http://www.delta.com.tw/products/plc.asp

2004-12-16

5011625201-4DE1

DVP-EH

DVP04DA-H
Analog Input Module
Instruction Sheet

1 WARNING

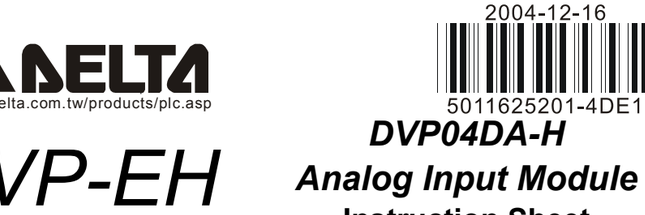
- ⚠ Please carefully read this instruction thoroughly prior to use the DVP04DA-H.
- ⚠ The DC input power must be OFF before any maintenance.
- ⚠ This is an OPEN-TYPE built-in DVP04DA-H, and the DVP04DA-H is certified to meet the safety requirements of IEC 61131-2 (UL 508) when installed in the enclosure to prevent high temperature, high humidity, exceessive vibration, corrosive gases, liquids, airbome 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 and damage DVP04DA-H.
- ⚠ Do not connect the AC power to any of the input/output terminals, or it may damage to the DVP04DA-H. 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 supply is OFF.
- ⚠ Make sure that the DVP04DA-H is properly grounded ⏚, to prevent any electromagnetic noise.

2 INTRODUCTION

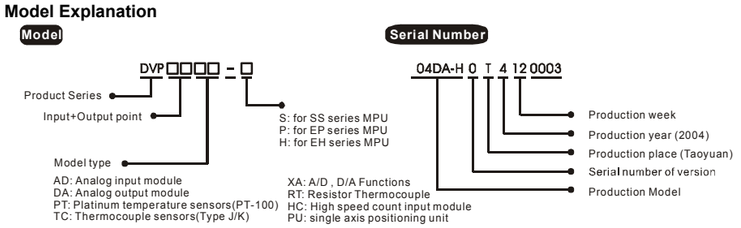
2.1 Model Explanation and Peripherals

- Thank you for choosing DELTA's PLC DVP Series. The analog output module of DVP04DA-H series can read/write the data of analog output module by using instructions FROM / TO via DVP-PLC EH Series 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.
- Software version of DVP04DA-H analog output module can be updated via RS-485.
- 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).

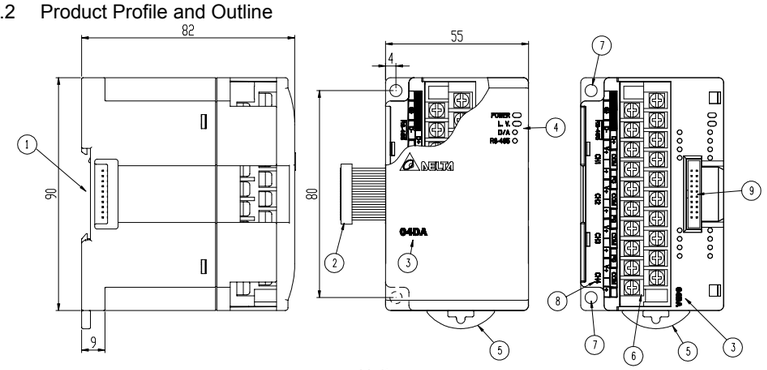
■ **Nameplate Explanation**



■ **Model Explanation**



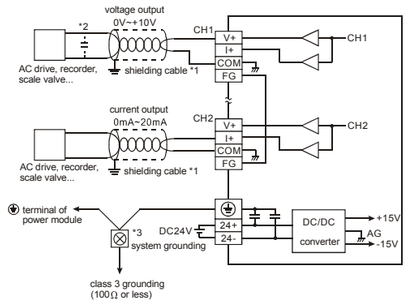
2.2 Product Profile and Outline



Unit:mm

1. DIN rail track (35mm)	6. Terminals
2. Mounting hole for wire to connect extension unit/extension module	7. Mounting hole
3. Model name	8. Terminal layout
4. Indicator for power, error and run status	9. Mounting port to connect extension unit/extension module
5. DIN rail clip	

2.3 External wiring



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

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

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

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

3 STANDARD SPECIFICATIONS

3.1 Specifications

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 / each module	
Analog Output Range	0~10V	0~20 mA
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 xchannels	
Max. Output Current	20 mA(1KΩ~2MΩ)	—
Tolerance Carried Impedance	—	0～500Ω
Digital Data Format	2's complementary of 16-bit, 13 Significant Bits	
Isolation Method	It has isolation between digital area and analog area. There is no isolation among channels.	
Protection	Voltage output has short circuit protection but short circuit for a long period short circuit may cause inner wiring damage and current output break.	
Communication mode (RS-485)	Yes, there are ASCII/RTU modes, communication rate can be 4800 /9600 /19200 /38400 /57600 /115200. Communication format of 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). Can't use RS-485 if PLC MPU connection is in series.	
Connect to DVP-PLC MPU in series	If DVP04DA-H 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

Power Specification	
Max. Rated Consuming Power	24 VDC (20.4VDC~28.8VDC) (–15%～+20%), 2W, supply from external power
Environment Condition	
Environment Condition	Follow the DVP-PLC MPU
Spec. of Prevent Static Electricity	All places between terminals and ground comply with the spec

4 CR (Control Register)

DVP04DA-H Analog Output Module					Explanation															
CR No.	RS-485 Parameters Address	Latched		Register Name	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#0	H 4032	○	R	Model type	System used, DVP04DA-H model code=H 0401															
#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															

DVP04DA-H Analog Output Module					Explanation															
CR No.	RS-485 Parameters Address	Latched		Register Name	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#3	H 4034																			
#4	H 4035																			
#5	H 4036																			
#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 CH1~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 used to save all error status. Please refer to fault code chart for details.															
#31	H 4051	○	R/W	Communication address setting	It is 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	It is 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 (only for RTU mode) b15: ASCII / RTU mode selection														
#33	H 4053	○	R/W	Reset to factory setting and set characteristics adjustable priority	b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 Reserved CH4 CH3 CH2 CH1 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 means if characteristic register is latched. b1=0 (factory setting, latched), b1=1 (not latched). 3. When b2 is set to 1, all settings will reset to factory setting.														
#34	H 4054	○	R	Software version.	It is hexadecimal to display software version. For example: H 010A means 1.0A.															
#35~#48				System used																

○ means latched.
× means not latched.
R means can read data by using FROM instruction or RS-485.
W means can write data by using TO instruction 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 know if there is extension module.
2. CR#1 is used to set two inner channels working mode of analog output module. Every channel has four modes to set and 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#23, CR#28, CR#29 Reserved.
4. CR #6 ~ CR#9 display CH1~CH4 output signal. The setting range is K0~K4000. Factory setting is K0 and unit is LSB.
5. CR#18 ~ CR#21 means the value of adjusting OFFSET value of CH1~CH4. The factory setting is K0 and unit is LSB. If output value equal to 0 after calculating, 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 means the value of adjust GAIN value of CH1~CH4. The factory setting is K2000 and unit is LSB. If output value equal to 2000 after calculating, 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
Instruction 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

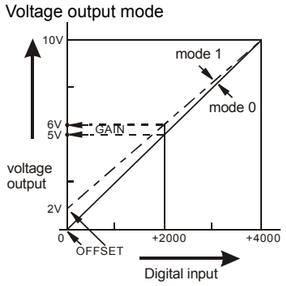
bps. b0: 4800bps. b1: 9600bps. (factory setting) b2: 19200bps. b3: 38400 bps. b4: 57600 bps. b5: 115200 bps. b6-b13: reserved. b14: exchange low and high byte of CRC check code. (only for RTU mode) b15=0: ASCII mode. b15=1: RTU mode. Communication format: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 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, such as characteristic register. Output latched function will save output setting in 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 through 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), while RTU mode is 8Bit, even bit, 1 stop bit (8 E 1).
    C. Function code: 03H—read data from register. 06H—write one WORD into register. 10H—write multiple WORD into register.

5 ADJUST D/A CONVERSION CHARACTERISTIC CURVE

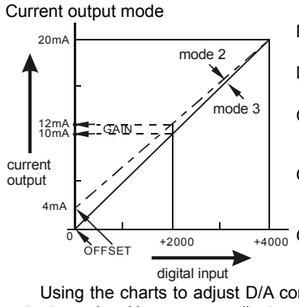
5.1 Adjust D/A Conversion Characteristic Curve

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



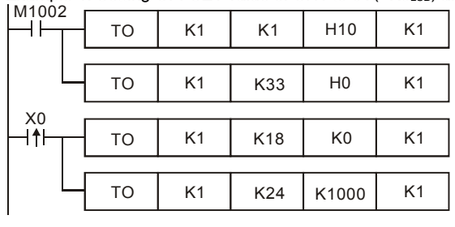
Mode 2 of CR#1: GAIN = 12mA(2400$_{LSB}$), OFFSET=4mA (800$_{LSB}$).
Mode 3 of CR#1: GAIN = 10mA(2000$_{LSB}$), OFFSET=0mA (0$_{LSB}$).
GAIN: The setting range of current output when digital input value is K2000 should be -8mA~+40mA (-1600$_{LSB}$ ~+8000$_{LSB}$).
OFFSET: The setting range of current output when digital input value is K0 should be -10mA ~+10mA (-2000$_{LSB}$ ~+2000$_{LSB}$).
GAIN－OFFSET: Setting range: +2mA~+30mA (+400$_{LSB}$ ~+6000$_{LSB}$).

Using the charts to adjust D/A conversion characteristic curve of voltage output mode and current output 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.

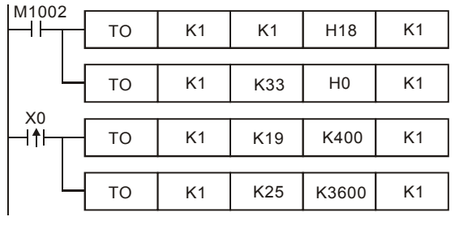
5.2 Program Example for Adjusting D/A Conversion Characteristics Curve

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



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

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

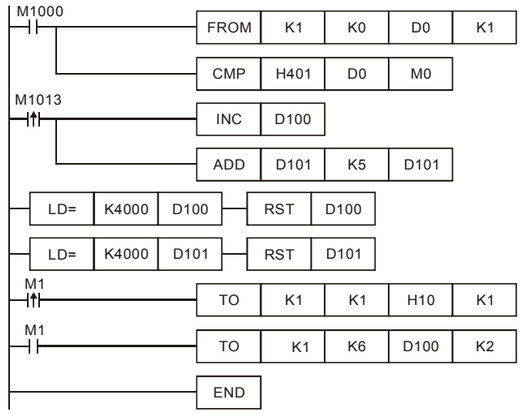


- Writing H18 into CR#1 of analog output module#0. Setting CH1 to mode 0 (voltage output 0V~+10V) and set CH2 to mode 3 (current output 0mA~ +20mA).
- Writing H0 into CR#33 and allow to adjust characteristic of CH1~CH4.
- When X0 switches from OFF to ON, K400$_{LSB}$ of OFFSET value will be wrote in CR#19 and K3600$_{LSB}$ of GAIN value will be wrote in 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. Normal run: 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 supply goes 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 instruction during controlling by 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 than lower bound.

- Program example:



Explanation:

- Reading the data of model type from extension module K1 and distinguish if the data is H0401 (DVP04DA-H model type).
- D100 will increase K1 and D101 will increase K5 every second.
- When value of D100 and D101 gets to K4000, they will be reset to 0.
- If the model type is DVP04DA-H, 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 change with D100 and D101 value.

7 INSTRUCTION EXPLANATION

API					Applicable model		
78	D	FROM	P	(m1) (m2) (D) (n)	ES	EP	EH
				Read special module CR data	✓	✓	✓

	Bit device				Word device										
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F
m_1					✳	✳									
m_2					✳	✳									
D								✳	✳	✳	✳	✳	✳	✳	✳
n					✳	✳									

- Note: The usage range of operand m_1 is 0~7.
  The usage range of operand m_2: 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 instruction (FROMP, DFROMP).

16-bit instruction (9 STEPS)

FROM	Continuous execution	FROMP	Pulse execution

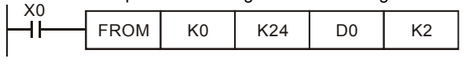
32-bit instruction (17 STEPS)

DFROM	Continuous execution	DFROMP	Pulse execution

- Flag: When M1083 On, it allows to enable interrupt during FROM/TO. Refer to the below 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 instruction to read CR data of special module.
- ◆ (D): When assigning bit operand, K1~K4 are used for 16-bit and K5~K8 are used for 32-bit.
- ◆ Please refer the footnote below for the calculation of special module number.

Program Example
- ◆ To read the content of CR#24 of special module#0 to D0 of PLC and to read the content of CR#25 of special module#0 to D1 of PLC. It can read 2 data in one time (n=2).
- ◆ The instruction will be executed when X0=ON. The instruction won't be executed when X0=OFF and the content of previous reading data won't change.



API					Applicable model		
79	D	TO	P	(m1) (m2) (S) (n)	ES	EP	EH
				Special module CR data write in	✓	✓	✓

	Bit device				Word device										
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F
m_1					✳	✳									
m_2					✳	✳									
S					✳	✳	✳	✳	✳	✳	✳	✳	✳	✳	✳
n					✳	✳									

- Note: The usage range of operand m_1 is 0~7.
  The usage range of operand m_2: 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 instruction (TOP, DTOP)

16-bit instruction (9 STEPS)

TO	Continuous execution	TOP	Pulse execution

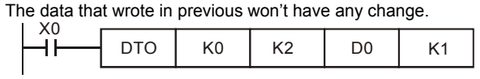
32-bit instruction (17 STEPS)

DTO	Continuous execution	DTOP	Pulse execution

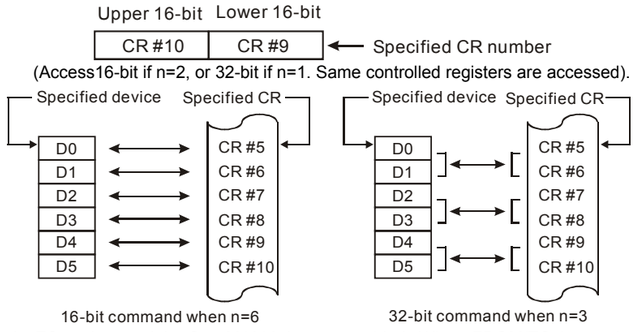
- Flag: When M1083=On, it allows to insert interrupt during FROM/TO. Refer to following for detail.

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 instruction 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
- ◆ Using 32-bit instruction DTO, program will write D11 and D10 into CR#3 and CR#2 of special module#0. It only writes a group of data in one time (n=1).
- ◆ The instruction will be executed when X0=ON and it won't be executed when X0=OFF. The data that wrote in previous won't have any change.



Footnote
- ◆ The rule of instruction operand
  - m1: arrangement number of special module. The number of special module that connects to PLC MPU. The numbering order of special module from the near to the distant of MPU is from 0 to 7. The maximum is 8 special modules and won't occupy I/O point.
  - m2: the number of CR. Built-in 16-bit of 49 groups memory of special module is called CR (Control Register). The number of CR uses decimal digital (#0~#48). All running status and setting values of special module have included.
  - If using FROM/TO instruction, the unit of read/write of CR is one number for one time. If using DFROM/DTO instruction, the unit of read/write of CR is two numbers in one time.



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