2004-09-29

5011613902-DE42

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

DVP04AD-S

DVP04AD-S *Analog Input Module*

Instruction Sheet

1 WARNING

⚠ Please carefully read this instruction thoroughly prior to use the DVP04AD-S.

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

⚠ This is an OPEN-TYPE built-in DVP04AD-S, and the DVP04AD-S 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, so as to avoid the hazard to users or any damage to the DVP04AD-S.

⚠ Do not connect the AC power to any of the input/output terminals, or it may damage to the DVP04AD-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 supply is Off.

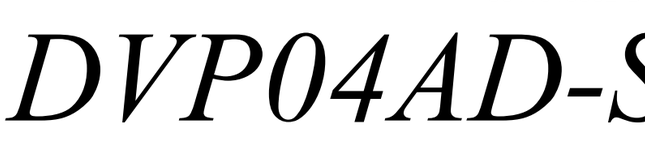
⚠ Make sure that the DVP04AD-S is properly grounded ⏚, to prevent any electromagnetic noise.

2 INTRODUCTION

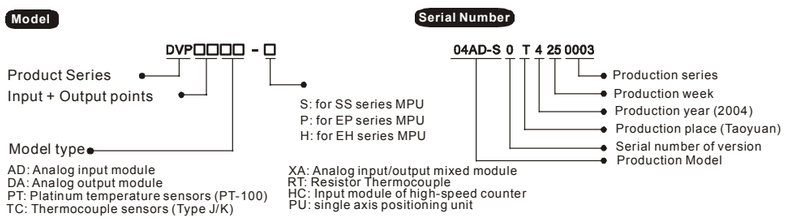
2.1 Model Explanation and Peripherals

- Thank you for choosing DELTA's PLC DVP Series. The analog input module receives external 4-point analog signal input (voltage or current) and converts it into 14 bits digital signal. The analog input module of DVP04AD-S series can read/write the data of analog input module by using commands FROM / TO via DVP-PLC SS/SA/SX Series MPU program. There are 49 CR(Control Register, each register has 16-bit) in each module.
- The software version of DVP04AD-S analog input module can be updated via RS-485 communication. Power unit and module are separate. Size is small and easy to install.
- Users can select input from voltage or current via wiring. Voltage input range is ±10V DC (resolution is 1.25 mV). Current input range is ±20 mA (resolution is 5 μA).

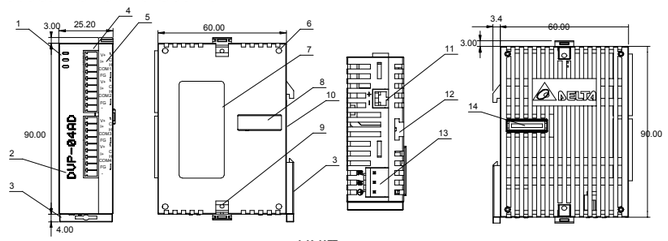
■ **Nameplate Explanation**



■ **Model Explanation**

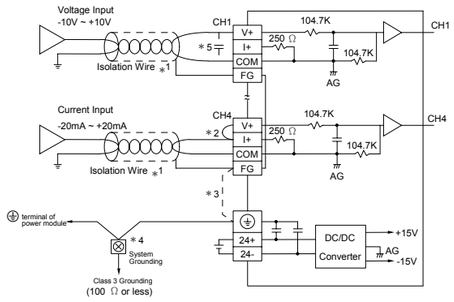


2.2 Product Profile and Outline



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

2.3 External wiring



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

Note 2: If current signal is connected, please short out V+ and I+ terminals.

Note 3: If noise is significant, please connect FG to grounding.

Note 4: Please connect ⏚ terminal of power module and ⏚ terminal of analog input module to system earth point and make system earth point be grounding or connects to machine cover.

Note 5: If noise interferes from loaded input wiring terminal is significant, please connect a capacitor with 0.1~0.47μF 25V for noise filtering.

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

3 STANDARD SPECIFICATIONS

3.1 Function Specifications

Analog/ Digital (4A/D) module	Voltage input	Current input
Power supply voltage	24 VDC(20.4VDC~28.8VDC) (–15% ~ +20%)	
Analog input channel	4 channel / each module	
Analog input range	±10V	±20 mA
Digital conversion range	±8000	±4000
Resolution	14 bits(1_{LSB}=1.25 mV)	13 bits (1_{LSB}=5 μA)
Input impedance	200 KΩ以上	250Ω
Overall accuracy	±0.5% of full scale of 25℃(77℉) ±1% of full scale during 0~55℃ (32~131℉)	
Response time	3 ms × channels	
Isolation Method	It has isolation between digital area and analog area. There is no isolation among channels.	
Absolute input range	±15 V	±32 mA
Digital data format	2's complementary of 16-bit, 13 Significant Bits	
Average function	Yes (CR#2~CR#5 can be set and setting range is K1~K4096)	
Self diagnose function	Upper and lower bound detection / channels	
Communication mode (RS-485)	MODBUS ASCII/RTU Mode. Communication baud rate of 4800 / 9600 / 19200 / 38400 / 57600 / 115200. For ASCII mode, date format is 7Bits, even, 1 stop bit (7 E 1), while RTU mode, date format is 8Bits, even, 1 stop bit (8 E 1). The RS-485 is disabled when the DVP04AD-S is connected in series with MPU.	
Connect to DVP-PLC MPU in series	If DVP04AD-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%), 2W, 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)

DVP04AD-S analog signal input module					Explanation
CR No.	RS-485 Parameter address	Latched	Register name		b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
#0	H 4000	○	R	Model type	System used, data length is 8bits (b7~b0). DVP04AD-S model code =H 88
#1	H 4001	○	R/W	Input mode setting	reserved / CH4 / CH3 / CH2 / CH1 Input mode setting: factory setting is H0000. Mode 0: input voltage mode (-10V~+10V). Mode 1: input voltage mode (-6V~+10V). Mode 2: input current mode (-12mA~+20mA) Mode 3: input current mode(-20mA~+20mA) Mode 4: none use.
#2	H 4002	○	R/W	CH1 average times	Average times setting of channel CH1~CH4. Setting range is K1~K4096 and factory setting is K10.
#3	H 4003	○	R/W	CH2 average times	
#4	H 4004	○	R/W	CH3 average times	
#5	H 4005	○	R/W	CH4 average times	
#6	H 4006	×	R	average value of CH1 input signal	Display average value of CH1~CH4 input signal
#7	H 4007	×	R	average value of CH2 input signal	
#8	H 4008	×	R	average value of CH3 input signal	
#9	H 4009	×	R	average value of CH4 input signal	
#10 ~ #11					Reserved
#12	H 400C	×	R	present value of CH1 input signal	Display present value of CH1~CH4 input signal
#13	H 400D	×	R	present value of CH2 input signal	
#14	H 400E	×	R	present value of CH3 input signal	
#15	H 400F	×	R	present value of CH4 input signal	
#16 ~ #17					Reserved
#18	H 4012	○	R/W	To adjust OFFSET value of CH1	Offset setting of CH1~CH4. Factory setting is K0 and unit is LSB. Voltage input: setting range is K-4000 ~K4000 Current input: setting range is K-4000 ~K4000
#19	H 4013	○	R/W	To adjust OFFSET value of CH2	
#20	H 4014	○	R/W	To adjust OFFSET value of CH3	
#21	H 4015	○	R/W	To adjust OFFSET value of CH4	
#22 ~ #23					Reserved
#24	H 4018	○	R/W	To adjust GAIN value of CH1	GAIN setting of CH1~CH4. Factory setting is K4000 and unit is LSB. Voltage input: setting range is K-3200 ~K16000. Current input: setting range is K-3200 ~K10400.
#25	H 4019	○	R/W	To adjust GAIN value of CH2	
#26	H 401A	○	R/W	To adjust GAIN value of CH3	
#27	H 401B	○	R/W	To adjust GAIN value of CH4	
#28 ~ #29					Reserved
#30	H 401E	×	R	Error status	It is the data register to save all error status. Please refer to fault code chart for detail.
#31	H 401F	○	R/W	Communication address setting	Setting RS-485 communication address. Setting range is 01~255 and factory setting is K1
#32	H 4020	○	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) , while 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 4021	○	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 is 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 be reset to factory setting.
#34	H 4022	○	R	Software version	In 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 command or RS-485.
W means can write data by using TO command or RS-485.
LSB (Least Significant Bit): 1. Voltage input: 1_{LSB}=10V/8000=2.5mV. 2. Current input: 1_{LSB}=20mA/4000=5μA.

Explanation:

1. CR#0: 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: CR#1 is used to set 4 internal channels working mode of analog input module. Every channel has four modes to set that can be set individually. For example: if set CH1 to mode 0 (b2~b0=000), CH2 to mode 1(b5~b3=001), CH3: mode2 (b8~b6=010), CH4: mode 3(b11~b9=011). Then CR#1 is set to H0688 and the upper bit (b12~b15) will reserved. The factory setting of CR#1 is H0000.
3. CR#2 ~ CR#5 are used to set average times of CH1~CH4. Setting range is K1~K4096 and factory setting is K10.
4. CR#6 to CR#9 are the average value that are calculated according to the value that is set in CR#2~CR#5 (average time of CH1~CH4 input signal). For example, if CR#2 (the average times of CH1) is 10, the average of CH1 input signal is calculated every 10 times.
5. CR#10, CR#11, CR#16, CR#17, CR#22, CR#23, CR#28, CR#29 are reserved.
6. CR#12 ~ CR#15: display present value of CH1~CH4 input signal.
7. CR #18~ CR #21: the content is the value to adjust OFFSET value of CH1~CH4 if analog input voltage or current is 0 after it converts from analog to digital. Voltage setting range: -5V~+5V(-4000_{LSB}~+4000_{LSB}). Current setting range: -20mA~+20mA (-4000_{LSB}~+4000_{LSB}).

8. CR #24~ CR #27: Value of analog input either in voltage or in current after converting to digital based upon full scale of 4000. Voltage setting range: -4V~+20V(-3200$_{LSB}$~+16000$_{LSB}$). Current setting range: -16mA~+52mA(-3200$_{LSB}$ ~+10400$_{LSB}$). Please be noticed that GAIN VALUE – OFFSET VALUE = +800$_{LSB}$~+12000$_{LSB}$ (voltage) or +800$_{LSB}$~+6400$_{LSB}$ (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.
9. 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

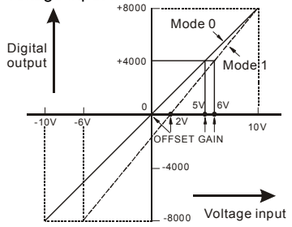
Note: Each fault code will have corresponding bit (b0~b7). Two or more faults may happen at the same time. 0 means normal and 1 means having fault.

10. CR#31: it is used to set RS-485 communication address. Setting range is 01~255 and factory setting is K1.
11. 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.
12. CR#33 is used to set the internal function priority. For example: characteristic register. Output latched function will save output setting in the internal memory before power loss.
13. CR#34: software version.
14. CR#35~ CR#48: system used.
15. The corresponding parameters address H4000~H4030 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), 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 A/D Conversion Characteristic Curve

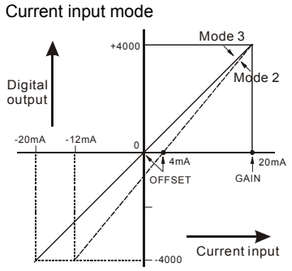
5.1 Adjust A/D Conversion Characteristic Curve

Voltage input mode



Mode 0 of CR#1 GAIN=5V(4000$_{LSB}$), OFFSET=0V (0$_{LSB}$)
Mode 1 of CR#1 GAIN=6V(4800$_{LSB}$), OFFSET=2V (1600$_{LSB}$)
GAIN: Voltage input value when digital output is 4000. Setting range is -4V~+20V(-3200$_{LSB}$~+16000$_{LSB}$)
OFFSET: Voltage input value when digital output is 0. Setting range: -5V~+5V(-4000$_{LSB}$ ~ +4000$_{LSB}$)
GAIN—OFFSET: Setting range is +1V~+15V (+800$_{LSB}$~+12000$_{LSB}$)

Current input mode



Mode 2 of CR#1: GAIN = 20mA(4000$_{LSB}$), OFFSET=4mA (800$_{LSB}$).
Mode 3 of CR#1: GAIN = 20mA(4000$_{LSB}$), OFFSET=0mA (0$_{LSB}$).
GAIN: Current input value when digital output is +4000. Setting range is -20 mA~+20 mA (-4000$_{LSB}$ ~ +4000$_{LSB}$)
OFFSET: Current input value when digital output value is 0. Setting range is-16 mA ~+52 mA (-3200$_{LSB}$ ~ +10400$_{LSB}$)
GAIN—OFFSET: Setting range is +4mA ~ +32mA (800$_{LSB}$~+6400$_{LSB}$)

The chart above is to adjust A/D 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 input: 1$_{LSB}$=10V/8000=1.25mV. 2. current input: 1$_{LSB}$=20mA/4000=5μA.

5.2. Program Example for Adjusting A/D Conversion Characteristics Curve

Example 1: setting OFFSET value of CH1 to 0V(=K0$_{LSB}$) and GAIN value of CH1 to 2.5V(=K2000$_{LSB}$).

- Writing H0 to CR#1 of analog input module no. 0 and set CH1 to mode 0 (voltage input -10V~+10V)
- Writing H1 to CR#33 and allow to adjust characters of CH1.
- When X0 switches from OFF to ON, K0$_{LSB}$ of OFFSET value will be written to CR#18 and K2000$_{LSB}$ of GAIN value will be written to CR#24.

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

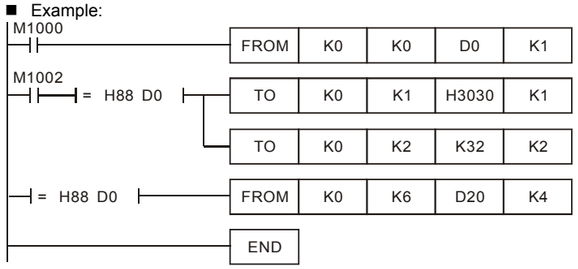
- Writing H18 to CR#1 of analog input mode no. 0 and set CH2 to mode 3 (current input: -20 mA ~ +20mA)
- Writing H0 to CR#33 and allow to adjust characteristics of CH4.
- When X0 switches from OFF to ON, K400$_{LSB}$ of OFFSET value will be wrote in CR#19 and K3600$_{LSB}$ of GAIN value will be wrote 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 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 by RS-485, A/D LED or D/A LED should blink.
5. After converting, ERROR LED should blink if input or output exceeds upper bound or below the lower bound.

■ Example:



Explanation:

- Reading the data of model type from expansion module K0 and distinguish if the data is H88 (DVP04AD-S model type).
- For DVP04AD-S model, M11 is on and the setting input mode is (CH1, CH3)= mode 0, (CH2, CH4)= mode 3.
- Setting the average times of CH1 and CH2 to K32.
- Reading the input signal average value of CH1~CH4 (4 data) and save them into D20~D23.

7 Related Instructions Explanation

API					Adaptive model		
78	D	FROM	P	(m1) (m2) (S) (n) Special module CR data read out	ES	EP	EH
					✓	✓	✓

	Bit device				Word device										
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F
m1					*	*									
m2					*	*									
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 command (FROMP, DFROMP).

16-bit command (9 STEPS)
FROM Continuous execution FROMP Pulse execution

32-bit command (17 STEPS)
DFROM Continuous execution DFROMP Pulse execution

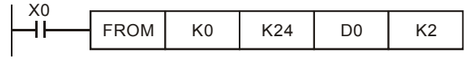
- Flag: When M1083=On, it allows to enable interrupt during FROM/TO. Refer to the below for detail.

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 one time.
- DVP-series PLC uses this command 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. 2pcs data are read in one time when n=2.
- The command will be executed when X0=ON. The command won't be executed when X0=OFF and the content of previous reading data has no change.



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

	Bit device				Word device										
	X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F
m1					*	*									
m2					*	*									
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: n= 1~(49-m2), EH: 1~(255-m2).
  For ES series, it doesn't support pulse execution command (TOP, DTOP)

16-bit command (9 STEPS)
TO Continuous execution TOP Pulse execution

32-bit command (17 STEPS)
DTO Continuous execution DTOP Pulse execution

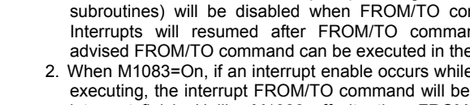
- Flag: When M1083=On, it allows to enable interrupt during FROM/TO. Refer to following for detail.

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 command to write data into CR of special module.
- (S): When assigning bit operand, K1~K4 are used for 16-bit and K5~K8 are used for 32-bit.

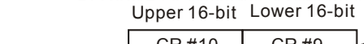
Program Example

- Using 32-bit command 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 command 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.

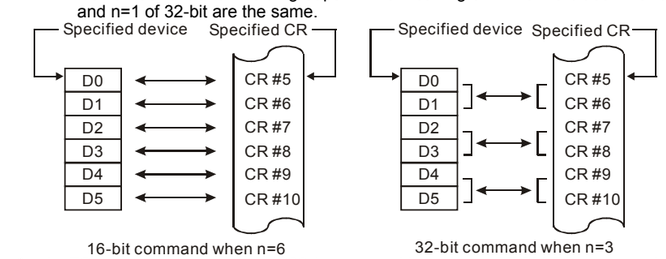


Footnote

- The rule of command 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 has included.
  - Use FROM/TO command to read/write 16-bit CR data in one command, while DFROM/DTO command to read/write 32-bit CR data in one command.



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



- In ES series models, flag M1083 is not provided. When FROM/TO command is executed, all interrupts (including external or internal interrupt subroutines) will be disabled. All interrupts will be executed after FROM/TO command is completed. Besides, 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:

1. 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.
2. 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.