2006-10-12

5011650500-SVE0

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

DVP-28SV

PLC that is micro, multi-functional, and with various instructions

Instruction Sheet

Warning

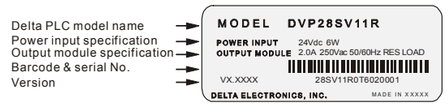
- ✓ *This instruction sheet only provides introductory information on electrical specification, functions, wiring, trouble-shooting and peripherals. For more information, please refer to "DVP-PLC Application Manual: Programming". For how to purchase its peripheral devices, please refers to the manual enclosed with the product or "DVP-PLC Application Manual".*
- ✓ *DVP28SV is an OPEN-TYPE device 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 opening the enclosure) in case danger and damage on the device may occur.*
- ✓ *DO NOT connect input AC power supply to any of the I/Ot terminals; otherwise serious damage may occur. Check all the wiring again before switching on the power and Do NOT tough any terminal when the power is switched on. Make sure the groud terminal ⏚ is correctly grounded in order to prevent electromagnetic interference.*

❶ Introduction

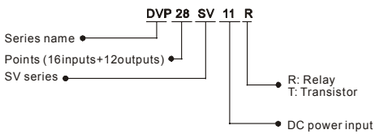
1.1 Model Explanation and Peripherals

Thank you for choosing Delta DVP28SV. 28SV is a 28-point (16 input + 12 output) PLC MPU, offering various instructions and is with 16K Steps program memory, able to connect with all SS/SA/SX/SC/SV series extension models, including digital input/output (max. 512 input/output extension points), analog modules (A/D, D/A tranformation and termperature units) and all kinds of new high-speed extenstion modules. Its 4-group high-speed (200KHz) pulse outputs and the two new 2-axis interpolation instructions satisfy all kinds of applications. DVP28SV is small in size and easy to install.

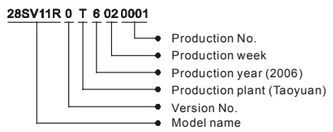
❖ **Nameplate Explanation**



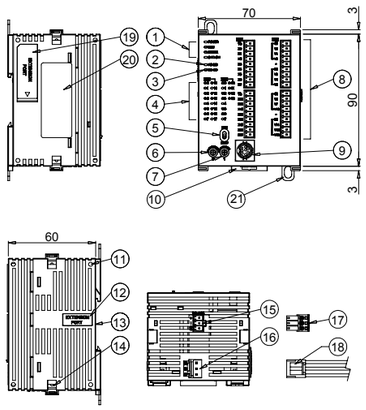
❖ **Model Name Explanation**



❖ **Serial No. Explanation**



1.2 Product Profile and Outline



1	POWER/RUN/BAT.LOW/ERROR indicator
2	COM1(RS-232) receiving communication (Rx) indicator
3	COM2(RS-485) sending communication (Tx) indicator
4	Input/output indicator
5	RUN/STOP switch
6	VR0: M1178 enabled/D1178 corresponding value
7	VR1: M1179enabled/D1179 corresponding value
8	Input/output terminal
9	COM1(RS-232) program I/O communication port
10	DIN rail clip
11	Extension module positioning hole
12	Extension module connection port
13	DIN rail (35mm)
14	Extension module fastening clip
15	COM2(RS-485) communication port (Master/Slave)
16	Power input port
17	3 P removable terminal (standard component)
18	Power input connection cable (standard component)
19	New high-speed extension module connection port
20	Nameplate
21	Direct fastening hole

❷ Function Specifications

Item			Specification		Note
Operation control method			Stored program; cyclic scanning system		
I/O control method			Batch processing and refresh I/O status when END instruction is executed		With instruction that can immediately refresh I/O status
Operation processing speed			Basic instruction (min. 0.24 us)		Application instruction
Program language			Instruction + ladder diagram + SFC		With step instruction
Program capacity			15,872 STEPS		SRAM + rechargeable battery + Flash
Instruction type			32 basic sequential instructions (including step ladder instructions)		193 application instructions
Relay (bit)	X	External input relay	X0 ~ X377, octal encoding; 256 points	Total **512** points	Corresponds to external input points
	Y	External output relay	Y0 ~ Y377, octal encoding; 256 points		Corresponds to external output points
	M	Auxiliary relay: General purpose	M0 ~ M499, 500 points (*2)	Total **4,096** points	The contact can be On/Off in the program.
		Auxiliary relay: Latched	M500 ~ M999, 500 points (*3) M2000 ~ M4095, 2,096 points (*3)		
		Auxiliary relay: Special purpose	M1000 ~ M1999, 1,000 points (part for latched)		
	T	Timer: 100 ms	T0 ~ T199, 200 points (*2) T192 ~ T199 for subroutine T250 ~ T255, 6 accumulative points (*4)	Total **256** points	Timer indicated by TMR instruction. If timing reaches its target, the T contact of the same No. will be On.
		Timer: 10 ms	T200 ~ T239, 40 points (*2) T240 ~ T245, 6 accumulative points (*4)		
		Timer: 1 ms	T246 ~ T249, 4 accumulative points (*4)		
	C	Counter: 16-bit counting up	C0 ~ C99, 100 points (*2) C100 ~ C199, 100 points (*3)	Total **253** points	Counter indicated by CNT (DCNT) instruction. If counting reaches its target, the C contact of the same No. will be On.
		Counter: 32-bit counting up/down	C200 ~ C219, 20 points (*2) C220 ~ C234, 15 points (*3)		
		Counter: 32-bit high-speed counting up/down	C235 ~ C244, 1 phase 1 input, 10 points (*3) C246 ~ C249, 1 phase 2 inputs, 4 points (*3) C251 ~ C254, 2 phase 2 inputs, 4 points (*3)		
	S	Step points: Initial	S0 ~ S9, 10 points (*2)	Total **1,024** points	Used for SFC Latched area setup Start: D1214（K500） End: D1215（K899）
		Step points: For zero return	S10 ~ S19, 10 points, used with IST instruction (*2)		
		Step points: General purpose	S20 ~ S499, 480 points (*2)		
		Step points: Latched	S500 ~ S899, 400 points (*3)		
		Step points: For alarm	S900 ~ S1023, 124 points (*3)		
Register (word data)	T	Present value in timer	T0 ~ T255, 256 points		When timing reaches the target, the contact continuity of timer appears.
	C	Present value in counter	C0 ~ C199, 16-bit counter, 200 points C200 ~ C254, 32-bit counter, 53 points		When counting reaches the target, the contact continuity of counter appears.
	D	Data register: General purpose	D0 ~ D199, 200 points (*2)	Total **10,000** points	Memory area for data storage; can be used for special indirect indication.
		Data register: Latched	D200 ~ D999, 800 points (*3) D2000 ~ D9999, 8,000 points (*3)		
		Data register: Special purpose	D1000 ~ D1999, 1,000 points		
		Data register: For Indirect indication	E0 ~ E7, F0 ~ F7, 16 points (*1)		
	N/A	File register	0 ~ 9,999 (10,000 points) (*4)		Extension register for data storage
Index	N	For main control loop	N0 ~ N7, 8 points		Control point for main control loop
	P	For CJ, CALL instructions	P0 ~ P255, 256 points		Position index of CJ and CALL
	I	Interruption subroutine: External interruption	I00□(X0), I10□(X1), I20□(X2), I30□(X3), I40□(X4), I50□(X5), 6 points (□=1: rising-edge trigger; □=0: falling-edge trigger)		Position index for interruption subroutine
		Interruption subroutine: Time interruption	I6□□(1ms), I7□□(1ms), I8□□(0.1ms) (□□=1~99)		
		Interruption subroutine: Interruption when high-speed counting reaches its target	I010, I020, I030, I040, I050, I060, 6 points		
		Interruption subroutine: Interruption during pulse output	I110, I120, I130, I140, 4 points		
		Interruption subroutine: Interruption during communication	I150, I160, I170, 3 points		
Constant	K	Decimal	K-32,768 ~ K32,767 (16-bit operation) K-2,147,483,648 ~ K2,147,483,647（32-bit operation）		
	H	Hex	H0000 ~ HFFFF (16-bit operation), H00000000 ~ HFFFFFFFF (32-bit operation)		
	F	Floating point	Displaying floating points by the length of 32 bits with IEEE754 standard ±1.1755 × 10^{-38} ~ ±3.4028 × 10^{+38}		
Serial communication ports (program write in/read out)			COM1: RS-232; COM2: RS-485 (can be master or slave); COM1 and COM2 can be used at the same time		
Analog rotary switch/RTC			Built-in 2 points VR/ RTC in MPU		
Special extension module			Right-side extension module and SS series share all modules, AD, DA, PT, TC, XA, PU (max. 8 modules extendable) Left-side can be connected with new high-speed extension modules (max. 8 module extendable)		

❶ **1. Non-latched area cannot be modified.* 2. The preset non-latched area can be modified into latched area by setting up parameters.* 3. The preset latched area can be modified into non-latched area by setting up parameters. *4. The fixed latched area cannot be modified*

After the DC24V power is switched off, the data in the latched area are stored in SRAM memory and its power is supplied by the rechargeable battery. Therefore, when the battery is damaged or cannot be changed, the data in the program and latched area will be lost. If the user needs to permanently save the data in the latched area in the program and device D, please refer to "Flash ROM permanently saved and recover mechanism" as stated below.

Permanently saved mechanism:

The user can use WPLSoft (Options -> PLC<=>Flash) to indicate whether to permanently store the data in the latched area in the program (including password) and device D in Flash ROM memory (new indicated data will replace all data previously saved in the memory).

Recover mechanism:

If the rechargeable battery is in low voltage, resulting in the loss of data in the program, PLC will automatically restore the data in the latched area in the program and device D of Flash ROM into SRAM memory (M1176 = On) next time when DC24V is re-powered. The ERROR LED flashing will remind the user that if the recorded program is able to resume its execution, the user only needs to shut down and re-power the PLC once to restart its operation (RUN).

	General purpose	Latched	Special auxiliary relay	Latched
M (Auxiliary relay)	M0 ~ M499	M500 ~ M999	M1000 ~ M1999	M2000 ~ M4095
	Start: D1200 (K512) End: D1201 (K999)		Part for latched; cannot be modified	Preset for latched Start: D1202 (K2,000) End: D1203 (K4,095)

	100 ms	10 ms	10 ms	1 ms	100 ms
T (Timer)	T0 ~ T199	T200 ~ T239	T240 ~ T245	T246 ~ T249	T250 ~ T255
	Preset for non-latched Start: D1204 (K-1) *1 End: D1205 (K-1) *1	Preset for non-latched Start: D1206 (K-1) *1 End: D1207 (K-1) *1	Accumulative-type Latched fixed		

	16-bit counting up		32-bit counting up/down		32 bit high-speed counting up/down	
C (Counter)	C0 ~ C99	C100 ~ C199	C200 ~ C219	C220 ~ C234	C235 ~ C245	C246 ~ C255
	Preset for non-latched	Preset for latched	Preset for non-latched	Preset for latched	Preset for latched	
	Start: D1208 (K96) End: D1209 (K199)		Start: D1210 (K216) End: D1211 (K234)		Start: D1212 (K235) End: D1213 (K255)	

	Initial	For zero return	General purpose	Latched	Alarm step
S (Step relay)	S0 ~ S9	S10 ~ S19	S20 ~ S499	S500 ~ S899	S900 ~ S1023
	Preset for non-latched Start: D1214 (K500) / End: D1215 (K899)			Preset for latched	Latched fixed

	General purpose	Latched	Special register	Latched
D (Register)	D0 ~ D199	D200 ~ D999	D1000 ~ D1999	D2000 ~ D9999
	Preset for non-latched	Preset for latched	Part for latched; cannot be modified	Preset for latched
	Start: D1216 (K200) End: D1217 (K999)			Start: D1218 (K2000) End: D1219 (K9999)
File register	K0 ~ K9999			
	Latched fixed			

When the power is On/Off or MPU is switched between RUN/STOP mode:

Memory type	Power Off→On	STOP→RUN	RUN→STOP	Clear non-latched area in M1031	Clear latched area in M1032	Initial factory setting
Non-latched	Cleared	Unchanged	Cleared when M1033 = Off	Cleared	Unchanged	0
			Unchanged when M1033 = On			
Latched	Unchanged			Unchanged	Cleared	0
Special M, special D (Indirect indicated register)	Initial setting	Unchanged		Unchanged		Initial setting
File register	Unchanged					0

❸ Electrical Specifications

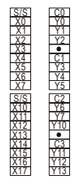
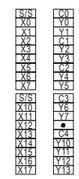
Item \ Model	DVP28SV11R	DVP28SV11T
Power supply voltage	24VDC (-15% ~ 20%) (with counter-connection protection on the polarity of DC input power)	
Inrush current	Max. 2.2A@24VDC	
Power consumption	6W	
Insulation resistance	＞5 MΩ (all I/O point-to-ground: 500VDC)	
Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV; Digital I/O: 1KV, Analog & Communication I/O: 1KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3): 26MHz ~ 1GHz, 10V/m	
Earth	The diameter of grounding wire shall not be less than that of the wiring terminal of the power. (When many PLCs are in use at the same time, please make sure every PLC is properly grounded.)	
Operation/storage	Operation: 0ºC ~ 55ºC (temperature); 50 ~ 95% (humidity); pollution degree 2 Storage: -40ºC ~ 70ºC (temperature); 5 ~ 95% (humidity)	
Vibration/shock immunity	International standards: IEC1131-2, IEC 68-2-6 (TEST Fc)/IEC1131-2 & IEC 68-2-27 (TEST Ea)	
Weight (g)	260g	240g

	Type	Current	Motion level			Responding time
Input point	DC (Sink or Source)	24VDC 5mA	X0~X7,X12~X13,X16~X17 Off→On ＞16.5VDC	X10~X11,X14~X15 Off→On ＞18.5VDC	X0~X17 On→Off ＜8VDC	Approx. 10 ms (can be adjusted within the range of 10 ~ 60 ms by D1020 and D1021)

	Type	Current	Voltage	Max. loading	Responding time	Mechanical life	Electrical life
Output point	relay-R	1.5A/1 point (5A/COM)	250VAC, ＞30VDC	75VA (inductive) 90 W (resistive)	Approx. 10 ms	2×10^7 times (without load)	1.5×10^5 times (5A 30VDC) 5×10^5 times (3A 120VAC) 3×10^4 times (5A 250VAC)
	transistor-T	General: 0.3A/1 point @40ºC High-speed: ＜1KHz, 0.3A/1 point @ 40ºC; ≥1KHz, 30mA/1point@40 ºC	30VDC	Max. 10KHz for Y5, Y7, Y10 ~ Y13	Off→On 20us On→Off 30us	–	–
				Max. 200KHz for Y0, Y1, Y2, Y3, Y4, Y6	Off→On 0.2us On→Off 0.2us		

❹ Model & I/O Configuration

Standard Functional MPU

Model	Input/output specification					I/O configuration	
	Power	Input		Output		Relay	Transistor
		Point	Type	Point	Type		
DVP28SV11R	24VDC	16	DC (Sink Or Source)	12	Relay		
DVP28SV11T					Transistor		

efesotomasyon.com

❺ Installation & Wiring

5.1 Mounting & Wiring

❖ How to install DIN rail

DVP-PLC can be secured to a cabinet by using the DIN rail of 35mm in height and 7.5mm in depth. When mounting PLC to DIN rail, be sure to use the end bracket to stop any side-to-side movement of PLC and reduce the chance of wires being loosen. A small retaining clip is at the bottom of PLC. To secure PLC to DIN rail, place the clip onto the rail and gently push it up. To remove it, pull the retaining clip down and gently remove PLC from DIN rail, as shown in figure 1.

❖ How to screw

Please use M4 screw (see figure 2) according to the dimension of the product. Please install PLC in an enclosure with sufficient space around it to allow heat dissipation (see figure 3).

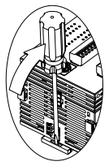


Figure 1

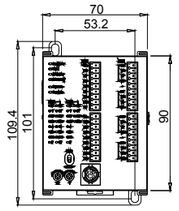


Figure 2 (Unit: mm)

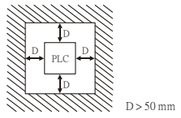
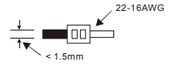


Figure 3

Wiring



1. Use 22-16AWG (1.5mm) single or multiple core wire on I/O wiring terminals. The specification of the terminal is shown in the figure on the left. The PLC terminal screws shall be tightened to 1.95 kg-cm (1.7 in-lbs).
2. DO NOT place the I/O signal wires and power supply wire in the same wiring duct.
3. Use 60/75 ºC copper wires only.



DO NOT install PLC in an environment with:

- *Dust, smoke, metallic debris, corrosive or flammable gas*
- *High temperature, humidity*
- *Direct shock and vibration*

5.2 Notes

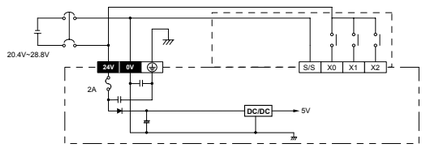
❖ Power input wiring

The power input of DVP-SV series is DC. When operating SV series, please make sure that:

1. The power is connected to the two terminals, 24VDC and 0V, and the range of power is 20.4VDC ~ 28.8VDC. If the power voltage is less than 20.4VDC, PLC will stop running, all outputs will go “Off” and ERROR indicator will flash continuously.

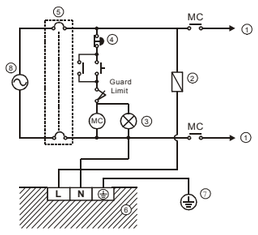
2. The power shutdown of less than 10 ms will not affect the operation of PLC. However, power shutdown time that is too long or the drop of power voltage will stop the operation of PLC and all outputs will go “Off”. When the power supply turns normal again, PLC will automatically return to its operation. (Please be aware of the latched auxiliary relays and registers inside PLC when programming.)

DC power input



❖ Safety wiring

Since DVP28SV is only compatible with DC power supply, Delta power supply modules (DVPPS01/DVPPS02) are suitable power supplies for DVP28SV. Users are suggested to install the protection circuit at the power supply terminal to protect DVPPS01 or DVPPS02.



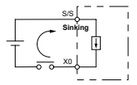
①	AC power supply load
②	Power circuit protection fuse (3A)
③	Power indicator
④	Emergency stop *This button can cut off the system power supply when accidental emergency takes place.*
⑤	System circuit isolation device *The device is made of electromagnetic contactor and relay as the switch to prevent the instability of system when the power is intermittently supplied.*
⑥	DVPPS01 / DVPPS02 (main processing unit)
⑦	Earth
⑧	Power supply AC: 100 ~ 240VAC, 50/60Hz

❖ Input point wiring

There are two types of DC inputs, SINK and SOURCE.

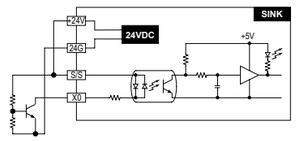
efesotomasyon.com

DC Signal IN

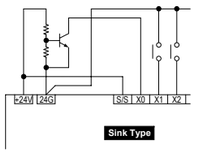


SINK mode
(common port for current input S/S)

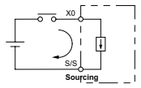
Input point loop equivalent circuit



Wiring loop

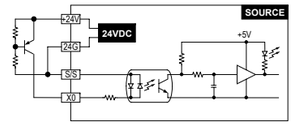


DC Signal IN

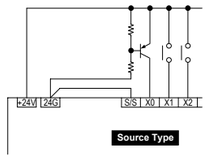


SOURCE mode
(common port for current output S/S)

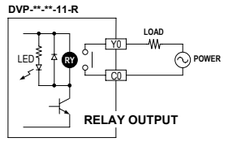
Input point loop equivalent circuit

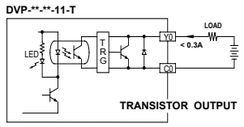


Wiring loop

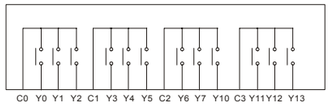


❖ Output point wiring



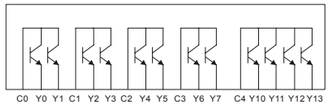


1. DVP-SV series have two output modules, relay and transistor. See “Function Specifications” for their specifications.
2. Be aware of the connection of shared terminals when wiring output terminals.
3. Output terminals, Y0, Y1, and Y2, of relay models use C0 common port; Y3, Y4, and Y5 use C1 common port; Y6, Y7, and Y10 use C2 common port; Y11, Y12, and Y13 use C3 common port, as shown below.



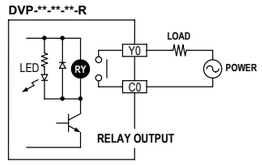
When output points are enabled, their corresponding indicators on the front panel will be on.

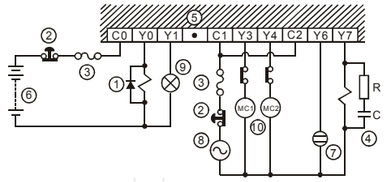
4. Output terminals, Y0 and Y1, of transistor models use C0 common port; Y2 and Y3 use C1 common port; Y4 and Y5 use C2 common port; Y6 and Y7 use C3 common port; Y10, Y11, Y12 and Y13 use C4 common port, as shown below.



5. Isolation circuit: The optical coupler is used to isolate signals between the circuit inside PLC and input modules.

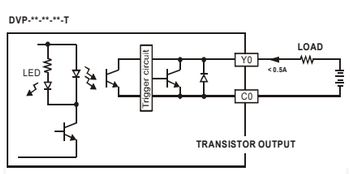
❖ Relay (R) contact circuit wiring

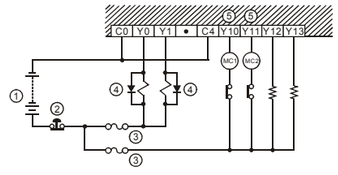




①	Flywheel diode (SB360 3A 60V): To extend the life span of contact	②	Emergency stop: Uses external switch
③	Fuse: Uses 5 ~ 10A fuse at the common port of output contacts to protect the output circuit.		
④	Varistor: To reduce the interference on AC load (R=100~120Ω, C=0.1~0.2uF)	⑤	Empty terminal: not in use
⑥	DC power supply	⑦	Neon indicator
⑧	AC power supply	⑨	Incandescent light (resistive load)
⑩	Manually exclusive output: Uses external circuit and forms an interlock, together with the PLC internal program, to ensure safety protection in case of any unexpected errors.		

❖ Transistor (T) contact circuit wiring





①	DC power supply	②	Emergency stop
③	Circuit protection fuse	④	Flywheel diode (SB360 3A 60V) + inductive load
⑤	Manually exclusive output: Uses external circuit and forms an interlock, together with the PLC internal program, to ensure safety protection in case of any unexpected errors.		

❻ Trial Operation

❖ Preparation

1. Before powering DVP28SV, be sure that you have checked if the I/O wiring is correct. You may damage PLC if AC110V or AC220V is directly supplied to input terminals or the output wiring is short-circuited.

2. When the peripheral devices are used to write program into PLC: If the ERROR indicator does not flash, the program you are using is legal and PLC is waiting for RUN instruction from you.

3. You can use HPP or WPLSoft to test “force On/Off” of output contacts.

❖ Operation & test

1. If the ERROR indicator does not flash, you can use RUN/STOP switch or peripheral device (HPP or WPLSoft) to give RUN instruction and the RUN indicator should be continuously on at this time. That the RUN indicator does not flash indicates PLC has no program in it.

2. When PLC is in operation, use HPP or WPLSoft to monitor the set value or temporarily saved value in timer (T), counter (C), and register (D) and force On/Off of output contacts. That the ERROR indicator is on (not flashes) indicates that part of the program exceeds the preset time-out. In this case, you have to set the RUN/STOP switch as STOP first, check special register D1008 and obtain the location in the program where time-out takes place. We suggest you use WDT instruction to correct this problem.

❖ Operation of PLC basic sequential instructions & application instructions

1. The basic sequential instructions and application instructions of DVP-SV series are compatible with all Delta DVP series PLCs. See Delta “DVP-PLC Application Manual” for relevant information.

2. All Delta DVP series PLCs are compatible with DVPHPP handheld programming panel, WPLSoft ladder diagram for program editing and exclusive transmission cables to connect with DVP28SV for program transmission, MPU control, program monitoring and so on.

❼ How to identify abnormality of PLC

To identify abnormality from the indicators on the panel, please check:

❖ POWER indicator

When PLC is powered, the POWER LED indicator on the front panel will be on (in green). That this indicator is not on or the ERROR indicator continuously flashes when PLC is powered indicates that the power supply +24V is insufficient or DC power supply 24V is overloaded. In this case, change another DC24V power supply. If the indicator is still off at this time, your PLC is malfunctioned. Send your PLC back to your distributor for repair.

❖ RUN indicator

Check your PLC status. When PLC is running, this indicator will be on. You can use HPP, the ladder diagram editing program or the switch on the panel to RUN or STOP PLC.

❖ ERROR indicator

1. If you enter illegal program into PLC or use instructions or devices that exceed their range, this indicator will flash (approx. every 1 second). When this happens, you have to obtain the error code from D1004 and save the address where the error occurs in register D1137 (if the error is a general circuit error, the address of D1137 will be invalid). Find out the cause of the error, amend the program and resend the program to PLC. If you cannot connect to PLC and this indicator keeps flashing quickly (approx. every 0.2 second), there should be insufficient 24VDC power supply. Please check if the 24VCD is overloaded.

2. If the ERROR indicator keeps flashing, you have to check the special relay M1008. M1008 is on indicates that the execution time of program loop exceeds the preset time-out (in D1000). In this case, turn the RUN/STOP switch to STOP, check the special register D1008 and obtain the location in the program where the time-out takes place. We suggest you use WDT instruction to correct this problem. After amending the program, you only need to resend the program to stop the indicator from flashing. If the indicator still keeps flashing at this time, switch off the power and check if there is any interference existing or conductive invader inside PLC.

ⓘ *For details of error codes (in D1004, hex coding), see “DVP-PLC Application Manual: Programming”.*

❖ BAT.LOW indicator

1. The rechargeable lithium-ion battery in DVP-28SV is mainly used on the latched procedure and data storage.
2. The lithium-ion battery has been fully charged in the factory and is able to retain the latched procedure and data storage for 12 months. If DVP28SV has not been powered and used for more than 12 months, the battery will be out of power upon normal consumption and the procedure and data will be lost.
3. The lithium-ion battery has longer life span than ordinary battery; therefore there is no need to change battery very frequently. You can charge the battery at any time without having to worry its chargeability will decrease. You can also recharge the battery even when there is still power in the battery.
4. Please be aware of the date of manufacturing; the charged battery can sustain for 12 months from this date. If you find out the BAT.LOW indicator stays on after PLC is powered, the battery voltage is low and the battery is being charged. DVP28SV has to remain on for more than 24 hours to fully charge the battery. If the indicator turns from on to “flash” (every 1 second), it indicates that the battery cannot be charged anymore. Please correctly process your data in time and send the PLC back to Delta for changing a new battery.

❖ Input indicator

On/Off of input point is indicated by input indicator or monitored by HPP. When the action criteria of the input point are true, this indicator will be on. If abnormality is identified, check if the indicator and input circuit are normal. Use of electronic switch with too much electricity leakage often results in unexpected actions of the input point.

❖ Output indicator

On/Off of output point is indicated by output indicator. When the output indicator (On/Off) does not correspond to the action of its load, please be aware of the follows:

1. The output contact may be melted or blocked out of overloading or short-circuited load, which will result in poor contact.

2. If you are suspicious that the output point may execute undesired action, check the output wiring circuit and whether the screw is properly tightened.

❖ Accuracy (second/month) of RTC

Temperature (˚C/˚F)	0 / 32	25 / 77	55 / 131
Max. inaccuracy (second/month)	-117	52	-132

efesotomasyon.com

The content of this instruction sheet may be revised without prior notice. Please consult our distributors or download the most updated version at http://www.delta.com.tw/industrialautomation