WEIDOS Controllers

Manual

Let’s connect

WEIDOS-MKR1010-A1	**4000003853**	**WEIDOS-ESP32-A1**	**4000003857**
WEIDOS-MKR1010-LORA-A1	**4000003854**	**WEIDOS- ESP32-LORA-A1**	**4000003858**
WEIDOS-MKR1010-NBIOT-A1	**4000003855**	**WEIDOS- ESP32-NBIOT-A1**	**4000003859**

Weidmüller

Prerequisite:

Software:

- Arduino IDE Platform Version 1.8.15 or above
- USB Drivers for WEIDOS-ESP32-A1 series

Hardware:

- External Power Supply unit (12/24Vdc)
- Micro USB type B to USB converter

Revision history

Version	Date	Change log	Author
00	2022-07	Release version	-

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.

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For further support please contact your local sales representative.

Preface

Application Considerations and Warranty

Read and Understand this Manual

Please read and understand this manual before using these products. Please, also consult your comments or questions before first use.

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 DESSIGNED TO ADDRESS THE RISKS, NEVER USE THESE PRODUCTS.

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

The manufacturer 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 uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

At the customer's request, the manufacturer 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, product, or other application or use.

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 manufacturer's test conditions, and the users most correlate it to actual application requirements. Actual performance is subject to the manufacturer 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 the devices 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

Manufacturer'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.

MANUFACTURER MAKES NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, REGARDING MERCHANABILITY, 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. MANUFACTURER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED

Limitations of Liability

MANUFACTURER 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 MANUFACTURER BE RESPONISBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS MANUFACTURER'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPIATE MODIFICATION OR REPAIR.

Content

1 About this documentation

1.1 Symbols and notes

The safety notices in this documentation are designed according to the severity of the danger.

DANGER

Imminent danger to life!
Notes with the signal word “Danger” warn you of situations which will result in serious injury or death if you do not follow the instructions given in this manual.

WARNING

Possible danger to life!
Notes with the signal word “Warning” warn you of situations which may result in serious injury or death if you do not follow the instructions given in this manual.

CAUTION

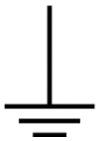
Risk of injury!
Notes with the signal word “Caution” warn you of situations which may result in injury if you do not follow the instructions given in this manual.

ATTENTION

Material damage!
Notes with the signal word “Attention” warn you of hazards which may result in material damage.

Text next to this arrow are notes which are not relevant to safety but provide important information about proper and effective work procedures.

Table that includes all the symbology that is used in this manual or serigraphy of Weidos products:

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	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

- 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 Manual regarding wiring considerations.
- Before using this product, it is the responsibility of the user to read the product's User Manual 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.

- Weidos Controllers are Open-Source devices. It is required that you install the Weidos PLC 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 Weidos family PLCs.
- In case of installation or maintenance of Weidos products 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.

2 Safety

This section includes general safety instructions for handling Weidos devices. Specific warning notices for specific tasks and situations are given at the appropriate places in the documentation. Failure to observe the safety and warning notices may result in damage to persons and material.

2.1 General Safety Notice

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 controller 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.
- 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.

Fuse protection
The operator must set up the equipment so that it is protected against overloading. The 12V DC or 24 V DC power supply units used must fulfill the SELV category, no matter whether they supply the system or feed-in modules. The output voltage of the feed-in power supply has to fulfill overvoltage category 1 according to IEC 61010.

Electromagnetic Compatibility RED Directive

The IEC 61000 standard on immunity requirements for electromagnetic compatibility applies to standard and additional wireless communications in Weidos products.

The immunity requirements have been selected to ensure an adequate level of immunity for devices used in industrial settings. The equipment meets the essential electromagnetic compatibility requirements concerning immunity.

According to the regulations that are part of EN 61131-2: 2007 and specifically, the sections

61000-6-2 for immunity and 61000-6-3 for emissions, Weidos models ensure the smooth operation of all your wireless networks in industrial and / or domestic environments.

3 Device Overview

Within Weidos devices, there are two main variants in terms of CPUs. These variants integrate MKR1010 and the ESP32 CPU's. Below, we specify the general specifications of Weidos controllers, main characteristics of each CPU board and basic functionalities.

3.1 General specifications

See next table for specs:

WEIDOS GENERAL SPECIFICATIONS		
Input Voltage	12 to 24VDC ⎓	
Input rated voltage	11.4 to 25.4 VDC ⎓	
Rated Power	30 W	
I max. at 24Vdc	1.5A	
Ambient Temperature (Operating)	0º to 60ºC	
Ambient Temperature (Storage)	-20º to 60ºC	
Ambient Humidity (Operating)	10% to 90% (Without Condensation)	
Ambient Environment (Operating)	With no corrosive gas	
Max. Operating Altitude	2000m (6562 ft)	Will work without de-rating at a maximum altitude of 2000m
Pollution Degree	PD2	Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.
Size	114x46x127 (mm)	
Communications	Ethernet – RS485 and Serial TTL (Selectable by switch) SPI – Wi-Fi (With external Antenna) – Bluetooth Low Energy – I2C	
USB consideration!	**Only meant for uploading or debugging, not always connected as a serial in a project!**	**Cannot be working in a final application**
Analog Input 12bit (0-10VDC)	0 to 10VDC Input Impedance: 39K Separated PCB ground Rated Voltage: 10VDC	I max: 2mA at 10VDC
Digital Isolated Input (5-24VDC)	5 to 24VDC I max: 12 mA Rated Voltage: 24 VDC ⎓	I max: 12 mA at 24VDC
Analog Output 10 bit (0-10VDC)	0 to 10VDC I max: 10 mA Separated PCB ground Rated Voltage: 10VDC ⎓	I max: 10 mA at 10VDC
Digital Isolated Output (24VDC*)	5 to 24VDC I max: 70 mA Rated Voltage: 24VDC ⎓	Imax at 24VDC: 410 mA (total amount of all Digital Outputs)
Multi-Function pins (3.3VDC/5VDC)	0 to 3,3 or 0 to 5 VDC Voltage range configurable by DIP switches Can be used as Digital Inputs, Digital Outputs, Interrupts or PWM signals	
Expandability	(I2C - 127 elements) - Serial Port and RS485 (Up to 32 devices with Modbus RTU)	

3.2 CPU Specifications

3.2.1 MKR1010

This section specifies the characteristics of the CPU included in the Weidos MKR1010 models, which are:

- WEIDOS-MKR1010-A1
- WEIDOS-MKR1010-LORA-A1
- WEIDOS-MKR1010-NBIOT-A1

See following table for CPU specs:

Microprocessor	ARM Cortex-M0 32-bit SAMD21
ROM	256 kB (internal)
SRAM	32 kB
Internal RTC Speed	32.768 kHz

3.2.2 ESP32

This section specifies the characteristics of the CPU included in the Weidos ESP32 models, which are:

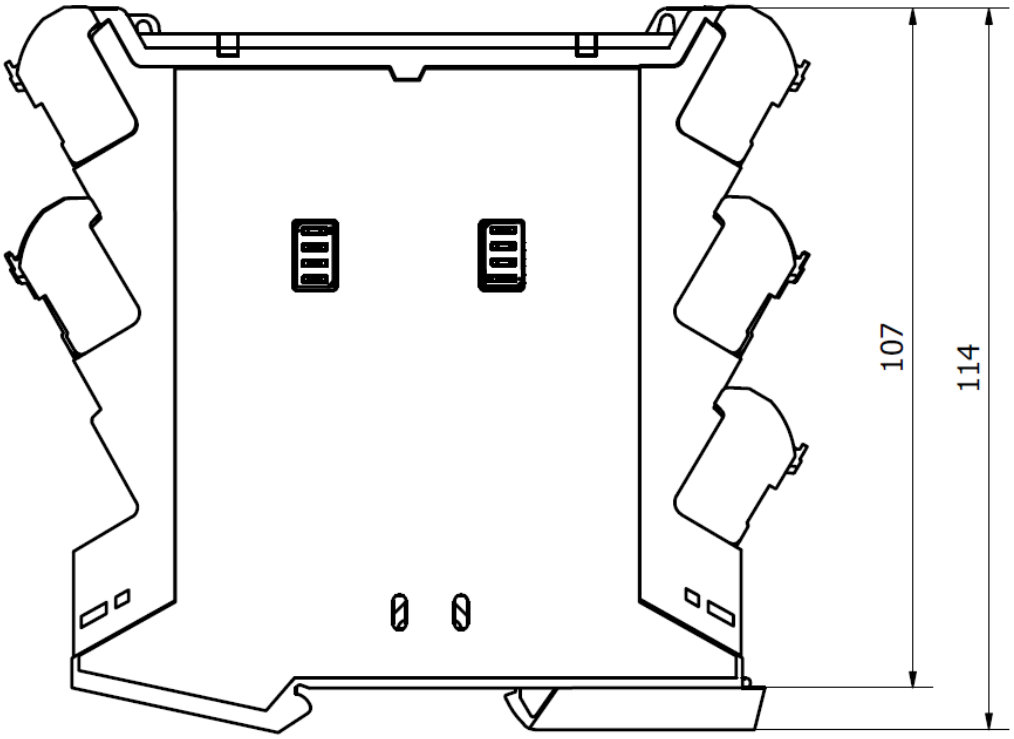
- WEIDOS-ESP32-A1
- WEIDOS-ESP32-LORA-A1
- WEIDOS-ESP32-NBIOT-A1

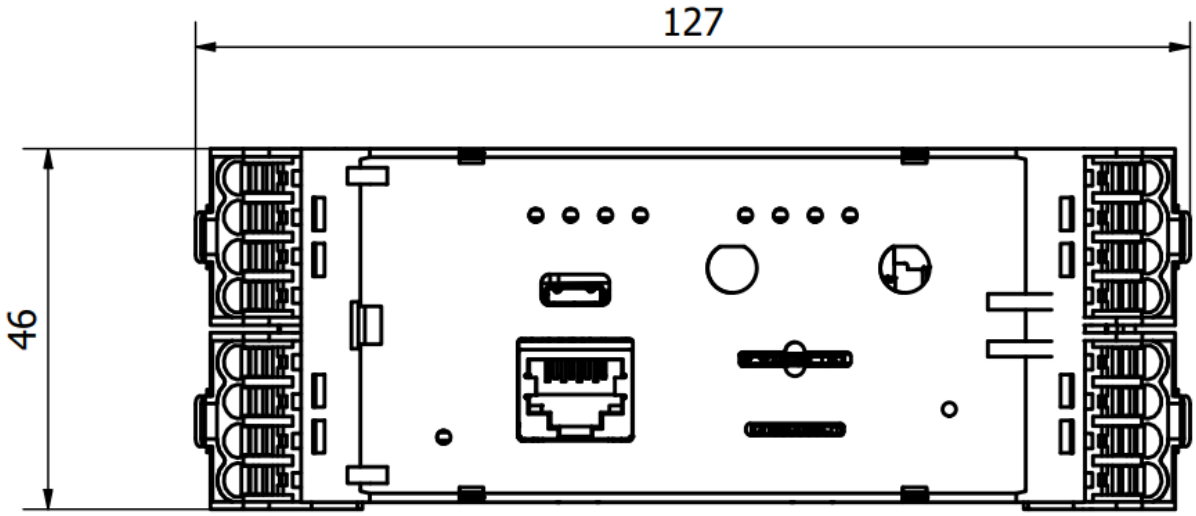
See following table for CPU specs:

Microprocessor	Xtensa® single-/dual-core 32-bit LX6 microprocessor(s), up to 600 MIPS (200 MIPS for ESP32-S0WD/ESP32-U4WDH)
ROM	448 kB (internal)
SRAM	520 kB SRAM
Internal RTC Speed	31.25 kHz clock

3.3 Mechanical Dimensions

See mechanical dimensions (mm) below:





3.4 Connector type

Weidos Controllers are equipped with “PUSH IN” connector system. This technology allows for fine-wired conductors with crimped wire-end ferrules or ultrasonically welded conductors, each with a maximum cross-section of 1.5 mm² (AWG24 – AWG14), to be inserted easily through the opening in the clamping terminal without having to use tools. To insert fine-wired conductors without wire-end ferrules, the pusher must be pressed in with a screwdriver.

Connector’s type:

		
Voltage Signals 0-10 V DC (Analog) 24 V DC (Digital & Supply)	**Serial Communications** RS485 / UART SPI & I2C	**Multi Function Pins** Direct to uController 3,3 VDC / 5 VDC

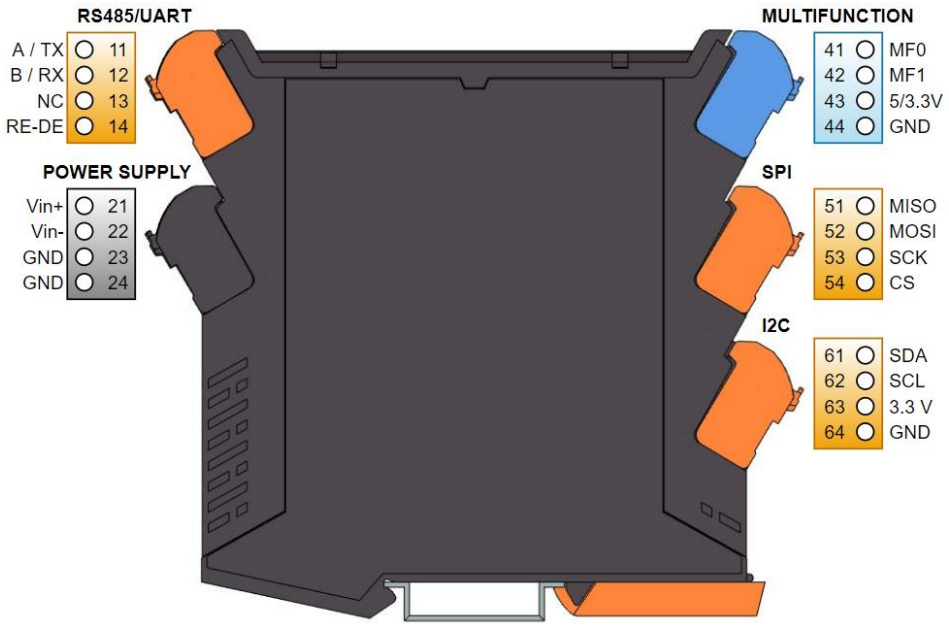
Connectors General Specifications:

Connectors PG	1.5 mm with four conductor connections
Max. Ampacity	10 A
Poles	4-pole

3.5 Device Overview

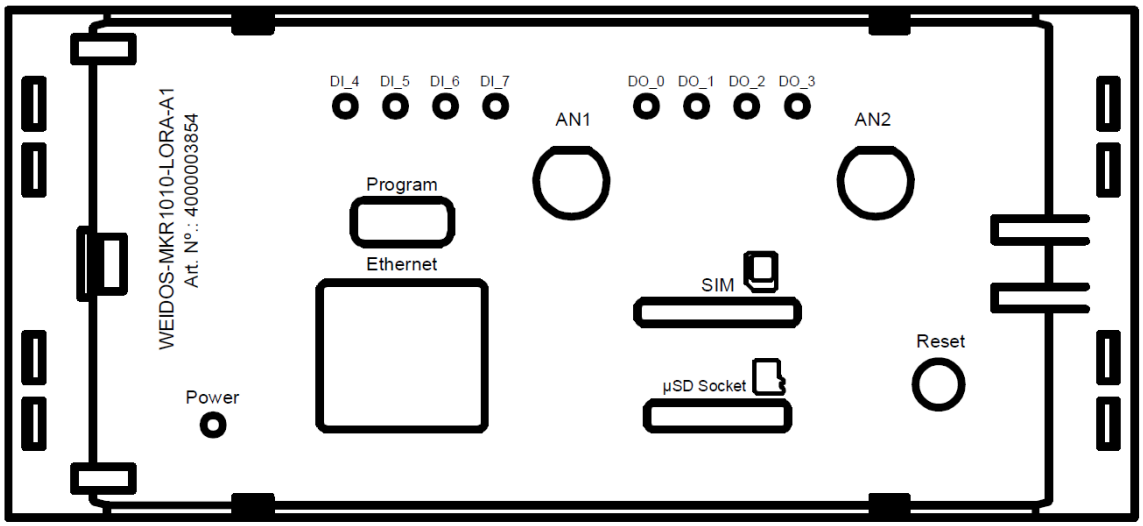
In this section we can see a general overview of Weidos device:

Right side:



Left side:

Top view:



3.6 Pinout description

In this section it is described all pins of Weidos devices:

RS-485 / UART CONNECTORS		
Pin Number	**Pin Name**	**Description**
11	A / Tx	Transmit Serial Data (Half-Duplex)
12	B / Rx	Receive Serial Data (Half-Duplex)
13	GND	Internal GND
14	RE-DE / NC	RE-DE pin High (send) Low (receive)
Comments		
UART or RS485 functionality selectable via DIP Switches. Remove Power Supply before changing DIP switches configuration.		

ANALOG INPUTS			
Pin Number	**Pin Name**	**Software Name**	**Description**
15	ADI_0	pin15 / ADI_0	Analogue/Digital Input
16	ADI_1	pin16 / ADI_1	Analogue/Digital Input
17	ADI_2	pin17 / ADI_2	Analogue/Digital Input
18	ADI_3	pin18 / ADI_3	Analogue/Digital Input

POWER SUPPLY & GND pins		
Pin Number	**Pin Name**	**Description**
21	Vin+	Device Power feed Vin+
22	Vin-	Device Power feed Vin-
23	GND	Internal GND
24	GND	Internal GND

DIGITAL INPUTS			
Pin Number	**Pin Name**	**Software Name**	**Description**
25	DI_4	pin25 / DI_4	Digital Input
26	DI_5	pin26 / DI_5	Digital Input
27	DI_6	pin27 / DI_6	Digital Input
28	DI_7	pin28 / DI_7	Digital Input

MULTI FUNCTION PINS			
Pin Number	**Pin Name**	**Software Name**	**Description**
41	MF0	pin41 / MF_0	Digital Input / Digital Output / PWM / Interrupt*
42	MF1	pin42 / MF_1	Digital Input / Digital Output / PWM / Interrupt*
43	3,3/5 Vout	-	3,3V / 5V Voltage Output**
44	GND	-	Internal GND
Comments			
*Remove Power Supply before changing DIP switches configuration. **Voltage signal selectable via DIP Switches (3,3 or 5 VDC).			

ANALOG OUTPUT			
Pin Number	**Pin Name**	**Software Name**	**Description**
45	AO_0	pin45 / AO_0	Analogue Output
46	Vcc out	-	≈Vin+ (12/24Vdc) – Depending on Power Supply
47	5 Vout	-	5 VDC (Sensor Supply)
48	3.3 Vout	-	3,3 VDC (Sensor Supply)

DIGITAL OUTPUT			
Pin Number	**Pin Name**	**Software Name**	**Description**
55	DO_0	pin55 / DO_0	Digital Output
56	DO_1	pin56 / DO_1	Digital Output
57	DO_2	pin57 / DO_2	Digital Output
58	DO_3	pin58 / DO_3	Digital Output

SPI			
Pin Number	**Pin Name**	**Software Name**	**Description**
51	MISO	MISO_0	Master Input Slave Output
52	MOSI	MOSI_0	Master Output Slave Input
53	SCK	SCK_0	Serial Clock
54	CS	CS	SPI_CS (Chip Select)

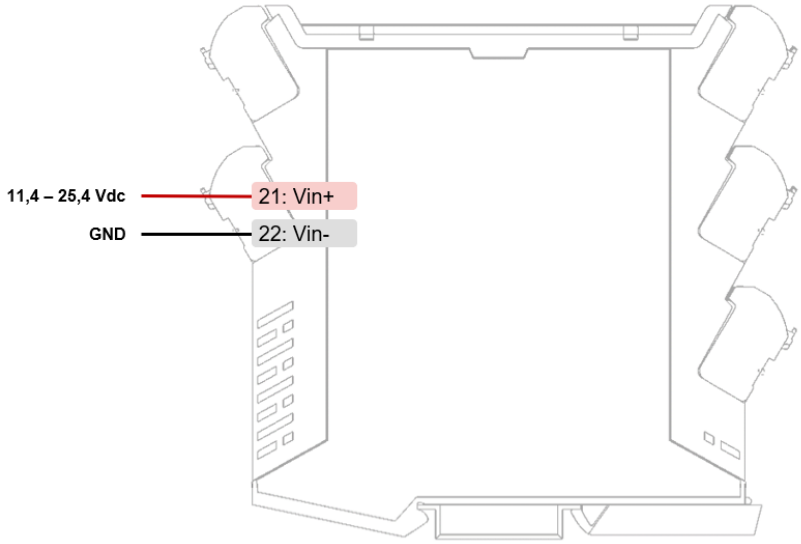
I2C			
Pin Number	**Pin Name**	**Software Name**	**Description**
61	SDA	SDA_0	SDA (Serial Data)
62	SCL	SCL_0	SCL (Serial Clock)
63	3.3V	-	3,3 VDC (Sensor Supply)
64	GND	-	Internal GND

3.7 Power Supply

Weidos controllers can be powered from 11,4 to 25,4VDC requiring a minimum of 0,8A to achieve a good performance. Polarity is NOT REVERSAL, make sure that Voltage and GND wiring (Vin+ and Vin-) are properly connected. Make sure that power supply is not higher than 25,4 VDC.

It is necessariy to use a ferrite in Power supply wiring to avoid undesired noise in the device. See installation instructions in Annexes.

Power Supply schematic:

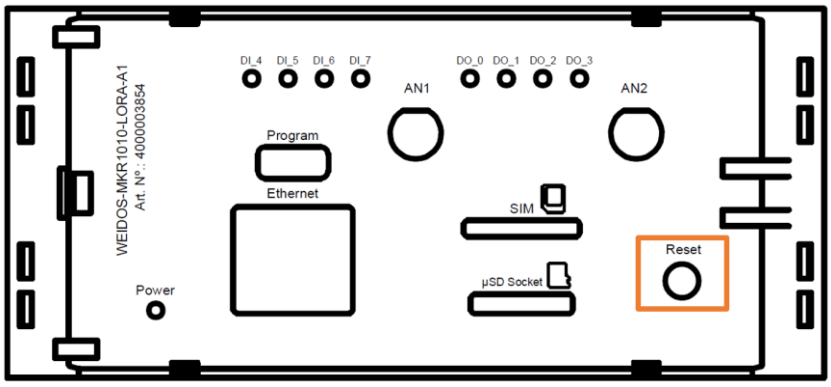


The standard, Part 1 of IEC 61010, sets the general safety requirements for the following types of electrical devices and their accessories, regardless of where use of the device is intended. The equipment must be powered from an external power source in accordance with IEC 61010-1, whose output is MBTS and is limited in power according to section 9.4 of IEC 61010-1.

	CAUTION
	Risk of injury! Once the equipment is installed inside an electrical cabinet, the MTBS cables of the equipment must be separated from the dangerous voltage cables.

3.8 Reset Button

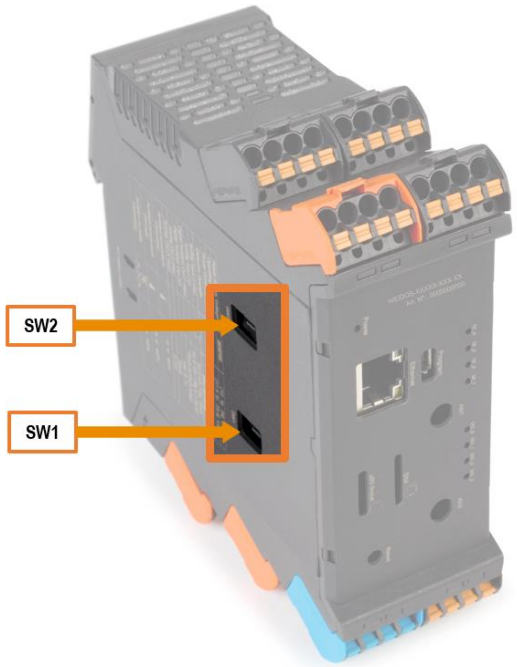
Located at the top cover of Weidos device.



It allows the internal logic to restart the program, to execute the set up again and to start the main loop of the program again. The data that is stored on the microSD card will be maintained without losing any information already stored, while the operations that have been left in the middle of execution will start again from the beginning of the program, losing the temporary values.

3.9 DIP-Switches Configuration

Weidos devices have two DIP switches (SW1 and SW2) on one side. These switches are meant for selecting the operational mode of the configurable pins.



As already mentioned, the configurable pins are the Serial RS485/UART connector and the Multifunction.

To use the serial port as RS485 or UART function, please, check to the table below:

RS485 / UART	SW1	SW2			
Dip-Switch Number					
Dip-Switch Possition	4	1	2	3	4
RS485	ON			ON	ON
UART 3,3 V TTL		ON	ON		

To switch Multifunction pins signal between 3,3 or 5 V DC, see table below:

MULTIFUNCTION PINS	SW1		
Dip-Switch Number			
Dip-Switch Possition	1	2	3
3,3 V TTL	ON	ON	ON
5 V TTL			

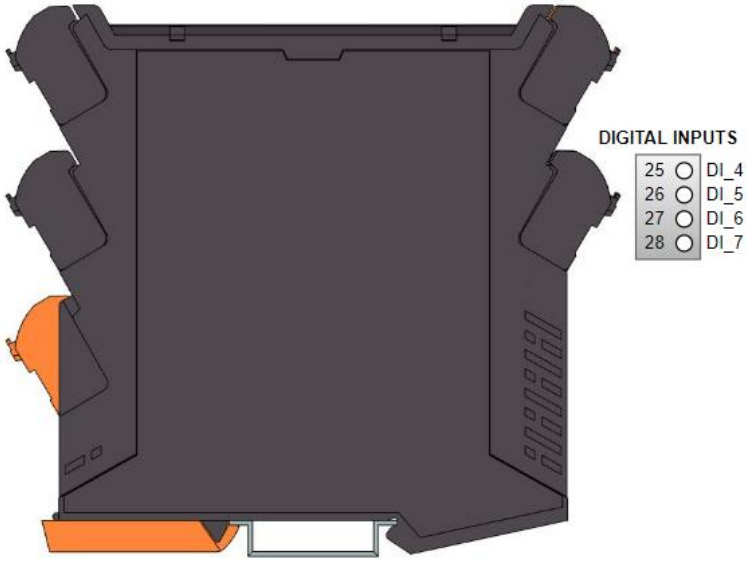
Note: Position of pins which are not shown on the image of each operation mode, is not relevant.

ATTENTION
Material damage! Disconnect Weidos from Power Supply before any change on DIP switches configuration.

3.10 IO's Configuration

3.10.1 Digital Inputs

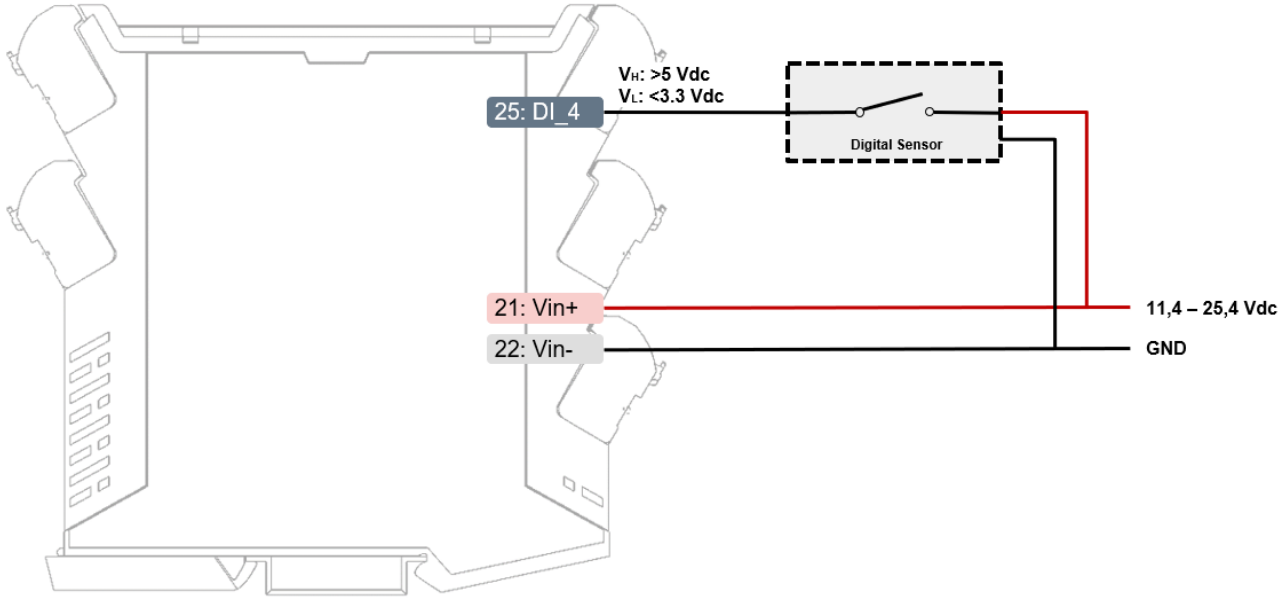
Digital Input pins are located on the following connector:



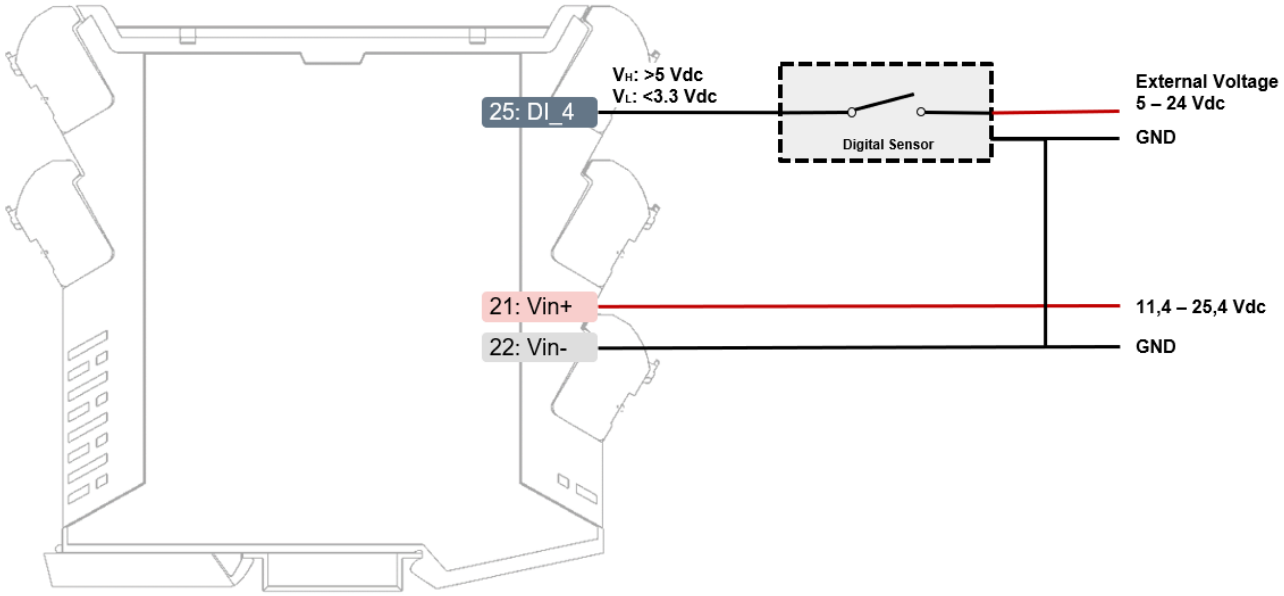
Check electrical characteristics for Digital Inputs in the following table:

Digital Inputs	
Voltage Level HIGH	> 5 V DC (max. 24 V DC)
Voltage Level LOW	< 3,3 V DC
I min	2 mA (at 5 V DC input) - 12mA (at 24 V DC input)

Typical wiring connection for digital inputs using voltage signal from main Power Supply:



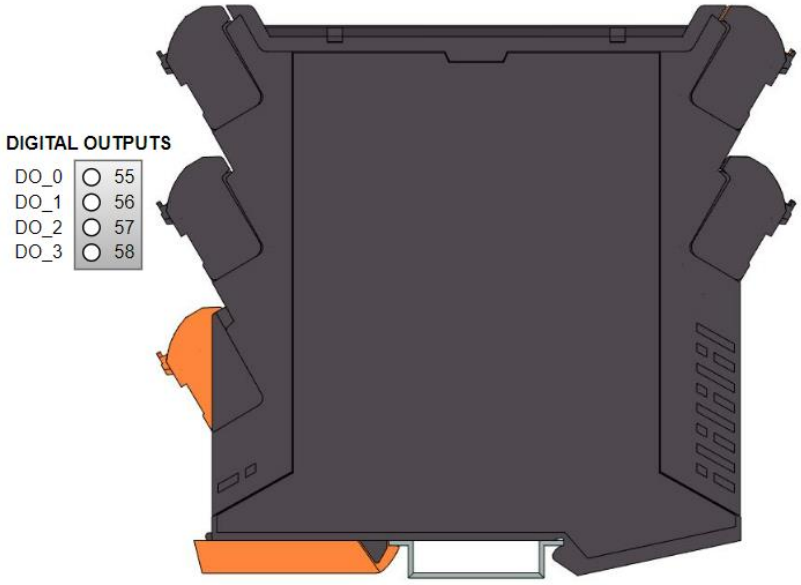
Wiring digital inputs using external voltage signal:



See Digital Inputs examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > Digital.**
Use Software Names defined in section 3.6 of this manual (Pinout description), to use Weidos pins.

3.10.2 Digital Outputs

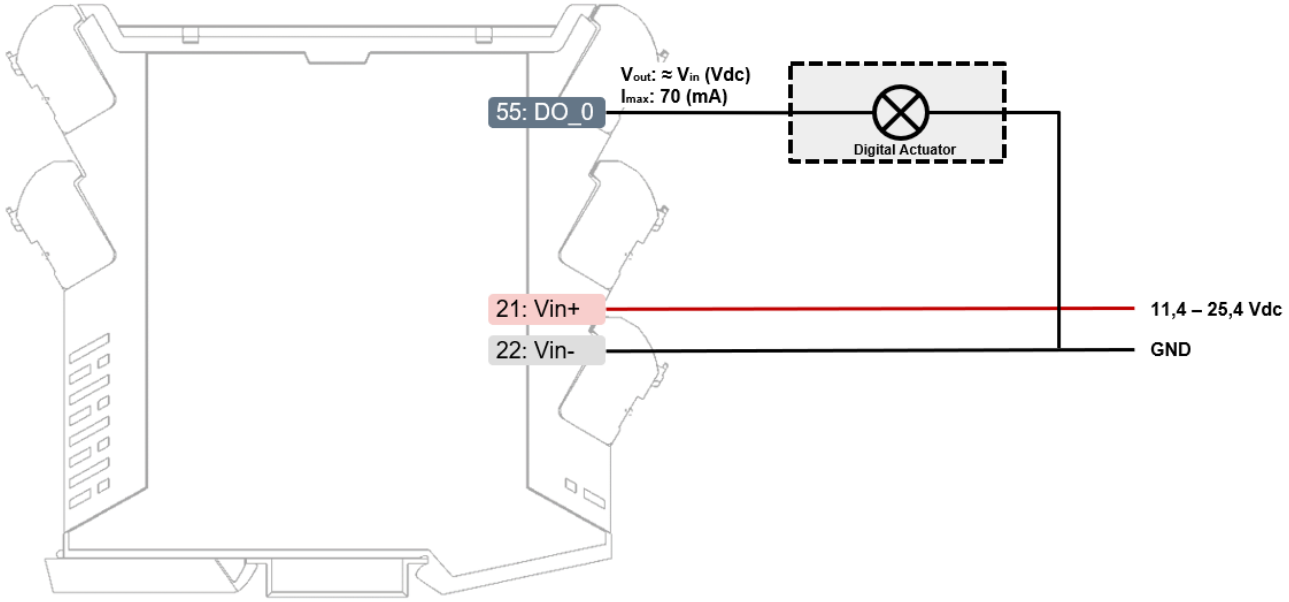
Digital Output pins are located on the following connectors:



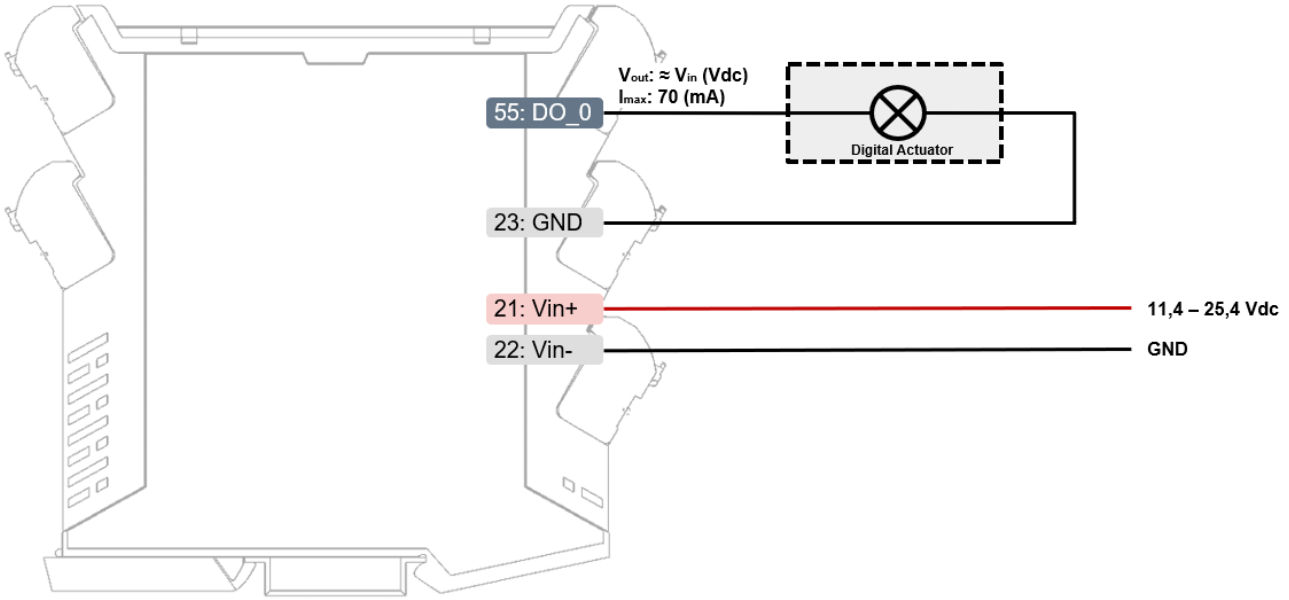
Check electrical characteristics for Digital Outputs in the following table:

Digital Outputs	
Output Voltage, High	Vin - 1,0V
Input Voltage, Low	GND (Supply Ground)
I max	70 mA (per channel)

Typical wiring connections:



Weidos GND pins can also be used for common ground connection:



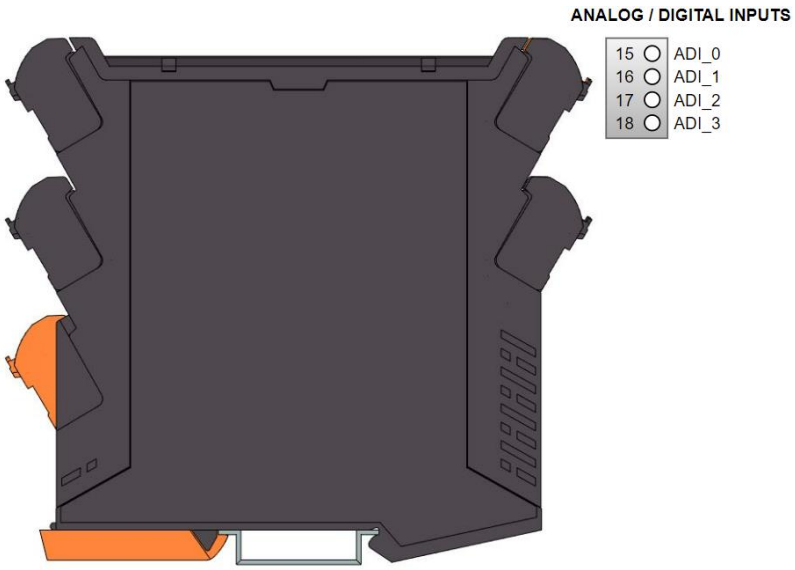
See Digital Outputs examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > Digital.**

Use Software Names defined in section 3.6 of this manual (Pinout description), to use Weidos pins.

ATTENTION
Material damage! Output from Digital Actuator must be connected to the common GND of Weidos Device. You can find several GND pins in Weidos controller for this purpose.

3.10.3 Analog / Digital Inputs (Configurable)

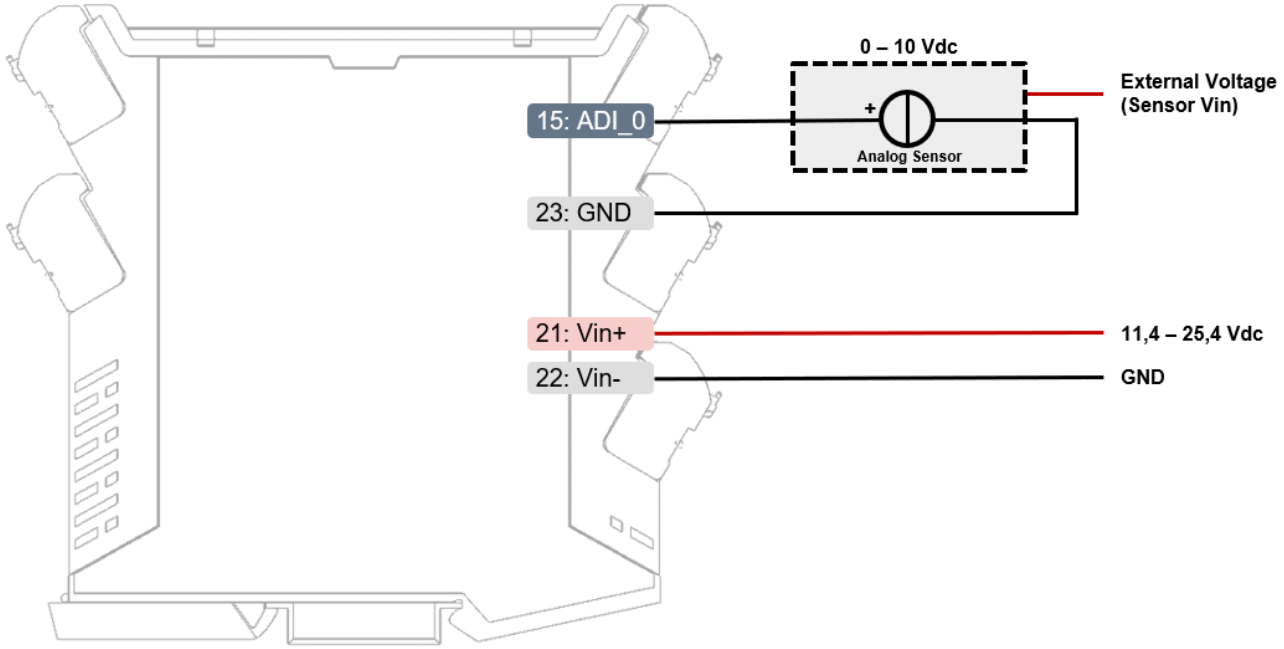
Analogue / Digital Input pins are located on the following connectors:



Check electrical characteristics for Analog/Digital Inputs in the following table:

Analog/Digital Inputs	
Input Range	0 to 10 V DC (max. 24 V DC when used as digital)
Type of Inputs	Referenced Single Ended (all analog inputs share the same common reference on the device)
Resolution ADC	12 bits maximum

Typical wiring connections:



The use of these inputs as analog or digital is selected via software by programming with the built-in functions analogRead() or digitalRead(). Do not depend on any external switch or additional hardware configuration.

As Digital Inputs, this pins will detect HIGH state between 5 and 24Vdc, in the same way as in the opto-isolated digital inputs

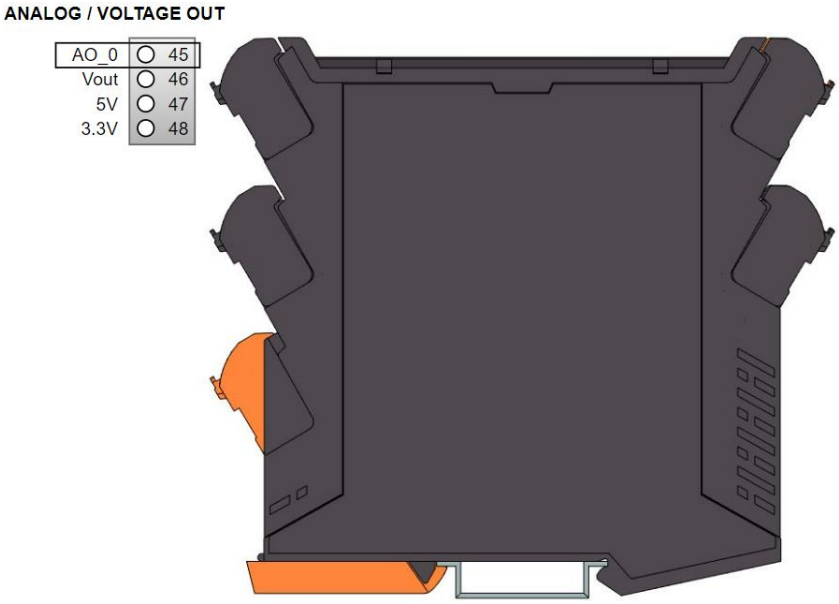
As Analog Inputs, this pins will detect the analog signal between 0 and 10Vdc with a resolution of 12 bits by default (lower resolution can be set via software).

See Analog Inputs examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > Analog.**

Use Software Names defined in section 3.6 of this manual (Pinout description), to use Weidos pins.

3.10.4 Analogue Output

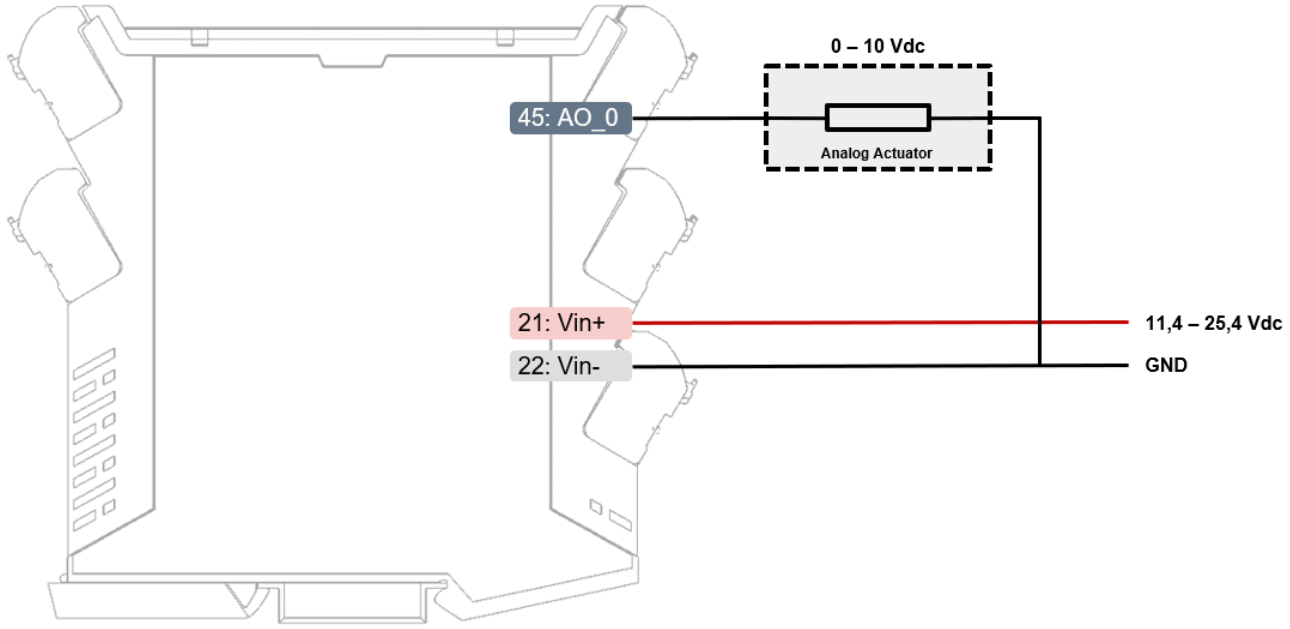
Analogue Output pin is located on the following connector:



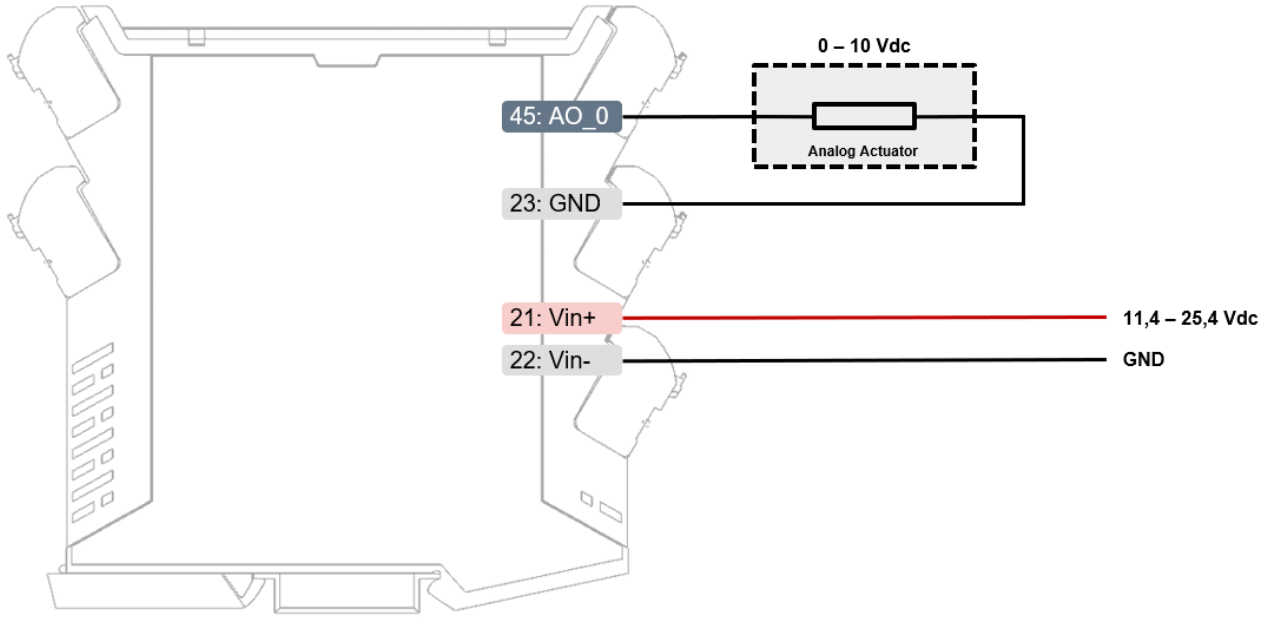
Check electrical characteristics for Analog Output in the following table:

Analog Output	
Output Range	0 to 10 V DC
Output Reference	Referenced Single Ended (analog output share the same common reference on the device)
Imax	10 mA
Resolution DAC	10 bits maximum

Typical wiring connection:



As already mentioned in Digital Outputs, Weidos GND pins can also be used for the common reference GND:



See Analog Output examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > Analog.**

Use Software Names defined in section 3.6 of this manual (Pinout description), to use Weidos pins.

ATTENTION
Material damage! Output from Analogue Actuator must be connected to the common GND of Weidos Device. You can find several GND pins in Weidos controller for this purpose.

3.10.5 Multifunction Pins

The multi-function pins accept different operational modes. They can be used as Digital Inputs, Digital Outputs, Interrupts or PWM signals (defined via Software PIN MODE).

MF pins can only operate at 3.3Vdc or 5Vdc (configurable by switch). It is very important to check the configuration of the switches for the use of the multi-function pins before making the connection to verify the voltage in which they are configured.

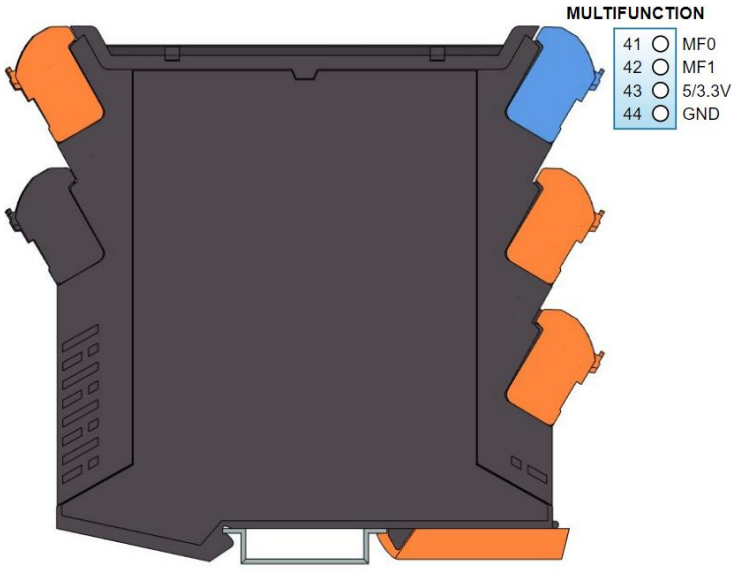
Please check the following table to select the desired signal voltage level:

MULTIFUNCTION PINS	SW1		
Dip-Switch Number			
Dip-Switch Possition	1	2	3
3.3 V TTL	ON	ON	ON
5 V TTL			

ATTENTION
Material damage! Disconnect Weidos from Power Supply before any change on DIP switches configuration.

As described in the last table, only DIP-Switches 1, 2 and 3 from SW1, need to be configured for operational voltage of multi-function pins selection. If they are all in the ON position, the pins will operate at 3,3 Vdc, while if all switches are in the OFF position, they will operate at 5 Vdc.

Multifunction pins are located in the following Weidos connector:



See Multifuntion examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > Multifunction** [Under development]

Pin 43 is mean for external sensor power supply and Voltage signal level will be the same configured in DIP switches for Multifunction Pins. Maximum output current in these pins would be:

	Definition	Conditions	Typical	Unit
Isource	Output current	V=3.3V	50	mA
		V=5V	50	mA

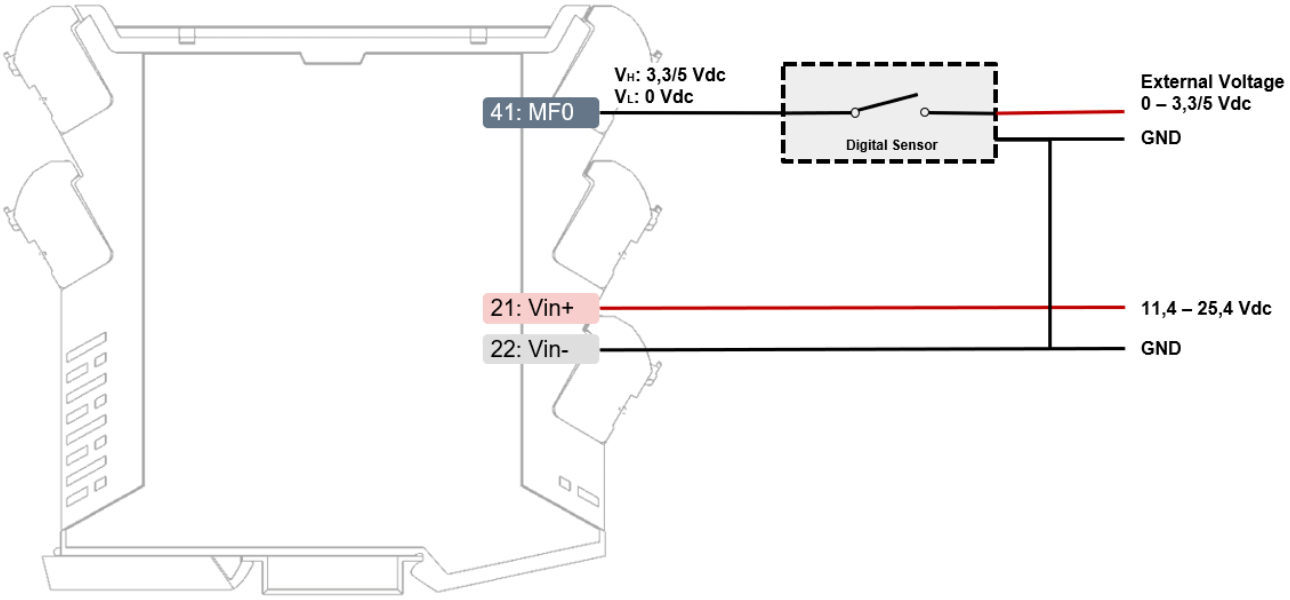
Intensity and Frequency Referrence Tests and Specs:

	Definition	Conditions	Typical	Unit
Vl	Low Level Voltage[1]	I=0mA, V=3.3V	55	mV
		I=5mA, V=3.3V	560	mV
		I=0mA, V=5V	70	mV
		I=5mA, V=5V	580	mV
Vh	High Level Voltage[1]	I=0mA, V=3.3V	3.3	V
		I=0mA, V=5V	5	V
Isink	Input current		5	mA
Isource	Output current[2]		40	uA
Freq	Working frequency		Limited by CPU	

[1] It must be considered that there is a pull-up in the output so, if the output is not configured, the external pin will be at high level by default.

[2] The internal pull up resistor valus is 10KΩ. The output of the MF will be able to give 5mA with a voltage of 2.5V.

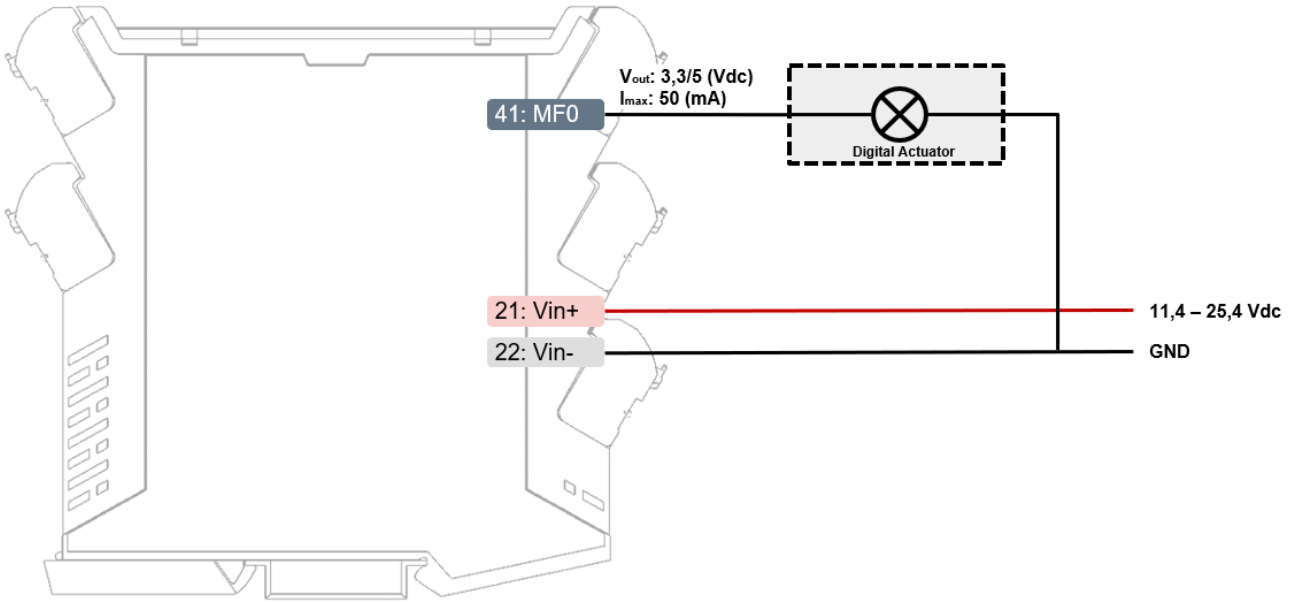
Typical Connection as Digital Inputs:



ATTENTION

Material damage!
Please, be aware that connecting higher voltage than 5 V DC will damage Weidos controller.

Typical Connection as Digital Outputs:



3.11 Communications

In this section of the manual, the communications, and functionalities available on the default Weidos models are individually listed.

3.11.1 UART

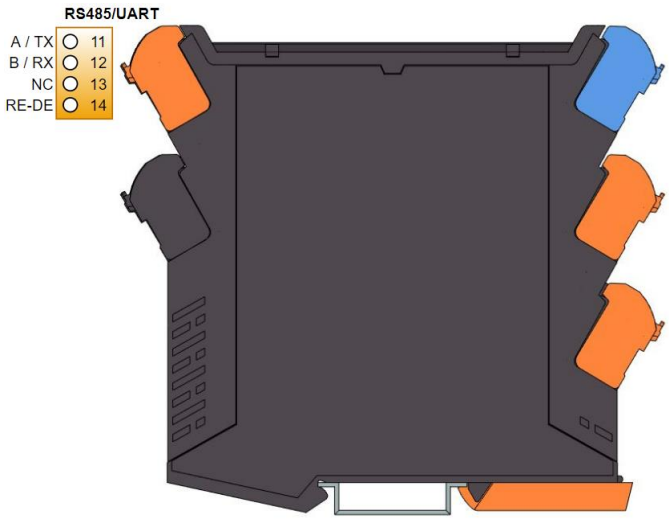
Weidos UART communication with Peripheral devices is possible through Serial connector pins 11 and 12. The Serial Connector accepts two communication protocols (UART and RS485).

Please check the following table to select UART mode:

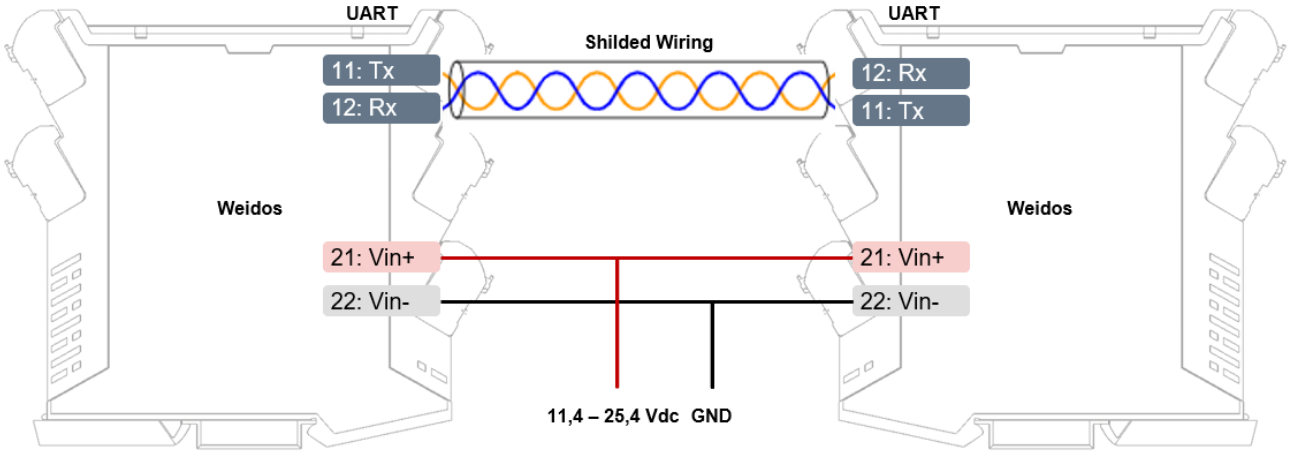
RS485 / UART	SW1	SW2			
Dip-Switch Number					
Dip-Switch Possition	4	1	2	3	4
RS485	ON			ON	ON
UART 3,3 V TTL		ON	ON		

ATTENTION
Material damage! Disconnect Weidos from Power Supply before any change on DIP switches configuration.

See Serial connector location in the following image:



Typical Connection:



Please, note that Serial communication pins work at 3.3Vdc TTL signal.

See UART examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > UART**

3.11.2 RS-485

Weidos accepts RS485 communication with Peripheral devices through Serial connector pins 11 and 12. As already mentioned, Serial Connector accepts two communication protocols (UART and RS485).

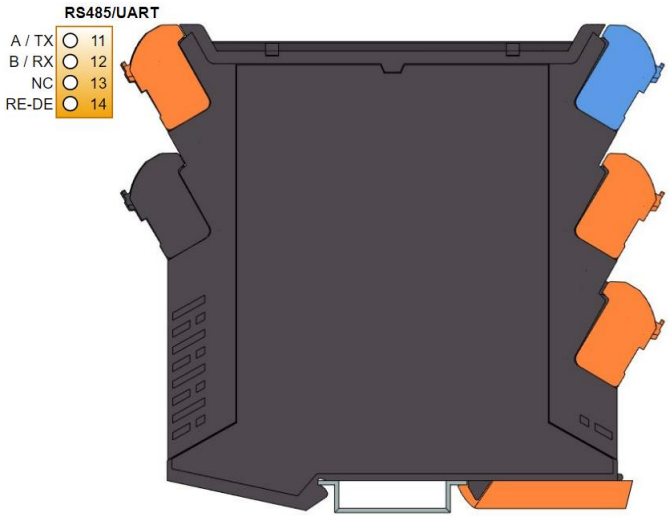
Please check the following table to select RS485 mode:

RS485 / UART	SW1	SW2			
Dip-Switch Number					
Dip-Switch Possition	4	1	2	3	4
RS485	ON			ON	ON
UART 3,3 V TTL		ON	ON		

ATTENTION

Material damage!
Disconnect Weidos from Power Supply before any change on DIP switches configuration.

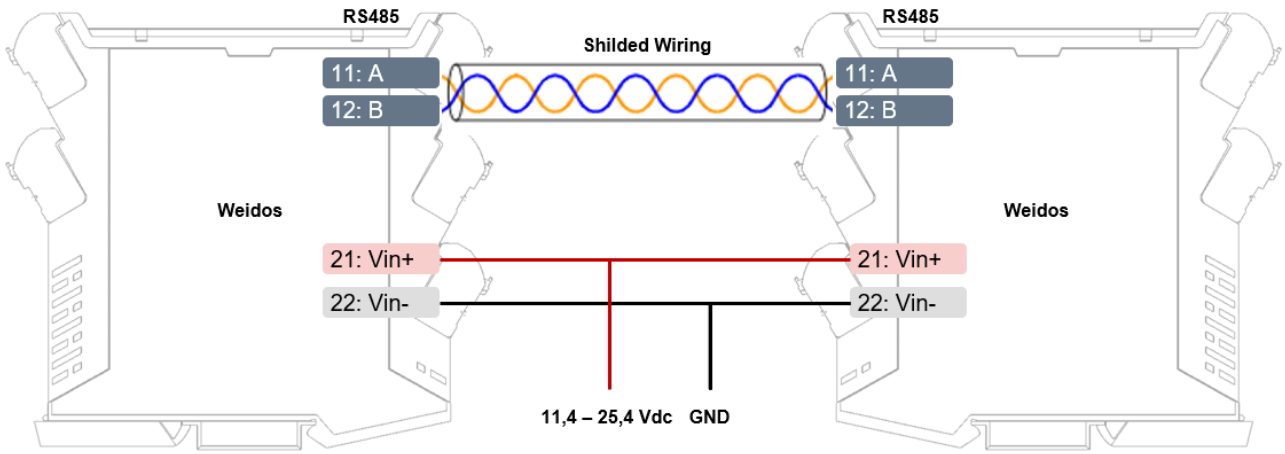
See Serial connector location in the following image:



For a good performance, it is recommended to use twisted pair and shielded wiring.

NOTE: RS-485 pins have an internal pull-up (A) and pull-down (B) of 20KΩ.

Typical Connection:

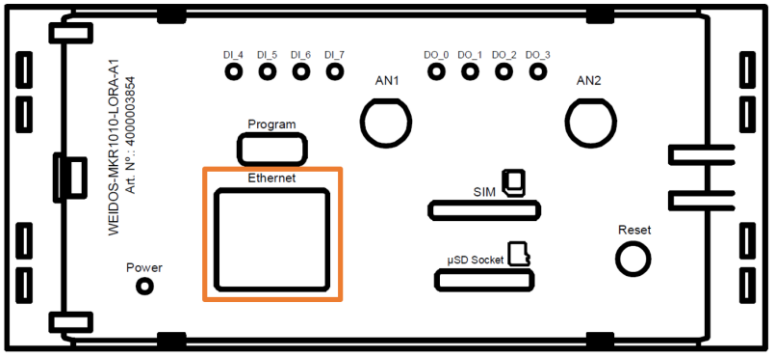


Please, note that Serial communication pins work at 3.3Vdc TTL signal.

See RS485 and ModbusRTU examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > RS485 / ArduinoModbus.**

3.11.3 Ethernet

Ethernet port location on the Weidos PLC Family products (Top Cover):



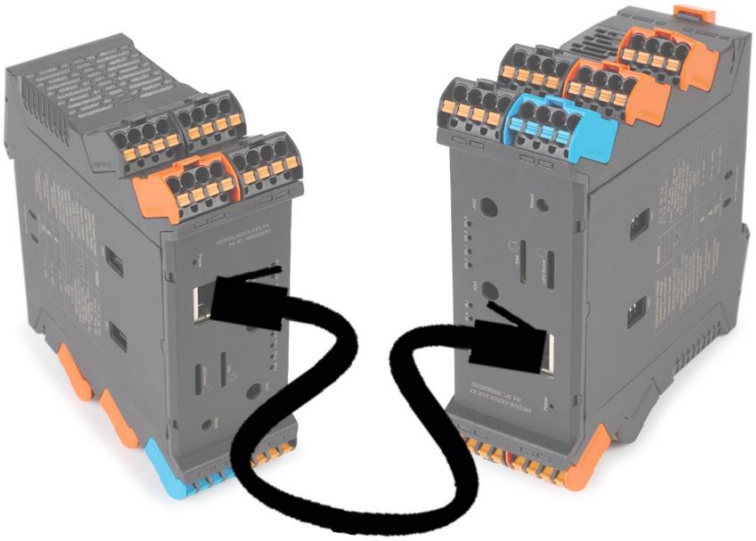
Weidos Ethernet port is based on W5500 IC.

Ethernet libraries for Arduino and ESP32 shields are compatible with the Weidos controllers. Ethernet shield communicates to the Internal CPU via SPI bus.

You can choose among multiple different protocols such as HTTP, HTTPS, MQTT, MQTTS, Modbus TCP and most of the Industrial Standards.

Using the Weidos boards in Arduino IDE, there is a library that simplifies the use of Ethernet port and also the protocol implementation.

Typical connection:



See Ethernet configuration examples in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > ETHERNET.**

3.11.4 WiFi

Weidos devices have an integrated WiFi specific chip. In case of MKR1010 models the chip is the NinaW102 and ESP32 variants use the HT40 chip.

The devices support Wi-Fi 802.11b/g/n in the 2.4 GHz ISM band and Bluetooth v4.2 (Bluetooth BR/EDR and Bluetooth low energy) communications. More details regarding bluetooth connectivity will be described in the specific part of the manual.

MKR1010 models use an integrated antenna mounted on the PCB while on ESP32 devices there is an external SMA connector (AN1), to connect the propper antenna for the use of this wireless technology.

All Weidos controllers can be configured as a client, to connect to any kind of existing Wi-Fi network or as an Access Point to create your own Network.

The specific set of examples provided for the MKR1010 and ESP32 models can be consulted at the WiFiNINA library reference page included on the Weidos boards installed in Software platform.

See WiFi configuration examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > WiFiNINA.**

3.11.5 Bluetooth Low energy

Bluetooth chipset of Weidos controllers supports Bluetooth low energy on the same RF antenna signal (the signal is switched between Bluetooth and Wi-Fi as the different RF technologies are never active simultaneously).

MKR1010 models use an integrated antenna mounted on the PCB while on ESP32 devices there is an external SMA connector (AN1), to connect the propper antenna for the use of this wireless technology.

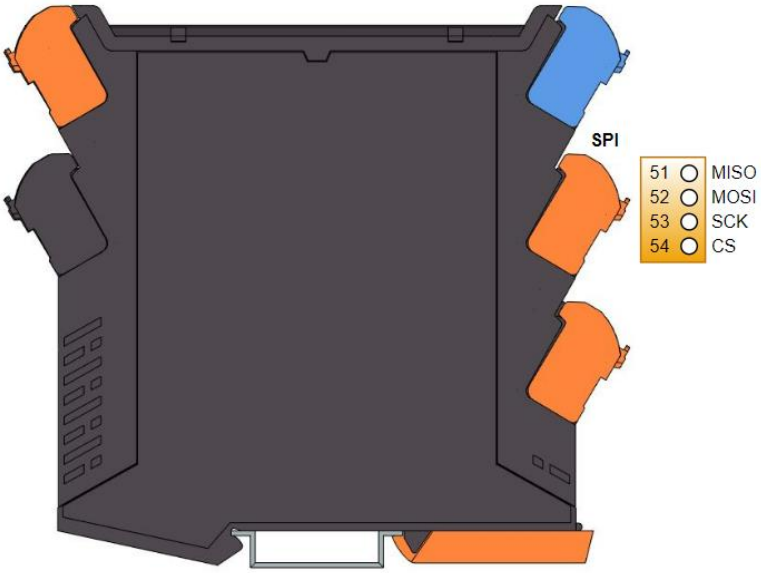
Controllers can be configured as a Client and as a Host. Explore the examples included in ArduinoBLE library inside Weidos Boards and see how to program it as a Central or Peripheral Bluetooth® device.

See Bluetooth configuration examples in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > Bluetooth** [Under development]

3.11.6 SPI

Weidos controllers have an external SPI connector to communicate with peripheral devices (sensors or actuators) using this protocol.

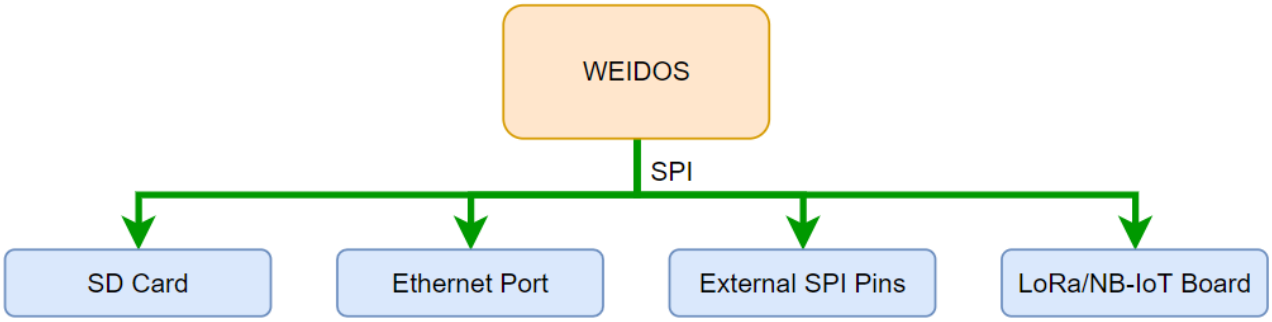
See SPI connector location in the following image:



MISO, MOSI and SCK connector pins for SPI bus are common to the internal communication bus. Chip Select pin is free available for the first external device. Each of the connected devices needs a single and dedicated CS pin. You can use 41:MF0 and 42:MF1 as CS pins in case of having more external SPI devices connected to Weidos.

Below we can see a wiring diagram for the internal SPI bus of Weidos controllers. Note that the peripheral SPI port operates at 3,3 V DC.

Internal SPI Block Diagram for Weidos Controllers:

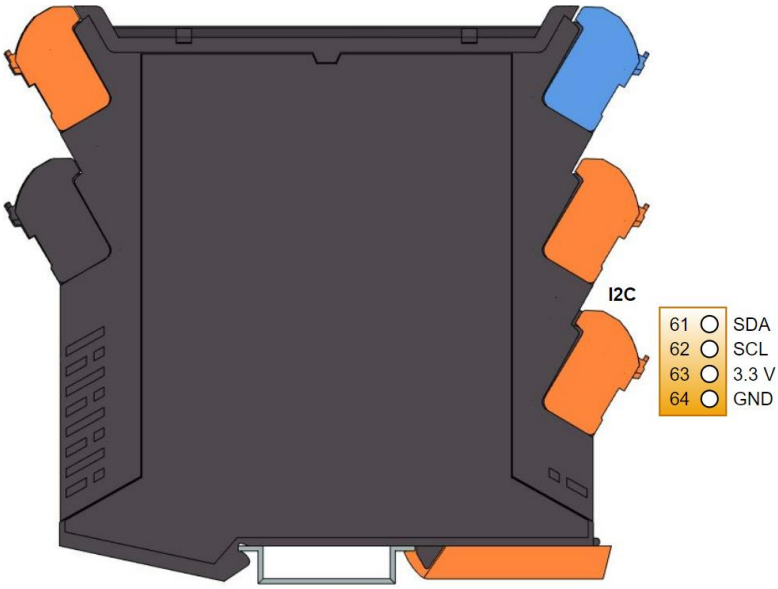


Using the Weidos boards in Arduino IDE, there is a library that simplifies the SPI protocols implementation.

See SPI communication examples in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > SPI**

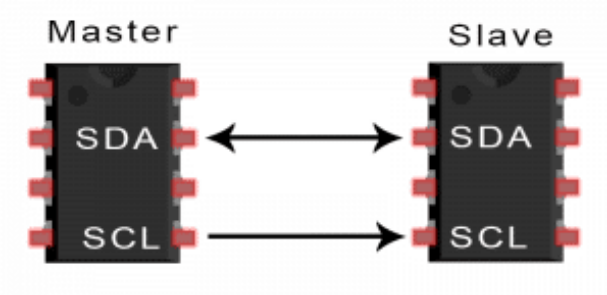
3.11.7 I2C

Weidos controllers have an external I2C connector to communicate with peripheral devices (sensors or actuators) using this protocol.



I2C only uses two wires to transmit data between devices:

See next figure for wiring connection:



SDA (Serial Data) – The line for the master and slave to send and receive data.

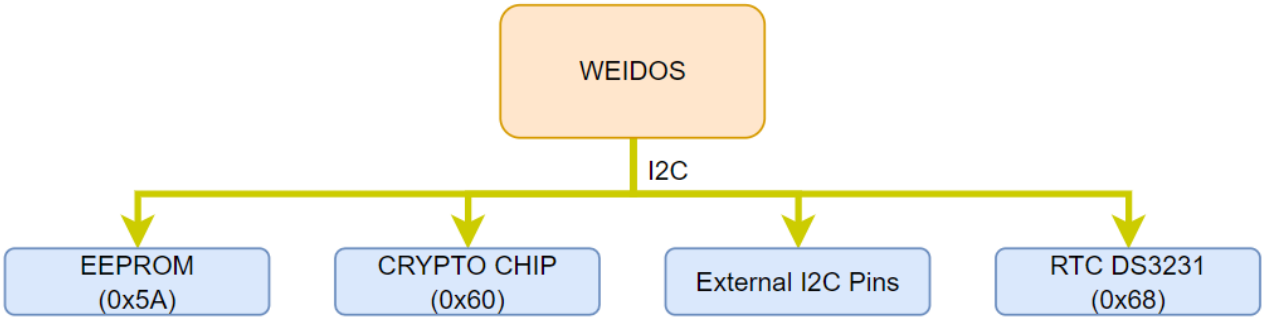
SCL (Serial Clock) – The line that carries the clock signal.

3,3 VDC and GND connectors, are meant for external sensor/actuator supply.

I2C protocol is widely used for attaching lower-speed peripheral ICs to processors and microcontrollers in short-distance, intra-board communication. Weidos I2C communication **DOES NOT REQUIRE** the 2k2Ω pull-up resistors as it have already integrated circuits for that.

Following the documentation, see the wiring diagram for the internal I2C bus of Weidos controllers. Note that the peripheral I2C port operates at 3.3Vdc.

Internal I2C Block Diagram for Weidos MKR1010 and ESP32 Controllers:



I2C addresses 0x20, 0x21 and 0x23 are reserved for internal use.

Using the Weidos boards in Arduino IDE, there is a library that simplifies the I2C protocols implementation. The library is defined as Wire.h

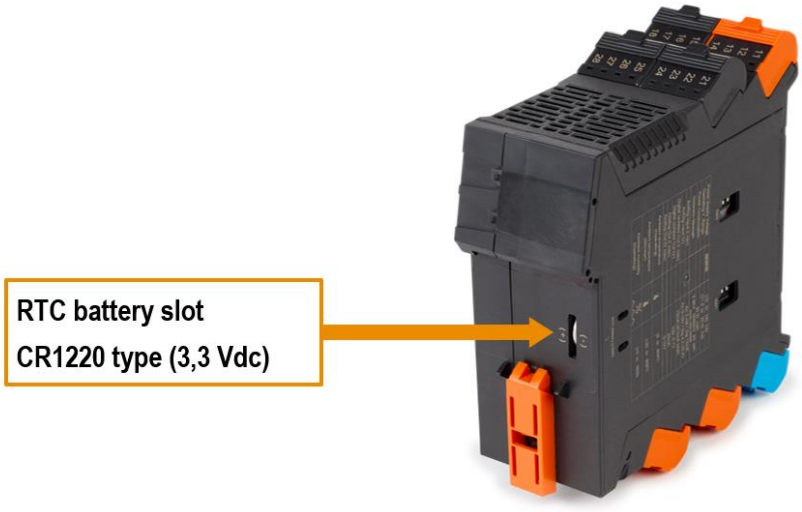
See I2C examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > I2C**

3.12 Other functionalities

3.12.1 RTC

Weidos RTC Module is based on DS3231 Chip. It uses I2C protocol for the communication with main CPU.

The internal Real Time Clock needs a 3,3 VDC battery (CR1220). Weidos products DOES NOT include the RTC battery. Battery must be inserted at the lower part of the enclosure.



Using the Weidos boards in Arduino IDE, there is a library that simplifies the RTC implementation.

See RTC configuration examples in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > RTClib.**

3.12.2 EEPROM

In Weidos controllers, a 512KB EEPROM memory is incorporated for hardcopy data writing/reading.

It is very useful for storing critical constant values for the application.

If it's required to record indelible data in the device and microSD card is not secure enough, it is recommended to use the internal EEPROM memory for this purpose.

Using the Weidos boards in Arduino IDE, there is a library that simplifies the EEPROM implementation.

See EEPROM examples of use in examples in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > E2PROM.**

3.12.3 ATECCX08 Chipset

The Microchip ATECC508A and ATECC608 integrates ECDH (Elliptic Curve Diffie Hellman) security protocol.

This is an ultra-secure method to provide key agreement for encryption/decryption, along with ECDSA (Elliptic Curve Digital Signature Algorithm) sign-verify authentication for the Internet of Things (IoT) market. This is a widely used protocol in applications like home automation, industrial networking, medical, as well as accessories and consumables authentication and more. In addition, the ATECC608A offer an integrated AES hardware accelerator strengthening hardware-based security for Ethernet applications and enable secure boot capabilities.

The integration of this security chip allows Weidos Controllers to build a secure Network environment with encrypted Transport Layer Security (TLS), allowing protocols such as HTTPS and MQTTS.

Using the Weidos boards in Arduino IDE, there is a library that simplifies the TLS protocol implementation.

See ATECCX08 examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > ArduinoECCX08.**

3.12.4 µSD slot

The micro-SD uses the SPI communication to interact with the internal CPU. SPI protocol is always enabled, as there are no switches to configure it.

The µSD socket is found in the TOP part of the Weidos enclosure, so in the frontal part of the Controller

Remember that the micro-SD card is NOT INCLUDED with the Controller purchase.

Using the Weidos boards in Arduino IDE, there is a library that simplifies the micro-SD implementation.

See µSD examples of use in ArduinoIDE **File > Examples > Examples for WEIDOS-XXX > SD.**

3.13 Additional Communications

The following section includes additional communication protocols that Weidos controllers incorporate depending on the model.

3.13.1 LoRa and LoRaWAN

Compatible with the following Weidos controller models:

- WEIDOS-MKR1010-LORA-A1
- WEIDOS-ESP32-LORA-A1

This board features the RN2483, RF technology-based SRD transceiver, which operates at a frequency of 433/868MHz from Microchip Technology. The Weidos LoRa PLCs feature an embedded LoRaWAN Class A compliant stack, providing a long-range spread spectrum communication with high interference immunity.

The RN2483 module is a fully certified 433/868MHz European R&TTE directive assessed radio modem combined with the advanced and straightforward command interface. The LoRa module offers an easy and reliable solution for developing highly integrated long-range IoT networks, security systems, alarm networks, building control, M2M interfaces, and similar applications that require simple and reliable networking solutions.

Type	LoRa
Applications	Can be used for developing highly integrated long-range IoT networks, security systems, alarm networks, building control, M2M interfaces, and similar applications that require simple and reliable networking solutions.
On-board modules	RN2483 - low-power long-range RF technology-based transceiver module
Radio Region	Europe
Key Features	Embeds LoRaWAN™ Class A protocol stack. Sub-GHz, 433/868 MHz European R&TTE Directive

Description	Min	Typ.	Max	Unit
Operating Frequency Range 1	433.050	-	434.790	MHz
Operating Frequency Range 2	863.000	-	870.000	MHz
UART interface baud rate	-	57600	-	bps

3.13.2 NB IoT

Compatible with the following Weidos PLC models:

- WEIDOS-MKR1010-NBIOT-A1
- WEIDOS-ESP32-NBIOT-A1

Allows LTE Cat NB1 connectivity based on the SARA-R412M, a specialized multi-band IoT module with very low power requirements, making it perfectly suited for various IoT-based applications. Ensures data integrity between applications via secure communication protocols, notably including two-way authentication between the client and server. Its most important advantage is the ability to use already widely established cellular network infrastructures. These features make the NB IoT click a perfect choice for a wide range of IoT applications such as smart metering, bike sharing, smart parking, smart city, security and asset tracking, home appliances, agricultural and environmental monitoring, and more.

Type	LTE IoT
Applications	Can be used for secure low-power IoT applications requiring deeper range (underground) and extended battery life.
On-board modules	Based on the SARA-R412M, an ultra-compact LTE Cat M1/NB1, and EGPRS module with multi-regional coverage with data communications up to 1200 kbit/s.
Key Features	LTE Cat M1/NB1, and EGPRS module with multi-regional coverage, low power consumption, high precision, ideal for mission-critical IoT solutions, ensures data integrity, over-the-air firmware updates, and more.

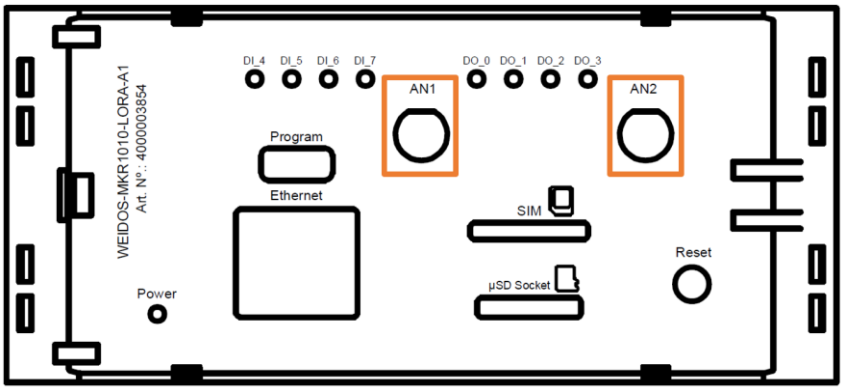
Description	Min	Typ.	Max	Unit
Operating Frequency Range	850	-	1900	MHz

Using the Weidos boards in Arduino IDE, there is a library that simplifies the LoRa and LoRaWAN protocols implementation.

3.13.3 Antennas

Weidos Controllers have 2 Antenna connectors. Both connectors are SMA Female connectors.

Antenna SMA Female connectors location on the Weidos PLC Family products (Top Cover):



AN1: For WiFi antenna in ESP32 Models

AN2: For LoRa or NBIoT antenna (Depending on Weidos Model).

All Weidmuller catalogue antennas are:

- Omni-Directional to cover maximum area extension
- Tiny design and robust handling thanks to prime quality housing materials
- 2m wire included (External Antennas)
- High temperature range
- SMA Connector
- High gain and efficiency

Depending on wireless technology used, see following table to select the most appropriated for the application.

WiFi & Bluetooth

General ordering data

Type	Gain	Efficiency	
WEIDOS-ANT-WIFI2400-DIPOLE-A	2,3 dBi	63,4%	**4000003867**
WEIDOS-ANT-WIFI2400-EXT-A1	4 dBi	80%	**4000003888**

Cellular

General ordering data

Type	Bands	
WEIDOS-ANT-CELLULAR-MONOPOLE-A1	600 MHz to 6 GHz	**4000003870**
WEIDOS-ANT-CELLULAR-EXT-A1	600 MHz to 6 GHz	**4000003871**

LoRa

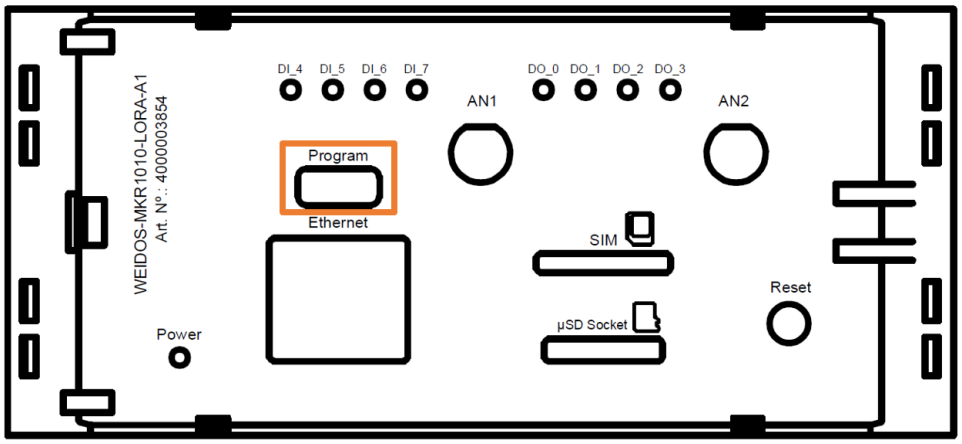
General ordering data

Type	Bands	
WEIDOS-ANT-LORA868-DIPOLE-A	868 MHz & 915 MHz	**4000003868**
WEIDOS-ANT-LORA868-EXT-A1	868 MHz & 915 MHz	**4000003869**

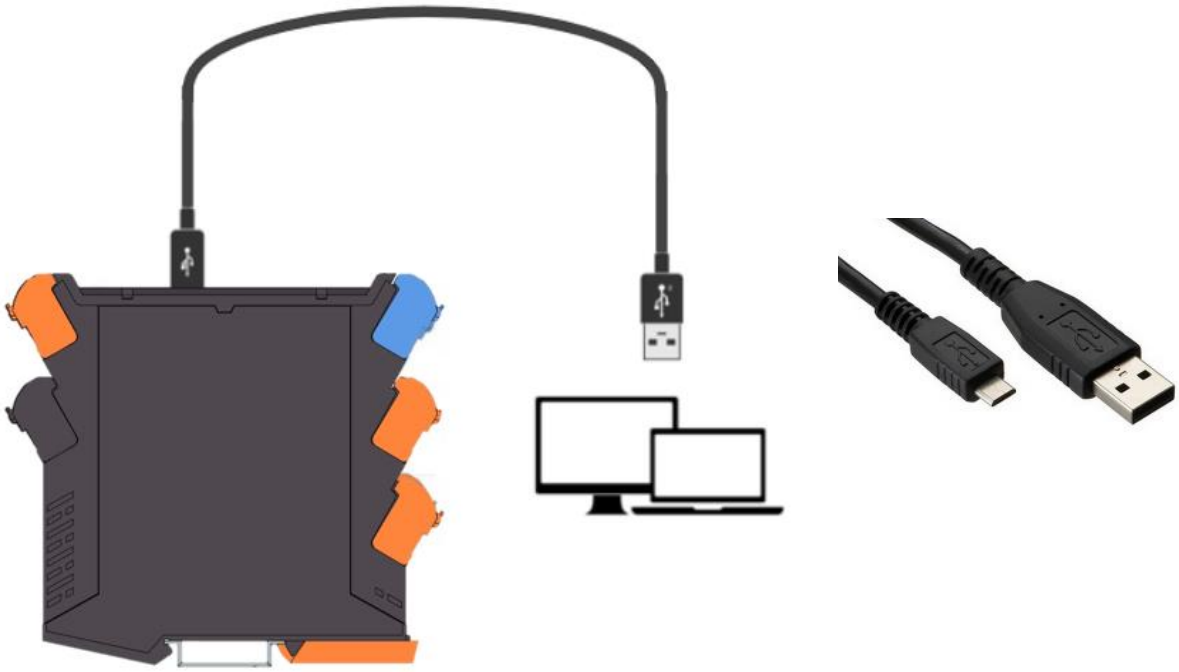
4 Software Programming

4.1 Connect WEIDOS to PC

Micro USB Port location on the Weidos PLC Family products (Top Cover):



Connect micro-USB 2.0 port from Weidos to PC or Laptop.



If using any of the Weidos models, you may need to install the following packages on your computer (MAC OSX / Windows/ Linux).

- USB Drivers
- Virtual COM Port Drivers

4.2 Arduino IDE

The products of the control series are programmable logic controllers. The Weidos controllers are configured, parameterized, and programmed using the Arduino IDE platform. You can download the Arduino IDE platform for any Operative System directly from this site.

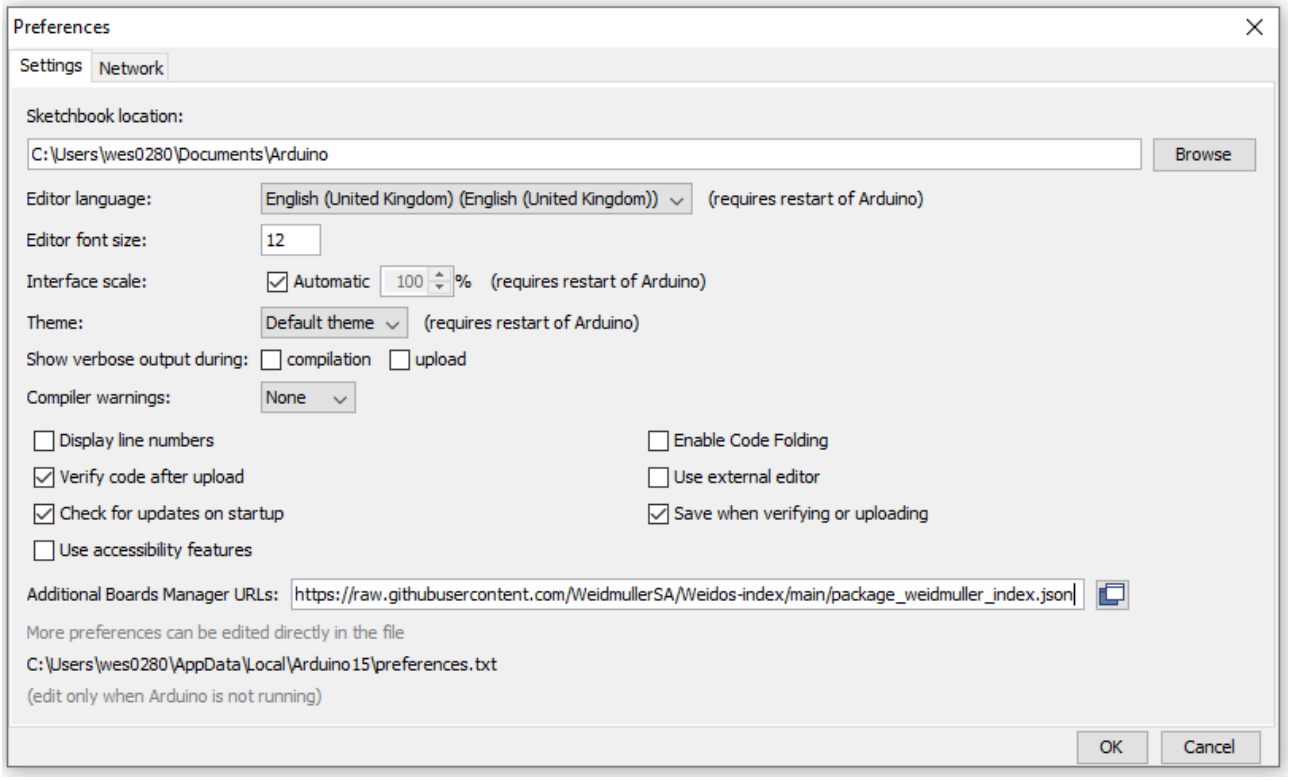
The steps to follow to install our equipment's to Arduino IDE are:

1- Open the Arduino IDE, version 1.8.13 or superior.

2- Press the "Preferences" option to "File" menu and open the preferences window.

3- In the text box "Additional boards manager URLs", add the direction:

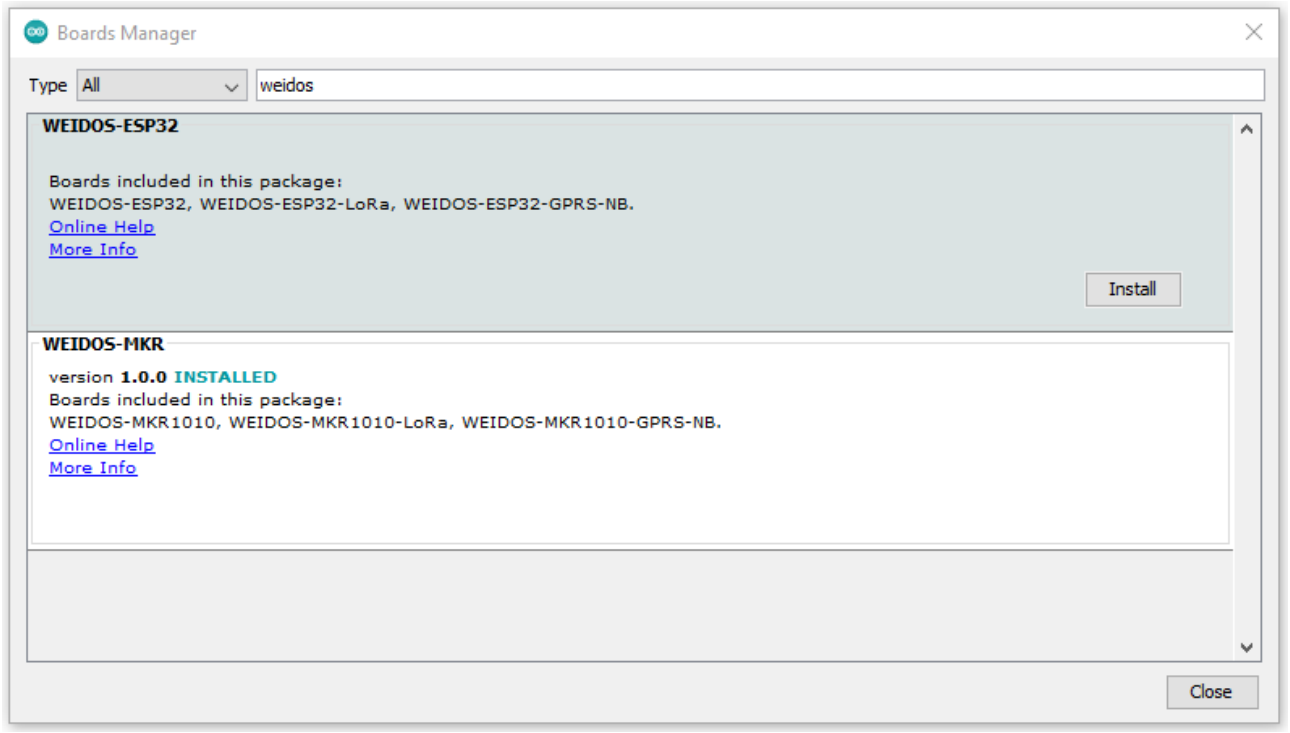
https://raw.githubusercontent.com/WeidmullerSA/Weidos-index/main/package_weidmuller_index.json



4- Close the preferences window with the "Ok" button.

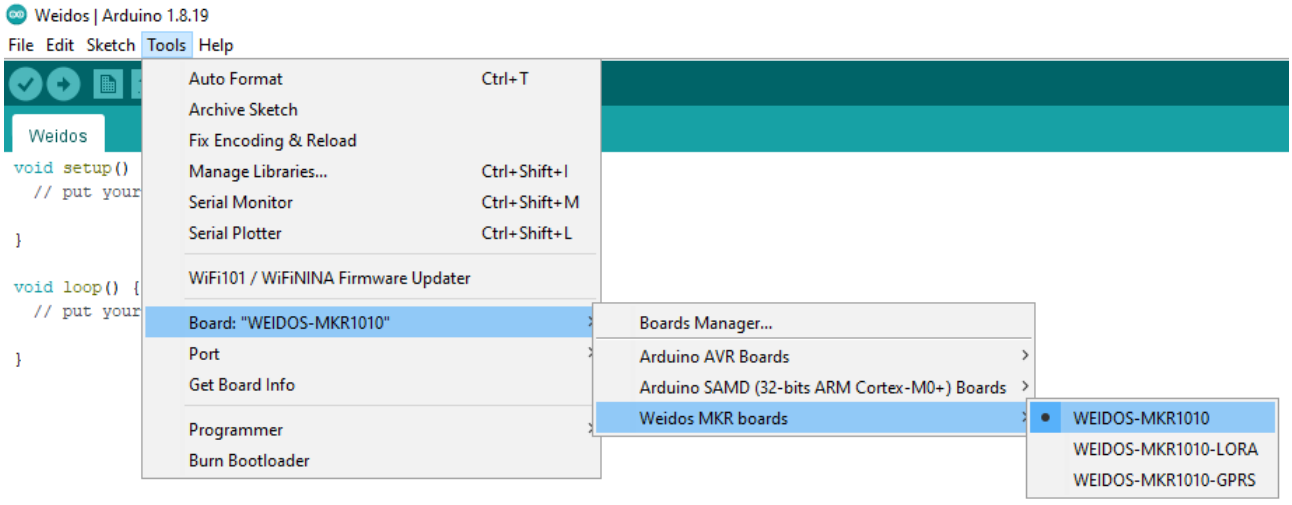
5- Click on "Tools" menu, and open the "Boards" submenu, and click the "Boards Manager" option, to open the Boards Manager window.

6- Search "weidos" in the search filter and select to the list and click "Install".



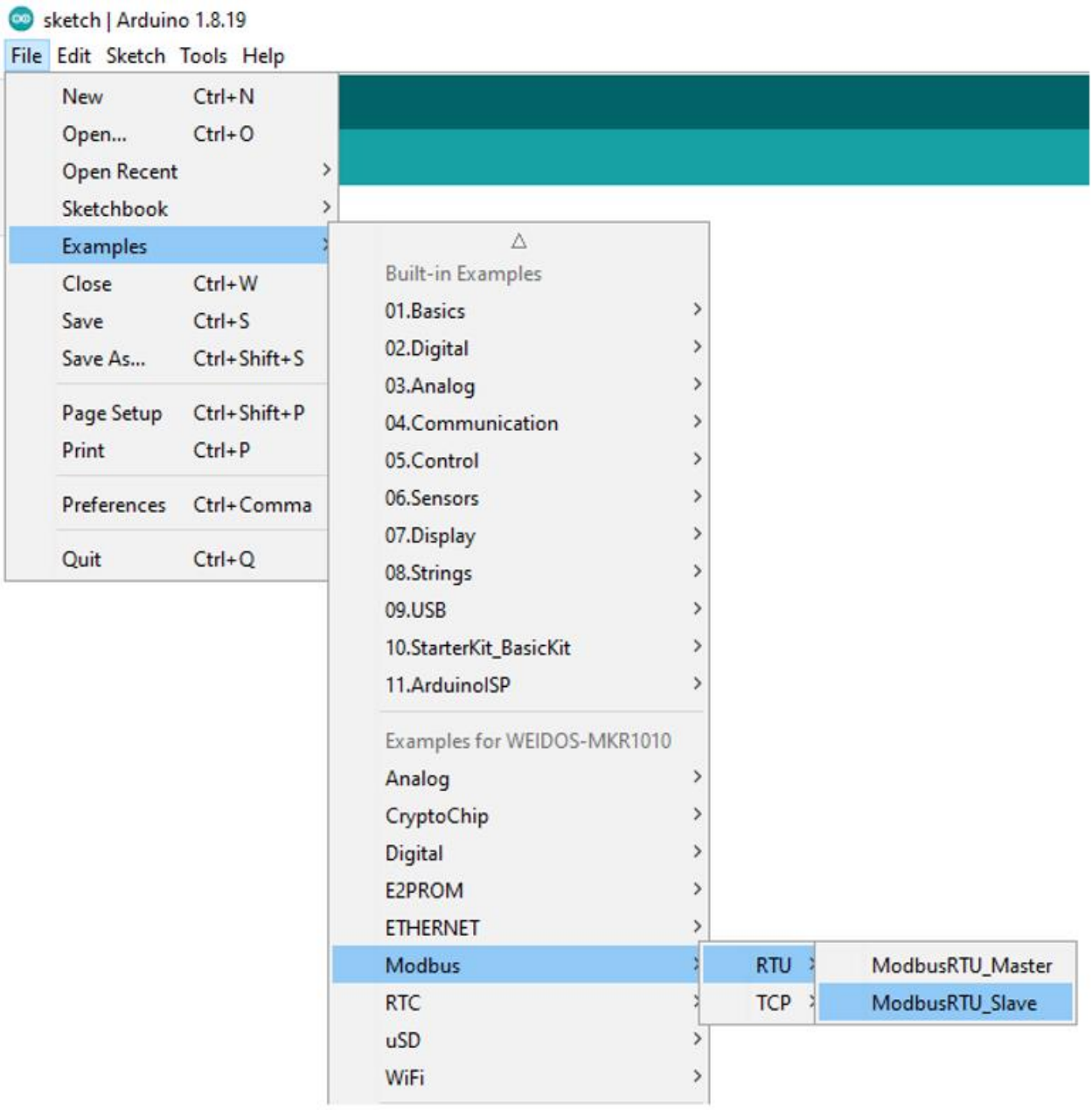
7- Close the “Boards Manager”.

Once it is performed that steps, you are available to select your concrete Weidos Model on Arduino IDE platform and start programming your Weidos device following the instructions represented on the image that you can find below.



4.3 Examples

Once the corresponding Weidos board variant has been selected, you will be able to access programming examples for each of the functionalities, communications and protocols that can be used in the device.


sketch | Arduino 1.8.19
File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Open Recent
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q
Built-in Examples
01.Basics
02.Digital
03.Analog
04.Communication
05.Control
06.Sensors
07.Display
08.Strings
09.USB
10.StarterKit_BasicKit
11.ArduinoISP
Examples for WEIDOS-MKR1010
Analog
CryptoChip
Digital
E2PROM
ETHERNET
Modbus
RTC
uSD
WiFi
RTU
TCP
ModbusRTU_Master
ModbusRTU_Slave

5 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 Weidos PLC from heat, high voltage, and electrical noise:

Always separate the devices that generate high voltage and high electrical noise from the Weidos PLC. When configuring the layout of the Weidos 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. Also consider 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 high energy, rapidly switched DC wiring.

Provide adequate clearance for cooling and wiring Weidos. Is designed for natural convection cooling. For proper cooling, you must provide a clearance of at least 20 cm above and below the devices. Also, allow at least 20 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 liquid filled capacitors) must be disposed of as described in Federal regulations.

Safety rules for maintenance personnel

Consider the following steps to follow. A false maneuver 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 lose 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.

Annexes

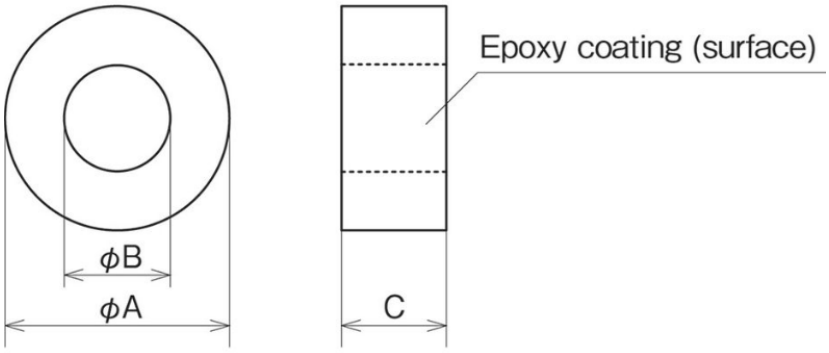
A1. Ferrite installation

Weidos devices include a TRM-16-8-16E-WE Epoxy coated ferrite core, to act as a frequency high impedance noise filter in hazardous environments.

Coated ferrite core has rounded corners to reduce load on cable and is made of Mn-Zn soft, epoxy coated.

The use of this ferrite for industrial uses is mandatory and necessary.

Ferrite model TRM-16-8-16E-WE



Ferrite model TRM-16-8-16E-WE measures legend

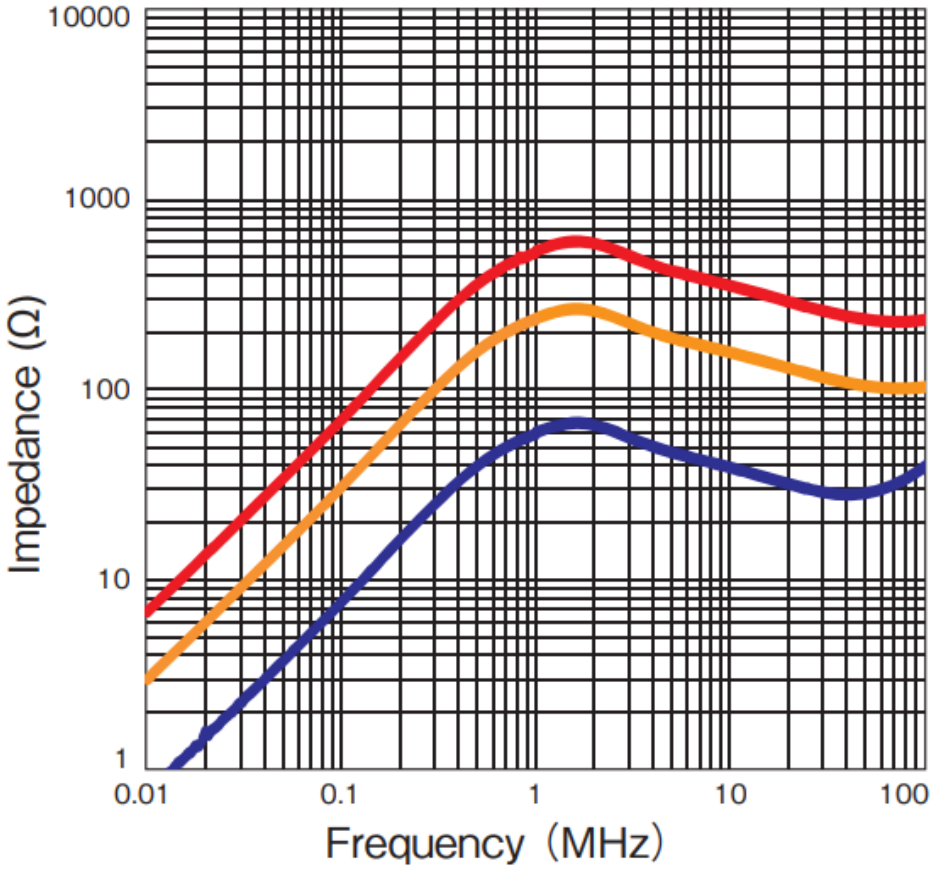
Ferrite Model	**A**	**B**	**C**	**Impedance* Ω/10MHz (2 turn)**
TRM-16-8-16E-WE	17.0	7.1	16.9	≧ 70

The mounting method of the ferrite included in the kit is as follows:

- In the wiring dedicated to the PLC power supply, the ferrite must be placed making 3 turns using the **negative pole** about **25 cm** from the PLC connector.

- The turns must be made to the ferrite following the instructions in the following image:

Impedance vs Frequency table depending on number of turns arround the ferrite (blue: 1 turn, yellow: 2 turns, red: 3 turns):



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As experienced experts we support our customers and partners around the world with products, solutions, and services in the industrial environment of power, signal and data. We are at home in their industries and markets and know the technological challenges of tomorrow. We are therefore continuously developing innovative, sustainable, and useful solutions for their individual needs. Together we set standards in Industrial Connectivity.

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