

DVP04TC-S Thermocouple Sensors

Instruction Sheet

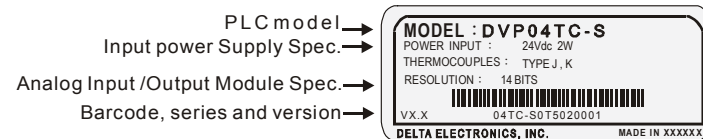
1 WARNING

- ⚠ Always read this instruction thoroughly before using the DVP04TC-S.
- ⚠ Make sure that power is OFF before wiring.
- ⚠ This is an OPEN TYPE PLC. The PLC 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, in order 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 PLC. Check all the wiring prior to power up.
- ⚠ Do NOT touch internal circuit within 1 minute after power is OFF.
- ⚠ Make sure that the DVP04TC-S is properly grounded (⊕), to avoid any electromagnetic noise.

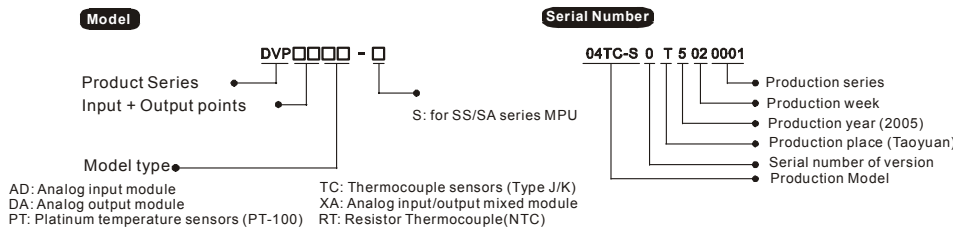
2 INTRODUCTION

2.1 Model Explanation and Peripherals

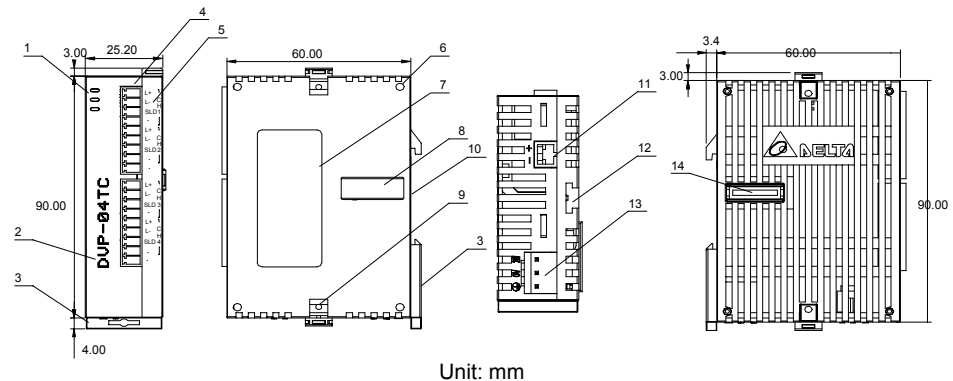
- Thank you for choosing DELTA's DVP Series PLC. The DVP04TC-S allows the connection of four thermocouple sensors (Type J/K). The DVP04TC-S series can read/write the data by using instructions FROM / TO via DVP-PLC SS/SA/SX/SC MPU program. There are 49 CR (Control Register) in each module and 16 bits for each register.
- DVP04TC-S thermocouple sensor can update software version by RS-485. Power supply and main processing units are sold separately.
- The DVP04TC-S works with both Centigrade and Fahrenheit. The input resolution for Centigrade is 0.1 degrees and for Fahrenheit is 0.18 degrees.
- Nameplate Explanation



Model Explanation

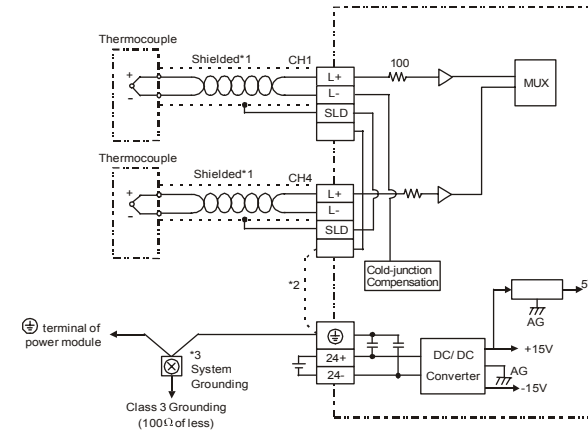


2.2 Product Profile and Outline



1. Status indicator (Power, RUN and ERROR)	8. Extension port
2. Model Number	9. Extension Clip
3. DIN rail clip	10. DIN rail location (35mm)
4. I/O terminals	11. RS-485 Communication port
5. I/O point indicator	12. Extension Clip
6. Extension hole of the extension unit mounting pins	13. DC Power input
7. Specification Label	14. Extension port

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-S thermocouple sensors module to system earth ground.
- Warning: DO NOT connect wires to the No Connection (●) terminals. Use copper conductor only. 60°C

2.4 Terminals of analog module

DVP04AD-S	DVP02DA-S	DVP04DA-S	DVP04PT-S	DVP04TC-S	DVP06XA-S	DVP08RT-S
0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0

3 STANDARD SPECIFICATIONS

3.1 Function Specifications

Platinum Temperature Module (04TC)	Centigrade (°C)	Fahrenheit (°F)
Power Supply Voltage	24 VDC(20.4VDC~28.8VDC) (-15%~+20%)	
Analog Input Channel	4 channels per module	
Sensors Type	J-type or K-type thermocouple	
Temperature Input Range	J-type: -100°C~700°C K-type: -100°C~1000°C	J-type: -148°F~1292°F K-type: -148°F~1832°F
Digital Conversion Range	J-type: K-1000~K7000 K-type: K-1000~K10000	J-type: K-3280~K12920 K-type: K-1480~K18320
Resolution	14 bits(0.1°C)	
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	250 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	Yes (CR#2~CR#5 may be set and the range is K1~K4096)	
Self Diagnostic Function	Yes	
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). For RTU mode, date format is 8Bits, even, 1 stop bit (8 E 1). The RS-485 is disabled when the DVP04TC-S is connected in series to an MPU.	
Connection to a DVP-PLC MPU in Series	When DVP04TC-S modules are connected to an MPU, the modules are numbered from 0 - 7. 0 is the closest to the MPU and 7 is the farthest. The Maximum number of modules is 8 modules and they do not occupy any digital I/O points of the MPU.	

3.2 Other Specification

Power Specification	
Maximum Power Consumption	2W at 24 VDC (20.4VDC~28.8VDC) (-15% ~ +20%)

Environment Condition	
Environment Condition	Follow the DVP-PLC MPU.
Static Electricity Prevention	All places between terminals and ground comply with the spec.

4 CR (Control Register)

CR No.	RS-485 Parameter address	Latched	Register name	Explanation																		
				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-S model code = H 8B																	
#1	H 4097	○	R/W	Thermocouple type	Reserved CH4 CH3 CH2 CH1 Example: Setting of CH1 1. b0: set 0 to use J-type and set 1 to use K-type 2. b1: Reserved. 3. b2: Reserved.																	
#2	H 4098	○	R/W	CH1 average number	The number of readings used for "average" temperature on channels CH1~CH4. Setting range is K1~K4096 and factory setting is K10.																	
#3	H 4099	○	R/W	CH2 average number																		
#4	H 409A	○	R/W	CH3 average number																		
#5	H 409B	○	R/W	CH4 average number																		
#6	H 409C	×	R	CH1 average degrees(C)	Average degrees for channels CH1~CH4. (unit: 0.1 degrees 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 40A2	×	R	CH1 average degrees(F)	Average degrees for channels CH1~CH4. (unit: 0.1 degrees F)																	
#11	H 40A3	×	R	CH2 average degrees(F)																		
#12	H 40A4	×	R	CH3 average degrees(F)																		
#13	H 40A5	×	R	CH4 average degrees(F)																		
#14	H 40A8	×	R	Present temperature of CH1 (C)	Present temperature of channels CH1~CH4. (unit: 0.1 degrees C)																	
#15	H 40A9	×	R	Present temperature of CH2 (C)																		
#16	H 40AA	×	R	Present temperature of CH3 (C)																		
#17	H 40AB	×	R	Present temperature of CH4 (C)																		
#18				Reserved																		
#19	H 40AE	×	R	Present temperature of CH1 (F)	Present temperature of channels CH1~CH4. (unit: 0.1degrees F)																	
#20	H 40AF	×	R	Present temperature of CH2 (F)																		
#21	H 40B0	×	R	Present temperature of CH3 (F)																		
#22	H 40B1	×	R	Present temperature of CH4 (F)																		
#23				Reserved																		
#24	H 40AE	○	R	CH1 OFFSET Value	Adjust offset value of channels CH1~CH4. The range is -1000~+1000 and factory setting is K0. (unit: 0.1 degrees C)																	
#25	H 40AF	○	R	CH2 OFFSET Value																		
#26	H 40B0	○	R	CH3 OFFSET Value																		
#27	H 40B1	○	R	CH4 OFFSET Value																		
#28-#29				Reserved																		
#30	H 40B4	×	R	Error status	Data register stores the error status, refer to fault code chart for details.																	
#31	H 40B5	○	R/W	Communication address setting	RS-485 communication address. Setting range is 01~255 and factory setting is K1																	
#32	H 40B6	○	R/W	Communication baud rate setting	Communication baud rate (4800, 9600, 19200, 38400, 57600 and 115200 bps). b0: 4800 bps (bit/sec). (factory setting) b1: 9600 bps (bit/sec). 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: RTU mode.																	
#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 Example: Setting of CH1 1. b0 Reserved 2. b1 Reserved 3. b2: Set to 1 and PLC will be reset to factory settings. Definition of ERR LED: b12~b15=1111(factory settings) 1. b12 corresponds to CH1: when b12=1, scale exceeds the range or external contact has no connection, ERR LED flashes. 2. b13 corresponds to CH2: when b13=1, scale exceeds the range or external contact has no connection, ERR LED flashes. 3. b14 corresponds to CH3: when b14=1, scale exceeds the range or external contact has no connection, ERR LED flashes. 4. b15 corresponds to CH4: when b15=1, scale exceeds the range or external contact has no connection, ERR LED flashes.	
#34	H 40B4	○	R	Software version	Display software version in hexadecimal. Example: H 010A = version 1.0A.																	
#35-#48				System used																		

- means 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.
- Explanation:
- CR#0: The PLC model type.

- CR#1: Used 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.
- CR#2 ~ CR#5: Used to set the times of input readings for the average temperature calculation. The available range is K1~K4096 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.)
- CR#6 ~ CR#9: The average temperature (°C). The average temperature is calculated from multiple temperature readings. Example: If CR#2 is 10, the temperature in CR#6 will be the average of the last 10 readings in CH1.
- CR#10 ~ CR#13: The average temperature (°F). The average temperature is calculated from multiple temperature readings. Example: If CR#2 is 10, the temperature in CR#12 will be the average of the last 10 readings in CH1.
- CR#14 ~ CR#17: display present temperature (°C) of CH1~CH4 input signal.
- CR#18, CR#23, CR#28, CR#29 are reserved.
- CR#19 ~ CR#22: display present temperature (°F) of CH1~CH4 input signal.
- CR#24 ~ CR#27: display offset value of channels CH1~CH4. The range is -1000~+1000 and unit is 0.1 degrees C. The definition of OFFSET is Actual temperature = temperature measured by DVP04TC-S – OFFSET value.
- CR#30 is a fault code register. Refer to the following chart.

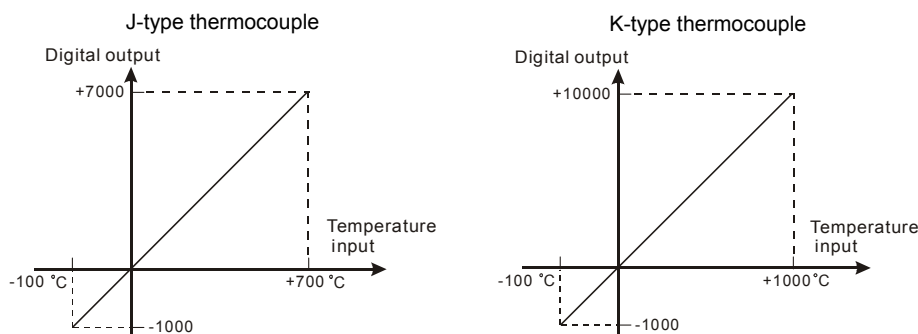
Fault description	Content	b15~b8	b7	b6	b5	b4	b3	b2	b1	b0
Power source abnormal	K1(H1)	Reserved	0	0	0	0	0	0	0	1
Analog input value error	K2(H2)		0	0	0	0	0	0	1	0
Setting mode error	K4(H4)		0	0	0	0	0	1	0	0
Offset/Gain error	K8(H8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16(H10)		0	0	0	1	0	0	0	0
Digital range 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 fault occurs.

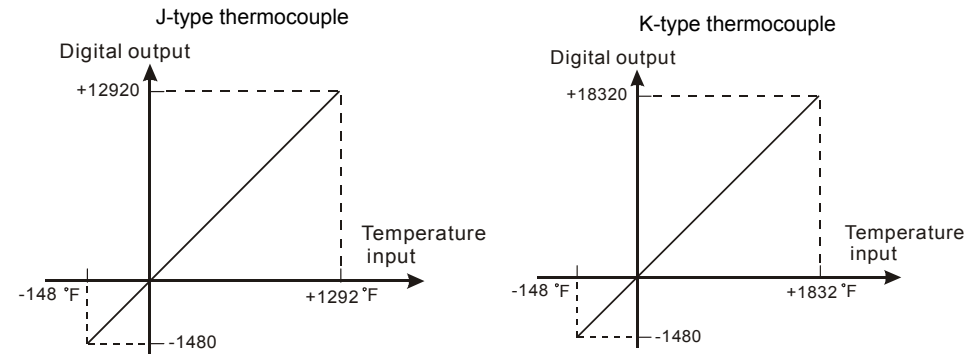
- CR#31: RS-485 communication address. Setting range is 01~255 and factory setting is K1.
- CR#32: RS-485 communication baud rate: 4800, 9600, 19200, 38400, 57600 and 115200. b0:4800bps, b1:9600bps (factory setting), b2:19200bps, b3:38400 bps, b4:57600 bps, b5:115200 bps, b6~b13: Reserved, b14: switch between low bit and high bit of CRC code (only for RTU mode), b15: ASCII / RTU mode. 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).
- CR#33: Used to reset the settings of CR registers to factory settings.
- CR#34: software version.
- CR#35~ CR#48: Reserved for internal system use.
- The corresponding parameters address H 4096~H 40C7 of CR#0~CR#48 may provide users to read/write data via RS-485 communication.
 - Communication baud rate: 4800, 9600, 19200, 38400, 57600, 115200 bps.
 - 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).
 - Function code: 03H—read data from register. 06H—write a WORD into register. 10H—write many WORDs into register.

5 Temperature/Digital Characteristic Curve

Temperature mode: (Centigrade)



Temperature mode: (Fahrenheit)

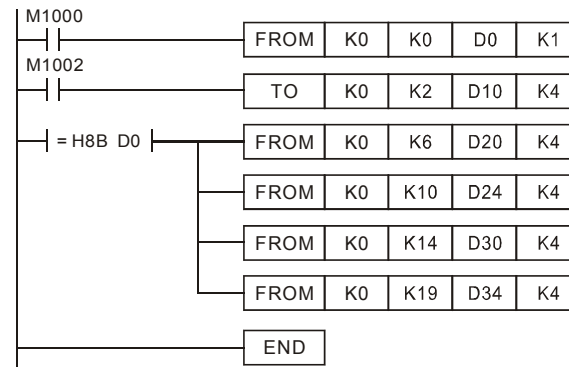


6 Initial PLC Start-up

LED display:

- Upon power-up, the ERROR LED will light for 0.5 seconds the POWER LED will light continuously.
- No errors= POWER LED on and ERROR LED off. Low Voltage error (lower than 19.5V), ERROR LED will blink continuously till the power supply rises above 19.5V.
- DVP04TC-S connected to PLC MPU in series = RUN LED on MPU will be lit and A/D LED or D/A LED should blink.
- After receiving the first RS-485 instruction the A/D LED or D/A LED will blink.
- If the input or output exceeds the upper or lower bounds, then the ERROR LED will blink.

Example:



Explanation:

- Reading the model type of extension module K0 (should be H8B for DVP04TC-S model type).
- The averaging number for CH1~CH4 will be D10~D13.
- If the model type is DVP04TC-S. Reading the average temperature (°C) of CH1~CH4 (4 data) from CR#6~CR#9 and save them into D20~D23.
- Reading the average temperature (°F) of CH1~CH4 (4 data) from CR#10~CR#13 and save them into D24~D27.
- Reading the present temperature (°C) of CH1~CH4 (4 data) from CR#14~CR#17 and save them into D30~D33.
- Reading the present temperature (°F) of CH1~CH4 (4 data) from CR#19~CR#22 and save them into D34~D37.

7 Related Instructions Explanation

API	D	FROM	P	(m1)	(m2)	(S)	(n)	Special module CR data read out	Applicable model
78								SS SA/SX/SC EH	
				*	*				
				*	*				
				*	*	*	*	*	*
				*	*				

Note: The usage range of operand m₁ is 0~7. The usage range of operand m₂: SS/SA: 0-48, EH: 0-254. The usage range of operand n: SS/SA: n= 1~(49-m2), EH: 1~(255-m2). SS series model doesn't support pulse execution instruction (FROMP, DFROMP).

Flag: When M1083=On, it allows to insert 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 one time.

DVP-series PLC uses this instruction to read CR data of special module.

D: When assigning bit operand, K1~K4 can be used for 16-bit and K5~K8 can be used for 32-bit.

Please refer the following footnote for calculation of special module number.

API	D	TO	P	(m1)	(m2)	(S)	(n)	Special module CR data write in	Applicable model
79								SS SA/SX/SC EH	
				*	*				
				*	*	*	*	*	*
				*	*				

Note: The usage range of operand m₁ is 0~7. The usage range of operand m₂: SS/SA: 0-48, EH: 0-254. The usage range of operand n: SS/SA: n= 1~(49-m2), EH: 1~(255-m2). For SS series, it doesn't support pulse execution instruction (TOP, DTO).

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.

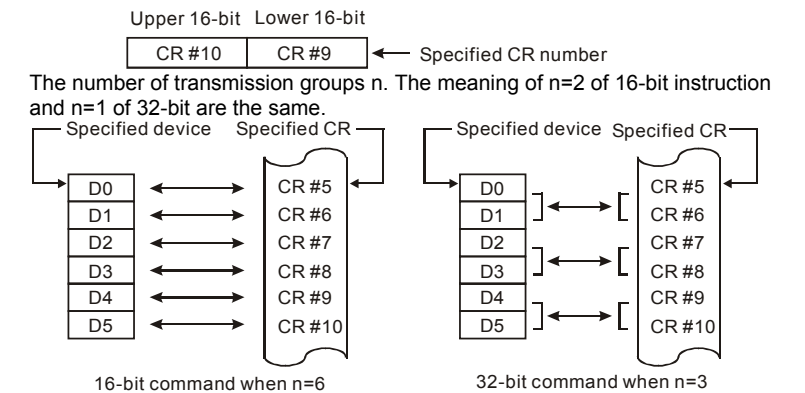
Footnote

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 has 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 SS 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 FROM/TO instruction is completed. Besides, FROM/TO instruction also can be executed in the interrupt subroutine.

The function of the flag M1083 (FROM/TO mode exchange) provided in SA/EH series models:

- When M1083=Off, 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.
- When M1083=On, if an interrupt occurs while FROM/TO instruction has been programmed, FROM/TO instruction will be interrupted to execute the interrupt. However, FROM/TO instruction cannot be executed in the interrupt subroutine.