

DVP04TC-H

Thermocouple Sensors

Instruction Sheet

1	WARNING
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Always read this instruction thoroughly before using the DVP04TC-H.



Make sure that power is OFF before wiring.



This is an OPEN TYPE Sensor module. It should be kept in an enclosure away from airborne dust, humidity, electric shock risk and vibration. Also, it is equipped with protective methods such as some special tools or keys to open the enclosure to prevent hazard to users or damage the PLC.



Do NOT connect the AC main circuit power supply to any of the input/output terminals, or it may damage the sensor. Check all the wiring prior to power up.



Do NOT touch internal circuit within 1 minute after power OFF.



Make sure that the DVP04TC-H is properly grounded  to enhance anti-interference ability.



Do NOT touch terminals or proceed maintenance while power ON.



Shorten the wire between sensor and PLC; also, keep power cable away from I/O wire to prevent any conductive interference.

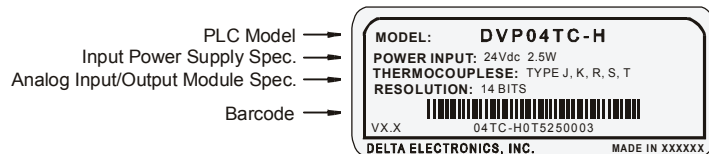
2	INTRODUCTION
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- Thank you for choosing DELTA's DVP Series products. The DVP04TC-H accepts four external thermocouple sensors (J, K, R, S, T type) and transfers the temperature sensed into 14-bit digital signal. The DVP04TC-H series can read/write the data by using instructions FROM / TO via DVP-PLC SS/SA/SX/SC MPU program. There are 49 CR (Control Register) in each module and 16 bits for each register. By using FROM/TO instruction of DVP-EH MPU, PLC can read/write the data inside the sensor. There are 49 Controlled Registers (CR, each register has 16 bits) in each sensor.

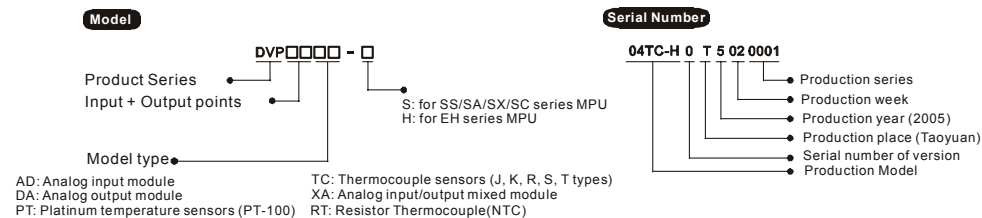
- DVP04TC-H thermocouple sensor can upgrade software version by RS-485. Power supply and MPU are sold separately with small size that enables easy installation.

- User can define DVP04TC-H to display either Celsius or Fahrenheit. The input resolution for Celsius is 0.1°C and for Fahrenheit is 0.18°F.

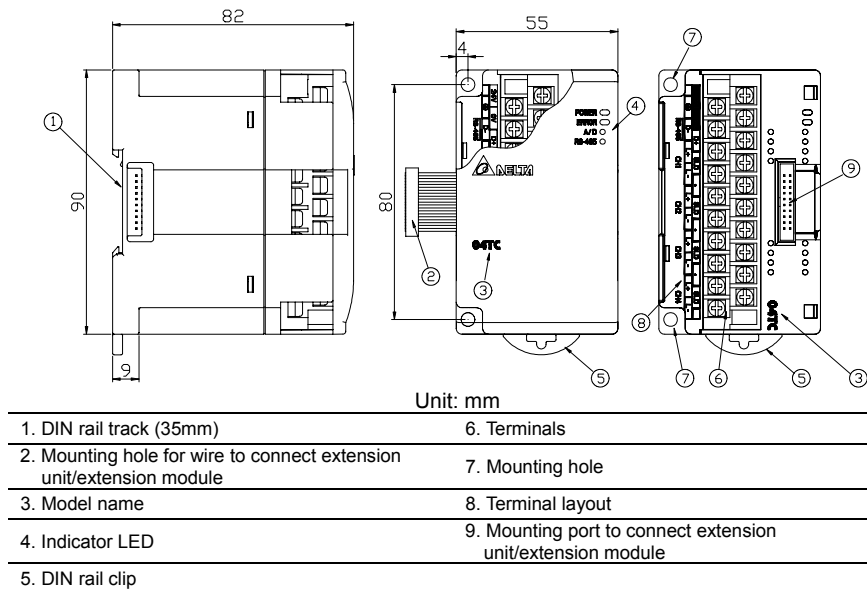
■ Nameplate Explanation



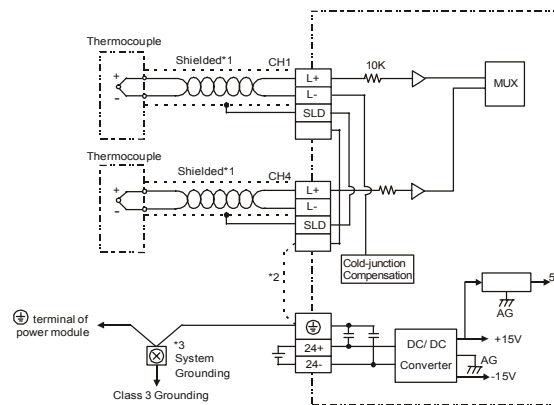
■ Model Explanation



2.2 Product Profile and Outline



2.3 External wiring



Note 1: Use only the wires that are supplied with your thermocouple sensor.
Tighten PLC terminal screws to a torque of 1.95 kg-cm (1.7 in-lbs).

Note 2: Terminal SLD is a grounding location for noise suppression.

Note 3: Please connect  terminal of power supply module and  terminal of DVP04TC-H thermocouple sensors module to system earth ground.

Note 4: DO NOT wire to null terminal ●

Note 5: Use copper conductor only, 60°/75°.

3	STANDARD SPECIFICATIONS
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3.1 Function Specifications

04TC Temperature Module	Celsius (°C)	Fahrenheit (°F)
Power Supply Voltage	24 VDC (20.4VDC~28.8VDC) (-15%~+20%)	
Analog Input Channel	4 channels per module	
Sensors Type	J, K, R, S, T types Thermocouple	
Temperature Input Range	J type: -100°C~700°C K type: -100°C~1000°C R type: -10°C~1700°C S type: -10°C~1700°C T type: -100°C~3500°C	J type: -148°F~1292°F K type: -148°F~1832°F R type: -14°F~3092°F S type: -14°F~3092°F T type: -148°F~662°F
Digital Conversion Range	J type: K-1000~K7000 K type: K-1000~K10000 R type: K-100~K1700 S type: K-100~K1700 T type: K-1000~K3500	J type: K-3280~K12920 K type: K-1480~K18320 R type: K-140~K30920 S type: K-140~K30920 T type: K-1480~K6620
Resolution	14 bits (0.1°C)	14 bits (0.18°F)
Overall Accuracy	±0.5% of full scale of 25°C(77°F), ±1% of full scale during 0~55°C (32~131°F)	
Response Time	200 ms × channels	
Isolation Method	Isolation between digital and analog circuitry. There is no isolation between channels.	
Digital Data Format	2's complement of 16-bit, (13 Significant Bits)	
Average Function	Available (se by CR#2~CR#5, range: K1~K20)	
Self Diagnostic Function	Available	
Communication Mode (RS-485)	MODBUS ASCII/RTU Mode. Communication baud rate: 4800, 9600, 19200, 38400, 57600, and 115200. For ASCII mode, date format is 7Bits, even, 1 stop bit (7 E 1). For RTU mode, date format is 8Bits, even, 1 stop bit (8 E 1). The RS-485 is disabled when the DVP04TC-H is connected to an MPU in series.	
Connection to a DVP-PLC MPU in Series	When DVP04TC are connected to an MPU, the temperature sensors are numbered from 0~7. (0 is the closet and 7 is the farthest to the MPU). Up to 8 sensors can be connected without occupying any digital I/O points of the MPU.	

3.2 Other Specification

Power Specification	
Maximum Power Consumption	2.5W at 24 VDC (20.4VDC~28.8VDC) (-15 % ~ +20 %), external power supply
Environment Condition	
Environment Condition	Follow the DVP-PLC MPU.
Approvals	   

4	CR (Controlled Register)
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DVP04TC-H platinum temperature sensors				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 4096	☐	R	Model type	System used, DVP04TC-H model code = H403															
#1	H 4097	☐	R/W	Thermocouple type	Reserved				CH4		CH3		CH2		CH1					
					Example: Setting of CH1 1. set (b2, b1, b0) to be (0, 0, 0) and select J type 2. set (b2, b1, b0) to be (0, 0, 1) and select K type 3. set (b2, b1, b0) to be (0, 1, 0) and select R type 4. set (b2, b1, b0) to be (0, 1, 1) and select S type 5. set (b2, b1, b0) to be (1, 0, 0) and select T type															
#2	H 4098	☐	R/W	CH1 average time	Average time setting for CH1~CH4. Setting range: K1~K20. Factory setting: K10.															
#3	H 4099	☐	R/W	CH2 average time																
#4	H 409A	☐	R/W	CH3 average time																
#5	H 409B	☐	R/W	CH4 average time																
#6	H 409C	☒	R	CH1 average degrees(°C)	Average degrees display for channels CH1~CH4. (unit: 0.1 °C)															
#7	H 409D	☒	R	CH2 average degrees(°C)																
#8	H 409E	☒	R	CH3 average degrees(°C)																
#9	H 409F	☒	R	CH4 average degrees(°C)																
#10	H 40A0	☒	R	CH1 average degrees(°F)	Average degrees display for channels CH1~CH4. (unit: 0.1 °F)															
#11	H 40A1	☒	R	CH2 average degrees(°F)																
#12	H 40A2	☒	R	CH3 average degrees(°F)																
#13	H 40A3	☒	R	CH4 average degrees(°F)																
#14	H 40A4	☒	R	Present temperature of CH1 (°C)	Present temperature display for channels CH1~CH4. (unit: 0.1 °C)															
#15	H 40A5	☒	R	Present temperature of CH2 (°C)																
#16	H 40A6	☒	R	Present temperature of CH3 (°C)																
#17	H 40A7	☒	R	Present temperature of CH4 (°C)																
#18				Reserved																
#19	H 40A9	☒	R	Present temperature of CH1 (°F)	Present temperature display for channels CH1~CH4. (unit: 0.1 °F)															
#20	H 40AA	☒	R	Present temperature of CH2 (°F)																
#21	H 40AB	☒	R	Present temperature of CH3 (°F)																
#22	H 40AC	☒	R	Present temperature of CH4 (°F)																
#23				Reserved																
#24	H 40AE	☐	R/W	CH1 OFFSET Value	Adjustable OFFSET value for CH1~CH4. Available range:-1000~+1000. Factory setting: K0. (unit: 0.1 °C)															
#25	H 40AF	☐	R/W	CH2 OFFSET Value																
#26	H 40B0	☐	R/W	CH3 OFFSET Value																
#27	H 40B1	☐	R/W	CH4 OFFSET Value																
#28~#29				Reserved																
#30	H 40B4	☒	R	Error status	The data register to store all the error status. See Fault Code Chart for details.															
#31	H 40B5	☐	R/W	Communication address setting	RS-485 communication address setting. Setting range: 01~255. Factory setting: K1															
#32	H 40B6	☐	R/W	Communication baud rate setting	Communication baud rate: 4800, 9600, 19200, 38400, 57600 and 115200 bps. Communication format: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 1); 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: switch between low bit and high bit of CRC code (only for RTU mode) b15: ASCII / RTU mode selection.															
#33	H 40B7	☐	R/W	Reset to factory setting	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
					Definition of ERR LED		CH4		CH3		CH2		CH1							
				1. Example: Setting of CH1 b0: Reserved b1: Reserved b2: Set to 1 and PLC will be reset to factory settings. 2. Definition of ERR LED: b12~b15=1111(factory settings) b12: corresponds to CH1: when b12=1 with the status of scale range exceeding or no connection for external contact, ERR LED will flash. b13: corresponds to CH2: when b13=1 with the status of scale range exceeding or no connection for external contact, ERR LED will flash. b14: corresponds to CH3: when b14=1 with the status of scale range exceeding or no connection for external contact, ERR LED will flash. b15: corresponds to CH4: when b15=1 with the status of scale range exceeding or no connection for external contact, ERR LED will flash.																
#34	H 40B4	☐	R	Software version	Display software version in hexadecimal. Example: H 010A = version 1.0A.															
#35~#48				System used																

Symbols:
☐: latched.
☒: non-latched.
R: read data by using FROM instruction or RS-485.
W: write data by using TO instruction or RS-485.

Explanation:

1. CR#0: The PLC model type.
2. CR#1: Use to set the working mode of four channels (CH1~CH4). There are 2 modes (J-type and K-type) for each channel and can be set individually. For example, If you want to set CH1~CH4 as following: CH1: mode 0 (b2~b0=000), CH2: mode 1(b5~b3=001), CH3: mode 0(b8~b6=000) and CH4: mode 1(b11~b9=001), you should set CR#1 to H0208. The higher bits (b12~b15) will be reserved and the factory setting is H0000.
3. CR#2 ~ CR#5: Use to set the average time of signals from CH1~CH4 temperature measured. The available range is K1~K20 and factory setting is K10. (Note: When PLC sets average times via TO/DTO instructions, please use rising-edge/falling-edge detection instruction (such as LDP and LDF) to get correct average times.)
4. CR#6 ~ CR#9: The average temperature (°C) of CH1~CH4 based on CR#2~5 average time. Example: If the average time is set to10, the result will be the average temperature (°C) of CH1~CH4 for latest 10 times accumulated.
5. CR#10 ~ CR#13: The average temperature (°F) of CH1~CH4 based on CR#2~5 average time. Example: If the average time is set to10, the result will be the average temperature (°F) of CH1~CH4 for latest 10 times accumulated.
6. CR#14 ~ CR#17: Display present temperature (°C) of CH1~CH4 input signal.
7. CR#18, CR#23, CR#28, CR#29 are reserved.
8. CR#19 ~ CR#22: Display present temperature (°F) of CH1~CH4 input signal.
9. CR#24 ~ CR#27: Display OFFSET value of CH1~CH4. Adjustable range: -1000~+1000. Unit is 0.1 °C. OFFSET definition: Actual temperature = temperature measured by DVP04TC-H – OFFSET value.
10. CR#30: Fault Code 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 fault occurs.										

11. CR#31: RS-485 communication address setting. Setting range: 01~255. Factory setting: K1.
12. CR#32: RS-485 communication baud rate setting: 4800, 9600, 19200, 38400, 57600 and 115200 pbs.
b0: 4800bps, b1:9600bps (factory setting), b2:19200pbs, b3:38400 pbs, b4:57600 pbs, b5:115200 pbs, b6~b13: Reserved, b14: switch between low bit and high bit of CRC code (only for RTU mode), b15: ASCII / RTU mode.
13. CR#33: For b0~b11, it is used to reset CR registers to factory settings. For b12~b15, it is used to defined EER led. Factory setting: b12~b15=1111.
14. CR#34: Software version.
15. CR#35~ CR#48: Reserved for internal system use.
16. CR#0~CR#48: The corresponding parameters address H 4096~H 40C7 of CR#0~CR#48 can be read/written by user via RS-485 communication.

a. Communication baud rate: 4800, 9600, 19200, 38400, 57600, 115200 pbs.

b. Modbus ASCII/RTU mode selections: ASCII mode is 7Bit, even bit, 1 stop bit (7 E 1). RTU mode is 8Bit, even bit, 1 stop bit (8 E 1).

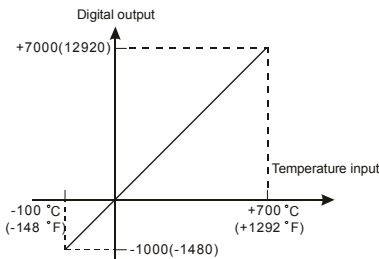
c. Function code: 03H—read data from register. 06H—write a WORD into register. 10H—write many WORDs into register.

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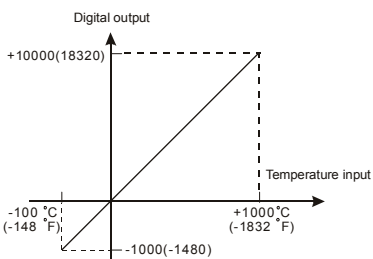
Temperature/Digital Characteristic Curve

Temperature mode: (Celsius and Fahrenheit)

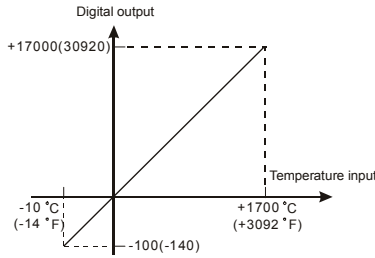
J-type thermocouple:



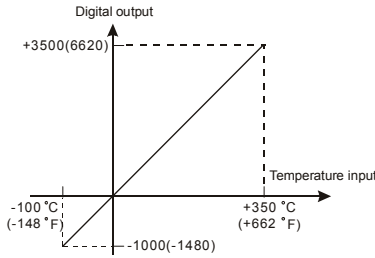
K-type thermocouple:



R&S-type thermocouple



T-type thermocouple



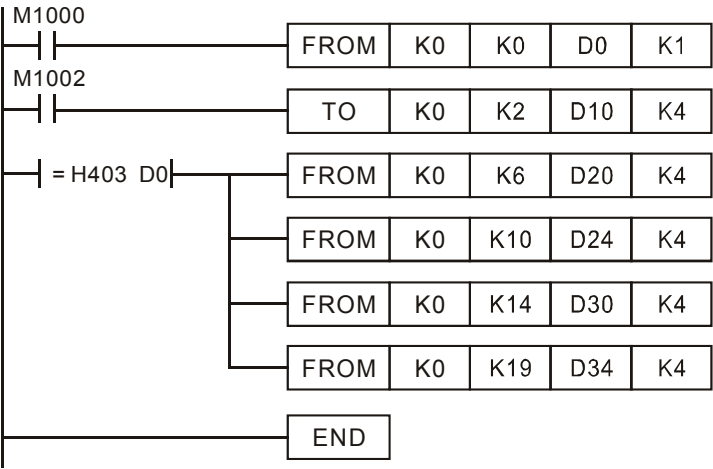
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Trial Run and Troubleshooting

■ LED display:

1. When power 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 be 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 DVP04TC-H connected to PLC MPU in series, RUN LED of MPU will be ON and A/D LED or D/A LED should blink.
4. After receiving the first RS-485 instruction, the A/D LED or D/A LED will blink.
5. After converting, ERROR LED should blink if input or output is higher than upper bound or lower than lower bound.

■ Example:



Explanation:

- Read K0 for the model type of extension module. (Should be H403 for DVP04TC-H).
- The averaging time for CH1~CH4 will be D10~D13.
- If the model type is DVP04TC-H, read the average temperature (°C) of CH1~CH4 (4 data) from CR#6~CR#9 and store them into D20~D23.
- Read the average temperature (°F) of CH1~CH4 (4 data) from CR#10~CR#13 and save them into D24~D27.
- Read the present temperature (°C) of CH1~CH4 (4 data) from CR#14~CR#17 and save them into D30~D33.
- Read the present temperature (°F) of CH1~CH4 (4 data) from CR#19~CR#22 and save them into D34~D37.

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Related Instructions Explanation

API	Mnemonic	Operands	Function	Controllers
78	D FROM	P (m) (m2) (D) (n)	Read CR from Module	ES EX SS SA SX SC EF

OP	Type	Bit Devices				Word devices											Program Steps
		X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F	
m ₁						*	*										FROM, FROMP: 9 steps DFROM, DFROMP: 17 steps
m ₂						*	*										
D									*	*	*	*	*	*	*	*	
n						*	*										

Operands:

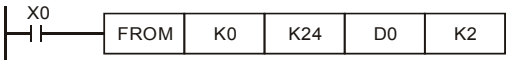
m₁: Number for special module (m₁=0~7) m₂: Number of CR (Control Register) of special module (m₂=0~48) that will be read D: Location to save read data n: Data words to read at one time (n =1~(49- m₂))

Explanations:

1. DVP PLC uses this command to read CR data of special module.
2. When **D** indicates bit operand, you can use K1~K4 for 16-bit command and K5~K8 for 32-bit command.
3. Please refer to the following footnote to see the detail of the numbering rule of special module.

Example:

Writing CR#24 of special module #0 into D0 and CR#25 of special module #0 into D1. only write two data once (n=2).



API	Mnemonic	Operands	Function	Controllers
79	D TO	P (m) (m2) (S) (n)	Write CR to Module	ES EX SS SA SX SC EF

OP	Type	Bit Devices				Word devices											Program Steps
		X	Y	M	S	K	H	KnX	KnY	KnM	KnS	T	C	D	E	F	
	m ₁					*	*										TO, TOP: 9 steps DTO, DTOP: 17 steps
	m ₂					*	*										
	S					*	*	*	*	*	*	*	*	*	*	*	
	n					*	*										

Operands:

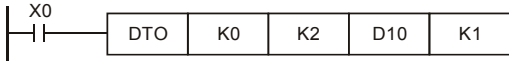
m₁: Number of special module (m₁=0~7) m₂: Number of CR (Control Register) of special module that will be written to (m₂=0~48) S: Data to write in CR n: number of words to write one time (n =1~(49- m₂))

Explanations:

1. When **S** assigns bit operand, K1~K4 can be used for 16-bit command and K1~K8 can be used for 32-bit command.
2. DVP-series PLC uses this command to write data into CR of special module.

Example:

Using 32-bit instruction DTO to write D11 and D10 into CR#3 and CR#2 of special module#0. Write data once a time only (n=1).

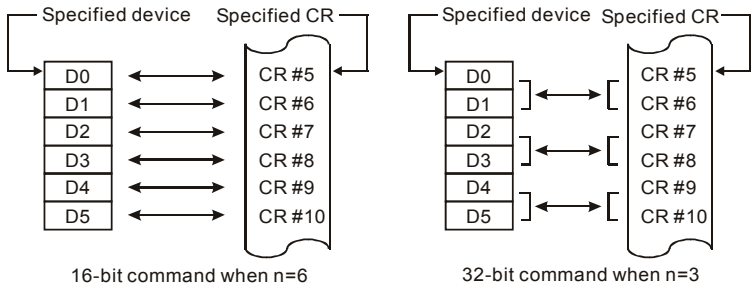


The rule of instruction operand:

1. m₁: number of special module that connects to PLC MPU. The numbering rule of special module from the near to the distant of MPU is from 0 to 7. The maximum is 8 special modules without occupying I/O point.
2. m₂: number of CR. There are 49 groups of 16-bit memory built in special module called CR (Control Register). The number of CR uses decimal digits (#0~#48) that include all running status and setting values of special module.
3. If using FROM/TO instruction, use one CR for one-time read/write. If using DFROM/DTO instruction, use 2 CRs for one-time read/write.



4. n: the group number of data transmission. n=2 of 16-bit instruction is same as n=1 of 32-bit instruction.



The function of Flag M1083 in SA/SX/SC/EH series:

1. When M1083=OFF and FROM/TO instruction is executed, all interrupts (including external or internal interrupt subroutines) will be disabled. All interrupts will be executed after FROM/TO instruction is completed. Besides, FROM/TO instruction also can be executed in the interrupt subroutine.
2. When M1083=ON and an interrupt occurs during FROM/TO instruction execution, FROM/TO instruction won't be executed until the interrupt signal complete its execution (100us delay for interrupt execution). Once the interrupt execution is completed, the program will skip FROM/TO instruction and execute the program next to FROM/TO which cannot be executed in the interrupt subroutine.