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D. Pneumatic and Fluid Modules

AE2, AF2, AR3—Air/Vacuum Module

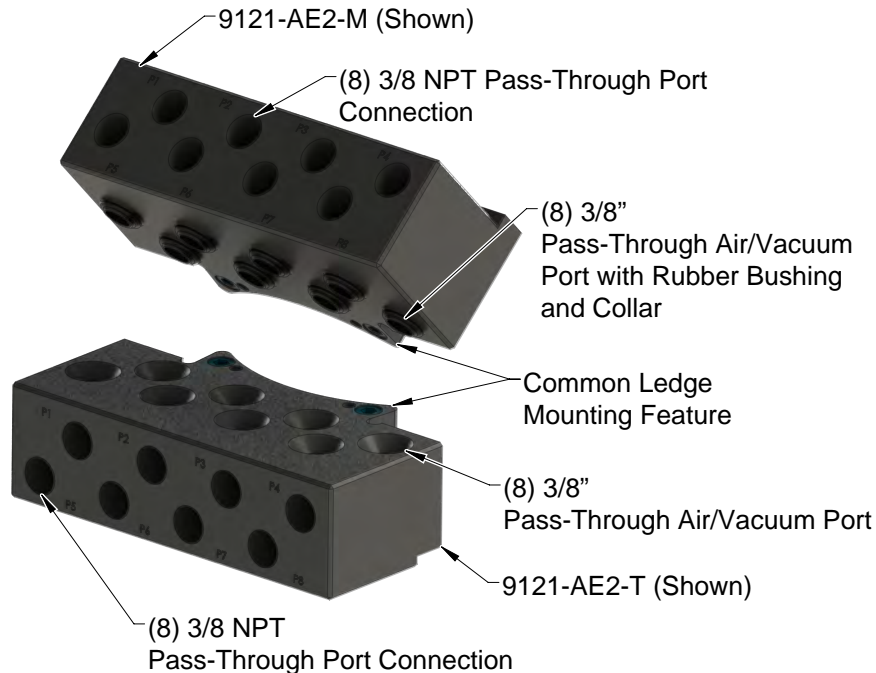
1. Product Overview

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



CAUTION: It is recommended, not to use fasteners with pre-applied adhesive more than three times. Fasteners used more than three times may come loose and cause equipment damage. Discard fasteners used more than three times and install new fasteners with pre-applied adhesive.



CAUTION: Air supply should be clean, dry, and non-lubricated. Supply pressure should not exceed 100 psi and should be filtered 50 micron or better. Connection lines should be properly strain relieved.

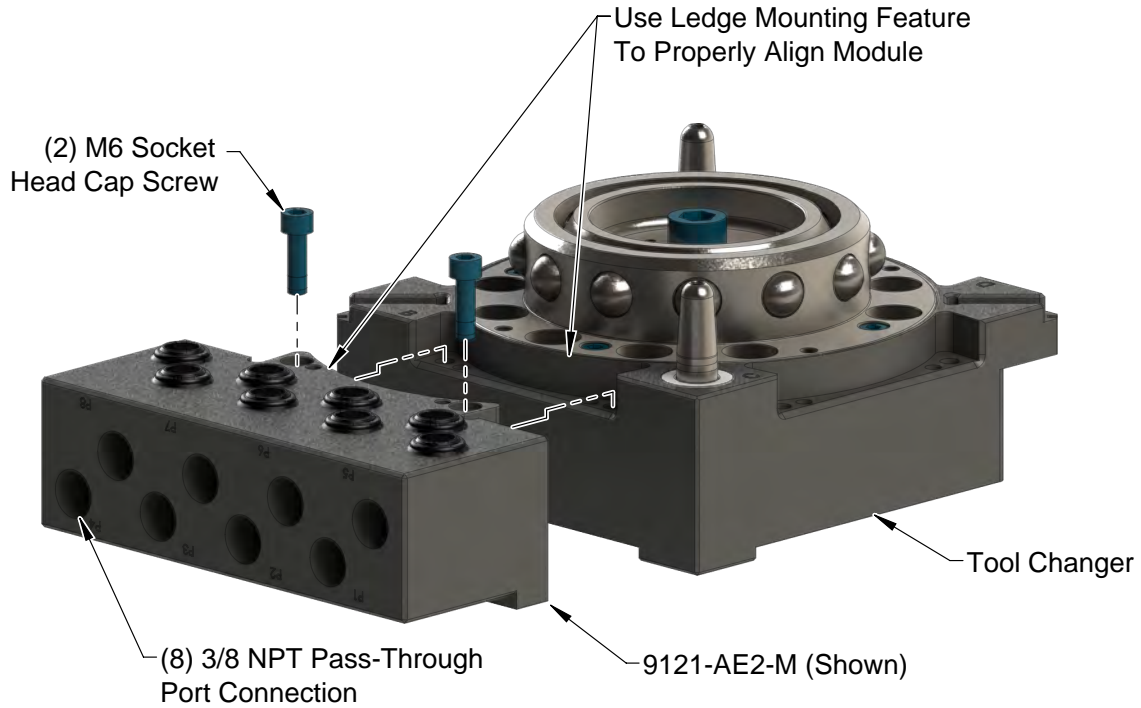
2.1 Module Installation

Tools required: 5 mm Allen® wrench, Torque wrench

Supplies required: Clean rag, Loctite® 242 (if fasteners do not have pre-applied adhesive)

1. With the Tool Changer installed, dock the Tool safely in the tool stand and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. Turn off and de-energize all circuits (e.g. electrical, air, water, etc.).
3. It may be necessary to clean the mounting surface(s) prior to installing the module in order to remove any debris that may be present.
4. Using the module's dowel pins on the mounting face as a guide, place the module at the appropriate location.
5. If fasteners do not have pre-applied adhesive, apply Loctite 242 to the supplied M6 socket head cap screws. Install the (2) M6 socket head cap screws securing the module to the Tool Changer and tighten to 89 in-lbs (10.06 Nm).
6. Connect air plumbing to the module after attaching the module to the Tool Changer body. Ensure that the connectors are cleaned prior to being secured as appropriate.
7. After installation is complete, module(s) may be placed in normal operation.

Figure 2.1—Master Module Installation



2.2 Module Removal

Tools required: 5 mm Allen wrench

1. If the Tool Changer is already installed, dock the Tool side of the Tool Changer safely in the tool stand and uncouple the Tool Changer to allow clear access to the Master and Tool plates of the Tool Changer.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Prior to removing the module use a marker pen to scribe a line or indication between the Tool Changer and module body as a reminder where the module is to be re-installed.
4. Depending upon the service or repair being done, connections up to the module may or may not need to be disconnected.
5. Remove the socket head cap screws and lift the module from the Tool Changer.

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](#)



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

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:	
<input type="checkbox"/> Clean mating surfaces using a nylon brush. <input type="checkbox"/> Inspect modules for air leaks. Replace components as necessary.	
6 months or 500,000 cycle Maintenance:	
<input type="checkbox"/> On the master module, inspect the rubber bushing seals for damage. Replace as required. Refer to Section 5.2—Service Procedures . <input type="checkbox"/> 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.



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

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](#).

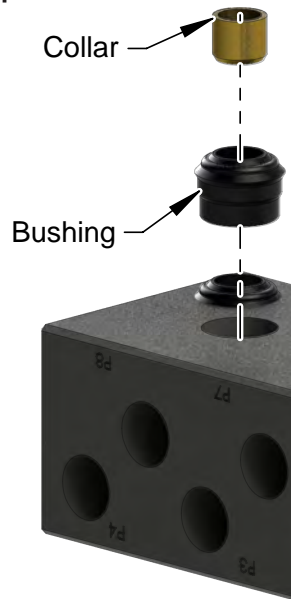
Tools Required: Needle nose pliers

Supplies Required: P80 Lubricant

The rubber bushings seal the air passages from the Master to the Tool module. If the bushing becomes cut or damaged, the component should be replaced.

1. If the Tool Changer is already installed, dock the Tool side of the Tool Changer safely in the tool stand and uncouple the Tool Changer to allow clear access to the Master and Tool plates of the Tool Changer.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Using needled nose pliers, grasp the bushing and pull it out of the module housing.
4. If the collar remains in the housing, remove the the collar.
5. Apply a thin coat of P80 lubricant to the bushing.
6. Insert the beveled (chamfered) end of the bushing into the bore. Leave the ribbed end of the bushing facing outward.
7. Insert the collar into the bushing. Make sure the bushing is seated completely in the bore.
8. If installation is complete, return all circuits to normal operation.

Figure 5.1 —Replacement of the Bushing and Collar



6. Recommended Spare Parts

Refer to [Section 8—Drawings](#).

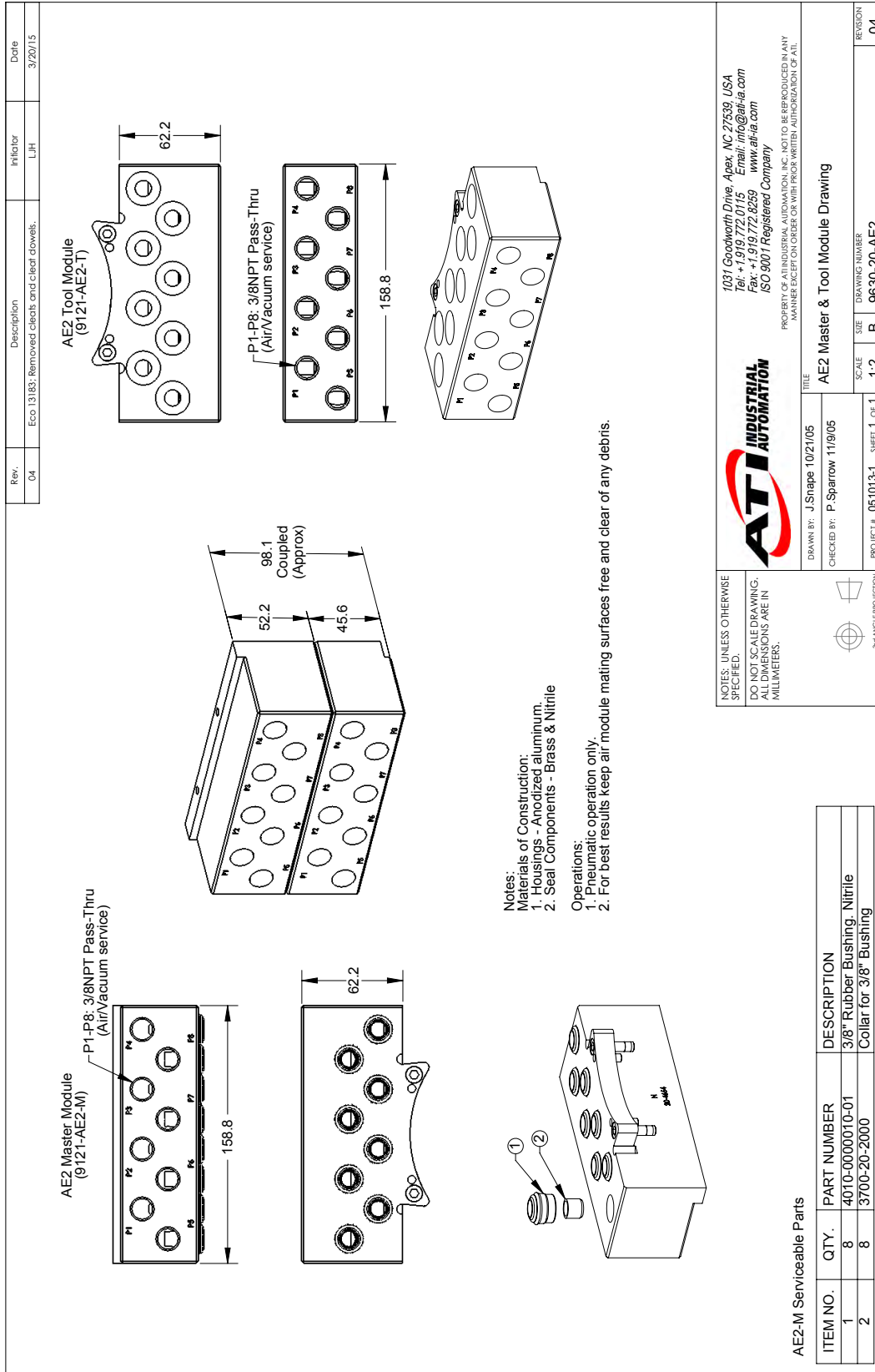
7. Specifications

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

8.1 9630-20-AE2



8.2 9630-20-AF2

Rev.	Description	Initiator	Date
04	Eco 9544: Replace Color with stainless version.	CF	3/8/2012
05	Eco 13183: Removed Cleats and Dowell	LH	12/8/2015

AF2 Master Module (9121-AF2-M)

P1-P8: 3/8G Pass-Thru (Air/Vacuum service)

AF2 Tool Module (9121-AF2-T)

P1-P8: 3/8G Pass-Thru (Air/Vacuum service)

Notes:

Materials of Construction:

1. Housings - Anodized aluminum.
2. Seal Components - Stainless & Nitrile

Operations:

1. Pneumatic operation only.
2. For best results keep air module mating surfaces free and clear of any debris.

Notes: UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DRAWING. DIMENSIONS ARE IN MILLIMETERS.

3RD ANGLE PROJECTION

AF2-M Serviceable Parts

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	8	3700-20-2169	Collar for 3/8" Bushing, Stainless
2	8	4010-0000010-01	3/8" Rubber Bushing, Nitrile

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AF2 Master & Tool Module Drawing

DRAWN BY: J. Shepe, 10/21/05
 CHECKED BY: P. Sparrow, 11/9/05

SCALE: 1:2
 SHEET: 1 OF 1
 DRAWING NUMBER: B 9630-20-AF2
 REVISION: 05

8.3 9630-20-AR3

Rev.	Description	Initiator	Date
02	ECO 13199: Removed 9005-20-1198 & 9005-20-1199 Check assemblies representations from drawing. Removed AR3-M Serviceable Parts note & boom table. Sorted AR3-M Serviceable Parts table & corrected balloons.	TBC	3/31/2015

AR3 Master Module (9121-AR3-M)
P1-P8: R3/8" Pass-Thru (Air/Vacuum service)

AR3 Tool Module (9121-AR3-T)

AR3-M Serviceable Parts

Notes:
Materials of Construction:
 1. Housings - Anodized aluminum.
 2. Seal Components - Brass & Nitrile

Operations:
 1. Pneumatic operation only.
 2. For best results keep air module mating surfaces free and clear of any debris.

NOTES: UNLESS OTHERWISE SPECIFIED:
 DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.

THIRD ANGLE PROJECTION

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DRAWN BY:	D. Swanson 4/12/10	TITLE:	AR3 Master & Tool Module Drawing
CHECKED BY:	D. Wagner 4/13/10	SCALE:	1:2
PROJECT #:	SHEET 1 OF 1	SIZE:	B
		DRAWING NUMBER:	9630-20-AR3
		REVISION:	02

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	8	3700-20-2000	Collar for 3/8" Bushing
2	8	4010-0000010-01	3/8" Rubber Bushing, Nitrile