Powering Business Worldwide™

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Eaton Logic Controller

ELCM Combination Analog Input/Output Modules

INSTRUCTION SHEET

[Applicable Combination Analog Input/Output modules]

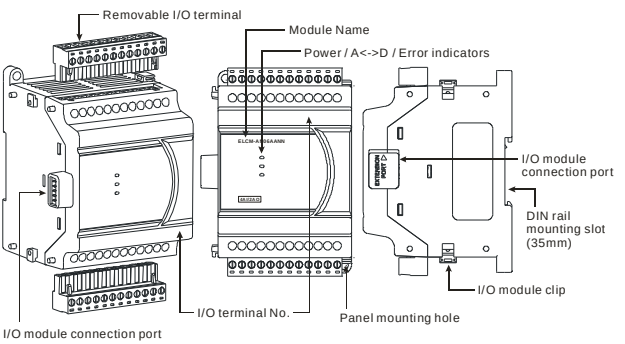
- ELCM-AN06AANN

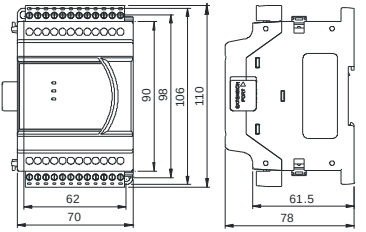
IL05004003E
002-1301220-02

The ELCM-AN06AANN combination analog input/output module supports 4 analog input channels (either voltage or current) and converts analog input signals into 16-bit digital data. For the analog outputs, the ELCM-AN06AANN supports 2 channels of 16-bit digital data from the ELCM and converts this digital data into analog output signals (either voltage or current). You can access the data in the module by using the FROM/TO instructions, and read the average value or write the output 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 module.
- Further information can be found in the “ELC Programming Manual” and “ELC Special Modules Operation Manual”.
- This analog I/O 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 power to any of the input terminals, as it will damage the modules. Check all wiring prior to power up.
- Ensure the ground terminal ⏚ is correctly grounded in order to prevent electromagnetic interference.
- This manual is subject to change without notice.

■ Product Profile & Dimension

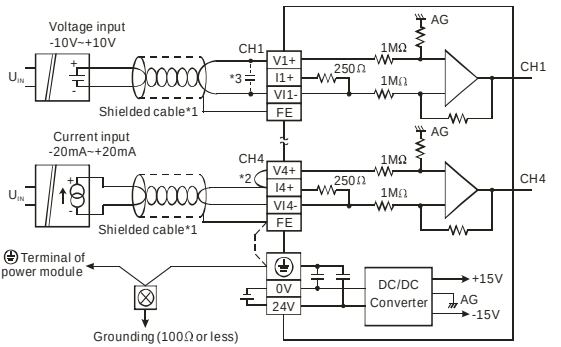




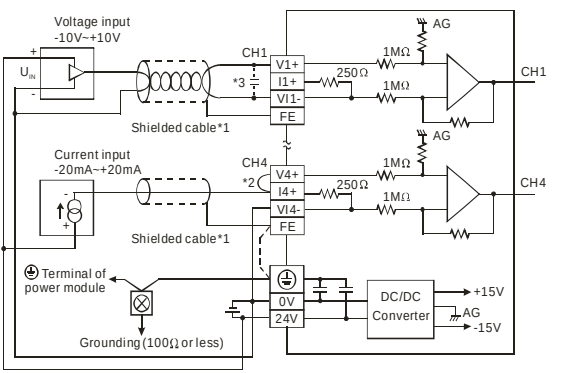
Unit: mm

■ External Wiring

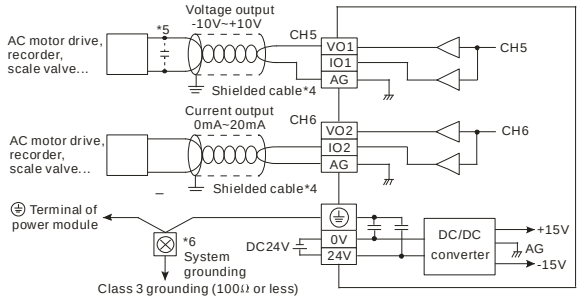
• Input: Active-type



• Input: Passive-type



• Output



Note 1: Please isolate analog input signals from power wiring.

Note 2: When the XA module analog input is connected to current signals, make sure you short-circuit "V+" and "I+" terminals.

Note 3: If the ripples at the loaded input terminal are large enough to cause noise interference on the wiring, connect a 0.1 ~ 0.47μF 25V capacitor as shown.

Note 4: Please isolate analog output signals from power wiring

Note 5: If the ripples at the loaded output terminal are large enough to cause noise interference on the wiring, connect a 0.1 ~ 0.47μF 25V capacitor as shown.

Note 6: Please connect the ⏚ terminal on both the power supply and the combination analog module to a suitable system earth ground

■ I/O Terminal Layout

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 4.75kg-cm (4.12 in-lbs) and please use 60/75°C copper conductor only.

■ Electrical Specifications

ELCM-AN06AANN	
Power supply voltage	24VDC (20.4VDC ~ 28.8VDC) (-15% ~ +20%)
Max. rated power consumption	2.5W, 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 ELC	The modules are numbered from 0 to 7 automatically by their distance from ELCM. A maximum of. 8 modules are allowed to connect to the ELCM.
Weight	213g

■ Functions Specifications

Common specifications	
Digital data format	2's complement of 16 bits
Response time	400 μs / each channel
Overall accuracy	±0.5% when in full scale within the range of (25°C, 77°F); ±1% when in full scale within the range of (0 ~ 55°C, 32 ~ 131°F)
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

Analog / Digital	Voltage input		Current input		
Analog input channel	4 channels / each module				
Range of analog input	±10V	±5V	±20mA	0 ~ 20mA	4 ~ 20mA
Range of digital conversion	±32,000	±32,000	±32,000	0 ~ 32,000	0 ~ 32,000
Min. / Max. range of digital data	±32,384	±32,384	±32,384	-384 ~+32,384	-384 ~+32,384
Hardware Resolution	14 bits	14 bits	14 bits	13 bits	13 bits
Input impedance	≧1MΩ		250Ω		
Range of absolute input	±15V		±32mA		
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				

Digital / Analog	Voltage output	Current output	
Analog output channel	2 channels / each module		
Range of analog output	-10V ~ 10V	0 ~ 20mA	4mA ~ 20mA
Range of digital conversion	-32,000 ~ +32,000	0 ~ +32,000	0 ~ +32,000
Max./Min. input range of digital data	-32,768 ~ +32,767	0 ~ +32,767	-6,400 ~ +32,767
Hardware Resolution	14 bits	14 bits	14 bits
Max. output current	5mA	—	
Tolerance load impedance	1KΩ ~ 2MΩ	0 ~ 500Ω	
Output impedance	0.5Ω or lower		
Protection	Voltage output is protected by short circuit. Short circuit lasting for too long may cause damage on internal circuits. Current output can be open circuit.		

■ Control Register

CR#	Attrib.		Register name	Explanation
#0	O	R	Module name	Set up by the system: ELCM-AN06AANN module code = H'00C4
#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): Voltage input (±10V) Mode 1 (H'0001): Voltage input (±5V) Mode 2 (H'0002): Voltage input (0 ~+10V) Mode 3 (H'0003): Voltage input (0 ~+5V) Mode 4 (H'0004): Current input (±20mA) Mode 5 (H'0005): Current input (0 ~+20mA) Mode 6 (H'0006): Current input (4 ~+20mA) 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	
#6	O	R/W	CH5 output mode setting	Output mode: Default = H'0000. Take CH5 for example: Mode 0 (H'0000):Voltage output (±10V) Mode 1 (H'0001):Current output (0~+20mA) Mode 2 (H'0002):Current output (4~+20mA) Mode -1 (H'FFFF):Channel 5 unavailable
#7	O	R/W	CH6 output mode setting	
#8	O	R/W	CH1 average times	Set average times in 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	CH1 average input value	Average value of input signals at CH1 ~ CH4
#13	X	R	CH2 average input value	
#14	X	R	CH3 average input value	
#15	X	R	CH4 average input value	
#16	X	R/W	CH5 output signal value	Voltage output range: K-32,000~K32,000. Current output range: K0~K32,000. Default: K0.
#17	X	R/W	CH6 output signal value	
#20	X	R	CH1 present input value	Present value of input signals at CH1 ~ CH4
#21	X	R	CH2 present input value	
#22	X	R	CH3 present input value	
#23	X	R	CH4 present input value	
#28	O	R/W	Adjusted Offset value of CH1	Set the adjusted Offset value of CH1 ~ CH4 Default = K0. Definition of Offset: The corresponding voltage (current) input value when the digital output value = 0
#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	

CR#	Attrib.		Register name	Explanation
#32	O	R/W	Adjusted Offset value of CH5	Set the adjusted Offset value of CH5 ~ CH6. Default = K0 Definition of Offset: The corresponding voltage (current) output value when the digital input value = 0
#33	O	R/W	Adjusted Offset value of CH6	
#34	O	R/W	Adjusted Gain value of CH1	Set the adjusted Gain value in CH1 ~ CH4.Default = K16,000. Definition of Gain: The corresponding voltage (current) input value when the digital output value = 16,000.
#35	O	R/W	Adjusted Gain value of CH2	
#36	O	R/W	Adjusted Gain value of CH3	
#37	O	R/W	Adjusted Gain value of CH4	
#38	O	R/W	Adjusted Gain value of CH5	Set the adjusted Gain value of CH5 ~ CH6. Default = K16,000. Definition of Gain: The corresponding voltage (current) output value when the digital input value = 16,000
#39	O	R/W	Adjusted Gain value of CH6	
#40	O	R/W	Set value changing prohibited	Prohibit set value changing in CH1 ~ CH4 Default= H'0000.
#41	X	R/W	Save all the set values	Save all the set values, Default = H'0000
#42	X	R/W	Return to default setting	Set all values to default setting, Default = H'0000
#43	X	R	Error status	Register for storing all error status. Refer to table of error status for more information.
#100	O	R/W	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~CH6 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	
#106	O	R/W	Set value of CH5 upper bound	
#107	O	R/W	Set value of CH6 upper bound	
#108	O	R/W	Set value of CH1 lower bound	Set value of CH1~CH6 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	
#112	O	R/W	Set value of CH5 lower bound	
#113	O	R/W	Set value of CH6 lower bound	
#114	O	R/W	Output update time of CH5	Set output update time of CH5 ~ CH6
#115	O	R/W	Output update time of CH6	

CR#	Attrib.		Register name	Explanation
#118	O	R/W	LV output mode setting of Ch5 ~ Ch6	Set the output mode of CH5~CH6 when the power is at LV (low voltage) condition. Default=0
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 using the FROM instruction. W: able to write data using the TO instruction.				

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

Description					
bit0	K1 (H'1)	Power supply error	bit7	K128 (H'80)	CH5 Conversion error
bit1	K2 (H'2)	Hardware error	bit8	K256 (H'100)	CH6 Conversion error
bit2	K4 (H'4)	Upper / lower bound error	bit9	K512(H'0200)	Mode setting error
bit3	K8 (H'8)	CH1 Conversion error	bit10	K1024(H'0400)	Sampling range error
bit4	K16 (H'10)	CH2 Conversion error	bit11	K2048(H'0800)	Upper / lower bound setting error
bit5	K32 (H'20)	CH3 Conversion error	bit12	K4096(H'1000)	Set value changing prohibited
bit6	K64 (H'40)	CH4 Conversion error	bit13 ~ bit15		Reserved
Note: Each error status is determined by the corresponding bit (b0 ~ b15) and there may be more than 2 errors occurring at the same time. 0 = normal; 1 = error					

■ Explanation on Special Registers D9900~D9999

When ELCM-PH/PA is connected with modules, registers D9900~D9999 will be reserved for storing values from those modules. You can apply the MOV instruction to access values in D9900~D99999.

When ELCM-PH/ELCM-PA controllers use ELCM-AN06AANN combination analog input/output modules, 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 input value
D9901	D9911	D9921	D9931	D9941	D9951	D9961	D9971	CH2 average input value
D9902	D9912	D9922	D9932	D9942	D9952	D9962	D9972	CH3 average input value
D9903	D9913	D9923	D9933	D9943	D9953	D9963	D9973	CH4 average input value
D9904	D9914	D9924	D9934	D9944	D9954	D9964	D9974	CH5 output value
D9905	D9915	D9925	D9935	D9945	D9955	D9965	D9975	CH6 output value

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 A/D Conversion Curve

Users can adjust the conversion curves according to the actual needs by changing the Offset value (CR#28 ~ CR#31) and Gain value (CR#34 ~ CR#37).

Gain: The corresponding voltage/current input value when the digital output value = 16,000.

Offset: The corresponding voltage/current input value when the digital output value = 0.

- Equation for voltage input Mode0 / Mode2: 0.3125mV = 20V/64,000 = 10V/32,000

$$Y = 16000 \times \left(\frac{X(V)}{10(V)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output,
X=Voltage input

- Equation for voltage input Mode1 / Mode3: 0.15625mV = 10V/64,000 =

$$Y = 16000 \times \left(\frac{X(V)}{5(V)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output,
X=Voltage input

- Equation for current input Mode4 / Mode5: 0.625μA = 40mA/64,000 = 20mA/32,000

$$Y = 16000 \times \left(\frac{X(mA)}{20(mA)} \times 32000 - Offset \right) \Big/ (Gain - Offset)$$

Y=Digital output,
X=Current input

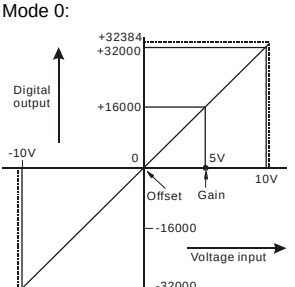
- Equation for current input Mode6: 0.5μA = 16mA/32,000

  Adopt the equation of current input mode4/mode5, substitute Gain for 19,200 (12mA) and Offset for 6,400 (4mA)

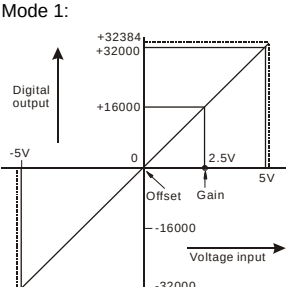
$$Y = 16000 \times \left(\frac{X(mA)}{20(mA)} \times 32000 - 6400 \right) \Big/ (19200 - 6400)$$

Y=Digital output,
X=Current input

- Mode 0:

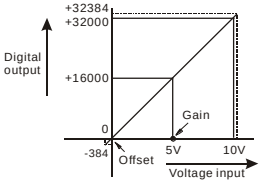


- Mode 1:

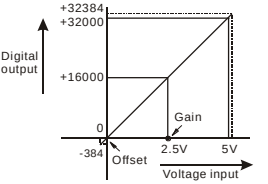


Mode 0 of CR#2 ~ CR#5	±10V, Gain = 5V (16,000), Offset = 0V (0)
Mode 1 of CR#2 ~ CR#5	±5V, Gain = 2.5V (16,000), Offset = 0V (0)
Range of digital conversion (Max./Min.)	±32,000 (±32,384)

• Mode 2:

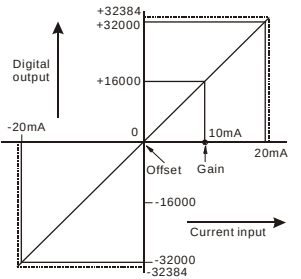


• Mode 3:



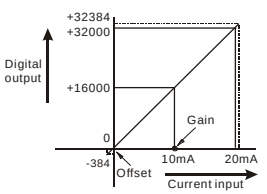
Mode 2 of CR#2 ~ CR#5	0 ~ +10V, Gain = 5V (16,000), Offset = 0V (0)
Mode 3 of CR#2 ~ CR#5	0 ~ +5V, Gain = 2.5V (16,000), Offset = 0V (0)
Range of digital conversion (Max./Min.)	0 ~ +32,000 (-384 ~ +32,384)

• Mode 4:

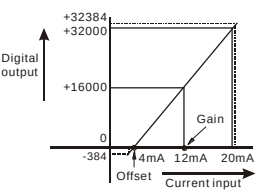


Mode 4 of CR#2 ~ CR#5	±20mA, Gain = 10mA (16,000), Offset = 0mA (0)
Range of digital conversion (Max./Min.)	±32,000 (±32,384)

• Mode 5:



• Mode 6:



Mode 5 of CR#2 ~ CR#5	0 ~ +20mA, Gain = 10mA (16,000), Offset = 0mA (0)
Mode 6 of CR#2 ~ CR#5	+4 ~ +20mA, Gain = 12mA (19,200), Offset = 4mA (6,400)
Range of digital conversion (Max./Min.)	0 ~ +32,000 (-384 ~ +32,384)

■ Adjust D/A Conversion Curve

Users can adjust the conversion curves according to the actual needs by changing the Offset value (CR#32 ~ CR#33) and Gain value (CR#38 ~ CR#39).

Gain: The corresponding voltage/current output value when the digital input value = 16,000.

Offset: The corresponding voltage/current output value when the digital input value = 0.

- Equation for voltage output Mode0: 0.3125mV = 20V/64,000

$$Y(V)=\left[\frac{X\times(Gain-Offset)}{16000}+Offset\right]\times\left(\frac{10(V)}{32000}\right)$$

Y=Voltage output,
X=Digital input

- Equation for current output Mode1: 0.625μA = 20mA/32,000

$$Y(mA)=\left[\frac{X\times(Gain-Offset)}{16000}+Offset\right]\times\left(\frac{20(mA)}{32000}\right)$$

Y=Current output,
X=Digital input

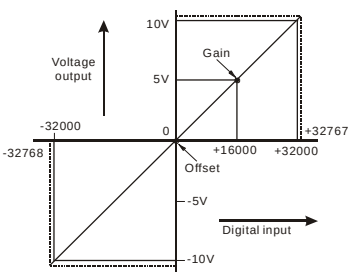
- Equation for current output Mode2: 0.5μA = 16mA/32,000

  Adopt the equation of current output Mode 1, substitute Gain for 19,200(12mA) and Offset for 6,400(4mA)

$$Y(mA)=\left[\frac{X\times(19200-6400)}{16000}+6400\right]\times\left(\frac{20(mA)}{32000}\right)$$

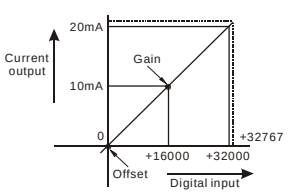
Y=Current output,
X=Digital input

- mode 0:



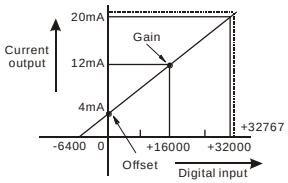
Mode 0 (CR#2 ~ CR#5)	±10V, Gain = 5V (16,000), Offset = 0V (0)
Range of digital conversion (Max./Min.)	±32,000 (-32,768 ~ +32,767)

- mode 1:



Mode 1 (CR#2 ~ CR#5)	0 ~ +20mA，Gain = 10mA (16,000), Offset = 0mA (0)
Range of digital conversion (Max./Min.)	0 ~ +32,000 (0 ~ +32,767)

- mode 2:



Mode 2 (CR#2 ~ CR#5)	4 ~ +20mA，Gain = 12mA (19,200), Offset = 4mA (6,400)
Range of digital conversion (Max./Min.)	0 ~ +32,000 (-6400 ~ +32,767)