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

2006-11-30

5011647900-6AE0

DVP06AD-S *Analog Input Module*

Instruction Sheet

Warning

- ✓ *Please read this instruction carefully before use.*
- ✓ *DO NOT tough any terminal when the power is switched on. Switch off the power before wiring.*
- ✓ *DVP06AD-S 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 to open the enclosure) in case danger and damage on the device may occur.*
- ✓ *DO NOT connect input AC power supply to any of the I/O terminals; otherwise serious damage may occur. Check all the wiring again before switching on the power.*
- ✓ *DO NOT touch any internal circuit in 1 minute after the power is switched off.*
- ✓ *Make sure the groud terminal ⏚ is correctly grounded in order to prevent electromagnetic interference.*

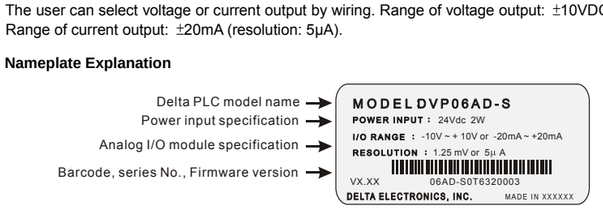
❶ Introduction

1.1 Model Explanation & Peripherals

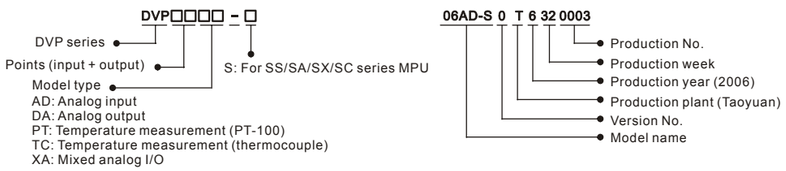
❖ Thank you for choosing Delta DVP series. The analog signal input module DVP06AD-S is able to receive 6 points of external analog signal inputs (both in voltage and current) and convert the signals into 14-bit digital ones. It is able to read and write the data in the module through FROM/TO instructions given by the program of DVP-PLC SS/SA/SX/SX series MPU. There are 49 16-bit control registers in the module.

❖ The user can select voltage or current output by wiring. Range of voltage output: ±10VDC (resolution: 1.25mV). Range of current output: ±20mA (resolution: 5μA).

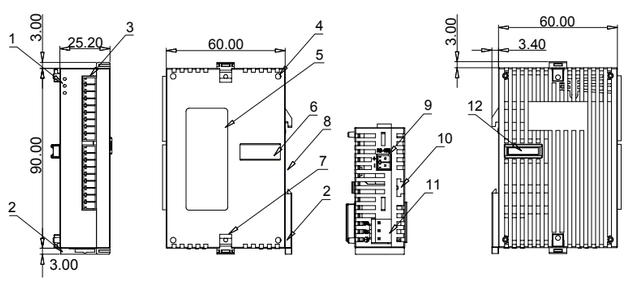
❖ **Nameplate Explanation**



❖ **Model/Serial No. Explanation**



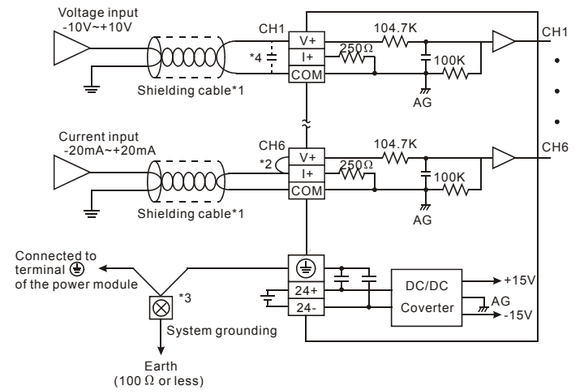
1.2 Product Profile & Outline



Unit: mm

1	POWER, ERROR, A/D indicator	7	Extension unit/module fixing clip
2	DIN rail clip	8	DIN rail (35mm)
3	Terminals	9	RS-485 communication port
4	Extension unit/module mounting hole	10	Extension unit/module fixing notch
5	Nameplate	11	Power input port
6	Extension unit/module connection port	12	Extension unit/module connection port

1.3 External Wiring



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

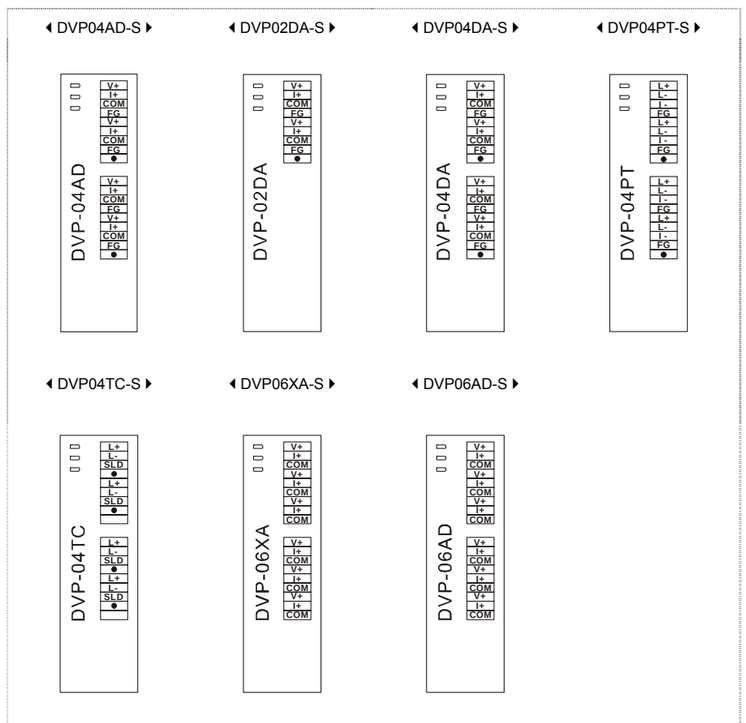
**2: When connecting to current signals, please make sure to short-circuit "V+" and "I+" terminals.*

**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 ripples at the loaded input terminal are too significant that causes noise interference on the wiring, connect the wiring to 0.1 ~ 0.47μF 25V capacitor.*

Note: DO NOT wire empty terminals ●

1.4 Terminal Configurations of the Analog Module



❷ Specifications

2.1 Functions

Analog/Digital (6A/D) Module	Voltage Input	Current Input
Power supply voltage	24VDC (20.4VDC~28.8VDC) (-15% ~ +20%)	
Analog input channel	6 channels/module	
Range of analog input	±10V	±20mA
Range of digital conversion	±8000	±4000
Resolution	14 bits(1_{LSB} = 1.25mV)	13 bits (1_{LSB} = 5μA)
Input impedance	200KΩ or more	250Ω
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale in the range of 0 ~ 55°C, 32 ~ 131°F	
Response time	3ms × the number of channels	
Isolation	Isolation between digital area and analog area. No isolation among channels.	
Range of absolute input	±15V	±32mA
Digital data format	13 significant bits out of 16 bits are available; in 2's complement.	
Average function	Yes. Available for setting up in CR#2 ~ CR#7; range: K1 ~ K20.	
Self-diagnosis	Upper and lower bound detection/channel	
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 ASCII data format: 7-bit, even bit, 1 stop bit (7, E, 1) RTU data format: 8-bit, even bit, 1 stop bit (8, E, 1) RS-485 cannot be used when connected to PLC MPU in series.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. Maximum 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	

2.2 Others

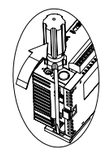
Power Supply	
Max. rated power consumption	24VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%), 2W supplied by external power
Environment	
Insulation resistance	＞5 MΩ (all I/O point-to-ground: 500VDC)
Noise immunity	ESD(IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT(IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, 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 L, N 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: 0°C ~ 55°C (temperature); 50 ~ 95% (humidity); pollution degree 2 Storage: -40°C ~70°C (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)

❸ Installation & Wiring

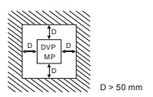
3.1 Mounting and Wiring

❖ **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 the figure.

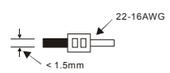


❖ Please install PLC in an enclosure with sufficient space around it to allow heat dissipation as shown in the figure.



❖ **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 °C copper wires only.



❹ Control Registers

DVP06AD-S analog input module					Description												
CR#	RS-485 parameter address		Latched	Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#0	H 4000	○	R	Model name	Set by the system. Data length: 8 bits (b7 ~ b0). DVP06AD-S model code = H C8															
#1	H 4001	○	R/W	Input mode setting	Reserved									CH6	CH5	CH4	CH3	CH2	CH1	
					Input mode: Default = H0000 ◦ Mode 0: Voltage input (-10V ~ +10V) Mode 1: Voltage input (-5V ~ +10V) Mode 2: Current input (-12mA ~ +20mA) Mode 3: Current input (-20mA ~ +20mA)															

DVP06AD-S analog input module					Description														
CR#	RS-485 parameter address	Latched		Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#2	H 4002	○	R/W	CH1 ~ CH6 Average times setting	CH2								CH1							
#3	H 4003	○	R/W		CH4								CH3							
#4	H 4004	○	R/W		CH6								CH5							
Range of settings in CH1 ~ CH6: K1 ~ K20. Default = K10. Default settings of CR2 ~ 4 are all H'0A0A																				
#5				Reserved																
#6	H 4006	×	R	CH1 input average	Average of input signals at CH1 ~ CH6															
#7	H 4007	×	R	CH2 input average																
#8	H 4008	×	R	CH3 input average																
#9	H 4009	×	R	CH4 input average																
#10	H 400A	×	R	CH5 input average																
#11	H 400B	×	R	CH6 input average																
#12	H 400C	×	R	CH1 input present value	Present value of input signals at CH1 ~ CH6															
#13	H 400D	×	R	CH2 input present value																
#14	H 400E	×	R	CH3 input present value																
#15	H 400F	×	R	CH4 input present value																
#16	H 4010	×	R	CH5 input present value																
#17	H 4011	×	R	CH6 input present value																
#18	H 4012	○	R/W	Adjusted OFFSET value of CH1	OFFSET settings at CH1 ~ CH6. Default = K0; Unit: LSB When voltage input, range: K-4,000 ~ K4,000 When current input, range: K-4,000 ~ K4,000 Please refer to this instruction sheet when setting OFFSET and GAIN.															
#19	H 4013	○	R/W	Adjusted OFFSET value of CH2																
#20	H 4014	○	R/W	Adjusted OFFSET value of CH3																
#21	H 4015	○	R/W	Adjusted OFFSET value of CH4																
#22	H 4016	○	R/W	Adjusted OFFSET value of CH5																
#23	H 4017	○	R/W	Adjusted OFFSET value of CH6																
#24	H 4018	○	R/W	Adjusted GAIN value of CH1	GAIN settings at CH1 ~ CH6. Default = K4,000; Unit: LSB When voltage input, range: K-3,200 ~ K16,000 When current input, range: K-3,200 ~ K10,400 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																
#30	H 401E	×	R	Error status	Register for storing all error status. See the table of error status for more information.															
#31	H 401F	○	R/W	Communication address setting	For setting RS-485 communication address. Range: 01 ~ 255. Default = K1															
#32	H 4020	○	R/W	Communication speed (baud rate) setting	For setting up communication speed: 4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200bps ASCII data format: 7-bit, even bit, 1 stop bit (7, E, 1) RTU data format: 8-bit, even bit, 1 stop bit (8, E, 1) b0: 4,800bps b1: 9,600bps (default) b2: 19,200bps b3: 38,400bps b4: 57,600bps b5: 115,200bps b6 ~ b13: reserved b14: High/low bit exchange of CRC checksum (only valid in RTU mode) b15: Switch between ASCII/RTU mode.															
#33	H 4021	○	R/W	Return to default setting; OFFSET/GAIN tuning authorization	b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 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 ~ b15 = 1, all values in CH1 ~ CH6 will return to default settings. b12 ~ b15 will return to 0 automatically after the setting is completed.															
#34	H 4022	○	R	Firmware version	Displaying the current firmware version in hex, e.g. version 1.00 is indicated as H0100.															
#35~#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 Bit): 1. For voltage input 1_{LSB} = 10V/8,000 = 1.25mV
2. For current input 1_{LSB} = 20mA/4,000 = 5μA

Explanations:

1. CR#0: Model name. The user can read the model name from the program and see if the extension module exists.
2. 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 (b2 ~ b0 = 00) and CH2: mode 1 (b5 ~ b3 = 01), CH3: mode 2 (b8 ~ b6 = 10), CH4: mode 3 (b11 ~ b9 = 11), CH5: mode 0 (b11 ~ b9 = 00), CH6: mode 1 (b11 ~ b9 = 01), CR#1 has to be set as H04EA and the higher bits (b12 ~ b15) have to be reserved. Default value = H0000.
3. CR#2 ~ CR#4: The settings of average times of the signals at CH1 ~ CH6. Range: K1 ~ K20. For example, if the average time at CH1 is to be set as K10 and CH2 as K18, CR#2 has to be set as H120A. CR#3 ~ 4 apply the same rule. The default setting of each channel = K10.
4. CR#5: reserved.
5. CR#6 ~ CR#11: The average of the signals at CH1 ~ CH6 obtained from the settings in CR#2 ~ CR#4. For example, if the settings in CR#2 ~ CR#4 is 10, the content in CR#6 ~ CR#11 will be the average of the most recent 10 signals at CH1 ~ CH6.
6. CR#12 ~ CR#17: The present value of input signals at CH1 ~ CH6.
7. CR#18 ~ CR#23: The adjusted OFFSET value of CH1 ~ CH6, representing the analog input voltage or current when the analog signal is converted into digital value 0.

   The adjustable range of voltage: -5V ~ +5V (-4,000$_{LSB}$ ~ +4,000$_{LSB}$)

   The adjustable range of current: -20mA ~ +20mA (-4,000$_{LSB}$ ~ +4,000$_{LSB}$)
8. CR#24 ~ CR#29: The adjusted GAIN value of CH1 ~ CH6, representing the analog input voltage or current when the analog signal is converted into digital value 4,000.

   The adjustable range of voltage: -4V ~ +20V (-3,200$_{LSB}$ ~ +16,000$_{LSB}$)

   The adjustable range of current: -16mA ~ +52mA (-3,200$_{LSB}$ ~ +10,400$_{LSB}$)

   Please note that: GAIN value – OFFSET value = +800$_{LSB}$ ~ +12,000$_{LSB}$ (voltage) or +800$_{LSB}$ ~ +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.
9. CR #30: Error status value (See the table below)

Error status	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1(H1)	reserved	0	0	0	0	0	0	0	1
Incorrect analog input value	K2(H2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4(H4)		0	0	0	0	0	1	0	0
Offset/Gain error	K8(H8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16(H10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32(H20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64(H40)		0	1	0	0	0	0	0	0
Instruction error	K128(H80)		1	0	0	0	0	0	0	0

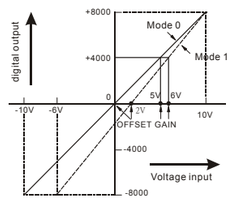
Note: Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error

10. CR#31: The setting of RS-485 communication address (Range: 01 ~ 255, default = K1).
11. CR#32: The setting of RS-485 communication speed. b0: 4,800bps; b1: 9,600bps (default); b2: 19,200bps; b3: 38,400bps; b4: 57,600bps; b5: 115,200bps; b6 ~ b13: reserved; b14: high/low bit exchange of CRC checksum (only valid in RTU mode); b15 = switch between ASCII/RTU mode
12. CR#33:
    1. The setting of whether the alarm indicator will flash when the input value exceeds upper/lower bound; for authorizations on OFFSET/GAIN tuning; returning CH1 ~ CH6 to default values.
    2. CR for input mode, setting of average times, OFFSET value and GAIN value will be reset after returning to default settings.
13. CR#34: Firmware version of the model.
14. CR#35 ~ CR#48: Parameters for system use.
15. CR#0 ~ CR#48: The corresponding parameter addresses H 4000 ~ H 4030 are for users to read/write data by RS-485 communication. When using RS-485, the user has to separate the module with MPU first.
    a. Communication baud rate: 4,800/9,600/19,200/38,400/57,600/115,200bps
    b. Modbus ASCII/RTU communication protocols: ASCII data format (7-bit, even bit, 1 stop bit (7, E, 1)); RTU data format (8-bit, even bit, 1 stop bit (8, E, 1)).
    c. Function codes: 03H (read register data); 06H (write 1 word datum to register); 10H (write many word data to register)
    d. Latched CR should be written by RS-485 communication to stay latched. CR will not be latched if written by MPU through TO/DTO instruction.

❺ Adjusting A/D Conversion Curve

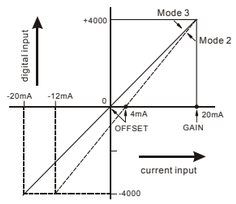
5.1 Explanation

Voltage Input Mode



CR#1 mode 0	GAIN = 5V (4,000$_{LSB}$) OFFSET = 0V (0$_{LSB}$)
CR#1 mode 1	GAIN = 6V (4,800$_{LSB}$) OFFSET = 2V (1,600$_{LSB}$)
GAIN	The voltage input value when the digital input value = 4,000 Range: -4V ~ +20V (-3,200$_{LSB}$ ~ +16,000$_{LSB}$)
OFFSET	The voltage output value when the digital input value = 0 Range: -5V ~ +5V (-4,000$_{LSB}$ ~ +4,000$_{LSB}$)
GAIN - OFFSET	Range: +1V ~ +15V (+800 $_{LSB}$ ~ +12,000 $_{LSB}$)

Current input mode



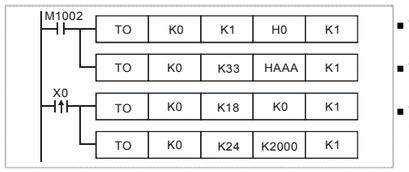
CR#1 mode 2	GAIN = 20mA (4,000$_{LSB}$) OFFSET = 4mA (800$_{LSB}$)
CR#1 mode 3	GAIN = 20mA (4,000$_{LSB}$) OFFSET = 0mA (0$_{LSB}$)
GAIN	The current input value when the digital input value = +4,000 Range: -16mA ~ +52mA (-3,200$_{LSB}$ ~ +10,400$_{LSB}$)
OFFSET	The current input value when the digital input value = 0 Range: -20mA ~ +20mA (-4,000$_{LSB}$ ~ +4,000$_{LSB}$)
GAIN - OFFSET	Range: +4mA ~ +32mA (800 $_{LSB}$ ~ +6,400 $_{LSB}$)

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

LSB refers to “least significant bit”: In voltage input, 1_{LSB}=10V/8000=1.25mV; in current input, 1_{LSB}=20mA/4000=5μA.

5.2 Program Example

Example 1: Set the OFFSET value of CH1 as 0V (= K0$_{LSB}$) and GAIN value as 2.5V (= K2,000$_{LSB}$)



- Write H0 into CR#1 of analog input module No. 0 and set CH1 in mode 0 (voltage input -10V ~ +10V)
- Write HAAA into CR#33 and allow OFFSET/GAIN tuning in CH1 ~ CH6.
- When X0 goes from Off to On, write the OFFSET value K0$_{LSB}$ into CR#18 and the GAIN value K2,000$_{LSB}$ into CR#24.

Example 2: Set the OFFSET value of CH2 as 2mA (= K400$_{LSB}$) and GAIN value as18mA (= K3,600$_{LSB}$)

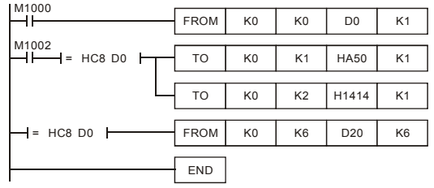
- Write H8 into CR#1 of analog input module N0. 0 and set CH2 in mode 3 (current input -20mA ~ +20mA)
- Write HAAA into CR#33 and allow OFFSET/GAIN tuning in CH1 ~ CH6.
- When X0 goes from Off to On, write the OFFSET value K400$_{LSB}$ into CR#19 and the GAIN value K3,600$_{LSB}$ into CR#25.

❻ Trial Operation & Troubleshooting

❖ LED Display

1. When the module is powered for the first time, POWER LED will be on and ERROR LED will be on for 0.5 second.
2. When the power supply is normal, POWER LED will be on and ERROR LED should be off. When the power supply is less than 19.5V, ERROR LED will keep being on until the power supply is higher than 19.5V.
3. When the module is connected to PLC MPU in series, the RUN LED on the MPU will be on and A/D LED will flash.
4. When controlled by RS-485, the A/D LED on the module will flash after receiving the first RS-485 instruction.
5. When the input or output value exceeds the upper bound or falls below the lower bound after conversion, ERROR LED will flash.

❖ Program Example



- Read the model name from K0 and see if it is DVP06AD-S: HC8.
- If D0 = HC8, set the input modes: (CH1, CH2) mode 0, (CH3, CH4) mode 1, (CH5, CH6) mode 2.
- Set the average times in CH1 and CH2 as K20.
- Read the average of input signals at CH1 ~ CH6 from CR#6 ~ CR#11 and store the 6 data in D20 ~ D25.

❼ Relevant Instructions

API 78	D	FROM	P	m1	m2	D	n	Read CR data in special modules

Instruction Explanation	m1: No. of special module (m1 = 0 ~ 7) m2: CR# in special module to be read D: Device for storing read data n: Number of data to be read at a time
Program Example	Read CR#24 of special modile No. 0 into D0 and CR#25 into D1. Only 2 groups of data is read at a time (n = 2) X0 FROM K0 K24 D0 K2

API 79	D	TO	P	m1	m2	S	n	Write CR data into special modules

Instruction Explanation	m1: No. of special module (m1 = 0 ~ 7) m2: CR# in special module to be written S: Data to be written into CR n: Number of data to be written at a time
Program Example	Use 32-bit instruction DTO to write the content in D11 and D10 into CR#3 and CR#2 of special moduel No. 0. Only 1 group of data is written in at a time (n = 1) X0 DTO K0 K2 D10 K1