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C. Control and Signal Modules

Integrated Single Solenoid Valve Adapters

1. Product Overview

Valve adapters provide air supply to the Master plate for actuation of the locking mechanism. Valve adapters have a single-solenoid valve that receives the unlatch signal from the control/signal module. A cable is supplied to connect the control/signal module to the solenoid valve. The valve adapters mount to a flat on the Tool Changer or Utility Coupler (usually Flat 'A' for the Tool Changer), and the control/signal module mounts to the valve adapter. Many variations of the valve adapter are available, depending upon the Tool Changer or Utility Coupler size and type of porting required by the customer. For a list of available adapters, refer to *Table 1.1*, and for the drawings, refer *Section 8—Drawings*.

Table 1.1—Valve Adapters with a Single Solenoid Models

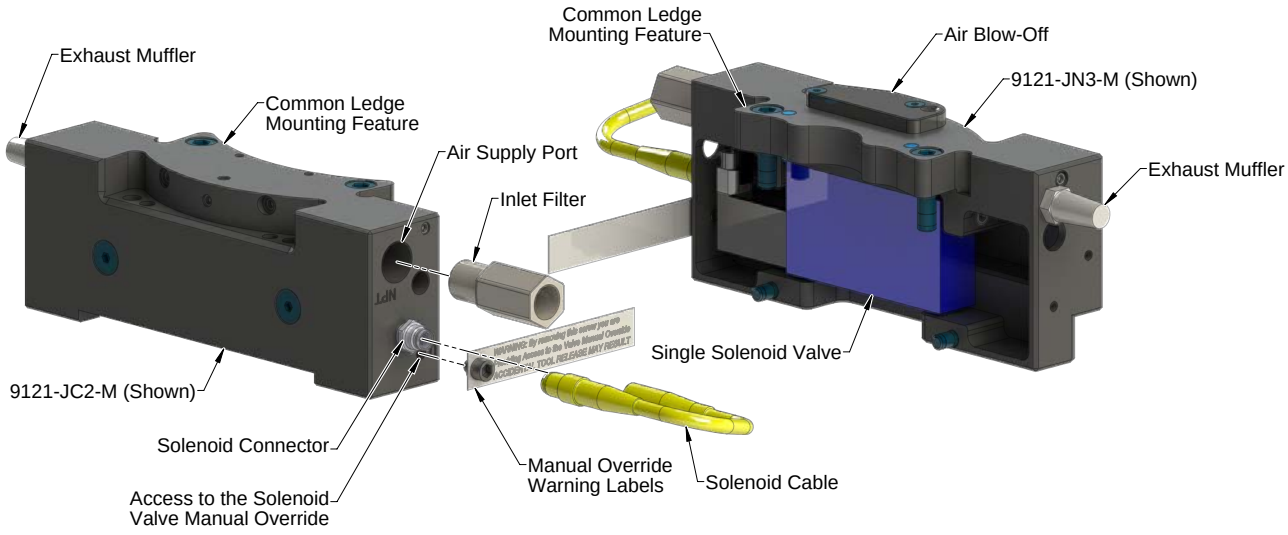
Valve Adapter	Description	Air Port Size	Compatible Tool Changer or Utility Coupler models
9121-JC2-M	Single Solenoid	1/4" NPT	QC-113, QC-210, QC-213, GL6L, GL7L
9121-JC3-M	Single Solenoid	1/4" NPT	QC-310, QC-313, QC-510, QC-1210
9121-JD3-M	Single Solenoid	G 1/4" (BSPP)	QC-310, QC-313, QC-510, QC-1210
9121-JN2-M	Single Solenoid with air blow-off	1/4" NPT	QC-113, QC-210, QC-213, GL6L, GL7L
9121-JN3-M	Single Solenoid witj air blow-off	1/4" NPT	QC-310, QC-313, QC-510, QC-1210

The valve adapter has a ledge mount to install the control/signal Master module and provides a single air port connection for the customer air supply. In addition to the aforementioned features, the valve adapter has the following items (refer to *Figure 1.2*):

- an air supply or for lock and unlock air connection to the Tool Changer or Utility coupler
- O-rings in the body to seal the air connection
- exhaust muffler
- solenoid cable
- air blow-off (if equipped)

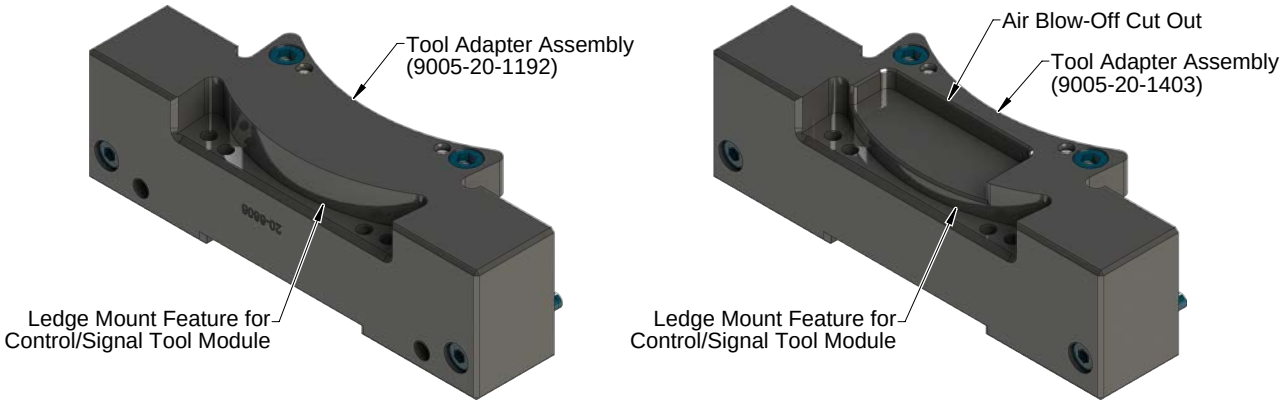
Access to the solenoid valve manual override is provide through a screw in the aluminum housing, refer to *Section 5.1.1—Solenoid Valve Manual Override Procedure* for more information.

Figure 1.2—Valve Adapters with a Single Solenoid



When a valve adapter is used on the Master side, a Tool adapter assembly (P/N #9005-20-1192) is required for the Tool side. The tool adapter assembly provides the proper spacing and a ledge mount for the control/signal Tool module. If the valve adapter on the Master has an air blow-off feature, then P/N #9005-20-1403 Tool adapter assembly is required.

Figure 1.3—Tool Adapters Assemblies



2. Installation

Valve adapters and Tool adapter assemblies are typically installed by ATI prior to shipment. The following instructions outline installation or removal procedures.

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.

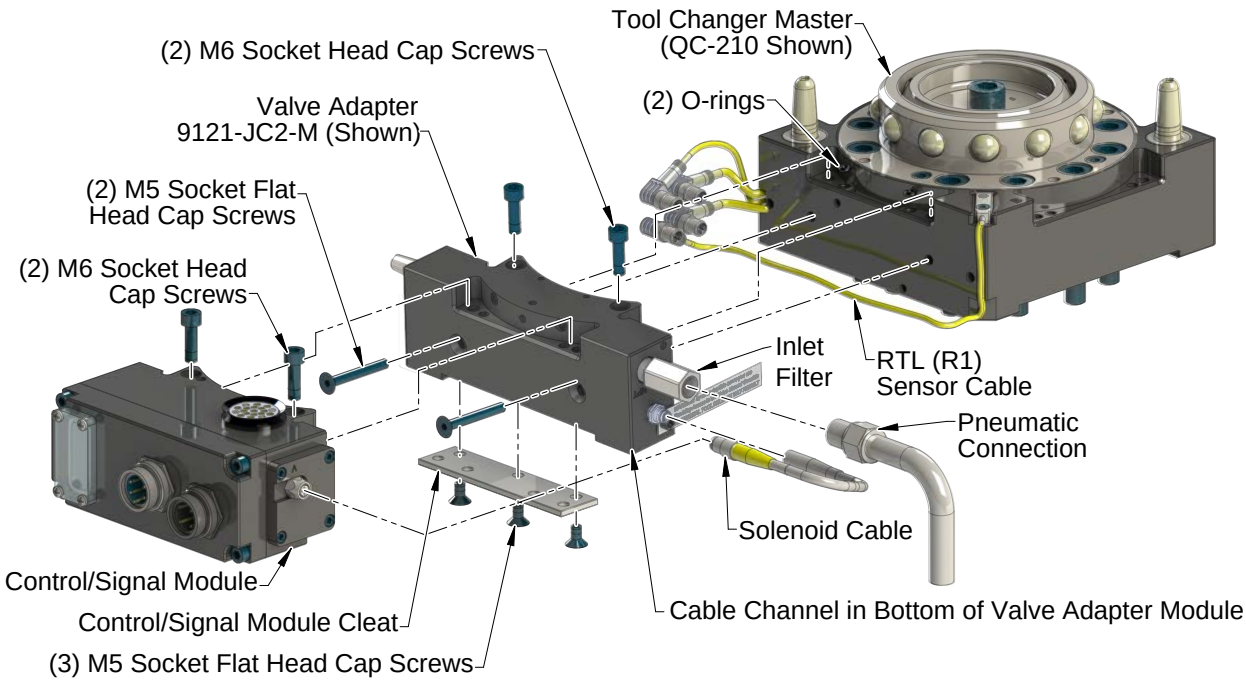
2.1 Valve Adapter Installation for QC-113, QC-210, QC-213, GL6L, GL7L

Tools required: *5 mm hex key, 3 mm hex key, torque wrench*

Supplies required: *clean rag, Loctite® 222, Loctite® 242, and Loctite® 569*

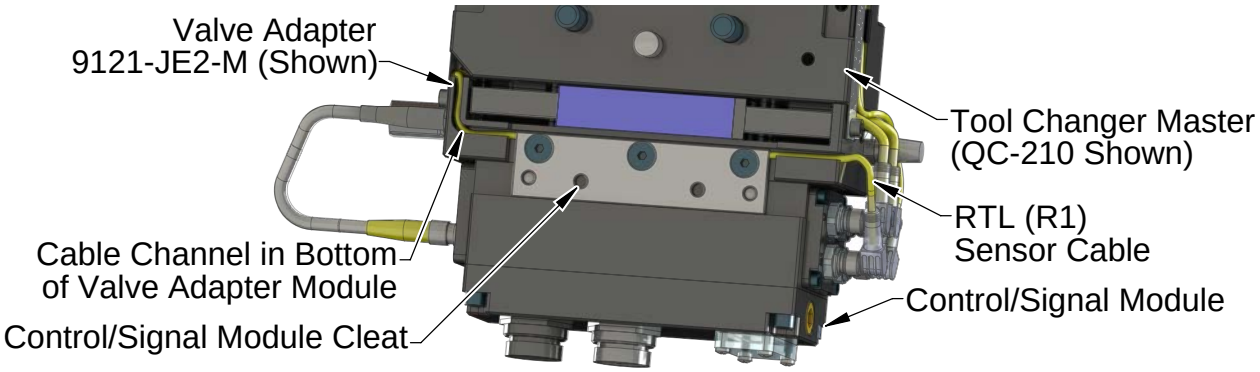
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Wipe down the mounting surfaces with a clean rag.
5. (2) O-rings are required on the Master side Flat 'A' interface. Make sure these O-rings are present and lightly lubricated (refer to *Figure 2.1*).
6. Place the valve adapter on the Tool Changer or Utility Coupler.
7. Apply Loctite® 242 to the supplied M6 socket head cap screws. Use a 5 mm hex key to install the (2) M6 socket head cap screws and tighten to 70 in-lbs (7.9 Nm).
8. Apply Loctite® 222 to the (2) supplied M5 socket flat head cap screws. Use a 3 mm hex key to install the (2) M5 socket flat head cap screws and tighten to 28 in-lbs (3.2 Nm).

Figure 2.1—Valve Adapter Installation (QC-210 Shown)



9. Route the RTL (R1) sensor cable through the cable channel in the bottom of the valve adapter (refer to *Figure 2.2*).
10. Install the cleat from the control/signal module to retain the RTL (R1) sensor cable in the cable channel. Use a 3 mm hex key to install the (3) M5 socket flat head cap screws and tighten to 14 in-lbs (1.6 Nm).
11. Make pneumatic connections to the inlet filter as required. Ensure that the connectors are cleaned prior to being secured as appropriate. ATI recommends using a thread sealant such as Loctite® 569 or similar.
12. Connect the solenoid cable to the connector on the valve adapter.

Figure 2.2—RTL (R1) Sensor Cable Routing



2.2 Valve Adapter Removal for QC-113, QC-210, QC-213, GL6L, GL7L0

NOTICE: Depending on maintenance or repair being performed, utilities to modules and Master plate may need to be disconnected.

Tools required: *5 mm hex key, 3 mm hex key*

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. Disconnect the solenoid cable from the control/signal module and valve adapter.
5. Remove the control/signal module off the valve adapter (refer to the control /signal module manual for instructions).
6. Use a 3 mm hex key to remove the (3) M5 socket flat head cap screws securing the control/signal module cleat and remove the cleat (refer to *Figure 2.1*).
7. Remove the RTL (R1) sensor cable from the cable channel in the bottom of the valve adapter (refer to *Figure 2.2*).
8. Use a 3 mm hex key to remove the (2) M5 socket flat head cap screws, and use a 5 mm hex key to remove the (2) M6 socket head cap screws. Lift the valve adapter off the Tool Changer or Utility Coupler).
9. Make sure that the O-rings are retained at the mounting interface on Master side Flat ‘A’.

2.3 Valve Adapter Installation for QC-310, QC-313, QC-510, QC-1210

Tools required: *5 mm hex key, 4 mm hex key, torque wrench*

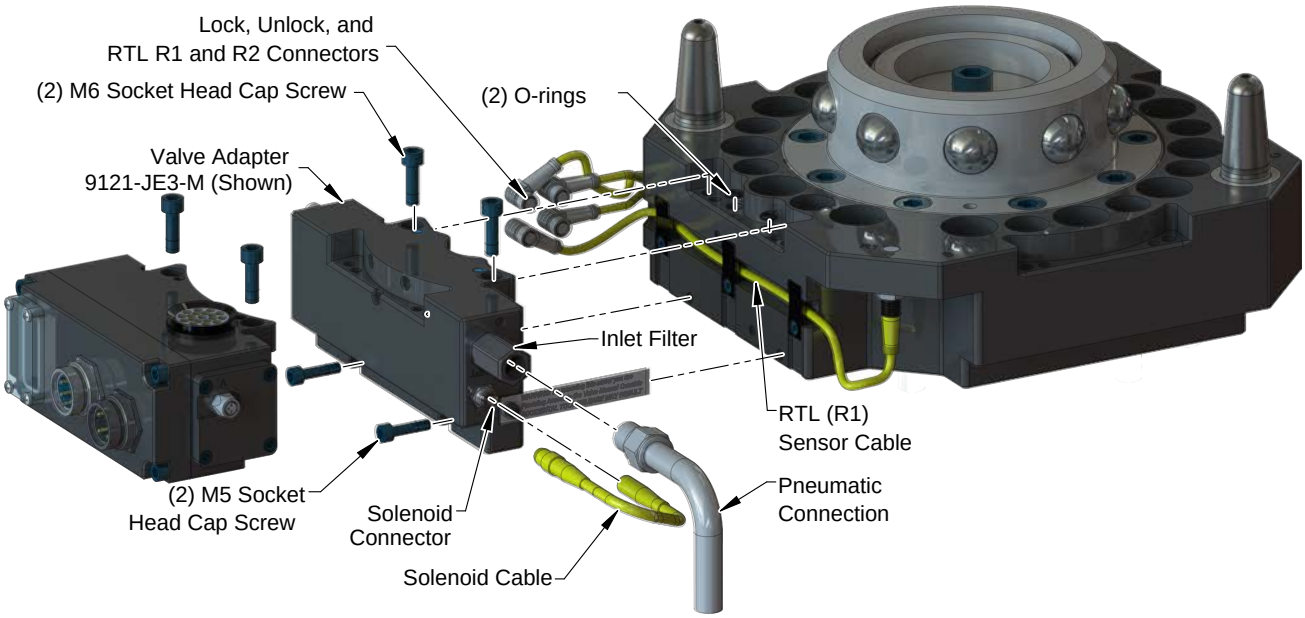
Supplies required: *clean rag, Loctite® 222, Loctite® 242, and Loctite® 569*

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. (2) O-rings are required on the Master side Flat 'A' interface. Make sure these O-rings are present and lightly lubricated (refer to *Figure 2.3*).

NOTICE: Makes sure the RTL (R1) sensor cable is in the cable channel in the Tool Changer body, so it will not get pinched when installing the valve adapter.

6. Place the valve adapter on the Tool Changer or Utility Coupler.
7. Apply Loctite® 242 to the supplied M6 socket head cap screws. Use a 5 mm hex key, to install the (2) M6 socket head cap screws and tighten to 70 in-lbs (7.9 Nm).
8. Apply Loctite® 222 to the (2) supplied M5 socket head cap screws. Use a 4 mm hex key, to install the (2) M5 socket head cap screws and tighten to 55 in-lbs (6.2 Nm).
9. Make pneumatic connections to the inlet filter as required. Ensure that the connectors are cleaned prior to being secured as appropriate. ATI recommends using a thread sealant such as Loctite® 569 or similar.
10. Connect the solenoid cable to the connector on the valve adapter.

Figure 2.3—Valve Adapter Installation (QC-310 Shown)



2.4 Valve Adapter Removal for QC-310, QC-313, QC-510, QC-1210

NOTICE: Depending on maintenance or repair being performed, utilities to modules and Master plate may need to be disconnected.

Tools required: *5 mm hex key, 4 mm hex key*

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. Remove the control/signal module off the valve adapter (refer to the control /signal module manual for instructions).
5. Use a 4 mm hex key to remove the (2) M5 socket head cap screws, and use a 5 mm hex key to remove the (2) M6 socket head cap screws. Lift the valve adapter module off the Tool Changer or Utility Coupler (refer to *Figure 2.3*).
6. Make sure that the O-rings are retained at the Master side Flat 'A' mounting interface.

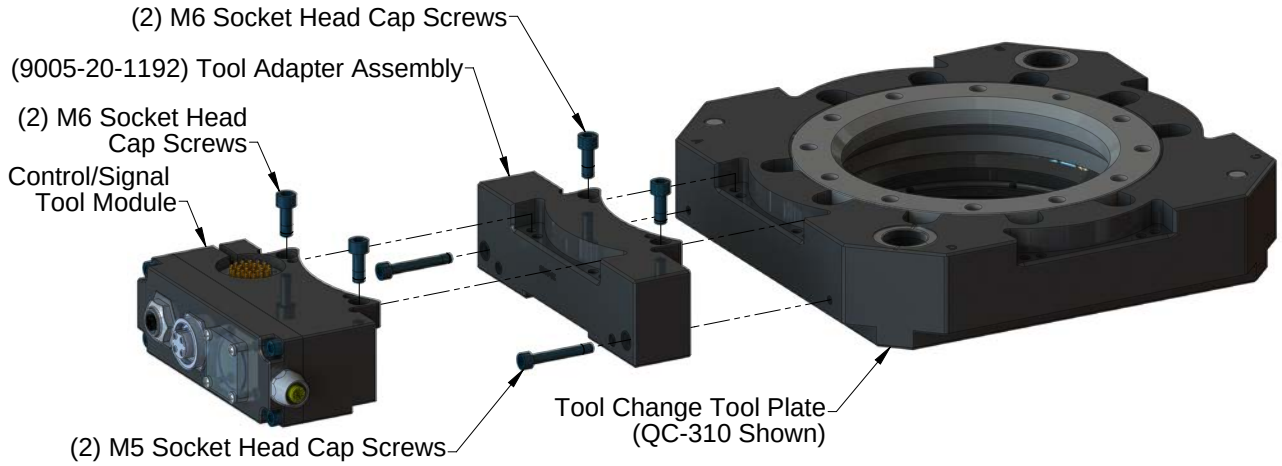
2.5 Tool Adapter Assembly Installation

Tools required: *5 mm hex key, 4 mm hex key, torque wrench*

Supplies required: *clean rag, Loctite® 222™ and 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 Tool adapter assembly on the Tool Changer or Utility Coupler.
6. Apply Loctite® 242 to the supplied M6 socket head cap screws. Use a 5 mm hex key to install the (2) M6 socket head cap screws and tighten to 89 in-lbs (10.0 Nm).
7. Apply Loctite® 222 to the (2) supplied M5 socket head cap screws. Use a 4 mm hex key to install the (2) M5 socket head cap screws and tighten to 52 in-lbs (5.9 Nm).

Figure 2.4—Tool Adapter Assembly Installation



2.6 Tool Adapter Assembly Removal

NOTICE: Depending on maintenance or repair being performed, utilities to modules may need to be disconnected.

Tools required: *5 mm hex key and 4 mm hex key*

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. Remove the control/signal module off the valve adapter (refer to the control /signal module manual for instructions).
5. Use a 4 mm hex key to remove the (2) M5 socket head cap screws, and use a 5 mm hex key to remove a (2) M6 socket head cap screws. Lift the tool adapter assembly off the Tool Changer or Utility Coupler (refer to *Figure 2.4*).

2.7 Pneumatic Connections

The air supply used for coupling and uncoupling the Tool Changer or Utility Coupler should be clean, dry, and non-lubricated. A supply pressure in the range of 60 to 100 psi (4.1–6.9 bar) is acceptable for operation of the locking mechanism; a setting of 80 psi is suggested. The air should be filtered 40 micron or better. A single air supply for lock and unlock air is required to operate the valve adapter, refer to *Figure 2.1* or *Figure 2.2* for connection.

CAUTION: Do not use the Tool Changer in a fail-safe condition. Do not transport the Tool Changer in a fail-safe condition. Possible damage to the locking mechanism could occur. Re-establish air pressure to the Tool Changer before returning to normal operations.

2.8 Electrical Connections

A cable from the control/signal module to the valve adapter supplies an electrical connection that controls the valve as described in *Section 1—Product Overview* and detailed in *Section 8—Drawings*. The control of the single-solenoid valve is integrated with an ATI-supplied control/signal module that is installed onto the valve adapter.

3. Operation

The unlatch command is sent from the control/signal module and passed-through the solenoid cable to control the solenoid valve. The single solenoid is spring loaded to the locked position; the unlatch command activates the solenoid to provide unlock air to the Tool Changer. When the unlatch command is made false (low), the solenoid returns to its lock position to provide lock air to the Tool Changer.

A customer can specify a safety functionality on the control/signal module that prevents the accidental unlock of the Tool Changer unless the Tool is nested in the tool stand. Depending on the functionality of the control/signal module, the ability to unlock the Tool Changer, unless the Tool is coupled and in the tool stand, may be denied. When the latter is the case, the manual override feature is available on the valve adapter, refer to *Section 5.1.1—Solenoid Valve Manual Override Procedure*. Use of the manual override should be restricted to contingency situations and only when the robot and tool are in the stand or storage location. Actuation of the unlatch valve manual override results in uncoupling the Tool Changer.

WARNING: Tool Changer release will occur with actuation of the Unlatch valve manual override. Use of the manual override is restricted to contingency situations. The Tool Changer and Tool should be in a stand or storage location prior to actuation of the manual override.

It is important that the valve adapter be supplied with clean, dry, non-lubricated air supplied between 60 and 100 psi (4.5–6.9 Bar) and filtered at 40 microns or better (refer to *Section 2.7—Pneumatic Connections*). Valve adapters are typically supplied with the Tool Changer or Utility Coupler to provide a fully integrated solution. The customer is required to supply the valve adapter with a single air supply.

4. Maintenance

Valve adapters require little maintenance. The only wear components are the valve itself and an exhaust muffler. Under normal operating conditions, the valve lasts for millions of cycles. Verify the exhaust muffler is unclogged every six months of operation or more frequently in dirty environments.

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.

To check if the exhaust muffler is clogged, remove the muffler and blow through the muffler. If it is difficult to blow through the muffler, replace (refer to *Section 5.2.1—Exhaust Muffler Replacement*).

5. Troubleshooting and Service Procedures

Troubleshooting information and service instructions are in the following sections. Troubleshooting information helps diagnose conditions, and service procedures help resolve some of these conditions are in the following sections.

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.

5.1 Troubleshooting

When attempting to troubleshoot the valve adapter, follow the actions listed in *Table 5.1*. If an issue persists, contact an ATI representative.

Table 5.1—Troubleshooting

Symptom	Cause	Resolution
Tool Changer or Utility Coupler does not lock / unlock or operates slowly.	Exhaust muffler is clogged.	Check/replace exhaust muffler; ensure clean air supply.
	No or not enough air pressure on the pneumatic connection.	Make sure Pneumatic connection has minimum pressure, refer to *Section 2.7—Pneumatic Connections.*
	Loose valve adapter or O-rings leaking or missing.	Verify that the fasteners connecting the control/signal module to the valve adapter are properly tightened. If air still leaking, remove the valve adapter from the Tool Changer or Utility Coupler and check for air leaks, damaged or missing O-rings. Refer to *Section 2.2—Valve Adapter Removal for QC-113, QC-210, QC-213, GL6L, GL7L0* or *Section 2.4—Valve Adapter Removal for QC-310, QC-313, QC-510, QC-1210.*
	Inlet filter clogged/damaged	Check/replace inlet filter. Refer to *Section 5.2.2—Filter Replacement*
	Solenoid cable is damaged	Check the solenoid cable for damage and continuity, if damaged replace.
	No power is supplied to the solenoid valve.	Verify valve power supply at control/signal module is present. if power is present, replace valve adapter.
Tool Changer will lock but not unlock	Control/Signal module safety features not met.	The tool stand Interlock, or other safety feature is preventing the Tool Changer from unlocking, refer to the control/signal module manual for more information. Control/signal module may not have bypass circuit and will have to be unlocked manually, refer to *Section 5.1.1—Solenoid Valve Manual Override Procedure.*

5.1.1 Solenoid Valve Manual Override Procedure

The manual override procedure should be used when the Tool Changer is locked without the Tool plate attached. The control module safety circuit does not allow the Tool Changer to be unlatched without the Tool plate attached and the tool in the tool stand.

WARNING: Do not use the solenoid valve manual override if the tool is locked to the Master. Using the manual override will release the Tool and may cause bodily injury or damage to equipment. If the Tool is attached to the Master, it must be secured in the tool stand or in a location where the tool weight is supported before using the manual override.

CAUTION: The manual override is not intended for normal operations. Manual override is to be used in situations where no alternative is available to unlock the Master. Do not execute the Latch command unless the Master and the Tool are ready to be coupled.

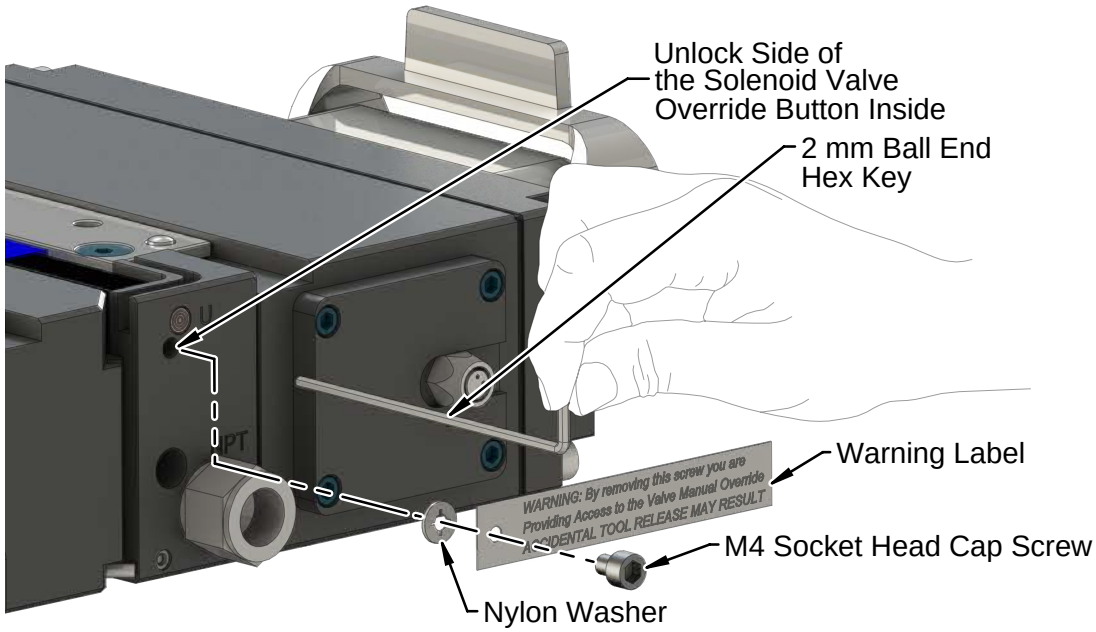
Tools required: *3 mm hex key, 2 mm ball end hex key*

1. Using a 3 mm hex key, remove the M4 socket head cap screws, warning label, and nylon washer from the Unlock side of the solenoid valve. The Unlock side is marked with a “U”.

CAUTION: Applying excess force can damage the solenoid or cause the override button to stick in one position. Actuation of valve override buttons requires about 1 mm of travel and minimal of force. Use a non-sharp object, similar to ball nose 2 mm hex key, to gently depress the override button; an air release should be heard when the solenoid is activated.

2. Insert a 2 mm ball end hex key in the unlock valve screw hole and gently depress the valve override button. An air release should be heard when the solenoid is actuated. Make sure the locking mechanism is fully retracted.
3. Using a 3 mm hex key, replace the M4 socket head cap screws, warning label, and nylon washer and tighten the screw.

Figure 5.1—Manual Override



5.2 Service Procedures

The following service procedures provide instructions for inspection, adjustment, test or replacement of components.

5.2.1 Exhaust Muffler Replacement

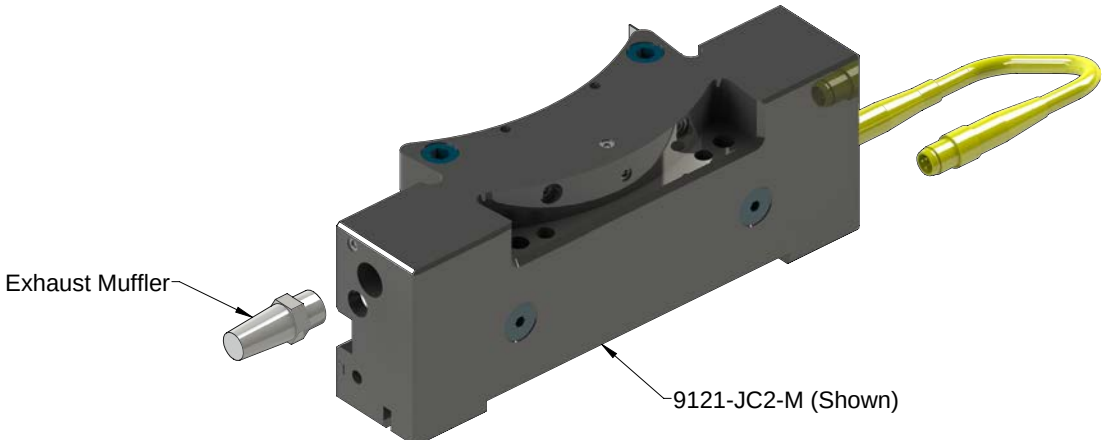
The exhaust muffler allows air from the Tool Changer or Utility Coupler locking mechanism to be vented to the atmosphere. If the muffler is clogged it may affect the ability to lock and unlock the Tool Changer. Remove and check to make sure the exhaust muffler is not clogged.

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

Tools required: *11 mm hex wrench*

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. Remove the exhaust muffler.
5. Determine if the muffler should be replaced, by blowing through the muffler:
   - If blowing through the exhaust muffler is difficult, discard the muffler and replace.
   - Otherwise, the muffler can be reused.
6. Use the wrench to thread the new exhaust muffler into the valve adapter housing. Tighten to contact plus one turn.
7. After the repair is complete, safely resume normal operation.

Figure 5.2— Exhaust Muffler Replacement



5.2.2 Filter Replacement

The inlet filter prevents particulates from entering the air supply to the Tool Changer or Utility Coupler locking mechanism. If the filter is clogged it may affect the ability to lock and unlock the Tool Changer. Check/replace the filter if there is a considerable reduction in unlocking speed.

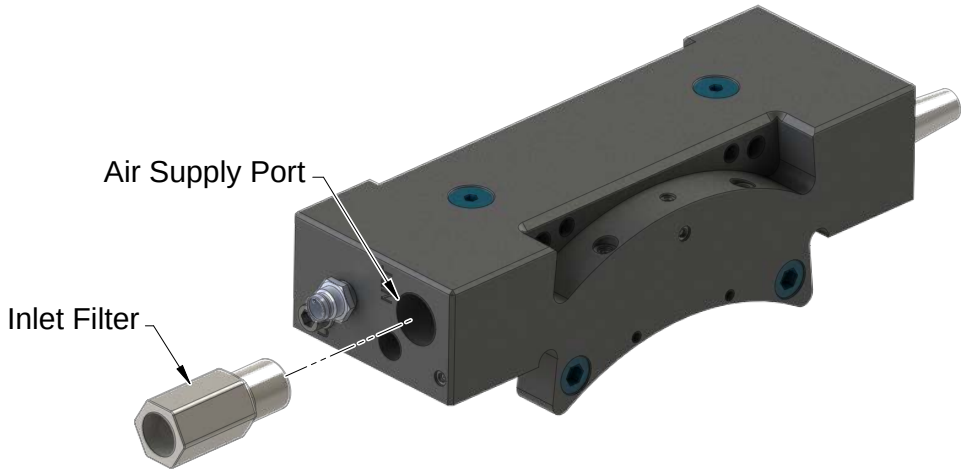
Parts required: *Refer to Drawings.*

Supplies required: *Loctite® 569 or similar*

Tools required: *5/8 mm hex wrench*

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. Disconnect the air supply to the filter.
5. Use a 5/8 hex wrench to remove the filter.
6. Replace clogged filter with new part:
   a. Apply Loctite 569 to air supply port.
   b. Use the wrench to thread the new filter into the valve adapter housing.
   c. Tighten filter to 15 ft-lb.
7. Reconnect air supply to filter and tighten air supply line fitting. Torque should not exceed 15 ft-lb.
8. After the repair is complete, safely resume normal operation.

Figure 5.3— Filter Replacement



6. Serviceable Parts

6.1 Single Solenoid Valve Adapters

Refer to *Section 8—Drawings* for serviceable part for single solenoid valve adapters.

6.2 Tool Adapter Assembly

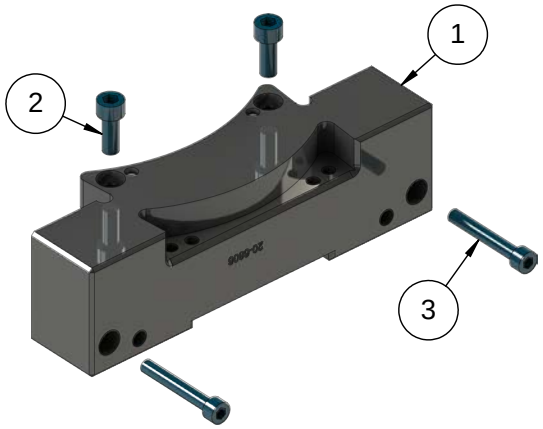


Table 6.1—Tool Adapter Assembly

Item Number	Qty.	Part Number	Description
1	1	9005-20-1192	Tool Adapter Assembly
	1	9005-20-1403	Tool Adapter Assembly, Supporting Air Blow Off
2	2	3500-1066016-15A	M6 x 16mm SHCS MB ND Microspheres
3	2	3500-1064035-15A	M5 x 35mm SHCS MB, ND Microspheres

7. Specifications

Table 7.1—Valve Adapter Specifications					
Models	**9121-JC2-M**	**9121-JC3-M**	**9121-JD3-M**	**9121-JN2-M**	**9121-JN3-M**
Weight	1.31 lbs (0.594 kg)	1.35 lbs (0.612 kg)	1.39 lbs (0.63 kg)	1.33 lbs (0.603 kg)	1.37 lbs (0.62 kg)
Pneumatic Connection	1/4” NPT		G 1/4” (BSPP)	1/4” NPT	
Interface Connections	Solenoid Valve Connector: M8 3-pin male with 0.16 m extension cable supporting latch and unlatch signals				
Electrical Rating	19-29 VDC operational voltage (Solenoid Valve)				
Current Draw	Switched Power: 250 mA @ 24 VDC (Solenoid Valve) (only when locking or unlocking Tool Changer).				
Air Pressure	60 - 100 psi (4.5 – 6.9 bar) clean, dry, non-lubricated air				
Air Filtration	40 microns				
Environmental Resistance	Dust and water resistant but not water proof or IP67 compliant				
Single Solenoid Valve	MAC Series 48, DC Voltage, 6 W Coil, 250 mA @ 19-29 VDC				
Operational Temperature Range	0 °F - 120 °F (-17.8 °C - 49 °C)				
Cv	1.1				

Table 7.2—Tool Adapter Assembly Specifications		
Models	**9005-20-1192**	**9005-20-1403**
Weight	1.33 lbs (0.603 kg)	1.32 lbs (0.60 kg)

8. Drawings

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