Driving efficiency and sustainability

Programmable Logic Controller

PLC200 e PLC201

User manual

User manual

PLC200 e PLC201

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The information below describes the reviews made in this manual.

Version	Revision	Description
V1.0.X	R00	First edition.
V1.1.X	R01	General Revision.
V1.2.X	R02	Added support for new products.

CONTENTS

1 SAFETY INSTRUCTIONS

This manual contains the information for the correct use of the product.

It was developed to be used by people with proper technical training or qualification to operate this kind of equipment. This manual presents all the functions and parameters of the product, but it is not intended to explain every possible application of the product. WEG will not take any liabilities for applications not described in this manual.

This product is neither intended for applications whose purpose is to ensure physical integrity and/or life of people, nor for any other application in which a fault of the product may create a situation of risk to the physical integrity and/or life of people. The designer who applies the product must provide ways to guarantee the safety of the installation even in the event of a failure of the Programmable Logic Controller.

1.1 SAFETY WARNINGS IN THE MANUAL

The following safety warnings are used in this manual:

DANGER!
The procedures recommended in this warning aim at protecting the user against death, serious injuries and considerable material damages.

ATTENTION!
The procedures recommended in this warning aim at preventing material damages.

NOTE!
The text provides important information for the complete understanding and proper operation of the product.

1.2 SAFETY WARNINGS ON THE PRODUCT

The following symbols are attached to the product as safety warnings:

Mandatory connection to the protective earth (PE).

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!
Only qualified personnel, familiar with the product and related equipment, must plan or perform the installation, commissioning, operation and maintenance of this equipment.
Such personnel must follow the safety instructions described in this manual and/or defined by local standards.
The noncompliance with the safety instructions may result in death risk and/or equipment damage.

NOTE!
For the purposes of this manual, qualified personnel are those trained and able to:
1. Install, ground, energize and operate the controller in accordance with this manual and the legal safety procedures in force.
2. Use the protective equipment according to the relevant standards.
3. Provide first aid.

ATTENTION!
Always disconnect the general power supply before touching any electrical component in connection with the product.
The electronic boards have components sensitive to electrostatic discharges. Do not touch components or connectors directly.
If necessary, first touch the grounding point of the product, which must be connected to the protective earth (PE), or use a proper grounding strap.

NOTE!
Read the whole user manual before installing or operating the product.

2 GENERAL INFORMATION

2.1 ABOUT THE MANUAL

This manual contains the main technical characteristics, functionalities and installation and operation instructions of the product.

This manual covers the entire PLC200 product line (PLC200, PLC201). However, the features described may not be present in all products within this line. Whenever a feature is specific to a particular product, this will be clearly indicated in the manual.

For detailed information on parameter setting, functions and accessories, refer to the documentation available on the website of WEG.

2.2 TERMS AND DEFINITIONS USED IN THE MANUAL

°C: degree Celsius.

A: ampere.

V: volts.

Ω**:** ohms.

CAN: Controller Area Network—type of communication network.

CPU: central processing unit.

kHz: kilohertz = 10^3 hertz.

MHz: megahertz = 10^6 hertz.

I/Os: inputs/outputs.

FLASH Memory: nonvolatile memory that can be electrically written and erased.

min: minute.

s: second.

ms: millisecond = 0.001 second.

RTD: resistance temperature detector.

USB: universal serial bus—type of serial communication interface designed to work according to the ”Plug and Play” concept.

WPS: WEG Programming Suite.

RTC: real time clock.

2.3 RECEIVING AND STORAGE

The product is supplied packed in a cardboard box. When receiving it, please check if:

- The product identification label matches the purchased model.
- Damages occurred during transportation.

If any problem is detected, report it to the Carrier immediately.

If the product is not installed soon, store it in a clean and dry location (temperature between -25 ºC and 60 ºC) with a cover to prevent ingress of dust into the product.

2.4 PACKAGE CONTENT

- Product with plug-in connectors.
- Installation, configuration and operation quick guide.
- Grounding plate.
- Closure of the communication busbar.

2.5 ABOUT THE PRODUCT

The Programmable Logic Controller PLC20X (PLC200 Series) is a device designed to meet small and medium-sized applications.

It has a 400 MHz single core ARM cortex M7 processor, with:

- Parameter table: To perform product configuration/control/monitoring.
- Program memory: To record programs generated by WPS.
- Volatile variable memory: To store the program's volatile variables.
- Retentive memory: To record the program's retentive variables.

It has four digital outputs, all of which are fast, with PWM functionality up to 300 kHz.

It also has eight digital inputs, all of which, depending on the configuration, can be used as fast inputs of up to 150 kHz (see Section 11 DIGITAL INPUTS on page 11-1)

As communication interfaces, it features one Ethernet port, one serial RS485 port (PLC201), one CAN port (PLC201) and USB type C port.

Built-in supercapacitors are used for the Real Time Clock (RTC) and for keeping the retentive data during power off, eliminating the need for batteries.

The product allows the connection of expansion cards for digital, analogue, thermocouple, PT100, PT1000, load cell, relay, SCW and other inputs and outputs, providing more flexibility for applications. It has plug-in connectors and can be mounted on a DIN 35 rail or directly on the panel.

The product is programmed through the WPS software.

Figure **??** on page **??** shows the product and the description of the communication interfaces, connections and LED indicators.

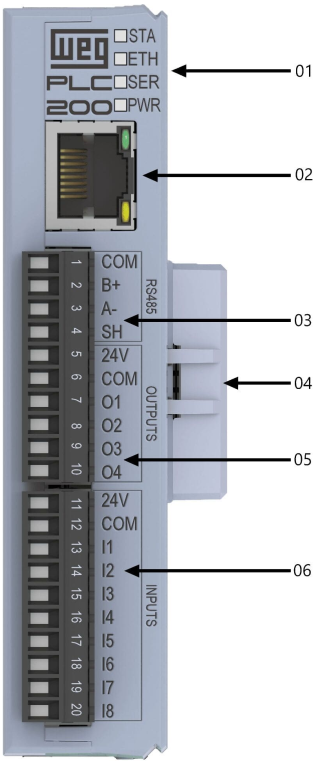


Figure 2.1: *The product*

N°	Information
1	LED indicators
2	Ethernet Connector
3	Serial RS485 Connector (PLC200) / CAN (PLC201)
4	Expansion Bus Closure
5	Digital Output Connector
6	Digital Input Connector

2.6 MEMORY

The product has Flash memory for storing programs, recipes, source files, variable tables and other user data. Memory allocation can be configured by the user through the WPS.

In addition, the product has volatile RAM memory for storing volatile variables and retentive RAM for storing retentive variables and recipes, which are maintained even after the product is de-energized.

Table 2.1 on page 2-3 shows the division of memories in the product:

Table 2.1: *Memory areas*

Area	Size	Use
Flash	1 MB	Stores all generated code, recipes, structures, source files etc.
Volatile RAM	128 kB	Stores all local and global volatile data.
Retentive RAM	4000 B	Stores all local and global retentive data, as well as recipes changed by the user.

NOTE!
Retentive memory is shared between retentive variables and recipes.

NOTE!
The retention time of variables may vary depending on the use of the RTC. See Section 2.8 RETENTION on page 2-4.

2.7 CLOCK

The product has an internal clock (RTC) that keeps the product date and time even if power is removed.

NOTE!
The RTC retention time may vary depending on the use of the retentive variables. See Section 2.8 RETENTION on page 2-4.

2.8 RETENTION

The product features Flash memory for storing the user's program and the product's parameters table. **Data saved in this memory is not lost**.

Important data, such as machine parameters, which are changed infrequently and cannot be lost (regardless of how long the product is powered off), can have their values saved in user parameters (P800...836).

> **NOTE!**
> Remember to save the parameters table in Flash (P204) after writing the important parameters in the user parameters.

> **DANGER!**
> Save the values in Flash only when necessary, as the number of writes is limited to 100,000 times. For example, if saving values every 10 ms, the maximum number of writes would be reached in just 16 minutes, and no new write to the table would be accepted, even for new product parameterization.

> **DANGER!**
> Powering off the product during data saving in Flash may corrupt the entire parameters table.

In addition to Flash memory, the product also features a region for storing retentive variables and recipes, known as retentive memory.

Both the internal clock and the retentive memory are maintained by the product through a supercapacitor.

It is possible to disable the RTC (through product parameters) to increase the retention time of retentive variables and recipes.

If the application does not use either retentive variables or recipes, the supercapacitor will automatically be used only to maintain the product's RTC, increasing the total retention time of the product's date and time.

> **ATTENTION!**
> It is necessary to keep the product powered for at least 2 hours to fully charge its supercapacitor and ensure the minimum retention time.

Refer to Section 14.1.2 Retention Time on page 14-1 to check the retention times.

2.9 INTERFACES, DIGITAL INPUTS AND OUTPUTS

Table 2.2 on page 2-4 contains the number of communication interfaces and digital inputs and outputs of the product:

Table 2.2: *Interfaces*

Interface	Quantity
Ethernet	1
USB-C	1
Isolated Serial RS485	1 (Only on PLC200)
CAN	1 (Only on PLC201)
Digital Inputs	8 (up to 8 fast)
Digital Outputs	4 (all fast)

2.10 PROTOCOLS

Table 2.3 on page 2-5 contains the existing protocols and their respective functions.

Table 2.3: *Protocols*

Protocol	Function	product
Modbus TCP	Client	Yes
	Server	Yes
EtherNet/IP	Scanner	No
	Adapter	Yes
Modbus RTU	Client	Yes
	Server	Yes
CANopen	Master	No
	Slave	No
MQTT	Client - Publisher	Yes
	Client - Subscriber	Yes
SNTP	Client	Yes

NOTE!
See the Parameters Manual and/or network manuals for more information.

2.11 BOOTLOADER

The bootloader is an auxiliary program that executes the main firmware of the product, which, in turn, runs all the functionalities.

Through the bootloader, new firmware can be uploaded to the product via USB, Ethernet, and Serial (Only PLC200).

In case of errors during firmware update, the product will respond as follows:

- Errors during firmware transfer: The product will continue operating with the previous firmware version.
- Interruptions (power down) during firmware writing (after successful transfer): The bootloader will attempt to write the new firmware again. During the writing process, all product LEDs will be lit in red.
- If the bootloader cannot load the written firmware and there is no firmware update available, all product LEDs will flash orange. If this happens, simply download the firmware via WPS again. Note: In this case, the update will only work via USB.

The parameter and the program table are not erased during firmware updates. However, a firmware update may make the parameter and/or the program table incompatible with the new firmware. In this case, it is necessary to compile the program in the updated version of WPS and download the parameter and/or program table again.

2.12 FAULT HANDLING

The product has diagnostics for a series of faults and alarms that may occur. Faults are displayed on P100 and alarms on P105. Refer to the Parameter Manual for more information.

NOTE!
It is necessary to clear errors so that the program can be sent to RUN.

The Table 2.4 on page 2-6 aims to provide a quick diagnosis and solution for common issues.

Table 2.4: Faults and Alarms

Fault/Alarm	Action
Program does not go to RUN	Check if the product is in fault. Any active fault prevents the program from going to RUN. Also check the termination of expansions; without it connected, the product starts in STOP.
Parameters are not retained when the product is restarted	Parameters are only saved if the ”Setup write” box is checked when downloading the program (remember to save the project), when writing ”1” in P204, and when downloading the entire parameter table through the ”Write parameters to the product” button.
Intrabus: Identification/addressing errors	Check if the accessories and closing are connected as shown in Section 3.3 CONNECTING THE ACCESSORIES on page 3-4.
Intrabus: Timeout/crc/command errors	Check if the contacts of all expansions are intact and that they were installed as shown in Section 3.3 CONNECTING THE ACCESSORIES on page 3-4. Ensure that all grounding points are well secured, as described in Section 4.2 CONNECTING THE GROUNDING on page 4-1.
Hardware watchdog	The product has a general watchdog with a fixed time of 2,4 seconds updated at the end of the scan cycle. That is, ensure that the scan cycle is never longer than 2,4 seconds. If the error persists, record the data from parameters P50 to P86 and report it to technical support.
Program watchdog	Some task took longer than configured in the Watchdog. Check the system markers to identify which task caused this fault.
Low battery	Keep the product powered for at least 30 minutes so that it can charge its supercapacitor, which is responsible for maintaining RTC values and retentive program variables.
Communication errors with WPS	Check the grounding of the product. Use shielded cables and avoid using USB hubs.
Network errors (Ethernet, RS485, CAN, etc.)	Refer to the Network Manual.

2.13 IMPORTANT NOTICE ABOUT CYBERSECURITY AND COMMUNICATIONS

This product/equipment can connect and exchange information through networks and communication protocols. It has been designed and subjected to tests to ensure correct operation with other automation systems using the protocols mentioned in this manual. Therefore, it is essential that the customer understands the responsibilities in connection with information and cybersecurity when using this equipment.

Consequently, it is the exclusive obligation of the customer to adopt in-depth defense strategies and implement policies and measures to ensure the security of the system as a whole, including with regard to communications sent and received by the equipment. Among such measures, we can point out the installation of firewalls, antivirus and malware protection applications, data encryption, authentication control and physical user access.

WEG and its affiliates take no liability for damages or losses arising from cybersecurity breaches, including, but not limited to, unauthorized access, intrusion, information, or data leak and/or theft, denial-of-service attacks, or any other form of security breach. Using this product under conditions for which it was not specifically designed is not recommended and may result in damage to the product, the network, and the automation system. Thus, it is essential that the customer understand that the external intervention by third-party software applications, such as sniffers or applications with similar actions, has the potential to cause interruptions or restrictions in the functionality of the equipment.

3 MECHANICAL INSTALLATION

The directions and suggestions must be followed aiming at the safety of people and the correct operation of the equipment.

3.1 MOUNTING

The product and its accessories can be installed on a 35 mm DIN rail, as shown in Figure 3.1 on page 3-1. To that end, proceed as follows:

(a) *(b)* *(c)*

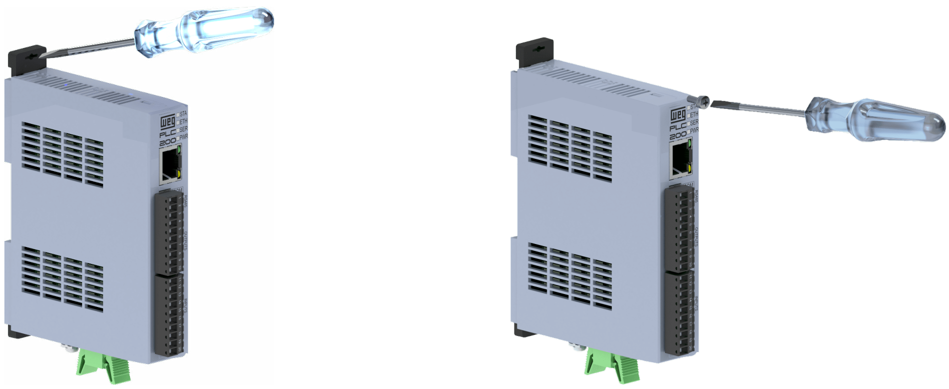
Figure 3.1: *Mechanical mounting on a DIN rail*

a) Move the two latches away.

b) Fit the controller on the DIN rail.

c) Close the two latches.

In addition to the DIN rail, the product can also be mounted directly to the panel using M3 screws, as shown in Figure 3.2 on page 3-1; in order to do so:



(a) *(b)*

Figure 3.2: *Mounting directly to the panel*

a) Move the two latches away.

b) Screw the product to the panel.

3.2 DIMENSIONS

3.2.1 Dimensions of the product

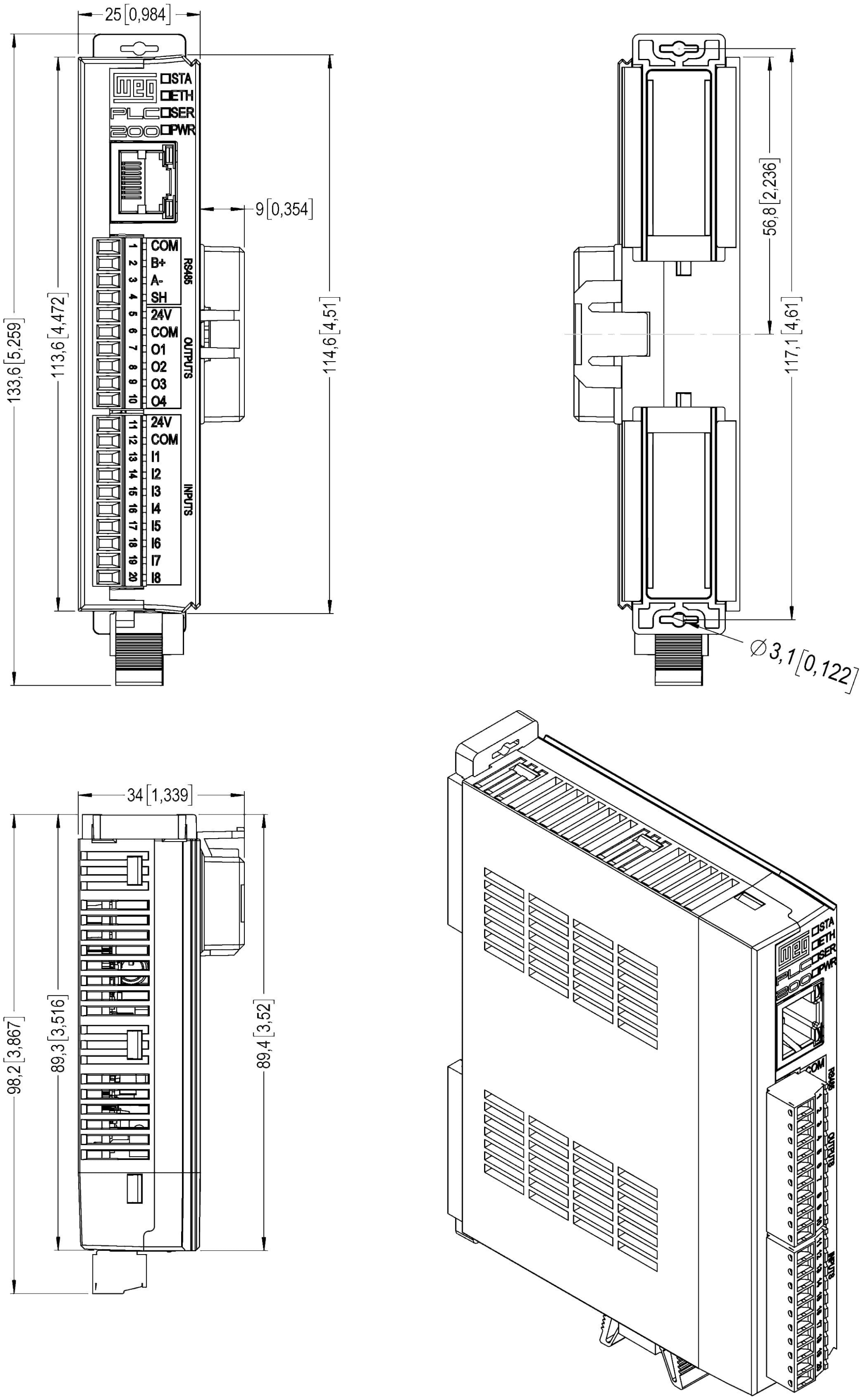


Figure 3.3: *Product dimensions in mm [pol]*

3.2.2 Accessory dimensions

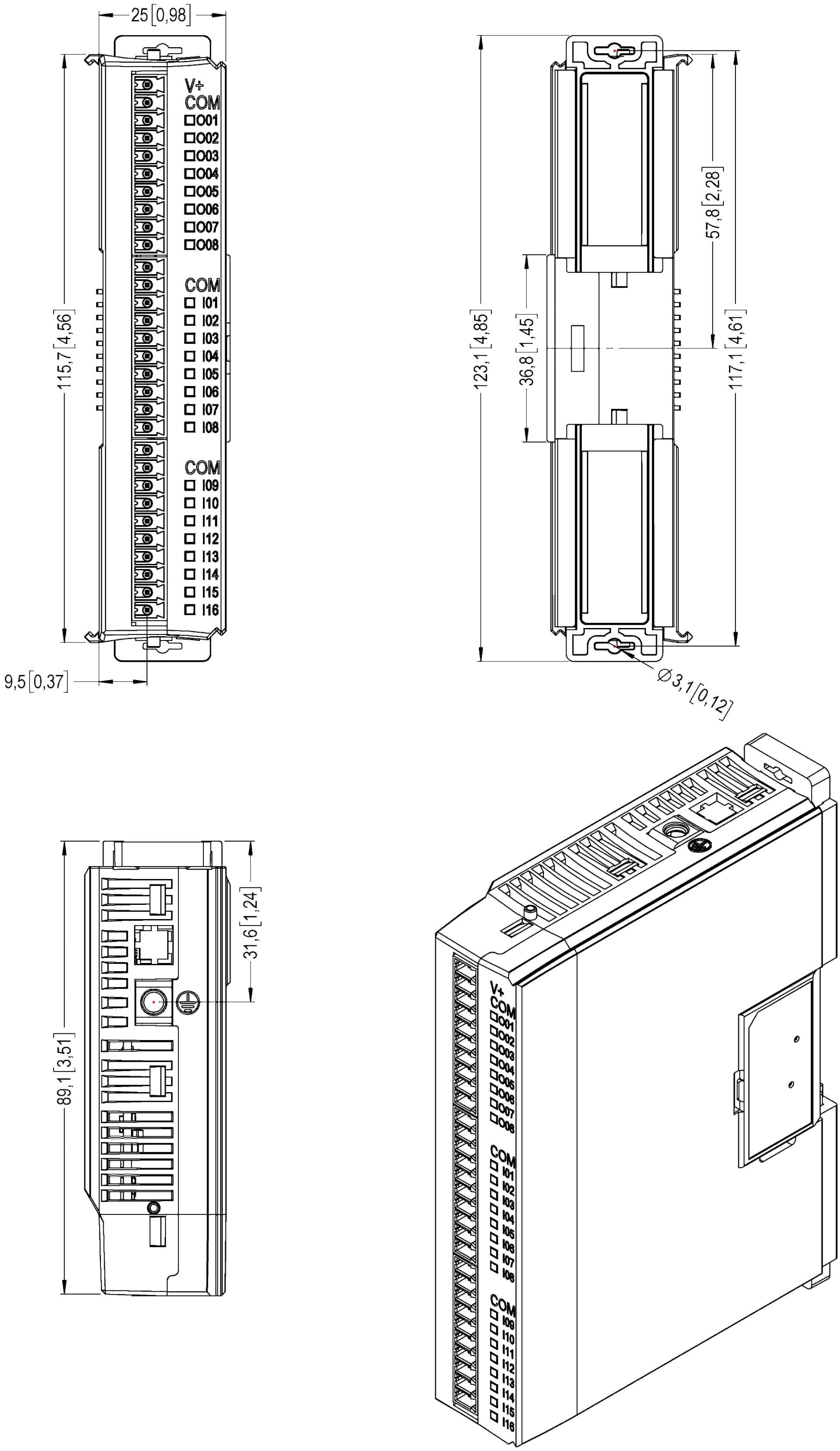
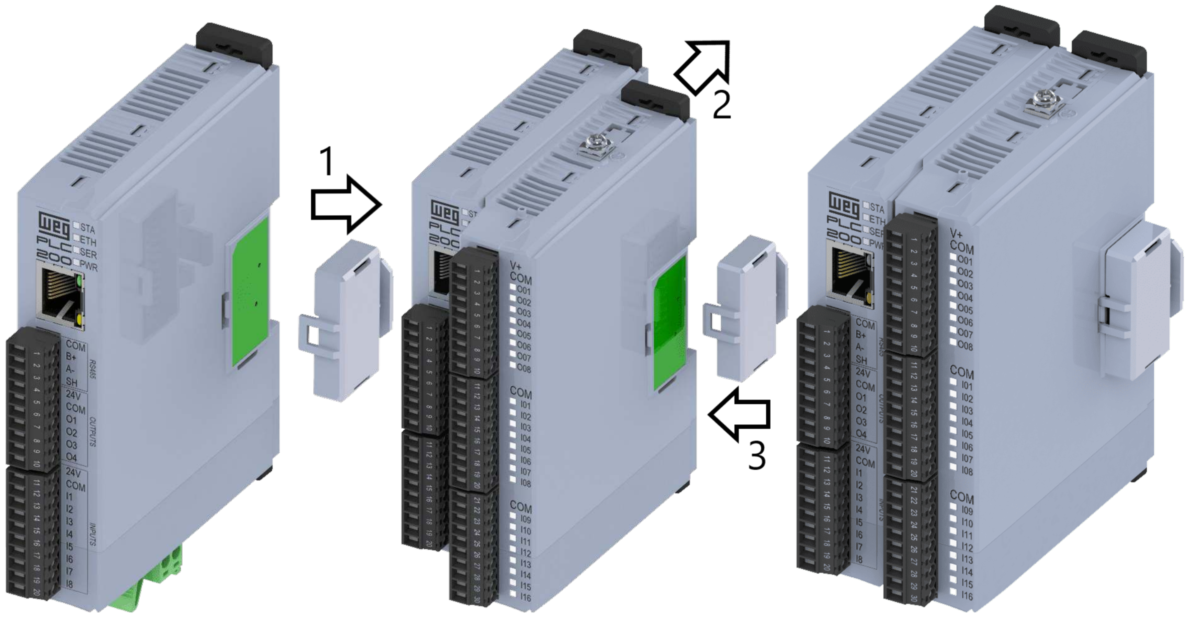


Figure 3.4: *Expansion dimensions in mm [pol]*

3.3 CONNECTING THE ACCESSORIES

The accessories must be inserted as shown in Figure 3.5 on page 3-4. Before adding a new accessory, the closure of the modules must be removed and then reinstalled after the accessory is connected.



(a) Remove closure *(b) Connect accessory and closure* *(c) Accessory installed*

Figure 3.5: *Connection of the Accessories*

Connecting the closure of the expansion communication busbar is essential for the product proper operation.

To install the closure correctly, first fit the part highlighted in red (1) to Figure 3.6 on page 3-4; then, with a slight rotation movement, fit part (2), which is close to the rail or panel.

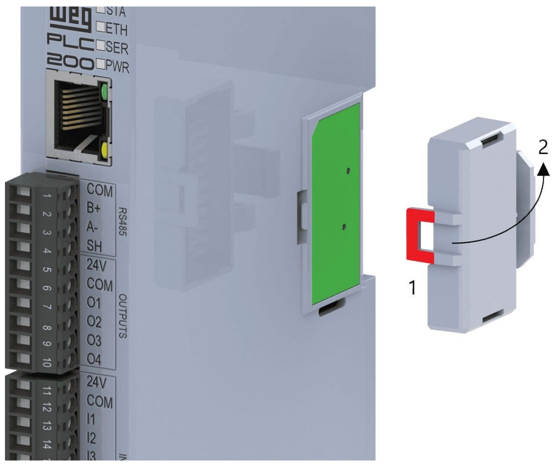


Figure 3.6: *Closure fitting*

> ⚠ **ATTENTION!**
> Accessories must be installed or removed with the product de-energized to avoid burning components and to allow them to be identified.

4 ELECTRICAL INSTALLATION

4.1 POWER SUPPLY

The producto must be powered by an external 24 V dc power supply with a current capacity of at least 1 A. The minimum supply voltage is 20.4 V, and the maximum 28.8 V.

Figure 4.1: *Power supply*

4.2 CONNECTING THE GROUNDING

Use the screws indicated in Figure 4.2 on page 4-2 to ground the product.

To connect the ground to the expansions, use the metal plate that comes with the product, as indicated by arrow 1 on Figure 4.2 on page 4-2. To connect the other expansions, use the metal plate indicated by arrow 2 on Figure 4.2 on page 4-2.

For analog expansion modules, it is recommended to use cables with the shield properly connected to the ground-mat.

The analog cable shield must be grounded using the metal clamp that comes with the expansion. Grounding the shield minimizes possible electromagnetic interference.

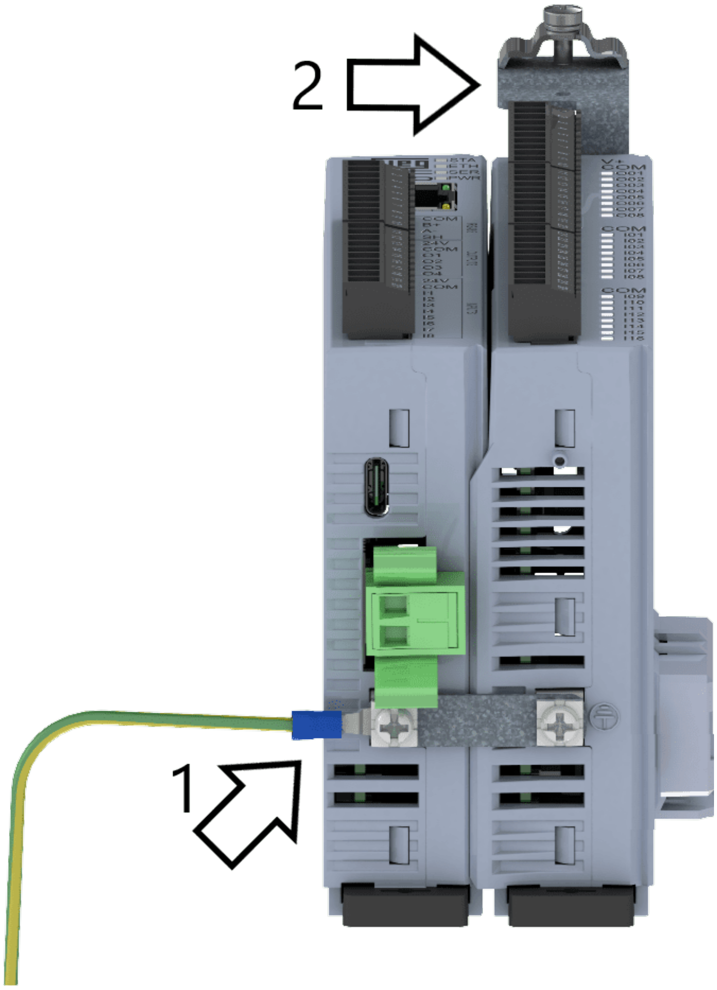


Figure 4.2: *Product grounding*

5 ETHERNET COMMUNICATION INTERFACE

The product has an Ethernet port that can operate at of 10/100 Mbps speeds.

Figure 5.1: *Ethernet port*

For the installation, it is recommended to use shielded Ethernet cables specific for industrial environments.

The port default IP can be checked in parameter **P852** (see the Parameters Manual).

The Ethernet interface allows:

- Modbus TCP: (Client/Server).
- EtherNet/IP: Adapter.
- MQTT: Client - *Publisher* and *Subscriber*.
- SNTP: For product date and time synchronization.
- Program transfer and monitoring.
- Firmware *update*.
- Parameter monitoring/writing.
- Web page.

6 RS485 COMMUNICATION INTERFACE (PLC200)

Isolated, multipoint serial interface intended for network communication. It operates as a network master and slave with Modbus RTU protocol.

The four channels necessary for connecting the Modbus network are in the same connector as the digital outputs, with the following pinout:

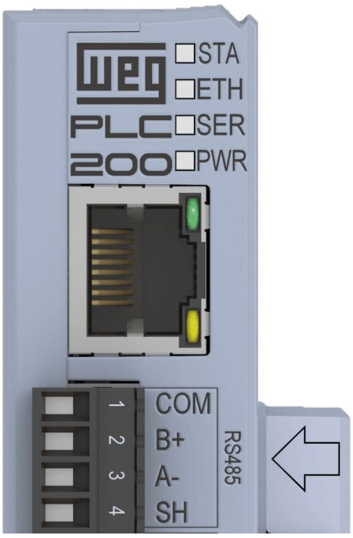


Figure 6.1: *RS485 pins*

Pin	Name	Function
1	COM	RS485 common
2	B +	B + communication signal
3	A -	A - communication signal
4	SH	Cable Shield

The RS485 serial communication address, baud rate and bytes are set through the product parameter table. Internal termination resistors can also be added to the RS485 network through the RS485 configuration parameters.

See the Parameters Manual for more information.

The RS485 interface allows:

- Modbus RTU: (Master/Slave).
- Program transfer and monitoring.
- Firmware *update*.
- Parameter monitoring/writing.

7 CAN COMMUNICATION INTERFACE (PLC201)

The PLC201 features an isolated CAN interface with its own internal power supply. It operates as a network master and slave using the CANopen protocol.

The 4 pins required for the CAN network connection are on the same connector as the digital outputs, with the following pinout:

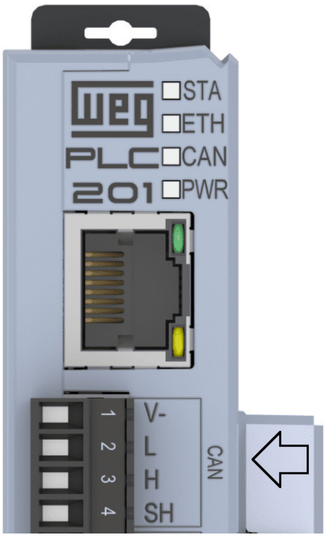


Figure 7.1: *CAN Pins*

Pin	Name	Function
1	V-	CAN network common
2	L	CAN_L communication signal
3	H	CAN_H communication signal
4	SH	Cable Shielding

The PLC201 has an internal power supply for the CAN network, so no external power is needed. However, it is recommended that pin 1 (V-) be connected to the master and the other slaves to keep the CAN network at the same voltage reference.

The CAN interface requires 120 Ω termination resistors at the endpoints of the network. The PLC201 has these resistors internally, which can be connected and disconnected using the CAN configuration parameters.

The CANopen network configuration, including address and baud rate, is set through the parameter table.

Refer to the Parameter Manual for more information.

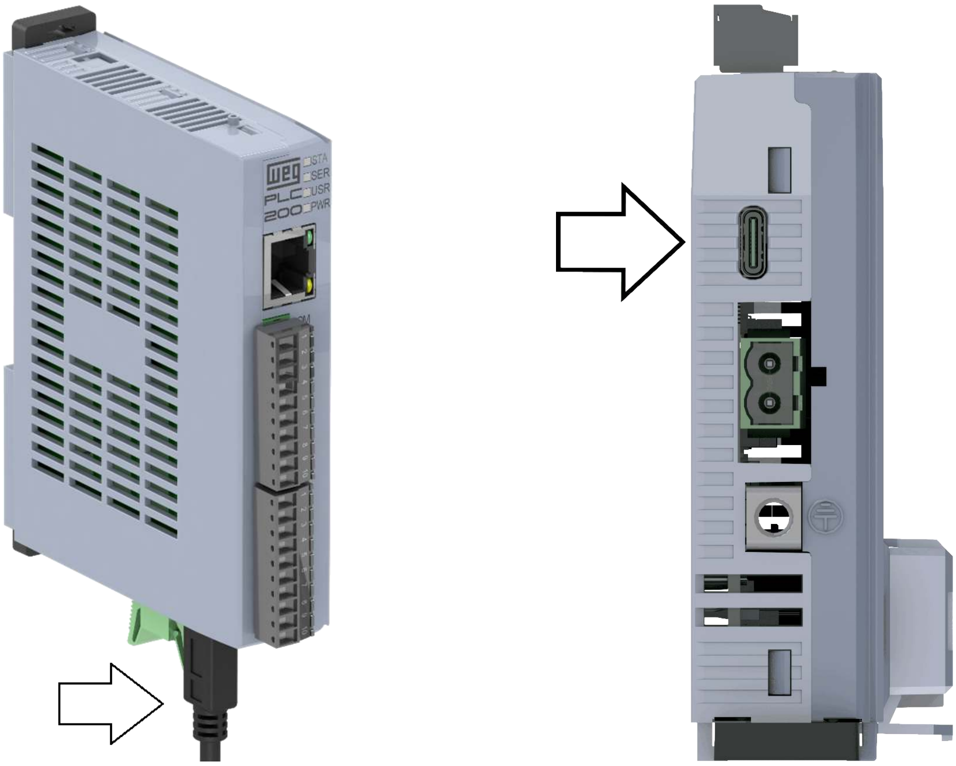
The CAN interface allows:

- CANopen: (Master/Slave).

8 USB INTERFACE

The product has a USB-C port. This USB port can be used for programming and monitoring the product through the WPS software, in addition to providing access to the product parameters via modbus RTU.

Figure 8.1 on page 8-1 shows the location of the USB-C port on the product.



(a) 3D view *(b) Product bottom view*

Figure 8.1: *USB-C port*

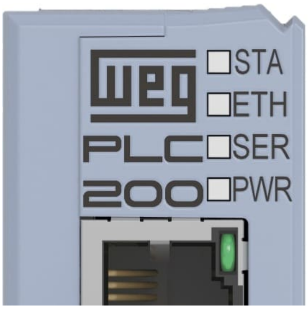
The USB interface allows:

- Program transfer and monitoring.
- Firmware *update*.
- Parameter monitoring/writing.

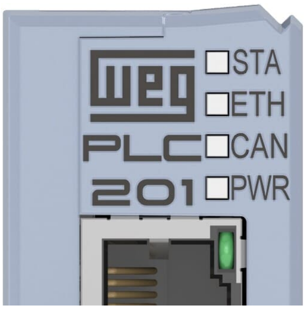
ATTENTION!
Use a shielded USB-C cable no longer than three meters.

9 INDICATIVE LEDS

The product has LEDs to indicate the controller and communication network status.



(a) PLC200



(b) PLC201

Figure 9.1: *LEDs*

9.1 STA - STATUS

It indicates the controller application status, as per Table 9.1 on page 9-1

Table 9.1: *Status LED*

Status	Description
Green	Program running
Red	Program stopped
Flashing red	Product in fault
Solid yellow	Invalid program
Flashing yellow	Program being saved
Off	No program

9.2 ETH - ETHERNET

It indicates the network status, as per Table 9.2 on page 9-1

Table 9.2: *LED Ethernet*

Status	Description	Comment
Off	No power	-
Flashing green/red	Equipment performing self-diagnosis	It occurs during initialization.
Green, flashing (100ms ON / 100ms OFF)	DHCP enabled, waiting for receiving IP Address configuration.	-
Green, flashing (250ms ON / 250ms OFF)	IP address configured and waiting for Modbus TCP or EtherNet/IP (Exclusive Owner) connection.	-
Green, solid	Equipment active, at least one Modbus TCP or EtherNet/IP (Exclusive Owner) connection established.	-
Red, flashing (100ms ON / 100ms OFF)	Recoverable failure.	-
Red, flashing (250ms ON / 250ms OFF)	EtherNet/IP (Exclusive Owner) connection timeout.	Indicates EtherNet/IP (Exclusive Owner) connection has timed out.
Red, flashing (500ms ON / 500ms OFF)	Modbus TCP connection timeout.	Indicates Modbus TCP connection has timed out.
Red, solid	Fatal error	Reinitializing the equipment is required.

9.3 SER - SERIAL - RS485 (PLC200)

It indicates the communication status via RS485, as per Table 9.3 on page 9-2

Table 9.3: *Serial LED - RS485*

Status	Description
Flashing green	It flashes green whenever a response telegram from the slave is transmitted to the network.
Flashing red	Data reception error.
Flashing red (1 second)	Timeout error when receiving data.

9.4 CAN (PLC201)

Indicates the communication status via the CAN interface. Check the product's CAN User Manual.

9.5 PWR - POWER

Red LED indicates that the product is energized.

10 DIGITAL OUTPUTS

The product has four isolated digital outputs. The digital output circuit must be externally powered by a 24 V source connected to pins 5 (24V) and 6 (COM) of the product.

All four digital outputs are push-pull, that is, they activate the load connected to both 24 V and COM. These outputs can be used as normal digital outputs, as independent PWM, with variable duty cycle from 0 to 100 % at up to 300 kHz or for controlling up to two step-motors.

Table 10.1 on page 10-1 contains the name and function of each of the connector pins that have digital outputs. For this connector, use AWG 30-16 cables.

Table 10.1: *Digital output description*

Pin	Description	Function 1	Function 2	Function 3
5	24V	Power positive of the outputs		
6	COM	Negative or common of the outputs		
7	O1	Digital output 1	PWM 1 (300 kHz)	Step-motor 1 - Pulses
8	O2	Digital output 2	PWM 2 (300 kHz)	Step-motor 2 - Pulses
9	O3	Digital output 3	PWM 3 (300 kHz)	Step-motor 1 - Direction
10	O4	Digital output 4	PWM 4 (300 kHz)	Step-motor 2 - Direction

NOTE!
Check the configuration parameters of the outputs (in the Parameter Manual) to configure the behavior in case of program stop or product failure.

10.1 ELECTRICAL INSTALLATION: DIGITAL OUTPUTS

The example of Figure 10.1 on page 10-1 shows two loads connected to DO1 in push-pull format, that is, when L1 is activated, L2 is deactivated, and vice versa. Other three loads are connected to outputs DO2 to DO4, which, when activated, apply V+ to the loads. In this example, only outputs DO2 and DO4 are activated.

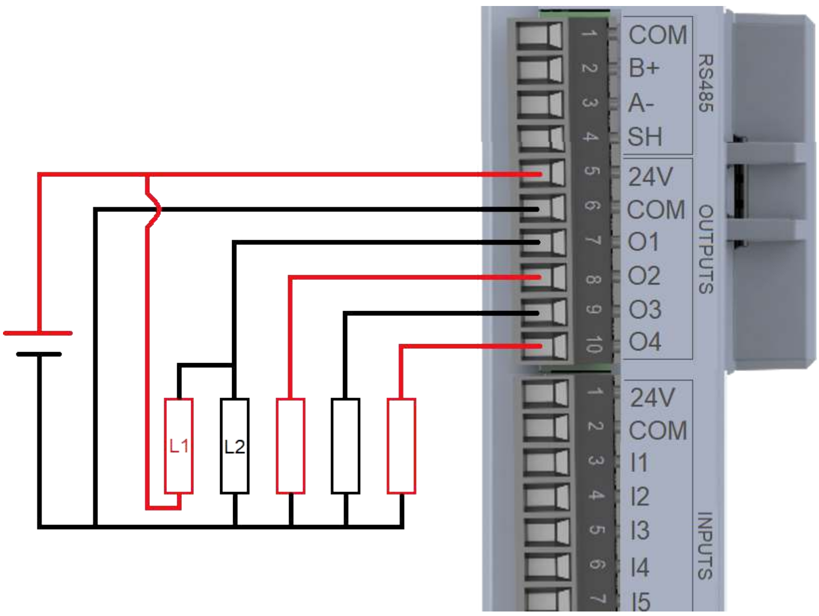


Figure 10.1: *Configuration as digital outputs*

10.2 ELECTRICAL INSTALLATION: FAST OUTPUTS (PWM)

The example of Figure 10.2 on page 10-2 shows the connection of the four outputs configured as PWM.

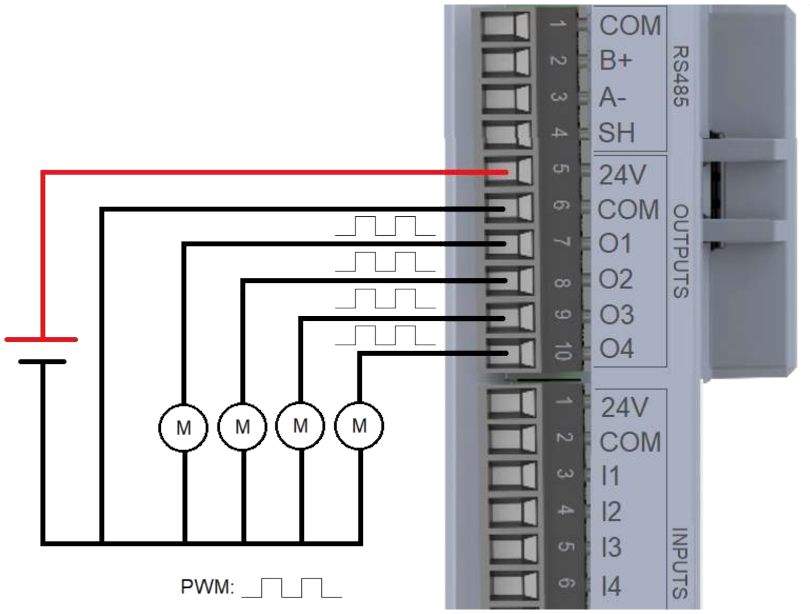


Figure 10.2: *Configuration as PWM outputs*

10.3 ELECTRICAL INSTALLATION: STEPPER MOTORS

Figure 10.3 on page 10-2 shows how to connect up to two step-motors with pulse and direction control.

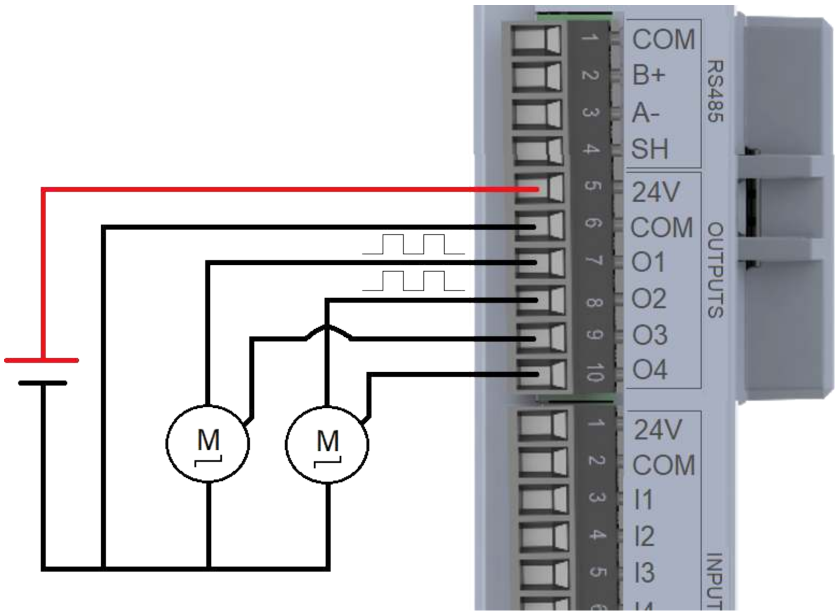


Figure 10.3: *Configuration as step-motor control*

NOTE!
In step-motor control mode, even if the direction output is not connected to the motor, it cannot be used as a normal output.

11 DIGITAL INPUTS

The product has eight isolated digital inputs that must be excited by a 24 V power supply. The levels to activate the inputs are 10 to 28.8 V for high level, and below 3 V for low level.

Additionally, has four fast counters that can be connected in some way to all digital inputs to count pulses with and without the direction signal and to count quadrature encoders. Table 11.1 on page 11-1 shows all pins related to the digital inputs, along with the possible functions of each one.

For these connectors, use AWG 30-16 cables.

Table 11.1: *Description of the digital inputs*

Pin	Description	Function 1	Function 2	Function 3	Function 4
1	24V	Power positive of the inputs			
2	COM	Negative or common of the inputs			
3	I1	Digital input	Pulse Quadrature A (enc 1)	Pulse input (enc 1)	Counter input
4	I2	Digital input	Pulse Quadrature B (enc 1)	Direction input (enc 1)	Digital input
5	I3	Digital input	Pulse Quadrature A (enc 2)	Pulse input (enc 2)	Counter input
6	I4	Digital input	Pulse Quadrature B (enc 2)	Direction input (enc 2)	Digital input
7	I5	Digital input	Pulse Quadrature A (enc 3)	Pulse input (enc 3)	Counter input
8	I6	Digital input	Pulse Quadrature B (enc 3)	Direction input (enc 3)	Digital input
9	I7	Digital input	Pulse Quadrature A (enc 4)	Pulse input (enc 4)	Counter input
0	I8	Digital input	Pulse Quadrature B (enc 4)	Direction input (enc 4)	Digital input

NOTE!
It is necessary to power the pins 1 (24V I/O) and 2 (COM) with an external 24 V source for the digital inputs to operate.

In Table 11.1 on page 11-1 it is possible to notice that inputs DI2, DI4, DI6 and DI8 cannot be set as a fast pulse counter individually. However, these inputs, when set to “Digital Input”, can be used as a task count source for frequencies up to 30 kHz*, depending on the system load.

NOTE!
*Tests conducted under the following conditions:

- All inputs configured to function 4, that is:

  DIs 1, 3, 5, and 7 configured as fast counters (do not influence product processing since counting is done via hardware).

  DIs 2, 4, 6, and 8 configured as digital inputs (influence product processing since counting is done via software).

- The application used for counting has the following characteristics:

  4 POUs for event counting.

  4 counting tasks, one for each DI (2, 4, 6, and 8), each triggering a POU every 10000 counted pulses.

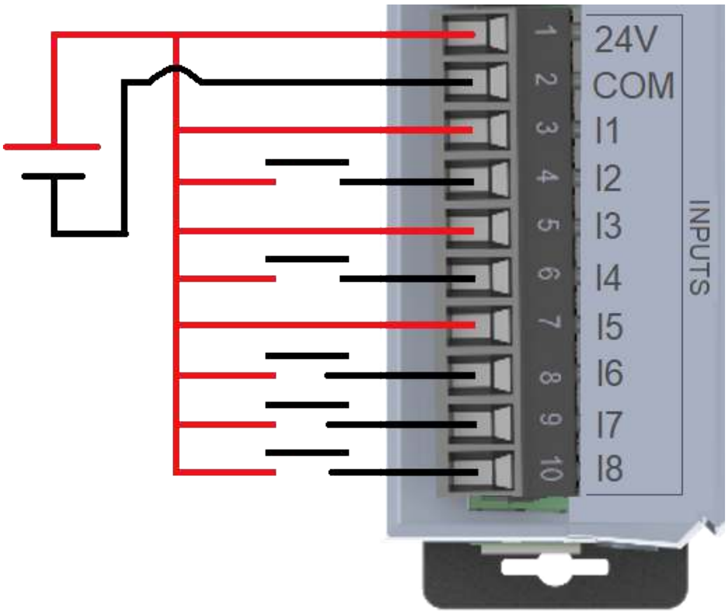
  Empty main ladder (POU).

- 30 kHz PWM applied to all 8 product inputs.

Under these conditions, all 8 inputs counted the same number of pulses, meaning no pulses were lost.

Below are some connection examples for digital inputs.

Figure 11.1 on page 11-2 shows how the connection should be made using all eight inputs as simple digital inputs.



Input	Status
I1	High
I2	Low
I3	High
I4	Low
I5	High
I6	Low
I7	Low
I8	Low

Figure 11.1: *Function 1 - Setting as digital inputs*

Figure 11.2 on page 11-2 shows how to connect up to four quadrature encoders.

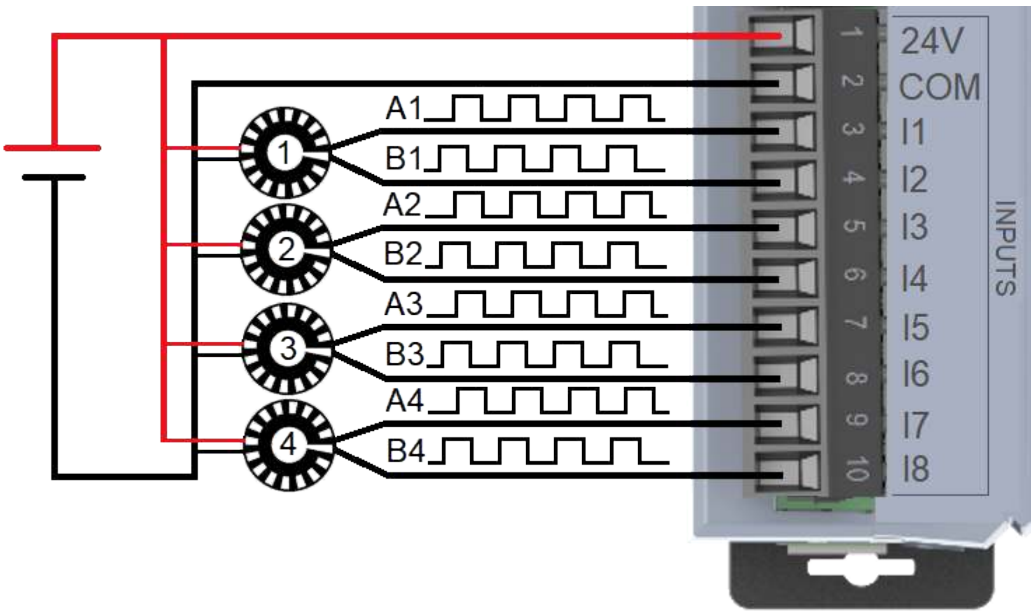


Figure 11.2: *Function 2 - Setting to quadrature encoder input*

Figure 11.3 on page 11-3 shows how to connect up to four fast counters with pulse signal and direction.

By default, if the direction signal is at logic level 0 (0 V), the counter will be incremented at each pulse; if the direction signal is at logic level 1 (24 V), the counter will be decremented at each pulse. However, this behavior can be configured in parameter **P5**.

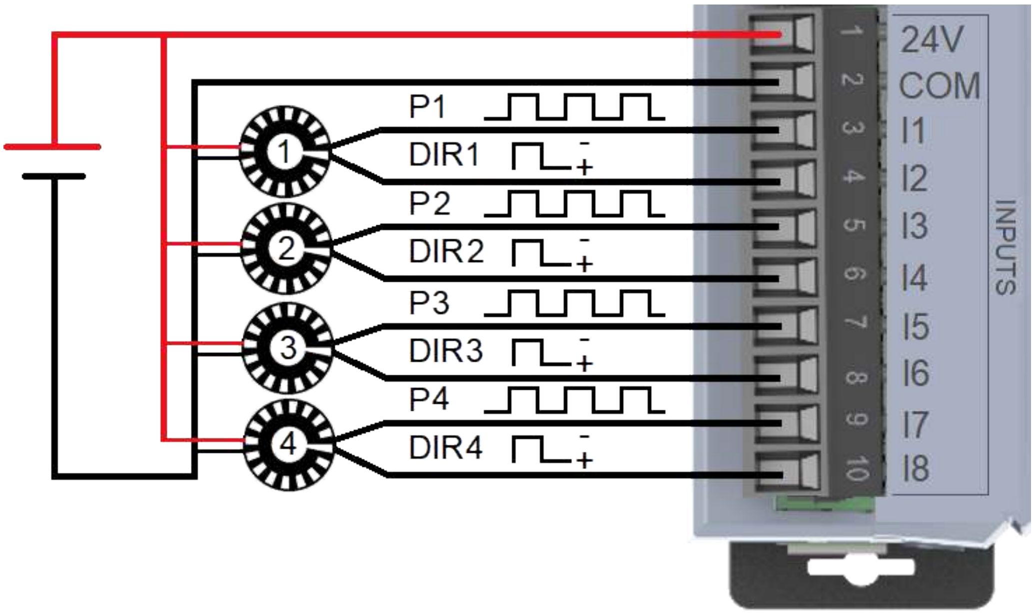
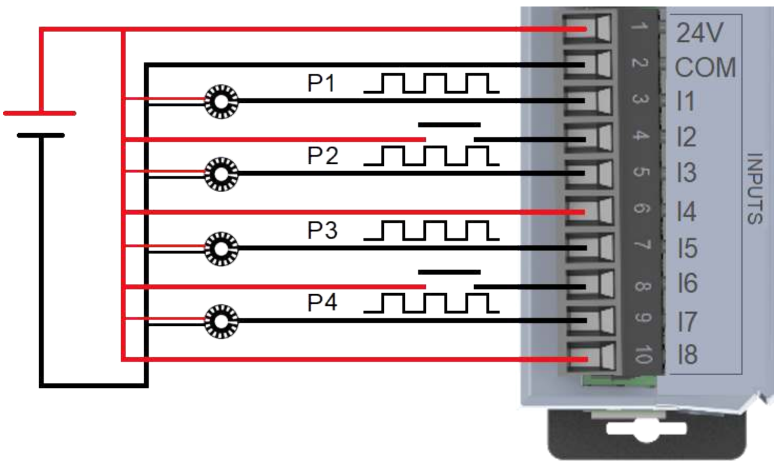


Figure 11.3: *Function 3 - Setting to fast counter with pulse and direction*

Figure 11.4 on page 11-3 shows how to connect up to four fast counters without the direction signal. These counters can simply be a sensor signal or a pushbutton. In this mode, the input that would be responsible for the direction signal is released for use as a common digital input.



Input	Status
I1	Fast counter
I2	Low
I3	Fast counter
I4	High
I5	Fast counter
I6	Low
I7	Fast counter
I8	High

Figure 11.4: *Function 4 - Setting to fast counter + digital input*

12 EXPANSION BOARDS

The product has a bus that allows connecting up to eight expansion boards, according to Figure 12.1 on page 12-1.

Figure 12.1: *Eight expansion boards connected*

Users can simply and quickly install expansion boards on the product, using the plug and play concept. When the product is energized, the electronic circuit identifies the number of expansions connected and their model and firmware version. Automatic addressing is also carried out according to the position of each board so that it is possible to access them through the communication bus.

NOTE!
Starting the product without the expansion bus termination (or with an error/poor contact) forces the program into the stop mode.

ATTENTION!
Accessories must be installed or removed with the PLC de-energized to avoid burning components and to allow them to be identified.

12.1 AVAILABLE MODELS

Table 12.1 on page 12-2 briefly presents each of the expansions available for the product. For more details, see the manual of each accessory.

Table 12.1: *Expansion models*

Model	Characteristic
MOD1.00 - 24DIs	24 bidirectional digital inputs
MOD1.10 - 24DOs	24 bidirectional digital inputs
MOD1.20 - 16DO/8DI	16 isolated 24 V/500 mA digital outputs and 8 bidirectional digital inputs
MOD1.30 - 08DO/16DI	8 isolated 24 V/500 mA digital outputs and 16 bidirectional digital inputs
MOD2.00 - 7AI	7 voltage or current analog inputs
MOD3.00 - 8AO	8 voltage or current analog outputs
MOD4.00 - 7TH	7 inputs for type J, K and T thermocouples
MOD5.00 - 4RTD	4 inputs for PT100 and PT1000 thermistors
MOD6.00 - 2SG	2 load cell inputs
MOD7.00 - 6RE	6 relay outputs
MOD8.00 - SCW	4 outputs for controlling WEG - SCW smart starters

12.2 ACCESSORY LIMIT

The product allows coupling up to eight expansion modules. However, there is a limit of 300 mA on the +/-15 V source that powers part of the circuit of some expansions.

To find out how many accessories can be coupled, use Table 12.2 on page 12-2 with the current consumption values of each module.

Table 12.2: *Current consumption of the expansions*

Model	Consumption
MOD1.xx	0 mA
MOD2.xx	40 mA
MOD3.xx	150 mA
MOD4.xx	0 mA
MOD5.xx	0 mA
MOD6.xx	30 mA
MOD7.xx	50 mA
MOD8.xx	0 mA

12.2.1 Configuration and Consumption Examples

Ex1: 1 x MOD3 + 3 x MOD2 + 4 x MOD1 = 1 x 150 + 3 x 40 + 4 x 0 = 270 mA (OK).

Ex2: 1 x MOD3 + 3 x MOD6 + 1 x MOD7 = 1 x 150 + 3 x 30 + 1 x 50 = 290 mA (OK).

Ex3: 1 x MOD3 + 3 x MOD6 + 3 x MOD7 = 1 x 150 + 3 x 30 + 3 x 50 = 390 mA (Current limit exceeded).

NOTE!
If the current limit or the number of accessories is exceeded, an error will be generated and the product will be in the stop mode until a valid combination of expansions is identified.

13 PROGRAMMING SOFTWARE - WPS

The WPS is an integrated tool that helps create automation applications, allowing monitoring, parameterization and programming in Ladder language (IEC 61131-3) of several WEG product families. The main features of WPS are:

- Suitable for a wide range of WEG products
- Parameter setting of the devices
- Programming of the devices in Ladder language and Structured Text
- Monitoring of the devices
- Assistance in the creation and configuration of automation applications

Furthermore, the WPS has a very detailed help menu regarding the product programming, explaining how to use the device’s full potential.

14 TECHNICAL DATA

14.1 OPERATION

14.1.1 Power supply

- Input voltage: 24.0 V
- Minimum input voltage: 20.4 V
- Maximum input voltage: 28.8 V
- Consumption at 24.0 V (on duty, without accessories, without networks): 100 mA

14.1.2 Retention Time

Table 14.1: *Retention time at room temperature (23 ºC)*

Settings	Time
User Program	10 years
Parameters Table and User Parameters	10 years
RTC + Retentive Variables and Recipes	5 days
Only Retentive Variables and Recipes	7 days
Only RTC	21 days

NOTE!
The application is never lost, only the value of the retentive variables, recipes and product clock will be reset if the supercapacitor charge runs out.

NOTE!
For values that cannot be lost, see notes in Section 2.8 RETENTION on page 2-4

ATTENTION!
High temperatures can damage the product and permanently reduce the retention time. Observe the operating temperature limits.

14.1.3 Temperature

- Operating temperature: 0 to 50 ºC
- Storage temperature: -25 to 60 ºC

14.1.4 Protection Rating

- IP20

14.1.5 Pollution Degree

- 2 (as per EN50178 and UL508C), with non-conductive pollution

14.2 I/OS

14.2.1 Inputs

- 8 x PNP
- Maximum input voltage of 28.8 V

- 4 fast counters up to 150 kHz per counter (see Section 11 DIGITAL INPUTS on page 11-1)
- High level: Vin ≥ 10 V
- Low level: Vin ≤ 5 V
- Consumption at 24 V: 0.74 mA
- Insulation voltage: 500 V
- Max number of DIs via expansion boards: 200 Points

14.2.2 Outputs

- 4 x Push-Pull
- Recommended voltage V+: 24 V
- Maximum voltage V+: 28.8 V
- Fast outputs: All
- Maximum frequency: 300 kHz
- PWM width: 0.0% to 100.0%
- Max current: 100 mA/output
- Step-motors: up to 2 motors (see Section 10 DIGITAL OUTPUTS on page 10-1)

14.3 PROCESSING AND MEMORY

14.3.1 Processing

- Processor: ARM cortex M7
- Operating frequency: 400 MHz

For a simple program, done with five thousand lines with contacts and coils, which resulted in ten thousand instructions, the product presents the following characteristics (with no expansions connected):

- Total cycle time: 2.2 ms
- Average time per instruction: 220 ns
- Size of the generated program: 120 kB
- Cycle time, per kB of program: 18.3 us/kB

14.3.2 Memories

- Flash memory 1 MB
- Volatile RAM memory: 128 kB
- Retentive RAM memory: 4 kB
- Maximum instruction capacity: approximately 80 thousand contacts and coils

14.4 COMMUNICATION

14.4.1 USB-C

- Program transfer and monitoring
- Firmware *update*
- Parameter monitoring/writing

14.4.2 Ethernet

- 1 port 10/100 Mbps
- Modbus TCP: (Client/Server)
  Max. number of connected servers: Unlimited
  Max. number of connected clients: 4
- EtherNet/IP: *Adapter*
- MQTT: Client - *Publisher* and *Subscriber*
- SNTP: For product date and time synchronization
- Program transfer and monitoring
- Firmware *update*
- Parameter monitoring/writing
- Web page

14.4.3 RS485

- Maximum rate: 256 kbps.
- Modbus RTU: (Client/Server)
  Max. number of servers: 246
- Program transfer and monitoring
- Firmware *update*
- Parameter monitoring/writing

14.4.4 CAN

- Maximum rate: 1 Mbps
- Network management (NMT): Manager (master) / Server (slave)
  Manager:
    63 TPDOs
    63 RPDOs
    1 SDO Client
    Producer or Consumer SYNC
    Producer and/or Consumer Heartbeat (up to 63 consumers)
    Node guarding Master or Slave
    Producer Follow
    512 bytes of input network markers
    512 bytes of output network markers
  Server:
    32 TPDOs
    32 RPDOs
    1 SDO Server
    SYNC Consumer
    Producer and/or Consumer Heartbeat
    Node guarding Slave

14.5 EXPANSIONS

- Maximum number: 8 (see section Section 12.2 ACCESSORY LIMIT on page 12-2)
- Number of DOs: 192
- Number of DIs: 192
- Analog Inputs: 56
- Analog Outputs: 16
- Thermocouple Inputs: 56
- PT100/PT1000 Inputs: 32
- Load Cells: 16
- Relays: 36
- SCW: 32

14.6 CERTIFICATIONS

- CE

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