

Manual

# piCOBOT<sup>®</sup>

Universal Robots ActiNav Bin Picking

Air driven ejector unit for vacuum gripper





This manual is available in the following languages at [piab.com](http://piab.com):



Chinese



English



French



German



Italian



Japanese



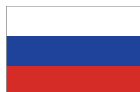
Korean



Polish



Portuguese (Brazil)



Russian



Spanish



Swedish

# Contents

<b>1. Introduction to the manual</b> . . . . .	<b>4</b>
1.1 About the manual . . . . .	4
1.2 Safety signs used in the manual . . . . .	4
1.3 Target group . . . . .	4
1.4 Values specified in manual . . . . .	4
<b>2. Safety</b> . . . . .	<b>5</b>
2.1 Disclaimer . . . . .	5
2.2 General safety . . . . .	5
2.3 Safe usage . . . . .	5
2.4 Risk assessment . . . . .	6
2.5 Intended use . . . . .	7
2.6 Misuse . . . . .	7
<b>3. Introduction to piCOBOT® UR ActiNav</b> . . . . .	<b>9</b>
3.1 Manufacturer . . . . .	9
3.2 Compliance . . . . .	9
3.3 Features . . . . .	9
3.4 Overview . . . . .	11
<b>4. Installation</b> . . . . .	<b>12</b>
4.1 What's in the box . . . . .	12
4.2 Pneumatic installation . . . . .	12
4.3 Pump technical information . . . . .	12
4.4 Compressed air quality . . . . .	12
4.5 Pneumatic diagram . . . . .	12
4.6 piCOBOT installation . . . . .	12
4.7 ActiNav pneumatic hose management	13
4.8 URcap installation . . . . .	14
<b>5. Technical data</b> . . . . .	<b>18</b>
5.1 Installation . . . . .	18
5.2 Environmental properties . . . . .	18
5.3 Operations . . . . .	18
5.4 Electrical input/output . . . . .	19
5.5 Vacuum flow . . . . .	19
5.6 Evacuation time . . . . .	19
<b>6. Dimensions</b> . . . . .	<b>20</b>
<b>7. Operation</b> . . . . .	<b>21</b>
7.1 Interface . . . . .	21
7.2 Blow-Off flow . . . . .	22
7.3 Menu overview . . . . .	23
7.4 Menu settings . . . . .	24
<b>8. Function</b> . . . . .	<b>27</b>
8.1 Parametrization and configuration . . . . .	27
8.2 Supervision . . . . .	29
<b>9. Maintenance</b> . . . . .	<b>31</b>
9.1 Preventive maintenance . . . . .	31
9.2 Spare parts . . . . .	32
9.3 Accessories . . . . .	32
9.4 Replacement of piCOBOT® filter . . . . .	33
9.5 Dismounting of chip . . . . .	33
<b>10. Troubleshooting</b> . . . . .	<b>34</b>
10.1 Mechanical troubleshooting . . . . .	34
10.2 URcap troubleshooting . . . . .	34
<b>11. Warranties</b> . . . . .	<b>35</b>
<b>12. Recycling and disposal</b> . . . . .	<b>35</b>

# 1. Introduction to the manual

## 1.1 About the manual

- The responsible party for the production site must ensure that this manual will be read and understood.
- The section on safety should be studied extra carefully.
- The manual should be stored on a known and easily accessible place, which can be digital.
- Carefully study the applicable parts of the manual before performing service and maintenance of the equipment.

## 1.2 Safety signs used in the manual

Take note of all warning, mandatory and other signs in this manual. They have the following meaning:

### 1.2.1 Warning signs



**Warning!**  
Failure to follow the instructions may result in death or serious injury!



**Warning!**  
Vacuum force



**Warning!**  
Exhaust



**Warning!**  
Unrestricted exhaust



**Warning!**  
Risk of crushing or entrapment of upper limbs

### 1.2.2 Mandatory signs



**Note!**  
Information that needs extra attention!



**Wear eye protection**



**Wear ear protection**

## 1.3 Target group

This manual, especially the section about safety, shall be read by all staff who will perform any type of work with the product or equipment:

- Operating personnel
- Service and maintenance personnel
- Cleaning staff (cleaning of equipment and the area around it)

## 1.4 Values specified in manual

The values specified in this manual were tested at:

- Room temperature (20°C [68°F] ± 3 °C [5.5°F]).
- Standard atmosphere (101,3 kPa [29.9 inHg] ± 1,0 kPa [0.3 inHg]).
- Relative humidity, 20-70%.

## 2. Safety

### 2.1 Disclaimer

Piab AB is not responsible for installation and operation of piCOBOT® on a robot system. The required steps must be undertaken in supervision and approval by authorized system integrators.

Piab AB is not responsible for safety of a complete robot system with piCOBOT® installed. The required steps must be undertaken in supervision and approval by authorized system integrators.

The product is intended to be incorporated into machinery or to be assembled with other machinery to constitute machinery covered by Directive 2006/42/EC, as amended. It is not allowed to put the machinery into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provision of Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the machinery referred to in this declaration.

### 2.2 General safety

The ejector unit described in this manual is designed for implementation in industrial systems and therefore it must not be used with the conditions other than those specified.

The correct use of the pneumatic equipment within a system is the responsibility of the system designer or person responsible for the technical specifications.

The machine owner will certify the final commissioning according to the regulations in force for each individual country.

The use of safety guards is recommended to minimize the risk of injury to persons. Pay close attention to the fact that compressed air may lead to *explosion* of closed containers, and vacuum may lead to the *implosion* of closed containers.

Consider the possibility of pressure drops in the pneumatic supply line. Provide for a safety system that prevents the risk of load being released, in order to prevent personnel injury or machine damages.

Consider the possibility of interrupted electrical or pneumatic supply, to protect persons and systems.

Consider the emergency stop when designing the system.



#### Warning!

Close the supplies of air and electrical power when leaving equipment for an extended time without running the ejector.



#### Warning!

Vacuum force



#### Warning!

Exhaust.  
The discharge air has a high output speed. Do not obstruct the discharge.



#### Warning!

Unrestricted exhaust.

### 2.3 Safe usage

It is up to the manufacturer of machinery to assess and convey the Personal Protective Equipment (PPE) needed by the operators or other personnel accessing to the work area.



#### Wear ear protection

Wear ear protection when working closer than 2-3 meters from the vacuum ejector in operation..



#### Wear eye protection

The piCOBOT® including its associated attachments (Adjustable Gripper and/or suction cup) have been inherently designed to minimize the consequences of an impact with human body when operated in a collaborative environment (limited power, force, speed and acceleration). However, due to the versatility of piCOBOT® in different customer applications, a system integrator must perform a safety assessment before operation of piCOBOT® is authorized.

The system integrators are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that any significant hazards in the complete robot application is eliminated. This includes, but is not limited to:

- Performing a risk assessment for the complete robot system
- Interfacing other machines and additional safety devices if defined by the risk assessment
- Setting up the appropriate safety settings in the robot software
- Ensuring that the user will not modify any safety measures
- Validating that the total robot system is designed and installed correctly
- Specifying instructions for use
- Marking the robot installation with relevant signs and contact information of the integrator
- Collecting all documentation in a technical file; including the risk assessment and this Manual.

### 2.3.1 Assembly

Compressed air may be dangerous if used by unskilled personnel. Assembling, using and maintaining systems should solely be carried out by experienced and specially trained personnel.

Prior to assembly and disassembly of the components, cut off voltage and pressure. Install and maintain the components only after thoroughly reading and understanding this manual.

### 2.3.2 Starting and operating

The final evaluation of the safety systems to be applied for starting up the product, after the assembly, is the task of the final manufacturer of machinery. In addition, the same manufacturer will certify the final commissioning according to the regulations in force for each individual country.

### 2.3.3 Maintenance

Maintenance must be carried out in accordance with the instructions in this manual. Prior to any maintenance work, check the conditions to prevent the sudden release of pieces, then suspend pneumatic/electrical supply, and discharge residual pressure.

### 2.3.4 Safety instructions



**Warning!**

Do not install or operate your product if it is damaged during transport, handling or use. Damage may result in bursting and cause injury or property damage.



**Warning!**

A damaged product can potentially emit hazardous materials and substances.



**Warning!**

If the product is used for evacuating solid content, ensure that a filter is used for preventing ejected objects.



**Warning!**

If foreign matters should enter the exhaust port, there is a risk of ejected objects and damage of the product.



**Warning!**

To avoid product damage and application failure, do not restrict or block the exhaust.



**Warning!**

Ensure that the vacuum and exhaust ports are not simultaneously blocked when the unit is generating vacuum. This is to avoid ejected objects and damage of the product, and application failure.



**Warning!**

Vacuum and exhaust air can cause severe injuries, keep hands, legs, hair and eyes away from vacuum inlets and exhausts.



**Warning!**

To avoid personal injury, equipment damage and application failure, ensure that the compressed air line is properly secured.

Handle the components with care.

During installation and maintenance, cut off voltage and pressure.

Follow the installation and commissioning instructions.

Modifying the components is prohibited. Handle the components with care.

Cleaning the environment and place of use is recommended.

## 2.4 Risk assessment

The system integrator must perform a risk assessment on the complete robot application. The piCOBOT® is only a component in a robot application thus the safe use of the piCOBOT® relies on the integrator's ability to design a safe robot application.

The piCOBOT® is designed with features especially suitable for collaborative applications:

- Compact design to minimize the volume envelope occupied by the end effector in limited working spaces.
- Low weight to reduce the impact inertia.
- Large surface area-to-volume ratio, to reduce the impact inertia (pressure).
- Securing the arms of the Adjustable Gripper defines a limited maximum load that they can cope with before they are displaced in case of an uncontrolled impact.
- Instantaneous reaction to E-stops with maintained vacuum function preventing loss of payload.
- Low TCP reduces the force exerted on the robot joints during motion.
- Rounded edges.
- Fool-proof installation of the pump unit to the robot interface.
- Sufficient number of fasteners for all attachment interfaces to ensure mechanical integrity.
- Captive attachment fasteners with round screw heads.
- Swiveling air supply connection to avoid entanglement of the air hose.
- Integrated LED lights in the ejector unit for indicating different operational states in different colors that allows for corrective actions being taken, away from the hazardous area.
- Exhaust air outlet direction designed to minimize risk for blowing into the eyes of operator.
- Constrained air hose by straps to avoid entanglement with other objects and/or robot body.

## 2.5 Intended use

- The product shall be used to evacuate air (non liquids) from a volume to create vacuum for gripping, holding and processes.
- For professional use only.

The piCOBOT® is an end-of-arm tooling on collaborative robots with payloads up to 7 kg [15.5 lbs]. The typical applications for piCOBOT® are:

- Industrial
- Pick-and-place
- Top loading
- Palletizing

- Machine tending
- Bin picking
- Order fulfillment
- Assembly.

## 2.6 Misuse

- The product shall not be used to evacuate liquids.
- The product shall not be used to evacuate solid content without the use of filter.
- The product shall not be used in a fully closed compartment (non ventilated) if not exhaust is piped away.
- The product shall not be used as standalone safety system to fulfill international lifting norms.
- The exhaust shall not be restricted or blocked.
- The vacuum and exhaust port shall not simultaneously be blocked when unit is generating vacuum.
- Do not install or operate the piCOBOT® if damaged.
- Do not operate the piCOBOT® if compressed air line is not properly secured, loose compressed air lines can cause severe injuries. Using compressed air pressure and/or electrical voltage outside specification can cause severe damage due to performance loss.
- Blow-Off functions or ejector exhaust shall not be used to pressurize sealed compartments such as cylinders and/or tank-volumes.

The piCOBOT® is only cleared for operation under conditions noted in this manual and the piCOBOT® datasheet.

- Any use or application deviating from intended use is deemed to be impermissible misuse. This includes, but is not limited to:
- Use outside the permissible operational conditions and specifications for piCOBOT®.
- Use before performing a risk assessment.
- Use in industrial robot applications (without limited force, power and speed).
- Use in collaborative but dusty environments or environments with risk for moulding splatter, without wearing protective glasses.
- Use in direct contact with water spray or excessive amount of water.
- Use in submerged applications/ environments.
- Use in potentially explosive atmospheres.

- Use in welding applications.
- Use in life critical applications.
- Use close to a human's head, face and eye area.
- Use as a climbing aid.
- Use as a lifting device by the ejector module mechanically (or any other way than use of suction cups).



## 3. Introduction to piCOBOT® UR ActiNav

### 3.1 Manufacturer

Piab AB  
P.O. Box 4501  
SE-18304 TÄBY  
SWEDEN



#### 3.1.1 Identification data

Each system is identified by a label with identification information, which is attached to the product.

For any communication with Piab AB or service centers always refer to the label information.

### 3.2 Compliance

piCOBOT® has been tested according to the following certifications:

- EN 61000-6-3 / EN 61000-6-4 Electromagnetic Compatibility - Emission
- EN 61000-6-1 / EN 61000-6-2 4 Electromagnetic Compatibility - Immunity
- EN ISO 9409-1 Industrial robots – mechanical interfaces
- ISO 9409-1:2004 [Type 50-4-M6].

piCOBOT® has been designed with the following standards in considerations:

- ISO DTR20218-1, Standard for robot end-effectors under development
- ISO/TS 15066 (Draft), Robots and robotic devices – Safety requirements for industrial robots – Collaborative operation.



#### Note!

If the product will be integrated and installed in another main system, a risk analysis needs to be carried out for the system as a whole.

All components of the product are free from silicone.

#### European Directives, CE

Directive	Standard detail and/or measurement reference
Electromagnetic Compatibility (EMC)	EN/(IEC) 61000-6-2:2005 EN/(IEC) 61000-64:2007+A1
RoHS2 Directive (2011/65/EU)	Compliant



#### UK Legislation, UKCA

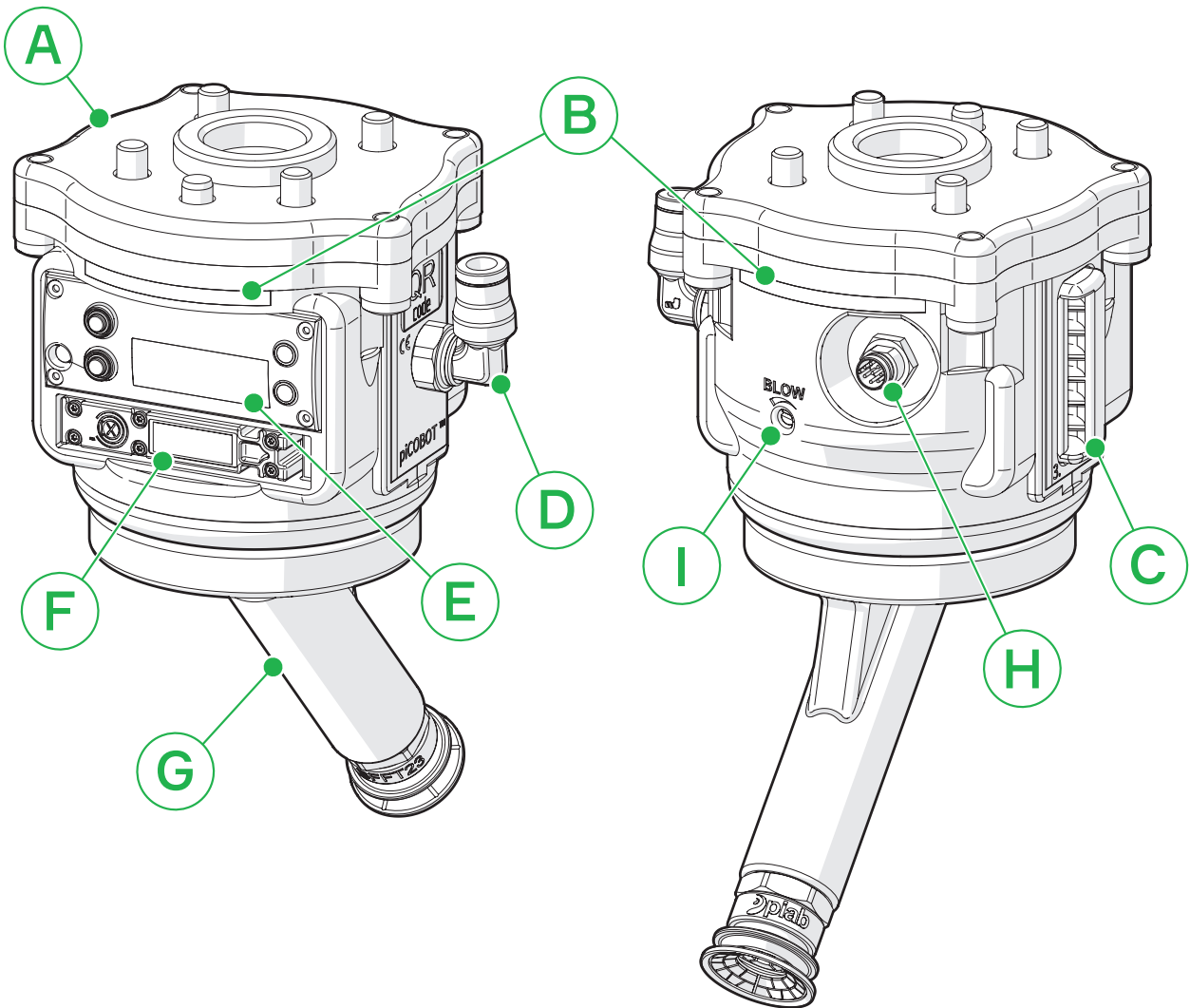
UK Legislation	Harmonised Standard and/or measurement reference
Electromagnetic Compatibility (EMC)	BS EN/(IEC) 61000-6-2:2005 BS EN/(IEC) 61000-6-4:2007+A1
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	Compliant

### 3.3 Features

- Mechanical and electrical interfaces.
- Flexible setting options to perfectly match application needs.
- Vacuum ejector based on COAX® technology with integrated controls.
- Optimized design for high reliability.
- Light weight and low build height.
- ATBO-Blow-Off is activated automatically after every vacuum cycle, and has an adjustable timer.

- Valves with Adaptive Pulse Width Modulation (A-PWM).
- Extra valve protection with Automatic Condition Monitoring (ACM) function that detects if the object being handled is leaking or non-leaking, triggering the use of Energy Saving (ES) or not.
- Integrated air/Energy-Saving (ES) function that automatically sets its own energy level and hysteresis in every cycle with the Automatic Level Determination (ALD) function. Energy usage can be reduced up to 90–95%.

### 3.4 Overview



Position	Description	Note
A	Adapter plate	Adapter plate for robot
B	LED indicator	See chapter Operation
C	Outlet	Exhaust air
D	Feed pressure inlet	Push-in style, 6 mm
E	OLED display and select buttons	See chapter Interface
F	piCHIP10x	Ejector unit
G	Vacuum port	G1/8" Female
H	Electrical connection	M8 8pin Male
I	Blow-Off screw	Adjustable Blow-Off flow

## 4. Installation

### 4.1 What's in the box

- piCOBOT®
- Cable M8 8pin female to M8 pin female
- Air tubing (outer diameter 6 mm, length 3 m)
- Velcro band x 3
- USB flash drive with URCap software
- Suction cups x 4 (BFFT23, B20XP, B20T81 and BX10).
- ActiNav Gripper
- Torx keys (T25 and T30)
- Spiral tube (length 1.77 m, outer diameter 6 mm)
- Spiral tube strap with straight tube connector (6 mm) x 2
- PTFE tape roll
- Manual.



#### Attention!

Before using the product, read the safety instructions to ensure a safe product operation.

### 4.2 Pneumatic installation

piCOBOT® can be installed in any orientation. Ensure that the exhaust from the ejector is not blocked. When connecting oil free compressed air and vacuum hoses to the unit, it is important to choose proper pipe dimensions, if using other hose than included, to prevent pressure drop. Avoid restrictive inner diameters, long piping distances, sharp bends, and small sized connections.

### 4.3 Pump technical information

Description	Unit	COAX®
Feed pressure, max.	MPa [psi]	0.7 [101.5]
Feed pressure, optimum	MPa [psi]	0.46 [66.7]

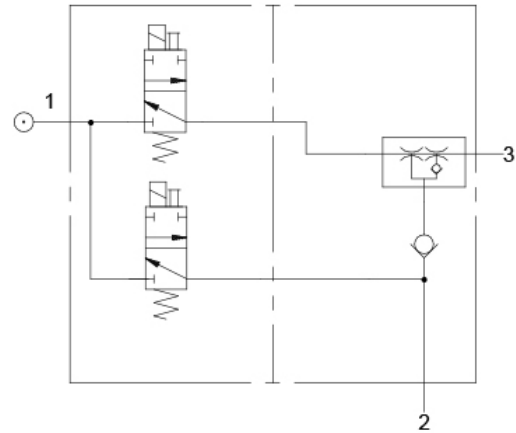
For further technical information please see the configurable datasheets.

### 4.4 Compressed air quality

Quality of the compressed air shall fulfill the requirements in DIN ISO 8573-1 class 4.

### 4.5 Pneumatic diagram

Vacuum NC and Blow-Off NC, with non-return valve.



- ① Compressed air
- ② Vacuum
- ③ Exhaust

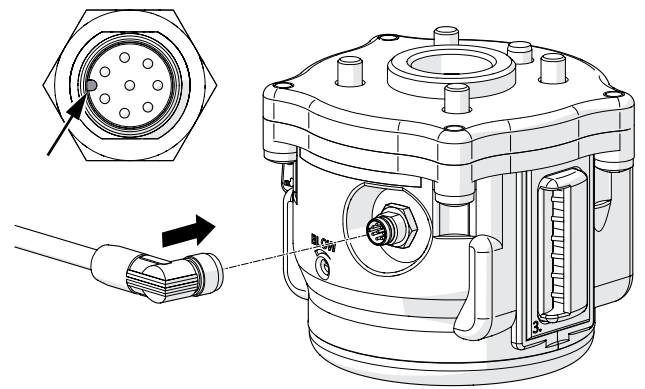
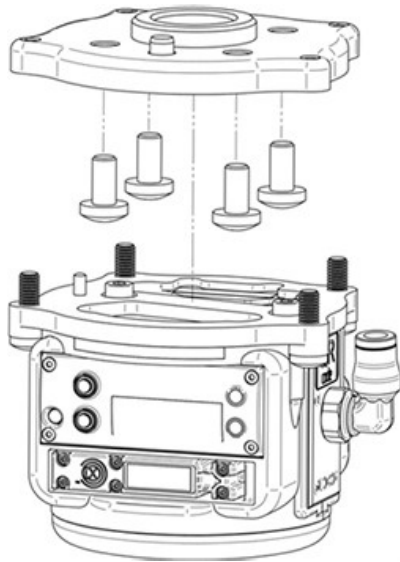


#### Warning!

Do not install or operate your piCOBOT® if damaged during transport, handling, or use. A damaged product may result in bursting and cause injury or property damage.

### 4.6 piCOBOT installation

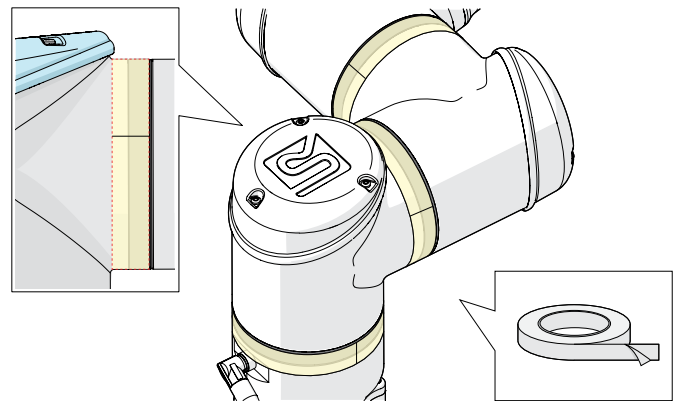
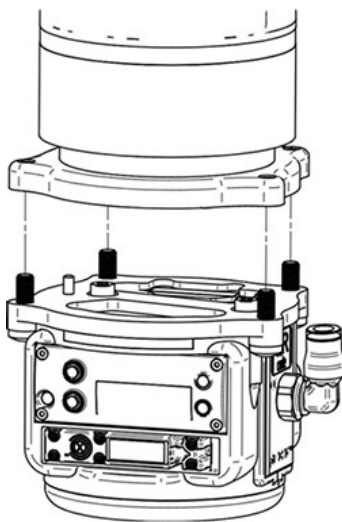
1. Unpack the box with the piCOBOT®, air hose, cable, suction cups and manual.
2. Unscrew the four captive Torx T25 screws to release the adapter plate.
3. Attach the adapter plate to your robot with four Torx T30 screws.



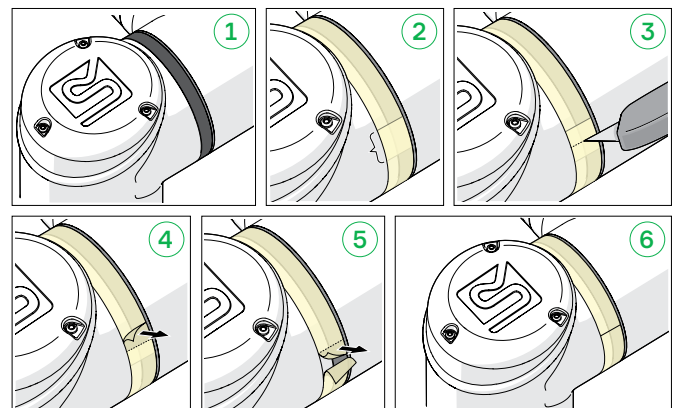
4. Mount the ActiNav Gripper to the piCOBOT®, see the figures in 3.4 Overview for the correct direction of the ActiNav Gripper.
5. Fasten the piCOBOT® to the adapter plate using the four captive Torx T25 screws.

### 4.7 ActiNav pneumatic hose management

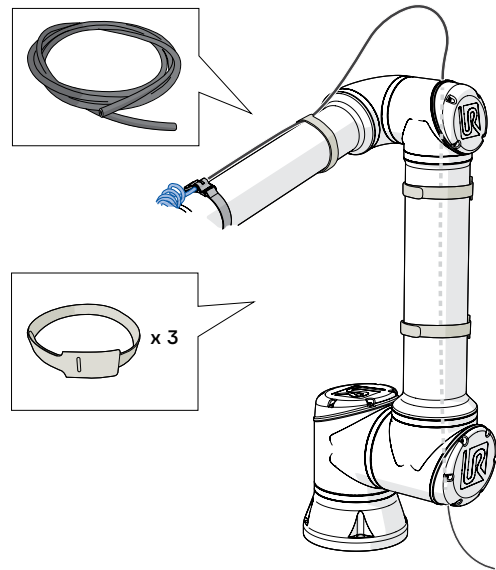
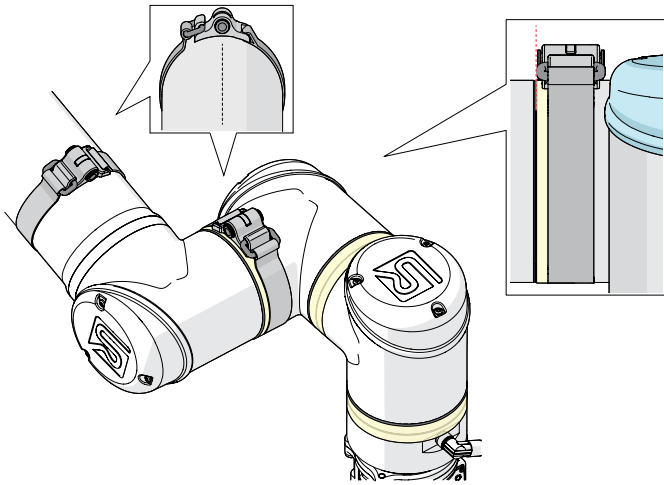
The rubber rings on the first, second and third wrist joints of the robot must be covered with PTFE tape (1) to prevent them from causing wear when rubbing against the air tubing. Attach the tape strips against the shiny edge of the rotational joints, do not put tape across the joints. Cut the tape strip edges so the two ends meet each other with no overlap. If there is overlap (2), cut through both layers of tape (3), remove the excess from the upper tape layer, flip the upper tape end back a little (4) and remove the lower tape layer excess (5). Push the two tape ends together precisely so that they join with no overlap (6).



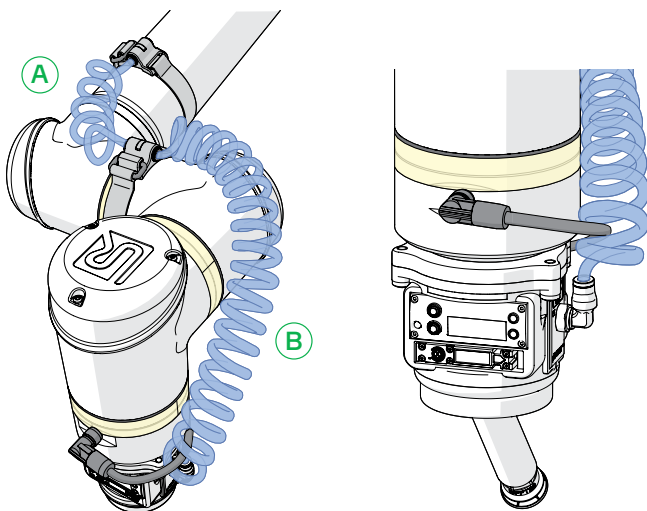
6. Mount the spiral tube on the robot arm, see detailed instructions in the section ActiNav pneumatic hose management.
7. Connect the air tubing to an air supply with compressed air and to the piCOBOT®.
8. Mount the electrical cable on the piCOBOT® and to the robot, note the guide notches for the right direction.



Attach the two spiral tube straps with straight tube connectors to the robot arm. Make sure that the straight tube connectors do not extend over any rotational joints of the robot.



Attach the spiral tube from the EOAT to the straight tube connector on the third wrist of the robot. Make sure the tube is properly inserted into the straight tube connector.



Cut the spiral tube leaving 4 to 5 loops (A) between the two straight tube connectors. Connect the new tube end to the straight tube connector on the second wrist of the robot.

Cut the spiral tube on the other tube end leaving 18 to 20 loops (B), depending on if the robot model is UR5 or UR10, between the EOAT and the straight tube connector. Connect the tube end to the straight tube connector on the second wrist of the robot.

Connect the air tubing to the straight tube connector on the third wrist of the robot. Attach the air tubing to the robot arm with the three Velcro bands. When tightening the Velcro band around the air tubing and robot arm, leave enough tube slack for a service loop that bridges the robot elbow.

## 4.8 URCap installation

The Piab URCap (referred to as URCap) shall be installed after the complete installation of piCOBOT® or KCS components onto the Robot. The URCap works with the CB3 and e-series UR-robots. The software needs to be version 3.6 or higher to be able to install (version 5 is shown in this manual).

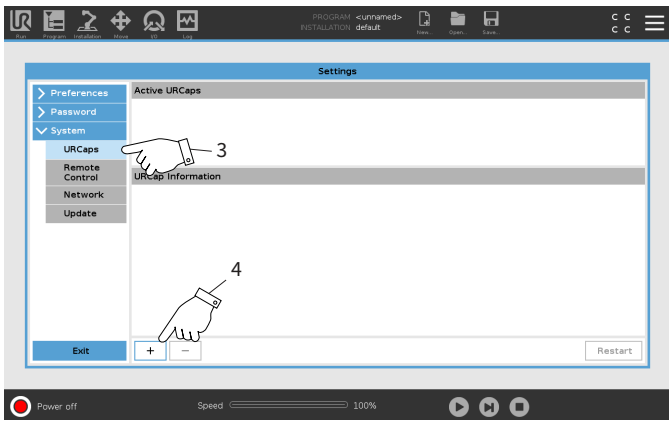
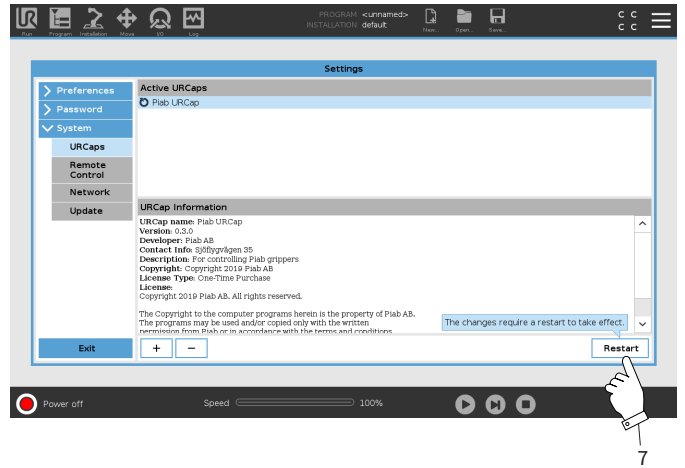
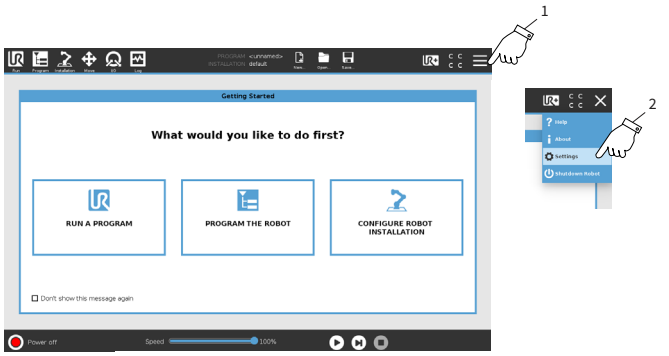
- Make sure that any previous existing URCap that uses the tool connector is disabled or uninstalled.
- Insert the provided USB-dongle into the Teach Pendant.
- Note that the latest version of URCap is available for download at [piab.com](http://piab.com)

**Note that the Installation of URCaps is according to the instructions provided by Universal Robots (UR).**

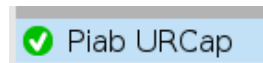
To install the URCap follow the steps below:

1. Press  $\equiv$
2. Select "Settings"
3. Select "URCap" below the System tab
4. Press + (plus)
5. Select Piab URCap
6. Press "Open"
7. Press "Restart"

After a complete Restart, the URCap program is now loaded.



After the restart it will show a green checkmark by the Piab URCap.

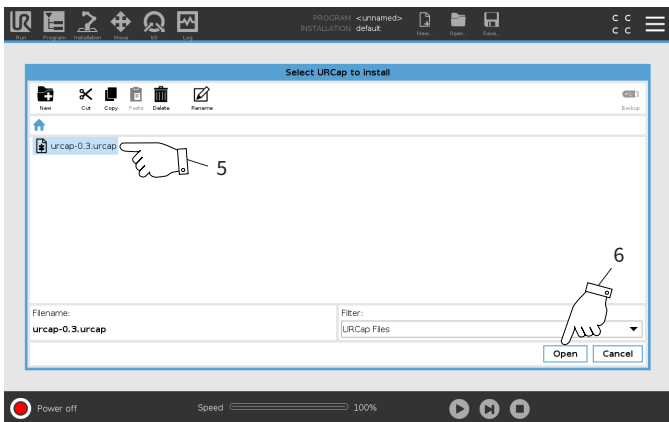


After a complete restart, under the Installation tab, the word Piab will appear. At this stage the URCap is now loaded.

The next step is to initialize your Piab product and start to program it.

### 4.8.1 URCap start up

When the URCap is installed, you need to set up your Piab product. Go to installation, URCaps and to Piab, shown in the drop-down list. Here you can set up your product to match your own to get the right Tool Center Point, TCP.



The TCP will be calculated of the options you chose of product, gripper, and cup/foam. You can add extra height to your TCP, the value will be added to the calculated TCP. If you for example have a suction cup extension, you can add the length of it and get a new TCP.

When you see the Piab URCap below Active URCaps, press restart.

You must set the calculated payload in the general tab. More info on how is given later in this chapter. The initialize tool option makes the tool turn on when the cobot starts up. If the initialize tool option is not selected, you must start it from the I/O tab. The picture will reflect the product when changing values.

**It is important that you make your choices in order from top to bottom.**

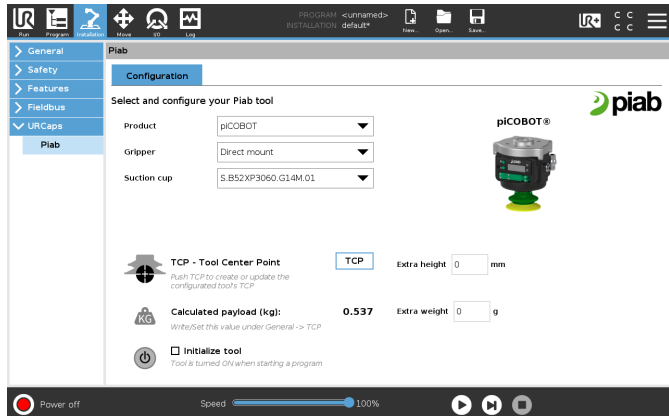
The first dropdown you choose which product you have, piCOBOT® or KCS gripper. Then the rest of the options will depend on that option.

Configuration

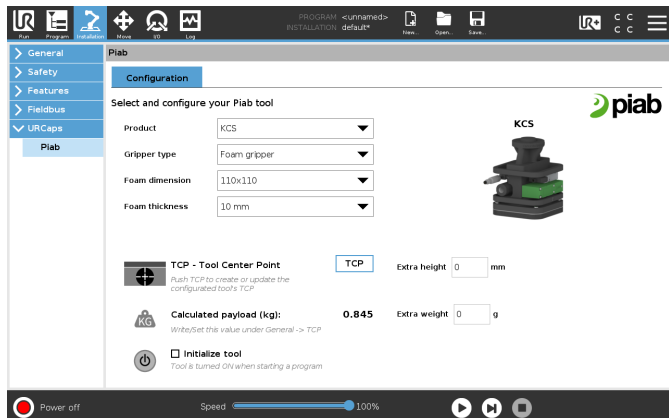
Select and configure your Piab tool

Product	piCOBOT
Gripper	piCOBOT KCS
Suction cup	S.B52XP3060.G14M.01

The piCOBOT® options are Adjustable gripper, ActiNav gripper or Direct mount and then which suction cup.

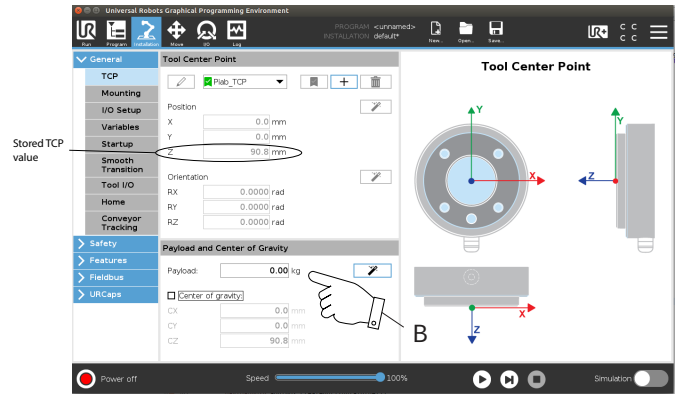
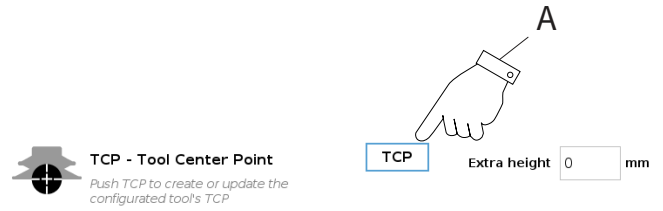


For the KCS, the options are Foam or Bag gripper and then the dimensions of the foam.



When you have configured you piCOBOT® or KCS above, press the TCP button to calculate it automatically.

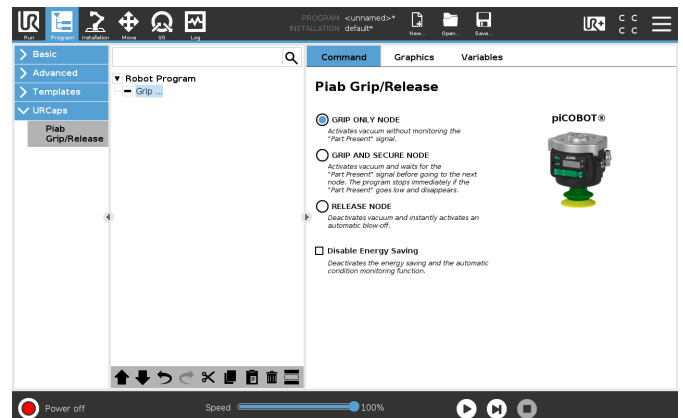
1. When you press the button, a text "TCP stored" will show up.
2. You must write and set the payload value in the General tab. Below TCP you will find the Payload field.



When programming the robot, there are different buttons for the piCOBOT® and KCS that will grip or release.

For the piCOBOT®, you can GRIP, GRIP AND SECURE, or RELEASE. The secure function is the Part Present (PP) function. There is also an option to disable Energy Saving (ES).

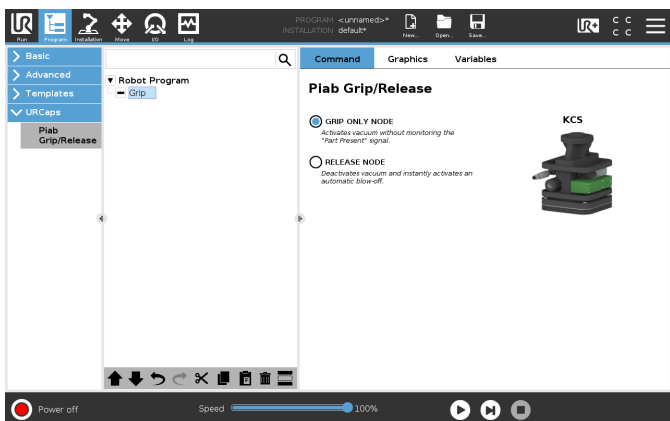
Check the UR manual for how to program the robot with nodes.



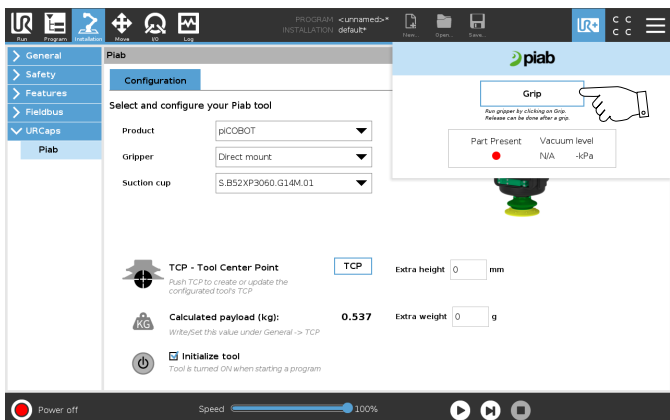
For the KCS, you can grip or release.



3. Select “URCap” below the System tab
4. Select Piabs URcap
5. Press – (minus) and remove the software.



If you press the UR+ logo up to the right, a button will pop up that allows to test the grip and release. It will show different options depending on your chosen product and on the latest option you have made. The GRIP AND SECURE feature shows for the piCOBOT® and GRIP ONLY for the KCS. This will not show up as a node in the program tab.



### 4.8.2 Uninstalling URcap

To remove the URcap, follow UR’s manual on how to uninstall URcaps. Or follow the steps below and refer to the pictures in the URcap installation chapter above. From the UR Main Menu:

1. Press ≡
2. Select “Settings”

## 5. Technical data

### 5.1 Installation

Description	Unit	Value
piCOBOT® weight (without suction cups)	g [oz]	683 [24.1]
ActiNav gripper weight (without suction cups)	g [oz]	60 [2.12]
Max handled weight	g [oz]	7,000 [246.9]
Material	-	PA, NBR, SS, Al, FPM, CuZn, Cu, PU
Supply voltage	VDC	24 ± 10%
Electrical connection	-	Connector M8, 8-pin male
Typical current consumption	mA	200
In rush current	mA	400
Valve shift peak current	mA	425
Valve shift peak current time	ms	<32
Feed pressure, max.	MPa [psi]	0.7 [101.5]
Connection, compressed air	-	ø6 mm push-in angle connector
Connection, vacuum	-	G1/8" female
ActiNav gripper internal volume	cm <sup>3</sup> [inch <sup>3</sup> ]	6 [0.37]

### 5.2 Environmental properties

Description	Unit	Value
IP classification	-	IP54
Temperature range	°C [°F]	0-40 [32-104]
Humidity	%RH	35-85
Vibration resistance at 2g xyz	Hz	8-200
Noise level range*	dBA	52-63

\* Higher noise level = free running vacuum (cups open)

### 5.3 Operations

Description	Unit	Value
Pressure drop	MPa [psi]	0.06 [0.018]
Blow-Off flow at 0.5 MPa and no counter pressure	NI/s [scfm]	0.282 [0.583]
Blow-Off flow at 0.5 MPa and 0.1 MPa counter pressure	NI/s [scfm]	0.09 [0.19]

Description	Unit	Value
Hysteresis	-	Adjustable
Function, Vacuum/Blow-Off	-	NC vacuum + NC Blow-Off
Display	-	OLED and gyro display

## 5.4 Electrical input/output

Description	Unit	Value
Electrical input/output	VDC	24, UR specific
Analog output	V	1-5
Accuracy of F.S. (Full Scale) analog output	-	±3%
Manual override , electrically activated	-	Yes, non-locking push style
Signal range (digital output)	kPa [inHg]	-101.3 - 140 [-29.92-41.34]
Response time valve	ms	10 ± 2
Switch output S1/S2, max	mA	2x40 simultaneously or 1x80 one at a time

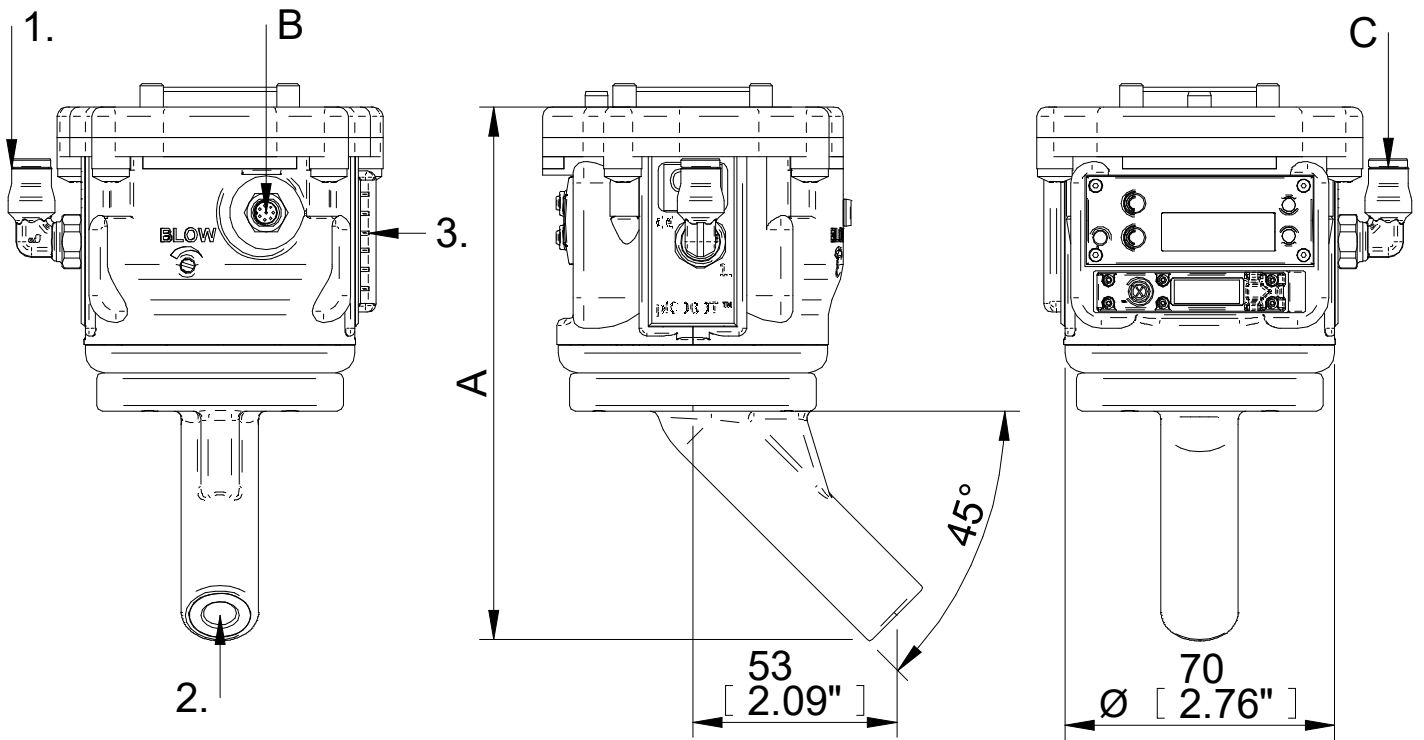
## 5.5 Vacuum flow

Feed pressure pump / nozzle MPa [psi]	Air consumption NI/s [scfm]	Vacuum flow NI/s [scfm] at different vacuum levels -kPa [-inHg]									Max vacuum -kPa [-inHg]
		0 [0]	10 [3]	20 [6]	30 [9]	40 [12]	50 [15]	60 [18]	70 [21]	80 [24]	
0.51 / 0.45	0.58	0.70	0.62	0.50	0.36	0.23	0.15	0.12	0.07	0.01	84
[73.97] / [65.25]	[1.23]	[1.48]	[1.32]	[1.06]	[0.76]	[0.48]	[0.32]	[0.24]	[0.14]	[0.03]	[24.81]

## 5.6 Evacuation time

Feed pressure pump / nozzle MPa [psi]	Air consumption NI/s [scfm]	Evacuation time s/l [s/cf] to reach different vacuum levels -kPa [-inHg]								Max vacuum -kPa [-inHg]
		10 [3]	20 [6]	30 [9]	40 [12]	50 [15]	60 [18]	70 [21]	80 [24]	
0.51 / 0.45	0.58	0.15	0.33	0.56	0.90	1.43	2.17	3.27	5.75	84
[73.97] / [65.25]	[1.23]	[4.28]	[9.31]	[15.88]	[25.52]	[40.41]	[61.52]	[92.73]	[162.79]	[24.81]

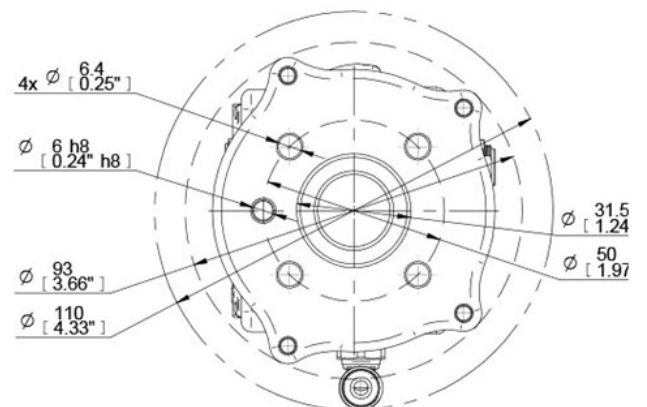
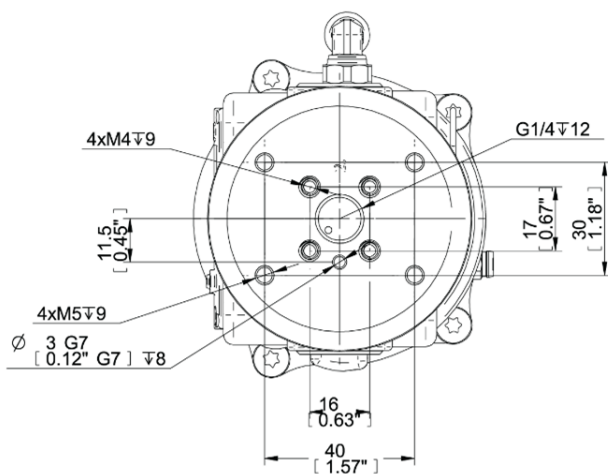
## 6. Dimensions



Description	Unit	Value
A	mm [in]	137 [5.39]
B	-	M8 8-pin male
C	mm	Ø6

Position	Description
1	Compressed air
2	Vacuum
3	Exhaust

The mechanical interface is an ISO 9409-1-50-4-M6 adapter plate (M01).  
 Also fits ISO 9409-1-50-7-M6 by using four screws (instead of seven).



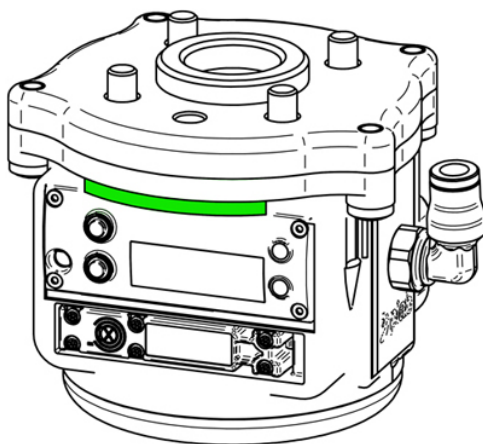
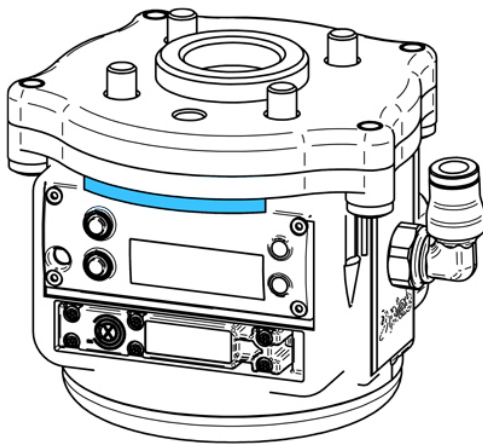
## 7. Operation

The LED will light up in different colors and with steady on or flashing light depending on which task is performed.

Task/Activity	Color
Vacuum On	Blue flashing
ES active	Blue steady
Idle	Green steady
Release (Blow-Off active)	Green flashing

(ES = Energy/Air Saving)

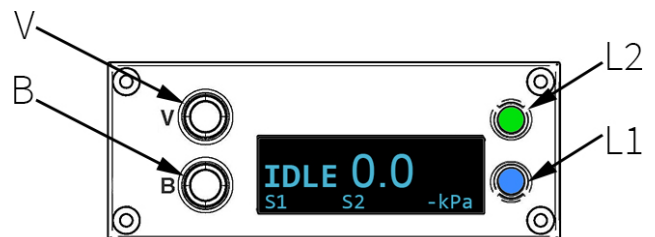
The two LEDs are located one on each side of piCOBOT®.



### 7.1 Interface

There are two buttons, one OLED screen and two LEDs in green and blue on the piCOBOT®. As soon as the piCOBOT® is turned on, the Piab logo is shown and shortly after the default screen (see picture below, showing the status IDLE with 0.0 vacuum). The real time vacuum level reading is displayed here when vacuum is achieved. The selected and active vacuum unit is shown in the bottom far-right corner. A screen saver is activated after 3 minutes if no signal in, or working with settings is present.

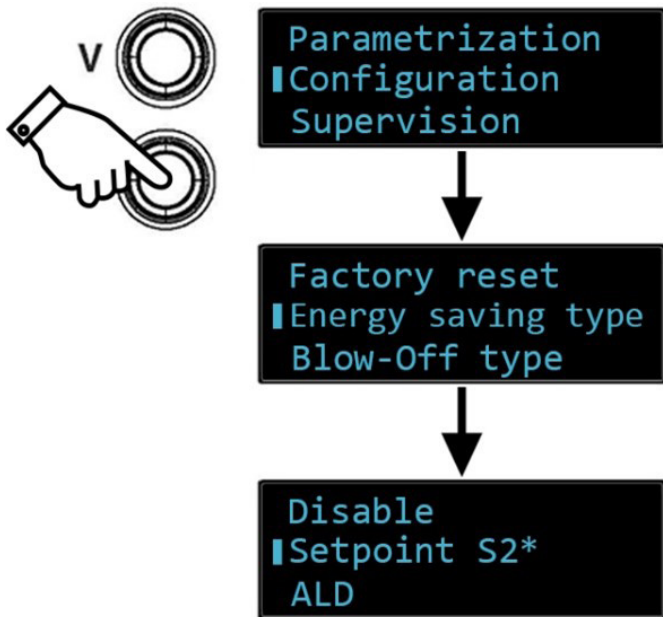
The blue LED L1 will light and IDLE will switch to VAC in the display when an incoming signal for *Vacuum on* is achieved. Likewise, for a *Blow-Off on* signal but then the green LED L2 is lit and IDLE switches to BO in the display. It is also possible to manually operate *Vacuum on* or *Blow-Off on* with the buttons "V" (*Vacuum on*) and "B" (*Blow-Off on*) when the piCOBOT® is powered with 24V. *Blow-Off on* will always override *Vacuum on*.



The information in the bottom of the display shows, from left to right, the output signal status on S1, normally Part Present (PP); S2, normally Energy Saving (ES) level achieved; and the active vacuum unit. The top left section in the display will show status conditions, e.g. when and which ES-Energy Saving function or which Blow-Off type is active and in action. The output signals and status conditions can represent different selectable features, for more info see the Menu overview and Menu setting on the coming pages.



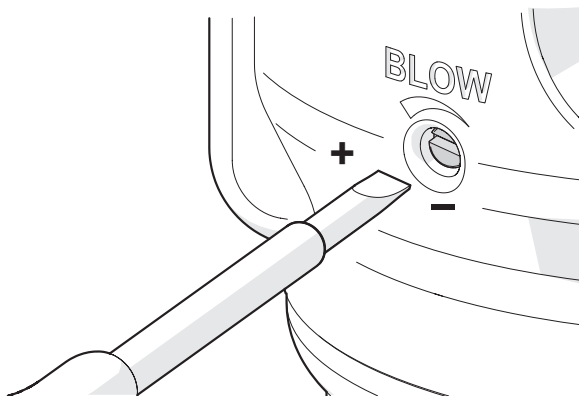
To enter the menus, press and hold "V" and "B" at the same time for 2 seconds. A small time-bar on the top of the display will gradually go from left to right until menus appear.



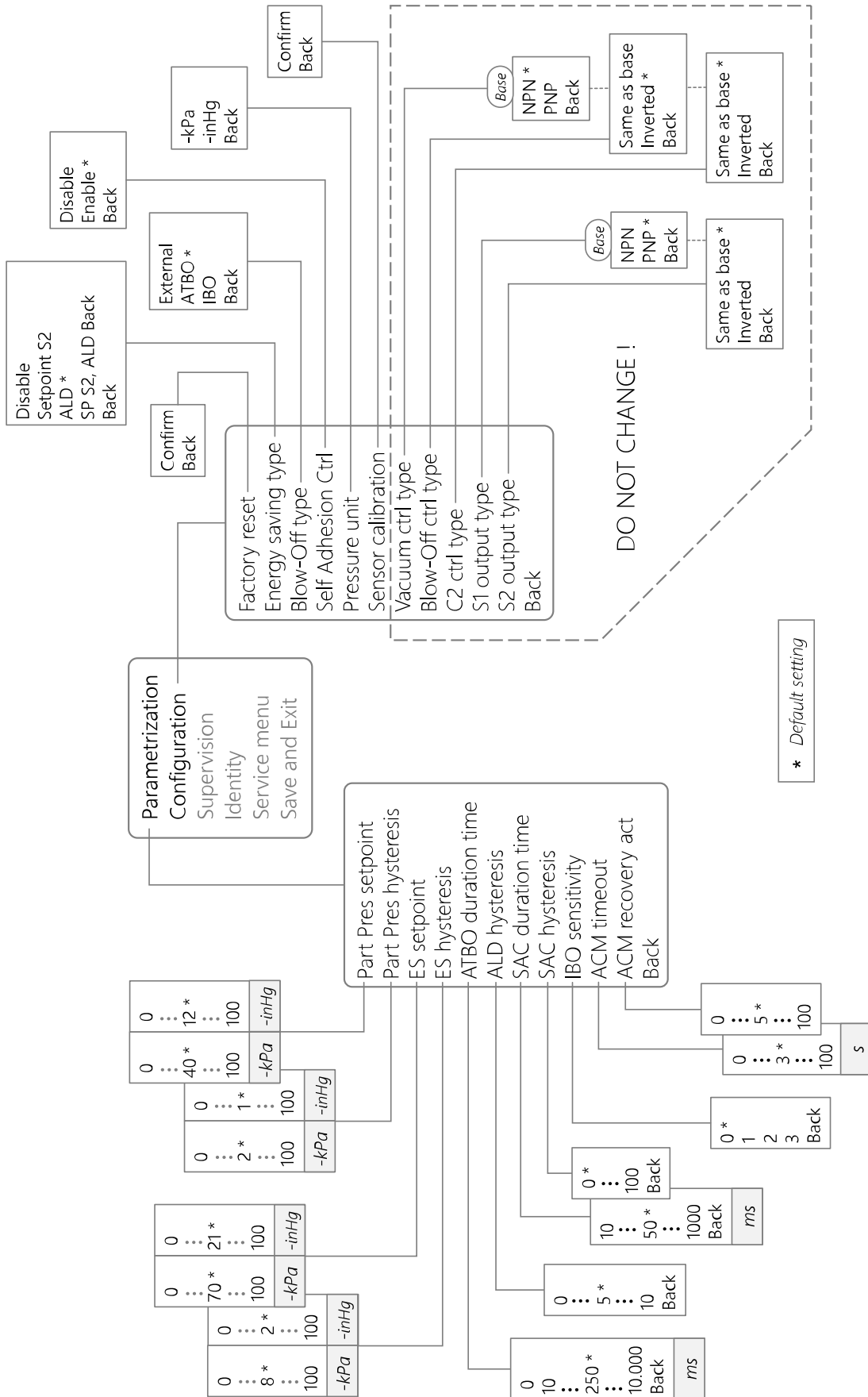
To navigate the menus, push “B” to toggle down and “V” to toggle up the list. Hold to scroll the list. Set your choice to the square marker and press both “V” and “B” at the same time. To select and set a value or choice in a menu, toggle to the square marker and press “V” and “B” at the same time again. Your choice is marked with \* and the OLED will quickly blink to confirm your setting. In the Parametrization menu wait for 2 seconds to leave the entered menu. All other menus have a “Back” function at the bottom of different selections. After 10 seconds without new input the screen automatically returns to its default position.

## 7.2 Blow-Off flow

The Blow-Off flow can be adjusted with the Blow-Off screw. The Blow-Off flow decreases when turning the screw clockwise and increases when turning the screw counter-clockwise. A high flow will release quickly but may cause light parts to move when released. A low flow will release more slowly but may be unnecessarily slow for heavy parts.



### 7.3 Menu overview



## 7.4 Menu settings

This is the first level of menus, for underlying menus and settings please see Menu settings on the next pages.

### Parametrization

Menu name	Preset value	Range	Unit	Comment
Part Present vacuum level setpoint	40	0...100	-kPa [-inHg]	Normally used as Part present level
Part Present hysteresis	2	0...100	-	-
Energy Saving (ES) vacuum level setpoint	70	0...100	-	Normally used as Energy Saving trigger level
Energy Saving (ES) hysteresis	8	0...100	-	-
ATBO duration time	250	0...10000	ms	Time set for ATBO
ALD hysteresis	0	0...10	-	ALD tuning
SAC duration time	50	0...1000	ms	Time set for SAC
SAC hysteresis	5	0...100	-	SAC tuning
IBO sensitivity	0	0...3	-	0 = Small vacuum system
ACM timeout	5	1...100	s	Time for all recovery actuations
ALD recovery actuations	3	1...100	pcs	Number of allowed recovery actuations

### Configuration

Important! Control and output types are preconfigured to fit the robot controller IO-types. Do not change control and output types.

Menu name	Configuration	Comment
Factory reset	Confirm	Returns unit back to factory set of parametrization and configuration values based on product CODE.
Energy Saving type	0=Off - ES disabled 1=On - ES on setpoint 2 2=On - ES with ALD 3=On - ES on setpoint 2 - ALD backup	Preset depending on configuration. See corresponding chapter Function.
Blow-Off type	0=Off - external 1=On - ATBO 2=On - IBO	Preset depending on configuration. See corresponding chapter Function.
Self Adhesion Control	0=Off - SAC disabled 1=On - SAC activated	Preset depending on configuration.
Pressure unit	0= -kPa 1= -inHg	-
Vacuum control type	0=NPN 1=PNP	Base input.



Menu name	Configuration	Comment
Blow-Off control type	0=Same as base 1=Inverted from base	Follows the base Vacuum control type.
C2 control type	0=Same as base 1=Inverted from base	Follows the base Vacuum control type.
S1 control type	0=NPN 1=PNP	Base input.
S2 control type	0=Same as base 1=Inverted from base	Follows the base S1 output type.

## Supervision

Menu name	Function	Unit	Comment
Cycle counter	Cycle counter	Cycles	See corresponding chapter Function.
UVD counter	Under Voltage Detection (UVD) counter	pcs	See corresponding chapter Function.
MAX volt	Highest Voltage Detected (MVD)	V	See corresponding chapter Function.
MIN volt	Lowest Voltage Detected (LVD)	V	See corresponding chapter Function.
SYS volt	System Voltage	V	See corresponding chapter Function.
MAX Acc	Short Term Maximum Acceleration (STMA)	g x 10	See corresponding chapter Function.
MAX Acc 2	Life Term Maximum Acceleration (LTMA)	g x 10	See corresponding chapter Function.
MAX temp	Maximum Temperature Detected (MTD)	°C	See corresponding chapter Function.
SYS temp	System Temperature	°C	See corresponding chapter Function.

## Identity

Menu name	Comment
Vendor ID	PIAB VENDOR ID
Device ID	E.g. 314, see your pump for the correct value
Vendor	Piab AB
Product name	piCOBOT®
Serial number	E.g. 16Q001234, see your pump for the correct value
Hardware revision (HW)	E.g. R02, see your pump for the correct value
Firmware revision (FW)	E.g. revision 1.0
Application TAG	Application TAG Example
Product ordering CODE	PCO.U2.M01.T.MC2.S221PA.X.6.CC.D.BXK2
Production date	E.g. 2019-02-20

## Service menu

Menu name	Comment
Piab lock	For Piab developers only.

# 8. Function

NOTE! Some functions are optional and chosen when configuring the piCOBOT for purchase. These functions are denoted with *(optional)*.

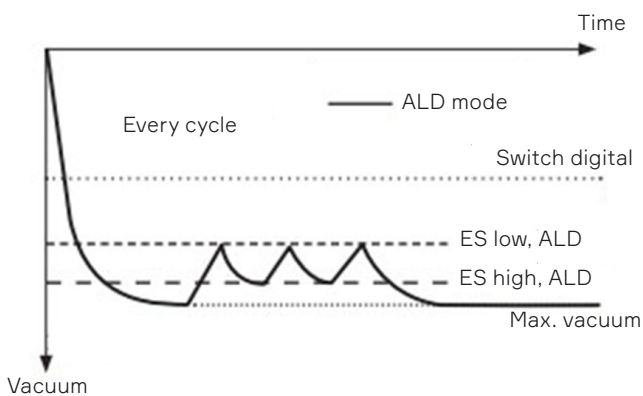
## 8.1 Parametrization and configuration

### Vacuum control

For more information about controlling your piCOBOT please see UR Cap manual.

### ENERGY SAVING TYPE --> Energy Saving – Automatic Level Determination (ALD)

Automatic “ES” Level Determination (ALD) Optional only if ES-mode is active and energy saving type ALD is selected. The unit will measure maximum achievable vacuum on the object every cycle and automatically set an optimized ES level and hysteresis- The calculation is re-calculated every cycle to give the most reliable condition every time a new object is handled. The calculation is based on set part present signal level and maximum achievable vacuum measured by an analog sensor. ALD can also be selected as a back-up for manually set ES (setpoint S2). In this case, ALD will be activated if S2 is not reached in order to always secure energy saving.



Parameter	Description
ALD hysteresis	Range 0 .. 10, where 0 = small hysteresis and 10 = large hysteresis.

### ENERGY SAVING TYPE --> Energy Saving on setpoint S2 ( Manual settings)

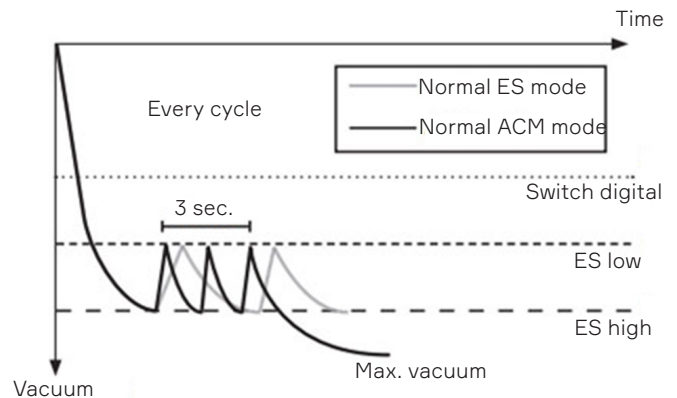
Energy Saving (ES) on setpoint S2 will operate the same way as Energy Saving ALD, with the only difference that the user needs to provide a value at which the unit will turn off, and a hysteresis (difference window) until the unit will turn vacuum on again. The value at which the unit will turn off vacuum generation is set in parameter S2 (ES setpoint). The difference (hysteresis) is set using parameter ES hysteresis. ES “low”, when unit turn vacuum on, is then internally calculated as (ES setpoint – ES hysteresis).

Parameter	Description
ES setpoint	Range 0 .. 100 -kPa [0 .. 29.5 -inHg]. S2 > S1
ES Hysteresis	Range 0 .. 100 -kPa [0 .. 29.5 -inHg]. Ensure that S2_setpoint - S2_hysteresis > S1

S1 and S2, feedback signal where in Std-IO ....

### Automatic “ES” Condition Monitoring (ACM)

Optional only if ES-mode is active to protect the life span of the valves, an automatic override function is implemented. If the supply valve is restarted 3 times within 3 seconds, the ES function is deactivated for the rest of the cycle. A nice feature if leakage occasionally occurs. If your piCOBOT® is configured or set with a leakage warning output the feature can also be used to monitor the wear of the suction cups. You can disable the ACM function by activating the digital input C2 on pin8 (Std-IO) or PDO OCTETO Bit4 (IO-Link). If you discover a leak in the system, you can temporarily turn off the ACM function by pushing once on either of the manual override buttons on the valve unit. The pump unit will then recharge vacuum in its ES hysteresis range, turn off -> on and tries to go into ES-mode when you have found the leak. Then the pump turns off and goes into ES-mode. Recycle the pump or push once again on any of the manual override buttons to activate the ACM mode again.



Parameter	Description
ACM Timeout	Range 1 .. 100 seconds. The minimum time (default 3 seconds) that must pass during which the ACM recovery actuations occur. If the time is longer for 3 (or whatever is set) actuations, the ACM function is not triggered. If the time is shorter, the ACM function is triggered. Can also be selected as an output option for S1 or S2.

Parameter	Description
ACM Recovery actuations	The number of recovery actuations (default = 2) that are allowed to occur within the ACM timeout without triggering the ACM function.

### Leakage Warning (LW)

Output signal that is activated from the ACM. Every time ACM is triggered, this indicates a leakage which can be transmitted on S1 or S2 signal port.

### Blow-Off control

Blow-Off is controlled either through SIO input (PNP or NPN, configurable). Blow-Off (always pneumatically normally closed) is activated by an "active" input signal. Active Blow-Off control will always override Vacuum control, terminating the vacuum generation and starting the Blow-Off. For related information, see Vacuum control on previous page.

### Blow-Off type --> External control (optional)

External control means that compressed air release function will start by an "active" input signal. The Blow-Off signal will override the vacuum signal as well as ATBO or IBO when it's active.

### Blow-Off type --> Automatic Timer Blow-Off (ATBO) (optional)

Automatic Timer Blow-Off (ATBO) means that the compressed air release function will start automatically after the vacuum valve is turned off. The Blow-Off duration is set with a timer. ATBO will save on I/Os needed to control piCOBOT®, can be of great importance if several units are connected to one controller. ATBO makes programming easier and can be used to fine-tune Blow-Off duration to cut cycles time.

Parameter	Description
ATBO Timer	Sets the duration of the Blow-Off in milliseconds. Range 0 .. 10 000 milliseconds.

### Blow-Off type --> Intelligent Blow-Off (IBO) (optional)

Intelligent Blow-Off (IBO) is an alternative to save compressed air for part release, in many vacuum applications the big air consumer. Intelligent Blow-Off will start automatically when the vacuum valve is turned off, and the duration of the Blow-Off is automatically adapted to the application. The Blow-Off duration is optimised, and blow-air will automatically stop when all vacuum is removed from the system. IBO is a self-learning function and only needs a few cycles to optimise Blow-Off duration for different system volumes. In the initial cycles, an extra Blow-Off puff can be presented to fully remove

vacuum. IBO-sensitivity - can be used to tune sensitivity for IBO depending on the size of the vacuum system.

Parameter	Description
IBO sensitivity	0 = Small vacuum system 1 = Medium vacuum system 2 = Large vacuum system 3 = Large vacuum system - large pressure drops

Low number = most energy efficient Blow-Off (suitable for small vacuum system). The higher the number the larger or more flow-restricted the system.

### Self Adhesion Control (SAC) (optional)

Self Adhesion Control (SAC) automatically removes "unwanted" vacuum with short blow puffs if the piCOBOT® vacuum control valve has not been activated. The puff duration is set with a timer in milliseconds. The hysteresis (or sensitivity) is set with a value from 0 – 100. A lower value gives a more sensitive SAC. Unwanted vacuum is typically created by an ergonomic vacuum handling device/ manipulator where a vacuum check/non-return valve is included. For example, ejectors with ES feature have a check/non-return valve inside. When suction cups are applied against a sealed object, the weight of the handling device compresses the cups and create a small bonding force. The force can be enough to move the object in an uncontrolled manner and even cause personal injuries if glass or metal sheets with sharp edges are handled. SAC will eliminate this problem completely. Selectable function.

Parameter	Description
SAC duration	Time for one Blow-Off puff in milliseconds (range 10..10 000) Default value = 50 ms.
SAC hysteresis	Low value = sensitive system for very light handled object, but at the risk of "ghost-puffs due to signal drift/disturbance. High value = robust but not as responsive system.

### Blow-Off Complete (BOC)

Output signal that is activated when Blow-Off is Complete, if an integrated automatic Blow-Off function, ATBO or IBO, is activated. The trigger output data will make it very easy to always program for fastest possible cycle-time. A proper use of a parameter is to initiate part release by setting the vacuum control signal to "OFF", wait for BOC to turn "HIGH", indicating that part has been released.

Parameter	Description
The BOC signal is indirectly affected by parameter IBO sensitivity. See chapter on Intelligent Blow-Off.	IBO sensitivity is described separately.

### S1 Standard-IO function

Selects which state to transmit on SIO output S1.

Parameter	Description
Part Present (PP)	Part Present vacuum level achieved. Vacuum Switch level S1 achieved.
Energy Saving vacuum level (ES)	Energy Saving vacuum level achieved. Vacuum Switch level S1 achieved.
Leakage Warning (LW)	Every time ACM is triggered, this indicates a leakage which can be transmitted on S1 signal port.
Blow-Off Complete (BOC)	The automatic Blow-Off sequence is completed.

### S2 Standard-IO function

Selects which state to transmit on SIO output S2.

Parameter	Description
Part Present (PP)	Part Present vacuum level achieved. Vacuum Switch level S1 achieved.
Energy Saving vacuum level (ES)	Energy Saving vacuum level achieved. Vacuum Switch level S1 achieved.
Leakage Warning (LW)	Every time ACM is triggered, this indicates a leakage which can be transmitted on S1 signal port.
Blow-Off Complete (BOC)	The automatic Blow-Off sequence is completed.

### Vacuum control type

This setting is considered the base pump input type of the pump (PNP or NPN).

Parameter	Description
NPN	NPN function of Vacuum control input pin (and all other input pins unless specifically configured otherwise).
PNP	PNP function of Vacuum control input pin (and all other input pins unless specifically configured otherwise).

### Blow-Off control type

Parameter	Description
Same as base input type	Sets the input type to operate PNP when base input type is PNP. NPN when base is NPN.
Input type inverted	Sets the input type to operate NPN when base input type is PNP. PNP when base is NPN. This function can be useful when configuring a system that which you want to behave in a specific manner during power-up for example.

### C2 control type

Parameter	Description
NPN	NPN function of S1 output signal pin (and all other output pins unless specifically configured otherwise).
PNP	PNP function of S1 output signal pin (and all other output pins unless specifically configured otherwise).

### S1 output type

S1 feedback signal. This setting is considered the base output type of the pump (PNP or NPN).

Parameter	Description
NPN	NPN function of Vacuum control input pin (and all other input pins unless specifically configured otherwise).
PNP	PNP function of Vacuum control input pin (and all other input pins unless specifically configured otherwise).

### S2 output type

Parameter	Description
Same as base input type	Sets the output type to operate PNP when base input type is PNP. NPN when base is NPN.
Input type inverted	Sets the input type to operate NPN when base input type is PNP. PNP when base is NPN.

## 8.2 Supervision

### Cycle counter

A cycle is counted every time Vacuum on has been activated and then deactivated.

### Under Voltage Detection (UVD) counter

UVD is a parameter that is measured during vacuum on, storing the lowest voltage recorded in the first 10 operating cycle after a power-cycle. Every power-cycle generates a new reading to be stored locally.

Up to 100 readings are possible to store, then a FIFO principle of replacement of data is applied.

#### **Highest Voltage Detected (HVD)**

MVD is a reading of the maximum voltage seen by the vacuum-ejector over the lifespan of the ejector. The reading is a single value representing the highest voltage recorded.

#### **Lowest Voltage Detected (LVD)**

LVD is a reading of the lowest voltage seen by the vacuum-ejector over the lifespan of the ejector. The reading is a single value representing the lowest voltage recorded.

#### **System Voltage**

System Voltage is the latest real-time reading of voltage. A new reading is read and made available every time the ejector returns to IDLE – state.

#### **Short Term Maximum Acceleration (STMA)**

The pump measures and provides the maximum value of the sum-acceleration from the last 5 minutes of operation.

#### **Life Term Maximum Acceleration (LTMA)**

The pump shall be able to measure and report maximum acceleration the pump has been submitted to (while under power) throughout the lifespan of the pump.

#### **Maximum Temperature Detected (MTD)**

Is recording of the maximum temperature seen by the vacuum-ejector over the lifespan of the ejector.

#### **System Temperature**

This is the latest reading of system temperature. A new value is made available every time the ejector returns to IDLE – state.

## 9. Maintenance

### 9.1 Preventive maintenance

The piCOBOT® has been designed to minimize the need of maintenance. To ensure safe operation the following general actions must be in place before safe operation of the piCOBOT® is possible.

- To prevent dust, dirt and larger particles jamming the ejector unit, causing impaired performance, the piCOBOT® must only be powered on and energized in the presence of either suction cups with filter or the Adjustable gripper and cups with filter.
- Maintenance must be performed with a fixed period short enough, to ensure a firm grip at all times.
- An overall inspection of the piCOBOT® must be performed on a regular basis with a duration depending on the application characteristics.

INFO:

- All maintenance must be performed in compliance with this manual, including safety instructions.
- Only authorized system integrators, or Piab AB, shall perform repairs.
- Only use original spare parts.

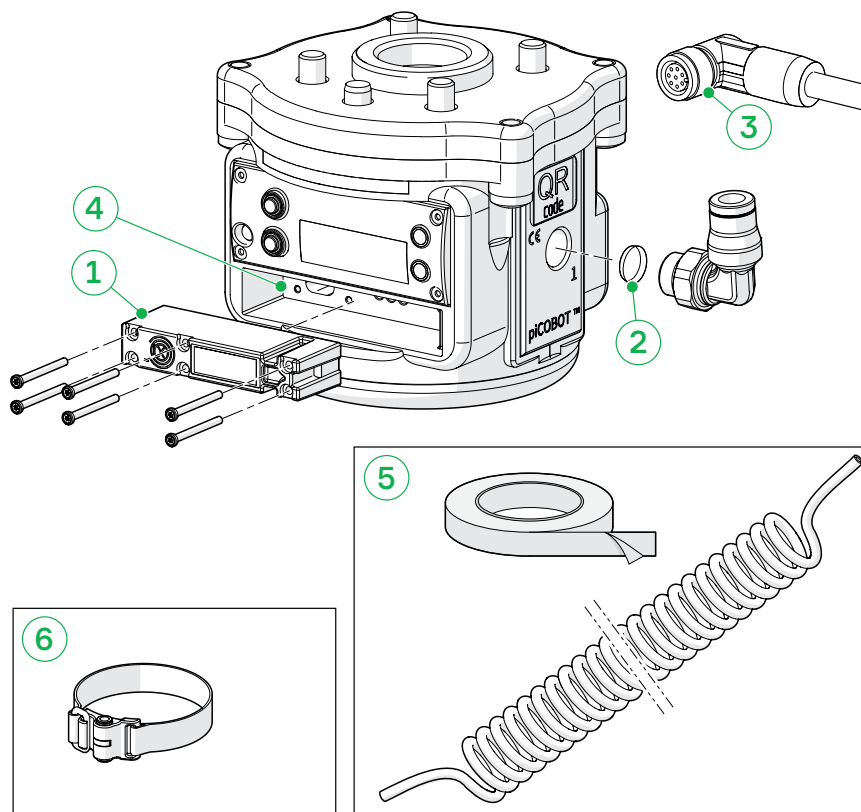
The following preventive maintenance actions are recommended specific to each part:

Parts for maintenance	Part No.	Action	Service action and/or inspection interval	Further action if unresolved
COAX® cartridge TI05-2	0123098	Clean	When/if max vacuum* is reduced by >5 -kPa [1.48 -inHg].	Replace part if desired vacuum level not achievable.
Suction cups filter	See piab.com	Clean	When/if free running vacuum** increase >5 -kPa [1.48 -inHg] or application failure.	Replace fitting.
Suction cups	-	Inspect	When/if poor gripping performance.	Replace fitting.
Compressed air filter	0212856	Clean	Periodicity depending on the application but at each scheduled service point.	Replace filter..
Electrical cable	0240732	Inspect	After 500 installations/removals.	Replace cable.
External device – compressed air regulator	N/A	Inspect and adjust feed pressure to correct pressure level if needed (0.5 MPa [72.5 psi].	When/if max vacuum* is reduced by >5 -kPa [1.48 -inHg].	Check compressor condition, capacity and potential compressed air system leakage.
External device – Power supply unit	N/A	Check the “System Voltage” warning issued on the OLED display.	Make sure that the supplied voltage to piCOBOT® is within the specified range (24 VDC +/- 10%) - below 21.6 VDC no proper function is guaranteed.	Size up Power supply or make sure it is not over loaded at any time.

\* Max vacuum is the vacuum level achieved by suction cups on a sealed work object.

\*\* Free running vacuum is the vacuum level displayed when the suction cups are not in contact with the work object and piCOBOT® is generating vacuum.

## 9.2 Spare parts



Pos	Article no	Quantity	Description
1	0123098	2	COAX® cartridge inside the indicated item Ti05-2
2	0212856	5	Compressed air filter
3	0240732	1	Cable M8-8P-F-Angled M8-8F-Angled, Length=0,17m
4	0212854	1	Chip gasket, screw, plug
5	0240733	1	Compressed air tube kit ActiNav
6	0240736	2	Tube holder 6mm cpl.

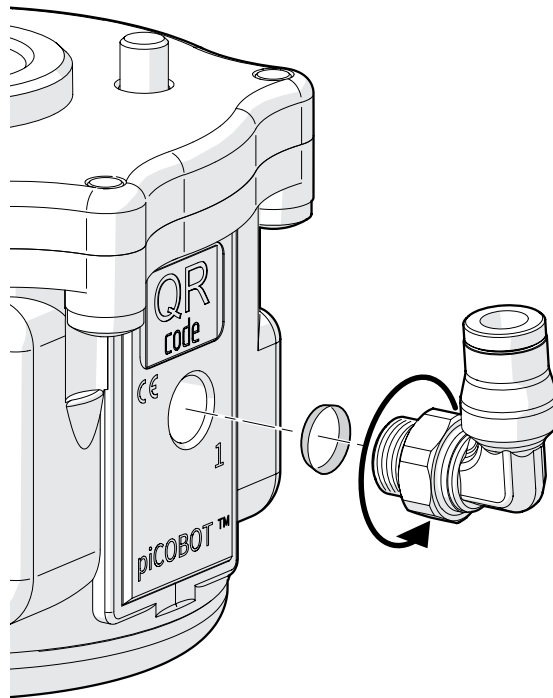
## 9.3 Accessories

Article no	Description
0240566	piCOBOT® ActiNav Gripper cpl.
0240672	Suction cup BFFT23 G1/8" Male
0205046	Suction cup B20XP G1/8" Male
0101183	Suction cup B20T81 G1/8" Male
0207053	Suction cup F-BX10 G1/8" Male
See <a href="http://piab.com">piab.com</a>	Other suction cups with G1/8" Male fittings are available.



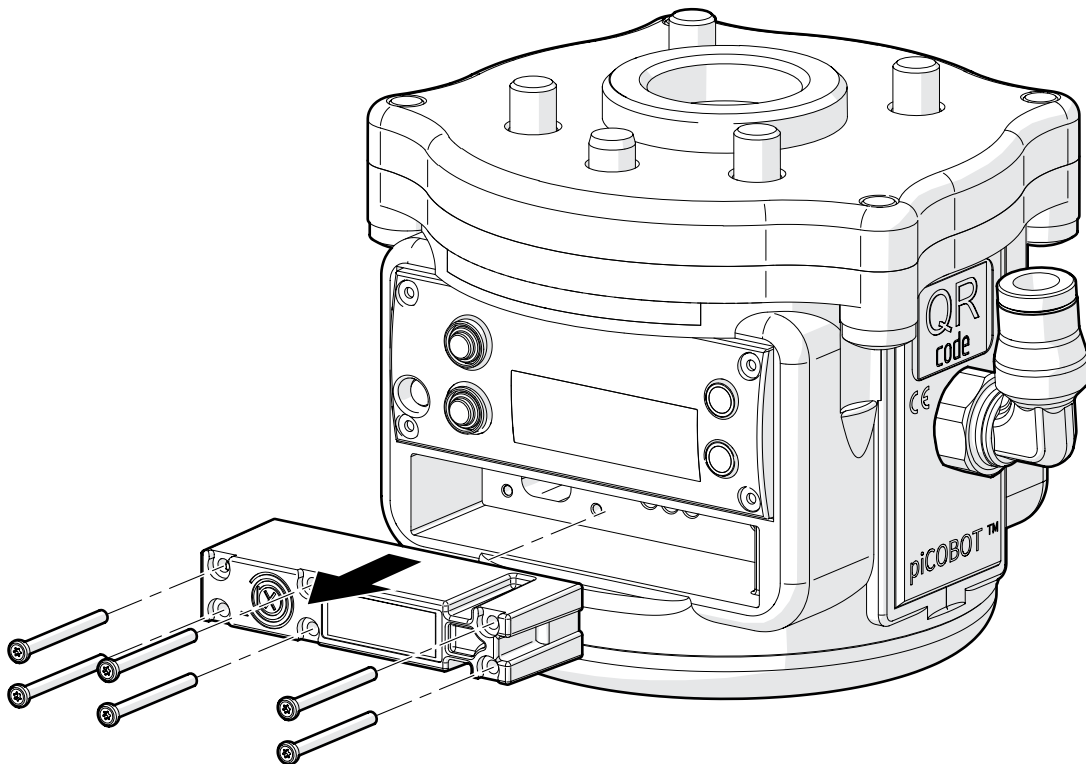
## 9.4 Replacement of piCOBOT® filter

Use a wrench, unscrew the angled connector. Use pliers, remove the filter and push in the new one.



## 9.5 Dismounting of chip

Unscrew the 6 Torx screws (shown by the arrows) using a T4 drive and pull out the chip.



# 10. Troubleshooting

## 10.1 Mechanical troubleshooting

Observation or error	Actions	Comment
No vacuum in system.	Inspect air supply connection.	-
	Inspect electrical connection.	-
	Inspect power supply.	Power supply is monitored on the display and shall be within 24 V +/- 10%.
Poor vacuum in system.	Check condition of suction cups.	Look for cracks and wear. Correct suction cup for the object?
	Clean filter in suction cups.	Clogged filter can manipulate "ready to go signal" in pump.
	Check O-ring sealing between pump and gripper.	Look for cracks and wear. Use correct torque for connection screws (4 screws).
	Clean COAX® cartridges in COAX® module.	-
	Inspect feed pressure filter.	Clean filter if needed.
	Check compressed air pressure drop.	Avoid too small hose inner diameter and too long hose.
	Check feed pressure.	Make sure compressed air feed pressure is according to recommendation.
Poor gripping.	Adjust ES levels.	ES will shut off vacuum and too low level gives less lifting force.
	Check angle and adjustment on suction cups.	-
	Revise the choice of suction cup(s).	The customer application might need other type of suction cups.
Ghost signal. S1 comes without object in contact.	Clean filter in suction cups.	-

## 10.2 URCap troubleshooting

In case the URCap is installed but the main functions e.g. "GRIP" or "RELEASE" do not work, the following actions are recommended:

- Uninstall all URCaps, reboot UR control box and reinstall Piab URCap.
- Check that the tool cable is undamaged and mounted correctly.
- Check if a new empty program works.

If Piab URCap is not supported on the robot, perform the following:

- Update the UR robot software to version 3.6 or higher.
- Consult your local UR robot supplier for troubleshooting.
- Override the URCap functionality by simply activating the tool I/O's (Default vacuum = 60%).

## 11. Warranties

Piab AB, denoted as the Seller, gives its Customers a five-year warranty from the receipt of the Products for vacuum pump Products (excluding electromechanical vacuum pumps, accessories and controls).

The Seller gives its Customers a one-year warranty from the receipt of the Products for all other Products (i.e. excluding vacuum pump Products but including electromechanical vacuum pumps, accessories and controls) if the failure has occurred within specified lifetime in terms of duty cycles as set out in the Product specification (if any). The warranty covers manufacture and materials defects in the Products and it also covers if the Products do not conform to the Product specification, excluding minor defects, if reasonably acceptable and that do not compromise efficiency in their use.

The warranty does not apply to any Product (including any component or other parts in such Products (such as suction cups, filter elements, sealings, hoses, foam, etc.) or to the software of any Products) that it was used other than the intended purpose, and: (a) has been subjected to abuse, misuse, negligence, improper storage, improper handling, improper use, improper installation, abnormal physical stress, abnormal environmental or working conditions, or use, application, installation, care, control or maintenance contrary to any applicable manual or instructions for the Products issued by the Seller or good trade practice regarding the same; or (b) has been reconstructed, repaired or altered by any persons or entities other than the Seller or its authorized representatives, or have a defect as a result of fair wear and tear or willful damage or caused by subsequent damages caused by other defective products.

The product warranty set forth in this Section is the only warranty given by the Seller in relation to the Products. The Customer may not rely, and has not relied, on any other information, statement or warranty (express or implied), whether based on applicable law or otherwise. In any case, the compensation is limited to the price of the products agreed between the parties and is excluded for indirect damages.

During the warranty period, the Seller shall replace or repair, at its own expense, faulty products determined by the Seller, in its sole discretion, to be covered by the warranty set out herein.

It is at the Seller's discretion whether a faulty Product should be returned to the Seller for replacement or if it should be repaired by the Seller

at the location of the Customer. Any replaced Products shall become the property of the Seller.

The Seller is not responsible for the cost of fitting replacement parts or components of any Products in to any products or alike of the Customer.

These Terms and Conditions shall apply to any repaired or replaced Products by the Seller.

## 12. Recycling and disposal



Environmental aspects are considered in the development process of Piab's products to make sure that a minimal environmental footprint is used. Piab is certified with ISO-14001.

Piab also complies with:

- RoHS (2002/95/EC)
- REACH (EC 1907/2006)

The ways of handling recycling and disposals vary from country to country, and therefore this process needs to be in full compliance with each national regulation.

If possible, disassemble the product into its various components. Electrical and electronic equipment should be handed over to an authorized body for disposal, as well as the metal parts. All other parts can either be recycled or sorted as waste.

# Evolving around the world

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