Powering Business Worldwide™

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5011699601-MPN1

Eaton Logic Controller

ELCM PT Temperature Modules

INSTRUCTION SHEET

[Applicable modules]

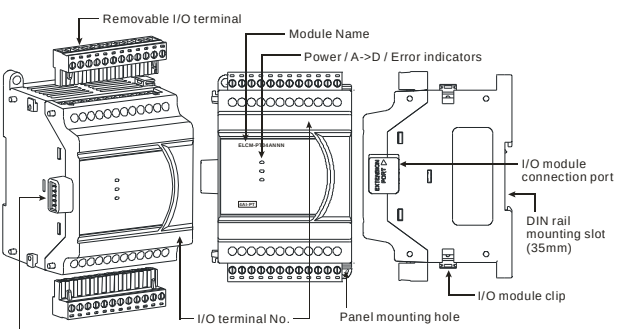
- ELCM-PT04ANNN

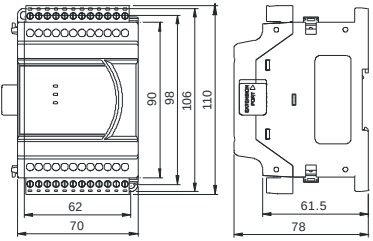
IL05004005E
002-1300520-02

The ELCM-PT04ANNN temperature measurement module supports 4 channels of platinum temperature sensors (PT100 3-WIRE 100Ω 3850 PPM/°C (DIN 43760 JIS C1604-1989)/ NI100 / PT1000 / NI1000) and converts these signals into 16-bit digital data. You can select the temperature to be displayed in Celsius (°C) or Fahrenheit (°F). Resolution of temperature in Celsius: 0.1°C and in Fahrenheit: 0.1°F. The data in the module may be accessed using the FROM/TO instructions, or you may read the average value of channels directly by using the 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. It should be read and understood before attempting to install or use the unit.
- Further information can be found in the “ELC Programming Manual” and “ELC Special Modules Operation Manual”.
- This module is a part of an OPEN TYPE control system. The ELCM should be kept in an enclosure away from airborne dust, humidity, electric shock risk and vibration. Your application may require that the enclosure be locked to prevent non-maintenance staff from operating the controller (e.g. key or specific tools that are required for opening the enclosure) in cases where danger and damage to equipment or personnel may occur. Do NOT touch the terminals while power is applied.
- DO NOT connect AC input power to any of the input terminals; otherwise serious damage may occur. Check all the wiring before switching on the power.
- Ensure the ground terminal ⏚ is correctly grounded in order to prevent electromagnetic interference.
- This manual is subject to change without notice.

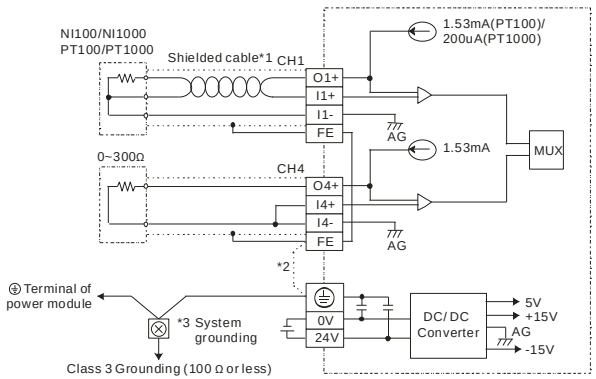
■ Product Profile & Dimension





Unit: mm

■ External Wiring



Note 1: Use cables specifically made for PT100 / PT1000 temperature sensors or use double shielded cables to minimize the effects of noise. Separate these inputs from other power cables that may cause interference. Please apply 3 wires for PT100 / PT1000. If a 2 wire sensor is used, please short-circuit I+ and I- terminals.

Note 2: Connect FE with ⏚ terminal if necessary for noise suppression.

Note 3: Connect the ⏚ terminal on both power supply and the ELCM-PT04ANNN to a proper system ground.

■ I/O Terminal Layout

O1+	I1+	I1-	FE	O2+	I2+	I2-	FE	O3+	I3+	I3-	FE
ELCM-PT04ANNN (4AI)											
24V	0V	⏚	FE	O4+	I4+	I4-	FE				

Note: Use 12-28 AWG single-core bare wire or multi-core (stranded) wire for the I/O wiring. The ELCM terminal screws should be tightened to 4.75 kg-cm (4.12 in-lbs) and please use 60/75°C copper conductor only.

■ Electrical Specifications

ELCM-PT04ANNN	
Power supply voltage	24VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%)
Max. rated power consumption	1.5W, supplied by external power source
Connector	IEC 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	IEC61131-2, IEC 68-2-6 (TEST Fc)/ IEC61131-2 & IEC 68-2-27 (TEST Ea)
Series connection to ELCM	The modules are numbered from 0 to 7 automatically by their distance from ELC. No.0 is the closest to ELCM. A maximum of 8 modules are allowed to connect to the ELCM.
Weight	202g

■ Functions Specifications

ELCM-PT04ANNN	Celsius (°C)	Fahrenheit (°F)	Input Impedance
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	3-WIRE PT100 / NI100 / PT1000 / NI1000, 0 ~ 300Ω input impedance		
Current excitation	1.53mA(PT100/NI100), 200uA (PT1000/NI1000)		
Range of input	PT100: -180°C ~ 800°C NI100: -80°C ~ 170°C PT1000: -180°C ~ 800°C NI1000: -80°C ~ 170°C	PT100: -292°F ~ 1,472°F NI100: -112°F ~ 338°F PT1000: -292°F ~ 1,472°F NI1000: -112°F ~ 338°F	0 ~ 300Ω
Range of digital conversion	PT100: K-1,800 ~ K8,000 NI100: K-800 ~ K1,700 PT1000: K-1,800 ~ K8,000 NI1000: K-800 ~ K1,700	PT100: K-2,920 ~ K14,720 NI100: K-1,120 ~ K3,380 PT1000: K-2,920 ~ K14,720 NI1000: K-1,120 ~ K3,380	0 ~ 3000
Resolution	16 bits (0.1°C)	16 bits (0.1°F)	16 bits (0.1Ω)
Average function	Supported. Available for setting up average times in CR#8 ~ CR#11. Range: K1 ~ K100.		
Self-diagnosis	Upper and lower bound detection in all channels		

ELCM-PT04ANNN	Celsius (°C)	Fahrenheit (°F)	Input Impedance
Isolation	Optical coupler isolation between digital circuits and analog circuits. No isolation among 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		

■ Control Register

CR#	Attrib.		Register content	Description
#0	O	R	Module name	Set up by the system: ELCM-PT04ANNN module code = H'0082
#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): PT100: -180°C ~ 800°C Mode 1 (H'0001): NI100: -80°C ~ 170°C Mode 2 (H'0002): PT1000: -180°C ~ 800°C Mode 3 (H'0003): NI1000: -80°C ~ 170°C Mode 4 (H'0004): 0~300Ω. Mode -1 (H'FFFF): Channel 1 unavailable
#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 average times	Set average times at CH1 ~ CH4 Range = K1 ~ K100 Default = K10
#9	O	R/W	CH2 average times	
#10	O	R/W	CH3 average times	
#11	O	R/W	CH4 average times	
#12	X	R	Average temperature measured at CH1	Average temperature measured at CH1 ~ CH3. Temperature unit: set in CR#7
#13	X	R	Average temperature measured at CH2	
#14	X	R	Average temperature measured at CH3	
#15	X	R	Average temperature measured at CH4	Average temperature measured at CH4. Temperature unit: set in CR#7
#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	

CR#	Attrib.		Register content	Description
#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: 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

Description					
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

- PID Control Registers

CR#				Attrib.		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. 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	Width of control output. Unit: ms
#133	#153	#173	#193	X	R	Output cycle	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 ELCM-PH/ELCM-PA controllers use expansion I/O modules, registers D9900~D9999 will be reserved for storing values from these modules. You can apply the MOV instruction to access values in D9900~D9999.

When ELCM-PH/ELCM-PA controllers use the ELCM-PT04ANNN, special registers are configured as shown 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	Module 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 average times is K1 ~ K100. When the average times is set to K1, the values displayed in D9900~D9999 are current values. You can use: 1. ELCM_AIO Configuration Function of ELCSoft or 2. FROM/TO instructions (CR#8 ~ CR#11) to set the average times as K1.

■ Adjust PT Conversion Curve

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

Offset in ELCM-PT04ANNN: Deviation digital value from the target value.

- Equation for temperature input Mode0 ~ Mode3: 0.1°

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

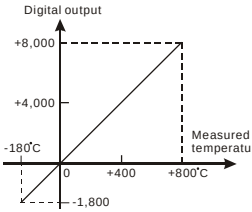
Y=Digital output, X=measured input temperature

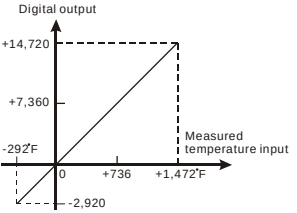
- Equation for input impedance Mode4: 0.1Ω = 300Ω/3,000

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

Y=Digital output, X=measured Input impedance

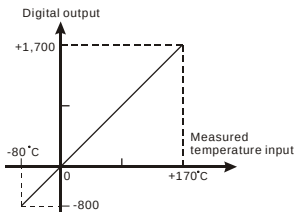
- Mode 0：
- Mode 2：



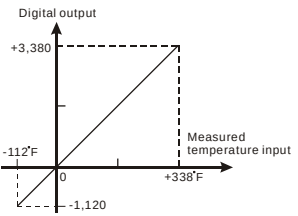


Mode 0, 2 of CR#2~ CR#5	-180°C ~ 800°C (-1800~8000), -292°F ~ 1472°F (-2920~14720)
Offset (CR#28 ~ CR#31)	Deviation digital value corresponds to 0°C/ °F

- Mode 1

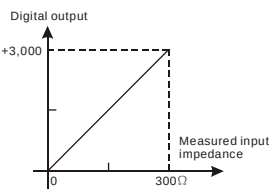


- Mode 3



Mode 1, 3 of CR#2~ CR#5	-80°C ~ 170°C (-800~1700) , -112°F ~ 338°F (-1120~3380)
Offset (CR#28 ~ CR#31)	Deviation digital value corresponds to 0°C/ °F

- Mode 4：



Mode 4 of CR#2 ~ CR#5	0 ~ 300Ω (0 ~ 3000)
Offset (CR#28 ~ CR#31)	Deviation digital value corresponds to 0Ω