



ELC-PC12NNDR/T ELC-PC12NNAR

Instruction Sheet

Logic Controller with Multi-Function,
Multiple Commands

⚠ WARNING

- This Instruction Sheet only provides descriptions for electrical specifications, general specifications, installation & wiring, troubleshooting and peripherals. Other detail information about programming and commands is compatible with ELC-PC/PA/PH series; please see ELC Application Manual. For more information about the optional peripherals, please see individual product manual.
- This is an OPEN TYPE Controller. The ELC should be kept in an enclosure away from airborne dust, humidity, electric shock risk and vibration. Also, it is equipped with protective methods such as some special tools or keys to open the enclosure, so as to avoid the hazard to users and the damage to the ELC.
- Never connect the AC main circuit power supply to any of the input/output terminals, as it will damage the ELC. Check all the wiring prior to power up. To avoid any electromagnetic noise, make sure the ELC is properly grounded (⏚). Do NOT touch terminals when power on.
- Battery replacement: use UL component type: TDRTL-2150/S lithium battery. Refer to following table for battery life. (NOTE: RTC should be reset after changing battery).

Temperature(°C)	0	25	50	70
Life(Years)	9	8	6	5

Precision of calendar timer:

At 0°C/32 F, less than -117 seconds error per month.

At 25°C/77 F, less than 52 seconds error per month.

At 55°C/131 F, less than -132 seconds error per month.

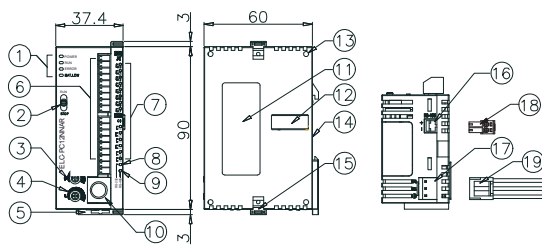
- Warning – Do not disconnect while circuit is live unless area is known to be non-hazardous.
- Power, input and output (I/O) wiring must be in accordance with Class 1, Div. 2 wiring methods - Article 501-10(B)(1) of the National Electrical Code.
- Suitable for use in Class 1, Division 2, Groups A, B, C, D or Non-Hazardous locations only.
- Warning – Explosion hazard - Substitution of components may impair suitability for Class 1, Division 2.
- Warning – Wxplosion hazard - Do not disconnect equipment unless power has been switched off or the area is known to be Non-Hazardous.

1 INTRODUCTION

1.1 Model Name Explanation and Peripherals

Thank you for choosing Eaton Logic Controller (ELC) series products. The ELC-PC series has a 12-points (8 input points + 4 outputs) ELC main processing unit with multiple commands for use. It also has an 8K Steps program memory to connect to every ELC-PC series expansion unit, including digital I/O (Maximum 128 Inputs / 128 Outputs expansion points), analog module, etc. for various applications.

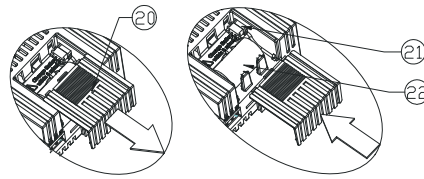
1.2 Product Profile and Outline



Unit: mm

1	Status indicator: POWER, RUN, ERROR, BAT.LOW
2	RUN/STOP switch
3	VR0: M1178 Start-up/D1178 corresponding value
4	VR1: M1179 Start-up/D1179 corresponding value
5	DIN rail clip
6	I/O terminals
7	I/O point indicators
8	COM1 (RS-232) (Rx) indicator
9	COM2 (RS-485) (Tx) indicator
10	COM1 (RS-232) programming port
11	Nameplate
12	Expansion port
13	Mounting hold of the expansion unit

Warning: Battery replacement: Please change the battery within 3 minutes, or the internal data of the ELC (including the program area, perpetual calendar and latched registers) could be lost or destroyed.



14	DIN rail (35mm)
15	Expansion unit clip
16	COM2 (RS-485) Communication port
17	DC Power input
18	2 pin removable terminal (standard accessory)
19	Power input cable (standard accessory)
20	Battery Cover
21	Battery socket connection
22	Battery mount

2 FUNCTION SPECIFICATIONS

Items		Specifications		Remarks	
Control Method		Stored program, cyclic scan system			
I/O Processing Method		Batch processing method (when END command is executed)		I/O refresh command is available	
Execution Speed		Basic commands (several us)		Application Commands (10~hundreds us)	
Program Language		Commands + Ladder Logic + SFC		Including the Step commands	
Program Capacity		7,920 STEPS		SRAM + Battery	
Commands		32 Basic sequential commands		168 Application commands	
Relay (bit mode)	X	External Input Relay	X0~X177, octal number system, 128 points	Total 256 points Correspond to external I/P point	
	Y	External Output Relay	Y0~Y177, octal number system, 128 points	Correspond to external O/P point	
	M	Auxiliary Relay	General	M0~M511, 512 points (*1)	Total 4,096 points Contacts can switch to On/Off in program
			Latched	M512~M999, 488 points (*3) M2000~M4095, 2,096 points (*3)	
			Special	M1000~M1999, 1,000 points (some are latched)	
	T	Timer	100ms	T0~T199, 200 points (*1)	Total 256 points When the timer that set by TMR command reaches the preset value, the T contact with the same number will be On.
				T192~T199 for Subroutine	
			10ms	T250~T255, 6 points Accumulative (*4)	
				T200~T239, 40 points (*1) T240~T245, 6 points Accumulative (*4) T246~T249, 4 points Accumulative (*4)	
	C	Counter	16-bit Count Up	C0~C95, 96 points (*1)	Total 250 points When the counter that set by CNT (DCNT) command reaches the preset value, the C contact with the same number will be On.
			32-bit Count Up	C96~C199, 104 points (*3)	
			32-bit Count Up/Dn	C200~C215, 16 points (*1) C216~C234, 19 points (*3)	
			32bit High-speed Count Up/Dn	C235~C245, 1 ph, 1 input, 9 points (*3) C246~C250, 1 ph, 2 input, 3 points (*3) C251~C254, 2 ph, 2 input, 3 points (*3)	
	S	Step point	Initial Step Point	S0~S9, 10 points (*1)	Total 1,024 points Usage device of step ladder diagram (SFC) Latched Range: Start: D1214 (K512) End: D1215 (K895)
Zero Point Reset			S10~S19, 10 points (use with IST command) (*1)		
General			S20~S511, 492 points (*1)		
Latched			S512~S895, 384 points (*3)		
Alarm			S896~S1023, 128 points (*3)		
Register (WORD data)	T	Current Value of the Timer	T0~T255, 256 points	When the timer reaches the preset value, the contact of timer will be On.	
	C	Current Value of the Counter	C0~C199, 16-bit counter, 200 points C200~C254, 32-bit counter, 50 points	When the counter reaches the preset value, the contact of counter will be On.	
	D	Data Register	General	D0~D199, 200 points (*1)	Total 5,000 points Can be memory area for storing data. E and F can be used as the special purpose of index indication.
			Latched	D200~D999, 800 points (*3) D2000~D4999, 3,000 points (*3)	
			Special	D1000~D1999, 1,000 points	
Index			E0~E3, F0~F3, 8 points (*1)		
None	File Register	0~1,599 (1,600 points) (*4)	Expansion register for storing data.		
Pointer	N	For Master Control Nested Loop	N0~N7, 8 points	Control point of master control nested loop	
	P	For CJ, CALL Commands	P0~P255, 256 points	The location point of CJ, CALL.	
	I	Interrupt Service	External Interrupt	I001 (X0), I101 (X1), I201 (X2), I301 (X3), I401 (X4), I501 (X5); 6 points (all are rising-edge trigger)	The location pointer of interrupt subroutine
			Time Interrupt	I6□□ (1ms), I7□□ (1ms), (□□ = 1~99ms)	
			Hi-speed Counter	I010, I020, I030, I040, I050, I060; 6 points	
Communication			I150, 1 point		
Constant	K	Decimal	K-32,768 ~ K32,767 (16-bit operation) K-2,147,483,648 ~ K2,147,483,647 (32-bit operation)		
	H	Hexadecimal	H0000 ~ HFFFF (16-bit operation), H00000000 ~ HFFFFFFF (32-bit operation)		
Programming Port		COM1: RS-232, COM2: RS-485 (Master/Slave), Can be used at the same time.			
Analog Volume / Perpetual Calendar (RTC)		ELC built-in 2 points VR / ELC built-in RTC			
Special Expansion Module		Use the same modules of ELC series. (Max. 8 Expansion Unit points)			

- *1: The non-latched area is fixed, and can't be changed.
 *2: The non-latched area can be changed to a latched area with parameter setting.
 *3: The latched area can be changed to a non-latched area with parameter setting.
 *4: The latched area is fixed, and can't be changed.

M Auxiliary Relay	General		Latched		Special auxiliary relay		Latched	
	M0-M511		M512-M999		M1000-M1999		M2000-M4095	
	Non-latched (fixed)		Latched (default) Start: D1200 (K512) End: D1201 (K999)		Some are latched and can't be changed		Latched (default) Start: D1202 (K2,000) End: D1203 (K4,095)	
T Timer	100 ms		10 ms		10ms		1 ms	
	T0-T199		T200-T239		T240-T245		T246-T249	
	Non-latched (fixed)		Non-latched (fixed)		Accumulative Latched (fixed)			
C Counter	16-bit count up		32-bit count up/down		32-bit high-speed count up/down			
	C0-C95		C96-C199		C200-C215		C216-C234	
	Non-latched (fixed)		Latched (default) Start: D1208 (K96) End: D1209 (K199)		Non-latched (fixed)		Latched (default) Start: D1210 (K216) End: D1211 (K234)	
S Step Relay	For general	Latched	Special register		Latched		For general	
	S0-S9	S10-S19	S20-S511		S512-S895		S896-S1023	
	It is fixed to be non-latched			Factory setting is latched Start: D1214 (K512) End: D1215 (K895)		It is fixed to be latched		
D Register	General		Latched		Special registers		Latched	
	D0-D199		D200-D999		D1000-D1999		D2000-D4999	
	Non-latched (fixed)		Factory setting is latched. Start: D1216 (K200) End: D1217 (K999)		Some are latched and can't be changed.		Factory setting is latched. Start: D1218 (K2,000) End: D1219 (K4,999)	
File Register	K0-K1,599							
	Latched (fixed)							

When switching between power On/Off or ELC RUN/STOP modes:

Memory Type	POWER Off→On	STOP→RUN	RUN→STOP	Clear all M1031 non-latched area	Clear all M1032 latched area	Factory Setting
Non-latched	Clear	Unchanged	M1033=Off, clear M1033=On, unchanged	Clear	Unchanged	0
Latched	Unchanged			Unchanged	Clear	0
Special M, Special D, Index register	Initial value	Unchanged		Unchanged		Initial value
File register	Unchanged					0

3 ELECTRICAL SPECIFICATIONS

Item	Model	ELC-PC12NDR/T	ELC-PC12NNAR
Power Supply Voltage		ELC: 24VDC (-15%~+20%) (With DC input reverse polarity protection), Expansion Unit: supplied by the ELC	
Fuse		2A / 250VAC	
Power Consumption		3.5W MAX	
Insulation Resistance		> 5 MΩ at 500 VDC (Between all inputs / outputs and earth)	
Noise Immunity		ESD(IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge EFT(IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV, Analog & Communication I/O: 1KV RS(IEC 61131-2, IEC 61000-4-3): 26MHz~1GHz, 10V/m	
Grounding		The diameter of grounding wire cannot be smaller than the wire diameter of terminals 24V and 0V (All ELC units should be grounded directly to the ground pole).	
Environment		Operation: 0°C~55°C (Temperature), 50~95% (Humidity), Pollution degree 2; Storage: -25°C~70°C (Temperature), 5~95% (Humidity)	
Agency Approvals		UL508 UL1604, Class1,Div2 Operating temperature code: T5 European community EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC	
Vibration / Shock Resistance		Standard: IEC61131-2, IEC 68-2-6 (TEST Fc) / IEC61131-2 & IEC 68-2-27 (TEST Ea)	
Weight (approx.) (g)		158	

DC Input Point Electrical Specification			
Input Type	DC (SINK or SOURCE)		
Input Current	24VDC 5mA		
Active Level	Off→On	X0,X1: above18.5VDC X2-X7: above16.5VDC	On→Off X0-X7: below 8VDC

Responding Time	Adjustable 0~20ms, Default 10ms, selected through D1020)	
AC Input Point Electrical Specification		
Rated Input Voltage	100 to 120 VAC (-15%~+10%)	
Maximum Input Current	Less than 20 mA	
Minimum ON Voltage	80 VAC	
Maximum OFF Voltage	30 VAC	
Output Point Electrical Specification		
Output Type	Relay-R	Transistor-T
Current Specification	1.5A/1 point (5A/COM)	0.3A/1 point @ 40°C; When the output of Y0 and Y1 is high-speed pulse, Y0 and Y1 = 30mA
Voltage Specification	Below 250VAC, 30VDC	30VDC
Maximum Loading	75VA (Inductive) 90 W (Resistive)	9W/1 point When the output of Y0 and Y1 is high-speed pulse, Y0 and Y1 = 0.9W (Y0 = 32kHz, Y1 = 10kHz), Y0 can be 50Khz using D registers
Responding Time	About 10 ms	Off→On 20us On→Off 30us Y0 and Y1 are specified points for high-speed pulse

4 MODEL NAME & I/O CONFIGURATION

Model	Input / Output				Profile Reference	I/O Configuration	
	Power	Input Unit		Output Unit			
		Point	Type	Point			Type
ELC-PC12NNAR	24VDC	8	100~120VAC	4	Relay		
ELC-PC12NNDR		8	DC Sink or Source	4	Relay		
ELC-PC12NNDT		8		4	Transistor		

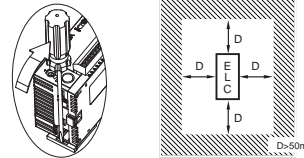
5 INSTALLATION & WIRING

5.1 Installation of the DIN rail

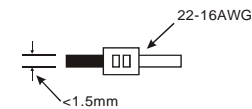
The ELC can be secured to a cabinet by using the DIN rail that is 35mm high with a depth of 7.5mm. When mounting the ELC on the DIN rail, be sure to use the end bracket to stop any side-to-side motion of the ELC, thus to reduce the chance of the wires being pulled loose. At the bottom of the ELC is a small retaining clip.

To remove it, pull down the retaining clip and gently pull the ELC away from the DIN rail. As shown on the right:

When installing the ELC, make sure that it is installed in an enclosure with sufficient space (as shown on the right) to its surroundings so as to allow heat dissipation.



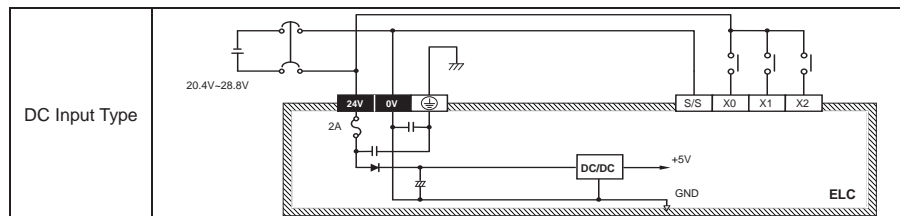
5.2 Wiring



- Please use 22-16AWG (1.5mm) wiring (either single or multiple core) for I/O wiring terminals. The specification for the terminals is as shown on the left. ELC terminal screws should be tightened to 1.95 kg-cm (1.7 lb-in). Use Copper Conductor Only, 60/75 °C.
- I/O signal wires or power supply should not run through the same multi-wire cable or conduit.

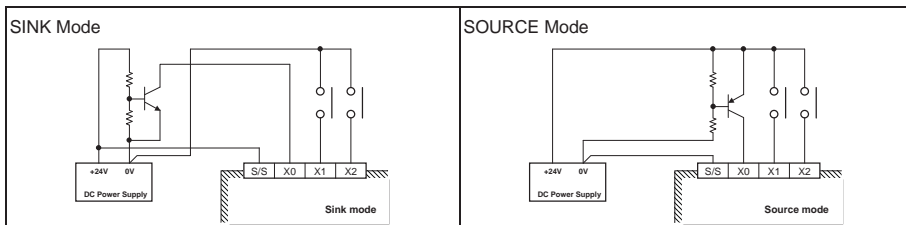
5.3 Power Input Wiring

- When DC voltage is supplied to the ELC, make sure the power is at terminals 24VDC and 0V (power range is 20.4VDC~28.8VDC). When voltage is lower than 20.4VDC, ELC will stop operating, all outputs will turn OFF and the ERROR LED will flash continuously.
- If the power-cut time is less than 10ms, the ELC still operates unaffectedly. If the power-cut time is too long or the power voltage drops, the ELC will stop operating and all the outputs will be Off.



5.4 Input Point Wiring

There are two types of DC type wiring: SINK and SOURCE, defined as follows:

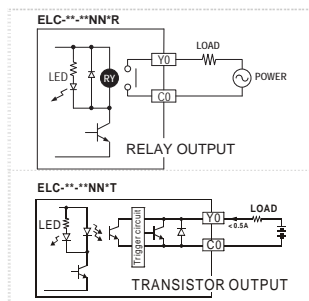


5.5 AC Type Wiring

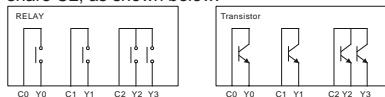
Input Circuit Connection	110V AC Input Specifications	
	Input voltage	100~120VAC (-15%~+10%)
	Input impedance	21Kohm/50Hz 18Kohm/60Hz
	Input current	4.7mA 100VAC/50Hz 6.2mA 110VAC/60Hz
	OFF→ON/ON→OFF	80V 3.8mA/30V 1.7mA
	Response time	OFF→ON:30ms ON→OFF:50ms
	Circuit isolation/Operation indication	Photocoupler/LED On

5.6 Output Point Wiring

Output point wiring



1. ELC-PC series have two output modules, relay and transistor. See "Function Specifications" for their specifications.
2. Please watch out the connection of common terminals while wire the outputs. For example, when wiring ELC-PC12NNDR/T, output terminal Y0 uses one common terminal C0, Y1 uses C1, and Y2-Y3 share C2, as shown below:



When output points are enabled, their corresponding indicators on the front panel will be on.

3. Isolation circuit: The optical coupler is used to isolate signals between the circuit inside ELC and input modules.

The Relay Output Circuit Wiring

	1 Flywheel diode: To extend the life span of contact*1
	2 Emergency stop: Uses external switch
	3 Fuse: Uses 5 ~ 10A fuse at the shared terminal of output contacts to protect the output circuit.
	4 Varistor: To reduce the interference on AC load*2:
	5 Empty terminal: no in use
	6 DC power supply
	7 AC power supply
	8 Incandescent light (resistive load)
	9 Manually exclusive output: Uses external circuit and forms an interlock, together with ELC internal program, to ensure safe protection in case of any unexpected errors. *3

*1: For switching direct current on inductive loads, a reverse-current protection diode should be installed in parallel with the load. The relay contact life decreases significantly if this is not done.

The reverse-current protection diode needs to satisfy the following specifications.

- The diode is rated for maximum reverse voltage of 5~10 times the load voltage.
- The forward current is more that the load current

*2: For switching AC on inductive loads, a surge absorber (0.1uF + "100ohm to 120ohm") should be installed in parallel with the load. The relay contact life decreases significantly if this is not done.

*3: Ensure all loads are applied to the same side of each ELC output, see above figure. Loads which should NEVER simultaneously operate(e.g. direction control of a motor), because of a critical safety situation, should not rely on the ELC's sequencing alone. Mechanical interlocks MUST be fitted to all critical safety circuits.

The Transistor Output Circuit Wiring

	1 DC power supply
	2 Emergency stop
	3 Circuit protection fuse
	4 Flywheel diode + inductive load
	5 Manually exclusive output: Uses external circuit and forms an interlock, together with ELC internal program, to ensure safe protection in case of any unexpected errors. *1

*1: Transistor outputs use internal zener diode(39V) as protection circuitry. When driving the inductive load with transistor output, a reverse-current protection diode can be installed in parallel with the load if necessary.

The reverse-current protection diode needs to satisfy the following specifications.

- The diode is rated for maximum reverse voltage of 5 to 10 times the load voltage.
- The forward current is more than the load current.

6 TRIAL RUN

☼ Power Indication

The "POWER" LED at the front of the ELC will be lit (in green) if the power is on.

■ Low Battery Voltage Indication

There is also a "BAT.LOW" LED at the front of the ELC. When the LED is on, it indicates that the battery voltage is insufficient. Please change the battery (within 3 minutes) as soon as possible; otherwise the user programs and the data in latched area may be lost.

■ Preparation

1. Prior to applying power, please verify that the power lines and the input/output wiring are correct. And be advised not to supply AC110V or AC220V into the I/O terminals, or it might short-circuit the wiring and would cause direct damage to the ELC.
2. After using the peripheral devices to write the program into the ELC and that the ERROR LED of the ELC is not on, it means that the program in use is legitimate, and it is now waiting for the user to give the RUN command.
3. Use ELC-HHP to execute the forced On/Off test of the output contact.

■ Operation & Test

If the "ERROR" LED of the ELC is not blinking, use RUN/STOP switch or the peripheral devices (ELC-HHP or ELCSOFT) to give the RUN command, and the RUN indicator will then be on. If the "RUN" LED is not on, it indicates that there is no program inside the ELC.

ELC-HHP could be utilized to monitor the settings and the registered values of the timer (T), the counter (C) and the data register (D) during operation, and moreover, to force the output contacts to conduct the On/Off action. If the ERROR LED is on (but not blinking), it means that the setting of the user's program has exceeded the preset overtime limit. At this time, please turn RUN/STOP switch to STOP and get program time-out address from special register D1008. (it is recommended to improve by WDT command)

■ ELC Input/Output Reaction Time

The total reaction time from the input signal to the output operation is calculated as follows:

Reaction Time = input delay time + program scan time + output delay time

Input delay time	Factory setting is 10ms. Please refer to special registers D1020~1021.
Program scan time	Please refer to the usage of special register D1010.
Output delay time	Relay module: 10ms. Transistor module: 20~30us.

■ Basic Commands and Application Commands of the ELC:

1. The basic commands and the application commands of the ELC of this series are totally applicable to the ELC. Refer to the ELC Technique Application Manual for relevant basic commands and application commands.
2. The ELC-HHP handheld programming panel and the ELCSOFT (Windows version) editing program of the ladder diagram are both good for use with the ELC. Also, the ELC could connect with the ELC-PC12NNDNR/T, ELC-PC12NNAR through specific transmission wire to execute the program transmission, the ELC control and the program monitoring.

7 TROUBLESHOOTING

Judge the errors by the indicators on the front panel. When errors occurred on ELC, please check:

☼ "POWER" LED

There is a "POWER" LED at the front of the ELC. When the ELC is powered On, the green LED light will be on.

☼ ELC "RUN" LED

Identify the status of the ELC. When the ELC is in operation, this light will be on, and users could thus use ELC-HHP or the editing program of the ladder diagram to give commands to make the ELC "RUN" or "STOP".

☼ "ERROR" LED

If incorrect programs are input to the ELC, the indicator will blink. Please check D1004(Error code) and D1137(Error step number).

When the ERROR LED is on (not blinking), it indicates that the execution time of the program loop has exceeded the time-out setting (set by D1000). Please turn the ELC RUN/STOP switch to STOP, and find out the address of the time-out program by special data register D1008. "WDT". After completing modifying program, user only need to reload program and this LED will be off at this moment. Once the LED still lights, please turn off the power and check if there is interference or any conductive material in ELC.

☼ "BAT.LOW" LED

When the battery voltage is low, the "BAT.LOW" LED will be on, please change the battery within 3 minutes to retain the ELC's internal user programs and data).

☼ "Input/Output" LED

The On/Off signals of the input point could be displayed through the "Input" LED. "Output" LED indicates if the output signals are On or Off.

* "RS-232, RS-485" LED

"RS-232" LED will light when RS-232 is receiving data, "RS-485" LED will light when RS-485 is transferring data.