



INDUSTRIAL SHIELDS

ESP32 ETHERNET & WIFI & BLUETOOTH PLC FAMILY

PLC ESP32 ETHERNET & WIFI & BLUETOOTH FAMILY



ESP32 Ethernet & WiFi & BLE PLC Family

Revised March 2021

Preface

This User Guide has been implemented by Boot & Work, S.L. working under the name Industrial Shields.

Purpose of the manual

The information contained in this manual can be used as a reference to operating, to functions, and to the technical data of the signal modules, power supply modules and interface modules.

Intended Audience

This User Guide is intended for the following audience:

- Persons in charge of introducing automation devices.
- Persons who design automation systems.
- Persons who install or connect automation devices.
- Persons who manage working automation installation.



Warnings:

- Unused pins should not be connected. Ignoring the directive may damage the controller.
- Improper use of this product may severely damage the controller.
- Refer to the controller's User Guide regarding wiring considerations.
- Before using this product, it is the responsibility of the user to read the product's User Guide and all accompanying documentation.
- Maintenance must be performed by qualified personnel familiarized with the construction, operation, and hazards involved with the control.
- Maintenance should be performed with the control out of operation and disconnected from all sources of power.
- Care should be taken when servicing electrostatic sensitive components. The manufacturer's recommendations for these components should be followed.
- The ESP32 ETHERNET&WIFI&BLUETOOTH PLCFamily PLCs are Open Type Controllers. It is required that you install the ESP32 ETHERNET&WIFI&BLUETOOTH PLCPLC in a

housing, cabinet, or electric control room. Entry to the housing, cabinet, or electric control room should be limited to authorized personnel. Failure to follow these installation requirements could result in severe personal injury and/or property damage. Always follow these requirements when installing ESP32 ETHERNET&WIFI&BLUETOOTH PLC family PLCs.

- In case of installation or maintenance of the ESP32 ETHERNET&WIFI&BLUETOOTH PLC please follow the instructions marked in the Installation and Maintenance section.
- Do not disconnect equipment when a flammable or combustible atmosphere is present. Disconnection of equipment when a flammable or combustible atmosphere is present may cause a fire or explosion which could result in death, serious injury and/or property damage.



Avertissements:

- Les broches non utilisées ne doivent pas être connectées. Ignorer la directive peut endommager le contrôleur.
- Une utilisation incorrecte de ce produit peut endommager gravement le contrôleur.
- Reportez-vous au Guide de l'utilisateur du contrôleur pour les considérations de câblage.
- Avant d'utiliser ce produit, il incombe à l'utilisateur de lire le Guide de l'utilisateur du produit et la documentation qui l'accompagne.
- La maintenance doit être effectuée par personnel qualifié familiarisé avec la fabrication, le fonctionnement et les dangers liés au contrôleur.
- La maintenance doit être effectuée avec l'équipement hors service et déconnectée de toutes les sources d'alimentation.
- Faites attention lors de l'entretien des composants sensibles à l'électricité statique. Les recommandations du fabricant pour ces composants doivent être suivies.
- Les automates de la famille ESP32 ETHERNET&WIFI&BLUETOOTH PLC sont des contrôleurs de type ouvert. Il est nécessaire d'installer l'automate ESP32 ETHERNET&WIFI&BLUETOOTH PLC dans un boîtier, une armoire ou une salle de contrôle électrique. L'accès au boîtier, à l'armoire ou à la salle de commande électrique doit être limité au personnel autorisé. Le non-respect de ces exigences d'installation peut entraîner des blessures graves et/ou des dommages matériels importants. Respectez toujours ces exigences lors de l'installation des automates de la famille ESP32 ETHERNET&WIFI&BLUETOOTH.
- En cas d'installation ou de maintenance du ESP32 ETHERNET&WIFI&BLUETOOTH PLC, veuillez suivre les instructions indiquées dans la section Installation et Maintenance.
- Ne débranchez pas l'équipement en présence d'une atmosphère inflammable ou combustible. La déconnexion de l'équipement en présence d'une atmosphère

inflammable ou combustible peut provoquer un incendie ou une explosion pouvant entraîner la mort, des blessures graves et/ou des dommages matériels.

Application Considerations and Warranty

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your comments or questions to Industrial Shields before using the product.

Application Consideration

THE PRODUCTS CONTAINED IN THIS DOCUMENT ARE NOT SAFETY RATED. THEY SHOULD NOT BE RELIED UPON AS A SAFETY COMPONENT OR PROTECTIVE DEVICE FOR ENSURING SAFETY OF PERSONS, AS THEY ARE NOT RATED OR DESIGNED FOR SUCH PURPOSES.

Please know and observe all prohibitions of use applicable to the products.

FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, NEVER USE THE INDUSTRIAL SHIELDS PRODUCTS.

NEVER USE THE INDUSTRIAL SHIELDS PRODUCTS BEFORE THEY ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Industrial Shields shall not be responsible for conformity with any codes, regulations or standards that apply to the combination of products in the customer's application or use of the product.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses may be suitable for the products:

- Systems, machines, and equipment that could present a risk to life or property.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installation subject to separate industry or government regulations.
- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

At the customer's request, INDUSTRIAL SHIELDS will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the system, machine, end product, or other application or use.

Intended use or of Industrial Shields products

Consider the following:

Industrial Shields products should only be used for the cases of application foreseen in the catalogue and the associated technical documentation. If third-party products and components are used, they must have been recommended or approved by Industrial Shields.

The correct and safe operation of the products requires that your transport, storage, installation, assembly, operation and maintenance have been carried out in a correct It must respect the permissible ambient conditions. You should also follow the indications and warnings that appear in the associated documentation.

The product / system dealt with in this documentation should only be handled or manipulated by qualified personnel for the task entrusted and observing what is indicated in the documentation corresponding to it, particularly the safety instructions and warnings included in it. Due to their training and experience, qualified personnel are in a position to recognize risks resulting from the handling or manipulation of such products / systems and to avoid possible hazards.

Disclaimers

Weights and Dimensions

Dimensions and weights are nominal and they are not used for manufacturing purposes, even when tolerances are shown.

Performance Data

The performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of INDUSTRIAL SHIELDS's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the INDUSTRIAL SHIELDS Warranty and Limitations of Liability.

Errors and Omissions

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

The control and drive components of an Industrial Shields PLC are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures. These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used. These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety information and instructions on the components and in the associated technical user documentation.

When carrying out a risk assessment of a machine in accordance with the EU Machinery Directive, the machine manufacturer must consider the following residual risks associated with the control and drive components of a PDS.

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example: – Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology – Response times of the controller and drive – Operating and/or ambient conditions not within the scope of the specification – Condensation / conductive contamination – Parameterization, programming, cabling, and installation errors – Use of radio devices / cellular phones in the immediate vicinity of the controller – External influences / damage.
2. Exceptional temperatures as well as emissions of noise, particles, or gas caused by, for example: – Component malfunctions – Software errors – Operating and/or ambient conditions not within the scope of the specification – External influences / damage.
3. Hazardous shock voltages caused by, for example: – Component malfunctions – Influence of electrostatic charging – Induction of voltages in moving motors – Operating and/or ambient conditions not within the scope of the specification – Condensation / conductive contamination – External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Warranty and Limitations of Liability

Warranty

Industrial Shields's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by Industrial Shields.

INDUSTRIAL SHIELDS MAKES NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, REGARDING MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. INDUSTRIAL SHIELDS DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED

Limitations of Liability

INDUSTRIAL SHIELDS SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

IN NO EVENT SHALL INDUSTRIAL SHIELDS BE RESPONISBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS INDUSTRIAL SHIELDS'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

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INDUSTRIAL SHIELDS

1 General Description ESP32 ETHERNET&WIFI&BLUETOOTH PLC FAMILY Product

1.1 Zones Table

| Model | Zones Table | | | |
|------------------|-------------|------------------|------------------|------------------|
| | Zone 0 | Zone A | Zone B | Zone C |
| ESP32 PLC 21+ | ✓ | Analog / Digital | - | - |
| ESP32 PLC 42+ | ✓ | Analog / Digital | Analog / Digital | - |
| ESP32 PLC 58+ | ✓ | Analog / Digital | Analog / Digital | Analog / Digital |
| ESP32 PLC 19R+ | ✓ | Relay | - | - |
| ESP32 PLC 38R+ | ✓ | Relay | Relay | - |
| ESP32 PLC 57R+ | ✓ | Relay | Relay | Relay |
| ESP32 PLC 38AR+ | ✓ | Analog / Digital | Relay | - |
| ESP32 PLC 53ARR+ | ✓ | Analog / Digital | Relay | Relay |
| ESP32 PLC 57AAR+ | ✓ | Analog / Digital | Analog / Digital | Relay |
| ESP32 PLC 54ARA+ | ✓ | Analog / Digital | Relay | Analog / Digital |
| ESP32 PLC 50RRA+ | ✓ | Relay | Relay | Analog / Digital |

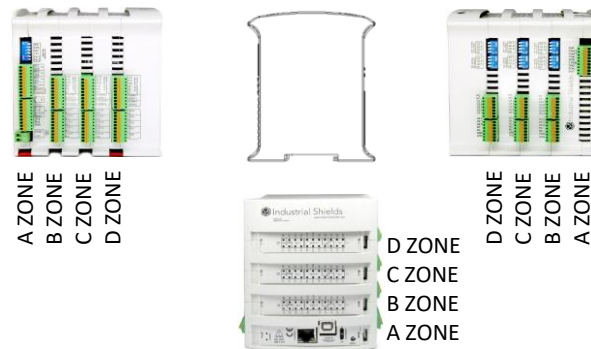
1.2 Measures Table

| | Measures Table | | | |
|------------------|----------------|------------|------------|------------|
| | | | | |
| Model | Height (mm) | Width (mm) | Depth (mm) | Weight (g) |
| ESP32 PLC 21+ | 119.5 | 70.1 | 101 | 380 |
| ESP32 PLC 42+ | 119.5 | 94.7 | 101 | 490 |
| ESP32 PLC 58+ | 119.5 | 119.3 | 101 | 600 |
| ESP32 PLC 19R+ | 119.5 | 70.1 | 101 | 380 |
| ESP32 PLC 38R+ | 119.5 | 94.7 | 101 | 490 |
| ESP32 PLC 57R+ | 119.5 | 119.3 | 101 | 600 |
| ESP32 PLC 38AR+ | 119.5 | 94.7 | 101 | 490 |
| ESP32 PLC 53ARR+ | 119.5 | 119.3 | 101 | 600 |
| ESP32 PLC 57AAR+ | 119.5 | 119.3 | 101 | 600 |
| ESP32 PLC 54ARA+ | 119.5 | 119.3 | 101 | 600 |
| ESP32 PLC 50RRA+ | 119.5 | 119.3 | 101 | 600 |

1.3 Zone - Nomenclature

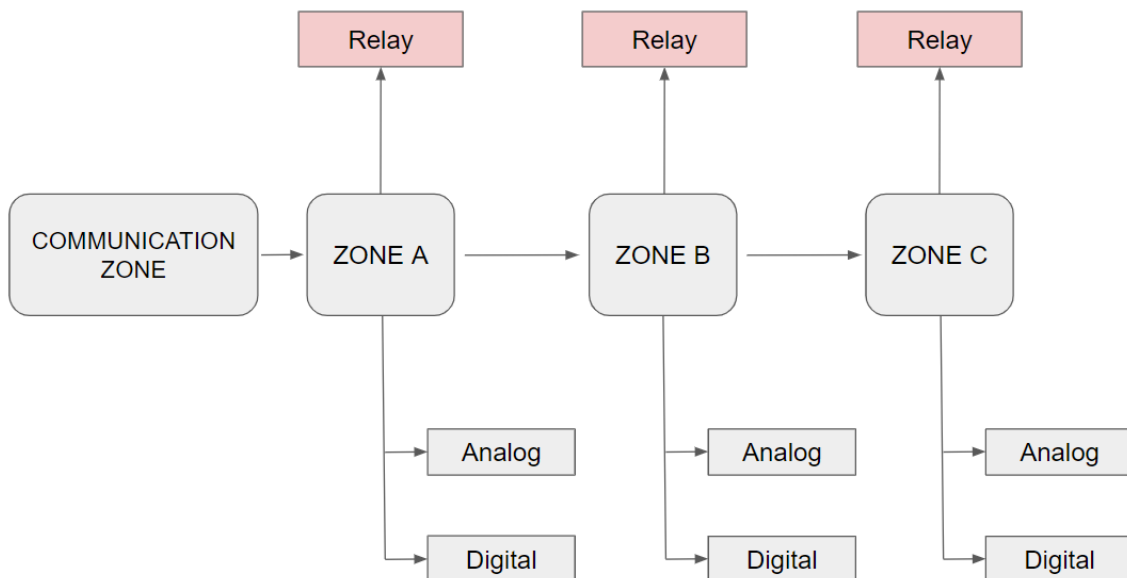
The nomenclature shown in this point will be used in the whole User Guide, so it is important to understand this nomenclature.

The nomenclature to differentiate the zones is based on Alphanumeric values, being 0 the internal communication shield and A, B or C the I/Os or Relay shield.



- The inputs in the zone A/B/C are named IX.X, being X any number suitable in the Shield. Outputs are named as QX.X.

1.4 Zone Distribution

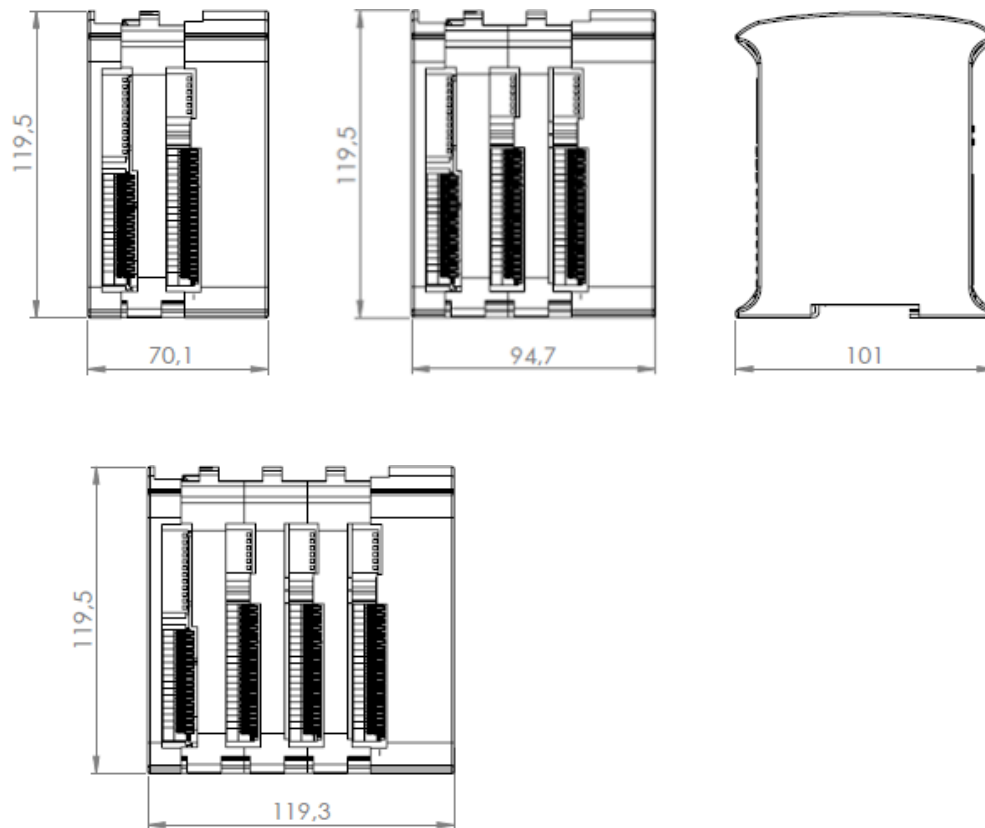


This is the possible zones scheme, whether the zone is Analog/Digital or Relay depends on your device, you can consult it on the [Zones Table](#). The distribution of the different features that provide the Raspberry PLC Family are described below.

1.5 Zone Features

| Shield | Zone Characteristics |
|----------------------|---|
| Communication Shield | (1x) Ethernet (1x) WiFi (1x) BLE (1x) USB (1x) I2C (1x) RS-232 (1x) HALF Duplex RS-485 (1x) SPI external Port (1x) RTC (1x) uSD Socket |
| Analog Shield | 13 Inputs: 13 Digital inputs, 6 of which can work as Analog Input 8 Outputs: 8 Digital Outputs, 3 of which can work as Analog Output |
| Relay Shield | 6 Inputs: 6 Digital Inputs, 4 of which can work as Analog Input 11 Outputs: 8 Relay Outputs 3 Digital Outputs, 3 of which can work as Analog Output |


1.6 Mechanical dimension



***NOTE:** This device includes one 2.4GHz antenna and one 5G antenna (for the 5G option), and both have a length of 5cm.




1.7 General Features

| ESP32 ETHERNET&WIFI&BLUETOOTH PLC FAMILY | | |
|--|---|---|
| MODEL TYPE | Controller General Specifications | Information |
| Input Voltage | 12 to 24Vdc --- | Fuse protection (2.5A) Polarity protection |
| Input rated voltage | 24 Vdc --- | |
| Rated Power | 30 W | |
| I max. | 1.5A | |
| Size | Consult the 1.6 Mesure Table section | |
| Clock Speed | External: 240 MHz Internal: 8 MHz | |
| External Flash Memory | 4 MB | |
| SRAM | 520 KB | |
| ROM | 448 KB | |
| Communications | I2C – Ethernet Port – WiFi – BLE – USB – RS485 – RS232 – SPI | Max232-Max485-W5500 |
| USB consideration! | Only meant for uploading or debugging, not always connected as a serial in a project! | Cannot be working in a final application |
| An/Dig Input 10bit (0-10Vcc) | 0 to 10Vac Input Impedance: 39K Separated PCB ground Rated Voltage: 10Vac 5 to 24Vdc I min: 2 to 12 mA Galvanic Isolation Rated Voltage: 24 Vdc --- | |
| Digital Isolated Input (24Vcc) | 5 to 24Vdc I min: 2 to 12 mA Galvanic Isolation Rated Voltage: 24 Vdc --- | |
| * Interrupt isolated Input HS (24Vcc) | 5 to 24Vdc I min: 2 to 12 mA Galvanic Isolation Rated Voltage: 24Vdc --- | |
| Analog Output 8bit (0-10Vcc) | 0 to 10Vac I max: 20 mA Separated PCB ground Rated Voltage: 10Vac --- | |
| Digital Isolated Output (24Vcc) | 5 to 24Vdc I max: 70 mA Galvanic Isolation Diode Protected for Relay Rated Voltage: 24Vdc --- | I _{max} 24Vdc: 410 mA |
| Relay Output (220Vac) | 220V Vac I max: 5A Galvanic Isolation Diode protected for Relay --- | |

| | | |
|--|--|--|
| PWM Isolated Output 8bit (24Vcc) | 5 to 24Vdc I max: 70 mA Galvanic Isolation Diode Protected for Relay Rated Voltage: 24Vdc  | |
| Expandability | I2C - 127 elements - Serial Port RS232/RS485 | |
| * By using this type of signal can no longer use Digital signal (24Vdc) | | |

2 Technical Specifications:

2.1 General Specifications:

| Item | | ESP32 ETHERNET&WIFI&BLUETOOTH PLC |
|---------------------------------|------------------------------|--|
| Power supply voltage | DC power supply | 12 to 24Vdc  |
| Operating voltage range | DC power supply | 11.4 to 25.4Vdc  |
| Power consumption | DC power supply | 30W max. |
| External power supply | Power supply voltage | 24Vdc  |
| | Power supply output capacity | 700Ma |
| Insulation resistance | | 20MΩ min.at 500Vdc between the AC terminals and the protective earth terminal. |
| Dielectric strength | | 2.300 VAC at 50/60 Hz for one minute with a leakage current of 10mA max. Between all the external AC terminals and the protective ground terminal. |
| Shock resistance | | 80m/s ² in the X, Y and Z direction 2 times each. |
| Ambient temperature (operating) | | 0° to 60°C |
| Ambient humidity (operating) | | 10% to 90% (no condensation) |
| Ambient environment (operating) | | With no corrosive gas |
| Ambient temperature (storage) | | -20° to 60°C |
| Power supply holding time | | 2ms min. |
| Weight | | See the measure table . |

2.2 Performance Specification:



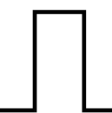




| | |
|-------------------------|--|
| Board | ESP32-WROOM-32UE |
| Control method | Stored program method |
| I/O control method | Combination of the cyclic scan and immediate refresh processing methods. |
| Programming language | Arduino IDE. Based on wiring (Wiring is an Open Source electronics platform composed of a programming language. (We recommend minimum version 1.8.13). http://arduino.cc/en/Tutorial/HomePage |
| Microcontroller | ESP32 |
| External Flash Memory | 4MB |
| Program capacity (SRAM) | 520KB |


| | |
|-------------|-------|
| SRAM in RTC | 16KB |
| Clock Speed | 40MHz |

2.3 Symbology

Table that includes all the symbology that is used in the serigraph of the ESP32 ETHERNET&WIFI&BLUETOOTH PLC

I/Os Analog/Digital PLUS:

| Symbol | Standard No. / Standard Title | Standard Reference No. / Symbol Title | Symbol Meaning |
|---|--|---------------------------------------|--|
|  | IEC 60417 / Graphical symbols for use on equipment | 5031 / Direct Current | Indicates that the equipment is suitable for direct current only; to identify relevant terminals |
|  | IEC 60417 / Graphical symbols for use on equipment | 5032 / Alternating Current | Indicates that the equipment is suitable for alternating current only; to identify relevant terminals |
|  | IEC 60417 / Graphical symbols for use on equipment | 5130 / Pulse General | To identify the control by which a pulse is started. |
|  | IEC 60417 / Graphical symbols for use on equipment | 5017 / Earth, Ground | To identify an earth (ground) terminal in cases where neither the symbol 5018 nor 5019 is explicitly required. |
|  | IEC 60417 / Graphical symbols for use on equipment | 5115 / Signal lamp | To identify the switch by means of which the signal lamp(s) is (are) switched on or off. |
|  | Medical Devices Directive 93/42/EEC | CE Marking | CE marking indicates that a product complies with applicable European Union regulations |
|  | ISO 7000/ Graphical symbols for use on equipment | 0434B / Warning symbol | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury |

| | | | |
|---|---|-----------------------------|--|
|  | ISO 7000/ Graphical symbols for use on equipment | 5036 / Dangerous Voltage | To indicate hazards arising from dangerous voltages |
|---|---|-----------------------------|--|

3 Precautions

Read this manual before attempting to use the ESP32 ETHERNET&WIFI&BLUETOOTH PLC and follow its descriptions for reference during operation.

3.1 ESP32 Board

This version of 10 I/Os Digital Module PLCs include ESP32 Board as controller.

3.2 Intended Audience

This manual is intended for technicians, which must have knowledge on electrical systems.

3.3 General Precautions

The user must operate ESP32 ETHERNET&WIFI&BLUETOOTH PLC according to the performance specifications described in this manual.

Before using ESP32 ETHERNET&WIFI&BLUETOOTH PLC under different conditions from what has been specified in this manual or integrating ESP32 ETHERNET&WIFI&BLUETOOTH PLC to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your INDUSTRIAL SHIELDS representative. Ensure that the rating and performance characteristics of ESP32 ETHERNET&WIFI&BLUETOOTH PLC are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment double safety mechanisms. This manual provides information for programming and operating the ESP32 ETHERNET&WIFI&BLUETOOTH.

4 Software interface

Industrial Shields PLC are programmed using Arduino IDE, which is a software based on the C language. They can also be programmed using directly C but it is much easier working with Arduino IDE as it provides lots of libraries that helps in the programming.

Industrial Shields provides boards for programming the PLCs much easier. Basically, it is no needed to define the pins and if that pins are inputs or outputs. Everything is set up automatically if using the boards.

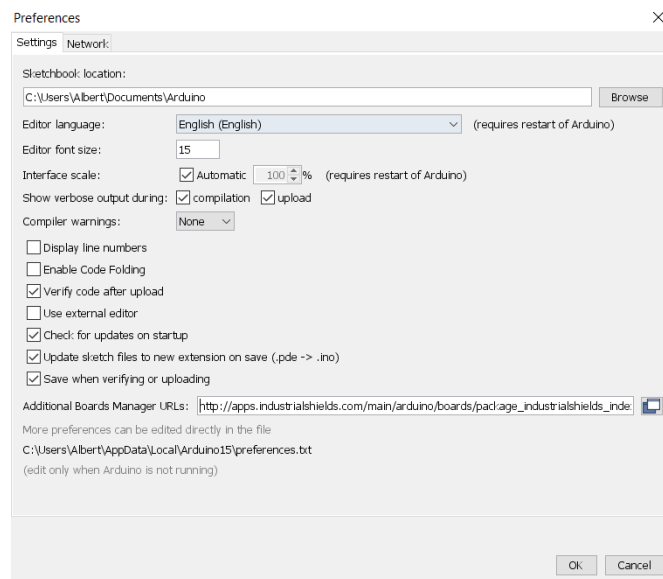
In order to install Industrial Shields boards, these are the steps that must be followed.

Requirements:

Arduino IDE 1.8.13 or above (better to have always the latest version).

Steps:

1. Open Arduino IDE and go to: “File -> Preferences” located in the top left corner.

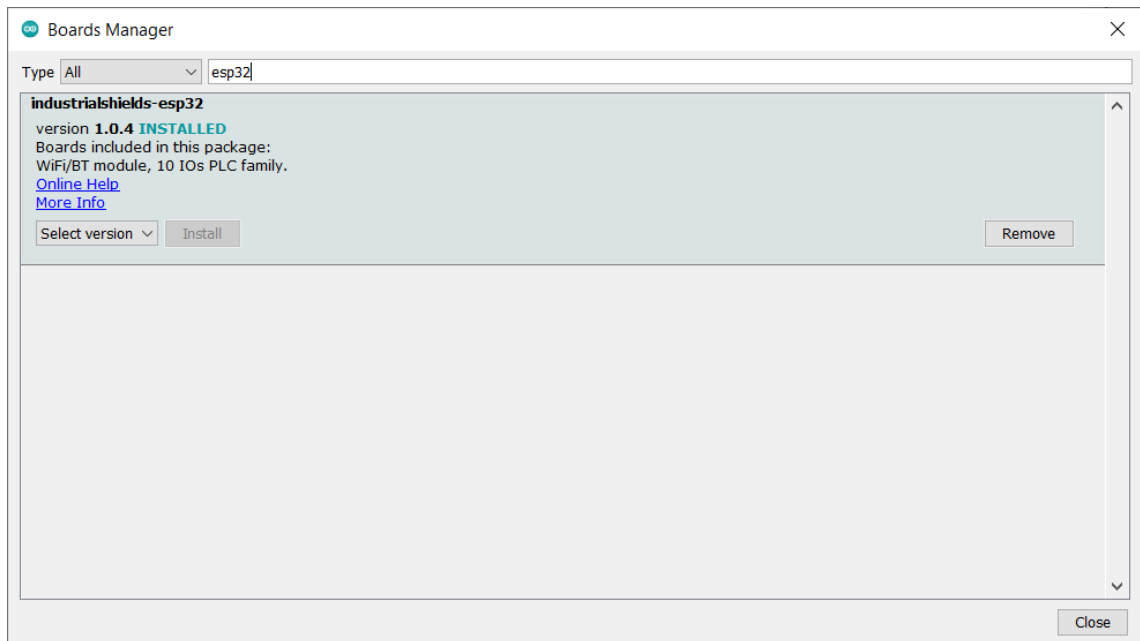


2. In Additional Boards Manager URLs write the following:

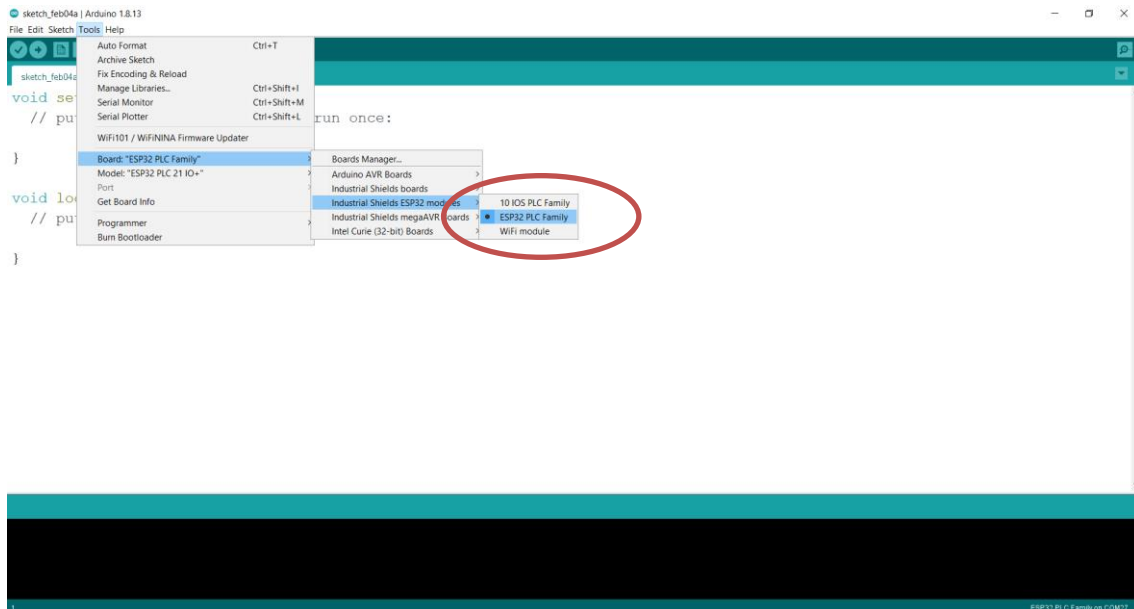
http://apps.industrialshields.com/main/arduino/boards/package_industrialshields_index.json

3. Press OK to save the changes.

4. Tools -> Board: ... -> Boards Manager. Search for the industrialshields-esp32 board and install the last version (it must be from the version 1.0.4 minimum):



Following these steps, you will be able to see now the Industrial Shields Boards:



Once it is selected the ESP32 PLC Family, an extra option will appear on Tools:

There, it can be selected the exact model for every family.

Also, there are some examples of programming in File -> Examples -> ESP32 PLC Family

Furthermore, there are some extra libraries that can be found in Industrial Shields github.

<https://github.com/IndustrialShields/>

5 How to connect PLC Arduino to PC

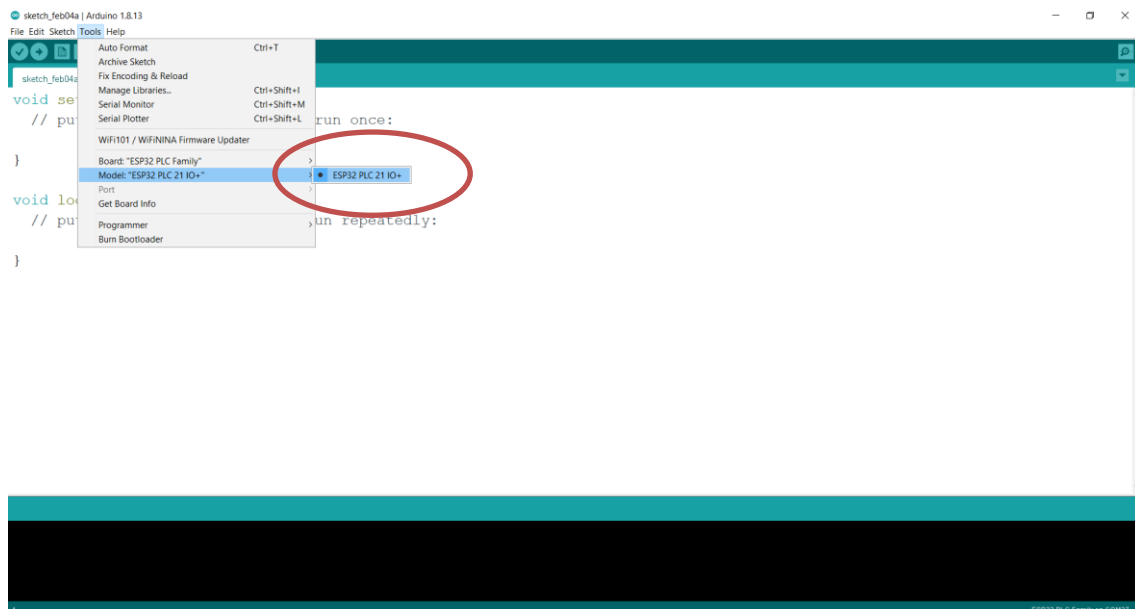
- Connect micro-USB port from PLC to PC.

NOTE:

ESP32 ETHERNET&WIFI&BLUETOOTH PLC uses micro-USB cable.



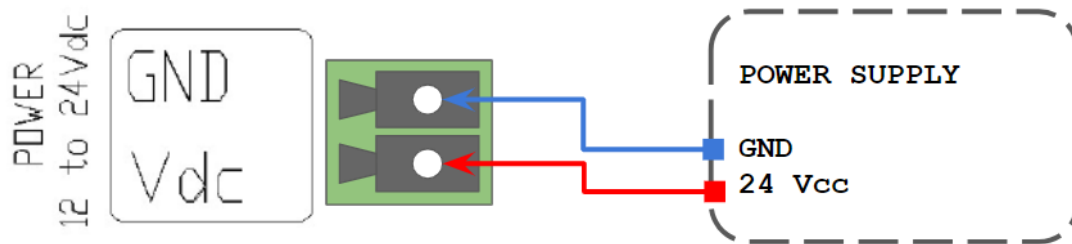
- Open Arduino IDE interface:
- Select Industrial Shields boards -> ESP32 PLC Family
- Select the correct ESP32 PLC Model:



- Select correct port for your board.

6 How to connect PLC to power supply

- ESP32 ETHERNET&WIFI&BLUETOOTH PLC is 12-24Vdc supplied. IMPORTANT: The polarity **IS NOT REVERSAL!**
- Make sure that the live and GND connector of the power supply match the PLC.
- Make sure that the power supply mains output is not higher than 24Vdc.



- Suggested power suppliers

Compact DIN rail power supply. Assembled on 35mm
DIN Rail:
-12Vdc / 24Vdc
-2.5A
-30W

Industrial Shields power supplies provide parallel operation, overvoltage protection, and overcurrent protection. There is a LED indicator for power status, the power supply is certified according to UL.



The standard, Part 1 of IEC 61010, sets the general safety requirements for the following types of electrical devices and their accessories, regardless of where use of the device is intended.

The equipment must be powered from an external power source in accordance with IEC 61010-1, whose output is MBTS and is limited in power according to section 9.4 of IEC 61010-1.

WARNING: Once the equipment is installed inside an electrical cabinet, the MTBS cables of the equipment must be separated from the dangerous voltage cables.

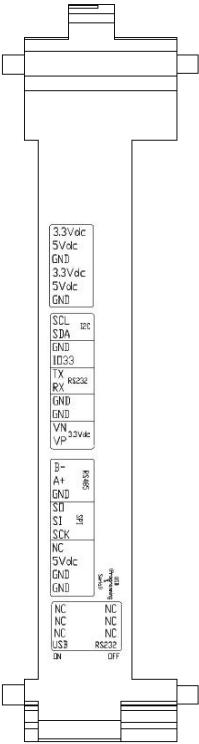
7 ESP32 ETHERNET&WIFI&BLUETOOTH PLC Pinout

7.1 I/Os Table

| | | IOs Table | | | | |
|-------|--------------|--------------|------------------------|-------------------------|-------------------------|--------------|
| Model | Reference | Analog Input | Digital Isolated Input | Digital Isolated Output | Digital/Analogic Output | Relay Output |
| 21+ | 01200X000200 | 6 | 7 | 5 | 3 | 0 |
| 42+ | 01200X000400 | 12 | 14 | 10 | 6 | 0 |
| 58+ | 01200X000600 | 16 | 21 | 15 | 9 | 0 |
| 19R | 01200X000100 | 4 | 2 | 0 | 3 | 8 |
| 38R | 01200X000300 | 8 | 4 | 0 | 6 | 16 |
| 57R | 01200X000500 | 12 | 8 | 0 | 9 | 24 |
| 38AR | 01200X000700 | 10 | 9 | 5 | 6 | 8 |
| 53ARR | 01200X000800 | 14 | 11 | 5 | 9 | 16 |
| 57AAR | 01200X000900 | 16 | 16 | 10 | 9 | 8 |
| 54ARA | 01200X001000 | 16 | 16 | 10 | 9 | 8 |
| 50RRA | 01200X001100 | 14 | 11 | 5 | 9 | 16 |

7.2 0 Zone connection

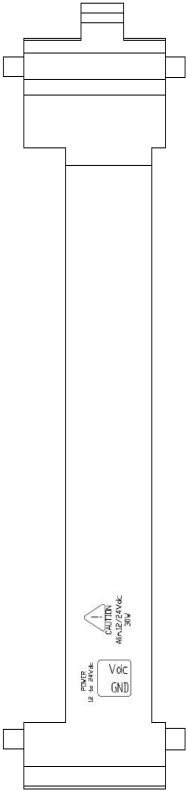
| Base (common unit) | |
|-----------------------|----------|
| A Zone | |
| PLC | Function |
| 3.3Vdc | - |
| 5Vdc | - |
| GND | - |
| 3.3Vdc | - |
| 5Vdc | - |
| GND | - |
| SCL | GPIO 22 |
| SDA | GPIO 21 |
| GND | - |
| IO33 | - |
| TX | RS232 |
| RX | RS232 |
| GND | - |
| GND | - |
| VN | SENS VN |
| VP | SENS VP |
| B- | RS485 |
| A+ | RS485 |
| GND | RS485 |
| 50 SO | GPIO 19 |
| 51 SI | GPIO 23 |
| 52 SCK | GPIO 18 |
| NC | - |
| 5Vdc | 5V |
| GND | Gnd |
| GND | Gnd |

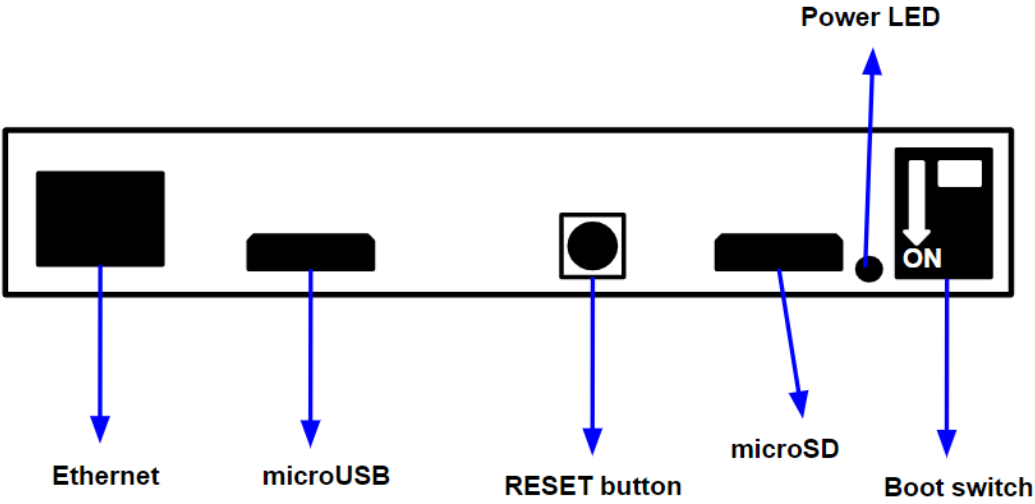


Communication Pins

Configuration Switch* (see [section 8](#) for configuring the communications. Enabling communications disables some I/Os)

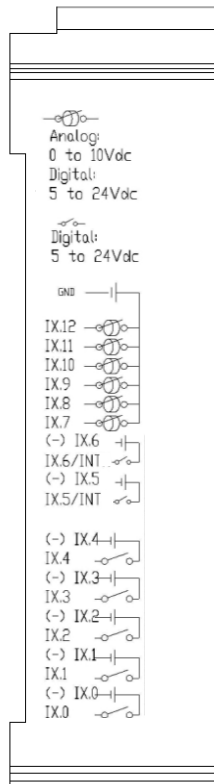
| Base (common unit) | |
|-----------------------|--------------|
| A Zone | |
| PLC | Function |
| Vdc | Power Supply |
| GND | GND |





7.3 Analog/Digital Zone connection (I/Os)

| X Zone | |
|-------------------------------|-----------------------|
| Raspberry PLC Connector | Function |
| IX.12 | Analog / Digital In |
| IX.11 | Analog / Digital In |
| IX.10 | Analog / Digital In |
| IX.9 | Analog / Digital In |
| IX.8 | Analog / Digital In |
| IX.7 | Analog / Digital In |
| (-)IX.6 | GND I0.6 |
| IX.6/INT¹ | Interrupt X In |
| (-)IX.5 | GND I0.5 |
| IX.5/INT¹ | Interrupt X In |
| (-)IX.4 | GND I0.4 |
| IX.4 | Digital Input |
| (-)IX.3 | GND I0.3 |
| IX.3 | Digital Input |
| (-)IX.2 | GND I0.2 |
| IX.2 | Digital Input |
| (-)IX.1 | GND I0.1 |
| IX.1 | Digital Input |
| (-)IX.0 | GND I0.0 |
| IX.0 | Digital Input |



Analog / Digital Inputs

Digital / Interrupt Inputs (isolated)

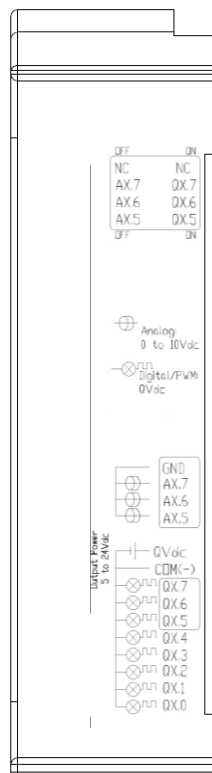
Digital Inputs (isolated)

Top Zone



Led indicator I/Os state

| X Zone | |
|-------------------------------|---------------------------|
| Raspberry PLC Connector | Function |
| GND | GND |
| AX.7² | Analog Out |
| AX.6² | Analog Out |
| AX.5² | Analog Out |
| Q/Vdc | External Isolated Out Vdc |
| COM(-) | External Isolated Out GND |
| QX.7² | Digital/PWM Out |
| QX.6² | Digital/PWM Out |
| QX.5² | Digital/PWM Out |
| QX.4 | Digital Out |
| QX.3 | Digital Out |
| QX.2 | Digital Out |
| QX.1 | Digital Out |
| QX.0 | Digital Out |



Configuration Switch
(See [Section 8](#) to select the correct configuration for outputs)

Analog Outputs

Voltage Supply/Reference for

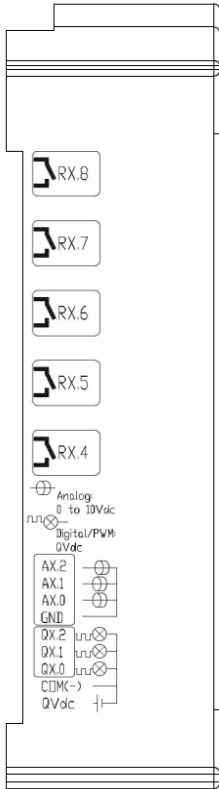
Digital/PWM Outputs (isolated)

¹ See the [Interrupt Equivalence Table](#).

² See [Section 8](#) to select the correct configuration for outputs.

7.4 Relay Zone connection (I/Os)

| X Zone | |
|-------------------|---------------------------|
| M-Duino Connector | Function |
| RX.8 | Relay Out |
| RX.7 | Relay Out |
| RX.6 | Relay Out |
| RX.5 | Relay Out |
| RX.4 | Relay Out |
| AX.2 ³ | Analog Out |
| AX.1 ³ | Analog Out |
| AX.0 ³ | Analog Out |
| GND | GND |
| QX.2 ³ | Digital/PWM Out |
| QX.1 ³ | Digital/PWM Out |
| QX.0 ³ | Digital/PWM Out |
| GNDCOM | External Isolated Out GND |
| 24VCOM | External Isolated Out Vdc |

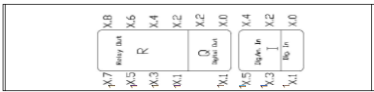


Relay Outputs

Analog Outputs

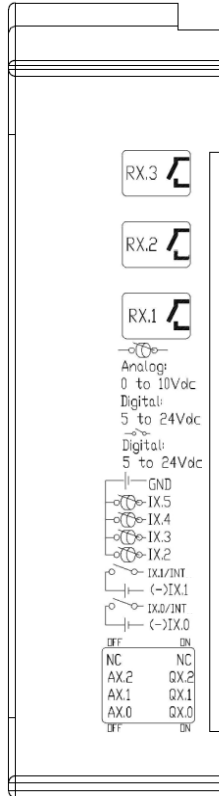
PWM/Digital Outputs

Top Zone



Led indicator I/Os state

| C Zone | |
|-----------------------|----------------------|
| M-Duino Connector | Function |
| RX.3 | Relay Out |
| RX.2 | Relay Out |
| RX.1 | Relay Out |
| GND | GND |
| IX.5 | Analog/Digital Input |
| IX.4 | Analog/Digital Input |
| IX.3 | Analog/Digital Input |
| IX.2 | Analog/Digital Input |
| IX.1/INT ⁴ | Interrupt X In |
| (-)IX.1 | GND IO.1 |
| IX.0/INT ⁴ | Interrupt X In |
| (-)IX.0 | GND IO.0 |



Relay Outputs

Analog Inputs

Interrupts/Digital Inputs (Isolated)

Configuration Switch
(See [Section 8](#) to select the correct configuration for outputs)

³ See [Section 8](#) to select the correct configuration for outputs.

⁴ See the [Interrupt Equivalence Table](#).

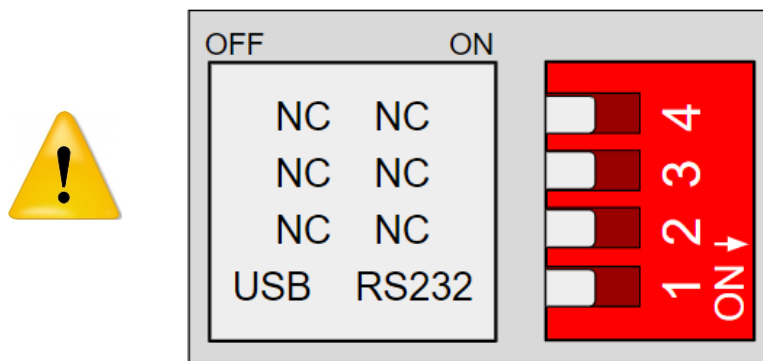
7.5 Interrupt equivalence table

| ZONE | ANALOG/DIGITAL | RELAY | RASPBERRY PIN |
|------|----------------|-------|---------------|
| A | 0.5 | 0.0 | GPIO27 |
| | 0.6 | 0.1 | GPIO26 |
| B | 1.5 | 1.0 | GPIO35 |
| | 1.6 | 1.1 | GPIO25 |
| C | 2.5 | 2.0 | GPIO34 |
| | 2.6 | 2.1 | GPIO5 |

8 Switch Configuration

8.1 0 Zone: Communications

| Switch | | |
|-----------|-------|-----|
| | ON | OFF |
| A ZONE | | |
| NC/NC | NC | NC |
| NC/NC | NC | NC |
| NC/NC | NC | NC |
| USB/RS232 | RS232 | USB |



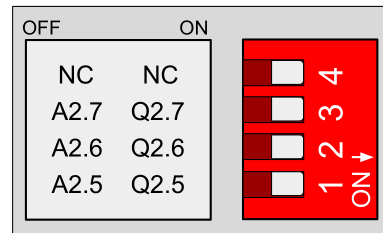
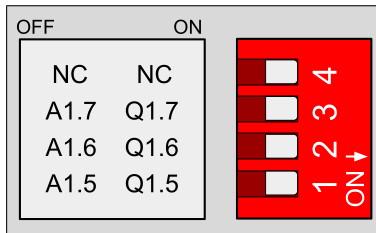
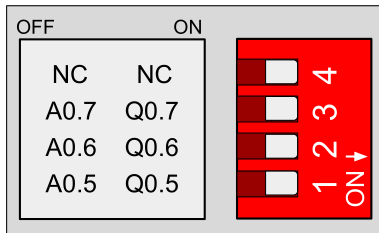
USB/RS232: Changing between USB / RS232. If this switch is ON, it enables RS232 communication and disables the Programming USB. If this switch is OFF, it disables RS232 communication and enables the Programming USB. (Programming USB must be activated to upload programs to the PLC).

8.2 Analog / Digital Zone

| ZONE A | | |
|--------|------|------|
| SWITCH | ON | OFF |
| NC | - | - |
| Q0.7 | Q0.7 | A0.7 |
| Q0.6 | Q0.6 | A0.6 |
| Q0.5 | Q0.5 | A0.5 |

| ZONE B | | |
|--------|------|------|
| SWITCH | ON | OFF |
| NC | - | - |
| Q1.7 | Q1.7 | A1.7 |
| Q1.6 | Q1.6 | A1.6 |
| Q1.5 | Q1.5 | A1.5 |

| ZONE C | | |
|--------|------|------|
| SWITCH | ON | OFF |
| NC | - | - |
| Q2.7 | Q2.7 | A2.7 |
| Q2.6 | Q2.6 | A2.6 |
| Q2.5 | Q2.5 | A2.5 |

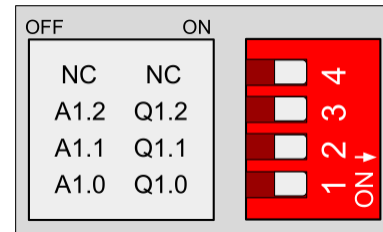
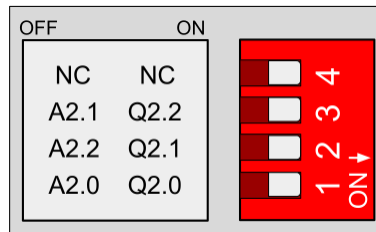
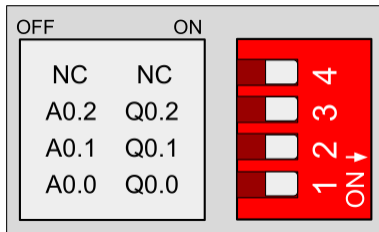


8.3 Relay Zone

| ZONE A | | |
|--------|------|------|
| SWITCH | ON | OFF |
| NC | - | - |
| Q0.2 | Q0.2 | A0.2 |
| Q0.1 | Q0.1 | A0.1 |
| Q0.0 | Q0.0 | A0.0 |

| ZONE B | | |
|--------|------|------|
| SWITCH | ON | OFF |
| NC | - | - |
| Q1.2 | Q1.2 | A1.2 |
| Q1.1 | Q1.1 | A1.1 |
| Q1.0 | Q1.0 | A1.0 |

| ZONE C | | |
|--------|------|------|
| SWITCH | ON | OFF |
| NC | - | - |
| Q2.2 | Q2.2 | A2.2 |
| Q2.1 | Q2.1 | A2.1 |
| Q2.0 | Q2.0 | A2.0 |



For the Analog Shield if a switch is set to ON, it can only act as Digital Output. If it is set to OFF, it can only act as an Analog Output.

If it is desired to use a Digital Output the pin must be set to ON and the pin that will provide this digital output is represented with QX.X, being X any number of the tables above.

If it is desired to use an Analog Output the pin must be set to OFF and the pin that will provide this analog output is represented with AX.X, being X any number of the tables above.

9 I/O ESP32 PLC 3.3V pins

The ESP32 ETHERNET&WIFI&BLUETOOTH PLC has some of the ESP32 board pins available. These pins can be programmed according to Raspberry features such as I/O's operating at 3.3V or any additional features present in the pins (for example I2C communication in pins SCL and

SDA). As these pins are directly connected to the ESP32 board, they are not as well protected as the normal inputs. These pins are mainly meant to be used as prototyping.

The Raspberry board available pins are summarized in the table below. In order to access to these pins some extra considerations must be taken in consideration.

| PLC terminal | ESP32 pin |
|--------------|-----------|
| VN | SENS VN |
| VP | SENS VP |
| MISO | GPIO 19 |
| MOSI | GPIO 23 |
| SCLK | GPIO 18 |
| IO33 | GPIO 33 |
| SCL | GPIO 22 |
| SDA | GPIO 21 |

***IMPORTANT:** Do not connect the terminals in the chart above to voltages higher than 3.3V. These terminals provide direct access to the ESP32 board.

There are some special conditions depending on these 3.3V. Now it is going to be shown the considerations to operate with these pins.

9.1 I2C

I2C communication **DOES NOT REQUIRE** a pull-up resistor for the ESP32 ETHERNET&WIFI&BLUETOOTH PLC. The pull-up resistor is already implemented in the PCB.

9.2 SPI – MISO/MOSI/SCK

The ESP32 ETHERNET&WIFI&BLUETOOTH PLC pins used for the SPI bus are summarized in the table below. For SPI bus MISO, MOSI and CLOCK pins are common to all the connected devices to the ESP32 ETHERNET&WIFI&BLUETOOTH PLC, conversely, each of the connected devices will have a single and dedicated SS pin.

| Function | PLC connection |
|----------|----------------|
| MISO | S0 |
| MOSI | SI |
| CLOCK | SCK |

10 A Zone Features: Communications & RTC & uSD

10.1 RS-232

For the RS-232 communication protocol there is a switch that affects it. See the [Section 8](#) for more information.

Using the boards of Industrial Shields, there is a library that simplifies the RS-232 implementation.

10.2 RS-485 (Half Duplex)

The RS-485 protocol will be always enabled.

Using the boards of Industrial Shields, there is a library that simplifies the RS-485 implementation.

10.3 Ethernet

ESP32 ETHERNET&WIFI&BLUETOOTH PLC Ethernet port controller is based on w5500 IC, which is the compatible IC compatible with Arduino Ethernet2 Shield libraries. All Ethernet shield Arduino libraries are compatible with the ESP32 ETHERNET&WIFI&BLUETOOTH PLC.

10.1 BLE

This device has got Bluetooth Low Energy provided by the ESP32. It uses the 4.2 BR/EDR version and BLE. The BLE is optimized for short burst data transmission, it uses the 2.4GHz ISM Band, 40 channels (w/ 2MHz spacing), the channel usage method of FHSS, the GFSK modulation. It has a power consumption of ~0.01x to 0.5x of reference (it depends on specific usage). It can be used on different network topologies: mesh, broadcast and point-to-point.

10.2 RTC

ESP32 ETHERNET&WIFI&BLUETOOTH PLC RTC Module is based on the DS1307 Chip. This chip works with the I2C protocol communication, so it is required to have enabled the I2C protocol.

Using the boards of Industrial Shields, there is a library that simplifies the RTC implementation called RTC.

10.1 I2C pins – SDA/SCL

The I2C protocol is meant to work in a pull-up configuration. A pull-up configuration means that when the pin is at rest (nothing connected to it) it always reads a HIGH value. In this case

it reads 3.3V when nothing is connected. The pull-up configuration is established by default in these pins.

If it is meant to work them as a GPIO at 3.3V, it must be considered that they are pull-up inputs.

10.2 SPI – MISO/MOSI/SCK

These pins can only work as a 3.3V if the Ethernet protocol is not going to be used. As the Ethernet protocol uses the SPI to communicate with the Arduino board, both behaviours cannot happen at the same time as the Ethernet would not work.

These pins are not established with a pull-up or a pull-down configuration. The state of these pins is unknown. If these pins must be used, they require a pull-up or a pull-down configuration. The Arduino board allows the pins to be set in a pull-up configuration. If not, it must be established an external pull-up or pull-down circuit in order to correctly work with these pins.

10.3 uSD

The microSD uses the SPI communication to interact with the ESP32. The SPI protocol is always enabled, as there are no switches that configure it.

Using the boards of Industrial Shields, there is a library that simplifies the uSD implementation called SD.

The microSD uage is conditioned by the switch configuration. See [the Section 8](#).



Verify that the CPU is not actively running a process before inserting the memory card.

Inserting a memory card will cause the CPU to go to STOP mode, which could affect the operation of an online process or machine. Unexpected operation of a process or machine could result in death or injury to personnel and/or property damage. Before inserting a memory card, always ensure that the CPU is offline and in a safe state.



Vérifiez que le processeur n'exécute pas activement un processus avant d'insérer la carte mémoire.

Si vous insérez une carte mémoire, la CPU passe en mode STOP, ce qui peut affecter le fonctionnement d'un processus ou d'une machine en ligne. Le fonctionnement inattendu d'un processus ou d'une machine peut entraîner la mort ou des blessures corporelles et / ou des dégâts matériels. Avant d'insérer une carte mémoire, assurez-vous toujours que la CPU est hors ligne et en sécurité.

11 **Additional Features**

11.1 WiFi 5G

This device has got 5G Wi-Fi based on the chip ISM43340.

12 Equivalence Table

The Digital/Analog I/Os of this device are connected to the ESP32 through I2C, using specific chips (see the [Section 13](#)). Here we have the equivalence tables (using Industrial Shields libraries, we do not have to consider these equivalences):

12.1 Pin-Out

12.1.1 Analog/Digital Devices Analog I/Os

| Analog Inputs | | |
|---------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| I0.7 | 0x49 | 2 |
| I0.8 | 0x49 | 3 |
| I0.9 | 0x48 | 3 |
| I0.10 | 0x48 | 2 |
| I0.11 | 0x48 | 1 |
| I0.12 | 0x48 | 0 |
| Zone B | | |
| I1.7 | 0x49 | 0 |
| I1.8 | 0x49 | 1 |
| I1.9 | 0x4a | 3 |
| I1.10 | 0x4a | 2 |
| I1.11 | 0x4a | 0 |
| I1.12 | 0x4a | 1 |
| Zone C | | |
| I2.7 | 0x4b | 3 |
| I2.8 | 0x4b | 2 |
| I2.9 | 0x4b | 0 |
| I2.10 | 0x4b | 1 |

| Analog Outputs | | |
|----------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| A0.5 | 0x40 | 13 |
| A0.6 | 0x40 | 6 |
| A0.7 | 0x40 | 7 |
| Zone B | | |
| A1.5 | 0x40 | 3 |
| A1.6 | 0x41 | 8 |
| A1.7 | 0x41 | 9 |
| Zone C | | |
| A2.5 | 0x41 | 10 |
| A2.6 | 0x41 | 6 |
| A2.7 | 0x41 | 7 |

12.1.2 Digital I/Os

| Digital Inputs | | | |
|----------------|-------------|------------|-----------|
| PLC Pinout | Chip ADDR | Chip INDEX | GPIO |
| Zone A | | | |
| I0.0 | ADDR = 0x21 | 6 | - |
| I0.1 | ADDR = 0x21 | 4 | - |
| I0.2 | ADDR = 0x21 | 5 | - |
| I0.3 | ADDR = 0x21 | 3 | - |
| I0.4 | ADDR = 0x21 | 2 | - |
| I0.5 | - | - | GPIO = 27 |
| I0.6 | - | - | GPIO = 26 |
| Zone B | | | |
| I1.0 | ADDR = 0x21 | 1 | - |
| I1.1 | ADDR = 0x21 | 0 | - |
| I1.2 | ADDR = 0x20 | 7 | - |
| I1.3 | ADDR = 0x20 | 6 | - |
| I1.4 | ADDR = 0x20 | 5 | - |
| I1.5 | - | - | GPIO = 35 |
| I1.6 | - | - | GPIO = 25 |
| Zone C | | | |
| I2.0 | ADDR = 0x20 | 4 | - |
| I2.1 | ADDR = 0x20 | 3 | - |
| I2.2 | ADDR = 0x20 | 2 | - |
| I2.3 | ADDR = 0x20 | 1 | - |
| I2.4 | ADDR = 0x20 | 0 | - |
| I2.5 | - | - | GPIO = 34 |
| I2.6 | - | - | GPIO = 5 |

| Digital Outputs | | |
|-----------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| Q0.0 | 0x40 | 11 |
| Q0.1 | 0x40 | 10 |
| Q0.2 | 0x40 | 9 |
| Q0.3 | 0x40 | 8 |
| Q0.4 | 0x40 | 12 |
| Q0.5 | 0x40 | 13 |
| Q0.6 | 0x40 | 6 |
| Q0.7 | 0x40 | 7 |
| Zone B | | |
| Q1.0 | 0x40 | 15 |
| Q1.1 | 0x40 | 14 |
| Q1.2 | 0x40 | 0 |
| Q1.3 | 0x40 | 1 |
| Q1.4 | 0x40 | 2 |
| Q1.5 | 0x40 | 3 |
| Q1.6 | 0x41 | 8 |
| Q1.7 | 0x41 | 9 |
| Zone C | | |
| Q2.0 | 0x41 | 15 |
| Q2.1 | 0x41 | 14 |
| Q2.2 | 0x41 | 13 |
| Q2.3 | 0x41 | 12 |
| Q2.4 | 0x41 | 11 |
| Q2.5 | 0x41 | 10 |
| Q2.6 | 0x41 | 6 |
| Q2.7 | 0x41 | 7 |

12.1.3 Relay Devices Analog I/Os

| Analog Inputs | | |
|---------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| I0.2 | 0x49 | 2 |
| I0.3 | 0x49 | 3 |
| I0.4 | 0x48 | 3 |
| I0.5 | 0x48 | 2 |
| Zone B | | |
| I1.2 | 0x49 | 0 |
| I1.3 | 0x49 | 1 |
| I1.4 | 0x4a | 3 |
| I1.5 | 0x4a | 2 |
| Zone C | | |
| I2.2 | 0x4b | 3 |
| I2.3 | 0x4b | 2 |
| I2.4 | 0x4b | 0 |
| I2.5 | 0x4b | 1 |

| Analog Outputs | | |
|----------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| A0.0 | 0x40 | 13 |
| A0.1 | 0x40 | 6 |
| A0.2 | 0x40 | 7 |
| Zone B | | |
| A1.0 | 0x40 | 3 |
| A1.1 | 0x41 | 8 |
| A1.2 | 0x41 | 9 |
| Zone C | | |
| A2.0 | 0x41 | 10 |
| A2.1 | 0x41 | 6 |
| A2.2 | 0x41 | 7 |

12.1.4 Digital I/Os

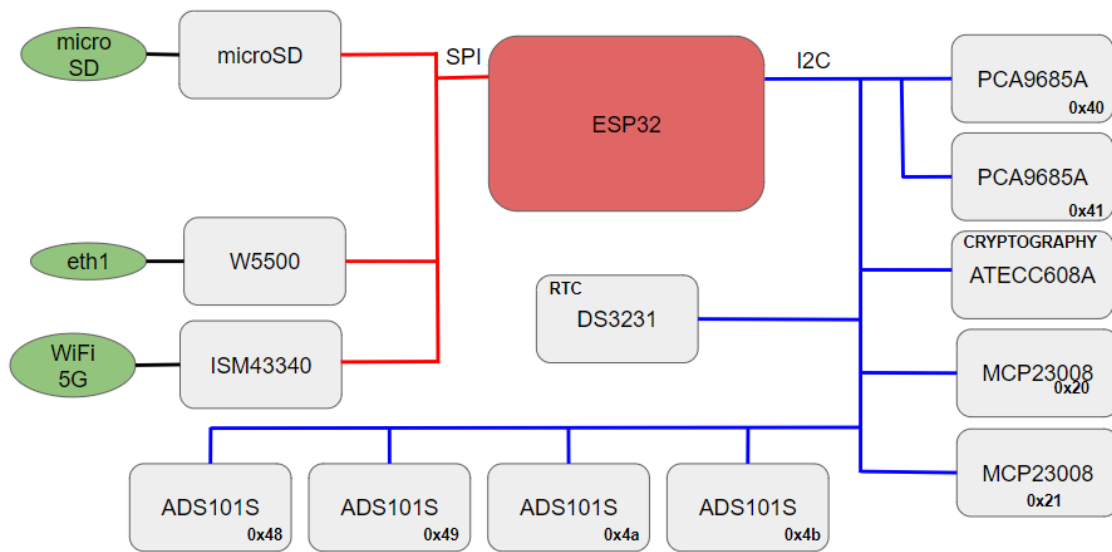
| Digital Inputs | |
|----------------|------|
| PLC Pinout | GPIO |
| Zone A | |
| I0.0 | 27 |
| I0.1 | 26 |
| Zone B | |
| I1.0 | 35 |
| I1.1 | 25 |
| Zone C | |
| I2.0 | 34 |
| I2.1 | 5 |

| Digital Outputs | | |
|-----------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| Q0.0 | 0x40 | 13 |
| Q0.1 | 0x40 | 6 |
| Q0.2 | 0x40 | 7 |
| Zone B | | |
| Q1.0 | 0x40 | 3 |
| Q1.1 | 0x41 | 8 |
| Q1.2 | 0x41 | 9 |
| Zone C | | |
| Q2.0 | 0x41 | 10 |
| Q2.1 | 0x41 | 6 |
| Q2.2 | 0x41 | 7 |

12.1.5 Relay

| Relay | | |
|------------|-----------|------------|
| PLC Pinout | Chip ADDR | Chip INDEX |
| Zone A | | |
| R0.1 | 0x21 | 4 |
| R0.2 | 0x21 | 6 |
| R0.3 | 0x21 | 3 |
| R0.4 | 0x21 | 5 |
| R0.5 | 0x40 | 12 |
| R0.6 | 0x40 | 8 |
| R0.7 | 0x40 | 9 |
| R0.8 | 0x40 | 10 |
| Zone B | | |
| R1.1 | 0x21 | 0 |
| R1.2 | 0x21 | 1 |
| R1.3 | 0x20 | 6 |
| R1.4 | 0x20 | 7 |
| R1.5 | 0x40 | 2 |
| R1.6 | 0x40 | 1 |
| R1.7 | 0x40 | 0 |
| R1.8 | 0x40 | 14 |
| Zone C | | |
| R2.1 | 0x20 | 3 |
| R2.2 | 0x20 | 4 |
| R2.3 | 0x20 | 1 |
| R2.4 | 0x20 | 2 |
| R2.5 | 0x41 | 11 |
| R2.6 | 0x41 | 12 |
| R2.7 | 0x41 | 13 |
| R2.8 | 0x41 | 14 |

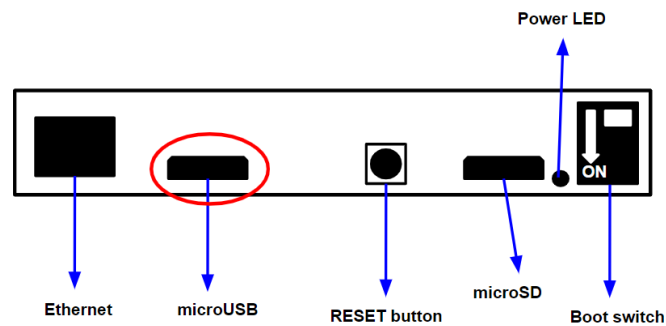
13 Internal I2C and SPI Connections



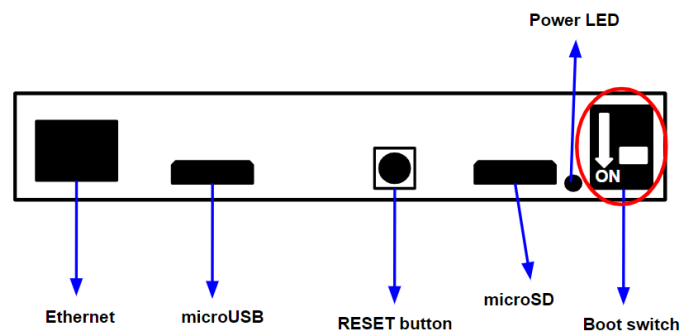
14 Instructions: How to upload a program

With these family devices, we must follow a certain protocol to successfully upload a program:

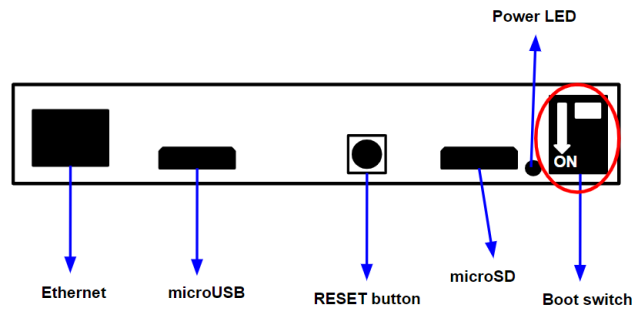
- Connect the microUSB cable to the microUSB port:



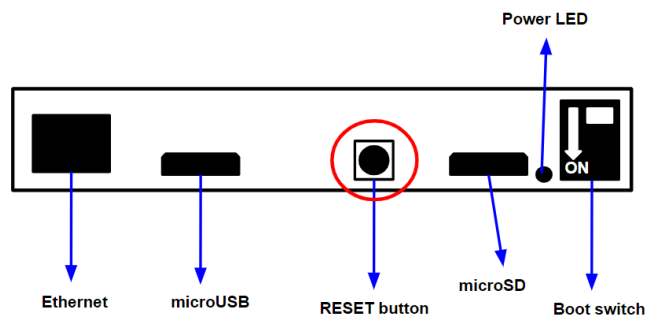
- Configure this switch (BOOT) in ON position:



- Upload the code.
- Once the code is uploaded, turn OFF the previous switch.

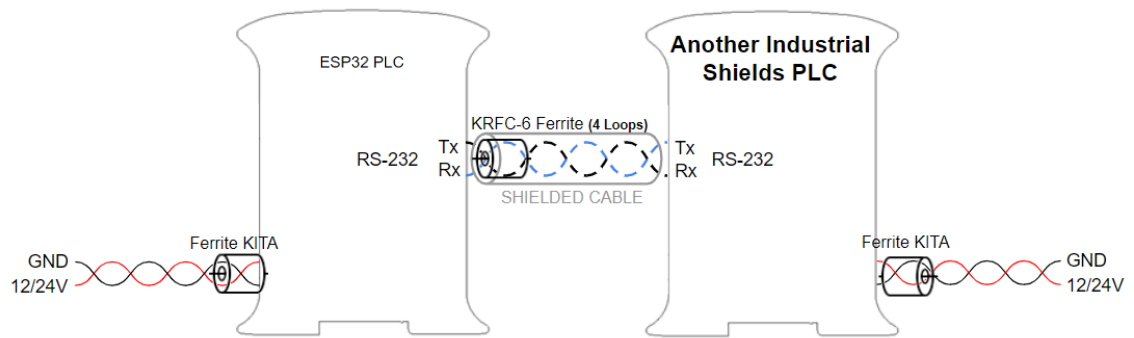


- Pulse the RESET button:



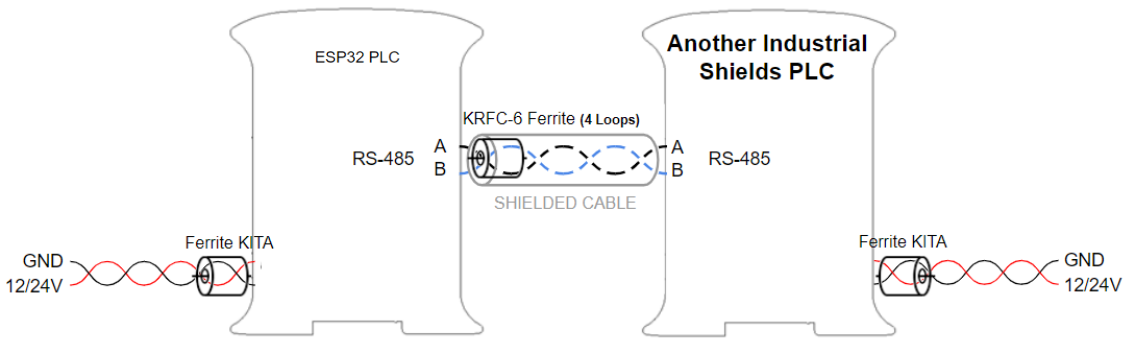
15 Instructions for interconnection between Industrial Shields controllers

15.1 RS-232 Communication:

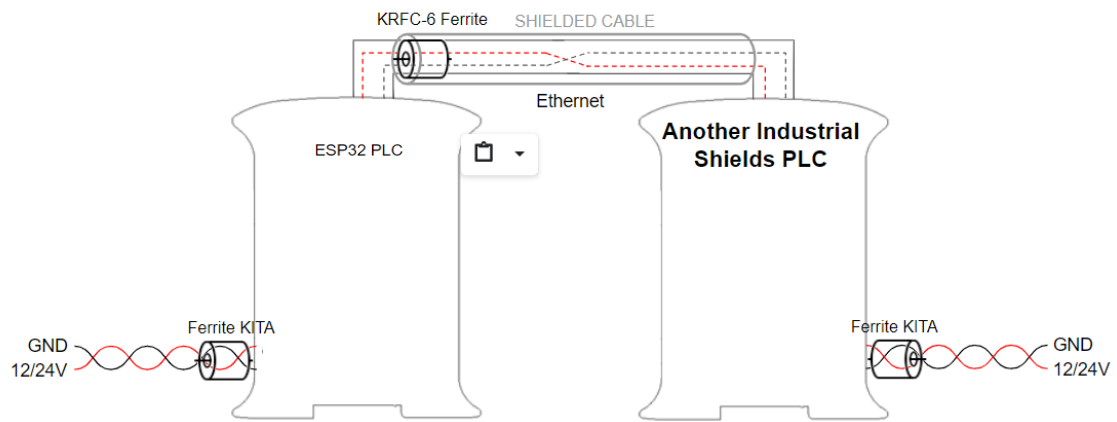


15.2 RS-485 Communication:

15.2.1.1 Half Duplex

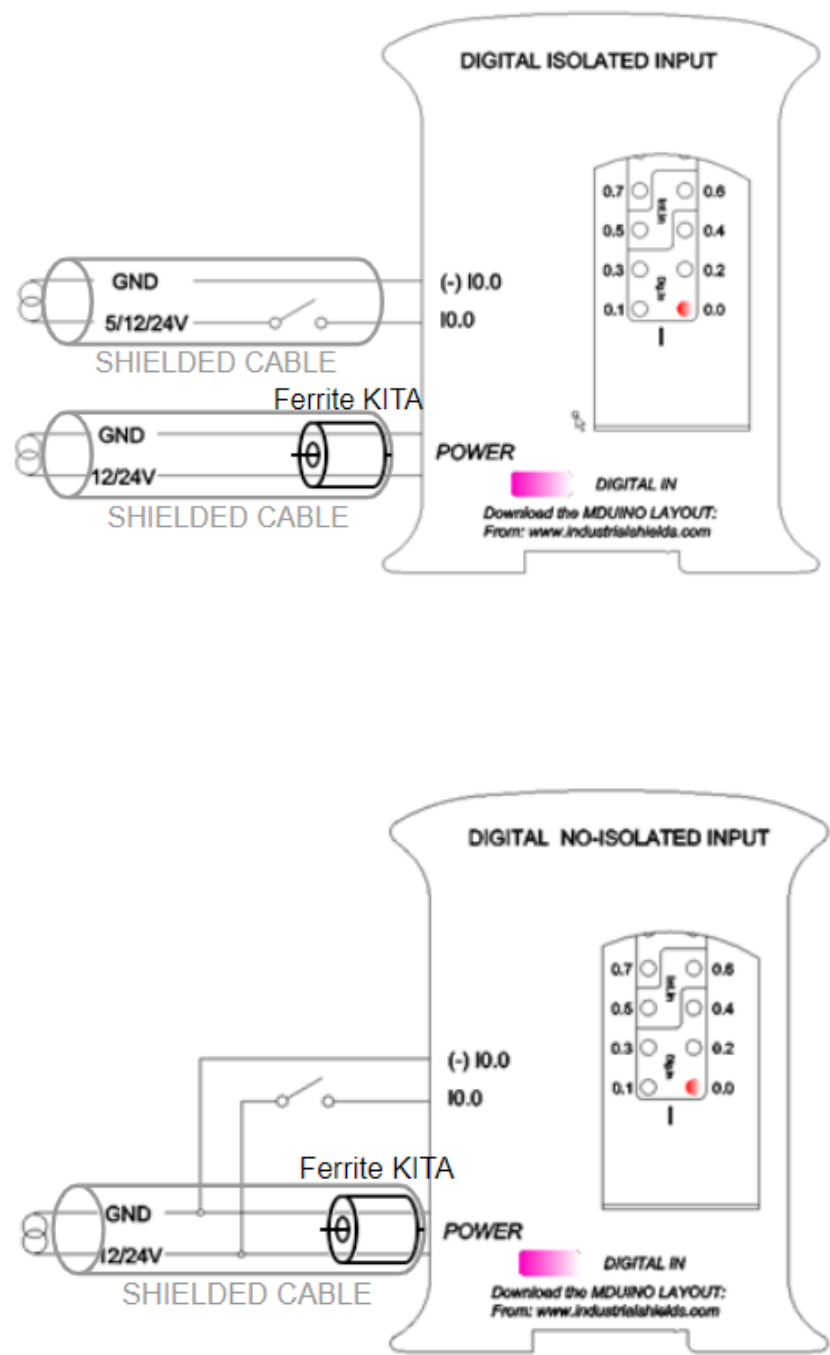


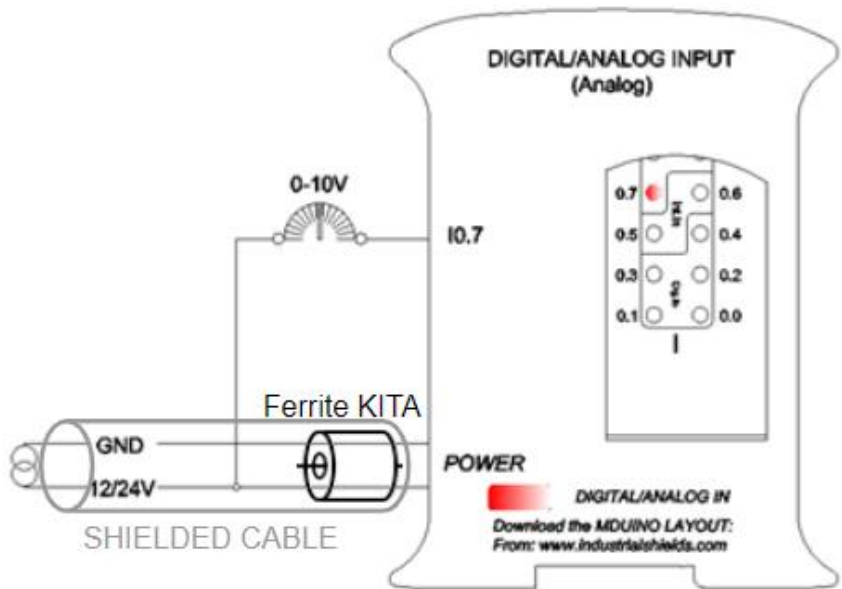
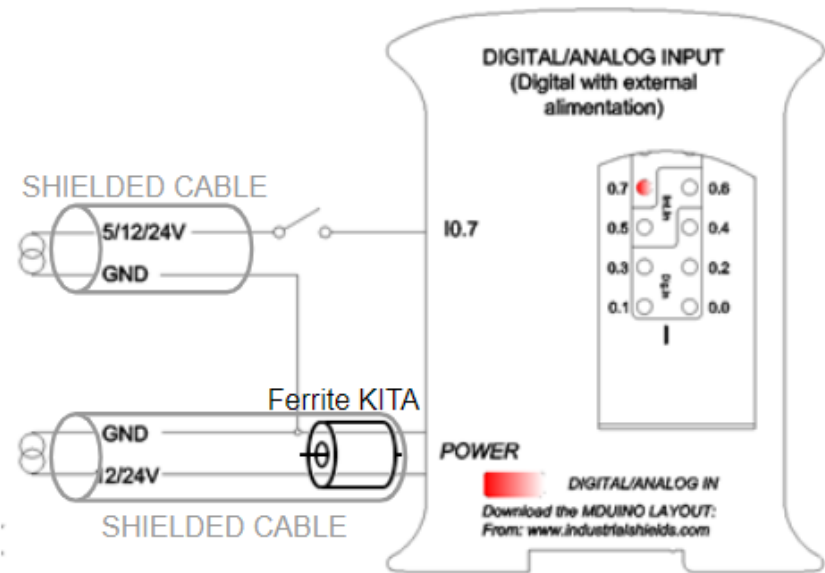
15.3 Ethernet

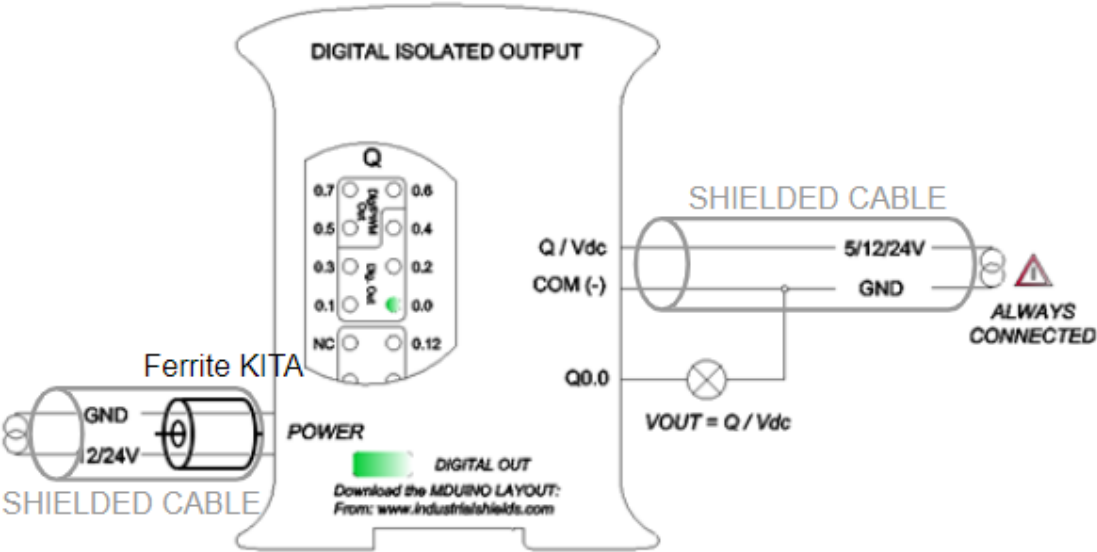
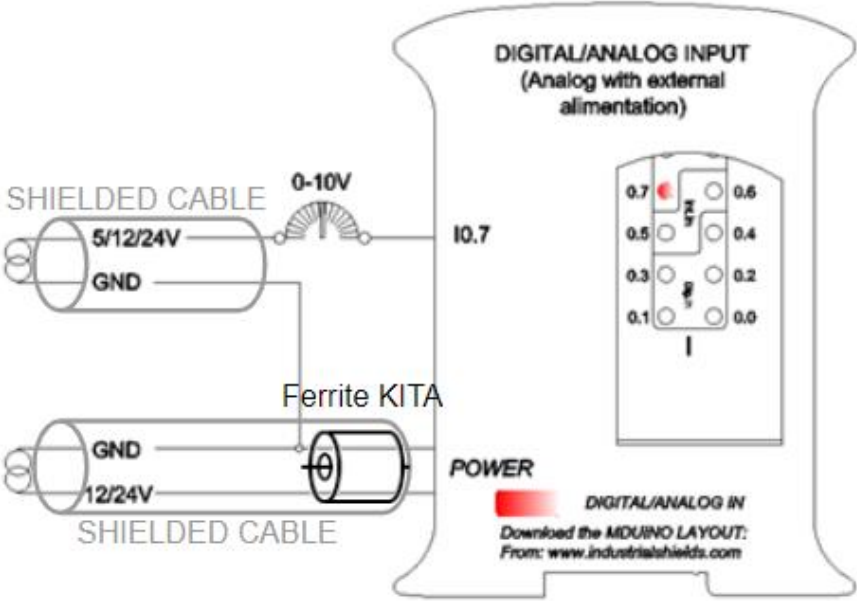


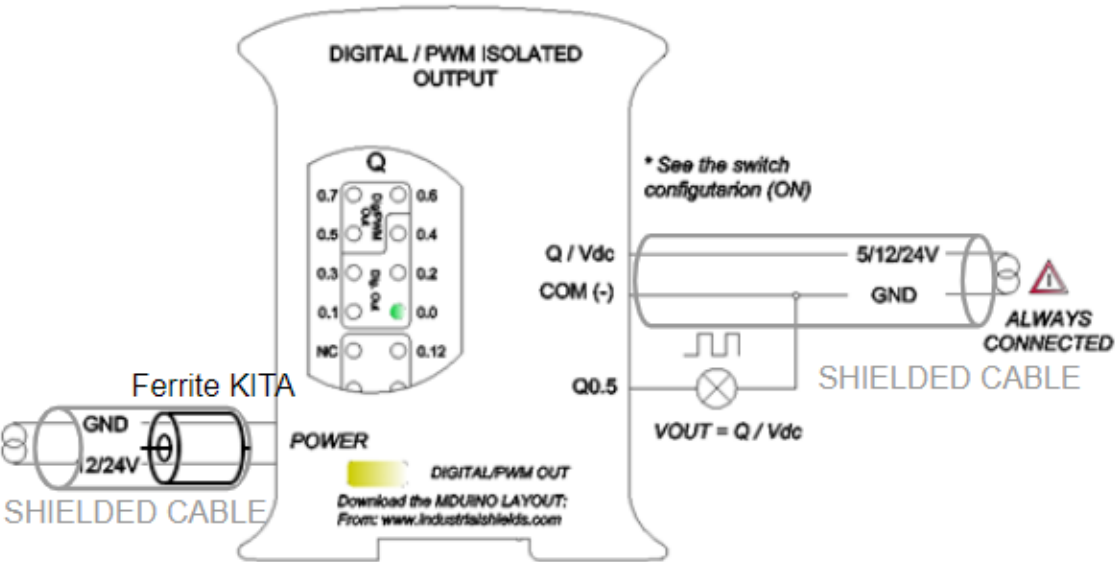
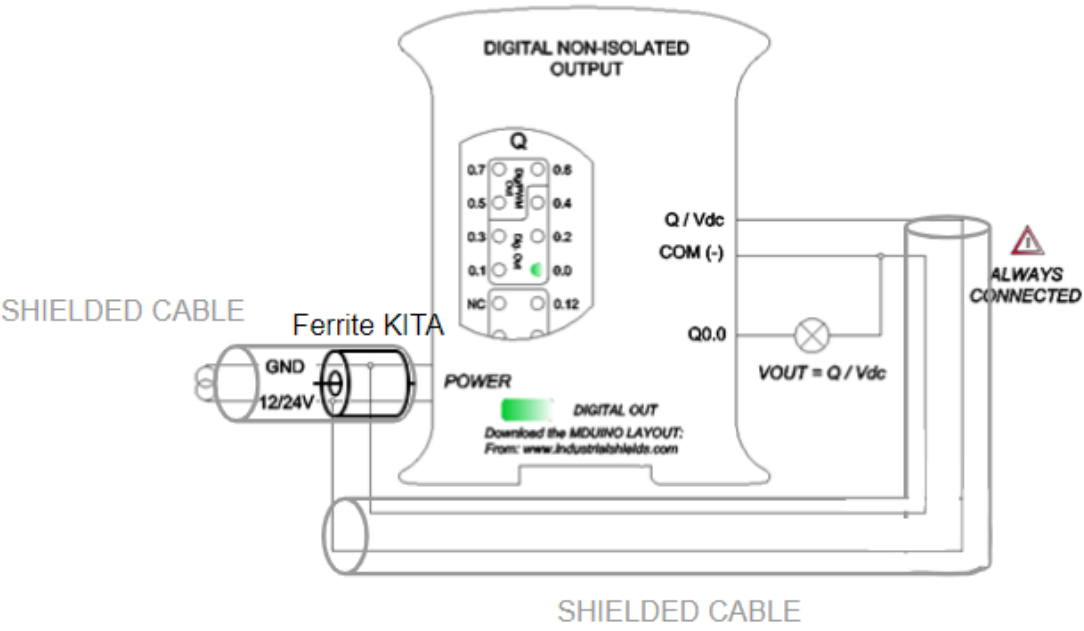
For an Ethernet communication between Industrial Shields equipment a **SFTP CAT-6 Ethernet crossover cable** must be used.

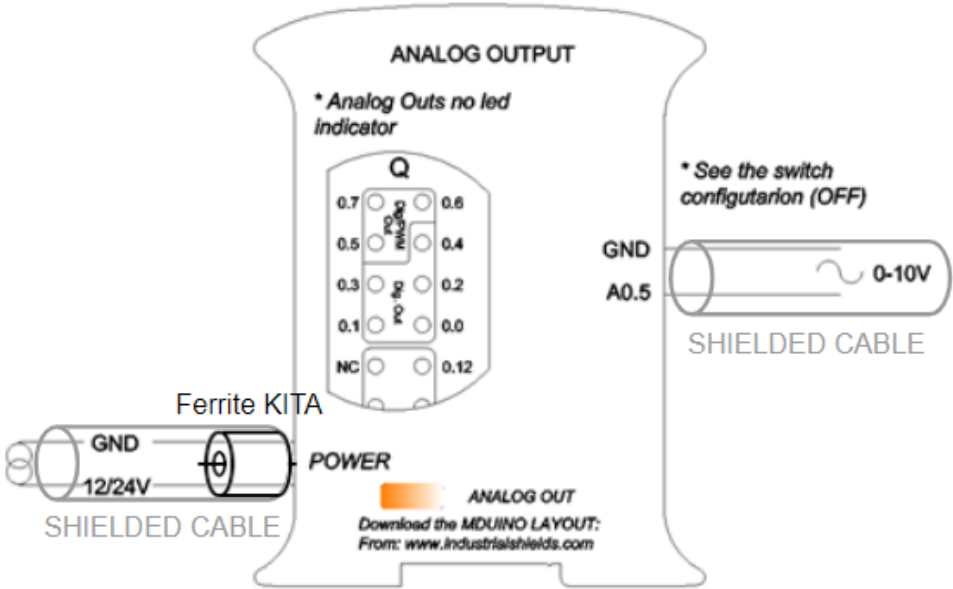
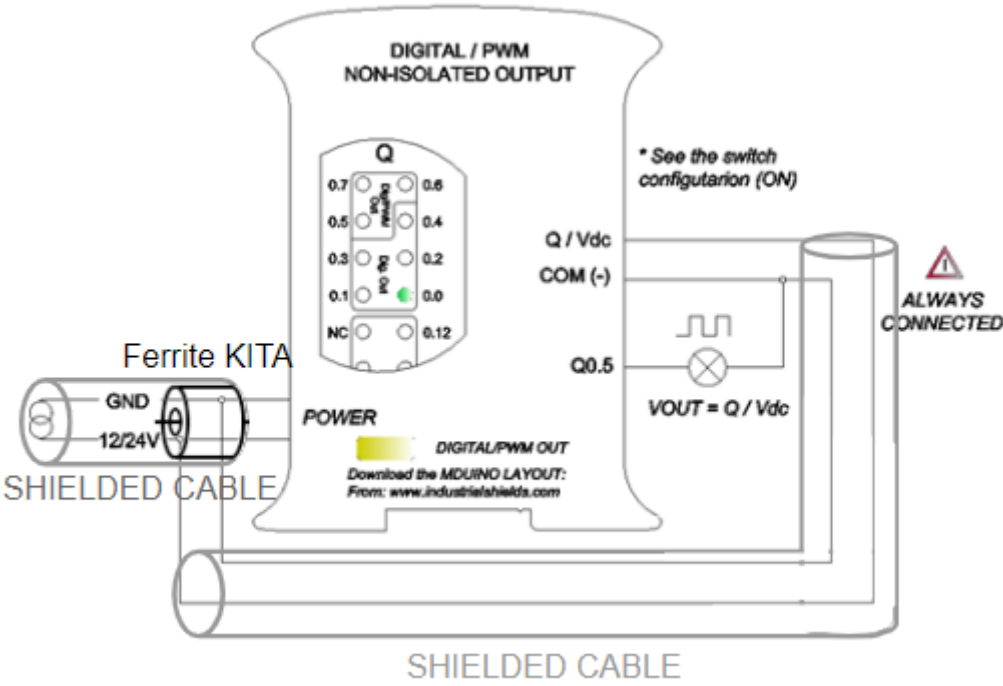
16 Typical Connections











17 Connector details:

The connector inside the PLCs that mounts on the PCB is MC 0,5/10-G-2,5 THT – 1963502 from Phoenix contact. [MC0,5/10-G-2,5THT](#)

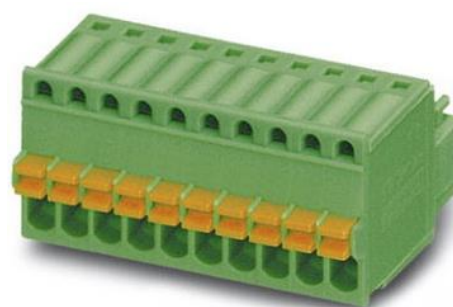
For I/O and power supply there is a FK-MC 0,5/10-ST-2,5 - 1881406 connector from Phoenix contact. [FK-MC 0,5/10-ST-2,5](#)

Connection details:

| | |
|--------------------------|---------------------|
| Article reference | MC 0,5/10-G-2,5 THT |
| Height | 8,1mm |
| Pitch | 2,5mm |
| Dimension | 22,5mm |
| Pin dimensions | 0,8x0,8mm |
| Pin spacing | 2,50mm |

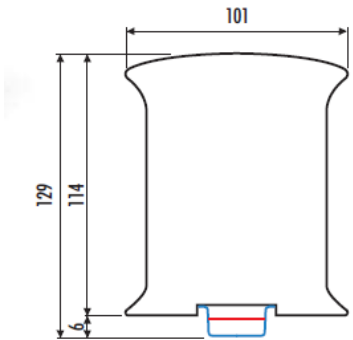


| | |
|---------------------------------------|----------------------|
| Article reference | FK-MC 0,5/10-ST-2,5 |
| Rigid conduit section min. | 0,14 mm ² |
| Rigid conduit section max. | 0,5 mm ² |
| Flexible conduit section min. | 0,14 mm ² |
| Flexible conduit section max. | 0,5 mm ² |
| Conduit section AWG/kcmil min. | 26 |
| Conduit section AWG/kcmil max. | 20 |

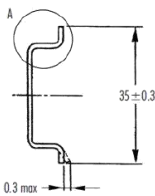
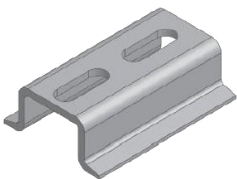


18 Mechanical Characteristics

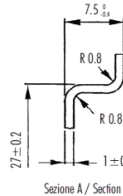
- Dimension ESP32 ETHERNET&WIFI&BLUETOOTH PLC:



- DIN Rail mounting

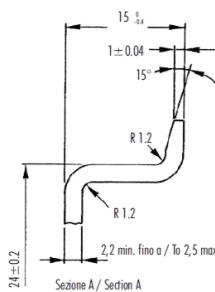


Profilato a cappello TH 35-7,5
Top hat rail TH 35-7,5



Sezione A / Section A

Profilato a cappello TH 35-15
Top hat rail TH 35-15



Sezione A / Section A



| CARATTERISTICHE | METODO | UNITA' DI MISURA | BLENDE PC/ABS |
|--|-------------|--------------------|---------------|
| Mecchaniche | | | |
| Resistenza a trazione allo spezzamento | ASTM D638 | MPa | 68 |
| Resistenza a trazione a rottura | ASTM D638 | MPa | 48 |
| Allungamento a rottura | ASTM D638 | % | 59 |
| Modulo in flessione | ASTM D790 | MPa | 2894 |
| Prova load con intaglio | ISO 180/174 | KJ/m ² | 5.5 |
| Termiche | | | |
| Temp. di ammorbidimento Visc. metodo B | ASTM D1525 | °C | 114 |
| Temperatura Ricetta 1.81 MPa | ASTM D1448 | °C | 97 |
| Fisiche | | | |
| Peso specifico | ASTM D792 | gr/cm ³ | 1.21 |
| Ritiro nella stampa | ASTM D955 | % | 0.4/0.6 |
| Mult Flow Index 260°C - 98N | ASTM D1238 | gr/10' | 11.1 |
| Comportamento alla fiamma | | | |
| Autostagionatura (mm di spessore) | UL94 | - | V-0 (0.8) |
| Filo Inardescen. 3.2 mm | IEC60952.1 | °C | 960 |

Italtronic si riserva il diritto di modificare il materiale con cui realizza i propri prodotti senza obbligo di preavviso.

| FEATURES | TEST METHOD | UNITS | BLENDE PC/ABS |
|---------------------------------------|-------------|--------------------|---------------|
| Mechanical test | | | |
| Resistance to tensile stress at yield | ASTM D638 | MPa | 68 |
| Tensile strength | ASTM D638 | MPa | 48 |
| Ultimate elongation | ASTM D638 | % | 59 |
| Flexure modulus | ASTM D790 | MPa | 2894 |
| Load test notched | ISO 180/174 | KJ/m ² | 5.5 |
| Thermal test | | | |
| Visc softening temperature method B | ASTM D1525 | °C | 114 |
| Relieving temperature 1.81 MPa | ASTM D1448 | °C | 97 |
| Physical test | | | |
| Specific gravity | ASTM D792 | gr/cm ³ | 1.21 |
| Mold shrinkage | ASTM D955 | % | 0.4/0.6 |
| Mult Flow Index 260°C - 98N | ASTM D1238 | gr/10' | 11.1 |
| Flame test | | | |
| Self extinguisher (thickness in mm) | UL94 | - | V-0 (0.8) |
| Inardescen thread 3.2 mm | IEC60952.1 | °C | 960 |

Italtronic can operate any change of the materials without being obliged to forewarn.

For optimal operation of the product, it must be located in an electrical cabinet with IK08 mechanical protection. The minimum IP protection degree required is IP56.

19 Installation and Maintenance

Notes for installation:

- The installation position should be free from the following: dust or oil smoke, conductive dust, corrosive or flammable gas, high temperature, condensation, and rain.
- Besides, vibration and impact also affect the PLC normal operation and shorten its lifespan; electric shock, fire or misact also damages the product. During drilling or wiring, prevent the metal particles or wire segments from falling into the PLC casing, which may cause fire, fault or misact.
- After the PLC installation, clean the ventilation duct to prevent blocking, which may cause bad ventilation, or even fire, faults or misact.
- Do not online connect, plug or unplug cables, which is apt to cause electric shock or damage the circuit. Installation and wire connection must be firm and reliable. Poor connection could cause misact.
- Use shielded twisted pair for the I/O of high frequency signal and analog signal to improve system IMS.

The installation environment should be free from dust, oil smoke, conductive particle, corrosive or flammable gases, high temperature, condensation, and rain.

Besides, vibration and impact also affect the PLC normal operation and shorten its lifespan. It is recommended to install the PLC, together with the matching switches and contactors, in a dedicated electric cabinet and keep the cabinet ventilated. If the location has high ambient temperature or heat generating equipment nearby, install forced convection devices on top or sides of the cabinet to avoid over-temperature. During drilling or wiring, prevent the metal particles or wire segments from falling into the PLC casing, which may cause fire, fault or misact. After the PLC installation, clean the ventilation duct to prevent blocking, which may cause bad ventilation, or even fire, faults or misact.

The only way to disconnect the equipment from the electrical network is by removing the connectors that feed the equipment. Once installed in the electrical cabinet it is very important to ensure the power connectors for proper operation.

Separate the ESP32 ETHERNET&WIFI&BLUETOOTH PLC from heat, high voltage and electrical noise:

Always separate the devices that generate high voltage and high electrical noise from the ESP32 ETHERNET&WIFI&BLUETOOTH PLC. When configuring the layout of the ESP32 ETHERNET&WIFI&BLUETOOTH PLC inside your panel, consider the heat-generating devices and locate the electronic-type devices in the cooler areas of your cabinet. Reducing the exposure to a high-temperature environment will extend the operating life of any electronic device. Consider also the routing of the wiring for the devices in the electric cabinet. Avoid placing low-voltage signal wires and communications cables in the same tray with AC power wiring and highenergy, rapidly-switched DC wiring.

Provide adequate clearance for cooling and wiring ESP32 ETHERNET&WIFI&BLUETOOTH PLC. Is designed for natural convection cooling. For proper cooling, you must provide a clearance of at least 25 cm above and below the devices. Also, allow at least 25 cm of depth between the front of the modules and the inside of the enclosure.

Notes for maintenance:

A well-planned and executed maintenance program is essential to the satisfactory operation of solid-state electrical equipment. The kind and frequency of the maintenance operation will vary with the kind and complexity of the equipment as well as with the nature of the operating conditions. Maintenance recommendations of the manufacturer or appropriate product standards should be followed.

The following factors should be considered when formulating a maintenance program:

- Maintenance must be performed by qualified personnel familiar with the construction, operation, and hazards involved with the control.
- Maintenance should be performed with the control out of operation and disconnected from all sources of power.
- Care should be taken when servicing electrostatic sensitive components. The manufacturer's recommendations for these components should be followed.
- Ventilation passages should be kept open. If the equipment depends upon auxiliary cooling, e.g., air, water, or oil, periodic inspection (with filter replacement when necessary) should be made of these systems.
- The means employed for grounding or insulating the equipment from ground should be checked to assure its integrity.
- Accumulations of dust and dirt on all parts, including on semiconductor heat sinks, should be removed according to the manufacturer's instructions, if provided; otherwise, the manufacturer should be consulted. Care must be taken to avoid damaging any delicate components and to avoid displacing dust, dirt, or debris in a way that permits it to enter or settle into parts of the control equipment.
- Enclosures should be inspected for evidence of deterioration. Accumulated dust and dirt should be removed from the top of the enclosures before opening doors or removing covers.
- Certain hazardous materials removed as part of maintenance or repair procedure (e.g., polychlorinated biphenyls (PCBs) found in some liquidfilled capacitors) must be disposed of as described in Federal regulations.

Safety rules for maintenance personnel

Consider the following steps to follow. A false manoeuvre could be the cause of an accident or material damage.

Do not disassemble or modify the modules. This could lead to breakdowns or malfunctions and could lead to injuries or fire.

- All types of radio communication devices, including mobile phones and personal handy-phone systems (PHS), must be kept more than **25cm** away from the PLC in all directions. Failure to observe this precaution exposes malfunctions caused by excess of temperature.
- Disconnect the external power supply of the system (on all phases) before connecting or disconnecting a module. Failure to observe this precaution may cause faults or malfunctions of the module.

- Tighten the screws of the terminal ports and the screws of the connectors within the prescribed tightening torque. Insufficient tightening can lead to loose parts or wires and cause malfunctions. Excessive tightening can damage the screws and / or the module, with the risk of falling, short circuits and malfunctions.
- Before handling a module, dispose of the electrostatic charge accumulated by the human body by touching a suitable conductive object. Failure to observe this precaution may cause faults or malfunctions of the module.

Repair note:

If the equipment is suitable to be repaired, it must be verified that the equipment remains in a safe state after repair.

20 Revision Table

| Revision Number | Date | Changes |
|-----------------|------------|----------------------|
| 0 | 01/03/2021 | First implementation |
| | | |
| | | |
| | | |
| | | |
| | | |

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