Open Source based PLCs Feature Guide

Industrial Shields

Open Souce based PLCs Feature Guide

This guide shows the features of the different ranges of industrial PLCs based on Open Source CPUs such as Arduino, Raspberry Pi or ESP32.

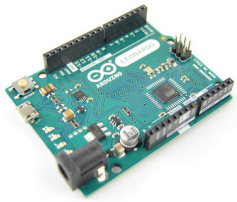
Typos of CPUs assembled in Industrial Shields PLCs

ARDUINO

Arduino is an open source electronics creation platform based on free hardware and software, allowing anyone to use and adapt them. Thanks to that, you can find in the market several types of boards, accessories and compatible applications created by different companies or developers. All of them are different, but using the same common base, which helps the community of creators to give them different types of use.

Arduino Leonardo

Microcontroller based on the ATmega32u4. With 20 digital input / output pins (7 can be used as PWM outputs and 12 as analog inputs). Micro USB connection, power connector, an ICSP and reset button.

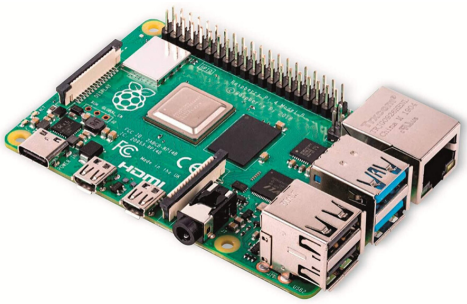


Arduino Mega

Microcontroller based on the ATmega1280. With 54 digital input / output pins (14 can be used as PWM outputs), 16 analog inputs, 4 UART, USB connection, power connector, ICSP, and reset button.

Raspberry Pi

Raspberry Pi is a low-cost, simple board computer developed in the UK by the Raspberry Pi Foundation. It is powerful enough to facilitate learning and perform basic tasks, and also allows you to program and compile programs that run on it.



ESP32

ESP32 is the name of a family of low-cost, low-power SoC chips with integrated Wi-Fi and Bluetooth dual-mode technology. It employs a Tensilica Xtensa LX6 microprocessor in its single and dual-core variants and includes antenna switches, RF balun, power amplifier, low noise receiver amplifier, filters, and power management modules.

Differences about CPUs you should know

Arduino was specifically designed so that anyone can create projects with its concept.
That is why its strenght lies in its ease of c**onnection with the world**, thanks to its analog and digital inputs and how easy it is to activate or deactivate with its software.

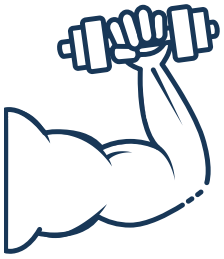
It is therefore a very versatile alternative.

However, the **Raspberry Pi** was designed as a computer itself, so it has **more computing power** than the Arduino boards.

What cannot be compared is Arduino's versatility, although it is gaining more and more in this respect thanks to the growing creation of extensions to add features.

In this sense, it is also important to talk about connectivity.
The Raspberry Pi has WiFi and Ethernet connectivity already buit into the board.

If we talk about the ESP32 board, the microcontroller is 10 times faster than the Arduino boards, and it also has a 32-bit, dual-core architecture.
The data processing speed is much faster than an ATmega board like the Arduino Mega.
As with the Raspberry Pi, the ESP32 also includes WiFi and Bluetooth.
It is also superior in the number of GPIOs and with higher resolution, 12 bits.



Inputs and Outputs. Available quantities and types

Inputs

All PLCs have analogue, digital and interrupt inputs. Those with the letter R in their description also have relay outputs.

Outputs

Analogical { **Min. 4** **Max. 16**

Digital { **Min. 9** **Max. 36**

Interruption { **Min 2** **Max 6**

Min 2 **Max 8** } Analogical

Min 8 **Max 22** } Digital

Min 8 **Max 23** } Relay

What you need to know about inputs and ouputs

PLCs can be adapted to the needs of inputs and outputs by selecting one or the other equipment and also thanks to the flexibility in being able to exchange the use between inputs and outputs.

The PLCs have a **switch** similar to the one in the image, which allows the adaptation, configuration and selection of uses for the inputs and outputs. Each equipment has its own particular configuration, which is beyond the scope of this guide.

More about inputs and outputs

The computers have USB ports, which are not properly inputs but could be confused.

It is important to always check the user's manual to avoid uses that could damage the equipment. An example is not supplying power via USB, which should only be used for programming the equipment.

Comunications in PLCs

There are multiple types of communication available for use in Open Source Hardware based PLCs.
As mentioned above, the number of inputs and outputs may vary depending on the equipment, the number of inputs or outputs configured or the accessories available in the PLC ranges such as WiFi, GPRS, LoRa or Dali.

Types of communications available

- I2C
- SPI
- Serial TTL (UART)
- Ethernet
- RS485 Half / Full Duplex
- RS232
- Wi-Fi & BLE
- GPRS / GSM

Certificates

Industrial Shields PLCs were oriented since the the first moment to projects and solutions for the industrial world. One of the most important requirements for a product to be part of the industrial sector is that it complies with the guarantees and certifications that are demanded.

Conform to health, safety and environmental protection (CE)

EN61010-1
EN61010-2-201
EN61131-2:2007
(Clause 8: Zone A / B EMC and clause 11: LVD)
EN61000-6-4:2007 + A1 2011 (Emissions)
EN 61000-6-2:2005 (Immunity)

Medical Devices Directive (CE): **93/42/EEC**

FCC Federal Code of Regulation (CFR) for Electronic Equipment: **EMC: FCC Part 15**

RoHS: **Directive 2002/95/EC | Restriction of Hazardous Substances (EEE)**

UL: STD 61010-2-201 and UL STD 61010-1

NCAGE (Commercial and Government Entity Code - Department of Defense):
NCAGE 99SGB | Commercial and Government Entity Code | Boot&Work Corp SL

Other relevant information

DIN Rail mounting

Maximum Consumption: **1.5A**
Power Supply Voltage (Vdc): **12-24**
Power consumption (VAC max.): **30**

Operating temperature: **0C-60C || 32F-140F**
Operating relative humidity % (no condensation): **10%-90%**
Moisture Sensitivity Level (MSL): **MSL 1 - Unlimited**

RoHS ¿RoHS Compliant by Exemption? **No**

Safety

Internal power supply
Galvanic isolation
Diode protected outputs
Protection against polarity reversal
Overcurrent fuse supply
Inputs protected against surges (resistance)
EMC (acording to IPC-2221)
Diferent ground planes (Single common points)
Coupling capasitors

Lead Free

Does not contain lithium

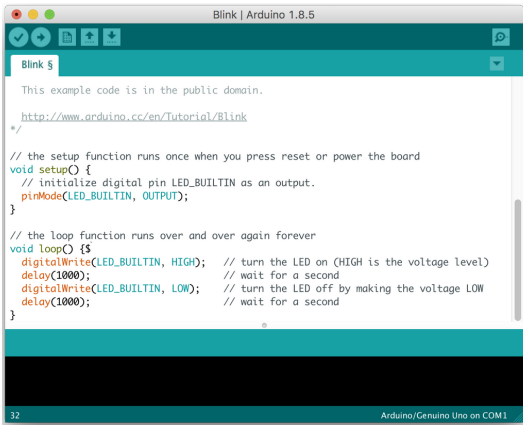
ECCN Number: **EAR99H**
STATIC Sensitive: **No**

Country of origin: **Spain**

Packaging measures (box): **13cm x 14cm x 8cm**

First steps – Arduino IDE and the Industrial Shields boards

¿What is Arduino IDE?



It is the Arduino Integrated Development Environment (IDE).

It is a multi platform application (for Windows, macOs, Linux) that is used to write and load programs on boards compatible with Arduino.

It can also be used with other boards, or equipment such as Industrial Shields ones, but for this it is necessary to install the boards.

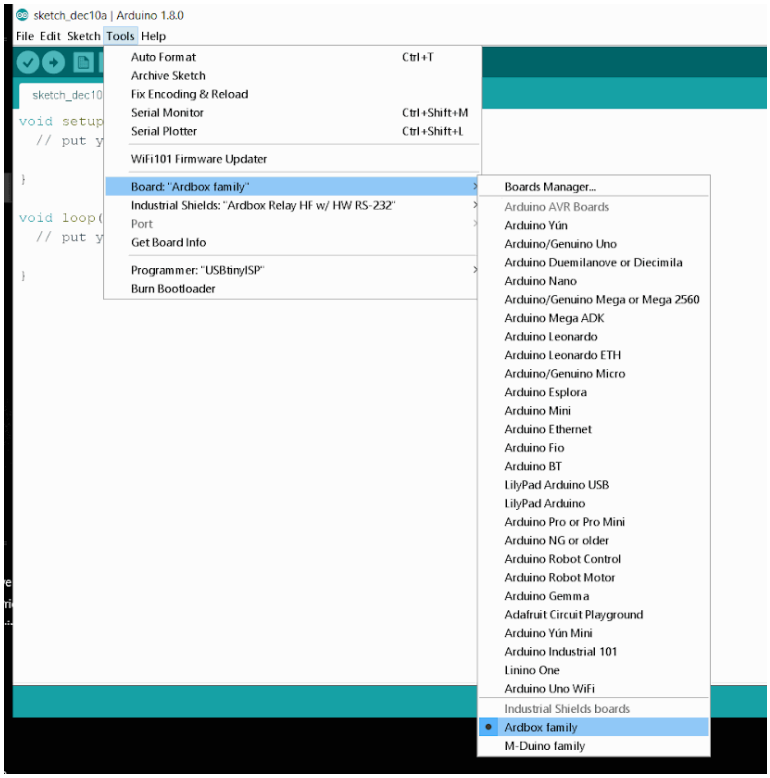
Benefits of installing the Industrial Shields Boards

The use of Industrial Shields boards simplifies the programming of the PLCs since they allow:

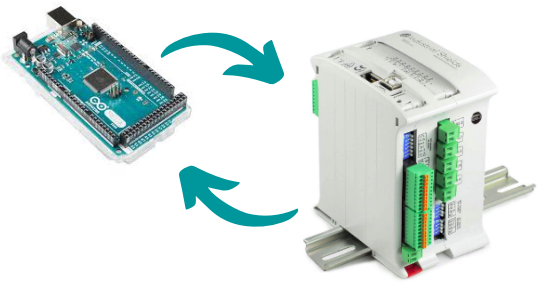
- Automatic definition / association of variables / pinmode of a pin
- Industrial Shields automatic boards (PLC features)

This is a "library collection" that is included in the Arduino IDE software, when they are selected and the Arduino board is not selected

Automatic definition / variable association / pinmode of a pin helps in pinout management.
If the sketch is not done with the boards, it cannot be expanded for future versions and for other models / teams.



Our pins (QX.X / IX.X / AX.X / RX.X) are referenced to a real Arduino pin.



Depending on the model or the equipment, these pins may be different.

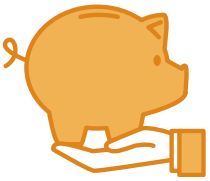
Usage examples

Once Industrial Shields boards are installed in Arduino IDE, we find different usage examples for Arduino based controller.

In Arduino IDE they can be found at:
> "File"
> "Examples"
> "MDuino Family Examples"

Benefits in using Arduino, Raspberry Pi or ESP32 controllers

Direct Impact on Costs



Different platforms can be used to program the Arduino-based equipment, the vast majority at no cost.

No license fees!

ARDUINO

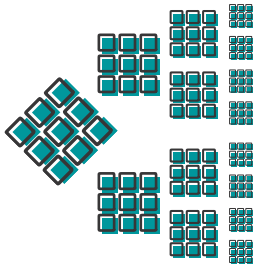
Arduino IDE, the original Arduino and the main one on the market to program Arduino boards, and therefore Industrial Shields PLCs, is free to download.

https://www.arduino.cc/en/main/software

Quantity and quality of inputs and outputs

The range of industrial PLCs based on Arduino, Raspberry Pi or ESP32, complete a range of multiple features in terms of types and quantities of inputs and outputs. There are countless applications in which to use these controllers, be it for **monitoring, control or automation solutions.**

In addition, the possibility of installation in master-slave mode must be taken into account, which greatly increases the number of available inputs and outputs.



Standard industrial communications, and more

In industrial environments, standard communications are required to facilitate the connection between all kinds of solutions, hardware or software, in the fastest, cheapest, safest and most reliable way. Industrial Shields PLCs have these requirements, although there may be manufacturers or sectors with specific solutions.

I2C	Serial TTL (UART)	Wi-Fi & BLE	RS485 Half / Full Duplex
SPI	Ethernet	GPRS / GSM	RS232

...and more Thanks to our flexibility we have added to our range of products, specific solutions that our clients have demanded, such as:

LoRa®

Long Range (LoRa), An ideal technology for connections over long distances and for IoT networks where sensors that do not have mains electricity are required.

DALI
Digital Addressable Lighting Interface

DALI, It is a protocol created to control lighting systems (Digital Addressable Lighting Interface = Interface Digital de Iluminación Direccionable).

Conclusion

The benefits of the different ranges of PLC, with the particularities of each CPU, the number of inputs and outputs, or specific accessories such as GPRS, WiFi, LoRa or DALI, ensure a range of possibilities. With rare exceptions where the specifications of the solution are going to be very exclusive, Industrial Shields PLCs are a great solution for industrial applications in all sectors, be it for automation, monitoring or control.

Do you need more information?

Contact us, let's **get in touch**

Our **commercial, technical and support team** will assist you by phone, email, skype; or using the ticket system or chat directly in our website.

Get in touch with us. We are here, glad to help and support you.

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