



*Powering Business Worldwide™*

2014-10-30



5012617702-PB22

## **ELC2 Series**

### **Programmable Logic Controllers**

## **INSTRUCTION SHEET**

[Applicable Controllers]

- ELC2-PB14NNDR
- ELC2-PB14NNDT
- ELC2-PB12NNDP

The ELC2-PBs include three 14-point controllers. The ELC2-PB series provides various instructions, and the size of the program memory is 8k steps. It is able to connect to all ELC series extension modules, including digital I/O (max. 224 I/O points) and analog modules (for A/D, D/A conversion and temperature measurement). Four groups of high-speed (10kHz) pulse outputs are included. ELC2-PB series controllers are small in size, and can be installed easily. Users do not have to install any batteries in ELC2-PBs. The ELC programs and the latched data are stored in the flash memories.

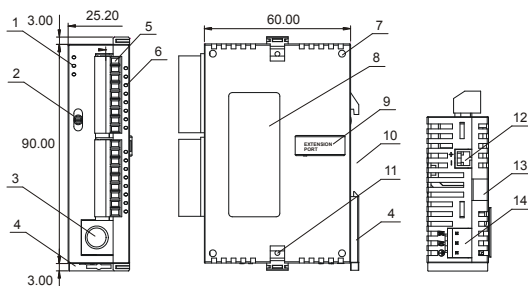
EN ✗ ELC2-PB is an OPEN-TYPE device. It should be installed in a control cabinet free of airborne dust, humidity, electric shock and vibration. To prevent non-maintenance staff from operating ELC2-PB, or to prevent an accident from damaging ELC2-PB, the control cabinet in which ELC2-PB is installed should be equipped with a safeguard. For example, the control cabinet in which ELC2-PB is installed shall require a tool or key to be opened.

EN ✗ Do NOT connect AC power to any of I/O terminals, otherwise serious damage may occur. Please check all wiring again before ELC2-PB is powered up. After ELC2-PB is disconnected, Do NOT touch any terminals in a minute. Make sure that the ground terminal (⬇) on ELC2-PB is correctly grounded in order to prevent electromagnetic interference.

FR ✗ ELC2-PB est un module OUVERT. Il doit être installé que dans une enceinte protectrice (boîtier, armoire, etc.) saine, dépourvue de poussière, d'humidité, de vibrations et hors d'atteinte des chocs électriques. La protection doit éviter que les personnes non habilitées à la maintenance puissent accéder à l'appareil (par exemple, une clé ou un outil doivent être nécessaire pour ouvrir a protection).

FR ✗ Ne pas appliquer la tension secteur sur les bornes d'entrées/Sorties, ou l'appareil ELC2-PB pourra être endommagé. Merci de vérifier encore une fois le câblage avant la mise sous tension du ELC2-PB. Lors de la déconnection de l'appareil, ne pas toucher les connecteurs dans la minute suivante. Vérifier que la terre est bien reliée au connecteur de terre afin d'éviter toute interférence électromagnétique.

## ■ Product Profile & Outline



Unit: mm



[ Figure 1 ]

1. POWER, RUN, ERROR indicator	8. Nameplate
2. RUN/STOP switch	9. Extension port
3. I/O port for program communication (RS-232)	10. DIN rail mounting slot (35mm)
4. DIN rail clip	11. Extension unit clip
5. I/O terminals	12. RS-485 communication port
6. I/O point indicator	13. Mounting rail for extension module
7. Mounting hole for extension module	14. DC power input

## ■ Specifications

Item	Specification
Control method	Stored program, cyclic scan system
I/O processing method	Batch processing method (when END instruction is executed)
Execution speed	LD instructions – 0.54μs, MOV instructions – 3.4μs
Program language	Instruction List + Ladder + SFC
Program capacity	7920 steps

Item				Specification	
Bit contacts	X	External inputs		X0~X377, octal number system, 256 points max.	Total 480+32 I/O(*4)
	Y	External outputs		Y0~Y377, octal number system, 256 points max.	
	M	Auxiliary relay	General	M0~M511, 512 points (*1) M768~M999, 232 points (*1) M2000~M2047, 48 points (*1)	Total 4096 points
			Latched	M512~M767, 256 points (*2) M2048~M4095, 2048 points (*2)	
			Special	M1000~M1999, 1000 points, some are latched	
	T	Timer	100ms (M1028=ON, T64~T126: 10ms)	T0~T126, 127 points (*1) T128~T183, 56 points (*1) T184~T199 for Subroutines, 16 points (*1)	Total 256 points
				T250~T255(accumulative), 6 points (*1)	
			10ms (M1038=ON, T200~T245: 1ms)	T200~T239, 40 points (*1) T240~T245(accumulative), 6 points (*1)	
				T127, 1 points (*1) T246~T249(accumulative), 4 points (*1)	
	C	Counter	16-bit count up	C0~C111, 112 points (*1) C128~C199, 72 points (*1) C112~C127, 16 points (*2)	Total 233 points
				C200~C223, 24 points (*1) C224~C232, 9 points (*2)	
			32-bit high-speed count up/down	C235~C242, 1 phase 1 input, 8 points (*2) C233~C234, 2 phase 2 input, 2 points (*2) C243~C244, 1 phase 1 input, 2 points (*2) C245~C250, 1 phase 2 input, 6 points (*2) C251~C254 2 phase 2 input, 4 points (*2)	Total 22 points
				Software	
				Hardware	
	S	Step point	Initial step point	S0~S9, 10 points (*2)	Total 1024 points
			Zero point return	S10~S19, 10 points (use with IST instruction) (*2)	
			Latched	S20~S127, 108 points (*2)	
			General	S128~S911, 784 points (*1)	
			Alarm	S912~S1023, 112 points (*2)	
Word register	T	Current value		T0~T255, 256 words	
	C	Current value		C0~C199, 16-bit counter, 200 words	
				C200~C254, 32-bit counter, 55 words	
	D	Data register	General	D0~D407, 408 words (*1) D600~D999, 400 words (*1) D3920~D4999, 1080 words (*1)	Total 5000 points
			Latched	D408~D599, 192 words (*2) D2000~D3919, 1920 words (*2)	
			Special	D1000~D1999, 1000 words, some are latched	
			Index	E0~E7, F0~F7, 16 words (*1)	

Item				Specification
Pointer	N	Master control loop		N0~N7, 8 points
	P	Pointer		P0~P255, 256 points
	I	Interrupt service	External interrupt	I000/I001(X0), I100/I101(X1), I200/I201(X2), I300/I301(X3), I400/I401(X4), I500/I501(X5), I600/I601(X6), I700/I701(X7), 8 points (01: rising-edge trigger  , 00: falling-edge trigger  )
			Timer interrupt	I602~I699, I702~I799, 2 points (Timer resolution = 1ms)
			High-speed counter interrupt	I010, I020, I030, I040, I050, I060, I070, I080, 8 points
			Communication interrupt	I140(COM1), I150(COM2), 2 points (*3)
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)	
Serial ports				COM1: built-in RS-232 (Client/Server) COM2: built-in RS-485 (Client/Server) COM1 is typically the programming port.
Real time clock				Year, Month, Day, Week, Hours, Minutes, Seconds
Special I/O modules				Up to 8 special I/O modules can be connected

Notes:

1. Non-latched area cannot be modified
2. Latched area cannot be modified
3. COM1: built-in RS232 port. COM2: built-in RS485 port.
4. There are 8 input points (X0~X7), and 6 output points (Y0~Y5) in ELC2-PB series. ELC2-PB occupies 16 input points (X0~X17), and 16 output points (Y0~Y17). Extension input points start from X20, and extension output points start from Y20.

## ■ Electrical Specifications

Model			
Item	ELC2-PB14NNDR	ELC2-PB14NNDT	ELC2-PB12NNDP
Power supply voltage	24 Vdc (-15% ~ 20%) (with reverse polarity protection on the DC input power) ELC-PS01: input 100 to 240 Vac, output 24 Vdc/1A ELC-PS02: input 100 to 240 Vac, output 24 Vdc/2A		
Inrush current	Max. 7.5A@24 Vdc		
Fuse capacity	1.85A/30 Vdc, Polyswitch		
Power consumption	1.8W	1.5W	
Power protection	With reverse polarity protection on the DC input power		
Insulation resistance	> 5MΩ (all I/O point-to-ground: 500 Vdc)		
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 L and N (All ELC2 controllers should be grounded directly to the ground pole).		
Operation / storage	Operation: 0°C ~ 55°C (temp.), 5 ~ 95% (humidity), Pollution degree2 Storage: -25°C ~ 70°C (temp.), 5 ~ 95% (humidity)		
Vibration / shock resistance	International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)		
Weight (g)	97g	82.5g	90g

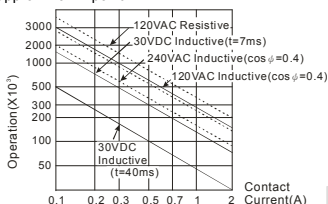
Spec.	Input Point	
Items	24 Vdc (-15% ~ 20%) single common port input	
Input No.	X0 ~ X3	X4 ~ X7
Input type	DC (SINK or SOURCE)	
Input Current (± 10%)	24 Vdc, 5mA	

Spec.		Input Point	
Items		24 Vdc (-15% ~ 20%) single common port input	
Input impedance		4.7kΩ	
Max. frequency		20kHz	10kHz
Action level	Off→On	> 15 Vdc	
	On→Off	< 5 Vdc	
Response time	Off→On	< 10μs	< 20μs
	On→Off	< 20μs	< 50μs
Filter time		Adjustable within 0 ~ 20ms by D1020 (Default: 10ms)	

Spec.		Output Point		
Items		Relay	Transistor	
Output No.		Y0 ~ Y5	Y0 ~ Y3	Y4, Y5
Max. frequency		1Hz	10kHz	1kHz
Working voltage		250 Vac, < 30 Vdc	5 ~ 30 Vdc <sup>#1</sup>	
Max. load	Resistive	1.5A/1 point (5A/COM)	0.5A/1 point (3A/COM)	
	Inductive	<sup>#2</sup>	15W (30 Vdc)	
	Lamp	20WDC/100WAC	2.5W (30 Vdc)	
Response time	Off→On	Approx. 10ms	20μs	100μs
	On→Off		30μs	100μs

#1: UP, ZP must work with external auxiliary power supply 24 Vdc (-15% ~ +20%), rated consumption approx. 10mA/point.

#2: Life curves



[ Figure 2 ]

## ■ Model Name & I/O Configuration

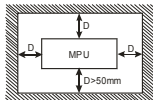
Standard functional ELC

Model	Input		Output		I/O Configuration		
	Point	Type	Point	Type	Relay	Transistor (NPN)	Transistor (PNP)
ELC2-PB14NNDR	8	DC (Sink or source)	6	Relay	S/S X0 X1 X2 X3 X4 X5 X6 X7	S/S X0 X1 X2 X3 X4 X5 X6 X7	S/S X0 X1 X2 X3 X4 X5 X6 X7
ELC2-PB14NNDT				Transistor (NPN)	C0 Y0 Y1 Y2 ● C1 Y3 Y4 Y5	UP ZP ● Y0 Y1 Y2 Y3 Y4 Y5	UP ZP ● DA PWM Y0 Y1 Y2 Y3
ELC2-PB12NNDP			4	Transistor (PNP)			

## ■ Dimension & Installation

Please install the ELC2 in an enclosure with sufficient space around it to allow heat dissipation. See [Figure 3].

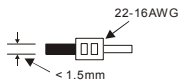
- **Direct Mounting:** Use M4 screw according to the dimension of the product.
- **DIN Rail Mounting:** When mounting the ELC2 to 35mm DIN rail, be sure to use the retaining clip to stop any side-to-side movement of the ELC2 and reduce the chance of wires being loose. The retaining clip is at the bottom of the ELC2. To secure the ELC2 to DIN rail, pull down the clip, place it onto the rail and gently push it up. To remove the ELC2, pull the retaining clip down with a flat screwdriver and gently remove the ELC2 from DIN rail.



[Figure 3]

## ■ Wiring

Use 22-16AWG (1.5mm) single or multiple core wire on I/O wiring terminals. See the figure in the right hand side for its specification. ELC2 terminal screws should be tightened to 1.90 kg-cm (1.65 in-lbs) and please use only 60/75°C copper conductor.



1. DO NOT wire empty terminal. DO NOT place the I/O signal cable in the same wiring circuit.
2. DO NOT drop tiny metallic conductors into the ELC2 while screwing and wiring terminals. When finished wiring, remove the protective sticker on the heat dissipation opening to ensure normal heat dissipation of the ELC2.

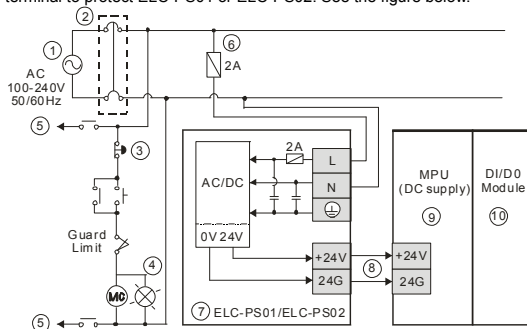
## ◆ Power Supply

The power input of ELC2-PB is DC. When operating ELC2-PB, please note the following points:

1. The power is connected to two terminals, 24VDC and 0V, and the range of power is 20.4 ~ 28.8 Vdc. If the power voltage is less than 20.4 Vdc, the ELC2 will stop running, all outputs will go off, and the ERROR indicator will start to blink continuously.
2. A power shutdown for less than 10ms will not affect the operation of the ELC2. However, a shutdown time that is too long or a drop of power voltage will stop the operation of the ELC2, and all outputs will go off. When the power returns to normal status, the ELC2 will automatically resume the operation. (Please take care of the latched auxiliary relays and registers inside the ELC2 when doing the programming).

## ◆ Safety Wiring

Eaton's power supply modules ELC-PS01 or ELC-PS02 are the suitable 24 Vdc power supplies for ELC2-PB. We suggest you install a protective circuit at the power supply terminal to protect ELC-PS01 or ELC-PS02. See the figure below.



[Figure 4]

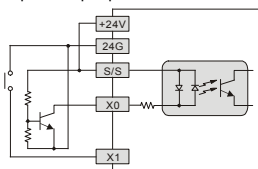
- |   |                              |
|---|------------------------------|
| ① AC power supply: 100 ~ 240VAC, 50/60Hz  | ② Breaker                    |
| ③ Emergency stop: This button cuts off the system power supply when accidental emergency takes place. |                              |
| ④ Power indicator   | ⑤ AC power supply load       |
| ⑥ Power supply circuit protection fuse (2A)   | ⑦ ELC-PS01/ELC-PS02          |
| ⑧ DC power supply output: 24VDC, 500mA  | ⑨ MPU (main processing unit) |
| ⑩ Digital I/O module  |                              |

## ◆ Input Point Wiring

There are two types of DC inputs, SINK and SOURCE. (See the example below. For detailed point configuration, please refer to the specification of each model.)

### ● DC Signal IN – SINK mode

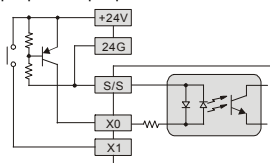
Input point loop equivalent circuit



[ Figure 5 ]

### ● DC Signal IN – SOURCE mode

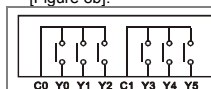
Input point loop equivalent circuit



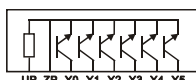
[ Figure 6 ]

## ◆ Output Point Wiring

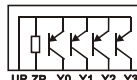
1. ELC2-PB series controllers have either relay or transistor outputs. Please note the connection of shared terminals when wiring output terminals.
2. Output terminals, Y0, Y1, and Y2, of relay models use C0 common port; Y3, Y4, and Y5 use C1 common port. See [Figure 7]. When the output points are enabled, their corresponding indicators on the front panel will be on.
3. The output terminals Y0~Y5 of the transistor (NPN) model are connected to the common terminals UP and ZP. See [Figure 8a]. The output terminals Y0~Y3 on the transistor (PNP) model are connected to the common terminals UP and ZP. See [Figure 8b].



[ Figure 7 ]



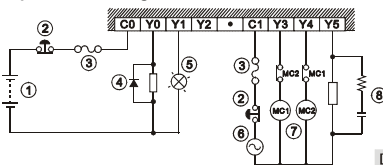
[ Figure 8a ]



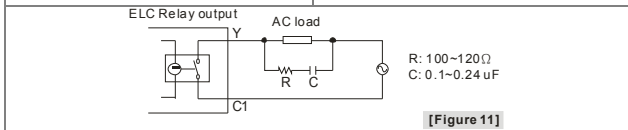
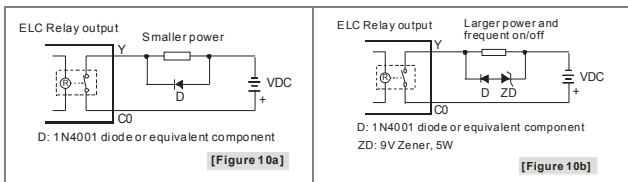
[ Figure 8b ]

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

### ● Relay (R) output circuit wiring

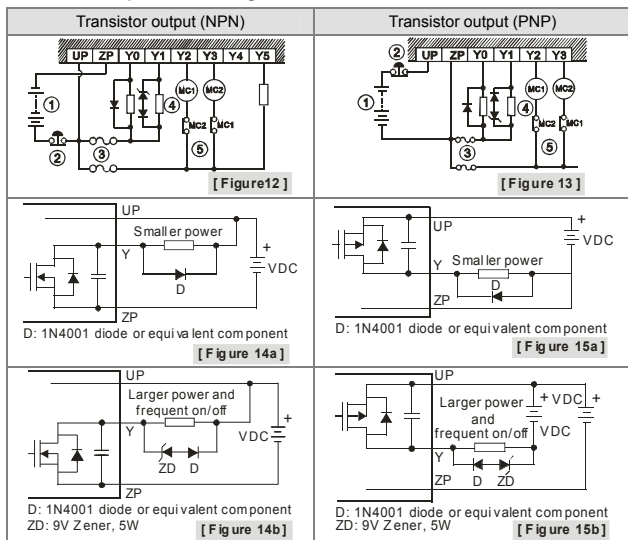


[ Figure 9 ]



- |  |  |
|--|--|
| ① DC power supply  | 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 Transient voltage suppressor (SB360 3A 60V): Extends the life span of contact.<br>1. Diode suppression of DC load: Used when in smaller power [Figure 10a]<br>2. Diode + Zener suppression of DC load: Used when in larger power and frequent On/Off [Figure 10b]  |  |
| ⑤ Incandescent light (resistive load)  | ⑥ AC power supply                      |
| ⑦ Manually 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 ELC internal program, to ensure safe protection in case of any unexpected errors. |  |
| ⑧ Absorber: Reduces the interference on AC load [Figure 11]  |  |

### • Transistor output circuit wiring



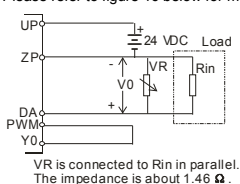
- |                   |                  |                           |
|-------------------|------------------|---------------------------|
| ① DC power supply | ② Emergency stop | ③ Circuit protection fuse |
|-------------------|------------------|---------------------------|



- ④ The output of the transistor model is "open collector". If Y0/Y1 is set to pulse output, the output current has to be bigger than 0.1A to ensure normal operation of the model.
1. Diode suppression: Used when in smaller power [Figure 14a] and [Figure 15a]
  2. Diode + Zener suppression: Used when in larger power and frequent On/Off [Figure 14b] and [Figure 15b]
- ⑤ Manually exclusive output: For example, Y2 and Y3 control the forward running and reverse running of the motor, forming an interlock for the external circuit, together with the PLC internal program, to ensure safe protection in case of any unexpected errors.

### • PWM DA output circuit wiring (Only for ELC2-PB12NNDP)

Please refer to figure 16 below for more information about wiring.

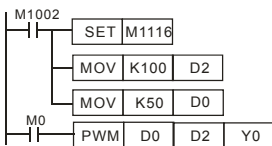


[Figure 16]

Item	Specifications
DA range	0~10Vdc
Value range	0~100
Resolution*1	0.1V (1~9V)
Output impedance	2kΩ
Minimum load	1.5kΩ
D/A conversion time	<70ms

\*1: 1~9V is a linear area. The resolution is 0.1V. 0~1V and 9~10V are nonlinear areas. The output probably can not reach the voltage set.

Please refer to the correction formula before you use the PWM DA output function.



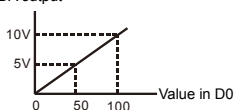
Please refer to the explanation of PWM for more information about setting the time unit for the pulses output by Y0.

Set the pulse cycle to 100μs.

Set the duty cycle of a pulse to 50%.

Set M0 to ON. Adjust the variable resistor so that V0 is 5V, as shown in the curve below.

DA output



### ◆ RS-485 Wiring

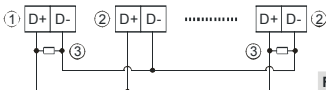


Figure 17

①	Client node
②	Server node
③	Terminal resistor

Note:

1. Terminal resistors are suggested to be connected to the client node and the last server node with resistor value of 120Ω.
2. To ensure communication quality, please apply double shielded twisted pair cable (20AWG) for wiring.

## ■ Troubleshooting & Indicator Description

Based on the indicators on the front panel, please check the following for errors:

### ☼ POWER indicator

When ELC2 is powered, the POWER LED indicator on the front panel will be on (in green). If this indicator is not on or the ERROR indicator keeps flashing when ELC2 is powered indicates that the 24Vdc power supply is insufficient or overloaded. In this case, change to a higher wattage 24Vdc power supply. If the indicator is still off at this time, your ELC2 is malfunctioned. Send your ELC2 back

to your distributor for repair.



#### RUN indicator

Check your ELC2 status. When ELC2 is running, this indicator will be on. You can use ELC-HHP, the ladder diagram editing program or the switch on the panel to RUN or STOP ELC2.



#### ERROR indicator

If you enter an incorrect program into ELC2 or use instructions or devices that exceed their range, this indicator will flash (approx. every 1 second). When this happens, you have to obtain the error code from D1004 and save the address where the error occurs in register D1137 (if the error is a general circuit error, the address of D1137 will be invalid). Find out the cause of the error, amend the program and resend the program to ELC2. If you cannot connect to ELC2 and this indicator keeps flashing quickly (approx. every 0.2 second), it means that the 24 Vdc power voltage is insufficient. Please check if the 24Vdc power supply is overloaded.

If the ERROR indicator is on, you have to check the special relay M1008. If M1008 is on, it indicates that the execution time of program loop exceeds the preset time-out (in D1000). In this case, turn the RUN/STOP switch to STOP, check the special register D1008 and obtain the location in the program where the time-out takes place. Please refer to the WDT instruction to solve this problem. After amending the program, you only need to resend the program to stop the indicator from flashing. If the indicator still keeps flashing at this time, switch off the power and check if there is any interference existing or conductive matter inside ELC2.

For details of error codes (in D1004, hex coding), see "ELC System Manual: Programming".



#### Input indicator

On/Off of input point is indicated by input indicator or monitored by ELC-HHP. When the action condition of the input point is true, this indicator will be on. If abnormality is identified, check if the indicator and input circuit are normal. Use of electronic switch with too much electricity leakage often results in unexpected actions of the input point.



#### Output indicator

On/Off of output point is indicated by the output indicator. When the output indicator (On/Off) does not correspond to the action of its load, please be aware of the following:

1. The output contact may be melted or blocked due to an over loaded or short-circuited load, which will result in poor contact.
2. If you are suspicious that the output point may execute an undesired action, check the output wiring circuit and whether the screw is properly tightened.



#### COM1 and COM2 indicators

If the RS232 LED indicator is On, it means that COM1 is receiving data.

If the RS485 LED indicator is On, it means that COM2 is sending data.