

DVP04TC-S Thermocouple Sensors

Instruction Sheet

1 WARNING

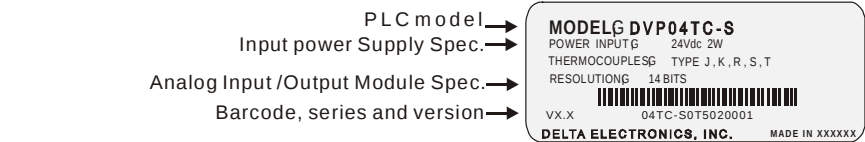
- Always read this manual thoroughly before using the DVP04TC-S.
- In order to avoid electric shock, do not touch the terminals or conduct any maintenance while power is applied to the PLC. Never open the PLC. Only qualified Delta personell should conduct any internal electrical work on the PLC.
- This is an OPEN-TYPE device and must be placed in an environment away from high temperatures, high humidity, excessive vibration, corrosive gases, liquids, airborne dust, and metallic particles when installed in an enclosure.
- Do not apply AC power to any of the input/output terminals, this will cause permanent damage to the DVP04TC-S. **Do NOT touch terminals when power on.**
- Make sure that the DVP-04TC is properly grounded , to avoid any electromagnetic noise.

2 INTRODUCTION

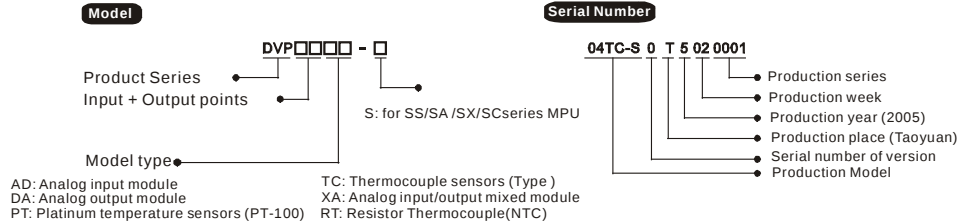
2.1Model Explanation and Peripherals

- Thank you for choosing DELTA's DVP Series PLC. The DVP04TC-S allows the connection of four thermocouple sensors (**Type J.K.R.S.T**). The DVP04TC-S series can read/write the data by using commands FROM / TO via DVP-PLC SS/SA/SX/SC MPU program. There are 49 CR (Control Register) in each module and 16 bits per 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.

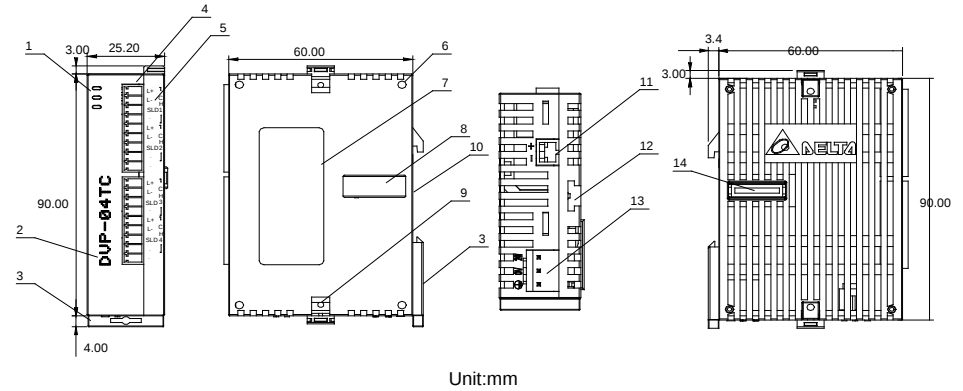
■ Nameplate Explanation



■ Model Explanation

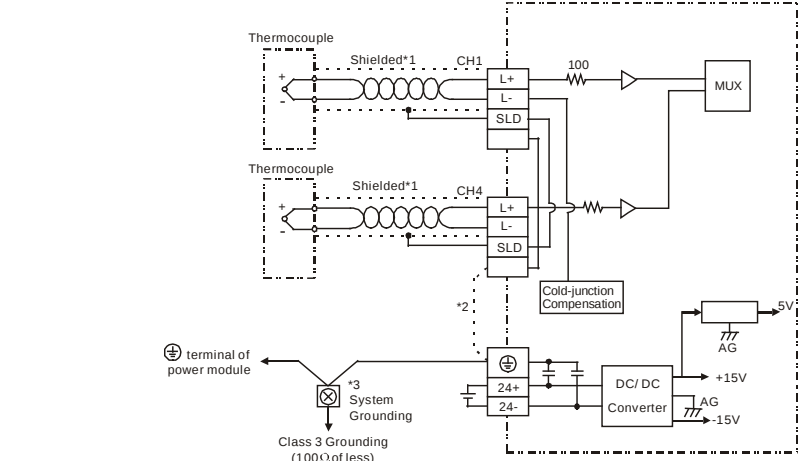


2.2Product Profile and Outline



1. Status indicator (Power, RUN and ERROR)	8. Expansion port
2. Model Number	9. Expansion 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. Expansion Clip
6. Expansion hole of the expansion unit mounting pins	13. DC Power input
7. Specification Label	14. Expansion port

2.3External wiring



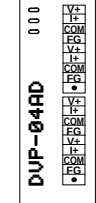
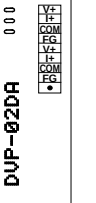
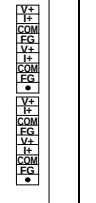
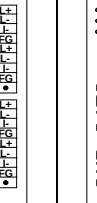
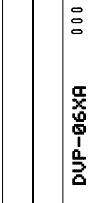
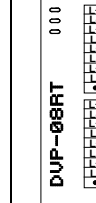
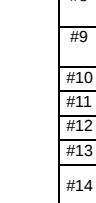
Note 1: Use only the wires that are supplied with your thermocouple sensor. Tighten PLC terminal screws to a torque of 1.95 kg-cm (1.7 in-lbs).

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, 60/75℃

2.4 Terminals of analog module

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

3 STANDARD SPECIFICATIONS

3.1Function 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 K-type R-type S-type T-type thermocouple	
Temperature input range	J type : -100℃~700℃ K type : -100℃~1000℃ R type : -10℃~1700℃ S type : -10℃~1700℃ T type : -100℃~350℃	J type : -148℉~1292℉ K type : -148℉~1832℉ R type : -14℉~3092℉ S type : -14℉~3092℉ T type : -148℉~662℉
Digital conversion range	J type : K-1000~K7000 K type : K-1000~K10000 R type : K-100~K17000 S type : K-100~K17000 T type : K-1000~K3500	J type : K-1480~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℃)	14 bits(0.18℉)
Overall accuracy	±0.5% of full scale of 25℃(77℉), ±1% of full scale during 0~55℃ (32~131℉)	
Response time	350 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 DVP04AD-S is connected in series to an MPU.
Connection to a DVP-PLC MPU in series	When DVP04-TC modules are connected to an MPU, the modules are numbered from 0 – 7. 0 is the closest to the MPU and 7 is the furthest. 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.

4 CR (CONTROLLED REGISTER)

DVP-04TC 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., DVP-04TC model code = H 8B															
#1	H 4097	☐	R/W	Thermocouple type	Reserved				CH4			CH3			CH2			CH1		
					Example: Setting of CH1															
					1. b2~b0: set (0,0,0) to use J-type															
					2. b2~b0: set (0,0,1) to use K-type															
					3. b2~b0: set (0,1,0) to use R-type															
4. b2~b0: set (0,1,1) to use S-type																				
5. b2~b0: set (1,0,0) to use T-type																				
#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	Average degrees for channels CH1~CH4. (unit: 0.1 degrees C)															
#6	H 409C	☒	R	CH1 average 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)	Average degrees for channels CH1~CH4. (unit: 0.1 degrees F)															
#10	H 40A2	☒	R	CH1 average 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)	Present temperature of channels CH1~CH4. (unit: 0.1 degrees C)															
#14	H 40A8	☒	R	Present temperature of CH1 (°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)	Present temperature of channels CH1~CH4. (unit: 0.1degrees F)															
#18				Reserved																
#19	H 40AE	☒	R	Present temperature of CH1 (°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)	Adjust offset value of channels CH1~CH4. The range is -1000~+1000 and factory setting is K0. (unit: 0.1 degrees C)															
#23				Reserved																
#24	H 40AE	☐	R	CH1 OFFSET Value																
#25	H 40AF	☐	R	CH2 OFFSET Value																
#26	H 40B0	☐	R	CH3 OFFSET Value																
#27	H 40B1	☐	R	CH4 OFFSET Value	Data register stores the error status, refer to fault code chart for details.															
#28~#29				Reserved																
#30	H 40B4	☒	R	Error status																
#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). 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: 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, ERR LED flashes. 2. b13 corresponds to CH2: when b13=1, scale exceeds the range, ERR LED flashes. 3. b14 corresponds to CH3: when b14=1, scale exceeds the range, ERR LED flashes. 4. b15 corresponds to CH4: when b15=1, scale exceeds the range, 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.
× 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.

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 allow to set separately. For example, If you want to set CH1~CH4 as 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 number of input readings used 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 using multiple temperature readings. Example: If CR#2 is 10, the temperature in CR#6 will be the average of the last 10 readings on CH1.
- CR#10 ~ CR#13: The average temperature (°C). The average temperature is calculated using multiple temperature readings. Example: If CR#2 is 10, the temperature in CR#12 will be the average of the last 10 readings on 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 DVP-04TC – 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
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 fault occurs.										

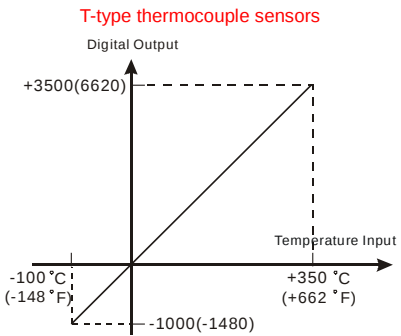
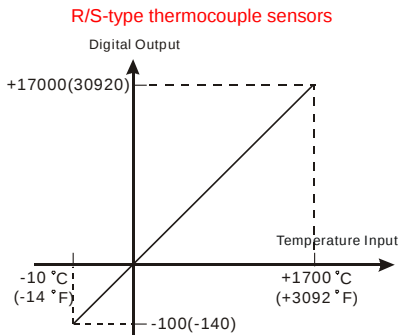
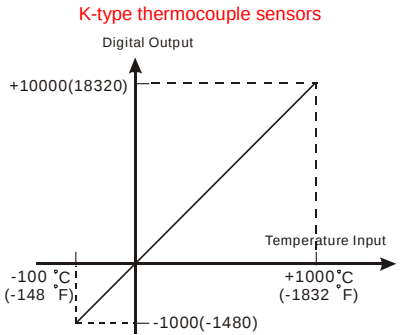
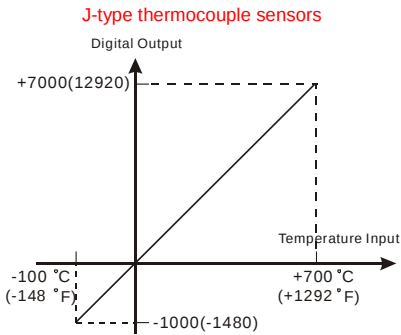
- CR#31: RS-485 communication address. Setting range is 01~255 and factory setting is K1.
- CR#32: RS-485 communication baud rate: 4800, 9600, 19200, 38400, 57600 and 115200. b0:4800bps, b1:9600bps (factory setting), b2:19200bps, b3:38400 bps, b4:57600 bps, b5:115200 bps, b6~b13: Reserved, b14: switch 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 defaults.
- 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.

TEMPERATURE/DIGITAL CHARACTERISTIC CURVE

Temperature mode: (Centigrade/Fahrenheit)

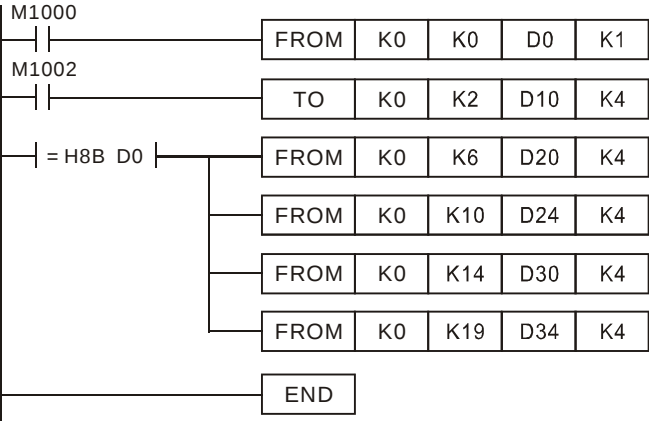


INITIAL PLC START-UP

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 command 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 expansion 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.

RELATED INSTRUCTIONS EXPLANATION

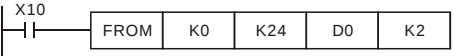
API		FROM	P	m1	m2	D	n	
78	D							Read special module CR data

Explanations:

m1: number of special module (m1=0~7). **m2**: CR number of special module that will be read. **D**: address for saving reading data. **n**: data number for reading once.

Example:

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



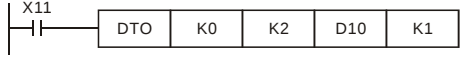
API		TO	P	m1	m2	S	n	
79	D							Special module CR data write

Explanations:

m1: number of special module (m1=0~7). **m2**: CR number of special module that will be wrote in. **S**: data to write in CR. **n**: data number to write in once.

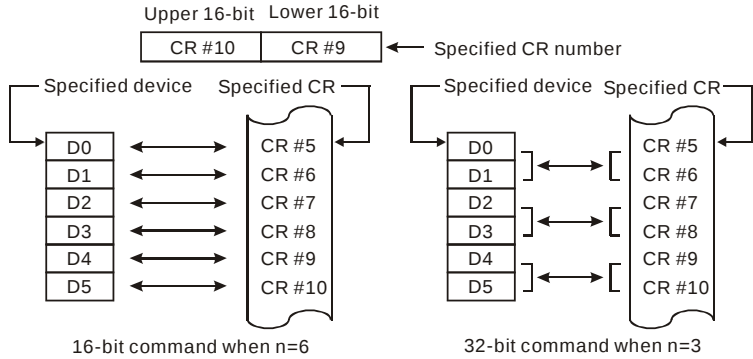
Example:

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



The rule of instruction operand:

- m1: number of special module. The special module closest to the ELC controller will be assigned 0, the next closest will be assigned 1, etc. for a total of 8 modules(0~7).
- m2: number of CR. Built-in of 48 groups of 16-bit memory of special module are called CR (Control Register). Each CR uses decimal digits (#0~#48).



- In PB models, flag M1083 is not provided. When the FROM/TO instruction is executed, all interrupts (including external or internal interrupt subroutines) will be disabled. All interrupts will be executed after the FROM/TO instruction is completed. The, FROM/TO instruction can also be executed in an interrupt subroutine.
- The function of the flag M1083 (FROM/TO mode) provided in PC/PA/PH 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.
 - When M1083=ON, if an interrupt occurs while the FROM/TO instruction has been programmed, The FROM/TO instruction will be interrupted to execute the interrupt. The FROM/TO instruction cannot be executed in the interrupt subroutine.