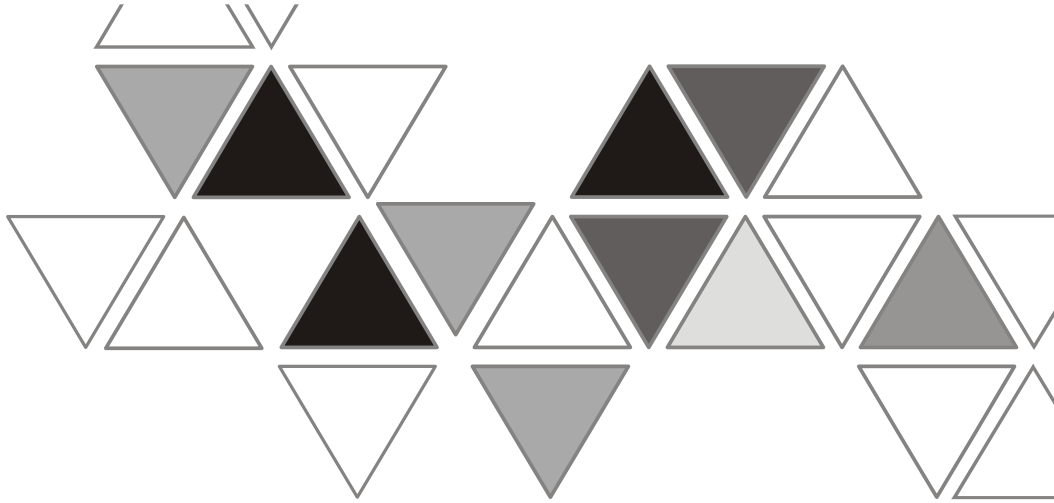




*DVP*04TC-E2

INSTRUCTION SHEET

安裝說明 安装说明

- ▲ *Temperature Measurement Module*
- ▲ 溫度量測模組
- ▲ 温度测量模块

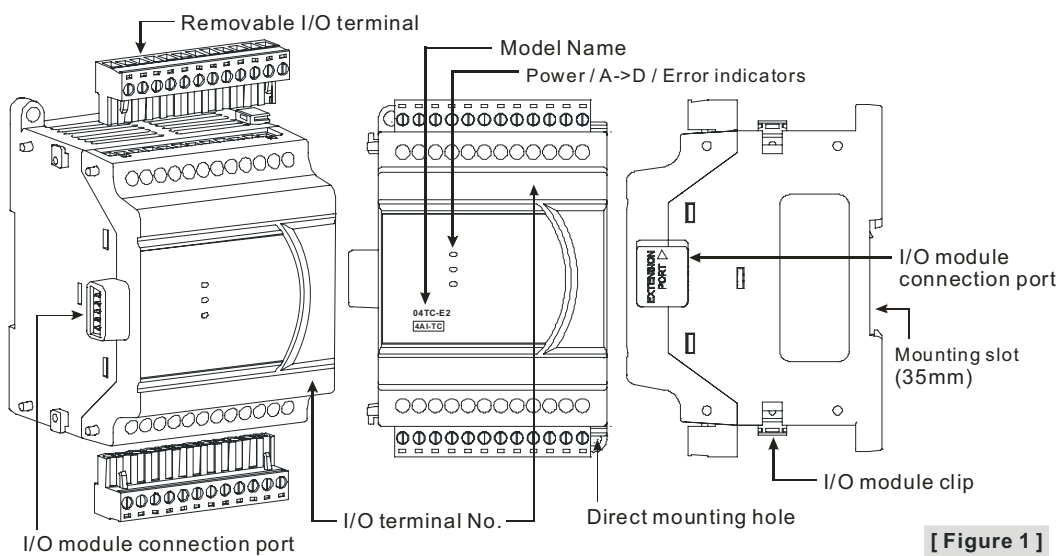


<http://www.delta.com.tw/industrialautomation>

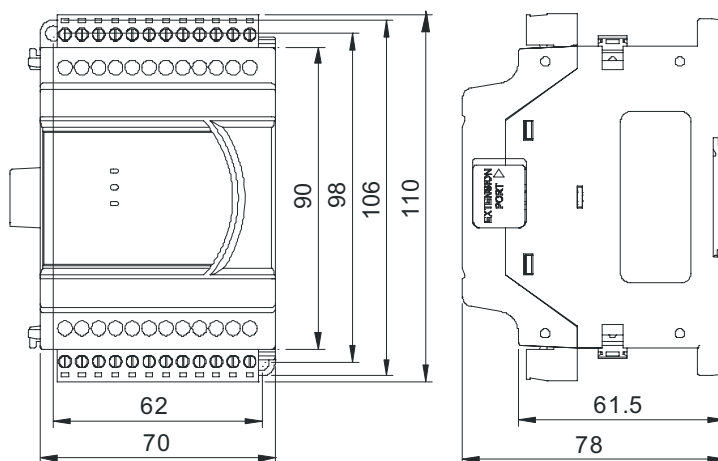
Thank you for choosing Delta's DVP series PLC. DVP04TC-E2 temperature measurement module receives 4 points of external thermocouple temperature sensors (J-type, K-type, R-type, S-type, T-type, E-type, N-type, $\pm 80\text{mV}$) and convert them into 16-bit digital signals. Users can select temperatures in Celsius (resolution: 0.1°C) or Fahrenheit (resolution: 0.1°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).

- ✓ This instruction sheet provides only information on the electrical specification, general functions, installation and wiring. For detailed program design and applicable instructions, please refer to "DVP-ES2 Operation Manual: Modules". For details of the optional peripheral, please refer to the instruction sheet enclosed in it.
- ✓ This is an OPEN TYPE I/O module 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 for operating the enclosure) in case danger and damage on the device may occur.
- ✓ DO NOT connect the 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. Make sure the ground terminal $\oplus$ is correctly grounded in order to prevent electromagnetic interference.

■ Product Profile & Dimension



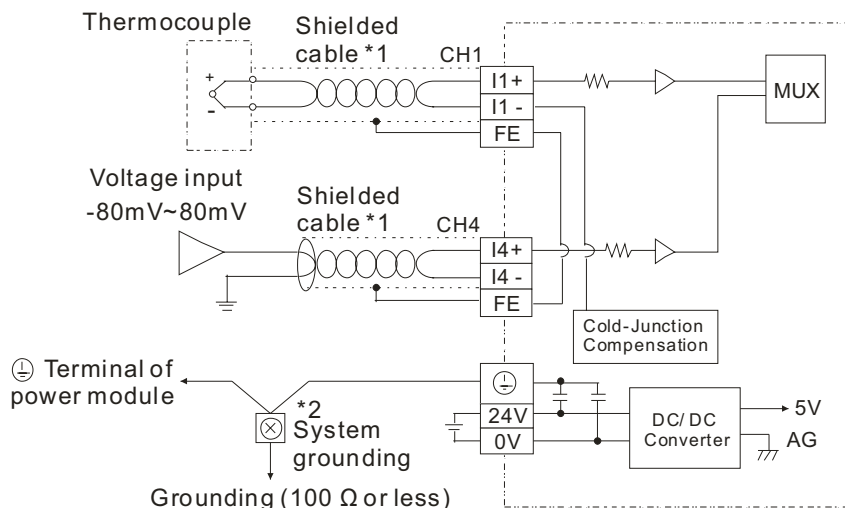
[Figure 1]



[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

I1+	I1-	FE	I2+	I2-	FE	I3+	I3-	FE	I4+	I4-	FE
DVP04TC-E2 (4AI)											
24V	0V	⊕	FE	FE	FE	FE	FE				

■ 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.), 50~95% (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		

DVP04TC-E2	Celsius (°C)	Fahrenheit (°F)	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: K0 ~ 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	16 bits (0.1°C)	16bits (0.1°F)	16 bits (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		

■ 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) 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) Mode 6 (H'0006): N-type (-150°C ~ 1,280°C) Mode 7 (H'0007): -80mV~+80mV Mode -1(H'FFFF): Close
#3	O	R/W	CH2 Input mode setting	
#4	O	R/W	CH3 Input mode setting	
#5	O	R/W	CH4 Input mode setting	
#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	

CR#	Attrib.		Register content	Description
#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
#42	X	R/W	Function: Return to default setting	Set all values to default setting, 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	Enable / Disable the upper and lower bound detection function. Default= H'0000.
#101	X	R/W	Upper and lower bound status	Display the upper and lower bound value, Default =H'0000
#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. Default = K-32000.
#109	O	R/W	Set value of CH2 lower bound	
#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)	Hardware 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

Description
<i>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</i>

• 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°

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

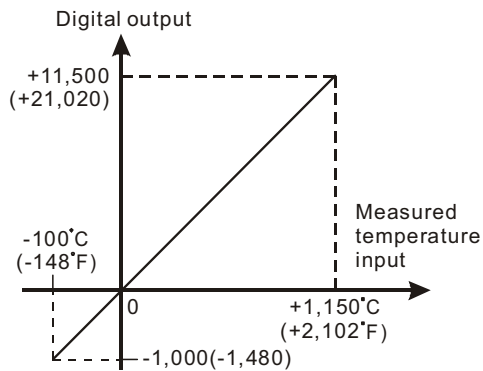
Y=Digital output, X=Measured input

- Equation for voltage input Mode7: $0.01\text{mV} = 80\text{mV}/8000$

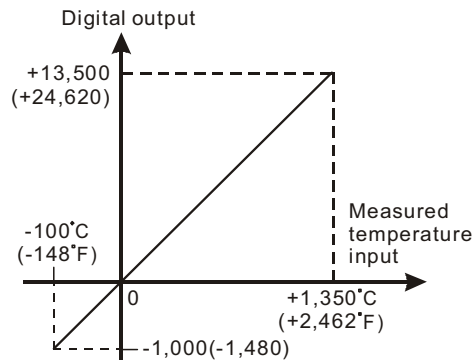
$$Y = \left(\frac{X(\text{mV})}{0.01(\text{mV})} - Offset \right)$$

Y=Digital output, X=Voltage input

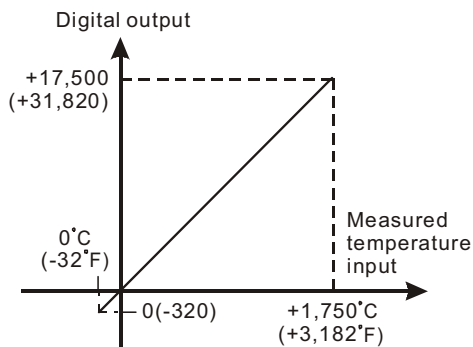
- Mode 0: J-type thermocouple



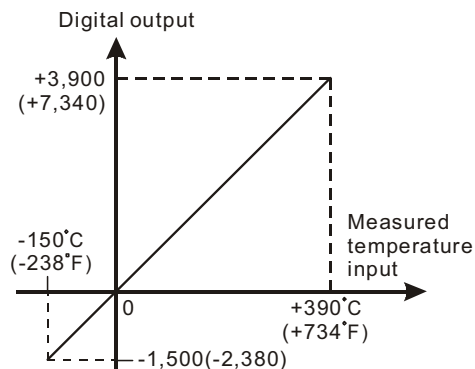
- Mode 1: K-type thermocouple



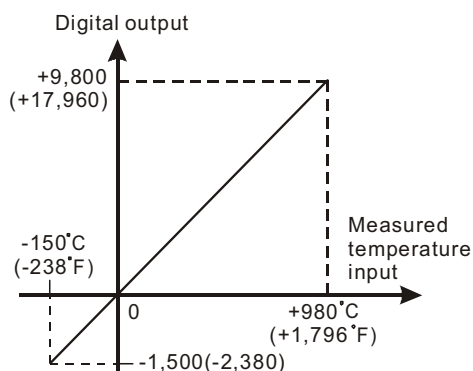
- Mode 2: R-type thermocouple
- Mode 3: S-type thermocouple



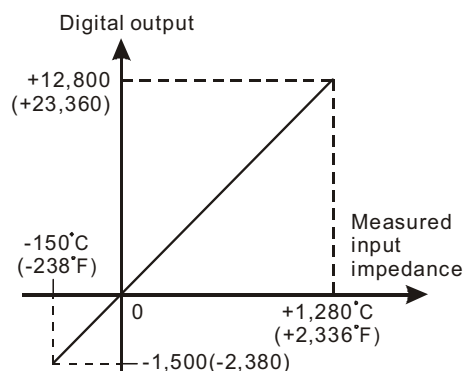
- Mode 4: T-type thermocouple



- Mode 5: E-type thermocouple

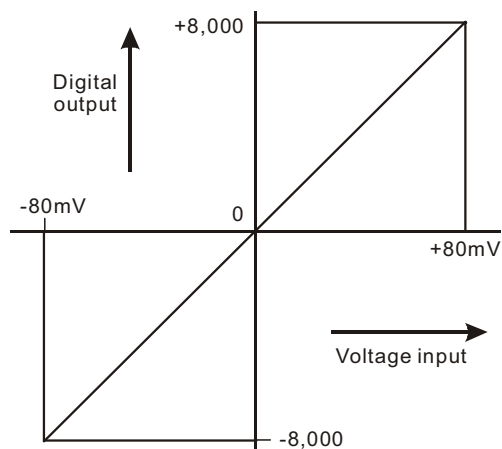


- Mode 6: N-type thermocouple



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