

MPM500 PNEUMATIC MODULE

USER MANUAL

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For Firmware Version 10.2

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Original instructions

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ABOUT THIS MANUAL

This user manual describes how to install Mecademic's MPM500 pneumatic module onto the Meca500 (R3 & R4) industrial robot arm and how to use it. You must read this manual thoroughly before installing or operating the MPM500.

Symbol definitions

The following table lists the symbols that may be used in Mecademic documents to denote certain conditions. Particular attention must be paid to the warning messages in this manual.

SYMBOL	DEFINITION
	NOTICE. Identifies information that requires special consideration.
	CAUTION. Provides indications that must be respected in order to avoid equipment or work (data) on the system being damaged or lost.
	WARNING. Provides indications that must be respected in order to avoid a potentially hazardous situation, which could result in injury.

Revision history

The firmware that is installed on Mecademic products has the following numbering convention:

{major}.{minor}.{patch}.{build}

Each Mecademic manual is written for a specific {major}.{minor}.{*}.{*} firmware version. On a regular basis, we revise each manual, adding further information and improving certain explanations. We only provide the latest revision for each {major}.{minor}.{*}.{*} firmware version. Below is a summary of the changes made in each revision.

REVISION	DATE	COMMENTS
A	June 13, 2024	Original version.

The document ID for each Mecademic manual in a particular language is the same, regardless of the firmware version and the revision number.

1. INTRODUCTION

The MPM500 is a custom pneumatic module developed by Mecademic, specifically for the Meca500 robot arm. The module essentially consists of two 3/2 NC valves and is easy to install, connect and dismount. The module allows easy integration between the Meca500 and a large variety of single- or double-action pneumatic grippers, suction cups, tool changers, and other pneumatic devices.



Familiarity with the Meca500 robot and its user manual is required prior to installing and using the pneumatic module.



Improper installation of the pneumatic module could seriously damage the Meca500 and the module itself. This module should therefore be used only by technical personnel who are familiar with the Meca500.

1.1. Inside the box

The MPM500 module is supplied either separately or with the Meca500. In both cases, the module, shown in [Figure 1](#), is delivered as a standard kit in an anti-static bag, the content of which is:

- 1 MPM500 module with a MGC-AA25 25 mm communication cable with a 90° connector;
- 3 M5×0.8 pneumatic barb fittings for tubes of 1/16 inch internal diameter (installed);
- 1 M5×0.8 pneumatic silencer (installed).



Figure 1: MPM500 module with barb fittings and silencer installed



Note that we also supply the MPM500 as a kit with a pneumatic gripper from Schunk, either MPG-plus 25 or Schunk MPZ-30, the appropriate adapter plates and 4-mm tubing.

2. TECHNICAL SPECIFICATIONS

Table 1 lists the main technical specifications for the MPM500 pneumatic module and Figure 2 shows its principal dimensions. The module essentially consists of two 3/2 NC solenoid valves that can be controlled independently.

Table 1: Technical specifications for the MPM500 pneumatic module

TECHNICAL SPECIFICATIONS	
Characteristic	Value
Pneumatic valve type	3/2 NC solenoid valves
Pneumatic valves action lines	ports 1 & 2
Compressed air connector	port IN
Operating pressure	7 bar (102 psi)
Flow rate	29.74 LPM (1.05 CFM)
Response time	ON/OFF: 8/10 ms
Ports	Four M5 threaded orifices, of which ports 1, 2, and IN are with preinstalled barb fittings for 1/16-in ID tubes and port OUT is with a preinstalled pneumatic muffler.
Housing	Coated aluminum alloy
Total weight	108 g
Operating temperature	5° to 55°C
Operating humidity	10% to 95% RH (non-condensing)



In order to avoid the malfunctioning of the valves, please ensure to supply compressed air within the required limits, as detailed in Table 1.

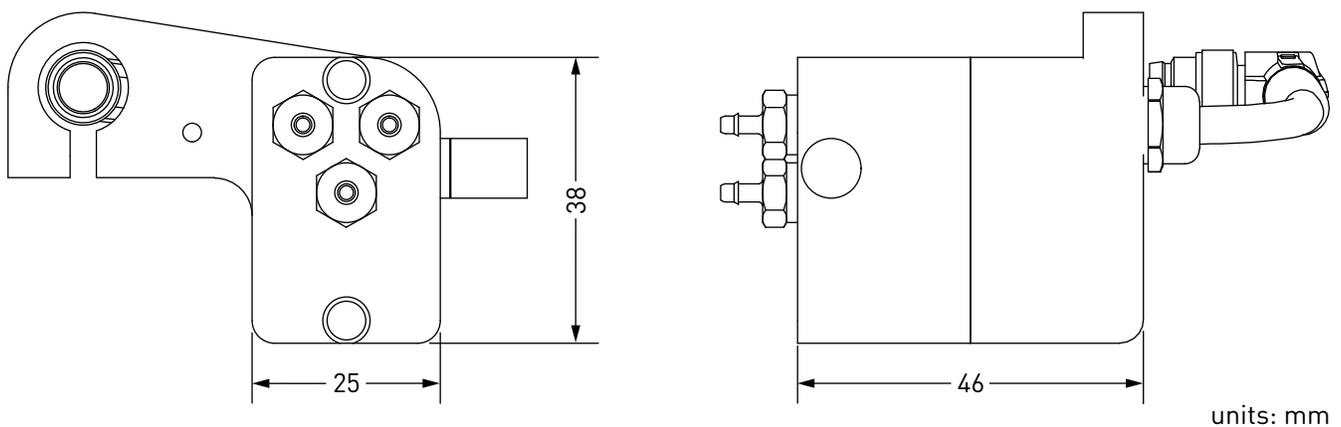


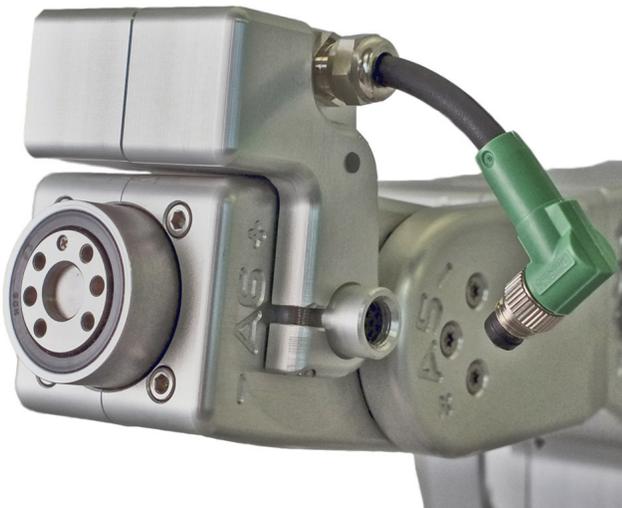
Figure 2: MPM500 pneumatic module dimensions

3. INSTALLING THE PNEUMATIC MODULE

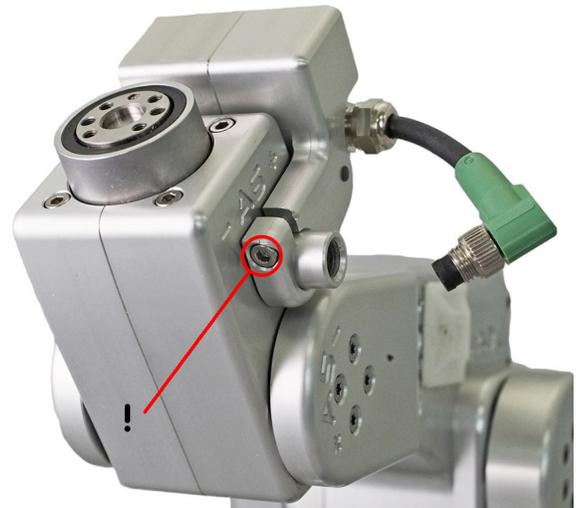
The MPM500 pneumatic module is designed for only one type of installation, as shown in [Figure 3](#). The module can be used with a variety of pneumatic grippers, suction cups, pneumatic tool changers or other pneumatic devices.



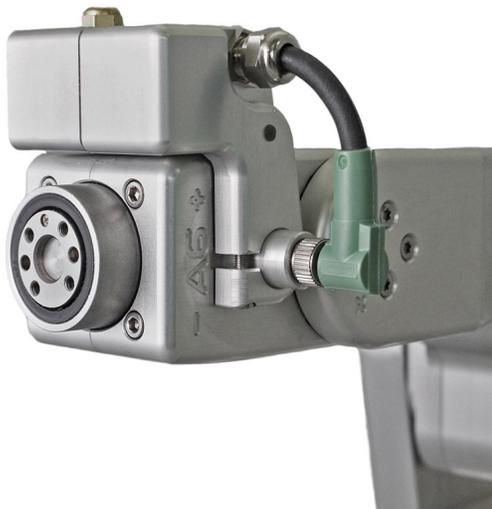
Make sure the Meca500 robot is powered off, before installing the MPM500 module.



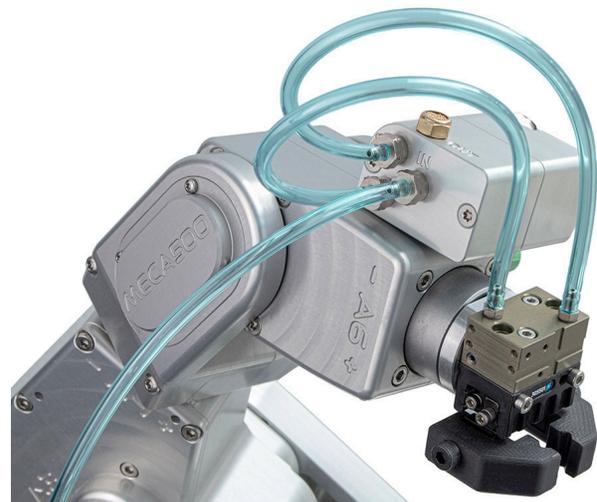
(a) positioning the module



(b) securing the module



(c) connecting the electric cable



(d) connecting the pneumatic tubes

Figure 3: Installing the MPM500 pneumatic module with Schunk's MPG-plus 25 pneumatic gripper

To install the MPM500 pneumatic module, make sure the robot is switched off, and then follow these steps:

1. Slide the MPM500 module on top of the Meca500's wrist, aligning it with the robot's electrical connector (Figure 3a).
2. Tighten the screw of the module clamp with an Allen key in order to secure it in place as shown in Figure 3b.
3. Connect the 6-pin SDR cable of the module to the Meca500's electrical connector (Figure 3c).
4. To complete the set-up, install your pneumatic tooling and then the required pneumatic tubing (Figure 3d). Examples of pneumatic circuits are given in the next section. Make sure the tubing is sufficiently long for the required range of motion of joint 6 of the robot.
5. Power the Meca500 (see its User Manual for more information).
6. After activation of the Meca500, the green LED on the module should emit steady light, indicating that the electrical connection is functional, as shown in Figure 4.

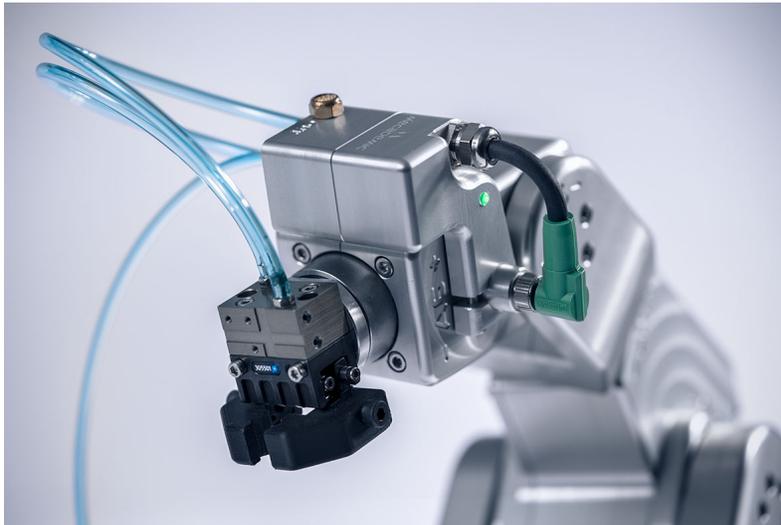


Figure 4: Pneumatic module connected to the Meca500 and to a double-action pneumatic gripper (MGP-plus 25, provided by Mecademic as a kit with the MPM500)

4. PNEUMATIC CIRCUIT EXAMPLES

As already specified, the MPM500 consists of two three-way, two-position normally closed valves that can be controlled independently. The valves share the same inlet port (IN) and exhaust port (OUT). The following two sections present three typical examples of pneumatic circuits.



if you operate the valves in a continuous manner, the module may heat up. This is normal.

4.1. Double-action pneumatic gripper

To connect your MPM500 to a double-action pneumatic gripper, as in [Figure 4](#), follow the circuit of [Figure 5](#). The compressed air should be introduced in the MPM500's IN port. It will be distributed to both 3/2 NC valves. The solenoid switch activates one valve which allows for the gripper to open/close its fingers, depending on which valve is activated. The gripper's pneumatic connectors should go in the MPM500's Port 1 and Port 2.

You should use the same pneumatic circuit in the case of a tool changer.

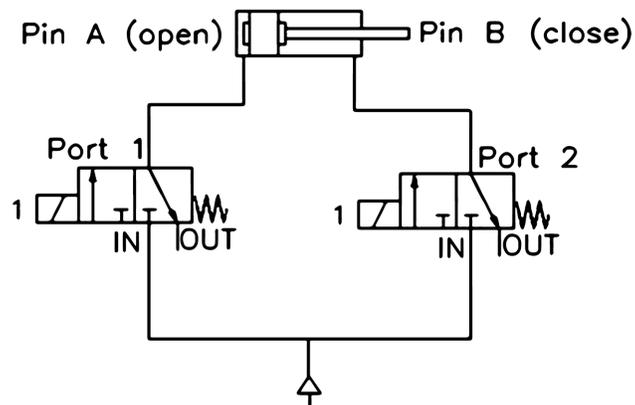


Figure 5: Pneumatic circuit in the case of a double-action pneumatic gripper

4.2. Vacuum suction cup

To connect the MPM500 to vacuum suction cups, follow the circuits on [Figure 6](#) or [Figure 7](#). In each of these two cases, only one of the valves is used.

With the first circuit ([Figure 6](#)), the compressed air must enter the MPM500's IN port. When the valve is activated the air flows towards a venturi vacuum pump and connects to its P+ port. The suction cup, and an additional air filter if necessary, are connected to the venturi vacuum pump's negative pressure (P-) port. The vacuum is toggled with the activation (open state) and release (close state) of the valve. If you have a compact venturi vacuum generator, this circuit is the most efficient one.

A more practical way to connect a suction cup, especially if your vacuum generator is bulky, is presented on [Figure 7](#). The compressed air is sent directly to the venturi pump on its positive pressure (P+) port.

The negative pressure (P-) port of the venturi is then connected to the OUT port of the MPM500. Here, it is important to connect to the OUT port and not the IN port, otherwise there is a risk for valve blockage.

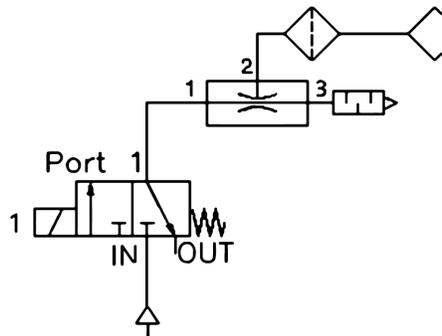


Figure 6: Pneumatic circuit in the case of a suction cup and a small venturi vacuum generator

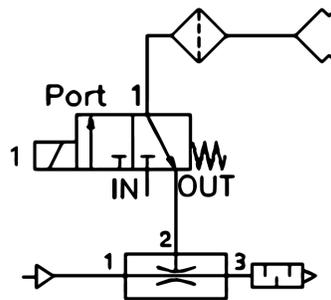


Figure 7: Pneumatic circuit in the case of a suction cup and a bulkier venturi vacuum generator

This circuit should also be used when working with a direct vacuum line. The vacuum line is connected to the OUT port of the MPM500, while the end-of-arm tooling is connected either to Port 1 or Port 2 of the pneumatic module.



If you are using a vacuum line instead of a compressed air line, make sure to connect it to the OUT port of the MPM500, as shown in [Figure 7](#).

5. OPERATING THE PNEUMATIC MODULE

The MPM500 pneumatic module is controlled in the same way as the Meca500. Its valves can be opened or closed using the `SetValveState(v_1, v_2)` command, where v_i ($i = 1$ or 2) is the state of valve i , with 1 for open, 0 for closed, and -1 for keep unchanged.

You can also request the state of the valves. Consult the Mecademic Robots Programming Manual for more details.

5.1. Firmware update

If you upgrade the firmware of your robot (using the procedure described in the Meca500 User Manual) while the pneumatic module is installed, the firmware of the module will be automatically updated. Otherwise, you can update the firmware of your module separately by following the same procedure, but selecting the file `m500_exttools_*.update`, instead of the file `Meca500_E_LD_*.update`.

5.2. Integration into the MecaPortal

The MecaPortal web interface automatically recognizes the MPM500 module and displays a CAD model of it, as well as a widget specific to the module (Figure 8). In the widget, you can control the states of the two valves.



Figure 8: Widget that appears in the MecaPortal jogging panel when the MPM500 is detected

5.3. Safety

The MPM500 pneumatic module is designed with safety in mind. However, additional tools connected to the module may lead to risks of injuries. Make sure that all connections are properly made and that you respect the technical specifications of the pneumatic module.

5.4. Activation and E-Stop

If an activated robot with an MPM500 pneumatic module becomes deactivated, the valves are no longer controllable and regain their default state, i.e., they close.

If an E-Stop is activated on a Meca500 R3, the whole system is powered off, while on a Meca500 R4, power is removed from the robot motors AND the MPM500 pneumatic module connected to the robot. Thus, in both cases, the valves return to their default state.



After a deactivation or an E-Stop, the valves regain their default states (i.e., closed). Therefore, if the robot's pneumatic EOAT is holding a part, the part might fall.

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