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D. Fluid/Air Modules

FL4

1. Product Overview

Modules providing air, fluid service are attached to the Master and Tool plates. Refer to the table and figure below for a description of the specific modules being presented in this section.

Significant forces are encountered when using the FL4 module. Assistance is required to overcome these forces when coupling the Tool Changer.

FL4-M	Stainless Steel Fluid/Air Master module with (5) Rc ½" (BSPT) self-sealing ports, 3/8 valves
FL4-T	Stainless Steel Fluid/Air Tool module with (5) Rc ½" (BSPT) self-sealing ports, 3/8 valves

Table 1.1—Fluid/Air Modules



Figure 1.1—Fluid/Air Module, Stainless Steel Construction

2. Installation

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

> **DANGER:** Power and air should always be removed prior to maintenance or repair. Failure to do this could result in personnel injury or damage to equipment.

2.1 Installation

1. It may be necessary to clean the mounting surface on the Tool Changer prior to installing the module in order to remove any debris that may be present.
2. Align the module to the holes in the Tool Changer mounting surface using the dowels that are pressed into the module housing. Push the module up flush with the Tool Changer surface.
3. Apply Loctite-242® (or similar) thread locker to the socket head cap screws and tighten using a hex key. Torque to 89 in-lbs (10 Nm).
4. Connect customer plumbing to the module.

2.2 Removal

1. All customer plumbing connections to the module need to be purged and disconnected. Once the supply lines have been turned off, the self-sealing valves on the module can be manually actuated to purge the line pressure. Cover the valves with a rag prior to purging in order to keep the fluid/air from impinging upon any person.
2. Remove the socket head cap screws and pull the module off the Tool Changer.

3. Operation

The fluid/air modules are designed to pass fluid/air utilities from the Master to the Tool for use by the customer's tooling.

Five (5) self-sealing valves are provided on the Master side so that the fluid/air circuits do not discharge during tool changes.

Typically, self-sealed valves are specified on the Tool for ports being used for fluid service.

The compressibility of gasses makes it unnecessary to isolate and discharge lines during a tool change. However, liquids are incompressible and therefore coupling lines while pressurized is to be avoided. Liquid displaced by mating coupler components creates extremely high pressure spikes and fluid velocities potentially causing seal damage. These problems become more pronounced as the operating pressure is increased.

In all liquid coupling applications, the customer is advised to take the following steps:

- Plumb the couplers using flexible hoses, which are able to absorb pressure spikes and pulses. Highly reinforced hoses and hard pipe must not be used.
- Turn off the supply pump to the circuit and discharge pressure in the lines prior to a tool change.
- Hydraulic pressure accumulators should be installed on both the Master and Tool side plumbing. This is particularly important on the Tool side, even with the pump turned off and Master side pressure discharged.
- During routine maintenance of the Tool Changer, the couplers should be inspected and re-lubricated. Water and most solvents will wash away lubricants necessary to prolong seal life.

> **CAUTION:** Failure to follow these steps will result inpremature seal failure, jetting of fluid from the couplers during tool changes, and significant pressure pulses in customer tooling.

> **CAUTION:** To maximize the life and performance of fluid/air components, read and follow the steps in the Operations section of this manual..

4. Maintenance

Once installed the operation of the fluid/air modules is generally trouble free. Periodically the condition of the self-sealing valves should be checked. A visual inspection and preventive maintenance schedule is provided in the table below.

4.1 Preventive Maintenance

Tool Change Frequency	Inspection Schedule	Action Required
	Weekly	Clean and inspect
< 1/minute	6 months	Seal replacement
> 1/minute	6 months or 500,000 cycles	Seal replacement

Checklist

Weekly Maintenance:

Clean mating surfaces.

Inspect modules for fluid/air leaks. Replace components as necessary.

6 months or 500,000 cycle Maintenance:

Remove and replace seals (See *Section 4.2—Master-Side Self-Sealing Valve*).

Inspect valve stem and dowel pin for straightness.

Re-lubricate bores.

Check that module mounting bolts are secure.

Tools and Materials Required:

- Metric hex keys
- Grease – Magnalube G (Teflon/Petroleum-based grease)



DANGER: Power and air should always be removed prior to maintenance or repair. Failure to do this could result in personnel injury or damage to equipment.

4.2 Master-Side Self-Sealing Valve

1. The self-sealing valve assembly (stem, check valve, spring and seals) can be inspected by removing the stem using a 2.5mm hex key. Be careful not to strip the hex on the stem during removal.
2. Once the stem is removed all seals can be inspected and replaced as required.
3. The spring in the assembly should be inspected and replaced as required.
4. The stem should be inspected for straightness and replaced if bent.
5. Lube seals and bores with Magnalube G (Teflon/Petroleum-based grease).
6. To re-install the valve assembly, all components should be arranged in order as they were removed. (See drawings in *Section* 8*—Drawings*.)
7. Loctite 242 (or similar) thread locker should be applied to the threaded end of the stem and the stem re-installed. The piston will have to be pushed down flush with the mating surface in order to get the stem thread started. It is important that the U-cup seal around the check valve is not damaged during this step. A small, flat-head screwdriver can be used to ensure that the U-cup seal is fully located in the recess and not folded over itself prior to screwing in the stem.

4.3 Tool-Side Self-Sealing Valve

1. The self-sealing valve assembly (plug, spring, piston, and seals) can be inspected by removing the plug on the bottom of the fluid/air module using a 10mm hex key. It may be necessary to remove the tool side fluid/air module to have access to the plug. (Refer to the *Section* 2*—Installation* for instructions for module removal.)
2. Once the plug is removed all seals can be inspected and replaced as required.
3. The spring in the assembly should be inspected and replaced as required.
4. The plug will contain a dowel pin. The pin should be inspected for straightness and replaced if bent.
5. Lube the seals and o-ring contact surfaces with Magnalube G (Teflon/Petroleum-based grease).
6. To re-install the valve assembly, all components should be arranged in order as they were removed. (See drawings in *Section* 8*—Drawings*.)
7. Care should be taken not to damage the O-ring around the plug base during installation.

5. Troubleshooting

Problem	Cause	Remedy
Fluid/Air Leakage	Damaged/Worn seals	Replace seals.
	Debris blocking valve seal	Clean in and around valve components. Ensure fluid stream is free of large particulates, filter as necessary.
	Bent stem	Replace stem. Check module attachment to Tool Changer. Check robot program and ensure parallel approach trajectory during Tool Changer coupling.
	Corrosion	Consult ATI for assistance.
Fluid spray during uncoupling	Surge/Water Hammer	Decrease pressure differential between supply and return lines or install pressure compensation system (e.g., accumulator or surge suppressor as close as possible to spraying port). Consult ATI for assistance.
Poor Flow	Flow path blockage	Inspect valve components and supply/return lines for blockage, clean/repair as necessary.
	Debris blocking valve seal	Clean in and around valve components. Ensure fluid stream is free of large particulates, filter as necessary.
Modules Won't Couple	Bent stem, dowel pin	Replace stem, dowels as necessary. Check module attachment to Tool Changer. Check robot program and ensure parallel approach trajectory during Tool Changer coupling.

6. Recommended Spare Parts

See drawings in *Section* 8*—Drawings*.

7. Specifications

Fluid/Air Modules	**FL4-M, FL4-T**	
Weight	TBD lbs (TBD kg) TBD lbs (TBD kg)	FL4-M FL4-T
Materials of Construction	Various	Stainless Steel housings and valve components, Nitrile-N Rubber seals, PVC plug.
Fluid Ports, (qty) Size (C_v, Min)	(5) Rc ½" (BSPT) (1.6)	Maximum pressure of 100psi (6.9bar), Nitrile seals, Self-sealing on Master and Tool.

8. Drawings

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