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B. Base Tool Changer

MC-50—Manual Tool Changer

1. Product Overview

The MC-50 Tool Changer is for collaborative robot applications with a maximum payload of 25 kg or small industrial robots with a maximum 10 kg payload. The Tool Changer has a Master Plate Assembly, which attaches to the robot, and a Tool Plate Assembly, which the user manually couples with the Master plate. Customers can attach different end-effectors, such as grippers or vacuum cup tooling, to the Tool plate. For added utilities, customers can install an ATI module on the Tool Changer, use the Tool Changer's integrated M5 pass-through air ports, or both.

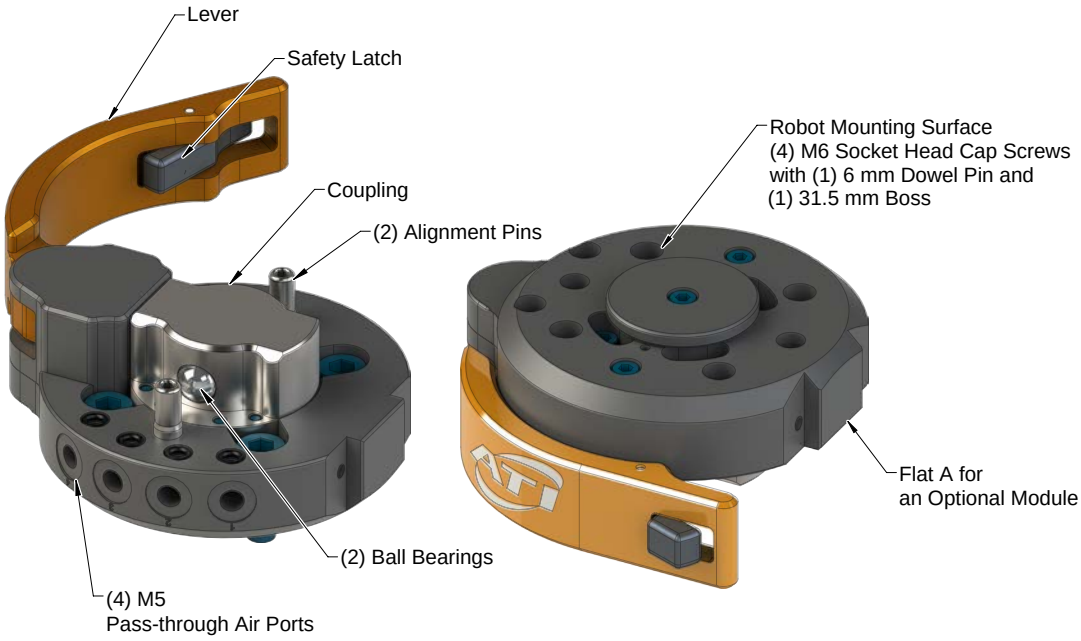
For technical specifications, refer to *Section 7—Specifications* and *Section 8—Drawings*. More information about the MC-50's locking mechanism is in *Section 3—Operation*.

1.1 Master Plate Assembly

The Master Plate Assembly is an anodized aluminum body with a hardened-steel locking mechanism and alignment pins. For optimal performance, directly mount the Master plate to a robot arm that has an ISO 9409-1-50-4-M6 mounting pattern: refer to *Section 2.1—Master Interface*. (4) M5 pass-through air ports are along one side of the Master plate. ATI provides optional fittings: *Section 6.3—Accessories*. Along the other side of the Master plate, is a lever for actuating the locking mechanism. Flat A of the Master plate is for mounting an optional ATI module.

The locking mechanism's main components include: a male coupling, a spring plunger, cam, and ball bearings. As the user closes the lever, the spring plunger moves a tapered cam that pushes the ball bearings against the Tool's bearing race. When the customer closes the lever, a spring-loaded safety latch clasps to a notch in the Tool side and securely locks the lever. For more information about how to couple and uncouple the MC-50, refer to *Section 3—Operation*.

Figure 1.1—Master Plate Assembly



1.2 Tool Plate Assembly

The Tool Plate Assembly is an anodized aluminium body with a bearing race and holes for the Master's alignment pins. A notch, which is for the safety latch on the Master Plate's lever, is in the side of the Tool plate. (4) M5 pass-through air ports are on the other side of the Tool plate. ATI provides optional fittings: *Section 6.3—Accessories*. Flat A is for mounting an optional ATI module.

Customers can attach their tooling with either the bolt-up or bolt-down mounting pattern in the Tool plate: refer to *Section 2.4—Tool Interface* and *Section 8—Drawings*.

Figure 1.2—Tool Plate Assembly

1.3 Optional Modules

On Flat A of the Master and Tool plates, customers can install an optional ATI Master and Tool module for added pass-through utilities such as signal and power. For help selecting modules, visit ATI's *website* or contact an ATI representative.

Each surface on Flat A has (2) M3X0.5 threaded holes. Some modules may need an adapter plate to be installed on Flat A. Each ATI module has a customer drawing that provides additional installation and operation information.

A general procedure for installing optional modules is in *Section 2.9—Optional Module Installation*. Because the *ML8* electrical modules are recommended most often, a specific procedure is in *Section 2.9.1—ML8 Modules Installation*.

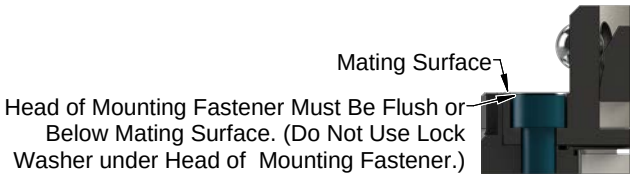
This manual also includes maintenance and service procedures that are common but not applicable for all ATI modules: *Section 4.3—Pin Block Inspection and Cleaning* and *Section 5.2.2—Replace O-ring Seals*.

2. Installation

All fasteners, which are used to mount the Tool Changer to the robot and to customer's tooling, should be installed with the recommended thread locker and torque values listed in *Table 2.1*. The guidelines in this table are based on engineering standards.

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.

WARNING: Do not use lock washers under the head of the mounting fasteners or allow the mounting fasteners to protrude above the mating surfaces of the Master and Tool plates. Allowing fasteners to protrude above the mating surface will create a gap between the Master and Tool plates and not allow the locking mechanism to fully engage, this can cause damage to equipment or personal injury. The mounting fasteners must be flush or below the mating surfaces of the Master and Tool plates.



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.

Table 2.1—Fastener Size, Class, and Torque Specifications

Mounting Conditions	Fastener Size & Property Class	Hex Key Size	Recommended Torque	Thread Locker
Master Plate Assembly to an interface plate (6061-T6 aluminum) Minimum thread engagement of 9 mm (0.35") [1.5x fastener ∅]	M6–1.0 Class 10.9 Socket head cap	5 mm	130 in-lbs (15 N-m)	Pre-applied adhesive or Loctite® 242
Master plate to a robot flange (steel: USS ≥ 90 KSI) Minimum thread engagement of 6 mm (0.24") [1.0x fastener ∅] (Confirm thread engagement with robot's manufacturer.)				
Bolt-down customer tooling (6061-T6 aluminum) to the Tool Plate Assembly	M5–0.8 Class 10.9 Socket head cap	4 mm	78 in-lbs (9 N-m)	
Bolt-up customer tooling (6061-T6 aluminum or steel: USS ≥ 90 KSI) to the Tool Plate Assembly	M6–1.0 Class 10.9 Socket head cap	5 mm	130 in-lbs (15 N-m)	
	(or) M6–1.0 Class 10.9 Flat head socket cap	4 mm	78 in-lbs (9 N-m)	
Optional module to the Master or Tool Plate Assembly	M3 x 0.5 Class 10.9 Socket head cap	2.5 mm	12 in-lbs (1.35 Nm)	Pre-applied adhesive or Loctite® 222
	(or) M3 x 0.5 Class 10.9 Flat head socket cap	2 mm	6 in-lbs (0.67 Nm)	

2.1 Master Interface

The Master Plate Assembly should be directly mounted to a robot arm that has an ISO 9409-1-50-4-M6 mounting pattern: (4) M6 bolts and (1) 6 mm dowel pin along a 50 mm bolt circle and a 31.5 mm diameter recess.

NOTICE: The Master's interface has (2) dowel pin holes so that customers can choose to rotate the mounting pattern 180°.

If the robot does not have this standard mounting pattern, then a customer can use an interface plate to install the Master Plate Assembly. For the mounting pattern on the Master Plate Assembly, refer to *Section 8—Drawings*.

If the customer chooses to design and build an interface plate, the following points should be considered:

- The interface plate should be designed to include bolt holes for mounting, (1) dowel pin hole and a boss for accurate positioning on the robot and Master plate.
- The thickness of the interface plate must be great enough to provide the necessary thread engagement for the mounting bolts.
- The interface plate must provide a rigid surface for a Master plate's boss.
- The plate design should allow space and clearance for Tool Changer's module attachments and accessories.

2.2 Installation of the Master Plate Assembly

Parts required: *Refer to Section 6—Serviceable Parts*

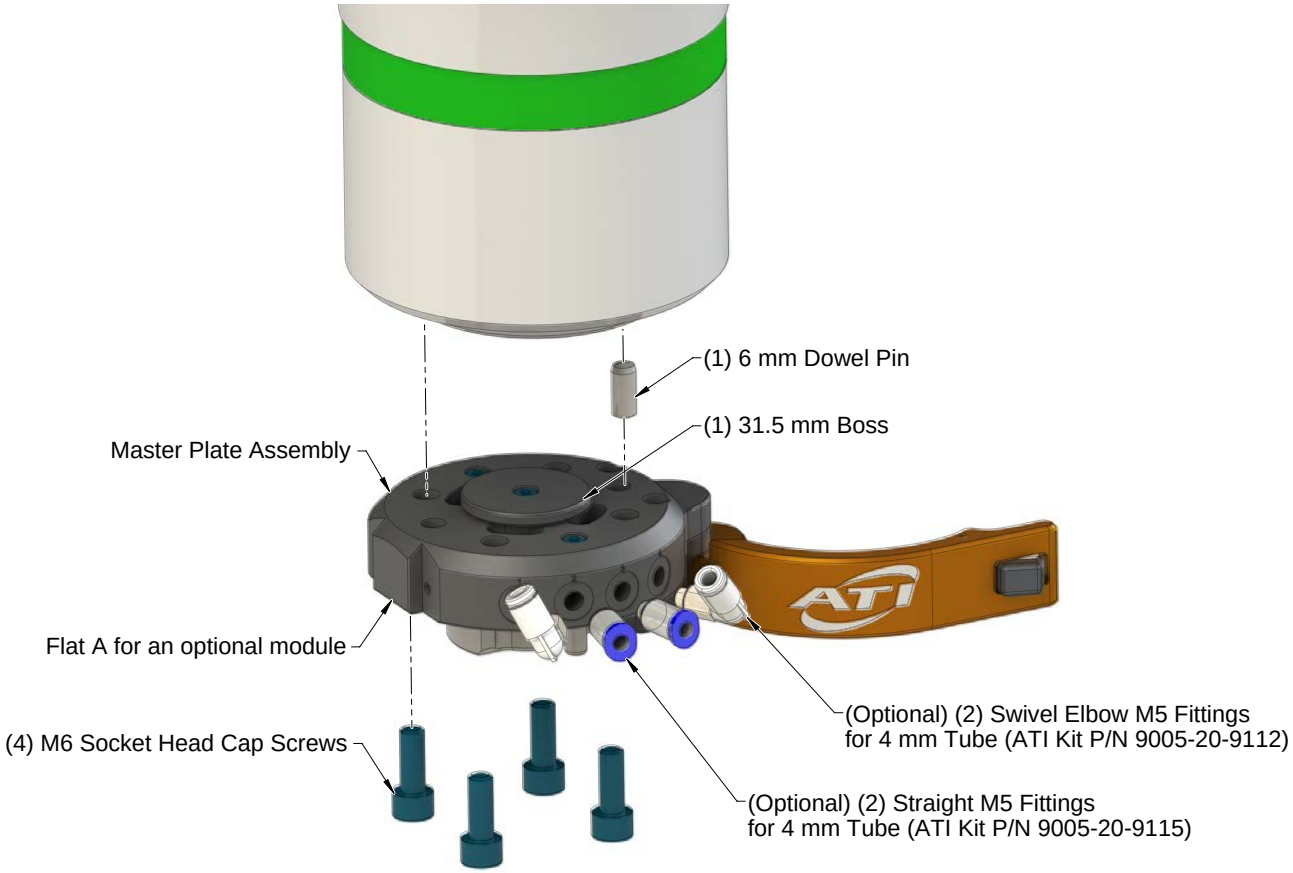
Tools required: *5 mm hex key, torque wrench*

Supplies required: *Clean cloth, Loctite® 242*

Refer to *Figure 2.1*

1. Wipe down the mounting surfaces with a clean cloth.
2. Insert a 6 mm dowel pin in the robot.
3. Apply Loctite 242 to the threads of the (4) M6 socket head cap screws.
4. Secure the Master plate on the robot with the (4) M6 socket head cap screws, which ATI provides.
5. Use a 5 mm hex key to tighten the (4) M6 socket head cap screws to the torque value per *Table 2.1*.
6. (Optional) Install air fittings and tubes into the (4) M5 air ports.
7. Safely resume normal operation.

Figure 2.1—Master Plate Assembly Installation



2.3 Removal of the Master Plate Assembly

WARNING: Always support the Master Plate Assembly as it's being removed. Otherwise, injury or damage to the equipment might occur.

Tools required: *5 mm hex key*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. (Optional) Disconnect air tubes from the M5 air fittings.
4. Using a 5 mm hex key, remove the (4) M6 socket head cap screws.
5. Remove the Master plate from the robot.

2.4 Tool Interface

The Tool Plate Assembly can either be installed to the customer's tooling or an interface plate with a bolt-down or bolt-up mounting pattern. For bolt-down, the Tool Plate Assembly attaches to the customer's tooling or interface plate with (4) M5 socket head cap screws. For bolt-up, the customer's tooling or interface plate attaches to the Tool Plate Assembly with (4) M6 socket head cap screws. In both cases, the Tool Plate Assembly aligns to the customer's tooling or interface plate with (1) dowel pin and a 31.5 mm recess.

NOTICE: The Tool's interface has (2) dowel pin holes so that customers can choose to rotate the mounting pattern 180°.

For more information about the Tool Plate Assembly's mounting pattern, refer to *Section 8—Drawings*.

When a customer chooses to design and build an interface plate, the following points should be considered:

- The interface plate should be designed to include bolt holes for mounting, (1) dowel pin hole and a 31.5 mm boss for accurate positioning on the Tool plate.
- The thickness of the interface plate must be great enough to provide the necessary thread engagement for the mounting bolts.
- The plate design should allow space and clearance for Tool Changer's module attachments and accessories.

2.5 Bolt-down Installation of a Tool Plate Assembly

Parts required: *(4) M5 socket head cap screws, (1) 6 mm dowel pin, optional air fittings (refer to Section 6.3—Accessories)*

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

Supplies required: *Clean cloth, Loctite® 242*

Refer to *Figure 2.2*.

1. Wipe down the mounting surfaces with a clean cloth.
2. Apply Loctite 242 to threads of the (4) customer-supplied M5 socket head cap screws.
3. Align the Tool Plate Assembly to the customer's tooling or interface plate with (1) customer-supplied 6 mm dowel pin and boss.
4. Secure the Tool Plate Assembly on the customer's tooling with the (4) M5 socket head cap screws. Tighten the screws to the torque value that is listed in *Table 2.1*.
5. (Optional) Install air fittings and tubes into the (4) M5 air ports.
6. Safely resume normal operation.

Figure 2.2—Tool Plate Assembly Bolt-down Installation

2.6 Bolt-down Removal for the Tool Plate Assembly

WARNING: Always support the Tool Plate Assembly as it's being removed. Otherwise, injury or damage to the equipment might occur.

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

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. (Optional) Disconnect air tubes from the M5 air fittings.
4. Remove the (4) M5 socket head cap screws that secure the Tool Plate Assembly on the customer's tooling.

2.7 Bolt-up Installation of a Tool Plate Assembly

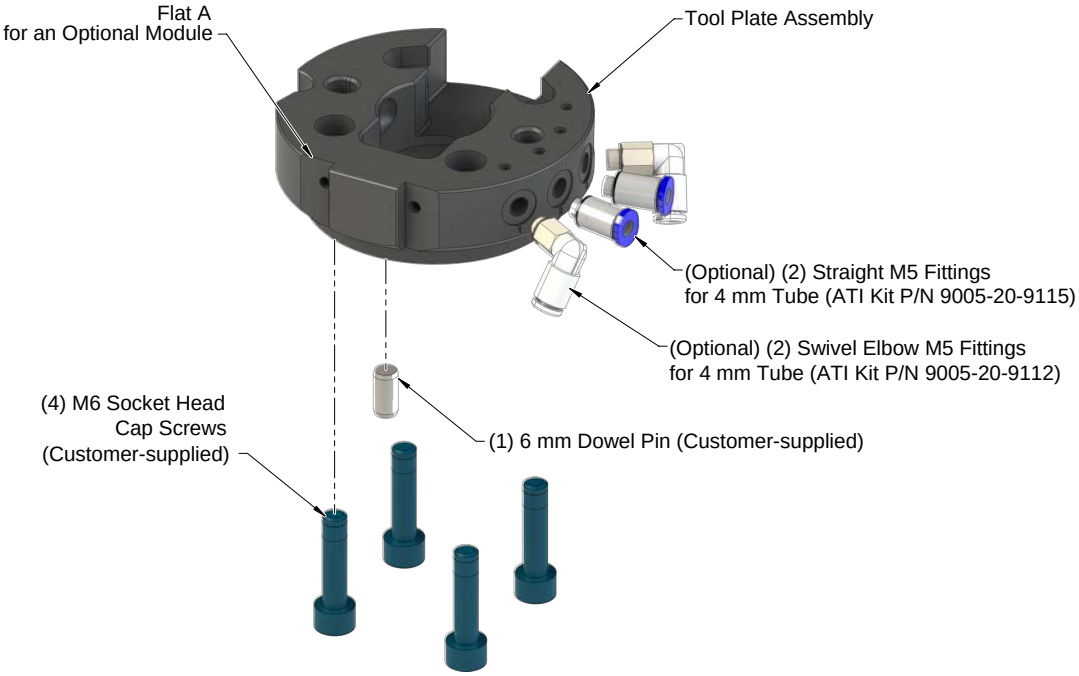
Parts required: *(4) M6 screws, (1) 6 mm dowel pin, optional air fittings (refer to Section 6.3—Accessories)*

Tools required: *Refer to Table 2.1, torque wrench*

Supplies required: *Clean cloth, Loctite® 242*

1. Wipe down the mounting surfaces with a clean cloth.
2. Align the Tool Plate Assembly to the customer's tooling or interface plate with (1) customer-supplied 6 mm dowel pin and a boss.
3. Apply Loctite 242 to threads of the (4) customer-supplied M6 screws.
4. Secure the customer's tooling on the Tool Plate Assembly with the (4) M6 screws. Tighten to the torque value per *Table 2.1*.
5. (Optional) Install air fittings and tubes into the (4) M5 air ports.
6. Safely resume normal operation.

Figure 2.3—Tool Plate Assembly Bolt-up Installation



2.8 Bolt-up Removal for the Tool Plate Assembly

WARNING: Always support the Tool Plate Assembly as it's being removed. Otherwise, injury or damage to the equipment might occur.

Tools required: *Refer to Table 2.1*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. (Optional) Disconnect air tubes to the M5 air fittings.
4. Remove the (4) M6 socket head cap screws that secure the customer's tooling on the Tool Plate Assembly.

2.9 Optional Module Installation

Typically ATI installs optional modules on Tool Changers before the product is shipped to the customer. The following procedure outlines field installation or removal as required. The MC-50 is compatible with many different types of modules.

2.9.1 ML8 Modules Installation

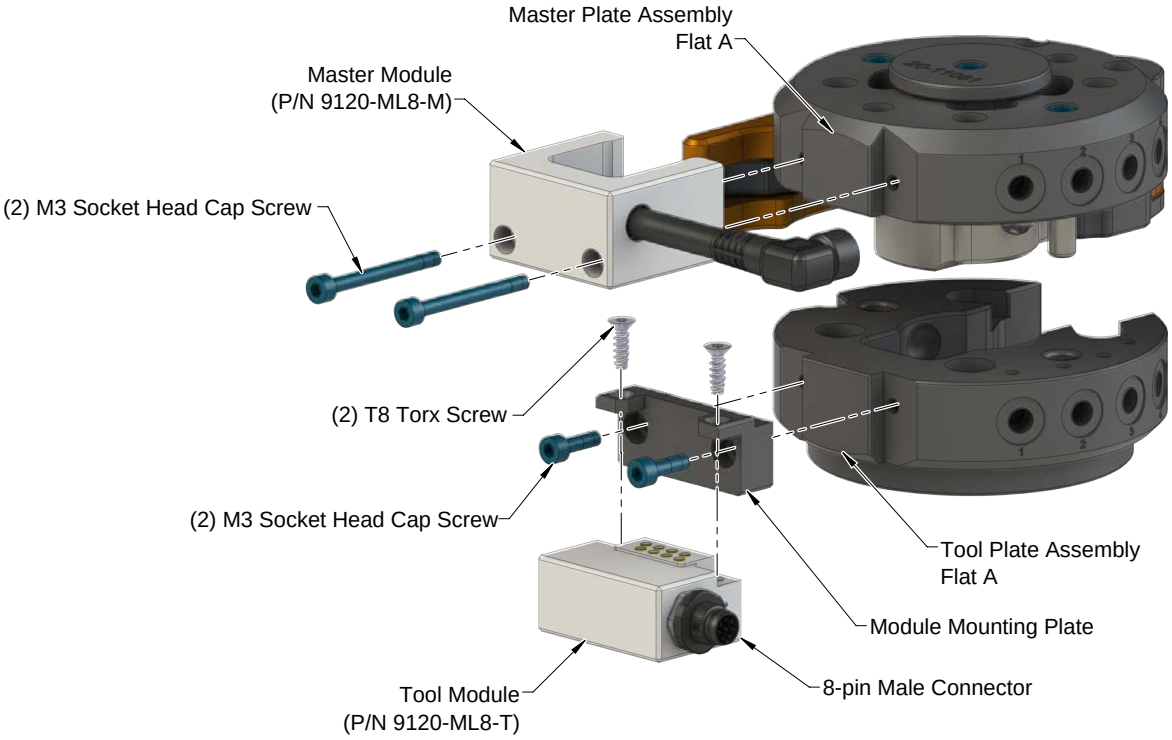
Tools required: *2.5 mm hex key, torque wrench, ATI-supplied L-key Torx wrench*

Supplies required: *Clean cloth, Loctite® 222*

Refer to *Figure 2.4*.

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Wipe down the mounting surfaces with a clean cloth.
4. Install the Master module:
   a. Apply Loctite 222 to the threads of the (2) M3 socket head cap screws.
   b. Secure the Master module on Flat A of the Master plate with (2) M3 socket head cap screws.
   c. Using a 2.5 mm hex key, tighten the (2) M3 socket head cap screws to the torque value in *Table 2.1*.
5. Remove the adapter plate from the Tool module:
   a. Using the ATI-supplied L-key Torx wrench, remove the (2) T8 torx screws.
   b. Remove the adapter plate from the Tool module.
6. Install the Tool's adapter plate:
   a. Apply Loctite 222 to the threads of the (2) M3 socket head cap screws.
   b. Secure the adapter plate to Flat A of the Tool module with the (2) M3 socket head cap screws.
   c. Using a 2.5 mm hex key, tighten the (2) M3 socket head cap screws to the torque value in *Table 2.1*.
7. Install the Tool module:
   a. Secure the Tool module to the adapter plate with (2) T8 torx screws.
   b. Using the ATI-supplied L-key Torx wrench, tighten the (2) T8 screws to 6 in-lbs (0.68 Nm).
8. Remove all packaged material such as protective caps, plugs, and tape from the modules prior to operation.
9. Connect the 8-pin connectors on the modules to the customer's application: refer to the *9630-20-ML8* drawing.
10. Safely resume normal operation.

Figure 2.4—ML8 Modules Installation



2.9.2 ML8 Modules Removal

Tools required: *2.5 mm hex key, L-key Torx wrench*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Disconnect any cables and air lines, if required.
4. Using a 2.5 mm hex key, remove the (2) M3 socket head cap screws that secure the Master module on the Master plate. Remove the module.
5. Using the ATI-supplied L-key Torx wrench, remove the (2) T8 torx screws that secure the Tool module on the adapter plate. Remove the module.
6. Using a 2.5 mm hex key, remove the (2) M3 socket head cap screws that secure the adapter plate on the Tool plate. Remove the adapter plate.

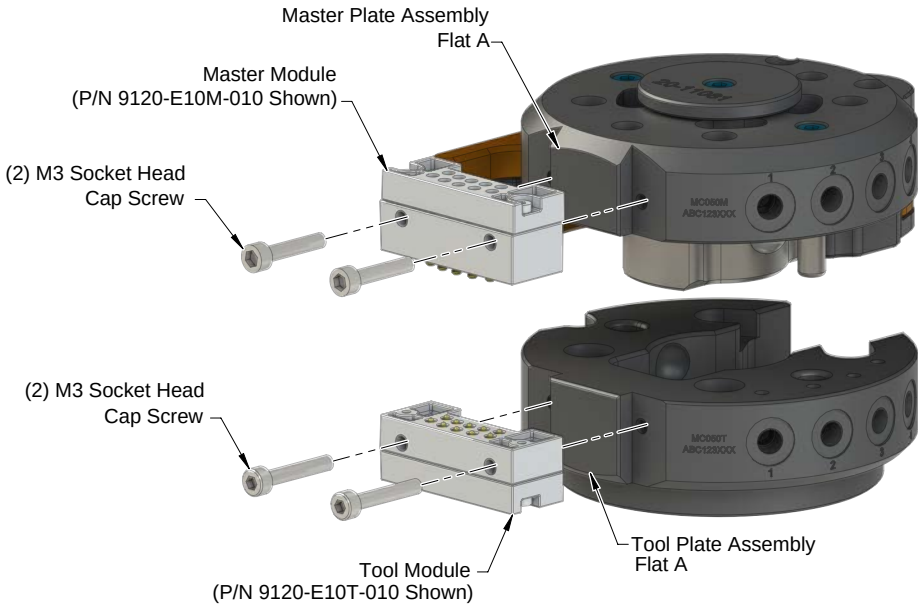
2.9.3 Standard Module Installation

Tools required: *Refer to Table 2.1, torque wrench*

Supplies required: *Clean cloth, refer to Table 2.1*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Wipe down the mounting surfaces with a clean cloth.
4. Apply threadlocker to the threads of the (4) M3 socket head cap screws: refer to *Table 2.1*.
5. Secure the Master and Tool modules to the Tool Changer with the (4) M3 socket head cap screws. Tighten to the torque value in *Table 2.1*.
6. Remove all packaged material such as protective caps, plugs, and tape from the modules prior to operation.
7. Connect any utilities such as power or air.
8. Safely resume normal operation.

Figure 2.5—Standard Module Installation



2.9.4 Standard Module Removal

Tools required: *Refer to Table 2.1*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Disconnect any cables and air lines, if required.
4. Using a 2.5 mm hex key, remove the (4) M3 socket head cap screws that secure the Master and Tool modules on the Tool Changer.
5. Remove the Master and Tool modules.

3. Operation

The MC-50's locking mechanism must be manually engaged and disengaged to couple and uncouple with the Tool Plate Assembly.

NOTICE: MC-50 Manual Tool Changers are manufactured with a National Safety Foundation (NSF) registered food-grade lubricant, which is rated H1 for incidental food contact and meets the United States Department of Agriculture (USDA) 1998 H1 guidelines. This multi-purpose synthetic grease is dielectric, food grade, clean, and environmentally friendly.

3.1 Coupling Sequence

CAUTION: The locking mechanism must be in the Unlock position when coupling the Tool Changer. If the Master Plate Assembly is not unlocked, damage to the unit, the robot, or both could occur. Always unlock the locking mechanism before coupling the MC-50.

1. Move the Tool Plate Assembly towards the Master Plate Assembly so that the (2) alignment holes align with the (2) alignment pins.

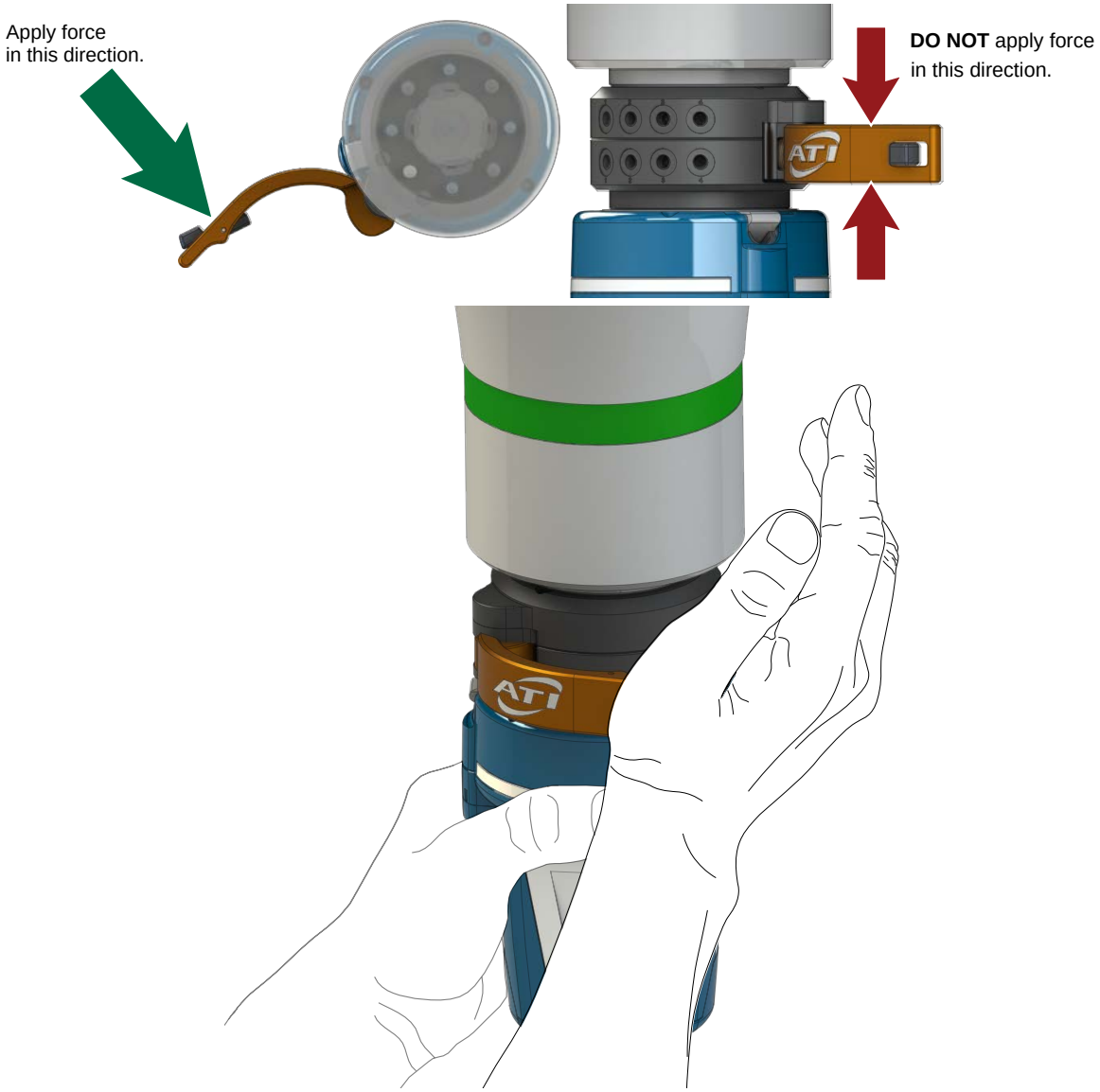
Figure 3.1—Coupling the Tool Changer

CAUTION: Make sure that any air or power lines from the air ports or optional module are not in the path of the lever or between the surfaces of the Master and Tool plate. Customers may want to use elbow air-fittings to route the lines away from the lever: refer to *Section 6.3—Accessories*. Failure to properly route utilities could prevent the locking mechanism from fully locking.

2. When the Tool completely contacts the Master's face so that there is no gap between the surfaces, hold the Tool in place.

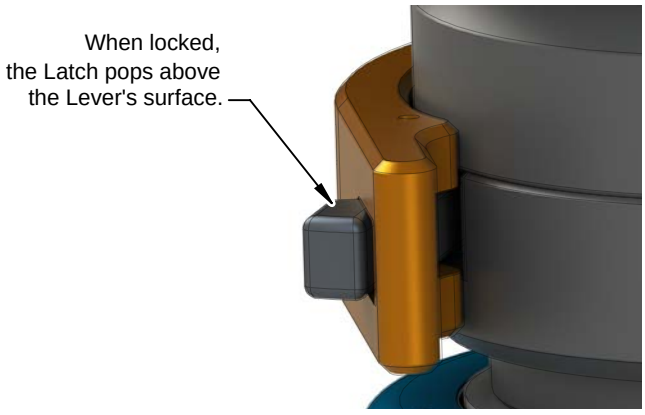
3. With an open palm, close the lever to actuate the locking mechanism.

Figure 3.2—Closing the Lever



4. Listen and feel for a click as the latch clasps onto the notch in the Tool plate.

Figure 3.3—Locked



3.2 Uncoupling Sequence

CAUTION: Before and during uncoupling of the Tool Changer, always support the Tool Plate Assembly to avoid injury or damage to the equipment.

1. With one hand, securely hold the customer tooling or Tool Plate Assembly.
2. With the other hand's thumb, fully depress the safety latch.
3. With the thumb depressing the safety latch, use the forefinger to pull behind and open the lever.
4. When the lever is completely open and in the Unlocked position, remove the Tool Plate Assembly.

Figure 3.4—Unlocking the Tool Changer

4. Maintenance

Regular preventative maintenance can extend the life and provide the best operation of the Tool Changer.

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.

NOTICE: The cleanliness of the work environment strongly influences the trouble-free operation of the Tool Changer. The dirtier the environment, the greater the need for protection against debris. Protection of the customer's tooling, the Master, the Tool and all of the modules may be necessary. Protective measures include the following: guards, deflectors, air curtains, and similar covers.

4.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule, which depends upon the application, is provided in the following table.

Table 4.1—Preventive Maintenance Check List

Application(s)	Inspection Schedule
General Usage Material Handling Docking Station	Monthly
Welding/Servo/Deburring, Foundry Operations (Dirty Environments)	Weekly

Checklist

Mounting Fasteners/Interface Connections

- ☐ Inspect the mounting fasteners for looseness, interferences, and wear. Tighten and correct as required. Refer to *Section 2—Installation*.

Ball Bearings/Alignment Pins/Bearing Race

- ☐ Inspect for wear and that there is proper lubrication. Superlube Multi-purpose Synthetic Grease with Syncolon, NSF (H1) Food Grade, NLGI 2 is suggested. Over time, lubricants can become contaminated with debris. Therefore, it is recommended to thoroughly clean the existing grease and replace with new as needed. See *Section 4.2—Cleaning and Lubrication of the Master and Tool Plate Assemblies*.
- ☐ Inspect for excessive alignment pin wear. Excessive wear may be a sign that the Master and Tool plates are not properly aligned during coupling. To replace worn alignment pins, refer to *Section 5.2.1—Alignment Pin Replacement*.
- ☐ Inspect the ball bearings for wear, which may be a sign that the payload is more than recommended in *Section 7—Specifications*.

Seals

- ☐ Inspect O-ring seals for wear, abrasion, and cuts. Refer to *Section 5.2.2—Replace O-ring Seals*.
- ☐ (As applicable) Inspect V-ring seals for wear, abrasion, and cuts. Refer to *Section 5.2.3—For Applicable, Optional Modules: V-ring Seal Inspection and Replacement*.

Electrical Contacts/Pin Block (Optional Module)

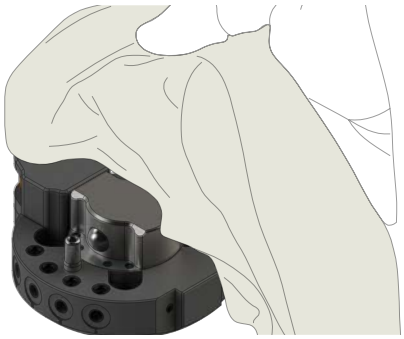
- ☐ Inspect for damage, debris, and stuck/burnt pins. Clean pin blocks as required, refer to *Section 4.3—Pin Block Inspection and Cleaning*.

4.2 Cleaning and Lubrication of the Master and Tool Plate Assemblies

Supplies required: *Clean cloth, Superlube Multi-purpose Synthetic Grease with Syncolon, NSF (H1) Food Grade, NLGI 2*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Use a clean cloth to completely remove lubricant and debris from the ball bearings, alignment pins, O-rings, male coupling, lever, and safety latch.

Figure 4.1—Cleaning Ball Bearings, Alignment Pins, O-rings, Male Coupling, and Lever

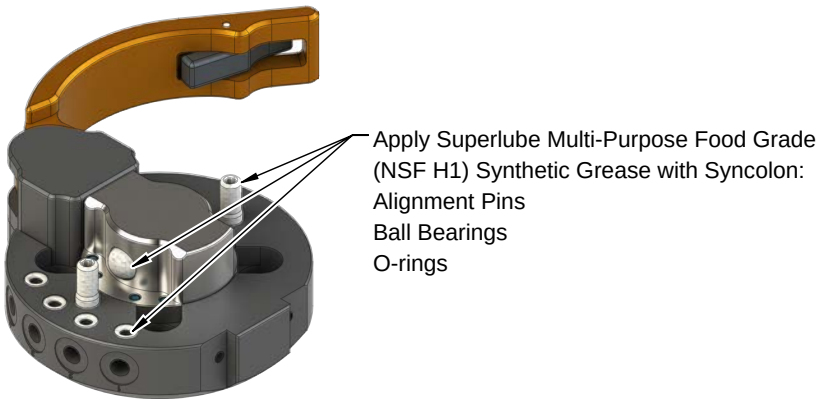


4. Check each ball bearing to make sure it moves freely. Additional cleaning may be necessary to loosen any ball bearings that are sticking in place.

Figure 4.2—Checking Ball Bearings

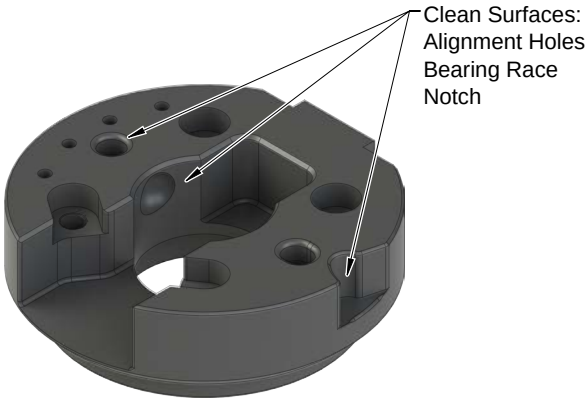
5. Apply a light coating of Superlube Multi-purpose Synthetic Grease with Syncolon, NSF (H1) Food Grade, NLGI 2 to the ball bearings, alignment pins, and O-rings.

Figure 4.3—Lubricate Ball Bearings, Alignment Pin and Cam



6. Use a clean cloth to completely remove grease and debris from the Tool plate's surfaces and alignment holes.

Figure 4.4—Cleaning Tool plate



NOTICE: No application of lubrication is necessary on the Tool plate components.

7. Safely resume normal operation.

4.3 Pin Block Inspection and Cleaning

Tools required: *Nylon Brush (ATI part number 3690-0000064-60)*

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. Inspect the Master and Tool pin blocks for debris or darkened pins.

Figure 4.5—Inspect Master and Tool Pin Blocks

5. If debris or darkened pins are present, use a vacuum to remove the debris, and clean using a nylon brush (ATI part number 3690-0000064-60).

NOTICE: Do not use an abrasive media and/or cleaners or solvents to clean the contact pins. Using abrasive media and/or cleaners or solvents will cause damage to the contact surface or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI part number 3690-0000064-60).

Figure 4.6—Clean Pin Blocks with a Nylon Brush

6. Inspect the Master and Tool pin blocks for stuck pins or pin block damage.

Figure 4.7—Stuck Pin and Pin Block Damage

7. If pins become stuck or if there is damage to the pin block, contact ATI for either a possible pin replacement procedure or module replacement.
8. Safely resume normal operation.

5. Troubleshooting and Service Procedures

The following section provides troubleshooting information to help resolve problems that might arise and service procedures for the Manual Tool Changer.

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

For help resolving problems with the MC-50, use the following table for guidance.

Table 5.1—Troubleshooting Procedures

Symptom	Cause	Resolution
Unit does not lock or unlock.	The locking mechanism's cam can not engage or disengage the ball bearings.	Clean the coupling and ball bearings. Lubricate the ball bearings as needed to restore smooth operation. Refer to *Section 4.2—Cleaning and Lubrication of the Master and Tool Plate Assemblies*.
	The lever is not smoothly or completely opening and closing.	Verify the body of the Master and Tool plates and lever are clean and without debris. If necessary clean. Check for debris around the lever, and clean if necessary.
	The safety latch does not completely close.	Clean around the lever's latch and the notch in the Tool plate.
	Prior to locking, a gap is between the coupled Master and Tool plates.	Check that the Tool plate is properly aligned with the Master. Verify the alignment pins and holes are properly clean and lubricated: refer to *Section 4.2—Cleaning and Lubrication of the Master and Tool Plate Assemblies*
		Verify there is no debris or utility lines between the Master and Tool prior to locking. If necessary, remove debris and re-route the utility lines.
		Verify the Master and Tool Plate Assemblies are correctly installed and that the heads of the mounting fasteners are not raised above the coupling surface of the plates: refer to *Section 2—Installation*.
		Verify the optional modules are properly installed and that there is no debris between the coupling surfaces. Refer to *Section 2.9—Optional Module Installation* and *Section 4.3—Pin Block Inspection and Cleaning*.

Table 5.1—Troubleshooting Procedures		
Symptom	**Cause**	**Resolution**
Air is not passing through the Tool Changer's air ports.	An air hose has cracks or damage.	Verify the tubing's material is not fractured or dented. Replace any damaged tubing.
	An air fitting is loosely connected in the air port.	Verify the proper air-fittings are used and that they are correctly installed: refer to *Section 6.3—Accessories* and *Section 2—Installation*.
	An air port's O-ring seal is worn, damaged, or missing.	Verify the O-ring seal is properly installed in the air port. Verify the seal is not fractured or otherwise damaged. If necessary, re-install or replace per *Section 5.2.2—Replace O-ring Seals*.
	Not enough air is being supplied to the application.	Check the application's specifications and air supply.
Power or signals are not passing through the optional, electrical modules.	The pin block has debris.	If applicable, verify the V-ring seal is not damaged or worn so that debris can enter the pin blocks. If damaged, replace per *Section 5.2.3—For Applicable, Optional Modules: V-ring Seal Inspection and Replacement*.
		Clean the pins per *Section 4.3—Pin Block Inspection and Cleaning*.

5.2 Service Procedures

Component replacement procedures are provided in the following sections:

5.2.1 Alignment Pin Replacement

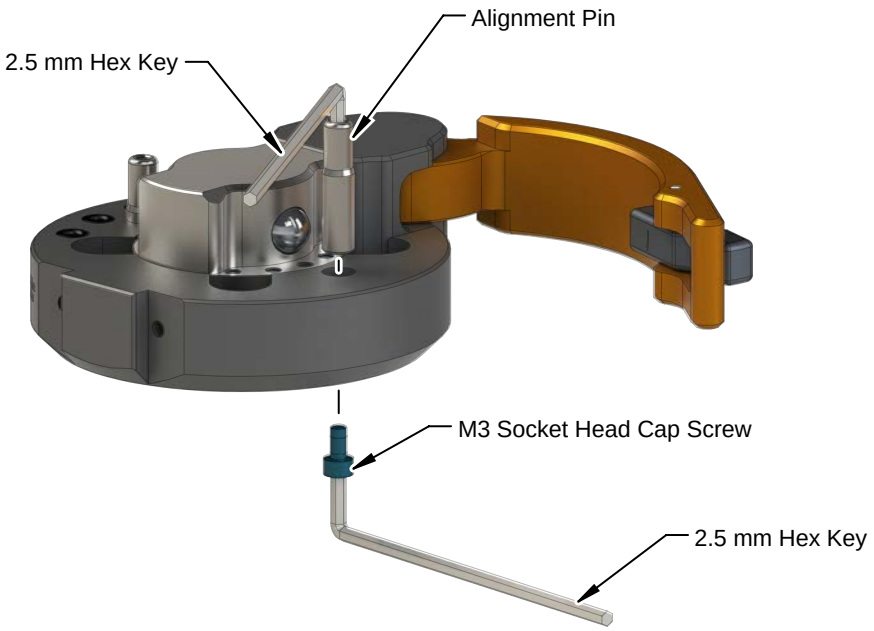
Parts required: *Refer to Section 6.1—MC-50 Master Serviceable Parts*

Tools required: *(2) 2.5 mm Hex Keys*

Supplies required: *Clean cloth, Loctite® 222, Superlube Multi-purpose Synthetic Grease with Syncolon, NSF (H1) Food Grade, NLGI 2*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Remove the Master plate from the robot: refer to *Section 2.3—Removal of the Master Plate Assembly*.
4. Insert a 2.5 mm hex key into the diamond-head of the alignment pin.
5. Using a second 2.5 mm hex key, remove the M3 socket head cap screw from the Master plate.
6. Remove the old alignment pin.
7. Use a clean cloth to remove debris and grease from the bore.

Figure 5.1—Alignment Pin Replacement



NOTICE: Make sure the diamond-head alignment pin is oriented as shown in *Figure 5.1*.

8. Apply Loctite 222 to the threads of the M3 socket head cap screw.
9. Place the new alignment pin in the bore.
10. Using a 2.5 mm hex key, install the M3 socket head cap screw into threaded-end of the alignment pin. Tighten to 12 in-lbs (1.4 Nm).
11. Apply Superlube Multi-purpose synthetic grease with syncolon, NSF (H1) Food Grade, NLGI 2 to the surface of the pin: refer to *Section 4.2—Cleaning and Lubrication of the Master and Tool Plate Assemblies*.
12. Install the Master plate: refer to *Section 2.2—Installation of the Master Plate Assembly*.
13. Safely resume normal operation.

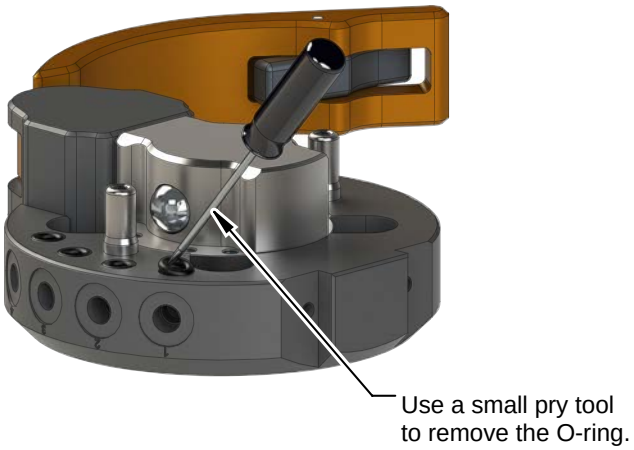
5.2.2 Replace O-ring Seals

Parts required: *Refer to Section 6.1—MC-50 Master Serviceable Parts*

Tools required: *Small screw driver, Clean cloth, Superlube Multi-purpose Synthetic Grease with Syncolon, NSF (H1) Food Grade, NLGI 2*

1. Turn off and de-energize all circuits, for example: power and air.
2. Uncouple the Master and Tool plates.
3. Use a small screw driver or similar tool to pry the O-ring seal out of the groove in the Master plate's air port.
4. Use a clean cloth to remove debris and grease from the air port.
5. Place a new O-ring in the groove of the air port.
6. Apply Superlube Multi-purpose Synthetic Grease with syncolon, NSF (H1) Food Grade, NLGI 2 to the surface of the O-ring: refer to *Section 4.2—Cleaning and Lubrication of the Master and Tool Plate Assemblies*.
7. Safely resume normal operation.

Figure 5.2—O-ring Replacement

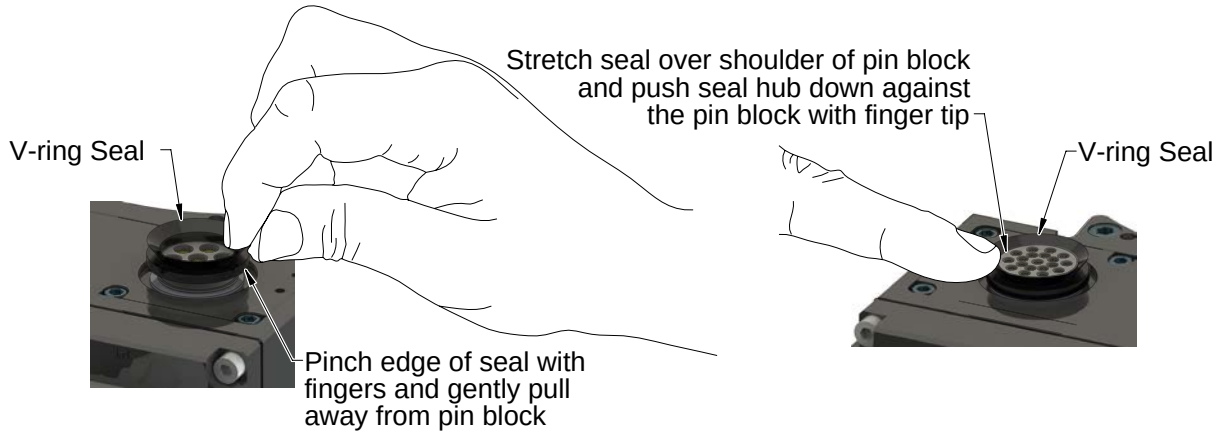


5.2.3 For Applicable, Optional Modules: V-ring Seal Inspection and Replacement

Parts required: *Refer to the module's ATI manual*
The seal protects the electrical connection between the Master and Tool module. Replace the seal if it becomes worn or damaged.

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. To remove the existing seal, pinch the edge of the seal and pull the seal away from the pin block on the Master module.
5. To install a new seal, stretch the new seal over the shoulder of the pin block.
6. Push the seal hub down against the pin block.
7. Safely resume normal operation.

Figure 5.3—V-ring Seal Replacement



6. Serviceable Parts

6.1 MC-50 Master Serviceable Parts

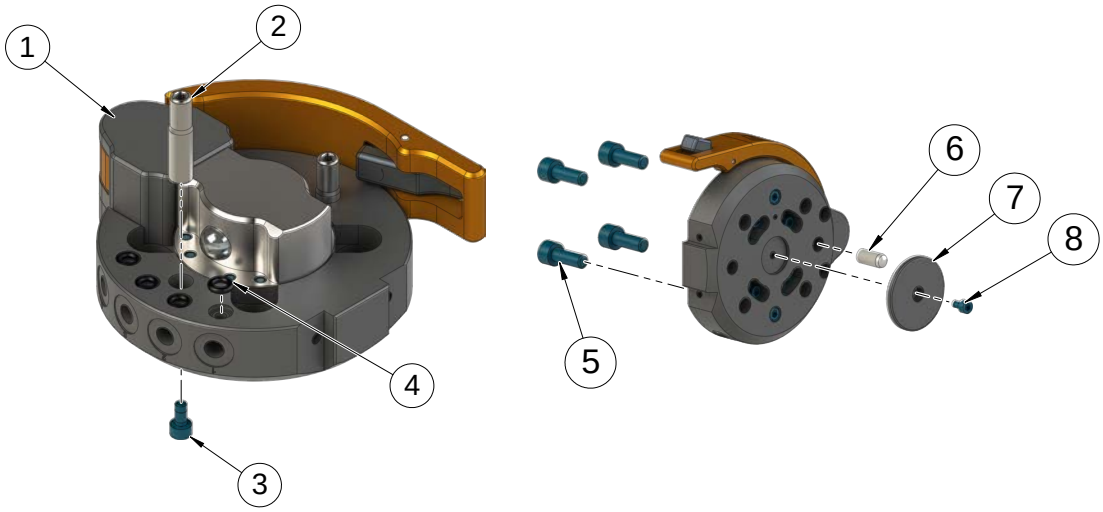


Table 6.1—MC-50 Master Plate Assembly			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9122-050M-000	MC-50 Master Plate Assembly
2	2	3700-20-11539	6 mm Diamond-head Alignment Pin
3	2	3500-1057006-15A	M3-0.5 x 6mm Socket Head Cap Screw with Pre-applied Adhesive
4	4	3410-0001016-01	O-ring 1/8” Inner Diameter, 1/4” Outer Diameter, and 1/16” Height
5	4	3500-1066016-15	M6-1 x 16 mm Socket Head Cap Screw with Pre-applied Adhesive
6	1	3540-0106014-11	6 mm x 14 mm Dowel Pin, Alloy Steel
7	1	9005-20-9218	Boss Plate Kit, which includes a 31.5 mm Outer Diameter Boss for a Tool Changer with a 16 mm Diameter Recess and a M3 Socket Head Cap Screw
8	1		

6.2 MC-50 Tool Serviceable Parts

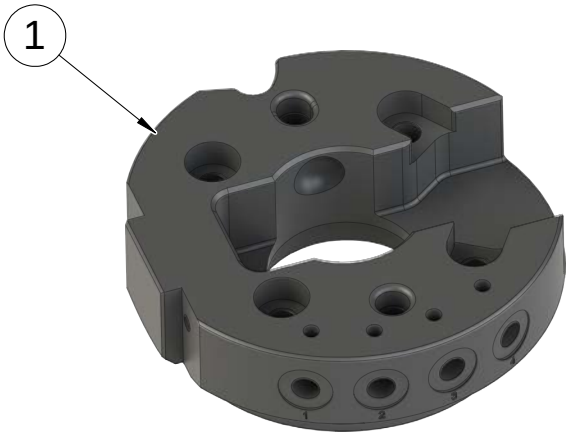


Table 6.2—MC-50 Tool Plate Assembly			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9122-050T-000	MC-50 Tool Plate Assembly

6.3 Accessories

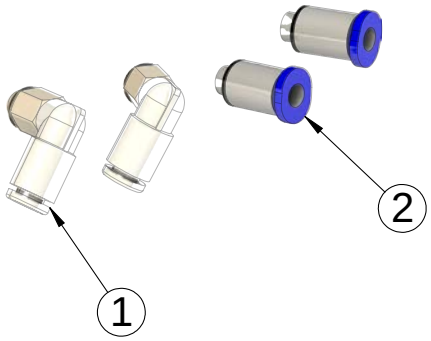


Table 6.3—Accessories for the MC-50			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9005-20-9112	(2) Swivel Elbow Fittings, M5 Male x 4 mm Tube
1	1	9005-20-9115	(2) Straight Fittings, M5 Male x 4 mm Tube
N/A	N/A	0290-70-0000-50-011	Superlube Multi-purpose Synthetic Grease with Syncolon, NSF (H1) Food Grade, NLG2: (1) 1/2 oz Tube

7. Specifications

Table 7.1—MC-50 Technical Specifications		
Recommended Max Payload for Cobot Applications	55 lbs (25 kg)	The total, maximum weight of tooling and modules that are attached to the MC-50.
Recommended Max Payload for Industrial Robot Applications	22 lbs (10 kg)	
Operating Temperature Range	-32–150°F (5–60°C)	The optimal temperature range during operation.
Recommended Maximum, Static Moment X-Y (Mxy)	221 lbf-in (25 Nm)	The maximum, static moment load of the tooling that is recommended for optimum performance.
Recommended Static Moment Z (Mz)	221 lbf-in (25 Nm)	
Maximum Dynamic Moment X-Y (Mxy)	664 lbf-in (75 Nm)	The total tooling, workpiece, and acceleration loads during normal operation.
Maximum Dynamic Moment Z (Mz)	664 lbf-in (75 Nm)	
E-stop Moment X-Y (Mxy)	92 lbf-ft (125 Nm)	The total tooling, workpiece, and acceleration loads during an E-stop.
E-stop Moment Z (Mz)	92 lbf-ft (125 Nm)	
Range of Force to Actuate	10–20 lbs (44.48–88.96 N)	Range of force that is needed to couple the Master and Tool Plate Assemblies.
Maximum Gap for Coupling	0.04 in (1 mm)	The maximum distance that is allowed between the Master and Tool before locking.
Repeatability X/Y Position	± 0.0004 in ± 0.01 mm	
Weight (coupled, no access.)	1.26 lbs (0.572 kg)	Master: 0.85 lbs (0.386 kg) Tool: 0.41 lbs (0.186 kg)
Pneumatic Pass-Through Ports	(4) M5	For optional air fittings, refer to *Section 6.3—Accessories*.
Mounting/Customer Interface	Master plate	ISO 9409-1-50-4 M6 (50 mm bolt circle) with a 31.5 mm boss. See *Section 8—Drawings*.
	Tool plate	ISO 9409-1-50-4 M6 (50 mm bolt circle) for either an M5 bolt-down pattern or an M6 bolt-up pattern. To align the Tool plate the customer's tooling (31.5 mm boss or 63 mm recess), use the Tool plate's 31.5 mm recess or 63 mm boss. See *Section 8—Drawings*.

8. Drawings

The customer drawing is available on the ATI website:
https://www.ati-ia.com/app_content/Documents/9630-20-MC050.auto.pdf.