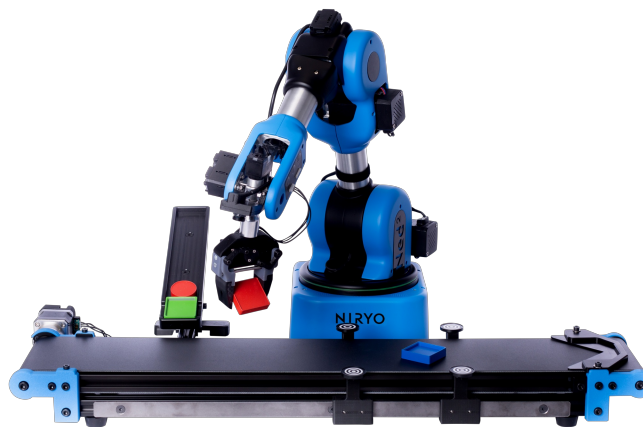
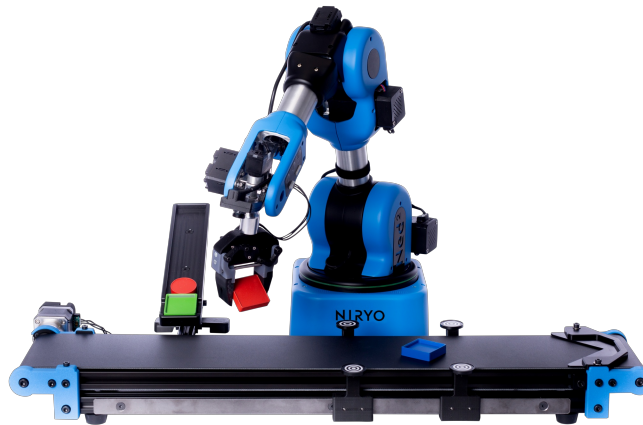


Ned2 User Manual



Ned2

Robot

Ned2 is a six-axis collaborative robot, based on open-source technologies. It is intended for education, research and Industry 4.0.



With the same aluminum structure as Ned, Ned2 will continue to meet your requirements in terms of **robustness, precision (0.5 mm)** and **repeatability (0.5 mm)**.

Ned2 is based on **Ubuntu 18.04** and **ROS Melodic** and benefits from the capabilities of the **Raspberry PI 4**, a **high performance 64-bit ARM V8 processor** and **4gb of RAM**.

Discover a robot with **increased performances**, thanks to **new servo motors featuring Silent Stepper Technology**, significantly reduces the noise level of the robot.

Ned2 is a **collaborative robot based on Ubuntu 18.04 and ROS** (Robot Operating System) Melodic, an open-source solution created for robotics. Through ROS, **Ned2 has multiple libraries** allowing you to conceive many programs, from the most simple to the most complex ones, responding then, in a flexible way, to your needs.

Ned2 tools technical specifications

Mounting a tool on Ned2 is made easy with our brand new **EasyConnect system**. Simply plug your tool, connect its cable to the control panel, and it is ready to use.



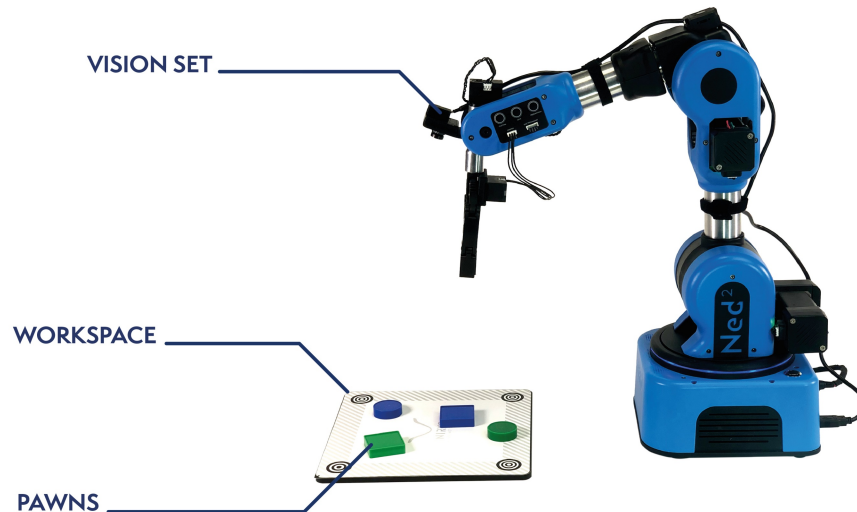
Ned2's package includes a **Custom Gripper**. Its standard jaws can manipulate small objects, and you can 3D print your own custom jaws.

Ned2 can also be used with:

- The [Large Gripper](#) (index.html#large-gripper) which has the ability to grab larger objects while keeping the ability to close entirely;
- The [Adaptive Gripper](#) (index.html#adaptive-gripper) which allow Ned2 to grab non-standard objects with complex shapes (eg. an egg);
- The [Vacuum Pump](#) (index.html#vacuum-pump) to grab objects with plane and non-porous surfaces;
- The [Electromagnet](#) (index.html#electromagnet) that is useful to manipulate metallic objects, from one to many (eg. screws, bolts...).

Ned2's Ecosystem is designed to let you reproduce advanced use cases of industry 4.0.

Vision Set

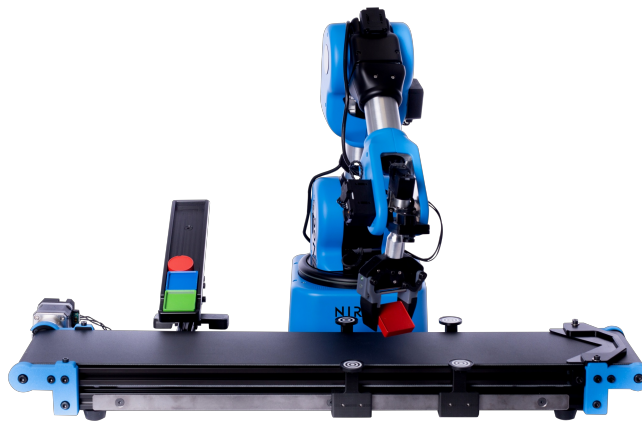


The Vision Set gives Ned2 the ability to detect objects and select the ones you want to interact with. It comes with a camera and objects of different shapes and colors to allow you to study topics such as image processing, machine learning and Artificial Intelligence thanks to the contribution of vision. This set includes:

- A camera;
- A workspace which is designed around a specific repositionnable material;
- 6 objects (3 rounds, 3 squares) of different colors to use our built-in recognition system based on colors and shapes. The squares are designed to be able to act as containers for the circles. Easily create an industry 4.0 pick & pack application with no particular knowledge of programming;
- A calibration tip to set your workspace up.

Conveyor Belt (v2)

The Conveyor Belt (v2) is the key add-on to prototype industry 4.0 production lines.



The Conveyor Belt (v2) is composed of:

- A mountable workspace to use vision functions directly on the Conveyor Belt;
- A slope that can help to create complex or multi-robot processes;
- An end-stop to stop the objects when they reach the end of the Conveyor Belt;
- The 6 objects of the Vision Set to extend the quantity of objects you can use on your production line.

With Ned2's ecosystem, you have the optimal solution to discover, learn and prototype industry 4.0 processes.

Overview of this manual

This manual contains instructions for:

- Safety Information about Ned2;
- Mechanical and electrical installation of the robot;
- Software of the robot;
- Maintenance and troubleshooting.

This manual should be read before:

- Installation and electrical connections;
- First usage of the robot;
- Maintenance and repair.

Safety notice

ⓘ Warning

You must read, understand, and follow all safety information in this manual.

It is important that the safety instruction on this manual and the electrical and the mechanical instructions are followed. The robot specifications should be respected to avoid all damage to the machine or to the user.

Additional content

You can find additional content by clicking on the link [here](https://docs.niryo.com/) (https://docs.niryo.com/).

Hardware introduction

This document contains a description of the Ned2 product, including details of the following:

- Mechanical and electrical installation instructions;
- precautions for safe use;
- technical characteristics of the robot;
- product warranty details.

Please refer to [software documentation](#) (index.html#advanced-programming) for programming details.

Important safety notice

Warning



The robot is assessed as a **partly completed machinery**. A risk assessment in accordance with the safety regulations applicable in your country is necessary prior to each installation and use of the robot. Be sure to follow the safety instructions in this manual.

Please note that:

- The robot can only be used under the proper technical conditions, for its intended uses, while taking into consideration potential hazards;
- the robot must be used in accordance with the instructions in this manual;
- Niryo is not liable for any modification made to the software or physical characteristics of the robot by the user.

We shall not be liable for any damage caused if it is used in a way that does not comply with the instructions given in this manual.

Safety instructions

User responsibility

- Make sure that the aforementioned **risk assessment** is performed before each use of the robot.
- Make sure that the incorporation of the robot into other applications or ecosystems does not affect the robot's safety aspects.

Hardware and/or software modifications

Any modification of the equipment is prohibited.

Niryo relies on the open-source philosophy. Software modifications are permitted. However, the modification of the software elements indicated below is **prohibited**:

- Low-level programming files (stack hardware).
- Configuration of the Raspberry Pi.
- Robot configuration file (speed and acceleration limits, position axes and torque limits).

- Embedded software and configuration of the motor parameters.

Niryo disclaims all liability for any damage caused to and by the robot as a result of these modifications.

Safety symbols

This section specifies all dangers that can arise when doing the work described in the User Manual. Each danger consists of:

- A caption specifying the danger level (DANGER, WARNING, or CAUTION) and the type of danger;
- A brief description of the danger;
- Instruction about how to eliminate danger.

Symbol	Designation	Description
	DANGER	Warns that if instructions are not followed, an accident will occur resulting in personal injury.
	WARNING	Warns that if instructions are not followed, an accident will occur which could lead to personal injury or damage to the product.
	CAUTION	Warns of possible damage to the product.
	NOTE	Describes an important fact or condition.
	ADVICE	Describes additional information or an easy way to use the function.
	ELECTROSTATIC DISCHARGE	Warns of a possible electrostatic discharge which could damage the robot.
	ELECTRICAL SHOCK	Warns of an electrical hazard.
	CHRUSHING OF HANDS	Warns of the risk of crushing hands between two mechanical parts.

General safety information

Danger



- Before installing, using or programming Ned2, you must read the specifications and the product manual.
- Install Ned2 and all the electrical equipment in accordance with the specifications and warnings in the Installation, Mechanical interface and Electrical interface chapters.
- It is important to ensure that any modification to the robot's software will not cause any danger or damage to the user and the product.
- Children are not permitted to handle the robot.

ⓘ Warning

- Make sure that the robot is properly installed on a firm surface with enough clearance to avoid shocks and collisions. (Refer to part 12.3. Range of motion of the robot).
- Cutting the power or activating the emergency stop button can cause the arm to drop. This drop is cushioned. Do not touch the robot when activating the emergency stop in order to avoid any collision.
- Be careful not to use the robot in unsuitable environments (e.g. outdoors).
- Do not put or install Ned2 in a damp environment or near water.
- Do not install or use Ned2 in hazardous environments (e.g. in a strong magnetic field, hazardous gas, fire or near flammable products) to prevent the hazards that can occur as a result of outdoor conditions.
- Make sure that external modifications to the motor parameters or robot software do not damage the product.
- The robot and motors generate heat when they are running. Do not touch or handle the robot during operation or after prolonged use, the high temperature may cause pain.
- Regularly monitor the motor and arm temperature in Niryo Studio.
- When the Ned2 is activated, keep away from the areas labeled with the pinch warning sticker, to avoid any injury.
- **Make sure to move to robot to home position before:**
 - powering Off;
 - powering On;
 - reboot motors with Niryo Studio.

ⓘ Caution

- Do not turn off the robot during a sequence or movement, except when absolutely necessary, as this can shorten the lifetime of the robot.
- Preferably switch off the robot using the push button. Avoid using the emergency stop button except in case of danger.
- Failure to follow the connection instructions could damage the tool or robot.

Voltage related risks, robot

A danger of high voltage is associated with the robot in:

- The power supply of the motors (12V , 11.4V, 5V);
- Ned2's grippers are powered by 5V. A risk of short circuit and sparks exists. Be sure to make the installations with the power disconnected.

Safety actions

- Fire extinguishing

ⓘ Note

Use a CARBON DIOXIDE (CO2) extinguisher in the event of a fire in Ned2's system.

- Manually stopping or overriding the arm: if needed, Ned2 arm can be stopped manually. This is possible since Ned2 arm is light, the arm force is limited, and the drivetrain power is limited.

To prevent unnecessary damage and wear of Ned2 arm, it is recommended to use the normal stopping functions of Ned2 (by the software or the top button).

Note

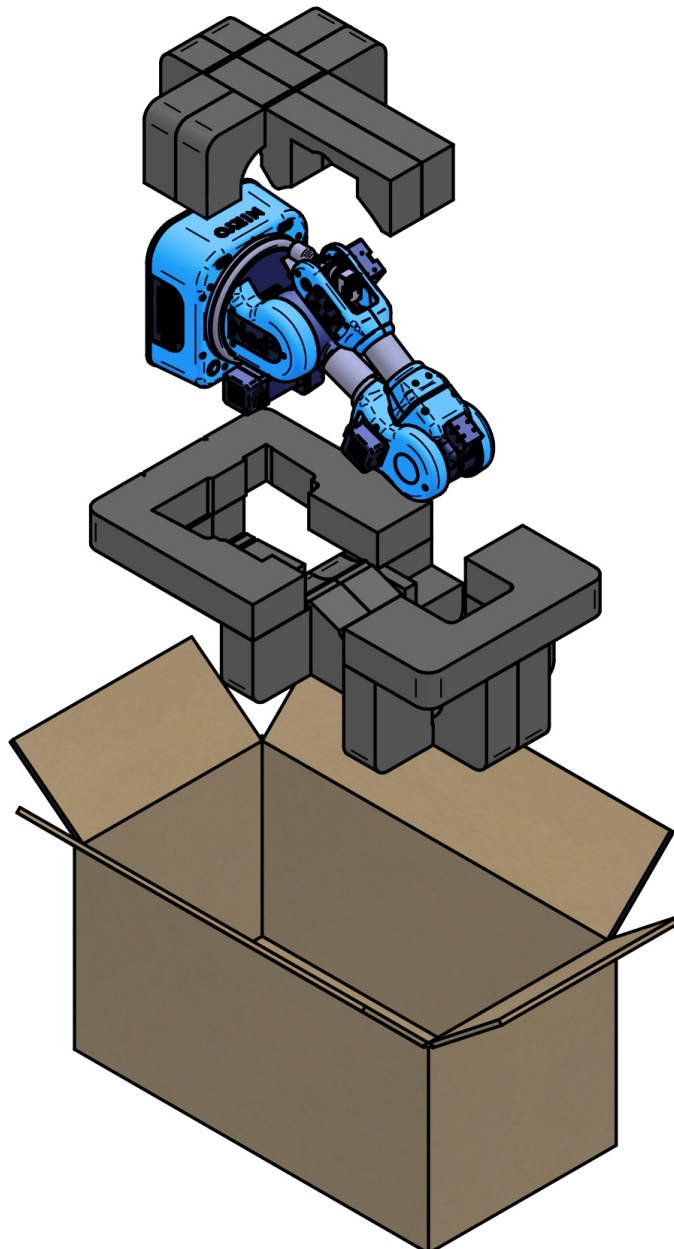
Ned2 is not equipped with brakes since its weight and design do not require a holding brake.

Installation and commissioning

This section specifies the procedures to follow during unpacking and transportation.

Transport

Be sure to transport the robot in its original box to avoid damage.



Warning

Maintain good posture when handling the arm or arm cartons to avoid back injuries.

What the box contains

When you order Ned2 you receive a box with the following items:

- 1x Ned2 Robot
- 1x Custom Gripper
- 1x Power supply
- 1x Safety box
- 2x Analog I/O connector
- 2x Digital I/O connector
- 1x Universal travel plug adapter
- 1x SD card reader
- 1x manual instruction
- 1x Quickstart



Intended use

The Ned2 robot is intended for educational, and research and development purposes, i.e.:

- learning robotics;
- research and development in robotics;
- simulation and prototyping of complete industrial scenarios such as “Pick & Place” (take an object to move it), “Pick & Pack” (take an object to insert it into a packaging);
- hardware application: connect and control the robot with sensors and external actuators in order to simulate an application, while respecting the conditions defined in this instruction manual.

The operations below do not comply with the uses set by Niryo. They include:

- use as a children's toy;
- use for industrial tasks;
- use for handling inappropriate objects (with unsuitable grippers, objects whose mass is greater than the maximum authorized load);
- use that exceeds the stated specifications.

Any use of the robot and its ecosystem that does not comply with the uses initially intended by Niryo must be expressly authorized by Niryo.

Unpacking and installation

1. Inspect Ned2's packaging to make sure that nothing is damaged;
2. Remove the packaging and make sure that the product has not been damaged in any way and that nothing has been mislaid during transport;
3. Put Ned2 in a location that has been specifically allocated to its use;
4. Pay attention to the commissioning and safety instructions.

Warning



- Maintain good posture when handling the arm or arm cartons to avoid back injuries.
- Make sure the robot is handled correctly so that the arm cannot fall during packing, loading, unloading or unpacking. Handling areas are provided to facilitate the transport of the robot (see below).
- Make sure that the robot is handled correctly so that hands cannot get caught in the joints. To do this, respect the handling zones specified below.

Robot handling area



Technical specifications

This section describes the technical specifications of Ned2.



Parameters	Value
Weight (kg)	7
Payload (g)	300
Reach (mm)	440
Degree of freedom	6 rotating joints
Joints range (rad)	$-2,949 \leq \text{Joint 1} \leq 2,949$ $-2,09 \leq \text{Joint 2} \leq 0,61$ $-1,34 \leq \text{Joint 3} \leq 1,57$ $-2,089 \leq \text{Joint 4} \leq 2,089$ $-1,919 \leq \text{Joint 5} \leq 1,922$ $-2,53 \leq \text{Joint 6} \leq -2,53$
Joints speed limit (rad/s)	$\text{Joint 1} \leq 0.785$ $\text{Joint 2} \leq 0.5235$ $\text{Joint 3} \leq 0.785$ $\text{Joint 4} \leq 1.57$ $\text{Joint 5} \leq 1.57$ $\text{Joint 6} \leq 1.775$
TCP max speed (mm/s)	468
Repeatability (mm)	+/- 0,5
Footprint (mm)	200x200
Mounting	Table
Temperature (°C)	5 - 45
Human-Machine interface	3 control buttons ("FreeMotion" button, button to save a pose and "Custom" button) LED Ring Speakers Microphone
Power supply	Input: AC100-240V / 50-60Hz, 2,5A Output: DC 12V - 7A ; 5V - 7A
I/O power supply	5V

Parameters	Value
Inputs/ Outputs Back panel	Digital inputs x3 Digital outputs x3 Analog outputs x2 Analog inputs x2
Inputs/ Outputs Control panel	Digital inputs x1 Digital outputs x1
Robot interface	2 x USB2.0 2 x USB3.0 1 x ETHERNET GIGABIT
Communication	Modbus TCP (master) TCP/IP
Materials	Aluminum ABS-PC (injection moulding)
Programming Environment	Niryo Studio C++ PyNiryoRos PyNiryo ROS
Collision detection	Accelerometer and gyroscope in the control panel
Certification	CE Conformity

Tools technical specifications

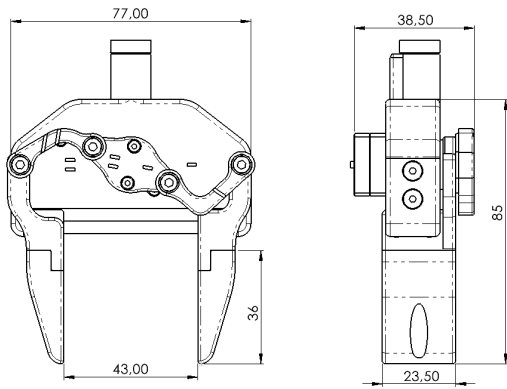
Tools Overview

Ned2 is compatible with 5 different sorts of tools:

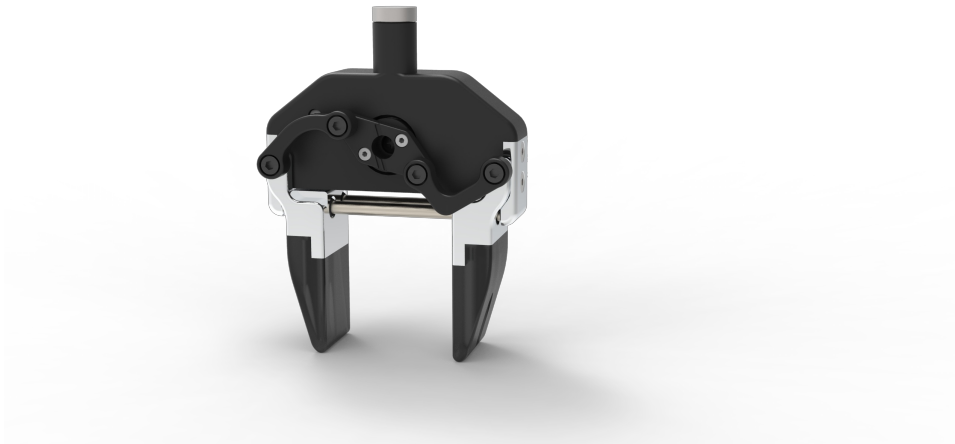
- 3 x Grippers
- 1 x Electromagnet
- 1 x Vacuum Pump

Specifications

Custom Gripper



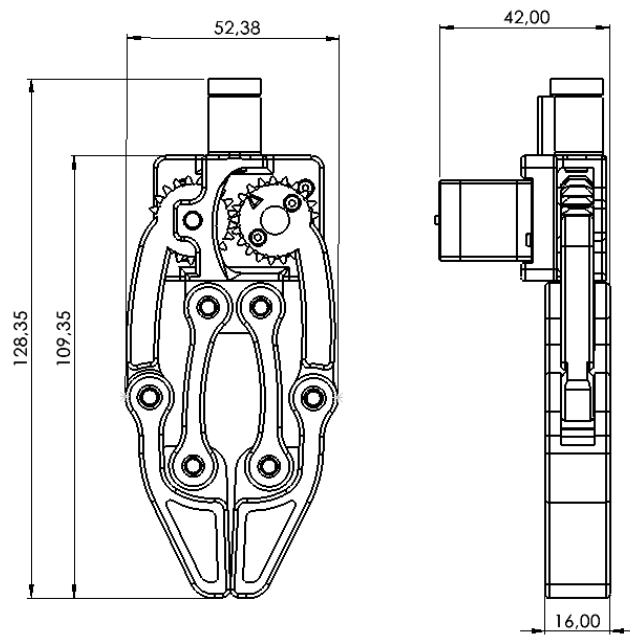
(_images/GRIPPER12.png)



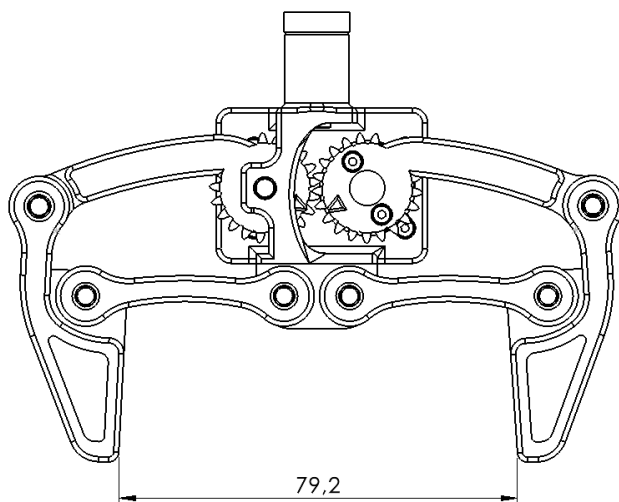
(_images/GRIPPER1.png)

Parameter	Description
Max operating width	43 mm
Picking distance from end effector base	85 mm
Motor	XL330 Servo Motor
Weight	87 g
Power Supply	5 V
Operating temperature	5-45°C

Large Gripper



(_images/GRIPPER2.png)



(_images/GRIPPER23.png)

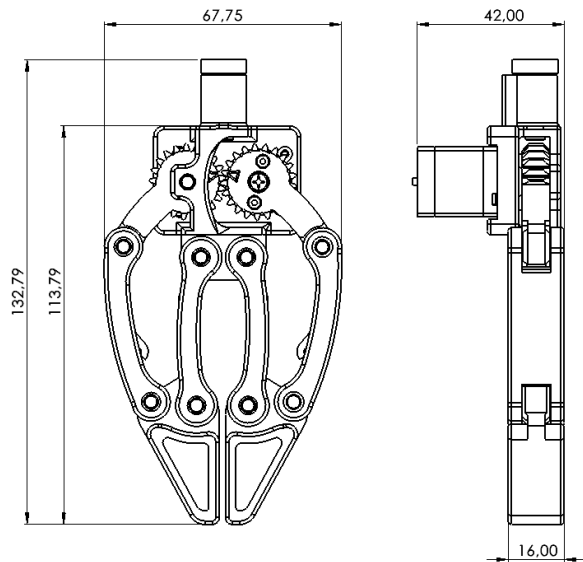


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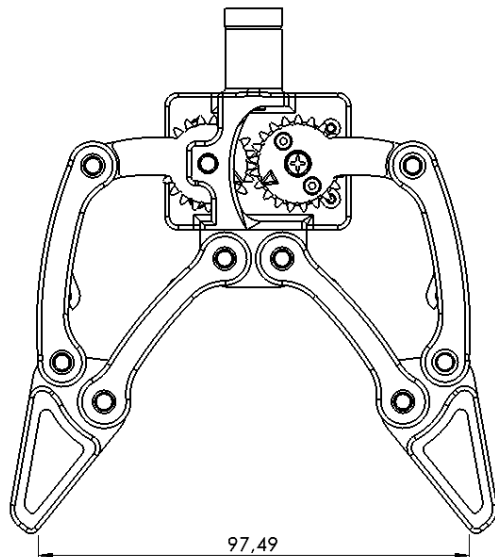
Parameter	Description
Max operating width	79.2 mm

Parameter	Description
Picking distance from end effector base	109.35 mm
Motor	XL330 Servo Motor
Weight	72.5 g
Power Supply	5 V
Operating temperature	5-45°C

Adaptive Gripper



(_images/GRIPPER3.png)



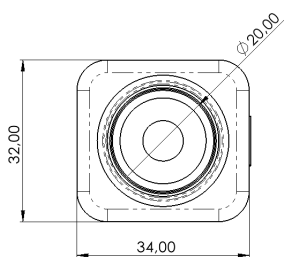
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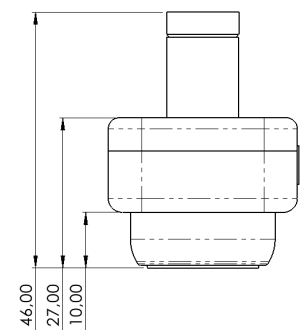
(_images/GRIPPER33.png)

Parameter	Description
Max operating width	97.49 mm
Picking distance from end effector base	113.79 mm
Motor	XL330 Servo Motor
Weight	83 g
Power Supply	5 V
Operating temperature	5-45°C

Electromagnet



(_images/ELECTROAIMANT1.png)



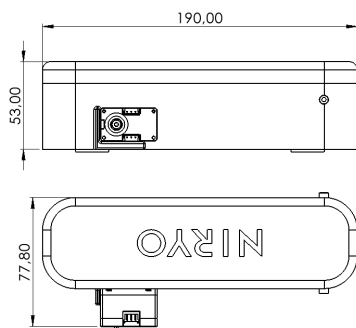
(_images/ELECTROAIMANT2.png)



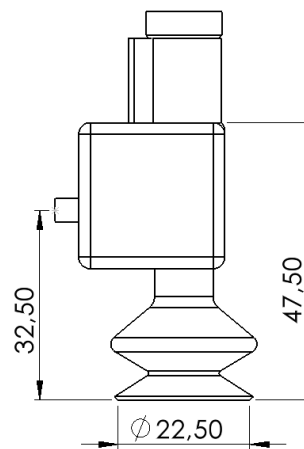
(_images/ELECTROAIMANT3.png)

Parameter	Description
Max operating width	20 mm
Picking surface	20 mm
Picking distance from end effector base	27 mm
Control interface	Digital output
Weight	44.5 g
Power Supply	5 V
Operating temperature	5-45°C

Vacuum Pump



(_images/VP.png)



(_images/VP2.png)



(_images/VP3.jpg)

Parameter	Description
Vacuum Pump control	Integrated XL330 servo motor
Weight	18 g
Total weight	183 g
Payload	300 g
Power Supply	5 V
Operating temperature	5-45°C
Vacuum Tube dimension	20 mm
Picking distance from end effector base	47.5 mm

Advice

In order to program the different tools, please refer to [Software documentation](#) ([index.html#advanced-programming](#)).

Robot operating mode

Ne2 Robot comes with 3 different operating modes.

Current mode can be determined visually via the color of the [Led Ring](#) ([index.html#led-ring-indications](#)) on the robot's base.

The different modes are listed in the table below

Operating Mode	Description
Manual mode - Robot calibration	The robot automatically defines the Zero positions of each axis.
Collaborative mode - Programming	Programming, editing, loading and execution of the programs
Manual mode - FreeMotion	The axes of the robot can be moved by hand.

Robot calibration

Ned2 does not have a mechanical calibration. The calibration phase is fully automatic and must be completed in order to control the robot. This matches up the position of each motor with its controller.

The procedure is as follows for the first 3 axes:

1. the axis rotates in the direction as shown in the photo below until it stops;
2. the axis stops when the limit is detected;
3. the axis moves back in the opposite direction;
4. the axis rotates in the direction up to the limit stop;
5. the axis stops when the limit stop is detected, and the Zero position is set at this point.



ⓘ Warning

Make sure that the robot is properly installed on a firm surface with enough clearance to avoid shocks and collisions. (Refer to [Range of motion of the robot](#) ([index.html#robot-workspace](#)))

It is strictly forbidden to put your fingers and hands in the joints of the robot when it is in motion.

Manual mode- FreeMotion

This mode is used to move the joints of the robot by hand in order to put the robot back in the required position. This mode is activated either by pressing and holding the FreeMotion button located on the [control panel](#) ([index.html#control-panel](#)) or by pressing and holding the button available on the [Niryo Studio programming interface](#) ([index.html#advanced-programming](#)) .

**ⓘ Warning**

Be careful not to put your fingers and hands in the joints or openings of the robot during FreeMotion mode.

Take great care when moving the robot by hand.

Be mindful of the gripping zones for the learning mode (see diagram below) and do not touch the motors.

Collaborative mode - Programming

This mode can be used to program, edit, load and run the robot's programs. The robot automatically switches to this mode once it has been calibrated.

ⓘ Warning



Be careful not to enter the robot's working area to avoid any collision.

Watch the robot's movements while using Niryo Studio.

Activate the emergency stop button in emergency or abnormal situations.

Operating conditions

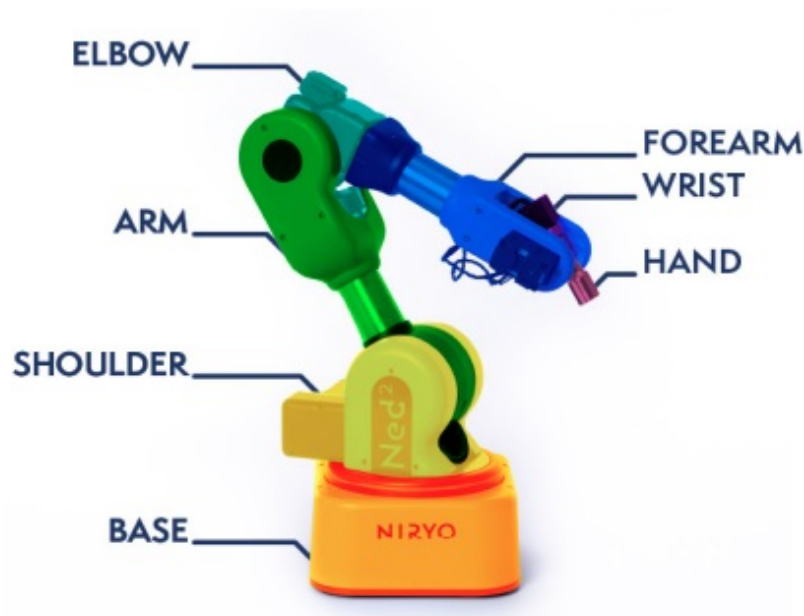
Parameters	Value
Minimum Ambient Temperature	+5°C
Maximum Ambient Temperature	+45°C

Mechanical interface

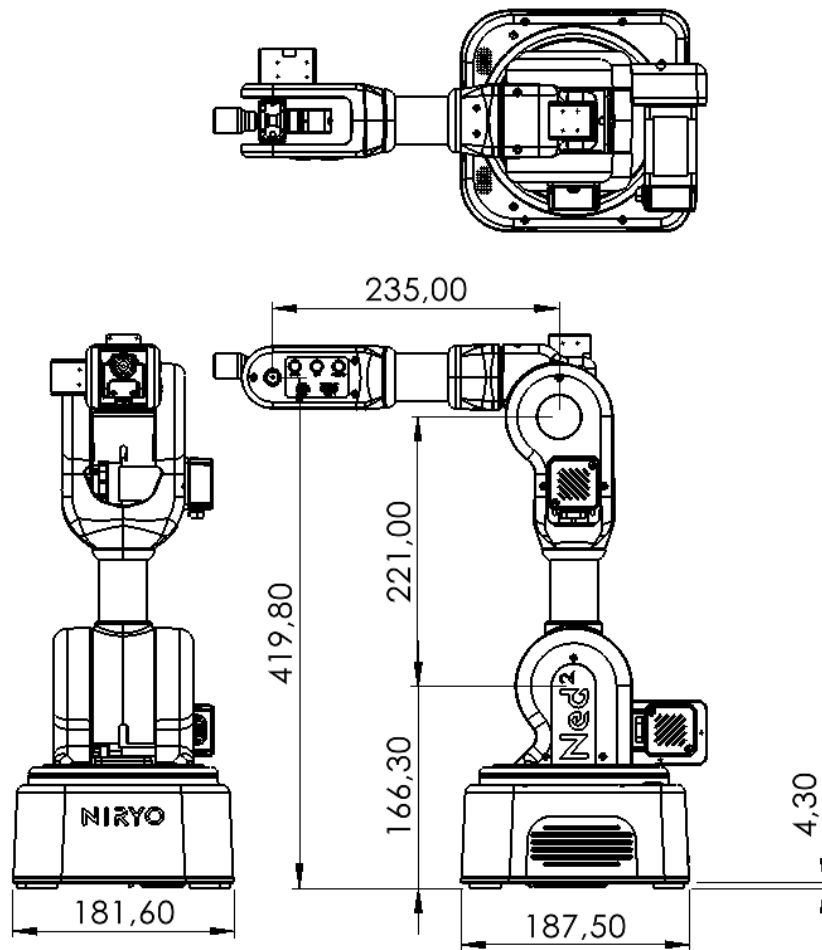
Mechanical Overview

This chapter introduces the mechanical and the electrical interfaces of Ned2.

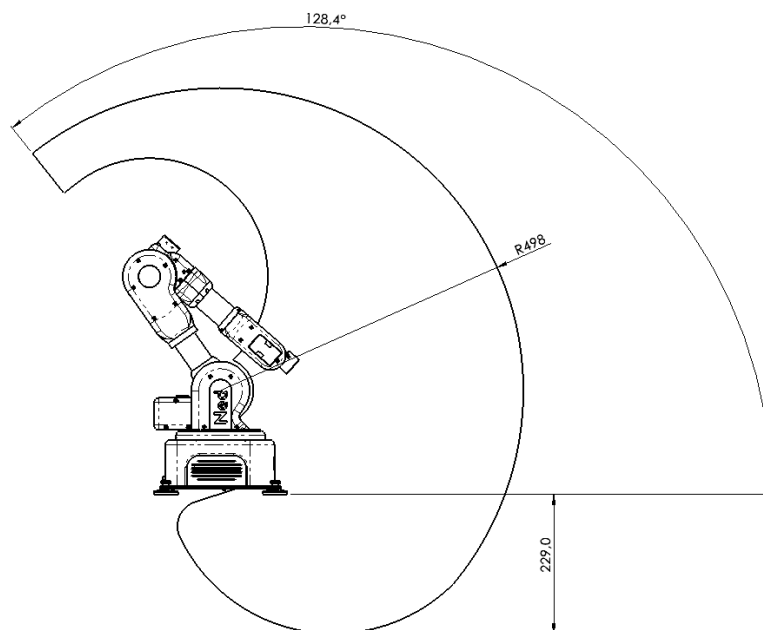
Ned2 is a 6-axis collaborative robotic arm. It consists mainly of six robot joints of aluminum with plastic covers. Ned2 consists of 7 parts :

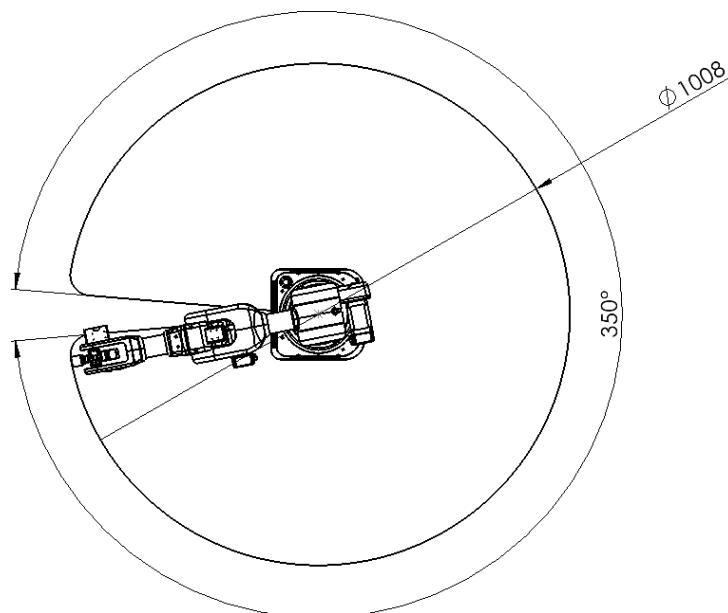


3D view of the robot



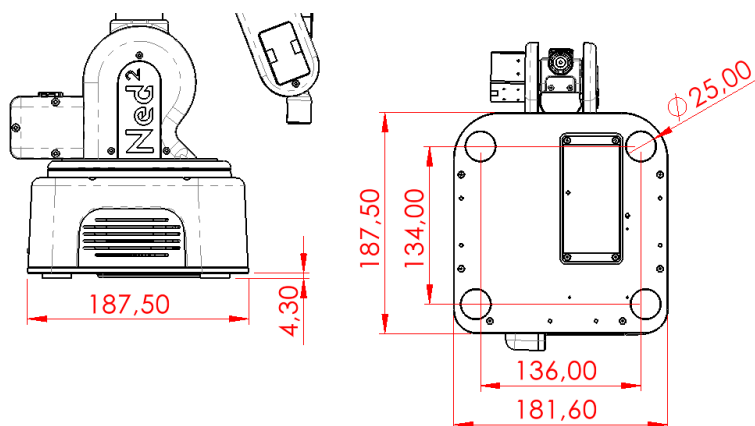
Robot workspace





Installation

The robot must be placed on a table or flat surface that is larger than the surface of its support unit.



Warning



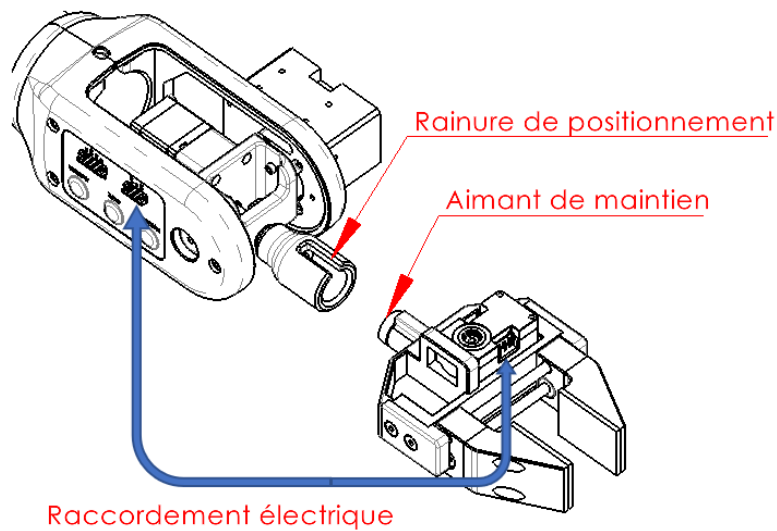
Make sure that the robot is properly installed on a firm surface with enough clearance to avoid shocks and collisions.

Tool mounting

Each tool has the same mechanical connector interface. This option allows a quick-change option of the tool and good stability.

- Put the groove on the side of the motor, pointing down;
- fix the gripper to the robot axis using the magnetic part.

Please find more information about Niryo tools in the section [tools technical specifications](#) ([index.html#specifications](#)).



⚠ Warning



- Be careful not to mount a gripper that is not supplied by Niryo. If you would like to design your own gripping tool, contact our Support Service;
- Never use loads greater than those stated in the robot specifications (chapter 9) as this could cause mechanical crushing should the object or the gripper fall. Such improper use could also damage the robot;
- Make sure that the tool is mounted correctly by following the assembly instructions above;
- Be careful not to put your fingers between the jaws of the gripper.

Vision Set mounting

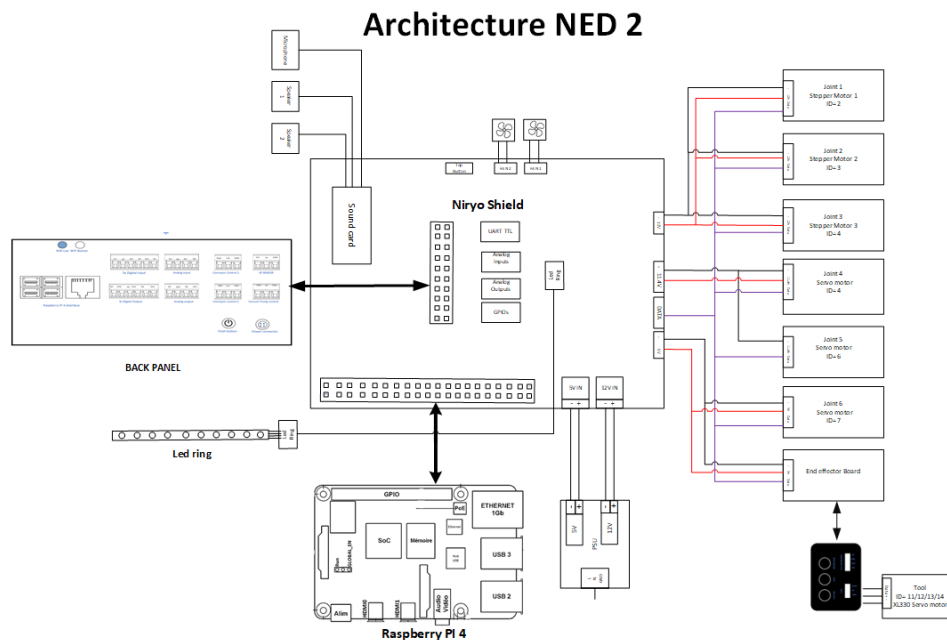
To mount the Vision Set, all you need to do is attach the camera to Ned2's wrist. The cable of the vision set need to pass through the wrist to avoid trouble during movement of the robot. You can set up and fix your workspace to Ned2's structure to have a stable environment.



Electrical interface

Electrical interface overview

Electrical architecture



Back Panel interface

Ned2 comes with I/O interface that can be used for wide range of equipments and Ned2 ecosystem.

The illustration below shows the different electrical and communication interfaces present on the back panel of the robot.



Connector table

1	2 x USB 2.0
2	2 x USB 3.0
3	RJ45 port
4	Wi-Fi status indicator
5	Wi-Fi button
6	3 x digital inputs
7	3 x digital outputs

8	2 x analog inputs
9	2 x analog outputs
10	Conveyor control interface
11	Conveyor control interface
12	Infrared sensor interface
13	Vacuum pump control interface
14	On/off button
15	General power input

Warning



Take great care in following the safety guidelines in the next section to avoid damaging the robot.

Be sure to respect the order of connection and the characteristics of the robot's inputs/outputs.

Make sure all the equipment and cables are dry. If water gets into the equipment, unplug the power cable.

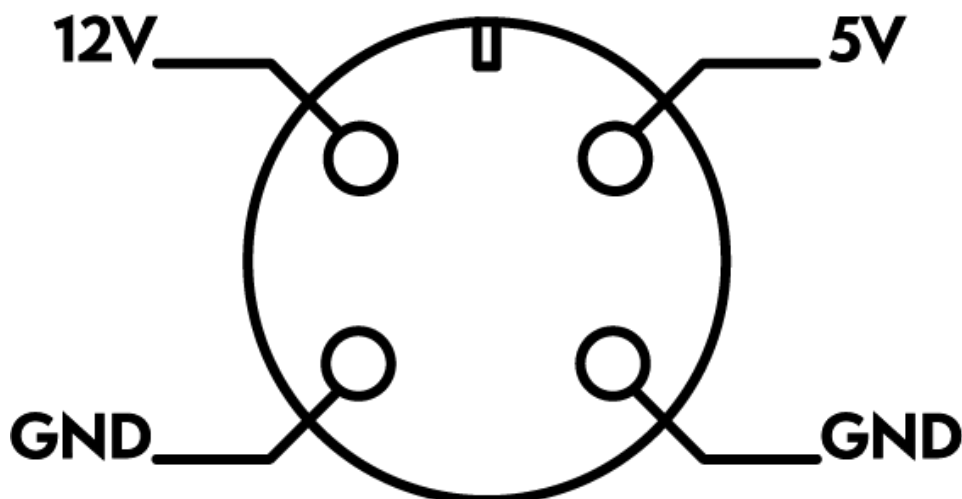
Do not unplug or turn off the robot while it is in use, as this could damage the robot's Raspberry Pi 4 or the micro SD card inside.

Before plugging in or unplugging the power supply, be sure to turn off the robot.

General power input

- Ned2 is powered with AC/DC adapter with two output ratings: 12V and 5V

Settings	Value
Frequency	50/60 Hz
Input	AC 100-240 V , 2.5 A
Output	12 V – 7 A; 5 V – 7 A



On/Off button

- The robot is **turned on** by pressing the power button on the back panel.

When the robot is starting on , the led ring displays white light.

After the robot start up completed, the indication of led ring will display blue light, the robot can be used normally at this time.

- The robot is **turned off** by pressing the same power button on the back panel.

When pressing the button ,the robot will start the Shutdown sequence. The led ring will display white **Breath** for 2 seconds.

Warning



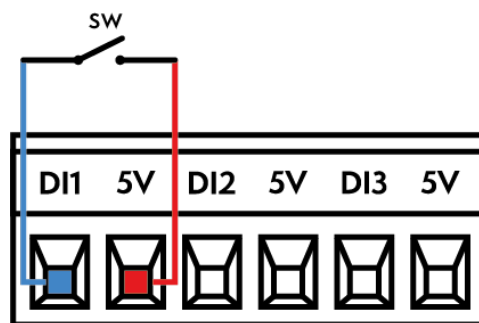
Make sure the robot is in home position when powering off or on the robot.

Digital inputs

The electrical specifications of the digital inputs are shown below:

Connector	Settings	Min	Max	Units
Digital inputs: Type -> NPN				
[DI1 - DI2 -DI3]	Voltage	0	5	V
	Current	0	5	mA

- This illustration below shows how to connect a switch to a digital input.

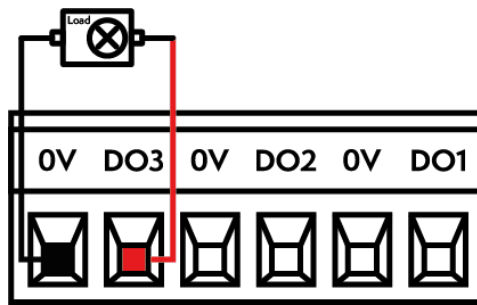


Digital outputs

The electrical specifications of the digital outputs are shown below:

Connector	Settings	Min	Max	Units
Digital outputs: Type -> PNP				
[DO1 - DO2 -DO3]	Voltage	0	5	V
	Current	0	250	mA

- This example shows how to connect a load in order to be controlled from a digital output.



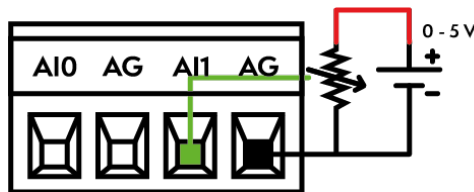
Analog inputs

The analog inputs can be used to measure voltage (0-5V) from an external equipement.

The electrical specifications are shown below:

Connector	Settings	Min	Max	Units
Analog input				
[AI1 - AI2]	Voltage	0	5	V
	Current	0	20	mA
	Resolution		12	bit

- This illustration below shows how to connect a potentiometer for reading values from 0-5V.



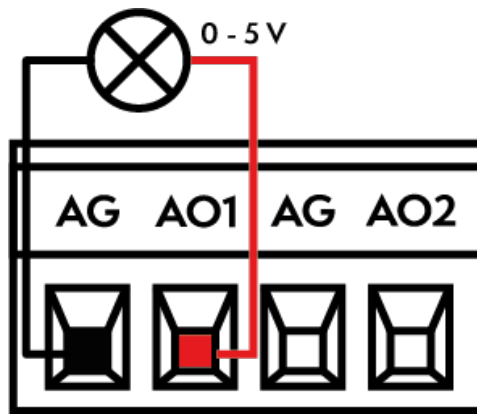
Analog outputs

The analog outputs can be used to set voltage (0-5V) to an external equipement.

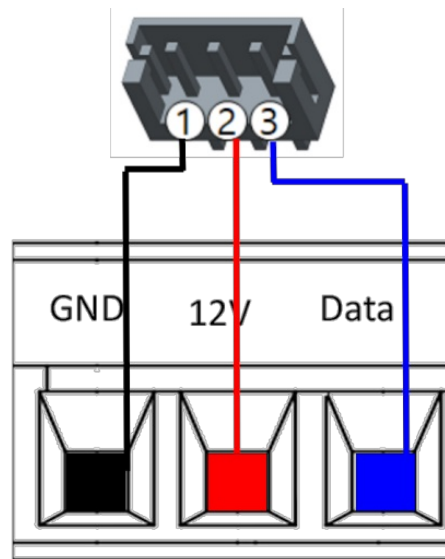
The electrical specifications are shown below:

Connector	Settings	Min	Max	Units
Analog output				
[AO1 - AO2]	Voltage	0	5	V
	Current	0	30	mA
	Resolution		12	bit

- This example shows how to connect a load in order to be controlled from an analog output.



Conveyor control interfaces

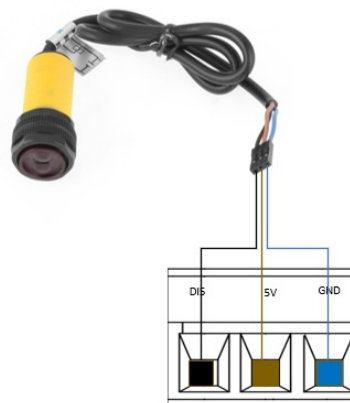


Advice

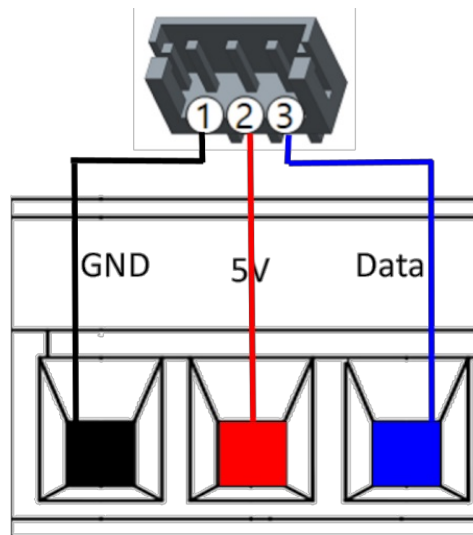


Please refer to the [conveyor v2 documentation](https://docs.niryo.com/product/conveyor-belt/v1.0.0/en/index.html) (<https://docs.niryo.com/product/conveyor-belt/v1.0.0/en/index.html>) for more information.

Infrared sensor interface



Vacuum pump control interface



Wi-Fi mode

The Wi-Fi indicator is used to display the Wi-Fi status in the robot.

Color	Description	Trigger
Solid blue	The robot is hotspot mode	Hotspot activated using Niryo Studio or the Wi-Fi button
2 blue blinks followed by a pause	The robot is connected to a network	The robot is connected to the network either with an Ethernet cable or via Wi-Fi
Quick blinking blue light	Wi-Fi mode change in progress	Press the Wi-Fi button
LED off	The robot's hotspot and Wi-Fi are not activated	In order to activate a mode, you must press the Wi-Fi button

Wi-Fi button

Function	Type of action	Condition	Status after action
Activate the hotspot	Short press	The robot is in a Wi-Fi mode	The robot is in hotspot mode
Activate the Wi-Fi	Short press	The Wi-Fi is not activated or the robot is in hotspot mode	The robot is in a Wi-Fi mode
Deactivate the hotspot and wifi	Long press	The Wi-Fi or hotspot mode is activated	The Wi-Fi (and hotspot) are disabled

Top button

The top button on the Ned2 has multiple functions, depending on how long your press on it or the number of presses.

Time/Number of presses	Function
A program is running	
1 short press (0.1 and 2 seconds)	Pauses the program
1 long press (> 2 seconds)	Stops the program
A program is paused	

Time/Number of presses	Function
1 short press (0.1 and 2 seconds)	Resumes the program where it left off
1 long press (> 2 seconds)	Stops the program
A program is defined with an automatic start	
1 short press (0.1 and 2 seconds)	Starts a saved program

Control Panel



FreeMotion button

- Pressing and holding this button deactivates the torques in the motors and performs the FreeMotion operation (find out more information on [operation mode section](#) ([index.html#manual-mode-freemotion](#))).

Save button

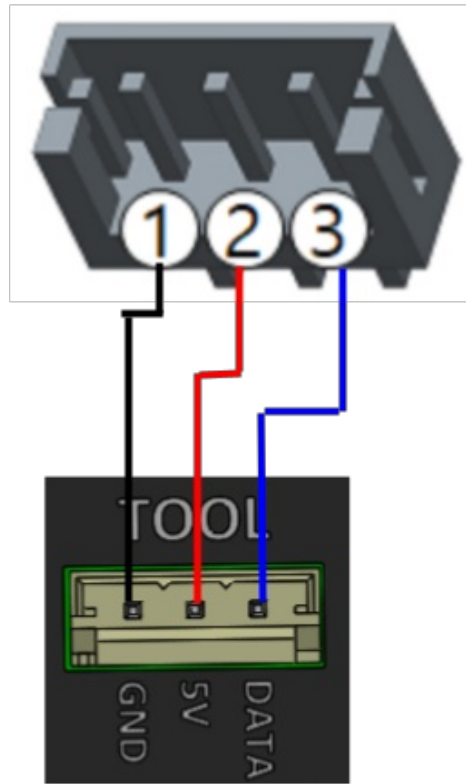
- A short press on this button saves the robot's position on Niryo Studio.

Custom button

- This button is programmable and allows the user to choose the type of action and the function of the button.
- For more information, please refer to [Niryo Studio documentation](#) (https://docs.niryo.com/product/niryo-studio/v4.0.0/en/source/blockly_api.html#i-o-for-ned2)

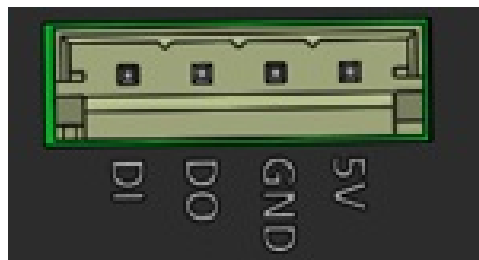
Gripper connector

- This connector is used to control the Custom Gripper, Large Gripper or Adaptive Gripper.



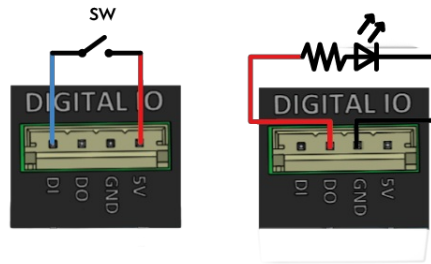
Electromagnet connector

- This connector is specifically for connecting Niryo's electromagnet.



- There is also a digital input for connecting a sensor, for example.
- Programming the input/output can be done through Niryo Studio.

Connector	Settings	Min	Max	Units
Digital inputs: Type -> PNP				
[DO4]	Voltage	0	5	V
	Current	0	250	mA
Digital inputs: Type -> NPN				
[DI4]	Voltage	0	5	V
	Current	0	5	mA



Safety box

The safety box contains the emergency stop. Activate the emergency stop button to immediately stop all robot motion.



⚠ Warning

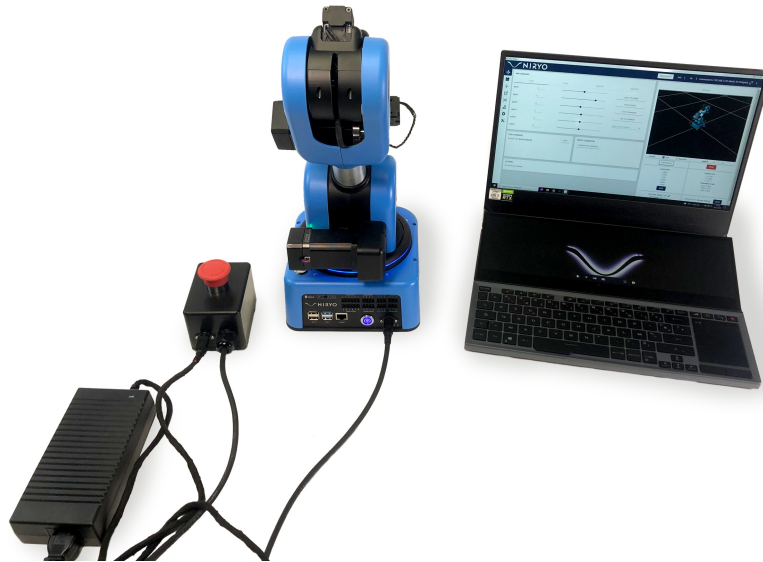


- The safety box should be always be wired to the robot.

Electrical connection

Powering ON

- To turn on the robot, make the connection as explained above. Make sure that the emergency stop button is deactivated and that the robot is installed according to the instructions given in the Safety instructions chapter.
- Press the On button and wait a few moments for the LED ring to light up (please refer to [led ring section](#)).
- Find more information on how to program and use the robot in the Niryo Studio manual.



Advice



- **Hardware can be tested for the very first time without using any software, as a program is pre-recorded at the factory to start automatically. To do this, follow the steps below:**
 - Make the electrical connection and switch on the robot as explained above
 - Wait until the LED ring performs a slow blue “Chase” (go to the [led ring section](#)) and the robot start-up sound starts (if this is the first time you are using the Ned2, it takes about two minutes)
 - Press the top button: the Ned2 will start with a calibration, then it will perform a pre-recorded sequence.

LED ring indications

Warning



- If software changes are made to the robot LED ring indications, then the indications given in this section may be wrong.

Color	Condition	Operating mode	Description	Troubleshooting
White Breath	Normal condition		Robot is booting	N/A
White to blue Breath	Normal condition		Starting the robot	N/A
Slow blue Chase	Normal condition	Manual mode - Calibration	Calibration required	Press the Custom button, or launch a calibration
Blue Snake	Normal condition	Manual mode - Calibration	Calibration in progress	N/A
3 yellow Flashing	Normal condition	Manual mode - Calibration	Calibration warning	N/A

Color	Condition	Operating mode	Description	Troubleshooting
Solid orange	Warning	Manual mode	One or more robot axes are outside the motion limits	Return the axes to within the limits and start a calibration.
1 white Breath lasting 2 seconds then 6 blinks in white	Normal condition	Manual mode	Shutdown in progress	N/A
Flashing red	Emergency	Manual mode	Motor error	Check the motor error codes in the “Hardware Status” panel of Niryo Studio. Contact the after-sales service if it persists, as there may be defective fan.
Solid white	Normal condition		Update in progress	N/A
Breath blue	Normal condition	Manual mode - FreeMotion	FreeMotion activated	N/A
Breath green	Normal condition	Manual mode	FreeMotion disabled	N/A
Solid green	Normal condition	Manual mode - Programming	Program running	N/A
Chase green	Normal condition	Manual mode - Programming	Program paused	A short press on the button to resume, a long press on the top button to cancel the current program
Chase orange	Warning	Manual mode - Programming	Error in the program	Check the logs on Niryo Studio and Launch a new action to clear this state
Solid red	Emergency		Fatal error	Check the logs on Niryo Studio and restart the robot
Flashing orange	Warning		A collision is detected	Perform a new action to remove the warning and check if the robot has collided with an obstacle
Flashing purple	Normal condition	Manual mode	Login to Niryo Studio	N/A
1 Flashing white	Normal condition	Manual mode – programming	Saving a position	N/A

Note



• Glossary of light indications:

- **Breath:** The light intensity increases and decreases periodically, suggesting a breath.
- **Snake:** The LED chaser runs through the LEDs at moderate speed. Several LEDs light up one after the other.
- **Chase:** Every third LED is on. All of them shift across, one LED after another.

Animation	Appearance	Gif
None	LEDs are turned off	
Solid	Set the whole LED Ring to the same color at once	
Flashing	Flashes a color according to a frequency	
Alternate	The different colors are alternated one after the other.	

Animation	Appearance	Gif
Chase	Movie theater light style chase animation.	
Rainbow	Draws rainbow that fades across all LEDs at once.	
Breath	Variation of light intensity to imitate breathing.	
Snake	Luminous snake that turns around the LED Ring.	

Note

In order to program the different electrical interfaces of the robot , please refer to [Niryo Studio Documentation](https://docs.niryo.com/product/niryo-studio/v3.2.1/en/index.html) (<https://docs.niryo.com/product/niryo-studio/v3.2.1/en/index.html>).

Maintenance, support and updating

Updating

The software version of the robot and the Firmware versions of the circuit boards can be updated in just a few steps using Niryo Studio. For more information, follow the online documentation at this [link](https://docs.niryo.com/product/niryo-studio/v4.0.0/en/source/settings.html) (<https://docs.niryo.com/product/niryo-studio/v4.0.0/en/source/settings.html>).

Warning



The robot will restart automatically when the update has been installed. Do not do any other operations with the robot before launching an update.

Maintenance and support

Niryo provides a support team dedicated to maintaining your robot and resolving technical problems. It will respond within 48 hours of your request.

Maintenance and repair procedures must be carried out in accordance with the safety instructions (Chapter 7) and the rules set out by our support team.

It can also provide answers to your questions on how to operate the robot.

Contact our team at support@niryo.com (<mailto:support%40niryo.com>) for more information.

Warranty condition

All products manufactured by Niryo are guaranteed for one year from the date the invoice was issued. In the event of a warranty claim, provide the invoice, serial number, and photos and videos to explain the problem. We can then perform a remote diagnosis and help you resolve the problem.

For more information, go to our warranty conditions in our terms of sale using the following link: <https://niryo.com/fr/conditions-generales-de-vente/> (<https://niryo.com/fr/conditions-generales-de-vente/>)

Disposal

This robot complies with European Directive 2012/19/CE on used electrical and electronic appliances (waste electrical and electronic equipment – WEEE).

Disposal must be done in accordance with the laws in force in each country.

Do not dispose of your robot with the residual waste. Find out about the collection points for electronic and electrical devices near you.

For more information on the disposal of our products, visit www.niryo.com/fr/mise_au_rebut.

Advanced Programming

There are many other ways to develop on Ned2.

For more information, please refer to the following links:

- [Niryo Studio](https://docs.niryo.com/product/niryo-studio/index.html) (https://docs.niryo.com/product/niryo-studio/index.html)
- [Python](https://docs.niryo.com/dev/pyniryo/index.html) (https://docs.niryo.com/dev/pyniryo/index.html)
- [ROS](https://docs.niryo.com/dev/ros/index.html) (https://docs.niryo.com/dev/ros/index.html)
- [Modbus](https://docs.niryo.com/dev/modbus/index.html) (https://docs.niryo.com/dev/modbus/index.html)

Suggest a modification

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