DVP-ES/EX

Programmable Logic Controller
Instruction Sheet

http://www.delta.com.tw/industrialautomation/

1 WARNING

⚠ This Installation Sheet only provides descriptions for electrical specifications, function specifications, installation & wiring, troubleshooting and peripherals. Other detail infromation about programming and instructions, please see PLC Application Manual. For more information about the optional peripherals, please refer to their individual instruction sheet or user manuals.

⚠ This is an OPEN TYPE PLC. The PLC should be kept in an enclosure away from airborne dust, high humidity, electric shock risk and vibration. Also, it should be equipped with protective methods such as some special tools or keys to open the enclosure, so as to avoid the hazard to users and the damage to the PLC. The power must be OFF before any maintenance.

⚠ Never connect the AC main circuit power supply to any of the input/output terminals, as it will damage the PLC. Check all the wiring prior to power up. To avoid any electromagnetic noise, make sure the PLC is properly grounded ⏚. Do NOT touch terminals when power on.
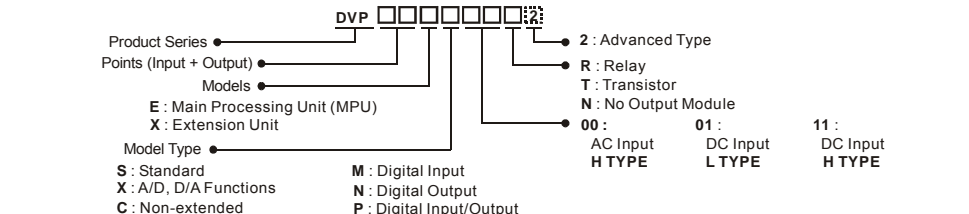
2 INTRODUCTION

2.1. Model Name Explanation and Peripherals

Thank you very much for purchasing Delta's DVP-ES/EX Series PLC. DVP-ES/EX Series provide the main processing units and extension units. The processing units offer 14~60 points and the extension units offer 8~32 points. The maximum input and output can be extended up to 128 points respectively. Also, it can be used on various applications according to input and output points, power supply, digital input and output modules.
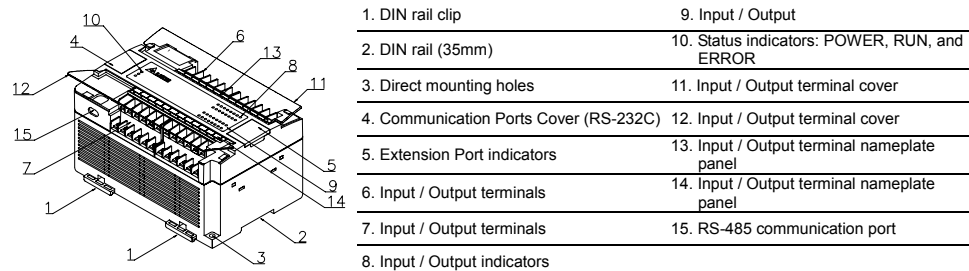
■ Nameplate Explanation

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                 32ES00R   2  T  5  14  0004
MODEL      : DVP32ES00R2                    Production series
POWER INPUT : 100~240Vac 50/60Hz 35VA MAX   Production week
OUTPUT MODULE : 2.0A 240Vac 50/60Hz RES LOAD Production year (2005)
                                            Production plant (Taoyuan)
VX.XX    32ES00R2T5140004                   Serial number of version
DELTA ELECTRONICS, INC.   MADE IN XXXXXX    Production Model
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PLC Model
Input Power Supply Spec.
Output Module Spec.
Barcode and Serial Number
MCU Version

■ Model/Serial Number Explanation

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DVP □ □ □ □ □ □ □ □
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- Product Series
- Points (Input + Output)
- Models
- Model Type — E : Main Processing Unit (MPU), X : Extension Unit
- S : Standard, X : A/D, D/A Functions, C : Non-extended
- 2 : Advanced Type
- R : Relay, T : Transistor, N : No Output Module
- 00 : AC Input H TYPE, 01 : DC Input L TYPE, 11 : DC Input H TYPE
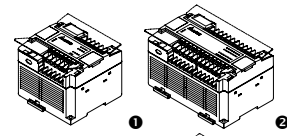- M : Digital Input, N : Digital Output, P : Digital Input/Output

■ Peripherals
◎ DVP-HPP Series: Handheld Programmable Panel
◎ WPLSoft: DVP-PLC Programming Software Tool (Windows based software)
◎ DVPACAB115: 1.5M Cable (HPP ⇔ PLC, provided in DVP-HPP Series)
◎ DVPACAB215: 1.5M Cable (PC ⇔ PLC)
◎ DVPACAB230: 3.0M Cable (PC ⇔ PLC)
◎ DVPACAB315: 1.5M Cable (HPP ⇔ PC)
◎ DVPACAB403: 30cm Cable (Main processing unit ⇔ Extension unit, or Extension unit ⇔ Extension I/O signal extension cable)
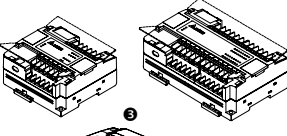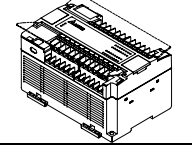
2.2. Product Profile and Outline

1. DIN rail clip
2. DIN rail (35mm)
3. Direct mounting holes
4. Communication Ports Cover (RS-232C)
5. Extension Port indicators
6. Input / Output terminals
7. Input / Output terminals
8. Input / Output indicators
9. Input / Output
10. Status indicators: POWER, RUN, and ERROR
11. Input / Output terminal cover
12. Input / Output terminal cover
13. Input / Output terminal nameplate panel
14. Input / Output terminal nameplate panel
15. RS-485 communication port

2.3. DVP-ES/EX Series Models

◎ ES Standard Main Processing Units (MPU-00)

Model Name	Power	Input Unit Point	Input Unit Type	Output Unit Point	Output Unit Type	Profile
DVP14ES00R2	100~240 VAC	8	DC Sink or Source	6	Relay	❶
DVP24ES00R2		16		8		
DVP32ES00R2		16		16		❷
DVP40ES00R2		24		16		
DVP60ES00R2		36		24		❸
DVP14ES00T2		8		6	Transistor	❶
DVP24ES00T2		16		8		
DVP32ES00T2		16		16		❷
DVP40ES00T2		24		16		
DVP60ES00T2		36		24		❸
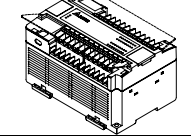
◎ ES Standard Main Processing Units (MPU-01,11)

Model Name	Power	Input Unit Point	Input Unit Type	Output Unit Point	Output Unit Type	Profile
DVP14ES01R2	24 VDC	8	DC Sink or Source	6	Relay	❹
DVP24ES01R2		16		8		❹
DVP24ES11R2		16		8		❷
DVP32ES01R2		16		16		❹
DVP14ES01T2		8		6	Transistor	❹
DVP24ES01T2		16		8		❹
DVP32ES01T2		16		16		❹
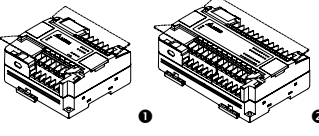
◎ EX Special Function Main Processing Units (MPU-00, MPU-11)

Model Name	Power	Input Unit DI	Input Unit AI	Input Unit Type DI	Input Unit Type AI	Output Unit DO	Output Unit AO	Output Unit Type DO	Output Unit Type AO	Profile Reference
DVP20EX00R2	100~240 VAC	8	4	DC Sink or Source	-20mA~20 mA or -10V ~ +10 V	6	2	Relay	0~20mA or 0～10V	
DVP20EX00T2		8	4			6	2	Transistor		
DVP20EX11R2	24 VDC	8	4			6	2	Relay		
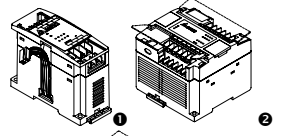
◎ Digital I/O Extension Unit for DVP-ES/EX Series- 00

Model Name	Power	Input Unit Point	Input Unit Type	Output Unit Point	Output Unit Type
DVP24XN00R	100~240 VAC	0	DC Sink or Source	24	Relay
DVP24XP00R		16		8	
DVP32XP00R		16		16	
DVP24XN00T		0		24	Transistor
DVP24XP00T		16		8	
DVP32XP00T		16		16	

◎ Digital I/O Extension Unit for DVP-ES/EX Series- 01 (L TYPE)

Model Name	Power	Input Unit Point	Input Unit Type	Output Unit Point	Output Unit Type	Profile
DVP16XM01N	24 VDC	16	DC Sink or Source	0	None	❶
DVP16XN01R		0		16	Relay	
DVP24XN01R		0		24		
DVP24XP01R		16		8		❷
DVP32XP01R		16		16		
DVP16XN01T		0		16	Transistor	
DVP24XN01T		0		24		
DVP24XP01T		16		8		
DVP32XP01T		16		16		

◎ Digital I/O Extension Unit for DVP-ES/EX Series-11 (H TYPE)

Model Name	Power	Input Unit Point	Input Unit Type	Output Unit Point	Output Unit Type	Profile
DVP08XM11N	24 VDC	8	DC Sink or Source	0	None	❶
DVP16XM11N		16		0		❷
DVP08XN11R		0		8	Relay	❶
DVP16XN11R		0		16		❸
DVP24XN11R		0		24		
DVP08XP11R		4		4		❶
DVP24XP11R		16		8		❸
DVP32XP11R		16		16		
DVP08XN11T		0		8	Transistor	❶
DVP16XN11T		0		16		❸
DVP24XN11T		0		24		
DVP08XP11T		4		4		❶
DVP24XP11T		16		8		❸
DVP32XP11T		16		16		

3 SPECIFICATIONS

3.1. Function Specifications

Items	Specifications	Remarks
Control Method	Stored program, cyclic scan system	
I/O Processing Method	Batch processing (when END instruction is executed)	I/O refresh instruction is available
Execution Speed	Basic commands (several us)	Application instructions (10 ~ hundreds us)
Program Language	Instruction, Ladder Logic, SFC	Including Step instructions

Items		Specifications	Remarks
Program Capacity		3792 Steps	Built-in EEPROM
Instructions		32 basic sequential instructions (including STL / RET)	107 application instructions
Step Relays (Latched)	Initial Step Point	10 points	S0~S9
	Zero Return Point	10 points	S10~S19
	General Step Point	108 points	S20~S127
Auxiliary Relays	General	512+232 points	M0~M511+M768~M999
	Latched	256 points	M512~M767
	Special	280 points	M1000~M1279
Timers	Digital	64 points (100 ms time base)	T0~T63
		63 points	T64~T126 (10 ms time base, when M1028 is ON)
		1 points	T127 (1 ms time base)
Counters	General	112 points	C0~C111
	Latched	16 points	C112~C127
	High Speed	13 points 1 phase 20KHz, 2 phase 5KHz	C235~C254 (all latched type)
Data Registers	General	408 points	D0 ~ D407
	Latched	192 points	D408~D599
	Special	200 points	D1000~D1143、D1256~D1311
Pointers	P	64 points	P0~P63
Index Registers	E / F	2 points	E(=D1028)、F(=D1029)
Constants	Decimal K	16 bit: -32768~+32767	32 bit: -2147483648~+2147483647
	Hexadecimal H	16 bit: 0000~FFFF	32 bit: 00000000~FFFFFFFF
Serial Communication		2 Ports is provided. RS-232C: Program read/write communication port, RS-485: General function communication port (controlled by RS instruction); Special drive instructions for Delta AC drive are also supported.	
Protection Features		Password, I/O examination, Execution time, Illegitimate instruction or operand	
Monitor / Debug		Program execution time display, Bit/Word, Device setting	

＊ Note: For more information about special relays and data registers, please refer to the Delta PLC Application Manual.

3.2. Electrical Specifications

Item / Model	DVP-14ES00 □	DVP-24ES00 □	DVP-32ES00 □	DVP-40ES00 □	DVP-60ES00 □	DVP-20EX00 □	DVP-14ES01 □	DVP-24ES□□ □	DVP-32ES01 □	DVP-20EX11 □
Power Supply Voltage	100~240VAC (-15%~10%), 50/60Hz ± 5%						24VDC (-15%~10%)			
Operation Specification	The PLC start to operate at power supply of 95~100VAC. If the voltage of power supply drops to 70VAC, the PLC will stop. Maximum power loss time is 10ms or less.						Maximum power loss time is 5ms or less.			
Fuse	2 A / 250VAC						2 A / 250VAC			
Power Consumption	20 VA	25VA	30VA	30VA	35VA	30 VA	5.5 W	6.5 W	8 W	8 W
DC24V Supply Current	400mA	400mA	400mA	400mA	400mA	400mA	—	—	—	—
Power Protection	DC24V output short circuit						DC24V input polarity			
Voltage Withstand	1500VAC(Primary-secondary), 1500VAC(Primary-PE), 500VAC(Secondary-PE)									
Insulation Resistance	> 5 MΩ at 500VDC (Between all inputs / outputs and earth)									
Noise Immunity	ESD: 8KV Air Discharge EFT: Power Line: 2KV, Digital I/O: 1KV, Analog & Communication I/O: 250V RS: 26MHz~1GHz, 10V/m									
Grounding	The diameter of grounding wire cannot be smaller than the wire diameter of terminals L and N (All DVP units should be grounded directly to the ground pole).									
Environment	Operation: 0°C ~55°C (Temperature), 50~95% (Humidity), Pollution degree2; Storage: -25°C ~70°C (Temperature), 5~95% (Humidity)									
Vibration / Shock Resistance	Standard: IEC1131-2, IEC 68-2-6（TEST Fc）/ IEC1131-2 & IEC 68-2-27 (TEST Ea)									
Weight (g)	400	552	580	596	750	536	260	414	430	386

Input Point Electrical Specifications		
Input Point Type	Digital Input	Analog Input (EX)
Input Type	DC (SINK or SOURCE)	Voltage input: -10V~+10V, Input Resistance: 112KΩ Current input: -20mA~+20mA, Input Resistance: 250Ω
Input Current	24VDC 5mA	
Active Level (Analog input resolution)	Off→On above 16VDC On→Off below 14.4VDC	Voltage input: 10bit Current input: 10 bit
Reaction Time (Conversion Sampling Time)	About 10ms (An adjustment range of 0~15ms could be selected through D1020 and D1021)	5ms (Time could be adjusted through D1118)

Output Point Electrical Specifications		
Output Point Type	Relay-R	Transistor-T
Current Specification	2A/1 point (5A/COM)	55°C 0.1A/1point, 50°C 0.15A/1 point 45°C 0.2A/1 point, 40°C 0.3A/1 point (2A/COM)
Voltage Specification	Below 250VAC, 30VDC	30VDC
Maximum Load	75VA (Inductive) / 90 W (Resistive)	9W/1 point
Reaction Time	About 10 ms	Off→On 20us On→Off 30us

3.3. AD/DA Specifications

| Items	Analog Input (A/D) Voltage Input	Analog Input (A/D) Current Input	Analog Output (D/A) Voltage Output	Analog Output (D/A) Current Output
Analog I/O Range	±10V	±20 mA	0 ~ 10V	0 ~ 20 mA
Digital Conversion Range	-512~+511	-512~+511	0 ~ 255	0 ~ 255
Resolution	10 bits(1_{LSB}=19.53125 mV)	10 bits (1_{LSB}=39.0625 μA)	8 bits(1_{LSB}=39.0625 mV)	8 bits (1_{LSB}=78.125 μA)
Input Impedance	> 112 KΩ	250Ω	—	

Items	Analog Input (A/D)		Analog Output (D/A)	
	Voltage Input	Current Input	Voltage Output	Current Output
Output Impedance	–		0.5Ω or lower	
Tolerance Carried Impedance	–		1KΩ~2MΩ	0~500Ω
Overall Accuracy	Non-linear accuracy: ±0.5% of full scale within the range of PLC operation temperature			
	Maximum deviation: ±1% of full scale at 20mA and +10V			
Reaction Time	2ms × channels			
Absolute Input Range	±15 V	±32 mA	–	
Digital Data Format	2's complementary of 16-bit, 10 Significant Bits		2's complementary of 16-bit, 8 Significant Bits	
Average Function	Provided			
Isolation Method	Isolation between digital area and analog area. But no isolation among channels.			
Protection	Voltage output has short circuit protection but a long period of short circuit may cause internal wire damage and current output break.			
External Wiring Diagram				

4   INSTALLATION & WIRING

■ Dimensions

Model Name (mm)	H	H1	W	W1	W2 (H Type)	W3 (L Type)
DVP14ES00(01)[11]R2/T2	100	95	99	104	82	50
DVP24ES00(01)[11]R2/T2	100	95	150	155	82	50
DVP32ES00(01)[11]R2/T2	100	95	150	155	82	50
DVP40ES00R2/T2	100	95	150	155	82	-
DVP60ES00[11]R2/T2	90	85.5	180.5	185	89.6	-
DVP20EX00[11]R2/T2	100	95	150	155	82	-
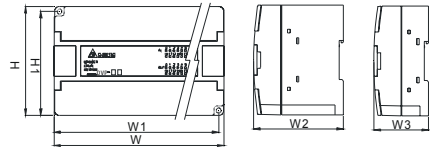
■ Terminal Wiring
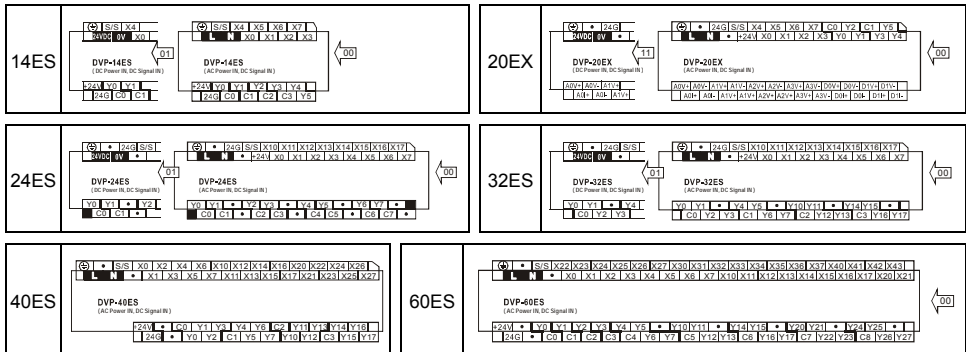
■ PLC Mounting Arrangements and Installation Notes

■ DIN Rail Installation

The DVP-PLC can be secured to a cabinet by using the DIN rail that is 35mm high with a depth of 7.5mm. When mounting the PLC on the DIN rail, ensure to use the end bracket to stop any side-to-side motion of the PLC, thus to reduce the chance of the wires being pulled loose. On the bottom of the PLC is a small retaining clip. To secure the PLC to the DIN rail, place it onto the rail and gently push up on the clip. To remove it, use a slotted screwdriver, place it on the groove of the retaining clip and press gently, then pull down on the retaining clip and gently pull the PLC away from the DIN rail.

For heat dissipation, ensure to provide a minimum clearance of 50mm between the unit and all sides of the cabinet. (as the figure shown below)
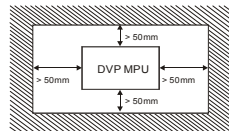
■ Direct mounting : Use the specified dimensions and install with M4 screws.

● Wiring
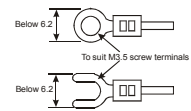
1. Please use O-type or Y-type terminals for I/O wiring terminals. The specification for the terminals is shown as the figure on the left. PLC terminal screws should be tightened to between 5~8 kg-cm (4.3~6.9 in-lbs). Only can use 60/75°C copper conducting wire.
2. DO NOT wire to the No Function terminals ⊡ . I/O signal wires or power supply should not run through the same multi-wire cable or conduit.
3. When tightening the screws and performing the wiring, please avoid that metallic particles fell into PLC. After completing wiring, please remove the label which is used to obstruct the metallic particles on the ventilation hole for well heat dissipation.

● Installation Notes

Incorrect installation may result in a PLC malfunction or premature failure of the PLC. Ensure to observe the following items when selecting a mounting location.

1. Do not mount the PLC in a location subjected to corrosive or flammable gases, liquids, or airborne dust or metallic particles.
2. Do not mount the PLC in a location where temperatures and humidity will exceed specification.
3. Do not mount the PLC in a location where vibration and shock will exceed specification.

■ Power Input Wiring

There are two power inputs provided in DVP series PLC, AC input and DC input. Please pay particular attention to the following notes:

1. Connect the AC input (100VAC~240VAC) to terminals L and N. Any AC110V or AC220V connected to the +24V terminal or input points will permanently damage the PLC.
2. The AC power inputs for the MPU and the I/O Expansion Unit should be ON or OFF at the same time.
3. Please use wires of 1.6mm or above for the grounding of the MPU.
4. If the power-cut time is less than 10ms, the PLC still operates unaffectedly. If the power-cut time is too long or the power voltage drops, the PLC will stop operating and all the outputs will be OFF. Once the power is restored, the PLC will return to operate automatically. (There are latched auxiliary relays and registers inside of the PLC, please be aware when programming.)

AC Input Type
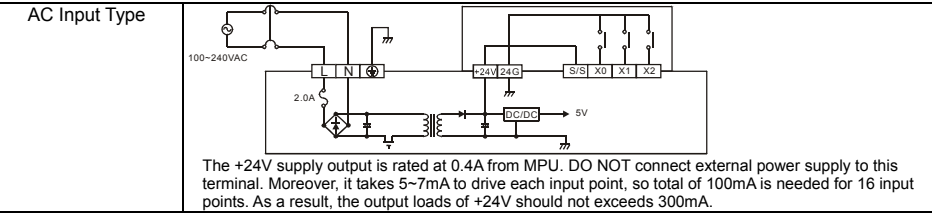
The +24V supply output is rated at 0.4A from MPU. DO NOT connect external power supply to this terminal. Moreover, it takes 5~7mA to drive each input point, so total of 100mA is needed for 16 input points. As a result, the output loads of +24V should not exceeds 300mA.

5. When DC voltage is supplied to the PLC, ensure the power is at terminals 24VDC and 0V (power range is 20.4VDC~26.4VDC). When the voltage is lower than 17.5VDC, PLC will stop operating, all outputs will turn OFF and the ERROR LED will flash continuously.

DC Input Type
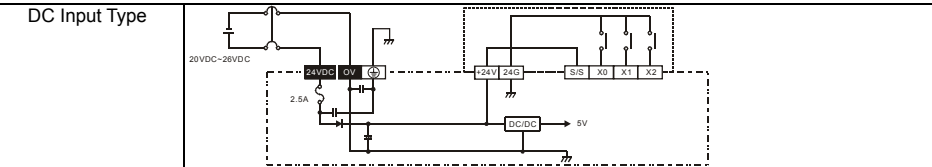
■ Safety Wiring

Since the PLC is in control of numerous devices, operation of either one device could affect the operation of other devices, therefore the breakdown of either one device would consequently be detrimental to the whole auto control system, and danger will thus be resulted. Please use the recommended wiring below for the power input:
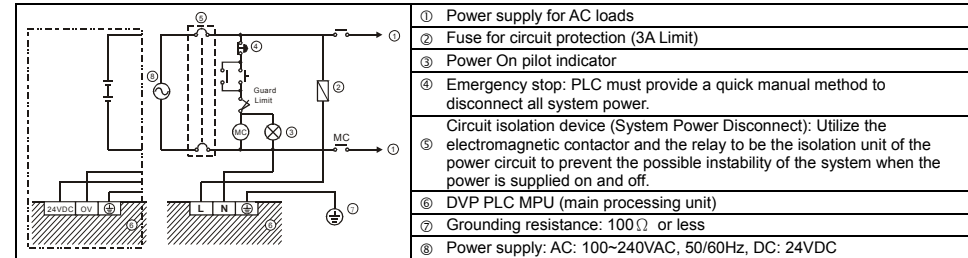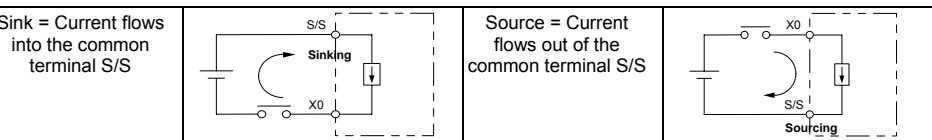

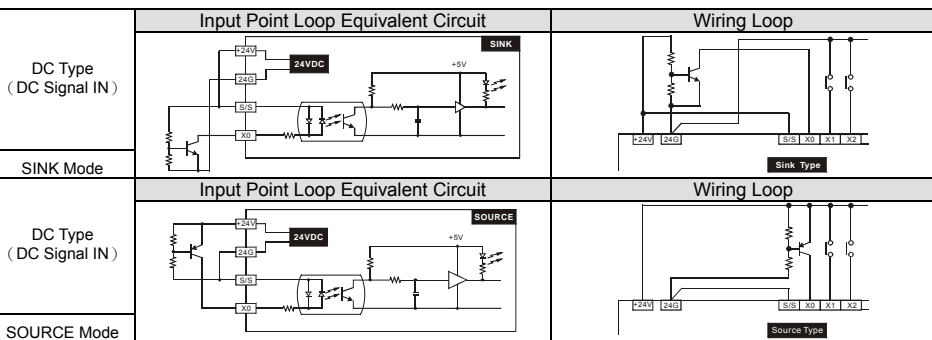| ①	Power supply for AC loads
②	Fuse for circuit protection (3A Limit)
③	Power On pilot indicator
④	Emergency stop: PLC must provide a quick manual method to disconnect all system power.
⑤	Circuit isolation device (System Power Disconnect): Utilize the electromagnetic contactor and the relay to be the isolation unit of the power circuit to prevent the possible instability of the system when the power is supplied on and off.
⑥	DVP PLC MPU (main processing unit)
⑦	Grounding resistance: 100Ω or less
⑧	Power supply: AC: 100~240VAC, 50/60Hz, DC: 24VDC

■ Input Point Wiring

The input signal of the input point is the DC power DC input. There are two types of DC type wiring: SINK and SOURCE, defined as follows:
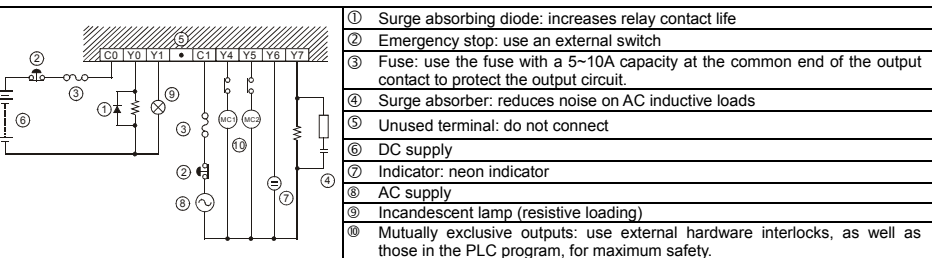
◎ Definition

| Sink = Current flows into the common terminal S/S	Source = Current flows out of the common terminal S/S

◎ Wiring

Input Point Loop Equivalent Circuit	Wiring Loop
DC Type (DC Signal IN) SINK Mode	
DC Type (DC Signal IN) SOURCE Mode	

◎ Practical Relay Output Wiring

①	Surge absorbing diode: increases relay contact life
②	Emergency stop: use an external switch
③	Fuse: use the fuse with a 5~10A capacity at the common end of the output contact to protect the output circuit.
④	Surge absorber: reduces noise on AC inductive loads
⑤	Unused terminal: do not connect
⑥	DC supply
⑦	Indicator: neon indicator
⑧	AC supply
⑨	Incandescent lamp (resistive loading)
⑩	Mutually exclusive outputs: use external hardware interlocks, as well as those in the PLC program, for maximum safety.

◎ Practical Transistor Output Wiring
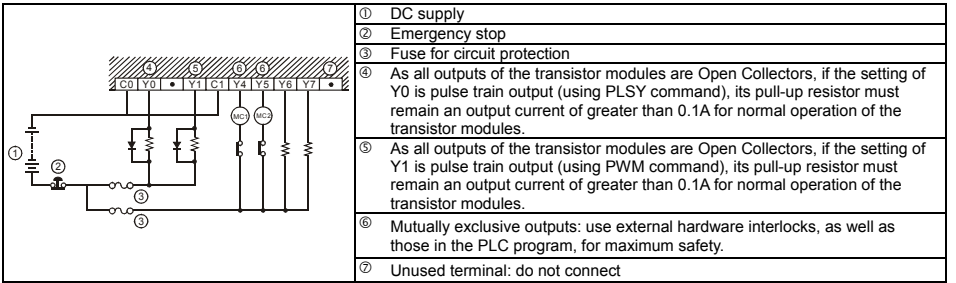
①	DC supply
②	Emergency stop
③	Fuse for circuit protection
④	As all outputs of the transistor modules are Open Collectors, if the setting of Y0 is pulse train output (using PLSY command), its pull-up resistor must remain an output current of greater than 0.1A for normal operation of the transistor modules.
⑤	As all outputs of the transistor modules are Open Collectors, if the setting of Y1 is pulse train output (using PWM command), its pull-up resistor must remain an output current of greater than 0.1A for normal operation of the transistor modules.
⑥	Mutually exclusive outputs: use external hardware interlocks, as well as those in the PLC program, for maximum safety.
⑦	Unused terminal: do not connect

5   TRIAL RUN

■ Power Indication

1. The "POWER" LED at the front of the MPU or the Extension Units will be lit (in green) if the power is on. If the indicator is not on when the MPU is powered up, it means that there is abnormal condition on the DC power supply of the PLC. It is thus necessary to check the wiring on terminals +24V and 0V. If the ERROR LED is blinking swiftly, it indicates that the +24V power supply of the PLC is insufficient.
2. The "LOW V." LED on the Expansion Unit is an indication that the input power voltage is insufficient, thus all outputs of the expansion unit should be turned off.

■ Operation and Test

1. If the ERROR LED of the MPU is not blinking, use the peripheral device to give the RUN command, and the RUN indicator will then be on.
2. HPP could be utilized to monitor the timer (T), the counter (C) and the data register (D) during operation, and moreover, to force the output contacts to conduct the On/Off action. If the ERROR LED is on (but not blinking), it indicates that the setting of the user's program has exceeded the preset overtime limit, thus users have to double check the program and perform the On/Off function again. (The PLC is at this moment back to STOP status automatically).

■ PLC Input/Output Reaction Time:

The total reaction time from the input signal to the output operation is calculated as follows:
Reaction Time = input delay time + program scan time + output delay time

Input delay time	Default 10ms. Please refer to the usage of special registers D1020~D1021.
Program scan time	Please refer to the usage of special register D1010.
Output delay time	Relay module: 10ms. Transistor module: 20~30us.

6   TROUBLESHOOTING

Judge the errors by the indicators on the front panel. When errors occurred on DVP series PLC, please check:

☼ "POWER" LED

There is a "POWER" LED at the front of the MPU. The "POWER" LED will be lit (in green) when the power in connected to MPU. If the indicator is not on when the MPU is powered up and with the input power being normal, it indicates that the PLC is out of order. Please have this machine replaced or repaired at a distributor near you.

☼ PLC "RUN" LED

Identify the status of the PLC. When the PLC is in operation, this light will be on, and the user could thus use HPP or the editing program of the ladder diagram to give commands to make the PLC "RUN" or "STOP".

☼ "ERROR" LED

If an incorrect program is input to the MPU, or the instruction and the device exceed the allowable range, the indicator will blink. At this moment, the user should check the error code saved in the MPU data register D1004 to correct the program. Find out the cause of the error and modify the programs. Then, re-send the correct program to the MPU.

If the ERROR LED is blinking swiftly, it suggests that the +24VDC power supply of the PLC is insufficient. Please check whether the power supply of 24VDC is normal or not.

When the ERROR LED is on (not blinking), it indicates that the execution time of the program loop has exceeded the time-out setting (set by D1000). Please check the program loop or use "WDT" instruction to solve the problem.

When the ERROR LED is on, please power down the MPU and start up it one time, and then check if the RUN LED is off. If the RUN LED is not off, please check if there is any noise and interference and check if any conductive material falling into the PLC.

☼ "Input" LED

The On/Off signals of the input point could be displayed through the "Input" LED. Also, the status signal of the input point could be monitored through the device monitoring function of HPP. As long as the input point is activated, the LED is on. Therefore, if an error is detected, please check HPP, the LED indicator and the input signal circuits. Please pay particular attention to check if an electrical switch with significant leakage current is used as it often results in the unexpected operation of input point.

☼ "Output" LED

Output LED indicates if the output signals are on or off. Please check the following items when the LED On/Off indication does not correspond to the commands:

1. Output contacts may be melted and stuck together due to a short circuit or current overload.
2. Check wiring and verify that the screws are tight and secure.