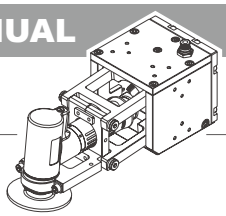
Mindman **TPG60 series**

# SERVICE MANUAL

## Pneumatic Grinder -

## Linkage Compliant Tool



## ⚠ Cautions

① This product is exclusively designed for robot deburring work, DO NOT use for other purpose.

② For your safety, DO NOT approach the robot when it is in automatic operation mode.

③ Grinding tools and burrs could cause injuries, be aware when you are working with them.

④ Collisions may cause damage to the compliant module. Be sure to thoroughly check before running in fully automated mode.

⑤ Severe bouncing of the tool on the workpiece may damage the compliant tool. Be sure to perform a check before running in full automatic mode.

⑥ The air supplied to the precision regulator and the compliant force should NOT be lubricated, otherwise the compliant module will be damaged.

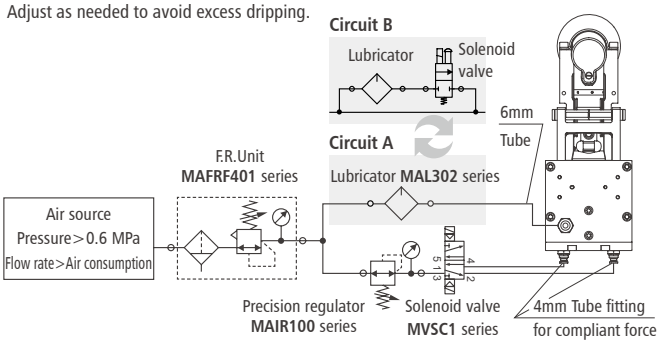
⑦ Never allow contact with the workpiece from a direction that is not aligned with the compliant module's direction.

⑧ The noise from grind could damage your hearing, be sure to always wear earplugs at work.

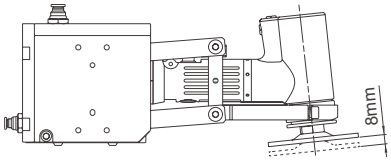
## Before Use

① Prepare a suitable air source as shown as the illustration below. The maximum flow rate of the thick lines should exceed the air consumption of the spindle.

* If excessive oil injection occurs, it is recommended to reduce the lubricant amount in **circuit A** or refer to **circuit B** to add an oil circuit switch to set the oil injection interval. Adjust as needed to avoid excess dripping.




② Check the CENTER POINT of the spindle (*1). While the spindle is at rest, apply 0.2 MPa of compliant pressure. Confirm that the spindle returns to the CENTER POINT, as shown in the figure below. If the spindle does not return or is not positioned at the CENTER POINT, please contact us. TPG60 has two 4mm tube fittings at the back, supplying air pressure to each to move the compliant mechanism either up or down, as shown in the diagram. Typically, the tube fitting that moves the mechanism downward is used. However, if a very low compliant force is desired, you can use the tube fitting that moves the mechanism upward and feed it with low air pressure to offset part of the mechanism's weight, thereby reducing the output compliant force.




③ The TPG60 has an 6mm tube connector at the top that supplies air pressure to drive the spindle. Listen to the operating sound; if there is any unusual noise or if the spindle does not run smoothly, please contact your supplier.

④ Install the compliant tool on the robot or a fixed position by screw holes and pin holes. (*1)

⑤ Setup TCP (Tool Center Point) of the compliant tool in robot controller by using either designed dimensions or the four-point calibration method. (*2)

⑥ You have finished the pre-use preparation, now you can start teaching-in robot paths.

*1. The CENTER POINT may not align exactly with the position shown in the illustration. A tolerance or gap of less than 0.5 mm is considered normal.

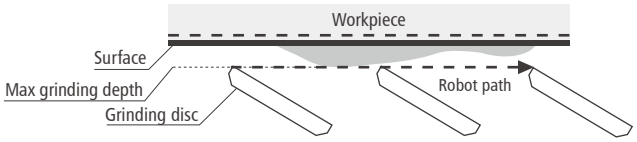
*2. Dimensions of tools are in the Appendix. If you need 3D model or 2D drawing, please download from website. www.mindman.com.tw

*3. It is recommended to start by using designed dimensions in the first place and then using four-point calibration method to improve the accuracy of TCP. When you implement the four-point calibration method, you need to indicate the point of TCP that you want with a sharp dummy tip.

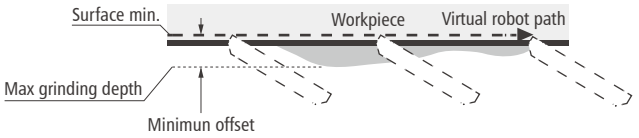
## Teach-in Robot Path

① Use a new grinding wheel and keep the compliant mechanism fully pressed down. Then teach the robot path so that the grinding disc just makes contact with the area on the workpiece that needs grinding, without interference. (*)

② Tilting the grinding disc approximately 30 degrees relative to the workpiece surface provides better grinding results and minimizes interference. The grinding path should ensure that the contact point moves toward the center of the grinding disc.




③ Add a depth offset to the path taught in the previous step to ensure that the grinding disc maintains contact with the workpiece. The offset should be greater than all dimensional variances, including the grinding depth required, but should not exceed the compliant stroke limit.




④ Adjust the arm's path to ensure the grinding wheel maintains a relatively fixed position within the floating range while moving across the workpiece surface. This minimizes excessive oscillation, resulting in a more stable cutting performance.

* Both workpiece or tool on robot are possible, depends on the aspect of system integration requirement.

## Operation

① Set the compliant force to a small value, such as 0.2MPa, then start operating the deburring process.

② If burrs are not fully removed, increase the compliant force. If only certain areas have residual burrs, reduce the robot arm speed along those specific segments. If the cutting is too deep, lower the compliant force or increase the robot arm speed.

③ If the tool bounces on the workpiece surface, it indicates insufficient compliant force adjust by increasing the compliant force or decreasing the robot arm speed.

④ If the spindle is blocked during operation, it may be caused by the high material removal rate. Reduce the compliant force will solve this program.

## Maintenance

① **Daily** Check whether the grinding disc is damaged or wore, replace it immediately when it has been invalid. Drain the water cup if it is full. Check the lubricating oil drip rate is normal.

② **Weekly** Ensure the spindle operates smoothly without unusual noises. Make sure compliant tool moves smoothly and can return to its CENTER POINT. At the origin, mechanical play of the spindle should be less than 0.5 mm when lightly shaken by hand, and it should reach both forward and backward LIMIT POSITIONS. If you notice any mechanical issues, please contact us.

## Specification

| | | |
|---|---|---|
| Compliant stroke | (mm) | 8 (one-sided) |
| Compliant force | (N) | 20～50 |
| Operating pressure | (MPa) | Compliant force: 0.2～0.5<br>Spindle: 0.6 |
| Air source requirement | | > 0.6 MPa, clean, dry, filtered ≤ 5μm |
| Air consumption | (LPM) | Complian force: Ignorable |
| | | Spindle: 150 |
| Recomm. lubricating oil (*) | | Turbine oil ISO-VG32 |
| Spindle idle speed | (rpm) | 18000 |
| Collet size | (inch) | 3/ Grinding wheel, sandpaper disc |
| Ambient temperature | (°C) | +5～+35 |
| Ambient hummidity | (%) | <95 |
| Weight | (kg) | 2.4 |

* Only for the pneumatic spindle. Adjust oil quantity as needed.