2nd module (DVP16SP) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “01 0F 0500 0008 01 55 3EFF” to the RTU-485 module to set the Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF of the 2nd module (DVP16SP) on the RTU-485 module's right.

15.1.7.7 In ASCII Mode, PLC Reads Input Signals and Sets Output Devices on the Right-Side DIO Modules of RTU-485

- **Network connection diagram**

  Refer to section 15.1.7.3 “Network connection diagram”.

- **Requirements**
  - If M0 is ON, read the contents of X0 to X2 from the 1st DIO module (DVP08ST) located on the right of the RTU-485.
  - If M1 is ON, set Y0=ON on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.
  - If M2 is ON, read the contents of X0 to X7 from the 2nd DIO module (DVP16SP) located on the right of the RTU-485.
  - If M3 is ON, set Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.

- **RTU-485 Configurations**

Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus ASCII; <7, E, 1>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus ASCII, 7, E, 1. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	9600 bps	RTU-485 module supports various transmission rates. In this example, the transmission rate is set to 9600 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

■ Inputs X0-X177 on the DIO module correspond to Modbus addresses H'0400-H'047F on the RTU-485 module. Here is the breakdown of which input on the DIO module is mapped to which Modbus address on the RTU-485 module.

Module	Input	Modbus Address	Description
DVP08ST	X0	H’0400	X0 on the DVP08ST is mapped to H'0400 on the RTU-485 module. A read operation on H'0400 is required to read the DVP08ST's X0.
	X1	H’0401	X1 on the DVP08ST is mapped to H'0401 on the RTU-485 module. A read operation on H'0401 is required to read the DVP08ST's X1.
	X2	H’0402	X2 on the DVP08ST is mapped to H'0402 on the RTU-485 module. A read operation on H'0402 is required to read the DVP08ST's X2.
	X3	H’0403	X3 on the DVP08ST is mapped to H'0403 on the RTU-485 module. A read operation on H'0403 is required to read the DVP08ST's X3.
	X4	H’0404	X4 on the DVP08ST is mapped to H'0404 on the RTU-485 module. A read operation on H'0404 is required to read the DVP08ST's X4.
	X5	H’0405	X5 on the DVP08ST is mapped to H'0405 on the RTU-485 module. A read operation on H'0405 is required to read the DVP08ST's X5.
	X6	H’0406	X6 on the DVP08ST is mapped to H'0406 on the RTU-485 module. A read operation on H'0406 is required to read the DVP08ST's X6.
	X7	H’0407	X7 on the DVP08ST is mapped to H'0407 on the RTU-485 module. A read operation on H'0407 is required to read the DVP08ST's X7.
DVP16SP	X0	H’0408	X0 on the DVP16SP is mapped to H'0408 on the RTU-485 module. A read operation on H'0408 is required to read the DVP16SP's X0.
	X1	H’0409	X1 on the DVP16SP is mapped to H'0409 on the RTU-485 module. A read operation on H'0409 is required to read the DVP16SP's X1.
	X2	H’040A	X2 on the DVP16SP is mapped to H'040A on the RTU-485 module. A read operation on H'040A is required to read the DVP16SP's X2.
	X3	H’040B	X3 on the DVP16SP is mapped to H'040B on the RTU-485 module. A read operation on H'040B is required to read the DVP16SP's X3.
	X4	H’040C	X4 on the DVP16SP is mapped to H'040C on the RTU-485 module. A read operation on H'040C is required to read the DVP16SP's X4.
	X5	H’040D	X5 on the DVP16SP is mapped to H'040D on the RTU-485 module. A read operation on H'040D is required to read the DVP16SP's X5.
	X6	H’040E	X6 on the DVP16SP is mapped to H'040E on the RTU-485 module. A read operation on H'040E is required to read the DVP16SP's X6.
	X7	H’040F	X7 on the DVP16SP is mapped to H'040F on the RTU-485 module. A read operation on H'040F is required to read the DVP16SP's X7.

Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between X0 to X177 of the modules on the right and the RTU-485 addresses.

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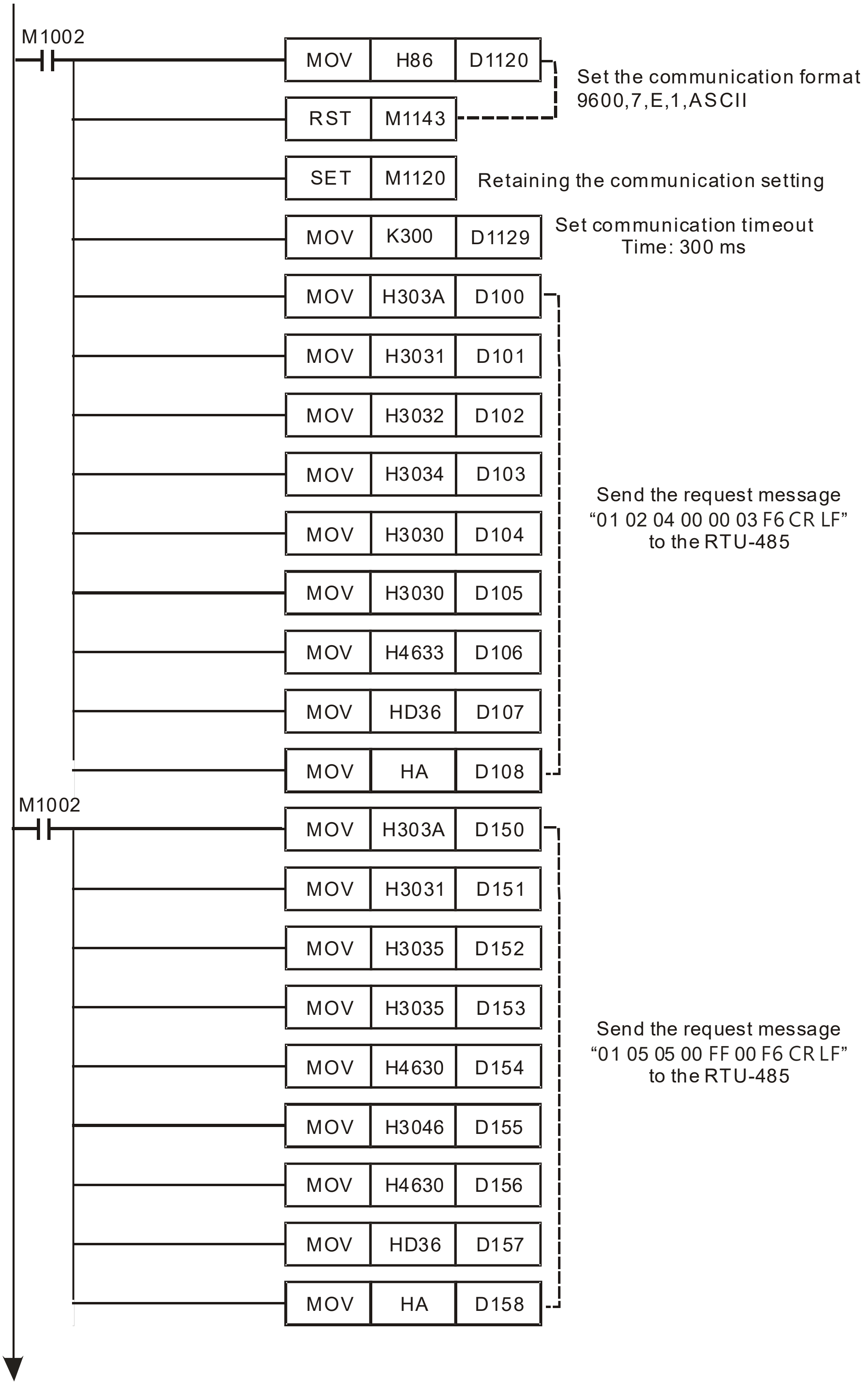
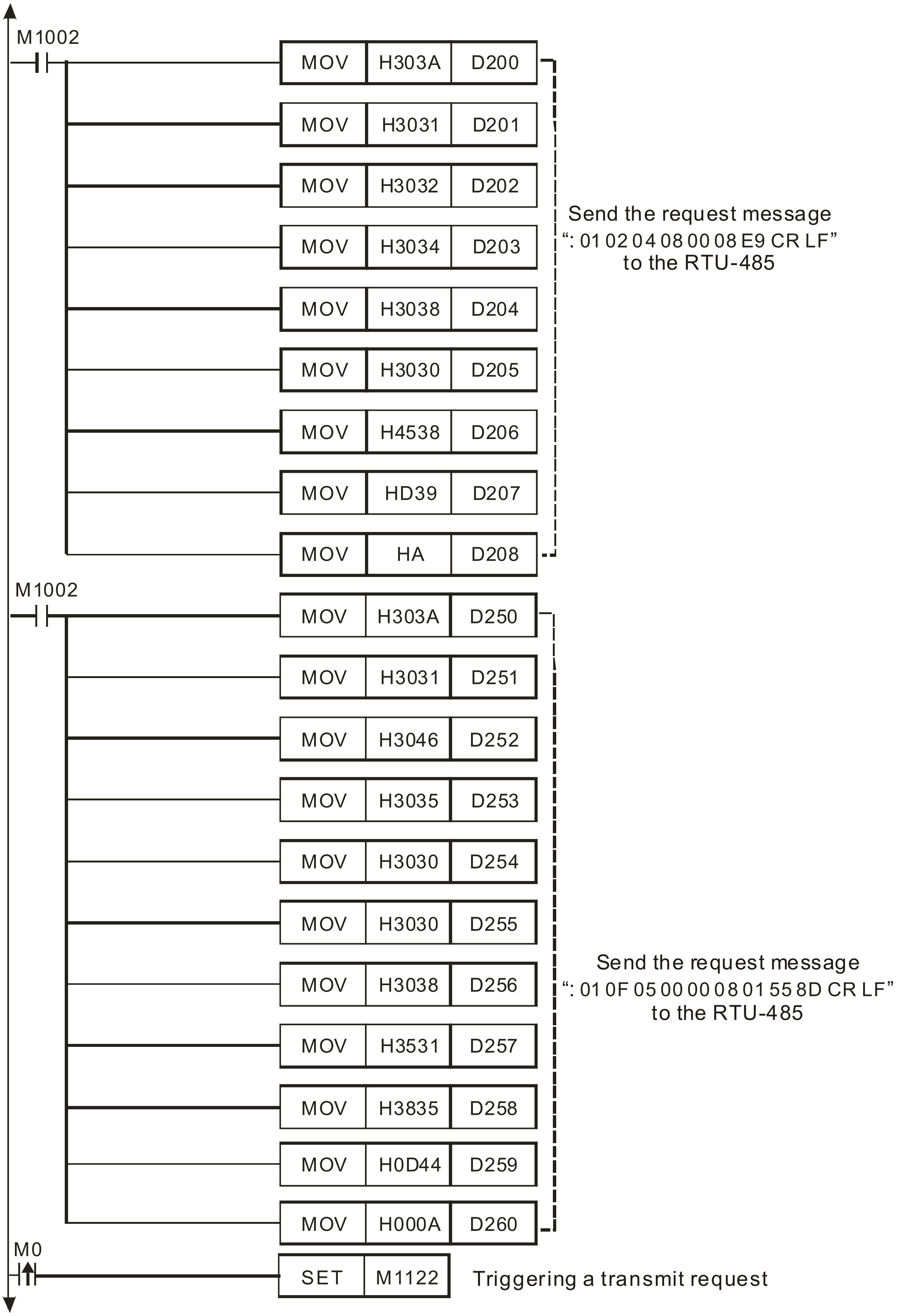
- Outputs Y0-Y177 on the DIO module correspond to Modbus addresses H'0500-H'057F on the RTU-485 module. Here is the breakdown of which output on the DIO module is mapped to which Modbus address on the RTU-485 module.

Module	Output	Modbus Address	Description
DVP16SP	Y0	H’0500	Y0 on the DVP16SP is mapped to H'0500 on the RTU-485 module. A write operation on H'0500 is required to write the DVP16SP's Y0.
	Y1	H’0501	Y1 on the DVP16SP is mapped to H'0501 on the RTU-485 module. A write operation on H'0501 is required to write the DVP16SP's Y1.
	Y2	H’0502	Y2 on the DVP16SP is mapped to H'0502 on the RTU-485 module. A write operation on H'0502 is required to write the DVP16SP's Y2.
	Y3	H’0503	Y03 on the DVP16SP is mapped to H'0503 on the RTU-485 module. A write operation on H'0503 is required to write the DVP16SP's Y3.
	Y4	H’0504	Y4 on the DVP16SP is mapped to H'0504 on the RTU-485 module. A write operation on H'0504 is required to write the DVP16SP's Y4.
	Y5	H’0505	Y5 on the DVP16SP is mapped to H'0505 on the RTU-485 module. A write operation on H'0505 is required to write the DVP16SP's Y5.
	Y6	H’0506	Y6 on the DVP16SP is mapped to H'0506 on the RTU-485 module. A write operation on H'0506 is required to write the DVP16SP's Y6.
	Y7	H’0507	Y7 on the DVP16SP is mapped to H'0507 on the RTU-485 module. A write operation on H'0507 is required to write the DVP16SP's Y7.

Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between Y0 to Y177 of the modules on the right and the RTU-485 addresses.

- **The program**


M1002
MOV H86 D1120
RST M1143
Set the communication format
9600,7,E,1,ASCII
SET M1120
Retaining the communication setting
MOV K300 D1129
Set communication timeout
Time: 300 ms
MOV H303A D100
MOV H3031 D101
MOV H3032 D102
MOV H3034 D103
MOV H3030 D104
MOV H3030 D105
MOV H4633 D106
MOV HD36 D107
MOV HA D108
Send the request message
"01 02 04 00 00 03 F6 CR LF"
to the RTU-485
M1002
MOV H303A D150
MOV H3031 D151
MOV H3035 D152
MOV H3035 D153
MOV H4630 D154
MOV H3046 D155
MOV H4630 D156
MOV HD36 D157
MOV HA D158
Send the request message
"01 05 05 00 FF 00 F6 CR LF"
to the RTU-485


M1002
MOV H303A D200
MOV H3031 D201
MOV H3032 D202
MOV H3034 D203
MOV H3038 D204
MOV H3030 D205
MOV H4538 D206
MOV HD39 D207
MOV HA D208
Send the request message
“: 01 02 04 08 00 08 E9 CR LF”
to the RTU-485
M1002
MOV H303A D250
MOV H3031 D251
MOV H3046 D252
MOV H3035 D253
MOV H3030 D254
MOV H3030 D255
MOV H3038 D256
MOV H3531 D257
MOV H3835 D258
MOV H0D44 D259
MOV H000A D260
Send the request message
“: 01 0F 05 00 00 08 01 55 8D CR LF”
to the RTU-485
M0
SET M1122
Triggering a transmit request

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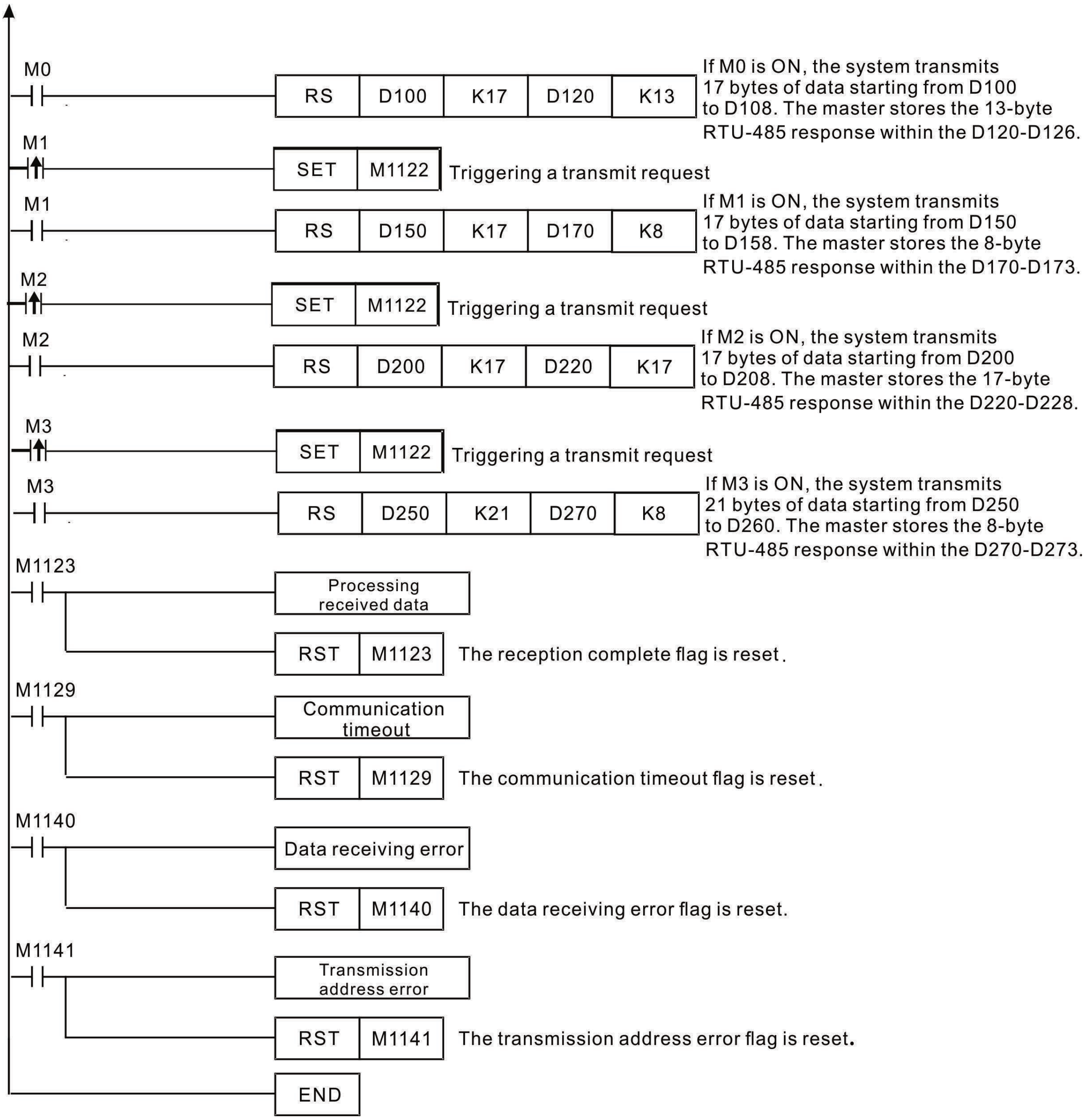
M0
RS D100 K17 D120 K13
If M0 is ON, the system transmits 17 bytes of data starting from D100 to D108. The master stores the 13-byte RTU-485 response within the D120-D126.
M1
SET M1122
Triggering a transmit request
M1
RS D150 K17 D170 K8
If M1 is ON, the system transmits 17 bytes of data starting from D150 to D158. The master stores the 8-byte RTU-485 response within the D170-D173.
M2
SET M1122
Triggering a transmit request
M2
RS D200 K17 D220 K17
If M2 is ON, the system transmits 17 bytes of data starting from D200 to D208. The master stores the 17-byte RTU-485 response within the D220-D228.
M3
SET M1122
Triggering a transmit request
M3
RS D250 K21 D270 K8
If M3 is ON, the system transmits 21 bytes of data starting from D250 to D260. The master stores the 8-byte RTU-485 response within the D270-D273.
M1123
Processing received data
RST M1123
The reception complete flag is reset.
M1129
Communication timeout
RST M1129
The communication timeout flag is reset.
M1140
Data receiving error
RST M1140
The data receiving error flag is reset.
M1141
Transmission address error
RST M1141
The transmission address error flag is reset.
END

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- **Program explanations**

  - Set the communication format. Master and slave must use the same format, which is configured here as 9600, 7, Even parity, 1 stop bit, ASCII.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “: 01 02 0400 0003 F6 0x0D 0x0A” to the RTU-485 module to read the X0 to X2 states of the 1st module (DVP08ST) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “: 01 05 0500 FF00 F6 0x0D 0x0A” to set the Y0=ON of the 2nd module (DVP16SP) on the RTU-485 module's right.
  - When M2 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “: 01 02 0408 0008 E9 0x0D 0x0A” to the RTU-485 module to read the X0 to X7 states of the 2nd module (DVP16SP) on the RTU-485 module's right.
  - When M3 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “: 01 0F 0500 0008 01 55 8D 0x0D 0x0A” to the RTU-485 module to set the Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF of the 2nd module (DVP16SP) on the RTU-485 module's right.

15.1.7.8 In RTU Mode, PLC Reads Input Signals and Sets Output Devices on the Right-Side DIO Modules of RTU-485

- **Network connection diagram**

  Refer to section 15.1.7.3 “Network connection diagram”.

- **Requirements**
  - If M0 is ON, read the contents of X0 to X2 from the 1st DIO module (DVP08ST) located on the right of the RTU-485.
  - If M1 is ON, set Y0=ON on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.
  - If M2 is ON, read the contents of X0 to X7 from the 2nd DIO module (DVP16SP) located on the right of the RTU-485.
  - If M3 is ON, set Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF on the 2nd DIO module (DVP16SP) located on the right of the RTU-485.

- **RTU-485 Configurations**

Item	Setting value	Description
Communication address	01	Setting range: H'01 to H'F0 (decimal: 1 to 240). In this example, the value is set to 1. Refer to section 15.1.3.2, “Address Setting Switch” for setting the communication address for RTU-485 module.
Communication format	Modbus RTU; <8, N, 2>	RTU-485 module supports various communication modes. In this example, the communication format is set to Modbus RTU, 8, N, 2. Refer to section 15.1.3.3, “Communication Setting Switch” for setting the format for RTU-485 module.
Transmission rate	19200 bps	RTU-485 module supports various transmission rates. In this example, the transmission rate is set to 19200 bps. Refer to section 15.1.3.3 for more details.

- **Explanations**

■ Inputs X0-X177 on the DIO module correspond to Modbus addresses H'0400-H'047F on the RTU-485 module. Here is the breakdown of which input on the DIO module is mapped to which Modbus address on the RTU-485 module.

Module	Input	Modbus Address	Description
DVP08ST	X0	H’0400	X0 on the DVP08ST is mapped to H'0400 on the RTU-485 module. A read operation on H'0400 is required to read the DVP08ST's X0.
	X1	H’0401	X1 on the DVP08ST is mapped to H'0401 on the RTU-485 module. A read operation on H'0401 is required to read the DVP08ST's X1.
	X2	H’0402	X2 on the DVP08ST is mapped to H'0402 on the RTU-485 module. A read operation on H'0402 is required to read the DVP08ST's X2.
	X3	H’0403	X3 on the DVP08ST is mapped to H'0403 on the RTU-485 module. A read operation on H'0403 is required to read the DVP08ST's X3.
	X4	H’0404	X4 on the DVP08ST is mapped to H'0404 on the RTU-485 module. A read operation on H'0404 is required to read the DVP08ST's X4.
	X5	H’0405	X5 on the DVP08ST is mapped to H'0405 on the RTU-485 module. A read operation on H'0405 is required to read the DVP08ST's X5.
	X6	H’0406	X6 on the DVP08ST is mapped to H'0406 on the RTU-485 module. A read operation on H'0406 is required to read the DVP08ST's X6.
	X7	H’0407	X7 on the DVP08ST is mapped to H'0407 on the RTU-485 module. A read operation on H'0407 is required to read the DVP08ST's X7.
DVP16SP	X0	H’0408	X0 on the DVP16SP is mapped to H'0408 on the RTU-485 module. A read operation on H'0408 is required to read the DVP16SP's X0.
	X1	H’0409	X1 on the DVP16SP is mapped to H'0409 on the RTU-485 module. A read operation on H'0409 is required to read the DVP16SP's X1.
	X2	H’040A	X2 on the DVP16SP is mapped to H'040A on the RTU-485 module. A read operation on H'040A is required to read the DVP16SP's X2.
	X3	H’040B	X3 on the DVP16SP is mapped to H'040B on the RTU-485 module. A read operation on H'040B is required to read the DVP16SP's X3.
	X4	H’040C	X4 on the DVP16SP is mapped to H'040C on the RTU-485 module. A read operation on H'040C is required to read the DVP16SP's X4.
	X5	H’040D	X5 on the DVP16SP is mapped to H'040D on the RTU-485 module. A read operation on H'040D is required to read the DVP16SP's X5.
	X6	H’040E	X6 on the DVP16SP is mapped to H'040E on the RTU-485 module. A read operation on H'040E is required to read the DVP16SP's X6.
	X7	H’040F	X7 on the DVP16SP is mapped to H'040F on the RTU-485 module. A read operation on H'040F is required to read the DVP16SP's X7.

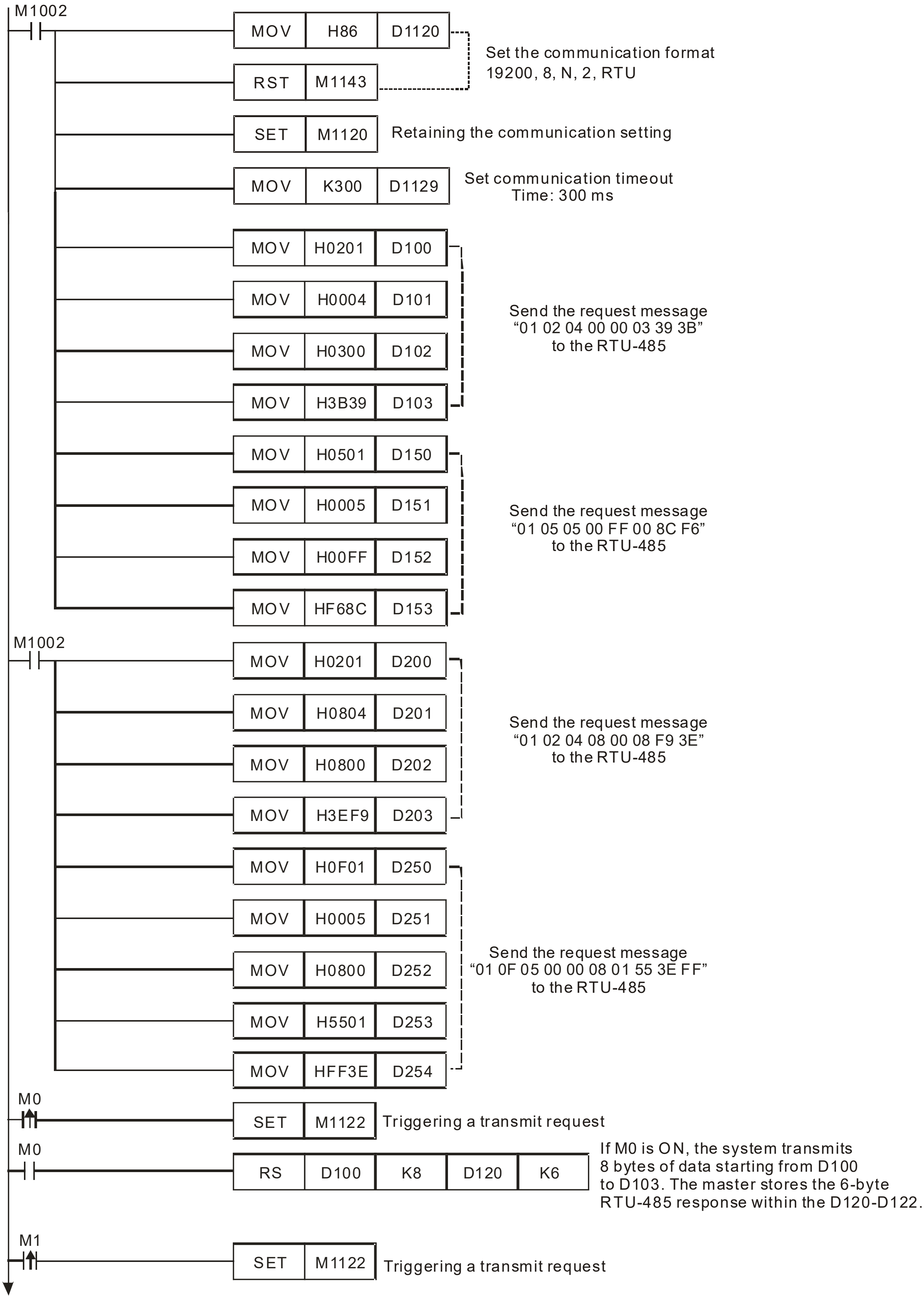
Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between X0 to X177 of the modules on the right and the RTU-485 addresses.

- Outputs Y0-Y177 on the DIO module correspond to Modbus addresses H'0500-H'057F on the RTU-485 module. Here is the breakdown of which output on the DIO module is mapped to which Modbus address on the RTU-485 module.

Module	Output	Modbus Address	Description
DVP16SP	Y0	H’0500	Y0 on the DVP16SP is mapped to H'0500 on the RTU-485 module. A write operation on H'0500 is required to write the DVP16SP's Y0.
	Y1	H’0501	Y1 on the DVP16SP is mapped to H'0501 on the RTU-485 module. A write operation on H'0501 is required to write the DVP16SP's Y1.
	Y2	H’0502	Y2 on the DVP16SP is mapped to H'0502 on the RTU-485 module. A write operation on H'0502 is required to write the DVP16SP's Y2.
	Y3	H’0503	Y03 on the DVP16SP is mapped to H'0503 on the RTU-485 module. A write operation on H'0503 is required to write the DVP16SP's Y3.
	Y4	H’0504	Y4 on the DVP16SP is mapped to H'0504 on the RTU-485 module. A write operation on H'0504 is required to write the DVP16SP's Y4.
	Y5	H’0505	Y5 on the DVP16SP is mapped to H'0505 on the RTU-485 module. A write operation on H'0505 is required to write the DVP16SP's Y5.
	Y6	H’0506	Y6 on the DVP16SP is mapped to H'0506 on the RTU-485 module. A write operation on H'0506 is required to write the DVP16SP's Y6.
	Y7	H’0507	Y7 on the DVP16SP is mapped to H'0507 on the RTU-485 module. A write operation on H'0507 is required to write the DVP16SP's Y7.

Note: Refer to section 15.1.5.1, “Addresses of Functional Areas in Digital I/O Module” for the mapping relationship between Y0 to Y177 of the module on the right and the RTU-485 addresses.

- **The program**



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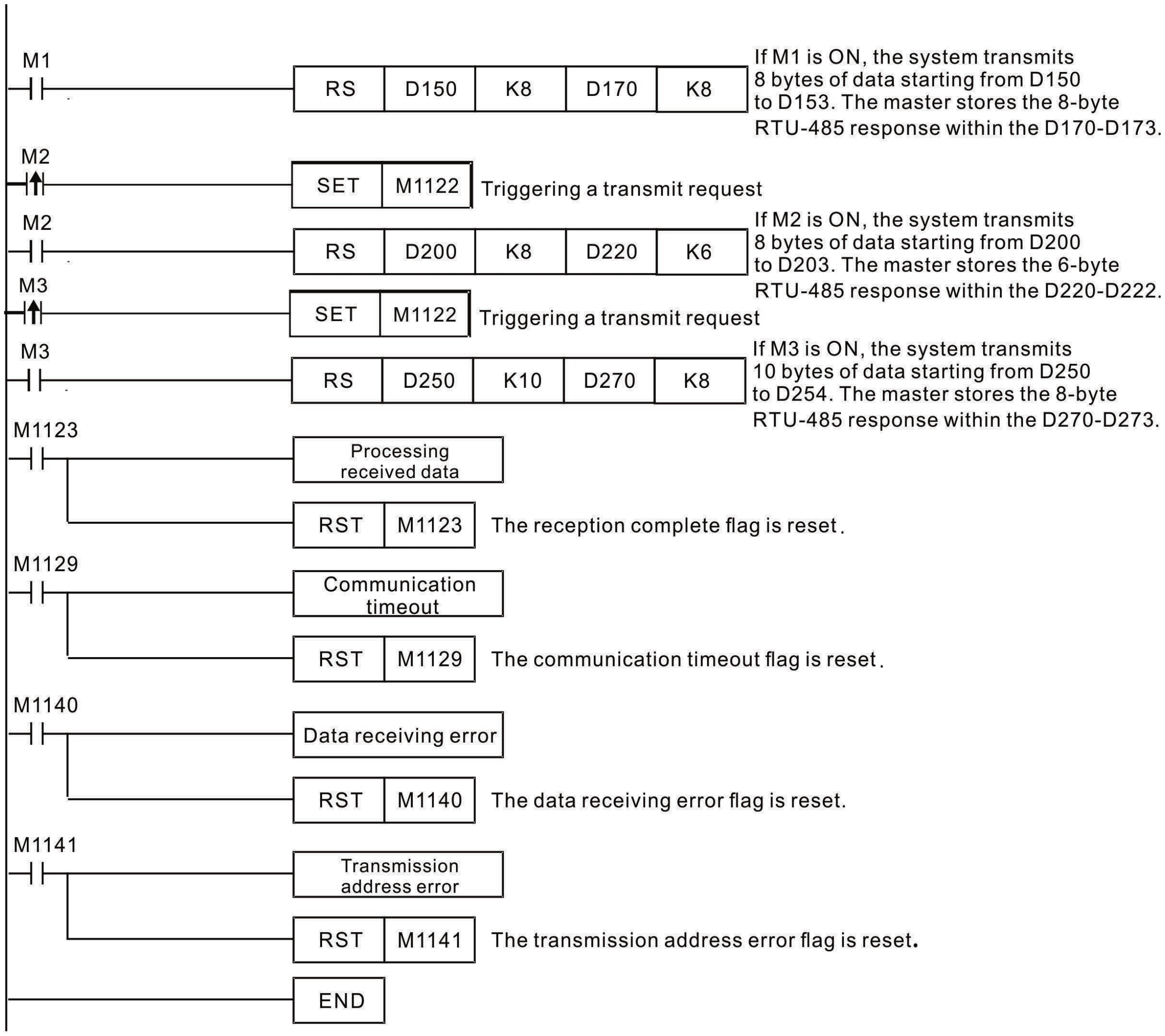

- **Program explanations**

  - Set the communication format. Master and slave must use the same format, which is configured here as 19200 (baud rate), 8 data bits, no parity, 2 stop bits, RTU mode.
  - Once the communication format is set, you must set the device M1120 (retaining the communication setting) of the COM2 to ON.
  - When M0 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “01 02 0400 0003 393B” to the RTU-485 module to read the X0 to X2 states of the 1st module (DVP08ST) on the RTU-485 module's right.
  - When M1 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “01 05 0500 FF00 8CF6” to set the Y0=ON of the 2nd module (DVP16SP) on the RTU-485 module's right.
  - When M2 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “01 02 0408 0008 F93E” to the RTU-485 module to read the X0 to X7 states of the 2nd module (DVP16SP) on the RTU-485 module's right.
  - When M3 is ON, triggering a transmit request, execute the RS instruction. At the same time, the master PLC sends the request message “01 0F 0500 0008 01 55 3EFF” to the RTU-485 module to set the Y0=ON, Y2=ON, Y4=ON, Y6=ON, Y1=OFF, Y3=OFF, Y5=OFF and Y7=OFF of the 2nd module (DVP16SP) on the RTU-485 module's right.

15.1.8 LED Indicator Description and Troubleshooting

Equipped with four LED indicators (POWER, RUN, ALARM, and RS-485), the RTU-485 provides visual cues for its operational status and communication connectivity.

- **POWER LED**

Status	Description	Solution
OFF	No power, or the operational power is faulty.	Verify the RTU-485 module operating power and ensure that connections are secure.
ON (Green)	The operating power of RTU-485 module is working correctly.	No action required.

- **RUN LED**

Status	Description	Solution
OFF	The RTU-485 module is in STOP state.	No action required.
ON (Green)	The RTU-485 module is in RUN state.	No action required.

- **ALARM LED**

Status	Description	Solution
OFF	The operating voltag is too low.	Verify the RTU-485 module operating power and ensure that connections are secure.
ON (Red)	RTU-485 module: Communication format misconfiguration.	Verify that the RTU-485 module communication format is configured correctly.
	RTU-485 module: Communication address setting error.	Verify that the RTU-485 module communication address is set in a valid range.
	The RTU-485 module has no I/O module connected.	Verify that the RTU-module is connected to an I/O module and the connection is secure.
	The RTU-485 module has exceeded its limit of 8 special I/O module connections.	Verify that the number of connected special I/O modules is within the 8-module limit.
	The number of digital I/O points connected to the RTU-485 module is out of range.	Verify that the RTU-485's connected digital I/O modules do not exceed 128 input points and 128 output points.

- **RS-485 LED**

Status	Description	Solution
OFF	The RTU-485 module is not communicating with the master device.	No action required.
Blinking (Red)	RTU-485 is communicating normally with the master device.	No action required.

15.2 RTU-CN01

15.2.1 Introduction

The RTU-CN01 module is defined as a CANopen slave with DVP Slim series DIO modules and special modules connected on its right side.

15.2.1.1 Features

- As a CANopen slave, the RTU-CN01 module supports services such as PDO, SDO, SYNC, NMT and Error Control.
- On its right side, the RTU-CN01 can connect to DVP Slim series right-side modules, supporting up to 128 digital input points and 128 digital output points, as well as 8 special modules including analog modules, temperature measurement modules, pulse modules, etc.
- A total of up to 14 DVP Slim series digital modules and special modules can be connected to the right side of the RTU-CN01.
- The network configuration software provides a graphical configuration interface, automatically scans and recognizes extension modules, configures CR registers of special modules as IO data, sets methods for error handling, and diagnoses the error status of each module.
- Users can choose whether the output values of the right-side special modules and digital output point values of digital modules should remain the same as they were before disconnection, or reset to zero when the RTU-CN01 is disconnected from the master.

15.2.1.2 CANopen Services

Supported services are the following:

- Standard CANopen protocol: DS301v4.02.
- Network Management service (NMT)
- Error Control and Heartbeat protocols
- PDO (Process Data Object) service, with a maximum of 8 TxPDOs and 8 RxPDOs configurable
- PDO transmission types: asynchronous, synchronous and cyclic, synchronous and acyclic
- SDO (Service Data Object) service

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15.2.1.3 Specifications

■ **CANopen communication port**

Item	Specification
Transmission method	CAN
Electrical isolation	500 VDC
Interface	Removable connector (5.08 mm)
Transmission cable	Two communication wires, one shield wire and one ground wire

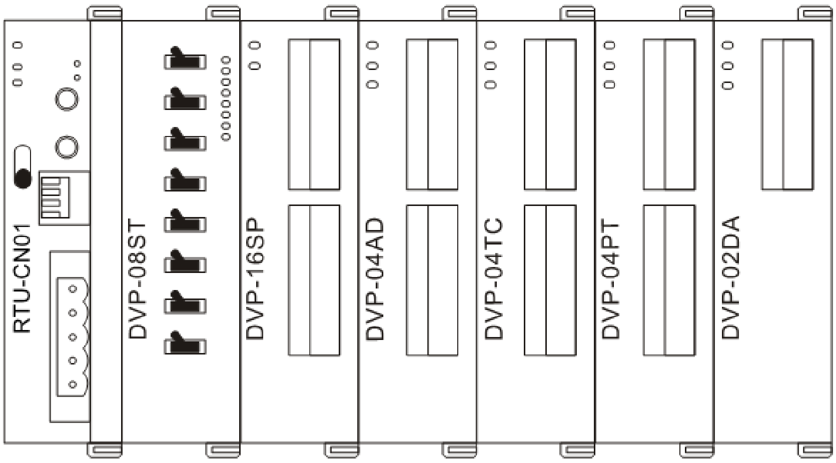
■ **CANopen communication**

Item	Specification
Message type	PDO, SDO, SYNC, Emergency, NMT
Transmission rate	10K, 20K, 50K, 125K, 250K, 500K, 800K, 1M (unit: bps)

■ **Electrical specification**

Item	Specification
Power voltage	24 VDC (-15% to 20%)
Consumption power	0.8 W
Insulation voltage	500 VAC
Weight	71 g

15.2.1.4 Extension Modules Connectable to RTU-CN01



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■ Digital modules connectable to RTU-CN01

DI/DO module (Model name)	Default I/O mapping data (CANopen→RTU-CN01)	Default I/O mapping data (RTU-CN01→CANopen)
DVP08SM11N	N/A	8 bits
DVP-08SM10N	N/A	8 bits
DVP16SM11N	N/A	16 bits
DVP06SN11R	8 bits	N/A
DVP08SN11R/T	8 bits	N/A
DVP08SN11TS	8 bits	N/A
DVP16SN11T	16 bits	N/A
DVP16SN11TS	16 bits	N/A
DVP08SP11R/T	8 bits	8 bits
DVP08SP11TS	8 bits	8 bits
DVP16SP11R/T	8 bits	8 bits
DVP16SP11TS	8 bits	8 bits
DVP32SM11N	N/A	32 bits
DVP32SN11TN	32 bits	N/A
DVP08ST11N	N/A	8 bits

■ Special modules connectable to RTU-CN01

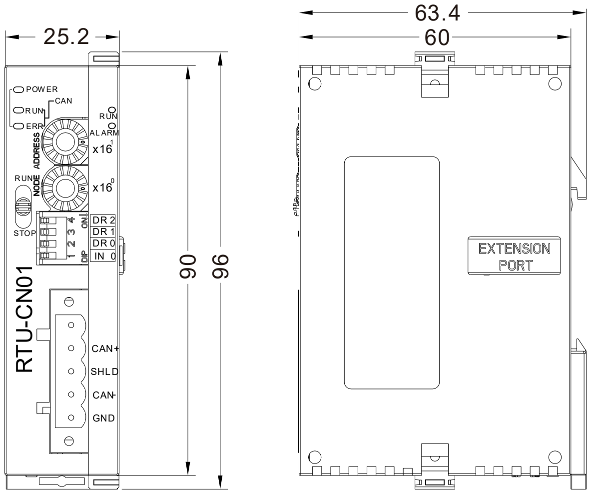
Special module (Model name)	Default I/O mapping data (CANopen→RTU-CN01)		Default I/O mapping data (RTU-CN01→CANopen)	
	Starting CR	Length (words)	Starting CR	Length (words)
DVP02DA-S	CR10	2	N/A	N/A
DVP02DA-S2	CR#10	2	N/A	N/A
DVP04DA-S	CR6	4	N/A	N/A
DVP04DA-S2	CR6	4	N/A	N/A
DVP04AD-S	N/A	N/A	CR12	4
DVP04AD-S2	N/A	N/A	CR12	4
DVP06AD-S	N/A	N/A	CR12	6
DVP06AD-S2	N/A	N/A	CR#12	6
DVP04TC-S	N/A	N/A	CR14	4
DVP04PT-S	N/A	N/A	CR18	4
DVP06PT-S	N/A	N/A	CR18	6
DVP06XA-S	CR10	2	CR12	4
DVP06XA-S2	CR10	2	CR12	4
DVP01PU-S	CR42	4	CR33	4
DVP02TUL-S	CR4	2	CR2	2
DVP02TUR-S	CR4	2	CR2	2
DVP02TUN-S	CR4	2	CR2	2

Note:

When special modules are connected to the RTU-CN01, the starting one of the communication registers (CRs) for data upload and download, as well as the length of the data to be uploaded or downloaded, can be configured using the CANopen network configuration tool.

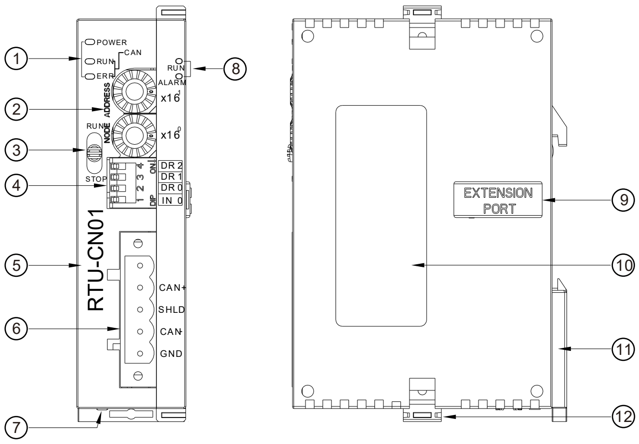
15.2.2 Dimensions and Parts

- **Dimensions**



Unit: mm

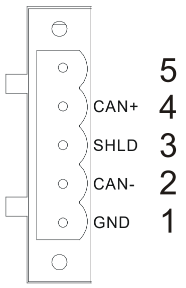
- **Parts**



No.	Name	Description
1	Status indicators	Indicate the power supply status, CANopen status and operational status of the module. See section LED Indicator Diagnosis for details.
2	Address switch	CANopen communication address setting
3	RUN/STOP switch	RUN: Start user program execution STOP: Stop user program execution
4	Function switch	Transmission rate and I/O data action settings
5	Model name	Model name of the module
6	CANopen connector interface	For CANopen communication
7	24V DC power interface	For supplying power to I/O modules
8	I/O module port	For connecting I/O modules
9	Nameplate	Label plate
10	DIN rail clip	For securing the device itself
11	I/O module clip	For securing I/O modules

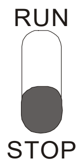
15.2.3 Terminals

15.2.3.1 CANopen Connector



Pin	Signal	Description
1	GND	0 VDC
2	CAN_L	Signal-
3	SHLD	Shielded
4	CAN_H	Signal+
5	-	Reserved

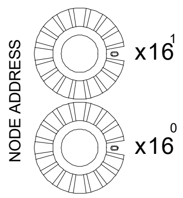
15.2.3.2 RUN/STOP Switch



RUN/STOP Switch	Description
STOP → RUN	1. To re-detect the extension modules. 2. To read/write the data in the extension modules.
RUN → STOP	To stop reading/writing the data in the extension modules.

15.2.3.3 Address Switches

The switches are for setting the node address of the RTU-CN01 module on the CANopen network within the range of 1 to 7F.



Setting	Description
1 to 7F	Valid CANopen node address
0, 80 to FF	Invalid CANopen node address

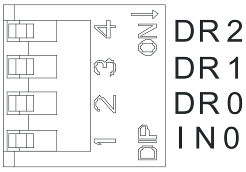
Example:

to set the node address of the RTU-CN01 module to 26 (1AH), set the corresponding switch of $x16^1$ to 1 and the corresponding switch of $x16^0$ to A.

Important:

- Set the node address with the power off. Power on the RTU-CN01 module after setting the address.
- Changes to the node address during operation of the module are ineffective.
- Adjust the rotary switch carefully with a flathead screwdriver to avoid scratches.

15.2.3.4 Function Switch



DR2	DR1	DR0	Transmission Rate (unit: bps)	Max. Communication Distance (unit: m)
OFF	OFF	OFF	10K	5000
OFF	OFF	ON	20K	2500
OFF	ON	OFF	50K	1000
OFF	ON	ON	125K	500
ON	OFF	OFF	250K	250
ON	OFF	ON	500K	100
ON	ON	OFF	800K	50
ON	ON	ON	1M	25

IN0

OFF: When the RTU-CN01 module is disconnected from the master, the output values of the special modules on its right side become 0 and all output points of its digital modules are set to OFF.

ON: When the RTU-CN01 module is disconnected from the master, the output values of the special modules on its right side and all output points of its digital modules remain the values and states prior to disconnection.

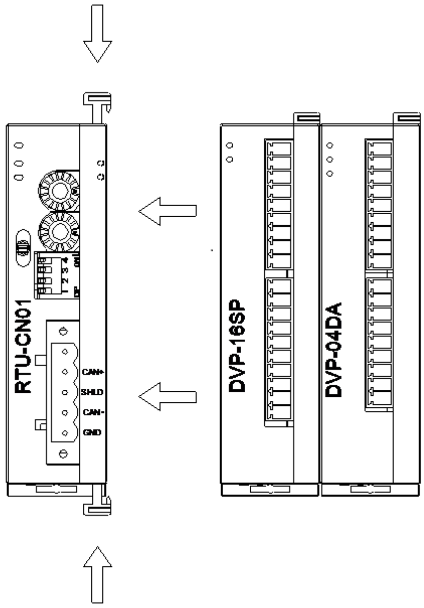
Important:

- Set the function switch with the power off. After the setup is completed, re-power the RTU-CN01 module.
- Adjust the DIP switch carefully with a flathead screwdriver to avoid scratches.

15.2.4 Installing

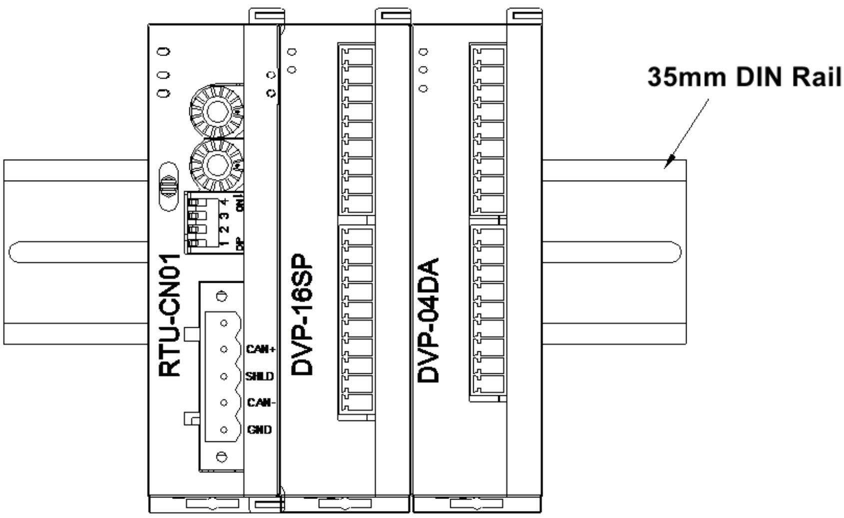
1. Connecting DVP Slim Extension Modules to RTU-CN01

- Pull open the I/O module clips on the top and the bottom of the RTU-CN01, align the extension modules with the guiding holes and then securely connect the extension modules to the RTU-CN01 as illustrated.
- Press the I/O module clips on the top and the bottom of the RTU-CN01 to fasten the extension modules.



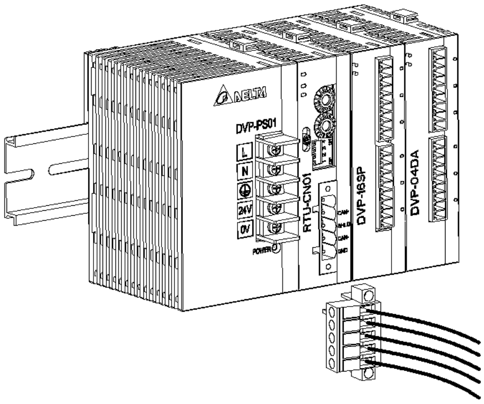
2. Installing RTU-CN01 and DVP Slim Modules on DIN Rail

- Use a 35 mm standard DIN rail.
- Pull open the DIN rail clips of the RTU-CN01 and extension modules. Mount the RTU-CN01 and extension modules into the DIN rail.
- Press the DIN rail clips of the RTU-CN01 and extension modules to secure them on the DIN rail.



3. Connecting to the CANopen Connector Interface

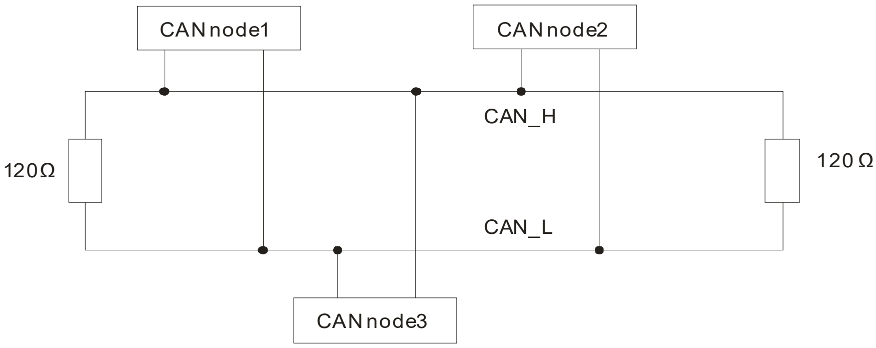
- Please wire the CANopen connector according to its pin definitions.
- Connect the communication connector to the CANopen interface of the RTU-CN01.



15.2.5 Wiring

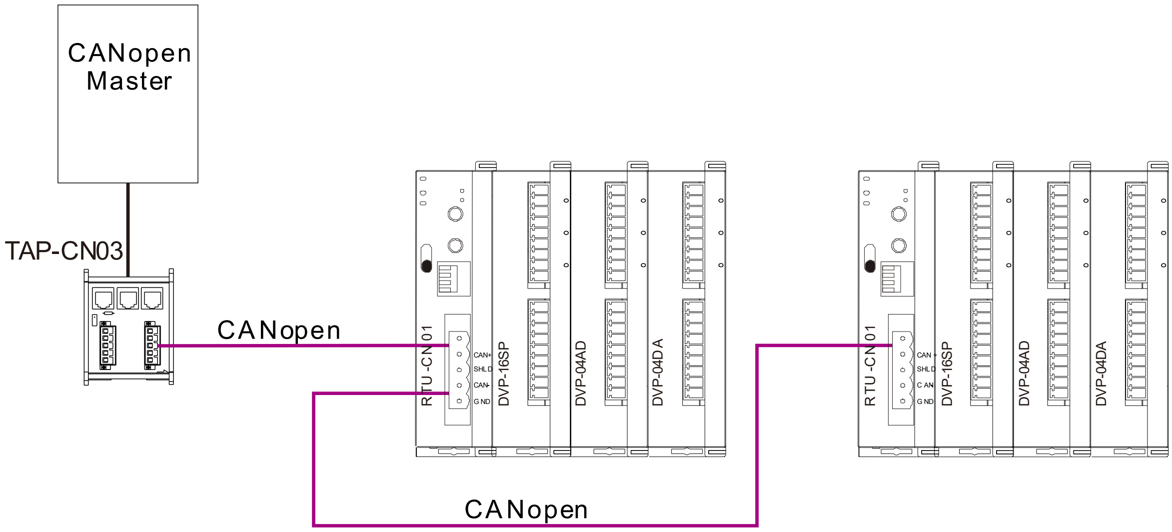
15.2.5.1 CANopen Network Topology

Each of the two ends of a CANopen network should be connected with a terminal resistor of 120 Ω to enhance the stability of CANopen communication. See the illustration of a basic CANopen network topology below.



15.2.5.2 Connecting to CANopen Interface

- Delta standard cables: UC-DN01Z-01A (thick cable), UC-DN01Z-02A (thin cable) and UC-CMC010-01A (thin cable) are recommended for building a CANopen network. Please keep the communication cable away from the power cable. For specifications of cables, see Appendix A List of Accessories.
- The terminal resistor of 120 Ω should be connected between CAN_H and CAN_L at each of both ends of the network. Users can purchase Delta terminal resistor, TAP-TR01.



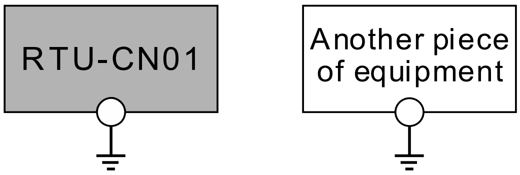
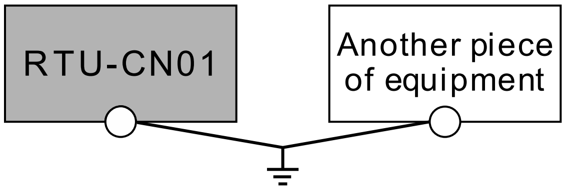
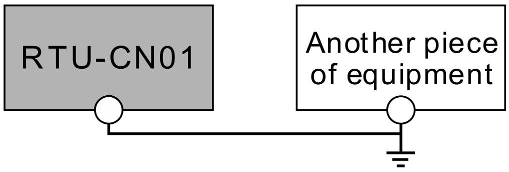
15.2.5.3 Power Input Wiring

15.2.5.3.1 Notes

The power input of RTU-CN01 is 24 VDC. Please notice the following points during use.

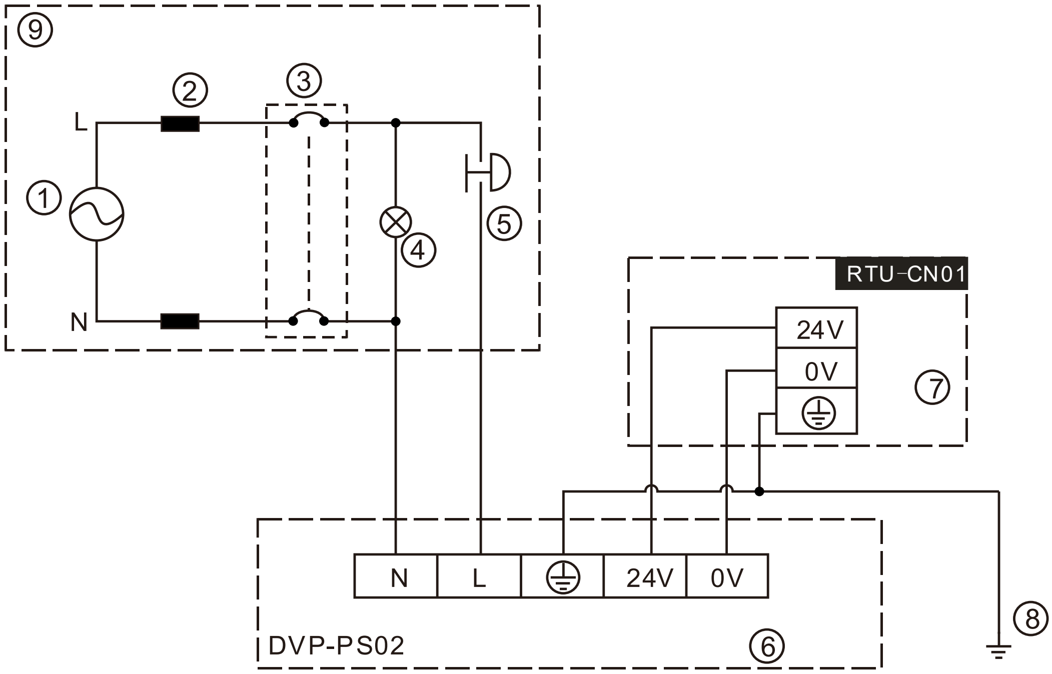
- Connect the supply power to the two terminals, 24 V and 0 V and the grounding terminal to the earth. Be cautious that the RTU-ECAT device may be damaged if the positive and negative polarities of the supply power are connected reversely.
- Please be sure to use certified power supply with SELV output or certified power supply providing double insulation evaluated by UL60950, or UL61010-1 and UL61010-2-201 standards.
- Use copper conductors as power wires only. The diameter of the power wire must be between 12 and 28 AWG and the rated temperature should be greater than 70°C. The power terminal block plug wiring torque is 4.5 in-lbs.
- The cables for the 110 and 220 VAC power supply and the 24 VDC power supply must be twisted and connected to the module as short as possible in length.
- Do not combine the AC 110 V, 220 V, and DC 24 V cables with the main circuit and I/O signal cables together and please keep them away from each other. If the space permits, it is recommended to separate these lines by more than 100 mm.

15.2.5.3.2 Ground

● The diameter of the ground should not be less than the diameters of the cables connected to the terminals L and N. ● If using multiple pieces of equipment, use a single-point ground.	 The single-point ground is better.
● If you cannot use a single-point ground, use a common-point ground.	 The common-point ground is permitted.
● Do not connect equipment ground wires together.	 The equipment can not be grounded in this way.

15.2.5.4 RTU-CN01 Wiring

- **Safety Circuit Wiring:**

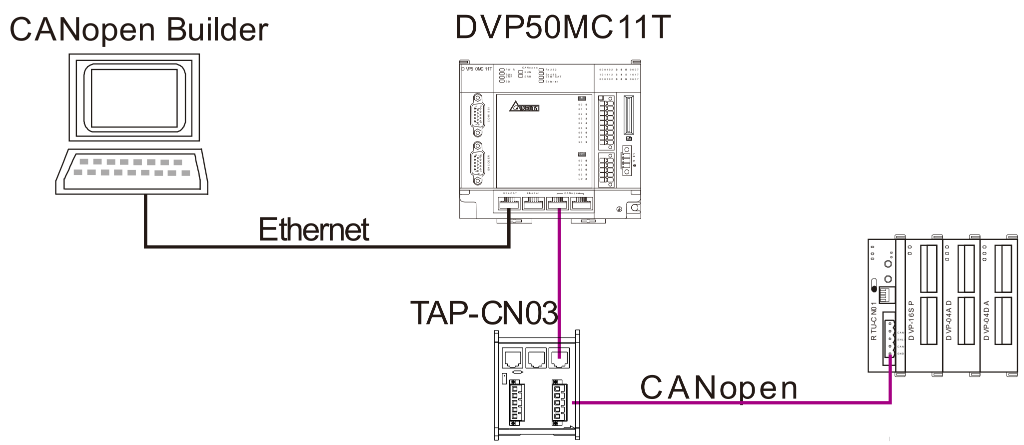


①	AC power supply: 100 to 240 VAC, 50/60 Hz.
②	Power supply circuit protection fuse
③	Circuit isolation device for the system: The electromagnetic contactor, relay and other switch can be used as the isolation device to prevent the system instability when the power supply is discontinuous.
④	Power supply indicator
⑤	Emergency stop button: The button cuts off the system power supply when an accidental situation occurs.
⑥	Delta power module DVP-PS02/24 VDC
⑦	RTU-CN01 device
⑧	Ground
⑨	Safety circuit

15.2.6 Configuring RTU-CN01

As a CANopen slave, RTU-CN01 works to achieve the data exchange between CANopen master and DVP Slim series extension modules.

1. RTU-CN01 sends the data that the CANopen master outputs to extension modules.
2. RTU-CN01 sends the data that extension modules input to the CANopen master.



- **Terms for RTU-CN01 Configuration**

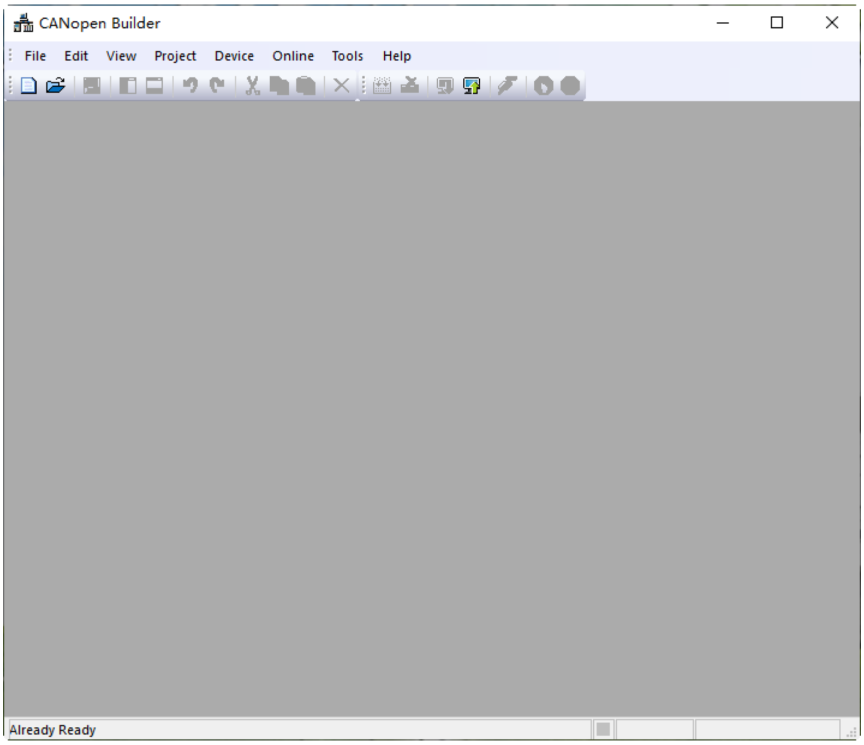
No.	Name	Unit	Description
1	Control word	Word	Controls the state of RTU-CN01 into RUN or STOP. When the content of the control word is 16#8000, RTU-CN01 is in STOP state. When the content of the control word is 16#8001, RTU-CN01 is in RUN state. See section 15.2.7.3 for more details.
2	Status word	Word	Displays the status of RTU-CN01. See section 15.2.7.3 for more details.
3	DI Module Points	Bit	The number of digital input points of digital modules connected on the right side of RTU-CN01. The number of digital input points is a multiple of 8. The number is counted as 8 when it is less than 8 and as 16 when it is greater than 8 but less than 16.
4	DO Module Points	Bit	The number of digital output points of digital modules connected on the right side of RTU-CN01. The number of digital output points is a multiple of 8. The number is counted as 8 when it is less than 8 and as 16 when it is greater than 8 but less than 16.
5	Input IO data length	Byte	The length of data that RTU-CN01 transmits to the master, which is configured in PDO.
6	Output IO data length	Byte	The length of data that the master transmits to RTU-CN01, which is configured in PDO.
7	Special Module Number	Unit	The number of special modules connected to RTU-CN01. Range: 0 to 8
8	Diagnostic Interval Time	Sec	The time interval when RTU-CN01 executes the diagnosis of the special modules on its right side. Range: 1 to 65; Default: 5 seconds
9	Special Module Offline Treatment	N/A	How RTU-CN01 will react when any special module connected is offline. You can choose “Ignore” or “Alarm”. Default: Alarm

No.	Name	Unit	Description
10	Special Module Error Treatment	N/A	How RTU-CN01 will react when it detects errors. You can choose “Ignore” or “Alarm”. Default: Alarm
11	Reset RTU	N/A	Restores the configuration of RTU-CN01 to default settings.
12	Clear Config	N/A	Clears the current configuration data of RTU-CN01.
13	Add control word and status word to I/O data	N/A	This parameter decides whether or not to add control word and status word to I/O data. If you do not choose the item, the I/O data in RTU-CN01 and CANopen master will not include control word and status word. If you choose the item, the I/O data in RTU-CN01 and CANopen master will include control word and status word.
14	Work mode	N/A	This parameter sets up the work mode of the special modules connected to RTU-CN01. When “Auto” is selected, RTU-CN01 will configure default CR registers of the special modules for CANopen I/O mapping data. When “Custom” is selected, you can configure any CR registers in the special module for CANopen I/O mapping data.
15	Input Link Number	Link	The number of input data links of the special modules connected to RTU-CN01. It is valid under Custom mode. The starting CR register and the number of CRs (Number) are specified in one input link e.g. Link1, Link2, etc.
16	Output Link Number	Link	The number of output data links of the special modules connected to RTU-CN01. It is valid under Custom mode. The starting CR register and the number of CRs (Number) are specified in one output link e.g. Link1, Link2, etc.
17	Input Data Length	Word	The total length of link input data of the special modules currently connected to RTU-CN01.
18	Output Data Length	Word	The total length of link output data of the special modules currently connected to RTU-CN01.
19	IO mapping	Word	The I/O mapping relation between the RTU-CN01 and special modules/digital modules connected to it.

15.2.7 Introduction to Software Interfaces

This section takes the CANopen Builder software as an example to describe how to configure the RTU-CN01. First, add the RTU-CN01 slave to the CANopen configuration interface of the CANopen Builder software.

1. Start the CANopen Builder software, and then the software interface is shown as follows.



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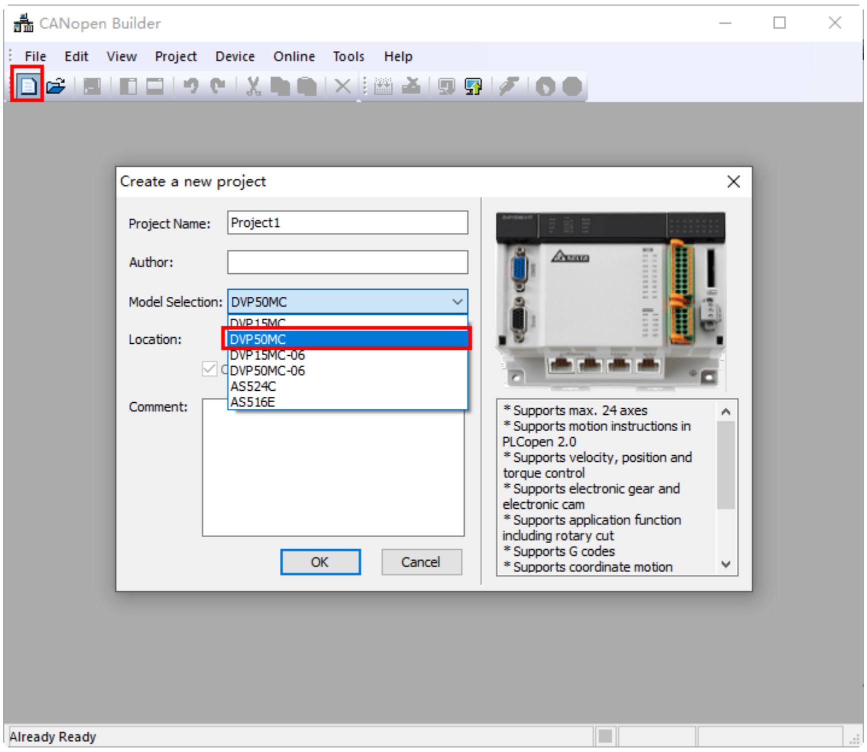
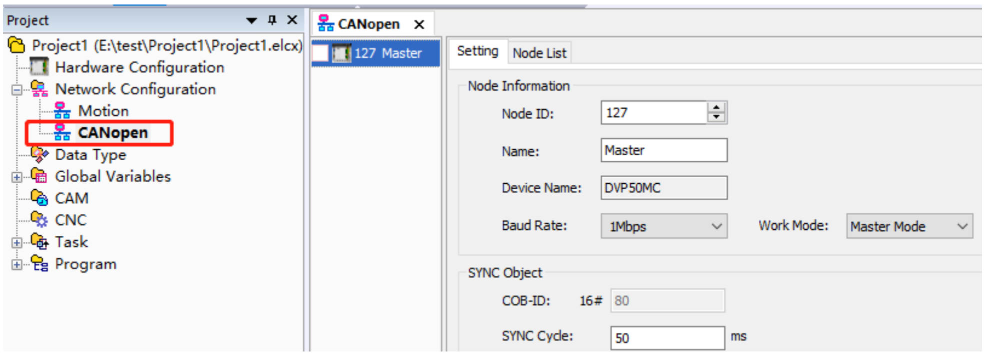
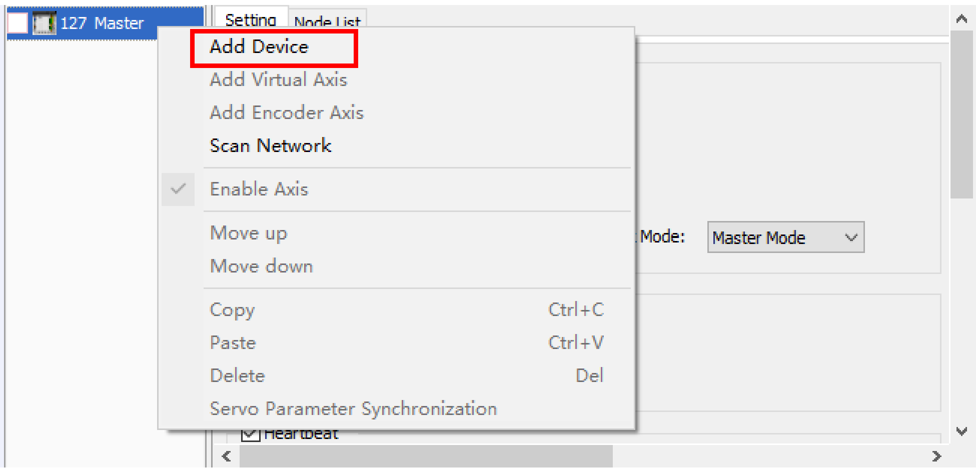
2. Click on "**New Project**", select DVP50MC11T in the "**Model Selection**" field. After setting is done, click the "**OK**" button to return to the main interface.



3. Click on the "+" to the left of “**Network Configuration**” item, and then double-click on “**CANopen**” to make the CANopen configuration interface appear.



4. Right-click on “**127Master**” in the CANopen configuration interface, and then click on “**Add Device**”. You can also click on “**Scan Network**” to scan the connected slave device



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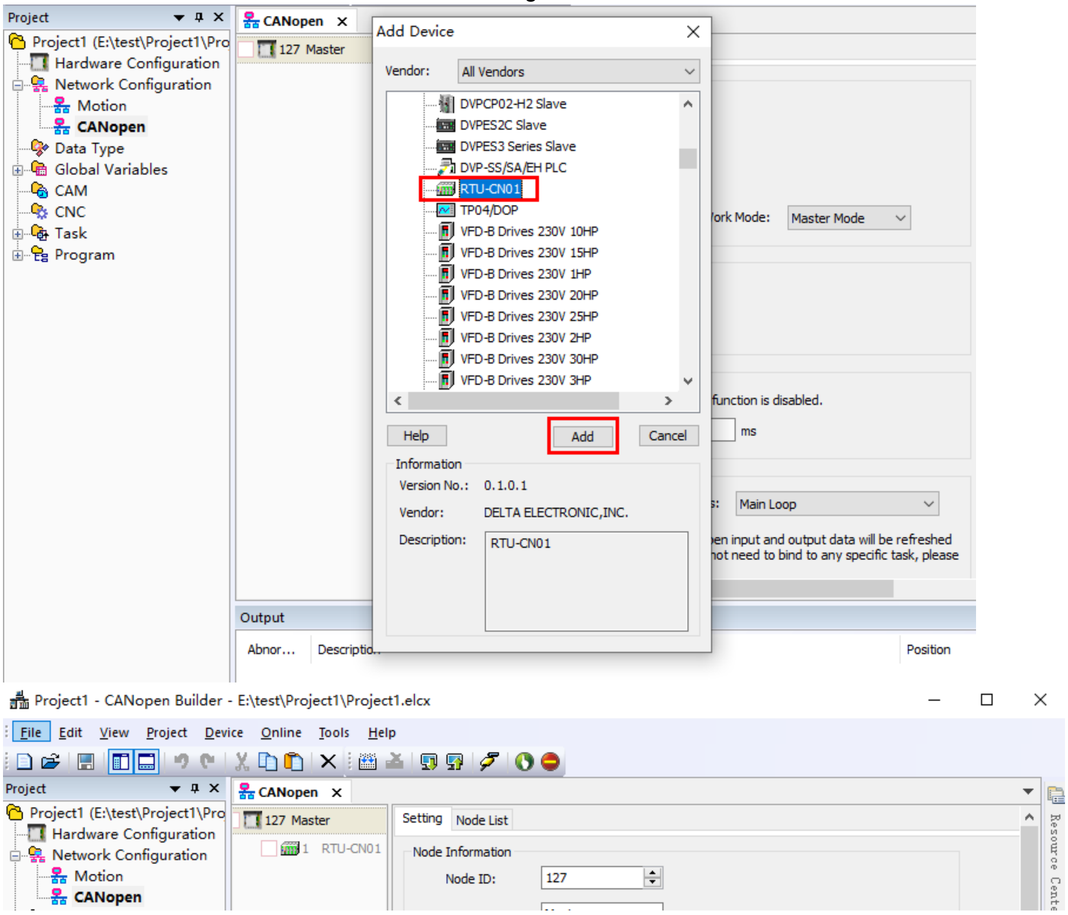
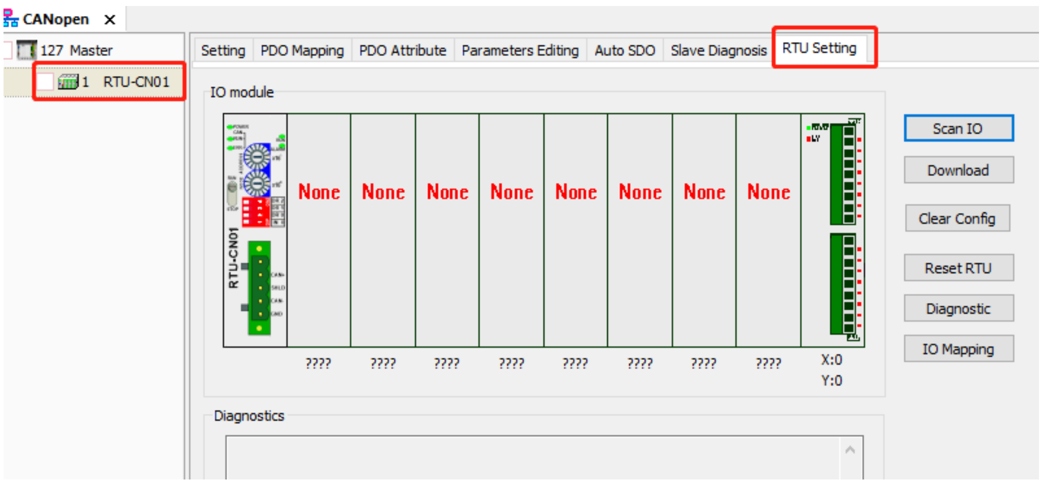
5. After clicking on "**Add Device**" option, a dialog box appears. Select RTU-CN01 in the dialog box and click "**Add**" button. Afterward, click "**Cancel**" to close the dialog box.



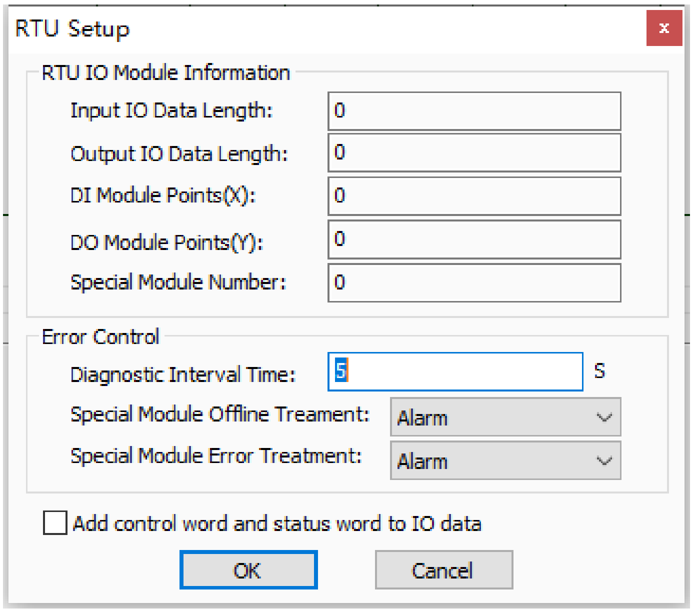
15.2.7.1 RTU Setting Tab

After the RTU-CN01 slave is added in the software, click on the RTU-CN01 on the left side, click on "**RTU Setting**" and then the main interface for configuring RTU is shown as below.



15.2.7.2 RTU Setup Interface

The “**RTU Setup**” window will pop up by double-clicking the RTU-CN01 symbol on the left of the “**RTU Setting**” interface. It mainly displays: the number of DVP Slim series special modules connected on the right side of RTU-CN01, the number of inputs and output points of digital modules, the error control treatment of RTU-CN01, and whether to add the control word and status word to IO data, as shown in the figure below.



Explanation of RTU setup parameters:

Item	Description	Default
Input Data Length	The total length of the status word of RTU-CN01 and the input data of the extension modules. Unit: Byte. The status word occupies 2 bytes. Each input channel of a special module occupies 2 bytes. 8 points for digital input are counted as 1 byte.	0
Output Data Length	The total length of the control word of RTU-CN01 and the output data of its extension modules. Unit: Byte. The control word occupies 2 bytes. Each output channel of a special module occupies 2 bytes. 8 points for digital output are counted as 1 byte.	0
DI Module Points (X)	The number of digital input points of the digital modules connected on the right side of RTU-CN01. The number of digital input points should be a multiple of 8. The number will be regarded as 8 when it is less than 8 and as 16 when it is greater than 8 but less than 16.	0
DO Module Points (Y)	The number of digital output points of the digital modules connected on the right side of RTU-CN01. The number of digital output points should be a multiple of 8. The number will be regarded as 8 when it is less than 8 and as 16 when it is greater than 8 but less than 16.	0
Special Module Number	The number of special modules connected to RTU-CN01. Range: 0-8	0
Diagnostic Interval Time	The interval time for RTU-CN01 to execute the diagnosis of special modules. Range: 1-65 seconds.	5 seconds

Item	Description	Default
Special Module Offline Treatment	How RTU-CN01 will react when the special module connected is offline. You can choose “Ignore” or “Alarm”.	Alarm
Special Module Error Treatment	How RTU-CN01 will react when it detects an error in a special module connected on its right side. You can choose “Ignore” or “Alarm”.	Alarm
Add control word and status word to IO data	For you to decide whether or not to add the control word and status word to I/O data. If you do not choose the item, the PDO configuration data for RTU-CN01 will not include the control word and status word. If you choose the item, the PDO configuration data for RTU-CN01 will include the control word and status word.	Not add control word and status word to I/O data

15.2.7.3 Control Word and Status Word in RTU-CN01

- Control word

Bit	Value	Description
bit0	0	RTU-CN01 is set to STOP as bit15 of the control word parameter is 1 and bit0 is 0.
	1	RTU-CN01 is set to RUN as bit15 of the control word parameter is 1 and bit0 is 1.
bit1	0/1	Reserved
bit2	0/1	Reserved
bit3	0/1	Reserved
bit4	0/1	Reserved
bit5	0/1	Reserved
bit6	0/1	Reserved
bit7	0/1	Reserved
bit8	0/1	Reserved
bit9	0/1	Reserved
bit10	0/1	Reserved
bit11	0/1	Reserved
bit12	0/1	Reserved
bit13	0/1	Reserved
bit14	0/1	Reserved
bit15	0	Control word is disabled. When the value of bit15 is 0, RTU-CN01 can NOT be switched to RUN or STOP state via bit0.
	1	Control word is enabled. When the value of bit15 is 1, RTU-CN01 can be switched to RUN or STOP state via bit0.

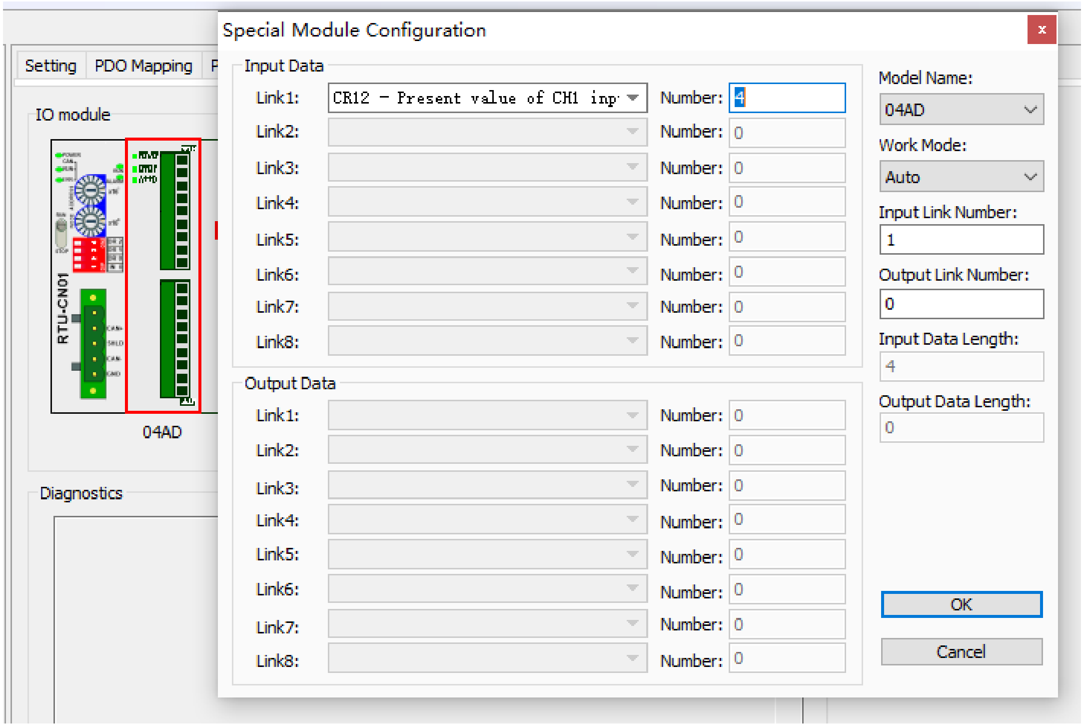
- Status Word

Bit	Status value	Description
bit0	0	RTU-CN01 detects extension modules.
	1	No extension module is detected by RTU-CN01.
bit1	0	The extension modules connected to RTU-CN01 are consistent with the configuration.
	1	The extension modules connected to RTU-CN01 are **inconsistent** with the configuration.

Bit	Status value	Description
bit2	0	No error occurs in special modules.
	1	An error occurs in special modules.
bit3	0	Special modules operate normally.
	1	It is detected that one special module fails to communicate with RTU-CN01.
bit4	0	The configuration data is valid.
	1	The configuration data is invalid.
bit5	0	The power voltage of RTU-CN01 is normal.
	1	The power of RTU-CN01 is in low voltage.
bit6	0	RTU-CN01 can identify connected modules.
	1	RTU-CN01 detects some special modules that cannot be identified.
bit7	0	RTU-CN01 is working normally.
	1	There are more than 8 special modules connected to RTU-CN01, or the number of digital input/output points exceeds 128.
bit8	0	Reserved
	1	Reserved
bit9	0	RTU-CN01 is in RUN state
	1	RTU-CN01 is in STOP state.
bit10	0/1	Reserved
bit11	0/1	Reserved
bit12	0/1	Reserved
bit13	0/1	Reserved
bit14	0/1	Reserved
bit15	0/1	Reserved

15.2.7.4 Special Module Configuration Interface

Double-click a special module symbol on the RTU Setting interface. For instance, with a double-click on the symbol of 04AD, the "**Special Module Configuration**" window will pop up for configuring the special module.



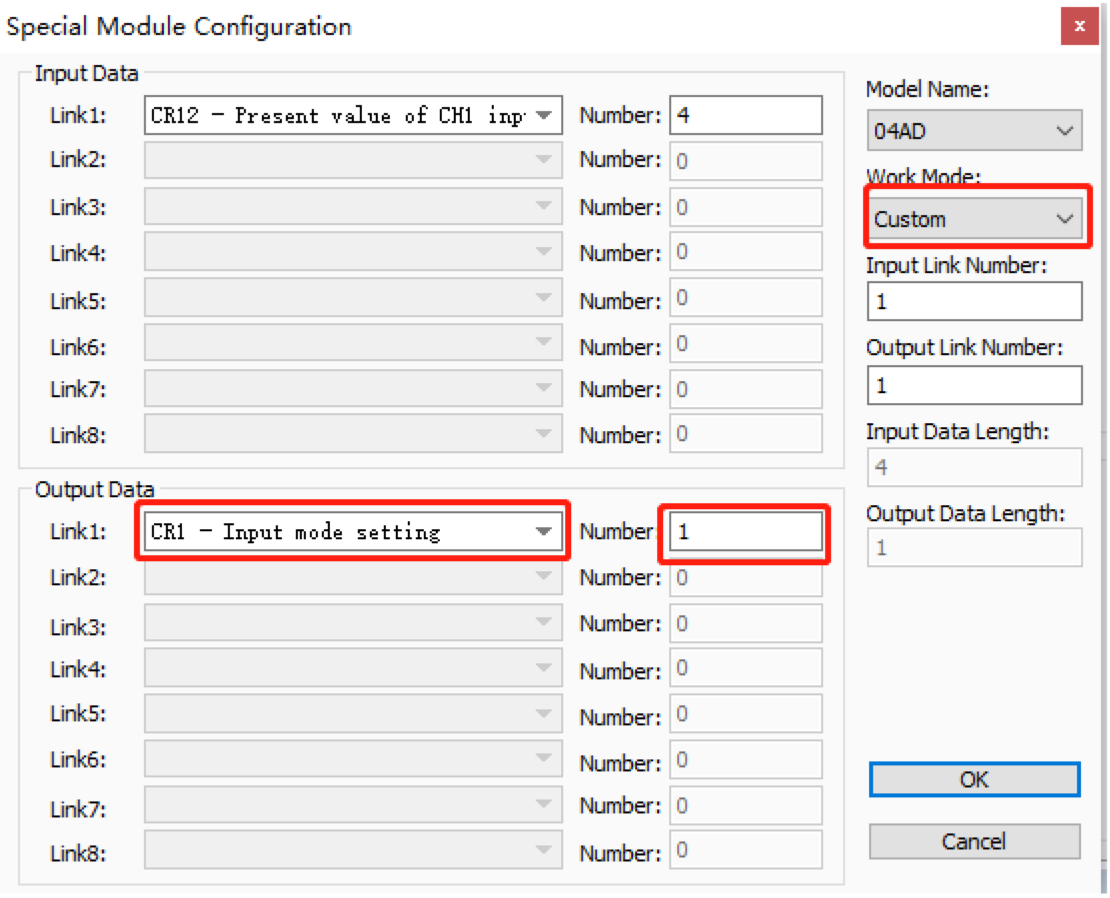
Explanation of the "Special Module Configuration" interface:

Item	Description
Module Name	One special module connected on the right side of RTU-CN01, such as 02DA, 04AD, 04DA, 04TC, 06AD and 06XA. Choose one from them based on actually connected special modules. Refer to Extension Modules Connectable to RTU-CN01 in section 15.2.1.4 for details. The special module positions configured in the software correspond to the positions of the special modules actually connected. The positions of digital modules are not counted. For example, the actually connected modules on the right side of RTU-CN01 are DVP04AD-S, DVP16SP11T and DVP04DA-S. So select 04AD for the first position on the right side of RTU-CN01 and 04DA for the second one. Enter 8 for digital input points (X) and 8 for digital output points (Y) on the rightmost side in the software window.
Work Mode	Auto mode and Custom mode are provided for option. If "**Auto**" is selected, CRs (internal registers in a special module) which are often used are assigned automatically by the software, e.g. the present value of the input signal of one AD module. The CR assigned by the software can not be replaced. If "**Custom**" is selected, choose CRs for the special module which need be configured in the software according to actual demand.
Input Link Number	The number of input data links to be opened. If the value is 1, Link 1 for input data will be opened in the software.
Output Link Number	The number of output data links to be opened. If the value is 2, both Link 1 and Link 2 for output data will be opened.
Input Data Length	The total lengths of link input data of the current special modules
Output Data Length	The total length of link output data of the current special modules

Item		Description
Input Data	Link1	The starting CR of input data link 1
	Number	The length of data which starts with input data link 1 (Unit: Word) If input data link 1 is specified as CR12, and Number specified for link 1 is 4, then CR12-CR15 are configured into the input data.
Output Data	Link1	The starting CR of output data link 1
	Number	The length of data which starts with output data link 1 (Unit: Word) If output data link 1 is specified as CR6, and Number specified for link 1 is 4, then CR6-CR9 are configured into the output data.

- Setting the input mode for a special module in the custom work mode

  With a double-click on the symbol of “**04AD**”, the following special module configuration window immediately appears. Select “**Custom**” in the Work Mode field. For Link1 of output data, choose “**CR1 -Input mode setting**” with the number set to 1. Then click “**OK**” to finish the setting.



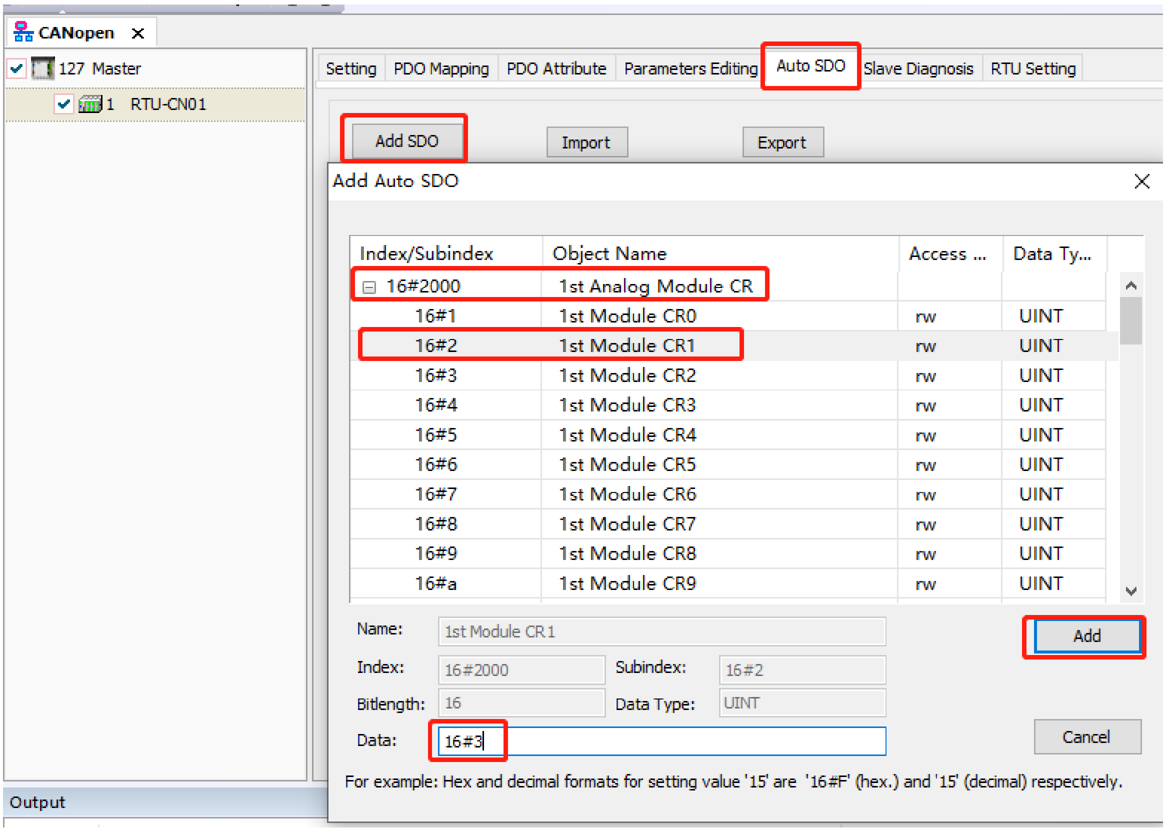
Note:

1. CR1 in DVP04AD-S sets the work modes for four channels of the module. (Four modes per channel for option)
2. Based on the actual need, users can use twelve bits of CR1 in the special module (bit0-bit11) to set the work mode for each channel individually.
3. For instance, to set the input mode to mode 0 (bit2-bit0=000) for channel 1, mode 1 (bit5-bit3=001) for channel 2, mode 2 (bit8-bit6=010) for channel 3, and mode 3 (bit11-bit9=011) for channel 4, the corresponding value in the PDO of CR1 should be set to 16#688.
4. The factory value of CR1 in DVP04AD-S is 0.

- Using Auto SDO to set the input modes for a special module

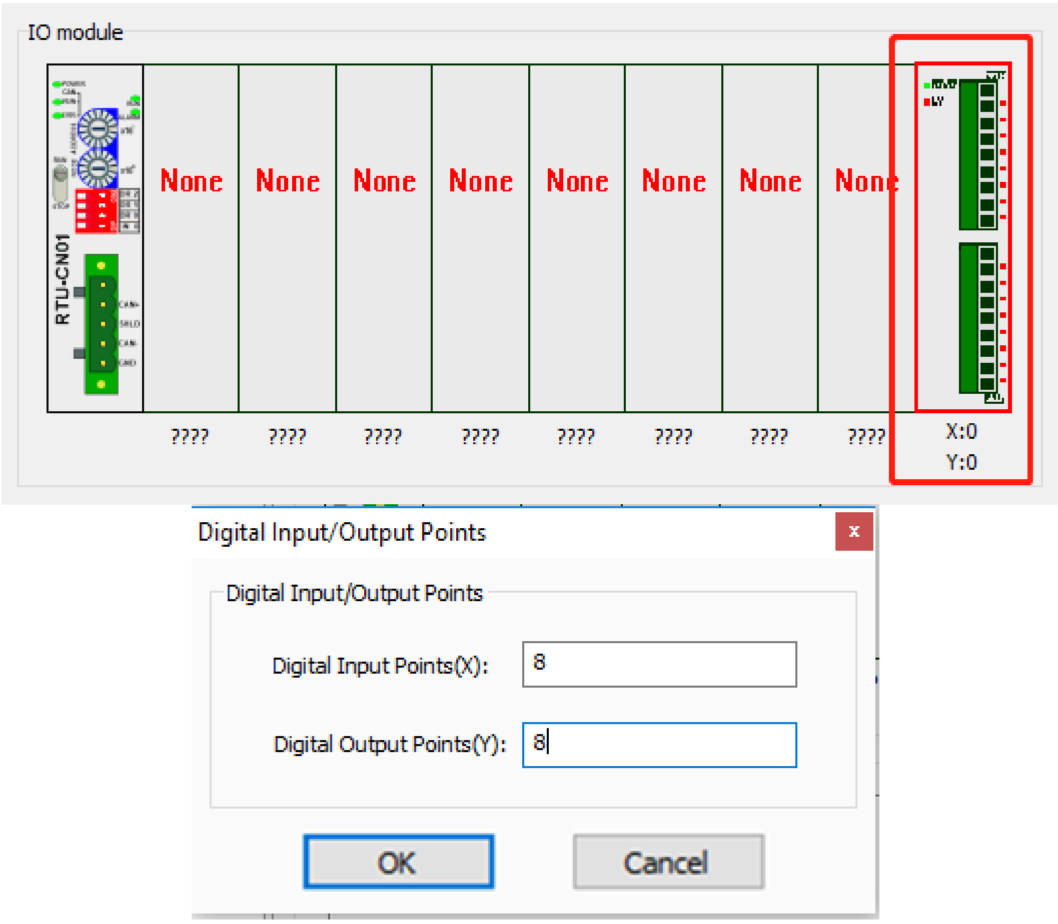
Click “**Add SDO**” button on the “**Auto SDO**” tab page. Choose the index 16#2000 since DVP04AD-S is the first module on the right of RTU-CN01. Choose the subindex16#2 since CR1 is the parameter for input mode setting.

To set the input mode to mode 3 for channel 1, and mode 0 for channel 2- channel 4, fill 16#3 in the “**Data**” field. Click “**Add**” to finish the setting.



15.2.7.5 The Interface for Configuring Digital Modules

With a double-click on the symbol in the red box below, the digital input/output points interface will appear on the RTU configuration main interface. This interface configures the number of input and output points of digital modules.



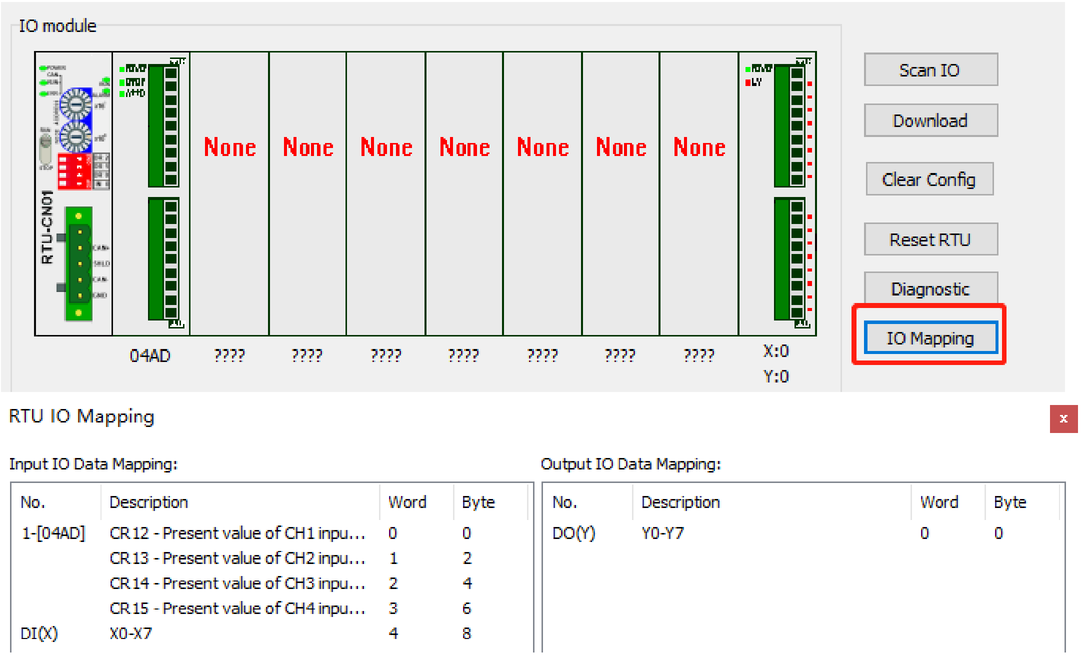
- Explanation of parameters on the “Digital Input/Output Points” interface:

Item	Description
Digital Input Points (X)	The number of all digital module input points. You can click the “**Scan IO**” button to get the number of all input points connected on the right side of RTU-CN01. You can also enter the number of input points on the right of RTU-CN01. The digital input point number should be a multiple of 8. It is counted as 8 if the number is less than 8 and counted as 16 if the number is greater than 8 but less than 16.
Digital Output Points (Y)	The number of all digital module output points. You can click the “**Scan IO**” button to get the number of all output points connected on the right of RTU-CN01. You can also enter the number of output points on the right side of RTU-CN01. The digital output point number should be a multiple of 8. It is counted as 8 if the number is less than 8 and counted as 16 if the number is greater than 8 but less than 16.

15.2.7.6 RTU IO Mapping Interface

When you click the **IO Mapping** button in the main interface, the **RTU IO Mapping** interface immediately appears, displaying a list of the inputs and outputs for both digital modules and special modules .

See details in the section: CANopen IO Mapping.



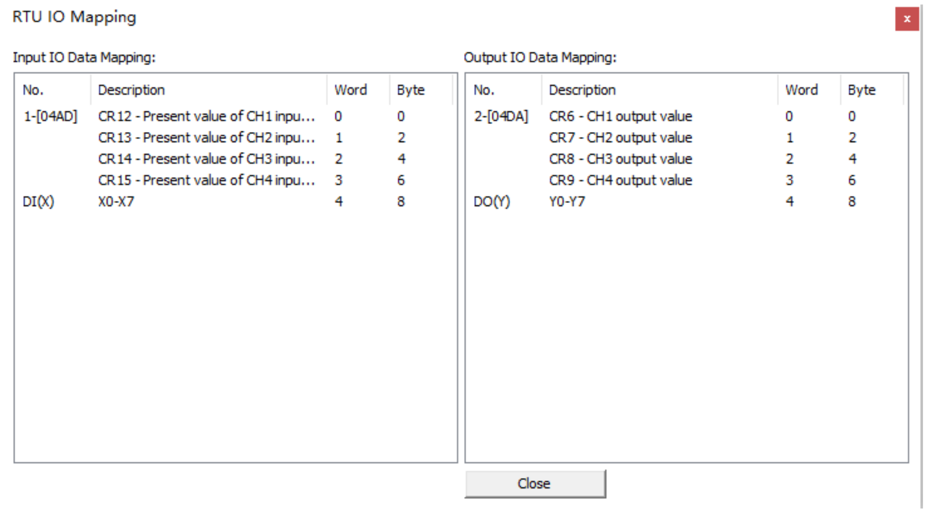
Explanation of parameters in the "RTU IO Mapping" interface:

Item	Description
Input IO Data Mapping	The data that RTU-CN01 transmits to the master
Output IO Data Mapping	The data that the master transmits to RTU-CN01
No.	Module names and positions of the special modules on the right side of RTU-CN01, including the special module name and its position number, the status word and control word as well as digital module input and output types.
Description	Names of mapping parameters
Word	Data lengths of mapping parameters (unit: word)
Byte	Data lengths of mapping parameters (unit: byte)

15.2.8 CANopen IO Mapping

15.2.8.1 IO Data Mapping

1. If the control word and status word of RTU-CN01 are excluded in IO data, only special modules and digital modules are configured. For example, in the following figure, only four channels of outputs for DVP04DA-S and four channels of inputs for DVP04AD-S and 8 digital inputs and 8 digital outputs are configured for IO data mapping.



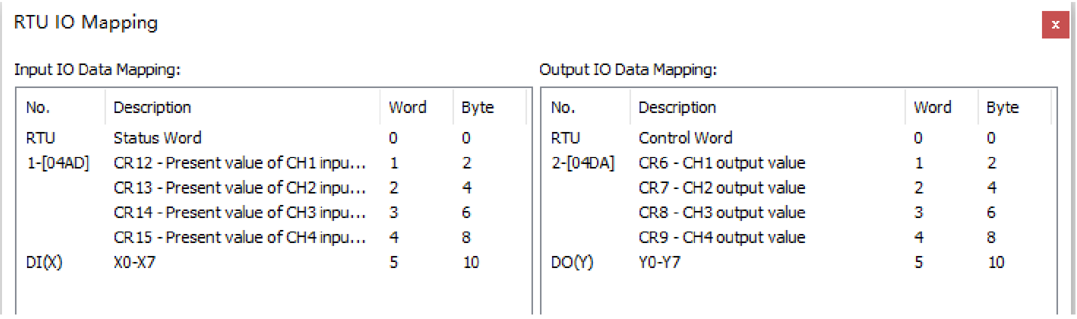
- CANopen Master →RTU-CN01

Master (Byte)	RTU-CN01	
Byte0	Special module	Low byte of the channel 1 output value of the 1st special module
Byte1		High byte of the channel 1 output value of the 1st special module
Byte2		Low byte of the channel 2 output value of the 1st special module
Byte3		High byte of the channel 2 output value of the 1st special module
……		……
ByteN	DIO module	Y0-Y7 of the 2nd DI/DO module
ByteN+1		Y0-Y7 of the 1st DI/DO module
ByteN+2		Y0-Y7 of the 4th DI/DO module
ByteN+3		Y0-Y7 of the 3rd DI/DO module
……		……

- CANopen Master ←RTU-CN01

Master (Byte)	RTU-CN01	
Byte0	Special module	Low byte of the channel 1 input value of the 1st special module
Byte1		High byte of the channel 1 input value of the 1st special module
Byte2		Low byte of the channel 2 input value of the 1st special module
Byte3		High byte of the channel 2 input value of the 1st special module
……		……
ByteN	DIO module	X0-X7 of the 2nd DI/DO module
ByteN+1		X0-X7 of the 1st DI/DO module
ByteN+2		X0-X7 of the 4th DI/DO module
ByteN+3		X0-X7 of the 3rd DI/DO module
……		……

2. When the control word and status word of RTU-CN01 are included in IO data. For example, in the following figure, four channels of outputs for DVP04DA-S and four channels of inputs for DVP04AD-S and 8 digital inputs and 8 digital outputs as well as of Control Word and Status Word are configured for IO data mapping.


RTU IO Mapping

Input IO Data Mapping:

No.	Description	Word	Byte
RTU	Status Word	0	0
1-[04AD]	CR12 - Present value of CH1 inpu...	1	2
	CR13 - Present value of CH2 inpu...	2	4
	CR14 - Present value of CH3 inpu...	3	6
	CR15 - Present value of CH4 inpu...	4	8
DI(X)	X0-X7	5	10

Output IO Data Mapping:

No.	Description	Word	Byte
RTU	Control Word	0	0
2-[04DA]	CR6 - CH1 output value	1	2
	CR7 - CH2 output value	2	4
	CR8 - CH3 output value	3	6
	CR9 - CH4 output value	4	8
DO(Y)	Y0-Y7	5	10

- CANopen master →RTU-CN01

Master (Byte)	RTU-CN01	
Byte0	RTU-CN01	Low byte of Control Word of RTU-CN01
Byte1		High byte of Control Word of RTU-CN01
Byte2	Special modules	Low byte of the channel 1 output value of the 1st special module
Byte3		High byte of the channel 1 output value of the 1st special module
Byte4		Low byte of the channel 2 output value of the 1st special module
Byte5		High byte of the channel 2 output value of the 1st special module
……		……
ByteN	DIO modules	Y0-Y7 of the 2nd DI/DO module
ByteN+1		Y0-Y7 of the 1st DI/DO module
ByteN+2		Y0-Y7 of the 4th DI/DO module
ByteN+3		Y0-Y7 of the 3rd DI/DO module
……		……

- CANopen master ←RTU-CN01

Master (Byte)	RTU-CN01	
Byte0	RTU-CN01	Low byte of Status Word of RTU-CN01
Byte1		High byte of Status Word of RTU-CN01
Byte2	Special modules	Low byte of the channel 1 input value of the 1st special module
Byte3		High byte of the channel 1 input value of the 1st special module
Byte4		Low byte of the channel 2 input value of the 1st special module
Byte5		High byte of the channel 2 input value of the 1st special module
……		……
ByteN	DIO modules	X0-X7 of the 2nd DI/DO module
ByteN+1		X0-X7 of the 1st DI/DO module
ByteN+2		X0-X7 of the 4th DI/DO module
ByteN+3		X0-X7 of the 3rd DI/DO module
……		……

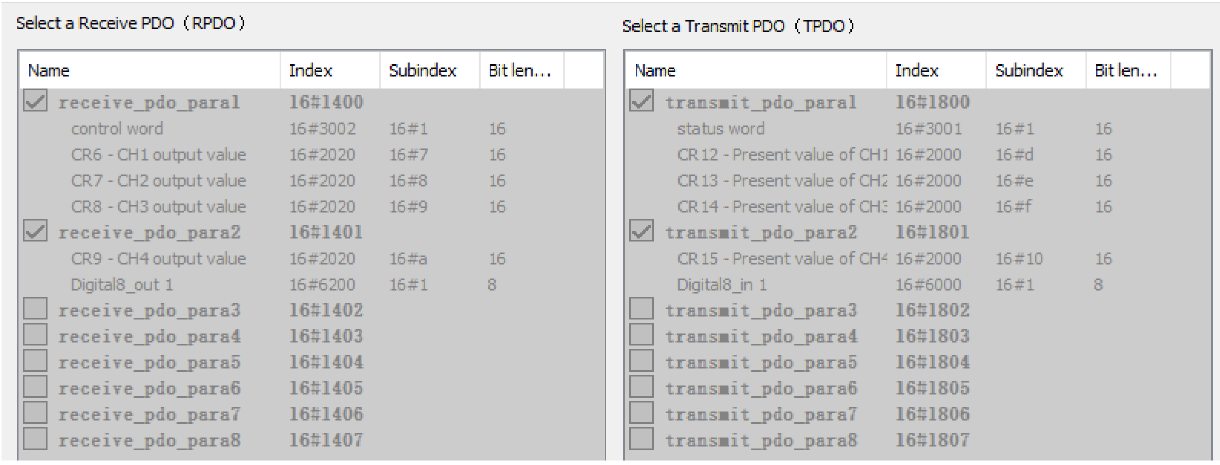
Note:

- If you choose "**Add control word and status word to I/O data**", the first words in the input and output data areas will automatically be assigned to Status Word and Control Word respectively.
- For the extension modules connected to RTU-CN01, no matter how special modules and digital modules are actually placed in sequence, the special modules are always arranged ahead of DI/DO modules in the software configuration.

15.2.8.2 PDO Mapping

- **View the configured PDO mappings.**

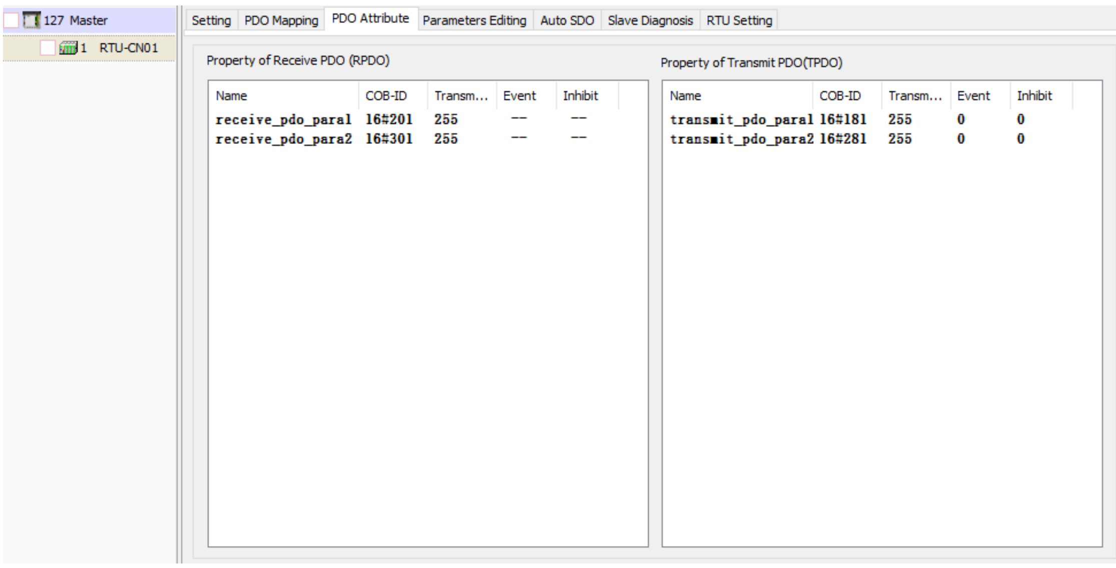
Click on "**PDO Mapping**" tab and then view the RTU parameters which have been configured as below.



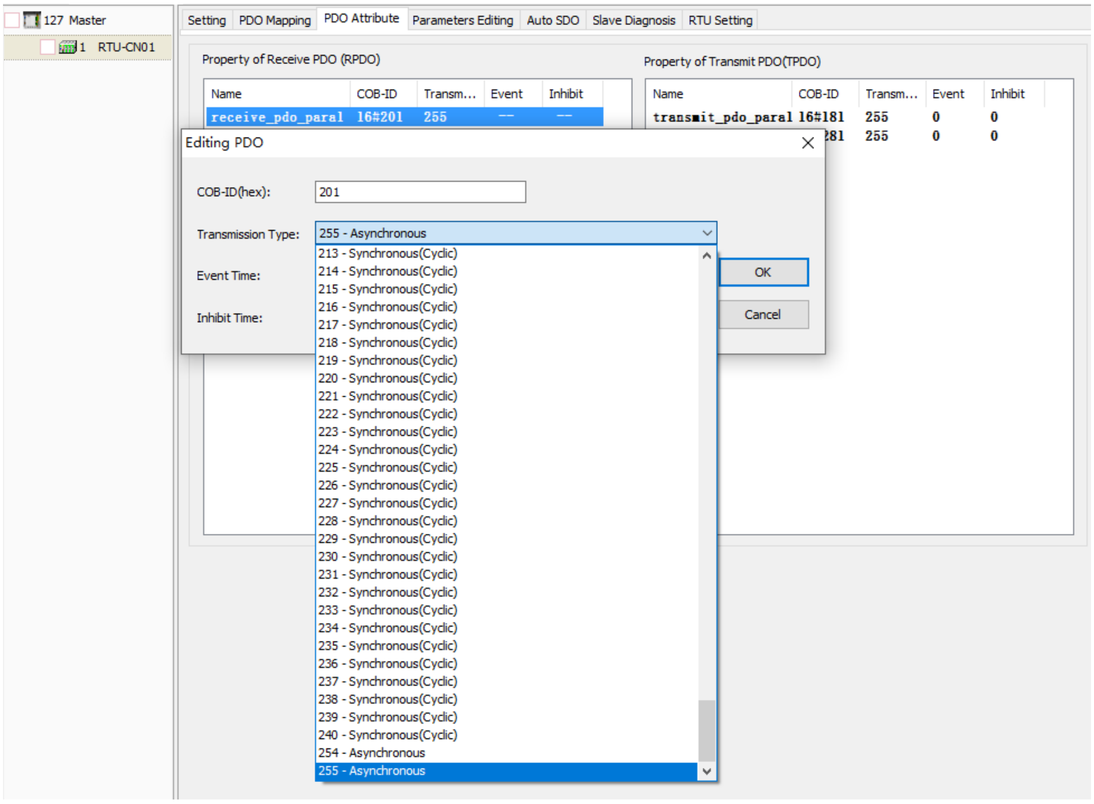
Note: the PDO mappings which have already been configured can only be viewed in the above window instead of being modified.

- **PDO Attribute**

Click on "**PDO Attribute**" tab on the RTU configuration interface. The following interface will then be displayed.



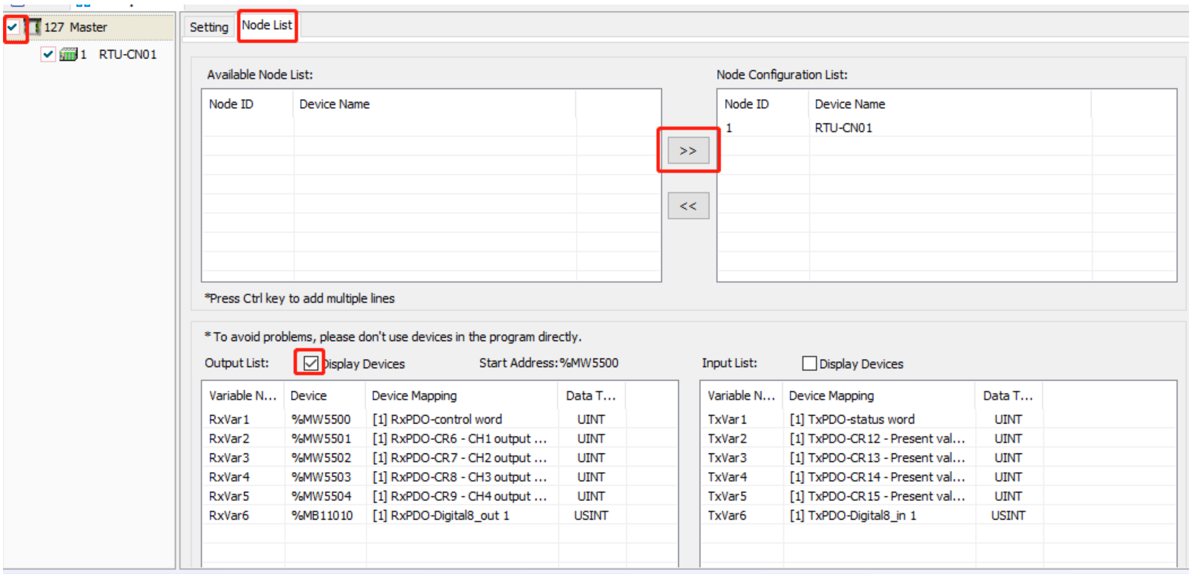
With a double-click on the selected PDO, the "**Editing PDO**" interface appears, where you can select one transmission type.



15.2.8.3 Adding RTU-CN01 Configuration to Node Configuration List

Here are the steps to add RTU-CN01 configuration to Node List:

Click on "**127 Master**", come to the "**Node List**" tab interface, and then select the box beside RTU-CN01 symbol or use >> button to add RTU-CN01 to the node list.



- Explanation of Node List Interface:

Item	Description
Available Node List	The list of slaves which can be configured to the master
Node Configuration List	The list of slaves which have already been configured to the master
Node ID	Node address of a slave
Device Name	Slave name
Output List	The mapping list of master output variables and devices and corresponding slave parameters
Input List	The mapping list of master input variables and devices and corresponding slave parameters
Variable Name	The name of a master variable which corresponds to a slave parameter
Device Mapping	Slave parameters which have been configured
Data Type	The data type of a slave parameter which corresponds to a master variable and device.
Display Devices	If the item is selected, the master devices which slave parameters correspond to are displayed. If not selected, they are hidden.

15.2.9 EDS File Parameters and PDO Transmission Types

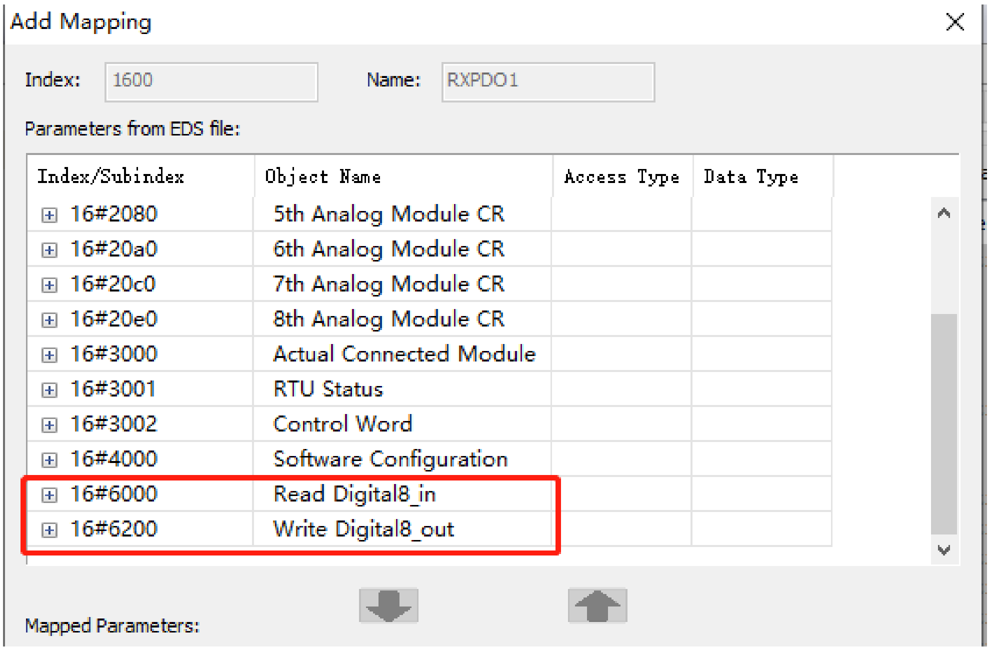
15.2.9.1 Parameters from the EDS File

- Parameters for digital modules on the right side of RTU-CN01

16#6000 and 16#6200 are parameters for digital modules on the right side of RTU-CN01. The index 16#6000 is the index for configuring input points. It contains 16 subindexes. Each subindex is configured with 8 input points. Subindex 1 corresponds to the 1st 8 point input of digital modules on the right side of RTU-CN01, subindex 2 corresponds to the 2nd 8 point input of digital modules on the right side of RTU-CN01 and so on. Subindex 16 corresponds to the 16th 8 point input of digital modules on the right side of RTU-CN01. Up to 128 input points can be configured in total.

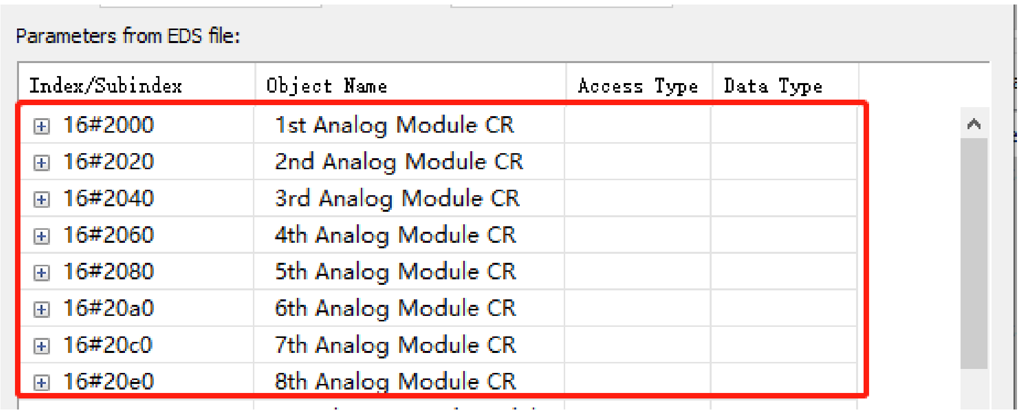
The index 16#6200 is the index for configuring output points. It contains 16 subindexes. Each subindex is configured with 8 output points. Subindex 1 corresponds to the 1st 8 point output of digital modules on the right side of RTU-CN01, subindex 2 corresponds to the 2nd 8 point output of digital modules on the right side of RTU-CN01 and so on. Subindex 16 corresponds to the 16th 8 point output of digital modules on the right side of RTU-CN01. Up to 128 output points can be configured in total.

For example, there is one DVP16SN11T and one DVP16SM11T on the right side of RTU-CN01. There are 16 output points and 16 input points in total. Each subindex for input or output configuration can be configured with 8 points and thus 2 subindexes are needed for the configuration of input points. That is, the index 16#6000 and subindex 16#1 correspond to X0-X7 of DVP16SM11T, and index 16#6000 and subindex 16#2 correspond to X10-X17 of DVP16SM11T. To configure the output points, the index 16#6200 and subindex 16#1, which correspond to Y0-Y7 of DVP16SN11T and the index 16#6200 and subindex 16#2, which correspond to Y10-Y17 of DVP16SN11T are used in the same way.



- Parameters for special modules on the right side of RTU-CN01

The following 16#2000-16#20e0 are parameters for the special modules on the right of RTU-CN01. The index 16#2000 is the index of the 1st special module on the right of RTU-CN01, 16#2020 is the index of the 2nd special module on the right of RTU-CN01 and so on. So in the same way,16#20e0 is the index of the 8th analog module on the right of RTU-CN01.



For a special module, its index includes 49 subindexes which correspond to CRs of the special module respectively. As shown below, the subindexes of the index 16#2000 correspond to CRs of the 1st special module on the right of RTU-CN01 respectively. E.g. index 16#2000 and subindex 16#1 correspond to CR0 of the 1st analog module on the right of RTU-CN01. Index 16#2000 and subindex 16#7 correspond to CR6 of the 1st analog module on the right of RTU-CN01.

The parameters, which are to be configured in RxPDO or TxPDO, are selected according to the access types (read/write) of the CR registers of the right module of RTU-CN01. E.g. the input values of four channels (CR12-CR15, read only) of DVP04AD-S on the right of RTU-CN01 need be configured in TxPDO.

Parameters from EDS file:

Index/Subindex	Object Name	Access Type	Data Type
⊟ 16#2000	1st Analog Module CR		
16#1	1st Module CR0	rw	UINT
16#2	1st Module CR1	rw	UINT
16#3	1st Module CR2	rw	UINT
16#4	1st Module CR3	rw	UINT
16#5	1st Module CR4	rw	UINT
16#6	1st Module CR5	rw	UINT
16#7	1st Module CR6	rw	UINT
16#8	1st Module CR7	rw	UINT
16#9	1st Module CR8	rw	UINT

- Parameter for the actual connection state of the modules on the right side of RTU-CN01

  Index 16#3000 is the parameter that shows the actual connection state of the modules on the right of RTU-CN01.

Parameters from EDS file:

Index/Subindex	Object Name	Access Type	Data Type
⊟ 16#3000	Actual Connected Module		
16#1	Analog Module Number	ro	USINT
16#2	Number of Input points	ro	USINT
16#3	Number of Output points	ro	USINT
16#4	1st Analog Module Code	ro	UINT
16#5	2nd Analog Module Code	ro	UINT
16#6	3rd Analog Module Code	ro	UINT
16#7	4th Analog Module Code	ro	UINT
16#8	5th Analog Module Code	ro	UINT
16#9	6th Analog Module Code	ro	UINT
16#a	7th Analog Module Code	ro	UINT

Explanation of parameters above:

Index	Subindex	Description	Data Type	Access Type	Range
0x3000	1	Number of special modules	UINT8	RO	0-8
	2	Number of input points	UINT8	RO	0-128
	3	Number of output points	UINT8	RO	0-128
	4	Module code of the 1st special module	UINT16	RO	Model code
	5	Module code of the 2nd special module	UINT16	RO	Model code
	6	Module code of the 3rd special module	UINT16	RO	Model code
	7	Module code of the 4th special module	UINT16	RO	Model code
	8	Module code of the 5th special module	UINT16	RO	Model code
	9	Module code of the 6th special module	UINT16	RO	Model code
	A	Module code of the 7th special module	UINT16	RO	Model code
	B	Module code of the 8th special module	UINT16	RO	Model code

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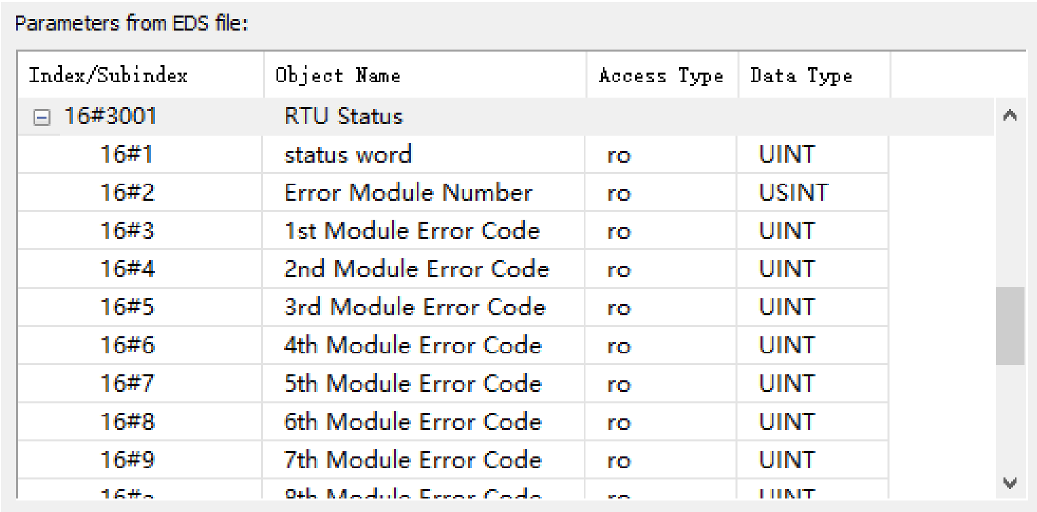
- Parameter for the state of RTU-CN01

Index 16#3001 is the parameter for showing the state of RTU-CN01.



Parameters from EDS file:

Index/Subindex	Object Name	Access Type	Data Type
16#3001	RTU Status		
16#1	status word	ro	UINT
16#2	Error Module Number	ro	USINT
16#3	1st Module Error Code	ro	UINT
16#4	2nd Module Error Code	ro	UINT
16#5	3rd Module Error Code	ro	UINT
16#6	4th Module Error Code	ro	UINT
16#7	5th Module Error Code	ro	UINT
16#8	6th Module Error Code	ro	UINT
16#9	7th Module Error Code	ro	UINT
16#a	8th Module Error Code	ro	UINT

Explanation of parameters above:

Index	Subindex	Description	Data Type	Access Type
0x3001	1	Status Word	UINT16	RO
	2	Number of special modules in error	UINT8	RO
	3	The error code of the 1st special module	UINT16	RO
	4	The error code of the 2nd special module	UINT16	RO
	5	The error code of the 3rd special module	UINT16	RO
	6	The error code of the 4th special module	UINT16	RO
	7	The error code of the 5th special module	UINT16	RO
	8	The error code of the 6th special module	UINT16	RO
	9	The error code of the 7th special module	UINT16	RO
	A	The error code of the 8th special module	UINT16	RO
	B	The state of the 1st special module	UINT8	RO
	C	The state of the 2nd special module	UINT8	RO
	D	The state of the 3rd special module	UINT8	RO
	E	The state of the 4th special module	UINT8	RO
	F	The state of the 5th special module	UINT8	RO
	10	The state of the 6th special module	UINT8	RO
	11	The state of the 7th special module	UINT8	RO
	12	The state of the 8th special module	UINT8	RO

Note: For error codes of special modules, refer to the description of error status CRs for special modules in DVP Series Module Manual.

See the table below for the meanings of special module status values:

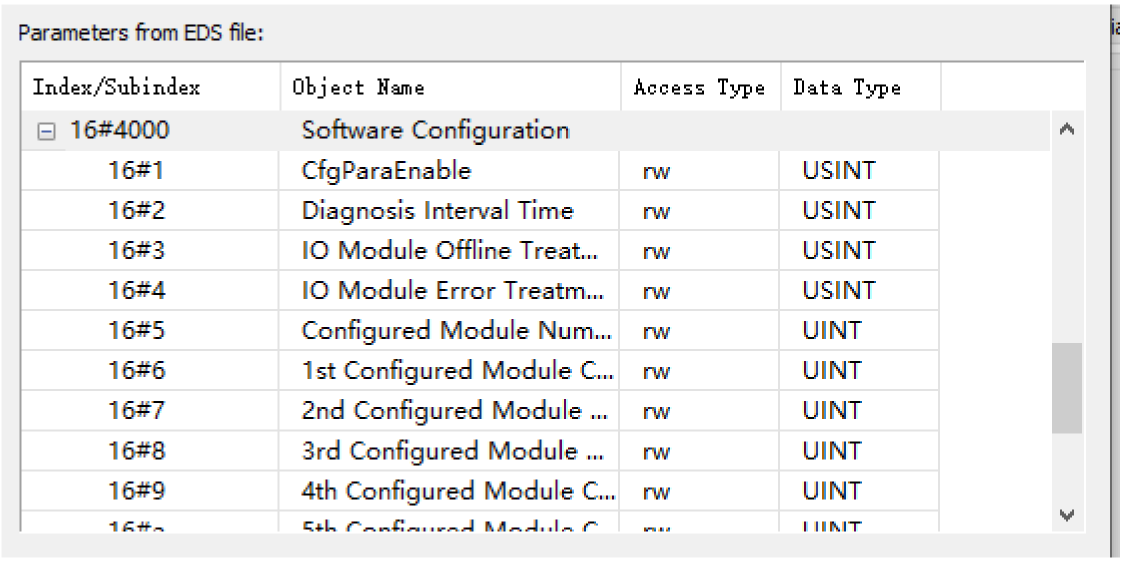
Special module state		
b0	0	The communication between RTU-CN01 and the special modules on its right is normal.
	1	The communication between RTU-CN01 and the special modules on its right fails.
b1	0	The special modules are working normally.
	1	An error occurs in special modules.
b2	0	The special modules on the right of RTU-CN01 are the same as configured in the software.
	1	The special modules on the right of RTU-CN01 are different from those configured in the software.
b3	0	Valid data configured in the software
	1	Invalid data configured in the software
b4	0	RTU-CN01 can identify the special modules on its right side.
	1	RTU-CN01 fails to identify the special module on its right side.
b5-b7		Reserved

- Control Word

  The index 16#3002 and subindex 1 refer to the control word parameter. See section 15.2.7.3 for details on the control word of RTU-CN01.

- Software-configured Parameters

  Index 16#4000 refers to the relevant parameters configured by the software.



Parameters from EDS file:

Index/Subindex	Object Name	Access Type	Data Type
16#4000	Software Configuration		
16#1	CfgParaEnable	rw	USINT
16#2	Diagnosis Interval Time	rw	USINT
16#3	IO Module Offline Treat...	rw	USINT
16#4	IO Module Error Treatm...	rw	USINT
16#5	Configured Module Num...	rw	UINT
16#6	1st Configured Module C...	rw	UINT
16#7	2nd Configured Module ...	rw	UINT
16#8	3rd Configured Module ...	rw	UINT
16#9	4th Configured Module C...	rw	UINT
16#a	5th Configured Module C	rw	UINT

Explanation of parameters:

Index	Subindex	Object Name	Meaning	Data Type	Access Type	Meaning
0x4000	1	CfgParaEnable	Configured parameters enabled	UINT8	RW	0: Enabled before the next RTU configuration download, after RTU configuration is reset. 1: Enabled after RTU configuration is downloaded.
	2	Diagnosis Interval Time	Interval time for diagnosis	UINT8	RW	The time interval for the diagnosis of the special modules on the right of RTU-CN01. Unit: second.
	3	IO Module OfflineTreatment	How to deal with the IO module offline	UINT8	RW	IO module offline/error treatment 0: Ignore 1: Alarm
	4	IO Module Error Treatment	How to deal with the error in IO modules	UINT8	RW	
	5	Configured Module Number	The number of special modules which have been configured	UINT8	R/W	The number of configured special modules; Range: 0-8
	6	1st Configured Module Code	The model code of the 1st special module which has been configured	UINT16	RW	It is 16#88 when 04AD is configured. It is 16#89 when 04DA is configured.
	7	2nd Configured Module Code	The model code of the 2nd special module which has been configured	UINT16	RW	
	8	3rd Configured Module Code	The model code of the 3rd special module which has been configured	UINT16	RW	
	9	4th Configured Module Code	The model code of the 4th special module which has been configured	UINT16	RW	
	A	5th Configured Module Code	The model code of the 5th special module which has been configured	UINT16	RW	
	B	6th Configured Module Code	The model code of the 6th special module which has been configured	UINT16	RW	
	C	7th Configured Module Code	The model code of the 7th special module which has been configured	UINT16	RW	

Index	Subindex	Object Name	Meaning	Data Type	Access Type	Meaning
	D	8th Configured Module Code	The model code of the 8th special module which has been configured	UINT16	RW	
	E	Reset RTU	Reset RTU-CN01	UINT8	R/W	0: Ineffective 1: RTU-CN01 is reset.

15.2.9.2 PDO Transmission Types

- See the following table for the explanation of PDO transmission types

Transmission type		Description	Remark
0	RxPDO	The master transmits a SYNCH message to the slave every SYNCH cycle. When there is any change to RxPDO data, RxPDO data is transmitted to the slave and the data that the slave receives is effective after receiving the next SYNCH message. When there is no change to RxPDO data, the master does not transmit RxPDO data to the slave.	SYNCH non-cyclic
	TxPDO	The master transmits a SYNCH message to the slave every SYNCH cycle. When TxPDO data changes, the slave sends the TxPDO data to the master after receiving the SYNCH message and TxPDO data that the master receives is effective immediately. When there is no change to TxPDO data, the slave does not transmit TxPDO data to the master.	
1-253	RxPDO	The master transmits a SYNCH message to the slave every SYNCH cycle. The master sends out RxPDO data to the slave once every 1-253 SYNCH cycle(s). The RxPDO data that the slave receives from the master is effective after it receives the next SYNCH message.	SYNCH cyclic
	TxPDO	The master transmits a SYNCH message to the slave every SYNCH cycle. The slave sends out TXPDO data to the master once for every 1-253 SYNCH messages received. The TxPDO data is effective immediately once received by the master.	
254	RxPDO	Same as transmission type 255	ASYNCH
	TxPDO	Same as transmission type 255	
255	RxPDO	When there is a change to RxPDO, the RxPDO data is transmitted to the slave and the data that the slave receives is effective immediately. When there is no change to RxPDO, the master does not send RxPDO data to the slave.	ASYNCH
	TxPDO	When the values of Event timer and inhibit timer are both 0, TxPDO data is transmitted to the master after TXPDO data changes and the data that the master receives is effective immediately. When TxPDO data does not change, the slave does not send out TxPDO data to the master. When neither of the Event timer nor the inhibit timer are 0, the slave sends out TxPDO data to the master once every a period of Event timer. After TxPDO data is sent once, no TxPDO data is allowed to be sent out within the period of inhibit timer. TxPDO data is transmitted to the master immediately once TxPDO data changes and the data that master receives is effective immediately.	

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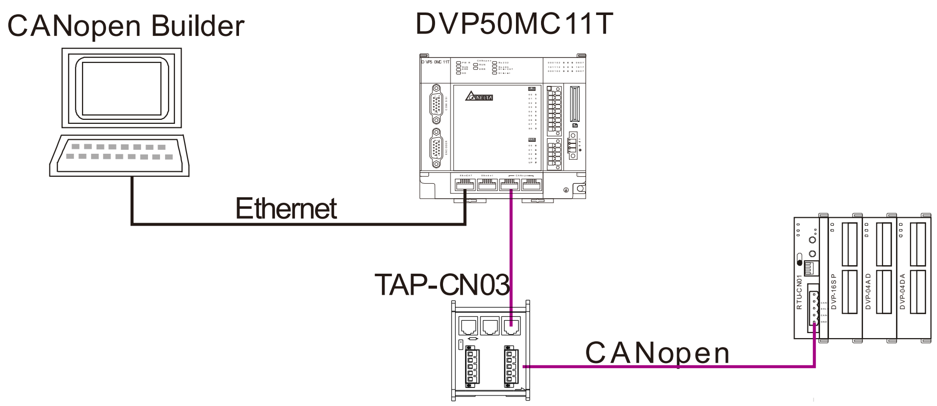
15.2.10 Application Examples

In this section, the first example shows how to configure RTU-CN01 module parameters and control DVP04DA-S, DVP04AD-S, and DVP16SP11T on the right side of RTU-CN01 through PDO mapping on the RTU configuration software interface. In the second example, these right-side modules are controlled through PDO mapping by using a master from a non-Delta vendor together with RTU-CN01.

- **Control requirement:**

1. The states of X0 to X7 of DVP16SP11T and present values of channel 1 to channel 4 of DVP04AD-S are monitored in real time.
2. When D_OUT=ON for DVP50MC CPU, Y0 to Y7 of DVP16SP11T change to ON. When D_OUT=OFF for DVP50MC CPU, Y0 to Y7 of DVP16SP11T change to OFF.
3. When DA=ON, channel 1 of DVP04DA-S outputs 2.50 V and channel 2 outputs 5 V. When DA=OFF, channel 1 and channel 2 of DVP04DA-S output 0 V voltage.

- **Constructing a CANopen network by RTU-CN01**



Note:

The terminal resistor of 120 Ω should be connected between CAN_H and CAN_L at each of both ends of the network.

- Devices used in the example

Device name	Description
DVP50MC11T	Delta PLC CPU
RTU-CN01	Delta CANopen remote IO module
DVP04DA-S	Delta analog output module
DVP04AD-S	Delta analog input module
DVP16SP11T	Delta digital input and output modules with 8 input points and 8 output points

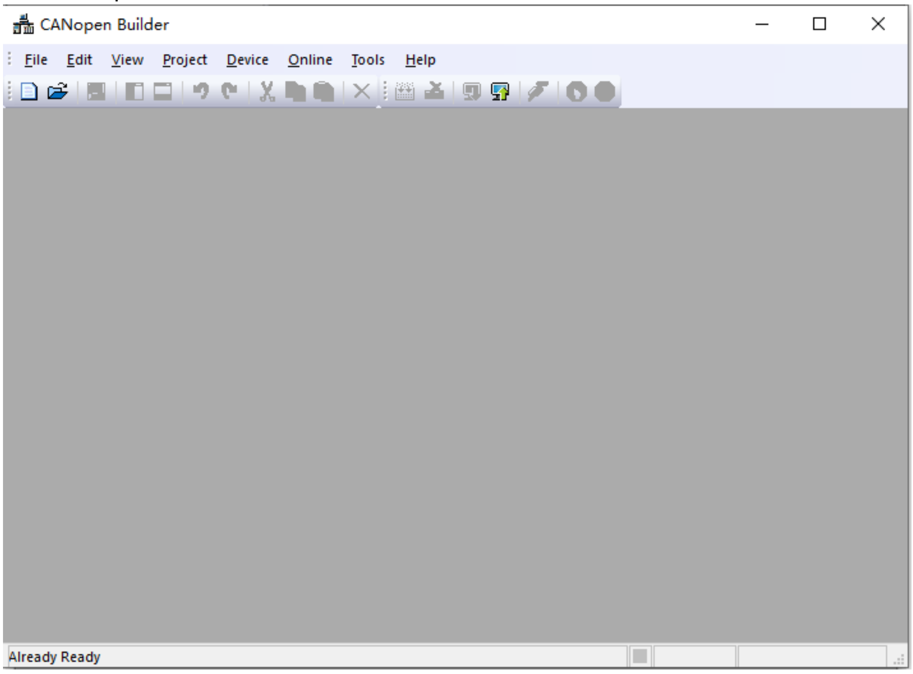
- Setup for the modules on field

Module name	CANopen node address	CANopen transmission rate
DVP50MC11T	127	1M
RTU-CN01	1	1M

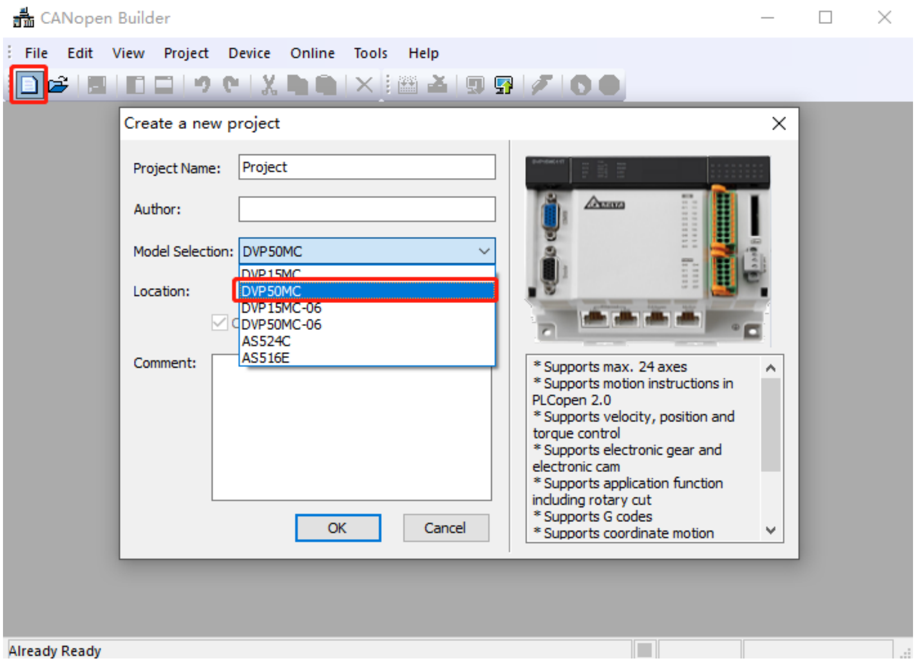
15.2.10.1 Configuring RTU-CN01 Parameters via CANopen Builder

15.2.10.1.1 Configuring RTU-CN01 Module

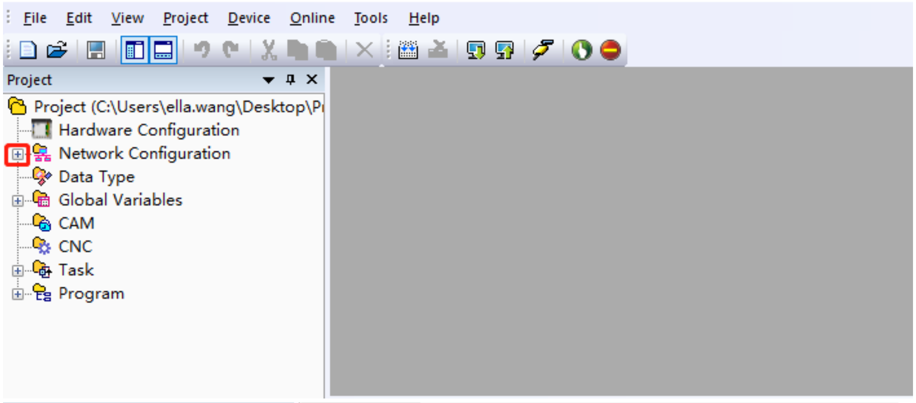
1. Start CANopen Builder and then see the software window as below.

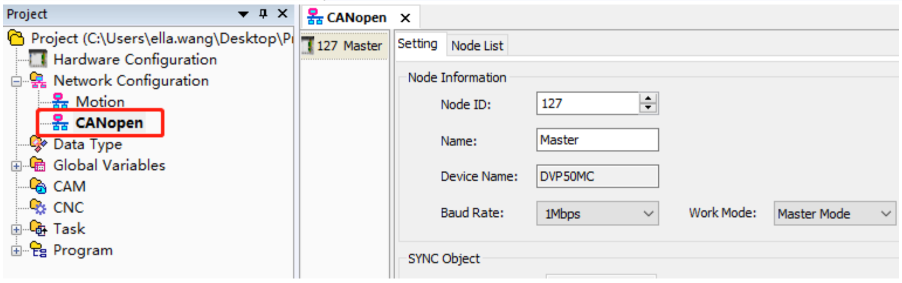


2. Click on the “**New Project**” button and then select “**DVP50MC11T**” in the window which pops up.

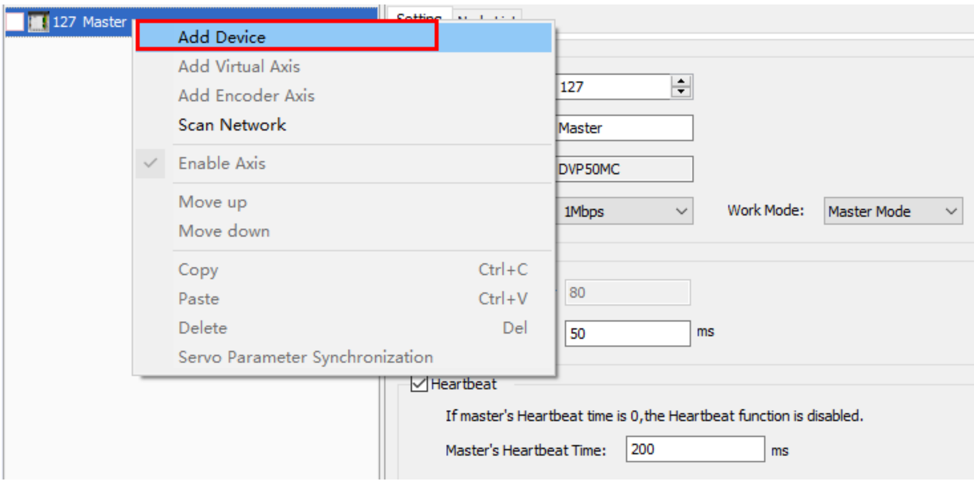


3. Click on "**OK**" button to return to the main interface. Click on the symbol "**+**" on the left of "**Network Configuration**" to unfold the network configuration. Then double-click on "**CANopen**" to make the CANopen configuration window appear.

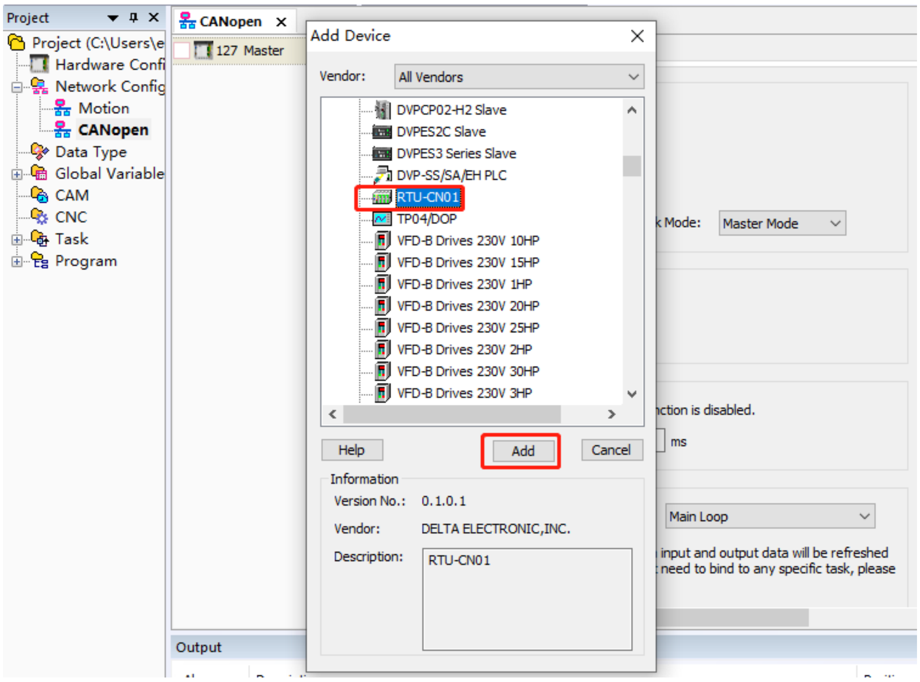




4. Right-click on "**127Master**" and then select "**Add Device**" from the context menu. You can also select "**Scan Network**" to scan all connected slaves.

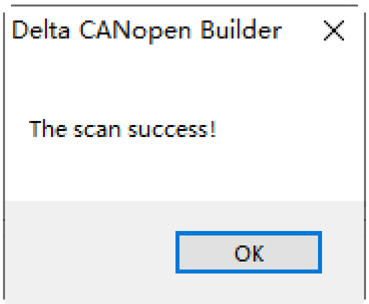


5. By clicking on "**Add Device**", the following dialog box appears. Find and select "RTU-CN01", and then click "**Add**" button.



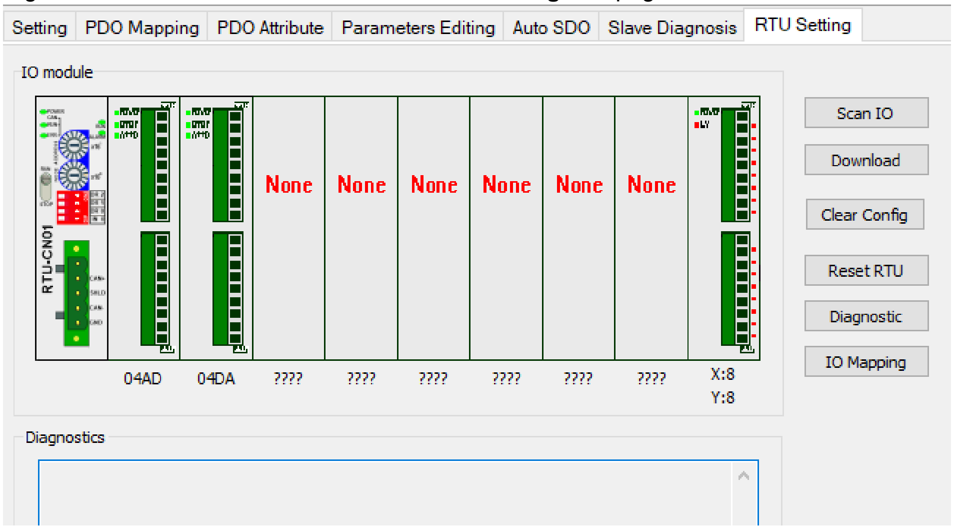
6. Click on the slave RTU-CN01 and then on "**RTU Setting**". You will see the RTU configuration interface as below.

7. Click on "**Scan IO**" button and then see the following dialog.

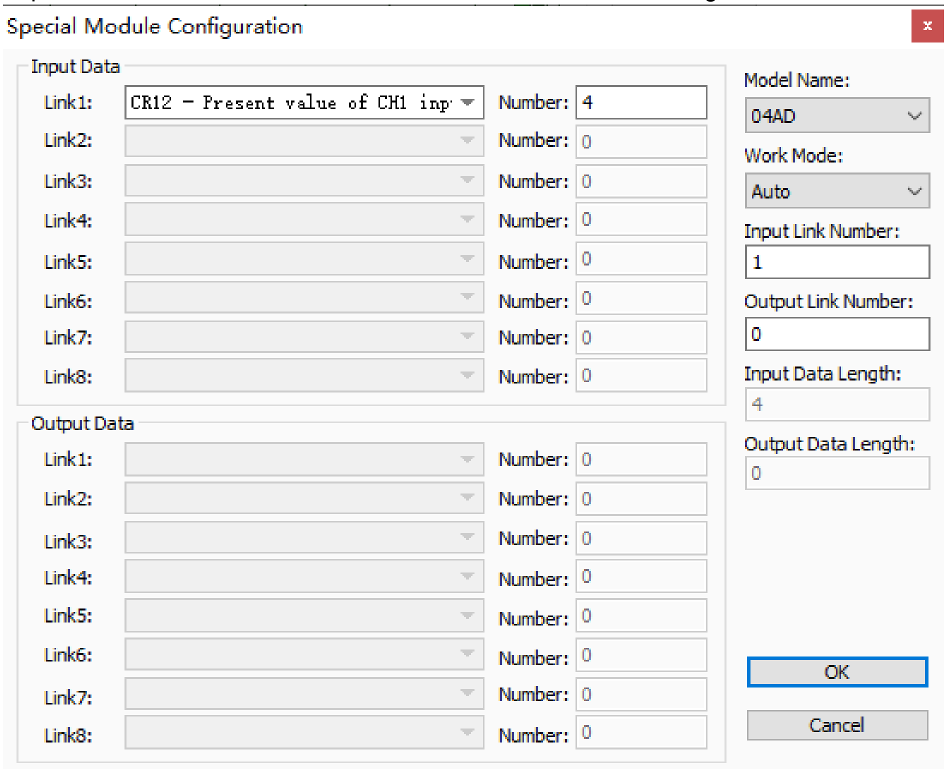


15

8. Click on “**OK**” button. CANopen Builder will detect special modules and the number of points of digital modules and show them on the “**RTU Setting**” tab page.



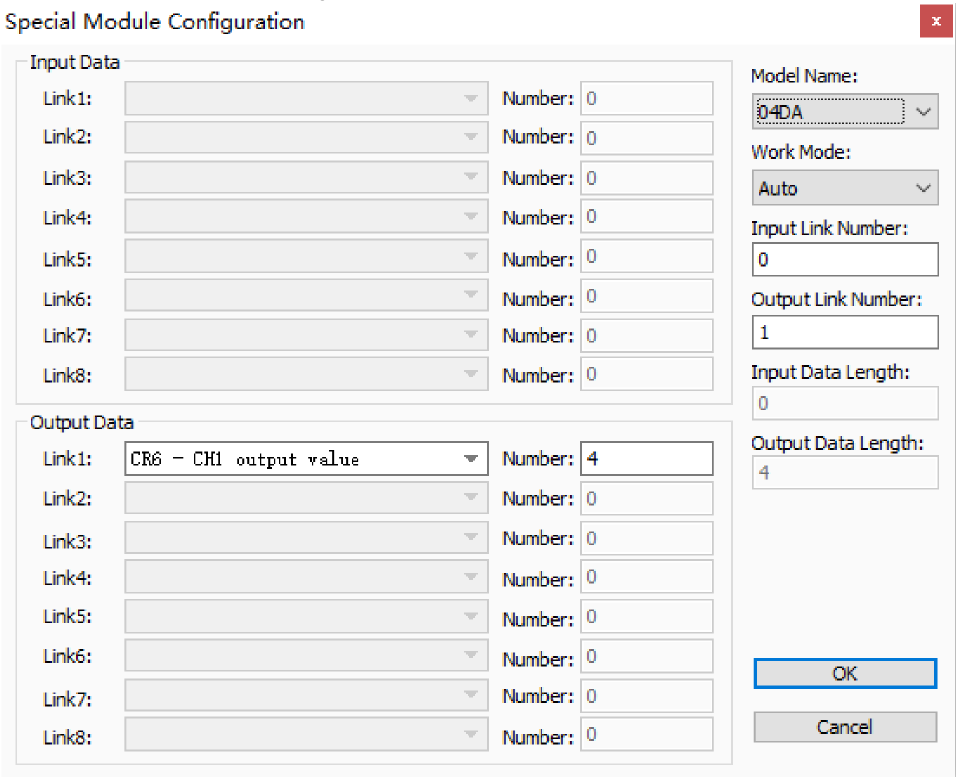
9. With a double-click on “**04AD**” symbol, the “**Special Module Configuration**” dialog appears. Four channels of present values for 04AD module are configured to be sent to the master. For detailed explanation, refer to section 15.2.7.4. Click “**OK**” to finish the configuration.



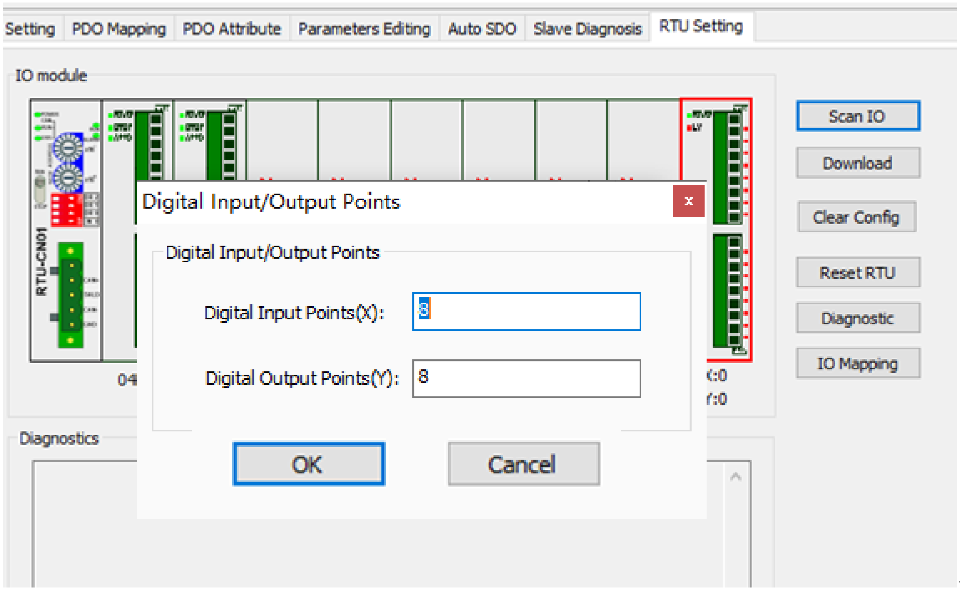
Note:

No matter whether the work mode is auto mode or custom mode, be sure to click “**OK**” to make the configuration effective after special modules are configured.

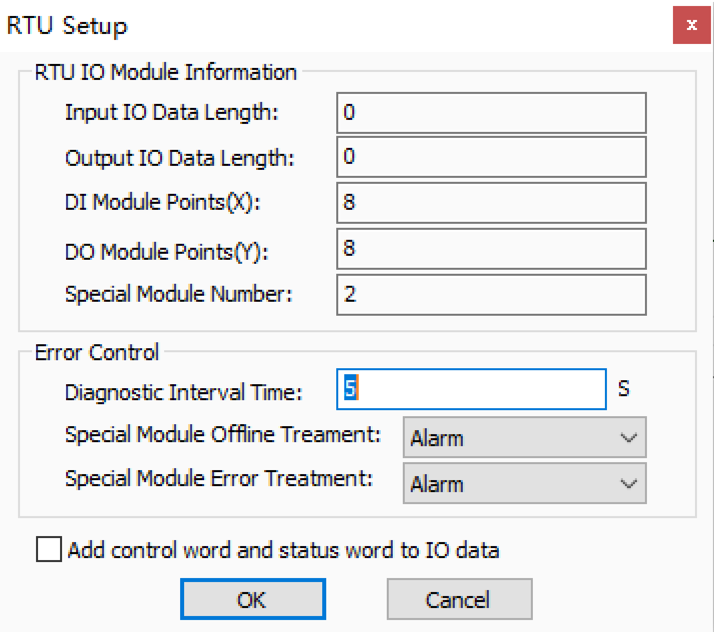
10. With a double-click on “**04DA**” symbol, the “**Special Module Configuration**” dialog box appears, where you select “**Custom**” as the work mode to reset the configuration of 04DA module. Click on “**OK**” button to finish the configuration.



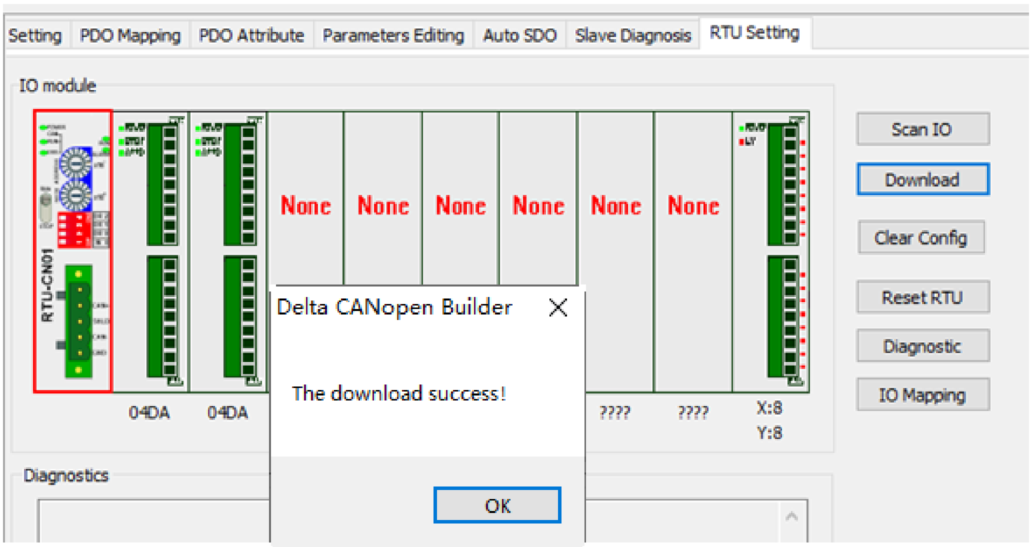
11. The “**Digital Input/Output Points**” interface appears by double-clicking the symbol of a digital module on the rightmost side of RTU-CN01. Click “**OK**” to finish the configuration.



12. By double-clicking "**RTU-CN01**" symbol, the "**RTU Setting**" dialog box appears. Refer to section 15.2.7.2 for details.

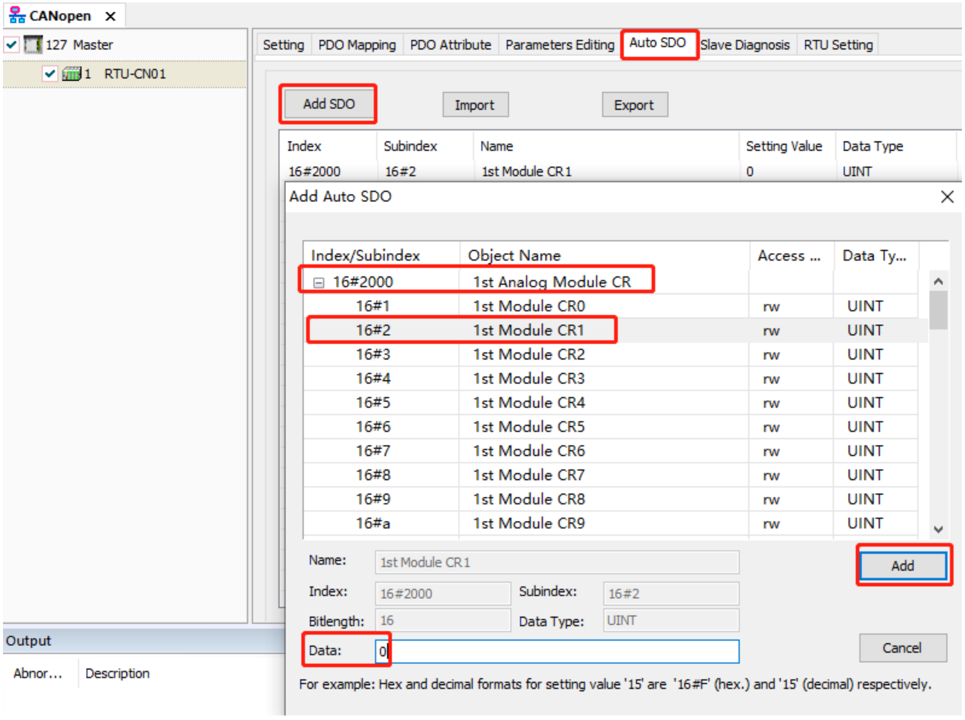


13. When the setting is complete, click "**OK**" to return to the RTU setting interface. After you have confirmed that the settings are correct, click "**Download**" button to download the configuration to the RTU-CN01 module on the interface of RTU-CN01 Setting. Then click "**OK**" to finish the download.



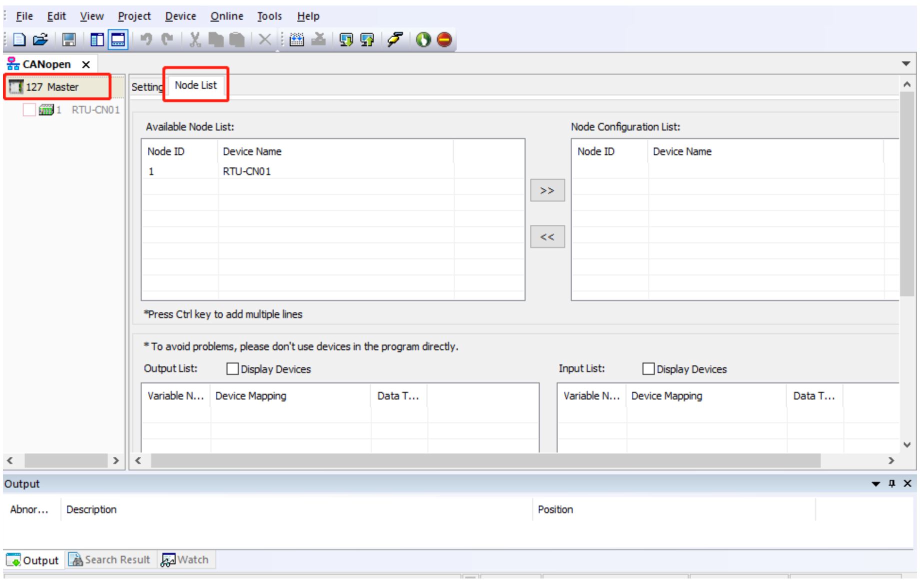
14. Click "**Add SDO**" button on the "**Auto SDO**" tab page. Choose the index 16#2000 since DVP04AD-S is the first module on the right of RTU-CN01. Choose the subindex16#2 since CR1 is the parameter for input mode setting.

To set the input modes to mode 0 for channel 1 to channel 4, fill 16#0 in the "**Data**" field. Click "**Add**" to finish the setting.



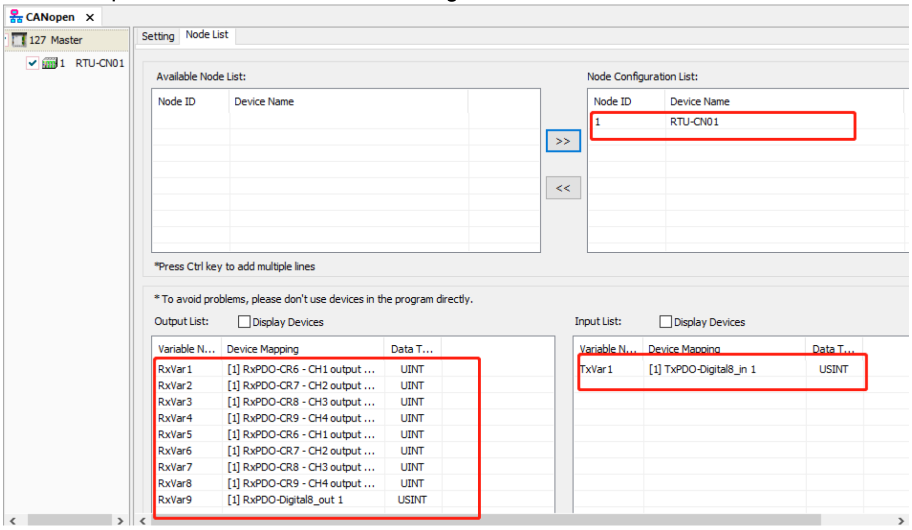
15.2.10.1.2 Downloading Configuration to CANopen Master

1. Click on “**127Master**” symbol on the CANopen configuration interface and then click on “**Node List**” tab. On the “**Node List**” tab page, you will see the available node RTU-CN01 is on the left and “**Node Configuration List**” is on the right in “**Available Node List**” area.



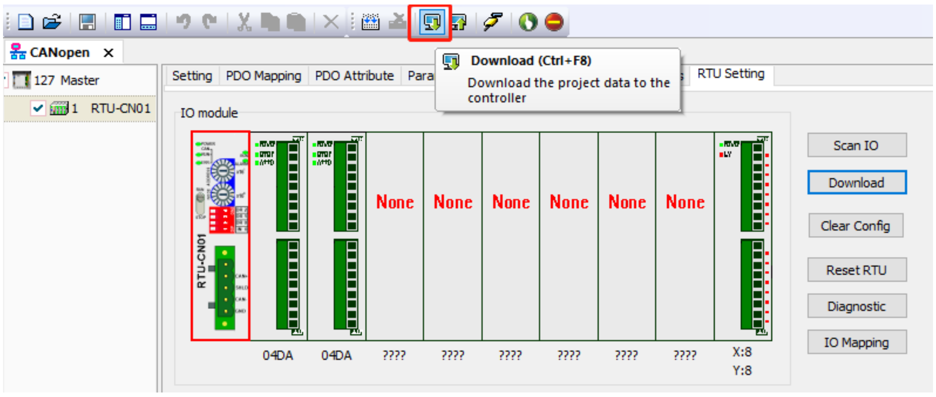
15

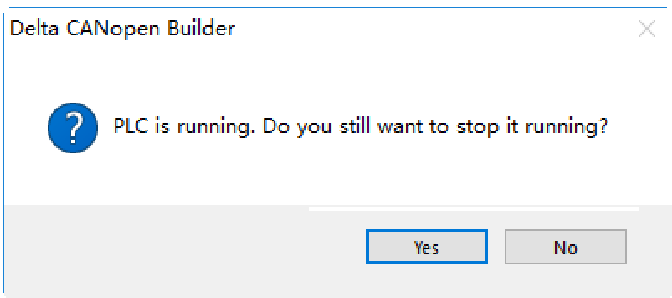
2. Add the CANopen slave device on the left to the node list on the right of the “**Node List**” tab page by selecting the CANopen slave node and then clicking >>.



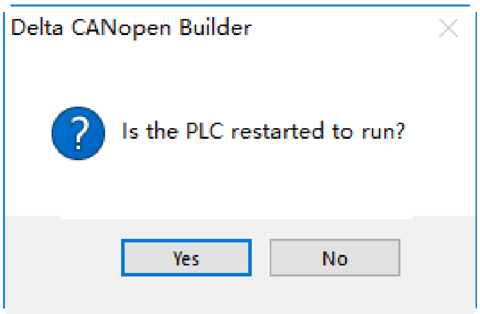
Note: Variable names in “**Output List**” and “**Input List**” can be modified manually.

3. Then click on  to download the configuration to the CANopen master DVP50MC. During the download, a reminder dialog will appear if 50MC is in RUN state as below. Just click “**Yes**” button to download the configuration to the master DVP50MC.

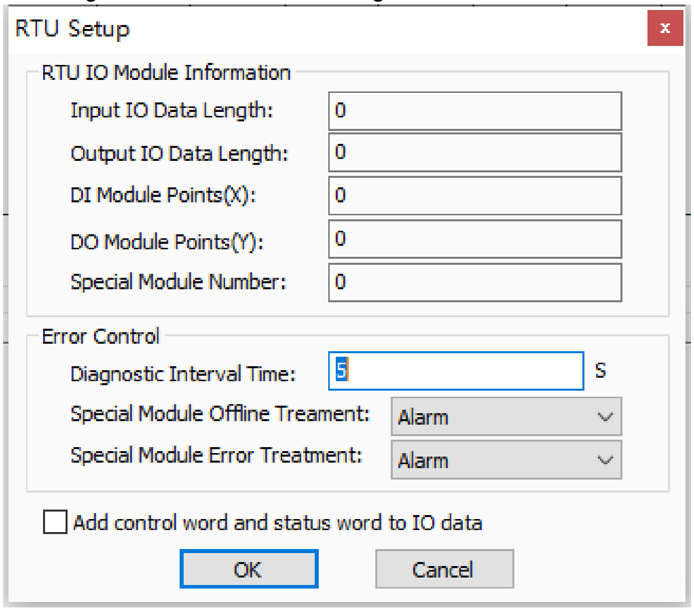




4. After the download is complete, the following dialog appears asking whether to restart the PLC. Select “**Yes**” to have DVP50MC enter the RUN state.



5. When the “**RUN**” and “**CAN RUN**” indicators of RTU-CN01 are in green and “**CAN**” indicator of DVP50MC is also in green, it means that the master and slave have managed to make a connection and then the IO data exchange can be carried out through PDO.



15.2.10.1.3 Program Control over RTU-CN01 in the CANopen Network

1. IO data mapping between the master PLC and RTU-CN01

- Controller → RTU-CN01 slave

Master variable name	CANopen bus data transmission	Slave parameter index	Slave parameter subindex	Slave parameter	Meaning of slave parameters
RxVar1		16#2020	16#7	CR6 of the 2nd module on the right of RTU-CN01	DVP04DA’s channel 1 setting value
RxVar2		16#2020	16#8	CR7 of the 2nd module on the right of RTU-CN01	DVP04DA’s channel 2 setting value
RxVar3		16#6200	16#1	8 points of digital output	DVP16SP’s output Y0-Y7

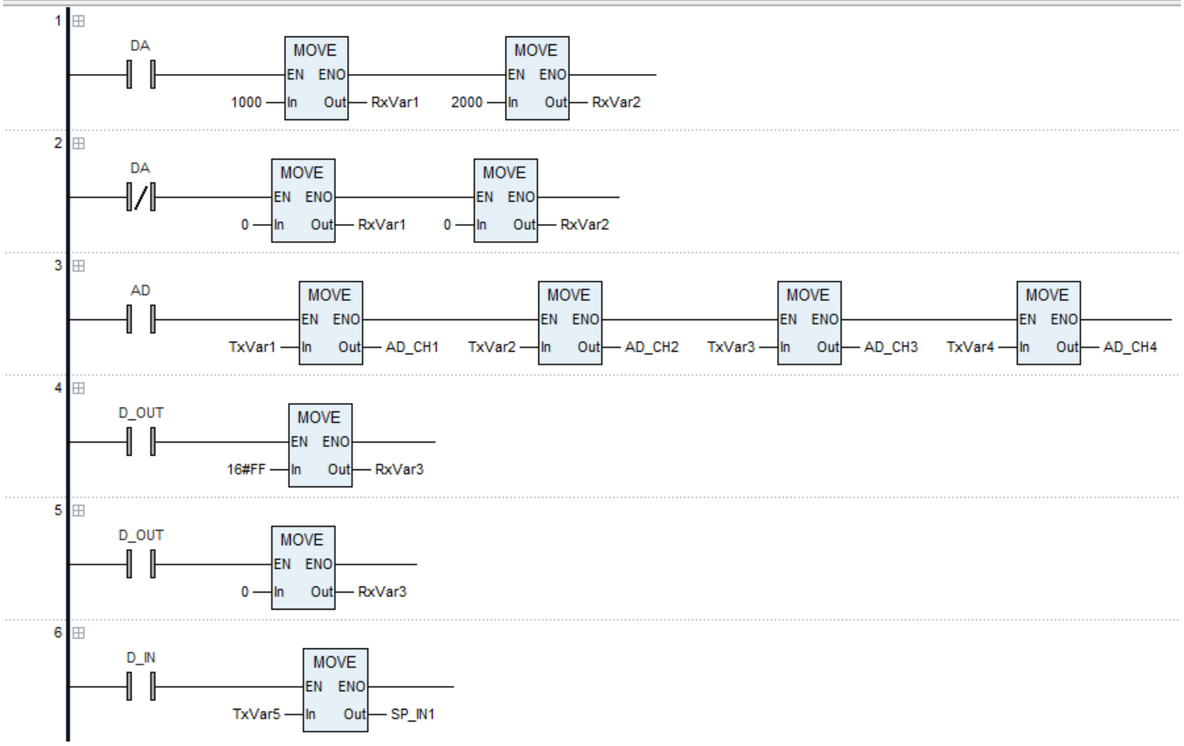
- RTU-CN01 slave → Controller

Master variable name	CANopen bus data transmission	Slave parameter index	Slave parameter subindex	Slave parameter	Meaning of slave parameters
TxVar1	⇦	16#2000	16#d	CR12 of the 1st module on the right of RTU-CN01	DVP04AD's channel 1 present value
TxVar2		16#2000	16#e	CR13 of the 1st module on the right of RTU-CN01	DVP04AD's channel 2 present value
TxVar3		16#2000	16#f	CR14 of the 1st module on the right of RTU-CN01	DVP04AD's channel 3 present value
TxVar4		16#2000	16#10	CR15 of the 1st module on the right of RTU-CN01	DVP04AD's channel 4 present value
TxVar5		16#6000	16#1	8 points of digital input	DVP16SP's input X0-X7

2. CANopen Network Control

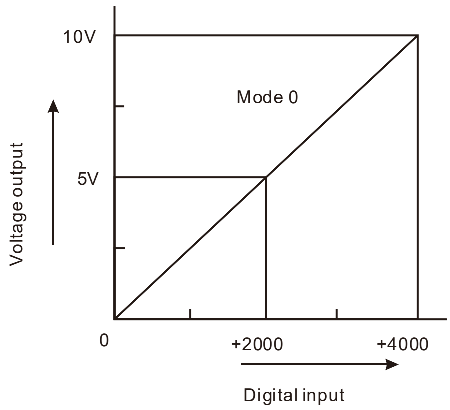
- Master PLC Control Program

Index	Scope	Name	Address	Data Type	Initial Value	Comment
1	VAR	DA		BOOL		
2	VAR	AD		BOOL		
3	VAR	AD_CH		INT		
4	VAR	AD_CH		INT		
5	VAR	AD_CH		INT		
6	VAR	AD_CH		INT		
7	VAR	D_OUT		BOOL		
8	VAR	D_IN		BOOL		
9	VAR	SP_IN		INT		

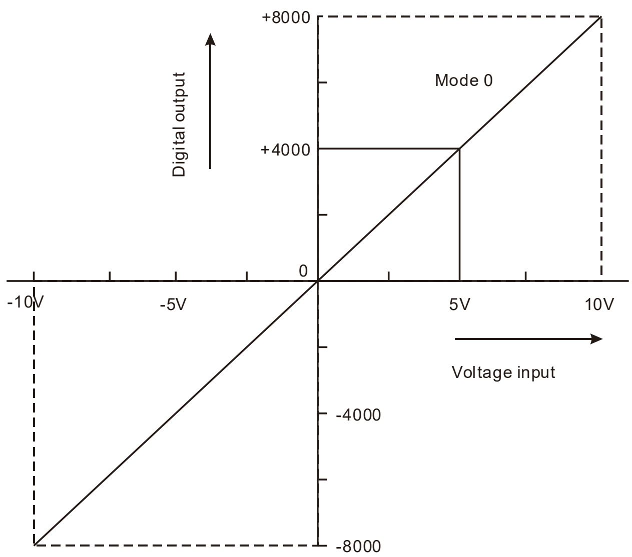


- **Program explanation**
  - When DA is TRUE, the value of RxVar1 is 1000, DVP04DA's channel 1 outputs 2.5 V voltage, the value of RxVar2 is 2000 and DVP04DA's channel 2 outputs 5 V voltage.
    When DA is FALSE, the values of RxVar1 and RxVar2 are both 0 and DVP04DA's channel 1 and channel 2 both output 0 V voltage.
  - When AD is TRUE, TxVar1-TxVar4 are assigned to AD_CH1 to AD_CH4 to read the present values of channel 1 to channel 4 of DVP04AD-S.
  - When D_OUT=ON, the value of RxVar3 is 16#FF (255) and DVP16SP11T is controlled to change its Y0-Y7 to ON.
    When D_OUT=OFF, the value of RxVar3 is 0 and DVP16SP11T is controlled to change its Y0-Y7 to OFF.
  - When D_IN=ON, TxVar5 is assigned to SP_IN1 to read the values of DVP16SP's input points X0-X7.

- **Digital-analog relations for DVP04DA-S and DVP04AD-S:**



Digital input -voltage output relation for DVP04DA-S in mode 0



Voltage input- digital output relation for DVP04AD-S in mode 0

15.2.10.2 Example of Using RTU-CN01 with Non-Delta Master

In the following example, the third-party software (S brand) is used to directly configure the PDO parameters which are used in section 15.2.10.1 in the PDO mapping window. You can learn from this section about how to configure RTU-CN01-related parameters via the third-party software.

- **Setting Transmission Rate**

The CANbus page appears with a click on "**CAN0**", where the transmission rate is set. Please ensure that the transmission rate of the master must be the same as that of acutally connected RTU-CN01.
For the transmission rate setup of RTU-CN01, refer to section 15.2.3.4 Function Switch.

- **Importing EDS File of RTU-CN01**

Start the S brand software and import EDS file by clicking on "**Tools**" >> "**Devices**" >> "**Install**". Select the EDS file to be added in the window. Afterward, click the "**Open**" button and then "**Install**" to install DTM (Device Type Manager).

- **Adding the Remote Device RTU-CN01**

Open the “**Devices**” window, and then add RTU-CN01 in the steps described below.

1. Right-click CAN0 and then select the “**Add Device…**” option from the context menu.
2. From the window that appears, click “**CANopen_Performance**” and then “**Add Device**” button to add a device.
3. Click the “**CANopen_Performance**” from the “**Devices**” list on the left, select RTU-CN01 as the remote device, and then click “**Add Device**”.

- **Configuring CANopen Parameters for the Remote Device**

Double-click RTU-CN01 icon, then a new tab page appears. Select the checkbox on the left of “**Enable Expert Settings**” and ensure that the node ID is the same as that of the actually connected CANopen slave.

- **Configuring PDO Mappings**

1. Receive PDO Mapping

With a click on the “**Receive PDO Mapping**” tab, the following interface appears. Select one desired Receive PDO, and then click "**Add Mapping…**".

In the window which appears then, select RTU-CN01 parameters which need to be configured, and configure them for Receive PDO by clicking “**OK**”. Max. 8 bytes of data can be configured for each PDO. For explanation of EDS file parameters, see section 15.2.9.1 Parameters from EDS File.

2. Send PDO Mapping

Configuring the Send PDO mappings:

Click “**Send PDO Mapping**” tab and select the desired Send PDO on the page. Then click “**Add Mapping**” button, select RTU-CN01 parameters which need to be configured, and finally click “**OK**” button to finish the configuration of parameters for Send PDO. For explanation of EDS file parameters, see section 15.2.9.1 Parameters from EDS File.

3. PDO Mapping

After configuring the Receive PDO and Send PDO mappings, click the “**PDO Mapping**” tab.

A. Configuring slave parameters to the master:

   Selecting the desired items to configure the slave PDO parameters to the master.

B. Setting PDO properties:

   The "**PDO Properties**" window appears by double-clicking the selected PDO on the PDO Mapping page. Then select the transmission type of the PDO there.

C. CANopen I/O Mapping:

   Click the “**CANopen I/O Mapping**” tab, where the configured parameters are displayed. Before using the configured parameters, type the variable names of the configured parameters to complete the mappings.

15.2.11 LED Indicator Diagnosis and Troubleshooting

15.2.11.1 LED Indicator Diagnosis

■ **POWER LED**

LED status	Indication	How to correct
Off	Power supply is abnormal.	Make sure that the power supply to RTU-CN01 works.
Green light on	Power supply is normal.	--

■ **CAN RUN LED**

LED status	Indication	How to correct
Green light in single flash	RTU-CN01 in STOP state	The upper computer is downloading the network configuration and RTU-CN01 is waiting until the download is complete.
Green light blinking	RTU-CN01 in Pre-operational state	1. Check if the CANopen bus cable is connected properly. 2. Ensure that the Transmission rates of all nodes in the network are the same. 3. Check if the slaves configured in the software have acutally been connected to the network. 4. Check if some slave is offline.
Green light ON	RTU-CN01 in RUN state	--

■ **CAN ERR LED**

LED status	Indication	How to correct
Off	Normal	--
Red light in double flashes	Some slave is offline.	1. Make sure that the CANopen bus cable is a standard cable. 2. Make sure that there is a terminal resistor at each of both ends of the CANopen bus.
Red light in single flash	The bus error exceeds the alert level.	1. Make sure that the CANopen bus cable is a standard cable. 2. Make sure that there is a terminal resistor at each end of the CANopen bus. 3. Check if there is too much interference around the CANopen bus cable.
Red light ON	Bus-off	1. Check if the bus cable in the CANopen network is connected properly. 2. Ensure that the transmission rates of all nodes in the network are the same and repower RTU-CN01.

■ **RUN LED**

LED status	Indication	How to correct
Green light ON	RTU-CN01 in RUN state	--
Off	RTU-CN01 in STOP state	Turn the switch to RUN
Blinking	The setting of the node address exceeds the allowed range.	Set the node address to a value between 1 and 127 by using the node address switch of RTU-CN01

■ **ALARM LED**

LED status	Indication	How to correct
Off	RTU-CN01 works normally or lacks the work power.	--
Red light blinking	1. The configuration data of RTU-CN01 is invalid. 2. The extension modules on the right of RTU-CN01 are in error or fail to communicate with RTU-CN01. 3. The setting of the node address exceeds the allowed range.	1. Check if the RTU-CN01 configuration download is normal, and re-download the RTU-CN01 configuration. 2. Check if the modules on the right side of the RTU-CN01 are normal after obtaining relevant diagnostic information via the CANopen Builder software. 3. Set the node address to a value between 1 and 127 by using the address switch of RTU-CN01
Red light ON	1. Fatal errors or errors in the configuration data of RTU-CN01. 2. The power supply voltage is too low.	1. Get relevant diagnostic information by the CANopen Builder software. 2. Make sure that the power supply to RTU-CN01 is normal.

15.2.11.2 Status Word Diagnosis

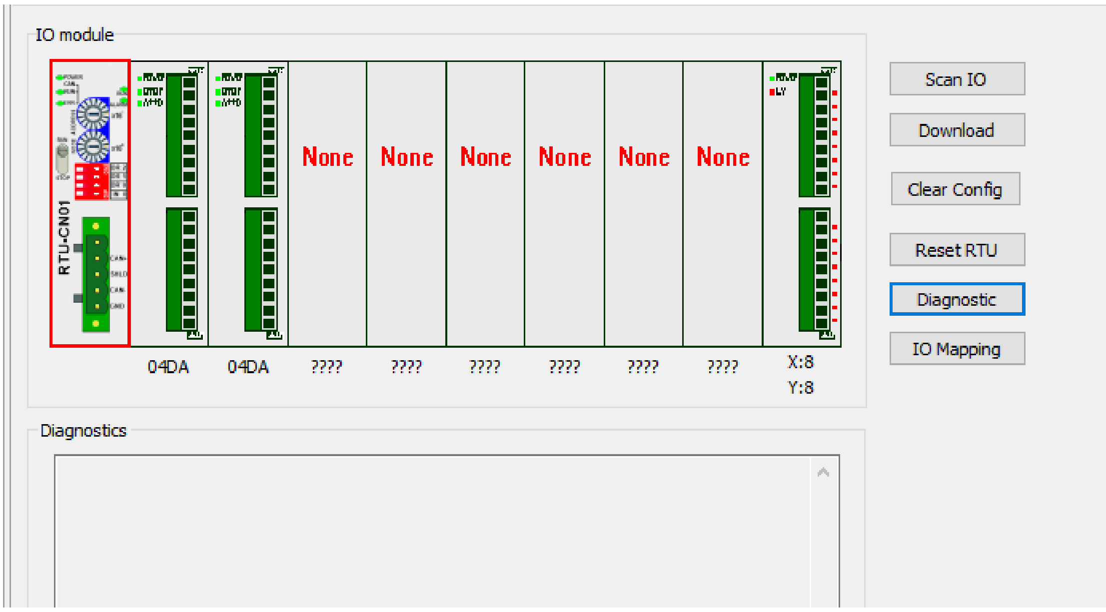
The status word of RTU-CN01 displays the operating states of special modules and digital modules. Refer to section 15.2.7.3 for details information about using the status word.

Bit	Status value	Indication	How to deal with
bit0	0	RTU-CN01 detected extension modules.	--
	1	RTU-CN01 failed to detect extension modules.	1. Check if there are extension modules on the right of RTU-CN01. 2. Repower RTU-CN01
bit1	0	Extension modules connected to RTU-CN01 are consistent with the configuration data.	--
	1	Extension modules connected to RTU-CN01 are inconsistent with the configuration data.	Redownload the configuration data to RTU-CN01 by CANopen Builder.
bit2	0	No errors in special modules	--

Bit	Status value	Indication	How to deal with
	1	Some error occurs in special modules.	Check special modules.
bit3	0	Special modules works normally.	--
	1	Special module offline	Check special modules and repower RTU-CN01.
bit4	0	Valid configuration data	--
	1	Invalid configuration data	Redownload the configuration data to RTU-CN01 by CANopen Builder.
bit5	0	RTU-CN01 is working normally.	--
	1	The work power for RTU-CN01 is under voltage.	Check the power module for RTU-CN01.
bit6	0	RTU-CN01 is working normally.	--
	1	RTU-CN01 detects some unrecognized special module.	Check if RTU-CN01 supports the special module.
bit7	0	RTU-CN01 is working normally.	--
	1	The number of special modules connected to RTU-CN01 exceeds 8 units or the number of digital IO points exceeds 128.	Remove the extra modules.
bit8	0/1	Reserved	
bit9	0	RTU-CN01 in RUN state	--
	1	RTU-CN01 in STOP state	1. Check the state of the RUN/STOP switch of RTU-CN01. 2. Check if H8000 was written to the control word of RTU-CN01. 3. Check if there is any fatal error in RTU-CN01

15.2.11.3 Software Diagnosis

In the main window of the RTU configuration, click the "**Diagnostic**" button to see relevant information in the "**Diagnostics**" area:



Note:

The software diagnostic function cannot start until the CANopen Builder software communicates with the controller normally. Otherwise, the software will report a communication timeout error.

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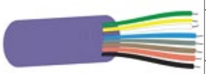
15.2.12 Communication Accessories

15.2.12.1 Cables

Figure	Model	Length (m)	Diameter (AWG)
	UC-DN01Z-01A	305	2#15, 2#18 SHLD PVC (Thick cable)
	UC-DN01Z-02A	305	2#22, 2#24 SHLD PVC (Thin cable)
	UC-CMC003-01A	0.3	4#26, 1#24 PVC (Thin cable)
	UC-CMC005-01A	0.5	4#26, 1#24 PVC (Thin cable)
	UC-CMC010-01A	1.0	4#26, 1#24 PVC (Thin cable)
	UC-CMC015-01A	1.5	4#26, 1#24 PVC (Thin cable)
	UC-CMC020-01A	2.0	4#26, 1#24 PVC (Thin cable)
	UC-CMC030-01A	3.0	4#26, 1#24 PVC (Thin cable)
	UC-CMC050-01A	5.0	4#26, 1#24 PVC (Thin cable)
	UC-CMC100-01A	10.0	4#26, 1#24 PVC (Thin cable)
	UC-CMC200-01A	20.0	4#26, 1#24 PVC (Thin cable)

Notes:

1. The maximum cable length for purchase is 305 m per reel and mimimum length is 1 m with the meter as a unit.
2. UC-DN01Z-01A and UC-DN01Z-02A can be used as the main-line cables as well as the branch-line cables. The maximum communication distances that they support are different.

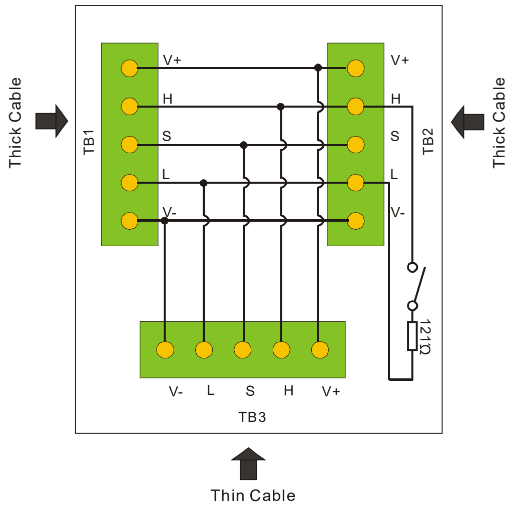
   The maximum communication distances the two cables support at different CANopen transmission speed are displayed as follows.

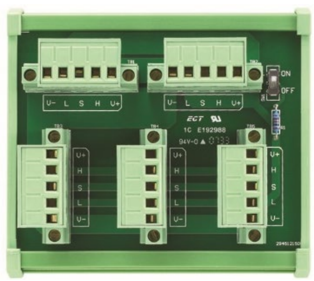
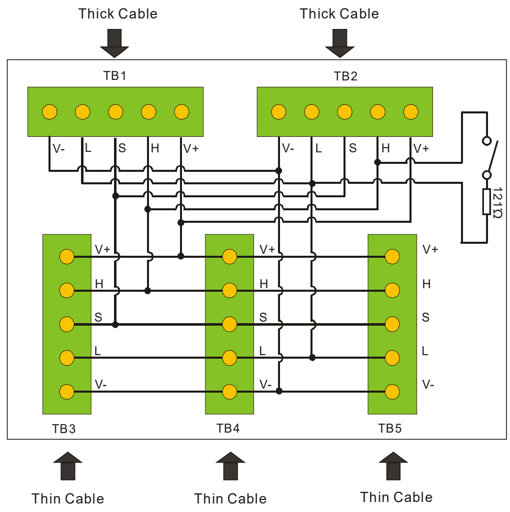
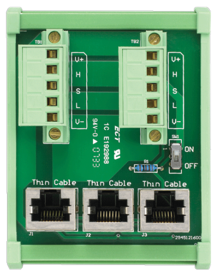
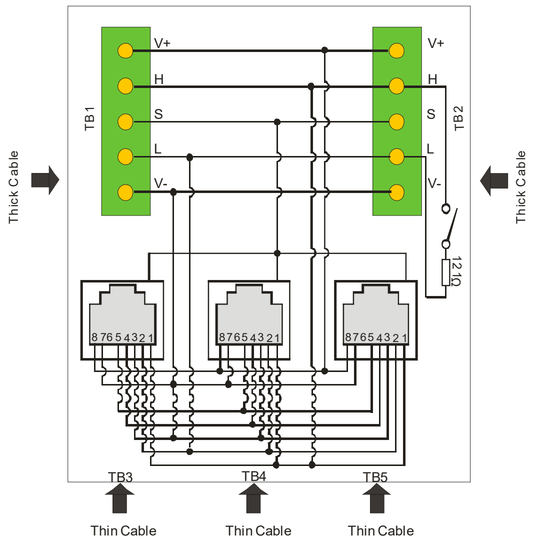
CANopen transmission speed (bit/s)	125K	250K	500K	1M
Max. communication distance for UC-DN01Z-01A (m)	500	250	100	40
Max. communication distance for UC-DN01Z-02A (m)	100	100	100	40

3. The maximum communication distance at a transmission speed is regulated in the CANopen protocol. The maximum communication distances and corresponding transmission speeds are shown in the following table.

Transmission speed (bit/s)	10K	20K	50K	125K	250K	500K	800K	1M
Max. communication distance (m)	5000	2500	1000	500	250	100	50	40

15.2.12.2 Distribution box

<table>
<tr><th colspan="2">Model</th><th>Circuit Figure</th></tr>
<tr><td>TAP-CN01</td><td></td><td>
</td></tr>
</table>

<table>
<tr><th colspan="2">Model</th><th>Circuit Figure</th></tr>
<tr><td>TAP-CN02</td><td></td><td></td></tr>
<tr><td>TAP-CN03</td><td></td><td></td></tr>
<tr><td>Connector</td><td colspan="2">Removable terminals (5.08 mm)</td></tr>
<tr><td>Terminal resistor</td><td colspan="2">120 Ω</td></tr>
</table>

15.3 RTU-ECAT

15.3.1 Introduction

RTU-ECAT is defined as an EtherCAT slave with DVP Slim series DIO modules and special modules connected on its right side.

15.3.1.1 Characteristics

- Compliant with the EtherCAT protocol, RTU-ECAT supports PDO, SDO, and other services in the COE protocol.
- Supports Distributed Clock SYNC and SyncManagers SYNC.
- On its right side, RTU-ECAT connects DVP Slim series right-side modules with up to 128 digital input points and 128 digital output points, as well as 8 special modules such as analog modules, temperature modules, pulse modules and etc.
- Supports a maximum of 14 DVP Slim series digital modules and special modules in total connected to its right side.
- Users can select that the output values of right-side special modules and digital output point values of digital modules maintain the last output values or set to zero when the RTU-EtherCAT device is disconnected from the master.

15.3.1.2 Specifications

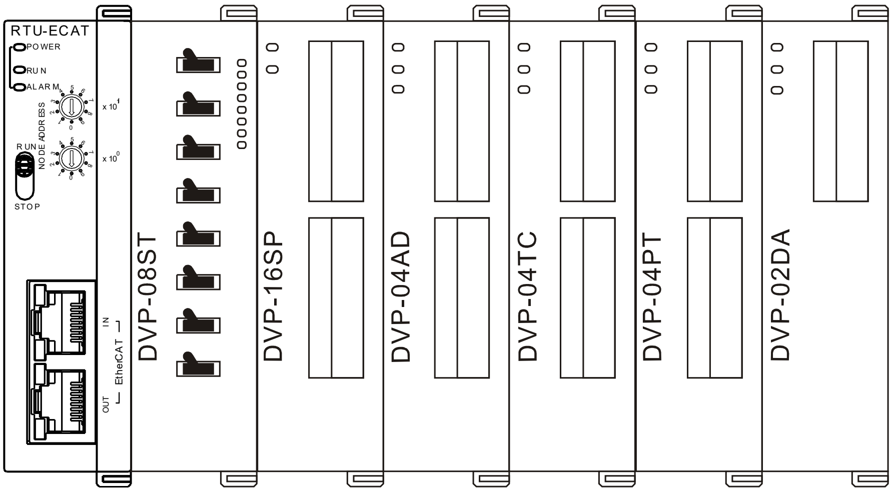
■ **Electrical specification**

Item	Specification
Power voltage	24 VDC (-15% to 20%)
Consumption power	1.8 W
Isolation voltage	500 VAC
Weight	84 g

■ **EtherCAT specification**

Item	Specification
Communication protocol	EtherCAT Protocol
Supported service	CoE (PDO, SDO)
Physical layer	100BASE-TX
Transmission rate	100M bps
Transmission medium	Category 5e or above shielded cable
Transmission distance	100 m
Topology structure	Linear topology

15.3.1.3 Extension Modules Connectable to RTU-ECAT



- Digital modules connectable to RTU-ECAT

DI/DO module (Model name)	Default I/O mapping data (EtherCAT master → RTU-ECAT)	Default I/O mapping data (RTU-ECAT → EtherCAT master)
DVP08SM11N	N/A	8 bits
DVP08SM10N	N/A	8 bits
DVP16SM11N	N/A	16 bits
DVP06SN11R	8 bits	N/A
DVP08SN11R/T	8 bits	N/A
DVP08SN11TS	8 bits	N/A
DVP16SN11T	16 bits	N/A
DVP16SN11TS	16 bits	N/A
DVP08SP11R/T	8 bits	8 bits
DVP08SP11TS	8 bits	8 bits
DVP16SP11R/T	8 bits	8 bits
DVP16SP11TS	8 bits	8 bits
DVP32SM11N	N/A	32 bits
DVP32SN11TN	32 bits	N/A
DVP08ST11N	N/A	8 bits

- Special modules connectable to RTU-ECAT

Special module (Model name)	Default IO mapping data (EtherCAT master →RTU-ECAT)		Default IO mapping data (RTU-ECAT → EtherCAT master)	
	Starting CR	Length (words)	Starting CR	Length (words)
DVP02DA-S	CR10	2	N/A	N/A
DVP02DA-S2	CR#10	2	N/A	N/A

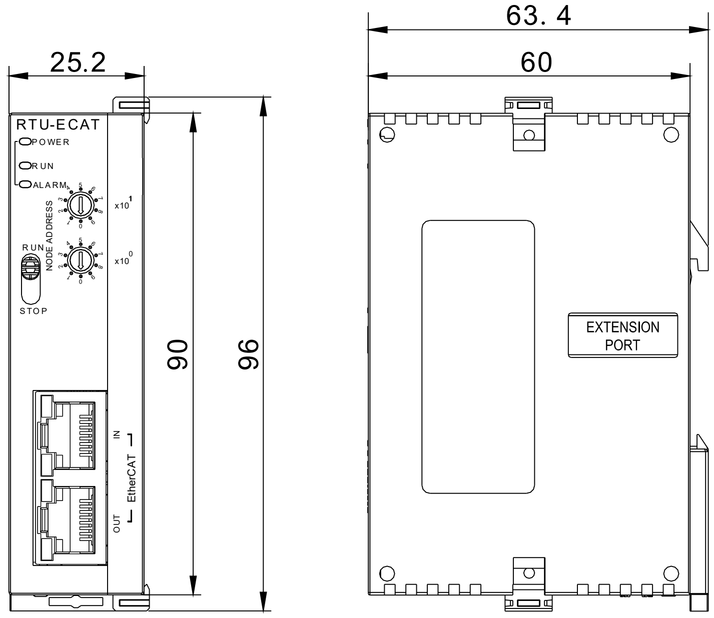
Special module (Model name)	Default IO mapping data (EtherCAT master →RTU-ECAT)		Default IO mapping data (RTU-ECAT → EtherCAT master)	
	Starting CR	Length (words)	Starting CR	Length (words)
DVP04DA-S	CR6	4	N/A	N/A
DVP04DA-S2	CR6	4	N/A	N/A
DVP04AD-S	N/A	N/A	CR12	4
DVP04AD-S2	N/A	N/A	CR12	4
DVP06AD-S	N/A	N/A	CR12	6
DVP06AD-S2	N/A	N/A	CR#12	6
DVP04TC-S	N/A	N/A	CR14	4
DVP04PT-S	N/A	N/A	CR18	4
DVP06PT-S	N/A	N/A	CR18	6
DVP06XA-S	CR10	2	CR12	4
DVP06XA-S2	CR10	2	CR12	4
DVP01PU-S	CR42	4	CR33	4
DVP02TUL-S	CR4	2	CR2	2
DVP02TUR-S	CR4	2	CR2	2
DVP02TUN-S	CR4	2	CR2	2

Note:

When special modules are connected to RTU-ECAT, the starting one of CRs for data upload and download and the length of data to be uploaded and downloaded can be set up via the EtherCAT network configuration tool.

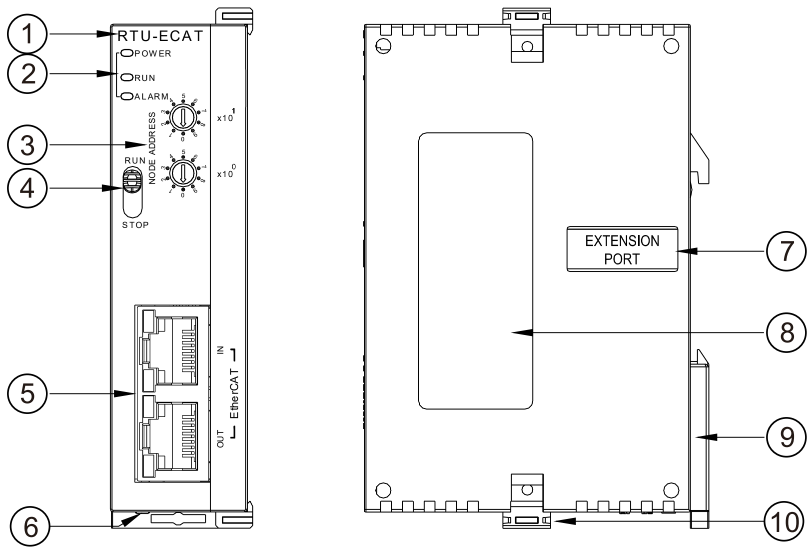
15.3.2 Dimensions and Parts

- **Dimensions**



Unit: mm

- **Parts**



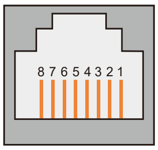
No.	Name	Description
1	Model Name	Model name of the module
2	Status indicators	Indicate the power supply status, EtherCAT status and operational status of the module. See section LED Indicator Diagnosis for details.
3	Address switch	EtherCAT communication address setting
4	RUN/STOP switch	RUN: Start user program execution STOP: Stop user program execution
5	EtherCAT port	For EtherCAT communication
6	24V DC power interface	For supplying power to I/O modules

No.	Name	Description
7	I/O module port	For connecting I/O modules
8	Nameplate	Label plate
9	DIN rail clip	For securing the device itself
10	I/O module clip	For securing I/O modules

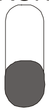
15.3.3 Terminals

15.3.3.1 EtherCAT Port

The EtherCAT port is for the EtherCAT communication. See the following table for the definitions of pins.

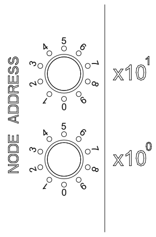
	Pin	Signal	Description
 EtherCAT	1	Tx+	Positive pole for transmitting data
	2	Tx-	Negative pole for transmitting data
	3	Rx+	Positive pole for receiving data
	4	Reserved	Reserved
	5	Reserved	Reserved
	6	Rx-	Negative pole for receiving data
	7	Reserved	Reserved
	8	Reserved	Reserved

15.3.3.2 RUN/STOP Switch

	RUN/STOP switch	Description
RUN  STOP	STOP → RUN	1. To re-detect extension modules. 2. To read/write the data in the extension modules.
	RUN → STOP	To stop reading/writing the data in the extension modules.

15.3.3.3 Address Switches

The switches are for setting up the node address of RTU-ECAT on the EtherCAT network.

	Switch setting	Description
	0 to 99	EtherCAT node address

Example:

To set the node address of RTU-ECAT to 26, set the corresponding switch of x10^1 to 2 and the corresponding switch of x10^0 to 6.

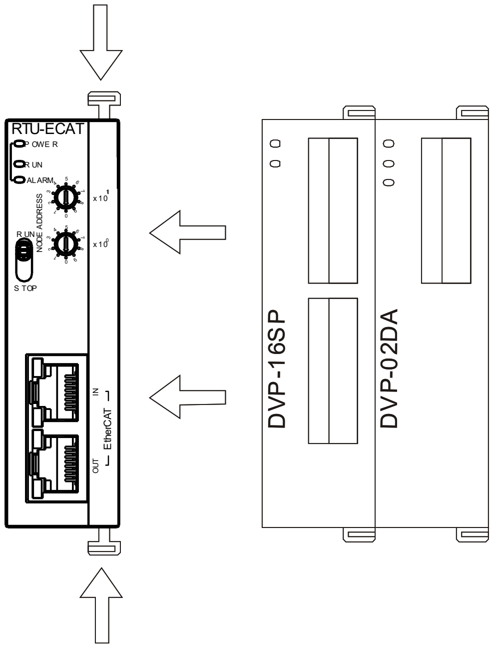
Important:

- Set the node address with the power off. Power on the RTU-ECAT module after setting the address.
- Changes to the node address during operation of the module are ineffective.
- Adjust the rotary switch carefully with a flathead screwdriver to avoid scratches.

15.3.4 Installing

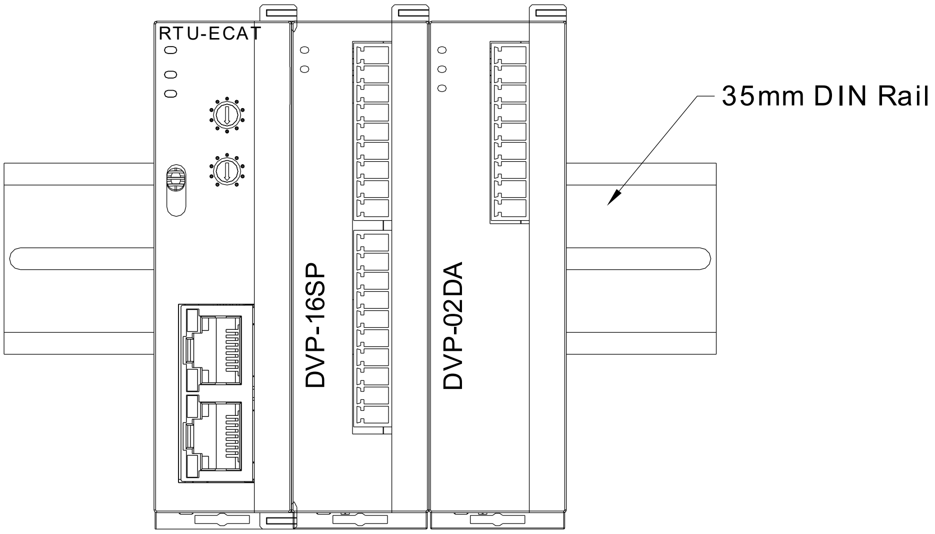
1. Installing DVP Slim Extension Modules to RTU-ECAT

- Pull open the I/O module clips on the top and the bottom of RTU-ECAT, align the extension modules with the guiding holes and then securely connect the extension modules to the RTU- ECAT as illustrated.
- Press the I/O module clips on the top and the bottom of the RTU-ECAT to fasten the extension modules.



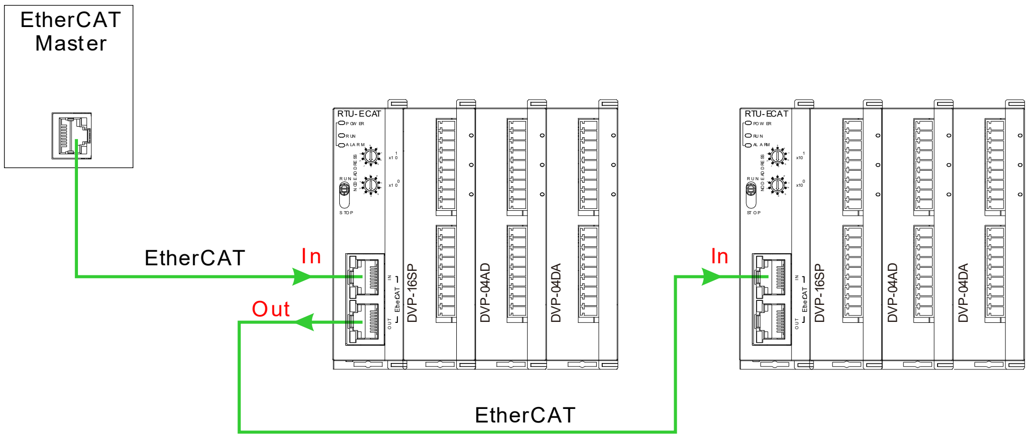
2. Installing RTU-ECAT and DVP Slim Modules on DIN Rail

- Use the 35 mm standard DIN rail.
- Pull open the DIN rail clips of the RTU-ECAT and extension modules. Insert RTU-ECAT and extension modules into the DIN rail.
- Press the DIN rail clips of the RTU-ECAT and extension modules to secure them on the DIN rail.



3. Connecting to the EtherCAT Port

- There is a strict network topology requirement for the EtherCAT network. The network must follow the rule that the input port of the current RTU-ECAT must be connected to the output port of the previous RTU-ECAT.
- Use Delta cables as EtherCAT cables. For specifications of Delta cables, refer to section 15.3.11.



15.3.5 Wiring

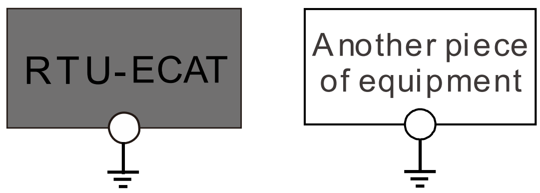
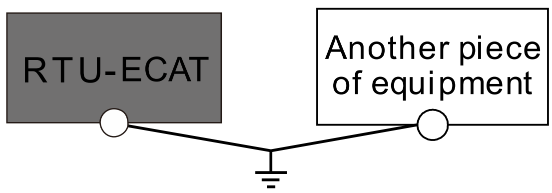
15.3.5.1 Power Input Wiring

15.3.5.1.1 Notes

The power input of RTU-ECAT is 24 V DC. Please notice the following points during use.

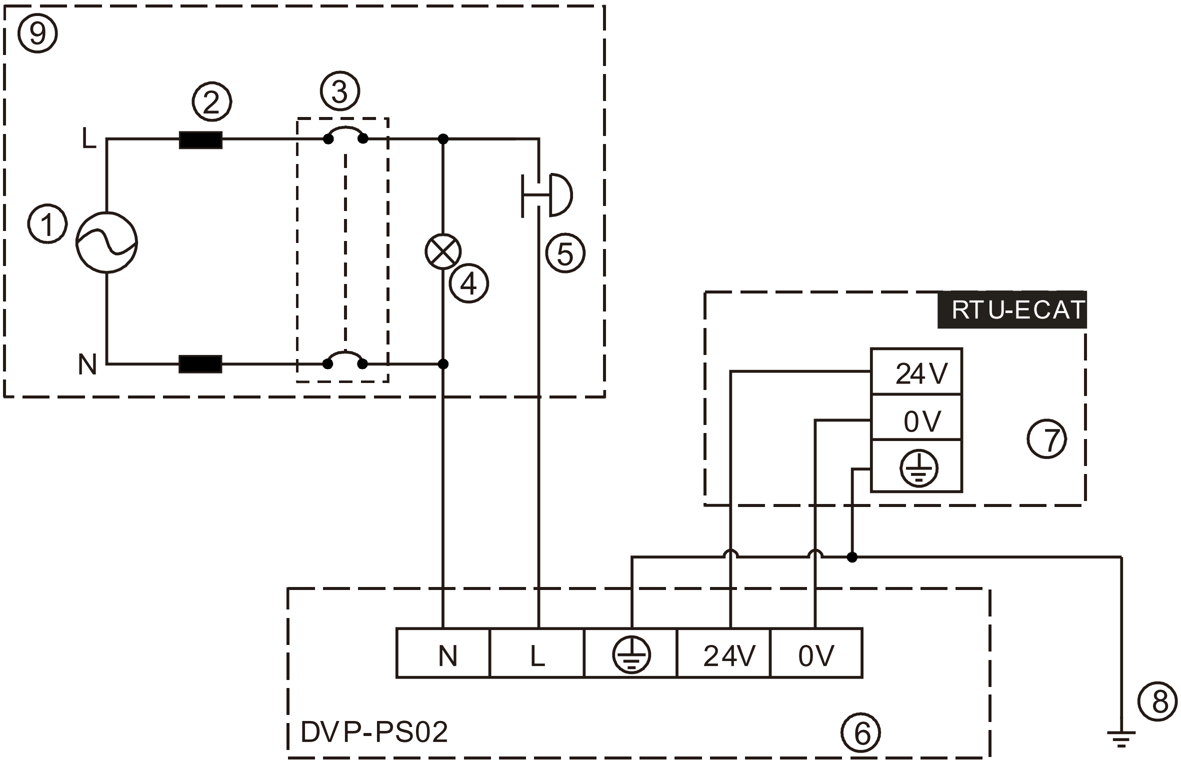
- Connect the supply power to the two terminals, 24 V and 0 V and the grounding terminal to the earth. Be cautious that the RTU-ECAT device may be damaged if the positive and negative polarities of the supply power are connected reversely.
- Please be sure to use certified power supply with SELV output or certified power supply providing double insulation evaluated by UL60950, or UL61010-1 and UL61010-2-201 standards.
- The diameter of the power wire must be between 12 and 28 AWG and the rated temperature should be greater than 70°C. The power terminal block plug wiring torque is 4.5 in-lbs.
- The cables of the AC power 110 V, 220 V and DC power 24 V must be twisted and connected to the module as short as possible in length.
- Do not combine the AC 110 V, 220 V, and DC 24 V cables with the main circuit and I/O signal cables together and please keep them away from each other. If the space permits, it's recommended to separate these lines by more than 100 mm.

15.3.5.1.2 Ground

• The diameter of the ground should not be less than the diameters of the cables connected to the terminals L and N. • If using multiple pieces of equipment, use a single-point ground.	 The single-point ground is better.
• If you cannot use a single-point ground, use a common-point ground.	 The common-point ground is permitted.
• Do not connect equipment ground wires together.	 The equipment can not be grounded in this way.

15.3.5.2 RTU-ECAT Wiring

- **Safety Circuit Wiring:**

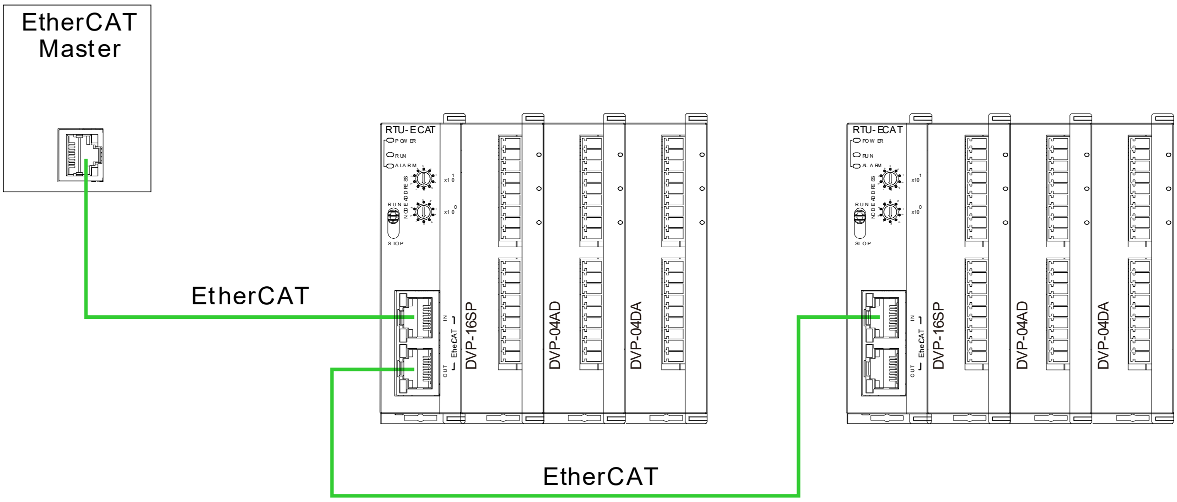


①	AC power supply: 100-240 VAC; 50/60 Hz.
②	Power supply circuit protection fuse
③	Circuit isolation device for the system: The electromagnetic contactor, relay and other switch can be used as the isolation device to prevent the system instability when the power supply is discontinuous.
④	Power indicator
⑤	Emergency stop button: The button cuts off the system power supply when an accidental situation occurs.
⑥	Delta power module DVP-PS02/24VDC
⑦	RTU-ECAT device
⑧	Ground
⑨	Safety circuit

15.3.6 Configuring RTU-ECAT

This section describes how RTU-ECAT as an EtherCAT slave realizes the data exchange between EtherCAT master and DVP Slim series extension modules.

1. EtherCAT master transmits the data to extension modules.
2. The input data from extension modules are transmitted back to EtherCAT master.



- **Terms for RTU-ECAT Configuration**

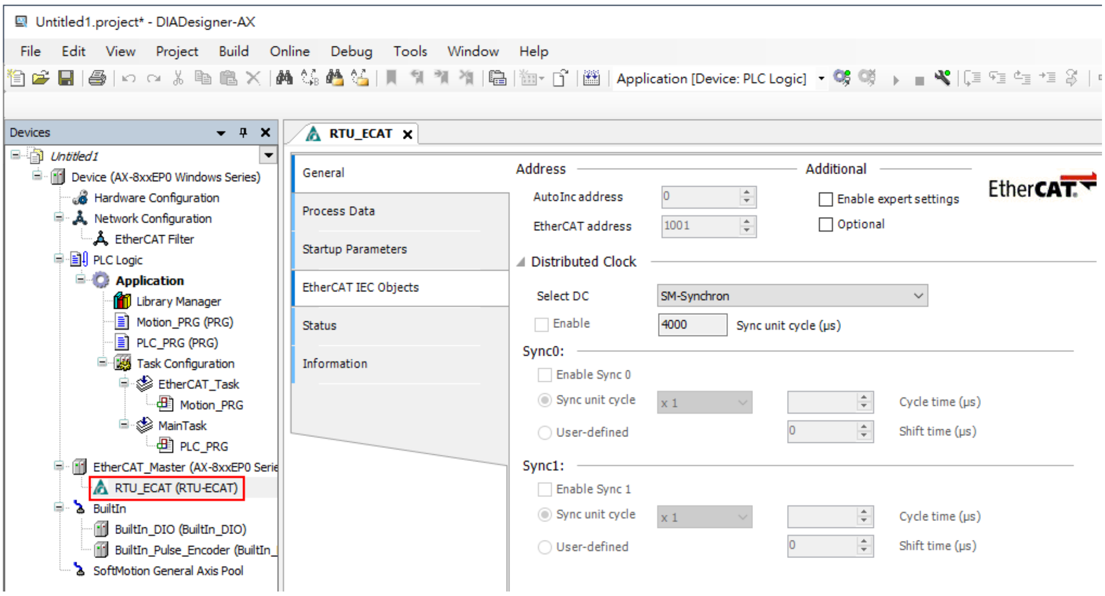
No.	Name	Unit	Description
1	Control word	Word	Sets the mode of RTU-ECAT. When the content of the control word is 8000 (Hex), RTU-ECAT is in STOP state. When the content of the control word is 8001 (Hex), RTU-ECAT is in RUN state. See section 15.3.8.3 for more details on the control word.
2	Status	Word	Status includes Error register (for error information), LV state (for voltage status), Error module number (for right-side module number) and Error list (for extension module errors) See section 15.3.8.4 for more details on the status.
3	Digital input points	Bit	The number of digital input points is a multiple of 8. The number is regarded as 8 when it is less than 8 and as 16 when it is greater than 8 but less than 16.
4	Digital output points	Bit	The number of digital output points is a multiple of 8. The number is regarded as 8 when it is less than 8 and as 16 when it is greater than 8 but less than 16.
5	Special module number	Unit	Number of special modules connected to RTU-ECAT Range: 0-8
6	Input data length	Word	The total length of input data of special modules on the right of RTU-ECAT
7	Output data length	Word	The total length of output data of special modules on the right of RTU-ECAT
8	IO mapping	N/A	The IO mapping between the RTU-ECAT and special modules connected to it.

15.3.7 Introduction to Software Interfaces

This section introduces how to configure the RTU-ECAT by taking the DIADesigner-AX software as an example.

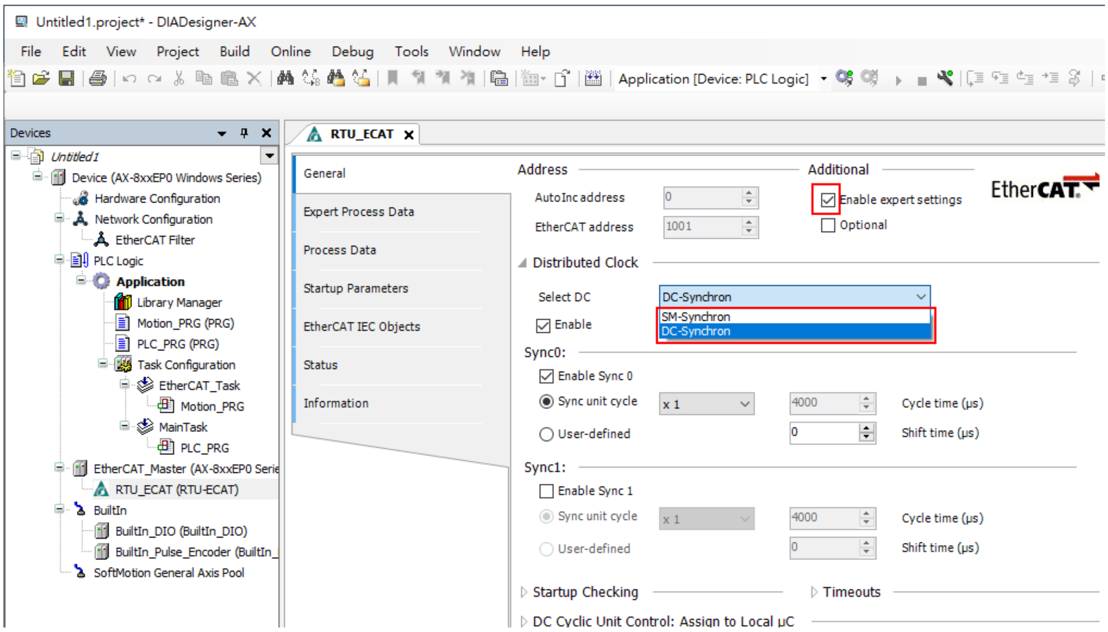
15.3.7.1 Main Interface for RTU Configuration

Double-click the symbol of RTU-ECAT on the left-side area of the DIADesigner-AX window as below. Then the main RTU configuration interface appears.



15.3.7.2 DC Interface

On the RTU configuration interface, check the checkbox of **Enable expert settings** and then select one option in the field of **Select DC** under **Distributed Clock**.



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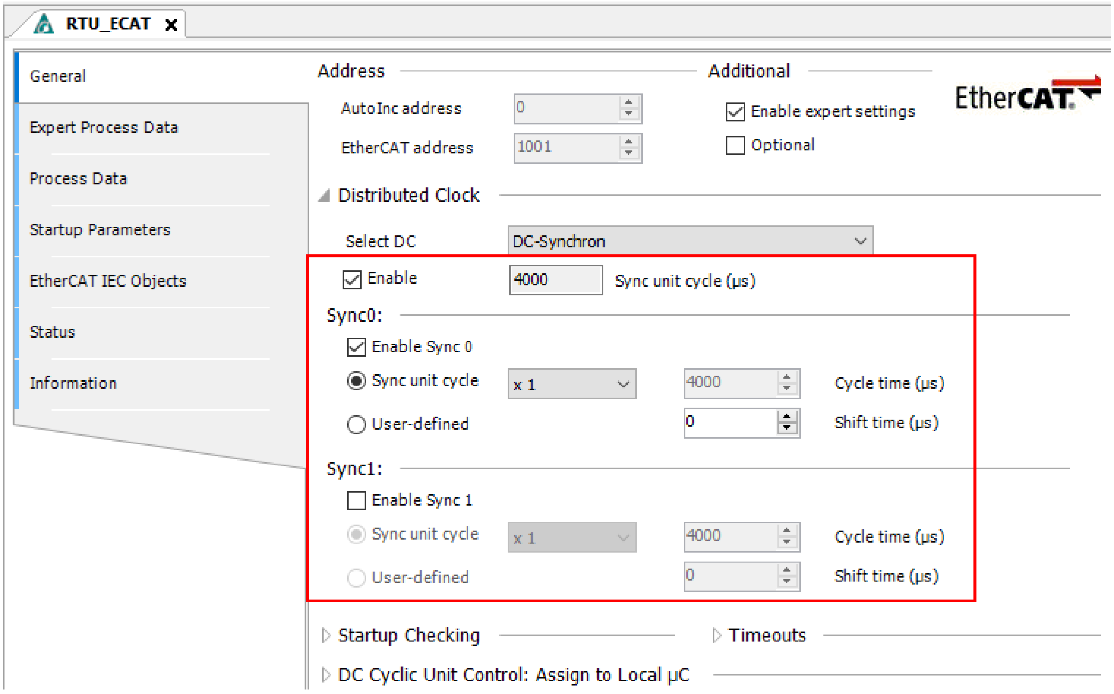
Distributed Clock (Operation Mode):

RTU-ECAT supports two modes: SM-Synchron and DC-Synchron. Either of the two operation modes can be chosen from the pull-down list.

Advanced Settings:

When choosing DC-Synchron as the operation mode, configure related parameters on the following "Advanced Settings" interface.



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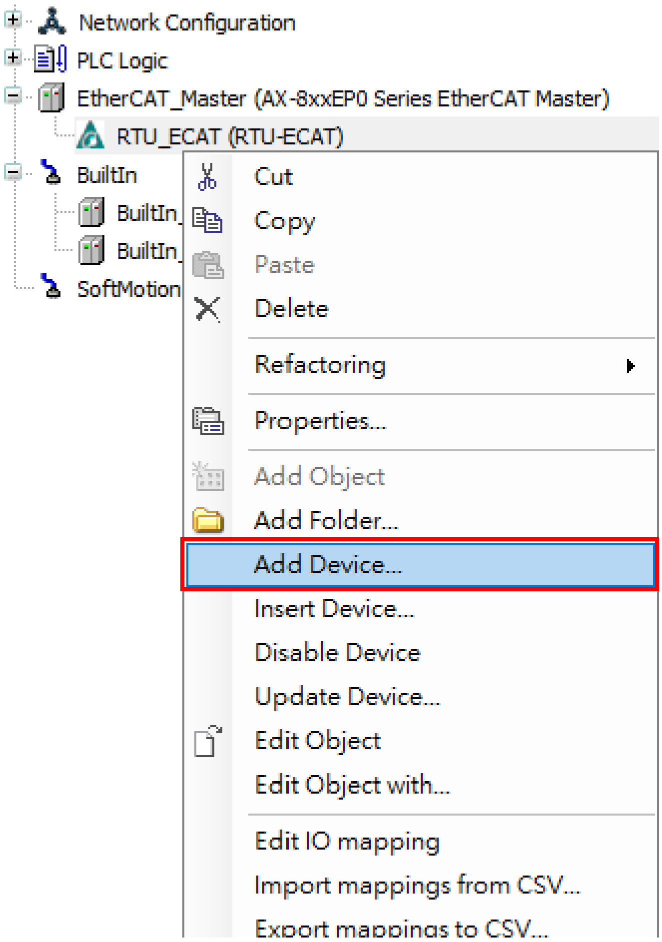
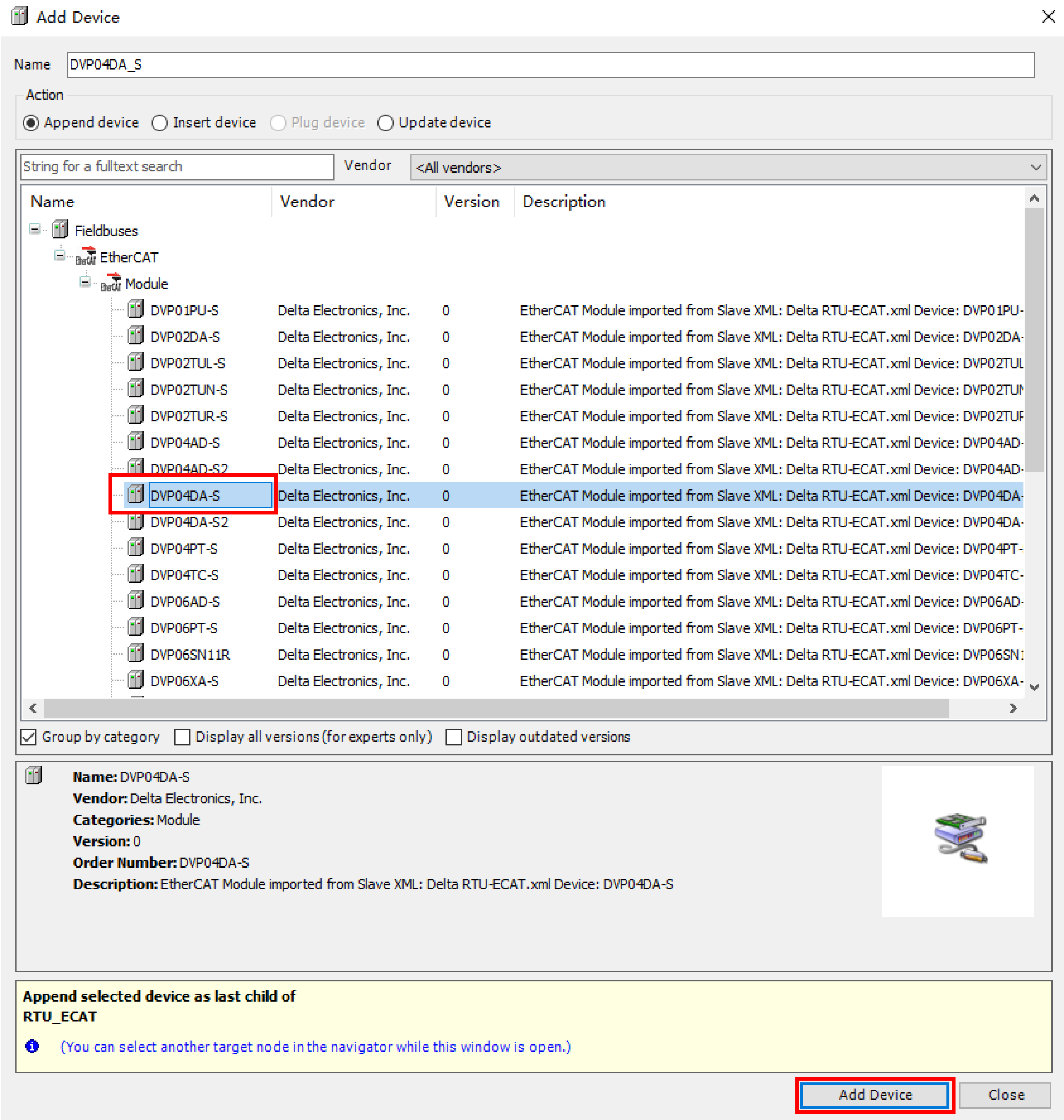
15.3.7.3 Right-side Configuration of RTU-ECAT

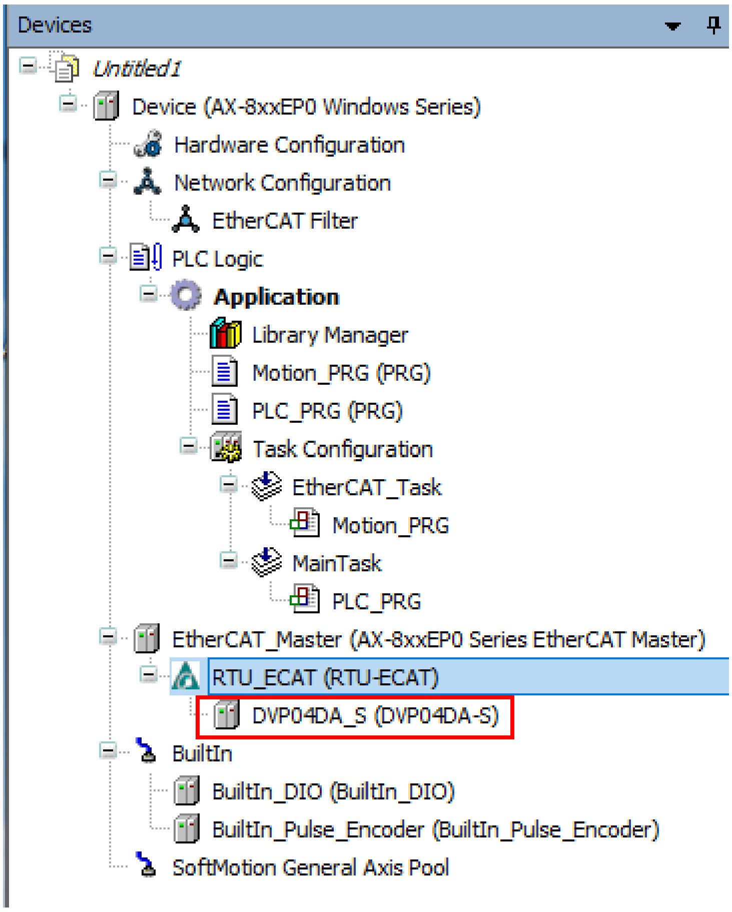
On the left-side area, right-click the symbol of RTU-ECAT and then select the "**Add Device …**" option from the dropdown menu that pops up.



The **Add Device** dialog box pops up, where you configure the modules according to the actually connected modules on the right side of RTU-ECAT. Select the desired module name, and then click the **Add Device** button or double-click the module name.



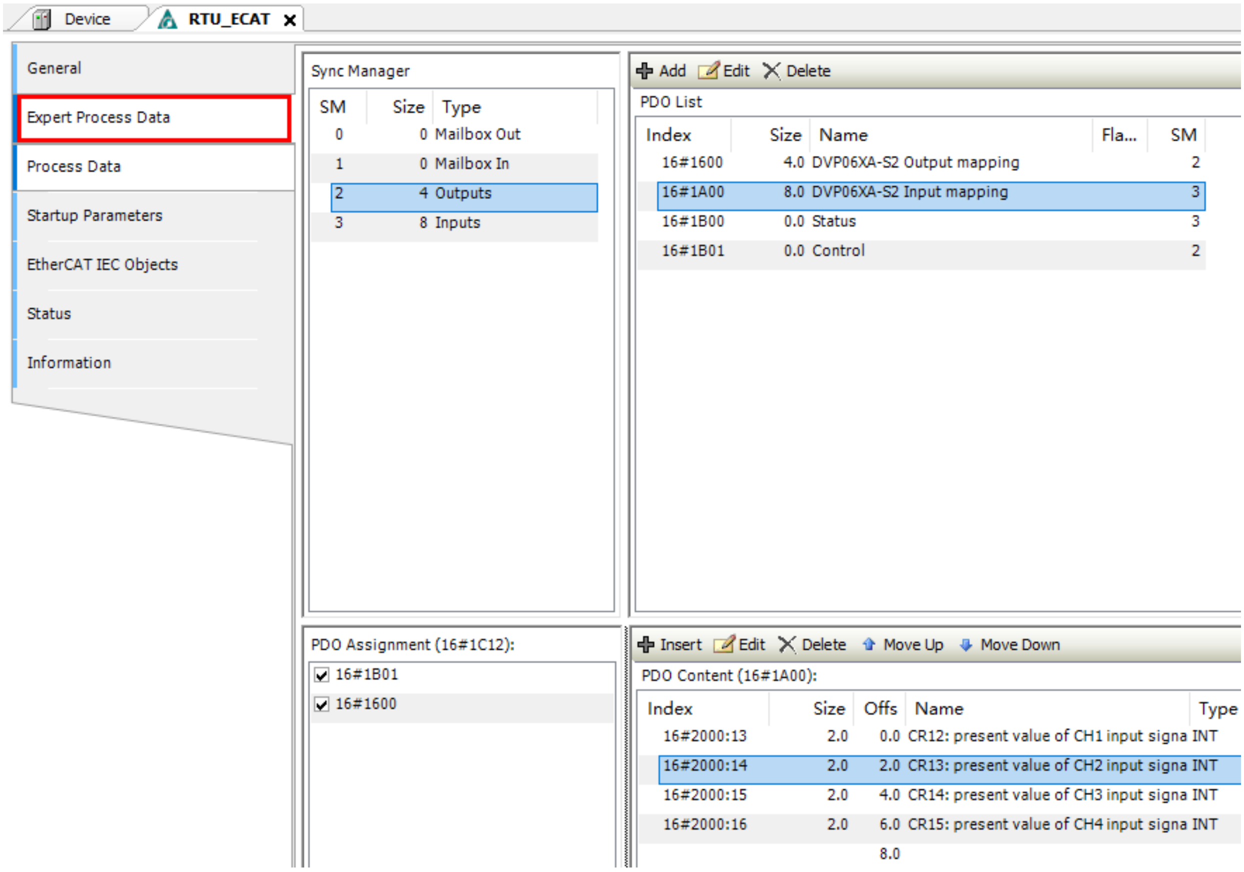
Then you can see that the module is successfully added to RTU-ECAT as shown in the following figure.



Please note that the extension modules must be added in order from the first one.

15.3.7.4 Data Exchange Configuration Interface of Special Modules

On the main RTU configuration interface, click the **"Expert Process Data"** tab. Then the data exchange configuration interface appears. Take the special module DVP06XA-S2 for example here.



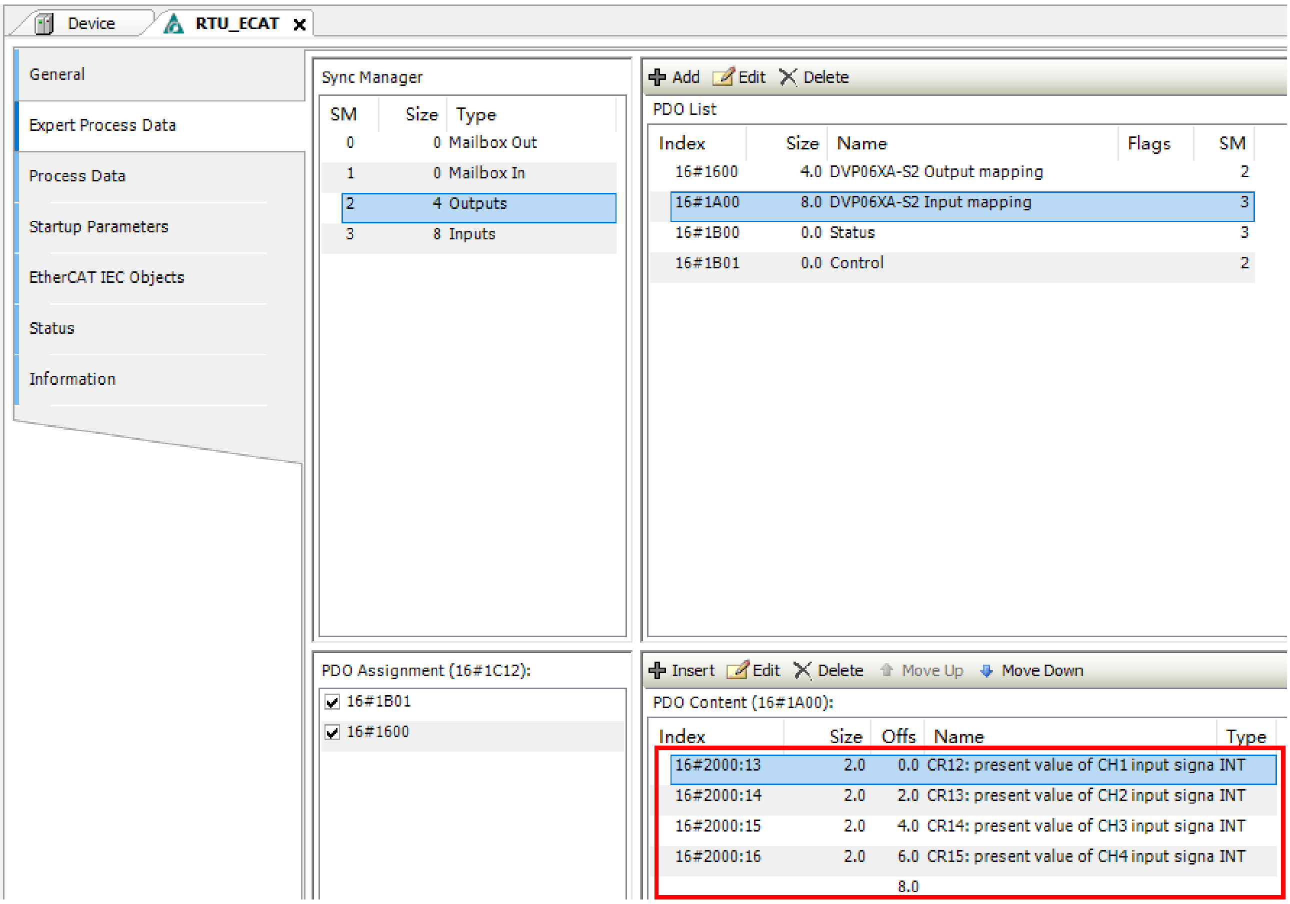
Explanation of PDO List on the configuration interface of special modules

Item	Description
Status	You can add or delete the parameters related to RTU-ECAT state, as well as the CRs with the property of Read in the special modules which have been configured.
Control	You can add or delete the control word in RTU-ECAT, as well as the CRs with the property of Write in the special modules which have been configured.
DVP06XA-S2 Input mapping	You can add or delete the CRs with the property of Read in DVP06XA-S2.
DVP06XA-S2 Output mapping	You can add or delete the CRs with the property of Write in DVP06XA-S2.

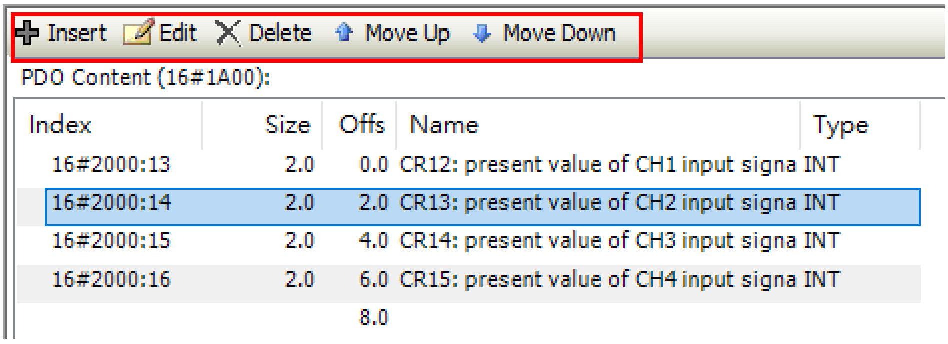
How to configure the input/output mappings of a special module

Here is an example of the input mapping configuration:

Select the row "**DVP06XA-S2 Input mapping**" in the "**PDO List**" field and then configure input mapping parameters in the "**PDO Content**" field.



Select one of the rows in the red box above to perform the action: Insert, Edit, Delete, Move Up or Move Down.



Explanation of the toolbars

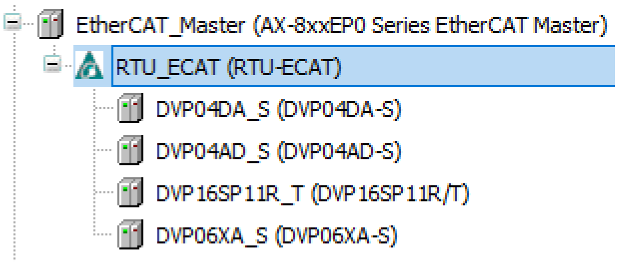
Item	Description
Insert	Add or insert a CR with the property of Read in the module. Selecting “Insert” in the place of an existing CR means to insert a CR row here. Selecting “Insert” in the empty place means to add a CR row in the end.
Edit	Edit current parameter information such as Name, Index, Sub Index, Data Type, and etc.
Delete	Delete one CR which has already been added
Move Up	Shift selected item to the previous row
Move Down	Shift selected item to the next row

15.3.8 Introduction of Parameters

15.3.8.1 Parameters for Right-side Special Modules

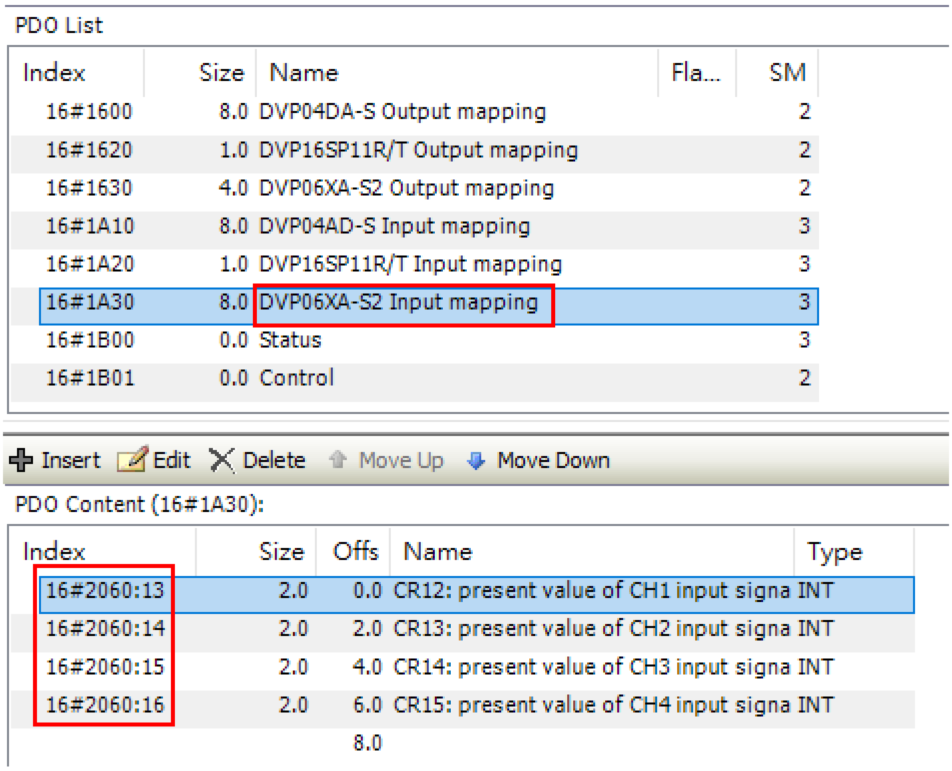
The index of the special module on the right of RTU-ECAT ranges from 16#2000 to 16#21A0 and the index value is determined by the position of the special module on the right of RTU-ECAT. For example, when the special module is the first one on the right of RTU-ECAT, its index is 16#2000. When the special module is the second one on the right of RTU-ECAT, its index is 16#2020. Similarly, when the special module is the 14th one on the right of RTU-ECAT, its index is 16#21A0.

As shown below, DVP04DA-S, DVP04AD-S, DVP16SP11T, and DVP06XA-S are connected on the right of RTU-ECAT in order and then the index for DVP04DA-S is 16#2000, for DVP04AD-S is 16#2020, and for DVP06XA-S is 16#2060.



Each subindex of a special module corresponds to one CR parameter of the special module. When the special module is located as the first one on the right of RTU-ECAT, the index 16#2000 and subindex 16#1 correspond to CR0 of the special module. When the special module is the second one on the right of RTU-ECAT, the index 16#2020 and subindex 16#7 correspond to CR6 of the special module.

For example, DVP04DA-S, DVP04AD-S, DVP16SP11T, and DVP06XA-S are connected on the right of RTU-ECAT in order and the indexes and subindexes for DVP06XA-S parameters are shown below.



PDO List

Index	Size	Name	Fla...	SM
16#1600	8.0	DVP04DA-S Output mapping		2
16#1620	1.0	DVP16SP11R/T Output mapping		2
16#1630	4.0	DVP06XA-S2 Output mapping		2
16#1A10	8.0	DVP04AD-S Input mapping		3
16#1A20	1.0	DVP16SP11R/T Input mapping		3
16#1A30	8.0	DVP06XA-S2 Input mapping		3
16#1B00	0.0	Status		3
16#1B01	0.0	Control		2

PDO Content (16#1A30):

Index	Size	Offs	Name	Type
16#2060:13	2.0	0.0	CR12: present value of CH1 input signa	INT
16#2060:14	2.0	2.0	CR13: present value of CH2 input signa	INT
16#2060:15	2.0	4.0	CR14: present value of CH3 input signa	INT
16#2060:16	2.0	6.0	CR15: present value of CH4 input signa	INT
		8.0		

Explanation of paramters for special modules on the right of RTU-ECAT

Index	Subindex	Description
16#2000	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 1st one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 1st one on the right of RTU-ECAT.
	…	…
16#2020	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 2nd one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 2nd one on the right of RTU-ECAT.
	…	…
16#2040	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 3rd one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 3rd one on the right of RTU-ECAT.
	…	…
16#2060	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 4th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 4th one on the right of RTU-ECAT.
	…	…
16#2080	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 5th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 5th one on the right of RTU-ECAT.
	…	…
16#20A0	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 6th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 6th one on the right of RTU-ECAT.
	…	…
16#20C0	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 7th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 7th one on the right of RTU-ECAT.
	…	…
16#20E0	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 8th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 8th one on the right of RTU-ECAT.
	…	…
16#2100	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 9th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 9th one on the right of RTU-ECAT.
	…	…
16#2120	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 10th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 10th one on the right of RTU-ECAT.

Index	Subindex	Description
	…	…
16#2140	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 11th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 11th one on the right of RTU-ECAT.
	…	…
16#2160	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 12th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 12th one on the right of RTU-ECAT.
	…	…
16#2180	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 13th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 13th one on the right of RTU-ECAT.
	…	…
16#21A0	16#1	The index and subindex that CR0 parameter corresponds to when the special module is located as the 14th one on the right of RTU-ECAT.
	16#2	The index and subindex that CR1 parameter corresponds to when the special module is located as the 14th one on the right of RTU-ECAT.
	…	…

15.3.8.2 Parameters for Connection Status of Right-Side Modules

The index 16#8200 shows the actual connection state of the modules on the right of RTU-ECAT

16#8200:16#00	Detected information		
:16#01	Digital in	RO	UINT
:16#02	Digital out	RO	UINT
:16#03	Anolog module number	RO	UINT
:16#04	Anolog module ID1	RO	UINT
:16#05	Anolog module ID2	RO	UINT
:16#06	Anolog module ID3	RO	UINT
:16#07	Anolog module ID4	RO	UINT
:16#08	Anolog module ID5	RO	UINT
:16#09	Anolog module ID6	RO	UINT
:16#0A	Anolog module ID7	RO	UINT
:16#0B	Anolog module ID8	RO	UINT

Explanation of parameters

Index	Subindex	Description	Data type	Access type
16#8200	16#1	The number of digital input points	Word	RO
	16#2	The number of digital output points	Word	RO
	16#3	The number of special modules	Word	RO
	16#4	The model code of the 1st special module	Word	RO
	16#5	The model code of the 2nd special module	Word	RO

Index	Subindex	Description	Data type	Access type
	16#6	The model code of the 3rd special module	Word	RO
	16#7	The model code of the 4th special module	Word	RO
	16#8	The model code of the 5th special module	Word	RO
	16#9	The model code of the 6th special module	Word	RO
	16#A	The model code of the 7th special module	Word	RO
	16#B	The model code of the 8th special module	Word	RO

15.3.8.3 Control Word Parameter

Explanation of the control word parameter

Index	Subindex	Description	Data type	Access type
16#A001	16#1	Control Word	WORD	RW

Explanation of bits of the control word parameter

Bit No.	Value	Description
bit0	0	RTU-ECAT is set to STOP as bit15 of the control word is 1 and bit0 is 0.
	1	RTU-ECAT is set to RUN as bit15 of the control word is 1 and bit0 is 1.
bit1	0	When RTU-EtherCAT is disconnected from the master, the output values of right-side special modules and digital output point values of digital modules keep the same as they are before disconnection.
	1	When RTU-EtherCAT is disconnected from the master, the output values of right-side special modules change to zero and digital output points of digital modules change to OFF.
bit2	0/1	Reserved
bit3	0/1	Reserved
bit4	0/1	Reserved
bit5	0/1	Reserved
bit6	0/1	Reserved
bit7	0/1	Reserved
bit8	0/1	Reserved
bit9	0/1	Reserved
bit10	0/1	Reserved
bit11	0/1	Reserved
bit12	0/1	Reserved

Bit No.	Value	Description
bit13	0/1	Reserved
bit14	0/1	Reserved
bit15	0	Control word is disabled. When the bit value is 0, RTU-ECAT can NOT be controlled to enter RUN or STOP state via bit0 in the control word.
	1	Control word is enabled. When the bit value is 1, RTU-ECAT can be controlled to enter RUN or STOP state via bit0 in the control word.

15.3.8.4 Status Indication Parameters

List of status indication parameters

Index	Subindex	Description	Data type	Access type
16#1001	16#0	Error register which contains error information of RTU-ECAT	WORD	RO
16#A000	16#1	LV state (low voltage state)	BYTE	RO
	16#2	Error module number: the number of the module with an error on the right side	BYTE	RO
	16#3	Error list: shows errors of extension modules	ARRAY [1..8] OF BYTE	RO

■ Error register

Status value	Description	How to correct
0x1000 (4096)	The special modules on the right of RTU-ECAT are inconsistent with the configuration in the software.	1. Ensure that the special modules configured in the software match the modules actually connected. 2. Ensure that the connection between the right-side special modules and RTU-ECAT is normal.
0x1001 (4097)	The special modules and digital modules on the right of RTU-ECAT are inconsistent with the configuration data.	1. Ensure that the special module number and input and output point numbers of digital modules configured in the software match the modules actually connected. 2. Ensure that the connection between the right-side modules and RTU-ECAT is normal.

Status value	Description	How to correct
0x1002 (4098)	An error occurs in the special modules on the right of RTU-ECAT	1. Ensure that the power supply to the right-side special modules is normal. 2. Check the error information of the special modules on the right of RTU-ECAT. Configure the error status CR registers for the right-side special modules to the input data of IO data and then get to know the cause based on the values in the error status CRs. Refer to error status CRs of the modules in DVP Series Module Manual for details on error codes of special modules.
0x1004 (4100)	The modules configured in the software are inconsistent with those actually connected, and meanwhile an error in extension modules on the right of RTU-ECAT occurs.	1. Ensure the modules configured in the software match those actually connected. 2. Ensure the power supply to the right-side modules works normally. 3. Check the error information of the right-side modules and then resolve the issue according to the instructions in the module manual.
0x1005 (4101)	The special modules configured on the right of RTU-ECAT exceeds 8 units.	Ensure that the number of special modules configured in the software is no more than 8 units.

■ LV state (voltage state)

Bit No.	Value	Description	How to correct
bit0	0	The voltage for RTU-ECAT is normal.	--
	1	The voltage for RTU-ECAT is abnormal.	Check if the voltage of the power supply to RTU-ECAT is normal.
bit1-bit7	0/1	Reserved	Reserved

■ Error module number (The number of the right-side module in error)

Bit No.	Value	Description	How to correct
bit0	0	The 1st special module on the right of RTU-ECAT is normal.	--
	1	The 1st special module on the right of RTU-ECAT is alarming.	Refer to “Error list (Extension module error information)” below.
bit1	0	The 2nd special module on the right of RTU-ECAT is normal.	--

Bit No.	Value	Description	How to correct
	1	The 2nd special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.
bit2	0	The 3rd special module on the right of RTU-ECAT is normal.	--
	1	The 3rd special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.
bit3	0	The 4th special module on the right of RTU-ECAT is normal.	--
	1	The 4th special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.
bit4	0	The 5th special module on the right of RTU-ECAT is normal.	--
	1	The 5th special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.
bit5	0	The 6th special module on the right of RTU-ECAT is normal.	--
	1	The 6th special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.
bit6	0	The 7th special module on the right of RTU-ECAT is normal.	--
	1	The 7th special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.
bit7	0	The 8th special module on the right of RTU-ECAT is normal.	--
	1	The 8th special module on the right of RTU-ECAT is alarming.	Refer to "Error list (Extension module error information)" below.

■ Error list (Extension module error information)

Bit	Description
Error list[0]	The error code in the 1st special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.

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Bit	Description
Error list[1]	The error code in the 2nd special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.
Error list[2]	The error code in the 3rd special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.
Error list[3]	The error code in the 4th special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.
Error list[4]	The error code in the 5th special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.
Error list[5]	The error code in the 6th special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.
Error list[6]	The error code in the 7th special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.
Error list[7]	The error code in the 8th special module on the right of RTU-ECAT; the error code value is the value in the error status CR of the special module. For details, refer to error status CRs of special modules in DVP Series Module Manual.

15.3.8.5 Refresh Time Parameter for RTU-ECAT's Right-Side IO modules

The time for scanning the right-side IO modules out for a cycle can be monitored through the **IOrefresh** parameter (Index: A000, Subindex: 11) so as to adjust the EtherCAT cycle time and control the status switch time for the input points and output points based on this parameter.

For example, when 14 pieces of DVP16SP (with 8 digital inputs and 8 digital outputs) are connected on the right side of RTU-ECAT, check that the **IOrefresh** (refresh time) is 5 ms through SDO. Therefore, it is suggested that the EtherCAT cycle time should be set between 2.5 ms and 5 ms.

16#A000:16#00	Status list			
:16#01	LV state	RO	USINT	0
:16#02	Error module number	RO	USINT	0
:16#03	Error list	RO	ARRAY [0..7] OF BYTE	[0,0,0,0,0,0,0,0]
:16#0B	IOrefresh	RO	UINT	5

In this case, we suggest that the actual status switch time for the input points and output points should be greater than 5 ms. If the switch time is less than or equal to 5 ms, the input and output status may fail to update due to insufficient switch time.

15.3.8.5.1 How to Read Right-Side IO Refresh Time through SDO and PDO

- **Read the value through SDO**

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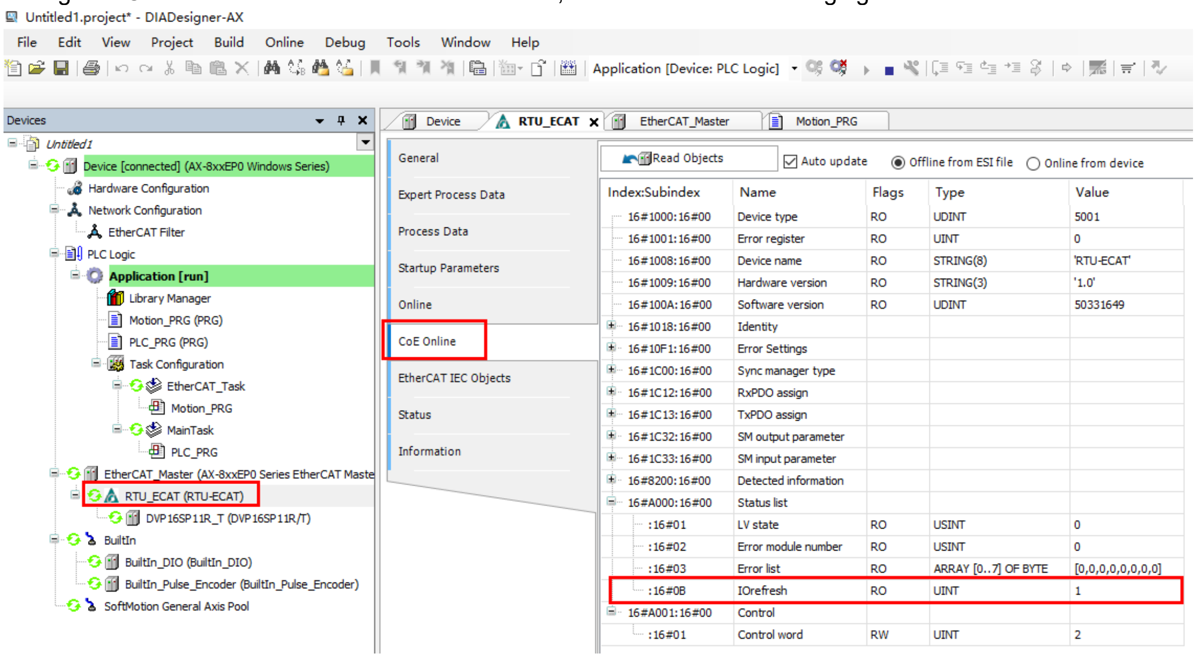
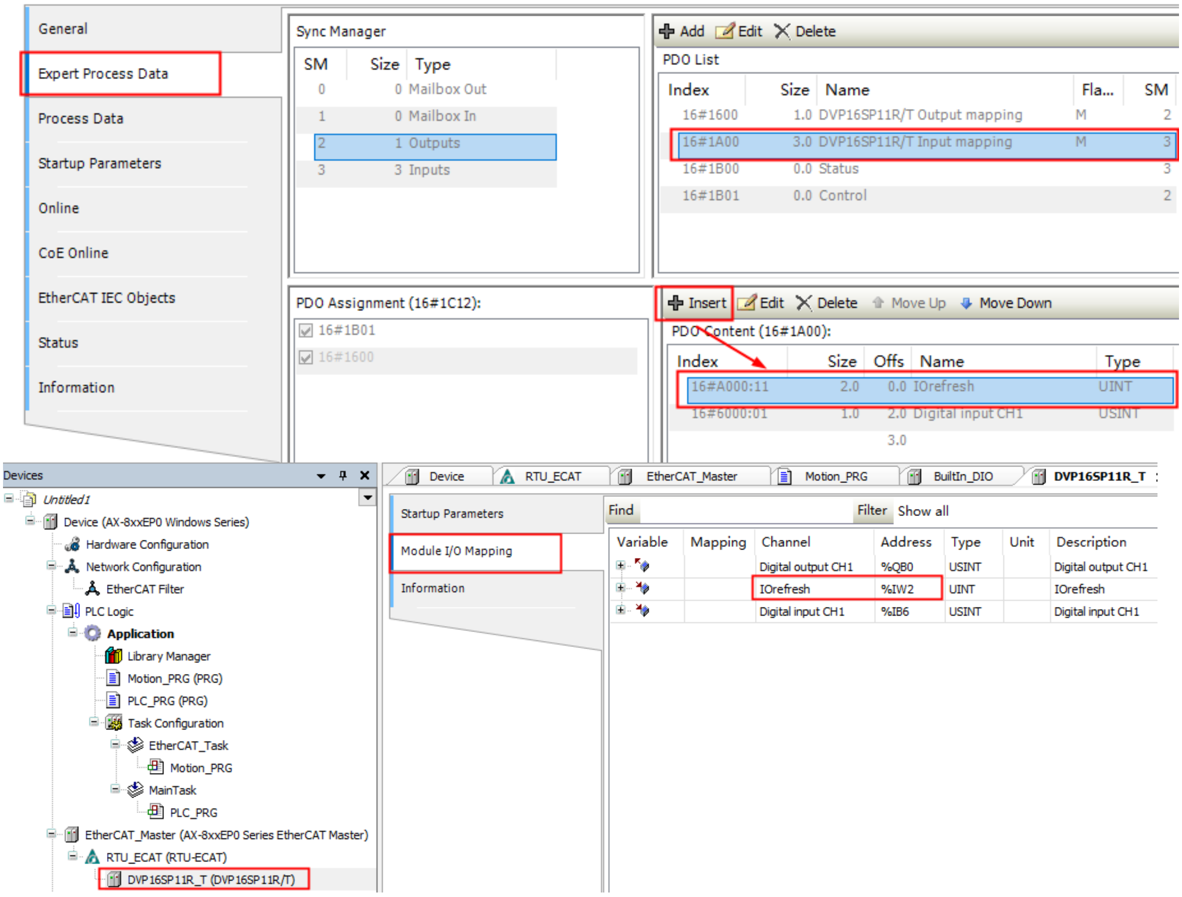
Double-click **RTU-ECAT** on the left-side Devices area, and then select "**CoE Online**". When 16#A000: 16#0B in the **CoE Online** tab is selected, the maximum value of the right-side IO refresh parameter is 1 (UINT), which is read through SDO and the maximum refresh time is 1 ms, as shown in the following figure.



- **Read the value through PDO**

Double-click **RTU-ECAT** on the left-side Devices area and then select “**Expert Process Data**”. Clicking "**16#1A00 DVP16SP11R/T Input mapping**" in the right-side PDO List and then **“Insert”** in the **PDO Content**, a dialog box will pop up, where you select 16#A000: 16#0B and then click “**OK**” to add the parameter to the PDO Input List.

After that, the maximum value 1 is read through the corresponding device address %IW2 in the program, and thus the maximum refresh time is 1 ms, as shown in the figure below.



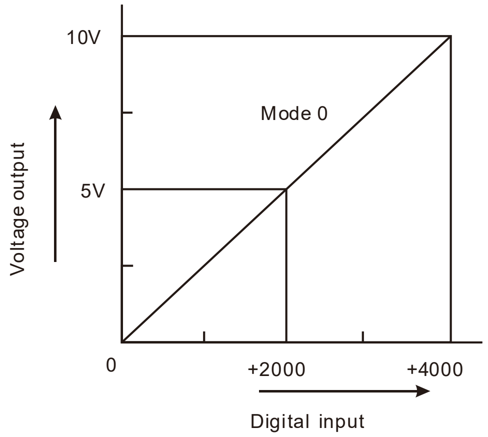
15.3.9 Application Example

This section provides an example of how to configure RTU-ECAT module parameters when RTU-ECAT works together with an EtherCAT master.

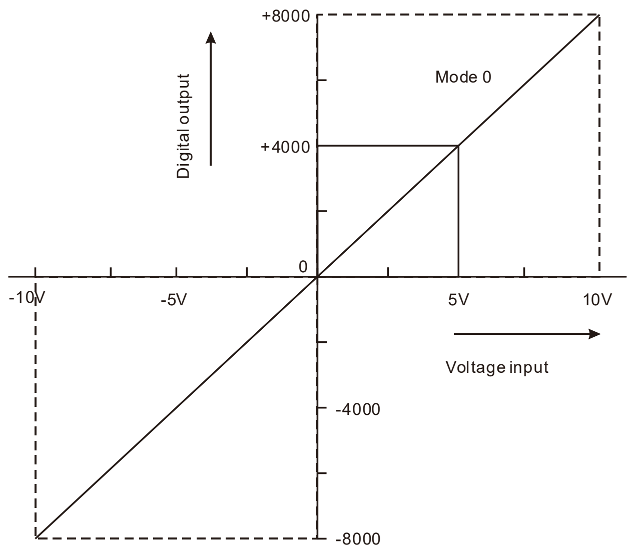
- **Control requirement**

1. DVP16SP11T is controlled to change its outputs Y0-Y7 to ON and its inputs X0-X7 are monitored via RTU-ECAT.
2. Channels 1-4 of DVP04DA-S are controlled to output the voltage of 5 V via RTU-ECAT.
3. The analog data conversion values of channels 1-4 of DVP04AD-S are read via RTU-ECAT.

- **Digital-Analog Relations for DVP04DA-S and DVP04AD-S**

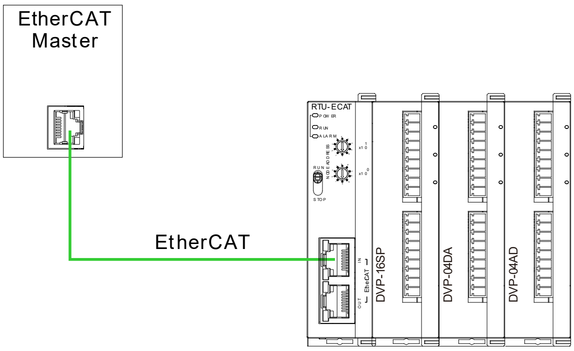


Digital input- Voltage output relation for DVP04DA-S in mode 0



Digital output- Voltage input relation for DVP04AD-S in mode 0

- **Constructing an EtherCAT network with RTU-ECAT**



- **Devices used in the example:**

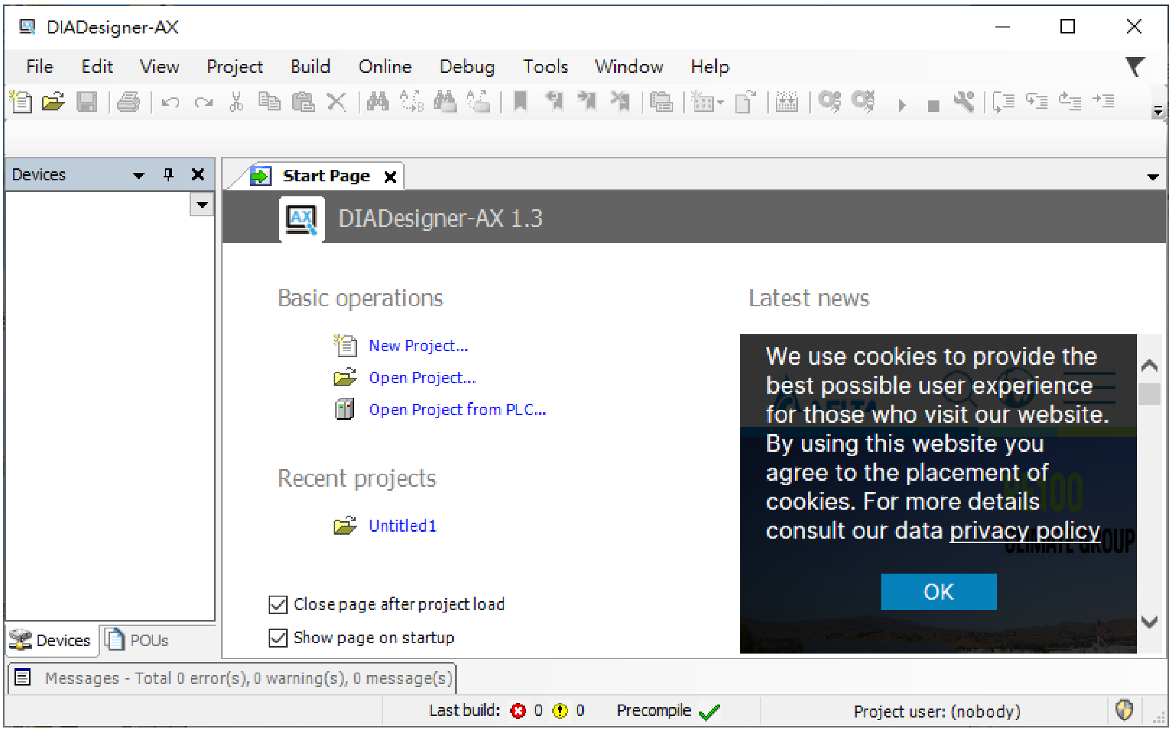
Device Name	Description
AX-832E CPU	Delta AX-8 series motion controller CPU
DIADesigner-AX	Delta EtherCAT configuration software
RTU-ECAT module	Delta EtherCAT remote IO module
DVP04DA-S	Delta analog output module
DVP04AD-S	Delta analog input module
DVP16SP11T	Delta digital IO module with 8 input points and 8 output points

Note:

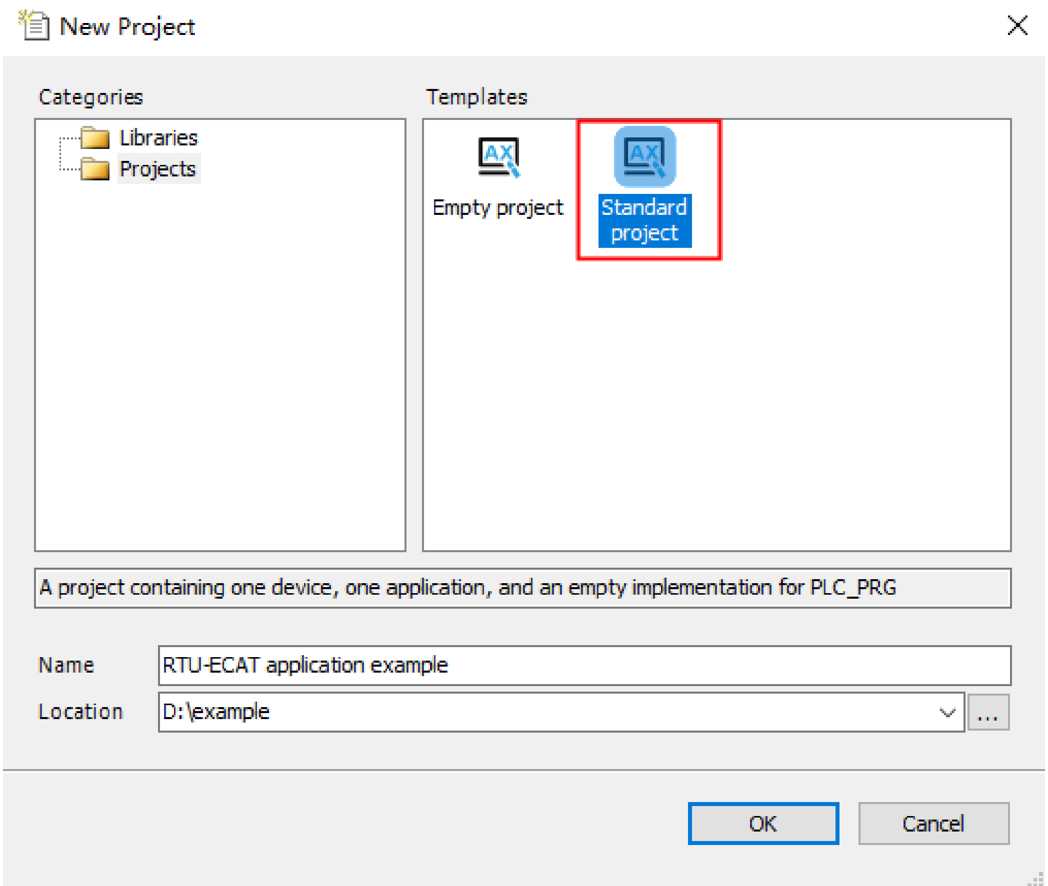
1. Please ensure that DVP16SP11T, DVP04DA-S, DVP04AD-S, and RTU-ECAT modules are operating normally and the whole network wiring is proper.
2. Refer to DVP Series Module Manual for more about DVP04DA-S and DVP04AD-S.

15.3.9.1 Using Delta AX8 Series CPU with RTU-ECAT

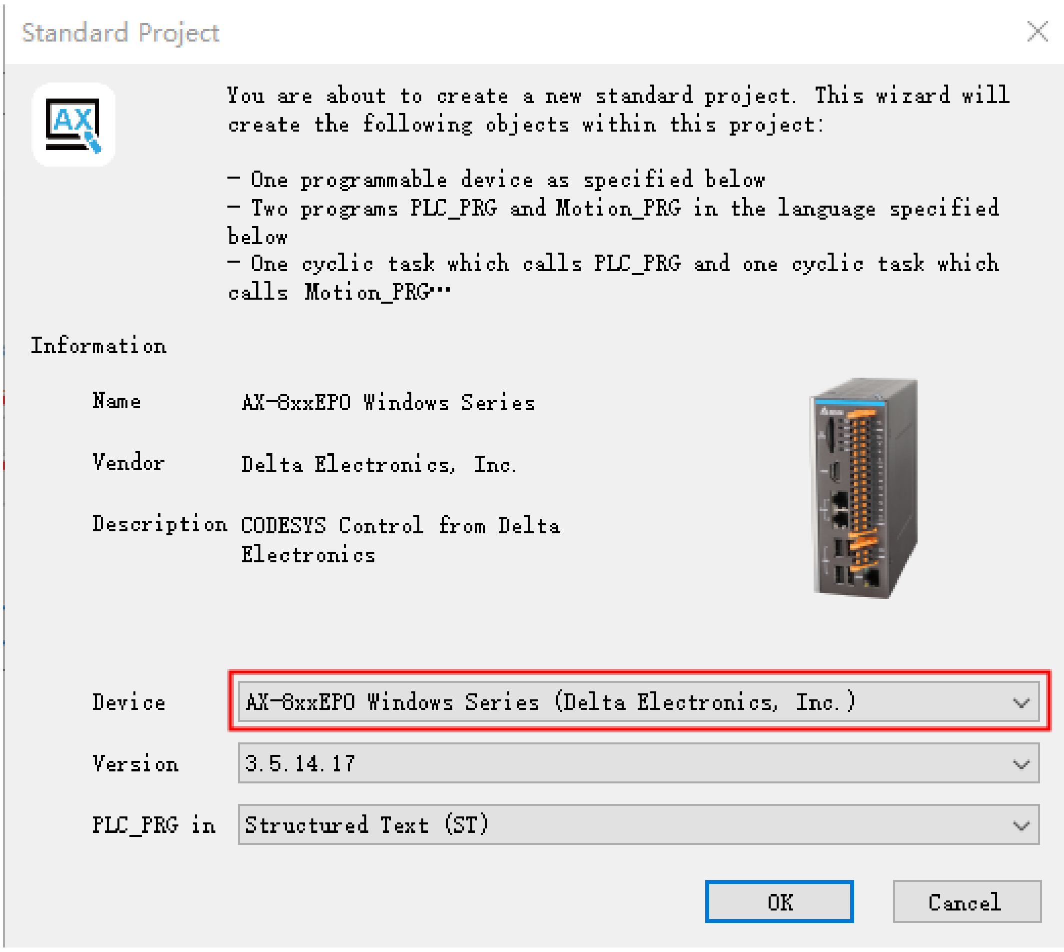
1. Start the software after downloading the DIADesigner-AX software from Delta official website and installing it.



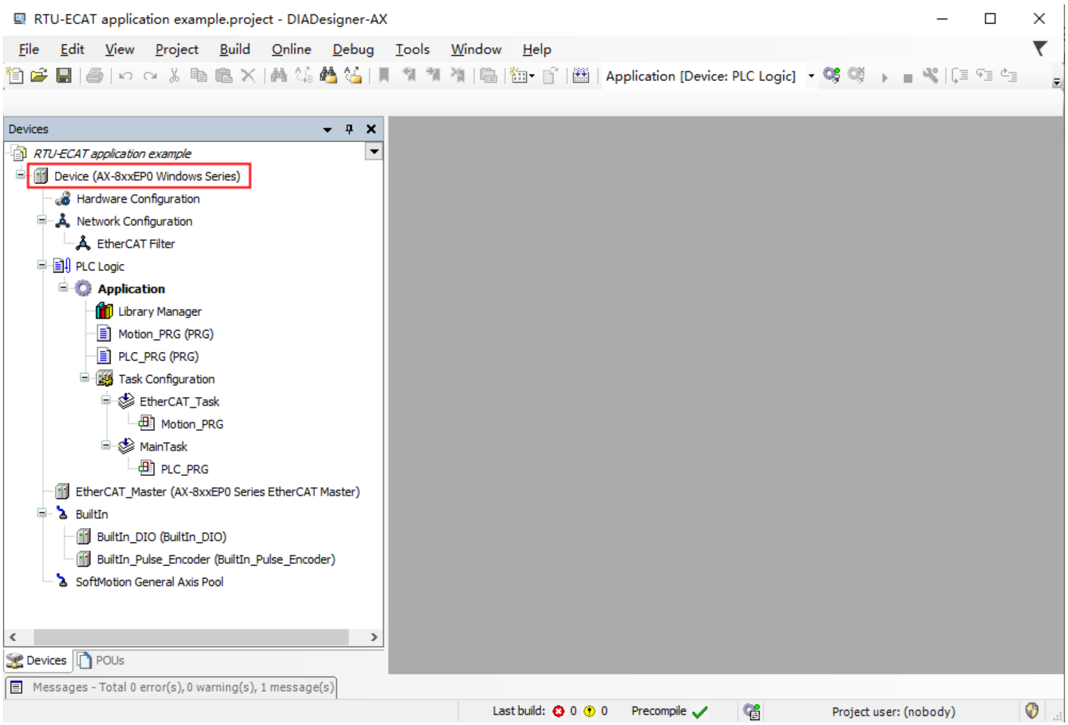
2. Create a new project by selecting the icon in the red box and then entering a project name and storage location.



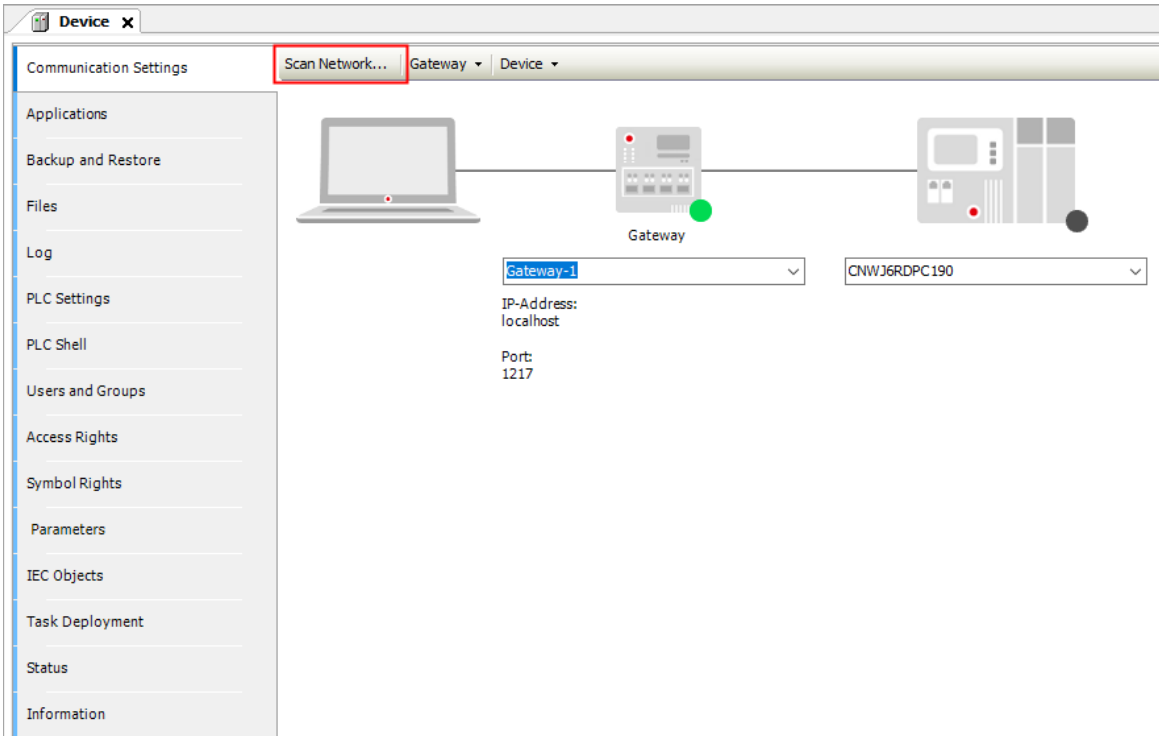
3. Click “**OK**” button to complete the setting. Afterward, select “**AX-8xxEP0 Windows Series (Delta Electronics, Inc.)**” in the “**Device**” field and then click “**OK**” in the pop-out window.



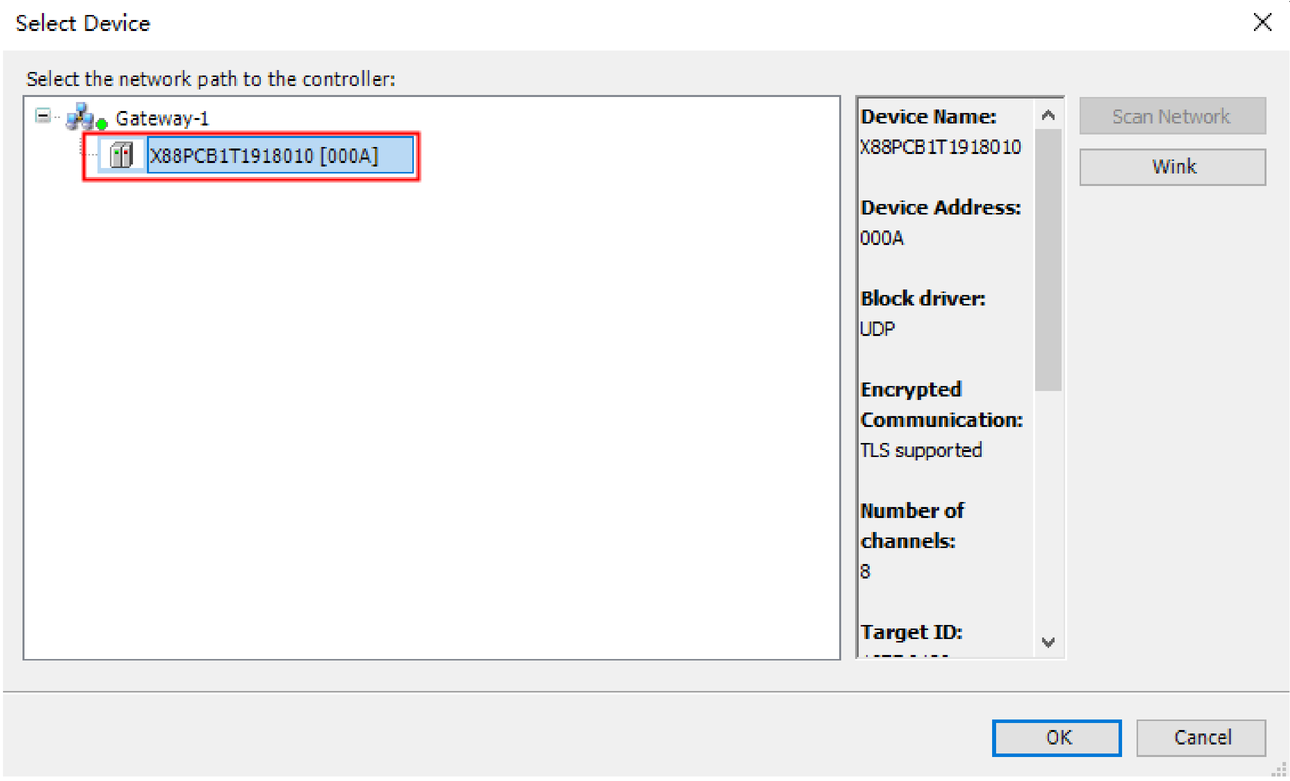
4. The created new project is shown as below.



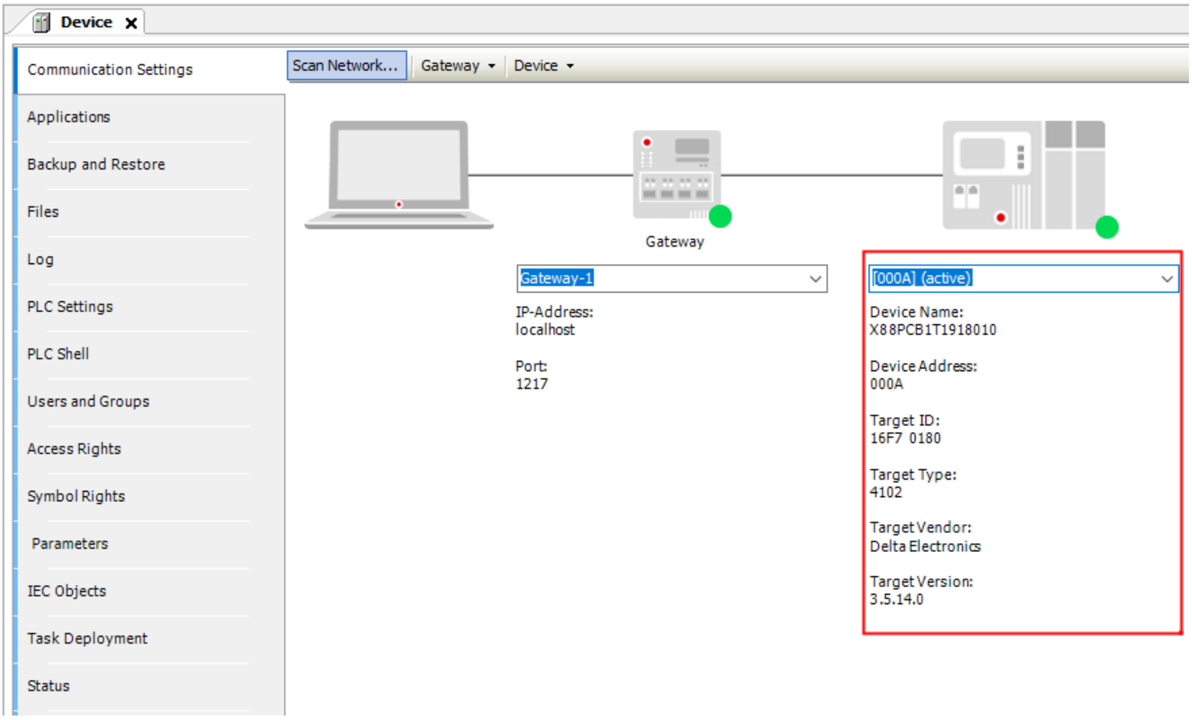
5. Double-click on “**Device**” in the red box above and then click on “**Scan Network…**” in the red box in the following window.



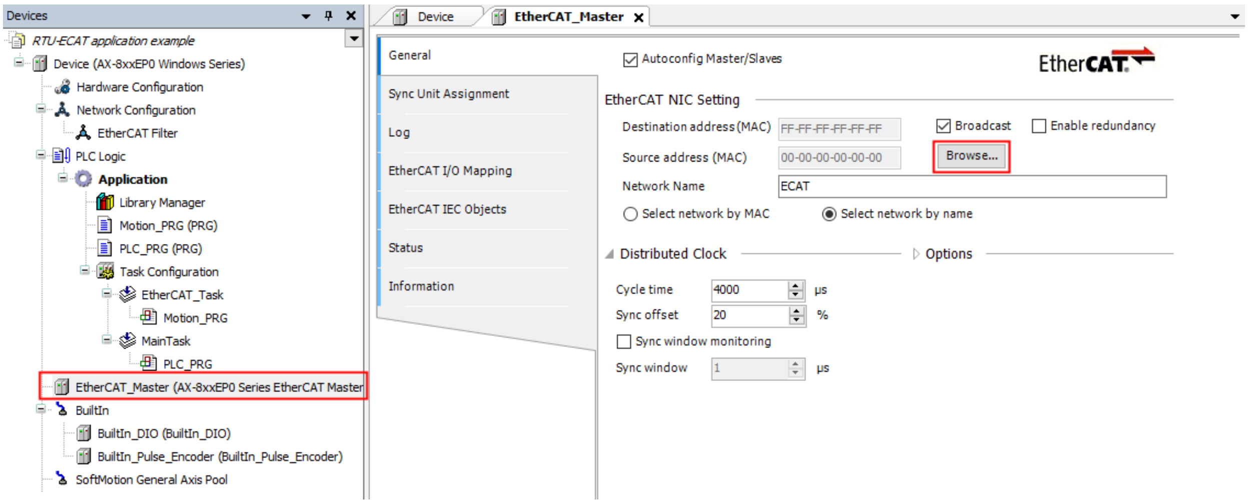
6. Then the following window appears, where the AX-8 series controller will be searched for automatically. After the AX-8 controller shows up, select the controller and click “**OK**” button.



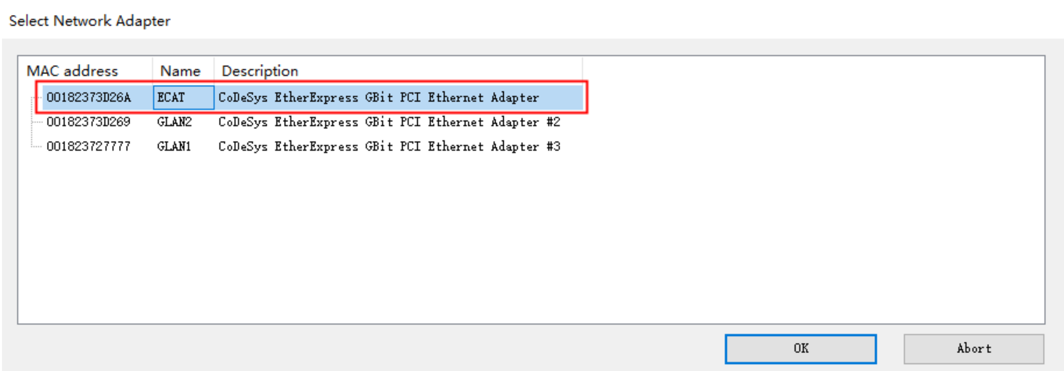
7. After the operations above are done, the connected PLC will automatically show up as below.



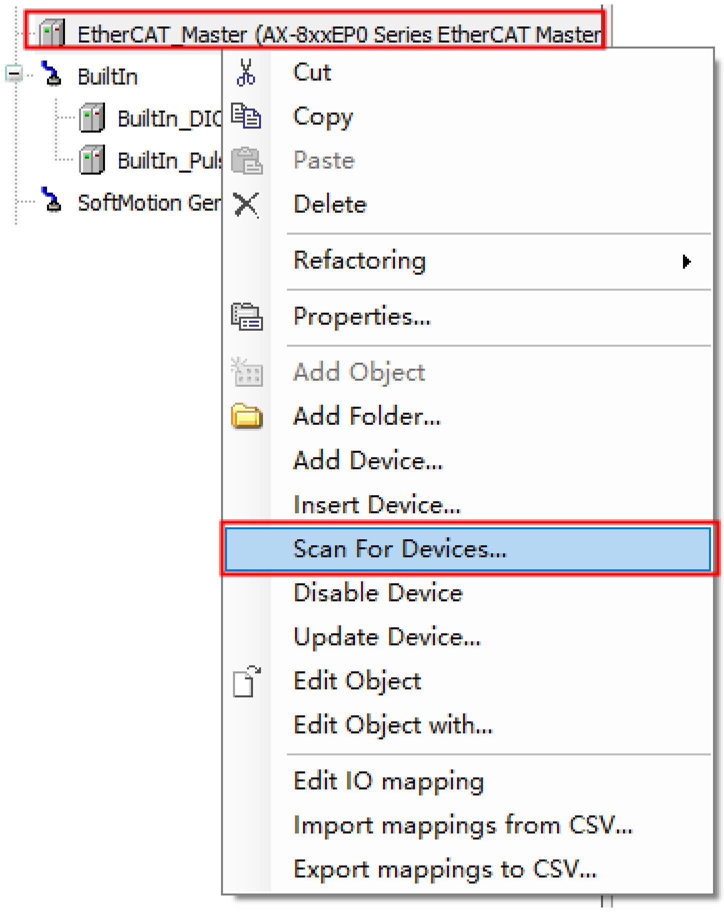
8. Double-click on "**EtherCAT Master**" in the red box below to open the "**EtherCAT Master**" tab.



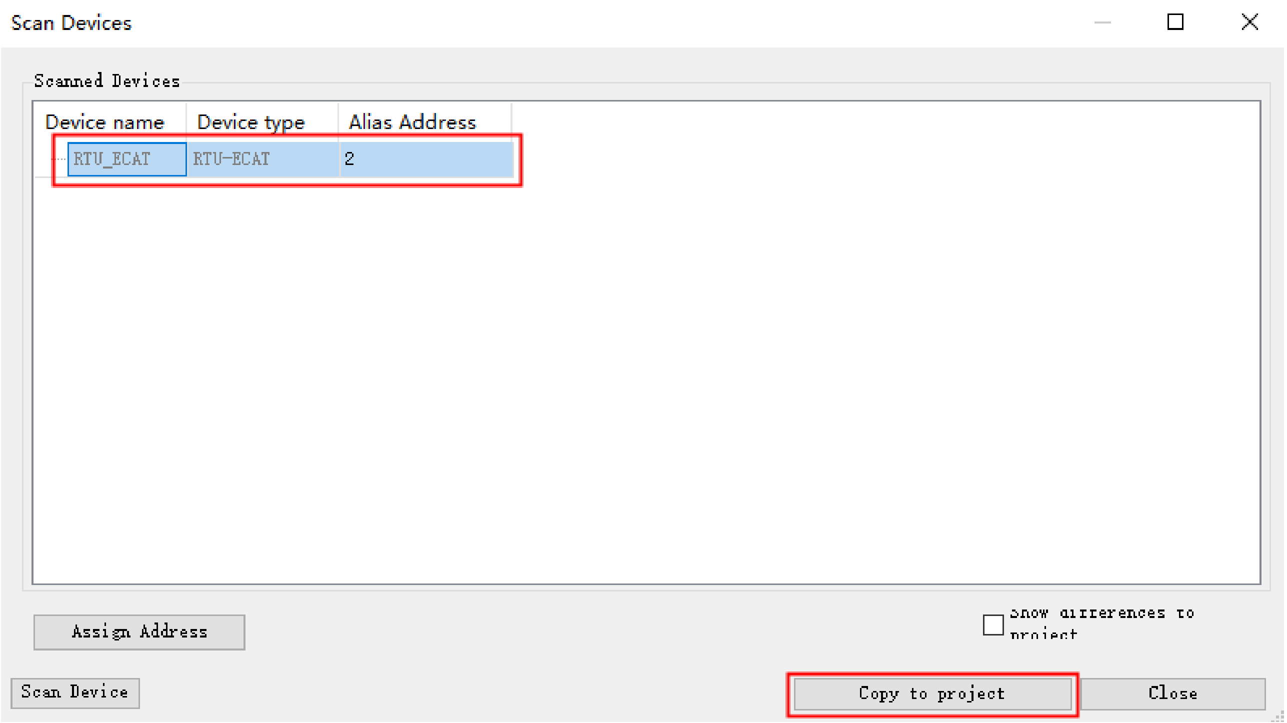
Click "**Browse" button in the "EtherCAT Master**" configuration area, then select the ECAT port from the pop-out "**Select Network Adapter**" window as below and afterwards click "**OK**" button.



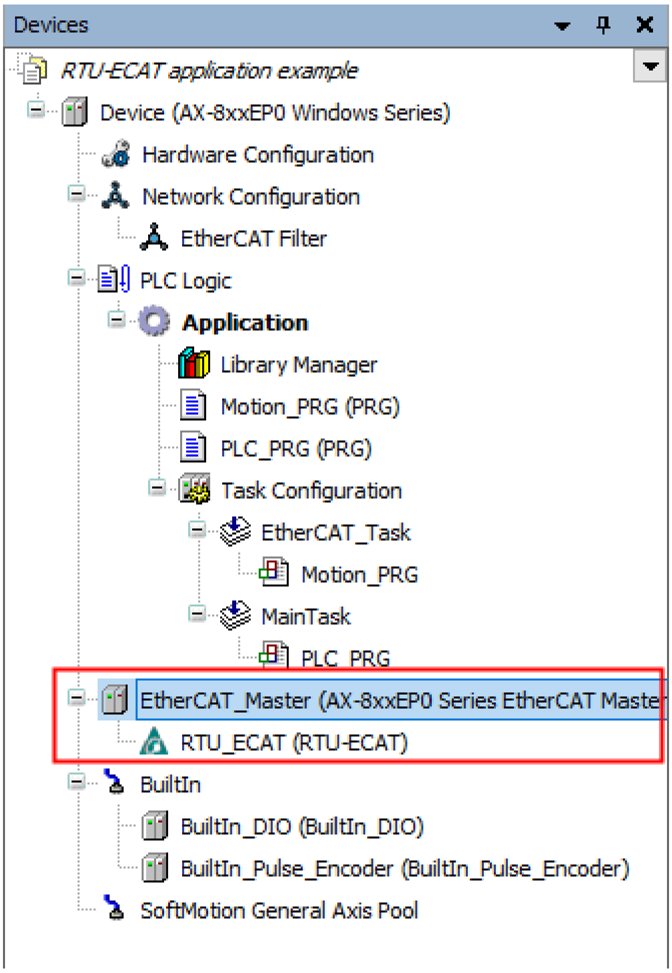
9. Right-click on the “**EtherCAT Master**” after the above action is done and then choose “**Scan For Devices…**” from the context menu.



10. Then the following “**Scan Devices**” window appears with the scanned slave as follows.



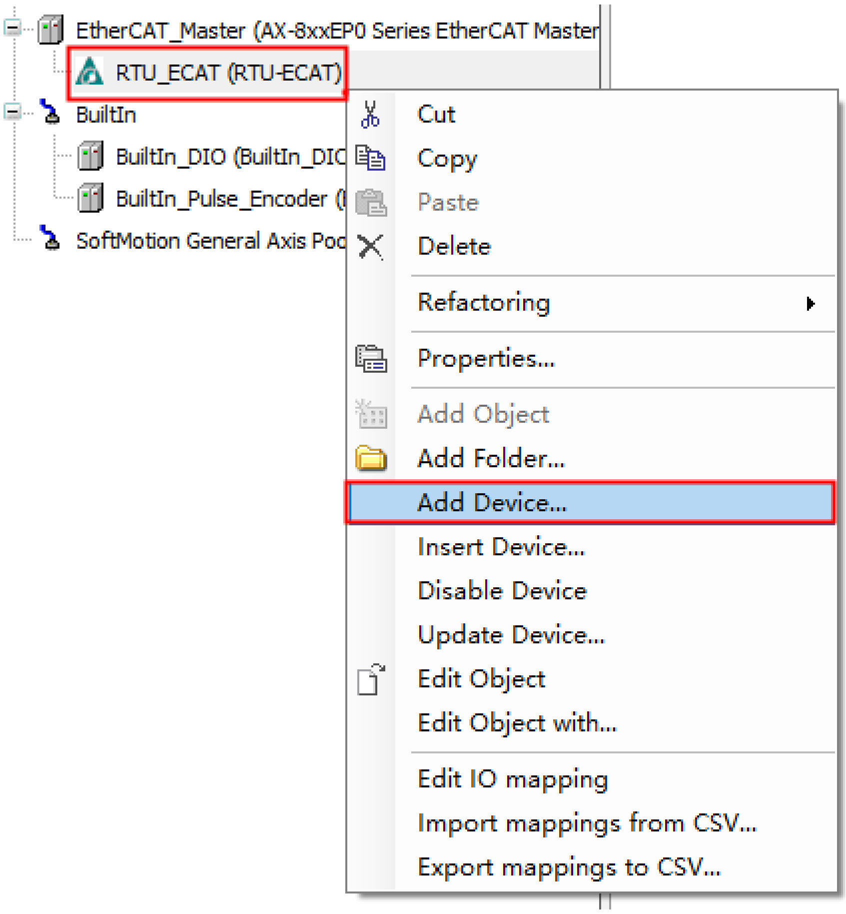
11. After the software scan is complete, select the scanned RTU-ECAT and then click on “**Copy to project**” to add the RTU-ECAT to the EtherCAT configuration.



Note:

If you need to add the RTU-ECAT parameters for read and write operations after adding the RTU-ECAT, set up the RTU-ECAT parameters first, and then add the extension modules.

12. Right-click on the RTU-ECAT after it has been added to the master, and select "**Add Device**" from the context menu to add extension modules.



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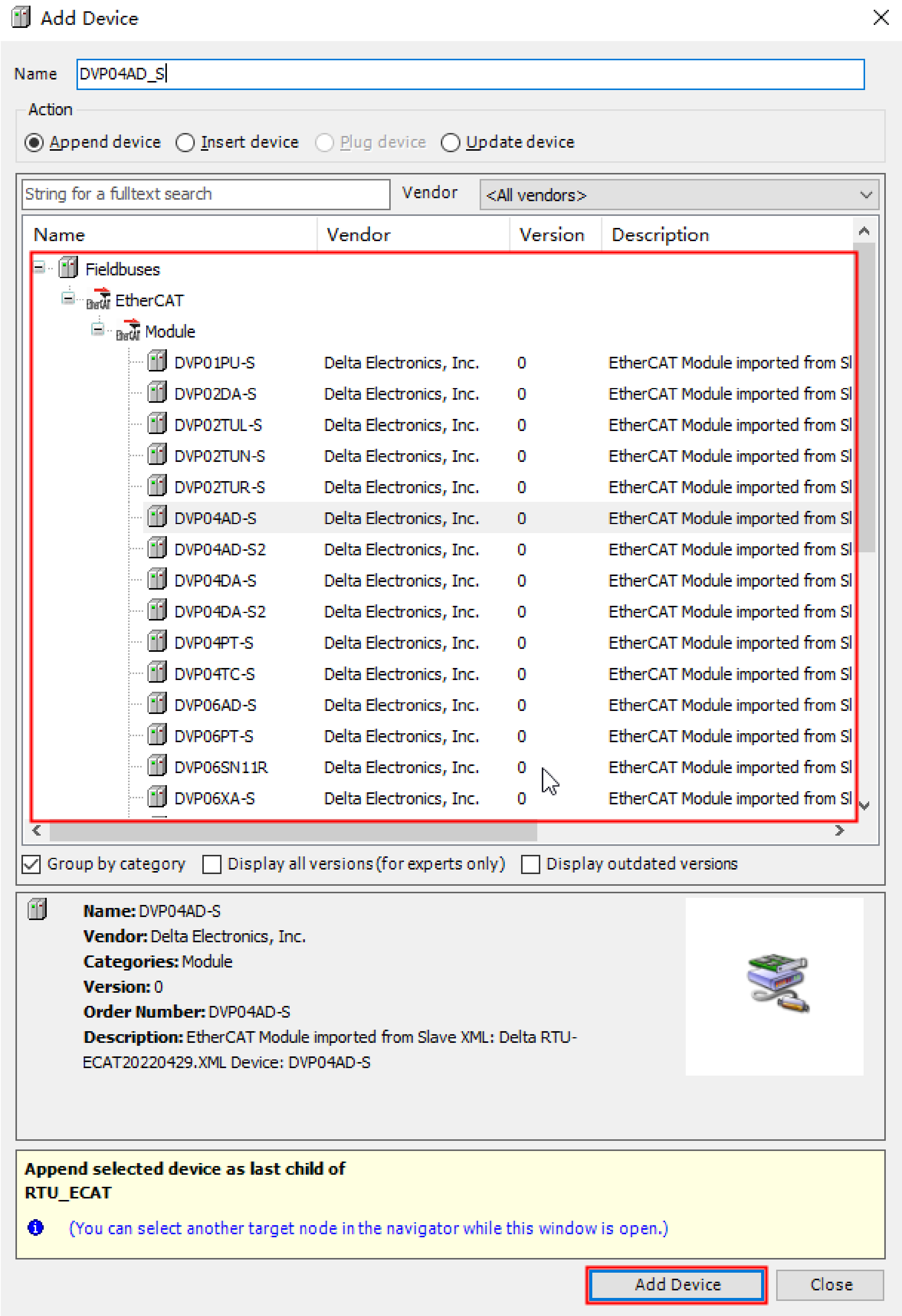
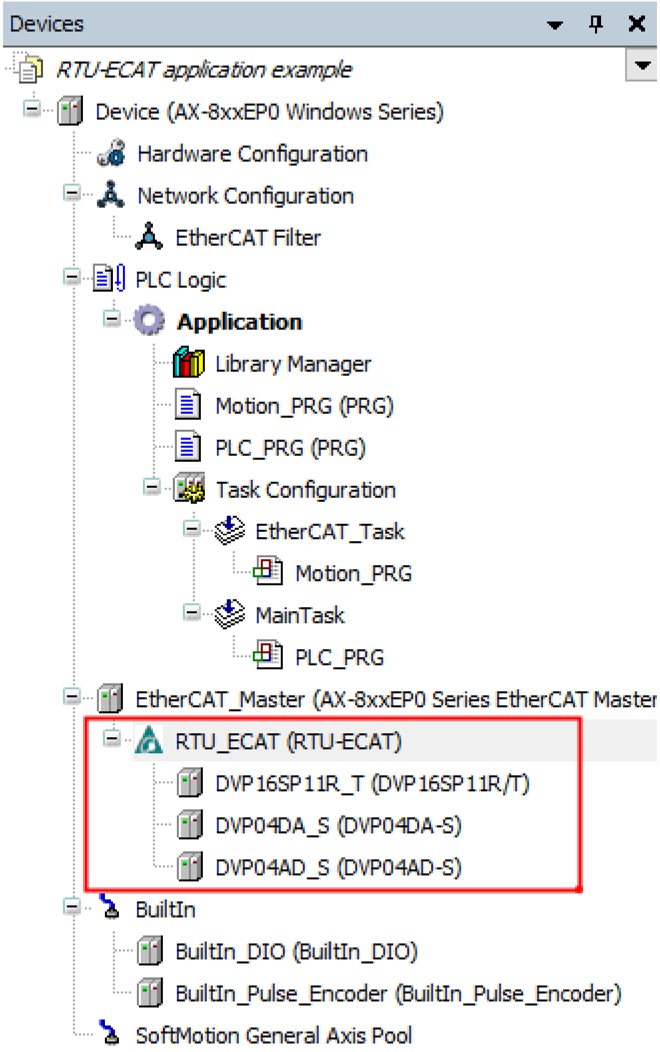
The following “**Add Device**” window appears, where you select extension modules.



13. Find out and select DVP16SP11R/T in the red box above and then click "**Add Device**" button to add DVP16SP11T/R to RTU-ECAT. In the same way, add DVP04DA-S and DVP04AD-S respectively to the RTU-ECAT configuration.



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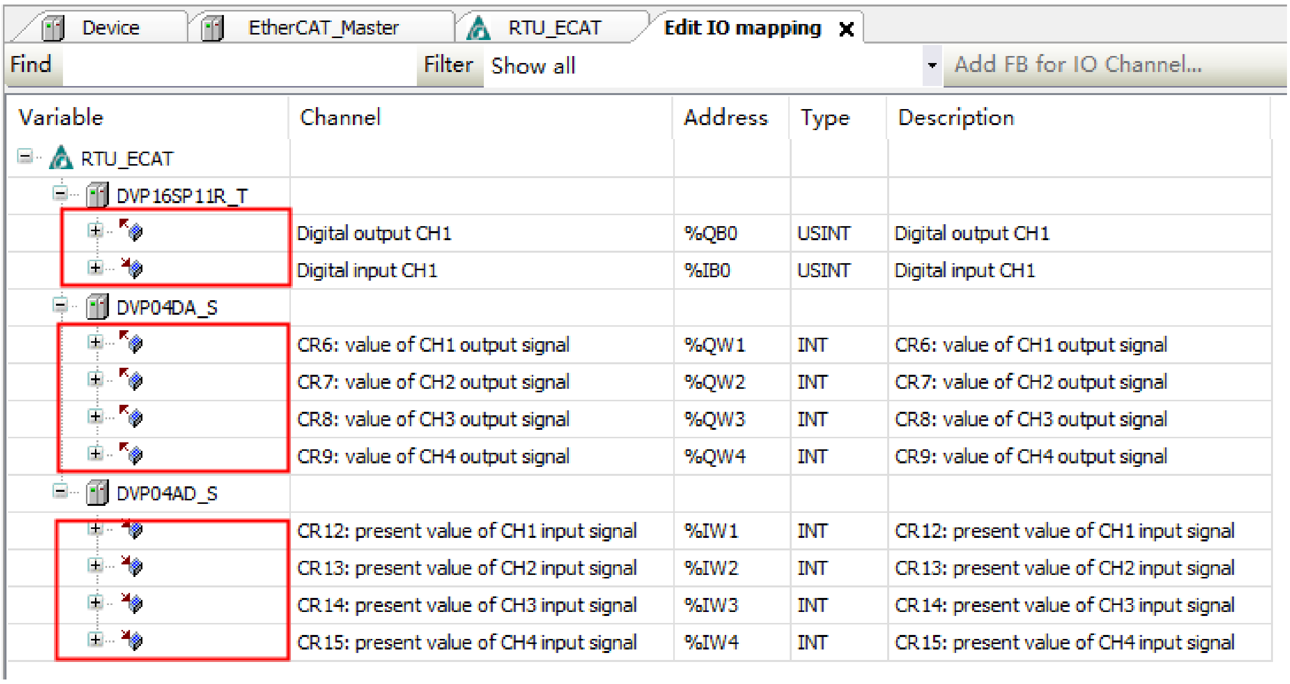
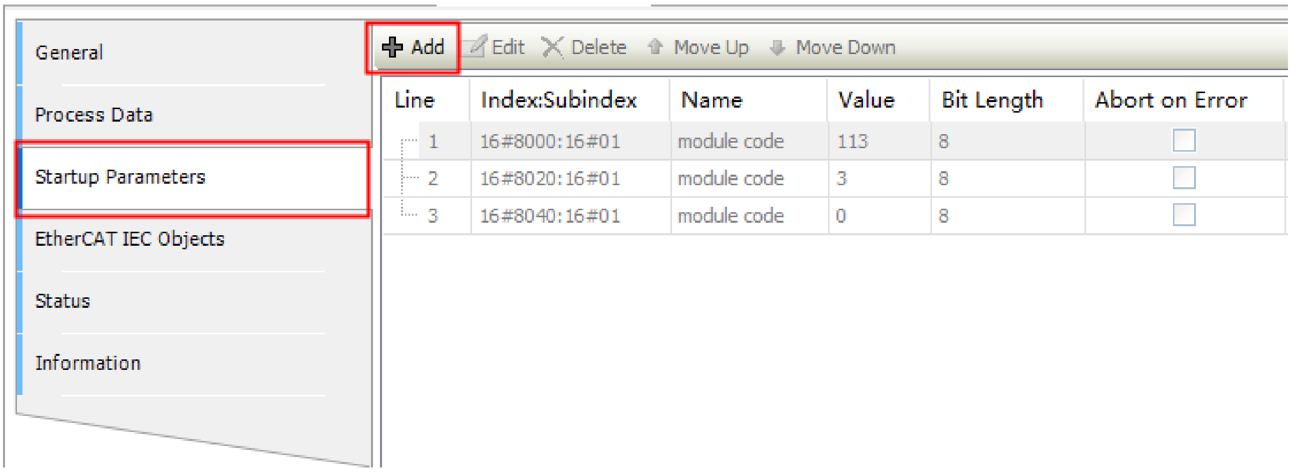
14. After the above configuration setting is complete, right-click on the RTU-ECAT and select “**Edit IO Mapping**” from the context menu to review the IO mapping information of RTU-ECAT.



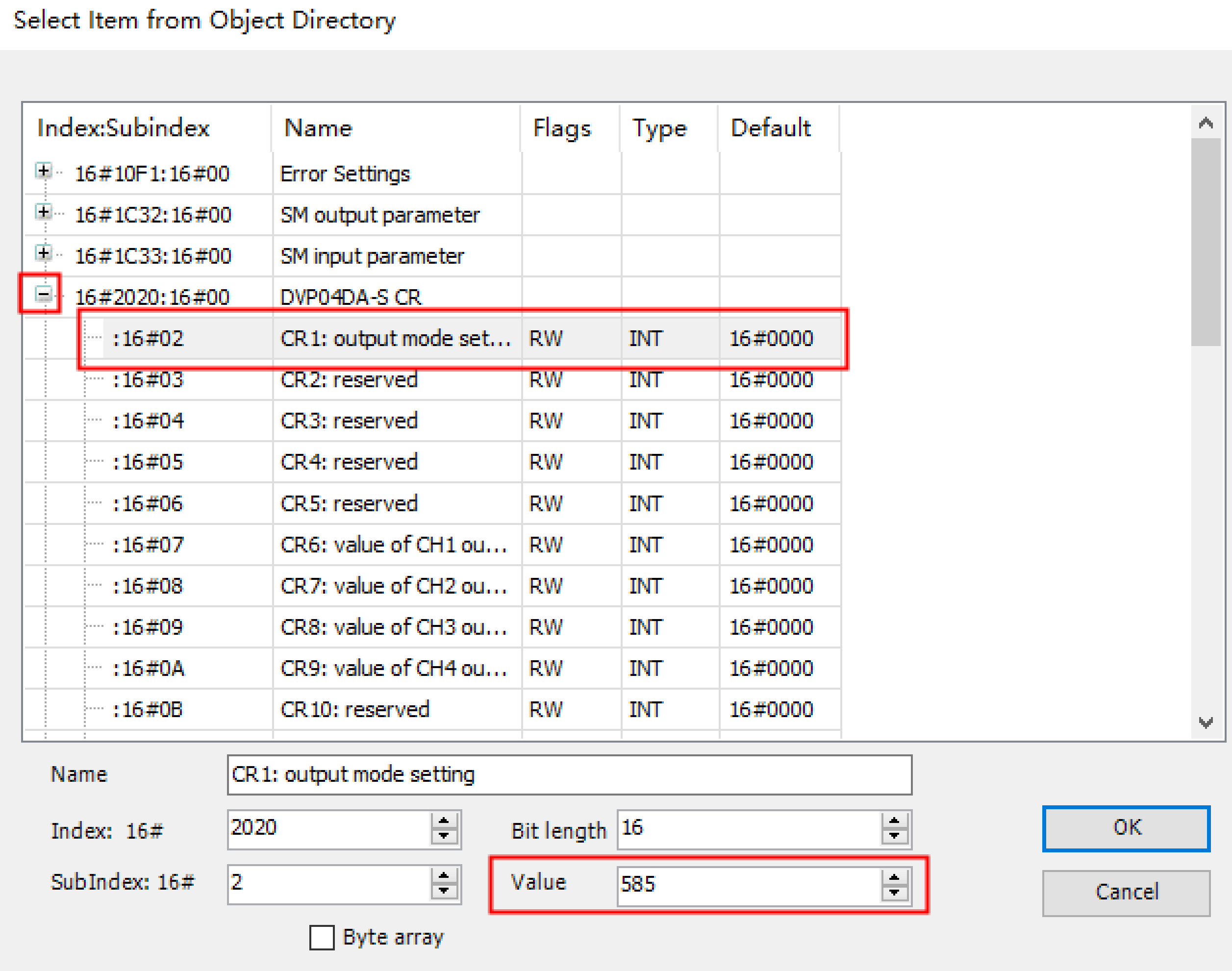
Variables are bound in the red boxes above. If module channels are not bound to variables, the I and Q devices in the “**Address**” column are valid. The values of module channels can be read through the I and Q devices in the program. If module channels are bound to variables , the I and Q devices in the “**Address**” column are invalid. The values of module channels can be read through variables in the program.

For example, when module channels are not bound to variables, write 255 in the %QB0 device in the program to change the Y0-Y7 output of DVP16SP11T into ON. If channels 1-4 of DVP04DA-S output 5 V voltage, write 2000 to %QW1-QW4 in the program and then read the value converted from the analog data of channels 1-4 of DVP04AD-S in %IW1-%IW4.

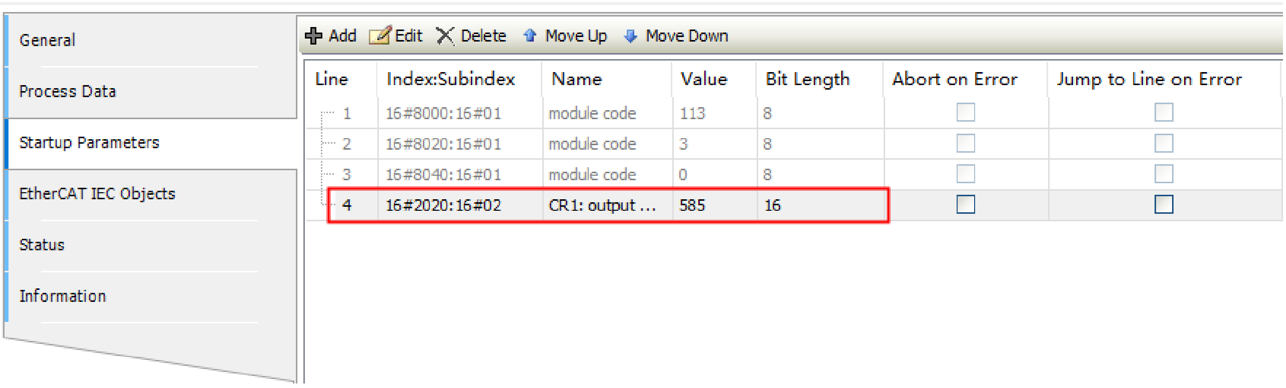
15. To modify the mode of channels 1-4 of DVP04DA-S as mode 1, click “**Startup Parameters**” tab in the configuration interface of RTU-ECAT to open the startup configuration interface and then click Add button as follows.



16. The following window appears, where you click beside DVP04DA-S to unfold all configurable CRs of DVP04DA-S, select the option “CR1: output mode setting” and enter 585 (16#249) in the “**Value**” field.



17. Click “**OK**” button to finish the setting. The “**Startup Parameters**” page is disaplayed as follows after the setting is complete.



Click the login button to download the EtherCAT configuration data to the AX8 series CPU. Then the mode of channels 1-4 of DVP04DA-S is automatically switched to mode 1. Refer to DVP Series Module Manual for details on CR1 of DVP04DA-S.

15.3.10 Error Diagnosis and Troubleshooting

15.3.10.1 LED Indicator Diagnosis

- **POWER LED**

LED status	Indication	How to correct
OFF	The power supply is abnormal.	Make sure that the power supply to RTU-ECAT is normal.
Green light ON	The power supply is normal.	--

- **ALARM LED**

LED status	Indication	How to correct
OFF	RTU-ECAT works normally or lacks the work power.	--
Red light blinking	Possible causes: 1. The configuration data of RTU-ECAT are invalid; 2. The extension modules on the right of RTU-ECAT are in error or are offline.	1. Check if the modules actually connected on the right of RTU-ECAT are consistent with those configured in the software. 2. Check the error information of the modules on the right of RTU-ECAT and then address the errors by following the related module manual instructions. 3. Check if the power supply and wiring of the modules on the right of RTU-ECAT are fine. 4. Make sure that the EtherCAT cables are properly connected.
Red light ON	The power supply voltage is too low.	Make sure that the power supply to RTU-ECAT is normal.

- **RUN LED**

LED status	Indication	How to correct
OFF	RTU-ECAT in STOP mode	1. Ensure that the power supply to RTU-ECAT and the connection are fine. 2. Check if the RUN/STOP switch of RTU-ECAT has been switched to RUN. 3. Check if the control word of RTU-ECAT is effective and controlling RTU-ECAT in STOP state.
Green light ON	RTU-ECAT in RUN mode	--

- **EtherCAT LED**

LED	LED status	Indication	How to correct
Green light	ON	The EtherCAT port is connected to the EtherCAT network.	--
	OFF	The EtherCAT port is not yet connected to the EtherCAT network.	Ensure that the hardware connection to the EtherCAT port is proper.

LED	LED status	Indication	How to correct
Yellow light	Blinking	Data is being transmitted or received via the EtherCAT port	--
	ON	No data is being transmitted or received via EtherCAT port.	Add the RTU-ECAT to the master.
	OFF	There is no hardware connection to the EtherCAT port.	Ensure that the hardware connection to the EtherCAT port is proper.

15.3.10.2 Status Indication Diagnosis

The status indication parameters of RTU-ECAT are used to display the operating states of special modules and DIO modules. See section 15.3.8.4 for details on related status indication parameters.

15.3.11 Communication Accessories

15.3.11.1 Cables

Figure	Model	Length (m)	Diameter (AWG)
	UC-EMC003-02A	0.3	4#22 PVC
	UC-EMC005-02A	0.5	4#22 PVC
	UC-EMC010-02A	1.0	4#22 PVC
	UC-EMC020-02A	2.0	4#22 PVC
	UC-EMC050-02A	5.0	4#22 PVC
	UC-EMC100-02A	10.0	4#22 PVC
	UC-EMC200-02A	20.0	4#22 PVC

15.4 RTU-EN01

15.4.1 Introduction

RTU-EN01 is an Ethernet remote I/O communication module, which can be connected to DVP-S series I/O modules.

15.4.1.1 Features

- Supporting smart PLC functions: counter, timer and real-time clock; operating independently without requiring PLC control or programming.
- Supporting MDI/MDI-X auto-detection, without the need for crossover cables, and auto-detecting 10/100 Mbps transmission rates.
- Supporting a maximum of 16 digital input/output modules (256 I/O points) and 8 analog input/output modules.
- Supporting up to 16 Modbus TCP connections.
- Supporting the Modbus TCP protocol for remote monitoring using graphic control software or Human Machine Interfaces (HMI).
- Able to operate as a Modbus TCP gateway, enabling the conversion from Modbus TCP commands to Modbus ASCII/RTU commands. (It can work in Master mode, allowing connection to up to 32 devices).
- Parameters can be set up on the webpage.

15.4.1.2 Specifications

- **Ethernet interface**

Item	Specifications
Interface	RJ-45 with Auto MDI/MDIX
Transmission method	802.3, 802.3u
Transmission cable	Category 5e, 100 m (Max)
Transmission rate	10/100 Mbps Auto-Detection
Communication protocol	ICMP, IP, TCP, UDP, DHCP, NTP, Modbus TCP, HTTP

- **Serial communication interface (COM1)**

Item	Specifications
Interface	Mini Dim
Transmission method	RS-232
Transmission rate	19,200 bps
Communication format	Stop bit: 1; Parity bit: None; Data bit: 8
Communication protocol	Delta Configuration
Transmission cable	DVPACAB215 / DVPACAB230 / UC-MS030-01A

- **Serial communication interface (COM2)**

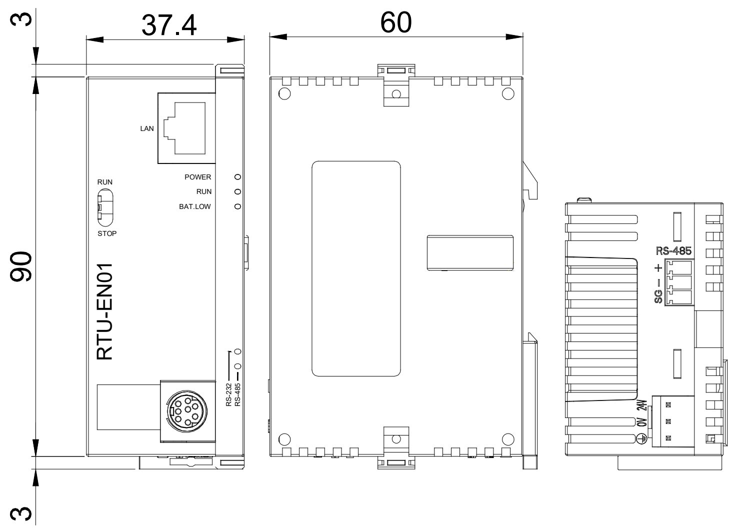
Item	Specifications
Interface	3-pin push-in terminal block
Transmission method	RS-485
Transmission distance	1,200 m
Transmission rate	110, 150, 300, 600, 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 (unit: bps)
Communication format	Stop bit: 1, 2; Parity bit: None, Odd, Even; Data bit: 7, 8
Communication protocol	Modbus ASCII, Modbus RTU

- **Electrical specification**

Item	Specifications
Power supply voltage	24 VDC (-15% to 20%)
Power fuse capacity	1.85 A / 30 VDC, resettable polyswitch
Power consumption	1 W
Insulation voltage	500 VAC
Weight	116 g

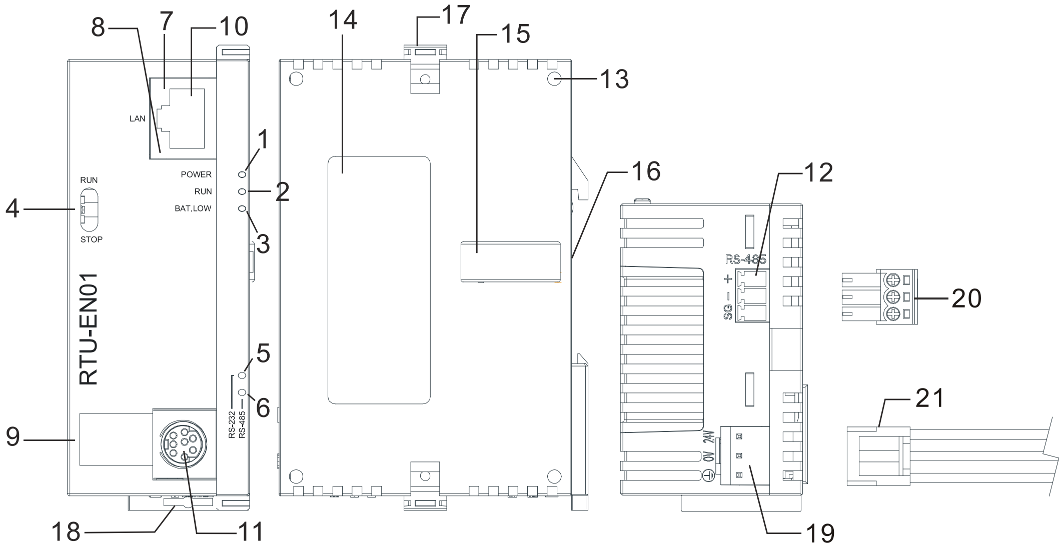
15.4.2 Dimensions and Parts

- **Dimensions**



Unit: mm

- **Parts**

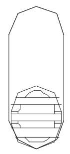


No.	Name	Description
1	POWER LED indicator (Green)	Indicates the power status of the module ON: The module is supplied with power. OFF: Not supplied with power.
2	RUN indicator (Green)	ON: RTU-EN01 is in RUN mode. OFF: RTU-EN01 is in STOP mode.
3	BAT.LOW indicator (Red)	Battery in low power indication
4	RUN/STOP switch	RUN: Start user program execution STOP: Stop user program execution
5	RS-232 indicator (Yellow)	Displaying communication status of RS-232 port
6	RS-485 indicator (Yellow)	Displaying communication status of RS-485 port
7	LINK/ACK indicator (Green)	Displaying the status of network
8	SPEED indicator (Yellow)	Displaying the speed of network connection
9	Digital display	Displaying the MODBUS station address.
10	Ethernet communication port	For connecting to the Ethernet network.
11	RS-232 communication port	For RS-232 communication wiring.
12	RS-485 communication port	For RS-485 communication wiring.
13	I/O module positioning hole	For positioning between modules.
14	Nameplate	Label plate
15	I/O module port	For connecting I/O modules.
16	DIN rail slot (35 mm)	For mounting the DIN rail.
17	I/O module clip	For securing I/O modules.
18	DIN rail clip	For securing the device itself.
19	Power supply input	For supplying power to I/O modules.
20	3-pin push-in terminal block (standard accessory)	An interface for RS-485 communication
21	Power supply connection cable (standard accessory)	For power supply.

15.4.3 Arrangement of Terminals

15.4.3.1 RUN/STOP Switch

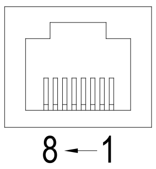
RUN



STOP

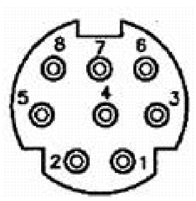
Status	Explanation
RUN	1. The RUN indicator on RTU-EN01 is ON. 2. The analog input/output module is in RUN status. 3. The smart PLC function is running.
RUN → STOP	1. The analog input/output module switches from RUN to STOP status. 2. Y points on the digital input/output module are all OFF.
STOP	1. The RUN indicator on RTU-EN01 is OFF. . 2. The analog input/output module is in STOP status. 3. The smart PLC function stops.
STOP → RUN	1. RTU-EN01 re-detects the information on the right-side modules. 2. The analog input/output module switches from STOP to RUN status.

15.4.3.2 RJ-45 PIN Definition



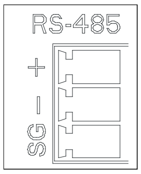
PIN	Signal	Definition
1	Tx+	Positive pole for data transmission
2	Tx-	Negative pole for data transmission
3	Rx+	Positive pole for data receiving
4	-	N/C
5	-	N/C
6	Rx-	Negative pole for data receiving
7	-	N/C
8	-	N/C

15.4.3.3 RS-232 PIN Definition



PIN	Signal	Definition
1	-	N/C
2	-	N/C
3	-	N/C
4	Rx	Receives data
5	Tx	Transmits data
6	-	N/C
7	-	N/C
8	GND	Ground

15.4.3.4 RS-485 PIN Definition

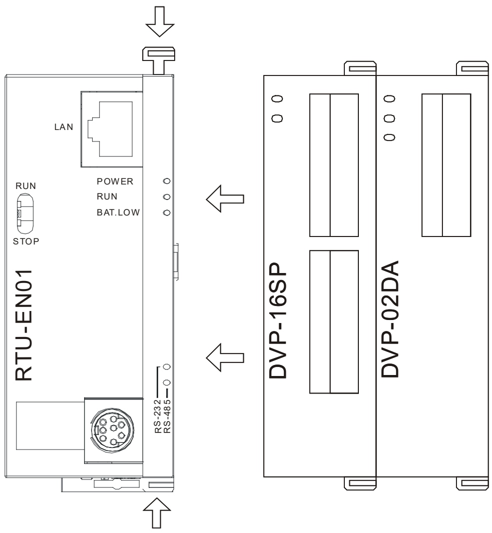


PIN	Signal	Definition
1	SG	Ground
2	D-	Negative pole for data
3	D+	Positive pole for data

15.4.4 Installation

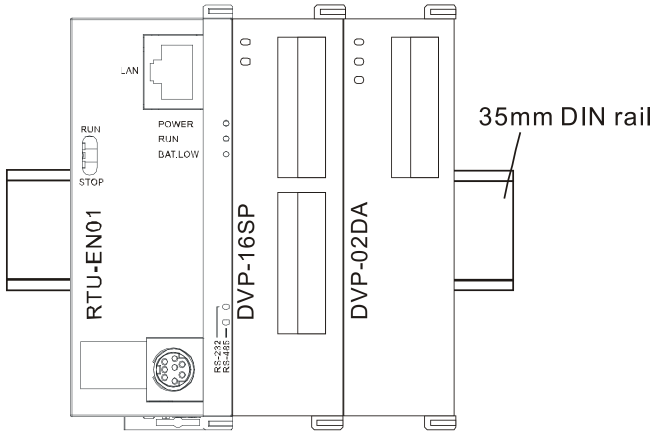
1. Connecting RTU-EN01 to DVP Slim Series IO Modules

- Open the IO module clips on the right top and bottom sides of RTU-EN01. Align the RTU-EN01 and the IO modules, and connect them securely.
- Press back the clips on the RTU-EN01 module to fasten the IO modules, ensuring proper contact between the modules.



2. Installing RTU-EN01 and DVP Slim Series IO Modules onto DIN Rail

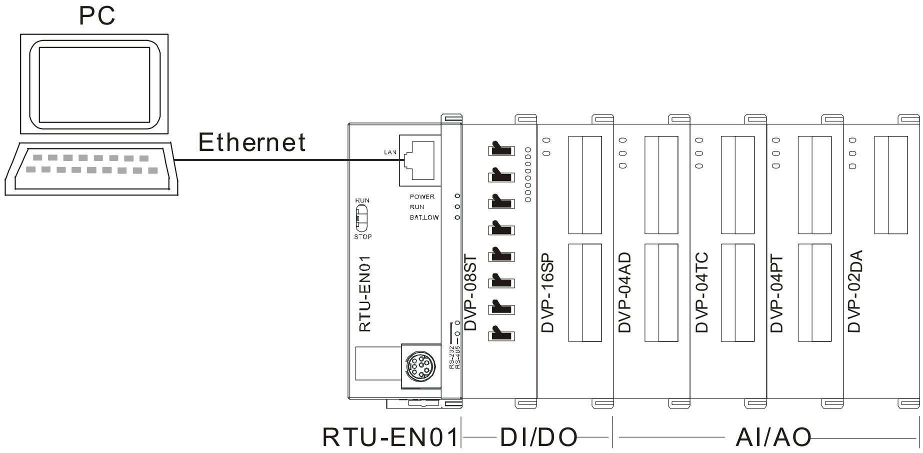
- Use a standard 35 mm DIN rail.
- Open the DIN rail clips on the RTU-EN01 and IO modules, and insert all of them onto the rail.
- Press back these clips of the RTU-EN01 and IO modules to fix them onto the rail.



15.4.5 Wiring

Due to the RTU-EN01's built-in Auto MDI/MDIX feature, a standard straight-through CAT-5e twisted-pair cable can be used for connection without the need for a crossover cable.

The following diagram illustrates the network cable connection between the computer and the RTU-EN01 module.



15.4.6 Word Devices and Bit Devices in RTU-EN01

15.4.6.1 Basic Registers (BR)

BR#	Attribute	Content	Explanation	Default	Latched
0	R	Model name	Set up by the system; read only. The model code of RTU-EN01= H'0600.	H'0600	Yes
1	R	Firmware version	Displaying the current firmware version in hex, e.g. V1.2 is indicated as a high byte = 0x01 and a low byte = 0x20.	-	Yes
2	R	Release date of the version	Displaying the data in decimal form. The 10,000s digit and 1,000s digit are for "month"; The 100s digit and 10s digit are for "day". 1s digit: 0 = morning; 1 = afternoon. Example: 12191 indicates the version released in the afternoon of December 19.	-	Yes
3	R/W	Start/Stop PLC function	-	-	No
4	-	Reserved	-	-	No
5	R/W	COM2 communication settings	RS-485 communication settings. Please refer to the table of baud rate setting and communication format setting.	H'0368	Yes
6	R/W	Address	For setting up the station address.	K'1	Yes
7	R	Number of DI points	Range: 0 to 256	-	No
8	R	Number of DO points	Range: 0 to 256	-	No
9	R	Error code	Displaying the errors. Please refer to the table of error codes.	-	No
10	-	Reserved	-	-	No
11	R/W	Communication timeout	For setting up the communication timeout (ms) in Modbus TCP mode.	K'5000	Yes
12	R/W	Communication delay time	For setting up the minimum interval time between communication data transmissions.	K'0	Yes
13	R/W	TCP connection idle time	For setting up idle time for TCP communication. Unit: second.	K'30	Yes
14 to 22	-	Reserved	-	-	No
23	R	Number of analog I/O modules	Max. 8	-	No
24	R	ID of the 1st analog I/O module	ID of the 1st analog I/O module	-	No
25	R	ID of the 2nd analog I/O module	ID of the 2nd analog I/O module	-	No
26	R	ID of the 3rd analog I/O module	ID of the 3rd analog I/O module	-	No
27	R	ID of the 4th analog I/O module	ID of the 4th analog I/O module	-	No
28	R	ID of the 5th analog I/O module	ID of the 5th analog I/O module	-	No
29	R	ID of the 6th analog I/O module	ID of the 6th analog I/O module	-	No
30	R	ID of the 7th analog I/O module	ID of the 7th analog I/O module	-	No
31	R	ID of the 8th analog I/O module	ID of the 8th analog I/O module	-	No
32 to 49	-	Reserved	-	-	No
50	R/W	RTC settings	Settings of the real-time clock	-	No
51	R/W	Year	1970 to 2099	-	Yes
52	R/W	Week	1 to 7	-	Yes

BR#	Attribute	Content	Explanation	Default	Latched
53	R/W	Month	1 to 12	-	Yes
54	R/W	Day	1 to 31	-	Yes
55	R/W	Hour	0 to 23	-	Yes
56	R/W	Minute	0 to 59	-	Yes
57	R/W	Second	0 to 59	-	Yes
58 to 59	-	Reserved	-	-	No
60	-	Reserved	-	-	No
61 to 63	-	Reserved	-	0	No
The symbol “R” refers to ready only; “R/W” refers to read and write.					

15.4.6.2 Explanations on BR

BR#0: Model Name

Explanations:

1. Model code of RTU-EN01 = H’0600.
2. You can read the model code in the program to see if the extension module exists.

BR#1: Firmware Version

Explanations:

The firmware version of RTU-EN01 is displayed in hex, e.g. H’0100 indicates version V1.00

BR#2: Release Date of the Version

Explanations:

Displaying the data in decimal form. 10,000s digit and 1,000s digit are for “month”; 100s digit and 10s digit are for “day”.

For 1s digit: 0 = morning; 1 = afternoon.

Example: 12191 indicates the version released in the afternoon of December 19.

BR#5: COM2 Communication Settings

Explanations:

BR#5							
b0 to b3							
Content	Interface	Explanation					
	COM2 RS-485	Data	Baud rate (bps)	Data	Baud rate (bps)	Data	Baud rate (bps)
		0x1	110	0x6	2,400	0xB	57,600
		0x2	150	0x7	4,800	0xC	115,200
		0x3	300	0x8	9,600		
		0x4	600	0x9	19,200		
		0x5	1,200	0xA	38,400		

b4 to b7								
	b7		b6 to b5			b4		
Explanation	Stop bit 0: 1 Stop bit 1: 2 Stop bits		Parity bit 00: None parity bit 01: Odd parity bit 11: Even parity bit			Data bit 0: 7 Data bits 1: 8 Data bits		
Content	0000 (0)	7-N-1	0011 (3)	8-O-1	1000 (8)	7-N-2	1011 (B)	8-O-2
	0001 (1)	8-N-1	0110 (6)	7-E-1	1001 (9)	8-N-2	1110 (E)	7-E-2
	0010 (2)	7-O-1	0111 (7)	8-E-1	1010 (A)	7-O-2	1111 (F)	8-E-2
b8 to b15								
Content	Explanation							
0x02	Modbus RTU Master							
0x03	Modbus ASCII Master							

BR#6: Address

Explanations:

For filling in or reading the Modbus address. Once set, the address will be shown in the message display.

Range: 1 to 247.

BR#7: Number of DI Points

15

Explanations:

Read the number of digital input points from BR#7. Range: 0 to 256. Maximum I/O points: 256 in total.

BR#8: Number of DO Points

Explanations:

Read the number of digital output points from BR#8. Range: 0 to 256. Maximum I/O points: 256 in total.

BR#9: Error Code

Explanations:

Error code = 0 indicates that no error has occurred.

Code	Indication	How to correct
F0	Returning to default setting	--
F1	RTU-EN01 being powered	--
F2	Power supply in low voltage	Check if the power supply of the module works normally.
F3	Internal error. Manufacturing error.	1. Check if the settings of smart PLC are incorrect. 2. Re-power RTU-EN01. If the error still exists, try step 3. 3. Reset RTU-EN01. If the error still exists, contact your local distributors.
F5	Network connection error	Check if RTU-EN01 is connected normally to the network.
F6	TCP connections exceed the limit	Check if the number of connected modules exceeds the maximum.
F7	RS-485 setting error	Check if the RS-485 communication format is correct.

Code	Indication	How to correct
F8	IP setting error	1. DHCP request failure. 2. IP setting error. 3. MASK setting error. 4. Gateway does not exist in the same subnet. 5. Returning to default setting.
F9	Right-side module error	Check if the configuration of the right-side modules has been modified. If the error still exists, check whether the number of I/O points exceeds the maximum limit, or if more than 8 analog I/O modules are connected.
04	Slave error	1. Check if RTU-EN01 and RS-485 are connected normally. 2. Check if the transmission speed of the module is consistent with that of other nodes on the network.
0b	No response from station	

BR#11: Communication Timeout (ms)

Explanations:

For setting up the communication timeout. Default = 5,000 ms. For example, to set the communication timeout to 7 seconds manually, write 7000 to BR#11. Range: 5 to 65,535.

BR#12: Communication Delay Time (ms)

Explanations:

For setting up the minimum interval time between Modbus commands. Default = 0 ms. For example, to set up the communication delay time to 100 ms manually, write 100 into BR#12. Range: 0 to 65,535.

15

BR#13: TCP Connection Idle Time (s)

Explanations:

For setting up the TCP connection idle time. Default = 30 seconds. Range: 5 to 65,535.
For example, to set up the idle time to 7 seconds manually, write 7 into BR#13.

BR#23: Number of Analog I/O Modules

Explanations:

Read the number of right-side modules from BR#23, up to 8 supported.

BR#24 to #31: ID of the 1^{st} to 8^{th} Analog I/O Module

Explanations:

Read the IDs of the 1^{st} to 8^{th} analog I/O modules from BR#24 to BR#31.

BR#50 to BR#57: RTC Settings

Explanations:

Allowed range for RTC: 1970/01/01 00:00:00 to 2037/12/31 23:59:59

How to set up:

1. Set BR50 to 1, RTU-EN01 will stop updating the RTC values.

2. Set BR50 to 2, RTU-EN01 will write the time values to RTC.
3. Once the setup is completed, RTU-EN01 will set BR#50 to 0.

BR50	0	1	2
	No action	RTC stops updating	RTC being set

15.4.6.3 External Input Contacts (RX)

RX#	Attribute	Content	Explanation	Default	Latched
0 to 255	R/W	External input contact	Input points on analog I/O module	OFF	NO
The symbol “R” refers to ready only; “R/W” refers to read and write.					

RX#0 to #255: External Input Contact

Explanations:

The right-side extension interface on RTU-EN01 can connect to DVP-Slim series I/O modules.

RTU-EN01 supports a maximum of 256 I/O points.

15.4.6.4 External Output Contacts (RY)

RY#	Attribute	Content	Explanation	Default	Latched
0 to 255	R/W	External output contact	Output points on analog I/O module	OFF	NO
The symbol “R” refers to ready only; “R/W” refers to read and write.					

RY#0 to #255: External Output Contact

Explanations:

The right-side extension interface on RTU-EN01 can connect to DVP-Slim series I/O modules.

RTU-EN01 supports a maximum of 256 I/O points.

15.4.6.5 Control Registers for Extension Modules (RCR)

RCR#	Attribute	Content	Explanation	Default	Latched
0 to 49	R/W	The 1st analog I/O module	Control register for the 1st analog I/O module	--	NO
50 to 99	R/W	The 2nd analog I/O module	Control register for the 2nd analog I/O module	--	NO
100 to 149	R/W	The 3rd analog I/O module	Control register for the 3rd analog I/O module	--	NO
150 to 199	R/W	The 4th analog I/O module	Control register for the 4th analog I/O module	--	NO
200 to 249	R/W	The 5th analog I/O module	Control register for the 5th analog I/O module	--	NO
250 to 299	R/W	The 6th analog I/O module	Control register for the 6th analog I/O module	--	NO
300 to 349	R/W	The 7th analog I/O module	Control register for the 7th analog I/O module	--	NO
350 to 399	R/W	The 8th analog I/O module	Control register for the 8th analog I/O module	--	NO
The symbol “R” refers to ready only; “R/W” refers to read and write.					

RCR#0 to #399: Control Registers for Right-Side Analog I/O Modules

Explanations:

By reading/writing RCR in RTU-EN01, you can read or write the data in the control registers (CR) inside the analog input/output modules.

Example: The analog module closest to RTU-EN01 is regarded the 1st module. RCR#0 corresponds to CR#0 in the 1st analog I/O module; RCR#50 corresponds to CR#0 in the 2nd analog I/O module.

15.4.6.6 Word Devices and Bit Devices for Timers (T)

T#	Attribute	Register/coil name	Explanation	Default	Latched
0	R/W	Timer 0	Timer	0/OFF	NO
1	R/W	Timer 1	Timer	0/OFF	NO
2	R/W	Timer 2	Timer	0/OFF	NO
3	R/W	Timer 3	Timer	0/OFF	NO
4	R/W	Timer 4	Timer	0/OFF	NO
5	R/W	Timer 5	Timer	0/OFF	NO
6	R/W	Timer 6	Timer	0/OFF	NO
7	R/W	Timer 7	Timer	0/OFF	NO
8	R/W	Timer 8	Timer	0/OFF	NO
9	R/W	Timer 9	Timer	0/OFF	NO
10	R/W	Timer 10	Timer	0/OFF	NO
11	R/W	Timer 11	Timer	0/OFF	NO
12	R/W	Timer 12	Timer	0/OFF	NO
13	R/W	Timer 13	Timer	0/OFF	NO
14	R/W	Timer 14	Timer	0/OFF	NO
15	R/W	Timer 15	Timer	0/OFF	NO
The symbol “R” refers to ready only; “R/W” refers to read and write.					

T#0: Timer 0

Explanations:

When the timer is enabled, it will start to time according to the settings. When the timing reaches the target, the bit device T0 will be ON. When the bit device is reset, the word device will be reset to 0 as well.

T#1 to #15: Timer 1 to 15

Explanations:

Please refer to T#0.

15.4.6.7 Word Devices and Bit Devices for Counters (C)

C#	Attribute	Register/coil name	Explanation	Default	Latched
0	R/W	Counter 0	Counting up/down counter	0/OFF	NO
1	R/W	Counter 1	Counting up/down counter	0/OFF	NO
2	R/W	Counter 2	Counting up/down counter	0/OFF	NO
3	R/W	Counter 3	Counting up/down counter	0/OFF	NO
4	R/W	Counter 4	Counting up/down counter	0/OFF	NO
5	R/W	Counter 5	Counting up/down counter	0/OFF	NO

C#	Attribute	Register/coil name	Explanation	Default	Latched
6	R/W	Counter 6	Counting up/down counter	0/OFF	NO
7	R/W	Counter 7	Counting up/down counter	0/OFF	NO
8	R/W	Counter 8	Counting up/down counter	0/OFF	NO
9	R/W	Counter 9	Counting up/down counter	0/OFF	NO
10	R/W	Counter 10	Counting up/down counter	0/OFF	NO
11	R/W	Counter 11	Counting up/down counter	0/OFF	NO
12	R/W	Counter 12	Counting up/down counter	0/OFF	NO
13	R/W	Counter 13	Counting up/down counter	0/OFF	NO
14	R/W	Counter 14	Counting up/down counter	0/OFF	NO
15	R/W	Counter 15	Counting up/down counter	0/OFF	NO
The symbol "R" refers to ready only; "R/W" refers to read and write.					

C#0: Counter 0

Explanations:

When the counter is enabled and RX turns from OFF to ON, counting up or down will be activated based on the settings. When the counting reaches the target, the counting will stop, and the bit device C0 will be set to ON. When the bit device is reset, the word device will be reset to 0 as well.

C#1 to #15: Counter 1 to 15

Explanations:

Please refer to C#0.

15.4.6.8 Bit Devices for Real-Time Clock (R)

R#	Attribute	Content	Explanation	Default	Latched
0	R/W	RTC 0	Real-time clock	OFF	NO
1	R/W	RTC 1	Real-time clock	OFF	NO
2	R/W	RTC 2	Real-time clock	OFF	NO
3	R/W	RTC 3	Real-time clock	OFF	NO
4	R/W	RTC 4	Real-time clock	OFF	NO
5	R/W	RTC 5	Real-time clock	OFF	NO
6	R/W	RTC 6	Real-time clock	OFF	NO
7	R/W	RTC 7	Real-time clock	OFF	NO
8	R/W	RTC 8	Real-time clock	OFF	NO
9	R/W	RTC 9	Real-time clock	OFF	NO
10	R/W	RTC 10	Real-time clock	OFF	NO
11	R/W	RTC 11	Real-time clock	OFF	NO
12	R/W	RTC 12	Real-time clock	OFF	NO
13	R/W	RTC 13	Real-time clock	OFF	NO
14	R/W	RTC 14	Real-time clock	OFF	NO

R#	Attribute	Content	Explanation	Default	Latched
15	R/W	RTC 15	Real-time clock	OFF	NO
The symbol “R” refers to ready only; “R/W” refers to read and write.					

R#0: RTC 0

Explanations:

When the RTC function is enabled, and the assigned trigger condition is true, RTU-EN01 will set the bit device R0 to ON and continue to output or stop based on the set time.

R#1 to #15: RTC 1 to 15

Explanations:

Please refer to R#0.

15.4.7 Modbus Communication

15.4.7.1 Function Codes Supported

Function code	Explanation	Devices supported
0x02	Read digital input point	RX, RY, T, R, C
0x03	Read register	BR, T, C, RCR
0x05	Write single bit device	RY, T, R, C
0x06	Write single register	BR, T, C, RCR
0x0F	Write multiple bit devices	RY, T, R, C
0x10	Write multiple registers	BR, T, C, RCR
0x17	Read/write multiple registers	BR, T, C, RCR

15.4.7.2 Exception Codes Supported

Exception code	Explanation
0x01	Illegal function
0x02	Illegal data address
0x03	Illegal data value
0x04	Slave device failure
0x0b	Gateway target device failed to respond.

15.4.7.3 Device Types and Device Addresses

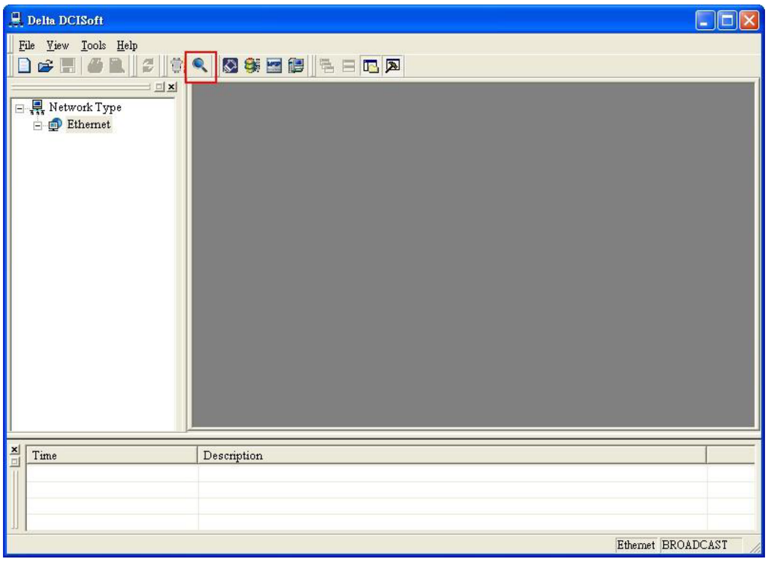
Device type	MODBUS address (Hex)	MODBUS address (Dec)	Number
RX	0x0400 to 0x04FF	101025 to 101280	256
Coil			
RY	0x0500 to 0x05FF	001281 to 001536	256
T	0x1600 to 0x160F	005633 to 005648	16
R	0x1900 to 0x190F	006401 to 006416	16
C	0x1E00 to 0x1E0F	007681 to 007696	16
Holding register			
Device type	**MODBUS address (Hex)**	**MODBUS address (Dec)**	**Number**
BR	0x0000 to 0x003F	400001 to 400064	64
T	0x1600 to 0x160F	405633 to 405648	16
C	0x1E00 to 0x1E0F	407681 to 407696	16
RCR	0x3000 to 0x318F	412289 to 412688	400

15.4.8 Setting up Software

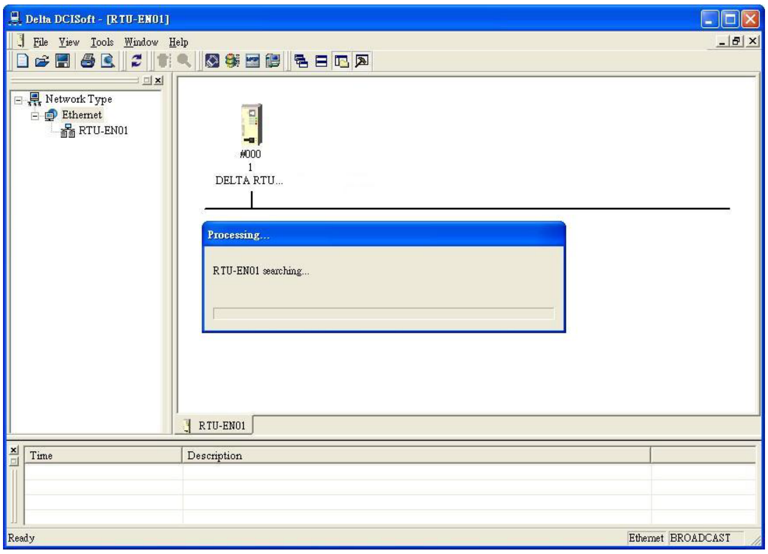
This section gives instructions on how to set up RTU-EN01 by DCISoft and explanations on each setup page. RTU-EN01 is set up by UDP port 20006; therefore, you have to be aware of the relevant settings of the firewall. See the explanations below on the software.

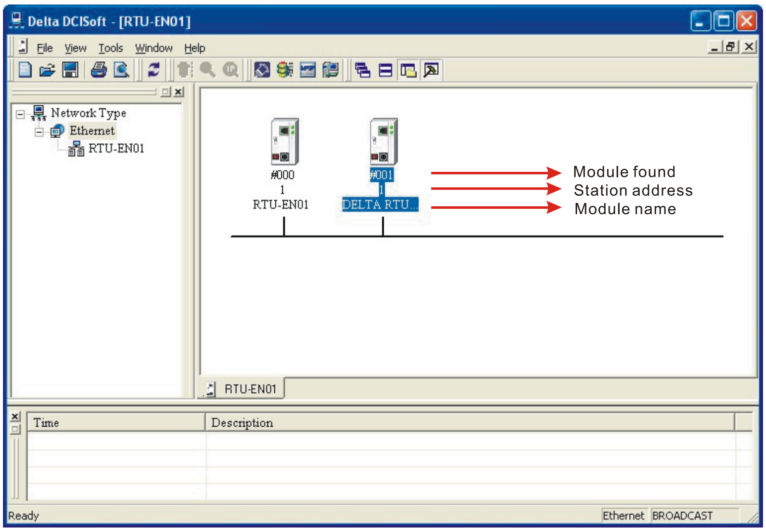
15.4.8.1 Setting up Communications and Searching for Communication Modules in DCISoft

1. Open DCISoft on the PC and click on the “IP Search” icon.

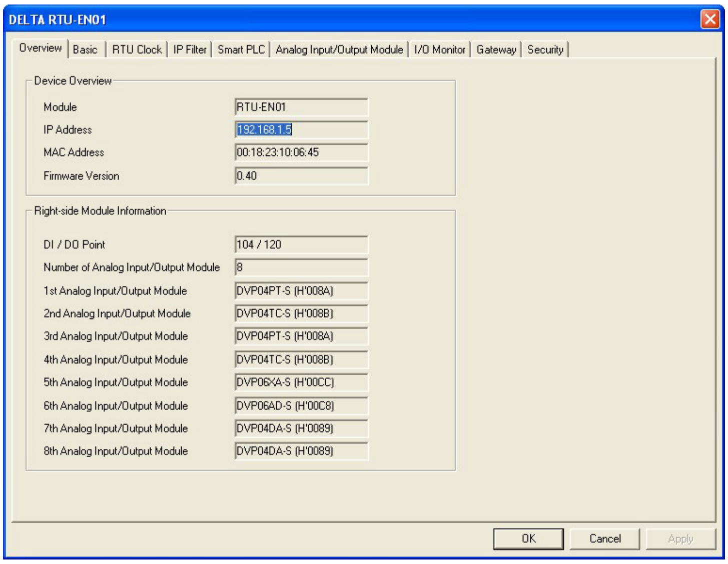


2. You will see the communication module found.

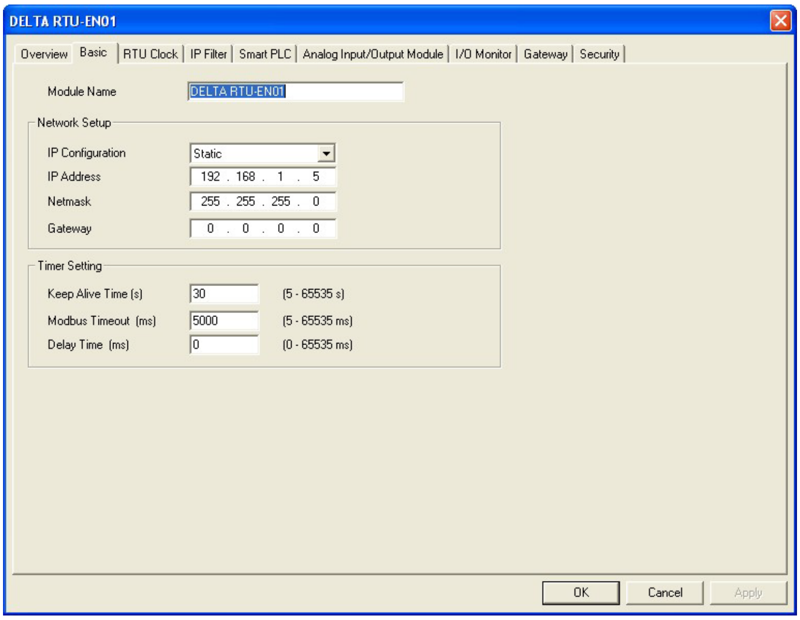




3. Double-click the module to open the setup page. The first page overviews the basic status of the module and the information about its right-side modules.



4. The next page is for basic network setup. Consult your Internet Service Provider for relevant network setting. For other settings, see BR#11 to BR#13.



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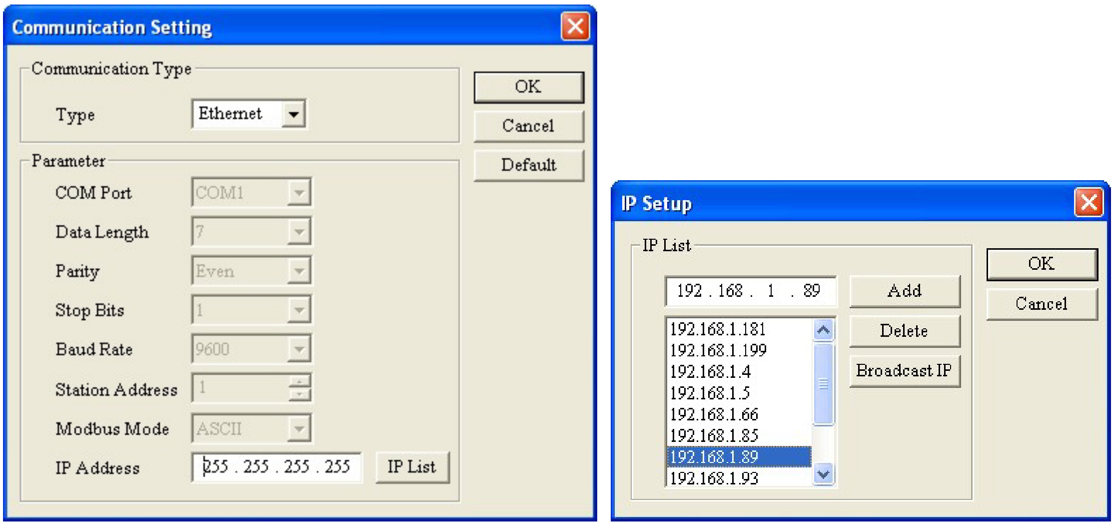
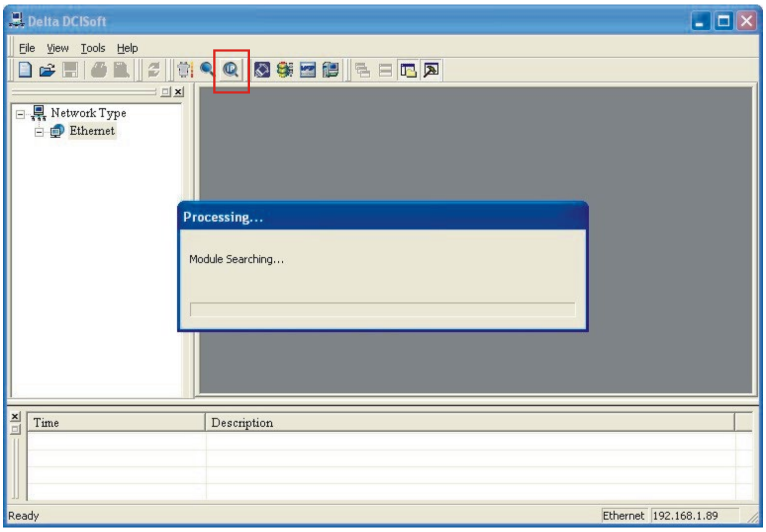
15.4.8.2 Recording IP Address

The IP list allows you to select modules directly and designate a module for search. Recording IP address adds the RTU-EN01 to the list, allowing the user to see it during the search.

1. In the IP list, you will see the network IPs already used. Click “Add” to record the known IP address into the list, then search for the module on the network using this designated IP.

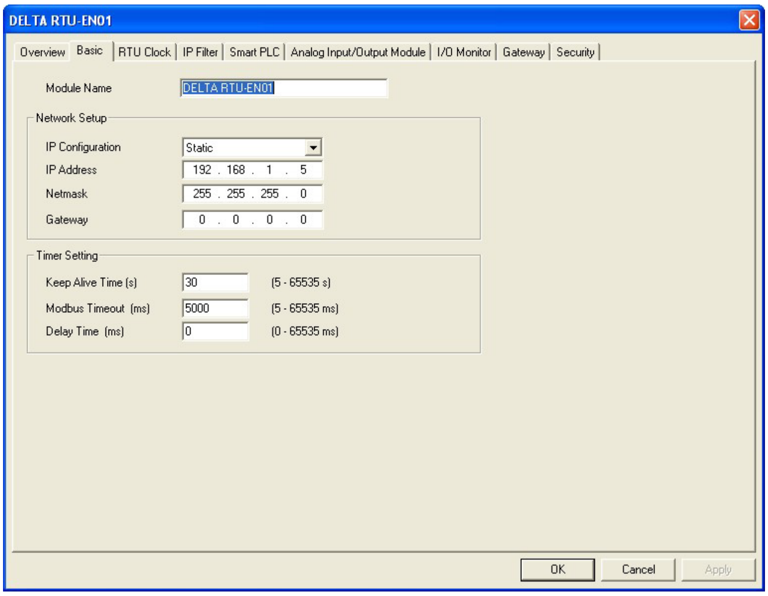


2. Click the icon to search for the module.



15.4.8.3 Basic Settings

The basic settings include parameters such module name, network settings and communication time.



1. Module name:

   Since there may be multiple RTU-EN01 modules on the network. You can assign a unique name to each module to easily identify them when needed.

2. Network setup:

   Enable dynamic IP (DHCP) or static IP. Consult your ISP for other relevant settings.

   - IP configuration:

   Static IP: Preset or manually modified by the user.

   DHCP: Automatically updated by the server. There must be a server in the LAN.

IP	Explanation
Static	The user enters the IP address, subnet mask, and gateway.
DHCP	DHCP server offers the IP address, subnet mask, and gateway.

   - IP address:

   IP address is the location of the equipment on the network. Every equipment connected to the network must have an IP address. Incorrect IP address will result in connection failure. Consult your ISP for how to set up IP address. The default IP for RTU-EN01 is 192.168.1.5.

   - Netmask:

   Subnet mask is an important parameter for subnet configuration. It determines whether the destination IP and the local device are in the same subnet. If not, the device will send the packet to the gateway, and the gateway will send the packet to another subnet. Incorrect settings may prevent communication between the destination device and RTU-EN01. To verify your settings are correct, perform bitwise AND operations between your IP and subnet mask and destination IP and subnet mask. If the two values obtained are the same, the two IPs are in the same subnet. The default subnet mask of RTU-EN01 is 255.255.255.0.

- Gateway:

  Gateway is the window for two different subnets, allowing the two ends in different subnets to communicate. For example, if the LAN needs to be connected to WAN, it will need a gateway to bridge the communication. The IP of the gateway has to be in the same subnet as RTU-EN01. The default gateway of RTU-EN01 is 192.168.1.1.

3. Timer setting:

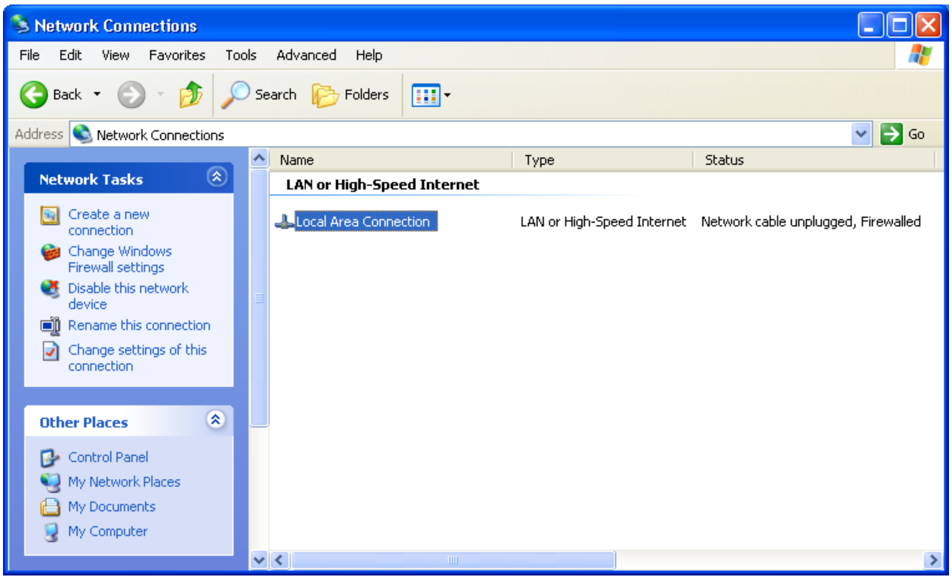
   You can set Keep Alive Time (TCP connection idle time), Modbus timeout and minimum delay time for every communication data. Please refer to the explanations on BR#11, BR#12, and BR#13.

15.4.8.4 Network Settings

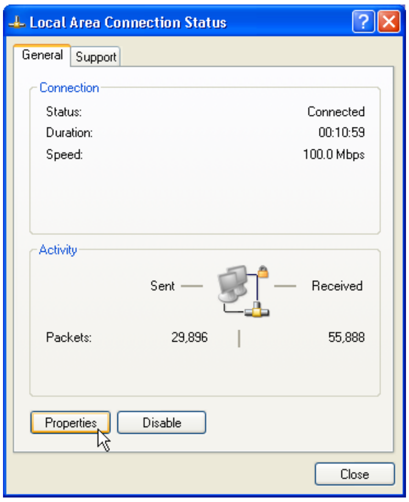
The first step for all the devices to connect to the network is to have its own IP (Internet Protocol) address. The IP address is like a number for every device to be identified on the network.

- Setting up static IP of the PC

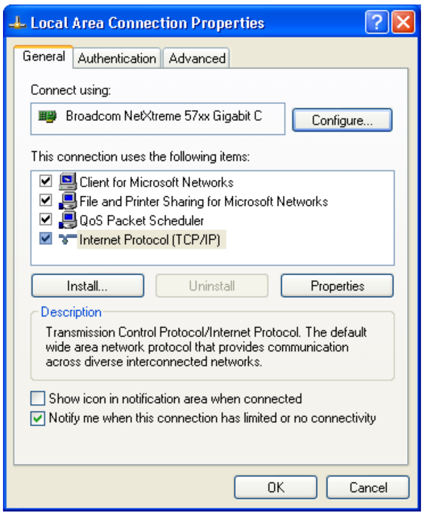
1. Enter Control Panel → Network Connection → click “Local Area Connection".



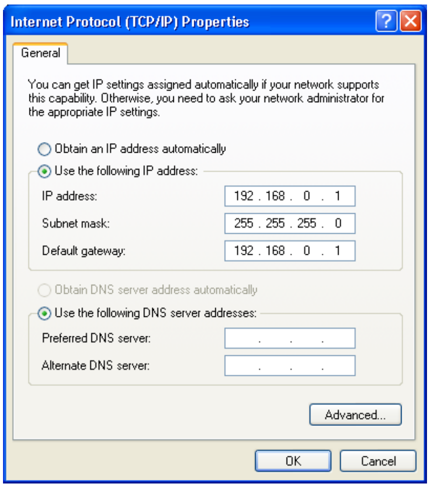
2. You will see the “Local Area Connection Status” window. Click “Properties”.



3. Click “Internet Protocol (TCP/IP)”.

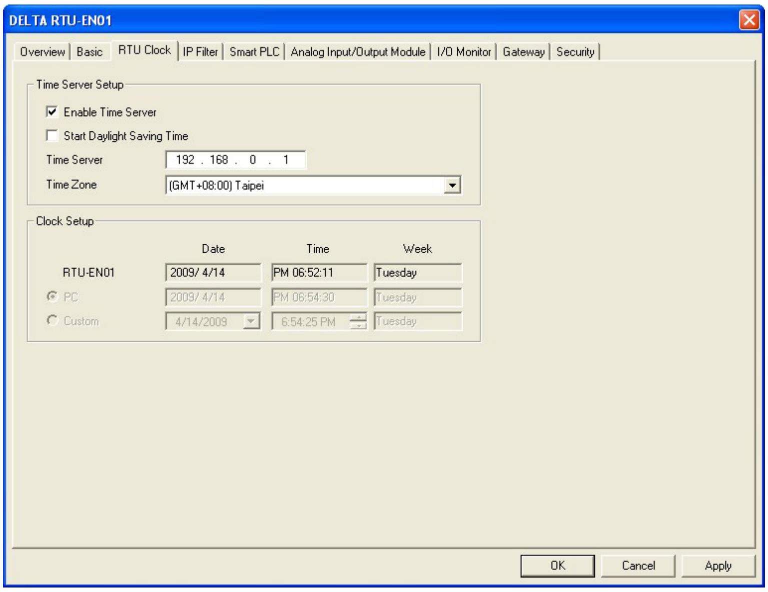


4. Enter “192.168.0.2” into IP address. Click “OK” to complete the IP address setting of the PC.



15.4.8.5 Setting up Time Server

RTU-EN01 offers real-time clock (RTC) functions. You can set up your own time for RTU-EN01 or update the time through NTP server.



1. Enable time server:
   RTU-EN01 executes automatic time correction from the NTP server on the network every 6 hours to ensure the time is correct in the RTC. To enable this function, first configure the NTP server IP address, time zone, and daylight saving time settings for your RTU-EN01.

2. Start daylight saving time:
   Daylight Saving Time; also known as summer time, is a conventional local time adopted by many countries in the world on a seasonal basis. Most commonly DST is obtained by adjusting the official local time forward, by one hour, for the spring, summer, and early autumn periods.

3. Time server:
   IP address of the time server. You can acquire correct time from the time server to correct the time in the CPU.

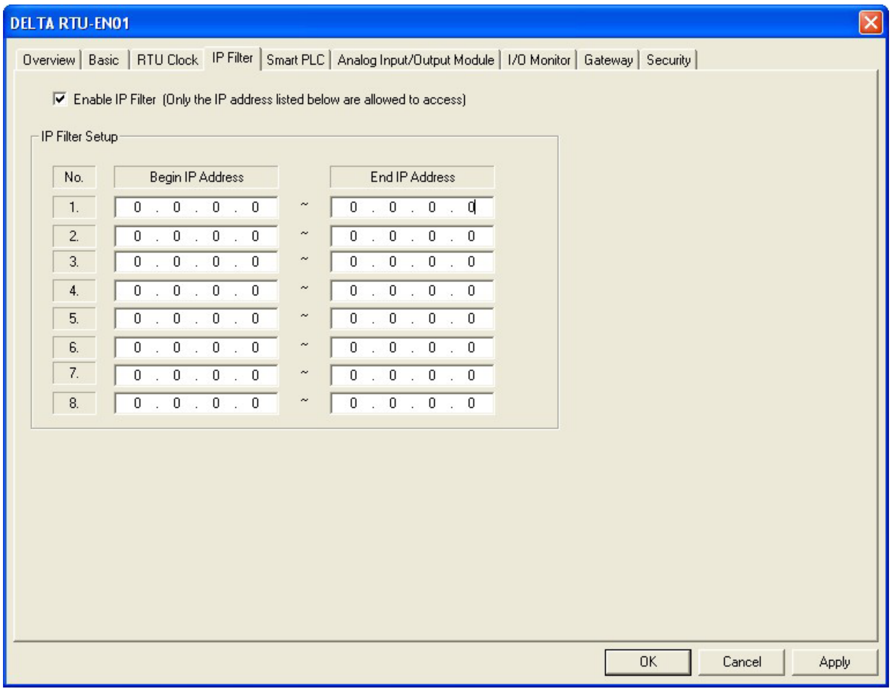
4. Time zone:
   There are 24 time zones on earth and follow Greenwich Mean Time (GMT) as the standard time. Select your time zone and adjust the offset between your local time and Coordinated Universal Time (UTC).

5. Clock setup:

   Set up the time in RTU-EN01. You can synchronize with the current time of the PC you're using, or set the time manually.

15.4.8.6 IP Filter

The IP filter is used to restrict the network connections, preventing potential errors caused by unauthorized or unknown IP addresses. Only the IPs within the specified range are allowed to connect; all other IPs will be rejected.



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1. Enable IP filter:

   Check the box to enable IP filter.

2. Begin IP address:

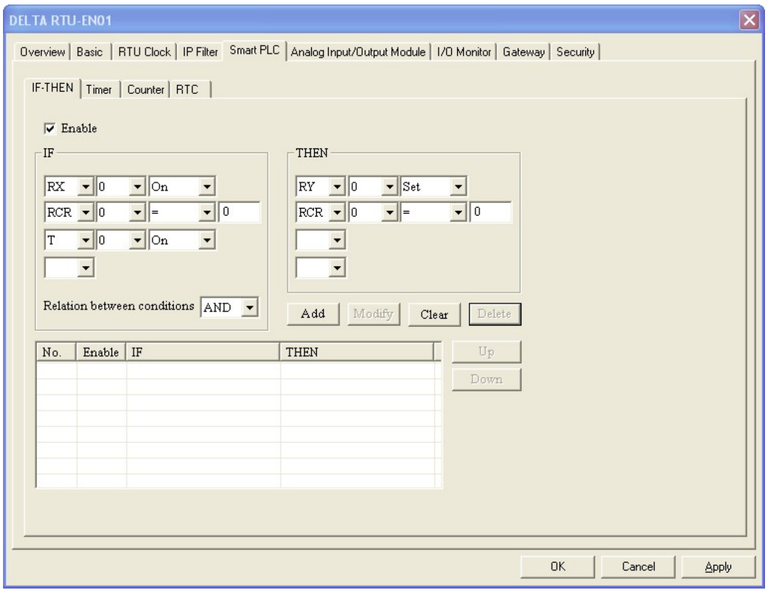
   Specifies the starting IP addresses allowed to establish connection. A maximum of 8 IPs can be configured.

3. End IP address:

   Specifies the ending IP addresses allowed to establish connection. A maximum of 8 IPs can be configured.

15.4.8.7 Smart PLC Setting: IF-THEN

RTU-EN01 features an independent Smart PLC function. IF-THEN is able to execute the corresponding actions based on the user-defined conditions. These conditions can be combined with counters, timers, RTC, digital I/O points, and analog I/O modules. You can use AND or OR as the trigger conditions. RTU-EN01 supports up to 16 IF-THEN functions.

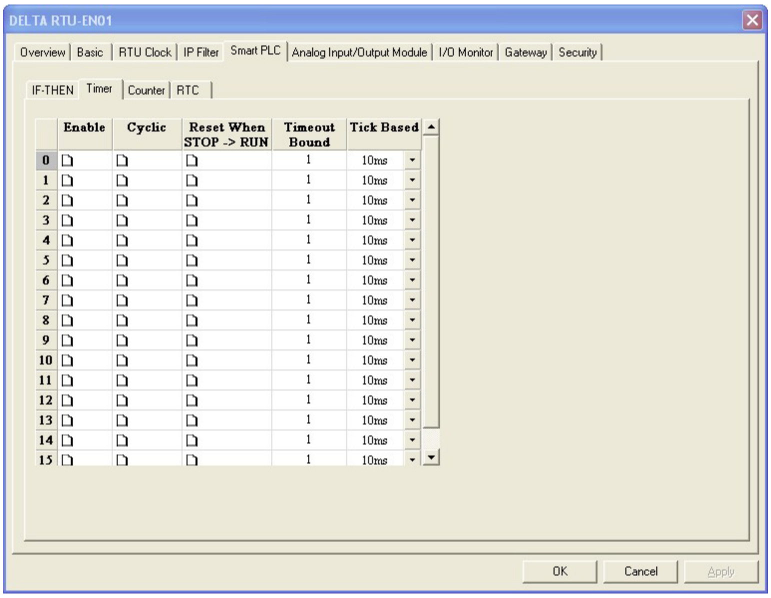


1. Enable:
   Check the box to enable IF-THEN.
2. IF:
   For trigger conditions, you can select bit devices RX, RY, C, T, RT or word device RCR. You can specify the trigger conditions such as ON, OFF, Rising, Falling, >, <, =, <>, >= or <=. The trigger condition can also be AND or OR. When the device is a register, the allowed trigger range is from K-32,768 to K32,767.
3. THEN:
   For the execution, you can select bit devices RY, C, T, RT or word device RCR. You can specify the actions such as Set, Reset, Toggle or set up a value for them. Please refer to the explanations on IF#13 to IF#24. When the device is a register, the allowed value range is from K-32,768 to K32,767.
4. Add, Modify, Clear, Delete:
   All the settings above can be added to the IF-THEN table below, or you can modify, clear or delete the settings.
5. Up, Down:

   You can move the IF-THEN setting upward or downward to change the execution order.

15.4.8.8 Smart PLC Setting: Timer

RTU-EN01 features an independent Smart PLC function. The timer operates according to the system time. There are 16 timers in RTU-EN01. The timing range is 10 ms to 655,35 s.



1. Enable:
   Decide whether to enable the timer in this column.

2. Cyclic:
   Decide whether to reset the timer and re-start the timing when the timing reaches the target in this column.

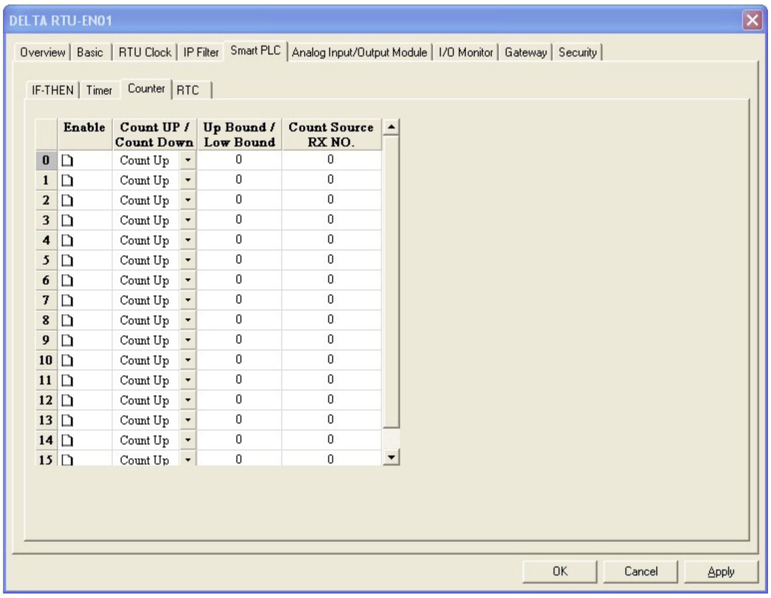
3. Reset When STOP->RUN:
   Decide whether to reset the timer when the system goes from STOP to RUN.

4. Timeout Bound, Tick Based:

   The time for the timer to reach the target. Range: 10 ms to 65,535 s.

15.4.8.9 Smart PLC Setting – Counter

RTU-EN01 features an independent Smart PLC function. The counter can be triggered by the external input points RX. When RX turns from OFF to ON, the counter will start to count. There are 16 counters in RTU-EN01, capable of counting up and counting down. The counting range is -32,768 to 32,767.



1. Enable:
   Decide whether to enable the counter in this column.

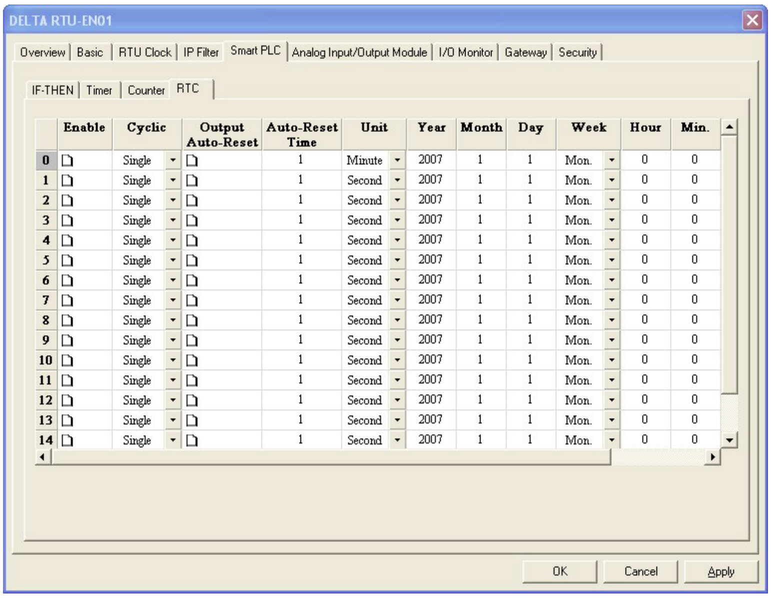
2. Count up/count down:
   Decide whether the counter will be counting up or counting down.

3. Up bound/low bound:
   The upper bound and lower bound of the counting. Range: -32,768 to 32,767.

4. Count source RX NO.:
   Number of the external input point RX of the counting source. Range: RX#0 to RX#255.

15.4.8.10 Smart PLC Setting – RTC

RTU-EN01 features an independent Smart PLC function. The real-time clock (RTC) can be triggered by the system at a specific time. There are 16 RTCs in RTU-EN01. You can designate the trigger time or trigger the RTC on a monthly, weekly or daily basis. Please refer to the explanations on R#0 to R#15.



1. Enable:
   Decide whether to trigger the RTC in this column.

2. Cyclic:
   Decide to trigger the RTC only once, or trigger it on a daily, weekly or monthly basis.

3. Output auto-reset:
   After the RTC is triggered, decide whether to retain the output for a period of time and reset the RTC automatically. R (Coil) will be OFF when the time for reset is reached.

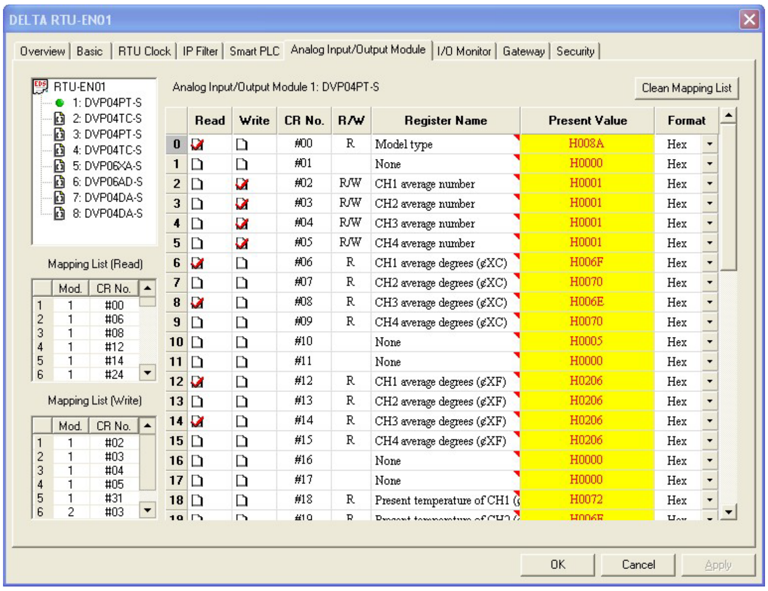
4. Auto-reset time, Unit:
   If you select to auto-reset the RTC, the bit device in RTC will retain the output for a period of time.
   Range: 1 s to 24 hr.
   Range for second as unit: 1 to 32,767
   Range for minute as unit: 1 to 3,600
   Range for hour as unit: 1 to 24

5. Year, Month, Day, Hour, Minute, Second, Week:
   The time to trigger the RTC.
   If you would like to trigger it only once, only Year, Month, Day, Hour, Minute and Second need to be set.
   If you would like to trigger on a daily basis, only Hour, Minute and Second need to be set.
   If you would like the RTC to be triggered on a weekly basis, you only need to set up Week, Hour, Minute and Second.
   If the RTC is triggered monthly, set up only Day, Hour, Minute and Second.

15.4.8.11 Analog Input/Output Modules

RTU-EN01 provides control registers (CR) for analog I/O modules and includes built-in CR mapping tables for read/write. You can select the CRs needed for reading/writing and use Delta's communication module DVPEN01-SL to map the CR directly to D registers in DVP-SV series PLC and read/write the D register through PLC program, controlling the analog I/O module connected to RTU-EN01. RTU-EN01 supports up to 64 data reading/writing operations.

▶ This function works with DVPEN01-SL firmware V2.0 or above.



1. Corresponding table:
   Open DCISoft and it will automatically load the control register information on the analog I/O modules. (When using Web settings, you have to load the EDS file for an analog I/O module by yourself.) Select the CRs to establish a mapping table. DVPEN01-SL will map the CRs established in the table to D registers in DVP-SV series PLC. You will be able to operate the analog I/O modules connected to RTU-EN01 by the values stored in D registers.

2. Read/Write:
   Select the CRs (read/write) to be added to the mapping table. Click "Apply" and the selected CRs will be added.

3. Clean Mapping List:
   Once applied, clear all the information in the mapping table.

4. CR No.:
   The number of control registers for all analog I/O modules connected to RTU-EN01.

5. R/W:
   Indicating whether the CR can be read or written.

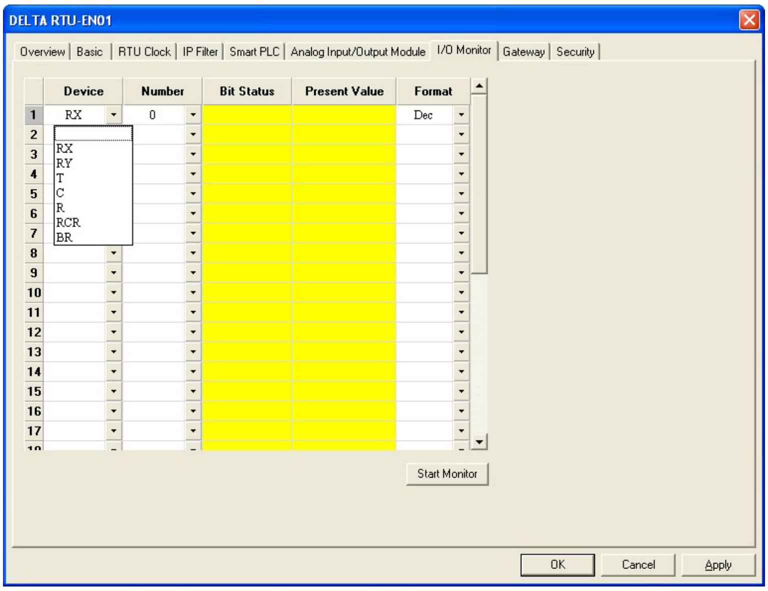
6. Register Name:
   The name of the CR for the analog I/O modules.

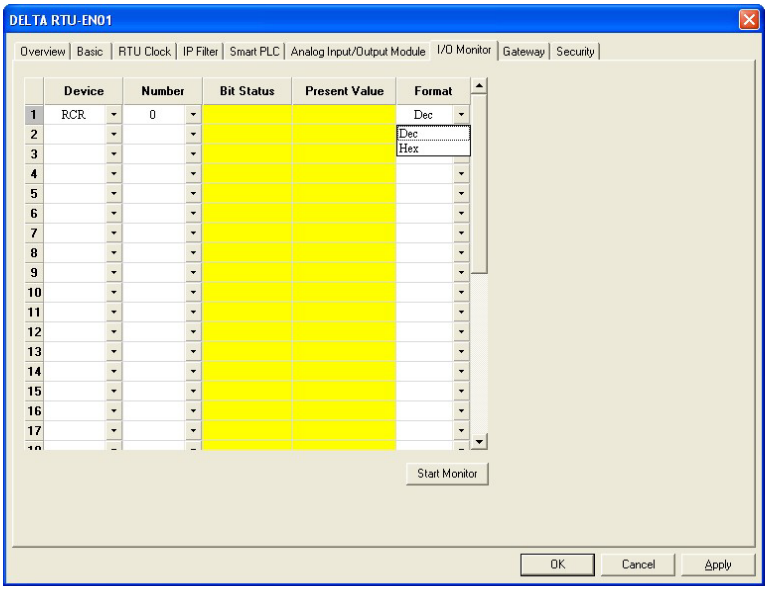
7. Present Value:
   The present values in the CRs for the analog I/O modules.

8. Format:
   Display format for the present values in the CRs. Available formats: hex, signed decimal integer and binary integer.

15.4.8.12 I/O Monitoring Table

RTU-EN01 is able to monitor internal registers online. Scroll the table to monitor devices RX, RY, T, C, R, RCR and BR, along with the bit status and present values in the registers. You can choose to monitor the present values in either decimal or hexadecimal format.





1. Device:

   Select an internal register in RTU-EN01.

   Bit devices: RX, RY, T, C, R

   Registers: T, C, R, RCR, BR.

2. Number:

   Select the bit devices and registers to be monitored by their numbers.

   RX#0 to RX#255, total 256 bits.

   RY#0 to RY#255, total 256 bits.

   T#0 to T#15, total 16 bits and 16 registers.

   C#0 to C#15, total 16 bits and 16 registers.

   R#0 to R#15, total 16 bits and 16 registers.

RCR#0 to RCR#399, total 400 registers.

BR#0 to BR#63, total 64 registers.

3. Format:

Select the format of the register to be monitored, decimal (Dec) or hexadecimal (Hex).

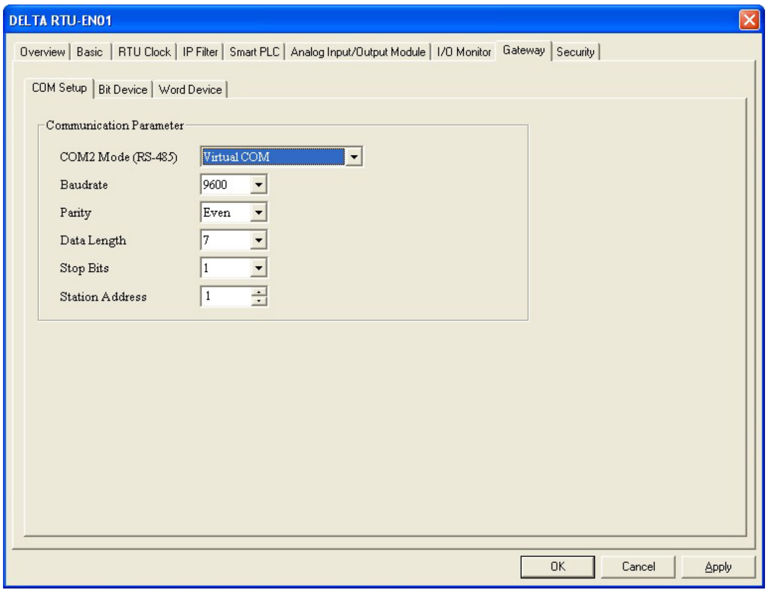
▶ Once the number and format are set, click “Apply” to save the setting and start the monitoring.

4. Start/Stop monitor:

Start or stop the saved and applied device number to be monitored. Unapplied saved settings will be deleted.

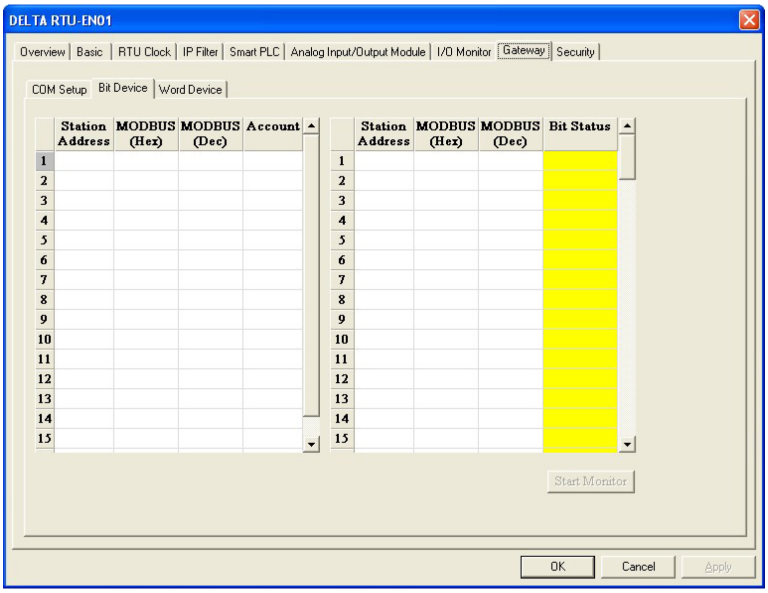
15.4.8.13 Setting up Gateway

RTU-EN01 supports Modbus TCP to RS-485 gateway functions. By configuring RTU-EN01, you can access the data in specific devices on the network. Gateway function enables fast data storage and retrieval, and supports real-time monitoring of up to 100 bit data and word data. The data can be temporarily stored in RTU-EN01, improving write/read speed and response time.



1. COM Setup

- COM2 Mode (RS-485):
  You can choose Modbus ASCII Master, Modbus RTU Master or Virtual COM.
- Baudrate:
  The baud rate for communication.
- Parity
- Data length
- Stop bits
- Station address:
  The Modbus address.



2. Bit device

For setting up the addresses for the bit type serial slave devices and reading their contents from the designated slave.

- Station address:

  Enter the address of the slave to be monitored. (Max. 16 slaves)

- MODBUS (Hex):

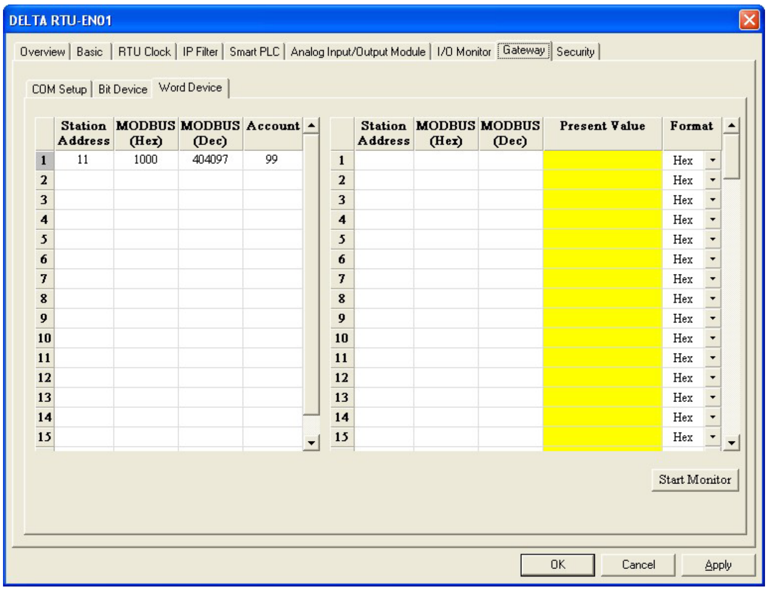
  Enter the hex Modbus address of the slave to be monitored.

- MODBUS (Dec):

  Enter the decimal Modbus address of the slave to be monitored.

- Account:

  Enter the quantity of devices of the slave to be monitored continuously (Max. 100).



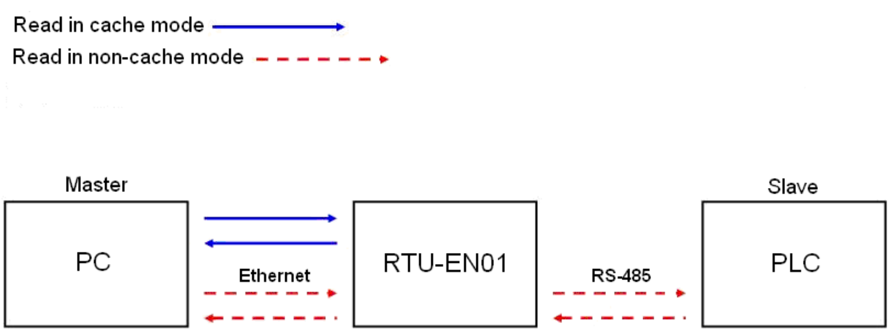
3. Word device

For setting up the addresses for the word type serial slave devices and reading their contents from the designated slave.

- Station address:
  Enter the address of the slave to be monitored. (Max. 16 slaves)
- MODBUS (Hex):
  Enter the hex Modbus address of the slave to be monitored.
- MODBUS (Dec):
  Enter the decimal Modbus address of the slave to be monitored.
- Account:
  Enter the quantity of devices of the slave to be monitored continuously (Max. 100).
  ▶ Once the information of slave monitoring is set, click "Apply" to save the setting and start the monitoring. Incomplete device information will be deleted.
- Format:
  Select the format of the register to be monitored, decimal (Dec), hexadecimal (Hex), or binary.
- Start/Stop monitor
  Start or stop the saved and applied device number to be monitored. Unapplied saved settings will be deleted.

Note:

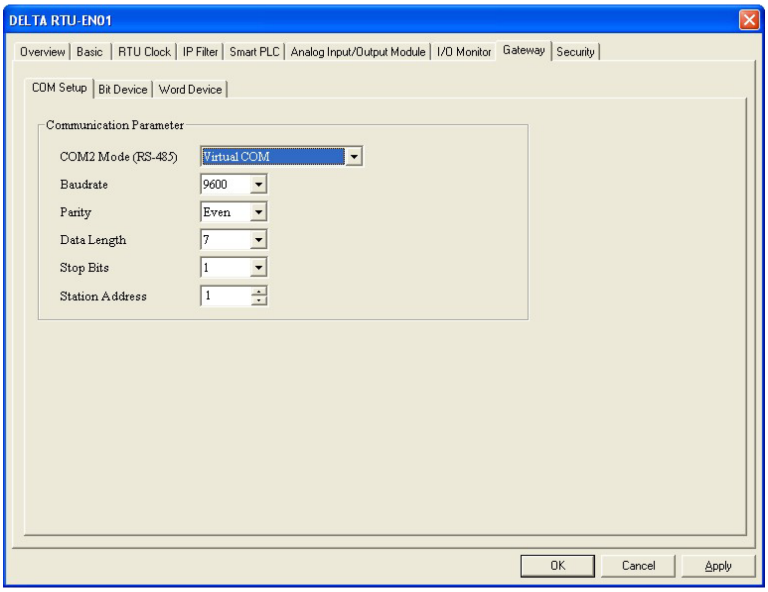
The default setting is cache-enabled mode. You can configure up to 16 sets of slave information for monitoring bits and words, with a maximum of 100 data points. In cache mode, you are able to send the read data back to the registers in RTU-EN01.



15.4.8.14 Virtual COM

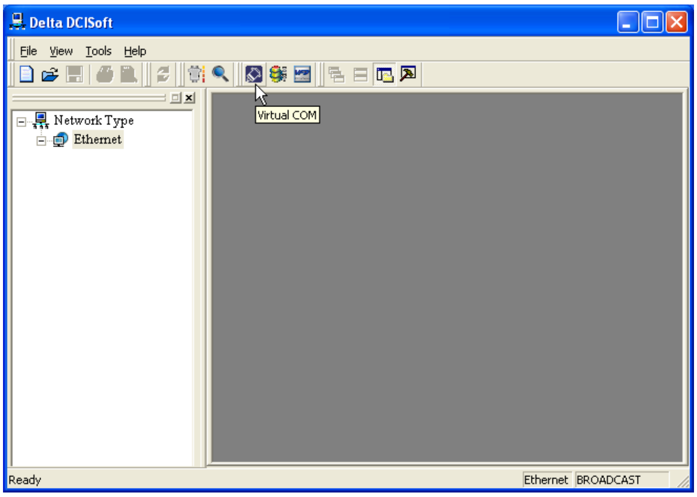
The virtual COM converts the data sent to RS-232 port into Ethernet.

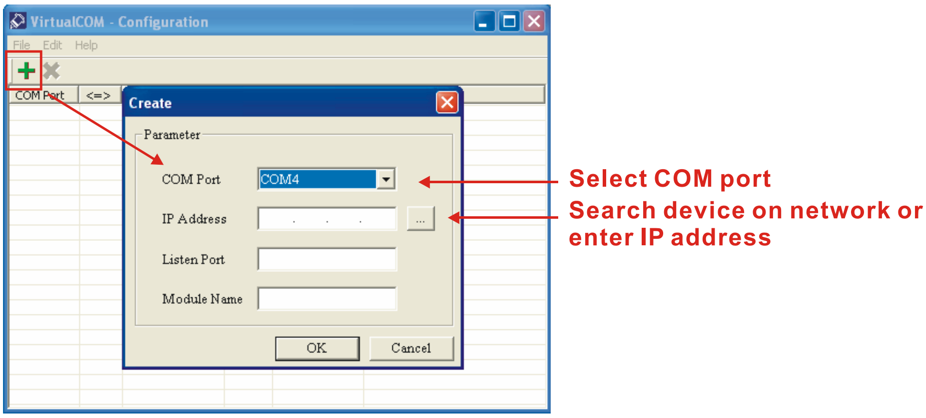
1. Select Virtual COM for COM2 mode (RS-485).



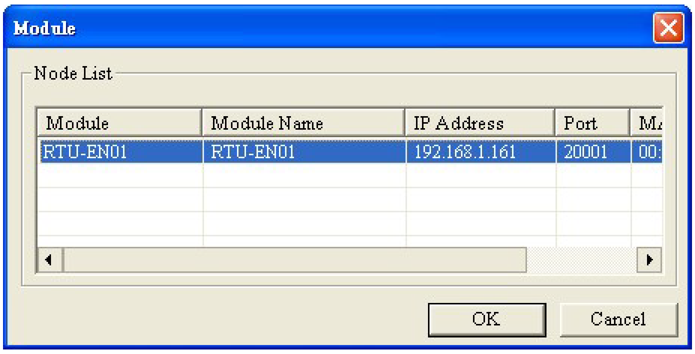
2. The default setting for listen port is 20001.

3. Open the setup page for Virtual COM.

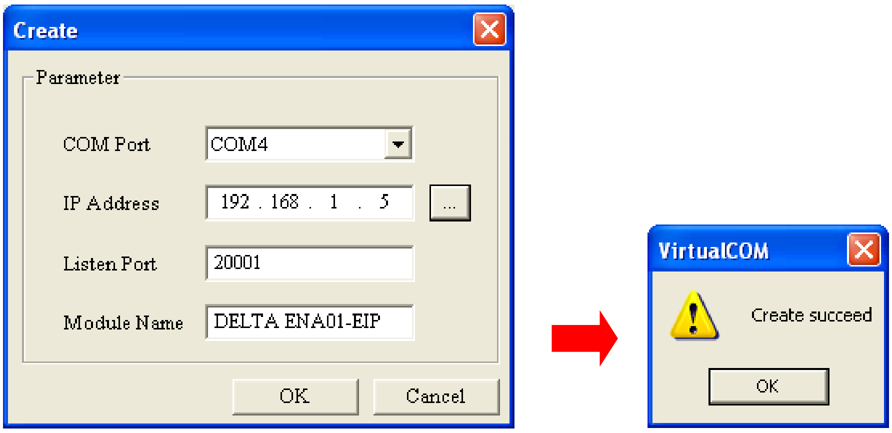




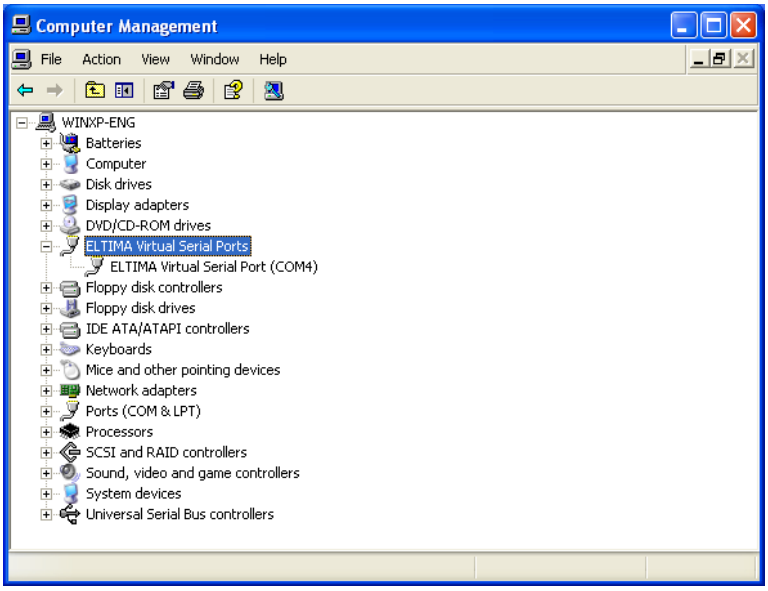
4. Press “Search”, and you will see all the connected devices on the network.



5. Select the device and click “OK”. Information on the device will be loaded in automatically. Press “OK” to complete the setup.

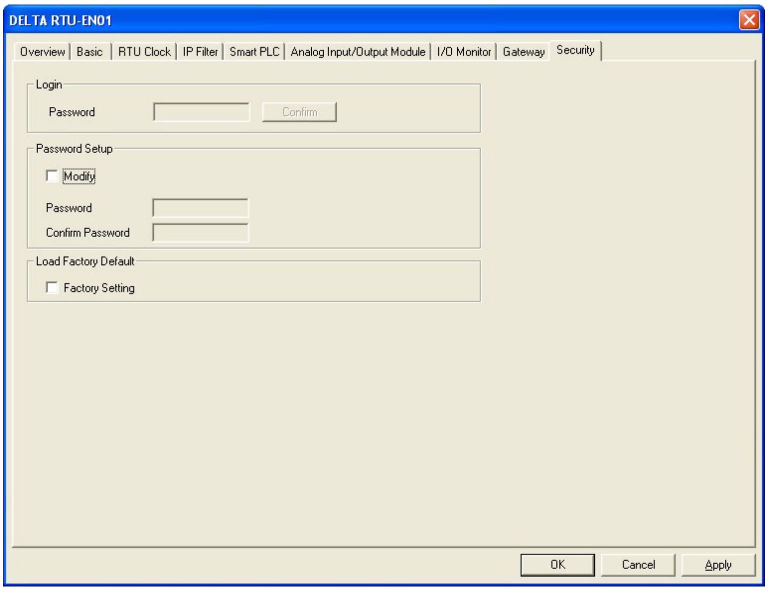


6. After the setup is completed, the newly configured virtual COM port will appear in “Computer Management”.



15.4.8.15 Security Setting

To prevent the set values in RTU-EN01 from being modified, you can set up passwords to lock the settings in RTU-EN01.



- Login:
  Log in to check and modify parameters.
- Password setup:
  Check the “Modify” box to set up the password.
- Password:
  Enter maximum 4 characters. Leave the field blank to clear the password.
- Confirm password:
  Enter the new password again.

Note:

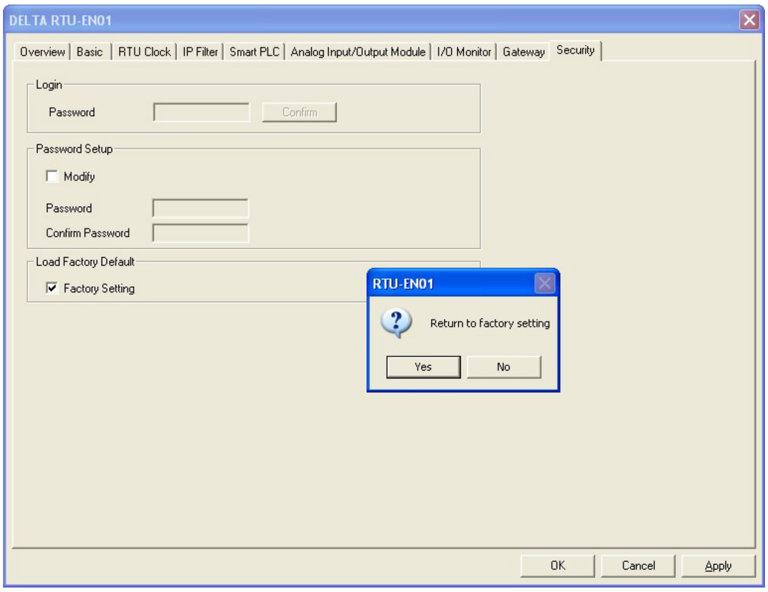
Once the password is locked, all the pages cannot be modified unless you unlock the password. However, if you set up RTU-EN01 by RS-232, you can return the setting to default value whether the password is locked or not. For example, if you have locked RTU-EN01 but forget the password, you must restore RTU-EN01 to default settings via RS-232, and all the configurations will return to default ones.

15.4.8.16 Returning to Default Settings

To restore all settings to their default values after making multiple modifications, check the “Factory Setting” box.

1. Returning to default settings

   Check “Factory Setting” box and click on “Yes”.



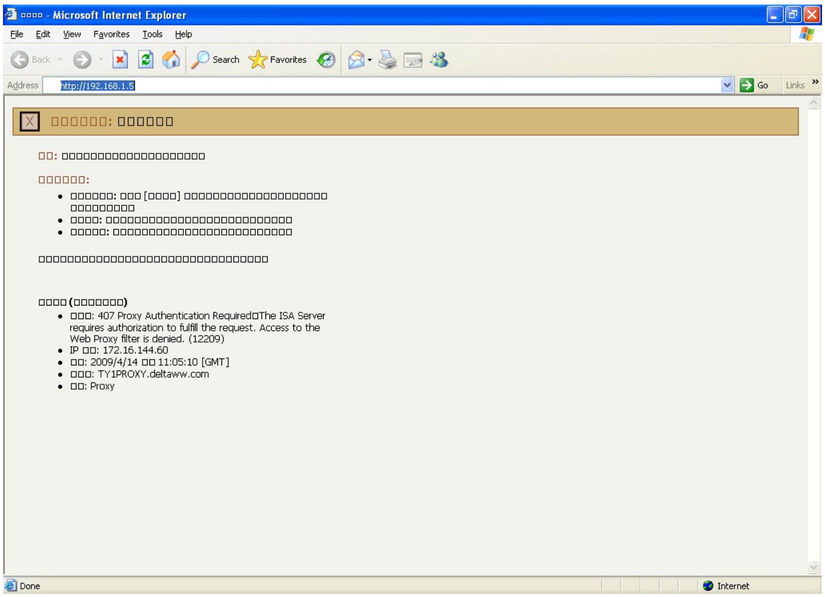
Note:

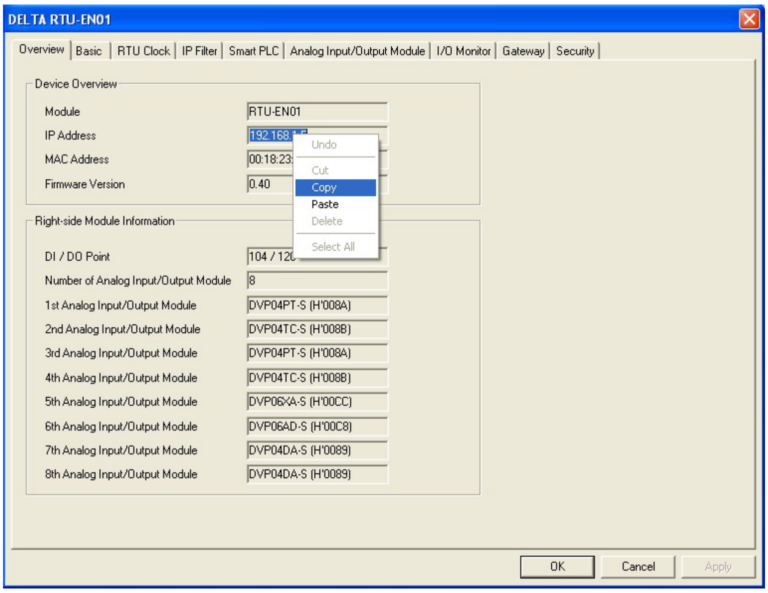
If you set up RTU-EN01 by RS-232, you can return to settings to default values whether the password is locked or not. It will take approximately 10 seconds to return to default settings, so DO NOT switch off the power within the 10 seconds.

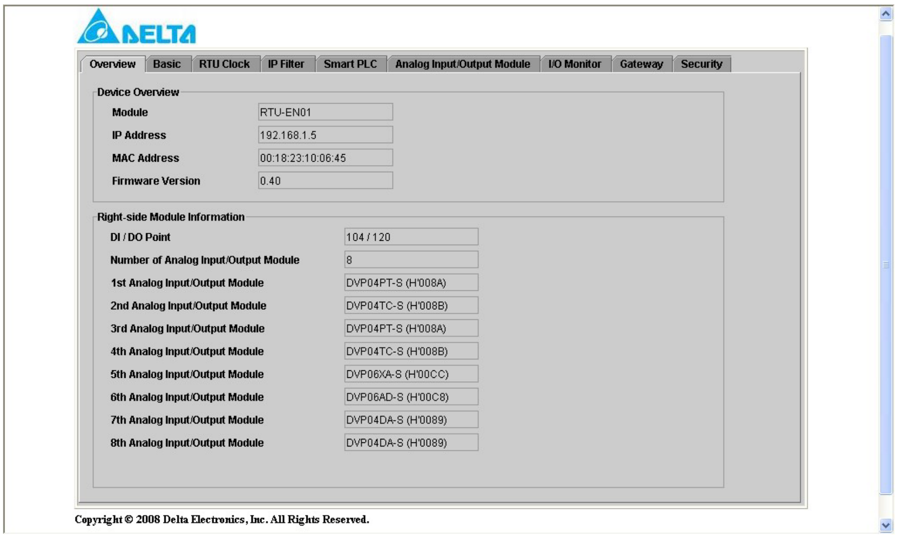
15.4.8.17 Web Function

RTU-EN01 offers Web function for the user to connect through Internet browser (e.g. Internet Explorer). You can set up and monitor RTU-EN01 by this function.

1. Refer to section 15.4.8 for the connection methods and communication setup instructions.
2. Open Internet browser and enter RTU-EN01's IP address "192.168.1.5" (default). You can also copy the IP address of RTU-EN01 in DCISoft and paste it to the address bar on the browser. Press "Enter" on keyboard to open the webpage.







3. To use the page of analog modules on the web, download “DeltaR-Side-S_ENU.eds” file from Delta’s website first and import the file to the page. Other settings are the same as the settings in DCISoft. Note: The webpage supports Java Runtime Environment (JRE) v1.4.2_xx and versions above.

4. Webpage troubleshooting

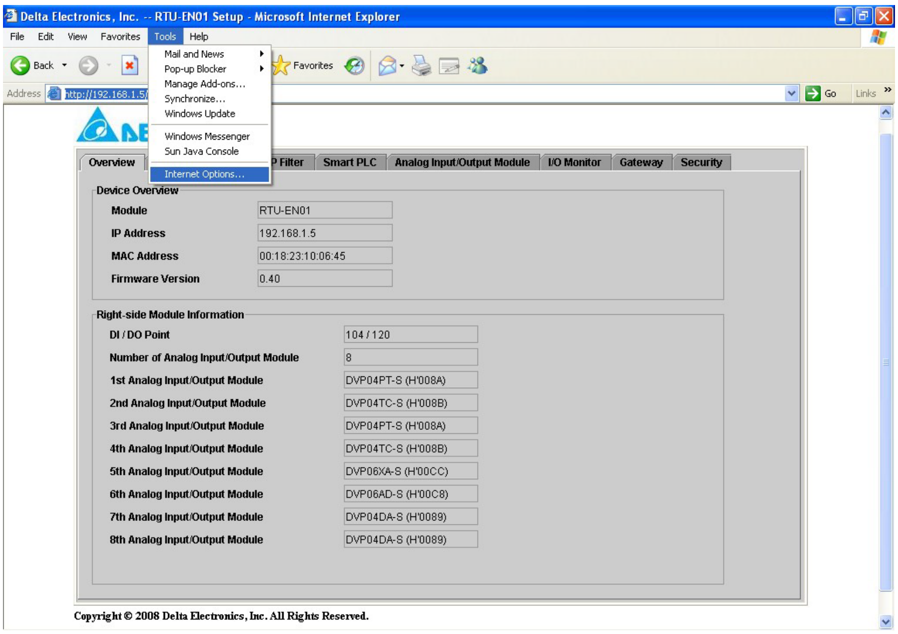
- Unable to connect:

(1) Check if Java is correctly installed. Connect to the Java page to confirm.

(2) Check Proxy settings. Close Proxy or set up exceptions.

- Close Proxy:

1. In IE, select “Tool” => “Internet Options…”.



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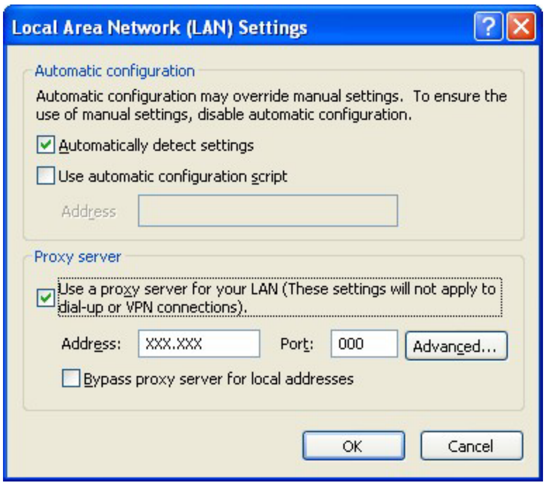
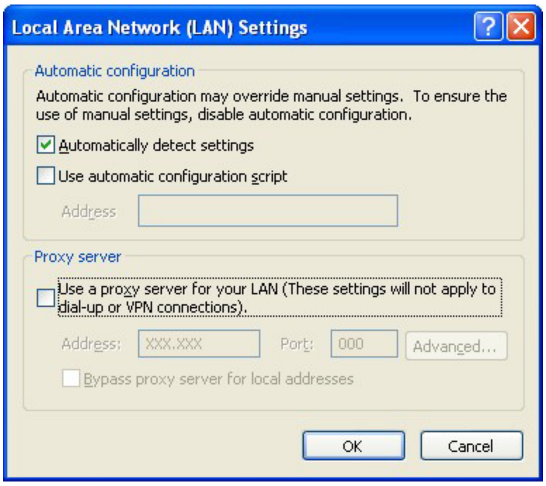
2. Select “Connections” and click “LAN Settings…".

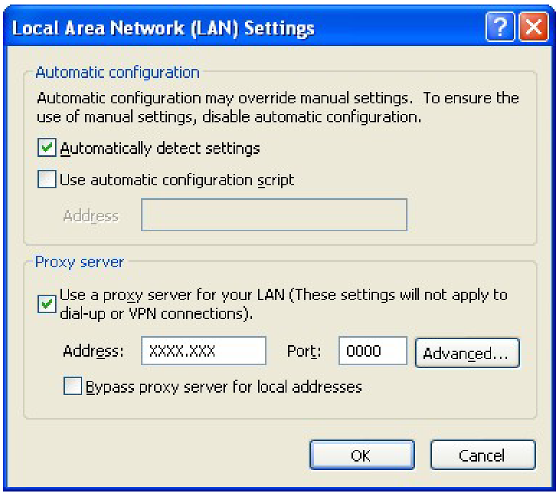
3. Uncheck “Proxy server” options and click "OK”.



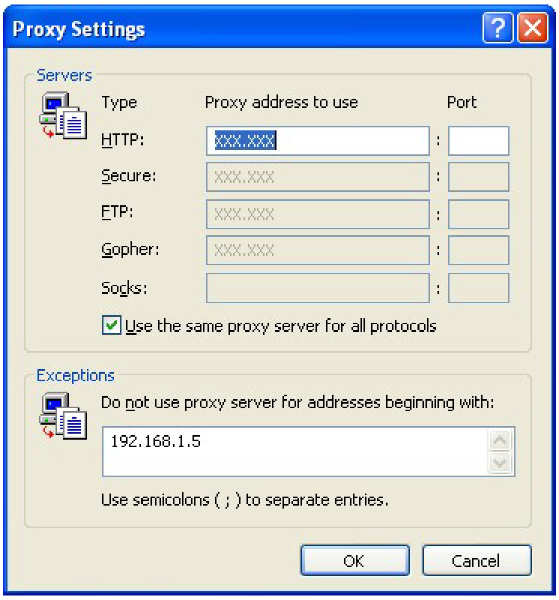


- Set up exceptions:

1. Click “Advanced…” on Local Area Network (LAN) Settings page.



2. Enter the IP address “192.168.1.5” of RTU-EN01 in Exceptions.

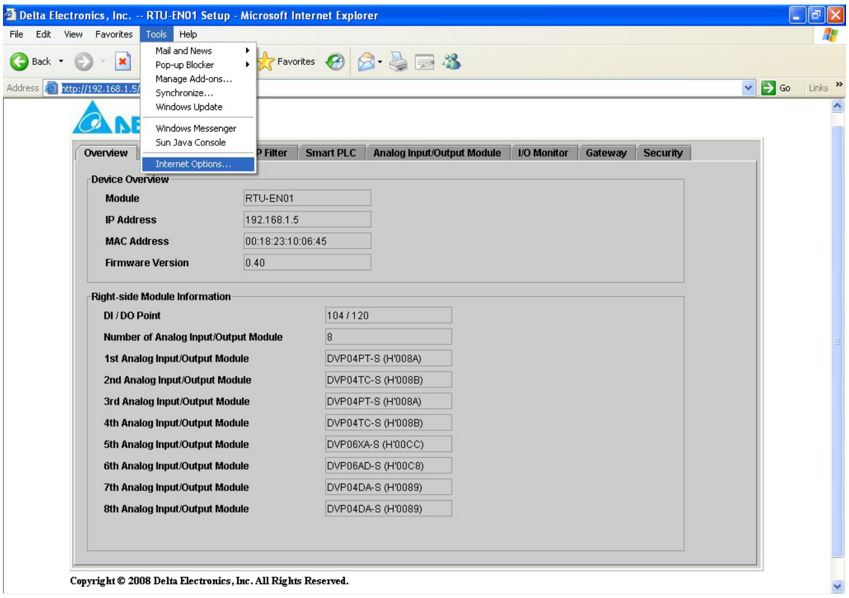


3. Click “OK”.

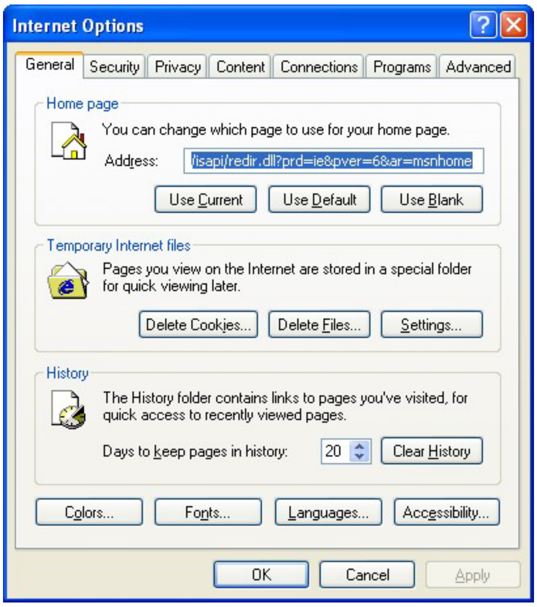
- Abnormal webpage action

Clear temporary Internet files:

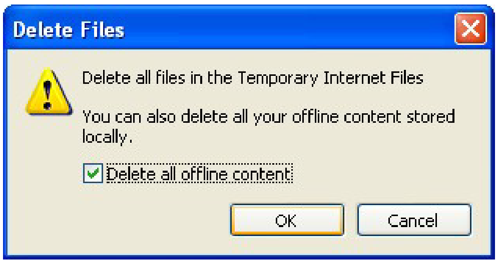
1. In IE, select “Tool” => “Internet Options…”.



2. In “General” page, click “Delete Files…” in Temporary Internet files column.



3. Check “Delete all offline content” and click "OK" .



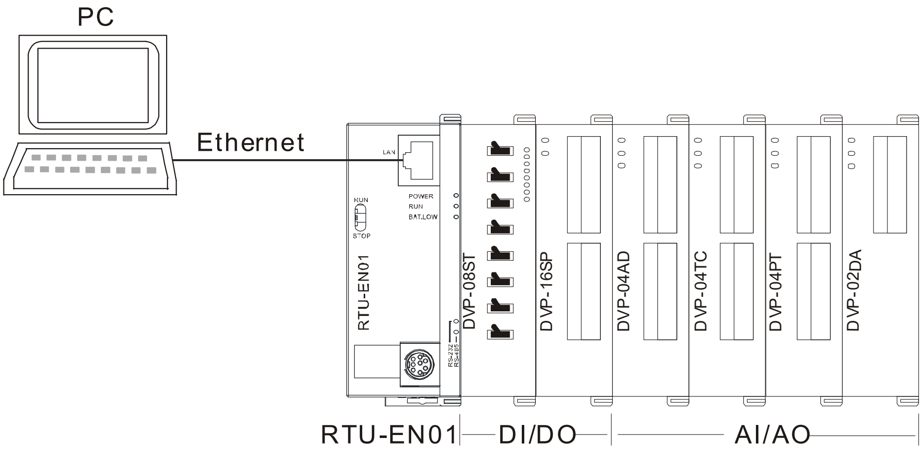
4. Click “OK” to leave the “General” page.

15.4.9 Application Examples – DCISoft

15.4.9.1 Smart PLC: IF-THEN

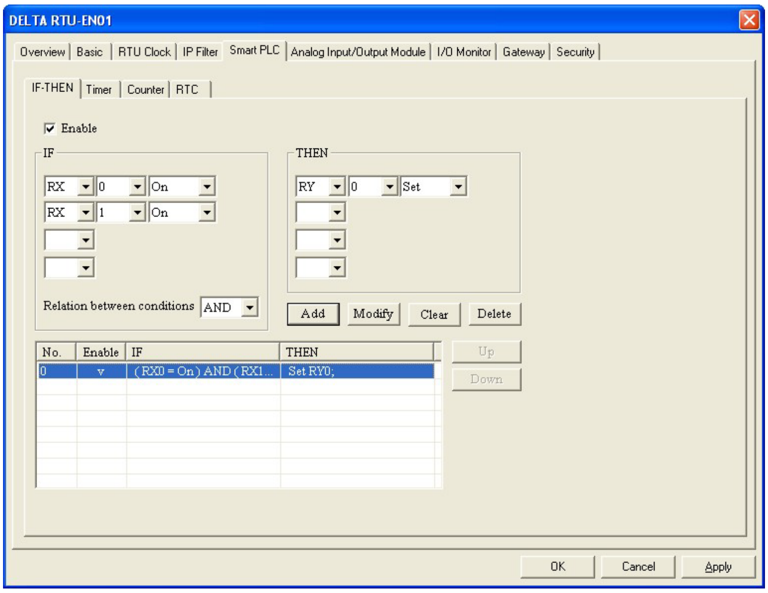
Application	Setting up IF-THEN in Smart PLC functions by using DCISoft.
Steps	(1) When RX#0 and RX#1 are ON, set RY0 to ON. (2) When RX#2 turns from OFF to ON, toggle RY1 (reversing its direction).

1. See the connection method as below. For communication setup instructions, please refer to section 15.4.8.

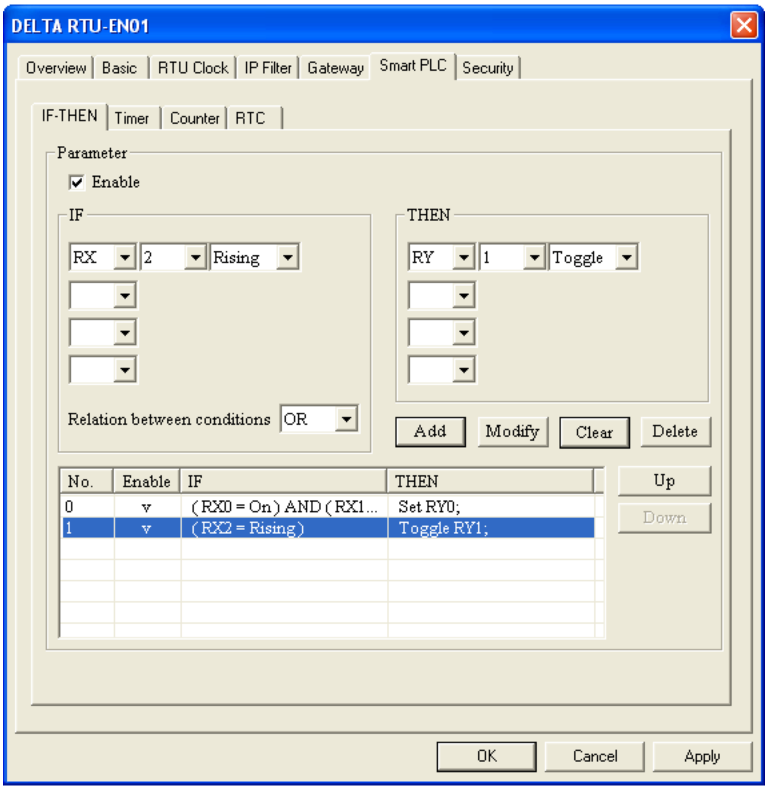


2. Open the setup page and select "Smart PLC".

3. Select "RX 0 On" and "RX 1 On" in the IF column and select "AND" for the relation between conditions. Next, select "RY 0 Set" in the THEN column and press "Add" to add the settings into the table below.



4. Select “RX 2 Rising” in the IF column and “RY 1 Toggle” in the THEN column.
   Press “Add” to add the settings into the table below. Press “Apply” to store these settings into RTU-EN01.



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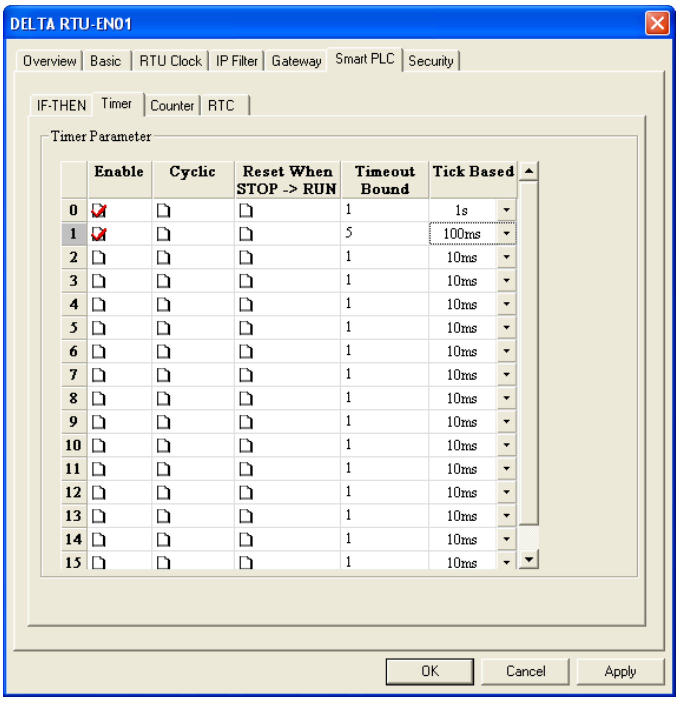
15.4.9.2 Smart PLC: Timer

Application	Setting up Smart PLC functions by DCISoft. After RY0 is On for 1 second, it will turn Off for 500 ms. This will repeat in cycle.
Steps	(1) Set up the timer: Timer 0= 1 s; Timer 1= 500 ms. (2) Set up IF-THEN: When the timing reaches the target, RY0 will be On or Off.

1. Open the setup page and select “Smart PLC”. Then, select “Timer”.

2. Check to “Enable” Timer 0 and Timer 1 and set Timer 0 to “1 s” and Timer 1 to “500 ms”. Click “Apply” to write the settings into RTU-EN01.

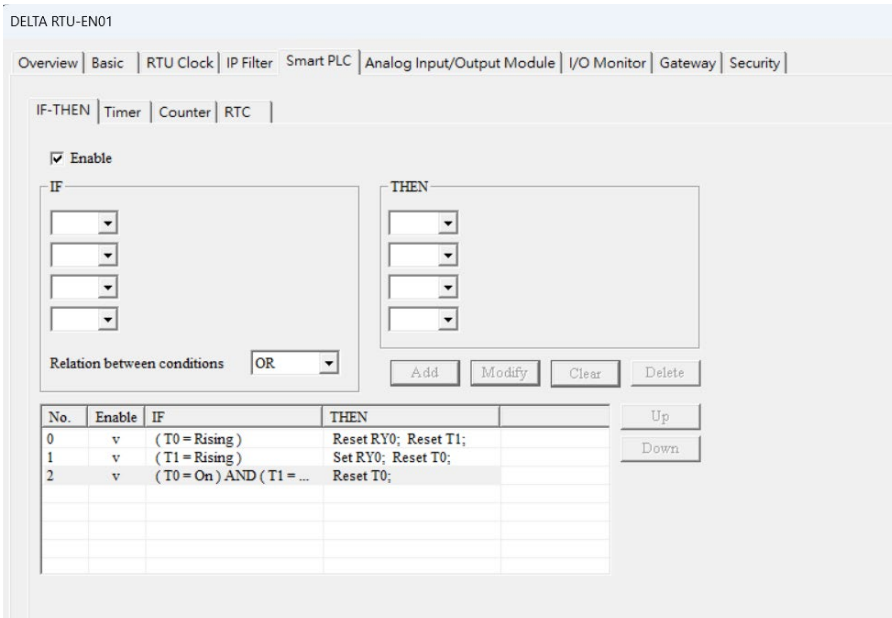


1. Switch to “IF-THEN” page and check the “Enable” box.

3. Select “T 0 Rising” in the IF column and “RY 0 Reset”, “T 1 Reset” in the THEN column. Click on “Add” to add the settings to the table below and press “OK” to save the settings into RTU-EN01.

4. Select “T 1 Rising” in the IF column and “RY 0 Set”, “T 0 Reset” in the THEN column. Click on “Add” to add the settings to the table below and press “OK” to save the settings into RTU-EN01.

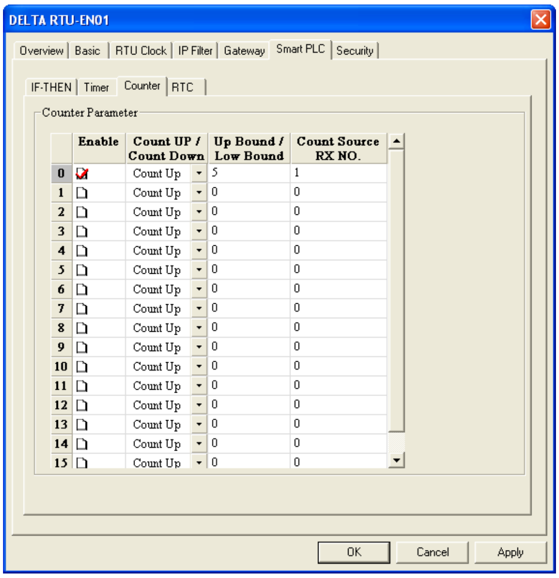
5. Select “T 0 On”, “T 1 On”, “AND” in the IF column and “T 0 Reset” in the THEN column. Click on “Add” to add the settings to the table below and press “OK” to save the settings into RTU-EN01.


DELTA RTU-EN01
Overview
Basic
RTU Clock
IP Filter
Smart PLC
Analog Input/Output Module
I/O Monitor
Gateway
Security
IF-THEN
Timer
Counter
RTC
Enable
IF
THEN
Relation between conditions
OR
Add
Modify
Clear
Delete
No.
Enable
IF
THEN
Up
Down
0 v (T0 = Rising) Reset RY0; Reset T1;
1 v (T1 = Rising) Set RY0; Reset T0;
2 v (T0 = On) AND (T1 = ... Reset T0;

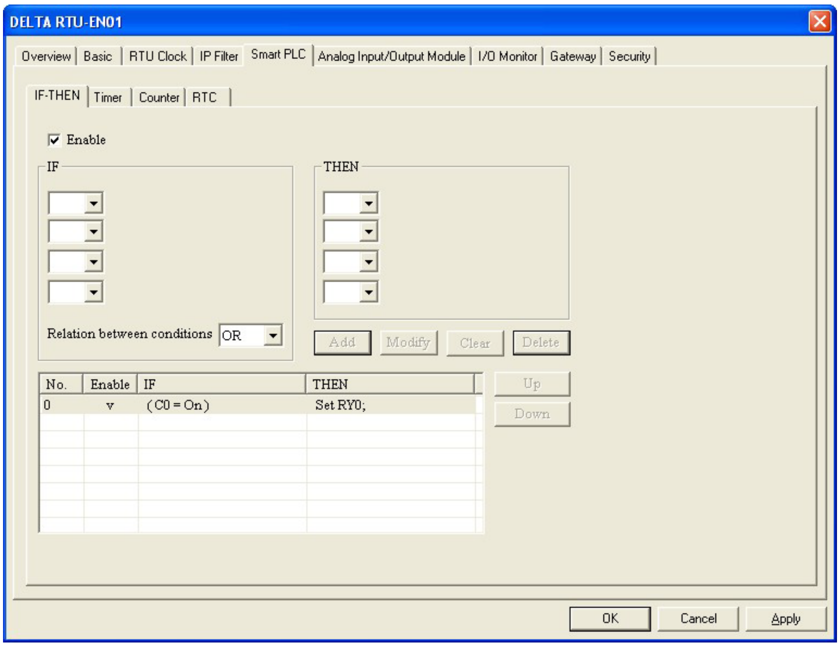
15.4.9.3 Smart PLC: Counter

Application	Setting up the counter by DCISoft. Once RX#1 counts for 5 times, RY0 will output.
Steps	(1) Set up counter C0: RX#1 counts up 5 times and reaches the target. (2) Set up IF-THEN: When the counting reaches the target, RY0 will output.

1. Open the setup page and select “Smart PLC”. Then, select “Counter”.
2. Check to “Enable” Counter 0, select “Count Up”, set Up Bound to “5” and Count Source RX NO. to RX”1”. Click “Apply” to write these settings into RTU-EN01.



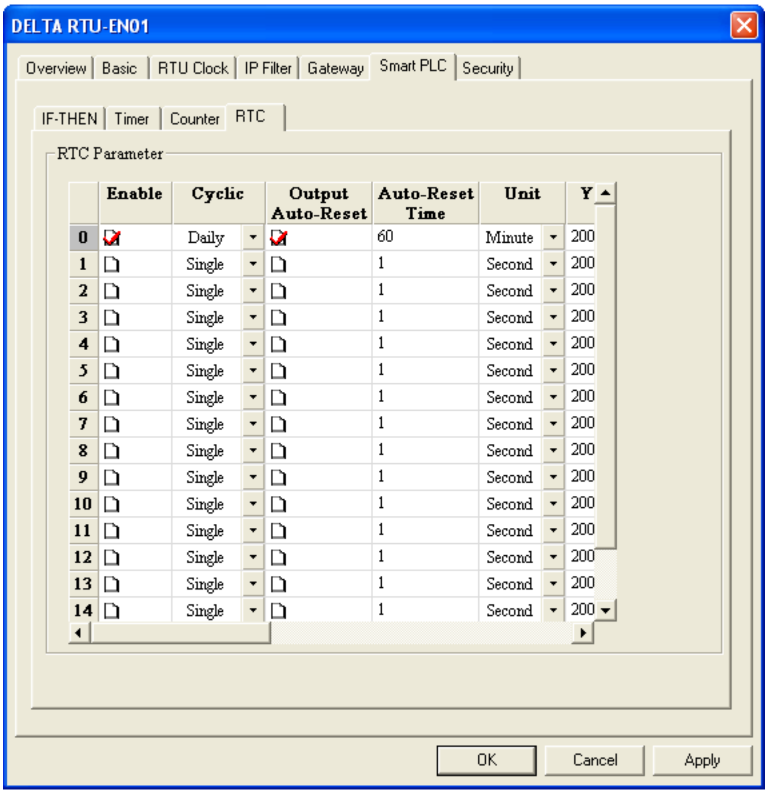
3. Switch to “IF-THEN” page and check the “Enable” box. Select “C 0 On” in the IF column and “RY 0 Set” in the THEN column. Click on “Add” to add the settings to the table below and press “OK” to save the settings into RTU-EN01.

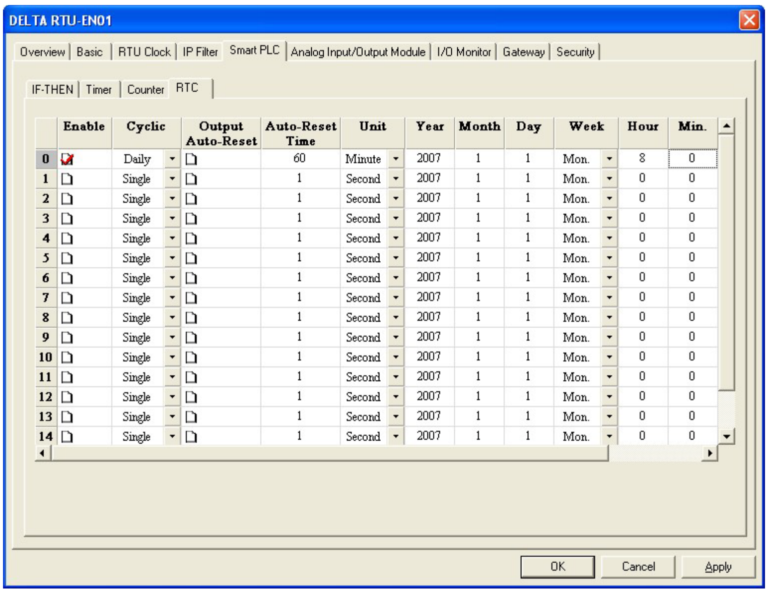


15.4.9.4 Smart PLC: RTC

Application	Setting up Smart PLC function by DCISoft. RY0 turns On at 08:00 and Off at 09:00 every day.
Steps	(1) Set up the RTC to be On at 08:00 every day and continue to be On for 1 hour. (2) Set up IF-THEN: When the timing reaches the target, RY0 will be On or Off.

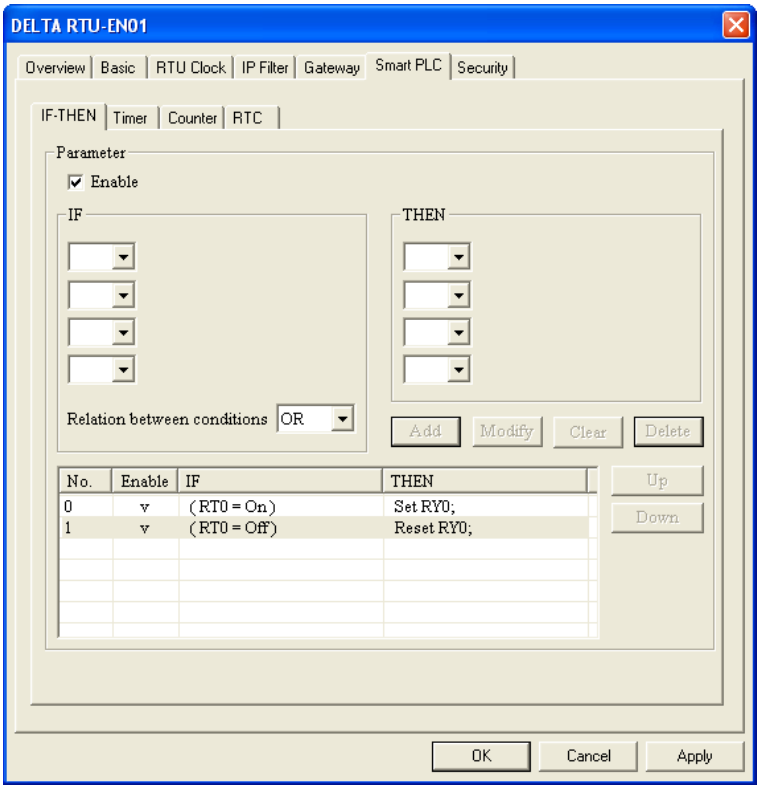
1. Open the setup page and select “Smart PLC”. Then, select “RTC”.
2. Check “Enable” of RTC 0 and set Cyclic to “Daily”, Auto-Reset Time to “60 Minute” and enabling time to 08:00:00. Press “Apply” to write the settings into RTU-EN01.





3. Switch to “IF-THEN” page. Check the “Enable” box and select “RT0 On” in the IF column and “RY 0 Set” in the THEN column. Press “Add” to add the settings to the table below.

4. Check “Enable” and select “RT0 Off” in the IF column and “RY 0 Reset” in the THEN column. Press “Add” to add the settings to the table below and click “OK” to save the settings into RTU-EN01.

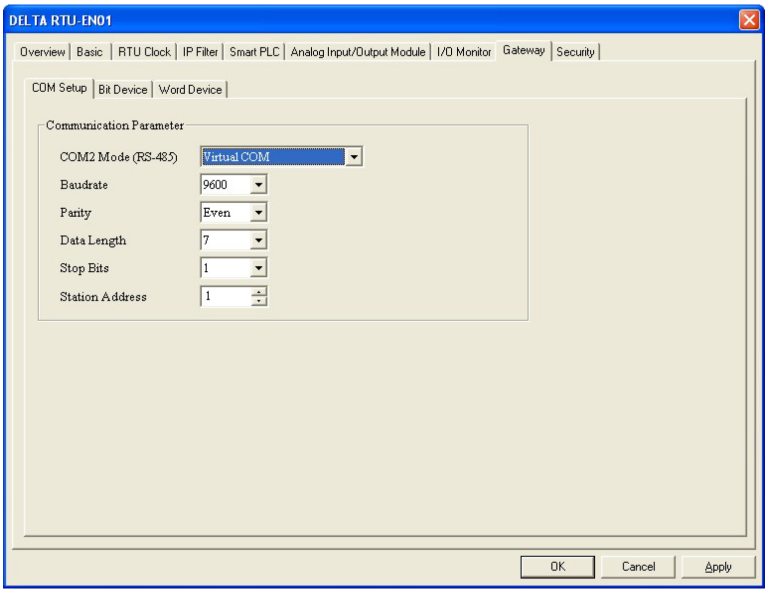


15.4.9.5 Virtual COM

Application	The virtual COM converts the data sent to RS-232 port into Ethernet. Virtual COM only connects to software supporting serial ports, e.g. Delta WPLSoft, VFDSoft, ASDASoft. See the examples below for how to connect VFD-E series AC motor drive to VFDSoft through by virtual COM.
Steps	(1) Select user-defined protocol and set the communication parameters for serial master/slave to the same as the parameters in VFD-E. (2) Set up virtual COM. (3) Open Delta VFDSoft, set up the communication format and establish the connection.

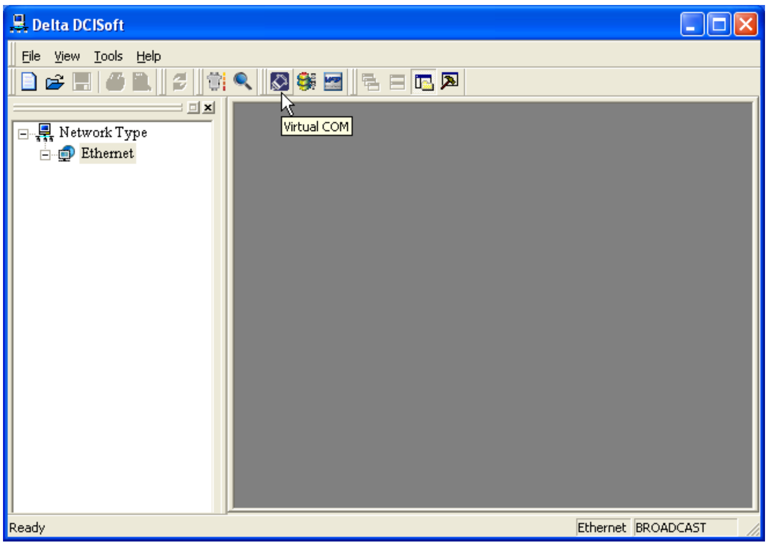
1. Setting up virtual COM

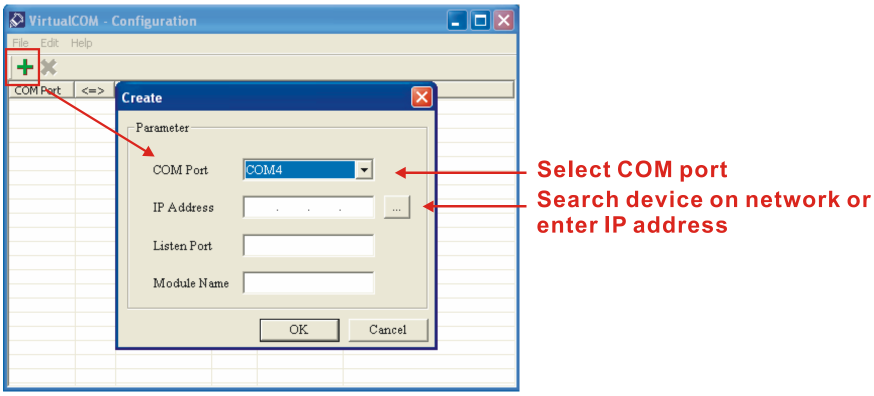
   a. Select Virtual COM for COM2 mode (RS-485) and set up the same communication parameters as those in VFD-E.



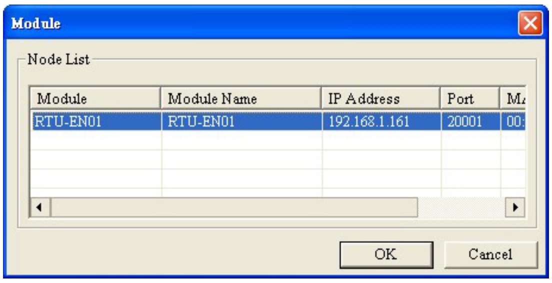
   b. The default setting for listen port is 20001.

   c. Open the setup page for Virtual COM.

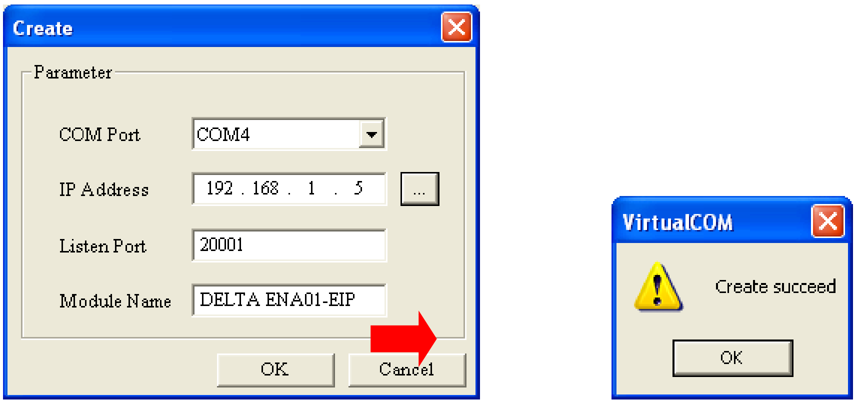




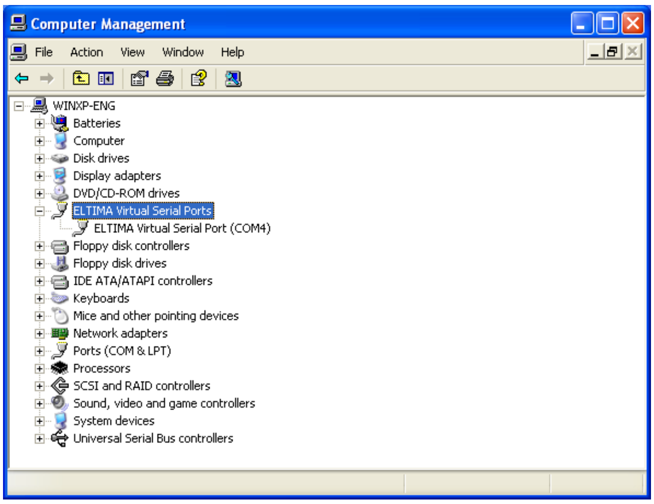
d. Press “Search” and you will see all the connected devices on the network.



e. Select the device and click “OK”. Information on the device will be loaded automatically. Press “OK” to complete the setup.

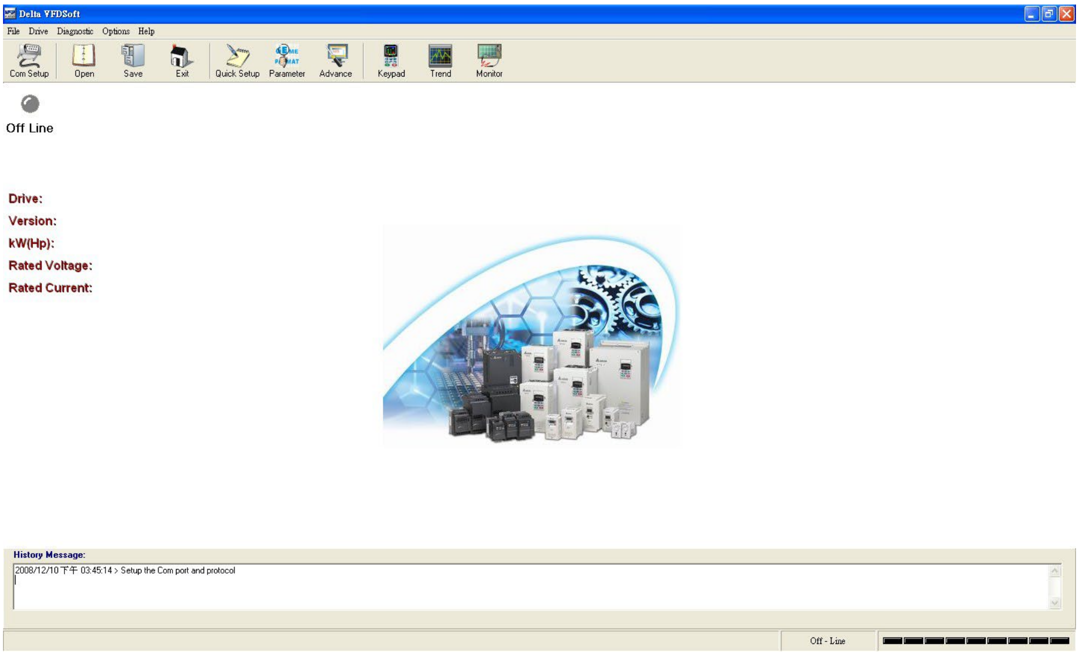


f. After the setup is completed, the newly configured virtual COM port will appear in “Computer Management”.



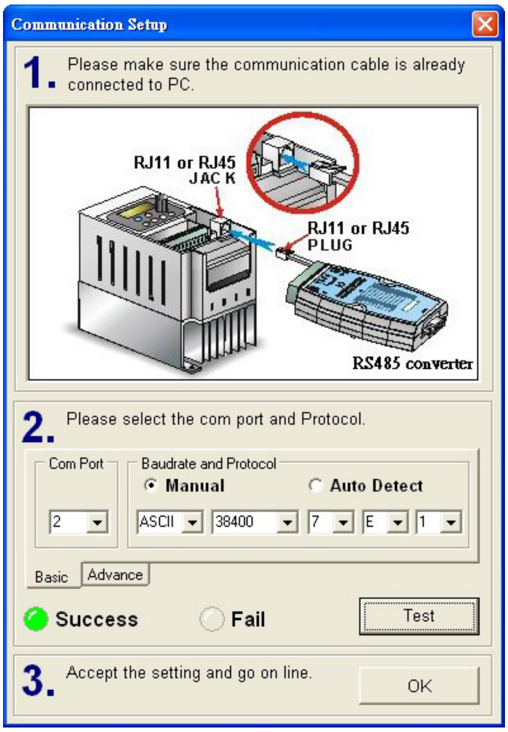
2. Use Virtual COM in Delta VFDSoft.

   a. Open Delta VFDSoft.



   b. Set up communication format

   Use the Virtual COM (COM2) previously set for the setting of “Com Port”. Next, enter the communication format (38400, 7, E, 1) for VFD-E. Click “Test”. A green flash indicates that the communication test is successful.



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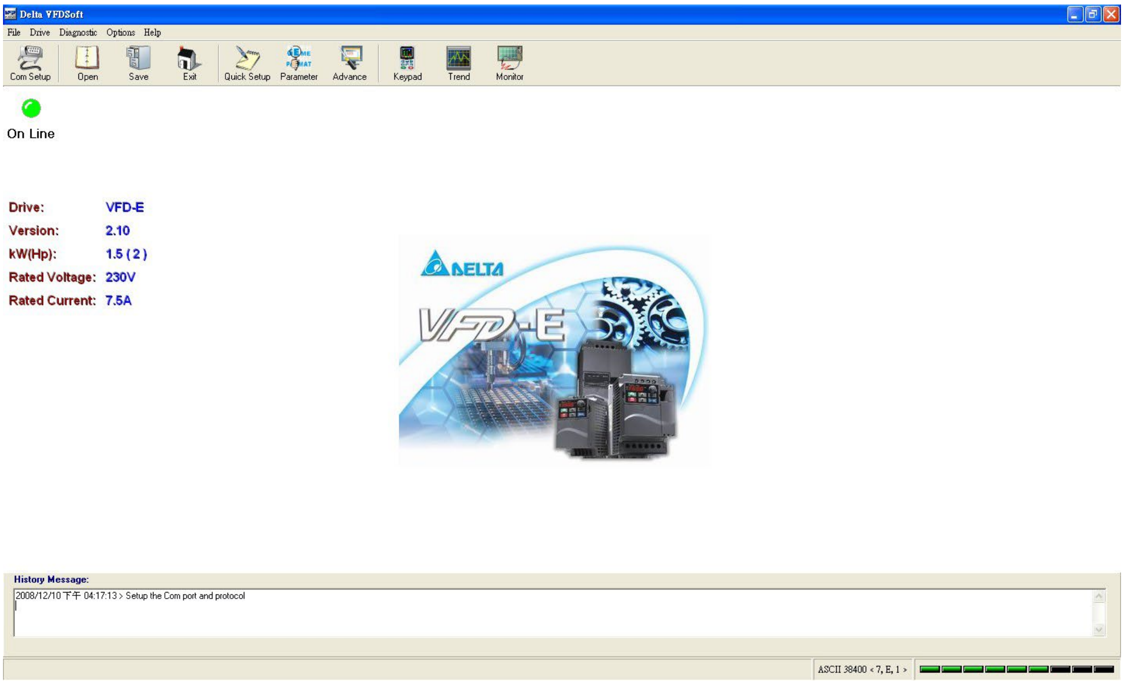
c. Click “OK” to establish a connection with VFD-D by VFDSoft.



15.5 RTU-PN12

15.5.1 Introduction

Thank you for choosing Delta RTU-PN12 module. To ensure correct installation and operation of the product, please read this operation manual carefully before use.

This manual only provides introductory information on RTU-PN12. For more detailed information on the PROFINET protocol, please refer to relevant references or literatures.

The PROFINET remote module, RTU-PN12 can be connected to the DVP-S series I/O modules, supporting digital modules and special modules.

15.5.1.1 Features

- Compliant with the PROFINET protocol, supporting the RT (Real-Time) communication
- Built-in digital I/O points: 8 DI and 8 DO (NPN output)
- Four channels of high-speed counters; counting modes: Single pulse, Pulse+direction, CW/CCW and A/B phase. Max input frequency: 200 kHz, and the Compare function is supported
- Four high-speed pulse output channels; output modes: Pulse+direction, A/B phase and CW/CCW Max output frequency: 200 kHz (Up to 100 kHz for A/B phase output)
- Built-in input points X3 and X7 both support the touch probe, counter gate control, and counter preset functions.
- RTU-PN12 supports dual-channel dual-touch probe captures.
- Up to 14 right-side extension modules (max 8 special modules; 128 DI+128 DO points)
- The I/O mapping allows bit-level, byte-level and word-level access.
- Fault shutdown*: RTU-PN12 outputs the fail-mode preset values and stops refreshing
- Webpage-based firmware update

*Note: The fault shutdown may happen in any of the following situations:

1. The backend stops running;
2. The PROFINET bus enters non-operational state by removing the cable or manually switching the state;
3. Local bus communication stops.

15.5.1.2 Specifications

- **Communication**

Item	Specification
Communication protocol	PROFINET
Communication port	100 Mbps / RJ45x2
Transmission rate	100 Mbps
Transmission cable	Category 5e or above
Max. transmission distance	100 meters
Topology type	Linear and star
Minimum cycle time for data exchange	1 ms

- **Electrical specifications**

Item	Specification
Supply voltage	24 VDC (20.4 VDC to 28.8 VDC) (-15% to +20%)
Fuse capacity	2.5 A/30 VDC
Power consumption	2 W
Power supply electricity	32 W
Protection	24 VDC output equipped with short-circuit protection and over-current protection.
Surge voltage protection	0.5 kV
Grounding	The ground wire diameter should not be less than the diameters of the cables connected to the terminals 24 V and 0 V.
Communication port isolation	Coupling Voltage: 1 kV
Weight	112 g

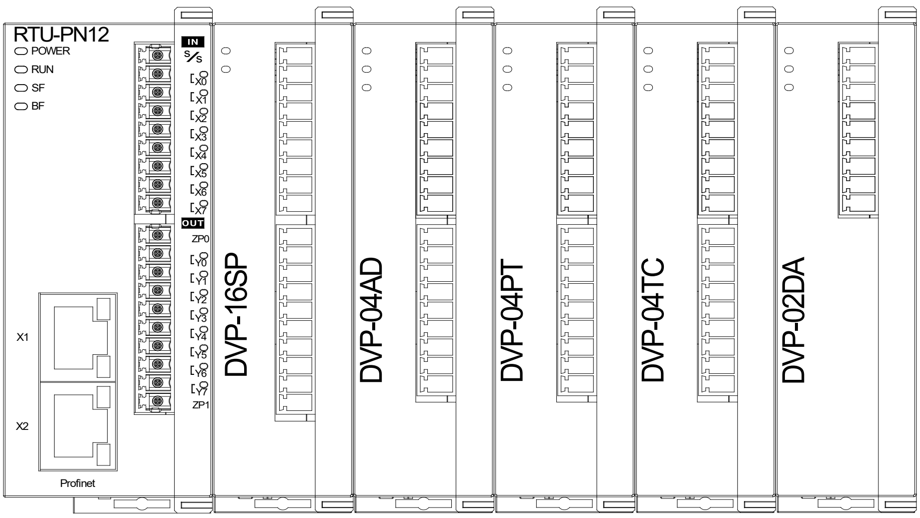
- **Electrical specifications for built-in digital inputs of RTU-PN12 (24 VDC)**

Item		Specification
Number of inputs		8 (X0 to X7)
Connector type		Removable terminal block
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
	ON→OFF	X0 to X7: < 2.5 μs
Maximum input frequency		X0 to X7: 200 kHz
Input impedance		4.7 KΩ
Digital input isolation		Coupling Voltage: 1 kV
Input display		The input LED indicators are ON.

- **Electrical specifications for built-in digital outputs of RTU-PN12**

Item		Specification
Connector type		Removable terminal block
Output form		Transistor-T (sinking)
Number of digital outputs		8 points (Y0 to Y7)
Voltage		5 to 30 VDC
Maximum load	**Resistance**	0.5 A
	Inductance	N/A
	Bulb	N/A
Switching frequency*1	**Resistance**	200 kHz
	Inductance	N/A
	Bulb	N/A
Maximum Response time	**OFF→ON**	2.5 μs
	ON→OFF	
Digital output isolation		Coupling Voltage: 1 kV

15.5.1.3 Extension Modules Connectable to RTU-PN12



- List of digital modules that RTU-PN12 supports:

Digital module (Model name)	Default I/O mapping data (Master → RTU-PN12) (Unit: bits)	Default I/O mapping data (RTU-PN12 → Master) (Unit: bits)
DVP08SM11N	N/A	8
DVP08SM10N	N/A	8
DVP16SM11N	N/A	16
DVP06SN11R	8	N/A
DVP08SN11R/T	8	N/A
DVP08SN11TS	8	N/A
DVP16SN11T	16	N/A
DVP16SN11TS	16	N/A
DVP08SP11R/T	8	8
DVP08SP11TS	8	8
DVP16SP11R/T	8	8
DVP16SP11TS	8	8
DVP32SM11N	N/A	32
DVP32SN11TN	32	N/A
DVP08ST11N	N/A	8

- List of special modules that RTU-PN12 supports:

Special module (Model name)	Default I/O mapping data (Master → RTU-PN12)		Default I/O mapping data (RTU-PN12 → Master)	
	Starting Control Register (CR)	Mapping data length (Unit: Words)	Starting Control Register (CR)	Mapping data length (Unit: Words)
DVP02DA-S	CR#10	2	N/A	N/A
DVP02DA-S2	CR#10	2	N/A	N/A
DVP04DA-S	CR#6	4	N/A	N/A
DVP04DA-S2	CR#6	4	N/A	N/A
DVP04AD-S	N/A	N/A	CR#12	4
DVP04AD-S2	N/A	N/A	CR#12	4
DVP06AD-S	N/A	N/A	CR#12	6
DVP06AD-S2	N/A	N/A	CR#12	6
DVP04TC-S	N/A	N/A	CR#14	4
DVP04PT-S	N/A	N/A	CR#18	4
DVP06PT-S	N/A	N/A	CR#18	6
DVP06XA-S	CR#10	2	CR#12	4
DVP06XA-S2	CR#10	2	CR#12	4

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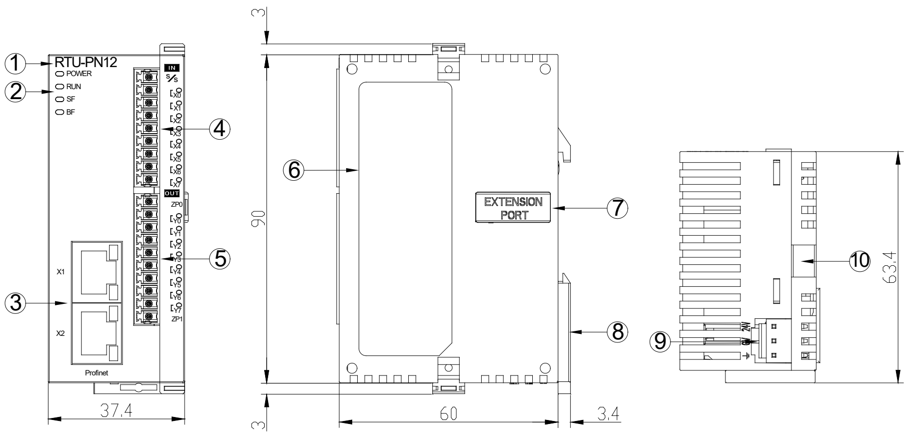
15.5.2 Module Profiles and Dimensions



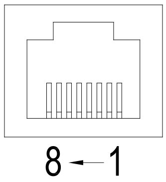
Unit: mm

No.	Name	Description
1	Model name	Model name of the module
2	Power LED indicator (Green)	Indicates the state of the power supply ON: The power is on OFF: No power
	RUN LED indicator (Green)	Indicates the initialization state of the module ON: Initialization success. OFF: Initialization failure or the power supply is NOT normal.
	SF LED indicator (Red)	Indicates the system state of the module ON: 1. The module is initializing; 2. Low voltage occurs. Blinking: 1. Abnormal right-side module 2. Right-side module configuration mismatch OFF: The system is operating fine.
	BF LED indicator (Red)	Indicates the connection state of the module. ON: No connection at the PROFINET port. Blinking: The connection is fine but the communication with PN-Controller is NOT normal. OFF: The communication with PN-Controller is normal.
3	PROFINET port X1	Connects to the PROFINET network
	PROFINET port X2	Connects to the PROFINET network
4	Built-in high-speed input interface	For general-purpose input and high-speed counting
5	Built-in high-speed output interface	For general-purpose output and high-speed pulse output
6	Label	Nameplate
7	Extension port	Connects to the extension module
8	DIN rail clip	Secures the module onto the DIN rail
9	Power input port	24 V DC power input for the module
10	Extension unit fixing clip	Secures the extension module

15.5.3 Terminals

15.5.3.1 PROFINET Ports: X1 and X2

The two RJ-45 Ports, X1 and X2 are for the connection to a PROFINET network.

Definition of PROFINET Port (RJ-45) Pins				
	Pin No.	Signal	Pin No.	Signal
	1	TX+	5	N/C
	2	TX-	6	RX-
	3	RX+	7	N/C
	4	N/C	8	N/C

15.5.3.2 High-speed Input and Output Interfaces

The RTU-PN12 module is equipped with eight built-in input and eight output points. These points can be configured for general-purpose I/O or high-speed pulse output. For high-speed counting and pulse output, the points are utilized in pairs to form individual channels, supporting four-channel high-speed counting and four-channel high-speed pulse output.

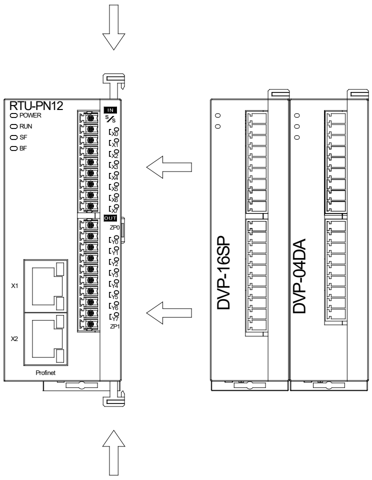
Input			Output		
Input point	Counter channel	Counting mode	Output point	Pulse output channel	Pulse output mode
X0	CH1 High-speed counter	Single pulse, Pulse+direction, CW/CCW and A/B phase (the maximum input frequency: 200 kHz)	Y0	CH1 High-speed pulse output	Pulse+direction, A/B phase and CW/CCW (the maximum output frequency: 200 kHz)
X1			Y1		
X2	CH2 High-speed counter		Y2	CH2 High-speed pulse output channel	
X3			Y3		
X4	CH3 High-speed counter		Y4	CH3 High-speed pulse output	
X5			Y5		
X6	CH4 High-speed counter		Y6	CH4 High-speed pulse output	
X7			Y7		

NOTE: Maximum output frequency for A/B phase: 100 kHz

15.5.4 Installation

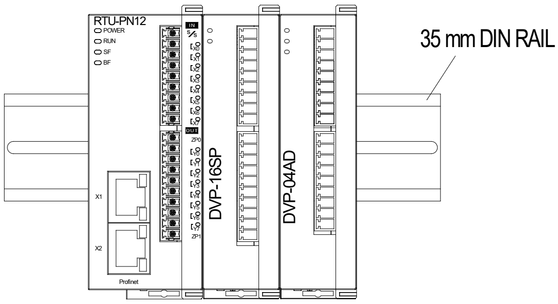
15.5.4.1 Connecting I/O Modules to RTU-PN12

- Open the top and bottom fixing clips of the RTU-PN12 module.
- Align the DVP-S series I/O modules with the positioning hole of RTU-PN12, and push the modules together until fully seated.
- Press both clips of the RTU-PN12 module to lock the I/O modules in place.



15.5.4.2 Installing RTU-PN12 with I/O Modules on DIN Rail

- Use a standard 35 mm DIN rail.
- Open the DIN rail clips on the RTU-PN12 and its I/O modules, and then press the entire assembly (RTU-PN12 with I/O modules) onto the DIN rail until fully seated.
- Push all DIN rail clips back to firmly secure the RTU-PN12 and its I/O modules onto the DIN rail.



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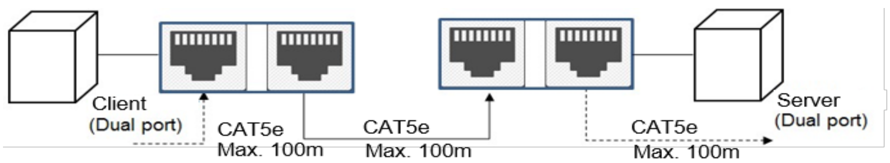
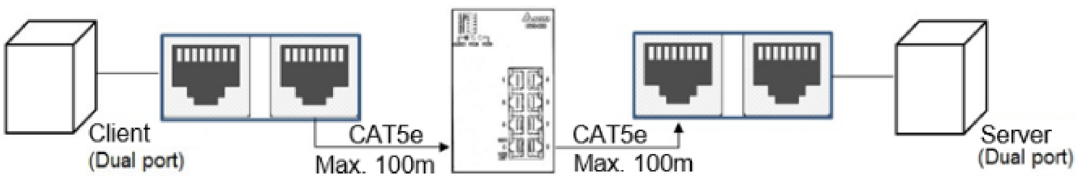
15.5.4.3 Connecting to the PROFINET Network

- **Linear topology**



- **Star topology**



15.5.5 Wiring

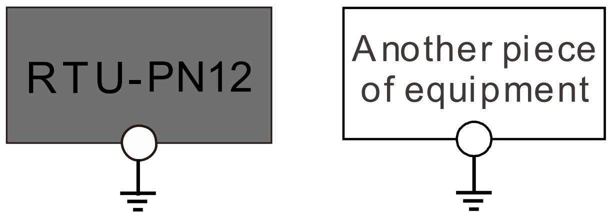
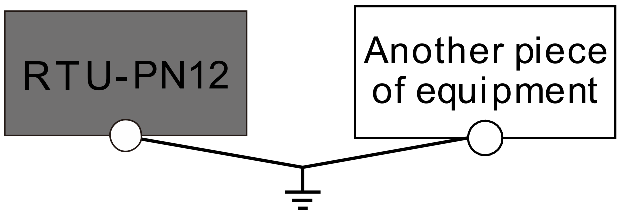
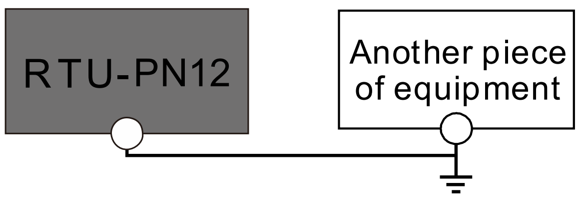
15.5.5.1 Power Input Wiring

15.5.5.1.1 Notes

The RTU-PN12's power input requires a 24V DC power supply. Observe these precautions during use:

- Connect the power supply to the two terminals, 24 V and 0 V, and attach the grounding terminal to earth. Be cautious that reverse polarity connection will damage the RTU-PN12.
- 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 UL61010-1 and UL61010-2-201, either LPS (Limited Power Source) or LE (Limited Energy) requirements.
- Use exclusively copper wires for the power line. The diameter of the power wire must be between 12 and 28 AWG and the rated temperature should be greater than 70°C. The plug wiring torque for the power terminal block is 4.5 in-lbs.
- The cables of the AC power 110 V, 220 V and DC power 24 V must be twisted and connected to the module as short as possible in length.
- Separate the AC 110 V, 220 V, and DC 24 V cables from the main circuit and I/O signal cables to keep them away from each other. Maintain minimum 100 mm spacing where possible.

15.5.5.1.2 Ground

• The diameter of the ground should not be less than the diameters of the cables connected to the terminals L and N. • If using multiple pieces of equipment, use a single-point ground.	 The single-point ground is better.
• If you cannot use a single-point ground, use a common-point ground.	 The common-point ground is permitted.
• Do not connect equipment ground wires together.	 The equipment can not be grounded in this way.

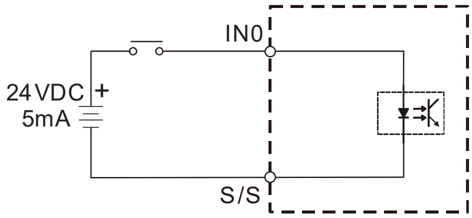
15.5.5.2 General Input Wiring

The RTU-PN12's 8 built-in digital inputs support both sinking and sourcing modes.

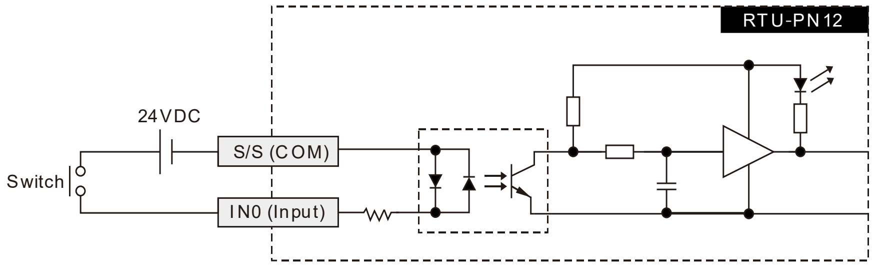
- Sinking

The current flows into the common terminal S/S in sinking mode.

Here is the simplified model:



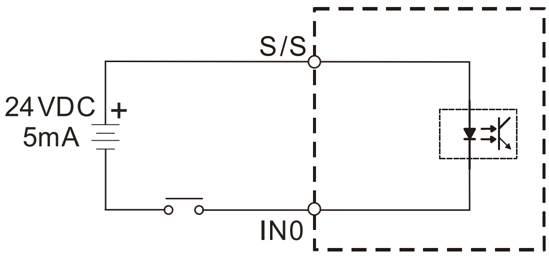
See the wiring circuit in the following figure.



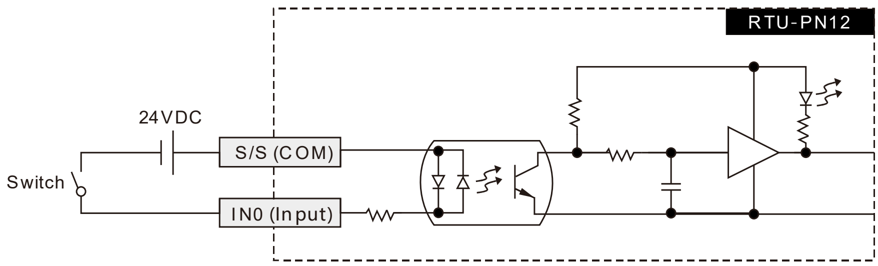
- Sourcing

The current flows from the common terminal S/S in sourcing mode.

Here is the simplified model:

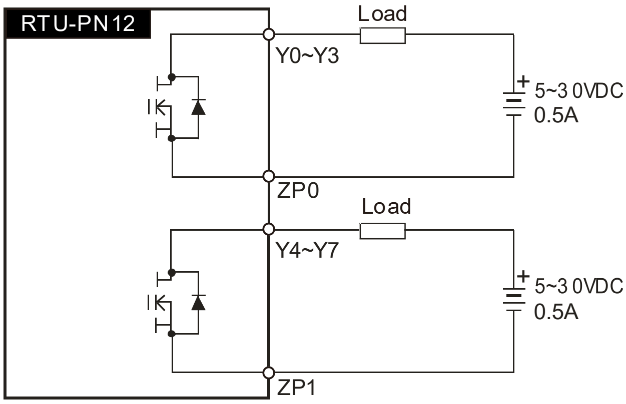


See the wiring circuit in the following figure.



15.5.5.3 General Output Wiring

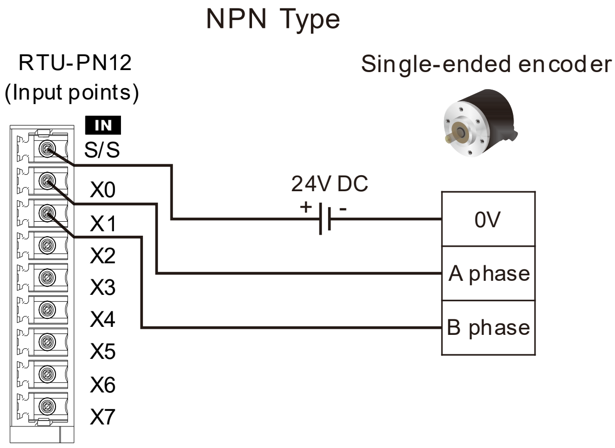
The RTU-PN12 features 8 built-in NPN transistor outputs with the following wiring diagram:



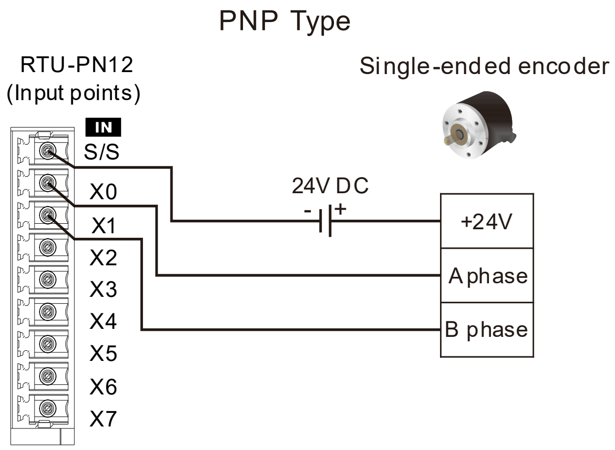
15.5.5.4 Wiring for High-Speed Counting

The RTU-PN12 supports four channels for high-speed counting. We take Channel 1 (X0, X1) for A/B phase counting for wiring configuration here:

- For single-ended NPN open-collector encoder connection



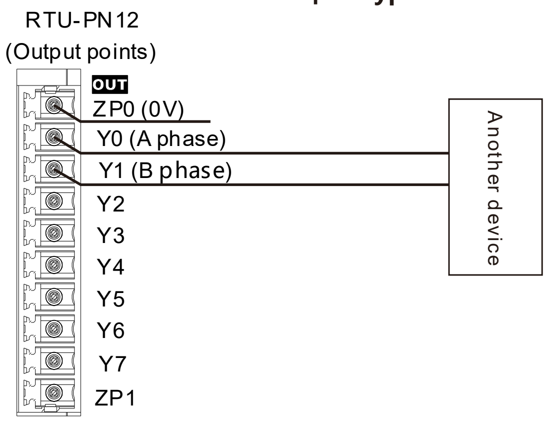
- For single-ended PNP open-collector encoder connection



15.5.5.5 Wiring for Pulse Output

The RTU-PN12 supports four-channel high-speed pulse output. We take channel 1 (Y0, Y1) for A/B phase output for wiring configuration below:

Pulse Output Type



15.5.6 Functions and Parameters

The RTU-PN12 module supports general-purpose input/output, right-side extension, pulse output, and high-speed counter functions. These functions are available by adding the corresponding slot modules to RTU-PN12. The functions and corresponding slot modules are listed as follows:

Function	Slot module	Description
System Diagnosis	RTU-PN12	Display the error code of RTU-PN12 and PROFINET connection status.
	ShareIn	Get RTU-PN12's module information
	ShareOut	
General-Purpose Input/Output	RTU-PN12	General input/output control
Right-Side Extension Input/Output	DVP08Input	Configure the right-side digital modules
	DVP08Input_Output	
	DVP08Output	
	DVP16Input	
	DVP16Output	
	DVP32Input	
	DVP32Output	
	DVP02DA-S/S2	Configure the right-side special modules
	DVP04AD-S	
	DVP04AD-S2	
	DVP04DA-S	
	DVP04DA-S2	
	DVP06AD-S/S2	
	DVP06XA-S	
	DVP06XA-S2	
	DVP04PT-S	

Function	Slot module	Description
	DVP04TC-S	
	DVP06PT-S	
Pulse Output	Pulse_Channel_1_Control	Control CH1 pulse output
	Pulse_Channel_2_Control	Control CH2 pulse output
	Pulse_Channel_3_Control	Control CH3 pulse output
	Pulse_Channel_4_Control	Control CH4 pulse output
High-Speed Counting, Counter Comparison	Counter_Channel_1_Control	Control CH1 counter and configure the counter1 comparison output
	Counter_Channel_2_Control	Control CH2 counter and configure the counter2 comparison output
	Counter_Channel_3_Control	Control CH3 counter and configure the counter3 comparison output
	Counter_Channel_4_Control	Control CH4 counter and configure the counter4 comparison output
Touch Probe	DI3_TOUCH_Counter ch1, Counter_Channel_1_Control	Capture CH1 high-speed counter value by triggering X3
	DI3_TOUCH_Counter ch3, Counter_Channel_3_Control	Capture CH3 high-speed counter value by triggering X3
	DI7_TOUCH_Counter ch1, Counter_Channel_1_Control	Capture CH1 high-speed counter value by triggering X7
	DI7_TOUCH_Counter ch3, Counter_Channel_3_Control	Capture CH3 high-speed counter value by triggering X7
High-speed Counter Preset &Gate Control	Counter_Channel_1_Control	Configure the high-speed counter preset value and DI function (Gate mode) for CH1 counter
	Counter_Channel_3_Control	Configure the high-speed counter preset value and DI function (Gate mode) for CH3 counter

15.5.6.1 System Diagnosis

The entire RTU-PN12 system can be diagnosed by using the Module Status parameter for the module status, the Profinet Status parameter for the PROFINET connection status, and the ShareIn/ShareOut slot modules for RTU-PN12 and its module information.

Classification	Parameter Name	Description
PNIO I/O Mapping	Module Status	Module status. When an error occurs, you can check the error code from this parameter.
	Profinet Status	PROFINET connection status
	ShareIn	Get RTU-PN12 and its module information.
	ShareOut	

15.5.6.1.1 Module Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Module Status	RTU-PN12's module status	UINT	-	Input

Explanation of values of this parameter:

Value	Explanation
0	No error. Modules are operating normally.
16#0001-16#0FFF	RTU-PN12's right-side module error. Displays the error code from the module when an error occurs in a right-side module.
16#1505	Right-side module configuration mismatch.
16#F011	Flash check error. Repower the device when this problem occurs. If the problem persists, contact your local authorized distributors.

15.5.6.1.2 PROFINET Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Profinet Status	PROFINET connection status	USINT	-	Input

Explanation of values of this parameter:

Value	Explanation
0	Not connected.
1	The PROFINET connection is already established.

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15.5.6.1.3 ShareIn/ShareOut

Parameter Name	Description	Data Type	Range	Input /Output Mapping
ShareIn	Feedback information received based on the command in ShareOut	Array [0..15] of Byte	-	Input
ShareOut	Command	Array [0..15] of Byte	-	Output

The version, number of right-side modules, etc. of RTU-PN12 can be obtained through the slot modules ShareIn and ShareOut.

The commands and corresponding feedback information are as follows:

Command in ShareOut	Feedback value in ShareIn
01 00	Version (4 bytes) + number of right-side digital input points (1 byte) + number of right-side digital output points (1 byte) + number of right-side analog modules (1 byte)
01 XX	Model name of the XXth analog module on the right side of the RTU-PN12 (2 bytes) (the range of XX: 1- 8)
FF 42 02	Total power-on time: days (2 bytes) +hours (1 byte) +minutes (1 byte)
FF 42 03	Refresh time of the right-side modules; unit: ms

15.5.6.2 General-Purpose Input/Output

The RTU-PN12 itself provides 8 input points and 8 output points, which are available in general input/output, pulse output, high-speed counting and probe functions. Only the following configuration parameters and PNIO I/O mapping parameters are required when the module's local I/O points are used for general-purpose input/output.

Classification	Parameter Name	Description
Configuration Parameters	DI input filter	Input filter time setting
	DO0-DO7_FailSafeMode	Fail-safe behavior of output points
	DO0-DO7 Fail mode pre-set value	Fail-safe preset value of output points
PNIO I/O Mapping	DI0-DI7 Input Status	Status of input points
	DO0-DO7 Output Status	Status of output points

15.5.6.2.1 DI input filter

Parameter Name	Description	Data Type	Range	Default
DI input filter	The filter parameter of an input point, with the unit of 100 us; available for the general-purpose inputs.	USINT	0-255	0

15.5.6.2.2 DO0-DO7_FailSafeMode

Parameter Name	Description	Data Type	Range	Default
DO0-DO7_FailSafeMode	Fail-safe behavior of output points	USINT	0-254	0

Explanation:

Bits 0-7 of this parameter correspond to output points Y0-Y7 respectively. The setting values of bits are explained as follows:

Setting Value	Explanation
FALSE	When a disconnection fault triggers an emergency stop of the machine, the RTU-PN12 outputs the preset value.
TRUE	When a disconnection fault triggers an emergency stop of the machine, the RTU-PN12's outputs hold pre-fault values.

15.5.6.2.3 DO0-DO7 Fail mode preset value

Parameter Name	Description	Data Type	Range	Default
DO0-DO7 Fail mode pre-set value	When a fault shutdown occurs, the RTU-PN12 module will output the preset value of the output points. Bit0-Bit7 correspond to output points Y0-Y7 respectively.	USINT	0-255	0

15.5.6.2.4 DI0-DI7 Input Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
DI0-DI7 Input Status	Status of input points	USINT	0-255	Input

15.5.6.2.5 DO0-DO7 Output Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
DO0-DO7 Output Status	Status of output points	USINT	0-255	Output

15.5.6.3 Right-Side Extension Input/Output

This section introduces configuration parameters and I/O mapping parameters for right-side modules. Refer to Section 15.5.1.3 for the right-side modules that RTU-PN12 supports and their mapping data lengths.

To use different digital modules for RTU-PN12, please combine slots based on total I/O lengths, ensuring the total I/O points for combined slot configurations match actual module configurations. For special modules, RTU-PN12 provides corresponding slots for your use.

Classification	Parameter Name	Description
Configuration parameters	FailSafeMode	Set the output status when a fault shutdown occurs.
	Fail mode pre-set value	When a fault shutdown occurs, a right-side module outputs the preset value of output points or the preset values of output channels.
	Channel Mode Setting	Set channel modes for a special module
	Cal. Offset/ Cal. Gain	Calibrate the Offset and Gain for a special module's channels
	Cal and Gain work mode	Select offset and gain work mode for a special module
PNIO I/O Mapping	Error Code	Shows the error code for a digital module or a special module
	Input Status	The status of a digital module's input points or values of a special module's input channels
	Output Status	The status of a digital module's output points or values of a special module's output channels

15.5.6.3.1 FailSafeMode

Parameter Name	Description	Data Type	Range	Default
FailSafeMode	Set the output status when a fault shutdown occurs.	USINT	0-255	0

For the digital output modules, bits 0-7 of this parameter correspond to their output points 0-7 respectively.

The setting values of bits are explained as follows:

Setting	Explanation
FALSE	When a disconnection fault triggers an emergency stop, all right-side module outputs switch to the user-defined preset values.
TRUE	When a disconnection fault triggers an emergency stop, all the right-side module outputs hold their last active states.

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For the analog output modules, their each channel is a parameter, and the settings of channels are explained as follows:

Setting	Explanation
Output preset value	When a disconnection fault triggers an emergency stop, all right-side module outputs switch to the use-defined preset values.
Output Holding	When a disconnection fault triggers an emergency stop, all right-side module outputs will hold their pre-fault values.

15.5.6.3.2 Fail mode preset value

Parameter Name	Description	Data Type	Range	Default
Fail mode pre-set value	Set the preset value of output points or an output channel when a fault shutdown occurs.	UINT	-	-

For digital output modules, bits 0-7 of this parameter correspond to output points 0-7 respectively. For analog output modules, each channel is one parameter. This parameter takes effect when the FailSafeMode parameter is set to Output preset value.

15.5.6.3.3 Channel Mode Setting

Parameter Name	Description	Data Type	Range	Default
Mode Setting	Set the modes for channels of a special module	USINT	-	-

This parameter is for setting the channel modes for a special module. For details on channel modes, see the corresponding module manual.

15.5.6.3.4 Cal. Offset/Cal. Gain

Parameter Name	Description	Data Type	Range	Default
Cal. Offset	Calibrate the Offset of a special module	UINT	-	-
Cal. Gain	Calibrate the Gain of a special module	UINT	-	-

This parameter is for setting the Gains and Offsets for a special module' channels. When Offset and Gain tuning is required, you can calibrate them through the two parameters. For detailed definitions, see the corresponding module manual.

15.5.6.3.5 Cal and Gain work mode

Parameter Name	Description	Data Type	Range	Default
Cal and Gain work mode	Select the Offset and Gain work mode for a special module.	ENUM	-	Default value

Explanation of settings:

Setting	Explanation
Default value	If you choose **Default value** for a special module, the Offset and Gain values are restored to default values when channel mode settings are modified.
User-defined value	Manually adjust the Offset and Gain for the special module's channels.

To adjust the Offset and Gain, please first set this parameter to **User-defined value**, and then calibrate the values of the Offset and Gain parameters.

15.5.6.3.6 Error Code

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Error Code	Error code from a special module on the right side	UINT	-	Input

When an error occurs in a right-side module, you can check its error code from this parameter. For details on the error code, please refer to CR30 for the special module in the module manual.

15.5.6.3.7 Input Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Input Status	The status of a digital module's input points or values of a special module's input channels	UINT	-	Input

15.5.6.3.8 Output Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Output Status	The status of a digital module's output points or values of a special module's output channels	UINT	-	Output

15.5.6.4 Pulse Output

The RTU-PN02 module supports 4 channels of high-speed pulse output. The lists of pulse output parameters for the four channels are the same.

The pulse output parameters are listed as below:

Classification	Parameter Name	Description
PNIO I/O Mapping	Pulse Output Channel Command	Pulse output command word
	Pulse Output Channel MotionMode	Pulse output motion mode
	Pulse Output Channel HomeMode	-
	Pulse Output Channel TargetPulses	Target output pulse count
	Pulse Output Channel TargetFrequency	Target output frequency
	Pulse Output Channel Acceleration Time	Acceleration time or pulse width (PWM)
	Pulse Output Channel Deceleration Time	Deceleration time or pulse period (PWM)
	Pulse Output Channel OutputMode	Pulse output mode
	Pulse Output Channel OutputDirection	Pulse output direction setting
	Pulse Output Channel CurrentPulse	Current output pulse count
	Pulse Output Channel ActualFrequency	Actual output frequency
	Pulse Output Channel Status	Pulse output status
	Pulse Output Channel Actual MotionMode	Actual motion mode of pulse output
	Pulse Output Channel Actual OutStatus	-

15.5.6.4.1 Pulse Output Channel Command

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel Command	Pulse output command word	UINT	0-1	Output

This parameter is the command word for a pulse output channel to enable or disable the high-speed pulse output function of RTU-PN12's output points.

Please set this parameter after all other pulse output parameters setting is complete.

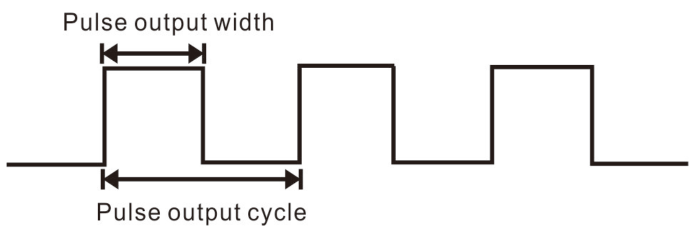
Bit	Explanation
Bit0	**False**: Stops the pulse output. If MotionMode is set to speed or position output mode, the pulse output will stop according to the set deceleration time when the Pulse Output Channel Command parameter is 0. If MotionMode is PWM mode, the pulse output will stop. **True**: Enables the pulse output function; the settings of relevant parameters for the pulse output are effective. If MotionMode is set to speed or position output mode, the pulse output will be performed according to the set acceleration time, deceleration time, target frequency, and number of output pulses after the Pulse Output Channel Command parameter changes from 0 to 1. If MotionMode is set to PWM mode, the pulse output will start when the Pulse Output Channel Command parameter changes from 0 to 1.
Bit7	**False**: When the communication between the RTU-PN12 and the master is lost during pulse output, the pulse output will stop immediately and the actual output pulse count will not be cleared to 0. After the connection between the RTU-PN12 and the master recovers, the pulse output will continue only after you set the Pulse Output Channel Command parameter to 0 and then to 1. **True**: If communication is lost between the RTU-PN12 and the master during pulse output, the pulse output will continue.

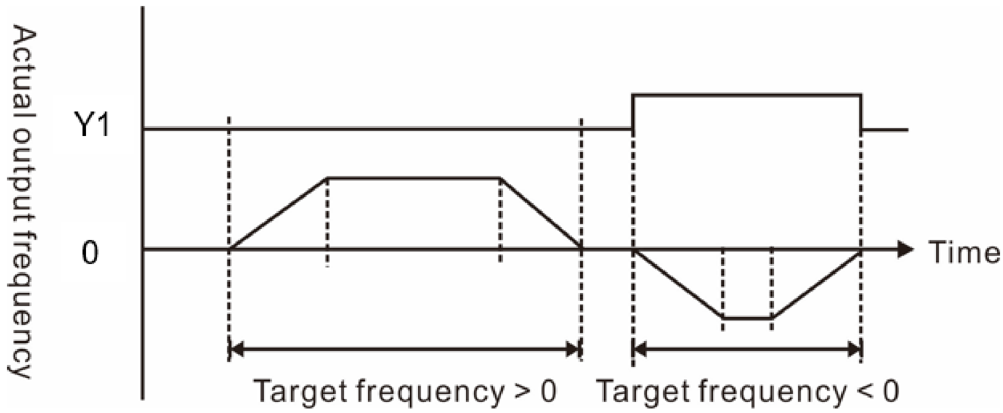
15.5.6.4.2 Pulse Output Channel MotionMode

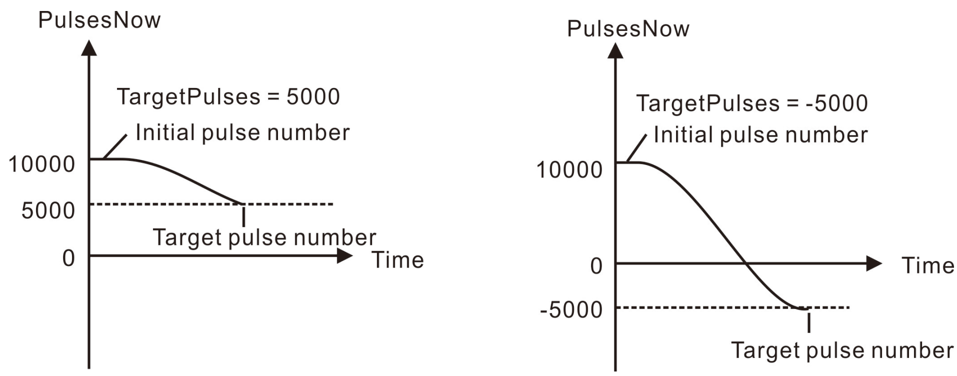
Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel MotionMode	Pulse output motion mode	USINT	0-5	Output

The parameter is available for selection of a motion mode for pulse output. The motion modes cover speed output, position output, PWM mode, home mode, and general output for option. This parameter setting is effective as the pulse output command value changes from 0 to 1.

The following table explains the setting values of this parameter by taking channel 1 for example.

Value	Explanation
0	General output mode, e.g. output points control cylinder actuation.
2	PWM mode: In this mode, the output point Y0 outputs pulse signals with the set pulse output cycle time (Pulse output channel Deceleration Time) and pulse output width (Pulse output channel Acceleration Time). 

<table>
<tr><th>Value</th><th>Explanation</th></tr>
<tr><td>3</td><td>Speed output mode:
In this mode, pulse output channel 1 continuously outputs pulse signals at the set target frequency (Pulse output channel TargetFrequency).


NOTE:
If neither of the acceleration time (Pulse output channel Acceleration Time) and the deceleration time (Pulse output channel Deceleration Time) is 0, the new target frequency after being modified during the pulse output will not take effect. If either the acceleration time (Pulse output channel Acceleration Time) or the deceleration time (Pulse output channel Deceleration Time) is 0, then the new target frequency after being modified during the pulse output can be effective.</td></tr>
<tr><td>4</td><td>Absolute position output mode:
In this mode, the output point outputs a corresponding number of pulses according to the set target pulse count (Pulse output channel TargetPulses), target frequency (Pulse output channel TargetFrequency), acceleration time (Pulse output channel Acceleration Time) and deceleration time (Pulse output channel Deceleration Time) and etc.


After the pulse output is complete, the current pulse count (Pulse output channel CurrentPulses) is equal to the target pulse count (Pulse output channel TargetPulses).</td></tr>
<tr><td>5</td><td>Relative position output mode:
In this mode, the output point outputs a corresponding number of pulses according to the set target pulse count (Pulse output channel TargetPulses), target frequency (Pulse output channel TargetFrequency), acceleration time (Pulse output channel Acceleration Time) and deceleration time (Pulse output channel Deceleration Time) and other parameters.
After the pulse output is complete, the actual pulse count (Pulse output channel CurrentPulses) is the sum of the current pulse count (Pulse output channel CurrentPulses) of when the pulse output starts and the target pulse count (Pulse output channel TargetPulses).</td></tr>
</table>

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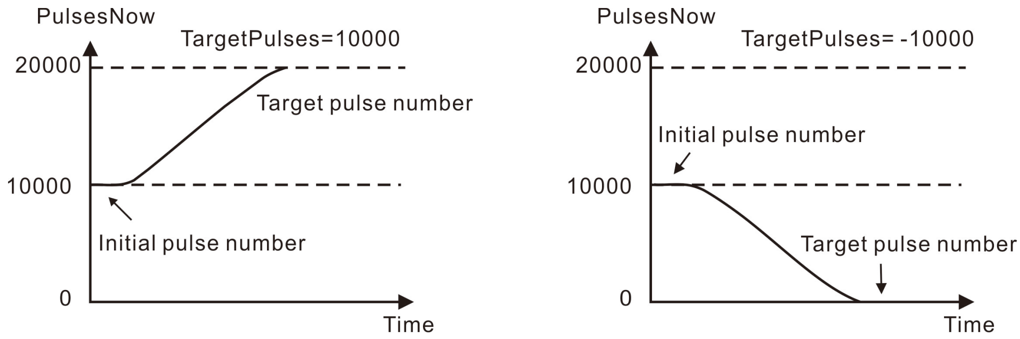
<table>
<tr><th>Value</th><th>Explanation</th></tr>
<tr><td></td><td>


</td></tr>
<tr><td>10</td><td>Home mode:
In this mode, the current pulse count (Pulse output channel CurrentPulses) is equal to the target pulse count (Pulse output channel TargetPulses) after the channel command (Pulse output channel Command) is set to 1.</td></tr>
</table>

15.5.6.4.3 Pulse Output Channel HomeMode

This parameter is reserved.

15.5.6.4.4 Pulse Output Channel TargetPulses

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel TargetPulses	Target output pulse count	DINT	-	Output

15.5.6.4.5 Pulse Output Channel TargetFrequency

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel TargetFrequency	Target pulse output frequency	DINT	-200K to 200K	Output

In speed output mode or position output mode, when the pulse output function is enabled, no pulse output will be performed if the **Pulse output channel TargetFrequency** parameter is set to 0.

If neither of the acceleration time (Pulse output channel Acceleration Time) and the deceleration time (Pulse output channel Deceleration Time) is 0 when the pulse output is enabled, the new target frequency will not take effect after the target frequency is modified during the pulse output.

If either the acceleration time (Pulse output channel Acceleration Time) or the deceleration time (Pulse output channel Deceleration Time) is 0 when the pulse output is enabled, then the new target frequency can be effective after the target frequency is modified during the pulse output.

Note: The direction of the target frequency cannot be directly modified.

15.5.6.4.6 Pulse Output Channel Acceleration Time

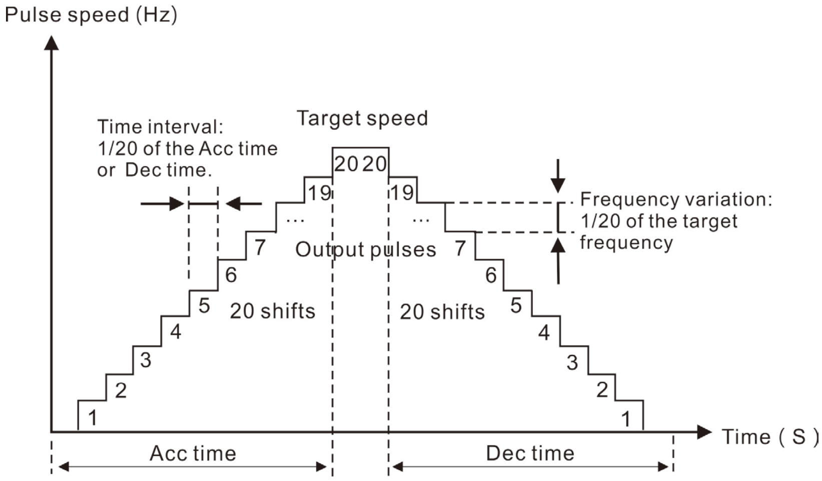
Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel Acceleration Time	Pulse output acceleration time or pulse width (PWM)	UDINT	-	Output

This parameter is for setting pulse output acceleration time or pulse width (PWM). Modifying this parameter value is not effective after the pulse output starts in non-PWM mode.

In speed output mode or position output mode, this parameter denotes the acceleration time for reaching the target output frequency, with the unit: ms.

When the pulse output function is enabled, if either the acceleration time or the deceleration time is 0, the pulse output will be performed at the target frequency directly from the static state, and stop immediately once the target pulse count is reached, without any acceleration and deceleration in the whole process.

If neither of the acceleration time and the deceleration time is 0, the pulse output will accelerate from the static state until the target frequency is reached, then decelerate while the target pulse count is being approached, and end up stopping once the target pulse count is reached.



As shown in the figure above, when the acceleration time and deceleration time are both not 0, there are 20 steps for each of acceleration and deceleration of the pulse output. The output frequency increases or decreases by 1/20 of the target frequency per step, with the unit: Hz, and the time for each step is 1/20 of the acceleration time or deceleration time with the unit: ms.

In PWM mode, this parameter stands for the pulse width, with the unit: us.

15.5.6.4.7 Pulse Output Channel Deceleration Time

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel Deceleration Time	Pulse output deceleration time or pulse period (PWM)	DINT	-	Output

This parameter is for setting pulse output deceleration time or pulse period (PWM). Modifying this parameter value is not effective after the pulse output starts in non-PWM mode.

In speed output mode or position output mode, this parameter means the deceleration time for reaching the target output frequency, with the unit: ms. In PWM mode, this parameter is the pulse output cycle with the unit: us.

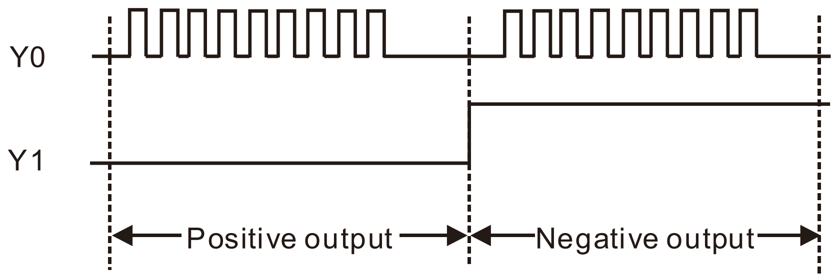
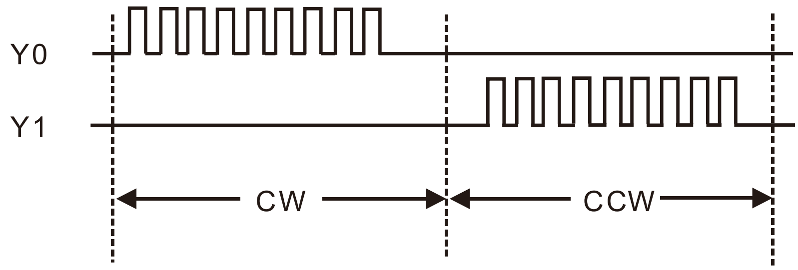
15.5.6.4.8 Pulse Output Channel OutputMode

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel OutputMode	Pulse output mode	USINT	0-2	Output

The parameter is available for the output mode setting for pulse output channels. There are three output modes:

Pulse+Direction, A/B phase, and CW/CCW for option. After this parameter setting is complete, it is effective when the command value changes from 0 to 1.

The following table explains the setting values of this parameter by taking channel 1 for example.

Value	Explanation
0	Pulse+Direction: Y0 outputs pulse signals and Y1 outputs direction signals. 
1	Phase A/B output: Y0 outputs phase A pulses, Y1 outputs phase B pulses. **Note:** When the A/B phase output mode is used, the maximum output frequency that RTU-PN12 supports is 100 kHz.
2	CW/CCW: Clockwise mode and counterclockwise mode. In CW mode, Y0 outputs pulse signals and Y1 is OFF. In CCW mode, Y0 is OFF and Y1 outputs pulse signals. 

To switch the output mode during pulse output process, please first set the **Pulse output channel command** parameter to 0 after the pulse output stops, and then modify this **Pulse output channel OutputMode** parameter to switch to another output mode. After switching the pulse output mode is complete, set the **Pulse output channel Command** parameter to 1. After that, the high-speed pulse output channel will output pulses in the new output mode.

15.5.6.4.9 Pulse Output Channel OutputDirection

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel OutputDirection	Pulse output direction setting	USINT	0-1	Output

In Pulse+Direction mode, this parameter takes effect when the pulse output is enabled. The action mode of the direction point can be set through this parameter.

The following table explains the values of this parameter by taking channel 1 for example.

Setting	Explanation
0	When pulses are output in the positive direction, Y1 is OFF. When pulses are output in the negative direction, Y1 is ON.
1	When pulses are output in the positive direction, Y1 is ON. When pulses are output in the negative direction, Y1 is OFF.

NOTE:

This parameter setting must be finished before the pulse output is enabled. Otherwise, the setting will not take effect. The state of Y1 will not be cleared when the pulse output is complete or the output stops.

15.5.6.4.10 Pulse Output Channel CurrentPulse

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output CurrentPulse	Current output pulse count	DINT	-	Input

The parameter shows the current output pulse count, which is an absolute value. Every time the **Pulse output channel Command** parameter changes from 0 to 1, in pulse output mode, this parameter value will vary based on the current value, which will not be cleared to 0.

15.5.6.4.11 Pulse Output Channel ActualFrequency

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output ActualFrequency	Actual output frequency	DINT	-	Input

This parameter shows the actual output frequency for a channel only when the motion mode of the pulse output is set to speed output or position output.

15.5.6.4.12 Pulse Output Channel Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Channel Status	Pulse output status	UINT	0-2	Input

This parameter shows the status information of a pulse output channel.
Explanation of setting values of this parameters:

Value	Explanation
0	No pulses are output by the channel.
1	Pulses are being output by the channel.

15.5.6.4.13 Pulse Output Channel Actual MotionMode

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Pulse Output Actual MotionMode	Actual motion mode of pulse output	USINT	-	Input

This parameter shows the current motion mode of a pulse output channel.

The parameter is the same as the **Pulse output channel MotionMode parameter** in the meaning of parameter values. Please refer to Section 15.5.6.3.2 for detailed explanation of the parameter values.

15.5.6.4.14 Pulse Output Channel Actual OutStatus

This parameter is reserved.

15.5.6.5 High-Speed Counting

The RTU-PN12 module supports 4 channels of high-speed counters, and only counter 1 and counter 3 support the two high-speed interrupt points X3 and X7 for special functions: counter preset, gate control and touch probe.
Refer to Section 15.5.6.6 for the touch probe function, Section 15.5.6.7 for the counter preset function and Section 15.5.6.8 for the gate control function. Four channels of high-speed counters. In this section, the high-speed counter function is introduced.
The high-speed counter parameters are listed as below:

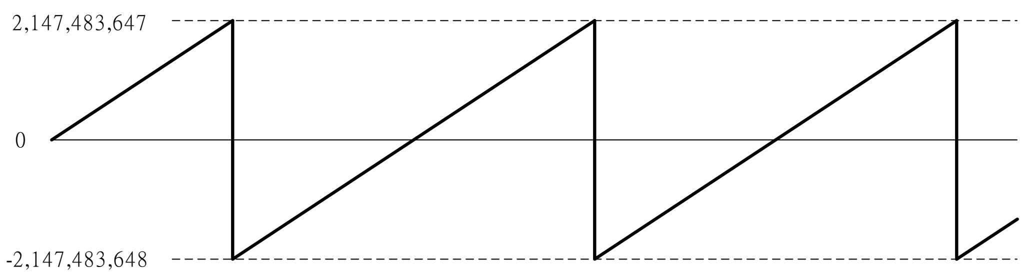
Classification	Parameter Name	Description
Configuration parameters	Counter type	Linear counter and ring counter
	Input signal type	Single pulse, Pulse+direction, CW/CCW and A/B phase
	Direction set	High-speed counting direction: forward, reverse. This parameter is only available for the Single Pulse signal type.
	AB-phase frequency	A/B phase frequency: 2x, 4x frequency
	Max value	The maximum value of a linear counter
	Min value	The minimum value of a linear counter
	Counting edge	The trigger edge of the counter. This parameter setting is only valid in Single Pulse and Pulse+Direction modes.
PNIO I/O Mapping	Counter Channel Present CounterValue	Current counter value
	Counter Channel Error Code	Counter error code
	Counter Channel Status	Counter status
	Counter Channel X Command	Counter command
	Counter Channel Spec Command	Special counter command

15.5.6.5.1 Counter Type

Parameter Name	Setting	Data Type	Range	Default
Counter type	Line Type, Annular Type (ring)	ENUM	-	Line Type

1. Ring counter

   The ring counter value is cyclical in the range of -2,147,483,648 to 2,147,483,647. When it is greater than 2,147,483,647, the count value changes to -2,147,483,648 and then the counting continues. When it is less than -2,147,483,648, the count value changes to 2,147,483,647 and then the counting continues.



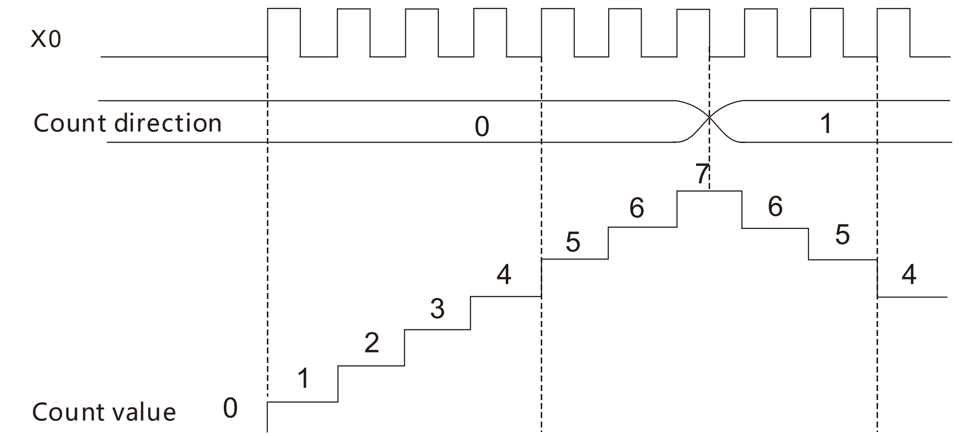
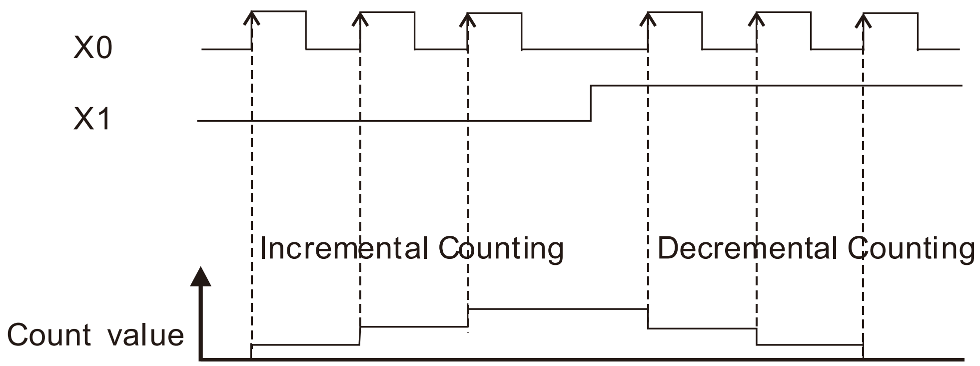
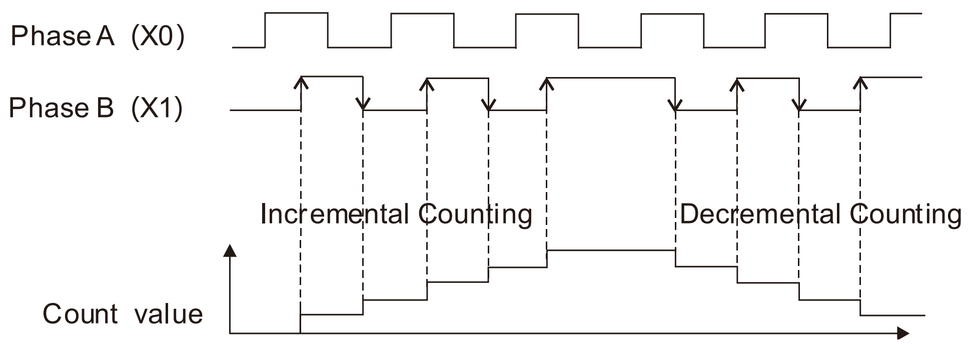
2. Linear counter

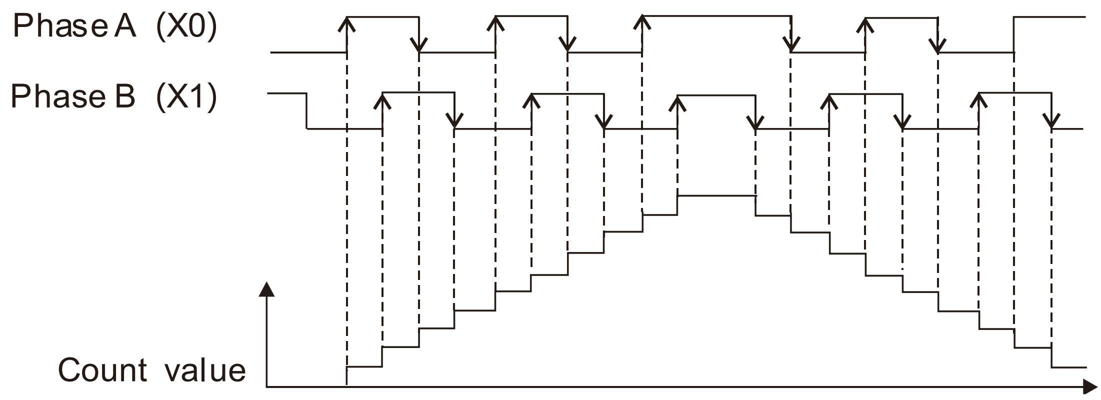
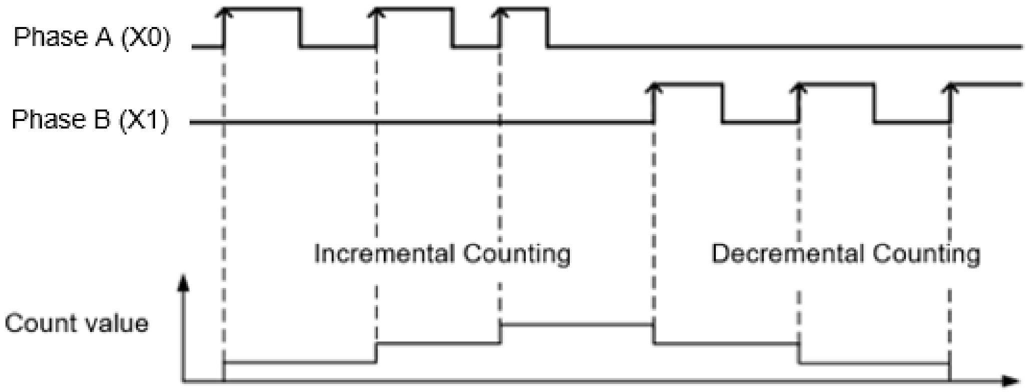
The maximum and minimum counter values must be set up. The counter counts up and down between the two limits. When the count value exceeds the maximum value, the count value will be maintained at the maximum counter value. When the count value is below the minimum value, the count value will be retained at the minimum counter value.

15.5.6.5.2 Input Signal Type

Parameter Name	Setting	Data Type	Range	Default
Input signal type	Single pulse, Pulse+direction, CW/CCW and A/B phase	ENUM	-	Single pulse

Illustration of pulse input types:

<table>
<tr><th>Pulse type</th><th>Timing to count</th></tr>
<tr><td>Single pulse</td><td>
</td></tr>
<tr><td>Pulse + direction</td><td>
</td></tr>
<tr><td>A/B phase (2x)</td><td>
</td></tr>
</table>

Pulse type	Timing to count
A/B phase (4x)	
CW/CCW	

15.5.6.5.3 Counting Direction

Parameter Name	Description	Data Type	Range	Default
Direction set	High-speed counting direction: forward, reverse. This parameter is only available for the signal type of single pulse.	ENUM	-	Forward

15.5.6.5.4 A/B Phase Frequency

Parameter Name	Description	Data Type	Range	Default
AB-phase frequency	2 octave frequency, 4 octave frequency	ENUM	-	4 octave frequency

15.5.6.5.5 Max Value

Parameter Name	Description	Data Type	Range	Default
Max value	The maximum value of a linear counter	DINT	0 to 2147483647	2147483647

15.5.6.5.6 Min Value

Parameter Name	Description	Data Type	Range	Default
Min value	The minimum value of a linear counter	DINT	-2147483648 to 0	-2147483648

15.5.6.5.7 Counting Edge

Parameter Name	Description	Data Type	Range	Default
Counting edge	The trigger edge of the counter. This parameter setting is only effective in Single Pulse and Pulse+Direction modes.	ENUM		Rising Edge

15.5.6.5.8 Counter Channel Command

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Counter Channel Command	Counter command	UINT	-	Output

Explanation of values of this parameter:

Value	Explanation
0	Disables the high-speed counting function. The channel stops counting immediately and the current count value remains unchanged.
1	Enables the high-speed counting function. The channel starts counting immediately and the counting continues from the last-recorded count value.
2	Enables the counter reset function. When the reset function is enabled, the channel's counter value is cleared to 0 and the channel stops counting immediately.

NOTE:

1. Please connect a 470 Ω, 5 W resistor between the input point and S/S common terminal if the input frequency is more than 100 kHz.
2. If the gate control is enabled, this parameter can only reset the counter value to zero. It cannot be used to enable or disable the high-speed counting function.

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15.5.6.5.9 Counter Channel Spec Command

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Counter Channel Spec Command	Special counter command	UINT	-	Output

Explanation:

Bit	Description
Bit0	The command bit for enabling the preset or gate control function of digital input point X3. When the X3 DI function is set to “Set pre-value”, Bit0 being True indicates that the preset function is enabled. When X3 is triggered by a rising edge, the current counter value will become the preset value. When the X3 DI function is set to “Gate mode”, Bit0 being True indicates that the gate control is enabled. The current counter can count normally only when X3 is True; when X3 is False, the current counter does not count. This setting is only valid for CH1 counter and CH3 counter.
Bit1	The command bit for enabling the preset or gate control function of digital input point X7. When the X7 DI function is set to “Set pre-value”, Bit1 being True indicates that the preset function is enabled. When X7 is triggered by a rising edge, the current counter value will be set to the preset value. When the X7 DI function is set to “Gate mode”, Bit1 being True indicates that the gate control function is enabled. The current counter can count normally only when X7 is True; when X7 is False, the current counter does not count. This setting is only valid for CH1 counter and CH3 counter.
Bit2	The command bit for enabling CH0 counter comparison. When Bit2 is True, the CH0 counter comparison is enabled.

Bit	Description
Bit3	The command bit for enabling CH1 counter comparison. When Bit3 is True, the CH1 counter comparison is enabled.

15.5.6.5.10 Counter Channel Present CounterValue

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Counter Channel Present CounterValue	Current counter value	DINT	-	Input

15.5.6.5.11 Counter Channel Error Code

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Counter Channel Error Code	Counter error code	UINT	-	Input

15.5.6.5.12 Counter Channel Status

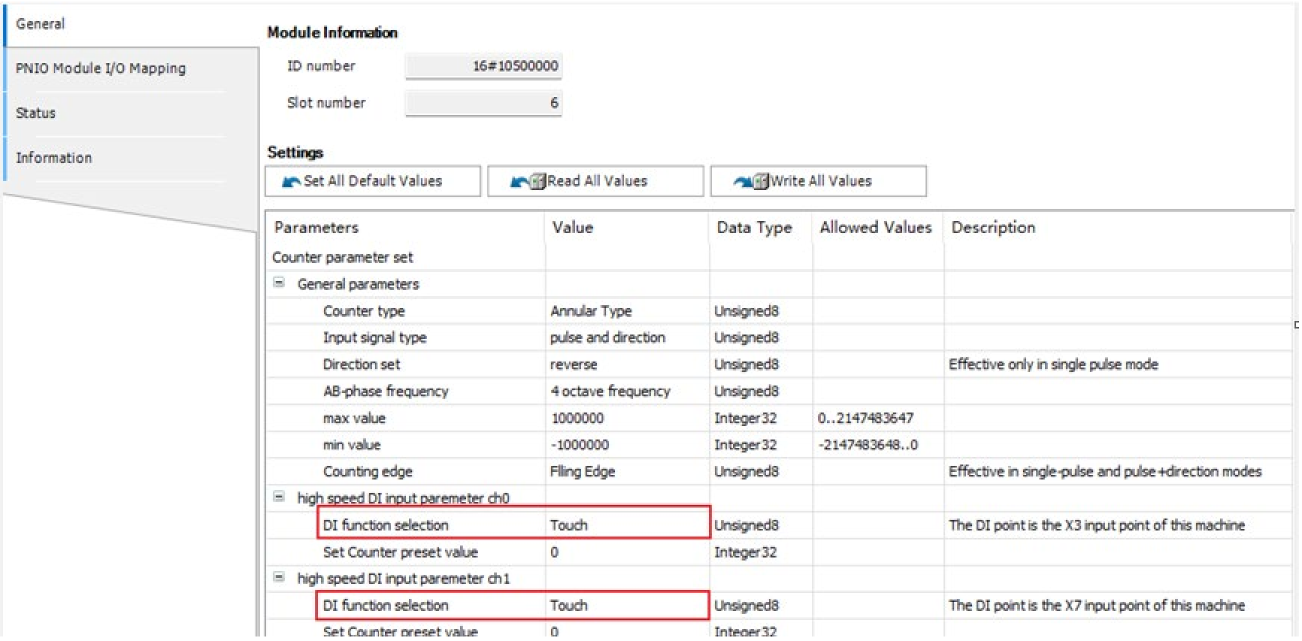
Parameter Name	Description	Data Type	Range	Input /Output Mapping
Counter Channel Status	Counter status	USINT	-	Input

Explanation of values of this parameter:

Value	Explanation
0	The counter is not counting.
1	The counter is counting.

15.5.6.6 Touch Probe

On the RTU-PN12, both CH1 and CH3 high-speed counters support the two high-speed points X3 and X7 for the touch probe function. Before using the touch probe function, set the configuration parameters "DI function selection" of the counter slot modules to "Touch”, and then configure the touch slot modules.



List of relevant parameters:

Classification	Parameter Name	Description
Configuration parameters	DI function selection	Set this parameter to "Touch". It is a counter slot module parameter.
	Touchmode	Set the trigger condition for touches: Single Rising Touch, Single Falling Touch, Single Rising and Falling Touch, Cycle Rising Touch, Cycle Falling Touch, Cycle Rising and Falling Touch
PNIO I/O Mapping	Touch Status	Touch status
	Touch Number	Number of touches
	TouchCounter Positive Value	Capture the current counter value on the rising edge
	TouchCounter Negative Value	Capture the current counter value on the falling edge
	Touch Cmd	Command word of the Touch function

15.5.6.6.1 Touch Mode

Parameter Name	Description	Data Type	Range	Default
Touchmode	Set the trigger condition for touches: Single Rising Touch, Single Falling Touch, Single Rising and Falling Touch, Cycle Rising Touch, Cycle Falling Touch, Cycle Rising and Falling Touch	ENUM	-	Single Rising Touch

15.5.6.6.2 Touch Command

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Touch Cmd	Command word of the Touch function	UINT	-	Output

Explanation:

Value	Explanation
0	Disable the touch function.
1	Enable the touch function.

For the single touch modes, if another touch is needed after one single touch is completed, the Touch Command parameter needs to be re-triggered. First, set the parameter to 0 to disable the touch function, and then set it back to 1 to start a new touch.

15.5.6.6.3 Touch Status

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Touch Status	Touch status	UINT	-	Input

Explanation:

Bit	Explanation
Bit0	The touch function is ON or OFF. When the command value is 1, Bit0 becomes TRUE, indicating that the touch function is ON.
Bit1	Rising-edge touch status. When Bit1 is True, the rising-edge touch is completed
Bit2	Falling-edge touch status. When Bit2 is True, the falling-edge touch is completed

15.5.6.6.4 Touch Number

Parameter Name	Description	Data Type	Range	Input /Output Mapping
Touch Number	Number of touches. Each successful touch increments the value of this parameter by one.	UNT	-	Input

15.5.6.6.5 Touch Counter Positive Value

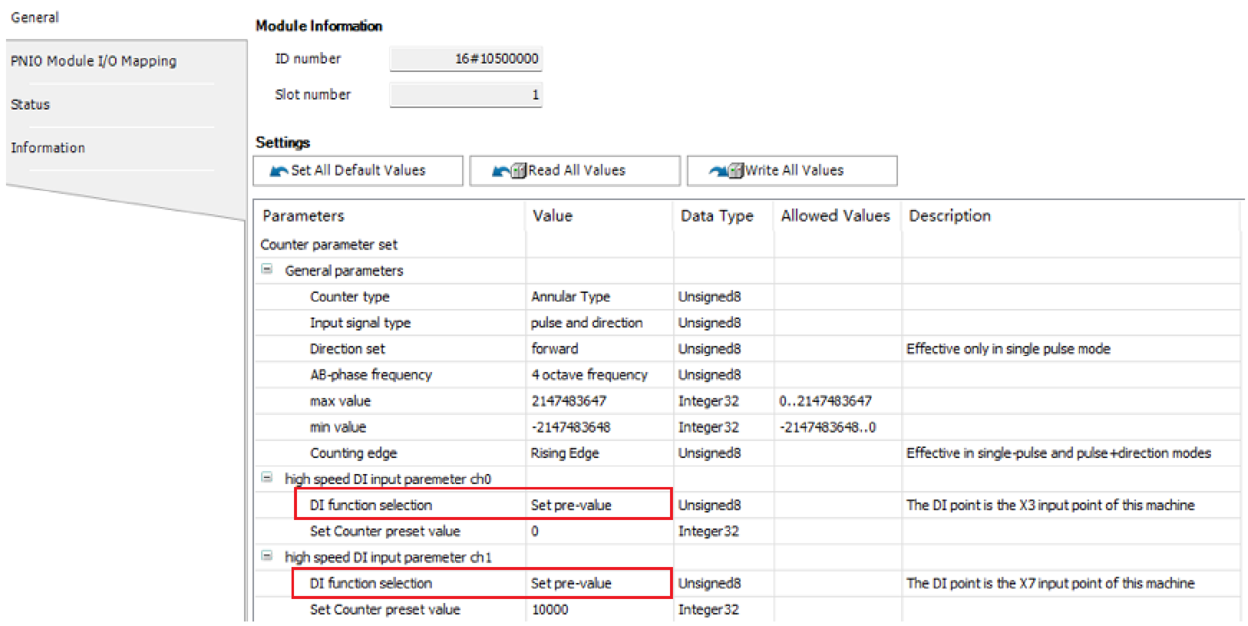
Parameter Name	Description	Data Type	Range	Input /Output Mapping
TouchCounter Positive Value	The value captured by the rising-edge touch	DINT	-	Input

15.5.6.6.6 Touch Counter Negative Value

Parameter Name	Description	Data Type	Range	Input /Output Mapping
TouchCounter Negative Value	The value captured by the falling edge touch	DINT	-	Input

15.5.6.7 Counter Preset Value

On the RTU-PN12, both CH1 and CH3 high-speed counters support the two high-speed interrupt points X3 and X7 for the counter preset function. Before using the preset function, you need to set the configuration parameters “DI function selection” of the counter slot modules to “Set Pre-value (set the preset value)”.



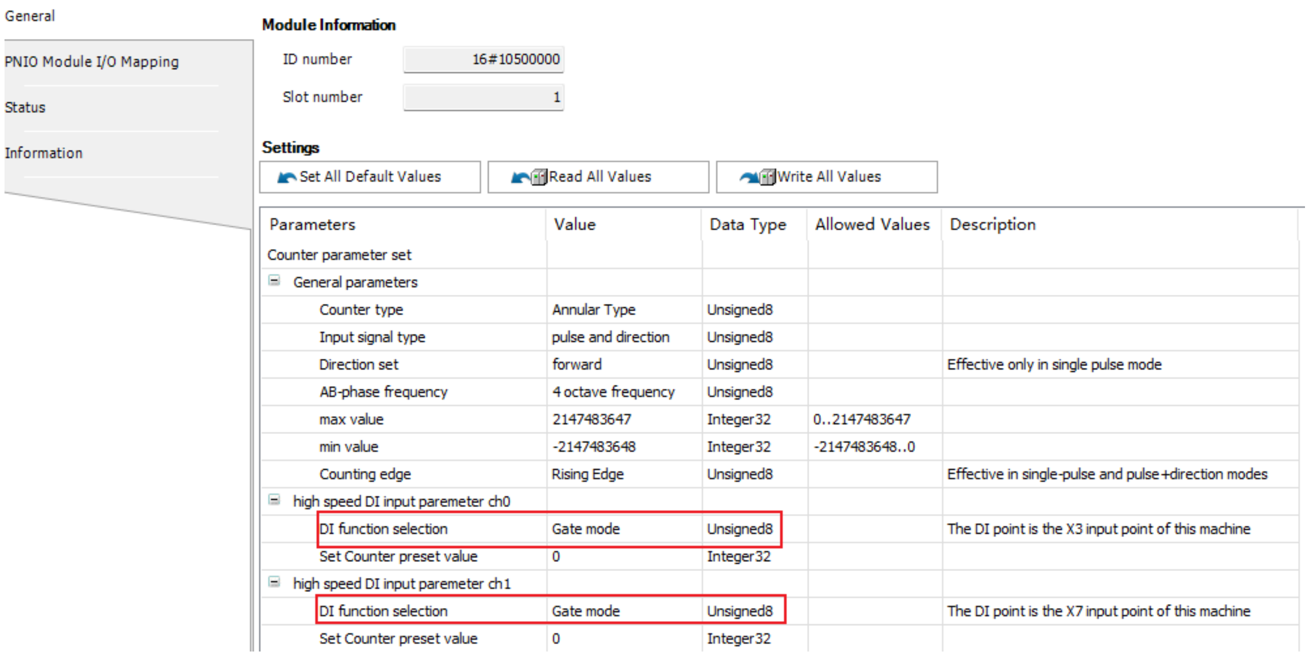
Parameters	Value	Data Type	Allowed Values	Description
Counter parameter set				
General parameters				
Counter type	Annular Type	Unsigned8		
Input signal type	pulse and direction	Unsigned8		
Direction set	forward	Unsigned8		Effective only in single pulse mode
AB-phase frequency	4 octave frequency	Unsigned8		
max value	2147483647	Integer32	0..2147483647	
min value	-2147483648	Integer32	-2147483648..0	
Counting edge	Rising Edge	Unsigned8		Effective in single-pulse and pulse+direction modes
high speed DI input paremeter ch0				
DI function selection	Set pre-value	Unsigned8		The DI point is the X3 input point of this machine
Set Counter preset value	0	Integer32		
high speed DI input paremeter ch1				
DI function selection	Set pre-value	Unsigned8		The DI point is the X7 input point of this machine
Set Counter preset value	10000	Integer32		

The counter preset function allows the counter value to be either reset to zero or set to the preset value when a digital input (DI) point is triggered. Taking the settings in the above figure for example, when X3 is triggered by a rising edge, the counter value is reset to zero; when X7 is triggered by a rising edge, the counter value is set to 10000.

To use this function, Bit0 or Bit1 of the Counter Channel Spec Command parameter must be set to True. For detailed description, please refer to Section 15.5.6.5.9.

15.5.6.8 Counter Gate Control

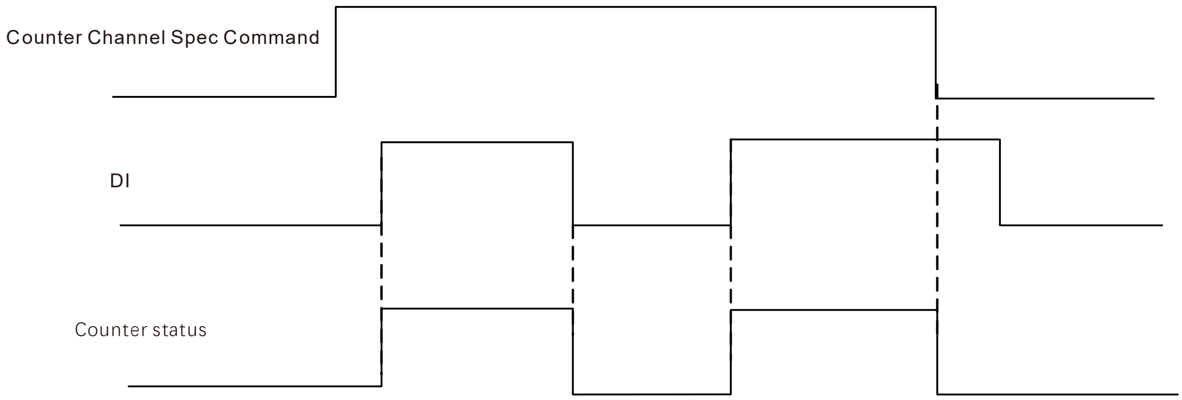
On the RTU-PN12, both CH1 and CH3 high-speed counters support the two high-speed interrupt points X3 and X7 for the gate control function. Before using this function, you need to set the configuration parameters "DI Function Selection" of the counter slot module to “Gate mode”.



Parameters	Value	Data Type	Allowed Values	Description
Counter parameter set				
General parameters				
Counter type	Annular Type	Unsigned8		
Input signal type	pulse and direction	Unsigned8		
Direction set	forward	Unsigned8		Effective only in single pulse mode
AB-phase frequency	4 octave frequency	Unsigned8		
max value	2147483647	Integer32	0..2147483647	
min value	-2147483648	Integer32	-2147483648..0	
Counting edge	Rising Edge	Unsigned8		Effective in single-pulse and pulse+direction modes
high speed DI input paremeter ch0				
DI function selection	Gate mode	Unsigned8		The DI point is the X3 input point of this machine
Set Counter preset value	0	Integer32		
high speed DI input paremeter ch1				
DI function selection	Gate mode	Unsigned8		The DI point is the X7 input point of this machine
Set Counter preset value	0	Integer32		

In Gate mode, you cannot enable or disable the counter with the "Counter Channel Command" parameter. The counter is only enabled if bit0 or bit1 of the "Counter Channel Spec Command" parameter is set and the hardware gate signal (on X3/X7) is active.

For details on the "Counter Channel Spec Command" parameter, please refer to Section 15.5.6.5.9.



15.5.6.9 Counter Comparison

On the RTU-PN12, four channels of high-speed counters all support the counter comparison function. Each counter supports up to two channels of comparison, which are available for digital output (DO) and counter action setting.

Taking CH1 high-speed counter for example, the relevant parameters are as follows:

⊟ Compare Channel_0				
Compare 1 value	0	Integer32		
Compare 1 Y	Y0	Unsigned8		
DO funtion	not use	Unsigned8		
DO Effective control parameter	0	Unsigned16		
Compare 1 Set-Counter action	not use	Unsigned8		
Compare 1 Set-pre value	0	Integer32		
⊟ Compare Channel_1				
Compare 2 value	0	Integer32		
Compare 2 Y	Y1	Unsigned8		
Y1 funtion	not use	Unsigned8		
DO Effective control parameter	0	Unsigned16		
Compare 2 Set-Counter action	not use	Unsigned8		
Compare 2 Set-pre value	0	Integer32		

Classification	Parameter Name	Description
Configuration parameters	Compare value	The comparison value of the counter.
	Compare Y	Select a digital output point (DO) for each comparison output channel.
	DO function	Set the output action of the assigned DO points when the counter comparison is triggered.
	DO Effective control parameter	Set the time of being ON of DO when the counter comparison is triggered.
	Compare Set-Counter action	Counter action
	Compare Set-pre value	Counter preset value
PNIO I/O Mapping	Counter Channel Spec Command	Counter comparison command word

15.5.6.9.1 Comparison Value

Parameter Name	Description	Data Type	Range	Default
Compare value	The comparison value of the counter. When the counter value matches or exceeds the comparison value, the comparison condition is triggered.	DINT	-	0

15.5.6.9.2 DO Selection

Parameter Name	Description	Data Type	Range	Default
Compare Y	Select a digital output point (DO) for each comparison output channel. Each counter is assigned two digital output points. For example, high-speed counter channel 1 uses the output points Y0 and Y1.	ENUM	-	Y0

15.5.6.9.3 DO Function Selection

Parameter Name	Description	Data Type	Range	Default
DO function	Select the output action of the assigned DO points when the counter comparison is triggered.	ENUM	-	Not use

Explanation of DO functions:

DO function selection	Description
Not use	Disables the output triggered by the counter comparison.
Set ON	When the counter comparison is triggered, the designated digital outputs (DO) are set to ON. This function is only valid for general output and invalid for pulse output. For example, if Y0 is the comparison output point, Y0 will be set to ON once the counter value exceeds the comparison value.
Set Off	When the counter comparison is triggered, the designated digital outputs (DO) are reset to OFF. This function is only valid for general output and invalid for pulse output. For example, if Y0 is the comparison output point, Y0 will be reset to OFF once the counter value exceeds the comparison value.
Toggle	When the counter comparison is triggered, the assigned digital outputs (DO) toggle their states. This function is only valid for general output and invalid for pulse output. For example, if Y0 is the comparison output point, its state will toggle once the counter value exceeds the comparison value.
Set ON sometime	When the counter comparison is triggered, the assigned digital outputs (DO) are set to ON for a specific period of time which is set by the DO effective control parameter. This function is valid when the output is a general output, and invalid when it is a pulse output. For example, Y0 is the comparison output and the DO effective control parameter is set to 10000. When the counter value exceeds the comparison value, Y0 will be ON for 1 second (10000 x 100 us), and then will be OFF after 1 second.
Set ON counter value	When the counter comparison is triggered, the assigned digital outputs (DO) are set to ON and remain ON until the counter accumulates an additional number of counts specified by the DO effective control parameter. It is valid when the output is a general output, and invalid when it is a pulse output. For example, Y0 is the comparison output and the DO effective control parameter is set to 10000. When the counter exceeds the comparison value, Y0 will set to ON, and when the counter accumulates another 10000 counts, Y0 will be OFF.
Pulse start*1	When the counter comparison is triggered, the corresponding pulse output channel is activated. This action is equivalent to setting the Pulse Output Channel Command parameter (see Section 15.5.6.4.1) to 1, starting the pulse output. This function is only valid when the output is a pulse output.
Pulse stop*1	When the counter comparison is triggered, the corresponding pulse output channel is deactivated. This action is equivalent to setting the Pulse Output Channel Command parameter (see Section 15.5.6.4.1) to 0, stopping the pulse output. This function is only valid when the output is a pulse output.

*1: If the DO function parameter is set to “Pulse start” or “Pulse stop”, the selected comparison output (DO) must be an even-numbered point Y0, Y2, Y4 or Y6.
If you select “Pulse start” for the DO function parameter, please first configure the relevant parameters for pulse output.

15.5.6.9.4 DO Effective Control Parameter

Parameter Name	Description	Data Type	Range	Default
DO Effective control parameter	Set the time of being ON of DO when the counter comparison is triggered. It is used with the DO function parameter together. This parameter is only valid when the DO function parameter is set to "Set ON sometime" and "Set ON counter value".	UINT	-	0

When the DO function parameter is set to "Set ON sometime", the unit is 100 us; when the DO function parameter is set to "Set ON counter value", the unit is counts.

15.5.6.9.5 Counter Action

Parameter Name	Description	Data Type	Range	Default
Compare Set-Counter action	Select the action of the counter when the counter comparison is triggered	ENUM	-	Not use

Explanation of counter actions:

Counter action	Description
Not use	Disables the counter action triggered by the counter comparison.
Counter stop	When the counter comparison is triggered, the current counter stops.
Set counter pre-value	When the counter comparison is triggered, the current value of the counter is set to the preset value, which is used with the Compare Set-pre value parameter together.

15.5.6.9.6 Counter Preset Value

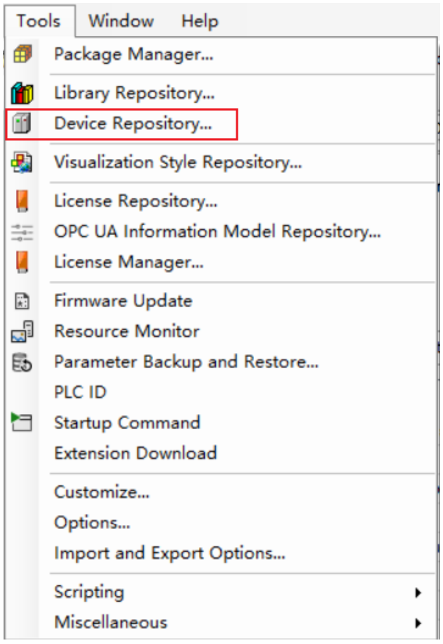
Parameter Name	Description	Data Type	Range	Default
Compare Set-pre value	When the counter comparison is triggered, the value of the counter will be set to the value of this parameter you set.	DINT	-	0

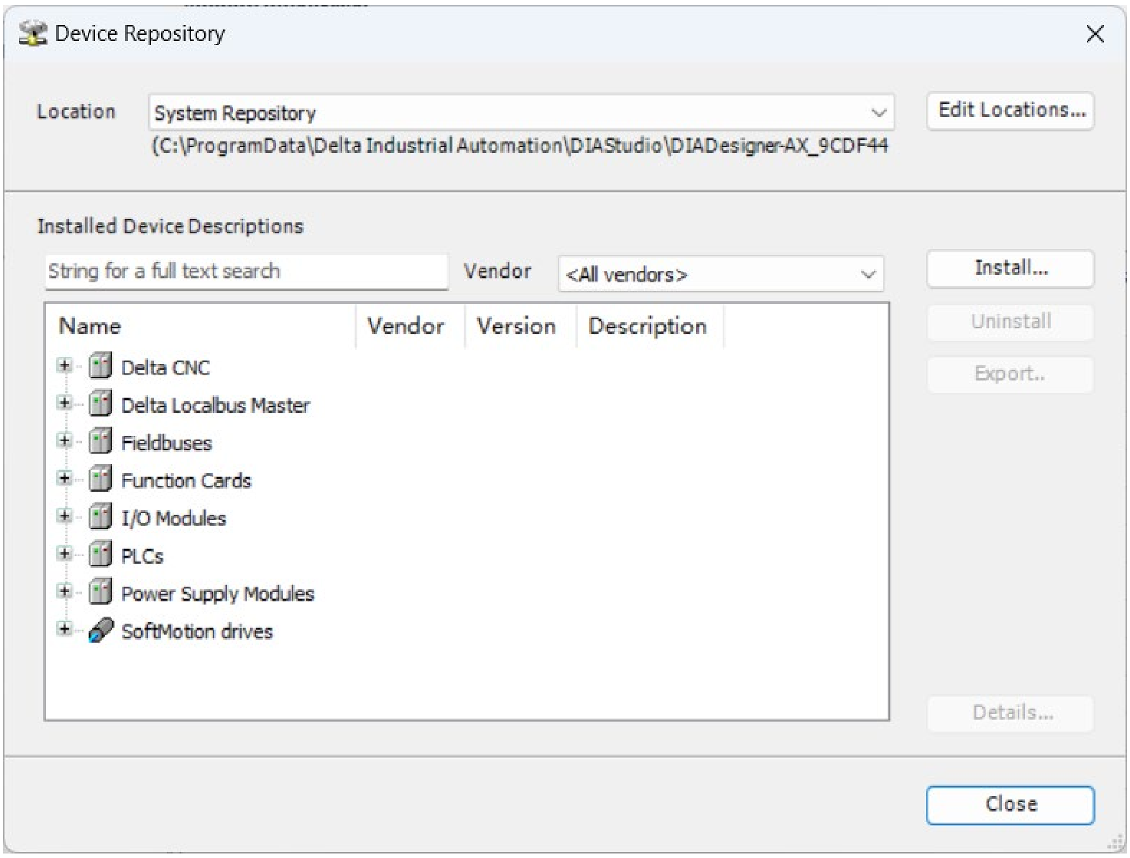
15.5.7 Settings in DIADesigner-AX

15.5.7.1 Install GSDML File

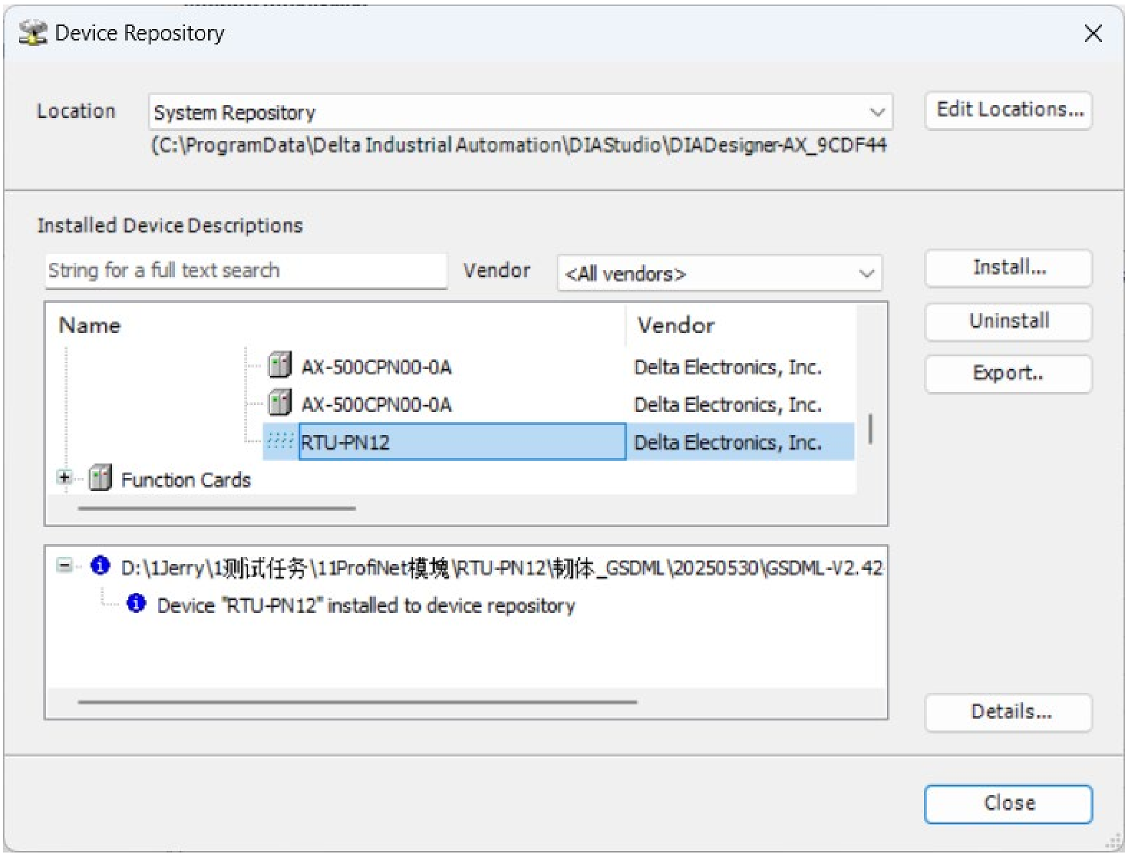
The RTU-PN12 already exists in the DIADesigner-AX software, and so no manual installation of the device is required. However, if you want to update it manually, the manual update steps are as follows:

1. In the menu bar, click ***Tools > Device Repository***…, then click ***Install***… and select the GSD file to be installed in the Device Repository window.



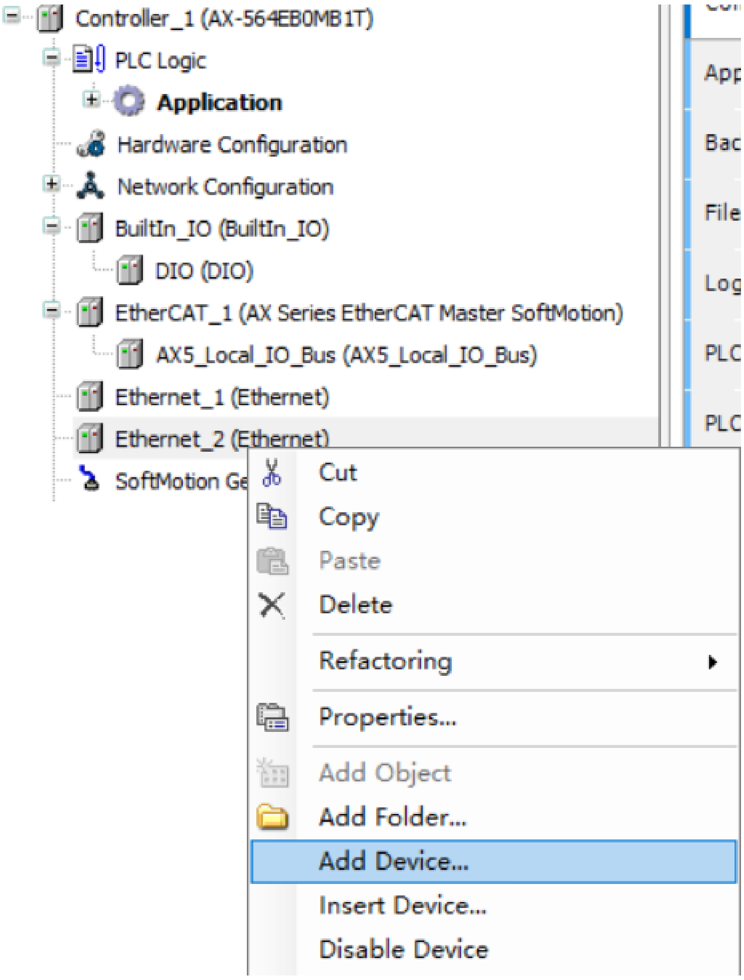


2. After the installation is completed, the manually added RTU-PN12 can be seen in the following window.

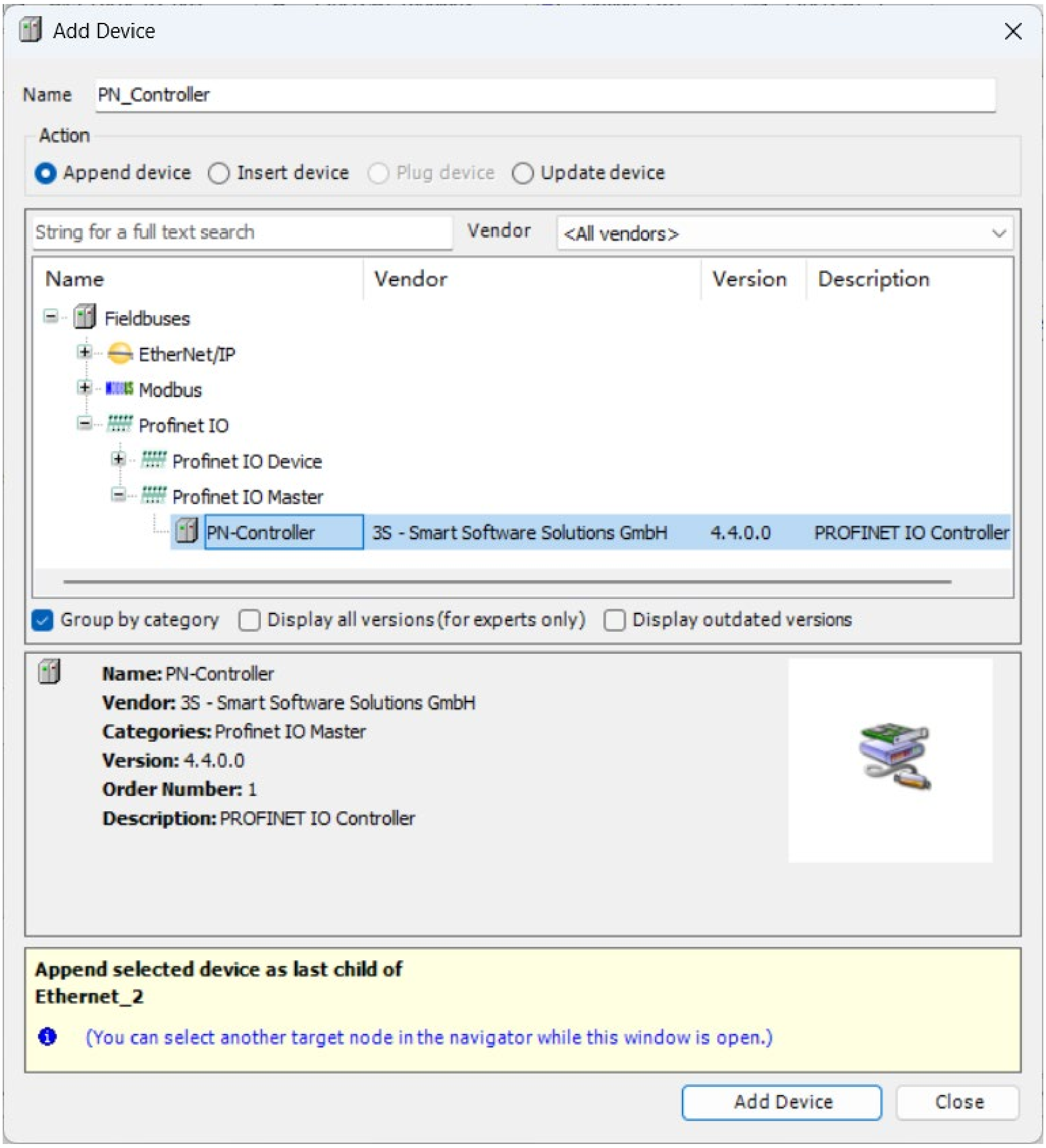


15.5.7.2 Scan for Devices

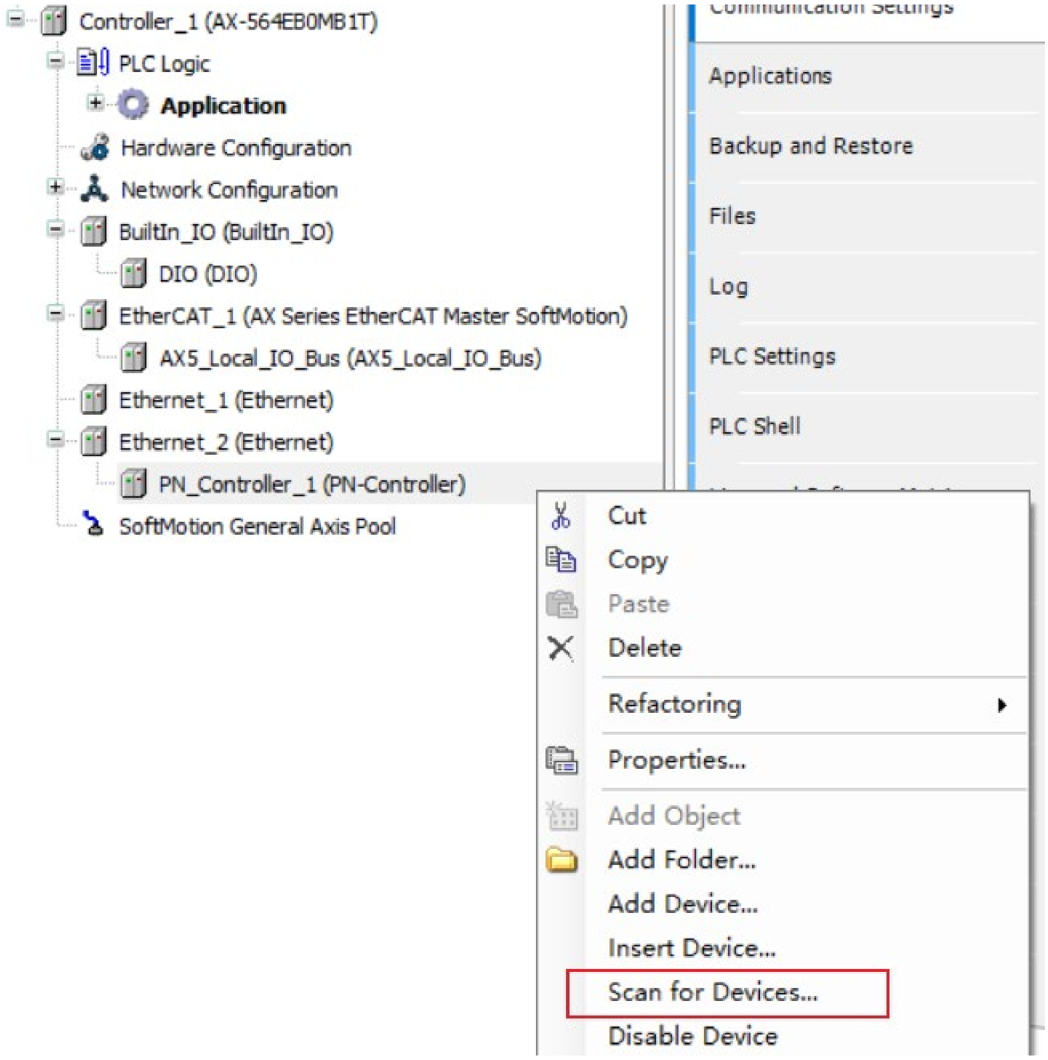
1. Open the DIADesigner-AX software, and create a new project. Right-click ***Ethernet*** in the Devices tree, click ***Add Device…*** from the context menu, and then select ***PN-Controller*** from ***Profinet IO Master*** under ***Profinet IO*** in the Add Device window to manually add the PN Controller.


Controller_1 (AX-564EB0MB1T)
PLC Logic
Application
Hardware Configuration
Network Configuration
BuiltIn_IO (BuiltIn_IO)
DIO (DIO)
EtherCAT_1 (AX Series EtherCAT Master SoftMotion)
AX5_Local_IO_Bus (AX5_Local_IO_Bus)
Ethernet_1 (Ethernet)
Ethernet_2 (Ethernet)
Cut
Copy
Paste
Delete
Refactoring
Properties...
Add Object
Add Folder...
Add Device...
Insert Device...
Disable Device

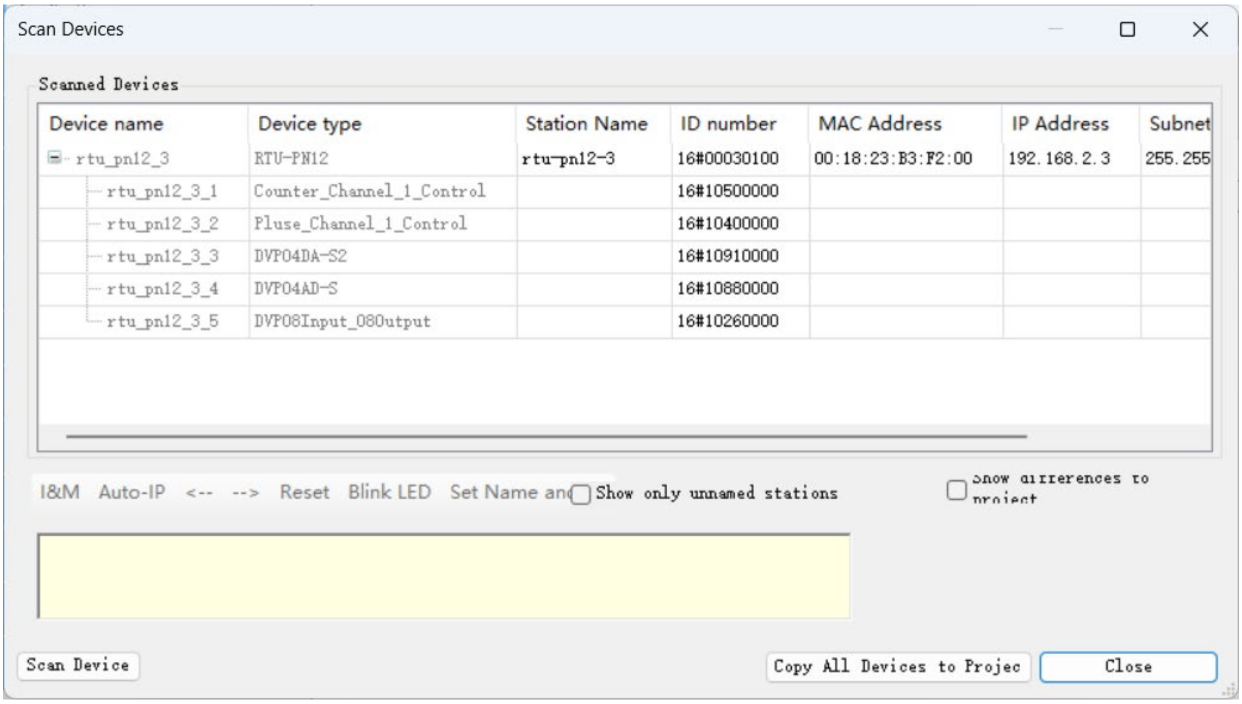
15


Add Device
Name
PN_Controller
Action
Append device
Insert device
Plug device
Update device
String for a full text search
Vendor
<All vendors>
Name
Vendor
Version
Description
Fieldbuses
EtherNet/IP
Modbus
Profinet IO
Profinet IO Device
Profinet IO Master
PN-Controller
3S - Smart Software Solutions GmbH
4.4.0.0
PROFINET IO Controller
Group by category
Display all versions (for experts only)
Display outdated versions
Name: PN-Controller
Vendor: 3S - Smart Software Solutions GmbH
Categories: Profinet IO Master
Version: 4.4.0.0
Order Number: 1
Description: PROFINET IO Controller
Append selected device as last child of
Ethernet_2
(You can select another target node in the navigator while this window is open.)
Add Device
Close

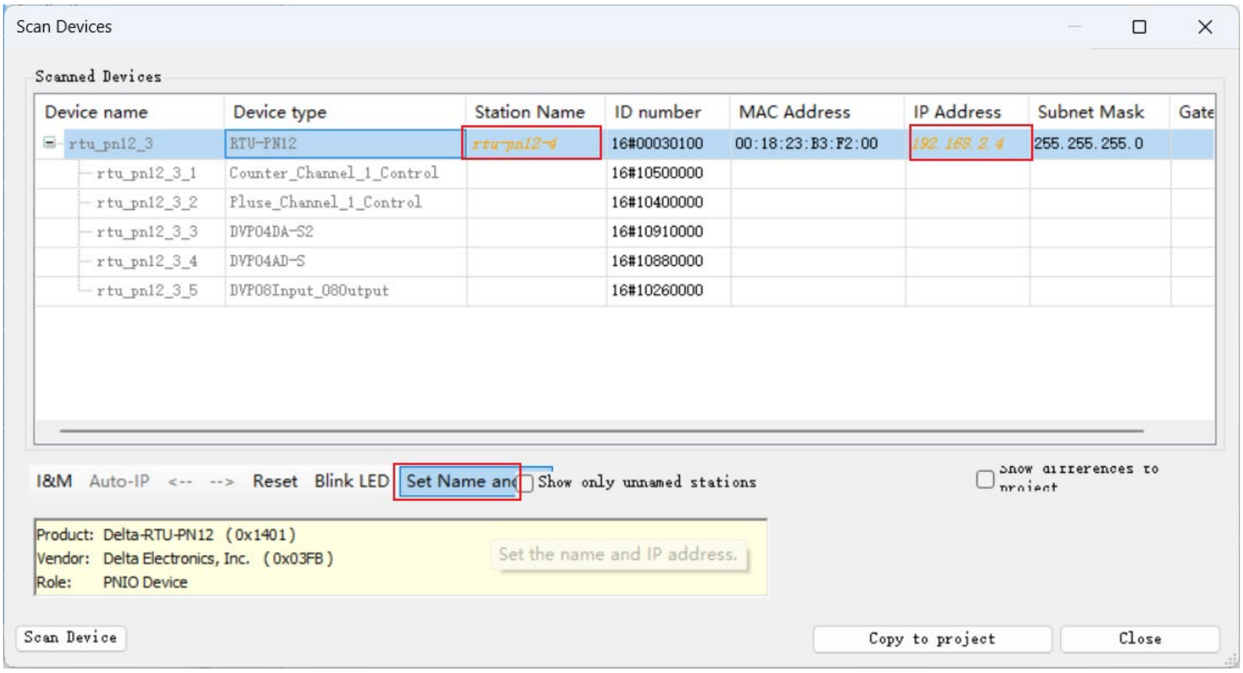
2. Right-click ***PN Controller*** in the Devices tree, and then click ***Scan for Devices***.



3. After scanning is complete, the RTU-PN12 and its module configurations show up. These module configurations are the last downloaded configurations, not the currently connected modules. Click the ***Copy to project*** button, and then the device will be added under **PN Controller**.

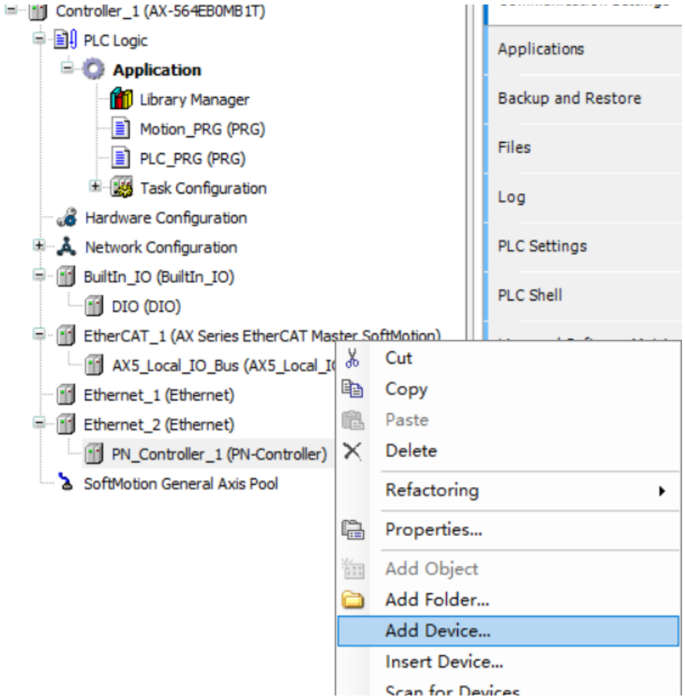


4. The station name and IP address can be set in the **Scan Devices** interface.

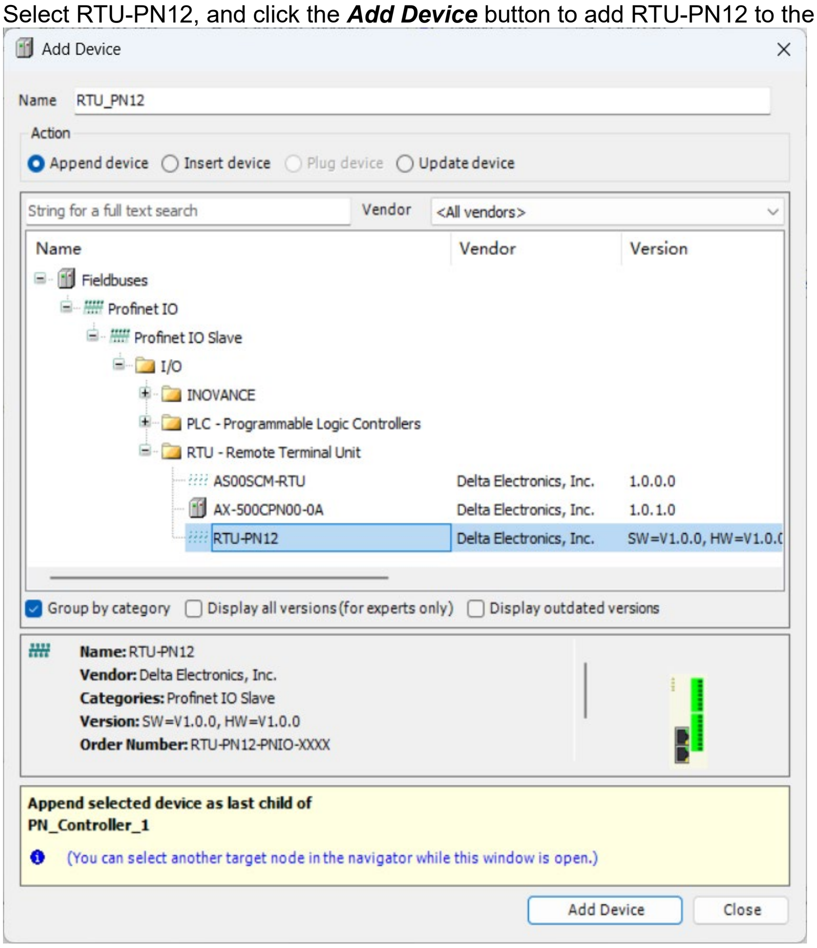


15.5.7.3 Manually Add RTU-PN12

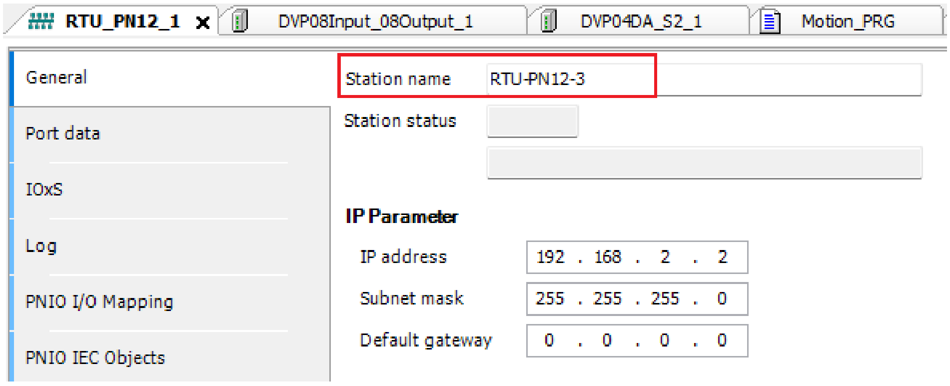
1. Right-click ***PN Controller*** in the Devices tree, and click ***Add Device…*** from the context menu.



2. Select RTU-PN12, and click the ***Add Device*** button to add RTU-PN12 to the Devices tree.



3. Double-click RTU-PN12 to come to the RTU-PN12 configuration interface, where you enter a name in **Station name** that exactly matches the actual station name.

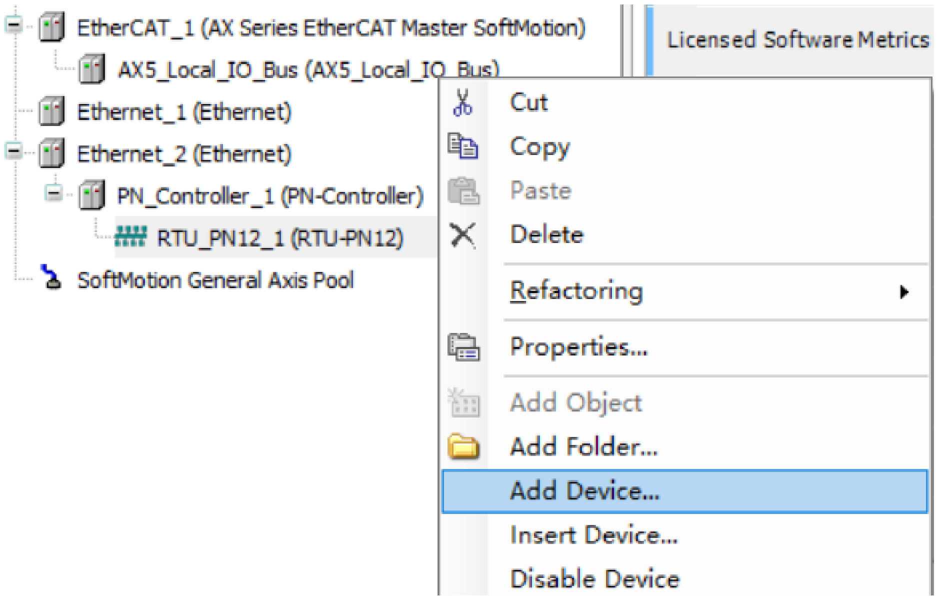


15.5.7.4 Manually Add a Slot Module

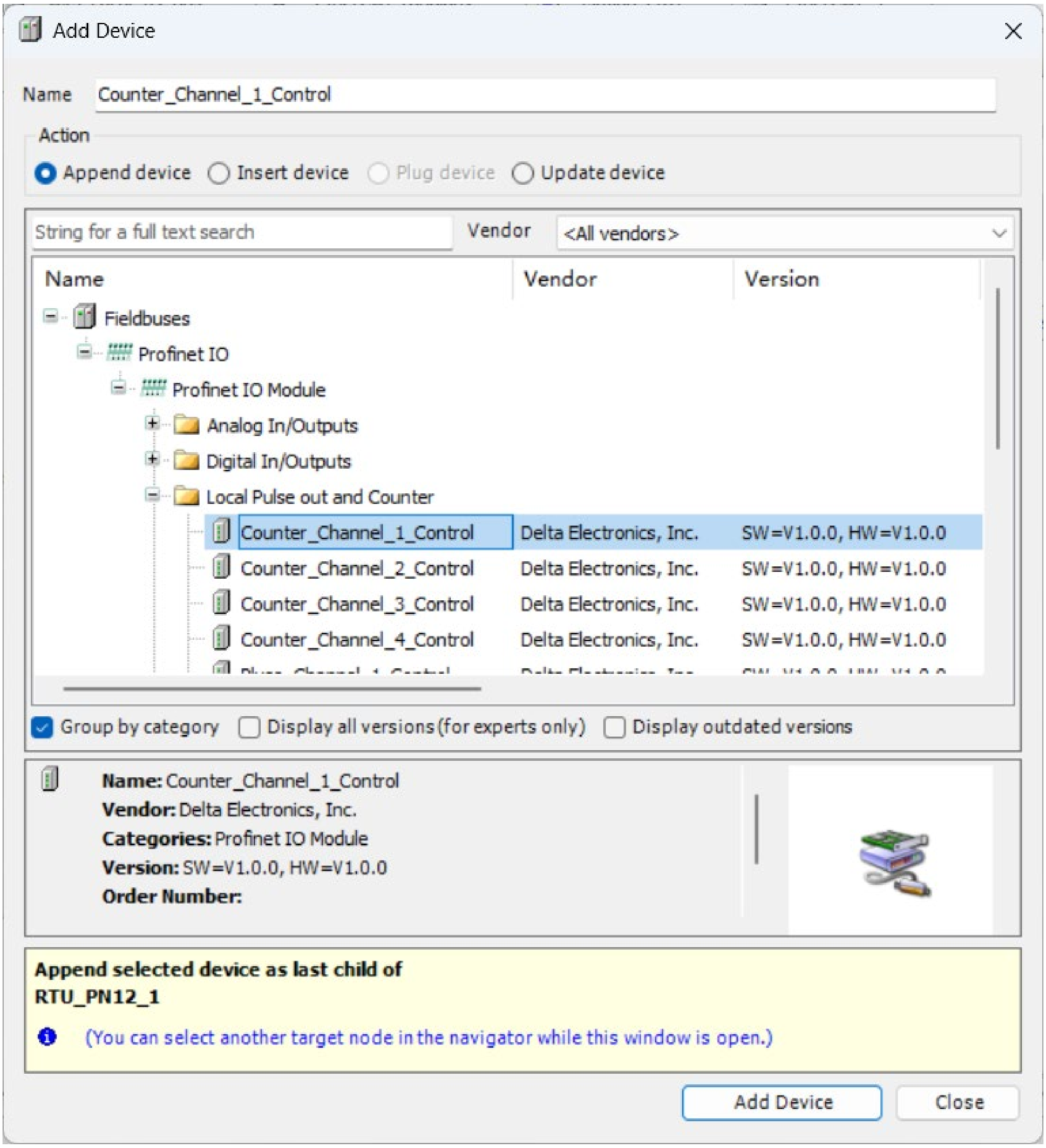
The RTU-PN12 does not support the Scan function, and the slot modules need to be added manually.

The operation steps are as follows:

1. Right-click ***RTU_PN12***, and click ***Add Device*** from the context menu to manually add a module.



2. Select the desired module and click the ***Add Device*** button.



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15.5.8 Application Examples

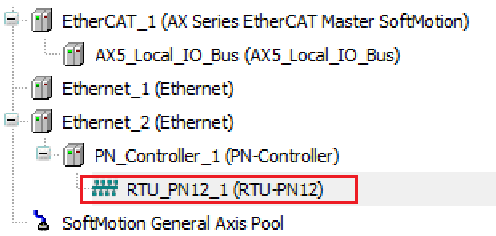
15.5.8.1 AX5 Controls RTU-PN12's Local Inputs and Outputs and Right-Side Modules DVP16SP and 04DA-S2

- **Control Requirements**

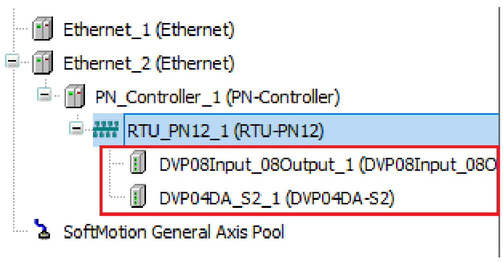
1. Output Control: Force ON RTU-PN12's local output points Y0-Y7;
   Input Monitoring: Monitor the status of RTU-PN12's local input points X0-X7.
2. Output Control: Force ON DVP16SP's output points 0-7;
   Input Monitoring: Monitor the status of DVP16SP's input points 0-7.
3. Voltage Output: Configure DVP04DA-S2's channels 1-4 to 5 V.

- **Settings in DIADesigner-AX**

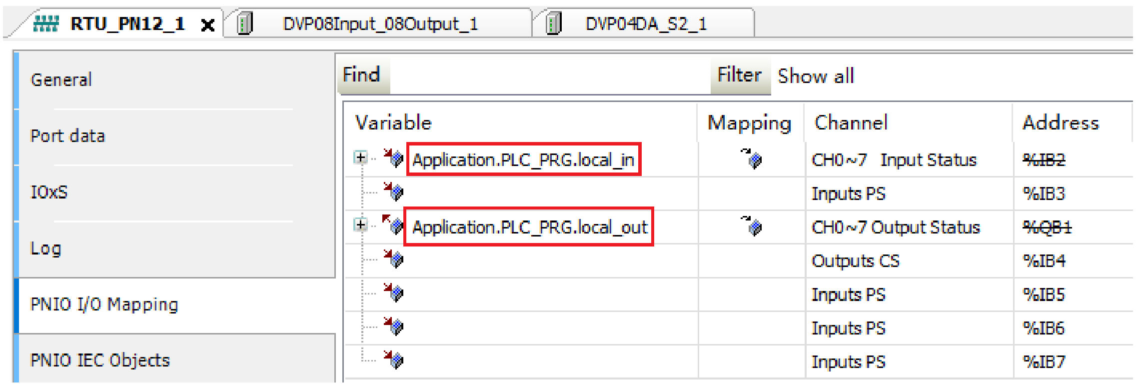
1. After opening the DIADesigner-AX software and creating a new AX5 project, add a **PN-Controller** under the **Ethernet** device, and **RTU-PN12** under the PN-Controller. For detailed operation, refer to Sections 15.5.7.2 and 15.5.7.3.

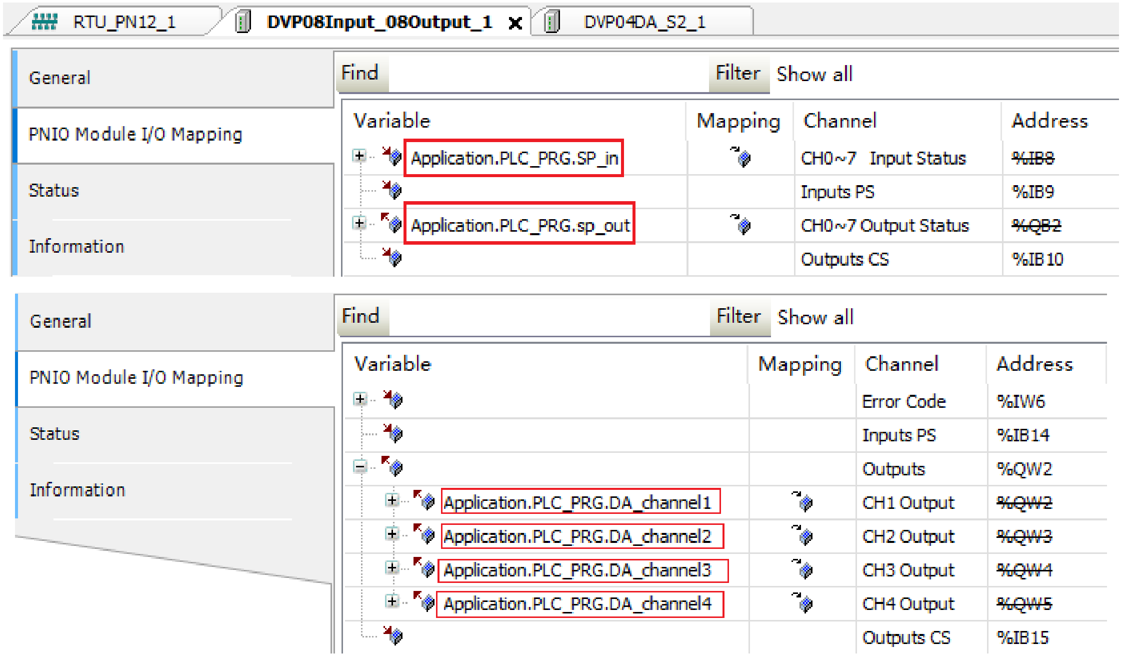


2. Add right-side slot modules, DVP08Input_08Output and DVP04D-S2 under the PN-Controller. For detailed operations, refer to Section 15.5.7.4.



3. Set the PNIO I/O mappings for RTU-PN12's local inputs and outputs, DVP08Input_08Output, and DVP04D-S2 respectively.





4. By writing values to variables in the program, all the output points: Y0-Y7 of RTU-PN12 and 0-7 of the right-side module DVP16SP are ON, and the channels 1- 4 of DVP04DA-S2 output 5 V voltage.

```
PROGRAM PLC_PRG
VAR
    local_in : BYTE;
    local_out : BYTE;
    SP_in:BYTE;
    sp_out:BYTE;
    DA_channel1:UINT;
    DA_channel2:UINT;
    DA_channel3:UINT;
    DA_channel4:UINT;
END_VAR
```

```
local_out := 255;
local_in ;
sp_out := 255;
SP_in;
DA_channel1 := 2000;
DA_channel2 := 2000;
DA_channel3 := 2000;
DA_channel4 := 2000;
```

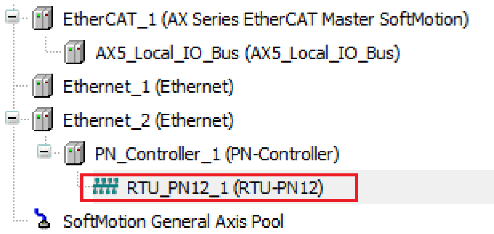
15.5.8.2 AX5 Controls RTU-PN12's Pulse Output and High-Speed Counting

- **Control Requirements**

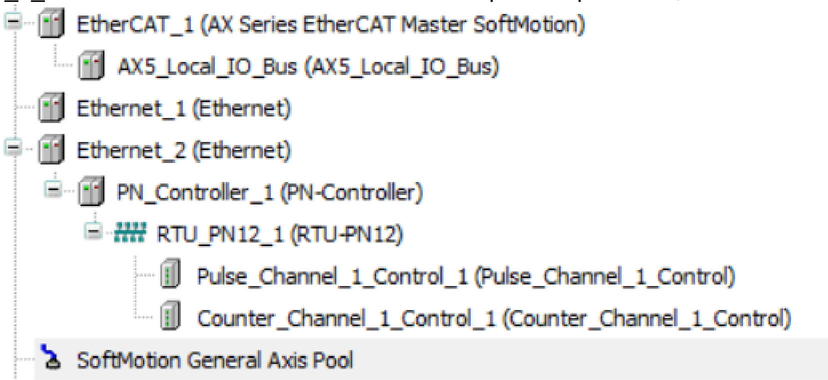
1. Select the pulse output mode: Pulse+Direction for RTU-PN12's pulse channel 1. Set the target output pulse number to 1000000, the target frequency to 100 kHz, and the acceleration/deceleration time to 1000 milliseconds.
2. High-speed counter channel 1 on the RTU-PN12 counts pulses output by its pulse output channel 1.

- **Settings in DIADesigner-AX**

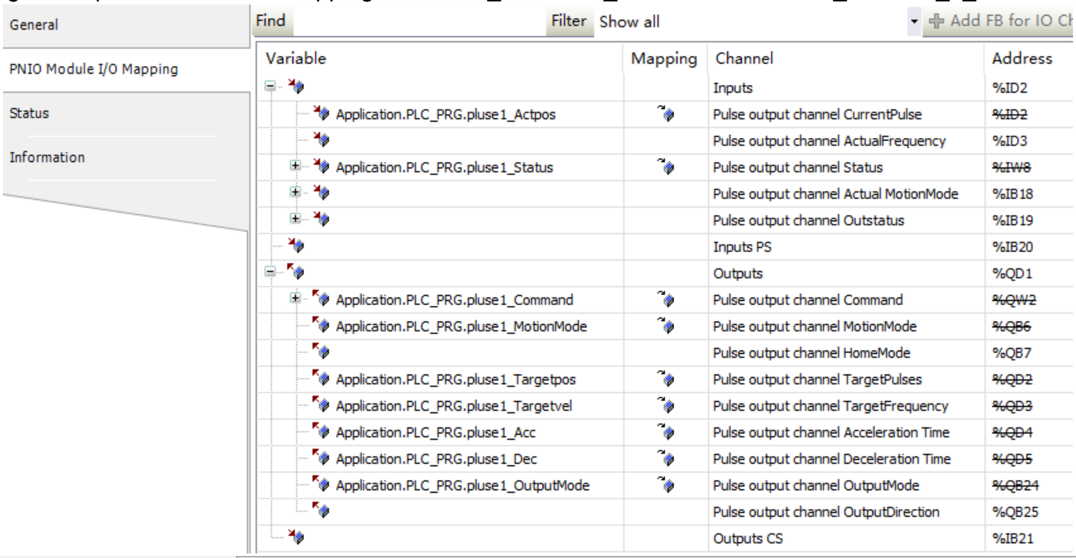
1. After opening the DIADesigner-AX software and creating a new AX5 project, add a **PN-Controller** under the **Ethernet** device, and add **RTU-PN12** under the **PN-Controller**. For detailed software operation, refer to Sections 15.5.7.2 and 15.5.7.3.



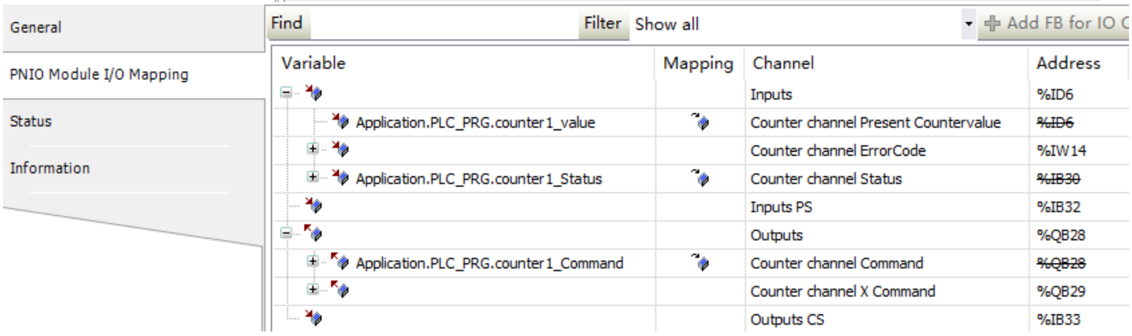
2. Add pulse output and high-speed counting slot modules: Pulse_Channel_1_Control and Counter_Channel_1_Control under the PN-Controller. For the specific operations, refer to Section 15.5.7.4.



3. Set the counter type to Pulse+Direction in the configuration parameter interface of Counter_Channel_1_Control.
4. Configure respective PNIO I/O mappings for Pulse_Channel1_Control and Counter_Channel_1_Control.



Variable	Mapping	Channel	Address
		Inputs	%ID2
Application.PLC_PRG.pluse1_Actpos		Pulse output channel CurrentPulse	~~%ID2~~
		Pulse output channel ActualFrequency	%ID3
Application.PLC_PRG.pluse1_Status		Pulse output channel Status	~~%IW8~~
		Pulse output channel Actual MotionMode	%IB18
		Pulse output channel Outstatus	%IB19
		Inputs PS	%IB20
		Outputs	%QD1
Application.PLC_PRG.pluse1_Command		Pulse output channel Command	~~%QW2~~
Application.PLC_PRG.pluse1_MotionMode		Pulse output channel MotionMode	~~%QB6~~
		Pulse output channel HomeMode	%QB7
Application.PLC_PRG.pluse1_Targetpos		Pulse output channel TargetPulses	~~%QD2~~
Application.PLC_PRG.pluse1_Targetvel		Pulse output channel TargetFrequency	~~%QD3~~
Application.PLC_PRG.pluse1_Acc		Pulse output channel Acceleration Time	~~%QD4~~
Application.PLC_PRG.pluse1_Dec		Pulse output channel Deceleration Time	~~%QD5~~
Application.PLC_PRG.pluse1_OutputMode		Pulse output channel OutputMode	~~%QB24~~
		Pulse output channel OutputDirection	%QB25
		Outputs CS	%IB21



Variable	Mapping	Channel	Address
		Inputs	%ID6
Application.PLC_PRG.counter1_value		Counter channel Present Countervalue	~~%ID6~~
		Counter channel ErrorCode	%IW14
Application.PLC_PRG.counter1_Status		Counter channel Status	~~%IB30~~
		Inputs PS	%IB32
		Outputs	%QB28
Application.PLC_PRG.counter1_Command		Counter channel Command	~~%QB28~~
		Counter channel X Command	%QB29
		Outputs CS	%IB33

5. Set **pulse_out** to TRUE in the program to start pulse output and high-speed counting.

```
PROGRAM PLC_PRG
VAR
    pulse1_Command : UINT;
    pulse1_MotionMode :USINT;
    pulse1_Targetpos :DINT;
    pulse1_Targetvel : DINT;
    pulse1_Acc :UDINT;
    pulse1_Dec :UDINT;
    pulse1_OutputMode :USINT;
    pulse1_Actpos :DINT;
    pulse1_Status :UINT;
    counter1_Command  :UINT;
    counter1_Status : UINT;
    counter1_value : DINT;
    RTIG1 : R_TRIG;
    pulse_Out: BOOL;
```

```
//Configure pulse output parameters
pulse1_OutputMode := 0 ;// The pulse output mode is set to Pulse+direction. (0: Pulse+direction; 1: A/B phase; 2: CW
pulse1_MotionMode := 4;//Set MotionMode to absolute position output.
pulse1_Acc := 1000;
pulse1_Dec := 1000; //Set the acceleration/deceleration time to 1000 ms.
pulse1_Targetvel := 100000;//Set the output frequency to 100k.

//Pulse output
RTIG1(CLK := pulse_Out);
IF RTIG1.Q THEN
       counter1_Command := 1;//Enable the high-speed counting.
       pulse1_Targetpos := pulse1_Actpos + 1000000; //move by 1000000 pulses from the current position.
       pulse1_Command := 1;//Enable the pulse output.
END_IF
counter1_Status;//Counter1 state
counter1_value;//Counter1 value
```

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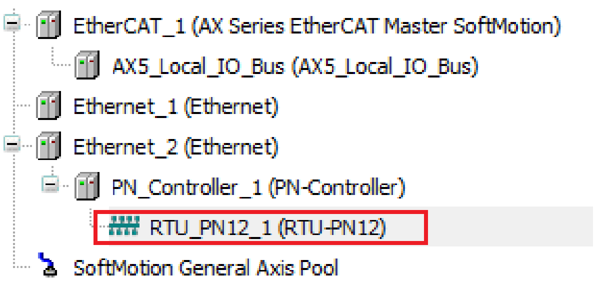
15.5.8.3 AX5 Controls RTU-PN12 for Cyclic Touch

- **Control requirement**

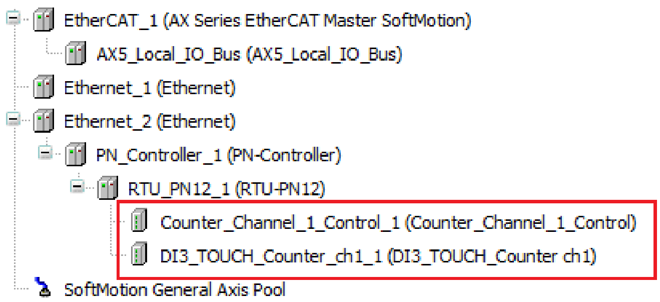
  Use the rising edge of the local input point X3 of RTU-PN12 to trigger a cyclic capture of the high-speed counter channel 1 value.

- **DIADesigner-AX settings**

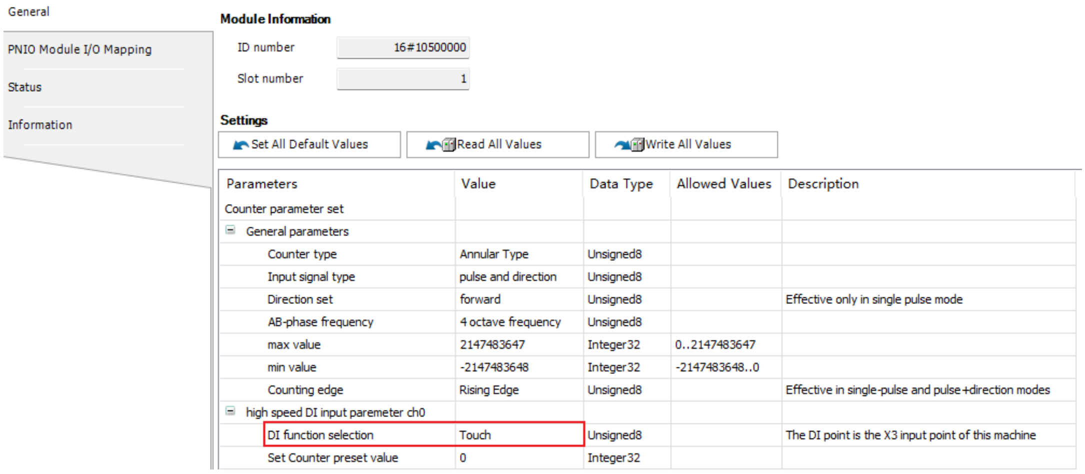
1. After starting the DIADesigner-AX software, create a new AX5 project, add a PN-Controller under the Ethernet device, and then add RTU-PN12 under the PN-Controller. For specific software operations, please refer to Sections 15.5.7.2 and 15.5.7.3.



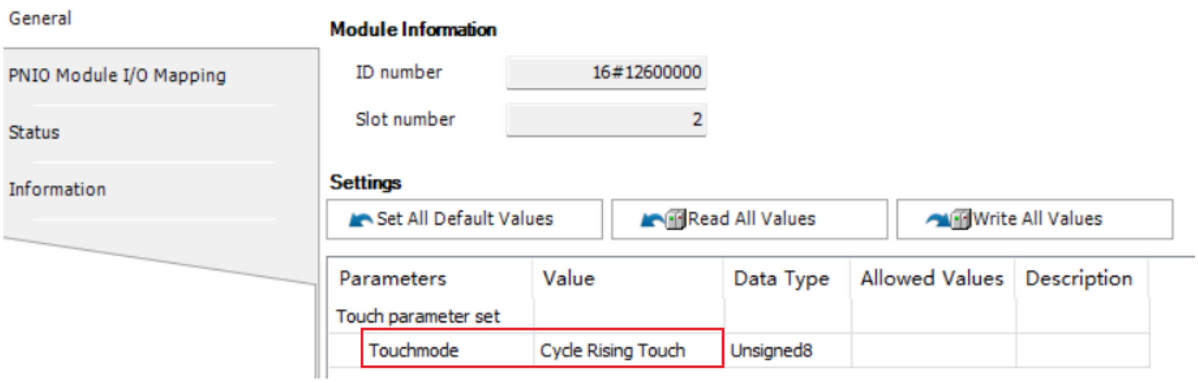
2. Add the high-speed counter and touch slot modules, Counter_Channel_1_Control and DI3_TOUCH_Counter_ch1_1 under the PN-Controller. For specific operations, please refer to Section 15.5.7.4.



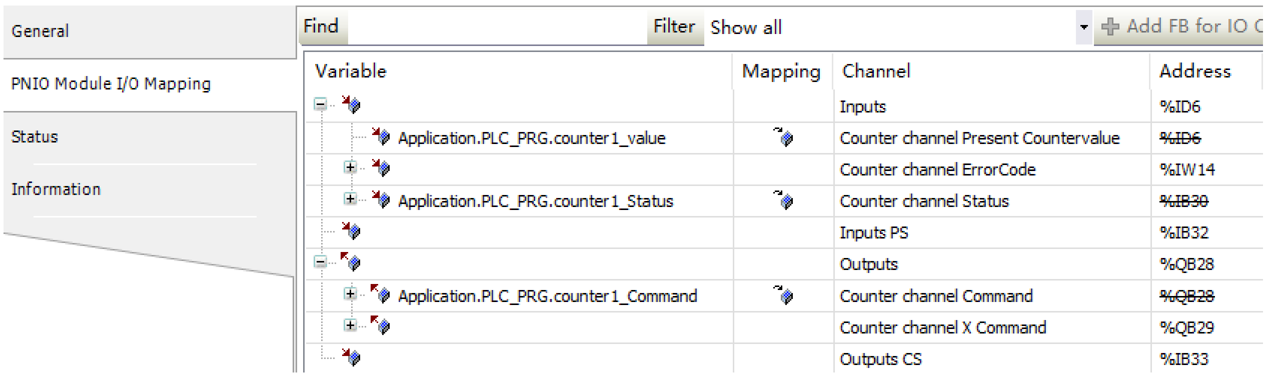
3. On the parameter setting page of Counter_Channel_1_Control, set the DI function to “Touch”.



4. On the parameter setting page of DI3_TOUCH_Counter ch1, set the Touchmode to “Cycle Rising Touch”.



5. Set the PNIO Module I/O Mappings for both Counter_Channel_1_Control_1 and DI3_TOUCH_Counter ch1.



General

PNIO Module I/O Mapping

Status

Information

Find | Filter: Show all | Add F

Variable	Mapping	Channel	Address
		Inputs	%ID6
Application.PLC_PRG.touch_Status		touch status	~~%IW12~~
Application.PLC_PRG.touch_num		touch number	~~%IW13~~
Application.PLC_PRG.touch_postive_pos		TouchCounter positive value	~~%ID7~~
		TouchCounter negative value	%ID8
		Inputs PS	%IB36
Application.PLC_PRG.touch_Command		Touch Cmd	~~%QW2~~
		Outputs CS	%IB37

6. The high-speed counter and touch functions are enabled in the program. When X3 is triggered by a rising edge, the current value of the counter will be captured and stored in the touch_postive_pos variable, and touch_num will increment by 1 each time a touch is performed.

Expression	Type	Value	Prepared va
counter1_Command	UINT	1	
counter1_Status	UINT	1	
counter1_value	DINT	100000	
touch_Command	UINT	1	
touch_num	UINT	2	
touch_Status	UINT	3	
touch_postive_pos	DINT	100000	

```
//START COUNTING
counter1_Command[ 1 ] := 1;
counter1_Status[ 1 ] ; //counter status
counter1_value[ 100000 ]; //counter value

//TOUCH PROBE
touch_Command[ 1 ] := 1; //start touch probe
touch_Status[ 3 ]; //touch probe status
touch_num[ 2 ] ; //capture numbers
touch_postive_pos[ 100000 ]; //Rising edge capture value RETURN
```

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15.5.9 LED Indicators and Troubleshooting

- **POWER LED**

The POWER LED indicates the state of the power supply for RTU-PN12.

LED status	Indication	How to correct
OFF	No power supply	1. Check if the power supply for RTU-PN12 is normal. 2. If the problem persists after restarting power, contact your local authorized distributors.
Green light ON	The power supply is normal.	No correction is required.

- **RUN LED**

The RUN LED indicates whether the initialization of RTU-PN12 is completed.

LED status	Indication	How to correct
OFF	Abnormal power supply or initialization failure	1. Check if the power supply for RTU-PN12 is normal. 2. If the problem persists after restarting power, contact your local authorized distributors.
Green light ON	Initialization success	No correction is required.

- **SF LED**

The SF (System Fault) LED indicates the system error of RTU-PN12.

LED status	Indication	How to correct
OFF	The system is working normally.	No correction is required.
Red light blinking	Inconsistent right-side configuration	Verify the right-side modules and their configuration.
	Abnormal right-side modules	
Red light ON	The initialization is in progress	No correction is required. The indicator will automatically turn off after initialization is done.
	Low voltage	Check the voltage of the module is normal.

- **BF LED**

The BF (Bus Fault) LED indicates the connection status of RTU-PN12 on the bus.

LED status	Indication	How to correct
OFF	The communication with the PN controller is normal.	No correction is required.
Red light blinking	The network cable is connected properly, but the communication with the PN-controller is abnormal.	Check the PN configuration and download the correct configuration to the PN-controller.
Red light ON	The PROFINET port is not wired yet.	Make sure that the cable and the PROFINET port are well connected.

- **Error codes**

To read the error code for a non-disconnection error, check the Module Status parameter. For details, please refer to sections 15.5.6.3.6 and 15.5.6.1.1.

MEMO

A

Appendix A EMC Standards

Table of Contents

A.1 EMC Standards for DVP Series

A.1.1 DVP Series EMC Standards

The EMC standards that are applicable to DVP series system are listed in the following tables.

- **EMI**

Port	Frequency range	Level (Normative)	Reference standard
Enclosure port (radiated) (measured at a distance of 10 meters)	30-230 MHz	40 dB (μV/m) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB (μV/m) quasi-peak	
AC power port (conducted)	0.15-30 MHz	73 dB (μV) quasi-peak	IEC 61000-6-4
		60 dB (μV) average	

- **EMS**

Environmental phenomenon	Reference standard	Test		Test level
Electrostatic discharge	IEC 61000-4-2	Contact		±4 kV
		Air		±8 kV
Radio frequency electromagnetic field Amplitude modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	80-1000 MHz	10 V/m
			1.4-2.0 GHz	3 V/m
			2.0-6.0 GHz	3 V/m
Power frequency magnetic field	IEC 61000-4-8	60 Hz		30 A/m
		50 Hz		30 A/m

A

- **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 ground)	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

A.1.2 Installation Instructions to meet EMC Standards

You must install an DVP 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.

A.1.3 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.

MEMO

Smarter. Greener. Together.

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