![DELTA logo] http://www.delta.com.tw/industrialautomation/

DVP 04DA-H2 Analog Output Module
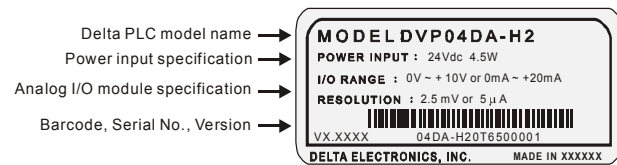
Instruction Sheet

⚠ Warning

- ✓ Please read this instruction carefully before use.
- ✓ Switch off the power before wiring.
- ✓ DVP04DA-H2 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 tough any terminal when the power is switched on. 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.
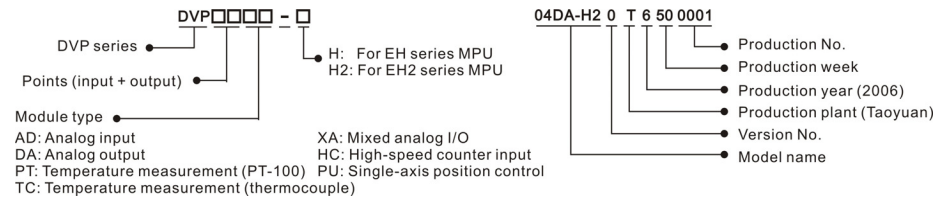
❶ Introduction

1.1 Model Explanation & Peripherals

❖ Thank you for choosing Delta DVP series. DVP04DA-H2 is able to read and write data of DVP04DA-H2 analog signal output modules through FROM/TO instructions given by the program of DVP-EH2 series MPU. The analog signal output module receives 4 groups of 12-bit digital data from PLC MPU and converts the data into 4 points of analog signals for output in either voltage or current.

❖ The user can select voltage or current output by wiring. Range of voltage output: 0V ~ +10VDC (resolution: 2.5mV). Range of current output: 0mA ~ 20mA (resolution: 5μA).
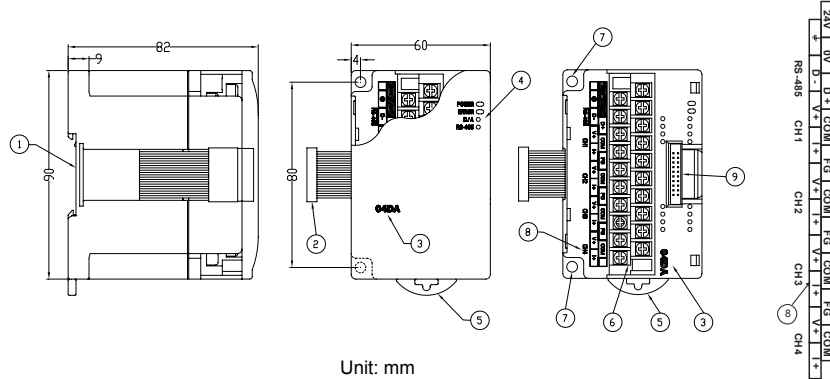
❖ **Nameplate Explanation**

Delta PLC model name →
Power input specification →
Analog I/O module specification →

MODEL DVP04DA-H2
POWER INPUT : 24Vdc 4.5W
I/O RANGE : 0V ~ +10V or 0mA ~ +20mA
RESOLUTION : 2.5mV or 5 μA

Barcode, Serial No., Version →
VX.XXXX   04DA-H20T6500001
DELTA ELECTRONICS, INC.   MADE IN XXXXXX

❖ **Model/Serial No. Explanation**

DVP□□□□ - □   04DA-H2 0 T 6 50 0001

- DVP series
- Points (input + output)
- Module type
  - AD: Analog input
  - DA: Analog output
  - PT: Temperature measurement (PT-100)
  - TC: Temperature measurement (thermocouple)
  - XA: Mixed analog I/O
  - HC: High-speed counter input
  - PU: Single-axis position control
- H: For EH series MPU
- H2: For EH2 series MPU
- Production No.
- Production week
- Production year (2006)
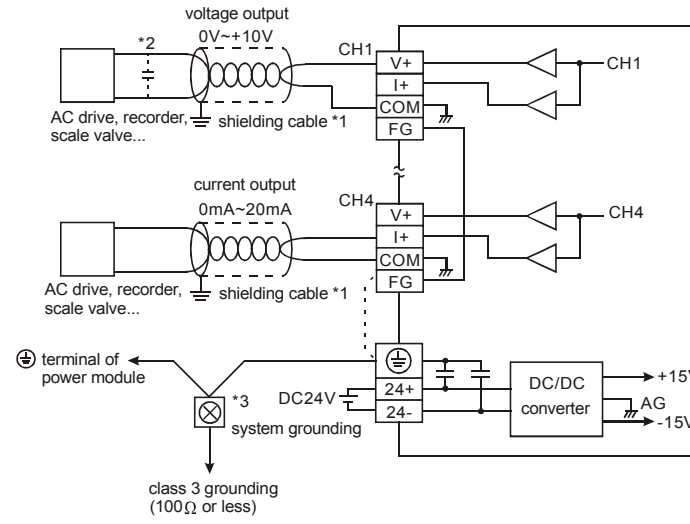- Production plant (Taoyuan)
- Version No.
- Model name

1.2 Product Profile (Indicators, Terminal Block, I/O Terminals)

Unit: mm

① DIN rail (35mm)
② Connection port for extension modules
③ Model name
④ POWER, ERROR, D/A indicator
⑤ DIN rail clip
⑥ Terminals
⑦ Mounting hole
⑧ I/O terminals
⑨ Mounting port for extension modules

1.3 External Wiring

Note:
1. When performing analog output, please isolate other power wirings.
2. 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.
3. Please connect the ⊕ terminal on both the power modules and DVP04DA-H2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.
4. DO NOT wire empty terminals ◼

❷ Specifications

2.1. Functions

Digital/Analog (4D/A) Module	Voltage Output	Current Output
Power supply voltage	24 VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%)	
Analog output channel	4 channels/module	
Range of analog output	0 ~ 10V	0 ~ 20mA
Range of digital data	0 ~ 4,000	0 ~ 4,000
Resolution	12 bits (1_{LSB} = 2.5mV)	12 bits (1_{LSB} = 5 μA)
Output impedance	0.5Ω or lower	
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range of 0 ~ 55°C, 32 ~ 131°F	
Responding time	3ms × the number of channels	
Max. output current	10mA (1KΩ ~ 2MΩ)	-
Tolerable load impedance	-	0 ~ 500Ω
Digital data format	11 significant bits out of 16 bits are available; in 2's complement	
Isolation	Internal circuit and analog output terminals are isolated by optical coupler. No isolation among analog channels.	
Protection	Voltage output is protected by short circuit. Short circuit lasting for too long may cause damage on internal circuits. Current output can be open circuit.	
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps 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.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. No.0 is the closest to MPU and No.7 is the furthest. 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%)., 4.5W supplied by external power

Environment	
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 Control Registers

CR#	RS-485 parameter address	Latched	Register content	Description b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
#0	H'4032	○ R	Model name	Set up by the system. DVP04DA-H2 model code = H'6401
#1	H'4033	○ R/W	Output mode setting	reserved / CH4 / CH3 / CH2 / CH1 — Output mode: Default = H'0000; Mode 0: Voltage output (0V ~ 10V); Mode 1: Voltage output (2V ~ 10V); Mode 2: Current output (4mA ~ 20mA); Mode 3: Current output (0mA ~ 20mA)
#2 ~ #5				Reserved
#6	H'4038	✕ R/W	CH1 output value	
#7	H'4039	✕ R/W	CH2 output value	Range of output value at CH1 ~ CH4: K0 ~ K4,000
#8	H'403A	✕ R/W	CH3 output value	Default = K0 (unit: LSB)
#9	H'403B	✕ R/W	CH4 output value	
#10 ~ #17				Reserved
#18	H'4044	○ R/W	Adjusted OFFSET value of CH1	
#19	H'4045	○ R/W	Adjusted OFFSET value of CH2	Range of OFFSET at CH1 ~ CH4: K-2,000 ~ K2,000
#20	H'4046	○ R/W	Adjusted OFFSET value of CH3	Default = K0 (unit: LSB)
#21	H'4047	○ R/W	Adjusted OFFSET value of CH4	
#22 ~ #23				Reserved
#24	H'404A	○ R/W	Adjusted GAIN value of CH1	
#25	H'404B	○ R/W	Adjusted GAIN value of CH2	Range of GAIN at CH1 ~ CH4: K-1,600 ~ K8,000
#26	H'404C	○ R/W	Adjusted GAIN value of CH3	Default = K2,000 (unit: LSB)
#27	H'404D	○ R/W	Adjusted GAIN value of CH4	
#28 ~ #29				Reserved
#30	H'4050	✕ R	Error status	Register for storing all error status. See the table of error status for more information.
#31	H'4051	○ R/W	Communication address setting	For setting up RS-485 communication address. Range: 01 ~ 255 Default = K1
#32	H'4052	○ R/W	Communication speed (baud rate) setting	Default = H'0002. 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. 0 = ASCII mode (default)
#33	H'4053	○ 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 — reserved / CH4 / CH3 / CH2 / CH1. Default = H'0000. Take the setting of CH1 for example: 1. When b0 = 0, the user is allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. When b0 = 1, the user is not allowed to tune CR#18 (OFFSET) and CR#24 (GAIN) of CH1. 2. b1 represents whether the OFFSET/GAIN tuning registers are latched. b1 = 0 (default, latched); b1 = 1 (non-latched) 3. When b2 = 1, all settings will return to default values. (except CR#31, CR#32)
#34	H'4054	○ R	Firmware version	Displaying the current firmware version In hex; e.g. version 1.0A is indicated as H'010A.
#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): For voltage output 1_{LSB} = 10V/4,000 = 2.5mV。
                                          For current output 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 four 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 = 000); CH2: mode 1 (b5 ~ b3 = 001), CH3: mode 2 (b8 ~ b6 = 010) and CH4: mode 3 (b11 ~ b9 = 011), CR#1 has to be set as H'000A and the higher bits (b12 ~ b15) have to be reserved. Default value = H'0000.

3. CR#2 ~ CR#5, CR#10 ~ CR#17, CR#22, CR#23, CR#28 and CR#29 are reserved.

4. CR#6 ~ CR#9: The output values of CH1 ~ CH4 (range: K0 ~ K4,000; default = K0; unit: LSB)

5. CR#18 ~ CR#21: The adjusted OFFSET value of CH1 ~ CH4 (default = K0, unit = LSB), representing the analog output voltage or current when the output digital value = 0 after calculation. The adjustable range: -2,000 ~ +2,000.

   The adjustable range of voltage: -5V ~ +5V (-2,000$_{LSB}$ ~ +2,000$_{LSB}$)
   The adjustable range of current: -10mA ~ +10mA (-2,000$_{LSB}$ ~ +2,000$_{LSB}$)

6. CR#24 ~ CR#2: The adjusted GAIN value of CH1 ~ CH4 (default = K2,000, unit = LSB), representing the analog output voltage or current when the output digital value = 2,000 after calculation.

The adjustable range of voltage: -4V ~ +20V (-1,600$_{LSB}$ ~ +8,000$_{LSB}$)

The adjustable range of current: -8 mA ~ +40 mA (-1,600$_{LSB}$ ~ +8,000$_{LSB}$)

Please note that: GAIN value – OFFSET value = +400$_{LSB}$ ~ +6,000$_{LSB}$ (voltage or current). When GAIN – OFFSET is small (steep oblique), the resolution of output signal will be finer and variation on the digital value will be greater. When GAIN – OFFSET is big (gradual oblique), the resolution of output signal will be rougher and variation on the digital value will be smaller.

7. 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(H'1)		0	0	0	0	0	0	0	1
Incorrect analog input value	K2(H'2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4(H'4)		0	0	0	0	0	1	0	0
OFFSET/GAIN error	K8(H'8)	reserved	0	0	0	0	1	0	0	0
Hardware malfunction	K16(H'10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32(H'20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64(H'40)		0	1	0	0	0	0	0	0
Instruction error	K128(H'80)		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

8. CR#31: The setting of RS-485 communication address (Range: 01 ~ 255, default = K1).

9. 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 = 0: ASCII mode; b15 = 1: RTU mode. 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).

10. CR#33: For authorizations on some internal functions, e.g. OFFSET/GAIN tuning. The latched function will store the output setting in the internal memory before the power is cut off.

11. CR#34: Firmware version of the model.

12. CR#35 ~ CR#48: Parameters for system use.

13. CR#0 ~ CR#34: The corresponding parameter addresses H'4032 ~ H'4054 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: H'03 (read register data); H'06 (write 1 word datum to register); H'10 (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.

❹ Adjusting D/A Conversion Curve

4.1 Explanation

Voltage Output Mode
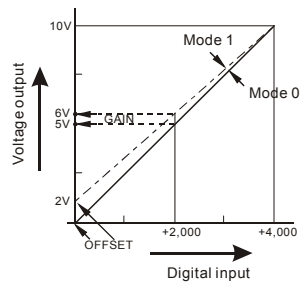
CR#1 mode 0	GAIN = 5V (2,000$_{LSB}$) OFFSET = 0V (0$_{LSB}$)
CR#1 mode 1	GAIN = 6V (2,400$_{LSB}$) OFFSET = 2V (800$_{LSB}$)
GAIN	The voltage output value when the digital input value = K2,000 Range: -4V ~ +20V (-1,600$_{LSB}$ ~ +8,000$_{LSB}$)
OFFSET	The voltage output value when the digital input value = K0 Range: -5V ~ +5V (-2,000$_{LSB}$ ~ +2,000$_{LSB}$)
GAIN - OFFSET	Range: +1V ~ +15V (+400$_{LSB}$ ~ +6,000$_{LSB}$)

Current Output Mode
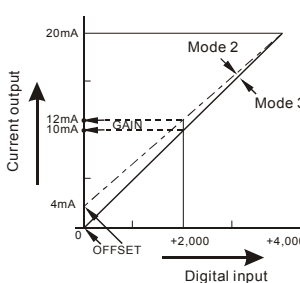
CR#1 mode 2	GAIN = 12mA (2,400$_{LSB}$) OFFSET = 4mA (800$_{LSB}$)
CR#1 mode 3	GAIN = 10mA (2,000$_{LSB}$) OFFSET = 0mA (0$_{LSB}$)
GAIN	The current output value when the digital input value = K2,000 Range: -8mA ~ +40mA (-1,600$_{LSB}$ ~ +8,000$_{LSB}$)
OFFSET	The current output value when the digital input value = K0 Range: -10mA ~ +10mA (-2,000$_{LSB}$ ~ +2,000$_{LSB}$)
GAIN - OFFSET	Range: +2mA ~ +30mA (+400$_{LSB}$ ~ +6,000$_{LSB}$)

4.2 Program Example

Example 1: Set the OFFSET value of CH1 as 0V (= K0$_{LSB}$) and GAIN value as 2.5V (= K1,000$_{LSB}$).

- Write H'10 into CR#1 of analog output module No.1 and set CH1 in mode 0 (voltage output 0V ~ +10V) and CH2 in mode 2 (current output 4mA ~ +20mA).
- Write H'0 into CR#33 and allow OFFSET/GAIN tuning in CH1 ~ CH4
- When X0 goes from Off to On, write the OFFSET value K0$_{LSB}$ into CR#18 and the GAIN value K1,000$_{LSB}$ into CR#24.

Example 2: Set the OFFSET value of CH2 as 2mA (= K400$_{LSB}$) and GAIN value as 18mA (= K3,600$_{LSB}$).


- Write H'18 into CR#1 of analog output module No.1 and set CH1 in mode 0 (voltage output 0V ~ +10V) and CH2 in mode 3 (current output 0mA ~ +20mA).
- Write H'0 into CR#33 and allow OFFSET/GAIN tuning in CH1 ~ CH4
- 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.

❺ Trial Operation & Troubleshooting

❖ **LED Display**

1. When the module is powered for the first time, POWER LED will be on. After ERROR LED being on for 0.5 second, D/A LED will start to flash.

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 controlled by RS-485, the RS-485 LED will flash after receiving RS-485 instruction.

4. When the input or output value exceeds the upper bound or falls below the lower bound after conversion, ERROR LED will flash.

❖ **Program Example**
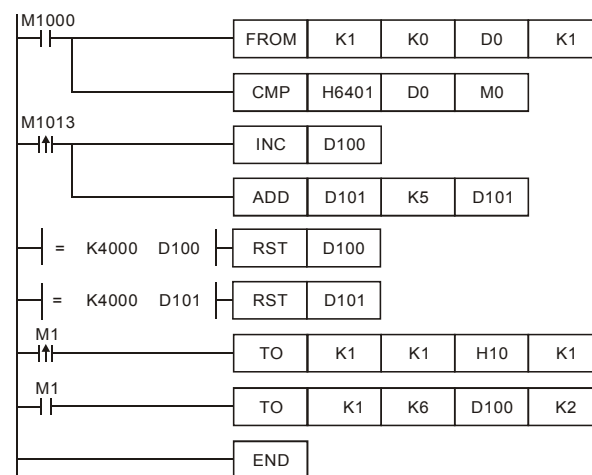
- Read the model name from K1 and see if it is DVP04DA-H2: H'6401.

- D100 increases K1 and D101 increases K5 every second.

- When D100 and D101 reach K4,000, they will be cleared as 0.

- See if the model is DVP04DA-H2 when M1 = On. If so, set up output mode: CH1 in mode 0; CH2 in mode 2.

- Write the output settings of D100 and D101 into CR#6 and CR#7. The analog output will change with the changes in D100 and D101.

❻ 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 module No.0 into D0 and CR#25 into D1. Only 2 groups of data is read at a time (n = 2).

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#7 and CR#6 of special module No.0. Only 1 group of data is written in at a time (n = 1).

Remarks

Operand rules

1. (m1): The No. of special modules connected to PLC MPU. No. 0 is the module closest to te MPU. Maximum 8 modules are allowed to connected to a PLC MPU and they will not occupy any I/O points.

2. (m2): CR#. CR (control register) is the 49 16-bit memories built in the special module, numbered in decimal as #0 ~ #48. All operation status and settings of the special module are contained in the CR.

3. FROM/TO instruction is for reading/writing 1 CR at a time. DFROM/DTO instruction is for reading/writing 2 CRs at a time.

4. Number of groups "n" to be transmitted: n = 2 in 16-bit instructions and n = 1 in 32-bit instructions mean the same.
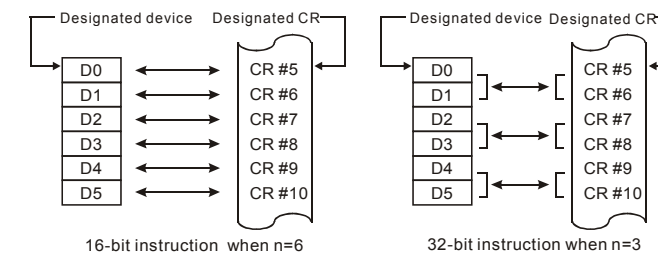
M1083 for switching instruction modes in EH2 series models

1. When M1083 = Off, during the execution of FROM/TO instruction, all external or internal interruption subroutines will be forbidden. The interruptions are allowed only after FROM/TO instruction finishes its execution. FROM/TO instruction can also be used in an interruption subroutine.

2. When M1083 = On and an interruption signal occurs during the execution of FROM/TO instruction, the interruption will be processed first (with a 100us delay) and the execution of FROM/TO will be stopped. After the interruption subroutine finishes its execution, the program will jump to the next instructio of FROM/TO. FROM/TO cannot be used in an interruption subroutine.