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5011698901-PHA1

Eaton Logic Controller

ELCM Controllers

INSTRUCTION SHEET

[Applicable Controllers]

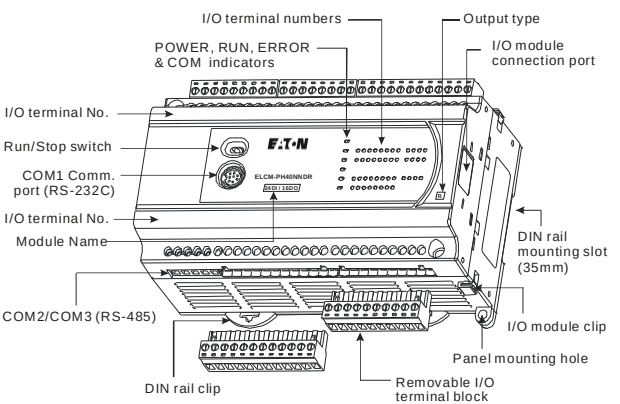
- ELCM-PH16NNDR
- ELCM-PH16NNDT
- ELCM-PH24NNDR
- ELCM-PH24NNDT
- ELCM-PH32NNDR
- ELCM-PH32NNDT
- ELCM-PH40NNDR
- ELCM-PH40NNDT
- ELCM-PA20AADR
- ELCM-PA20AADT

IL05001006E
002-1300020-02

Thank you for choosing this Eaton Logic Controller (ELC). The ELCM-PH/PA series has controllers with 16 to 40 embedded I/O points and are expandable using 8 to 16 point digital I/O modules. The maximum number of I/O points, including those on the controller is 256. ELCM-PH/PA controllers can be configured with different mixes of digital, analog, and specialty I/O, to suit a wide variety of applications.

- 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 series Programming Manual.
- These are OPEN TYPE controllers and therefore should be installed in an enclosure free of airborne dust, humidity, electric shock and vibration. Your application may require that the enclosure be locked to prevent non-maintenance staff from operating the controllers (e.g. key or specific tools that are required for operating the enclosure) in cases where danger and damage to equipment or personnel may occur.
- DO NOT connect AC power to any of the DC I/O terminals; serious damage may occur. Check all wiring before switching on power.
- Ensure that the ground terminal ⏚ is properly grounded in order to prevent electromagnetic interference.
- This manual is subject to change without notice.

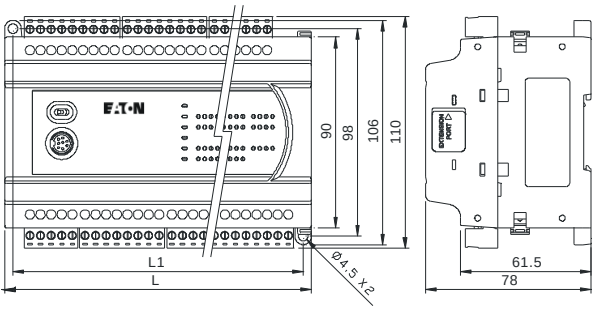
■ Product Profile



Note: The above figure is the layout of ELCM-PH40NNDR.

■ Dimensions

ELCM-	PH16NNDR/T	PH24NNDR/T	PH32NNDR/T	PH40NNDR/T	PA20AADR/T
L	105	125	145	165	145
L1	97	117	137	157	137



Unit: mm

■ Electrical Specifications

ELCM- / Item	PH16NND R/T	PH24NND R/T	PH32NND R/T	PH40NND R/T	PA20AAD R/T
Power supply voltage	100 ~ 240VAC (-15% ~ 10%), 50/60Hz ± 5%				
Connector	IEC standard removable terminal block (Pin pitch: 5mm)				
Operation	ELCM-PH/PA starts to run when the power rises to 95 ~ 100VAC and stops when the power drops to 70VAC. If the power is suddenly lost, the controller will continue running for 10ms.				
Power supply fuse	2A/250VAC				
Power consumption	30VA				
DC24V current output	500mA				
Power supply protection	24VDC output short circuit protection				
Voltage withstand	1,500VAC (Primary-secondary), 1,500VAC (Primary-PE), 500VAC (Secondary-PE)				
Insulation resistance	> 5MΩ at 500VDC (between all I/O points and ground)				
Noise immunity	ESD: 8KV Air Discharge EFT: Power Line: 2KV, Digital I/O: 1KV, Analog & Communication I/O: 1KV RS: 26MHz ~ 1GHz, 10V/m				
Grounding	The diameter of grounding wire shall not be less than that of L, N terminal of the power supply. (When many ELCs are in use at the same time, please make sure every ELC is properly grounded.)				
Environment	Operation: 0°C~55°C (temperature), 50~95% (humidity), pollution degree 2 Storage: -25°C~70°C (temperature), 5~95% (humidity)				
Vib. / shock resistance	IEC61131-2, IEC 68-2-6 (TEST Fc)/ IEC61131-2 & IEC 68-2-27 (TEST Ea)				
Weight	R: 377g T: 351g	R: 414g T: 387g	R: 489g T: 432g	R: 554g T: 498g	R: 462g T: 442g

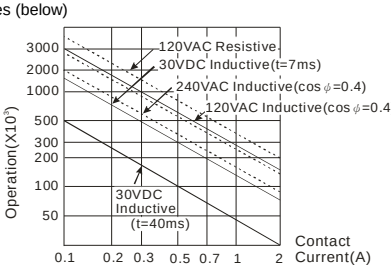
Input Point				
Input point type		Digital input		
Input type		DC (SINK or SOURCE)		
Input current		24VDC, 5mA		
Action level	Input No.	X0, X2	X1, X3 ~ X7	X10 ~ X17, X20 ~ #1
	Off → On	>15VDC		
	On → Off	< 5VDC		
Response time	Off → On	2.5μs	20μs	10ms
	On → Off	5μs	50μs	10ms
Filter time	X0 ~ X7	Adjustable within 0 ~ 20ms in D1020 (Default: 10ms)		
Input impedance		4.7KΩ		

Output Point					
Output point type		Relay-R	Transistor-T		
Output point number		All	Y0, Y2	Y1, Y3	Y4 ~ Y17, Y20 ~ #1
Voltage specification		< 250VAC, 30VDC	5 ~ 30VDC #2		
Maximum load	Resistive	2A/1 point (5A/COM)	0.5A/1 point (4A/ZP)		
	Inductive	#3	12W (24VDC)		
	Lamp	20WDC/100WAC	2W(24VDC)		
Response time	Off → On	Approx .10ms	2μs	20μs	100μs
	On → Off		3μs	30μs	100μs

#1: Please refer to "I/O Terminal Layout" for the max. X/Y No. on each controller.

#2: UP, ZP must work with external auxiliary power supply 24VDC (-15% ~ +20%), rated consumption approx. 1mA/point.

#3: See life curves (below)



A/D and D/A Specifications (For ELCM-PA Controller Only)

Items	Analog Input (A/D)			Analog Output (D/A)		
	Voltage	Current		Voltage	Current	
Analog I/O range	±10V	±20mA	4 ~ 20mA	±10V	0 ~ 20mA	4 ~ 20mA
Digital conversion range	±2,000			±2,000	0 ~ +4,000	
Resolution #1	12-bit					

Items	Analog Input (A/D)		Analog Output (D/A)	
	Voltage	Current	Voltage	Current
Input impedance	> 1MΩ	250Ω	-	
Output impedance	-		0.5Ω or lower	
Tolerance carried impedance	-		> 5KΩ	< 500Ω
Overall accuracy	Non-linear accuracy: ±1% of full scale within the range of ELC operation temperature Maximum deviation: ±1% of full scale at 20mA and +10V			
Response time	2ms (set up in D1118) #2		2ms #3	
Absolute input range	±15V	±32mA	-	
Digital data format	2's complement of 16-bit, 12 significant bits			
Average function	Provided (set up in D1062) #4		-	
Isolation method	No Isolation between digital circuit and analog circuit			
Protection	Voltage output has short circuit protection, but a long period of short circuit may cause internal wire damage and open circuit of current output.			

#1: Resolution formula

Analog Input (A/D)		Analog Output (D/A)	
Voltage	Current	Voltage	Current
$(5mV = \frac{20V}{4000})$	$(10\mu A = \frac{40mA}{4000})$	$(5mV = \frac{20V}{4000})$	$(5\mu A = \frac{20mA}{4000})$

#2: When the scan period is longer than 2ms or the set value, the setting will follow the scan period.

#3: When the scan period is longer than 2ms, the setting will follow the scan period.

#4: When the average times is "1", the present value will be read.

■ Power Budgeting

◆ Supply Current and Current Consumption of Controller (+24VDC)

Item / Controller	Internal Supply Current #1 (mA)	External Supply Current #2 (mA)	Internal BUS Max Current Consumption (mA)	External I/O Max Current Consumption (mA)
ELCM-PH16NNDR	500	500	85	40
ELCM-PH16NNDT			50	48
ELCM-PH24NNDR			85	80
ELCM-PH24NNDT			50	88
ELCM-PH32NNDR			130	80
ELCM-PH32NNDT			60	96
ELCM-PH40NNDR			130	120
ELCM-PH40NNDT			60	136
ELCM-PA20AADR			240	40
ELCM-PA20AADT			220	46

#1: Internal Supply Current supplied: Internal BUS Max Current Consumption + Internal IO-BUS Max Current Consumption.

#2: External Supply Current supplied: External I/O Max Current Consumption + External I/O Max Current Consumption for Expansion modules

◆ Current Consumption of Expansion Modules (+24VDC)

Item / Module	Internal IO-BUS Max Current Consumption (mA)	External I/O Max Current Consumption (mA)
ELCM-EX08NNDN	10	40
ELCM-EX08NNDR	30	20
ELCM-EX08NNDT	10	24
ELCM-EX08NNNR	50	0
ELCM-EX08NNNT	10	8
ELCM-EX16NNDN	15	80
ELCM-EX16NNDR	15	80
ELCM-EX16NNDT		48
ELCM-EX16NNNR	15	80
ELCM-EX16NNNT		16
ELCM-AN04ANNN	28	40
ELCM-AN02NANN		80
ELCM-AN04NANN		120
ELCM-AN06AANN		95
ELCM-PT04ANNN		40
ELCM-TC04ANNN		30

◆ Calculating System Current Consumption

Example: ELCM-PH32NNDR + ELCM-EX08NNNR x 3 + ELCM-AN04ANNN + ELCM-AN04NANN

Item / Controller	Internal Current Consumption (mA)	External Current Consumption (mA)
ELCM-PH32NNDR	130	80
ELCM-EX08NNNR	50	0
ELCM-EX08NNNR	50	0
ELCM-EX08NNNR	50	0
ELCM-AN04ANNN	28	40
ELCM-AN04NANN	28	120
Total	336	200

System Current Consumption:

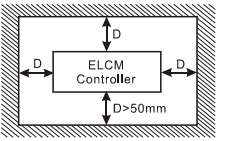
Internal → 130 + (50 x 3) + 28 + 28 = 336 (mA), < 500(mA) OK

External → 80 + 0 + 40 + 120 = 240 (mA), < 500(mA) OK

■ Installation

Please install the ELCM in an enclosure with sufficient space around it to allow for proper ventilation, as shown in the figure.

- **DIN Rail Mounting:** When mounting the ELCM to 35mm DIN rail, be sure to use the retaining clip to stop any side-to-side movement of the ELCM and reduce the chance of wires becoming loose. The retaining clip is at the bottom of the ELCM. To secure the ELCM to DIN rail, pull down the clip, place it onto the rail and gently push the clip up. To remove the ELCM, pull the retaining clip down with a flat screwdriver and gently remove the ELCM from DIN rail.



■ Wiring

1. 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) using 60/75°C copper conductor only.
2. DO NOT wire empty terminals. DO NOT place input signal wires and power wires in the same wiring circuit.
3. DO NOT drop tiny metallic conductors into the ELCM while installing the controller or other equipment.
   - Please attach the dustproof sticker to the ELCM before installing to prevent conductive objects from dropping in.
   - Tear off the sticker before running the ELCM to ensure proper ventilation.

◆ Power Supply

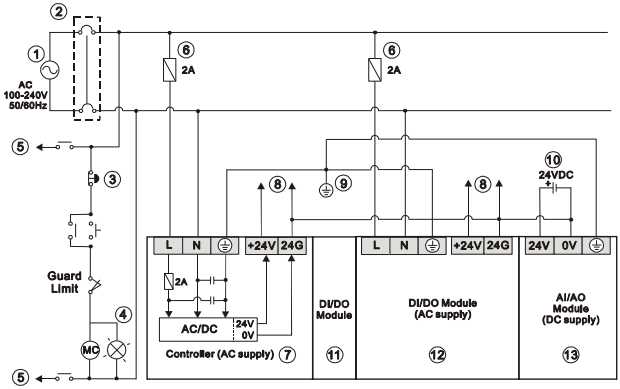
The power input type for ELCM-PH/PA controllers is AC. When operating ELCM-PH/PA controllers, please note the following:

1. The range of the input voltage should be 100 ~ 240VAC (nominal). The power supply should be connected to L and N terminals. Please note: wiring 110VAC or 220VAC to +24V output terminal or any of the digital input points will result in serious damage to the ELCM.
2. The AC power inputs for the controller and the digital I/O modules should be ON or OFF at the same time.
3. Use 1.6mm wire (or larger) for the grounding of the ELCM.
4. A power loss for less than 10ms will not affect the operation of the ELCM. However, longer power loss or a sustained drop of power supply voltage will stop the running of the ELCM, and all outputs will turn “OFF”. When proper power is restored, the ELCM will resume operation. (Please keep this in mind when you use latched auxiliary relays and registers in your ELCM program.)
5. The +24V output is rated at 0.5A from the controller. DO NOT connect other external power supplies to this terminal. Every input terminal requires 5 to 7mA to be driven; e.g. the 16 point input will require approximately 100mA. Therefore, +24V terminal cannot support an external load that is more than 400mA.

◆ Safety Wiring

In an ELCM control system, many devices are controlled at the same time and actions of any device could influence another device, i.e. breakdown of

any device may cause the breakdown of the entire control system. Therefore, we suggest you wire a protection circuit at the power supply input terminal. See the figure below.



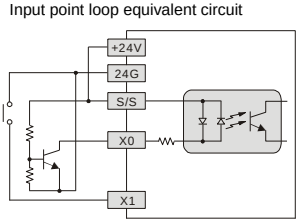
① AC power supply:100 to 240VAC, 50/60Hz	② Breaker
③ Emergency stop: This button cuts off the system power supply when accidental emergency takes place.	
④ Power indicator	⑤ AC power supply load
⑥ Power supply circuit protection fuse (2A)	⑦ ELCM (main processing unit)
⑧ DC Sensor power supply output: 24VDC, 500mA	⑨ Grounding resistance: < 100Ω
⑩ DC power supply: 24VDC	⑪ Digital I/O module (DC supply)
⑫ Digital I/O module (AC supply)	⑬ Analog I/O module (DC supply)

◆ I/O Point Wiring

There are 2 types of DC inputs, SINK and SOURCE. (See the examples below. For detailed wiring configuration, please refer to the specification of each controller.)

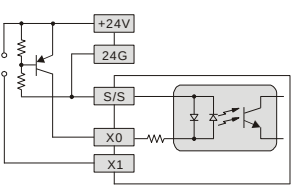
- DC Signal IN – SINK mode

Input point loop equivalent circuit

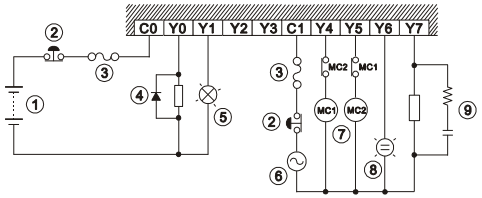


- DC Signal IN – SOURCE mode

Input point loop equivalent circuit



- Relay (R) output circuit wiring



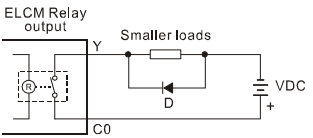
① DC power supply

② Emergency stop: Use an external switch

③ Fuse: Use 5 to 10A fuse at the shared terminal of output contacts to protect the output circuit

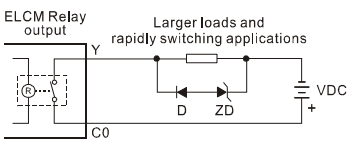
④ Transient voltage suppressor: To extend the life span of relay contacts.

1. Diode suppression of DC load: Used with smaller loads.



D: 1N4001 diode or equivalent component

2. Diode + Zener suppression of DC load: Used with larger loads, and for rapidly switching applications.



D: 1N4001 diode or equivalent component
ZD: 9V Zener, 5W

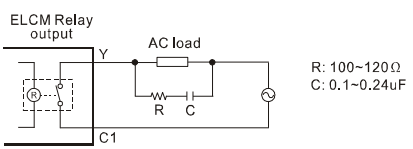
⑤ Incandescent light (resistive load)

⑥ AC power supply

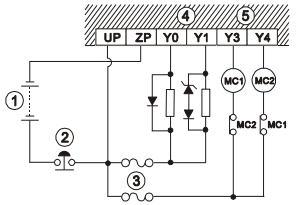
⑦ Mutually exclusive output: For example, Y4 and Y5 control the forward running and reverse running of the motor, forming an interlock for the external circuit, together with the ELCM internal program, to ensure safe operation in case of any unexpected errors.

⑧ Neon indicator

⑨ Suppressor: To reduce the interference on AC load.



• Transistor (T) output circuit wiring

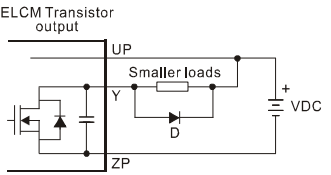


① DC power supply ② Emergency stop

③ Circuit protection fuse

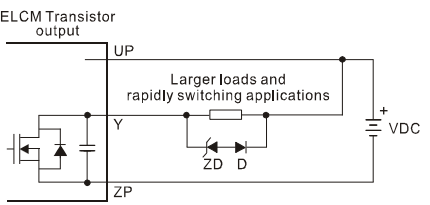
④ The output of the transistor is “open collector”. If Y0/Y1 is set to pulse output, the output current has to be 0.05 ~ 0.5A to ensure normal operation of the output.

1. Diode suppression: Used for smaller loads.



D: 1N4001 diode or equivalent component

2. Diode + Zener suppression: Used with larger loads, and for rapidly switching applications.

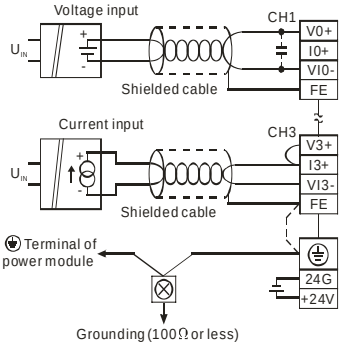


D: 1N4001 diode or equivalent component
ZD: 9V Zener, 5W

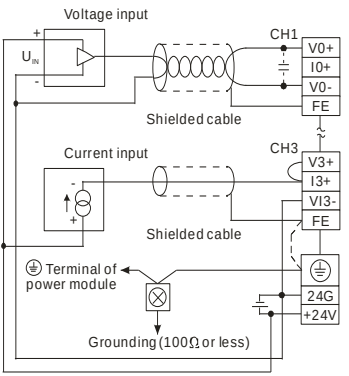
⑤ Mutually exclusive output: For example, Y3 and Y4 control the forward running and reverse running of the motor, forming an interlock for the external circuit, together with the ELCM internal program, to ensure safe operation in case of any unexpected errors.

◆ A/D and D/A External Wiring (For ELCM-PA Controller Only)

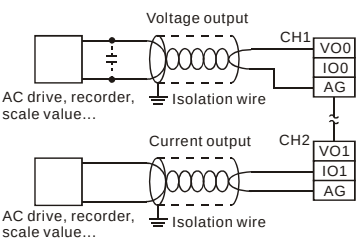
• A/D: Active



• A/D: Passive



• D/A



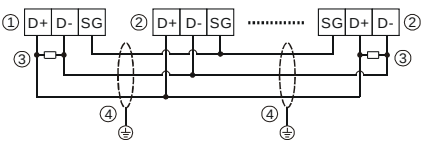
Note: When the analog to digital module is connected to current signals, make sure to short-circuit “V+” and “I+” terminals as shown above.

◆ A/D and D/A Analog Function (For ELCM-PA Controller Only)

Default of analog input average times is K2. If set value = K1, ELCM takes the present value.

Device	Function
D1062	Average times of AD (CH0 ~ CH3): 1 ~ 20, Default = K2
D1110	Average value of analog input channel 0 (AD 0)
D1111	Average value of analog input channel 1 (AD 1)
D1112	Average value of analog input channel 2 (AD 2)
D1113	Average value of analog input channel 3 (AD 3)
D1115	Analog mode selection, 0: voltage, 1: current (Default: voltage) bit0 ~ bit3 refer to AD0 ~ AD3 bit4 ~ bit5 refer to DA0, DA1
	Current mode selection: bit8 ~ bit11 refer to AD0 ~ AD3, 0: -20mA ~ 20mA, 1: 4 ~ 20mA bit12, bit13 refer to DA0 ~ DA1, 0: 0~20mA, 1: 4 ~ 20mA
D1116	Analog output channel 0 (DA 0)
D1117	Analog output channel 1 (DA 1)
D1118	Analog input filter setting (ms) Sampling time of analog/digital conversion sampling time will be regarded as 2ms If D1118≦2

◆ RS-485 Wiring

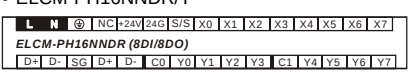


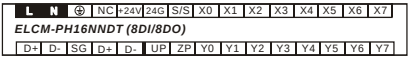
① Master node	② Slave node
③ Terminal resistor	④ Shielded cable

Note: 1. Terminal resistors are recommended on the master and the last slave with a resistor value of 120Ω.
2. To ensure communication quality, please use double shielded twisted pair cable (20AWG) for wiring.
3. When voltage drop occurs between the internal ground references of two systems, connect the Signal Ground point (SG) to reduce the potential between systems so that stable communications can be obtained.

■ I/O Terminal Layouts

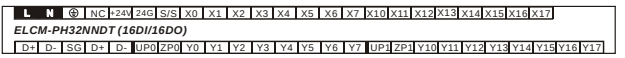
• ELCM-PH16NNDR/T



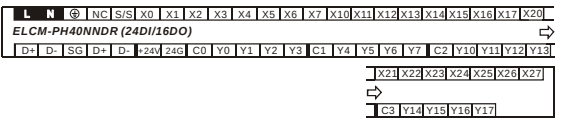


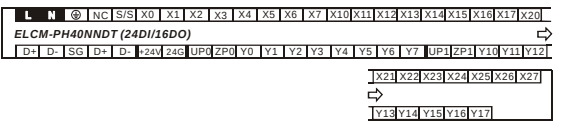
- ELCM-PH24NNDR/T

- ELCM-PH32NNDR/T



- ELCM-PH40NNDR/T





- ELCM-PA20AADR/T