Andrew Alliance

Andrew+

User Manual

About this manual

This user manual is specially designed to detail the device's functions and features.

- Please read this manual before using the device to ensure proper use and safety
- Please view this manual as part of the product and keep it somewhere easily accessible
- Ensure adequate material resistance when using chemical substances
- Descriptions are based on the default setting of the device
- Images and screenshots may differ in appearance from the actual product
- Content may different from the final product, or from software provided by service providers or carriers, and is subject to change without prior notice
- Andrew Alliance is not liable for performance issues or incompatibilities caused by misuse of this device

Instruction icons

 **DANGER** Situation that could cause injury to yourself and others	 **DANGER** Radiation with potential for risk to health or death as a consequence	 **DANGER** Biohazard with potential for risk to health or death as a consequence
 **CAUTION** Situation that could cause damage to your device or other equipment	 **NOTE** Notes, usage tips, or additional information	

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1214 Vernier (Geneve)
Switzerland

Abbreviations used

MCP	Microplate
LH	Liquid handling
DWP	Deepwell plate
BSL	Biosafety level
PIPETTE ADAPTOR	Magnetic interface device adaptor
AA PIPETTE	Andrew Alliance electronic pipette
OLM	Optical localization module
LLD	Liquid level detector
TIS	Tip insertion system
ROW	Rest of the world

Glossary

Tool	Device which can be automatically handled by Andrew+ Robot. Some tools may require an adaptor (e.g. PIPETTE ADAPTOR) as interface to allow the manipulation
Tool stand	Part of Andrew+ Robot designed to host up to 4 tools. The tool stand is the right arm of Andrew+ and allows the charging and wire communication with the tools
Docking stations	Optional component used by Andrew+ to host additional tools for experiments which require more than 4 tools or tools which cannot be installed on Andrew+'s tool stand
Pipette+	Smart pipette stand+ with cloud connectivity capable of wirelessly control ling Andrew Alliance electronic pipettes

Delivery package

QUANTITY	PART NUMBER	DESCRIPTION
1	718.8000	Andrew+ robot
1	718.5151 (EU) or 718.5161 (US) or 718.5171 (UK)	Power cord
1	718.5131	Power supply
1	718.5871	Ethernet cable
1	218.1301	Waste Domino

1. Introduction

This paragraph describes the few steps to follow in order to have your Andrew+ unit operational in less than 5 minutes.

1.1. Unit description

Andrew+ is a laboratory benchtop robot able to execute experiments according to protocols described by a user through its software: OneLab™.

Andrew+ is capable of handling a variety of laboratory tools which are automatically used by the system. Examples of such tools are:

- Andrew Alliance electronic pipettes
- Labware grabber
- Liquid level detector

Laboratory conventional consumables required to execute experiments are arranged into a magnetic-based modular system called Dominos. Using its camera, Andrew+ can localize and identify the consumables present on the working area. Andrew+ stands on a base which has a dual functionality: avoiding involuntary movement of Andrew+ and hosting the Optical Location Module (OLM) with which Andrew+ can measure the length of the pipettes and tips. The right arm of Andrew+ can hold up to a maximum of 4 tools. Their manipulation does not require any user intervention. Your consumables should be placed in Dominos to allow Andrew+ to identify them. Depending on your protocol, you can have 2 Dominos for a small experiment and up to 11 Dominos, compatible with multi-channel pipettes, for a complex one. Andrew+ is made for research and development, industrial laboratories and routine work, with applications limited but not restricted to life sciences, biotechnology, chemistry, clinical research and diagnostic.

1.2. Safety precautions and warnings

For safe and correct use of Andrew+, it is recommended that both operating and service personnel follow the instructions contained in this guide when installing, using, cleaning, and maintaining this instrument. If the instructions described in this manual are not carefully followed, Andrew+ cannot function correctly and the warranty will be null and void.

DANGER:

Potential injuries

The potential exists for bodily harm if you interfere with the work area of the instrument while it is running.

- **DO NOT** put any part of your body into the working area of Andrew+ when it is moving.
- **DO NOT** put hands or fingers into this area when Andrew+ is grabbing or releasing a tool.
- **DO NOT** put hands or fingers inside the vertical movement of Andrew+. Consumables can be moved only when Andrew+ is switched off or when its arm is folded back in the idle position. The hand should be close to the shoulder.
- The laboratory tools compatible with Andrew+ can be removed or placed on the pipette rack only when Andrew+ is in the idle position.
- **DO NOT** stay close to Andrew+'s arm when Andrew+ is opening its arm.
- **DO NOT** place anything inside the Optical Location Module aperture.
- **DO NOT** try to open manually the aperture of the Optical Location Module.
- **DO NOT** place your fingers in front of the hand light or in front of the hand camera of Andrew+.

Use of biohazardous and radioactive substances

If Andrew+ can be potentially biohazardous due to the use of biohazardous substances, it should be prominently marked with symbol:

At a minimum, a biohazard symbol should be near the sampling area and visible during NORMAL USE.

Any part of the equipment that contains biohazardous waste material which can be removed from the equipment during NORMAL USE, or a biohazardous drain connection, should be marked with an appropriate biohazard symbol.

Be aware that Andrew Alliance S.A.:

Will receive for repair or get back from loan Andrew+ only if the instrument is removed and decontaminated from Biological risks and that the appropriate ***Decontamination Form*** has been properly completed and sent to Andrew Alliance Service & Support at support@andrewalliance.com

Entry into your Biosafety level 4 by Andrew Alliance personnel, or its representatives, is not permitted under any circumstances.

Entry into your BSL 3 is permitted and Services provided with confidentiality, when you can justify that removal of the Product from your location is not feasible. In this instance, you must provide evidence of decontamination, when asked, for Products that require Service. You must provide a list of recommended inoculations available against the bio-hazardous materials used, providing information about hazards in the location, instructions for safe entry into the location, instructions in the event of a fire, exposure or spill and other potential emergencies, ensuring the provision of appropriate safety equipment that is in appropriate working order, and with full guidance for use.

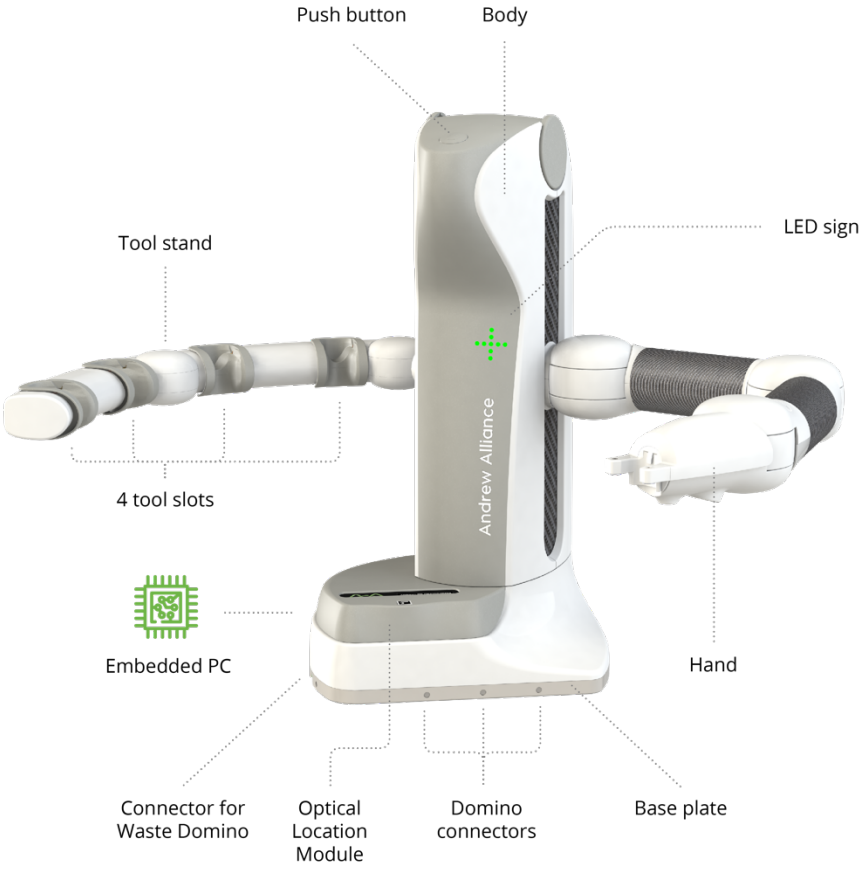
Waivers are not signed before entry or visit to any bio-hazardous area at your location.

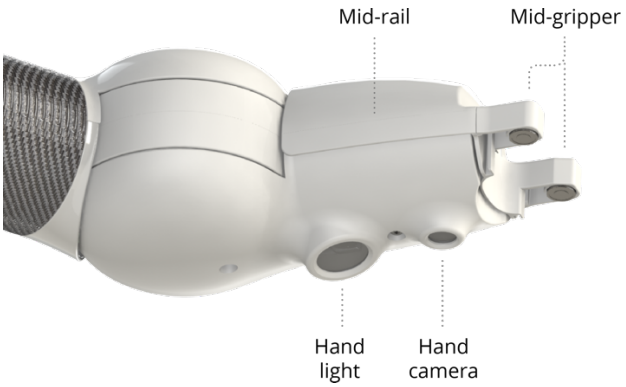
Andrew Alliance retains the right to refuse Services until the above requirements are met to the complete satisfaction of company employees who have been trained to expect appropriate safety standards.

1.3. Symbols

Advice to be aware and to be careful about!
These symbols point out a potential danger for users and/or damage to Andrew+ if they are not followed. When this symbol is visible, it is mandatory to carefully read the User Manual before taking any action or using the system.

2. Overview of the hardware





3. Technical specifications

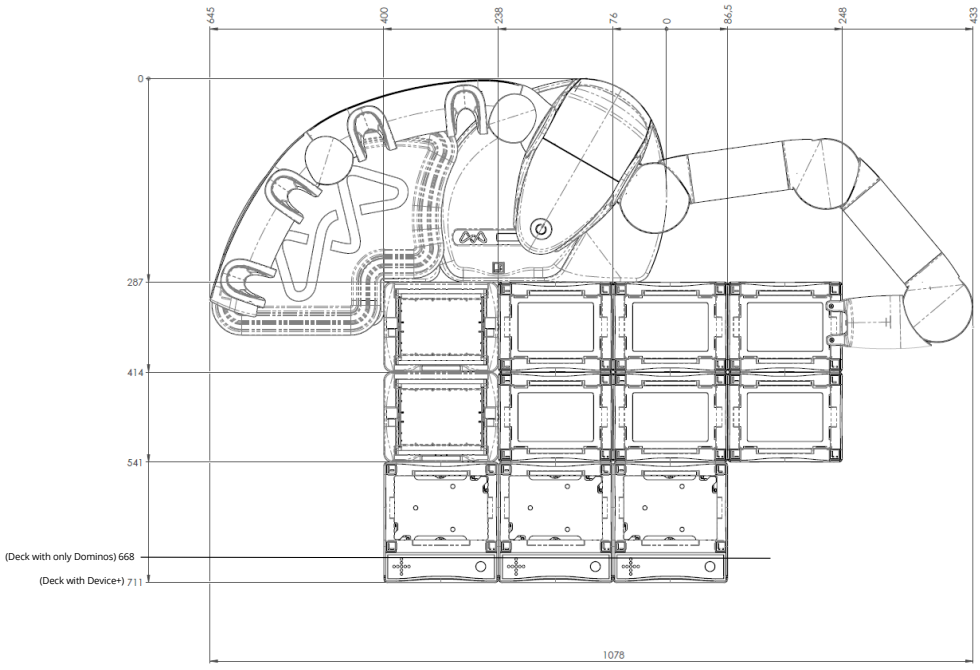
TECHNICAL SPECIFICATION	DEFINITION
Warranty	1 year
Power requirement	Voltage range 90~264 VAC, AC current 1.85A/115VAC, 1.0A/230VAC, Frequency 47~63Hz, inrush current (max) 120A/230VAC
Electrical configuration	Andrew+ should be connected exclusively with the power supply GSM220B24-R7B, in Asia, and GSM160B24-R7B, in ROW, and electrical cable supplied with the instrument
Interfaces	• Wi-fi (2.4 GHz / 5 GHz) • Ethernet connection (1Gigabit)
Operating temperature	4°C-37°C
Imaging system	Hand: • High resolution camera equipped with white LED light OLM: • High resolution camera equipped with low power white LED and class II red laser (wavelength = 650 nm)
Operating humidity	Maximum relative humidity 80% for temperatures up to 37° C.
Altitude	Up to 2000 m above mean sea level
Safe operating conditions for the system	• Fluctuation of the supply voltage up to 10% of the rated voltage • Transient overvoltage
Degree of protection	IP 20
Required personal computer characteristics	Tablet or computer equipped with Internet browser and network capability.
Dimensions	Dimension with both arms folded: 53.5 cm (H) x 43 cm (W) x 45.5 cm (L)
Weight	16 kg (only the robot)
Audio	Integrated audio system (nominal power = 1.5 W)
Additional external power interfaces	• Connection with docking station (1A @ 24 V) • 4 tool slots embedded in the tool stand (500mA @ 7.5 V)
Working space	Domino self-assembling configuration dynamically set-up on a conventional bench space, allowing operations on an arbitrary set of Domino from 1 up to 11 elements compatible with multi-channel pipette - according to available space and experiment requirements.

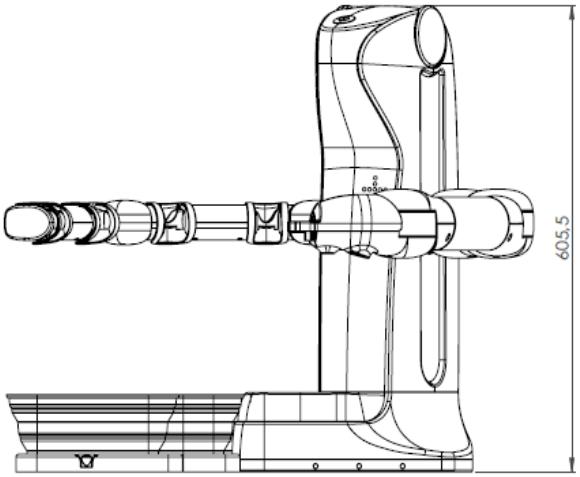
4. Working area of Andrew+

The required working area of Andrew+ depends on the complexity of the protocol. In fact, based on the number of consumables, one or more Dominos may be needed. The image below shows the maximum working area of Andrew+ when the system is used with 11 Dominos.

Andrew+ should have enough space to work!
Its work area should free of any obstacles; dimensions:

- Width: **1078 mm** / 42.52 in
- Depth:
  - Only with Dominos: **668 mm** / 26.3 in
  - With at least one Device+ on the edge: **711 mm** / 29 in
- Height: **606,5 mm** / 23.88 in





5. Unpacking Andrew+

5.1. Andrew+ is delivered fully assembled and requires no tools for the next steps.

Open the cardboard and remove the top foam-based protection.

To take out Andrew+ from its cardboard, put one of your hands on the base and the other hand on the top of the body, then lift up Andrew+.

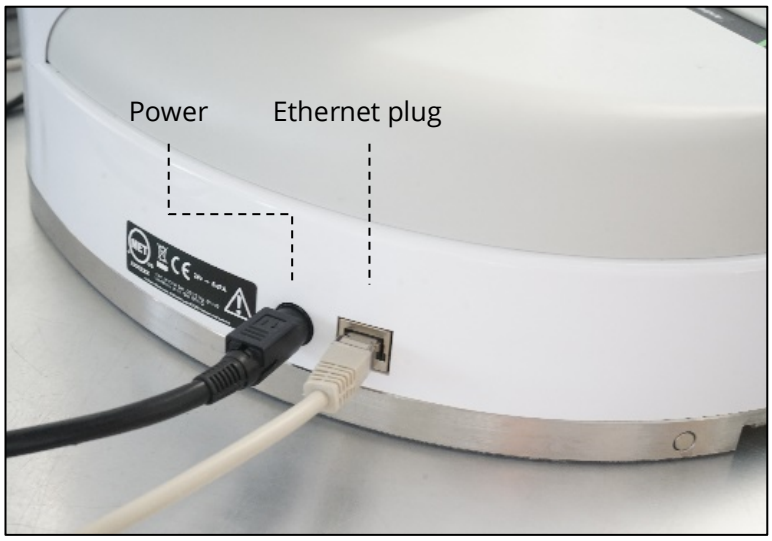
DO NOT grab Andrew+ from its arms, doing so will cause irreversible damage to the unit.

Install Andrew+ on a level and stable bench. The bench surface must be clean with acetone or ethanol before placing Andrew+.

Please check that the bench is level. This is required in order to guarantee the proper operation of Andrew+.

Open the left arm of Andrew+, afterwards open the right arm as well. Verify that the right arm is completely open. A magnetic connection should be automatically established between the two portions of the joints in the shoulder. The same should happen for the elbow.

Connect the power supply to Andrew+ using the power plug present in its base plate. Andrew+ can be connect wirelessly (via Wifi) but if an Ethernet connection is needed, connect the Ethernet cable provided by Andrew Alliance to Andrew+.



DO NOT use any other power supply except the one provided by Andrew Alliance.

Connect the power supply to one of the wall plugs present in your lab. At this point, Andrew+ turns on automatically and the booting procedure of the embedded PC is initiated.

6. Connect Andrew+ to OneLab

1. Verify that Andrew+ is connected to the power plug
2. Wait for the LED present on Andrew+'s body to turn blue and starts blinking
3. Connect your computer, tablet or smartphone to the Wi-fi of Andrew+
4. Go to you Wi-Fi settings and select the network with the name corresponding to the serial number of your Andrew+
5. The LED present on Andrew+ will stop blinking after a successful Wi-Fi connection.
6. Launch a web browser, type **http://192.168.2.1** and follow the on-screen steps to continue

If you don't have a Wi-Fi compatible device, please refer to our online help: http://help.andrewalliance.com

For any additional help, feel free to contact our support team (see *15.1. How to contact Andrew Alliance support team*)

7. Andrew+ tools

The capability to manipulate several tools enables different functionalities in Andrew+. The description of some of those tools is provided in this section

7.1. Single-channel and multi-channel electronic pipettes

Andrew+ is capable of manipulating Andrew Alliance electronic pipettes, both single-channel and 8-channel models.

The same pipettes can be used in manual mode or using Pipette+.

To allow Andrew+ to handle those pipettes, it is necessary to equip each Andrew Alliance electronic pipette with a **pipette adaptor**.

In particular, there are two types of pipette adaptor: one model for single-channel pipettes and one model for 8-channel pipettes

Pipette adaptor
for single-channel pipette

Pipette adaptor
for 8-channel pipette

DO NOT forget to equip each Andrew Alliance electronic pipette with a PIPETTE ADAPTOR before placing it into Andrew+'s tool stand.

DO NOT put pipettes other than Andrew Alliance branded electronic pipettes in the tool stand of Andrew+

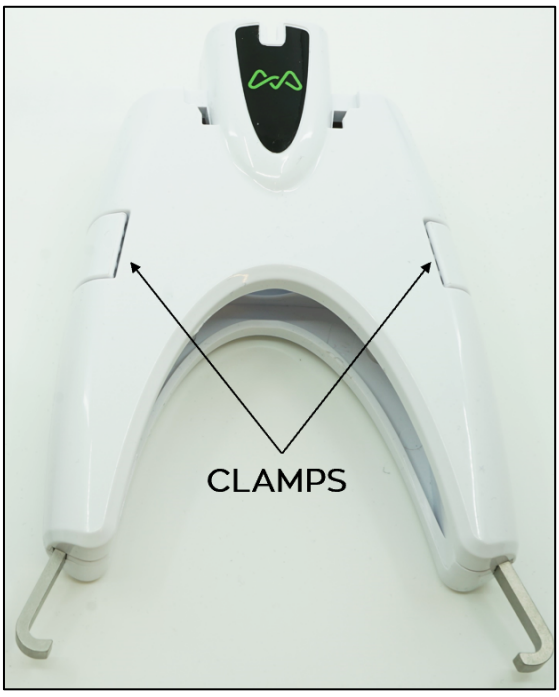
7.1.A. How to equip Andrew Alliance pipette with pipette adaptor

The installation of the pipette adaptor is very simple and is described in this section

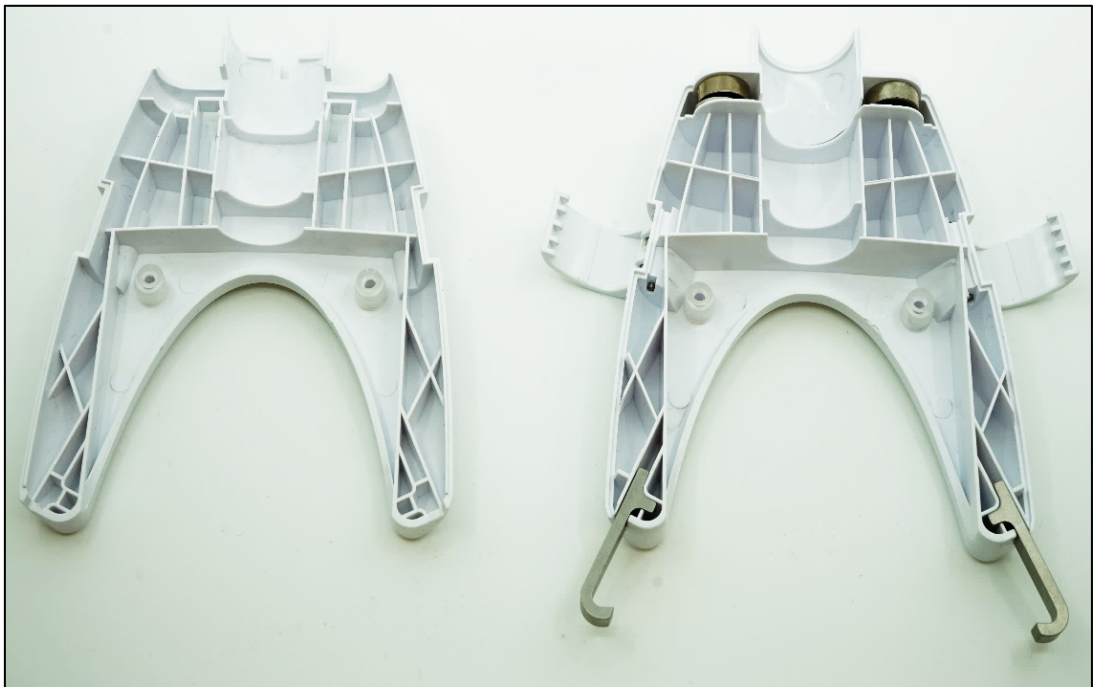
Select which pipette adaptor is required according to the type of pipette:

- 718.4001 for single-channel pipette
- 718.4101 for 8-channel pipette

Open the pipette adaptor using the two small clamps present on its side (highlighted by the two arrows in the image below)



Separate the two part of the pipette adaptor.



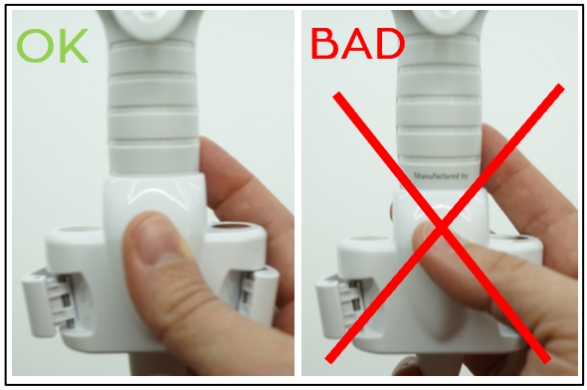
Position the pipette inside the pipette adaptor.

Once the pipette is correctly positioned, close the pipette adaptor.

Use the two clamps to secure the tightness of the pipette inside the pipette adaptor. Keep pressing the two parts of pipette adaptor with your hands, while closing the clamps.

Verify that the pipette adaptor is correctly installed.

Check the back of the pipette and verify that any marking is visible when the pipette adaptor is installed



7.1.B. How to install Andrew Alliance pipettes on Andrew+ tool stand

To equip Andrew+ with Andrew Alliance pipettes it is sufficient to place them in any available slot of the tool stand. It is not necessary to turn on the pipettes before placing them. The display of the pipette should be oriented toward the user as indicated in the picture on the right.

Please be sure that the metallic pins present on the side of the pipette are in contact with the metallic pins present in the slot of the tool stand.

7.2. Labware gripper

The Labware gripper is a compact Bluetooth controlled device which allows Andrew+ to manipulate labware.

It is composed of two main parts: the clamp, whose geometry and shape can be different according to the consumable shape, and the body, responsible for the communication with Andrew+ and the control of the actuator.

The Labware gripper does not require any pipette adaptor to be compatible with Andrew+ and it can be placed in any slot of the tool stand. It has two metallic pins on the side which allow the charging of the embedded battery and the serial communication with Andrew+.

7.3. Liquid level detector

The Liquid Level Detector (LLD) is a compact Bluetooth controlled device which allows Andrew+ to identify the location of liquid levels in consumables placed on its working deck by using ultrasonic waves. This process requires no contact with actual liquids, thus no risk of contamination and there is no need for conductive tips. It has the benefit of:

- Removing the need to manually enter the stock solution volumes during experiment preparation.
- Removing the possible user errors related to the previous point.
- Measures the position of the liquid level during the execution of an experiment (e.g. evaporation liquids).

The LLD does not require any pipette adaptor to be compatible with Andrew+ and it can be placed in any slot of the tool stand. It has two metallic pins on the side which allow the charging of the embedded battery and the serial communication with Andrew+.

8. Dominos

The conventional consumables required to execute experiments are arranged into a magnetic-based modular system called Dominos. By means of this system, Andrew+ can identify the type of consumable and their position in the working area. Each Domino can host one or more consumables according to its design.

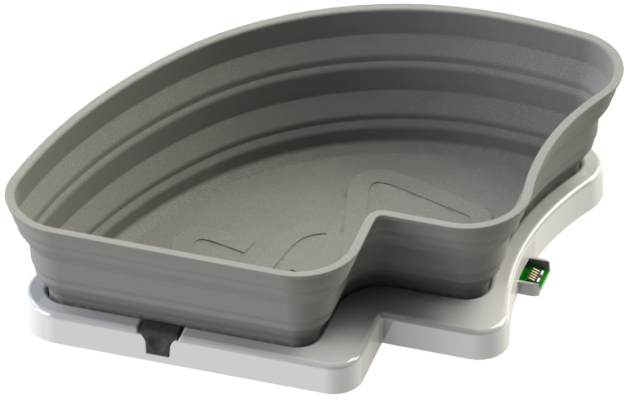
Each Domino is equipped with two or more markers optimized for its optical tri-dimensional location.

An additional label containing the name of the Domino and its unique serial number is present as well. Such information is also stored in two Datamatrix markers which are scanned by Andrew+ for traceability purposes.

For additional information about cooled Dominos, please download the Domino catalog on www.andrewalliance.com or contact Andrew Alliance.

8.1. Waste

The waste Domino is equipped with two electronic connectors: one side is connected to the base of Andrew+ and one connects to additional docking stations in case more than 4 tools are required during the execution of the experiment.



The waste Domino hosts a foldable silicone waste designed by Andrew Alliance, and capable of containing up to 900 pipette tips 1mL.

How to install the Waste Domino

- Facing Andrew+, place the Waste Domino on the left side of its body.
- Then simply slide the Waste Domino inside the base plate of Andrew+, verifying the alignment between the connectors present on the Waste DOMINO and inside the base plate

8.2. Tip box Domino

There are three types of tip box Dominos, according to the type of tips which can be hosted.

8.2.A. Tip box Domino based on TIS technology

The tip box Domino, based on patented TIS technology, can hosts racks of tips compatible with Andrew Alliance pipettes of up to 1250 µL. The TIS technology decreases the required force to carry out tip insertion and improve its accuracy and reproducibility.

8.2.B. Tip box DOMINO for 10mL tips and Tip box DOMINO for 5mL tips

These tip box Dominos are designed and optimized to host the high volume tip rack for 5mL and 10mL Andrew Alliance pipette.

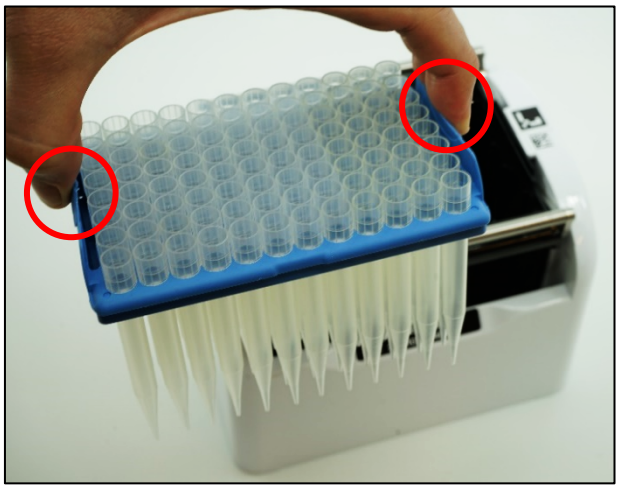
Tip rack holder 5mL Domino
for tip rack for 5mL Andrew Alliance pipette

Tip rack holder 10mL Domino
for tip rack for 10mL Andrew Alliance pipette

8.2.C. Installation of the tip rack

Select the right Domino according to the tip type. In particular

- 218.1201, in case of 10mL tips
- 218.1252, in case of 5mL tips
- 218.1101, for all the other tips
- Manipulate the tip rack using the two flaps present on the shortest edges of the tips rack



Place the tip rack inside the tip Domino, and apply a vertical pressure to ensure the correct insertion of the tip rack

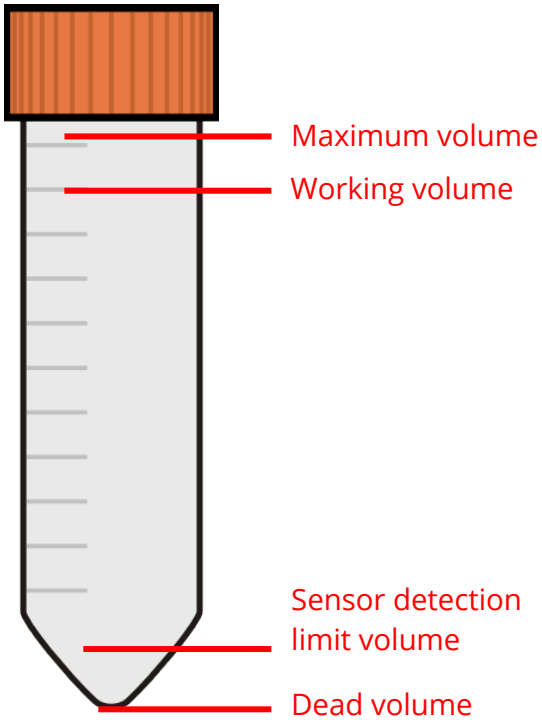
9. External tool docking station

In case of complex experiments which require more than 4 tools, it is possible to equip Andrew+ with an additional docking station capable of hosting up to 3 tools. The power and data connections with Andrew+ are established via an electronic connector placed in the Waste Domino. The connector of docking station must be placed on top of the one in the Waste Domino.

10. Liquid handling operations

10.1. Volumes in consumables

The following remarks about volume definitions are important regarding the selection of the most suitable consumable for your experiment and for the correct design of your protocol.



- **Maximum volume**
  It represents the maximum volume which the consumable can host
- **Working volume**
  It represents the suggested maximum volume to be used with this consumable
- **Sensor detection limit volume**
  It represents the minimum volume which Andrew+ can detect using LLD
- **Dead volume**
  It represents the amount of liquid which cannot be further aspirated by Andrew+

11. How to use Andrew+

Andrew+ executes experiments described in protocols designed with OneLab software. The same software is required to monitor the execution of such experiments. The communication between OneLab and embedded intelligence present in Andrew+ is achieved via ethernet or Wi-fi connection.

It is also possible to partially control Andrew+ using the push button present on the face of the robot. In particular, according to the duration of pressure applied to the button, the status of Andrew+ can be changed. The table below summarizes the various possibilities:

From status...	Action on the push-button	Action triggered by the push-button
An experiment is Running		The machine is put in **Pause**
An experiment is Paused		The machine is put in **Resume**
The installation mode (hotspot) is OFF	 5 times	The installation mode is **turned ON**
1. The installation mode (hotspot) is ON 2. The machine status is not In Error/Standby/Booting	 5 times	The installation mode is turned is **turned OFF**
Any experiment status	 press for 20s	1. The PC is **shut down softly** ; The plus LEDs can be blinking. 2. The machine is put in **Standby** status after 15 seconds
Any experiment status	 press for 30s (Emergency exit)	The machine is put in **Standby** status
The machine is in Idle state	 press for 5s	The machine is put in **Standby** status. The embedded PC is **turned OFF**, so the unit is not more accessible via OneLab
The machine is in Standby status		The machine is **turned ON** and it is put in **Booting** status.

The “Plus” LED present on the body on Andrew+ indicates the different status of the experiment and of the instrument. The table below summarizes the different status and the visual and sound notifications associated

STATUS OF THE INSTRUMENT	DESCRIPTION	LED	SOUND
Booting	Andrew+ is booting (after turning it ON)	White	-
Idle	1. Andrew+ has booted and is waiting for any operation to be made. 2. An experiment has ended, and is waiting for any operation to be made	Green heart beat	1. Device ready 2. Experiment end
Workbench validation	Andrew+ is checking the Dominos in its workbench. It is composed of different steps.	Green fast heart beat	Different sounds depending on the step
Start	An experiment is starting	Green fast heart beat	Experiment start
Running	An experiment is running	Green fast heart beat	-
Pause	An experiment is paused	Orange blinking	-
Resume	An experiment is resumed	Green	-
Waiting for user action	Andrew+ is waiting for an action from the user	Orange	Waiting for user action
Abort	An experiment is aborted	Red	-
Communication lost	Andrew+ cannot communicate with OneLab because of network issues or lost of Internet connection	Orange blinking	-

Error	An error is triggered by any of the below cases: • Validation of the workbench failed • An error during the experiment • A collision happened during a movement • Any operation in the experiment, preparation, start could not be run	Red	Error notification
Error	Dead PC. Communication with the PC is not possible	Red horizontal line	Error notification
Standby	PC, Waste Domino and Arm are powered down Tool stand is powered	-	-
Locate me	Andrew+ is indicating its position via sound and visual notification This action is triggered through the device page in OneLab, action “Locate me”	Violet blinking	Locate me

12. Maintenance

12.1. General information

Andrew+ does not require periodic maintenance, if used properly and in a clean environment. Nevertheless, it is possible to carry out periodic checks and very simple actions to guarantee the best status and results of Andrew+.

12.1.A. Recommended maintenance if Andrew+ is moved

If Andrew+ is moved, we strongly suggest cleaning the silicone mat on the bottom of the baseplate using acetone. By doing so, the required gripping between Andrew+ and the bench is guaranteed. The bench to which Andrew+ will be moved must be cleaned as well.

12.2. Compatible solvents with Andrew+

To clean all the parts of Andrew+, the compatibility with the following solvents have been tested:

- Isopropanol alcohol
- Ethanol
- Acetone
- 2% bleach solution

Use of soft tissue to clean all the Andrew+ parts to avoid possible scratches on their surfaces

DO NOT clean the electronical connectors present in the tool stand, waste DOMINO and base plate

13. Unit end of life

When a unit reaches the end of its useful life, contact Andrew Alliance for directions and information on the end-of-life policy.

This is in accordance with the European Union Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)

14. Certification

a) Electrical safety
   i) IEC61010 Issued: 2010/06/10 Ed:3 + IEC61010-2-081 Issued: 2015/01
   ii) UL61010 Issued: 2004/07/12 Ed:2 Rev:208/10/28
   iii) CAN/CSA C22.2#61010-1 Issued:2004/07/12 Ed:2 (R2009)
b) EMC
   i) CENELEC EN 61326-1 Issued :2006/05/01
   ii) ETSI EN 301 489-17
c) RADIO
   ETSI EN 300 328, V1.9.1
d) EMF
   EN 62479:2010

e) FCC
   i) FCC 47 CFR 15B cl A Issued: 2011/04/21
   ii) FCC 47 CFR Part 18
   This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of these equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
   Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.
   iii) This Class A digital apparatus complies with Canadian ICES- 003
f) RoHS 2 2011/65/EU

15. Contacts

15.1. How to contact Andrew Alliance support team

Chat with support directly in OneLab software

Send us an email to
support@andrewalliance.com

We will reply within 1 business day

Call us
+41 22 518 0357

Mon-Fri: 8:00 – 17:00 CET

15.2. Andrew Alliance contacts/locations

Andrew Alliance S.A. (Headquarters)	**Andrew Alliance US**	**Andrew Alliance France**
Chemin Grenet 21 1214 Vernier (Genève) Switzerland	135 Beaver St, Suite 402 Waltham, MA 02452 USA	10 rue Boyer Barret, 75014 Paris France
Tel: +41 22 518 0357	Tel: +1-781-761-0119	Tel: +33 9 70 73 80 99