

DVP04TC-H2 Temperature Measurement Module

Instruction Sheet



Warning

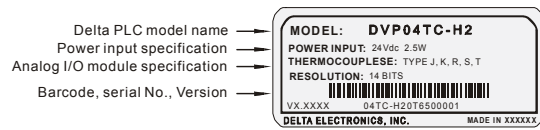
- ✓ Please read this instruction sheet carefully before use.
- ✓ Switch off the power before wiring.
- ✓ DVP04TC-H2 is an OPEN-TYPE device and therefore should be installed in an enclosure free of airborne dust, humidity, electric shock and vibration. The enclosure should prevent non-maintenance staff from operating the device (e.g. key or specific tools are required to open the enclosure) in case danger and damages on the device may occur.
- ✓ DO NOT connect input AC power supply to any of the I/O terminals; otherwise serious damage may occur. Check all the wiring again before switching on the power.
- ✓ DO NOT touch any terminal when the power is switched on.
- ✓ Make sure the ground terminal ⊕ is correctly grounded in order to prevent electromagnetic interference.
- ✓ Keep the wire as short as possible between RTD and PLC and the power wire as far away as possible from I/O wire to prevent interference.

1 Introduction

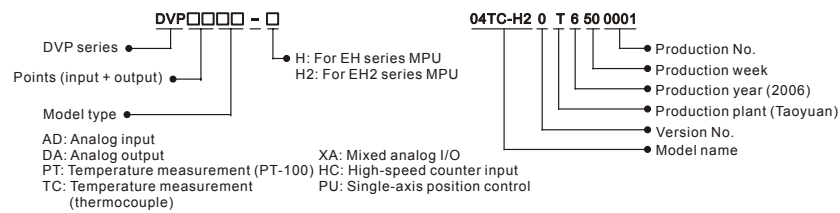
1.1 Model Explanation & Peripherals

- ❖ Thank you for choosing Delta's DVP series. DVP04TC-H2 is able to receive 4 points of external thermocouple temperature sensors (J-type, K-type, R-type, S-type, T-type) and convert them into 14-bit digital signals. Besides, through FROM/TO instructions in DVP-EH2 MPU program, DVP04TC-H2 is able to read and write the data in the module. There are 49 16-bit control registers (CR) in DVP04TC-H2.
- ❖ The power unit and module of DVP04TC-H2 are separate, compact in size and easy to install.
- ❖ DVP04TC-H2 displays temperatures in Celsius (resolution: 0.1°C) and Fahrenheit (resolution: 0.18°F).

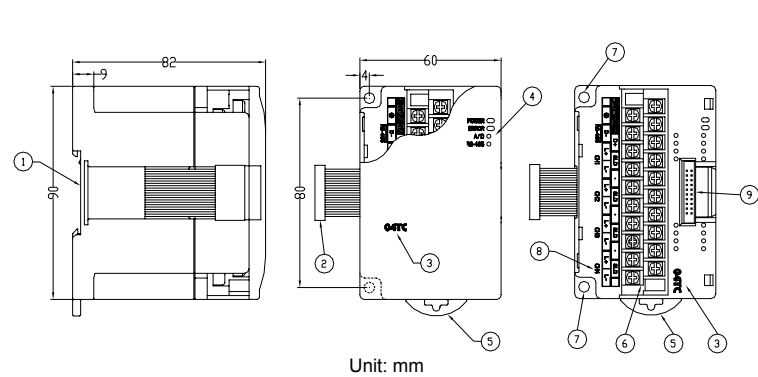
❖ Nameplate Explanation



❖ Model/Serial No. Explanation

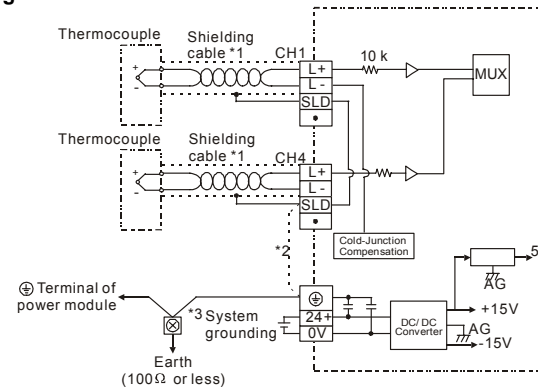


1.2 Product Profile (Indicators, Terminal Block, I/O Terminals)



- | | |
|---|---|
| ① DIN rail (35mm) | ⑥ Terminals |
| ② Connection port for extension unit/module | ⑦ Mounting hole |
| ③ Model name | ⑧ I/O terminals |
| ④ POWER, ERROR, A/D indicator | ⑨ Mounting port for extension unit/module |
| ⑤ DIN rail clip | |

1.3 External Wiring



- *1: The wiring used for analog input should adopt the connection cable or shielding cable of thermocouple temperature sensor J-type or K-type and should be separated from other power cable or wirings that may cause interference. The screw torque of the terminal should be 1.95 kg-cm (1.7 in-lbs).
 - *2: Terminal SLD is the ground location for noise suppression.
 - *3: Please connect the ⊕ terminal on both the power module and DVP04TC-H2 to the system earth point and ground the system contact or connect it to the cover of power distribution cabinet.
- Note: DO NOT wire empty terminal ⊖.
Note: Use 60/75°C copper conductor only.

2 Specifications

2.1 Functions

Temperature measurement (04TC) module	Celsius (°C)	Fahrenheit (°F)
Power supply voltage	24 VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%)	
Analog output channel	4 channels/module	
Applicable sensor types	J-type, K-type, R-type, S-type, T-type thermocouple	
Range of input temperature	J type: -100°C ~ 700°C	J type: -148°F ~ 1,292°F
	K type: -100°C ~ 1,000°C	K type: -148°F ~ 1,832°F
	R type: -10°C ~ 1,700°C	R type: -14°F ~ 3,092°F
	S type: -10°C ~ 1,700°C	S type: -14°F ~ 3,092°F
	T type: -100°C ~ 350°C	T type: -148°F ~ 662°F
Range of digital conversion	J type: K-1,000 ~ K7,000	J type: K-1,480 ~ K12,920
	K type: K-1,000 ~ K10,000	K type: K-1,480 ~ K18,320
	R type: K-100 ~ K17,000	R type: K-140 ~ K30,920
	S type: K-100 ~ K17,000	S type: K-140 ~ K30,920
	T type: K-1,000 ~ K3,500	T type: K-1,480 ~ K6,620
Resolution	14 bits (0.1)	
Overall accuracy	±0.5% when in full scale (25°C, 77°F) ±1% when in full scale within the range of 0 ~ 55°C, 32 ~ 131°F	
Response time	200 ms × the number of channels	
Isolation	Isolation between digital area and analog area. No isolation among channels.	
Digital data format	13 significant bits out of 16 bits are available; in 2's complement	
Average function	Yes; available for setting up in CR#2 ~ CR#5; range: K1 ~ K20	
Self-diagnosis	Upper and lower bound detection/channel	
Protection	The voltage output is protected by short circuit. Please also be aware that being short circuit for too long period of time may cause damage on internal circuit. The current output can be open circuit.	
Communication mode (RS-485)	ASCII/RTU mode. Communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps ASCII data format: 7-bit, Even bit, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even bit, 1 stop bit (8, E, 1) RS-485 cannot be used when connected to PLC MPU.	
When connected to DVP-PLC MPU in series	The modules are numbered from 0 to 7 automatically by their distance from MPU. No. 0 is the closest to MPU and No. 7 is the furthest. Maximum 8 modules are allowed to connect to MPU and will not occupy any digital I/O points.	

2.2 Others

Power Supply	
Max. rated power consumption	24 VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%), 2.5W supplied by external power.
Environment	
Environment spec.	Same as that of DVP-PLC MPU

3 Control Register

DVP04TC-H2				Description															
CR #	RS-485 Parameter address	Latched	Register content	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
#0	H'4096	○	R	Model name				Set up by the system. DVP04TC-H2 model code = H'6403											
#1	H'4097	○	R/W	Thermocouple type				Reserved		CH4		CH3		CH2		CH1			
#2	H'4098	○	R/W	CH1 average time				Take the setting of CH1 for example: 1. When (b2, b1, b0) is set as (0,0,0), choose J-type 2. When (b2, b1, b0) is set as (0,0,1), choose K-type 3. When (b2, b1, b0) is set as (0,1,0), choose R-type 4. When (b2, b1, b0) is set as (0,1,1), choose S-type 5. When (b2, b1, b0) is set as (1,0,0), choose T-type											
#3	H'4099	○	R/W	CH2 average time				Range of settings in CH1 ~ CH4: K1 ~ K20 Default = K10											
#4	H'409A	○	R/W	CH3 average time															
#5	H'409B	○	R/W	CH4 average time															
#6	H'409C	×	R	Average °C temp. measured at CH1															
#7	H'409D	×	R	Average °C temp. measured at CH2				Average Celsius temperature measured at CH1 ~ CH4. Unit: 0.1°C											
#8	H'409E	×	R	Average °C temp. measured at CH3															
#9	H'409F	×	R	Average °C temp. measured at CH4															
#10	H'40A0	×	R	Average °F temp. measured at CH1															
#11	H'40A1	×	R	Average °F temp. measured at CH2				Average Fahrenheit temperature measured at CH1 ~ CH4 Unit: 0.1°F											
#12	H'40A2	×	R	Average °F temp. measured at CH3															
#13	H'40A3	×	R	Average °F temp. measured at CH4															
#14	H'40A4	×	R	Present °C temp. measured at CH1															
#15	H'40A5	×	R	Present °C temp. measured at CH2				Present Celsius temperature measured at CH1 ~ CH4 Unit: 0.1°C											
#16	H'40A6	×	R	Present °C temp. measured at CH3															
#17	H'40A7	×	R	Present °C temp. measured at CH4															
#18				Reserved															
#19	H'40A9	×	R	Present °F temp. measured at CH1															
#20	H'40AA	×	R	Present °F temp. measured at CH2				Present Fahrenheit temperature measured at CH1 ~ CH4 Unit: 0.1°F											
#21	H'40AB	×	R	Present °F temp. measured at CH3															
#22	H'40AC	×	R	Present °F temp. measured at CH4															
#23				Reserved															
#24	H'40AE	○	R/W	OFFSET value of CH1				Adjustable OFFSET settings at CH1 ~ CH4. Range: -1,000 ~ +1,000 Default = K0 Unit: 0.1°C											
#25	H'40AF	○	R/W	OFFSET value of CH2															
#26	H'40B0	○	R/W	OFFSET value of CH3															
#27	H'40B1	○	R/W	OFFSET value of CH4															
#28 ~ #29				Reserved															
#30	H'40B4	×	R	Error status				Register for storing all error status. See the table of error status for more information.											
#31	H'40B5	○	R/W	Communication address setting				For setting RS-485 communication address. Range: 01 ~ 255 Default = K1											
#32	H'40B6	○	R/W	Communication speed (baud rate) setting				For setting up communication speed: 4,800/9,600/19,200/38,400/57,600/115,200 bps ASCII data format: 7-bit, Even bit, 1 stop bit (7, E, 1) RTU data format: 8-bit, Even bit, 1 stop bit (8, E, 1) Default: H'0002 b0: 4,800 bps b1: 9,600 bps (default) b2: 19,200 bps b3: 38,400 bps b4: 57,600 bps b5: 115,200 bps b6 ~ b13: reserved b14: High/low bit exchange of CRC checksum (only valid in RTU mode) b15: Switch between ASCII/RTU modes; 0 = ASCII mode (default)											
#33	H'40B7	○	R/W	Returning to default setting				Take the setting of CH1 for example: 1. b0 is reserved. 2. b1 is reserved. 3. When b2 is set as 1, all the settings will return to default settings. ERR LED definition: default of b12 ~ b15 = 1111 1. b12 corresponds to CH1. When b12 = 1 or the scale exceeds the range, ERR LED will flash. 2. b13 corresponds to CH2. When b13 = 1 or the scale exceeds the range, ERR LED will flash. 3. b14 corresponds to CH3. When b14 = 1 or the scale exceeds the range, ERR LED will flash. 4. b15 corresponds to CH4. When b15 = 1 or the scale exceeds the range, ERR LED will flash.											
#34	H'40B8	○	R	Firmware version				Displaying the current firmware version in hex; e.g. version 1.0A is indicated as H'010A											
#35 ~ #48				For system use															

Symbols

- : latched (when written in through RS-485 communication)
- ×: non-latched
- R: Able to read data by FROM instruction or RS-485 communication
- W: Able to write data by TO instruction or RS-485 communication

Explanations:

- CR#0: Model name. The user can read the model name from the program and see if the extension module exists.

- CR#1: The working mode of the 4 channels in the sensors selected by the temperature measurement module. There are 2 modes (J-type and K-type) for each channel which can be set up separately. For example, if the user needs to set up CH1: mode 0 (b2 ~ b0 = 100); CH2: mode 1 (b5 ~ b3 = 001); CH3: mode 0 (b8 ~ b6 = 000) and CH4: mode 1 (b11 ~ b9 = 001), CR#1 has to be set as H0208 and the higher bits (b12 ~ b15) have to be reserved. The default value = H'0000.
- CR#2 ~ CR#5: The times to average the temperatures measured at CH1 ~ CH4. Range: K1 ~ K20. Default = K10. Please note that when PLC MPU writes in the average time by TO/DTO instruction, please use the rising/falling edge contact detection instructions (LDP/LDF...) in case you may not obtain the correct average temperature.
- CR#6 ~ CR#9: The average Celsius temperature measured at CH1 ~ CH4 obtained from the average time settings in CR#2 ~ CR#5. For example, if the average time is set as 10, the content in CR#6 ~ CR#9 will be the average of the most recent 10 temperature signals in Celsius at CH1 ~ CH4.
- CR#10 ~ CR#13: The average Fahrenheit temperature measured at CH1 ~ CH4 obtained from the average time settings in CR#2 ~ CR#5. For example, if the average time is set as 10, the content in CR#10 ~ CR#13 will be the average of the most recent 10 temperature signals in Fahrenheit at CH1 ~ CH4.
- CR #14 ~ CR #17: Displaying the present temperature in Celsius at CH1 ~ CH4
- CR#18, CR#23, CR#28 and CR#29 are reserved.
- CR #19 ~ CR #22: Displaying the present temperature in Fahrenheit at CH1 ~ CH4
- CR #24 ~ CR #27: The adjusted OFFSET value of CH1 ~ CH4. Range: -1,000 ~ +1,000. Unit: 0.1°C. Temperature measured by the module – OFFSET value = Actual temperature displayed.
- CR #30: Error status (see the table below)

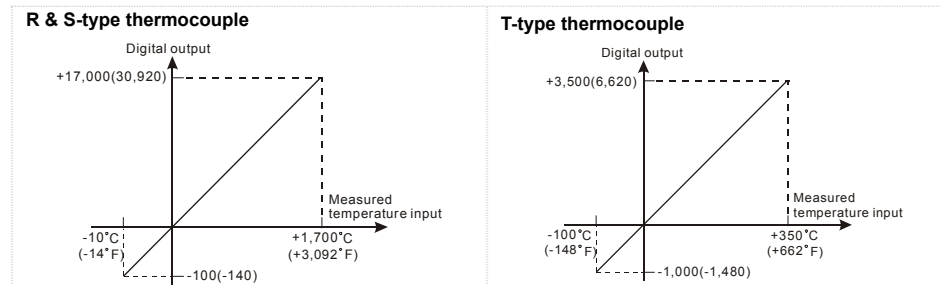
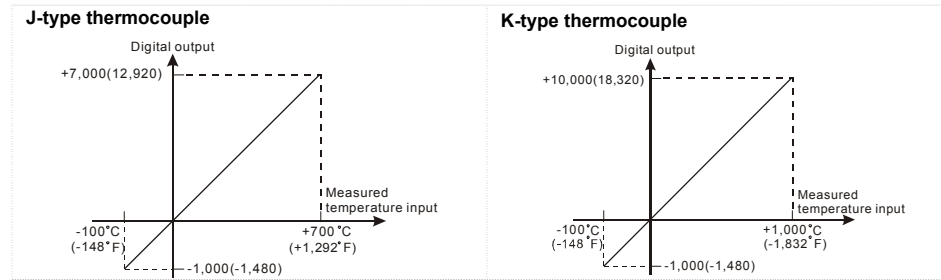
Error status	Content	b15 ~ b8	b7	b6	b5	b4	b3	b2	b1	b0
Abnormal power supply	K1(H'1)	reserved	0	0	0	0	0	0	0	1
Scale exceeds the range or wiring to empty external contact	K2(H'2)		0	0	0	0	0	0	1	0
Incorrect mode setting	K4(H'4)		0	0	0	0	0	1	0	0
OFFSET/GAIN error	K8(H'8)		0	0	0	0	1	0	0	0
Hardware malfunction	K16(H'10)		0	0	0	1	0	0	0	0
Abnormal digital range	K32(H'20)		0	0	1	0	0	0	0	0
Incorrect average times setting	K64(H'40)		0	1	0	0	0	0	0	0
Instruction error	K128(H'80)		1	0	0	0	0	0	0	0

Note: Each error status is determined by the corresponding bit (b0 ~ b7) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error

- CR#31: The setting of RS-485 communication address. Range: 01 ~ 255. Default = K1.
- CR#32: The setting of RS-485 communication speed. b0: 4,800bps; b1: 9,600bps (default); b2: 19,200bps; b3: 38,400bps; b4: 57,600bps; b5: 115,200bps; b6 ~ b13: reserved; b14: high/low bit exchange of CRC checksum (only valid in RTU mode); b15: switching between ASCII mode and RTU mode.
- CR#33: b0 ~ b11: For returning the CR settings to default settings. b12 ~ b15: ERR LED definition. Default: b12 ~ b15 = 1111.
- CR#34: Firmware version of the model.
- CR#35 ~ CR#48: Parameters for system use.
- CR#0 ~ CR#34: The corresponding parameter address H'4096 ~ H'40B8 are for users to read/write data by RS-485 communication. When using RS-485, the user has to separate the module with MPU first.
 - Communication baud rate: 4,800/9,600/19,200/38,400/57,600/115,200 bps.
 - Modbus ASCII/RTU communication protocol: ASCII data format (7-bit, Even bit, 1 stop bit (7, E, 1)); RTU data format (8-bit, Even bit, 1 stop bit (8, E, 1)).
 - Function: H'03 (read register data); H'06 (write 1 word datum into register); H'10 (write many word data into register).
 - Latched CR should be written by RS-485 communication to stay latched. CR will not be latched if written by MPU through TO/DTO instruction.

4 Temperature/Digital Curve

Temperature measurement modes

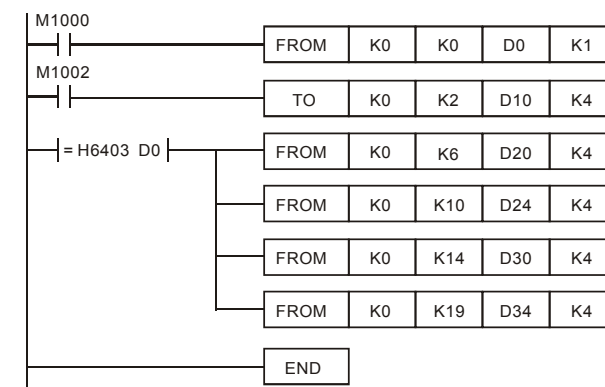


5 Trial Operation & Troubleshooting

❖ LED Display

- When the module is powered for the first time, POWER LED will be on and ERROR LED will be on for 0.5 second. After this, A/D LED will start to flash.
- When the power supply is normal, POWER LED will be on and ERROR LED should be off. When the power supply is less than 19.5V, ERROR LED will keep being on until the power supply goes higher than 19.5V.
- When controlled by RS485, RS-485 LED on the module will flash after receiving the RS-485 instruction.
- When the input or output value exceeds the upper bound or falls below the lower bound after conversion, ERROR LED will flash.

❖ Program Example



- Read the model name from K0 and see if it is DVP04TC-H2: H'6403
- Set the average times in CH1 ~ CH4 as D10 ~ D13.
- If D0 = H'6403, read the average temperature (°C) measured in CH1 ~ CH4 from CR#6 ~ CR#9 and store the 4 data in D20 ~ D23.
- Read the average temperature (°F) measured in CH1 ~ CH4 from CR#10 ~ CR#13 and store the 4 data in D24~ D27.
- Read the average temperature (°C) measured in CH1 ~ CH4 from CR#14 ~ CR#17 and store the 4 data in D30~ D33.
- Read the average temperature (°F) measured in CH1 ~ CH4 from CR#19 ~ CR#22 and store the 4 data in D34~ D37.

6 Relevant Instructions

API	D	FROM	P	(m1)	(m2)	(D)	(n)	Read CR data in special modules
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Instruction Explanation
 (m1): No. of special module (m1 = 0 ~ 7) (m2): CR# in special module to be read
 (D): Device for storing read data (n): Number of data to be read at a time

Program Example
 Read CR#24 of special module No. 0 into D0 and CR#25 into D1. Only 2 groups of data are read at a time (n = 2).

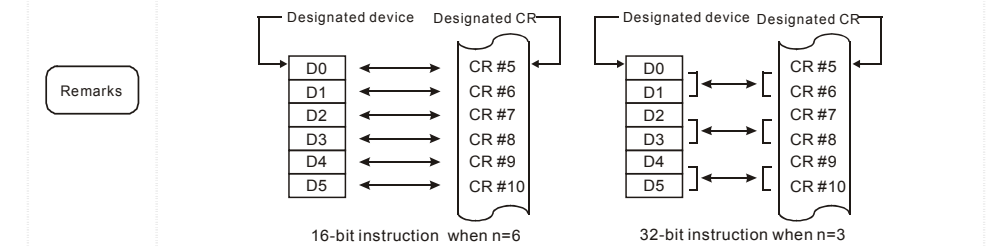
API	D	TO	P	(m1)	(m2)	(S)	(n)	Write CR data into special module
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Instruction Explanation
 (m1): No. of special module (m1 = 0 ~ 7) (m2): CR# in special module to be written
 (S): Data to be written into CR (n): Number of data to be written at a time

Program Example
 Use 32-bit instruction DTO to write the content in D11 and D10 into CR#7 and CR#6 of special module No. 0. Only 1 group of data is written in a time (n = 1).

■ Operand rules

- (m1): The No. of special modules connected to PLC MPU. No. 0 is the module closest to te MPU. Maximum 8 modules are allowed to be connected to a PLC MPU and they will not occupy any I/O points.
 - (m2): CR#. CR (control register) is the 49 16-bit memories built in the special module, numbered in decimal as #0 ~ #48. All operation status and settings of the special module are contained in the CR.
 - FROM/TO instruction is for reading/writing 1 CR at a time. DFROM/DTO instruction is for reading/writing 2 CRs at a time.
-
- Number of groups "n" to be transmitted: n = 2 in 16-bit instructions and n = 1 in 32-bit instructions mean the same.



■ M1083 for switching instruction modes in EH2 series models

- When M1083 = Off, during the execution of FROM/TO instruction, all external or internal interruption subroutines will be forbidden. The interruptions are allowed only after FROM/TO instruction finishes its execution. FROM/TO instruction can also be used in an interruption subroutine.
- When M1083 = On and an interruption signal occurs during the execution of FROM/TO instruction, the interruption will be processed first (with a 100us delay) and the execution of FROM/TO will be stopped. After the interruption subroutine finishes its execution, the program will jump to the next instructio of FROM/TO. FROM/TO cannot be used in an interruption subroutine.