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D. Pneumatic and Fluid Modules

AE2, AF2, AR3—Air/Vacuum Module

1. Product Overview

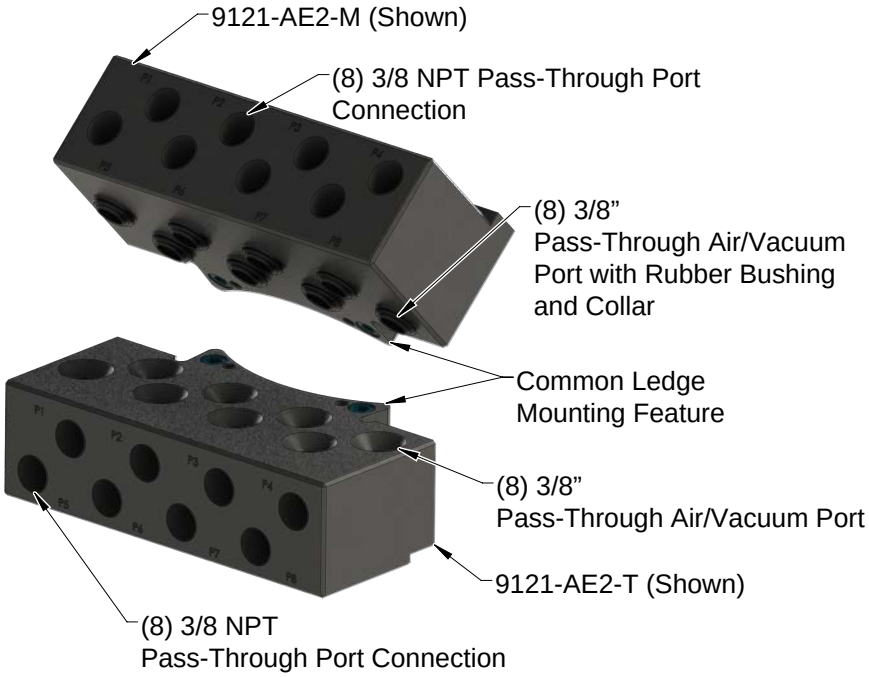
AE2, AF2, and AR3 modules provide air and vacuum services when attached to the Master and Tool plates. Refer to *Table 1.1* and *Figure 1.1* for a description of the different modules. Refer to *Section 7—Specifications* and *Section 8—Drawings* for more information. Significant forces are encountered when using these modules. Assistance from the robot may be required to overcome these forces when coupling the Tool Changer.

NOTICE: The Master and Tool modules are supplied with (8) pass-through ports used for air and vacuum service.

Table 1.1—AE2, AF2, and AR3 Air/Vacuum Modules

Module	Pass-Through Air/Vacuum Port Connection Size
AE2	(8) 3/8 NPT
AF2	(8) G 3/8 (BSPP)
AR3	(8) Rc 3/8 (BSPT)

Figure 1.1—AB2 Modules



2. Installation

The air modules are typically installed by ATI prior to shipment. The steps below outline the field installation or removal as required.

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

CAUTION: Do not use the Tool Changer with air pressure below 60 psi. Safe, reliable operation of the Tool Changer is dependent on a continuous supply of compressed air at a pressure of 60 to 100 psi. Robot motion should be halted if the air supply pressure is below 60 psi.

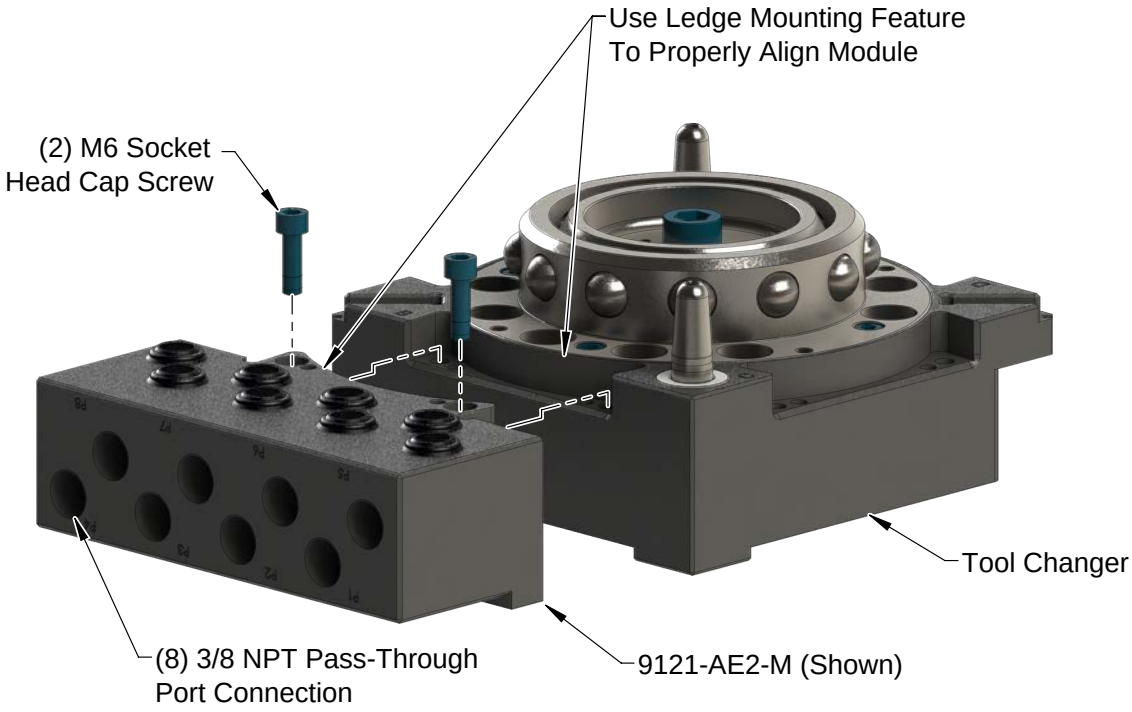
2.1 Module Installation

Tools required: *5 mm hex key, torque wrench*

Supplies required: *clean rag, Loctite® 242*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Wipe down the mounting surfaces with a clean rag.
5. Place the module into the appropriate location on the Tool Changer or Utility Coupler body. Align the module with the Tool Changer using the dowels in the bottom of the ledge feature.
6. Apply Loctite 242 to the supplied M6 socket head cap screws. Using a 5 mm hex key, install the (2) M6 socket head cap screws securing the module to the Tool Changer or Utility Coupler and tighten to 89 in-lbs (10.0 Nm).
7. Ensure the air connectors are clean and connect to the module.
8. Safely resume normal operation.

Figure 2.1—Master Module Installation



2.2 Module Removal

Tools required: *5 mm hex key*

Supplies required: *paint marker*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use a paint marker to indicate where the module is to be re-installed.
5. Disconnect air plumbing to the module.
6. Remove the (2) M6 socket head cap screws using a 5 mm hex key.
7. Remove the module.

3. Operation

The air/vacuum modules pass air/vacuum utilities from the Master to the Tool for use by the customer's tooling. Pass-through ports on the modules are for unchecked pressure or air/vacuum applications.

4. Maintenance

Once installed, the operation of the air/vacuum modules is generally trouble free. Refer to *Section 4.1—Preventive Maintenance*

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4.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule is provided in *Table 4.1*.

Table 4.1—Preventive Maintenance Schedule

Inspection Schedule	Action Required
Weekly	Clean and inspect
6 months or 500,000 cycles	Seal replacement
Checklist	
Weekly Maintenance:	
☐ Clean mating surfaces using a nylon brush.	
☐ Inspect modules for air leaks. Replace components as necessary.	
6 months or 500,000 cycle Maintenance:	
☐ On the master module, inspect the rubber bushing seals for damage. Replace as required. Refer to *Section 5.2—Service Procedures*.	
☐ Check that module mounting bolts are secure. Refer to *Section 2.1—Module Installation*.	

5. Troubleshooting and Service Procedures

This troubleshooting section provides information to help diagnose conditions with the Tool Changer or air module as well as service procedures for component replacement.

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5.1 Troubleshooting Procedures

Refer to the table below for troubleshooting information.

Table 5.1—Troubleshooting Procedures

Symptom	Possible Cause	Correction
Air Leakage	Damaged/Worn seals	Replace rubber bushings as needed. Refer to *Section 5.2—Service Procedures*.
	Corrosion	Consult ATI Applications Engineering for assistance.
Poor Flow	Flow path blockage	Inspect valve components and supply/return lines for blockage. Clean/repair as necessary.
Modules Won't Couple	Debris is caught between the Master and Tool plates.	Clean debris from between the Master and Tool plates using a nylon brush. Verify the mounting fasteners are secure and do not protrude above the mating surfaces. Refer to *Section 2.1—Module Installation*.

5.2 Service Procedures

The following service procedures provide instructions for replacement of components.

5.2.1 Rubber Bushing Replacement

Parts Required: *Refer to Section 8—Drawings.*

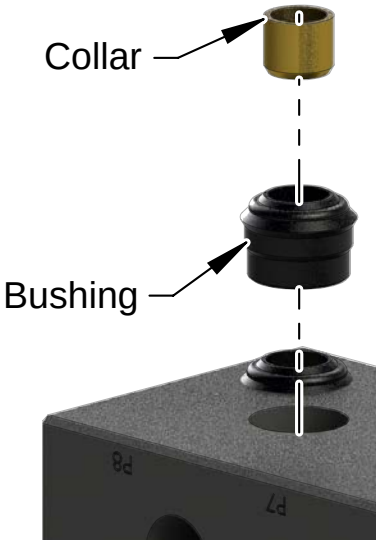
Tools required: *Needle-nose pliers*

Supplies required: *P80 lubricant*

Rubber bushings seal the ports in the Master and Tool plates. If the bushings are damaged, replace them.

8. Place the Tool in a secure location.
9. Uncouple the Master and Tool plates.
10. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
11. Remove the bushing and collar.
    a. Use needle-nose pliers to remove the bushing from the module housing.
    b. If the collar remains in the module housing or inside the bushing, remove the collar.
12. Install the replacement bushing.
    a. Apply a thin coat of P80 lubricant to the outer surface of the replacement bushing.
    b. Insert the beveled (chamfered) end of the bushing into the port.
    c. Insert the collar into the bushing.
    d. Seat the bushing completely in the bore.
13. Safely resume normal operation.

Figure 5.1 —Replacing the Bushing and Collar



6. Recommended Spare Parts

Refer to *Section 8—Drawings*.

7. Specifications

Table 7.1—Master Module Specifications				
Module	**Materials of Construction**	**Weight**	**Ports Connection, (quantity) Port Size (C_v)**	**Pressure (Maximum)**
9121-AE2-M	Anodized aluminum housing with Nitrile seals and brass seal collars	2.55 lbs (1.16 kg)	3/8 NPT (8) 3/8" pass-through (1.6)	100 psi (6.9 bar)
9121-AF2-M	Anodized aluminum housing with Nitrile seals and stainless steel seal collars	2.60 lbs (1.18 kg)	G 3/8 (BSPP) (8) 3/8" pass-through (1.6)	
9121-AR3-M	Anodized aluminum housing with Nitrile seals and brass seal collars	2.55 lbs (1.16 kg)	Rc 3/8 (BSPT) (8) 3/8" pass-through (1.6)	

Table 7.2—Tool Module Specifications				
Module	**Materials of Construction**	**Weight**	**Ports Connection, (quantity) Port Size (C_v)**	**Pressure (Maximum)**
9121-AE2-T	Anodized aluminum housing	2.30 lbs (1.04 kg)	3/8 NPT (8) 3/8" pass-through (1.6)	100 psi (6.9 bar)
9121-AF2-T			G 3/8 (BSPP) (8) 3/8" pass-through (1.6)	
9121-AR3-T			Rc 3/8 (BSPT) (8) 3/8" pass-through (1.6)	

8. Drawings

Drawings are available on the *ATI website* or by contacting an ATI representative.