

DVP04TC-E2

Instruction Sheet

安 裝 說 明
安 裝 說 明

Temperature Measurement Module

溫度量測模組

温度测量模块

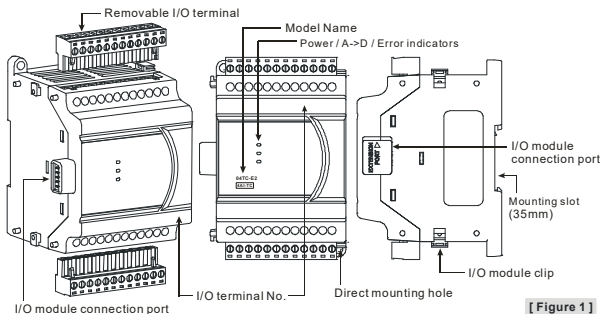
DVP-0280630-02
20220112



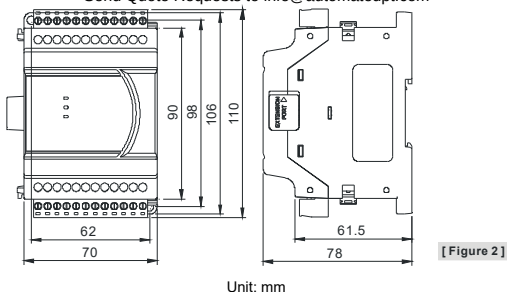
Thank you for choosing Delta's DVP series PLC. DVP04TC-E2 temperature measurement module receives 4 points of external thermocouple temperature sensors (J-type, K-type, R-type, S-type, T-type, E-type, N-type, $\pm 80\text{mV}$) and convert them into 16-bit digital signals. Users can select temperatures in Celsius (resolution: 0.1°C) or Fahrenheit (resolution: 0.18°F). In addition, you can access the data in the module by applying FROM/TO instructions or read the average value of channels directly by using MOV instruction (Please refer to allocation of special registers D9900 ~ D9999).

- EN ✖ DVP04TC-E2 is an OPEN-TYPE device. It should be installed in a control cabinet free of airborne dust, humidity, electric shock and vibration. To prevent non-maintenance staff from operating DVP04TC-E2, or to prevent an accident from damaging DVP04TC-E2, the control cabinet in which DVP04TC-E2 is installed should be equipped with a safeguard. For example, the control cabinet in which DVP04TC-E2 is installed can be unlocked with a special tool or key.
- EN ✖ DO NOT connect AC power to any of I/O terminals, otherwise serious damage may occur. Please check all wiring again before DVP04TC-E2 is powered up. After DVP04TC-E2 is disconnected, Do NOT touch any terminals in a minute. Make sure that the ground terminal $\oplus$ on DVP04TC-E2 is correctly grounded in order to prevent electromagnetic interference.
- FR ✖ DVP04TC-E2 est un module OUVERT. Il doit être installé que dans une enceinte protectrice (boîtier, armoire, etc.) saine, dépourvue de poussière, d'humidité, de vibrations et hors d'atteinte des chocs électriques. La protection doit éviter que les personnes non habilitées à la maintenance puissent accéder à l'appareil (par exemple, une clé ou un outil doivent être nécessaire pour ouvrir a protection).
- FR ✖ Ne pas appliquer la tension secteur sur les bornes d'entrées/Sorties, ou l'appareil DVP04TC-E2 pourra être endommagé. Merci de vérifier encore une fois le câblage avant la mise sous tension du DVP04TC-E2. Lors de la déconnection de l'appareil, ne pas toucher les connecteurs dans la minute suivante. Vérifier que la terre est bien reliée au connecteur de terre $\oplus$ afin d'éviter toute interférence électromagnétique.

■ Product Profile & Dimension



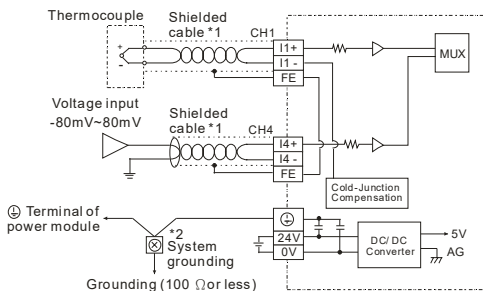
[Figure 1]



[Figure 2]

Unit: mm

External Wiring



Note 1: Wiring for analog input should adopt the connection cable or shielding cable of thermocouple temperature sensor J-type, K-type, R-type, S-type, T-type, E-type and N-type and should be separated from other power cable or wirings that may cause interference.

Note 2: Connect the ⊕ terminal on both power module and DVP04TC-E2 to the system grounding point then ground the point or connect it to the cover of power distribution cabinet.

I/O Terminal Layout

1	2	3	4	5	6	7	8	9	10	11	12
I1+	I1-	FE	I2+	I2-	FE	I3+	I3-	FE	I4+	I4-	FE
DVP04TC-E2 (4AI)											
24V	0V	⊕	FE	FE	FE	FE	FE				
1	2	3	4	5	6	7	8				

Electrical Specifications

DVP04TC-E2	
Power supply voltage	24VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%)
Max. rated power consumption	1.2W, supplied by external power source
Connector	European standard removable terminal block (Pin pitch: 5mm)
Operation/storage	Operation: 0°C~55°C (temp.), 5~95% (humidity), Pollution degree2 Storage: -25°C~70°C (temp.), 5~95% (humidity)
Vibration/shock immunity	International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)/ IEC61131-2 & IEC 68-2-27 (TEST Ea)

Series connection to DVP-PLC MPU	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.
----------------------------------	---

■ Functions Specifications

DVP04TC-E2	Celsius (°C)	Fahrenheit (°F)	Voltage input
Analog input channel	4 channels		
Digital data format	2's complement of 16 bits		
Response time	200ms / each channel		
Overall accuracy	±0.3% when in full scale (25°C, 77°F) ±0.6% when in full scale within the range of 0 ~ 55°C, 32 ~ 131°F		
Applicable sensor type	J-type, K-type, R-type, S-type, T-type, E-type, N-type thermocouple; ±80mV voltage input		
Range of input	J-type: -100°C ~ 1,150°C K-type: -100°C ~ 1,350°C R-type: 0°C ~ 1,750°C S-type: 0°C ~ 1,750°C T-type: -150°C ~ 390°C E-type: -150°C ~ 980°C N-type: -150°C ~ 1,280°C	J-type: -148°F ~ 2,102°F K-type: -148°F ~ 2,462°F R-type: 32°F ~ 3,182°F S-type: 32°F ~ 3,182°F T-type: -238°F ~ 734°F E-type: -238°F ~ 1,796°F N-type: -238°F ~ 2,336°F	±80mV
Range of digital conversion	J-type: K-1,000 ~ K11,500 K-type: K-1,000 ~ K13,500 R-type: K-0 ~ K17,500 S-type: K-0 ~ K17,500 T-type: K-1,500 ~ K3,900 E-type: K-1,500 ~ K9,800 N-type: K-1,500 ~ K12,800	J-type: K-1,480 ~ K21,020 K-type: K-1,480 ~ K24,620 R-type: K320 ~ K31,820 S-type: K320 ~ K31,820 T-type: K-2,380 ~ K7,340 E-type: K-2,380 ~ K17,960 N-type: K-2,380 ~ K23,360	±8,000
Resolution	0.1°C	0.18°F*1	0.01mV
Average function	Supported. Available for setting up sampling range in CR#8 ~ CR#11. Range: K1 ~ K100.		
Self-diagnosis	Upper and lower bound detection in all channels		
Isolation	Optical coupler isolation between digital circuits and analog circuits. Isolation between analog channels. 500VDC between digital circuits and Ground 500VDC between analog circuits and Ground 500VDC between analog circuits and digital circuits 500VDC between 24VDC and Ground 120VAC between analog channels		

*1: The unit of temperature would be displayed as 0.1°C/0.1°F. If the temperature unit is set to be Fahrenheit, the second decimal place would not be shown.

■ Control Register

CR#	Attrib.		Register content	Description
#0	O	R	Model name	Set up by the system: DVP04TC-E2 model code = H'0083
#1	O	R	Firmware version	Display the current firmware version in hex.
#2	O	R/W	CH1 Input mode setting	Input mode: Default = H'0000. Take CH1 for example: Mode 0 (H'0000): J-type (-100°C ~ 1,150°C) Mode 1 (H'0001): K-type (-100°C ~ 1,350°C) Mode 2 (H'0002): R-type (0°C ~ 1,750°C)
#3	O	R/W	CH2 Input mode setting	

CR#	Attrib.		Register content	Description
#4	O	R/W	CH3 Input mode setting	Mode 3 (H'0003): S-type (0°C ~ 1,750°C) Mode 4 (H'0004): T-type (-150°C ~ 390°C) Mode 5 (H'0005): E-type (-150°C ~ 980°C)
#5	O	R/W	CH4 Input mode setting	Mode 6 (H'0006): N-type (-150°C ~ 1,280°C) Mode 7 (H'0007): -80mV~+80mV Mode -1(H'FFFF): Close
#7	O	R/W	Temperature unit setting	Select the temperature unit (Celsius °C / Fahrenheit °F). Default = H0(°C)
#8	O	R/W	CH1 sampling range	Set sampling range at CH1 ~ CH4 Range = K1 ~ K100 Default = K10
#9	O	R/W	CH2 sampling range	
#10	O	R/W	CH3 sampling range	
#11	O	R/W	CH4 sampling range	
#12	X	R	Average temperature measured at CH1	Average temperature measured at CH1 ~ CH2 Temperature unit: set in CR#7
#13	X	R	Average temperature measured at CH2	
#14	X	R	Average temperature measured at CH3	Average temperature measured at CH3 ~ CH4 Temperature unit: set in CR#7
#15	X	R	Average temperature measured at CH4	
#20	X	R	Present temperature measured at CH1	Present temperature measured at CH1 ~ CH4 Temperature unit: set in CR#7
#21	X	R	Present temperature measured at CH2	
#22	X	R	Present temperature measured at CH3	
#23	X	R	Present temperature measured at CH4	
#28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of Ch1 ~ Ch4. Default = K0 Range: K-400 ~ K400 Temperature unit: set in CR#7 Definition of Offset at Ch1 ~ Ch4 in DVP04TC-E2: Deviation digital value from the target value.
#29	O	R/W	Adjusted Offset value of CH2	
#30	O	R/W	Adjusted Offset value of CH3	
#31	O	R/W	Adjusted Offset value of CH4	
#40	O	R/W	Function: Set value changing prohibited	Prohibit set value changing in CH1 ~ CH4
#41	X	R/W	Function: Save all the set values	Save all the set values, Default =H'0000
#43	X	R	Error status	Register for storing all error status. See the table of error status for more information.
#100	O	R/W	Function: Enable / Disable limit detection	Upper and lower bound detection, b0~b3 corresponds to CH1 ~ CH4 (0: Disable/ 1: Enable). Default= H'0000.
#101	X	R/W	Upper and lower bound status	Display the upper and lower bound status (0: Not Exceeding; 1: Exceeding upper and lower bound value), b0~b3 corresponds to CH1 ~ CH4 lower bound, b8~b13 corresponds to CH1 ~ CH4 upper bound.
#102	O	R/W	Set value of CH1 upper bound	Set value of CH1~CH4 upper bound. Default = K32000.
#103	O	R/W	Set value of CH2 upper bound	
#104	O	R/W	Set value of CH3 upper bound	
#105	O	R/W	Set value of CH4 upper bound	
#108	O	R/W	Set value of CH1 lower bound	Set value of CH1~CH4 lower bound.

CR#	Attrib.	Register content	Description
#109	O R/W	Set value of CH2 lower bound	Default = K-32000.
#110	O R/W	Set value of CH3 lower bound	
#111	O R/W	Set value of CH4 lower bound	

※ CR#43: Error status value. See the table below:

Description					
bit0	K1 (H'1)	Power supply error	bit6	K64 (H'40)	CH4 Conversion error
bit1	K2 (H'2)	Temperature sensor error	bit9	K512(H'0200)	Mode setting error
bit2	K4 (H'4)	Upper / lower bound error	bit10	K1024(H'0400)	Sampling range error
bit3	K8 (H'8)	CH1 Conversion error	bit11	K2048(H'0800)	Upper / lower bound setting error
bit4	K16 (H'10)	CH2 Conversion error	bit12	K4096(H'1000)	Set value changing prohibited
bit5	K32 (H'20)	CH3 Conversion error	bit13	K8192(H'2000)	Communication breakdown on next module
Note: Each error status is determined by the corresponding bit (b0 ~ b13) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error					

※ Module Reset (Available for firmware v1.10 or above): When modules need reset, write H'4352 in CR#0 then disconnect and turn on the power again. The resetting initializes all parameter setups to provide normal function for other modules. Connect to only one module during reset, wait 1 second before disconnecting the power.

• PID Control Registers

CR#				Save		Register content	Description
CH1	CH2	CH3	CH4				
#120	#140	#160	#180	O	R/W	Set temperature value	Please set the temperature value according to proper range of each sensor type. Default = K0
#121	#141	#161	#181	O	R/W	Sampling time (s)	Range: K1 ~ K30 (s). Default = K2
#122	#142	#162	#182	O	R/W	K _P	Proportional control constant. Default = K121
#123	#143	#163	#183	O	R/W	K _I	Integral constant. Default = K2,098
#124	#144	#164	#184	O	R/W	K _D	Derivative constant. Default = K-29
#125	#145	#165	#185	O	R/W	Upper limit of I value	Upper limit of I value. Default = K0
#126	#146	#166	#186	O	R/W	Lower limit of I value	Lower limit of I value. Default = K0
#127	#147	#167	#187	X	R	I value	Current accumulated offset value
#128	#148	#168	#188	O	R/W	Heating/cooling	0: Heater, 1: Cooler. Default = K0
#129	#149	#169	#189	O	R/W	Upper limit of output	Upper limit of output. Default = K32,000
#130	#150	#170	#190	O	R/W	Lower limit of output	Lower limit of output. Default = K0
#131	#151	#171	#191	X	R	Output percentage	Output percentage (Unit: 0.1%)
#132	#152	#172	#192	X	R	Output width (ms)	Width of control output. Unit: ms
#133	#153	#173	#193	X	R	Output cycle (ms)	Cycle of control output. Unit: ms
#134	#154	#174	#194	X	R	Output volume	Output volume
#135	#155	#175	#195	X	R/W	PID_RUN/STOP	0: STOP, 1: RUN. Default = K0
#136	#156	#176	#196	X	R/W	Auto-tuning	0: Disabled, 1: Auto-tuning. Default = K0
Symbols: O: When CR#41 is set to H'5678, the set value of CR will be saved. X: set value will not be saved. R: able to read data by using FROM instruction. W: able to write data by using TO instruction.							

■ Explanation on Special Registers D9900~D9999

When DVP-ES2 MPU is connected with modules, registers D9900~D9999 will be reserved for storing values from modules. You can apply MOV instruction to operate values in D9900~D9999.

When DVP-ES2 MPU is connected with DVP04TC-E2, the configuration of special registers is as below:

Module #0	Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Description
D1320	D1321	D1322	D1323	D1324	D1325	D1326	D1327	Model Code
D9900	D9910	D9920	D9930	D9940	D9950	D9960	D9970	CH1 average temperature
D9901	D9911	D9921	D9931	D9941	D9951	D9961	D9971	CH2 average temperature
D9902	D9912	D9922	D9932	D9942	D9952	D9962	D9972	CH3 average temperature
D9903	D9913	D9923	D9933	D9943	D9953	D9963	D9973	CH4 average temperature

Note 1: D9900 ~ D9999 are average input values of CH1 ~ CH4 and the sampling range is K1 ~ K100.

When the sampling range is set to K1, the values displayed in D9900~D9999 are current values.

You can use: 1. ES_AIO Configuration Function of WPLSoft or 2. FROM/TO instructions (CR#8 ~ CR#11) to set the sampling range as K1.

■ Adjust TC Conversion Curve

Users can adjust the conversion curves according to the actual needs by changing the Offset value (CR#28 ~ CR#31).

Offset in DVP04TC-E2: Deviation digital value from the target value.

- Equation for temperature measured Mode0 ~ Mode6: 0.1°

$$Y = \left(\frac{X(^{\circ})}{0.1(^{\circ})} - \text{Offset} \right)$$

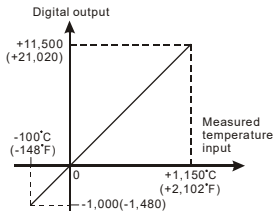
Y=Digital output, X=Measured input

- Equation for voltage input Mode7: 0.01mV = 80mV/8000

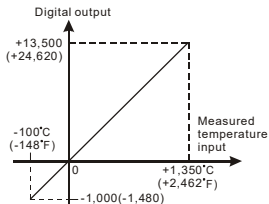
$$Y = \left(\frac{X(\text{mV})}{0.01(\text{mV})} - \text{Offset} \right)$$

Y=Digital output, X=Voltage input

- Mode 0: J-type thermocouple

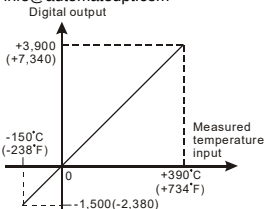
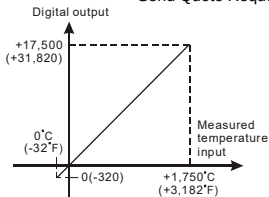


- Mode 1: K-type thermocouple



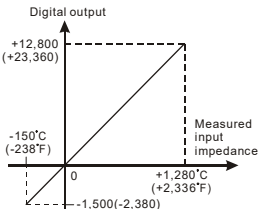
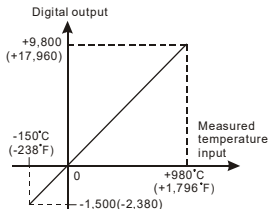
- Mode 2: R-type thermocouple
- Mode 3: S-type thermocouple

- Mode 4: T-type thermocouple



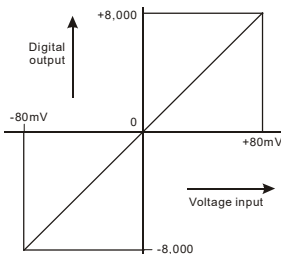
• Mode 5: E-type thermocouple

• Mode 6: N-type thermocouple



Mode 0 of CR#2~ CR#5	-100°C ~ 1150°C (-1000~11500) -148°F ~ 2102°F (-1480~21020)
Mode 1 of CR#2~ CR#5	-100°C ~ 1350°C (-1000~13500) -148°F ~ 2462°F (-1480~24620)
Mode 2, 3 of CR#2~ CR#5	0°C ~ 1750°C (0~17500) 32°F ~ 3182°F (320~31820)
Mode 4 of CR#2~ CR#5	-150°C ~ 390°C (-1500~3900) -238°F ~ 734°F (-2380~7340)
Mode 5 of CR#2~ CR#5	-150°C ~ 980°C (-1500~9800) -238°F ~ 1796°F (-2380~17960)
Mode 6 of CR#2~ CR#5	-150°C ~ 1280°C (-1500~12800) -238°F ~ 2336°F (-2380~23360)
Offset (CR#34 ~ CR#37)	Deviation digital value corresponds to 0°C/ °F

• Mode 7:



Mode 7 of CR#2~ CR#5	-80mV ~ +80mV (-8000~8000)
Offset (CR#34 ~ CR#37)	Deviation digital value corresponds to 0mv