DVP04DA-S

DVP04DA-S   *Analog Output Module*

Instruction Sheet

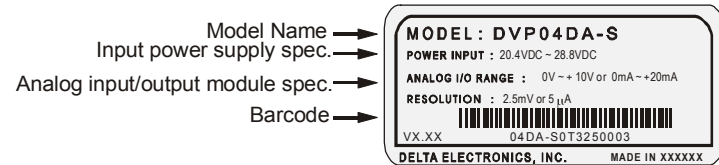|	
1. Status indicator (Power, RUN and ERROR)	8. Expansion port
2. Model name	9. Expansion unit clip
3. DIN rail clip	10. DIN rail (35mm)
4. I/O terminals	11. RS-485 Communication port
5. I/O point indicator	12. Mounting rail of the expansion unit
6. Mounting hole of the expansion unit	13. DC Power input
7. Nameplate	14. Expansion port

1 WARNING

⚠ Please carefully read this instruction thoroughly prior to use the DVP04DA-S.

⚠ The DC input power must be OFF before any maintenance.

⚠ This is an OPEN-TYPE built-in DVP04DA-S, and the DVP04DA-S is certified to meet IEC 61131-2 (UL 508) safety requirements when installed in the enclosure to prevent high temperature, high humidity, excessive vibration, corrosive gases, liquids, airborne dust or metallic particles. Also, it is equipped with protective methods such as some special tool or key to open the enclosure, in order to prevent the hazard to users or any damage to the DVP04DA-S.

⚠ Do not connect the AC power to any of the input/output terminals, or it may damage the DVP04DA-S. Make sure that all the wiring is well conducted prior to power on.

⚠ Do not touch the internal circuit for at least 1 minute after the power is OFF.

⚠ Make sure that the DVP04DA-S is properly grounded ⏚ to prevent any electromagnetic noise.
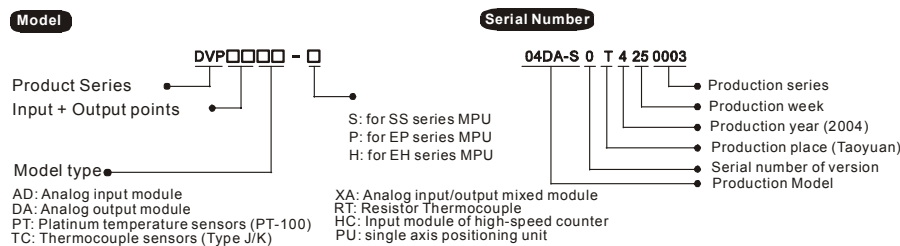
2 INTRODUCTION

2.1   Model Explanation and Peripherals

● Thank you for choosing DELTA DVP PLC Series. The analog output module of DVP04DA-S series can read/write the data of analog output module by using commands FROM / TO via DVP-PLC SS/SA/SX MPU program. The analog output module receives 12-bit digital data of 4 groups from PLC MPU and converts it into 4 points analog output signal either in voltage or in current.

● The Software version of DVP04DA-S analog output module can be updated via RS-485 communication. Power unit and module are separate. Size is small and easy to install.

● Users can select output from voltage or current via wiring. Voltage output range is 0V ~ +10V DC (resolution is 2.5 mV). Current output range is 0mA ~ 20mA (resolution is 5 μA).
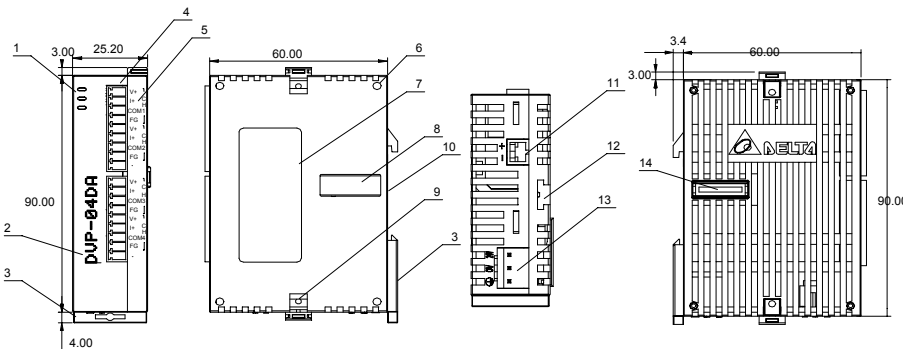
■ **Nameplate Explanation**

Model Name
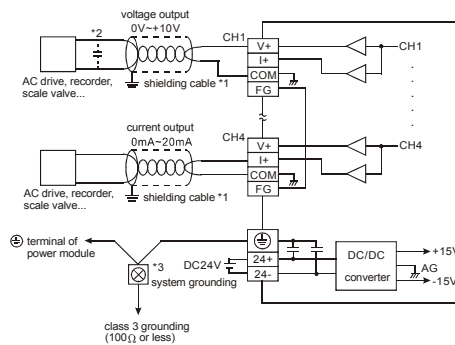Input power supply spec.
Analog input/output module spec.
Barcode

```
MODEL : DVP04DA-S
POWER INPUT : 20.4VDC ~ 28.8VDC
ANALOG I/O RANGE :  0V~ +10V or  0mA ~ +20mA
RESOLUTION :  2.5mV or 5uA
VX.XX       04DA-S0T3250003
DELTA ELECTRONICS, INC.      MADE IN XXXXXX
```

■ **Model Explanation**

Model
Serial Number

DVP□□□□ – □
Product Series
Input + Output points
Model type●

S: for SS series MPU
P: for EP series MPU
H: for EH series MPU

AD: Analog input module
DA: Analog output module
PT: Platinum temperature sensors (PT-100)
TC: Thermocouple sensors (Type J/K)

XA: Analog input/output mixed module
RT: Resistor Thermocouple
HC: Input module of high-speed counter
PU: single axis positioning unit

04DA-S 0 T 4 25 0003
Production series
Production week
Production year (2004)
Production place (Taoyuan)
Serial number of version
Production Model

2.2   Product Profile and Outline

Unit: mm

2.3   External wiring

voltage output 0V~+10V
AC drive, recorder, scale valve...
shielding cable *1
CH1
V+
I+
COM
FG
CH1

current output 0mA~20mA
AC drive, recorder, scale valve...
shielding cable *1
CH4
V+
I+
COM
FG
CH4

terminal of power module
class 3 grounding (100 Ω or less)
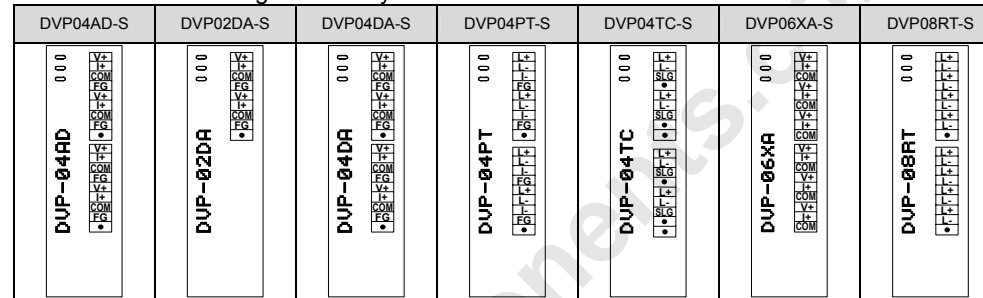*3 system grounding
DC24V
24+
24−
DC/DC converter
+15V
AG
−15V

Note 1: Please isolate analog output and other power wiring.

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

Note 3: Please connect ⏚ power module terminal and ⏚ analog output module terminal to system earth point and make system earth point be grounded or connects to machine cover.

Warning: DO NOT wire to the No function terminal ●.

2.4   Terminal of analog module layout

DVP04AD-S	DVP02DA-S	DVP04DA-S	DVP04PT-S	DVP04TC-S	DVP06XA-S	DVP08RT-S
DVP-04AD	DVP-02DA	DVP-04DA	DVP-04PT	DVP-04TC	DVP-06XA	DVP-08RT

3 STANDARD SPECIFICATIONS

3.1   Specifications

Digital/Analog (2D/A) Module	Voltage Output	Current Output
Power Supply Voltage	24 VDC (20.4VDC~28.8VDC) (−15%~+20%)	
Analog Input Channel	2 channels / each module	
Analog Output Range	0~10V	0~20mA
Digital Data Range	0~4000	0~4000
Resolution	12 bits (1$_{LSB}$=2.5 mV)	12 bits (1$_{LSB}$=5 μA)
Output Impedance	0.5Ω or lower	
Overall Accuracy	±0.5% of full scale of 25℃(77℉). ±1% of full scale during 0~55℃ (32~131℉).	
Response Time	3 ms × channels	
Max. Output Current	20mA (1KΩ~2MΩ)	—
Tolerance Carried Impedance	—	0~500Ω
Digital Data Format	2's complementary of 16-bit, 13 Significant Bits	
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 short circuit may cause internal wire damage and current output break.	
Communication Mode (RS-485)	Yes, communication formats are (4800 / 9600 / 19200 / 38400 / 57600 / 115200bps) Communication format: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 1). Communication format of RTU mode is 8Bit, even bit, 1 stop bit (8 E 1). When connecting to PLC MPU in series, RS-485 can't be used.	
Connect to DVP-PLC MPU in Series	If DVP04DA-S modules are connected to MPU, the modules are numbered from 0 – 7. 0 is the closest and 7 is the furthest to the MPU. 8 modules is the max and they do not occupy any digital I/O points of the MPU.	

3.2   Other Specification

Max. Rated Consuming Power	24 VDC (20.4VDC~28.8VDC) (-15%~+20%), 4W, supply from external power
Environment Condition and Wiring	Follow the DVP-PLC MPU
Spec of Prevent Static Electricity	All places between terminals and ground comply with the spec

4 CR (Control Register)

CR No	DVP04DA-S Analog Output Module RS-485 Parameters Address	Latched		Register Name	Explanation
#0	H 4032	◯	R	Model type	System used, data length is 8 bits (b7~b0). DVP-04DA model code=H 89
#1	H 4033	◯	R/W	Output mode setting	Reserved / CH4 / CH3 / CH2 / CH1. Output mode setting: factory setting is H0000. Mode 0: output voltage mode (0V~10V). Mode 1: output voltage mode (2V~10V). Mode 2: output current mode (4mA~20mA). Mode 3: output current mode (0mA~20mA). Mode 4: none use.
#2 ~ #5				Reserved	
#6	H 4038	◯	R/W	CH1 output value	The output setting range of channel CH1~CH4 is K0~K4000. Factory setting is K0 and unit is LSB.
#7	H 4039	◯	R/W	CH2 output value	
#8	H 403A	◯	R/W	CH3 output value	
#9	H 403B	◯	R/W	CH4 output value	
#10 ~ #17				Reserved	
#18	H 4044	◯	R/W	To adjust OFFSET value of CH1	It is used to set the OFFSET value of CH1~CH4. The setting range is K-2000~K2000. The factory setting is K0 and unit is LSB.
#19	H 4045	◯	R/W	To adjust OFFSET value of CH2	
#20	H 4046	◯	R/W	To adjust OFFSET value of CH3	
#21	H 4047	◯	R/W	To adjust OFFSET value of CH4	
#22 ~ #23				Reserved	
#24	H 404A	◯	R/W	To adjust GAIN value of CH1	It is used to set the GAIN value of CH~CH4. The setting range is K-1600~K8000. The factory setting is K2000 and unit is LSB.
#25	H 404B	◯	R/W	To adjust GAIN value of CH2	
#26	H 404C	◯	R/W	To adjust GAIN value of CH3	
#27	H 404D	◯	R/W	To adjust GAIN value of CH4	
#28 ~ #29				Reserved	
#30	H 4050	✕	R	Error status	Data register to save all error status. Please refer to fault code chart for detail.
#31	H 4051	◯	R/W	Communication address setting	Used to set RS-485 communication address. The setting range is from 01 to 255 and the factory setting is K1.
#32	H 4052	◯	R/W	Communication Baud Rate setting	Used to set communication baud rate (4800, 9600, 19200, 38400, 57600, 115200bps). Communication format: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 1). Communication format of RTU mode is 8Bit, even bit, 1 stop bit (8 E 1). b0: 4800 bps (bit/sec.) b1: 9600 bps (bit/sec.) (Factory setting) b2: 19200 bps (bit/sec.) b3: 38400 bps (bit/sec.) b4: 57600 bps (bit/sec.) b5: 115200 bps (bit/sec.) b6-b13: reserved. b14: exchange low and high byte of CRC check code (RTU mode only) b15: ASCII / RTU mode selection
#33	H 4053	◯	R/W	Reset to factory setting and set characteristics adjustable priority	Reserved / CH4 / CH3 / CH2 / CH1. Output latched setting, factory setting H0000. Give CH1 setting for example: 1. When b0=0, user can set OFFSET and GAIN value of CH1 (CR#18, CR#24). When b0=1, inhibit user to adjust OFFSET and GAIN value of CH1 (CR#18, CR#24). 2. b1 is used to check if characteristic register is latched. b1=0 latched (factory setting), b1=1 not latched. 3. When b2 is set to 1, all settings are reset to factory setting.
#34	H 4054	◯	R	Software version.	Show software version in hexadecimal. For example: H 010A means 1.0A.
#35~#48				System used	

◯ means latched.   ✕ means not latched.   R means can read data by using FROM command or RS-485.
W means can write data by using TO command or RS-485.
LSB (Least Significant Bit): 1. Voltage output: 1$_{LSB}$=10V/8000=2.5mV. 2. Current output: 1$_{LSB}$=20mA/4000=5μA.

Explanation:

1. The content of CR#0 is model type, user can read the data from program to check if there is expansion module.
2. CR#1 is used to set two internal channels working mode of analog output module. Every channel has four modes that can be set individually. For example: if setting CH1 to mode 2 (b2~b0=010), CH2 to mode 1(b5~b3=001). It needs to set CR#1 to H000A. The factory setting of CR#1 is H0000.
3. CR#2 ~ CR#5, CR#10 ~ CR#17, CR#22, CR#28, CR#29 Reserved.
4. CR #6 ~ CR#9 display CH1 ~ CH4 output signals. The setting range is K0~K4000. Factory setting is K0 and unit is LSB.
5. CR#18 ~ CR#21 are used to adjust the OFFSET value of CH1 and CH4. The factory setting is K0 and unit is LSB. If output value equal to 0 after calculation, the adjustable range of analog output voltage or current is -2000~+2000.
   Voltage adjustable range: -5V~+5V(-2000$_{LSB}$~+2000$_{LSB}$).
   Current adjustable range: -10mA~+10mA (-2000$_{LSB}$~+2000$_{LSB}$).
6. CR#24 ~ CR#27 are used to adjust the GAIN value of CH1 and CH4. The factory setting is K2000 and unit is LSB. If output value equal to 2000 after calculation, the adjustable range of analog output voltage or current is -1600~+8000.
   Voltage adjustable range: -4V~+20V(-1600$_{LSB}$~+8000$_{LSB}$).
   Current adjustable range: -8mA ~+40mA (-1600$_{LSB}$~+8000$_{LSB}$).
   Please be noticed that GAIN VALUE – OFFSET VALUE = +400$_{LSB}$ ~+6000$_{LSB}$ (voltage or current). If the value difference comes up small (within range), the output signal resolution is then slim and the variation is definitely larger. On the contrast, if the value difference exceeds the range, the output signal resolution becomes larger and the variation is definitely smaller.
7. CR#30 is fault code. Please refer to the following chart.

Fault Description	Content	b15~b8	b7	b6	b5	b4	b3	b2	b1	b0
Power Source Abnormal	K1(H1)	Reserved	0	0	0	0	0	0	0	1
Analog Input Value Error	K2(H2)		0	0	0	0	0	0	1	0
Setting Mode Error	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
Digital Range Error	K32(H20)		0	0	1	0	0	0	0	0
Average Times Setting Error	K64(H40)		0	1	0	0	0	0	0	0
Command Error	K128(H80)		1	0	0	0	0	0	0	0

Note: Each fault code will have corresponding bit (b0~b7). Two or more faults may happen at the same time. 0 means normal and 1 means having fault.

8. CR#31 is used to set RS-485 communication address. The setting range is from 01 to 255. The factory setting is K1.
9. CR#32 is used to set RS-485 communication baud rate: 4800, 9600, 19200, 38400, 57600, 115200

bps. b0: 4800bps, b1: 9600bps, (factory setting) b2: 19200bps, b3: 38400 bps, b4: 57600 bps, b5: 115200 bps, b6-b13: reserved, b14: exchange low and high byte of CRC check code. (RTU mode only) b15=0: ASCII mode, b15=1: RTU mode. Communication format: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 1), while RTU mode is 8Bit, even bit, 1 stop bit (8 E 1).

10. CR#33 is used to set the internal function priority. For example: characteristic register. Output latched function will save output setting to the internal memory before power loss.
11. CR#34 is software version of model type.
12. CR#35~ CR#48 are used for system.
13. The corresponding parameters address H4032~H4063 of CR#0~CR#48 are provided for user to read/write data via RS-485.
   A. Communication baud rate: 4800, 9600, 19200, 38400, 57600, 115200 bps.
   B. Communication format: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 1). Communication format of RTU mode is 8Bit, even bit, 1 stop bit (8 E 1).
   C. Function code: 03H—read data from register. 06H—write one WORD to register. 10H—write multiple WORD to register.

## 5   ADJUST D/A CONVERSION CHARACTERISTIC CURVE

5.1 Adjust D/A Conversion Characteristic Curve

Voltage output mode:
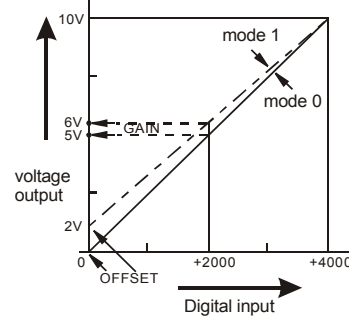
Mode 0 of CR#1: GAIN = 5V(2000$_{LSB}$), OFFSET=0V (0$_{LSB}$)

Mode 1 of CR#1: GAIN = 6V(2400$_{LSB}$), OFFSET=2V (800$_{LSB}$).

GAIN: The setting range of voltage output value when digital input value is K2000 should be -4V~+20V(-1600$_{LSB}$ ~+8000$_{LSB}$).

OFFSET: The setting range of voltage output value when digital input value is K0 should be -5V~+5V(-2000$_{LSB}$ ~ +2000$_{LSB}$).

GAIN—OFFSET: Setting range: +1V~+15V (+400$_{LSB}$ ~ +6000$_{LSB}$).
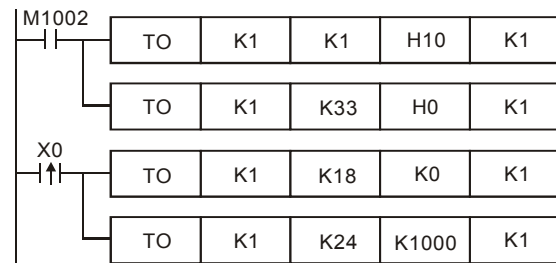
Current output mode
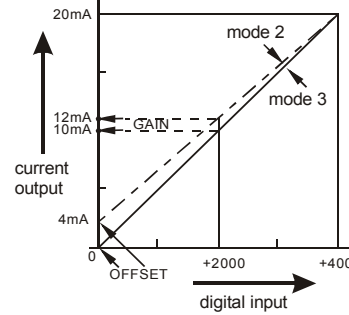
Mode 2 of CR#1: GAIN = 12mA (2400$_{LSB}$), OFFSET=4mA (800$_{LSB}$).

Mode 3 of CR#1: GAIN = 10mA (2000$_{LSB}$), OFFSET=0mA (0$_{LSB}$).

GAIN: The setting range of current output when digital input value is K2000 should be -8mA~+40mA (-1600$_{LSB}$ ~+8000$_{LSB}$).

OFFSET: The setting range of current output when digital input value is K0 should be -10mA ~+10mA (-2000$_{LSB}$ ~+2000$_{LSB}$).

GAIN—OFFSET: Setting range: +2mA~+30mA (+400$_{LSB}$ ~+6000$_{LSB}$).

The charts above are D/A conversion characteristic curve of voltage input mode and current input mode. Users can adjust conversion characteristic curve by changing OFFSET values (CR#18~CR#21) and GAIN values (CR#24~CR#27) depend on application.

LSB (Least Significant Bit): 1.voltage output: 1$_{LSB}$=10V/4000=2.5mV. 2.current output: 1$_{LSB}$=20mA/4000=5μA.

5.2 Program Example for Adjusting D/A Conversion Characteristics Curve

Example 1: Setting OFFSET value of CH1 to 0V(=K0$_{LSB}$) and GAIN value is 2.5V(=K1000$_{LSB}$).

- Writing H10 to CR#1 of analog output module#0. Setting CH1 to mode 0 (voltage output 0V~ +10V) and CH2 to mode 2 (current output 4mA~ +20mA).
- Writing H0 to CR#33 and allow CH1 ~ CH4 to adjust characteristic.
- When X0 switches from Off to On, K0$_{LSB}$ of OFFSET value will be written to CR#18 and K1000$_{LSB}$ of GAIN value will be written to CR#24.

Example 2: Setting OFFSET value of CH2 to 2mA (=K400$_{LSB}$) and GAIN value is 18mA (=K3600$_{LSB}$).
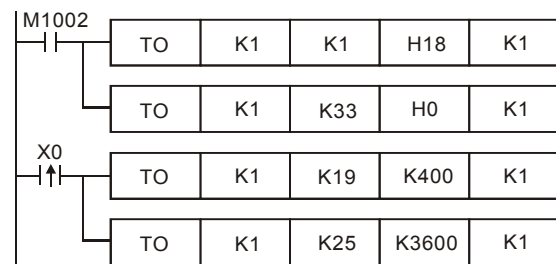

- Writing H10 to CR#1 of analog output module#0. Setting CH1 to mode 0 (voltage output 0V~ +10V) and CH2 to mode 3 (current output 0mA~ +20mA).
- Writing H0 to CR#33 and allow CH1 ~ CH4 to adjust characteristic.
- When X0 switches from Off to On, K400$_{LSB}$ of OFFSET value will be written to CR#19 and K3600$_{LSB}$ of GAIN value will be written to CR#25.

6   INITIAL PLC START-UP

■ Lamp display
1. When power is on, POWER LED will be lit and ERROR LED will be lit for 0.5 second.
2. It is normal that POWER LED should be lit and ERROR LED should turn off. When power supply is lower than 19.5V, ERROR LED will blink continuously till the power voltage is higher than 19.5V.
3. When it connects to PLC MPU in series, RUN LED on MPU will be lit and A/D LED or D/A LED should blink.
4. After receiving the first RS-485 command during controlling via RS-485, A/D LED or D/A LED should blink.
5. After converting, ERROR LED should blink if input or output exceeds the upper bound or below the lower bound.

■ Program example:
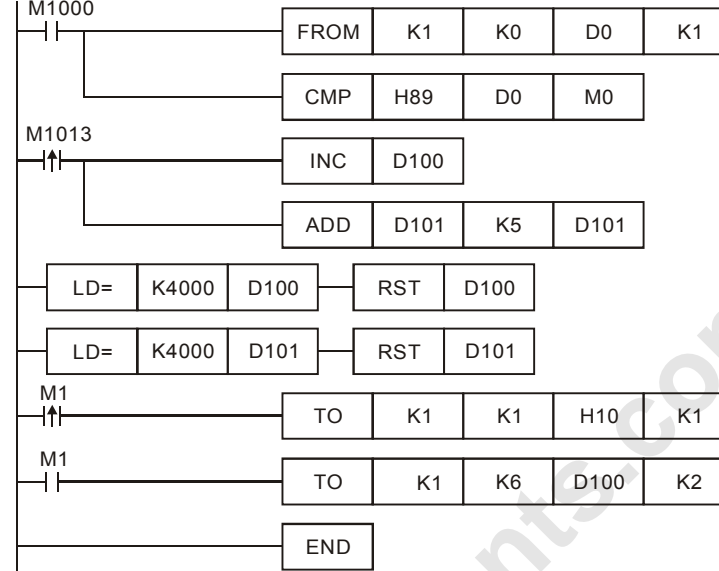
Explanation:
- Read the data of model type from expansion module K1 and distinguish if the data is H89 (DVP04DA-S model type).
- D100 will increase K1 and D101 will increase K5 every second.
- When value of D100 and D101 attain to K4000, they will be reset to 0.
- If the model type is DVP04DA-S, M1 will be on and set the output mode: CH1 mode to 0, CH2 mode to 2.
- Writing output setting CR#6 and CR#7 to D100 and D101. Analog output will vary with D100 and D101 value.

7   COMMAND EXPLANATION

API 78	D	FROM	P	(m₁) (m₂) (D) (n)	Read special module CR data	Adaptive model

	Bit device				Word device												16-bit command (9 STEPS)			
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F					
m₁					*	*										FROM	Continuous execution	FROMP	Pulse execution
m₂					*	*													
D							*	*	*	*	*	*	*			32-bit command (17 STEPS)			
n					*	*										DFROM	Continuous execution	DFROMP	Pulse execution

- Note: The usage range of operand m₁ is 0~7. The usage range of operand m₂: ES/EP: 0-48, EH: 0-254. The usage range of operand n: ES/EP: n=1~(49-m2), EH: 1~(255-m2). ES series model doesn't support pulse execution command (FROMP, DFROMP).
- Flag: When M1083 on, it allows to enable the interrupt during FROM/TO. Refer to following for detail.

Command Explanation
- (m₁): the number for special module. (m₂): the number of CR (Control Register) of special module that will be read. (D): the location to save reading data. (n): the data number of reading ONCE.
- DVP-series PLC uses this command to read CR data of special module.
- (D): When assign the bit operand, K1~K4 are used for 16-bit and K5~K8 are used for 32-bit.
- Please refer the footnote below for calculation the special module number.

Program Example
- Read the content of CR#24 of special module#0 save it to D0 of PLC, and read the content of CR#25 of special module#0 save it to D1 of PLC. 2 data are read in one time when n=2.
- Command will be executed when X0=ON. Command won't be executed if X0=OFF and the content of previous reading data won't change.
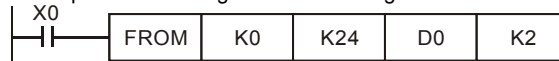
API 79	D	TO	P	(m₁) (m₂) (S) (n)	Special module CR data write in	Adaptive model

	Bit device				Word device												16-bit command (9 STEPS)			
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F					
m₁					*	*										TO	Continuous execution	TOP	Pulse execution
m₂					*	*													
S					*	*	*	*	*	*	*	*	*	*	32-bit command (17 STEPS)			
n					*	*										DTO	Continuous execution	DTOP	Pulse execution

- Note: The usage range of operand m₁ is 0~7. The usage range of operand m₂: ES/EP: 0-48, EH: 0-254. The usage range of operand n: ES/EP: 1~(49-m2), EH: 1~(255-m2). For ES series, it doesn't support pulse execution command (TOP, DTOP)
- Flag: When M1083 on, it allows to enable the interrupt during FROM/TO. Refer to below for detail.

Command Explanation
- (m₁): the number of special module. (m₂): the number of CR (Control Register) of special module that will be wrote in. (S): the data to write in CR. (n): the data number to write in one time.
- DVP-series PLC uses this command to write data into CR of special module.
- (S): When assigning bit operand, K1~K4 can be used for 16-bit and K5~K8 can be used for 32-bit.

Program Example
- Use 32-bit command DTO, program will write D11 and D10 to CR#3 and CR#2 of special module#0. It only writes one group of data in one time when n=1.
- Command will be executed when X0=ON, will not be executed when X0=OFF. The previous write data won't be changed.
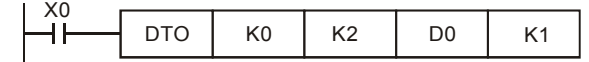
Footnote
- The rule of command operand
  - m1: arrangement number of special module. The number of special module that connects to PLC MPU. The number sequence of special module from the closest to the furthest of MPU is from 0 to 7. 8 modules is the max and it won't occupy I/O point.
  - m2: the number of CR. There are 49 CR (Control Register) with 16-bit each built-in memory in the special module. The number of CR uses decimal digital (#0~#48). All running status and setting values of special module have included.
  - FROM/TO command is used to read/write CR data 1pcs at a time, while DFROM/DTO command is used to read/write CR data 2pcs in one time.

Upper 16-bit   Lower 16-bit

CR #10	CR #9	← Specified CR number

- The number of transmission groups n. The meaning of n=2 of 16-bit command and n=1 of 32-bit are the same.

16-bit command when n=6   32-bit command when n=3
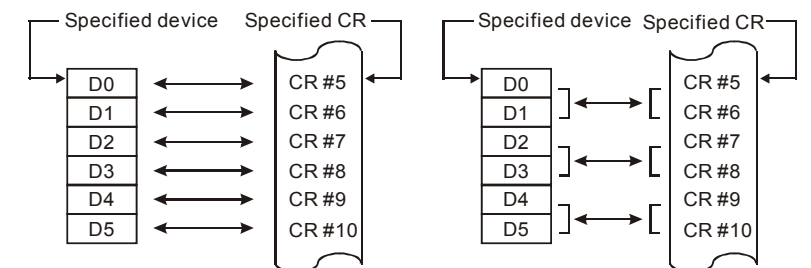
- In ES series models, flag M1083 is not provided. All interrupts (including external or internal interrupt subroutines) will be disabled when FROM/TO command is executed. Interrupts will be resumed after FROM/TO command complete. Please be advised FROM/TO command also can be executed in the interrupt subroutine.
- The function of the flag M1083 (FROM/TO mode exchange) provided in EP/EH series models:
  A. When M1083=Off, all interrupts (including external or internal interrupt subroutines) will be disabled when FROM/TO command is executed. The Interrupts will resumed after FROM/TO command complete. Please be advised FROM/TO command can be executed in the interrupt subroutine.
  B. When M1083=On, if an interrupt enable occurs while FROM/TO command are executing, the interrupt FROM/TO command will be blocked till the requested interrupt finish. Unlike M1080 off situation, FROM/TO command cannot be executed in the interrupt subroutine.