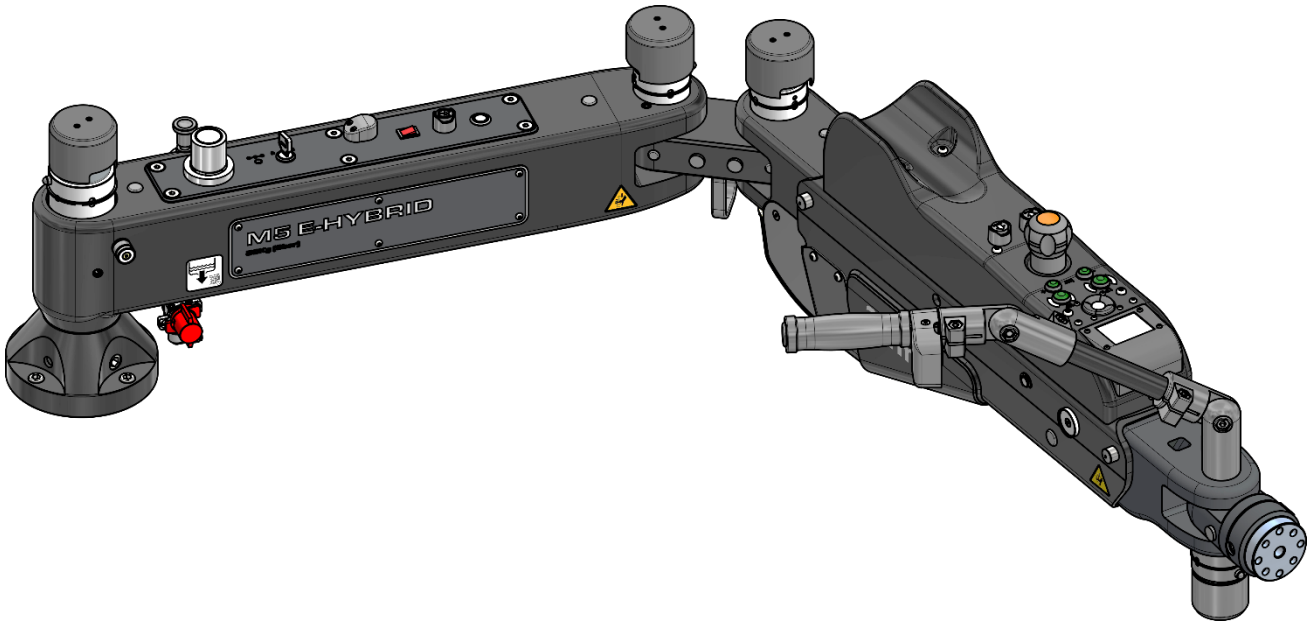
INSTRUCTION MANUAL

M5E-HYBRID MANIPULATOR

3arm®



TECNOSPIRO MACHINE TOOL, S.L.U.
P.I Pla dels Vinyats I, s/n nau 1
08250 - Sant Joan de Vilatorrada. Barcelona - España
Telf. +34 938 76 43 59
E-mail: 3arm@3arm.net

ISO 9001
BUREAU VERITAS
Certification

TECNOSPIRO
MACHINE TOOL SLU

DESIGN & QUALITY
3arm
Made in Barcelona

www.3arm.net

TABLE OF CONTENTS

1 INTRODUCTION

Dear Customer,

Congratulations to you on your choice and congratulations to the dedicated people at Tecnospiro Machine Tool for their continuous efforts on improving ergonomics at work.

We hope these simple instructions will be helpful for you for starting and operating the manipulator. We suggest you pay special attention to the pages on the concepts of installation, safety and maintenance.

We hope your manipulator will have a long life and that you can reaffirm the very good investment you have made in acquiring this product.

2 ABOUT THIS MANUAL

This document corresponds to the M5E-HYBRID Manipulator instruction manual.

- ORIGINAL MANUAL –

Intellectual/Industrial Property Information:

Tecnospiro Machine Tool, S.L.U. (the Company) informs that all content in this document including, for example, the text, images, graphic designs, brands, trading and company names (hereinafter, the Intellectual/Industrial Property), belong to the Company and that the Company is the exclusive owner of their use. Copying, reproduction, distribution, public communication and total or partial use of the Intellectual/Industrial Property, in any form or manner, even quoting the sources, is prohibited, unless expressly agreed in writing by the Company. The use of any content that due to its characteristics is similar to the Industrial/Intellectual Property is also considered an infringement of the Company's Industrial/Intellectual Property rights.

2.1 CONSIDERATIONS

- ✓ Before using the equipment, be sure to read this instruction manual and follow the instructions for use and safety correctly.
- ✓ All the instructions listed in this manual refer to the individual unit. It is the end user's responsibility to analyse and apply all the necessary safety measures required for the end use.
- ✓ This manual must be kept for the entire life of the equipment, in a place close to it for future consultations.
- ✓ If any part of this manual is unclear, confusing or inaccurate, please do not hesitate to contact us.
- ✓ The content of this manual may be subject to change without prior notice.
- ✓ If the manual is lost or damaged, contact TECNOSPIRO MACHINE TOOL, S.L.U. to provide a new one.
- ✓ Reproducing or sharing this documentation – or part of it – to third parties is only permitted with express written authorisation from TECNOSPIRO MACHINE TOOL, S.L.U.
- ✓ The illustrations shown in this manual may differ in some details from its specific configuration and should be understood as a standard representation.

Paragraphs indicating assembly, adjustment, installation or maintenance steps are framed with a brown background.

Paragraphs with highlighted information are framed with a grey background.

2.2 DOCUMENT VERSION

Document	Date - version
Instruction manual M5E-HYBRID Manipulator	18/10/2023

3 SAFETY INFORMATION

3.1 SCOPE OF APPLICATION

This section contains very important information related to the safety of your manipulator, it is addressed to all personnel involved in any of the life phases of this equipment (transport, assembly and installation, commissioning, adjustment, learning, operation, cleaning, maintenance, fault finding/detection, dismantling/de-commissioning).

3.2 ALERTS AND GENERAL CONSIDERATIONS

- ✓ The equipment described in this document has been built in accordance with the current technological level and in accordance with the applicable technical standards in terms of safety. However, improper use, or incorrect integration by the end user can generate risk of injury.

- ✓ The equipment must only be used in perfect technical condition, respecting the safety regulations and the instructions provided in this document.

- ✓ Any breakdown that may affect safety must be corrected immediately.

- ✓ Without the proper authorisation of TECNOSPIRO MACHINE TOOL, S.L.U., no modification of equipment should be made.

- ✓ The equipment must only be operated for its intended use, any other use is strictly prohibited. Any use other than that indicated is considered misuse and is prohibited. The manufacturer assumes no responsibility for any damage that may arise from this. This is solely at the user's own risk.

- ✓ Do not use the equipment in any way that is not considered in this manual and pay special attention to the uses mentioned in section 3.3 EXCLUSIONS, which must not be carried out.

- ✓ The operator must only use the equipment after having received the instructions for its use.

- ✓ The integrator/end user must ensure that the load-mounting device is suitable for the end application.

- ✓ Do not exceed the maximum working load limits (WLL) indicated in this manual and on the manipulator's identification plate.

- ✓ It is recommended that only one operator use the manipulator at a time, any other use must be evaluated by the integrator/end user.

- ✓ When it is not in use, it must be left in the retracted or parking position. Ensure the air supply to the

equipment has been cut off at the end of the working day.

- ✓ The operator may only use the manipulator for safe movements, accompanying the movement of the equipment at all times, and thus reducing the risk of uncontrolled or involuntary movements of the manipulator and/or the load.

- ✓ Although the parts with a higher risk of possible shearing or mechanical gripping are protected and have guards, it is forbidden to manipulate the moving components and joints when it is in use.

- ✓ The operator must remain outside of the vertical path of the swivel arm.

- ✓ The work area of the manipulator and its surrounding area must respect safety, health and hygiene at work conditions. It is the integrator/end user's responsibility to conduct a study to guarantee safety.

- ✓ The presence of third parties in the manipulator's work area must be restricted as much as possible, thus avoiding any impact on safety. For any other use, an additional study of the hazards derived from this way of working must be carried out.
- ✓ Only authorised personnel may be present in this area while the manipulator is in use.

- ✓ It is important that the users who operate this manipulator are familiar with and sufficiently trained to use this product or similar products.

- ✓ It is recommended that the operator have basic knowledge of: Safety procedures, precautions, safe work habits and cargo handling.

- ✓ In any case, the operator must read and understand this manual before use regardless of their knowledge, training or experience with similar equipment, especially the sections dedicated to installation, operation and safety.

- ✓ It is the responsibility of the integrator, owner and/or end user to determine the suitability of the product for each use, as well as its place of installation and the specific definition of the task to be carried out with this product within the limits stated in this manual.

- ✓ The devices for manipulation and loading may be subject to different regulations in every country. These regulations may not be specified in this manual.

- ✓ The appropriate distances that allow people to circulate safely must be added around the perimeter of the equipment. The work areas must be kept clear of obstacles, columns, etc. that could hinder the work of the operators.

- ✓ For tasks of maintenance, adjustment, cleaning, etc. there must be the spaces necessary for these tasks.

- ✓ If you have questions about handling or maintenance procedures, please

contact the authorised technical service.

3.3 EXCLUSIONS

The following is beyond the scope of use of this manipulator:

- ✓ Handling loads whose nature could lead to hazardous situations (molten metal, acids/alkalines, radioactive material, especially fragile loads).
- ✓ Operation subject to special rules described in chapter 1 of the standard UNE-EN 14238:2005+A1, related to "Cranes. Manually controlled load manipulating devices".
- ✓ Operation in severe conditions (e.g. extreme environmental conditions such as freezing, high temperatures, corrosive environment, strong magnetic fields).
- ✓ Loads greater than the maximum working load limits (WLL).
- ✓ Lifting and/or handling of people or animals.
- ✓ Use in areas with risk of explosion.
- ✓ Installation in outdoor areas.
- ✓ Handling of any component or functions of the equipment outside of those specified in this manual.
- ✓ Use by people who have not completed the occupational risk prevention course.
- ✓ Use by people with some type of disability or by animals.

3.4 SYSTEM INTEGRATOR

The system's integrator or end user is responsible for integrating the machine in the installation, respecting all the relevant safety measures.

The integrator/end user is responsible for the following tasks:

- ✓ Siting of the manipulator.
- ✓ Connections of the manipulator.
- ✓ Risk assessment.
- ✓ Facilities with the necessary safety and protection functions.
- ✓ Issue of the EC statement of compliance.
- ✓ Placement of the CE marking.
- ✓ Preparing the machine's service instructions.

3.5 SYMBOLOGY AND ICONS

Throughout this manual and in the structure of the machine, different symbols and pictograms can be observed, the meaning of which is summarised below.

	General danger symbol. This symbol is usually accompanied by another symbol, or a more detailed description of the danger.
	Trapping hazard
	Electrical hazard
	Danger, hot surface

3.6 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The personal protection equipment for the manipulator is merely safety footwear for all stages of the life of the equipment.

It is the integrator/end user's responsibility to define the personal protection equipment derived from the final application of the equipment, in order to comply with the essential health, safety and hygiene requirements.

Operators should not wear loose clothing, rings or bracelets that may fall within the mechanism of the equipment.

It is also mandatory to wear the hair collected to avoid snags with the moving parts of the equipment.

3.7 TRAINING LEVEL OF THE STAFF INVOLVED

All people working with the equipment must have read and understood the safety chapter of the documentation.

The minimum level of training to use the manipulator shall be:

- Production workers: occupational risk prevention course, full training on work stations and residual risks of the equipment. Minimum of one year's experience in similar facilities.

- Maintenance workers: Occupational risk prevention course, complete training in handling, operation, maintenance and conservation of equipment and residual risks. Minimum of two years' experience in similar facilities and with the technical level necessary to perform tasks without problems.

- Cleaning operators: Occupational risk prevention course, training on products and procedures for carrying out cleaning tasks.

- Apprentices/students: They may only work on the equipment if supervised at all times by one of the facility's suitably qualified employees.

- Public (non-operators): Visitors or passers-by must maintain a minimum safety distance of two metres from the edges of the perimeter of the equipment.

3.8 RESIDUAL RISKS

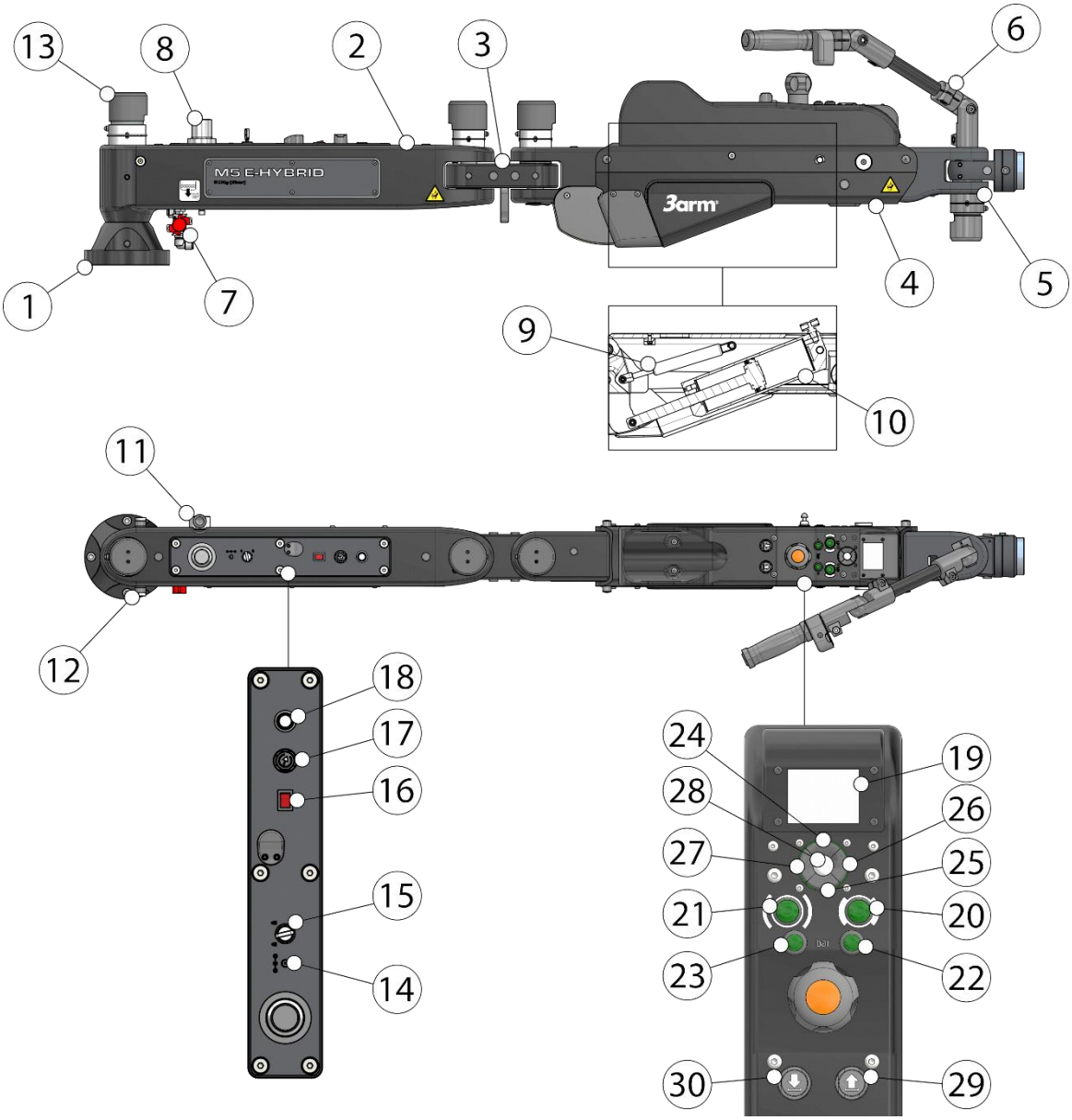
The residual risks of the equipment would be:

- ✓ Entrapment, slamming and crushing of hands due to movements of the tools, both opening/closing and rotating/turning operations.
- ✓ Slamming and crushing of hands or feet due to the falling of the part released from the tools.
- ✓ Slamming and crushing when moving the manipulator's arm.
- ✓ Slamming and cutting the manipulator's arm with the structure.
- ✓ Entrapment, slamming and/or crushing due to the manipulator falling or flipping.
- ✓ Electrical contact.
- ✓ Thermal contact.
- ✓ Fires and explosions.
- ✓ Ergonomic hazards.

4 GENERAL DESCRIPTION AND TECHNICAL INFORMATION

The manual control load handling device consists of a pendular parallelogram. Balanced with a gas spring and a pneumatic cylinder, plus a radial arm. The assembly of both secures the clamping head and keeps it in a perpendicular position to the work area. It is equipped with different systems such as a knob and a safety handle, which also helps to steer the equipment. To make it functional, different load securing devices must be added with which a final product that can be adapted to different working conditions can be obtained.
The built-in electronics facilitate the regulation of the equipment until the load to be handled becomes weightless, so that the manipulator can carry out the task with easy, safe and precise movements.

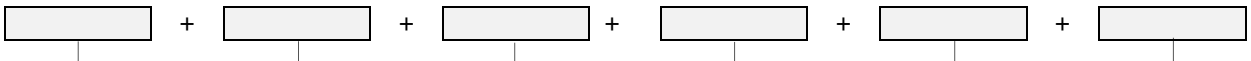
4.1 MAIN PARTS



1.- Base
2.- Radial arm
3.- Connection
4.- Tilting arm
5.- Head
6.- Grip - Handlebar
7.- Safety valve
8.- Power regulator
9.- Gas supply
10.- Pneumatic cylinder
11.- Close
12.- Magnet (Folded position)
13.- Pneumatic locks
14.- Loading jack
15.- Safety key
16.- Power switch
17.- Residual pressure release
18.- Reset button
19.- Screen
20.- Activate actuator and high pressure
21.- Deactivate actuator and low pressure
22.- Raise pressure
23.- Lower pressure
24.- Revolving up
25.- Revolving down
26.- Rotating clockwise
27.- Rotating counterclockwise
28.- Locking
29.- Raising the elevator
30.- Lowering the elevator

4.2 SETTINGS

4.2.1 SETTINGS TABLE



Radial arm + Arm

PB5	Tabletop
PT5	Ceiling-mounted
PX5	Customised

Lift

-	Without lift
E	With lift

Arm lock

L0	No lock
L2	Pneumatic lock
LX	Customised lock

Head

CA5	Horizontal Head
CC5	Revolving head 90º
CC5X	Revolving head custom Xº
CD5	Vertical head
CE5	Manual Rotating Head with lock
CF5	90º Revolving Head + M. Rotating
CF5X	Revolving Xº Head + M. Rotating
CG511	Revolving Head 90º + Rotating 90º
CG512	Revolving Head 90º + Rotating 180º
CG513	Revolving Head 90º + Rotating 270º
CG5X1	Revolving Head Xº + Rotating 90º
CG5X2	Revolving Head Xº + Rotating 180º
CG5X3	Revolving Head Xº + Rotating 270º
CH51	Short Rotating Head 90º
CH52	Short Rotating Head 180º
CH53	Short Rotating Head 270º
CI5	Manual Rotating Head
CX5	Customised Head

Electro-pneumatic system

Code	Effect	Rotation
EA5	Basic	0
EB5	Basic	1
EC5	Basic	2
ED5	Actuator	0
EE5	Actuator	1
EF5	Actuator	2
EG5	Suction cup	0
EH5	Suction cup	1
EI5	Suction cup	2
EX5	Customised	

Handlebar

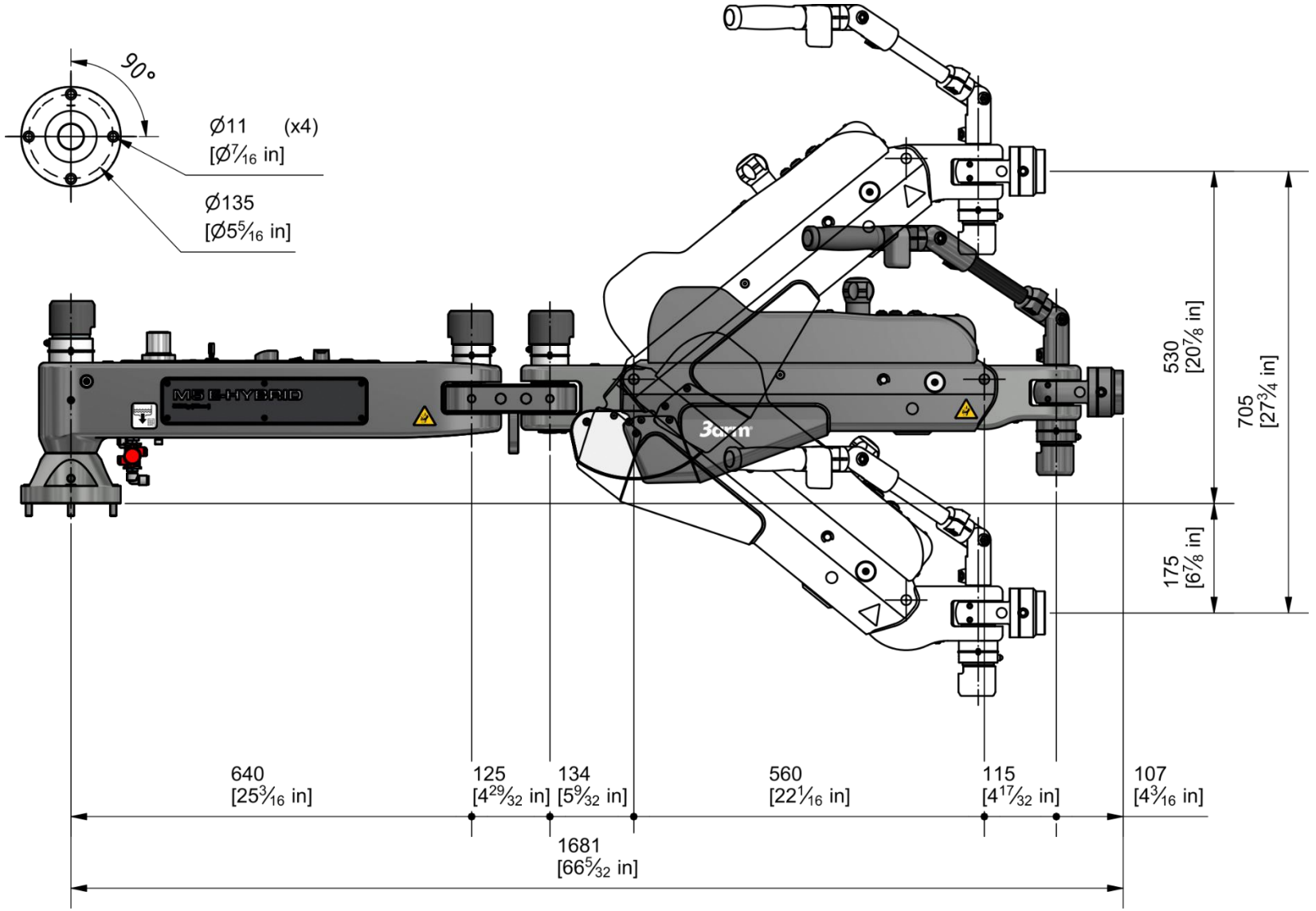
MA5	Single handlebar
MB5	Double handlebar
MC5	No handlebar
MD5	Automatic double handlebar
ME5	Vertical handlebar (only with CD5)
MX5	Custom handlebar

4.2.2 ORDER EXAMPLE

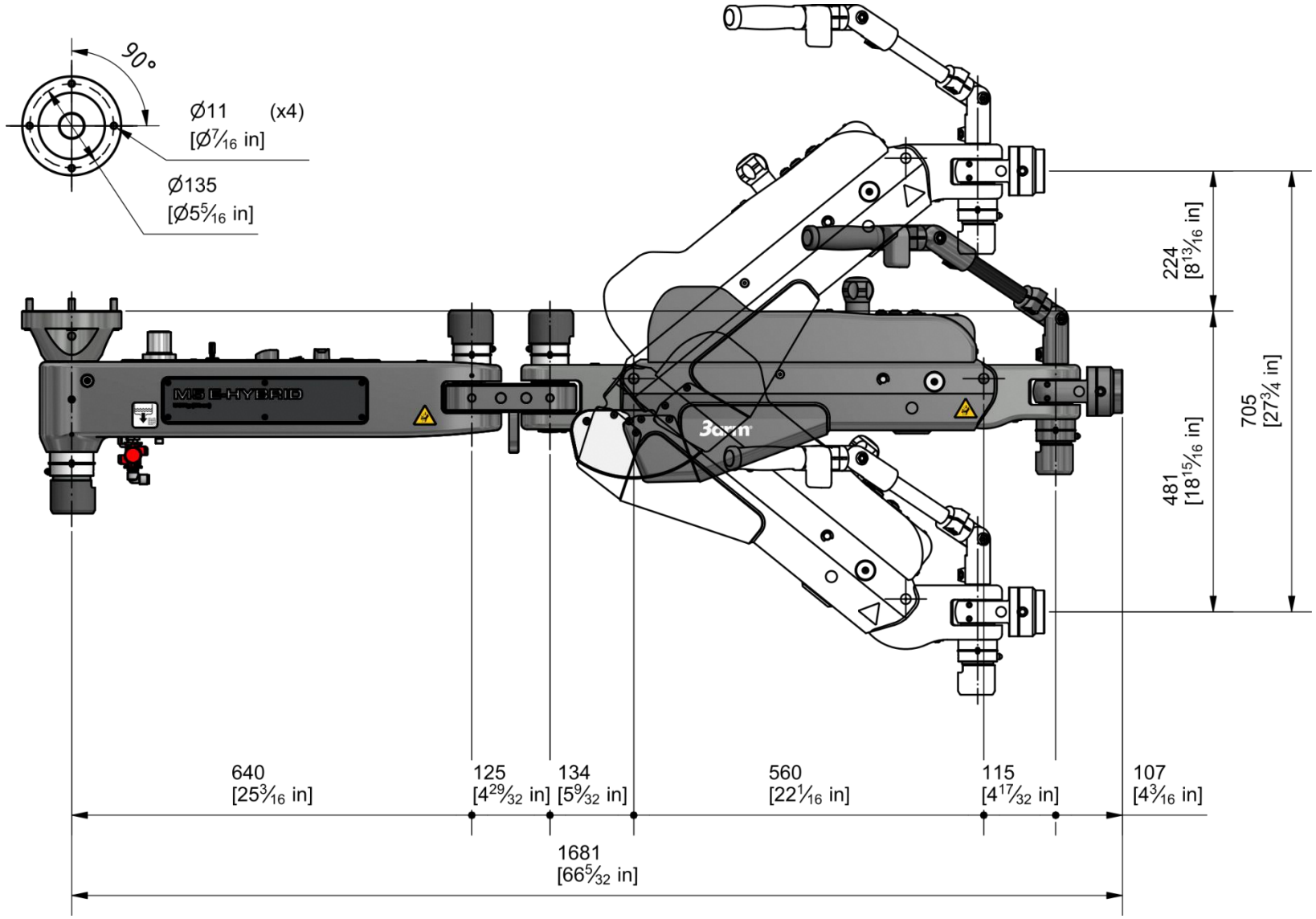
Order example: **MANIPULATOR M5- PB5+CE51+MA5+NC5+L0E (XX kg)**
XX= Weight of head and load-securing device.

4.3 GENERAL DIMENSIONS

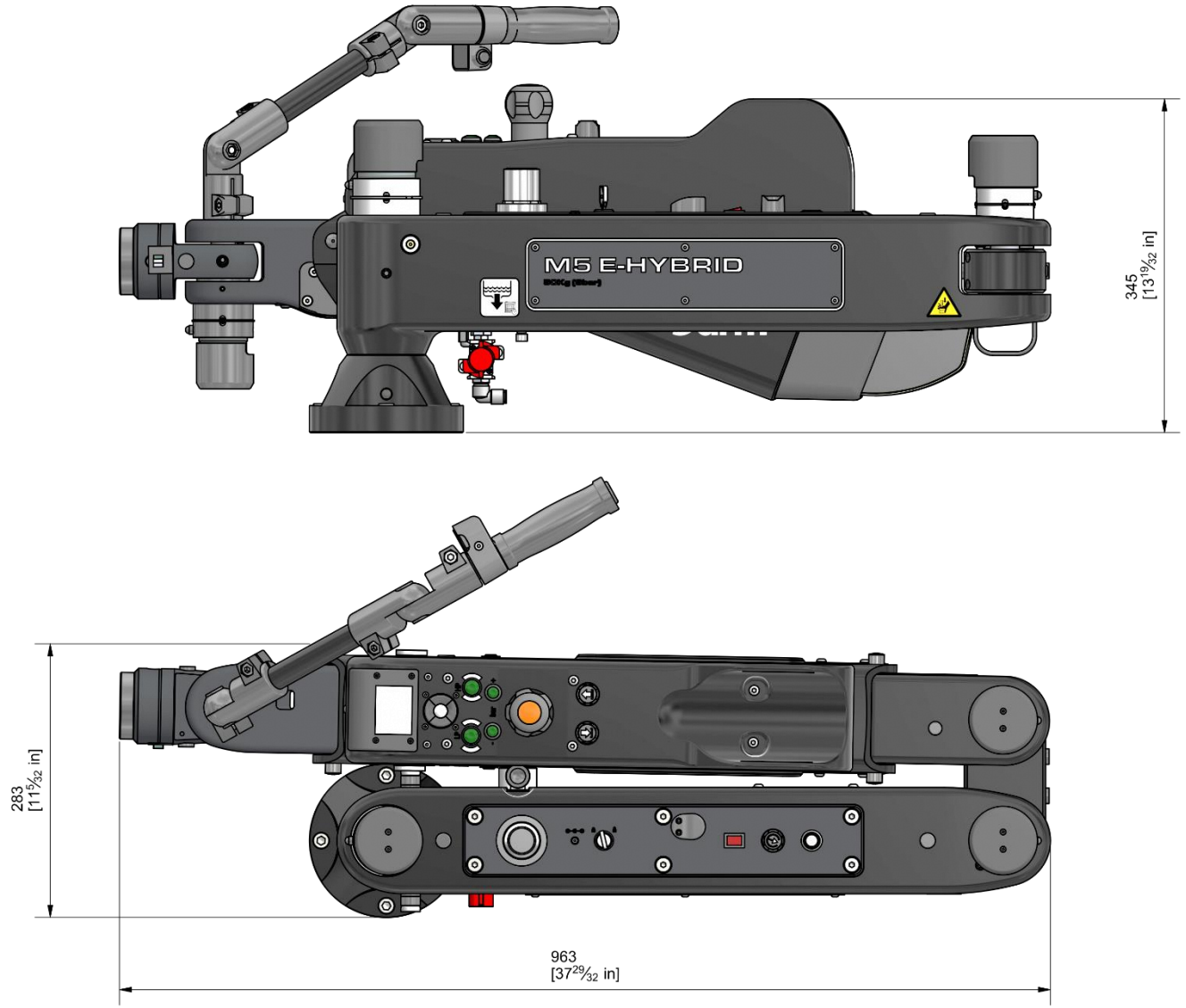
4.3.1 Extended position (Tabletop version)



4.3.2 Extended position (Ceiling-mounted version)

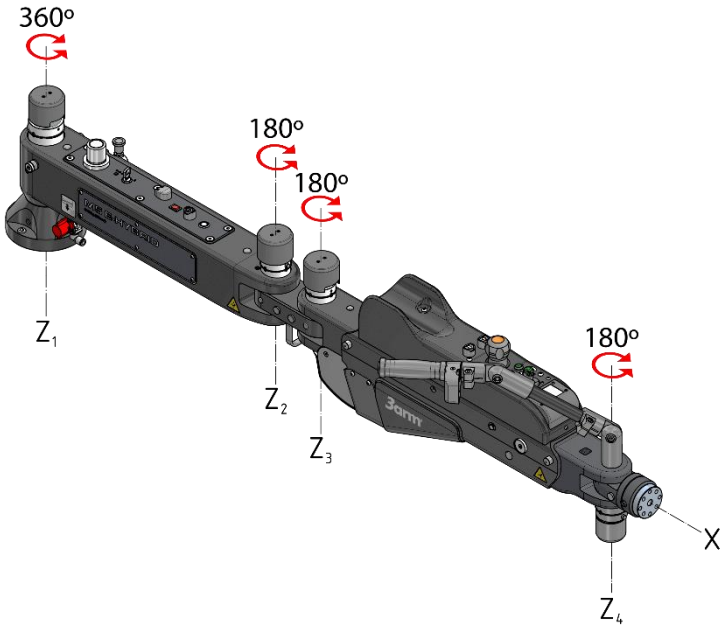


4.3.3 Retracted position – Parking



4.4 MOVEMENTS

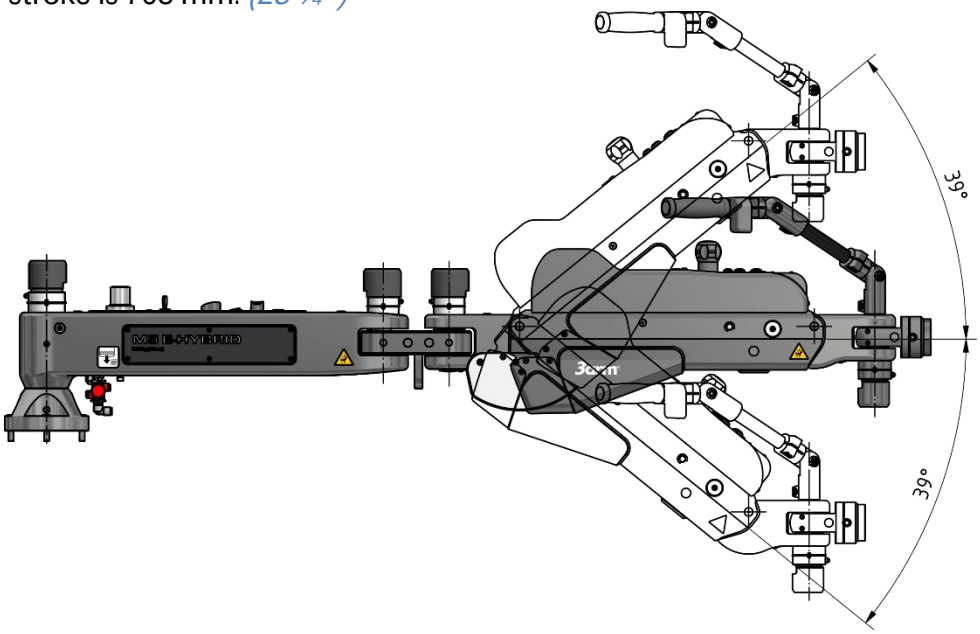
4.4.1 Arm and radial arm movements



Base Rotation movement - radial arm: 360º (Z_1 Axis)
Radial arm – joint rotation movement: 180º (Z_2 axis)
Joint – arm rotation movement: 180º (Z_3 axis)
Head rotation movement: 180º (Z_4 axis).
Head rotation movement[1]: 360º (4x90º) (X axis)

4.4.2 Ascending and descending arm movements

The arm can move from -39º to + 39º from the horizontal.
The vertical stroke is 705 mm. *(28 ¾ ")*



This movement is made by the operator, although the weightless system facilitates it.

[1] May vary depending on the head chosen.

4.5 CONSIDERATIONS OF USE

The equipment should only be operated for its intended use. Any other use is forbidden [See GENERAL WARNINGS AND CONSIDERATIONS page 6].

The manipulator must only be used with the type of loads that have been considered in its design, without exceeding the working load limit (WLL) indicated in the technical specifications and in the identification plate of the equipment.

Only one operator can work with this manipulator at a time and must use safe movements and transitions.

The manipulator is designed for fast, controlled, and repetitive load handling.

4.6 DESIGN CONSIDERATIONS

The manipulator has been designed applying the mechanical resistance requirements corresponding to the standard UNE-EN 13001-1:2006+A1:2009/AC: 2010EN and UNE-EN 13001-2:2006+A1:2009/AC: 2010.

All parts and components accessible to the operator have been manufactured without sharp edges or angles that could cause injury.

All the indications of the UNE-EN 14238:2005+A1:2010EN standard, regarding ergonomics and noise emission, have been considered.

4.7 TECHNICAL SPECIFICATIONS

4.7.1 General technical specifications

GENERAL TECHNICAL SPECIFICATIONS		
Dimensions and mass		
	Height	345 mm *(13.6")*
	Length	963 mm *(37.9")*
	Width	283 mm *(11.2")*
	Mass	48 kg *(106 lb)*
Movements		
	ZX Plan	± 39º
	XY working radius	1680 mm *(66.1")*
	$Z_{1\ axis}$	360º
	$Z_{2\ axis}$	180º
	$Z_{3\ axis}$	180º
	$Z_{4\ axis}$	180º
	Vertical travel	705 mm *(27.8 ")*
Reaction torque		
Maximum torque	Max. vertical work Head	350 Nm *(258 ft lb)*
Load capacity		
	Maximum net load range	0-50Kg *(0-110 lb)*
	Maximum net load	50 kg *(110 lb)*
	Maximum gross load *(load securing device + load to be handled)*	70 kg *(154 lb)*
Batteries		
	Battery capacity	5 Ah
	Charging time	60 - 90 min
	Working operation	17 - 25 h
	Service life	≤80% after approx. 1000 cycles
Electrical specifications		
	Supply voltage	100-240Vac 50-60Hz
	Operating voltage	24V
	Power	100 W
	Type of protection	IP42
Pneumatic specifications		
	Power fluid	Pressurised air
	Max. working pressure	0.7 MPa *(7 bar)*
	Operating pressure[2]	0.45 - 0.65 MPa *(4.5 - 6.5 bar)*
	Maximum instant consumption	515 dm^3/min
Operating conditions		
	Temperature[3]	+5 to +45ºC
	Relative humidity	Max. 70%
	Environment	Interior industrial environments
	Noise	<70 dB(A)
	Min. illumination at work station	500 lux

[2] The equipment will not operate below 4 bar.
[3] The temperature range will be reduced to +10 to +45°C if suction cups are used on the load securing device.

4.7.2 Maximum load

The manipulator can support up to 50 kg *(110 lb)* net load and 70 kg *(154 lb)* gross load.

- ✓ **Net load**, refers to the mass of the load you want to work with.
- ✓ **Gross load**, refers to the sum of the net load and the load securing device.

MAXIMUM LOAD

- ✓ The manipulator can carry a net load of up to 50 kg *(110 lb).* (Regardless of the weight of the securing device).

4.7.3 Working pressures

Depending on the working conditions and the mass of the load you wish to work with, you must adjust the supply pressure according to the following table.

WORKING PRESSURE		
Pressure (bar)	Pressure (MPa)	Maximum net load (kg)/(lb)
6	0.6	50 *(110 lb)*
5	0.5	41.6 *(92 lb)*
4	0.4	33.3 *(73 lb)*

Always set 1 bar (0.1 MPa) above the required pressure of the load to be handled to allow for the pressure drop when actuating an actuator and enable the equipment to operate more smoothly.

4.7.4 Pneumatic consumption

Electro-pneumatic load handling equipment has an associated pneumatic consumption. The following table details the maximum consumption per cycle:

ACTUATORS	MAXIMUM CONSUMPTION PER CYCLE
Main cylinder	4.2 dm^3
Locking cylinders	1 dm^3
Revolving module	4 dm^3
Rotating module	2 dm^3

4.8 IDENTIFICATION

A sticker on the radial arm identifies the manipulator and indicates the following features.

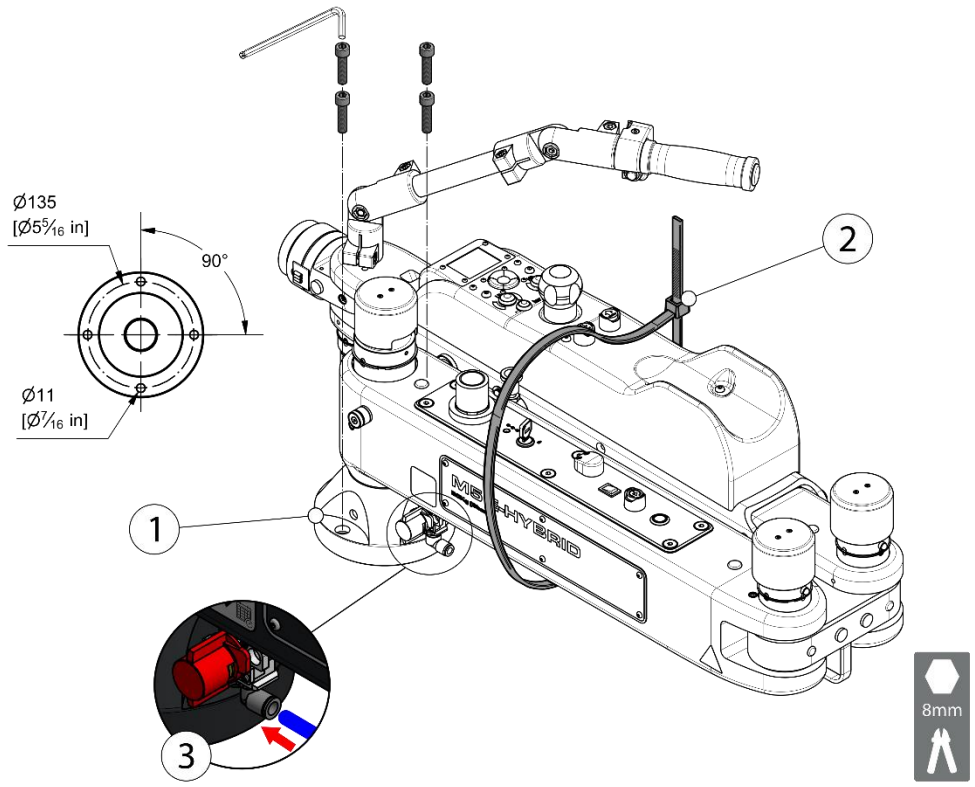
CE and UKCA Marking, Manufacturer (name, address and company name), Date of manufacture, Serial number, Model, Working Load Limit (WLL), Voltage, Power, Batteries and Working Pressure.

5 INSTALLATION

GENERAL CONSIDERATIONS ABOUT THE INSTALLATION

- ✓ The work bench or installation location must be a horizontal surface, thus avoiding shifts and deviations.
- ✓ The steps to follow for the installation will depend on the fastening method and the alternatives available in the selected location. In any case, the integrator, owner and/or end user is responsible for determining the product's suitability for each use, the installation location, specifically defining the task to be performed within the limits set forth in this manual and the issue of the statement of compliance.
- ✓ ATTENTION! Do not cut the ties, unlock the arm or connect the air intake until the load securing device installation is complete, otherwise the arm could begin a violent upward movement that could cause damage.

1. **Remove the manipulator from its original packaging.**
2. **Secure the base** (1) of the manipulator with four M10 screws (Recommended torque 45 Nm) *(8 mm Allen key).*
3. **Install** the load securing device (if any).
4. **Cut the safety flanges** (2).
5. **Make the air connection** (3) (Ø8 mm tube).
6. **Check that the connection has been made properly** and that there is no risk of leaks or anomalies in the supply.



The surface where the equipment is placed must withstand a minimum torque of 1500 Nm.

INSTALLATION LOCATION

Do not install the equipment in environments such as:

- ✓ areas with explosion or fire hazards
- ✓ exterior areas
- ✓ corrosive areas
- ✓ areas with extreme temperatures (very high or very low)
- ✓ areas with high humidity
- ✓ dusty areas
- ✓ areas with high electromagnetic emissions

SUPPLY AIR

- ✓ The supply air must meet the specifications shown in [See COMPRESSED AIR MAINTENANCE UNIT page52].
- ✓ Use clean air. If the compressed air contains chemicals, organic solvents, synthetic oil or corrosive gases, the parts may be damaged or may cause malfunction.
- ✓ When there is excessive condensation, install a device that removes water, for example, a dryer or water dryer (condensate collector), on the inlet side of the air filter.

ABOUT THE LOAD SECURING DEVICE

- ✓ If the manipulator has an approved load securing device provided by the manufacturer, this may be assembled in the equipment itself, following the recommendations and guidelines in the manual supplied.
- ✓ If the equipment does not have an approved load-securing device, the integrator must attach the assembly/disassembly instructions to this manual.

6 ADJUSTMENTS

GENERAL CONSIDERATIONS ABOUT THE SETTINGS

The settings indicated in this section assume that the manipulator and the corresponding load-mounting device are duly installed and integrated following the guidelines in this manual and, if appropriate, in the manual of the load-mounting device supplied.

6.1 OPENING AND CLOSING THE MAIN VALVE

The main valve allows or restricts the supply of pressurised air for the manipulator. It also allows de-energising of the pneumatic circuit of the equipment.

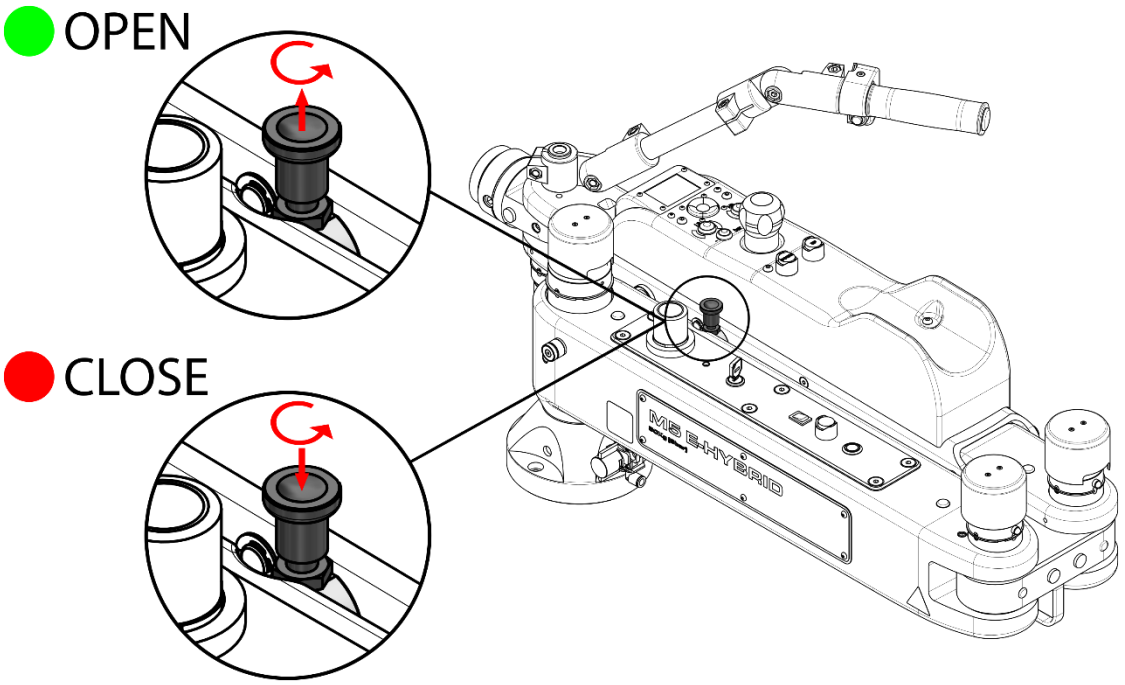
PERIODS OF INACTIVITY

The main valve must restrict the passage of air in the closed position (CLOSE) when the equipment is not in use.

6.2 PARKING POSITION – WORKING POSITION

Follow these guidelines to bring the Manipulator to the work station:

1. Unlock the locking device: pull the knob upwards and, without letting go, turn slightly counter-clockwise.
2. Accompany the arm away from its initial position.
3. Proceed in reverse order to interlock the locking device.



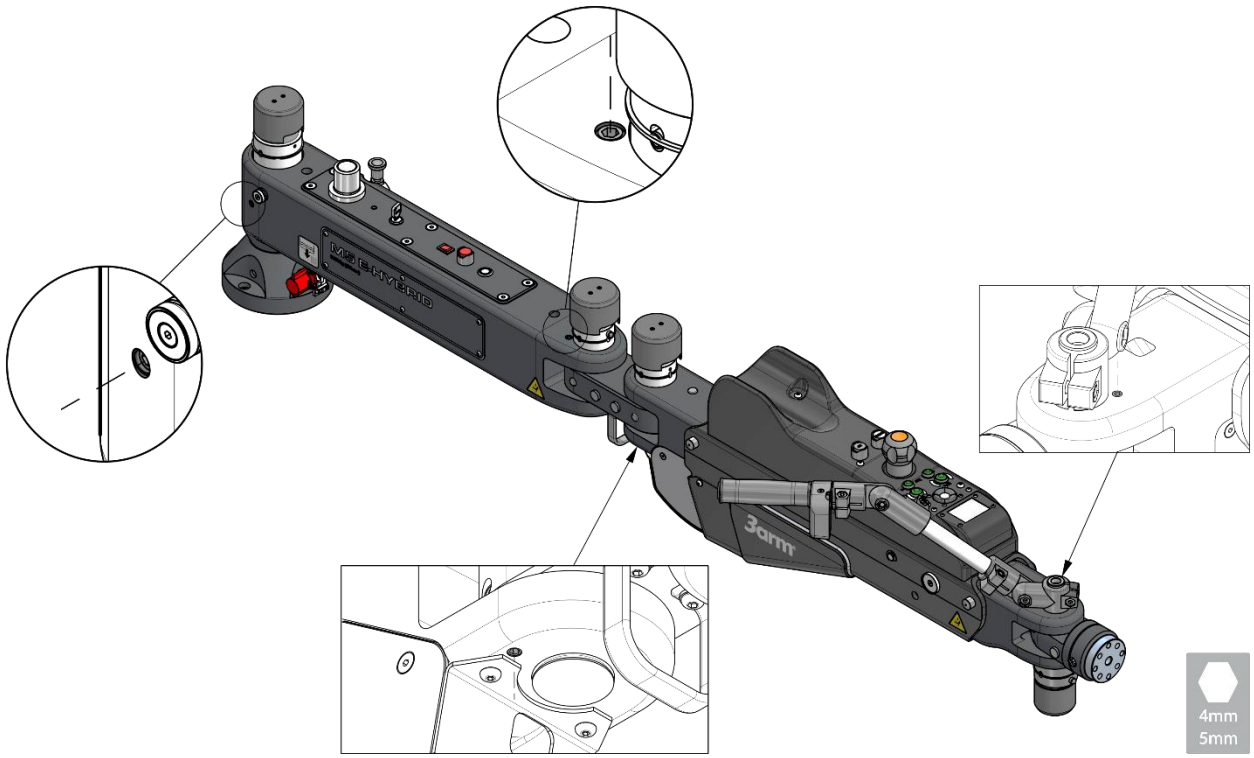
PARKING POSITION

- ✓ When the manipulator is not in use, it must be left in the collected or parking position with the locking device correctly locked.
- ✓ In installation and maintenance tasks and when changing the load securing device, or any other element on the manipulator, position the manipulator in parking mode making sure that the locking device remains correctly locked.
- ✓ Close the main valve while the equipment is not in use.

6.3 REGULATION OF THE RESISTANCE TO ROTATION.

Threaded rods located on the base – parallel, parallel – joint, joint – cross and fork – head enable the rotation of the different axes of the manipulator's movement to be adjusted. The studs can be tightened or loosened to regulate this turning resistance (Allen key 4 and 5 mm).

The rotation resistance adjustment is especially useful in situations where the operator's base is not completely horizontal and thus avoids slight rotation of the joints due to the unevenness of the floor.



SHIFTING AND DEVIATIONS

Correctly adjusting the regulation of the rotational resistance prevents the risk of shifting and deviations during the operation of the manipulator.

6.4 PRESSURE REGULATION

The objective of this regulation is to maintain the manipulator's swivel arm balanced and therefore ensure the assembly's weightlessness is adapted to the load and working conditions.

There are several workload pressures.

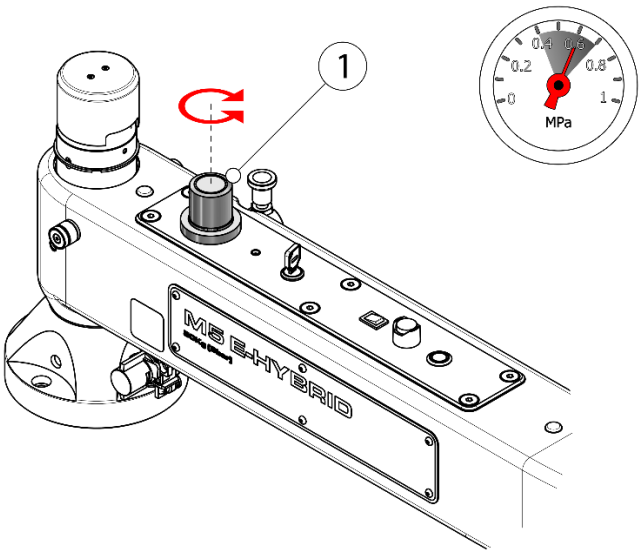
- **Supply pressure:** Pressure of air entering the equipment.
- **Low pressure (LP)** This is the pressure that will reach the cylinder when the manipulator is not carrying a load.
- **Minimum high pressure (MIN)** This is the minimum pressure that reaches the cylinder when the operator is carrying a load. The conversion to Kg will appear on the screen.
- **Maximum high pressure (MAX)** This is the maximum pressure that reaches the cylinder when the operator is carrying a load. The conversion to Kg will appear on the screen.

These pressures can be easily and safely varied to suit the weight of the load to be handled. Must be adjusted according to the working conditions, following these guidelines:

6.4.1 Regulating the supply pressure

Adjust the air supply pressure to the working conditions by adjusting the **pressure regulator (1).**

1. Push up on the knob edge to unlock the anti-rotation mechanism.
2. Turn the knob left or right to adjust the pressure. (max. 0.7 MPa) (pressure should be approx. 0.1 Mpa greater than the highest pressure), taking as a reference [SeeWorking pressures page 20].



The minimum supply pressure is 4 bar. The equipment will not work if the pressure is lower.

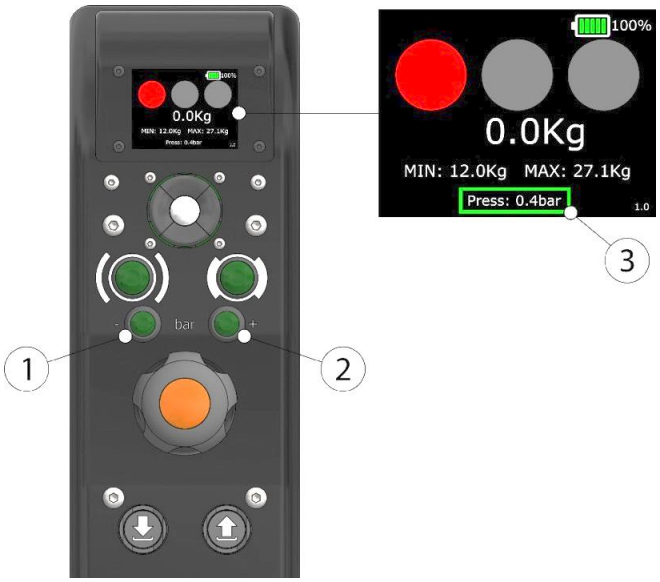
6.4.2 Unloaded arm balancing (Low pressure - LP)

CAUTION

- ✓ To adjust the unloaded arm, it is necessary to have the approved load securing tools installed (clamp, suction cups, magnet, etc.) and to have the equipment duly integrated.
- ✓ Do not activate high pressure during this process.

1. Ensure that the equipment remains with the low pressure activated [See OPERATION page 31].
2. Adjust the low pressure (LP) using the buttons (1) lower pressure and (2) raise pressure so that the manipulator tilting arm is balanced on its own. The pressure value will change instantly in zone (3).
3. Press buttons (1) and (2) at the same time for 1 second to save the selected value. When the value is saved, a green box will appear in the area (3) of the screen.

The pressure corresponding to MIN and MAX will be the same, but when the new value is saved, the MIN and MAX weight will be updated instantly and recalculated so that the low pressure (LP) is 0 kg.



6.4.3 Loaded arm balancing (High Pressure - HP)

There are two reference pressures:

- The minimum pressure (MIN): the pressure that enters the cylinder when the high pressure is activated. Corresponds to the minimum load to be handled. The conversion to Kg will appear on the screen.
- Maximum pressure (MAX): the maximum pressure that will enter the cylinder. Corresponds to the maximum load to be handled. The conversion to Kg will appear on the screen.

The range between the minimum high pressure and the maximum high pressure will be the available work range [See OPERATION page 31].

6.4.3.1 *Minimum high pressure regulation (MIN)*

CAUTION

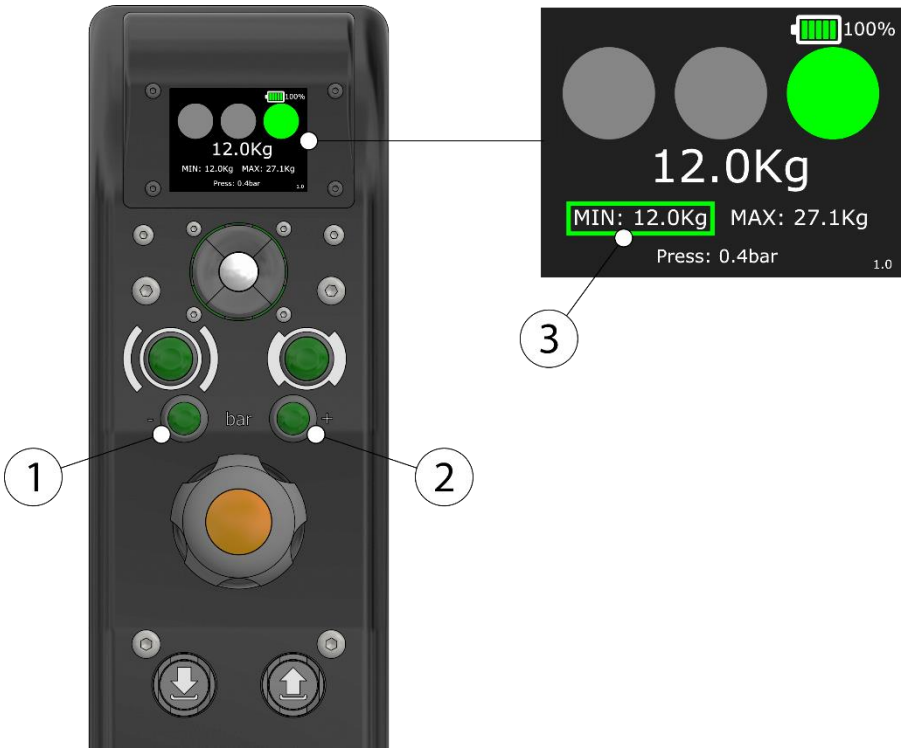
- ✓ To adjust the loaded arm, it is necessary to have the approved load securing tools installed (clamp, suction cups, magnet, etc.) and to have the equipment duly integrated.
- ✓ Refrain from activating high pressure without grip and/or no load.

The following process will regulate the pressure that will enter the cylinder when the high pressure is activated. This will reduce your load range to be lifted, avoiding working with a pressure range that would correspond to lower loads.
In order to make the regulation more intuitive, the screen will show the approximate load to be supported by the equipment in kg.

This adjustment can be made in any of the 3 operating states of the equipment.

1. Press buttons (1) and (2) at the same time for 3 seconds. A red box will appear in zone (3) and the minimum high pressure (MIN) edit mode will be activated.
2. Set the minimum high pressure MIN using the buttons down (1) and up (2) according to the minimum load to be handled. The load value will change instantly in zone (3).
3. Press buttons (1) and (2) at the same time for 1 second to save the selected value. When the value is saved, a green box will appear in the area (3) of the screen.

For good use of the equipment, it is recommended to set the minimum high pressure (MIN) lower than the one corresponding to the minimum load to be handled. A more precise adjustment is made later during operation [See OPERATION page 31].



6.4.3.2 Maximum high pressure regulation (MAX)

CAUTION

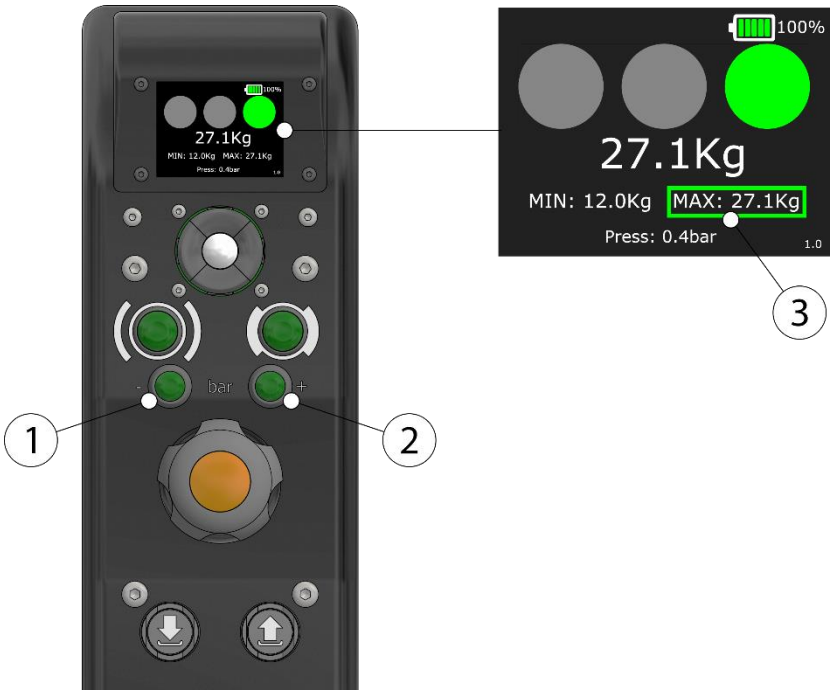
- ✓ To adjust the loaded arm, it is necessary to have the approved load securing tools installed (clamp, suction cups, magnet, etc.) and to have the equipment duly integrated.
- ✓ Refrain from activating high pressure without grip and/or no load.

The following process will regulate the maximum pressure that will enter the cylinder with the high pressure activated. This will reduce your load range to be lifted, avoiding working with a pressure range that would correspond to higher loads.
In order to make the regulation more intuitive, the screen will show the approximate load to be supported by the equipment in kg.

This adjustment can be made in any of the 3 operating states of the equipment.

1. Press buttons (1) and (2) at the same time for 5 seconds. A red box will appear in zone (3) and the maximum high pressure (MAX) edit mode will be activated.
2. Set the maximum high pressure MAX using the buttons down (1) and up (2) according to the maximum load to be handled. The load value will change instantly in zone (3).
3. Press buttons (1) and (2) at the same time for 1 second to save the selected value. When the value is saved, a green box will appear in the area (3) of the screen.

For good use of the equipment, it is recommended to regulate the maximum high pressure (MAX) higher than the maximum load to be handled. A more precise adjustment is made later during operation [See OPERATION page 31].



7 OPERATION

The manipulator is designed to handle loads manually.

Although load handling is manual, the built-in electronics provide precise control over the pneumatic action that assists in gripping, orienting and supporting the load.

INTEGRATION

This operator requires a load securing/tooling device to perform a given application. It is the responsibility of the integrator to study, design and validate the load-mounting device depending on the application. This device must be authorised by the manufacturer of the manipulator.

This chapter must be complemented with the corresponding section on the operation of the load securing device chosen.

OPERATION

The equipment must only be used after correct integration and after correctly installing the load securing device.

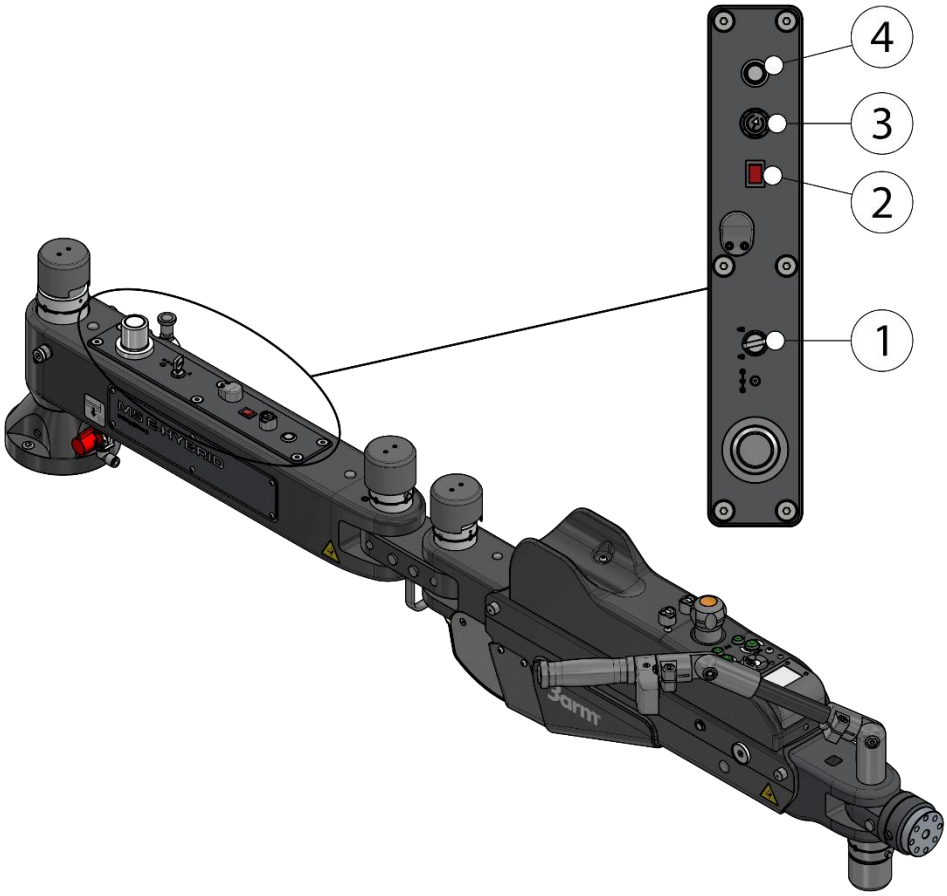
Status messages will be displayed at all times on the screen incorporated in the arm cover. For any questions, please consult [See SCREEN page 43].

If the operator is provided with a tool with a different purpose than lifting, transportation, pivoting or swinging, it must include an emergency stop device acting on the pneumatic loading/feeding movements, and its reliability level must be at least PL 'c'.
The emergency stop must act on the pneumatic supply of the manipulator and require the person using the manipulator and tool assembly to install a solenoid valve as a cut-off device for the pneumatic supply.

7.1 IGNITION SEQUENCE

Before starting to handle loads and after making the appropriate adjustments [See ADJUSTMENTS page 24]. To start the manipulator:

1. Insert and turn the key (1) towards (🔓).
2. Turn on the switch (2).
3. Keep the button (3) pressed until the residual pressure is completely released.
4. Press the reset button (4).



At the end of the working day, turn off the switch, turn and remove the key and turn off the power supply to the equipment [See OPENING AND CLOSING THE MAIN **VALVE** page 24].

If there is a power outlet near the equipment, it is recommended to keep the equipment connected to the charger to avoid premature battery wear.

7.2 SINGLE HANDLEBAR

OPERATION

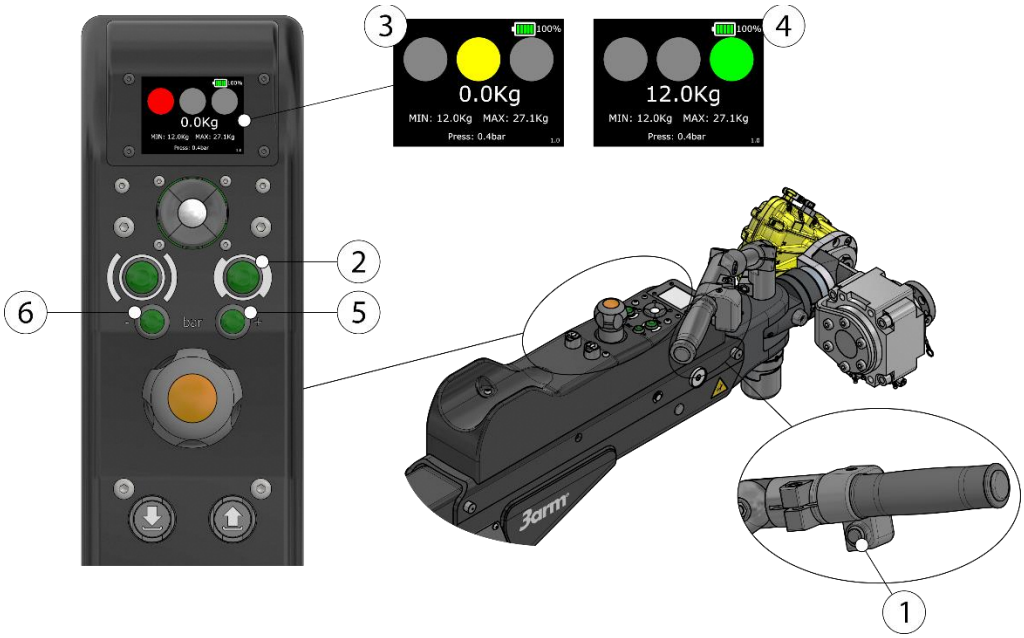
- The following information regarding the operation of the M5E-Hybrid Manipulator is for information purposes only. The equipment must only be used after proper integration and correct installation of the load securing device.
- Do not activate the high pressure without a load-mounting device duly installed and integrated.

All the actuators on the [4]equipment must remain locked to prevent unintentional activation.

To **activate the high pressure**:

1. Bi-manual safety system, press buttons (1) and (2) at the same time. The air flow to the actuator will be enabled and this will then be able to carry out its function. The light on the screen (3) will change from red to amber, the actuator will remain activated.
2. Bi-manual safety system, press buttons (1) and (2) at the same time. The high pressure will be activated, the screen (4) will turn green and the manipulator will fill the cylinder to the pressure corresponding to the minimum MIN load.
3. Pressing the button[5] (5) will allow air to flow into the cylinder and the load will be lifted.
4. Pressing the button (6) will decrease the cylinder pressure and the load will be lowered.

Repeat step **3** and **4** until the desired load balance is found within the range between MIN and MAX.

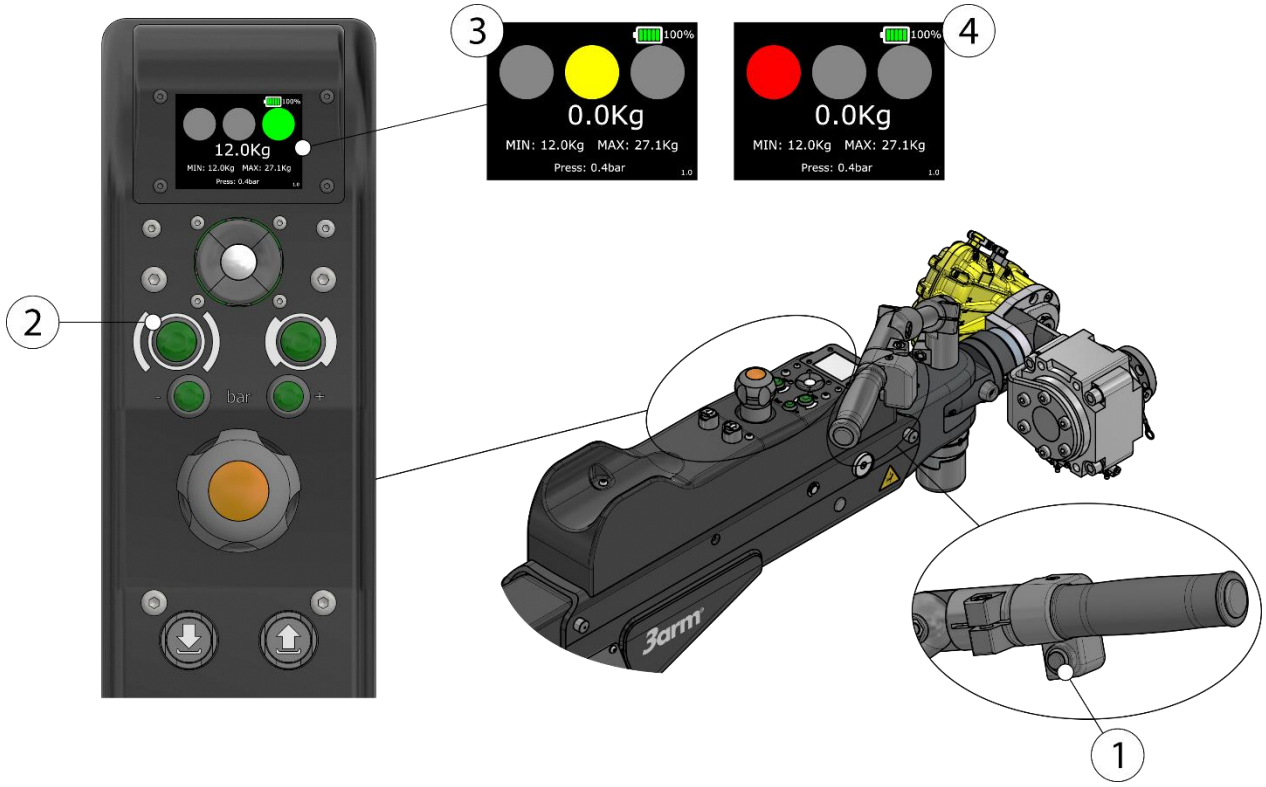


[4] Actuators of the Manipulator: Opening/closing clamp or clamping device, transition from low to high pressure or vice versa, movement of the turning module or revolving module.
[5] Holding down the buttons (5 or 6) will allow a faster intake airflow.

To **activate the low** pressure:

1. Bi-manual safety system, press buttons (1) and (2) at the same time. The manipulator will empty the cylinder to low pressure and the screen (3) will turn from green to amber, the actuator will remain activated.
2. Bi-manual safety system, press buttons (1) and (2) at the same time. Air flow will be allowed to the actuator for deactivation, the light on the screen (4) will turn red.

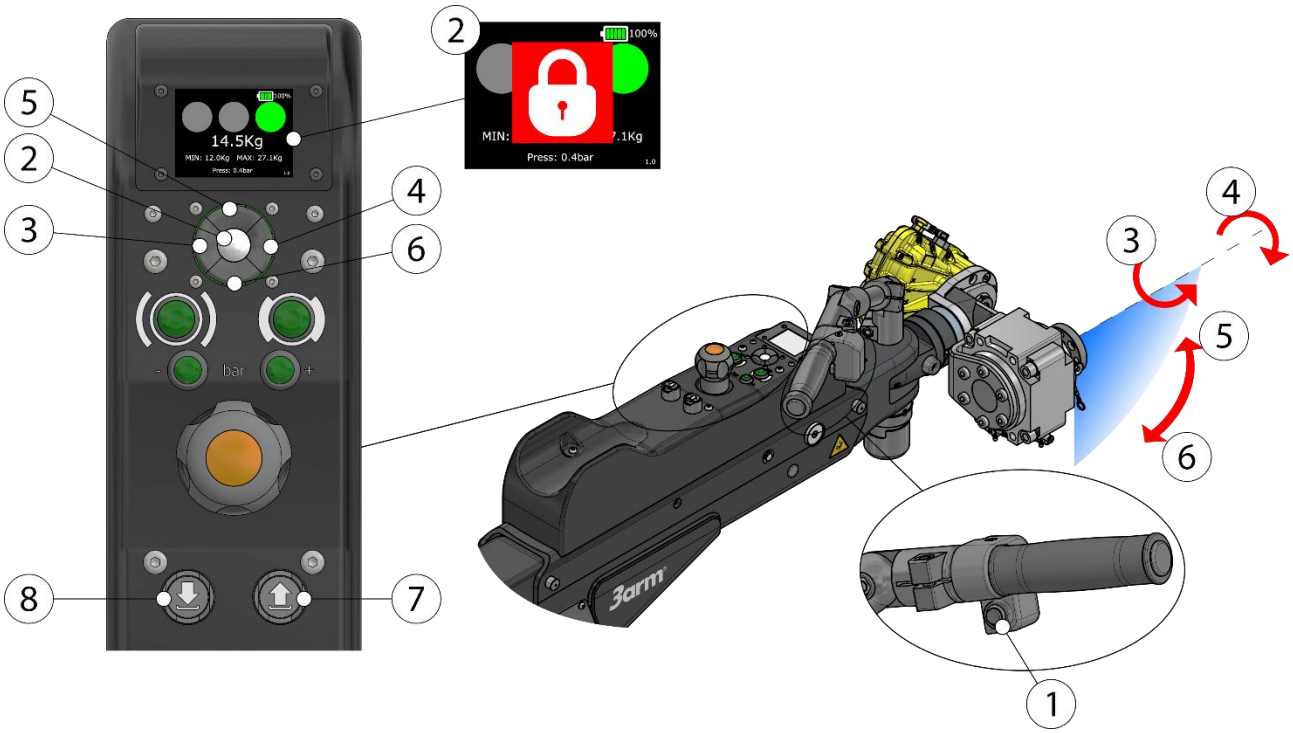
If the manipulator is purchased together with a suitable securing device, the complete operating cycle can be found in the appendix for the corresponding securing device.



7.2.1 Actuators

In order to adapt to the environment and facilitate load handling, the manipulator can be fitted with various rotating, locking and lift control modules.

The function of the arm buttons is detailed below, for more detailed information see [See HEADS page 74]:



IDENT	FUNCTION
1	ENABLING MECHANISM/SAFETY SYSTEM
2*	PNEUMATIC LOCKING/UNLOCKING MANIPULATOR JOINTS
3*	ACTIVATION COUNTERCLOCKWISE ROTATING ACTUATOR
4*	ACTIVATION CLOCKWISE ROTATING ACTUATOR
5*	ACTIVATION REVOLVING UP ACTUATOR
6*	ACTIVATION REVOLVING DOWN ACTUATOR
7*	RAISE PNEUMATIC LIFT/COLUMN D100
8*	LOWER PNEUMATIC LIFT/COLUMN D100

***Opional**

ADDITIONAL INFORMATION

Only for equipment with pneumatic locking, rotation modules and/or hoist.

To block **the manipulator:**

Press the button (2). The pneumatic locks of the manipulator will be activated. When the lock is activated, the message will appear on the screen (2). To unlock, press the button (2) again.

For more details on the operation of the Revolving and/or Rotating modules, [See HEADS page 74].

To **hoist the equipment:**

- To **hoist the manipulator,** press the button (1) and (7) at the same time.
- To **lower the manipulator,** press the button (1) and (8) at the same time.

7.3 DOUBLE HANDLEBAR

OPERATION

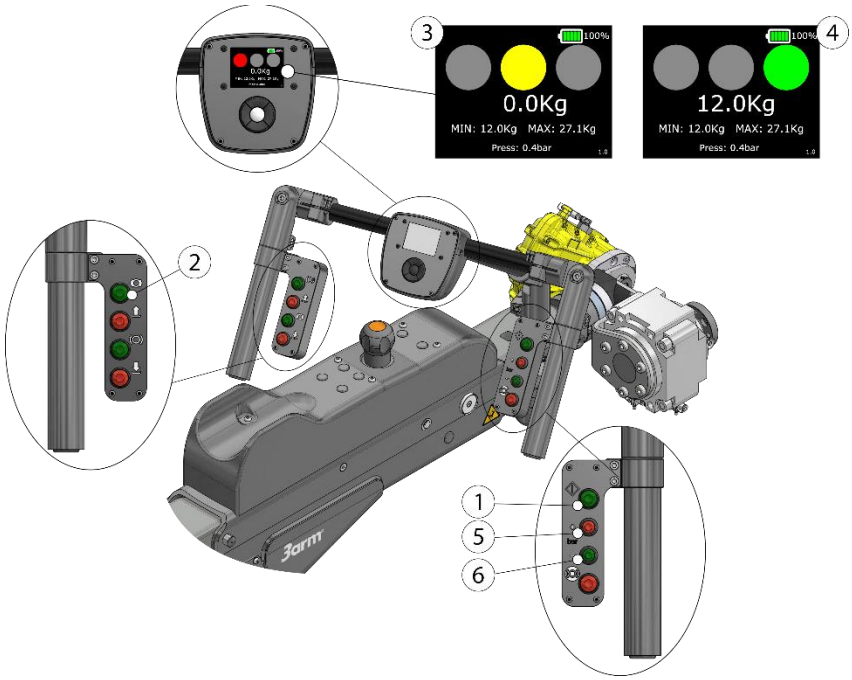
- The following information regarding the operation of the M5E-Hybrid Manipulator is for information purposes only. The equipment must only be used after proper integration and correct installation of the load securing device.
- Do not activate the high pressure without a load-mounting device duly installed and integrated.

All the actuators on the [6]equipment must remain locked to prevent unintentional activation.

To **activate the high pressure**:

1. Bi-manual safety system, press buttons (1) and (2) at the same time. The air flow to the actuator will be enabled and this will then be able to carry out its function. The light on the screen (3) will change from red to amber, the actuator will remain activated.
2. Bi-manual safety system, press buttons (1) and (2) at the same time. The high pressure will be activated, the screen (4) will turn green and the manipulator will fill the cylinder to the pressure corresponding to the minimum MIN load.
3. Pressing the button[7] (5) will allow air to flow into the cylinder and the load will be lifted.
4. Pressing the button (6) will decrease the cylinder pressure and the load will be lowered.

Repeat step **3** and **4** until the desired load balance is found within the range between MIN and MAX.

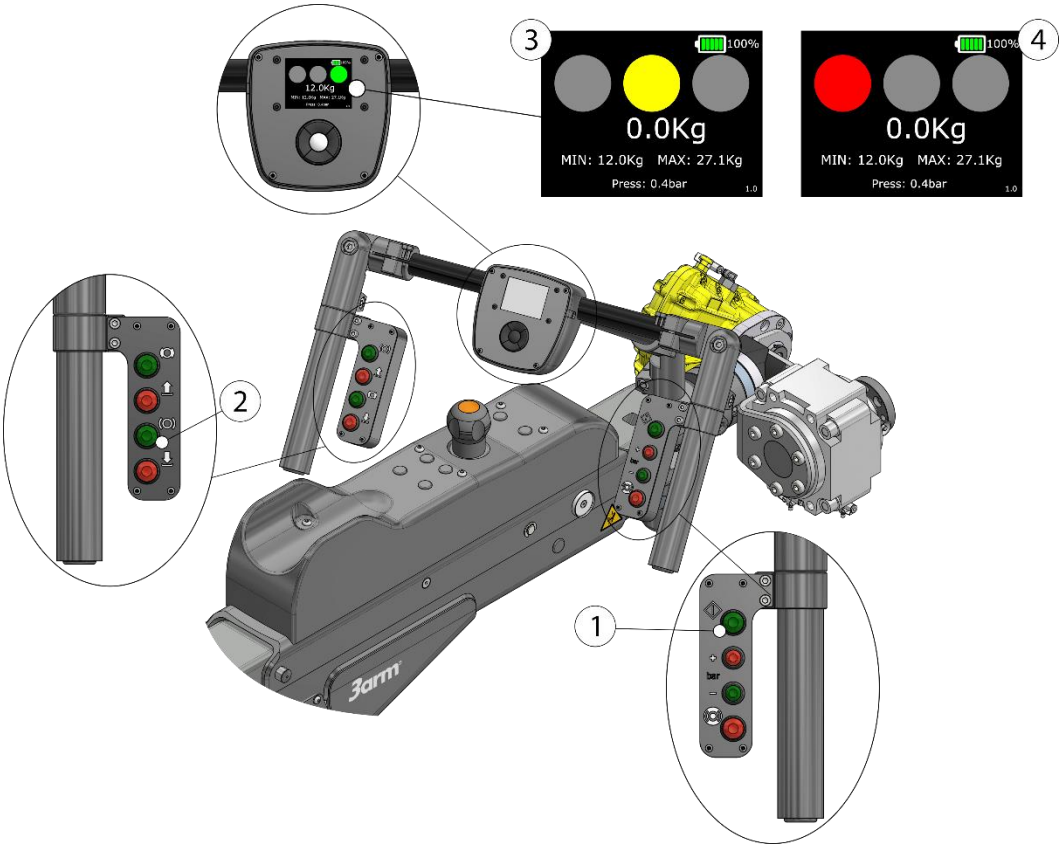


[6] Actuators of the Manipulator: Opening/closing clamp or clamping device, transition from low to high pressure or vice versa, movement of the turning module or revolving module.
[7] Holding down the buttons (5 or 6) will allow a faster intake airflow.

To **activate the low** pressure:

1. Bi-manual safety system, press buttons (1) and (2) at the same time. The manipulator will empty the cylinder to low pressure and the screen (3) will turn from green to amber, the actuator will remain activated.
2. Bi-manual safety system, press buttons (1) and (2) at the same time. Air flow will be allowed to the actuator for deactivation, the light on the screen (4) will turn red.

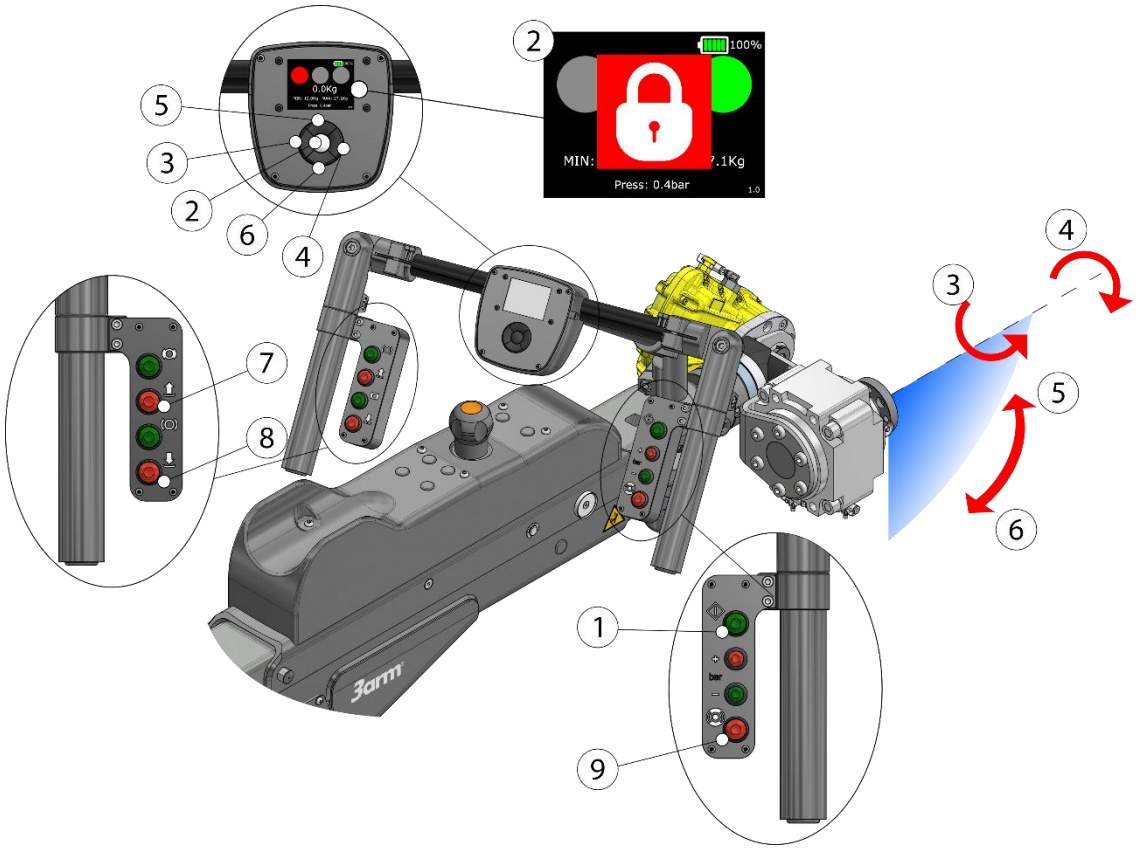
If the manipulator is purchased together with a suitable securing device, the complete operating cycle can be found in the appendix for the corresponding securing device.



7.3.1 Actuators

In order to adapt to the environment and facilitate load handling, the manipulator can be fitted with various rotating, locking and lift control modules.

The function of the arm buttons is detailed below, for more detailed information see [See HEADS page 74]:



IDENT	FUNCTION
1	ENABLING MECHANISM/SAFETY SYSTEM
2*	PNEUMATIC LOCKING/UNLOCKING MANIPULATOR JOINTS
3*	ACTIVATION COUNTERCLOCKWISE ROTATING ACTUATOR
4*	ACTIVATION CLOCKWISE ROTATING ACTUATOR
5*	ACTIVATION REVOLVING UP ACTUATOR
6*	ACTIVATION REVOLVING DOWN ACTUATOR
7*	RAISE PNEUMATIC LIFT/COLUMN D100
8*	LOWER PNEUMATIC LIFT/COLUMN D100
9*	PNEUMATIC HANDLEBAR LOCK

***Optional**

ADDITIONAL INFORMATION

Only for equipment with pneumatic locking, rotation modules and/or hoist.

To block **the manipulator:**

Press the button (2). The pneumatic locks of the manipulator will be activated. When the lock is activated, the message will appear on the screen (2). To unlock, press the button (2) again.

For more details on the operation of the Revolving and/or Rotating modules, [See HEADS page 74].

ADDITIONAL INFORMATION

Only for equipment with a lift.

- To **hoist the manipulator,** press the button (1) and (7) at the same time.
- To **lower the manipulator,** press the button (1) and (8) at the same time.

ADDITIONAL INFORMATION

Only for equipment with a pneumatic lock on the handlebar.

To **move the handlebar**:

Press the button (9), it deactivates the pneumatic lock of the handlebar. You can adjust the wanted height of the handlebar. When you stop pressing the button (9) the handlebar will be locked again.

7.4 VERTICAL HANDLEBAR

This handlebar is specially designed for fast and dynamic pick and place applications, using suction cup or magnet-type actuators. In the case of applications with grippers, a bi-control button is added for the user's safety.

OPERATION

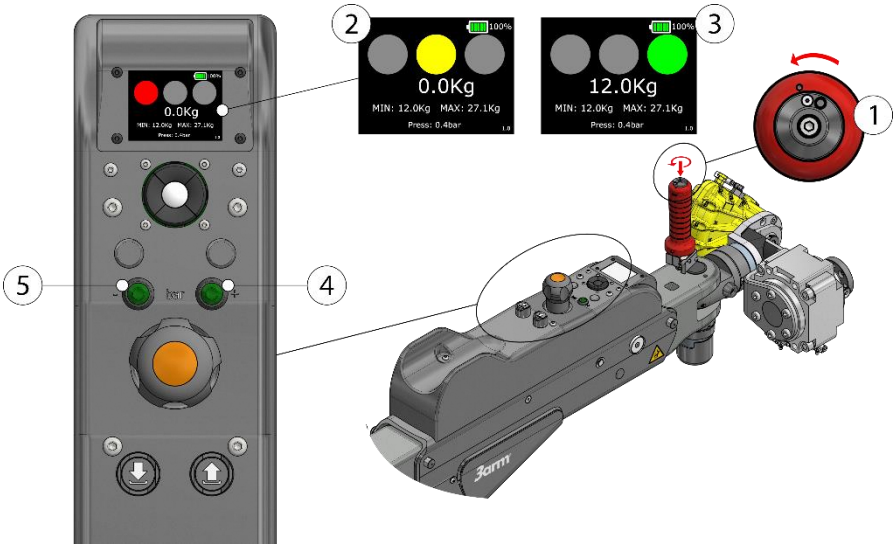
- The following information regarding the operation of the M5 Manipulator is informative. The equipment must only be used after correct integration and after correctly installing the load securing device.
- Do not activate the high pressure without a load-mounting device duly installed and integrated.

The handle remains locked by default to prevent accidental activation of the high/low pressure or opening of the grippers or mounting devices.

To **activate the high pressure**:

1. Press the centre button of the handle (1) and, without releasing it, turn it counter clockwise. The load securing device, e.g. a clamp, will close its grip. If the signals of the security sensors are correct, the light on the screen (2) will change from red to amber, the actuator will remain activated.
2. One second later, the high pressure will be activated, the screen (3) will turn green and the manipulator will fill the cylinder to the pressure corresponding to the minimum MIN load.
3. Pressing the button[8] (4) will allow air to flow into the cylinder and the load will be lifted.
4. Pressing the button (5) will decrease the cylinder pressure and the load will be lowered.

Repeat step **3** and **4** until the desired load balance is found within the range between MIN and MAX.

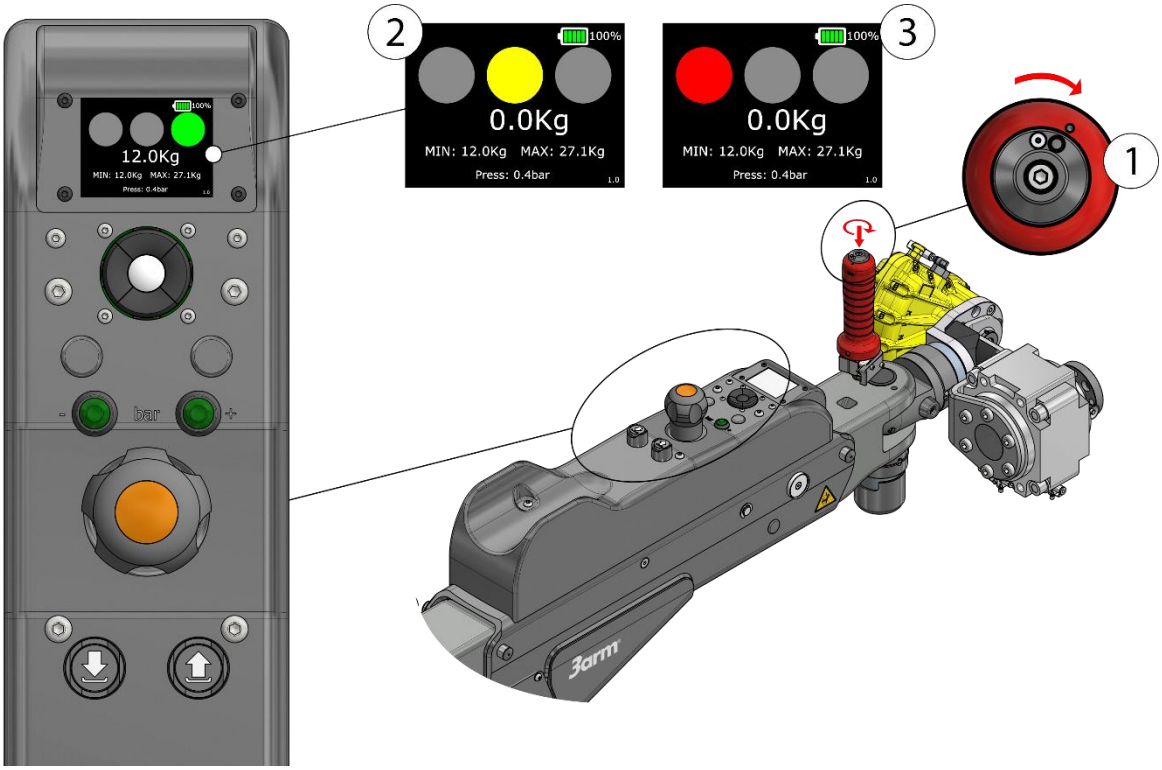


[8] Holding down the buttons (4 or 5) will allow a faster intake airflow.

To **activate the low** pressure:

1. Press the centre button of the handle (1) and, without releasing it, turn it clockwise. The manipulator will empty the cylinder to low pressure and the screen (2) will turn from green to amber, the actuator will remain activated.
2. Then the load securing device, for example a clamp, will open its grips. Air flow will be allowed to the actuator for deactivation, the light on the screen (3) will turn red.

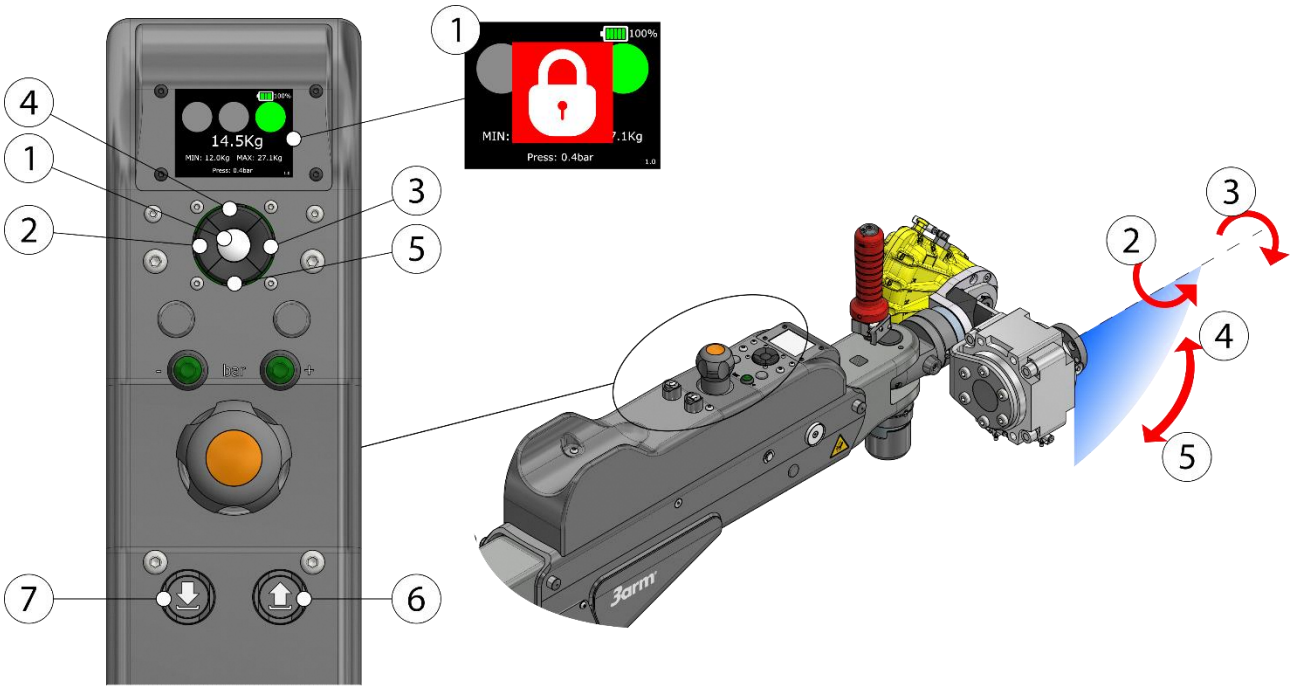
If the manipulator is purchased together with a suitable securing device, the complete operating cycle can be found in the appendix for the corresponding securing device.



7.4.1 Actuators

In order to adapt to the environment and facilitate load handling, the manipulator can be fitted with various rotating, locking and lift control modules.

The function of the arm buttons is detailed below, for more detailed information see [See HEADS page 74]:



IDENT	FUNCTION
1	PNEUMATIC LOCKING/UNLOCKING MANIPULATOR JOINTS
2	ACTIVATION COUNTERCLOCKWISE ROTATING ACTUATOR
3	ACTIVATION CLOCKWISE ROTATING ACTUATOR
4	ACTIVATION REVOLVING UP ACTUATOR
5	ACTIVATION REVOLVING DOWN ACTUATOR
6	RAISE PNEUMATIC LIFT/COLUMN D100
7	LOWER PNEUMATIC LIFT/COLUMN D100

ADDITIONAL INFORMATION

Only for equipment with pneumatic locking, rotation modules and/or hoist.

To block **the manipulator:**

Press the button (1). The pneumatic locks of the manipulator will be activated. When the lock is activated, the message will appear on the screen (2). To unlock, press the button (1) again.

For more details on the operation of the Revolving and/or Rotating modules, [See HEADS page 74].

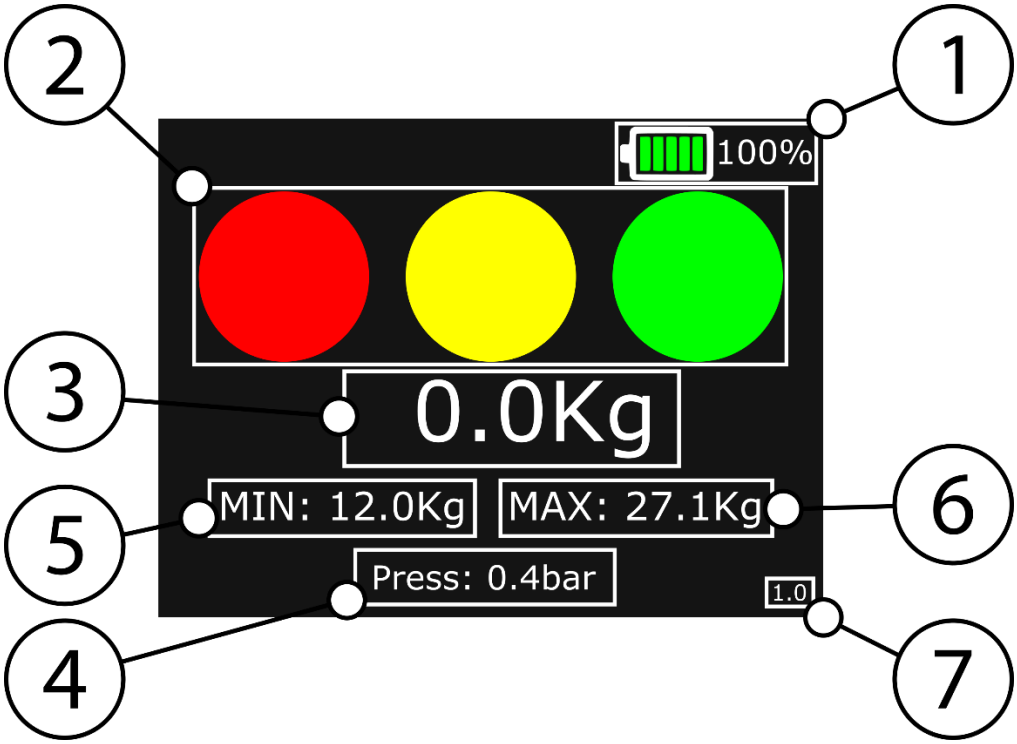
To **hoist the equipment:**

- To **hoist the manipulator,** press the button (6).
- To **lower the manipulator,** press the button (7).

7.5 SCREEN

The main screen will show at all times:

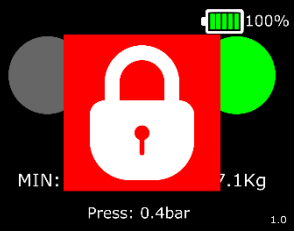
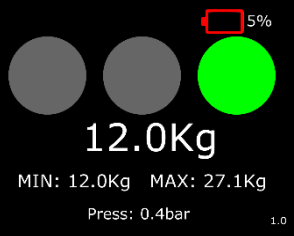
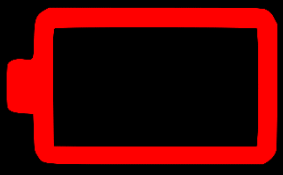
1. Battery status, visually and numerically.
2. The status traffic light:
- Red: **No part**. Low pressure and actuator disabled.
- Amber: **With properly** secured part. Low pressure, actuator activated and part detected.
- Green: **Ready to work**. High pressure, actuator activated and part detected.
3. Load being supported by the manipulator.
4. The pressure that will reach the cylinder when the low pressure is activated will be the pressure that will balance the arm when it is not supporting the load.
5. The load that the equipment will bea when the high pressure is activated will be the pressure that will balance the arm for the minimum load to be handled.
6. The load that will support the equipment when the high pressure is activated will be the pressure that will balance the arm for the maximum load to be handled.
7. Version of the software that incorporates the controller.



After 30 seconds of inactivity, the screen will go into sleep mode to save battery power. Pressing any button will return you to the last state you were in.

7.5.1 Screen messages

The M5E manipulator screen also show messages giving information on the status of the machine and the action required to exit that status and return to the normal operating cycle. The following messages may appear:

	Insufficient supply pressure (less than 4 bar). [See Regulating the supply pressure page 27]
	Necessary to extract residual pressure. Relief valve. [See IGNITION SEQUENCE page 32]
	Resetting necessary. [See IGNITION SEQUENCE page 32]
	Pneumatic locks activated. In this state you can only use the rotation modules. All equipment joints are locked.
	Low battery, the battery indicator will blink when it drops below 5%. [See RECHARGING THE BATTERIES page 45]
	Battery depleted. Connect the equipment to the power supply and recharge the battery. [See RECHARGING THE BATTERIES page 45]
	Battery charging.

7.6 RECHARGING THE BATTERIES

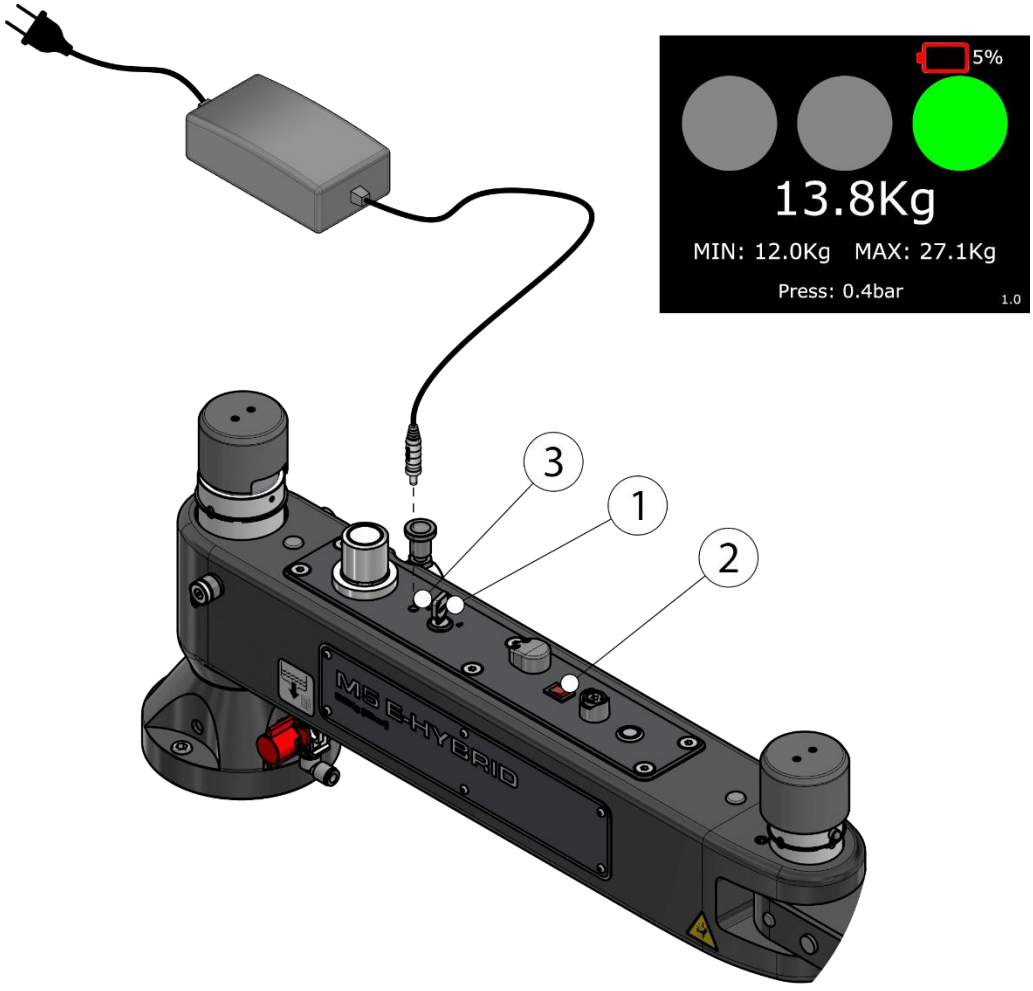
When the battery is depleted (below 5%), the equipment must be recharged.

If the equipment is in operation, skip step **1.**

1. Insert and turn the key (1) and turn on the switch (2).
2. Connect the charger to the power supply and the jack to the connector (3).

You can continue to use the equipment as usual during charging without any problems.

If you are not satisfied with the battery life, the capacity can be increased. Consult your 3Arm© distributor.



The charging point must have a 30mA residual current circuit breaker and a disconnection time of 0.2 seconds.

8 SAFETY DEVICES

8.1 BI-MANUAL SYSTEM

In order to reduce the possibility of the user using their hands to access dangerous movements of the manipulator and/or built-in tooling, a bi-manual system is provided to perform the actions that carry the highest risk of trapping, slamming and crushing.

This applies to all actions that enable or disable an actuator (opening and closing tools, activation or deactivation of rotation modules, high and low pressure).

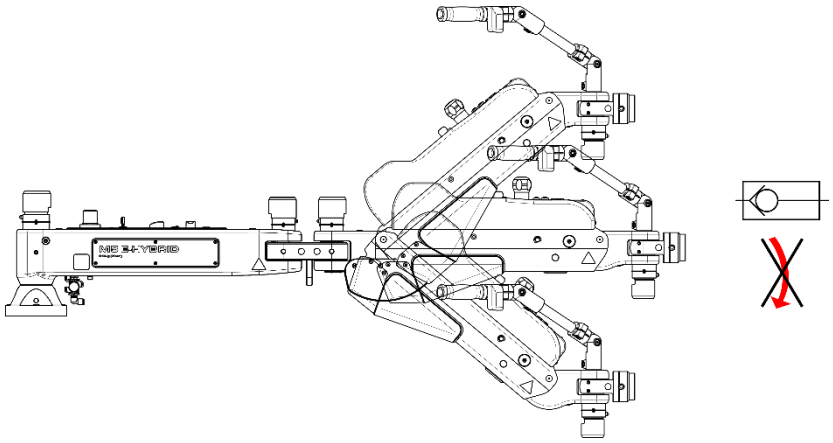
The operating mode will then be as follows:

Press the bi-manual safety button on the handlebar and[9] the button of the corresponding actuator at the same time [See OPERATION page 31].

[9] Max. synchronisation tolerance = 0.5 seconds.

8.2 LOCKING THE ARM'S SWIVEL MOTION

In the event of sudden failure of the pneumatic power supply, a non-return valve will lock the arm preventing its sudden and uncontrolled descent.



VERIFICATION

- ✓ Its correct operation must be checked as detailed below and at the periods indicated in the maintenance programme. [See MAINTENANCE PROGRAMME page 51].
- ✓ To ensure this verification is effective, an approved load securing device must be installed next to the manipulator.

Steps for verification:

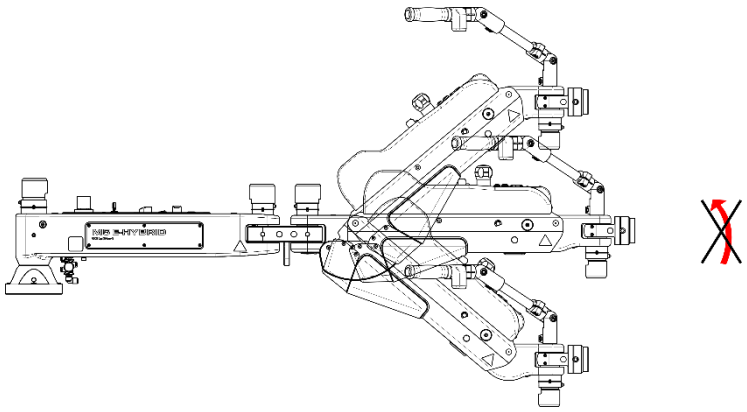
1. Open the main valve (ON position) and check the air supply [See OPENING AND CLOSING THE MAIN VALVE page 24].
2. Activate high pressure in the equipment [See OPERATION page 31].
3. Close the main valve (CLOSE position) [See OPENING AND CLOSING THE MAIN VALVE page 24].

The swivel arm must remain still or be lowered slightly after the air supply is cut off.

8.3 SAFETY VALVE IN THE ACTUATOR TO ENSURE THE PART IS CLAMPED CORRECTLY

If the workpiece is incorrectly clamped and an attempt is made to activate the high pressure, this will not be activated, preventing its sudden and uncontrolled ascent.

The status will not change (to amber) on the screen until there is a signal that the workpiece is correctly clamped.



VERIFICATION

- ✓ Its correct operation must be checked as detailed below and at the periods indicated in the maintenance programme. [See MAINTENANCE PROGRAMME page 51].
- ✓ To ensure this verification is effective, an approved load securing device must be installed next to the manipulator.

Steps for verification:

1. Open the main valve (ON position) and check the air supply [See OPENING AND CLOSING THE MAIN VALVE page 24].
2. Activate the actuator with the part to be clamped. [See OPERATION page 31].
3. Check the correct activation of the safety sensor located on the actuator, which indicates the correct clamping of the workpiece.
4. Disable the actuator [See OPERATION page 31].

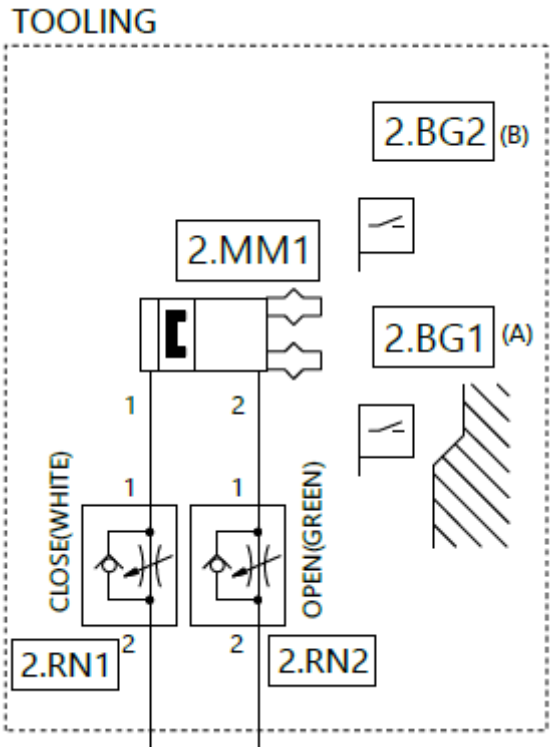
8.4 SAFETY SENSOR

This equipment requires the signal of 2 security sensors so that the sequence is safe.

The type of sensor chosen for part presence confirmation will depend in each case on the final application. A proximity sensor will be used in most applications (inductive, capacitive, limit switches...), and in other cases vacuum, optical, etc. sensors can be used. Its function will always be to give permission for the change of state from low pressure to high pressure.

With correct part presence, the high pressure can be advanced and activated [See OPERATION page 31].

If the sensor does not receive a part presence signal, it will not be allowed to activate the high pressure, thus preventing uncontrolled and sudden ascent of the arm. Both signals from the security sensors (2.BG1 and 2.BG2) will be required to activate the high pressure.



If the equipment stops receiving the part presence signal from the sensor (2.BG1) and the equipment has high pressure activated, the low pressure would be activated to avoid uncontrolled and sudden ascent of the arm due to falling of the part to be handled.
On the other hand, If the equipment stops receiving the part presence signal from the sensor (2.BG2), the equipment will continue with the high pressure activated.

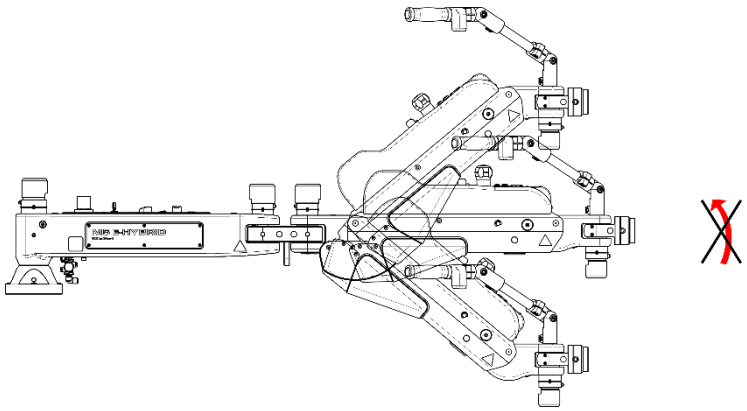
In the bottom part of the headmember always will be two M8 three pin connectors to connect the two safety sensors required.

For applications that only have one safety signal, an electrical jumper will be supplied. This jumper should be installed in 2.BG2.

8.5 LOW PRESSURE ACTIVATION IN CASE OF LOSS OF CORRECT ACTUATOR CLAMPING SIGNAL

Valid if there is a safety valve for correct clamping.

In case of sudden failure of securing the part to be manipulated, low pressure is automatically activated, thus avoiding uncontrolled and sudden rise.



VERIFICATION

- ✓ Its correct operation must be checked as detailed below and at the periods indicated in the maintenance programme. [See MAINTENANCE PROGRAMME page 51].
- ✓ To ensure this verification is effective, an approved load securing device must be installed next to the manipulator.
- ✓ If necessary, have two operators to carry out this task with total safety.

Steps for verification:

1. Open the main valve (ON position) and check the air supply [See OPENING AND CLOSING THE MAIN VALVE page 24].
2. Set the MIN load to 5Kg [See Minimum high pressure regulation (MIN) page 29].
3. Activate the actuator without any part to be clamped. [See OPERATION page 31].
4. Activate the safety sensor located on the actuator, which indicates the correct clamping of the workpiece.
5. Activate high pressure on the equipment. CAUTION: when activating high pressure, the arm will ascend with a force of 5 kg [See OPERATION page 31].
6. Stop activating the safety sensor and check that the arm is lowered, i.e. that the low pressure is activated.

The swivel arm must remain with low pressure activated.

9 ELECTRO-PNEUMATIC SYSTEM

Please refer to the electro-pneumatic diagram corresponding to the chosen configuration in the documentation supplied with your Manipulator.

10 MAINTENANCE

10.1 MAINTENANCE PROGRAMME

DESCRIPTION ELEMENT	ACTION / PERIOD	PERIOD
Regulator filter (air group)	Look for breaks, scratches or any deterioration of the transparent resin vessel on the air filter, regulator.	Periodically
	Replace the filter cartridge.	Every two years or when the pressure drop is 0.1 MPa, whichever comes first.
Bi-manual control (Single handlebar)	Checking the correct use of the handle-knob system according to [See BI-MANUAL SYSTEM page 46].	Before each use
Crankpin CR (mounted on the head CB5, CF5 and CI5)	Rubber components such as gaskets are considered consumables and their condition must be checked every year and replaced every three years. [See CHECKING THE JOINTS page 61]. 	Yearly/every three years
Electro-pneumatic circuit	Check its proper functioning, in particular the safety systems according to [See ELECTRO-PNEUMATIC SYSTEM page 51].	Before each use
Screws and fasteners	Check tightening and functionality of the securing elements.	Periodically
Drain filter regulator	Purge the air filter belonging to the filter regulator assembly.	Periodically
General cleaning	When dirty, clean with a mild household product. Do not use other cleaning agents, as they may cause damage.	Periodically
General check of the pneumatic connections	Carry out a general check of the pneumatic connections. [See ELECTRO-PNEUMATIC SYSTEM page 51].	Periodically
Gas spring	Check its correct operation and, if necessary, replace it [See REPLACING THE CYLINDER AND THE GAS SPRING page 53].	Before each use
Correct workpiece clamping sensor	Check that the sensor light works correctly when detecting a part. If not, disconnect the sensor, power it at 24V and check that it switches correctly. If it does not work, replace it.	Before each use

10.2 COMPRESSED AIR MAINTENANCE UNIT

For good functioning of the compressed air unit, an air quality level of class 1.4.1 is recommended, according to the table attached. ISO 8573-1 2010.

ISO 8573-1:2010 CLASS	PARTICLES				WATER		OIL
	Maximum number of particles of the following size [µm]/m³ of compressed air			Mass Concentration	Vapour Pressure Dewpoint	Content of liquid	Total content (liquid, aerosol, gas)
	0.1 - 0.5 µm	0.5 - 1 µm	1 - 5 µm	[mg/m³]	[°C]	[g/m³]	[mg/m³]
0	By definition of the user, less contamination than class 1						
1	≤ 20000	≤ 400	≤ 10	-	≤ -70	-	≤ 0.01
2	≤ 400000	≤ 6000	≤ 100	-	≤ -40	-	≤ 0.1
3	-	≤ 90000	≤ 1000	-	≤ -20	-	≤ 1
4	-	-	≤ 10000	-	≤ +3	-	≤ 5
5	-	-	≤ 100000	-	≤ +7	-	-
6	-	-	-	≤ 5	≤ +10	-	-
7	-	-	-	5 - 10	-	≤ 0.5	-
8	-	-	-	-	-	0.5 - 5	-
9	-	-	-	-	-	5 - 10	-
X	-	-	-	> 10	-	> 10	> 5

Periodically check the water level accumulated in the reservoir, and bleed if it has reached the limit.

10.3 PNEUMATIC LOCKING BRAKES

It is advisable to revise the functioning of the locking brakes periodically.
The frequency of this revision will, in each case, depend on the number of cycles carried out with them. It is recommended that correct operation is checked every 6 months. To check, adjust or replace [See PNEUMATIC LOCKS page 55].
The stroke of the locking brake actuators is 1.2 mm.

CAUTION

Do not operate the pneumatic locking brakes when disassembled, or when empty (disassembled assemblies), as this will damage the mechanism.

10.4 CHECKING THE GAS SPRING OPERATION

To check that the gas spring is working correctly:

- ✓ Adjust the ***low pressure (LP) between 0 - 0.3 MPa***[10] [See Unloaded arm balancing (Low pressure - LP) page 28].
- ✓ Check that the ***arm is able to stay balanced in a horizontal position within the indicated pressure range.*** If not, consider replacing it.

[10] If the tooling assembly exceeds the load that the shock absorbers can withstand (20Kg), the 0.3 MPa must be exceeded. Because the additional load that the gas springs cannot support is supplied by removing load range from the main cylinder.

10.5 REPLACING THE CYLINDER AND THE GAS SPRING

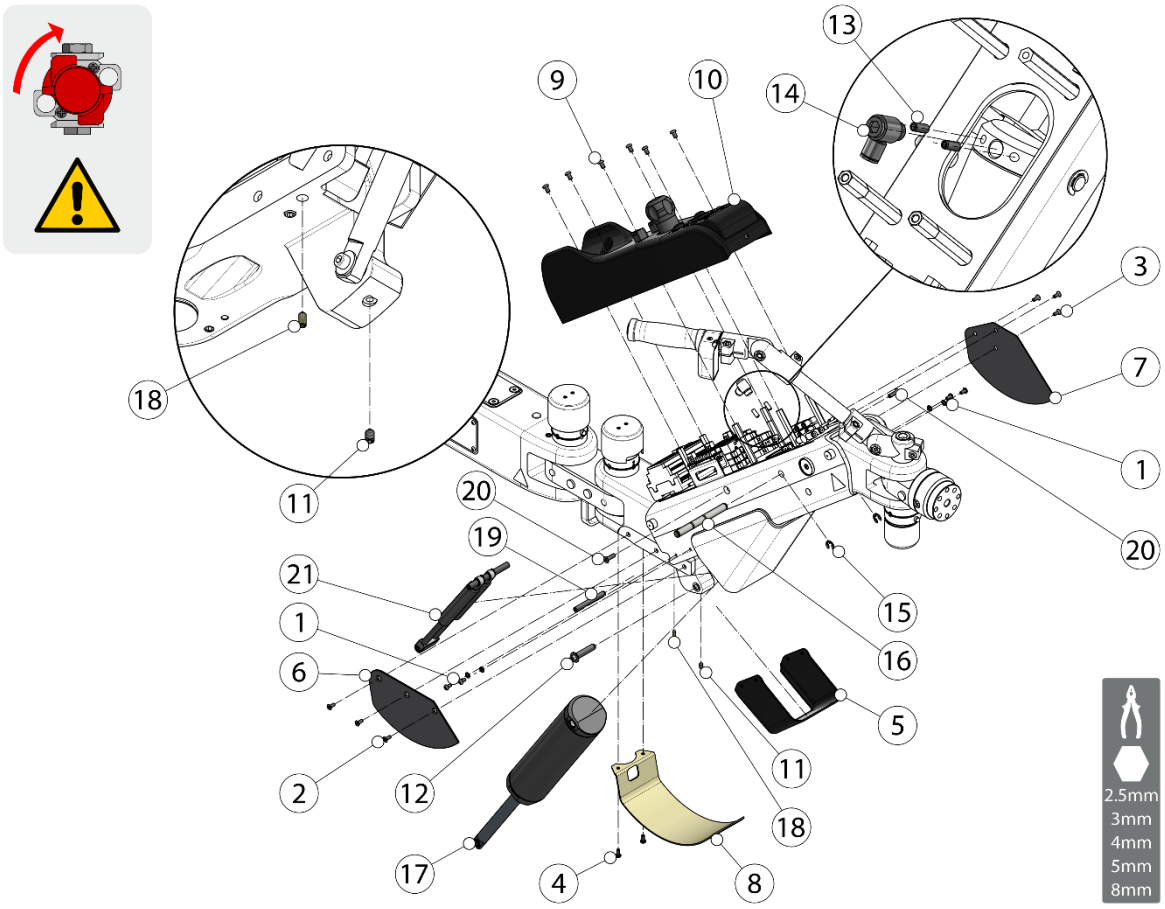
BEFORE REPLACING THE GAS SPRING

- ✓ The equipment must be duly installed and integrated.
- ✓ Disconnect the pneumatic supply from the equipment [See OPENING AND CLOSING THE MAIN VALVEpage 24].
- ✓ It is advisable to dedicate two operators to this task.

1. Swivel the arm to its highest position.

KEEP THE ARM IN THAT POSITION

2. Remove the screws (1, 2, 3, 4) (3 mm Allen key) and the covers (5, 6, 7, 8).
3. Remove the screws (9) (4 mm Allen key) and remove the control cover (10) taking care not to pinch any tubes or cables.
4. Loosen the stud (11) (3 mm Allen key) and remove the axis (12).
5. Loosen the stud (13) (3 mm Allen key) and the coupling (14) (8 mm Allen key).
6. Remove the safety washers (15) and the cylinder shaft (16).
7. The cylinder (17) will be free, you can remove it and replace it with the new one.
8. Loosen the stud (18) (2.5 mm Allen key) and remove the shaft (19) (M5 extractor).
9. Remove the screws (20) (4 mm Allen key), the shock absorber will be free, you can remove it and replace it with the new one.
10. Proceed in reverse order for assembly.



10.6 BATTERY REPLACEMENT

BEFORE REPLACING THE BATTERY

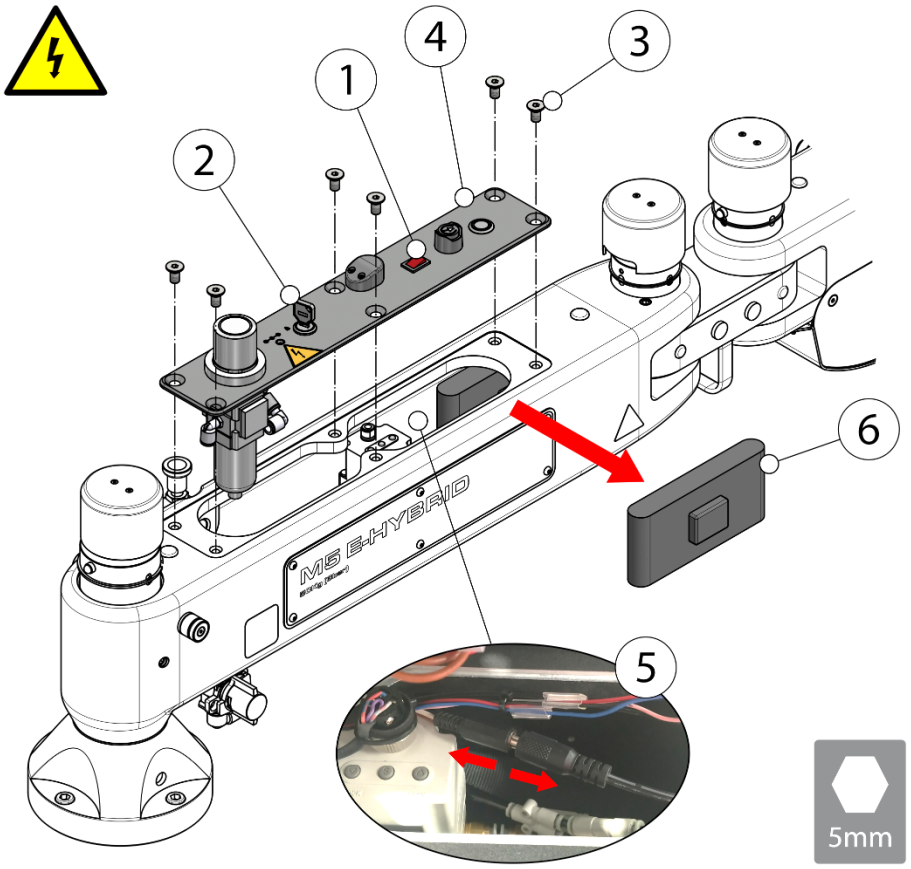
- ✓ The equipment must be duly installed and integrated.
- ✓ Tampering with the battery is forbidden.

1- Turn off the switch (1) and/or the key (2).

2- Remove the 6 screws (3) (5mm Allen key) and remove the cover (4), be careful not to pinch tubes and cables in the process.

3- Disconnect the battery jack (5).

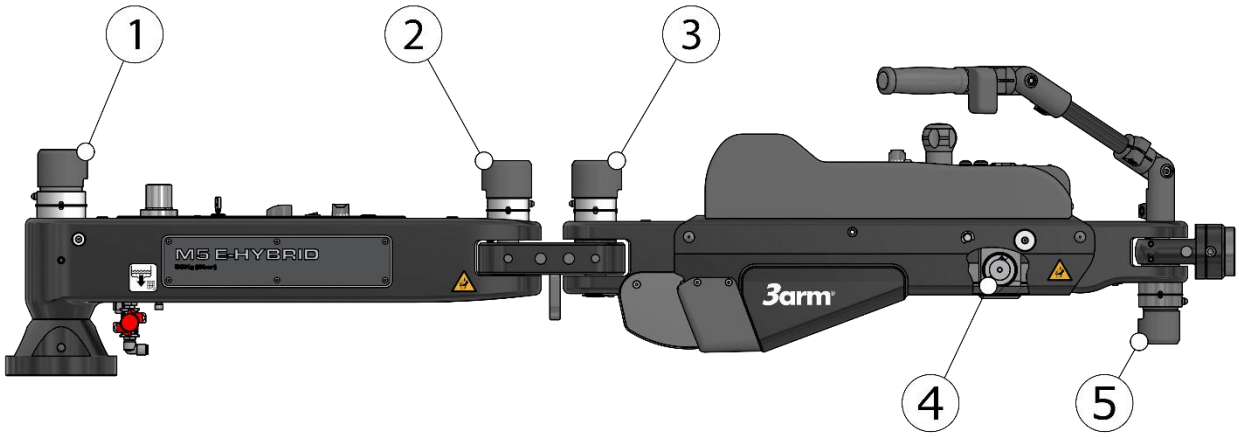
4- Remove and replace the battery (6). The battery is attached to the inside of the parallel with double-sided tape, you will need to replace it with the new battery.



10.7 PNEUMATIC LOCKS

If the manipulator's pneumatic locks malfunction, follow these check points.

10.7.1 PNEUMATIC LOCKS: IDENTIFICATION



1- Base radial lock
2- Front joint radial lock
3- Rear joint radial lock
4- Arm tilting lock
5- Head radial lock

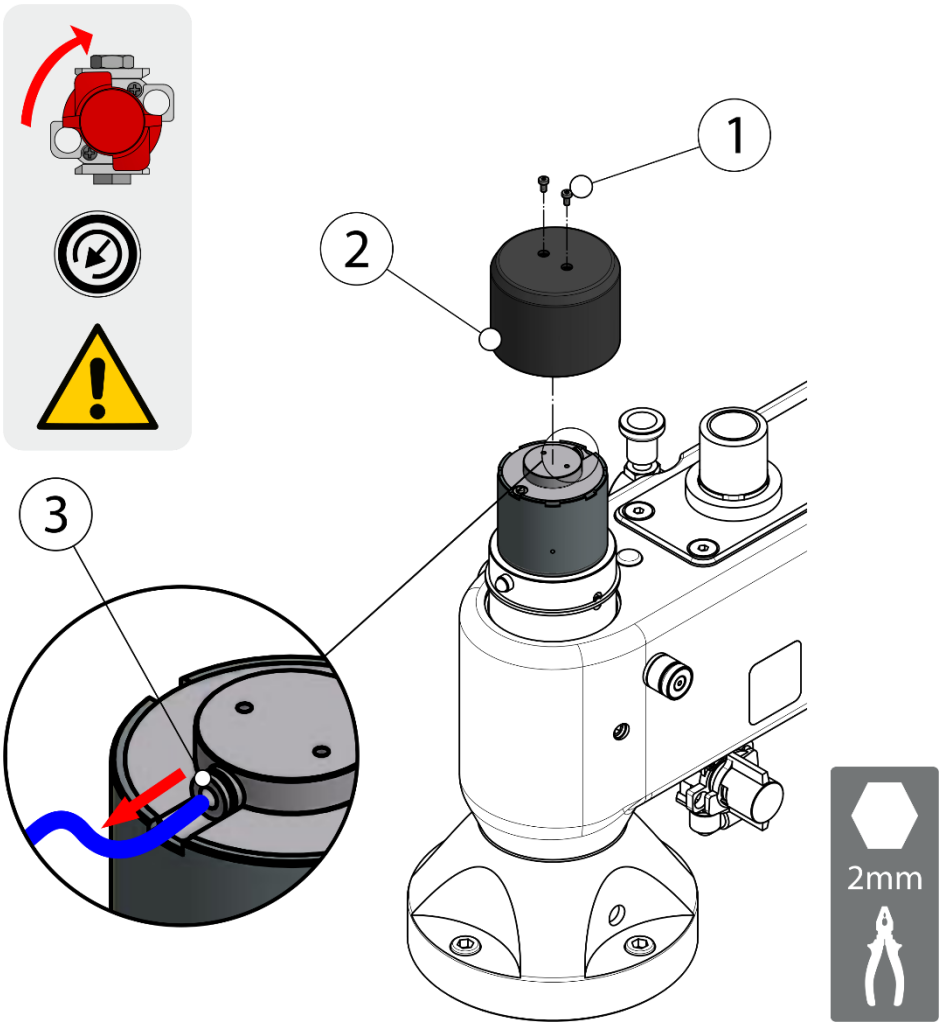
10.7.2 CHECKING THE AIR SUPPLY

Operation valid for any radial locking cylinder.

To perform this check:

1. Release the air pressure of the arm.
2. Remove the screws (1) (2mm Allen key) and remove the cap (2).
3. Disconnect the air supply tube from the coupling (3) that supplies the cylinder.
4. Allow the air to pass and activate the lock in question, checking that air flows through the tube.
5. Proceed in reverse order for assembly and verify the functioning of the lock again.

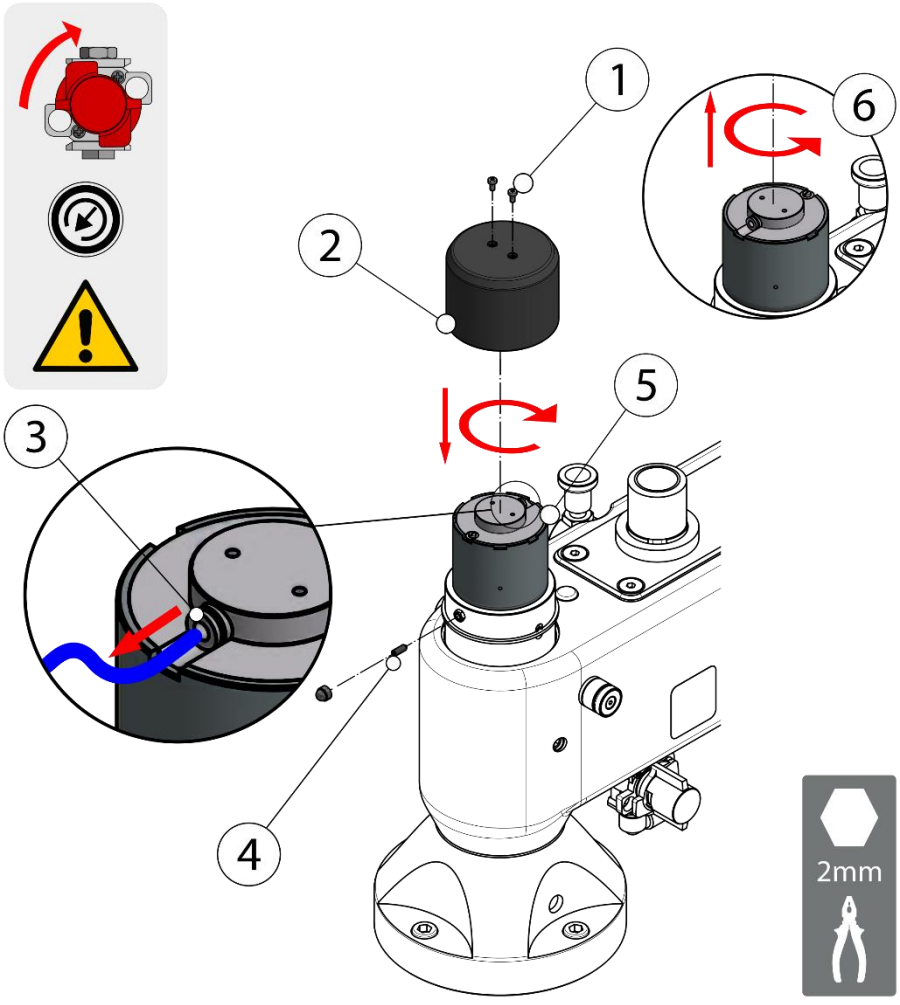
If the check is not satisfactory, the pneumatic diagram must be checked paying special attention to the clamps and the connection between tubes and taps. [See ELECTRO-PNEUMATIC SYSTEM page 51].



10.7.3 CHECKING THE ADJUSTMENT OF THE RADIAL CYLINDERS

Operation valid for any radial locking cylinder.

1. Release the air pressure of the arm.
2. Remove the screws (1) (2mm Allen key) and remove the cap (2).
3. Disconnect the air supply tube from the coupling (3) that supplies the cylinder.
4. Loosen the studs (4) (2 mm Allen key).
5. Screw the cylinder (5) clockwise until it stops.
6. Slightly unscrew the cylinder (5) anticlockwise (6) (approx. 1/12 turn).
7. Proceed in reverse order for assembly and verify the functioning of the lock again.



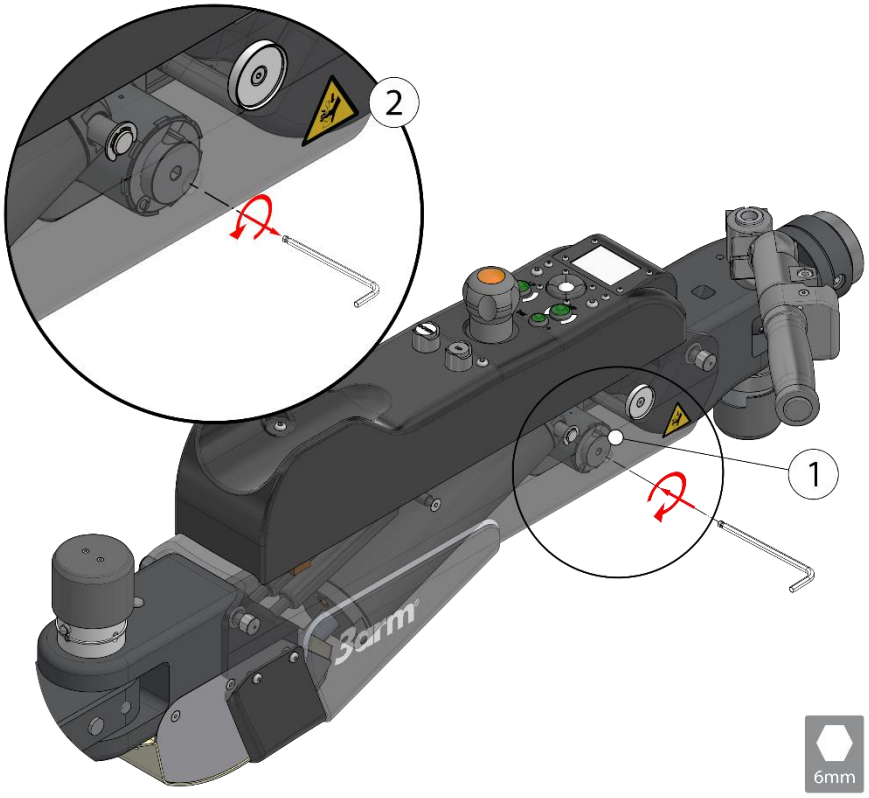
If the problem persists, it is probably due to a fault in the functioning of the cylinder (it must be replaced), or wear of the pads (they must be replaced).

10.7.4 CHECKING THE ADJUSTMENT OF THE SWIVEL CYLINDER

GENERAL CONSIDERATIONS ABOUT THE SETTINGS

DO NOT screw or unscrew the cylinder more than ½ turn to avoid pinching the pneumatic tubes.

1. Remove the cap.
2. Screw the cylinder (1) (6mm Allen key) clockwise until tight.
3. Slightly unscrew the cylinder (1) (6mm Allen key) anticlockwise (2) (approx. 1/12 turn).
4. Recheck the operation of the lock and replace the cap.

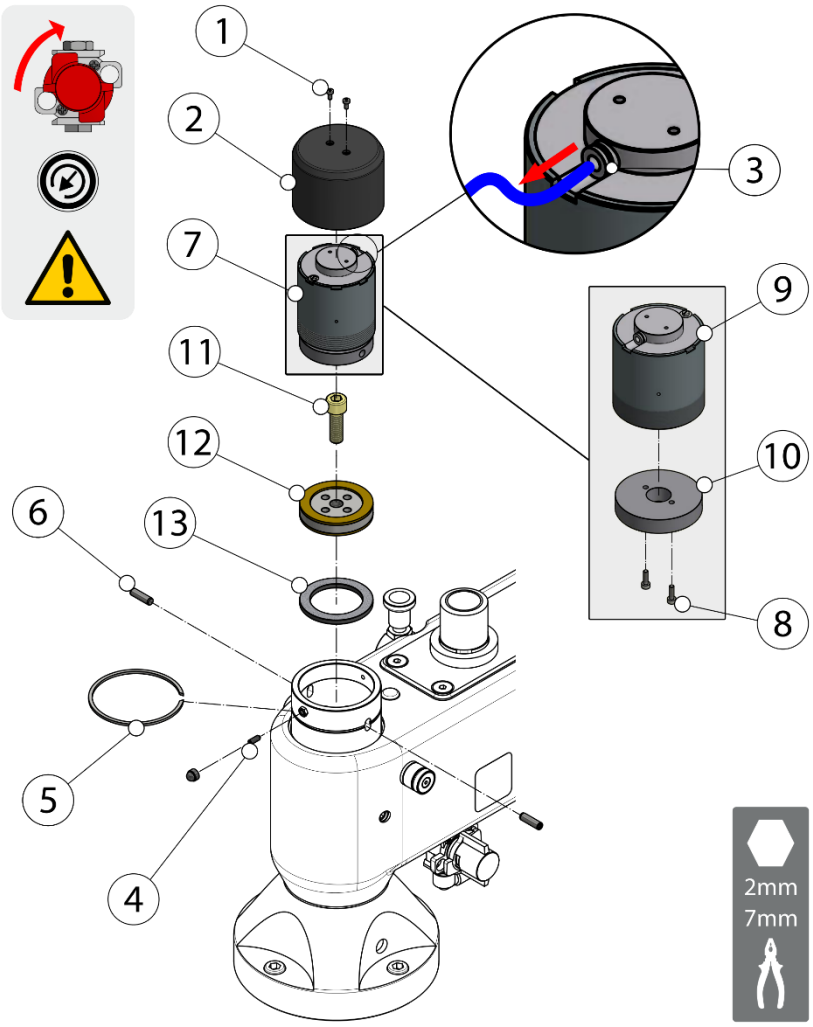


If the problem persists, it is probably due to cylinder malfunction, you should contact your 3arm® dealer for a replacement.

10.7.5 REPLACING THE CYLINDER AND/OR RADIAL PADS

Operation valid for any locking cylinder (except tilting).
If you wish to replace the locking cylinder (9) carry out steps 1- 6 and 10-16.
If you have the pad replacement kit (parts 10, 12 and 13) carry out the full process.

1. Release the air pressure of the arm.
2. Remove the screws (1) (2mm Allen key) and remove the cap (2).
3. Disconnect the air supply tube from the coupling (3) that supplies the cylinder.
4. Loosen the studs (4) (2 mm Allen key).
5. Remove the safety ring (5) and use an M4 extractor to remove the pins (6).
6. Unscrew the cylinder assembly (7) and remove it.
7. Remove the screws (8)[11] (2 mm Allen key) and separate the cylinder (9) from the pushrod (10).
8. Remove the screw (11)[12] (7 mm Allen key) and use an M10[13] extractor to take out the brake assembly with the pads (12) and remove the brake disc (13).



[11] A 2.5mm Allen key will be required for the base cylinder.
[12] An 8mm Allen key will be required for the base cylinder and a 6mm for the head cylinder.
[13] An M8 extractor will be required for the head cylinder.

9. Replace the brake assembly (12) and the brake disc (13) and screw them onto the shaft of the base with the screw (11)[14] (7 mm Allen key).
10. Replacing the pushrod (10).
11. Assemble the cylinder (9) and the pushrod (10) with the screws (8)[15] (2 mm Allen key).
12. Position the cylinder assembly (7) and screw it on clockwise until the pushrod holes coincide (10) with the elongated holes of the lug.
13. Fit the pins (6).
14. Screw the cylinder assembly (7) all the way on and unscrew it slightly, anticlockwise (approx. 1/12 turn).
15. Tighten the stud (4), fit the safety ring (5) and connect the supply pipe.
16. Put the cover in place (2) with the screws (1) (2 mm Allen key).
17. Check the lock works correctly.

INFORMATION

The cylinder replacement kit includes the part (9).
The pad replacement kit includes parts (10), (12) and (13).

[14] An 8mm Allen key will be required for the base cylinder and a 6mm for the head cylinder.
[15] A 2.5mm Allen key will be required for the base cylinder.

10.8 TIGHTENING THE SCREWS

To ensure the equipment functions correctly, it is advisable to check the tightness of all the screws periodically. The recommended period is every 6 months. The recommended torque for the 4 screws of the arm is 75Nm.

10.9 GENERAL CLEANING

It is advisable to carry out a general clean of the arm and accessories every week to keep the whole unit in good condition and prolong its useful life.

10.10 CHECKING THE PNEUMATIC CIRCUIT

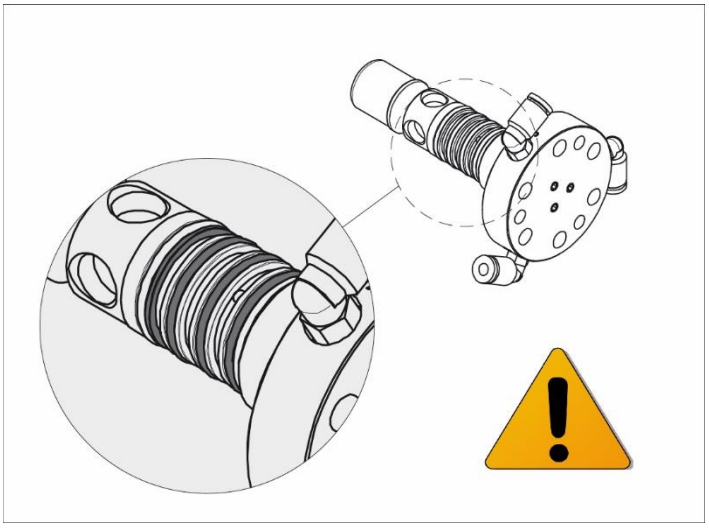
Carry out a general check of the fixings and housings between tubes. Check there is no air leakage and that the connectors are working correctly.

10.11 CHECKING THE JOINTS

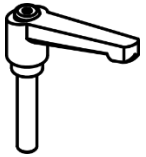
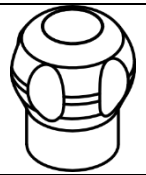
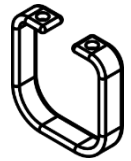
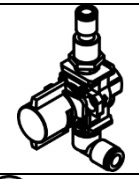
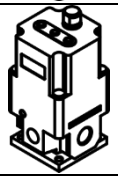
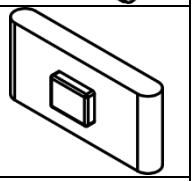
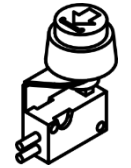
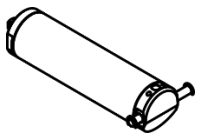
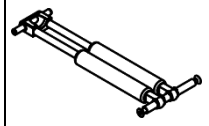
The gaskets located in the coupling allows the continuity of air flow from the manipulator to the grip system so if it is in poor condition, worn and/or badly positioned, it can cause operational problems.

Before inserting the grip system in conjunction with the manipulator head, you must:

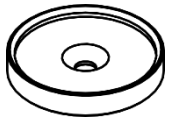
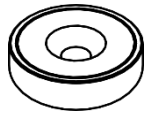
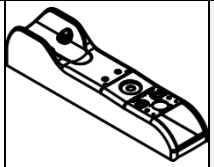
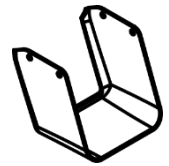
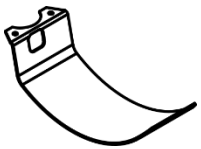
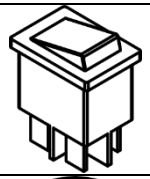
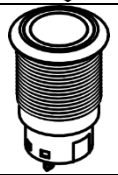
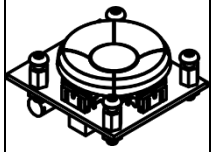
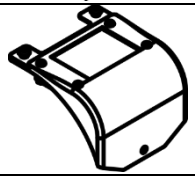
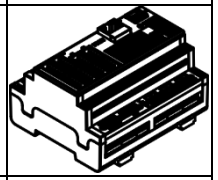
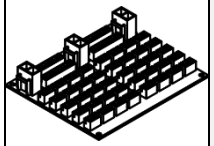
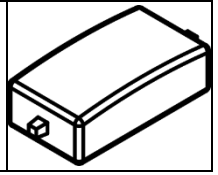
Check that each of the four joints is properly positioned in its respective housing. You must also check they are in good condition.

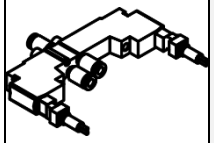
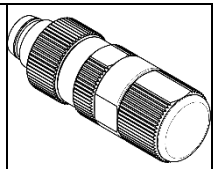


11 SPARE PARTS

CODE	DESCRIPTION	PICT.	CODE	DESCRIPTION	PICT.
CM145000	BASE BRAKE HANDLE		**AC004046**	POSITIONER	
CM10290C	KNOB		**W5160900**	GROMMETS UNION	
NH029006	POWER SUPPLY REGULATOR		**NH128300**	SAFETY VALVE	
NH128800	ELECTRONIC CONTROLLER		**EL110700**	BATTERY	
M3153100R	LIFT BUTTON (UP)		**M3171800R**	LIFT BUTTON (DOWN)	
W51596A0R	CYLINDER UNIT M5		**W5xxxxA4**[16]	SHOCK ABSORBER UNIT M5	

[16] XXXX corresponds to the nitrogen load in Newtons.

MV401503	MAGNETIC BASE FIXING		**CL035006**	MAGNETIC BASE	
E5244900	COMPLETE ARM COVER		**W51582A0**	LOWER ARM COVER	
W51584A0	CROSS PROTECTION COVER		**W52391A0**	HEAD PROTECTION COVER	
EL010396	SWITCH		**EL109400**	KEY ISOLATOR	
EL109500	RESET BUTTON		**E5245400R**	NAVIMEC SET	
E5245100R	SCREEN SET		**EL110300**	CONTROLINO	
EL109900	CONNECTING PLATE		**EL110800**	CHARGER	

E5245600R	SOLENOID VALVE ACTUATOR		**EL111600**	ELECTRIC JUMPER SENSOR M8	
E5246000	PARALLEL CABLE KIT		**E5245800**	ARM CABLE KIT	

11.1 PNEUMATIC LOCKS (SPARE PARTS)

	CYLINDER	*UNIT BRAKES*	*COVER CYLINDER*
RADIAL BASE	W5178900	W5179500	W5180600
RADIAL CROSS	W5179000	W5179800	W5180600
RADIAL HEAD	MV405504	MV4064A4	MV405903
SWIVEL	W5179400	MV406604	-

12 WARRANTY

See attached guarantee document.

13 GUIDELINES FOR PACKAGING, TRANSPORT AND DISMANTLING

13.1 PACKAGING

Follow the instructions below for packing the equipment for location changes or shipments for repair and maintenance.

13.1.1 Preparatory measures

The equipment must be placed out of service. Assembling the "transport safety elements" will prevent movement during transport and thus possible damage to the installation.

13.1.2 Choice of packaging

For long transport distances, the components of the production installation must be packed in such a way that they are protected from atmospheric conditions.

13.1.3 Inscription on the packaging

Observe the specific provisions of the country in which the equipment is transported. In fully closed packaging, an indication must be placed on the packaging indicating where the top is.

13.1.4 Packaging procedure

Place the components of the machine on manufactured wooden pallets. Use lashing straps to ensure the components are secured against possible falls. Attach all the technical documentation that must accompany the machine.

13.2 TRANSPORT

The following data must be taken into account for transport.

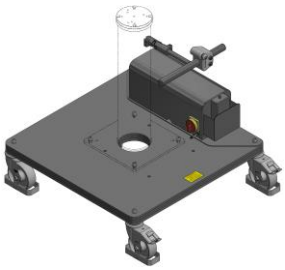
- ✓ External dimensions depending on the segment (width x height x depth), approx. mm: 1100 x 500 x 415 mm
- ✓ Total weight depending on the segment: approx. 50-55 kg

13.3 DISASSEMBLY

- ✓ The equipment must be taken out of service by duly trained and authorised personnel.
- ✓ The machine must be dismantled taking the safety instructions, waste disposal and recycling into account.
- ✓ Protect the environment. The machine must be disposed of pursuant to current regulations and guidelines on safety, noise prevention, environmental protection and accident prevention.

14 ACCESSORIES

TROLLEY



To move the work unit.
It has four orientable wheels.

DESCRIPTION	DIMENSIONS	
Trolley 700	700 x 700 mm	27 9/16" x 27 9/16"
Trolley 900	900 x 900 mm	35 7/16" x 35 7/16"
Electric trolley	800 x 800 mm	31 1/2" x 31 1/2"
Electric trolley	900 x 900 mm	35 7/16" x 35 7/16"

FIXED COLUMN PR

To secure to the floor using four metal studs.

DESCRIPTION/DIMENSIONS	
Column 275 PR	10 13/16"
Column 375 PR	14 3/4"
Column 450 PR	17 3/4"
Column 635 PR	25"
Column 740 PR	29 1/8"
Column 850 PR	33 7/16"
Column 1100 PR	43 5/16"
Column 1350 PR	53 1/8"
Column 1600 PR	63"

LIFT PR

It consists of a telescopic column and a pneumatic cylinder with anti-rotation.

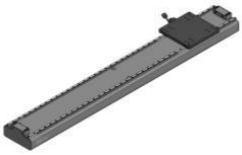
DESCRIPTION	VERTICAL TRAVEL
Lift 300 PR	300 mm – 11 7/8"
LIFT 550 PR	550 mm – 21 5/8"
Lift 750 PR	750 mm – 29 1/2"

EXTENSION

Extender that enables the arm's working area to be increased. It can also be installed on other accessories, such as column, lift, beam, etc.

DESCRIPTION	ADDITIONAL WORK AREA
Extension 600	600 mm – 23 5/8"
Extension 1000	1000 mm – 39 3/8"

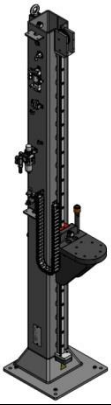
FLOOR RAIL



Rail to fasten to the floor and on which the different columns and lifts can be fastened. Several sections can be joined from a base section 2 m. The horizontal position can be locked at any point.

CODE	DESCRIPTION	TRAVEL
CL040000	Floor rail	1520 mm – 59 13/16"

COLUMN D100



Pneumatic lift. The vertical position can be locked at any point, it has a pneumatic cylinder. It can be secured to the ground, on a trolley or on the ground rail to have movement on two shafts.

DESCRIPTION	VERTICAL TRAVEL
Column 1500 D100	952 mm – 37 7/16"
Column 2000 D100	1455 mm – 57 5/16"
Column 2500 D100	1999mm – 78 11/16"

BASE ROTATION LIMITER

Support that limits the rotation of the radial arm of the equipment. The stops can be moved to adjust the range of rotation.

CODE	DESCRIPTION
LG000104	Rotation Limiter

14.1 COMPATIBILITY TABLE

ACCESSORY	M5E-HYBRID
CARRIAGE	●
COLUMN PR	●
LIFT PR	●
EXTENSION	●
FLOOR RAIL	●
COLUMN D100	●
ROTATION LIMITER	●

● = Compatible
⦸ = NOT Compatible

NOTES

DATE	DESCRIPTION

CE STATEMENT OF COMPLIANCE

The manufacturer:

Company: TECNOSPIRO MACHINE TOOL, S.L.U.
Address: P.I. Pla dels Vinyats I, s/n nau 1
City: Sant Joan de Vilatorrada
Country: Spain - EU

Declares that this product:

Name:	M5E-HYBRID Manipulator
Serial number:	From 001-006

It is classified as a machine according to the Machinery Directive 2006/42/EC and to which this Declaration refers, and complies with the following European EC Directives, and their applicable Essential Health and Safety Requirements (EHSR):

2006/42/EC – Machinery Directive

2014/68/EU – Pressure Equipment Directive

2014/30/EU - Electromagnetic Compatibility Directive

2014/35/EU - Low Voltage Directive

2011/65/EU - Directive on Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

Authorised for documentation:

Mr Ramon Jou Parrot of TECNOSPIRO MACHINE TOOL, S.L.U.

Sant Joan de Vilatorrada, Wednesday, 18 October 2023

Ramon Jou Parrot, Technical Director

3arm®

TECNOSPIRO MACHINE TOOL SLU

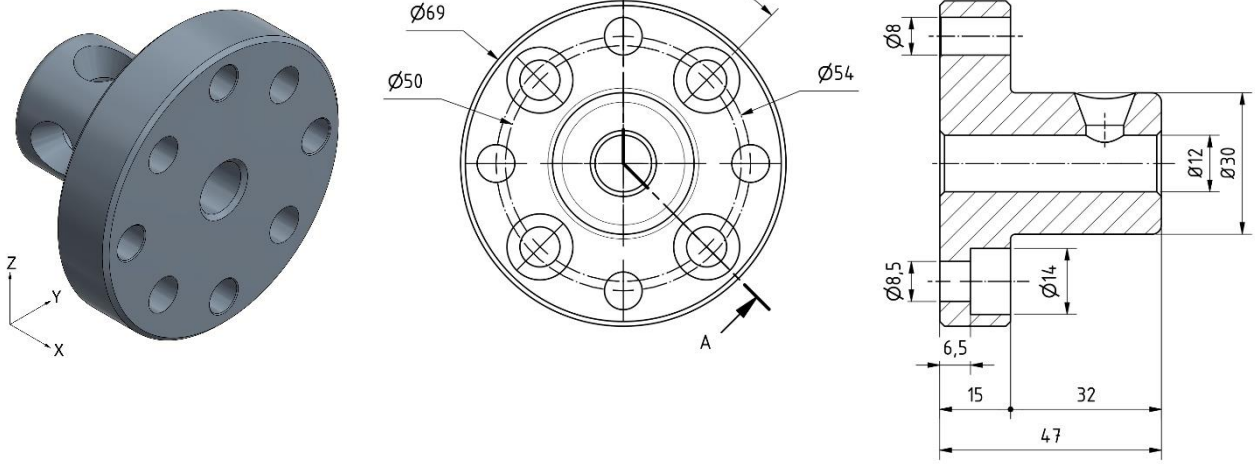
HEAD ATTACHMENT

TABLE OF CONTENTS

1 HEADS

To complement the manoeuvrability of your equipment, the M5E-HYBRID Manipulator has several heads that allow you to move and rotate the load according to your needs:

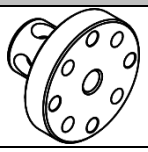
1.1 HORIZONTAL HEAD (CA5)



X: 4x90º
Z: ±90º (Swivel base)

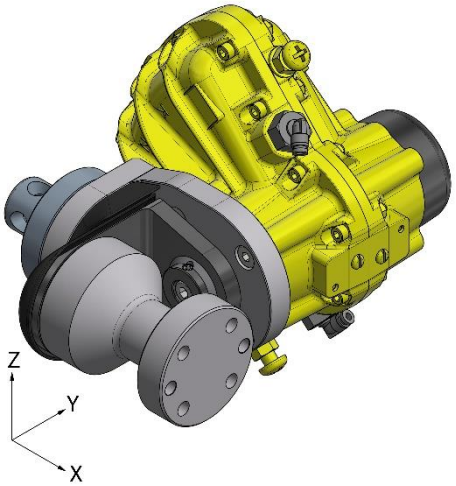
This head allows manual rotation of the crankpin every 90º. To do this:

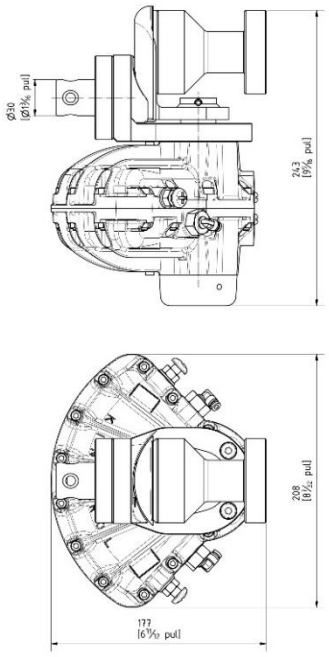
1. Loosen the studs (8 mm Allen key) in the Manipulator until the crankpin can rotate freely.
2. Rotate the crankpin (90º, 180º or 270º).
3. Retighten the studs securing the crankpin.

CODE	*DESCRIPTION*	*PICT.*
W5157600	HORIZONTAL HEAD M5 CA5	

1.2 REVOLVING HEAD (CC5)

The CC5 is a rotation head for the M5E-HYBRID Manipulator, which pivots with respect to the horizontal axis, allowing us to limit and customise the rotation angle, as defined by the customer.

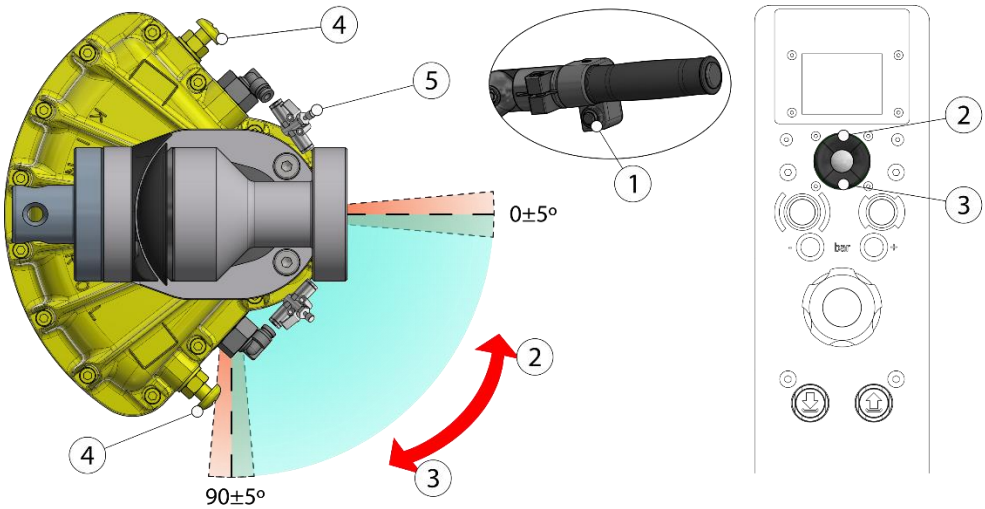




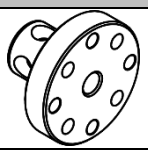
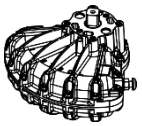
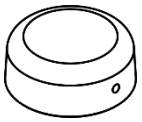
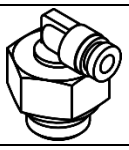
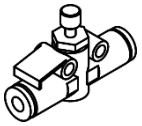
Y: 90º±10º
Z: ±90º (Swivel base)
Maximum torque: 170 Nm

This head makes it possible to swivel the load[17]. To do this:

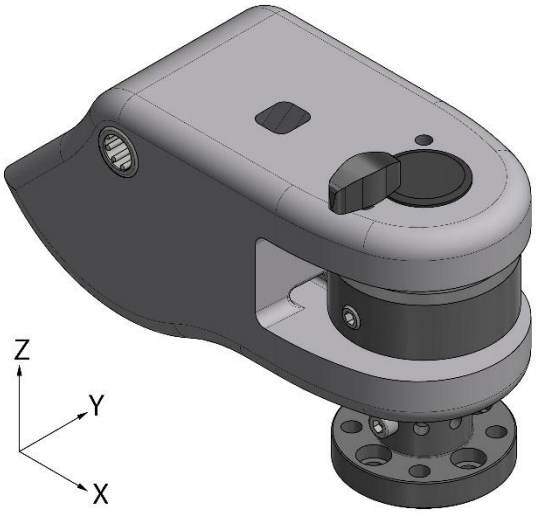
1. Bi-manual safety system, press buttons (1) and (2) at the same time to lift the load.
2. Bi-manual safety system, press buttons (1) and (3) at the same time to lower the load.
3. Tighten or loosen the screws (4) to change the working angle by ±5° at each stop.
4. Adjust the rotation speed with the flow regulators (5).

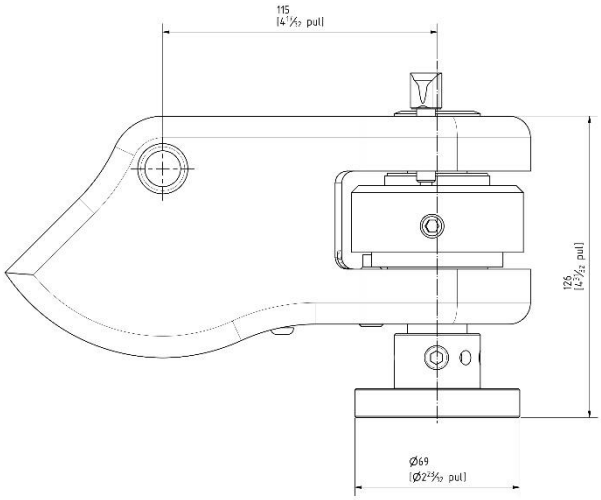


[17] Models: - 90º
- Customised angular stroke (less than 90º)

CODE	DESCRIPTION	PICT.
W5157600	HORIZONTAL HEAD M5 CA5	
W5165500	REVOLVING MODULE - K08	
W3104000	REVOLVING BACK COVER	
NH027956	CONNECTOR KQB2L04-G02	
NH027466	FLOW REGULATOR AS1002F-04	

1.3 VERTICAL HEAD (CD5)

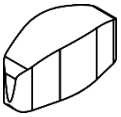




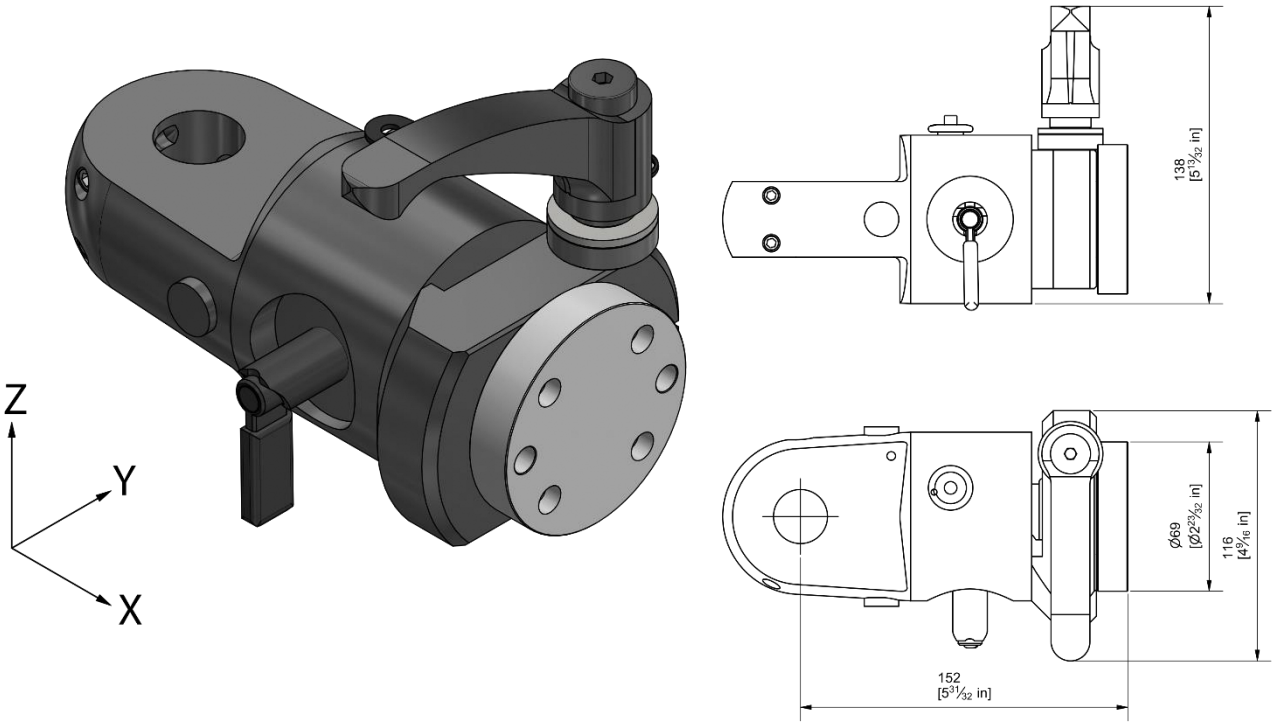
Z: 340°

This head makes it possible to rotate the load manually. To do this:

5. Adjust the rotation speed with the friction handle (1).

CODE	DESCRIPTION	PICT.
W5174500	STRIP BW100 M5	
CA018746	NYLON TIP STUD M8x40 GN 913.3-M8-40-KU	
AC004036	HANDLE ELESA CT.476/30 B-M8 8356	

1.4 MANUAL ROTATING HEAD WITH LOCK (CE5)

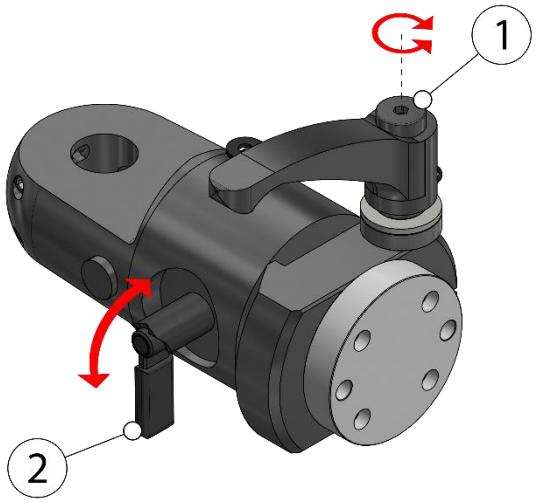


X: ±180º[18] (4x90º)
Z: ±90º (Swivel base)

This head allows manual rotation of the crankpin. To do this:

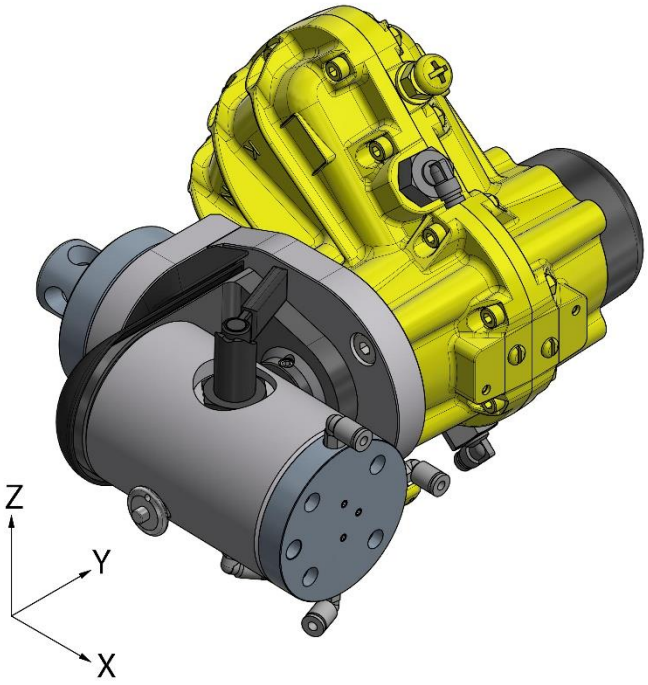
6. Loosen the handle (1) and turn the positioner (2) 180°, the crankpin will be free.
7. Move the crankpin to the desired position (90º, 180º -90º or -180º).
8. Turn the positioner (2) back to its initial position and tighten the handle (1).

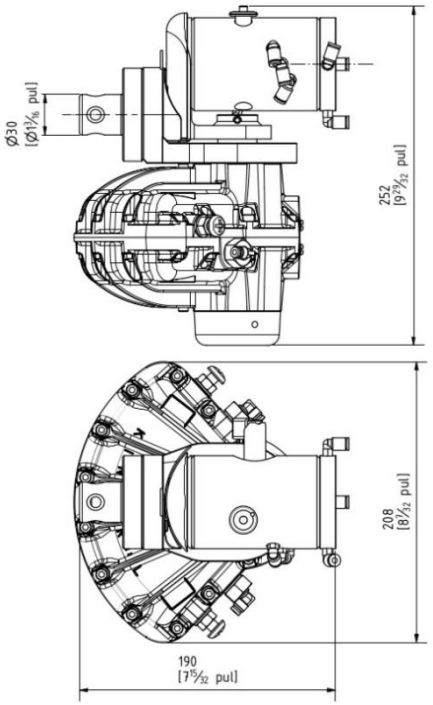
If another working angle is desired, leave the positioner (2) free and firmly tighten the handle (2) to lock.



[18] In order to avoid pinching any pneumatic tube. If you do not have tools with pneumatic action, you can rotate 360º

1.5 REVOLVING + MANUAL ROTATING HEAD (CF5)





X: 4x90º
Y: 90º±10º [19]
Z: ±90º (Swivel base)
Maximum torque: 170 Nm

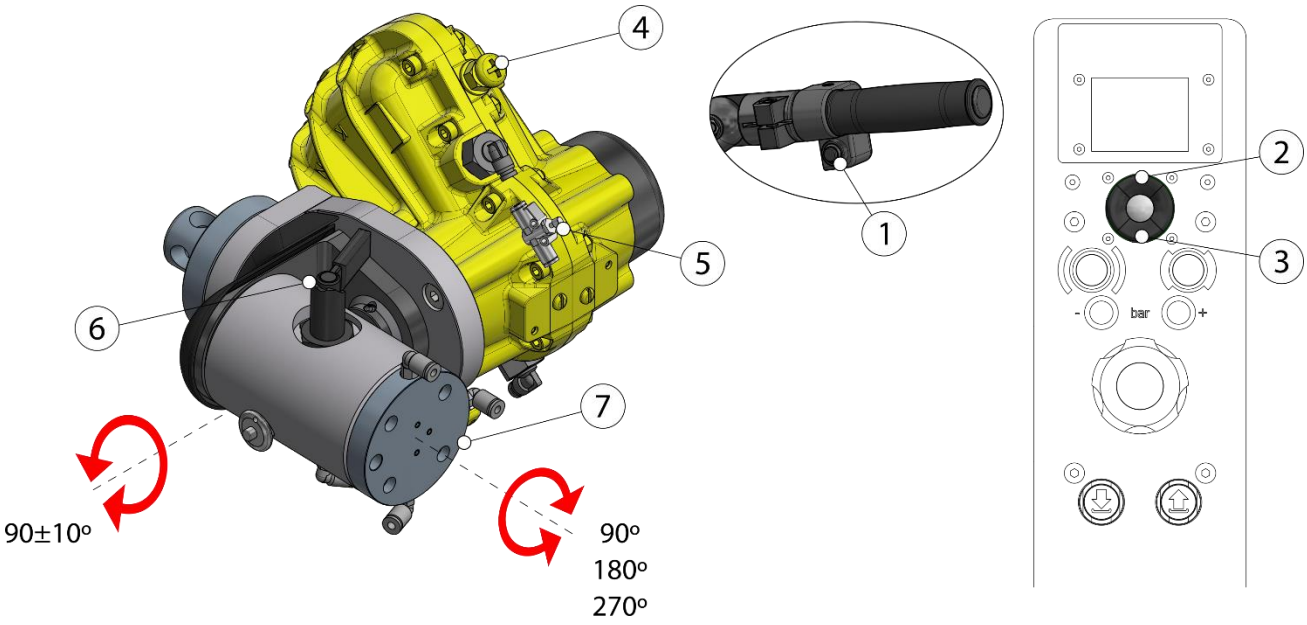
This head makes it possible to swivel and rotate the load. To swivel:

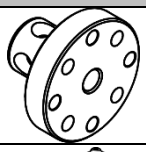
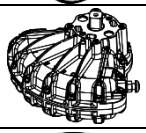
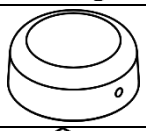
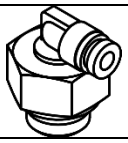
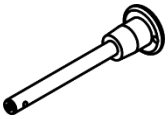
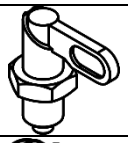
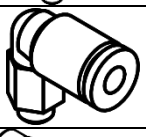
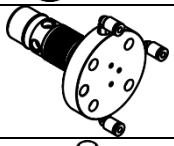
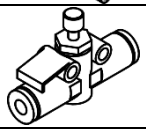
1. Bi-manual safety system, press buttons (1) and (2) at the same time to lift the load.
2. Bi-manual safety system, press buttons (1) and (3) at the same time to lower the load.
3. Tighten or loosen the screws (4) to change the working angle by ±5° at each stop.
4. Adjust the rotation speed with the flow regulators (5).

To rotate:

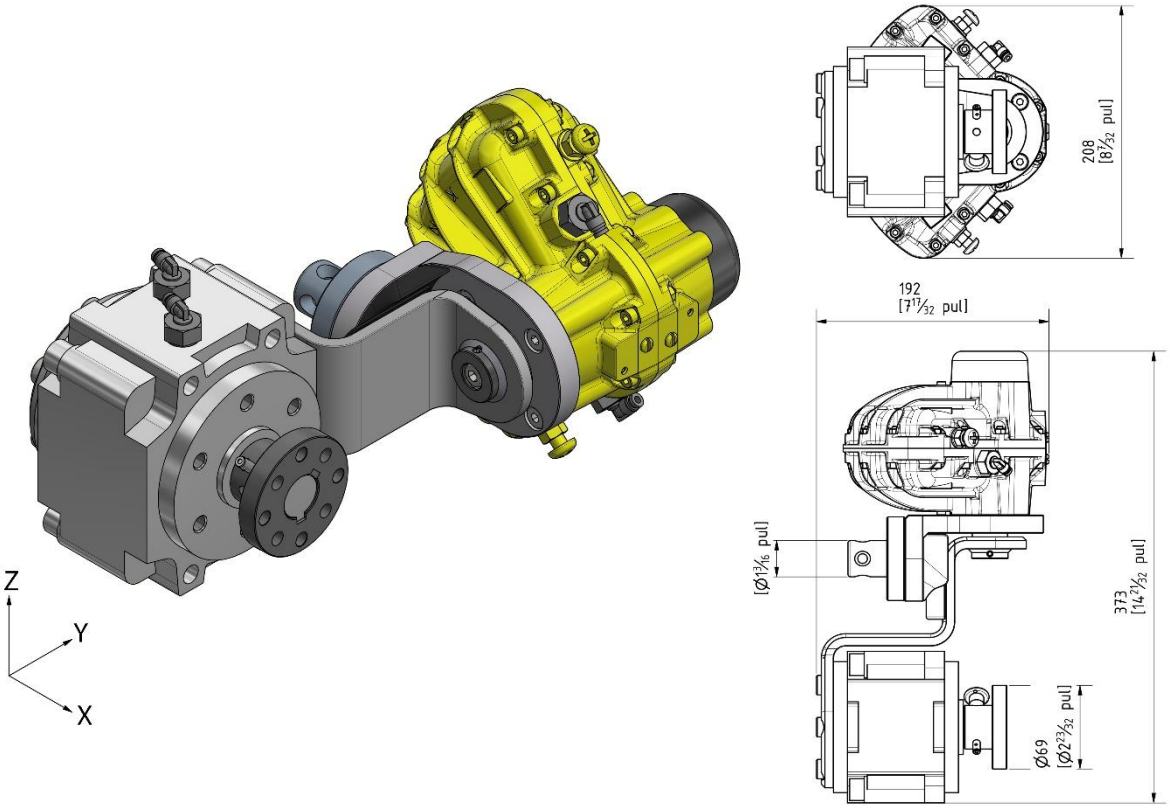
1. Turn the positioner (6) 180º to release the crankpin (7).
2. Move the crankpin (7) to the desired position (90º, 180º or 270º).
3. Rotate the positioner (6) back to its initial position.

[19] Models: - 90º
- Customised angular stroke (less than 90º)



CODE	DESCRIPTION	PICT.
W5157600	HORIZONTAL HEAD M5 CA5	
W5165500	REVOLVING MODULE - K08	
W3104000	REVOLVING BACK COVER	
NH027956	CONNECTOR KQB2L04-G02	
CM123300	KIPP POSITIONER Ø6x50	
W5206400	NORELEM POSITIONER M16x1.5	
NH027016	CONNECTOR KQB2L04-M5	
W5174800	CRANKPIN CR M5	
NH027466	FLOW REGULATOR AS1002F-04	

1.6 REVOLVING + ROTATING HEAD (CG5)



X: 90º / 180º / 270º (Maximum torque 90 / 45 Nm)
Y: 90º±10º [20] (Max. torque 170 Nm)
Z: ±90º (Swivel base)

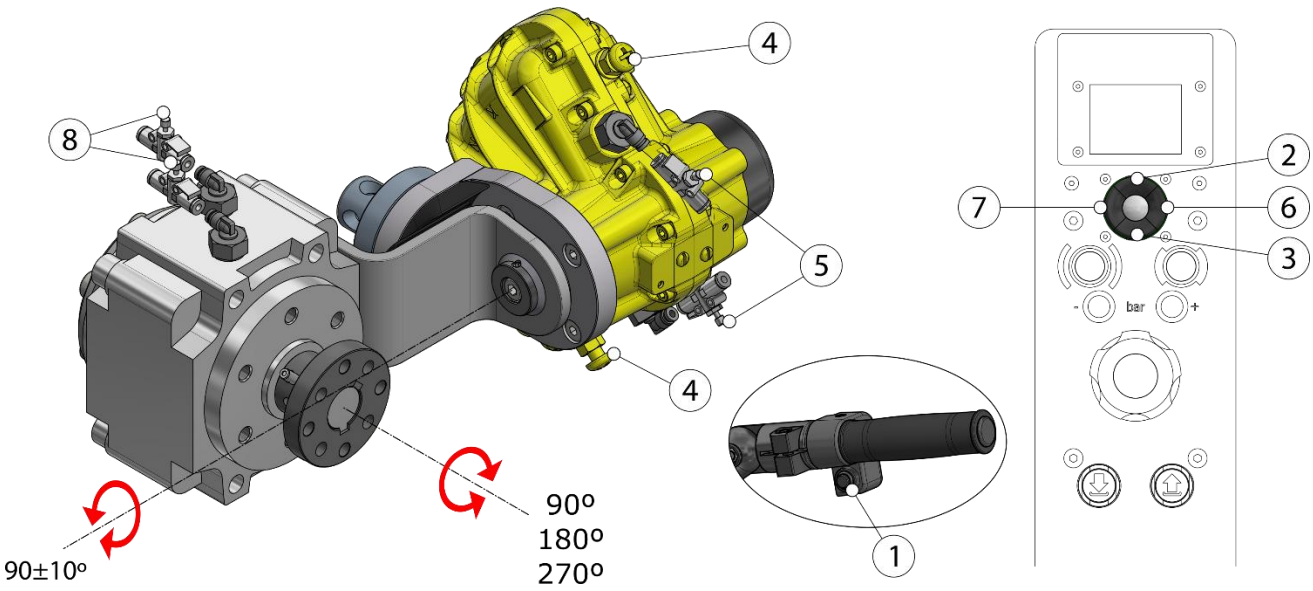
This head makes it possible to swivel and rotate the load. To swivel:

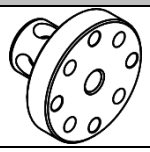
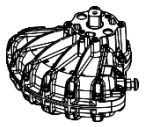
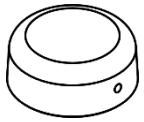
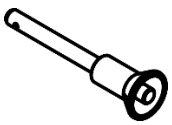
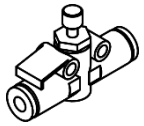
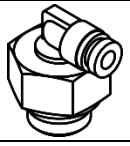
1. Bi-manual safety system, press buttons (1) and (2) at the same time to lift the load.
2. Bi-manual safety system, press buttons (1) and (3) at the same time to lower the load.
3. Tighten or loosen the screws (4) to change the working angle by ±5° at each stop.
4. Adjust the rotation speed with the flow regulators (5).

To rotate:

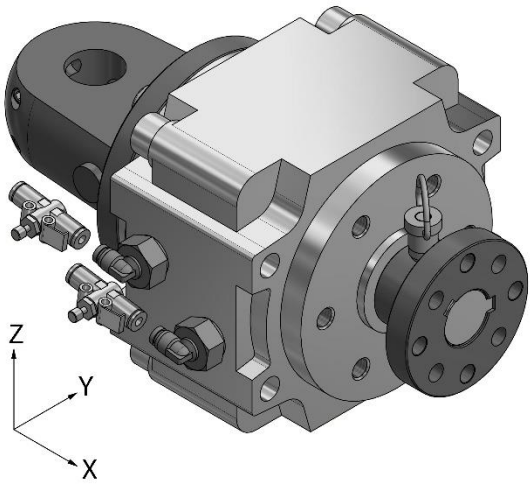
1. Bi-manual safety system, press buttons (1) and (6) at the same time to rotate the load clockwise.
2. Bi-manual safety system, press buttons (1) and (7) at the same time to rotate the load counterclockwise.
3. Adjust the rotational speed with the flow controllers (8).

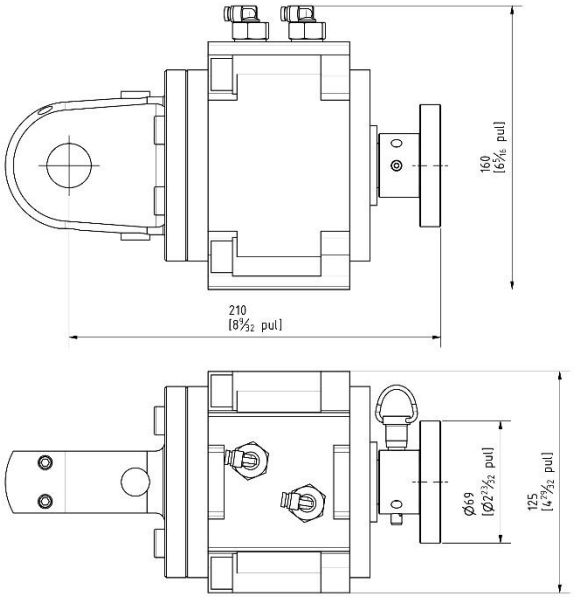
[20] Models: - 90º
- Customised angular stroke (less than 90º)



CODE	DESCRIPTION	PICT.
W5157600	HORIZONTAL HEAD M5 CA5	
W5165500	REVOLVING MODULE - K08	
W3104000	REVOLVING BACK COVER	
CM125000	KIPP POSITIONER Ø6x40	
NH027466	FLOW REGULATOR AS1002F-04	
NH027956	CONNECTOR KQB2L04-G02	
W5174500	STRIP BW100 M5	
CM121800	CABLE RETENTION	

1.7 ROTATING HEAD (CH5)

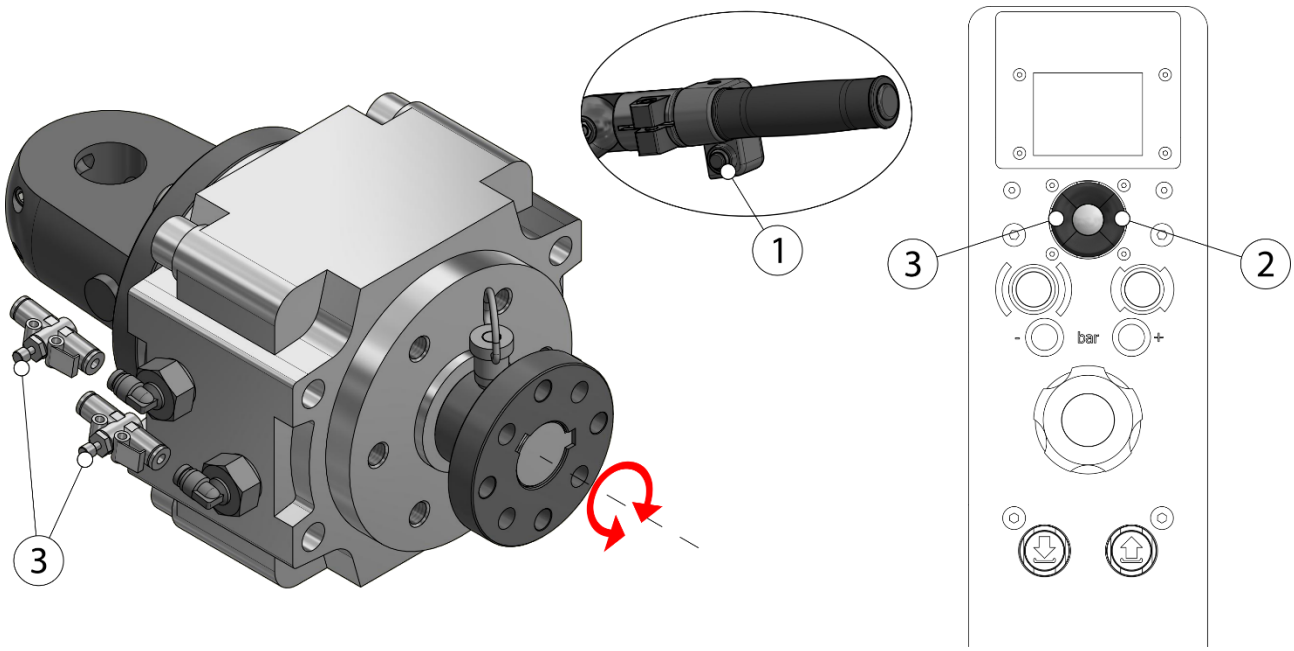


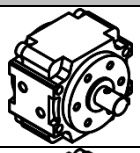
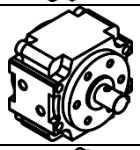
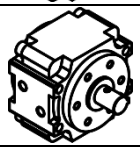
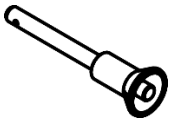
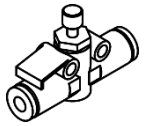
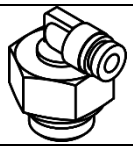


X: 90º / 180º / 270º
Z: ±90º (Swivel base)
Maximum torque: 90 Nm / 45Nm

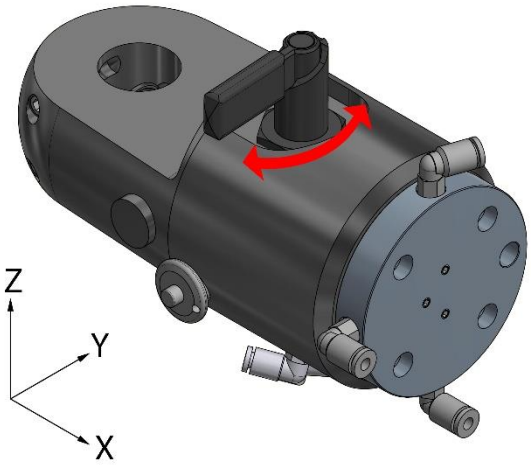
This head makes it possible to rotate the load. To do this:

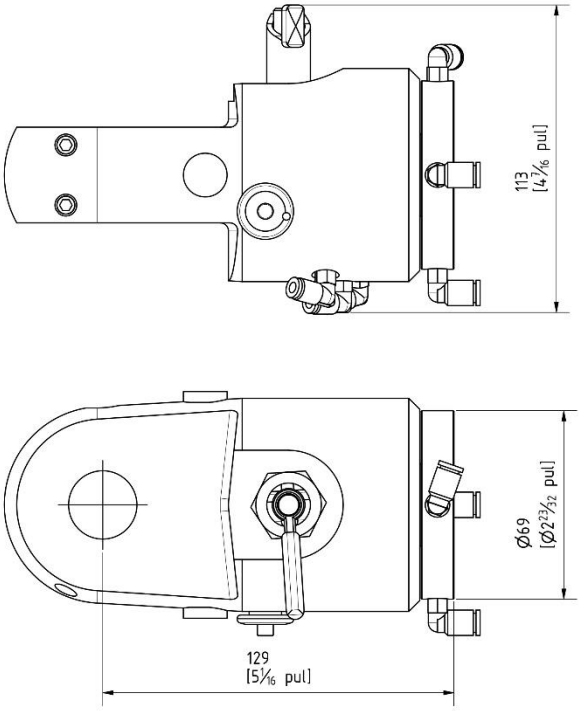
1. Bi-manual safety system, press buttons (1) and (2) at the same time to turn the load clockwise.
2. Bi-manual safety system, press buttons (1) and (3) at the same time to turn the load counterclockwise.
3. Adjust the rotation speed with the flow regulators (2).



CODE	DESCRIPTION	PICT.
W5177200	ROTATION ACTUATOR CRB1BW100-90D-XF	
W5181100	ROTATION ACTUATOR CRB1BW100-180S-XF	
W5190700	ROTATION ACTUATOR CRB1BW100-270S-XF	
CM125000	KIPP POSITIONER Ø6x40	
NH027466	FLOW REGULATOR AS1002F-04	
NH027956	CONNECTOR KQB2L04-G02	
W5174500	STRIP BW100 M5	
CM121800	CABLE RETENTION	

1.8 MANUAL ROTATING HEAD (CI5)

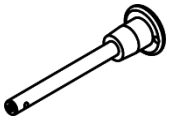
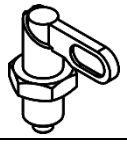
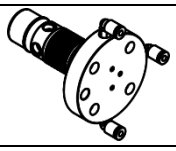




X: 4x90º
Z: ±90º (Swivel base)

This head allows manual rotation of the crankpin every 90º. To do this:

1. Rotate the positioner 180º to release the crankpin.
2. Move the crankpin to the desired position (90º, 180º or 270º).
3. Rotate the positioner back to its initial position.

CODE	*DESCRIPTION*	*PICT.*
CM123300	KIPP POSITIONER Ø6x50	
W5206400	NORELEM POSITIONER M16x1.5	
NH027016	CONNECTOR KQB2L04-M5	
W5174800	CRANKPIN CR M5	

APPENDIX ACTUATORS

TABLE OF CONTENTS

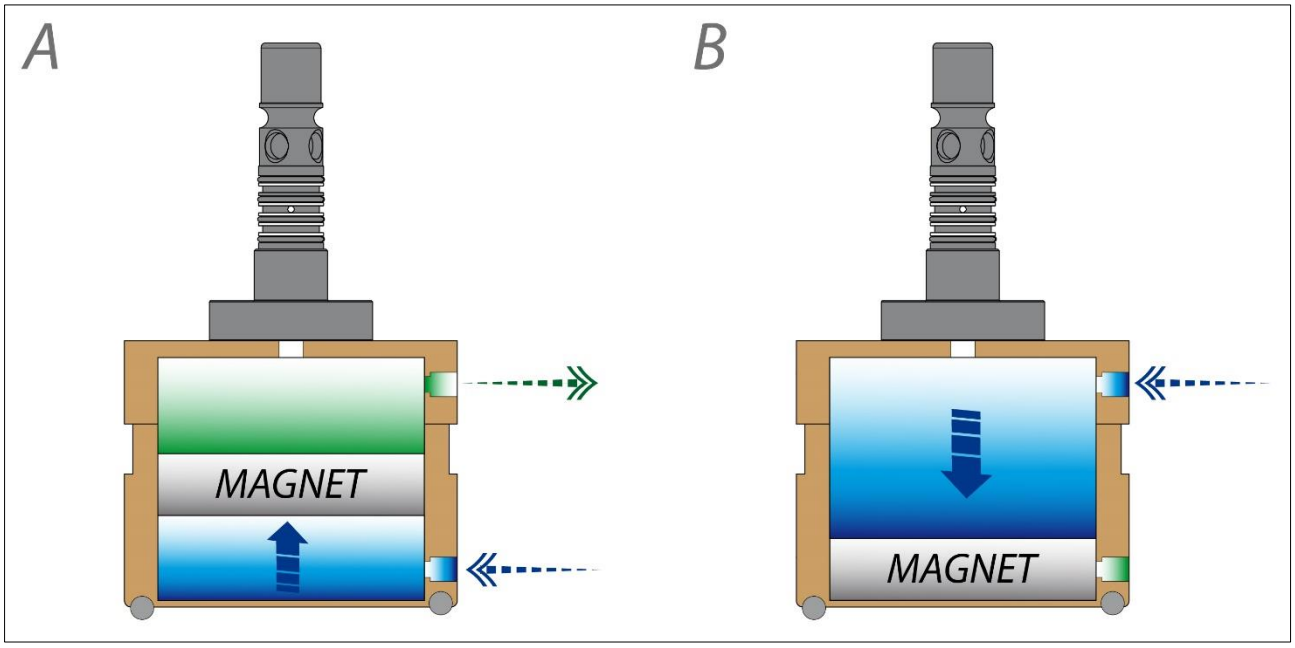
1 ACTUATORS

To complement the functionality of your equipment, the M5E-HYBRID Manipulator has several actuators that will allow you to pick up and hold the load according to your needs:

1.1 MAGNET

1.1.1 DESCRIPTION AND OPERATING PRINCIPLE

The magnet-type load clamping device provides the M5E-HYBRID manipulator with the appropriate complement for handling loads of ferrous materials with flat surfaces thicker than 2mm (e.g. bars, plates, etc.). In the loose workpiece position, the air pushes the magnet away from the gripping surface. (Drawing to the left - A). In the position to grip the part the air pushes the magnet down, closer to the grip surface (Drawing on the right - B).



WARNING

- ✓ The selection and design must be made carefully for each working load.
- ✓ The integrator/end user must ensure that the load securing device is suitable for the end application.

ADDITIONAL INFORMATION

- ✓ The models with rubber will not mark the surface of the workpiece and increases the friction with the workpiece.

1.1.2 OPERATIVE

WARNING

- ✓ The sequence described below supposes that the installation, settings such as the Opening of the main valve, the regulation of the supply pressure, the balancing of the arm at no load and with load, and the correct integration have been carried out following the guidelines indicated in the manual.
- ✓ Do not release the working load (low pressure) until it is resting on an appropriate, safe surface.
- ✓ Verify that the manipulator and the holding device receive compressed air before each use.

1. Bring the manipulator close to the workload and ensure the holding device remains in contact with the grip surface of the load.
2. Activate the high pressure [See OPERATION page 31].

NOTE: If the high pressure is not activated (and subsequently cannot hold the load) it is likely that the clamping device is not in contact with the workload or only partially. In this case, the safety sensor will not give the necessary signal to activate the high pressure. [See SAFETY SENSOR page 49].

3. Move the working load to the destination location. Rest the load on an appropriate, safe surface.
4. To release the load, activate the low pressure [See OPERATION page 31]. The magnet will stop working.

FAILURE IN THE AIR SUPPLY

- ✓ Although the manipulator is designed to minimise possible damage caused by an untimely start-up after an interruption of the air supply, the operator must be aware that the M5E-HYBRID manipulator's swivel arm and its load securing device and consequently the workload can drop violently and without warning, and rise violently and without warning after the air supply has been restored.
- ✓ If the air supply is cut off, close the main valve and move the manipulator to its retracted or parking position, ensuring that the closing device is activated [See OPENING AND CLOSING THE MAIN VALVE and Retracted position – Parking page 24 and 16].

1.2 CLAMP

1.2.1 DESCRIPTION AND OPERATING PRINCIPLE

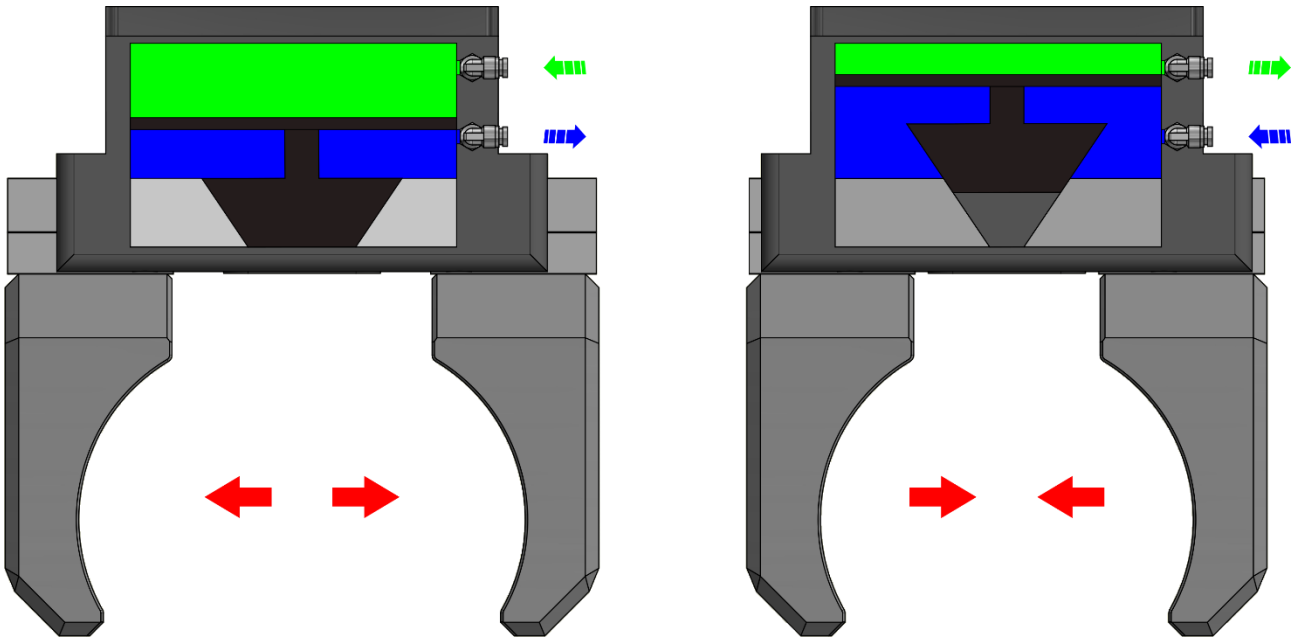
The clamp-type gripping device provides the M5E-HYBRID manipulator with the correct grip on the workload and the necessary movements for proper handling.

Its main application is the manipulation and lifting of preferably cylindrical or circular loads. (Example: crankshafts and camshafts).

The jaws are opened and closed using the compressed air, which pushes the piston up or down. The lever system of the kinematic system converts the vertical movement of the piston into a synchronous angular movement of the jaws (in angular models) or a parallel movement (in parallel models).

WARNING

- ✓ The selection and design must be made carefully for each working load.
- ✓ The integrator/end user must ensure that the load securing device is suitable for the end application.



1.2.2 OPERATIVE

WARNING

- ✓ The sequence described below supposes that the installation, settings such as the Opening of the main valve, the regulation of the supply pressure, the balancing of the arm at no load and with load, and the correct integration have been carried out following the guidelines indicated in the manual.
- ✓ Do not release the working load (low pressure) until it is resting on an appropriate, safe surface.
- ✓ Verify that the manipulator and the holding device receive compressed air before each use.

1. Bring the manipulator close to the workload and ensure the holding device remains in contact with the grip surface of the load.
2. Activate the high pressure [See OPERATION page 31].

NOTE: If the high pressure is not activated (and subsequently cannot hold the load) it is likely that the clamping device is not in contact with the workload or only partially. In this case, the safety sensor will not give the necessary signal to activate the high pressure. [See SAFETY SENSOR page 49].

3. Move the working load to the destination location. Rest the load on an appropriate, safe surface.
4. To release the load, activate the low pressure [See OPERATION page 31]. The magnet will stop working.

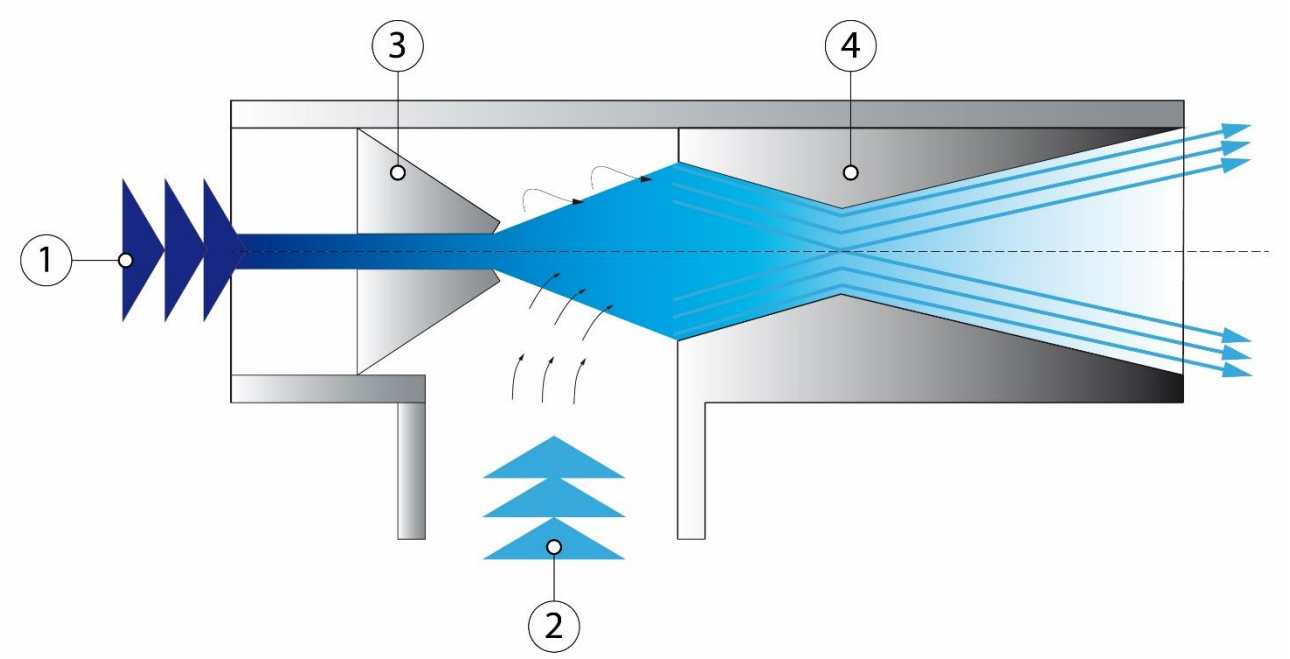
FAILURE IN THE AIR SUPPLY

- ✓ The clamps have springs that keep them closed if the air supply is cut off (there is also the inverse system which opens the grippers).
- ✓ Although the manipulator is designed to minimise the possible damage caused by an untimely start-up after an interruption in the air supply, the operator must be aware that the M5E-HYBRID manipulator's swivel arm and its load securing device and consequently the workload can drop violently and without warning, and rise violently and without warning after the air supply has been restored.
- ✓ If the air supply is cut off, close the main valve and move the manipulator to its retracted or parking position, ensuring that the closing device is activated [See OPENING AND CLOSING THE MAIN VALVE and Retracted position – Parking page 24 and 16].

1.3 SUCTION CUP

1.3.1 DESCRIPTION AND OPERATING PRINCIPLE

The suction-type load gripping device in conjunction with the M5E-HYBRID manipulator enables the gripping and handling of the workload by creating a vacuum. The vacuum is generated with the Venturi effect, in which a nozzle (3) is fed with compressed air (1). The jet created drags the ambient air (2) into its turbulence, which then passes into the mixer (4) to be expelled. This action creates the depression that generates the necessary vacuum.



WARNING

- ✓ The selection and design must be made carefully for each working load.
- ✓ The integrator/end user must ensure that the load securing device is suitable for the end application.

1.3.2 OPERATIVE

WARNING

- ✓ The sequence described below supposes that the installation, settings such as the Opening of the main valve, the regulation of the supply pressure, the balancing of the arm at no load and with load, and the correct integration have been carried out following the guidelines indicated in the manual.
- ✓ Do not release the working load (low pressure) until it is resting on an appropriate, safe surface.
- ✓ The M5E-HYBRID manipulator and the clamping device must be checked for pressurised air before each use.
- ✓ Keep the grip surface as smooth and clean as possible.

1. Bring the manipulator close to the workload and ensure the holding device remains in contact with the grip surface of the load.
2. Activate the high pressure [See OPERATION page 31].

NOTE: If the joystick cannot be unlocked, it is likely that the vacuum switch is detecting insufficient vacuum pressure, so it will not give the signal necessary to activate the high pressure [See SAFETY SENSOR page 49].

3. Move the working load to the destination location. Rest the load on an appropriate, safe surface.
4. To release the load, activate the low pressure [See OPERATION page 31]. The magnet will stop working.

FAILURE IN THE AIR SUPPLY

- ✓ Although the manipulator is designed to minimise the possible damage caused by an untimely start-up after an interruption in the air supply, the operator must be aware that the M5E-HYBRID manipulator's swivel arm and its load securing device and consequently the workload can drop violently and without warning, and rise violently and without warning after the air supply has been restored.
- ✓ If the air supply is cut off, close the main valve and move the manipulator to its retracted or parking position, ensuring that the closing device is activated.

1.4 HOOK

1.4.1 DESCRIPTION AND OPERATING PRINCIPLE

The hook-type load securing device is the perfect accessory of the M5 Manipulator for handling loads.

WARNING

- ✓ The selection and design must be made carefully for each working load.
- ✓ The integrator/end user must ensure that the load securing device is suitable for the end application.

1.4.2 OPERATIVE

WARNING

- ✓ The sequence described below supposes that the installation, settings such as the Opening of the main valve, the regulation of the supply pressure, the balancing of the arm at no load and with load, and the correct integration have been carried out following the guidelines indicated in the manual.
- ✓ Do not release the working load (low pressure) until it is resting on an appropriate, safe surface.
- ✓ Verify that the M5 Manipulator and the holding device receive compressed air before each use.
- ✓ Keep the grip surface as smooth and clean as possible.

As a passive actuator, the load securing device follows the operation sequence of the M5 Manipulator [See OPERATION page 31].