

Multi-function, Built-in Analog I/O, Multiple Instructions PLC Instruction Sheet

DVP-SX

1 WARNING

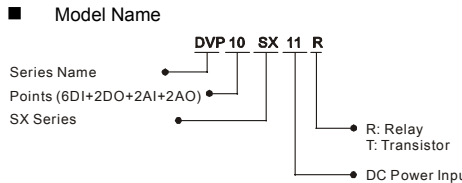
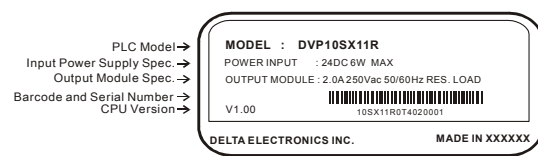
- This Instruction Sheet only provides descriptions for electrical specifications, general specifications, installation & wiring, troubleshooting and peripherals. Other detail information about programming and instructions is compatible with EP series; please see PLC Application Manual. For more information about the optional peripherals, please see individual product manual.
- This is an OPEN TYPE PLC. The PLC should be kept in an enclosure away from airborne dust, humidity, electric shock risk and vibration. Also, it is equipped with protective methods such as some special tools or keys to open the enclosure, so as to avoid the hazard to users or damage the PLC.
- Do Not connect the AC main circuit power supply to any of the input/output terminals, or it may damage the PLC. Check all the wiring prior to power up. To avoid any electromagnetic noise, make sure the PLC is properly grounded.

2 INTRODUCTION

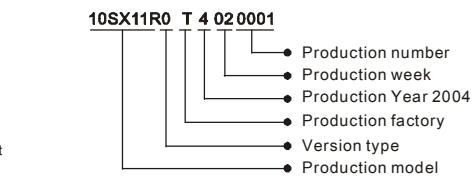
2.1 Model Name Explanation and Peripherals

Thank you for choosing DELTA PLC DVP series. The DVP-SX series is a 10-point (4DI+2DO+2AI+2AO) special main processing unit. Besides the same instructions and functions as DVP-SA series, 2-CH 12-bit analog voltage/current input and 2-CH 12-bit analog voltage/current output are all bipolar. There is built-in 2-digit 7-segment display corresponds to internal register directly to display PLC station or user-defined code.

Nameplate Explanation



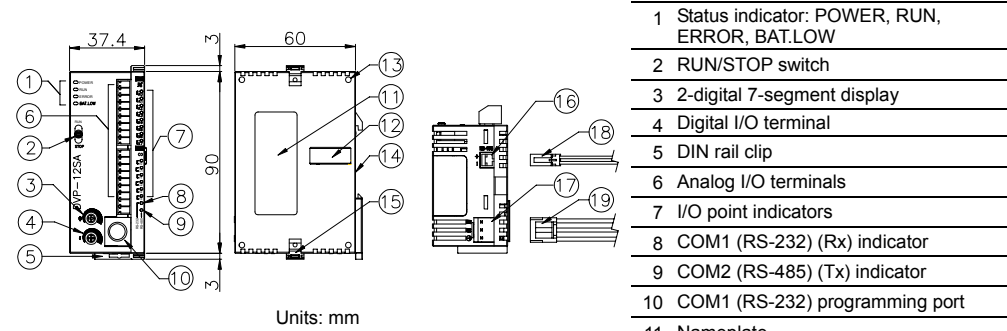
Serial Number



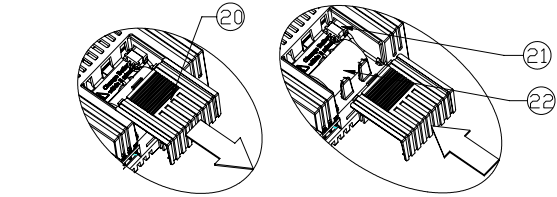
Peripherals

- DVPHPP02: Handheld Programming panel
- WPLSoft: Windows Ladder Logic Programming Software
- DVPACAB115: 1.5M Cable (HPP ↔ PLC, included in DVPHPP02)
- DVPACAB215: 1.5M Cable (PC (DB9+DB25) ↔ PLC)
- DVPACAB230: 3.0M Cable (PC (DB9+DB25) ↔ PLC)
- DVPACAB2A30: 3.0M Cable (PC (DB9) ↔ PLC)

2.2 Product Profile and Outline



※ Battery replacement: the replacement must be finished within 3 minutes, or the internal data of the PLC (including the program area, RTC and latched registers) could be lost or destroyed.



3 FUNCTION SPECIFICATIONS

Items	Specifications	Remarks
Control Method	Stored program, cyclic scan system	
I/O Processing Method	Batch processing method (when END instruction is executed)	I/O refresh instruction is available
Execution Speed	Basic instructions (several us)	Application Instructions (10~hundreds us)
Program language	Instructions + Ladder Logic + SFC	Including the Step instructions
Program Capacity	7920 STEPS	SRAM + Battery
Instructions	32 Basic sequential instructions (including STL/RET)	168 Application instructions
Relay (bit mode)	X External input relay	X0~X177, octal number system, 128 points
	Y External output relay	Y0~Y177, octal number system, 128 points
M Auxiliary Relay	General	M0~M511, 512 points (*1)
	Latched	M512~M999, 488 points (*3)
	Special	M2000~M4095, 2096 points (*3)
T Timer	100ms	T0~T199, 200 points (*1)
	10ms	T192~T199 for Subroutine
	1ms	T250~T255, 6 points Accumulative (*4)
		T200~T239, 40 points (*2)
C Counter	16-bit count up	C0~C95, 96 points (*1)
	32-bit count up/down	C96~C199, 104 points (*3)
	32bit high-speed count up/down	C200~C215, 16 points (*1)
		C216~C234, 19 points (*3)
S Step point	Initial step point	S0~S9, 10 points (*1)
	Zero point reset	S10~S19, 10 points (use with IST instruction) (*1)
	General	S20~S511, 492 points (*1)
	Latched	S512~S895, 384 points (*3)
T Current value of the timer	General	T0~T255, 256 points
	Special	T256~T259, 4 points Accumulative (*4)
C Current value of the counter	General	C0~C199, 16-bit counter, 200 points
	Special	C200~C254, 32-bit counter, 50 points
D Data register	General	D0~D199, 200 points (*1)
	Latched	D200~D999, 800 points (*3)
	Special	D2000~D4999, 3000 points (*3)
	Index	D1000~D1999, 1000 points
N File register	General	E0~E3, F0~F3, 8 points (*1)
	Special	E4~E9, F4~F9, 16 points (*3)
P For master control nested loop	General	P0~P255, 256 points
	Special	P256~P259, 4 points Accumulative (*4)
I Interrupt Service	External interrupt	I001 (X0), I101 (X1), I201 (X2), I301 (X3), I401 (X4), I501 (X5); 6 points (all are rising-edge trigger)
	Time interrupt	I600 (1ms), I700 (1ms), I800 (1~99ms)
	Hi-speed counter	I010, I020, I030, I040, I050, I060; 6 points
	Communication	I150, 1 point
K Decimal	General	K-32,768 ~ K32,767 (16-bit operation)
	Special	K-147,483,648 ~ K2,147,483,647 (32-bit operation)
H Hexadecimal	General	H0000 ~ HFFFF (16-bit operation), H00000000 ~ HFFFFFFF (32-bit operation)
	Special	H00000000 ~ HFFFFFFF (32-bit operation)
Programming port	COM1: RS-232, COM2: RS-485 (Master/Slave), They can be used at the same time.	
Analog Volume / RTC	MPU built-in bipolar 2-CH A/D, D/A, 12 bits, 2-digit 7-segment display, built-in RTC	
Special Extension Module	Use the same modules (AD, DA, PT, TC, XA, RT) of SS series. (Max. 8 Extension Unit points)	

*1: The non-latched area is fixed, and can't be changed.
*2: The non-latched area can be changed to a latched area with parameter setting.
*3: The latched area can be changed to a non-latched area with parameter setting.
*4: The latched area is fixed, and can't be changed.

	General	Latched	Special auxiliary relay	Latched
M Auxiliary Relay	M0~M511	M512~M999	M1000~M1999	M2000~M4095
	Non-latched (fixed)	Latched (default) Start: D1200 (K512) End: D1201 (K999)	Some are latched and can't be changed	Latched (default) Start: D1202 (K2000) End: D1203 (K4095)
T Timer	100 ms	10 ms	10ms	1 ms
	T0 ~T199	T200~T239	T240~T245	T250~T255
C Counter	16-bit count up		32-bit count up/down	
	C0~C95	C96~C199	C200~C215	C216~C234
	Non-latched (fixed)	Latched (default) Start: D1208 (K96) End: D1209 (K199)	Non-latched (fixed)	Latched (default) Start: D1210 (K216) End: D1211 (K234)
			32-bit high-speed count up/down	C235~C245 C246~C255
D Register	General	Latched	Special registers	Latched
	D0~D199	D200~D999	D1000~D1999	D2000~D4999
File Register	Non-latched (fixed)	Factory setting is latched. Start: D1216 (K200) End: D1217 (K999)	Some are latched and can't be changed.	Factory setting is latched. Start: D1218 (K2000) End: D1219 (K4999)

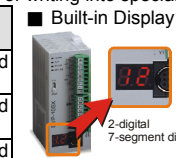
※ When switching between power On/Off or MPU RUN/STOP modes:

Memory Type	POWER Off→On	STOP→RUN	RUN→STOP	Clear all M1031 non-latched area	Clear all M1032 latched area	Factory Setting	
Non-latched	Clear	Unchanged	M1033=Off, clear M1033=On, unchanged	Clear	Unchanged	0	
Latched		Unchanged		Unchanged	Clear	0	
Special M, Special D, Index register	Initial value	Unchanged		Unchanged		Initial value	
File register	Unchanged						0

4 BUILT-IN ANALOG I/O AND 7-SEGMENT DISPLAY

Built-in 2-CH 12-bit A/D and 2-CH 12-bit D/A are bipolar. It can read A/D converted digital value and get designated analog output by reading special D or writing into special D. Refer to the table below for corresponding special D.

Device No.	Function
D1056	Present value of AD card channel 0 (CH0)
D1057	Present value of AD card channel 1 (CH1)
D1110	Average value of AD card channel 0 (CH0)
D1111	Average value of AD card channel 1 (CH1)
D1116	DA card channel 0 (CH0)
D1117	DA card channel 1 (CH1)
D1118	Conversion sampling time (ms)



This built-in display corresponds to special D directly. User can use it to display error code or station when executing PLC LINK. It is fairly convenient for system maintenance. Refer to the table below for corresponding special D.

Device No.	Function
M1196	Number system setting for display (Off: Decimal, On: Hexadecimal)
M1197	The decimal point setting between the middle and the right-most numbers
M1198	The decimal point setting after the right-most number
D1196	Display content

5 ELECTRICAL SPECIFICATIONS

Item	Model	DVP10SX11R/T	DVP08SM11N	DVP08SN11R/T	DVP08SP11R/T	DVP16SP11R/T
Power supply voltage	MPU: 24VDC (-15%~20%) with DC input reverse polarity protection Extension Unit: supplied by the MPU					
Fuse	2A / 250VAC					
Power Consumption	6W	5W	5W	8W	8W	
Insulation Resistance	> 5 MΩ at 500 VDC (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 Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV 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 degree 2; 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 (approx.) (g)	158	128	154 / 146	141 / 136	162 / 154	

Electrical Specification of Input Point		Electrical Specification of Output Point		
Input Type	DC (SINK or SOURCE)	Output Type	Relay-R	Transistor-T
Input Current	24VDC 5mA	Current Specification	1.5A/1 point (5A/COM)	0.3A/1 point @ 40°C; When the output of Y0 and Y1 is high-speed pulse, Y0 and Y1 = 30mA
Active Level	Off→On, above 16VDC	Voltage Specification	Below 250VAC, 30VDC	30VDC
	On→Off, below 14.4VDC	Maximum Loading	75VA (Inductive) 90 W (Resistive)	9W/1 point When the output of Y0 and Y1 is high-speed pulse, Y0 and Y1 = 0.9W (Y0 = 32kHz, Y1 = 10kHz)
Responding Time	About 10ms (An adjustment range of 0~10,000ms could be selected through D1020 and D1021)	Responding Time	About 10 ms	Off→On 20us On→Off 30us Y0 and Y1 are specified points for high-speed pulse

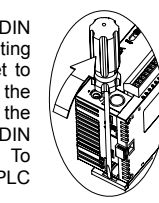
6 MODEL NAME & I/O CONFIGURATION

Model	Power	Input				Output			
		Point	Type	Point	Type				
DVP10SX11R	20.4-28.8 VDC	DO	AO	DO	AO	DO	AO	DO	AO
DVP10SX11T		4	2	2	2	Relay	-20~20mA or	Resistor	-10~+10V

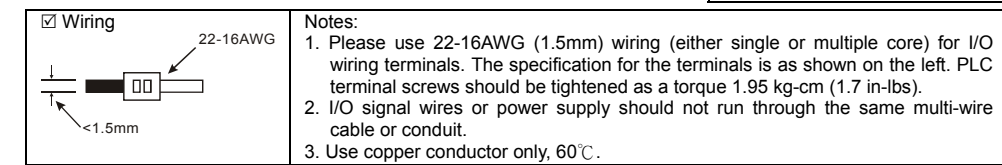
7 INSTALLATION & WIRING

7.1 PLC Mounting Arrangements and Wiring Notes

Installation of the DIN rail
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, be sure 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. At the bottom of the PLC has a small retaining clip. To secure the PLC to the DIN rail, place it onto the rail and gently push up the clip. To remove it, pull down the retaining clip and gently pull the PLC away from the DIN rail. As shown on the right:

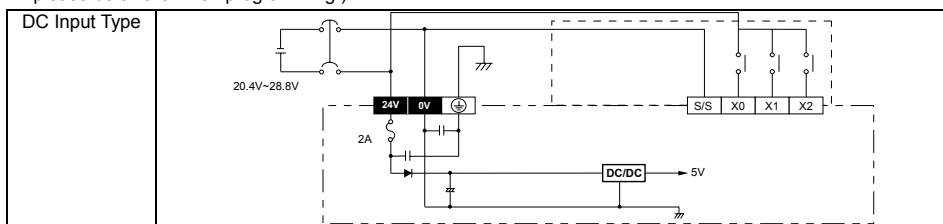


When install the DVP series PLC, make sure that it is installed in an enclosure with sufficient space (as shown below) to its surroundings so as to allow heat dissipation.

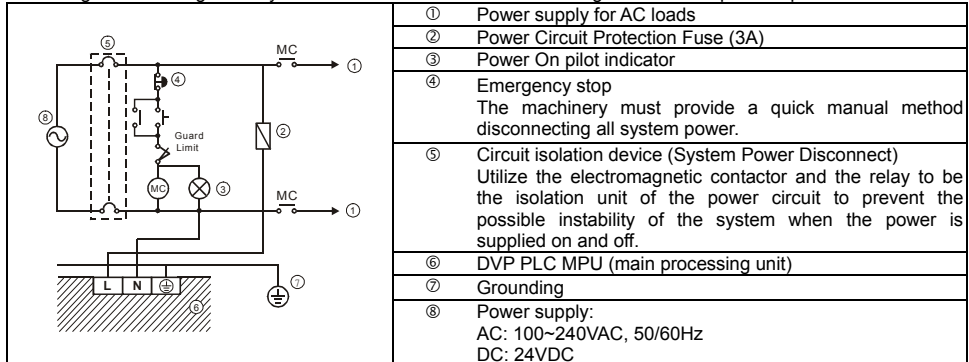


7.2 Wiring Notes

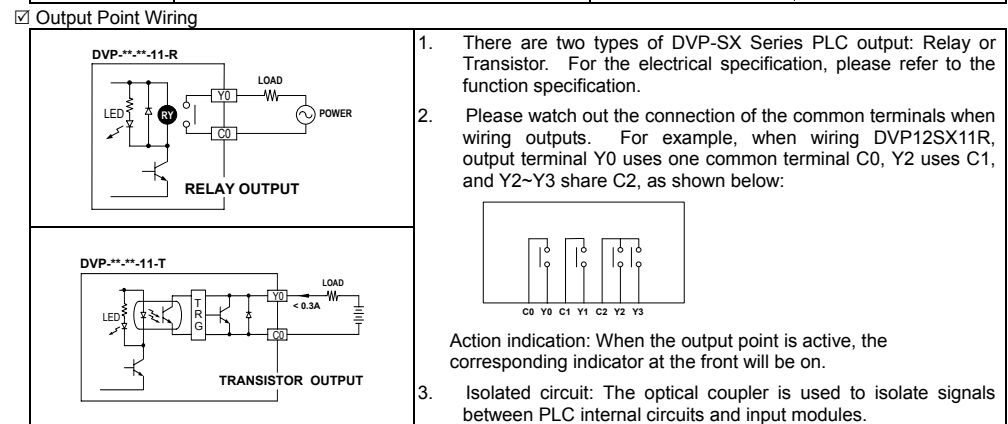
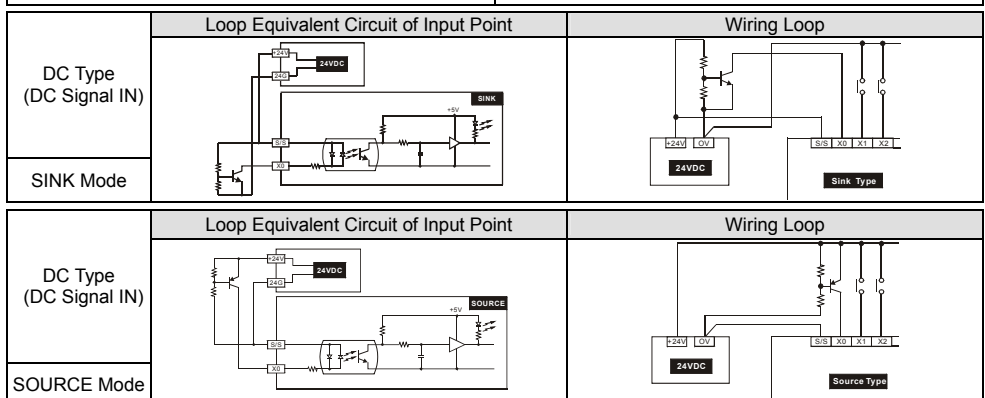
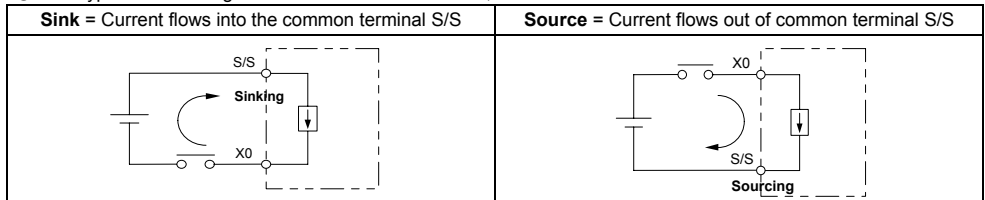
- Power Input Wiring**
 DVP-SX series input power supply is DC input. Please take a note of listed items when operating DVP-SX. Series.
1. Please make sure the power is at terminals 24VDC and 0V (power range is 20.4VDC~28.8VDC). When voltage is lower than 20.4VDC, PLC will stop operation, all outputs will be off and ERROR LED will flash continuously.
 2. Please use wires of 1.6mm or above for the MPU ground.
 3. PLC operation has no affect if the power-off time is less than 10ms. However, if the power-off time is too long or the power voltage drops, the PLC will stop operation and all the outputs will be off. Once the power is restored, the PLC will return to operation automatically. (There are latched auxiliary relays and registers inside of the PLC, please be aware when programming.)



- Safety Wiring**
 Since the PLC is used to control numerous devices, motion of one device could affect the motion of other devices, therefore the breakdown of either one device would consequently be detrimental to the whole auto control system, and damage could be significantly. Please use the recommended wiring below for the power input:



- Input Point Wiring**
 DC power is used for input signals.
 Two types of DC wiring are used: SINK and SOURCE, defined as follows:



8 TRIAL RUN

- Power Indication**
 The "POWER" LED at the front of the MPU or the Extension Units will be lit (in green) if power is on. If the indicator is not on when the MPU is powered up, it means that the 24V DC power supply of the PLC is overloaded. It is thus necessary to remove the wiring on terminals +24V and 24G, and use a 24VDC power supply instead. If the ERROR LED is blinking swiftly, it suggests that the +24V power supply of the PLC is not enough.
- Low Voltage Indication**
 The "LOW V." LED on the Extension Unit is an indication that the input power voltage is not enough, thus all outputs of the extension unit should be turned off.
- Low Battery Voltage Indication**
 There is also a "BAT.LOW" LED at the front of the MPU. When the LED is on, it indicates that the battery voltage is not enough. Please change the batter (within 3 minutes) immediately; otherwise the user programs and the data in latched area may be lost.
- Preparation**
1. Prior to applying power, please verify that the power lines and the input/output wiring are correct. **DO NOT** supply AC110V or AC220V to the I/O terminals, or it might cause the wire short and would direct damage the PLC.
 2. After using the peripheral devices to write the program into the MPU and that the ERROR LED of the MPU is not on, it means that the program in use is legitimate, and it is now waiting for the user to give the RUN instruction.
 3. Use HPP to execute the forced On/Off test of the output contact.
- Operation & Test**
 If the "ERROR" LED of the MPU is not blinking, use RUN/STOP switch or the peripheral devices (HPP or WPLSoft) to send the RUN instruction, and the RUN indicator will then be on. If the "RUN" LED is not on, it means no program inside the PLC.
 HPP could be utilized to monitor the settings and the registered values of the timer (T), the counter (C) and the data register (D) during operation. Moreover, HPP forces the output contacts to conduct the On/Off action. If the ERROR LED is on (but not blinking), it means that the setting of the user's program 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 automatically)
- PLC Input/Output Response Time**
 The total response 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 | 10ms (factory default), 0~15ms adjustable. Please refer to the usage of special registers D1020~1021. |
| Program scan time | Please refer to the usage of special register D1010. |
| Output delay time | Relay module: 10ms. Transistor module: 20~30us. |
- Basic Instructions and Application Instructions of the PLC:**
1. The basic instructions and the application instructions of the MPU of this series are totally applicable to the DELTA DVP-PLC EP Series MPU. Refer to the DELTA PLC Technique Application Manual for the basic instructions and application instructions.
 2. All Delta DVP-PLC series can use DVPHPP handheld programming panel and the WPLSoft (Windows version) to edit program. A specific transmission wire is used for PLC connects to DVP12SX MPU in order to execute the program transmission, the MPU control, the program monitor, etc.

9 EXTENSION UNIT INFORMATION

DVP-SX series is capable to handle different more I/O points (input point X and output point Y) via extension units. Extension units can handle the combination signals of AI/AO and DI/DO. Max DI/DO points (including MPU DI/DO) can up to 128/128 points. Error LED on PLC MPU will be blinking when DI or DO point exceeds 128 points.

Digital I/O Extension unit

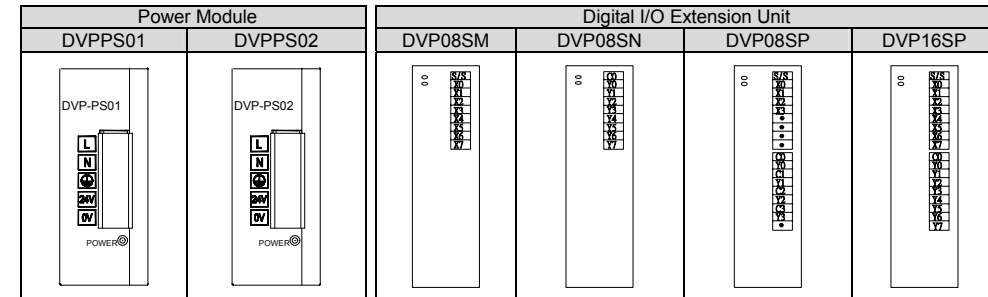
Model	Power	Input / Output				Profile reference
		Input Unit		Output Unit		
		Point	Type	Point	Type	
DVP08SM11N	24VDC (Supply from MPU)	8	DC Sink or Source	0	None	
DVP08SN11R		0		8	Relay	
DVP08SN11T		0		8	Transistor	
DVP08SP11R		4		4	Relay	
DVP16SP11R		8		8	Transistor	
DVP08SP11T		4		4		
DVP16SP11T		8		8		

Analog / Temperature Module Extension Unit

Model	Power	Input / Output		Profile reference
DVP04AD-S	24VDC (Supply from external power)	4 in/0 out	14-bit resolution, -10~+10V (1.25mV) or -20~+20mA (5 μA)	
DVP02DA-S		0 in/2 out	12-bit resolution, 0~+10V (2.5mV) or 0~+20mA (5 μA)	
DVP04DA-S		0 in/4 out	12-bit resolution, 0~+10V (2.5mV) or 0~+20mA (5 μA)	
DVP06XA-S		4 in/2 out	12-bit resolution, AI: -10~+10V (5mV) or -20~+20mA (20 μA) 12-bit resolution, AO: 0~+10V (2.5mV) or 0~+20mA (5 μA)	
DVP04PT-S		4 in/0 out	-200~+600 °C (0.1 °C) or -328~1112 °F (0.18 °F)	
DVP04TC-S		4 in/0 out	J type: -100~700 °C (0.1 °C) or type: -100~1000 °C (0.1 °C)	
DVP08RT-S		8 in/0 out	-20~+160 °C (0.1 °C) or -4~320 °F (0.18 °F)	

Power Output Module

Model	Input / Output		Profile reference
	Input power	Output power	
DVPPS01	100~240VAC (50/60Hz)	Output Voltage: 24VDC Max. Output current: 1A	
DVPPS02	100~240VAC (50/60Hz)	Output Voltage: 24VDC Max. Output current: 2A	



10 TROUBLESHOOTING

- Judge the errors by the indicators on the front panel. When errors occurred on DVP PLC, please check:
- "POWER" LED**
 There is a "POWER" LED at the front of the MPU. When the MPU powered on, the green LED light will be on. If the indicator is not on after the input power to MPU is normal, it indicates that the PLC is out of order. Please have this machine replaced or repaired at a dealer near you.
- PLC "RUN" LED**
 Identify the status of the PLC. When the PLC is in operation, this light will be on, and users could thus use HPP or the editing program of the ladder diagram to send instructions to PLC for "RUN" or "STOP".
- "ERROR" LED**
 If incorrect programs are input to the MPU, or the instructions and the components exceed the allowable range, the indicator will blink. In this case, the user should check both the error codes saved in the MPU data register D1004 and the Error Code Table below to correct the programs. The address that the error occurs will be stored in data register D1137 (the address saved in D1137 is invalid in case of common loop error).
 When the ERROR LED is on (not blinking), users should make a judgment from the special relay M1008 of the MPU. If it is on, it indicates that the execution time of the program loop has exceeded the time-out setting (set by D1000). Please place the PLC RUN/STOP switch to STOP, and find out the address of the time-out program via special data register D1008. "WDT" instruction can be used to solve the problem.
- "BAT.LOW" LED**
 When the battery voltage is low, the "BAT.LOW" LED will be on, and the battery should be replaced as soon as possible; otherwise the user program and the data in latched area will be lost. (On the unplugged PLC, please change the battery within 3 minutes to retain the PLC internal user programs and data).
- "Input" LED**
 The On/Off signals of the input point could be displayed through the "Input" LED, or the status of the input point could be monitored through the device monitoring function of HPP.
- "Output" LED**
 Output LED indicates the output signals are on or off. Please check the following items when the LED On/Off indication does not correspond to the instructions: 1. Output contacts may be melted and stuck together due to a short circuit or overload current. 2. Check wiring and verify that the screws are tight.

Error Code (D1004, Hexadecimal Number) Table

Code	Explanation	Code	Explanation	Code	Explanation
0001	Device S exceeds the usage limit	0E04	C register exceeds the usage limit	C404	FOR-NEXT exceeds 6 levels
0002	Misused Label P	0E05	Misused operand CXXX of DCNT	C405	Misused STL/RET
0003	KnSm exceeds the usage limit	0E0F	Index registers E and F exceed the usage limit		Misused SRET/IRET
0102	Misused Label I	0E18	BCD conversion error	C407	Misused MC/MCR
0202	Misused MC	0E19	Division Error (divisor=0)		Misused END/FEND
0302	Misused MCR	0E1A	Component exceeds the usage limit (including E and F error)	C408	STL has been used for more than 9 times consecutively
0401	Device X exceeds the usage limit	0E1B	The root is negative		MC/MCR used within STL
0403	KnXm exceeds the usage limit	0E1C	FROM/TO communication error	C409	I/P used within STL
0501	Device Y exceeds the usage limit	0F04	D register exceeds the usage limit		STL/RET used within Subroutine
0503	KnYm exceeds the usage limit	0F05	Misused operand DXXXX of DCNT	C40A	STL/RET used within the Interrupt Service Routine
0601	Device T exceeds the usage limit	0F06	Misused SFTR operands		Misused MC/MCR (Subroutine)
0604	T register exceeds the usage limit	0F07	Misused SFTL operands	C40B	Misused MC/MCR (ISR)
0801	Device M exceeds the usage limit	0F08	Misused REF operands		MC/MCR does not begin from N0 nor of continuous status
0803	KnMm exceeds the usage limit	0F09	Misused WSFR, WSFL operands	C40C	Misused MC/MCR
0D01	Misused DECO operands	0F0A	Misused TTMR, STMR instructions	C40D	Use I/P incorrectly
0D02	Misused ENCO operands	0F0B	SORT instruction exceeds the usage times limit	C40E	IRET does not go after the last FEND instruction
0D03	Misused DHSCS operands	0F0C	TKY instruction exceeds the usage times limit		SRET does not go after the last FEND instruction
0D04	Misused DHSCR operands	0F0D	HKY instruction exceeds the usage time limit	C41C	I/O points of the extension unit exceed the limit
0D05	Misused PLSY operands	1000	Misused ZRST operands	C41D	Special extension module exceeds the limit
0D06	Misused PWM operands	C400	Illegal instructions	C41E	Error setting of Ext. module
0D07	Misused FROM/TO operands	C401	Loop error	C41F	Data write in memory failure
0D08	Misused PID operands	C402	Misused LD / LDI instructions	C4FF	Invalid instruction
0D09	Misused DHSZ operands	C403	Misused MPS instructions	C4EE	Missing END statement
0E01	Device C exceeds the usage limit				