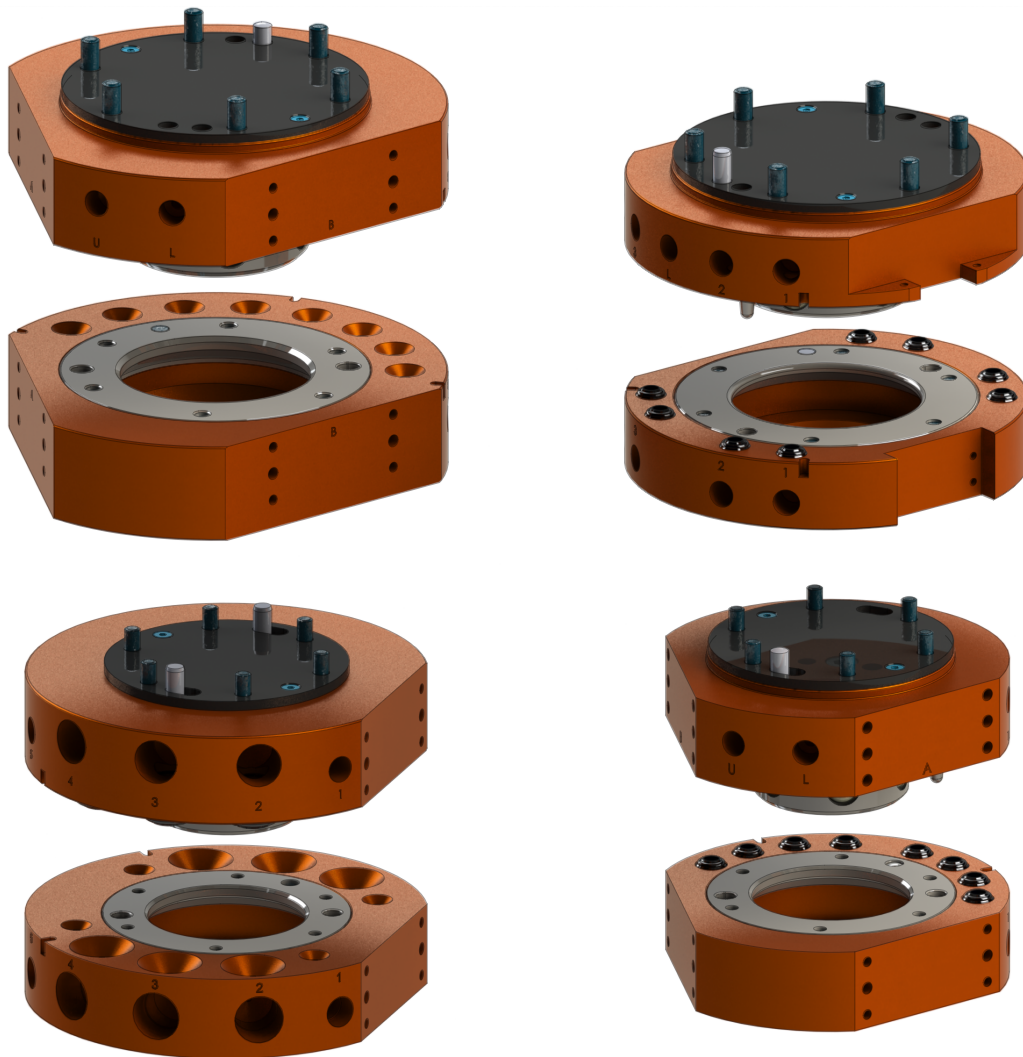




Robotic Tool Changer QC-40 through QC-100

Manual



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Engineered Products for Robotic Productivity

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Foreword

This manual contains basic information applicable to all ATI robotic Tool Changers. Certain models have their own manuals that contain more detailed information. Also, additional information about electrical, pneumatic, fluid, high-power, and high-current modules and other options are available in other manuals and documents.

Please contact ATI Industrial Automation with any questions concerning your particular model.



CAUTION: This manual describes the function, application, and safety considerations of this product. This manual must be read and understood before any attempt is made to install or operate the product, otherwise damage to the product or unsafe conditions may occur.

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Glossary

Term	Definition
Bearing Race	A steel ring in the Tool plate that is engaged by the locking balls during the coupling of the Tool Changer or Utility Coupler.
Cam	A multi tapered sliding cylinder attached to the piston that forces the locking balls outward during the locking process.
Coupling	The physical action of the locking the Master and Tool plates together. See Lock
Cover Plate	A protective closure plate on standard Master assemblies which closes the pneumatic chamber.
Detection Shaft	Threaded stem inserted into the robot side of the piston, functions as a target to actuate the Lock/Unlock sensors.
Electrical Module	Any of a wide variety of utility modules that pass electrical power and signals through the Master and Tool modules to the end-effector.
End-effector Interface Plate	Plate between the Tool plate and the customer's end-effector (tooling). Enables customized mounting to the end-effector.
End-Effector	Tool used by the robot to perform a particular operation or function.
Fluid Module	Any of a wide variety of utility modules that pass fluids through the Master and Tool modules to the end-effector.
High Current Module	Any of a wide variety of utility modules that pass electrical power through the Master and Tool modules to the end-effector.
Interface Plate (IP)	Optional customized component used to adapt a Tool Changer or Utility Coupler to the user's robot or tooling.
L/U	Lock/Unlock sensing capability allows the customer to determine the state of the master assembly locking mechanism.
Lock Port	Pneumatic port on the Master plate through which air pressure is supplied to Lock the Master plate to the Tool plate.
Lock Sensor	A proximity sensor that detects the position of the pneumatically actuated piston when it is in the locked or missed tool position.
Locked	An output signal provided by a proximity sensor, indicating that the coupling mechanism is in the Locked position.
Locking Balls	Hardened steel ball bearings used in the fail-safe locking mechanism. The locking balls are forced outward by the cam against the bearing race to pull the Master and Tool plates together.
Locking Mechanism	Manual, pneumatic, or electrical driven device that draws the Master and Tool plates together securing them in a fail-safe locked condition until the mechanism is unlocked. The locking mechanism consists of locking balls, cam, ball cage, bearing race, and either an lever, pneumatic cylinder or an electric motor.
Lock	The lock air pressure provided to the Master plate locking mechanism forcing the cam to press the locking balls against the bearing race. This locks the Master and Tool plates together.
Master plate	The half of the Tool Changer that is mounted to a robot. The Master plate contains the locking mechanism.
Moment	The applied force multiplied by the distance it is from a point.
No-Touch™	Design feature of all ATI Tool Changer products that allows coupling the Master plate and Tool plate without physical contact prior to locking.
Piston	Cylinder located in the Master plate that actuates the locking mechanism.

Term	Definition
Pneumatic Module	Any of a wide variety of utility modules that pass air or vacuum through the Master and Tool modules to the end-effector.
Sensor Plate	Cover plate for the back side of the Master plate, seals the pneumatic chamber and provides mounting points for the Lock/Unlock switches.
Servo Module	Any of a wide variety of utility modules that pass electrical power and servo signals through the Master and Tool modules to the end-effector equipped with a servo motor.
SIP	Sensor Interface Plate used to adapt the Tool Changer Master to the customer-supplied robot. The interface plate contains sensors that determine the state (Locked/Unlocked/No Tool) of the Master plate.
Tool plate	The half of the Tool Changer to which various tools or end-effectors are mounted.
Tool Stand	Stand that holds Tools not being used by the robot.
Trip Dog	A physical device used to activate a mechanical switch, use in the tool stand Interlock circuit.
Uncoupling	The physical action of the unlocking the Master and Tool plates. See Unlock
Unlatch	The output supplied to the ATI Master module to uncouple the Tool Changer.
Unlock Port	Pneumatic port on the Master plate through which air pressure is supplied to Unlock the Master plate from the Tool plate.
Unlock Sensor	A proximity sensor that detects the position of the pneumatically actuated piston when it is in the unlocked position.
Unlocked	An output signal provided by a proximity sensor, indicating that the coupling mechanism is in the Unlocked position.
Unlock	The unlock air pressure provided to the Master plate locking mechanism forcing the cam to release the locking balls from the bearing race. Allowing the Master and Tool plates to be separated.

1. Safety

The safety section describes general safety guidelines to be followed with this product, explanations of the notifications found in this manual, and safety precautions that apply to the product. Product specific notifications are imbedded within the sections of this manual (where they apply).

1.1 Explanation of Notifications

These notifications are used in all of ATI manuals and are not specific to this product. The user should heed all notifications from the robot manufacturer and/or the manufacturers of other components used in the installation.



DANGER: Notification of information or instructions that if not followed will result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.



WARNING: Notification of information or instructions that if not followed could result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.



CAUTION: Notification of information or instructions that if not followed could result in moderate injury or will cause damage to equipment. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

NOTICE: Notification of specific information or instructions about maintaining, operating, installing, or setting up the product that if not followed could result in damage to equipment. The notification can emphasize, but is not limited to: specific grease types, best operating practices, and maintenance tips.

1.2 General Safety Guidelines

Prior to purchase and installation, the customer should verify that the Tool Changer selected is rated for the maximum loads and moments expected during operation. Particular attention should be paid to dynamic loads caused by robot acceleration and deceleration. These forces can be (exponentially) greater than the value of static forces in high acceleration or deceleration situations. To verify an ATI product is rated for a particular application, refer to the product specifications section and/or drawing section for each component in this manual or contact ATI for assistance.

The customer is responsible for ensuring that the area between the Master and Tool sides is clear of foreign objects during mating and subsequent coupling. Failure to do so may result in serious injury to personnel.



DANGER: The gap between the Master and Tool sides is a pinch point. All personnel should abstain from placing any part of their body or clothing in the gap, especially during actuation of the locking mechanism.

The customer is responsible for understanding the function of the Tool Changer and implementing the proper fasteners and/or software to operate the Tool Changer safely. The Tool Changer should be controlled such that there is no chance of locking or unlocking in a position that would endanger personnel and/or equipment. If Lock/Unlock (L/U) and Ready-to-Lock (RTL) sensing capability are used, monitor the status and apply interlocks to prevent injury and damage to personnel and equipment.

All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of stress/strain, kinking, rupture, etc. Functional failure of electrical, pneumatic, or fluid lines may result in injury and damage to personnel and equipment.

All electrical power, pneumatic and fluid circuits should be disconnected during servicing.

1.3 Safety Precautions



WARNING: Remove all temporary protective materials (caps, plugs, tape, etc.) on locking face of Tool Changer and modules prior to operation. Failure to do so will result in damage to Tool Changers, modules, and end-of-arm tooling and could cause injury to personnel.



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 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: During operation, the area between the Master and Tool must be kept clear. Failure to keep area clear will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.



WARNING: The Tool Changer is only to be used for intended applications and applications approved by the manufacturer. Using the Tool Changer in applications other than intended will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.



CAUTION: The Master plate locking mechanism must not be actuated without being mounted to the interface plate. Damage to the Cover Plate and O-ring may result. Always attach the Master plate to the Interface plate prior to attempting any operations.

2. Product Overview

ATI Tool Changers enhance the versatility of a robot by enabling the use of multiple customer tools, such as: grippers, vacuum cup tooling, pneumatic and electric motors, weld guns, and more.

The Tool Changer consists of a Master plate, which is attached to the robot arm, and a Tool plate, which is attached to customer tooling. When the robot picks up the customer tooling, a pneumatically-driven locking mechanism couples the two plates. The patented, fail-safe locking mechanism utilizes a multi-tapered cam with ball locking technology to ensure the Tool Changer does not uncouple if air pressure falls below 60 psi (4.1 bar) during operation.

The robot can be programmed to select the desired customer tooling by coupling the Master plate to the Tool plate. Electricity, fluid, and other forces of energy transfer to the customer tooling through optional modules that are attached to the Master and Tool plates. Refer to the ATI website for compatible modules or contact an ATI sales representative for more details.

Robotic Tool Changer models are available with different anodizing, pneumatic port sizes, and quantities; refer to [Table 2.1](#) for specific part numbers.

Table 2.1—Standard QC Tool Changer Models and Features

Model	Payload	Flats	Plate	Pneumatic Ports	Part No.
QC-40	110 lbs	(2) Flat	Master	(8) 1/8" NPT Pass through ports (2) 1/8" NPT Lock/Unlock air ports	9120-040M-000-000 9120-040M-000-000-B
			Tool	(8) 1/8" NPT Pass through ports	9120-040T-000-000 9120-040T-000-000-B
			Master	(8) 1/8"-28 BSPP Pass through ports (2) 1/8"-28 BSPP Lock/Unlock air ports	9120-040M-000-000-E
			Tool	(8) 1/8"-28 BSPP Pass through ports	9120-040T-000-000-E
			Master	(8) 1/8" BSPT Pass through ports (2) 1/8" BSPT Lock/Unlock air ports	9120-040M-000-000-R
			Tool	(8) 1/8" BSPT Pass through ports	9120-040T-000-000-R
QC-41	110 lbs	(1) Flat	Master	(6) 3/8" NPT Pass through ports (4) 1/8" NPT Pass through ports (2) 1/8" NPT Lock/Unlock air ports	9120-041M-000-000 9120-041M-000-000-B
			Tool	(6) 3/8" NPT Pass through ports (4) 1/8" NPT Pass through ports	9120-041T-000-000 9120-041T-000-000-B
			Master	(6) 3/8"-19 BSPP Pass through ports (4) 1/8"-28 BSPP Pass through ports (2) 1/8"-28 BSPP Pass through ports	9120-041M-000-000-E
			Tool	(6) 3/8"-19 BSPP Pass through ports (4) 1/8"-28 BSPP Pass through ports	9120-041T-000-000-E
QC-43	110 lbs	(2) Flat	Master	(8) 1/8" NPT Pass through ports (2) 1/8" NPT Lock/Unlock air ports	9120-043M-000-000
			Tool	(8) 1/8" NPT Pass through ports	9120-043T-000-000
			Master	(8) 1/8"-28 BSPP Pass through ports (2) 1/8"-28 BSPP Lock/Unlock air ports	9120-043M-000-000-E
			Tool	(8) 1/8"-28 BSPP Pass through ports	9120-043T-000-000-E
QC-60	160 lbs	(2) Flat (1) J16 pattern and (1) K series	Master	(8) 1/8" NPT Pass through ports (2) 1/8" NPT Lock/Unlock air ports	9120-060M-000-000 9120-060M-000-000-B
			Tool	(8) 1/8" NPT Pass through ports	9120-060T-000-000 9120-060T-000-000-B
			Master	(8) 1/8"-28 BSPP Pass through ports (2) 1/8"-28 BSPP Lock/Unlock air ports	9120-060M-000-000-E
			Tool	(8) 1/8"-28 BSPP Pass through ports	9120-060T-000-000-E
			Master	(8) 1/8" BSPT Pass through ports (2) 1/8" BSPT Lock/Unlock air ports	9120-060M-000-000-R
			Tool	(8) 1/8" BSPT Pass through ports	9120-060T-000-000-R
QC-71	180 lbs	(2) Flats	Master	(8) 1/4 NPT Pass through ports (2) 1/8 NPT Lock/Unlock air ports	9120-071M-000-000
			Tool	(8) 1/4 NPT Pass through ports	9120-071T-000-000
			Master	(8) 1/4 BSPP Pass through ports (2) 1/8" BSPP Lock/Unlock air ports	9120-071M-000-000-E
			Tool	(8) 1/4 BSPP Pass through ports	9120-071T-000-000-E
QC-100	330 lbs	(2) Flats	Master	(8) 3/8 NPT Pass through ports (2) 1/8 NPT Lock/Unlock air ports	9120-100M-000-000
			Tool	(8) 3/8 NPT Pass through ports	9120-100T-000-000
			Master	(8) G 3/8 BSPP Pass through ports (2) G 1/8 BSPP Lock/Unlock air ports	9120-100M-000-000-E
			Tool	(8) G 3/8 BSPP Pass through ports	9120-100T-000-000-E

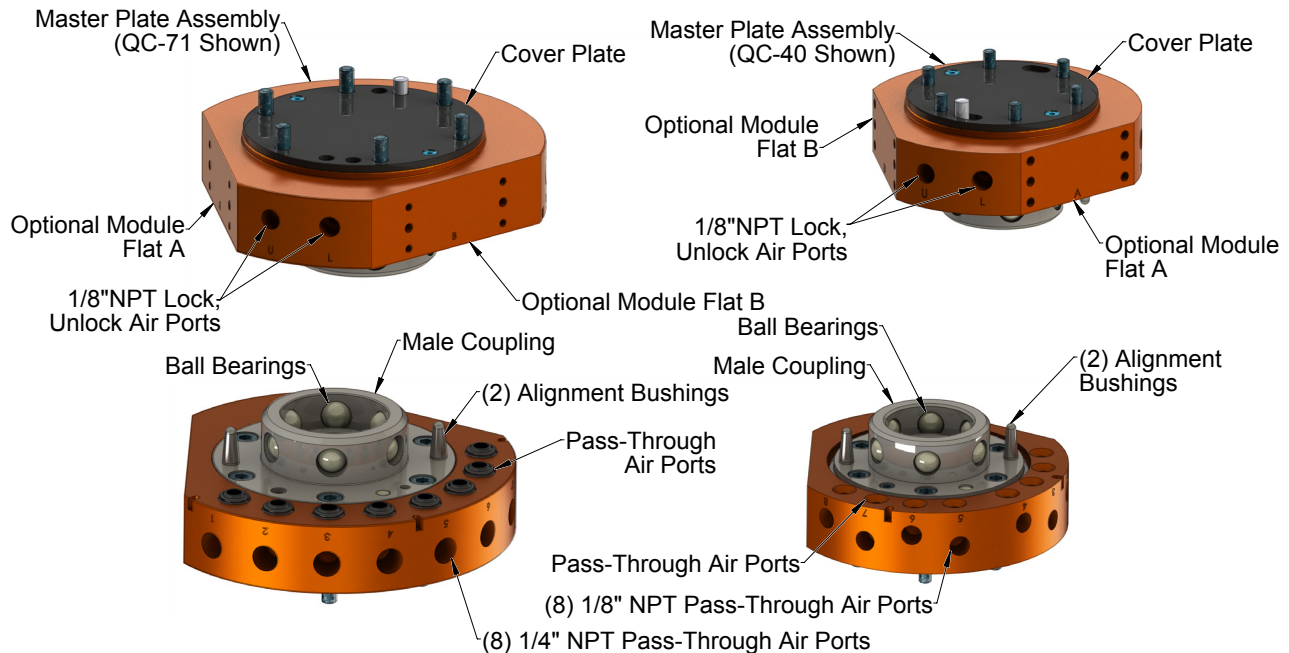
Notes:

- QC Tool Changer Master and Tool plate Assemblies with (-B and -E) Part Numbers have black anodized bodies.
- Additional options are available upon request.

2.1 Master Plate Assembly

The Master plate assembly includes an anodized aluminum body, a hardened stainless-steel locking mechanism, and hardened steel alignment pins. The locking mechanism consists of a cam, a male coupling, and chrome-steel ball bearings. The Master plate provides one or (2) flat sides for mounting optional modules, depending on the model. Optional modules can be arranged to suit the application.

Figure 2.1—Master Plate Assemblies



The air port provides Lock and Unlock air for the locking mechanism and pass through air for the end of arm tooling. An adapter plate assembly provides a standoff for the air ports and a mounting pattern to attach to the robot arm.

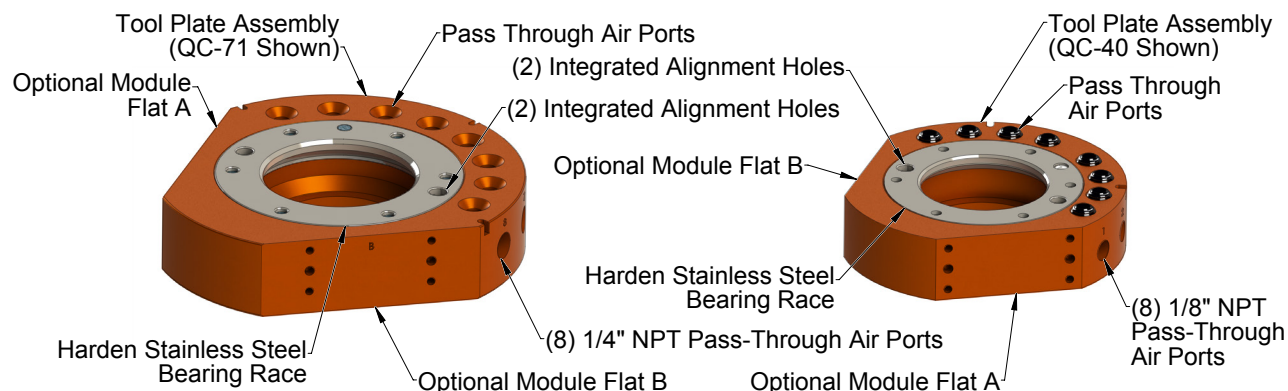
Alignment pins mate with bushings to ensure repeatable alignment during the coupling process. An extreme pressure grease is applied to the cam, male coupling, ball bearings, and pins to enhance performance and maximize the life of the Master plate assembly. In some models, the Master plate is equipped with tapered alignment pins. The Master plates of other models, such as the QC-43, have hardened stainless steel alignment bushings.

A cover plate is attached to the Master to protect the internal locking mechanism during shipment. The cover plate can be removed during installation if replaced by an interface plate or sensor interface plate. Refer to [Section 3—Installation](#) for details.

2.2 Tool Plate Assembly

The Tool plate assembly includes an anodized aluminum body and hardened stainless-steel bearing race. The Tool plate provides one or (2) flat sides for mounting optional modules, depending on the model. Optional modules can be arranged to suit the application. In some models the bearing race or Tool plate body has integrated alignment holes or bushings, other models such as the QC-43 Tool plate have hardened steel alignment pins. The Tool plate is equipped with pass-through air ports to supply end of arm tooling.

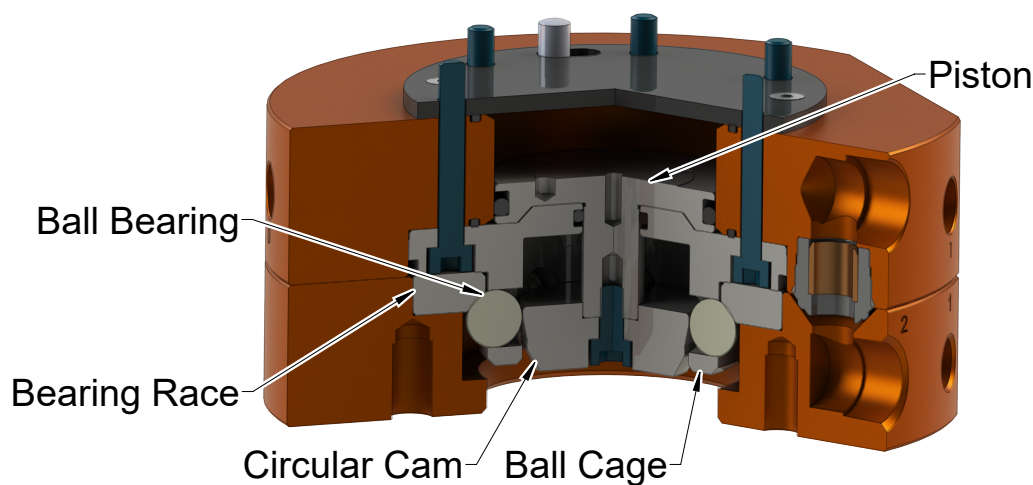
Figure 2.2—Tool Plate Assemblies



2.3 Master Plate/Tool Plate Locking Mechanism

The coupling of the Master plate and the Tool plate is achieved through a patented, high-strength, high-repeatability, stainless steel mechanism. During locking, steel balls in the Master plate are driven outward by a circular cam attached to a pneumatically actuated piston. The cam profile has (3) features: a lead-in angle (conical), a fail-safe surface (cylindrical) area, and a secondary angle (conical). The lead-in angle initiates the coupling process, the fail-safe surface assures the coupling will not be compromised in case of air loss (fail-safe feature), and the secondary angle provides rigid coupling during normal operation. The balls engage a bearing race (or “locking ring”) in the Tool plate and lock the Master plate and Tool plate tightly together.

Figure 2.3—Locking Mechanism



2.4 Optional Sensor Interface Plate (SIP)

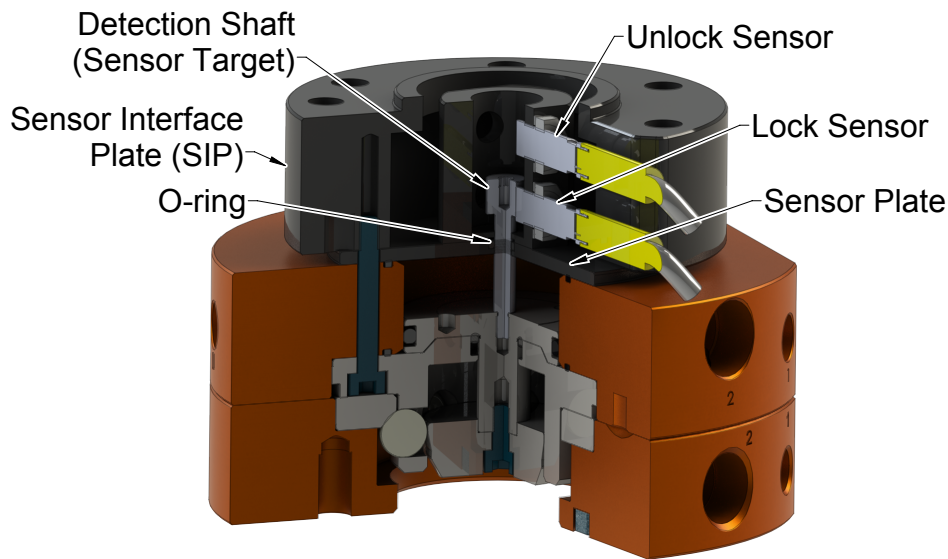
The Sensor Interface Plate (SIP) system provides locking mechanism position signals to the customer's process controller. These signals can indicate (2) possible conditions for the Master plate: Locked or Unlocked.

The SIP system utilizes sensors to detect the position of the pneumatically-actuated piston in the Master plate. These sensors are available in PNP and NPN. For other available options, contact ATI for more information.

The SIP system consists of an interface plate (which joins the Master plate to the robot), a detection shaft, a sensor plate, proximity switches, and an O-ring.

The sensor plate also replaces the simple cover plate on the backside of the Master. The sensor plate provides mounting locations for the proximity sensors and closes the pneumatic chamber of the Master. The SIP provides mounting holes for attaching the Master to the customer's application and retains the sensor plate.

Figure 2.4—Optional Sensor Interface Plate



2.5 Optional Modules

Tool Changers have one or (2) flats depending on the model. Optional modules support the pass through of utilities, such as, signal, fluid/air, and power, etc. Refer to [Table 2.2](#) for more information. Some modules require an adapter plate.

For assistance in choosing the right modules, visit the specific QC model webpages by clicking on the links in [Table 2.2](#), or contact an ATI Sales Representative.

Table 2.2—Tool Changer Models and Features	
Model	For the most current list, information, and specifications for compatible Optional Modules, click the following links:
QC-40	QC-40 Web Page and select the Compatible modules tab
QC-41	QC-41 Web Page and select the Compatible modules tab
QC-43	QC-43 Web Page and select the Compatible modules tab
QC-60	QC-60 Web Page and select the Compatible modules tab
QC-71	QC-71 Web Page and select the Compatible modules tab
QC-100	QC-100 Web Page and select the Compatible modules tab
Note: The ATI website provides information on the standard compatible modules additional custom modules are available, contact an ATI Sales Representative directly	

3. Installation

The Master plate of the Tool Changer mounts to the robot arm using an interface plate or a sensor interface plate (SIP). Custom interface plates are available from ATI upon request. Refer to [Section 3.1—Master Interface Plates](#) or [Section 2.4—Optional Sensor Interface Plate \(SIP\)](#) for more information.

The end-effector is typically attached to the Tool plate with a tool interface plate, standard and custom tool interface plates are available from ATI upon request. Refer to [Section 3.3—Tool Interface Plate](#) for more information.

All fasteners used to mount the Tool Changer to the robot and to customer's tooling should be tightened to a torque value as indicated. Refer to [Table 3.1](#). Furthermore, fasteners should have pre-applied adhesive or be applied with removable (blue) Loctite® 222. [Table 3.1](#) contains recommended values based on engineering standards.

Pneumatic lines and electrical cables are attached, bundled, and must be strain-relieved in a manner that allows for freedom of movement during operation.



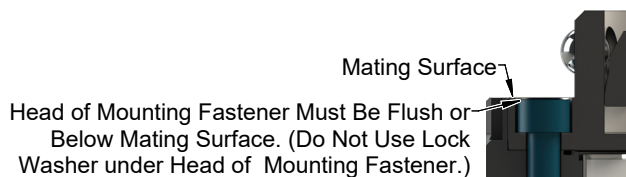
WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits 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: All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of over stressing, pullout, or kinking the lines. Failure to do so can cause critical electrical and/or pneumatic lines to malfunction and might result in injury to personnel or damage to equipment.



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: Do not apply Lock or Unlock air pressure to the Tool Changer prior to installing an interface plate or sensor interface plate (SIP). Applying air pressure can damage the cover plate, O-ring or may cause injury to personnel from flying debris. Always install an appropriate interface plate or SIP and have the Tool Changer mounted securely to the robot before applying air pressure. Refer to [Section 3.1—Master Interface Plates](#) and [Section 3.2—Master Plate Installation and Removal](#) for more information.



CAUTION: Failure to follow the Interface plate or tool interface plate design consideration in [Section 3.1—Master Interface Plates](#) and [Section 3.3—Tool Interface Plate](#) may result in cover plate O-ring damage or loosening of the interface during operation. Follow the guidelines provided when designing an interface plate, TIP for the Tool Changer.



CAUTION: Do not use fasteners that exceed the thread depth in the Tool Changer. Refer to [Section 9—Drawings](#) for details on mounting hole thread depth. Secure the Tool Changer with the proper length fasteners. This is true for both robot and tool interfaces.



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 3.1—Fastener Size, Class, and Torque Specifications

Mounting Conditions	Fastener Size and Property Class	Recommended Torque	Thread Locker
QC-40, QC-41, and QC-43 Master plate to Interface plate or Sensor Interface plate, Supplied Fasteners	M5 x 0.8 Class 12.9		Pre-applied Adhesive or Loctite 222
	Socket head cap	45 in-lbs (5.08 Nm)	
QC-60 and QC-71 Master plate to Interface plate or Sensor Interface plate, Supplied Fasteners	M6 x 1.0 Class 12.9		Pre-applied Adhesive or Loctite 242
	Socket head cap	90 in-lbs (10.2 Nm)	
	Socket flat head cap	60 in-lbs (6.78 Nm)	
QC-100 Master plate to Interface plate or Sensor Interface plate, Supplied Fasteners	M8 x 1.25 Class 12.9		
	Socket head cap	140 in-lbs (15.82 Nm)	
Tool Interface Plate to QC-40, QC-41, QC-43, QC-60 and QC-71 Tool plate Minimum thread engagement of 12 mm [1.5X fastener Ø]. <i>Do not exceed maximum available thread depth of 14 mm as shown in Section 9—Drawings</i>	M8 x 1.25 Class 12.9		
	Socket head cap	140 in-lbs (15.82 Nm)	
	Socket flat head cap	85 in-lbs (9.6 Nm)	
Tool Interface Plate to QC-100 Tool plate Minimum thread engagement of 15 mm [1.5X fastener Ø]. <i>Do not exceed maximum available thread depth as shown in Section 9—Drawings</i>	M10 x 1.5 Class 12.9		
	Socket head cap	55 ft-lbs (75 Nm)	
Optional Module or adapter plate to Master or Tool plate, Supplied Fasteners	M3 x 0.5 Class 12.9		Pre-applied Adhesive or Loctite 222
	Socket head cap	10 in-lbs (1.13 Nm)	
	Socket flat head cap	8 in-lbs (0.9 Nm)	
	M4 x 0.7 Class 12.9		
	Socket head cap	15 in-lbs (1.69 Nm)	
	Socket flat head cap	10 in-lbs (1.13 Nm)	

3.1 Master Interface Plates

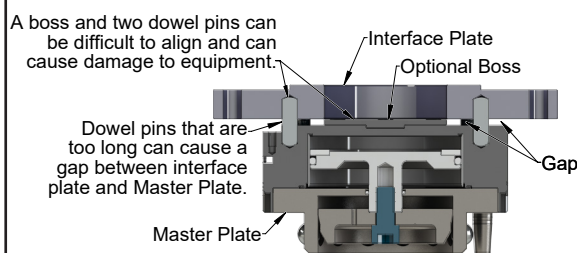
The Master plate is typically attached to the robot arm. An interface plate can adapt the Master plate to a specific robot arm. Alignment features (dowel holes and bosses) accurately position and bolt holes secure the Master plate to the robot arm or an interface plate. Custom interface plates are available from ATI upon request (refer to the drawings for technical information on mounting features.)



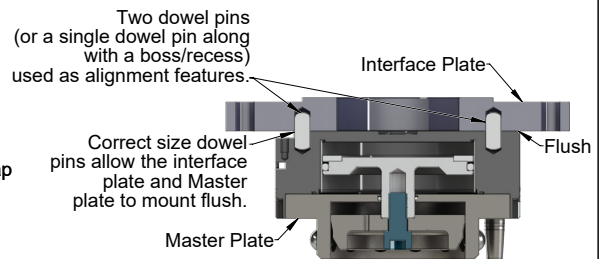
CAUTION: Do not use more than two alignment features when securing a Master plate to an interface plate. Using more than two alignment features can cause damage to equipment. Use either two dowel pins or a single dowel pin, along with a boss/recess feature to align the Master plate with the interface plate.

CAUTION: Do not use dowel pins that are too long or do not allow the interface plate and Master body to mate flush. Using dowel pins that are too long will cause a gap between the interface plate and Master body and damage the equipment. Use dowel pins that will not extend further than allowed by the Master body.

Incorrect Mounting of Master Plate



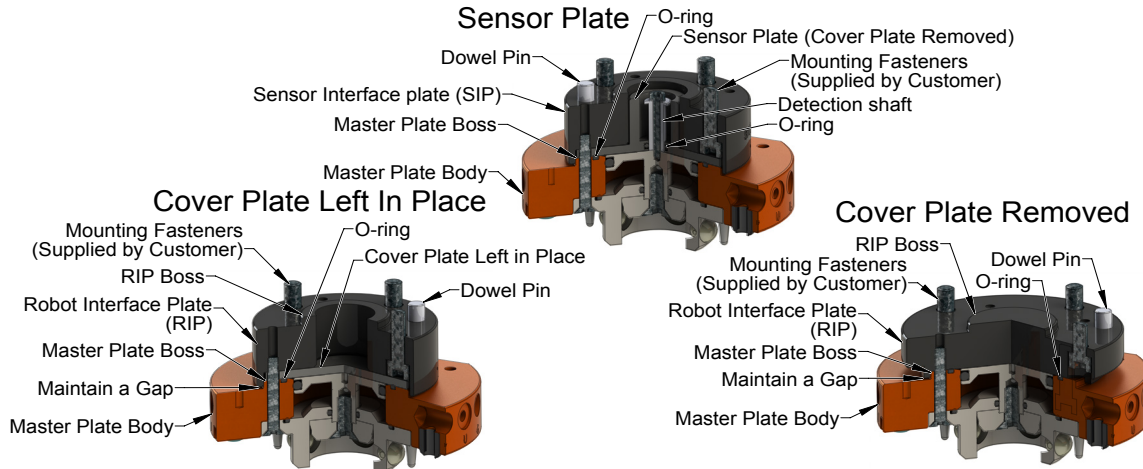
Correct Mounting of Master Plate



If the customer chooses to design and build an interface plate, consider the following points:

- The interface plate should include bolt holes for mounting and either two dowel pins or a dowel pin and a boss for accurate positioning on the robot and Master plate. The dowel and boss features prevent unwanted rotation. Refer to the robot manual for robot mounting features.
- The thickness of the interface plate must be sufficient to provide the necessary thread engagement for the mounting bolts.
- Dowel pins must not extend out from the surface of the interface plate farther than the depth of the dowel holes in the Master plate.
- If a boss is used on the Master plate, a recess of proper depth and diameter must be machined into the interface plate to correspond with the boss on the Master plate.
- Mounting bolts that are too long can create a gap between the interface plate and the Master plate, which can damage equipment.
- The interface plate must provide rigid mounting to the Master plate.
- The interface plate design must account for clearances required for Tool Changer module attachments and accessories.

Figure 3.1—Interface Plate and Sensor Interface Plate with Master Plate Configurations



3.2 Master Plate Installation and Removal

The Tool Changer Master plate is mounted to the robot flange using a SIP or interface plate. A cover plate is attached to the Master plate to protect the internal locking mechanism during shipment. The cover plate will have to be removed if a SIP is being used and may have to be removed if an interface plate is being used. The interface plate can be designed to accommodate the cover plate.

3.2.1 Master Plate Installation

Tools required: 2 mm and 4 mm, 5 mm, or 6 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 222 or 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. Using the alignment features, position the interface plate to the robot arm and secure with ATI supplied or customer supplied fasteners, refer to [Figure 3.1](#). Refer to [Table 3.1](#) for proper fasteners and torque.
6. Depending on the type of interface plate that you are installing, choose from the following options:
 - a. If installing an interface plate that is replacing the cover plate, go to step [7](#).
 - b. If installing a sensor interface plate or an interface plate that incorporates the cover plate, go to step [9](#).
7. Remove the (2) M3 socket Flat head screws that secure the cover plate to the Master plate using a 2 mm hex key.
8. Remove the cover plate.

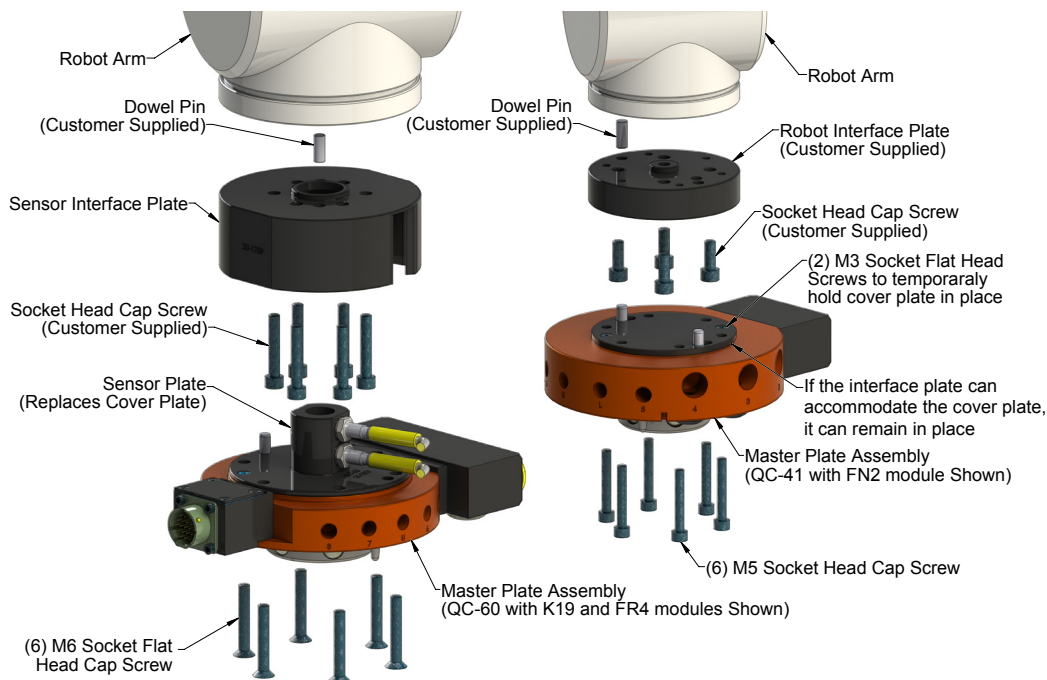


CAUTION: Make sure the O-ring is properly seated in the groove in the Master plate. If the O-ring is not properly seated in the groove it can be cut or damaged, resulting in a leaking seal. Properly seat O-ring into groove in Master body.

9. If equipped, connect the Lock and Unlock sensor cables.
10. Using the alignment features, position the interface plate to the Master plate and secure with supplied fasteners, refer to [Figure 3.2](#). Refer to [Table 3.1](#) for proper fasteners and torque.

11. Connect all Lock / Unlock and pass-through air utilities to the Master plate. For lock and unlock air, refer to [Section 3.8—Air Requirements](#).
12. If equipped, connect other utilities to the optional modules on the Master plate.
13. Safely resume normal operation.

Figure 3.2—Typical Master Plate Installation



3.2.2 Master Plate Removal

Refer to [Section 3.2—Master Plate Installation and Removal](#) for Master module removal instruction.

Tools required: 4 mm, 5 mm, or 6 mm hex key, torque 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. If equipped, disconnect the lock and unlock sensor cables.
5. Remove the fasteners that secure the Master plate to the interface plate.
6. Remove the Master plate. Note: Removal of the interface plate is not required.

3.3 Tool Interface Plate

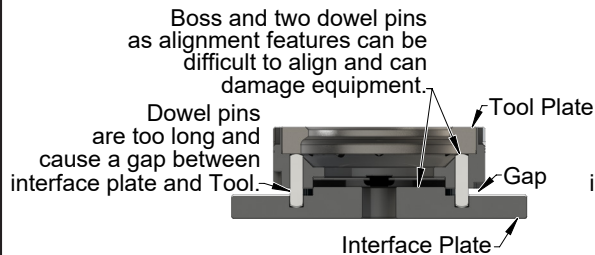
The Tool plate is attached to the customer's tooling. An interface plate can adapt the Tool plate to customer tooling. Alignment features (dowel holes and a recess) accurately position and bolt holes to secure the Tool plate to customer tooling. Custom interface plates can be supplied by ATI (refer to the application drawing).



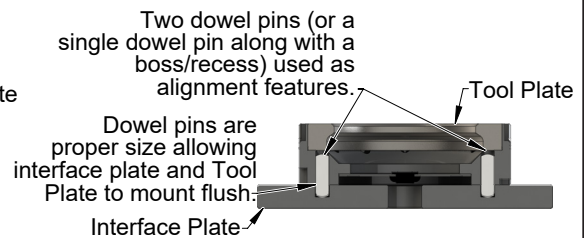
CAUTION: Do not use more than two alignment features when securing a Tool plate to an interface plate. Using more than two alignment features can cause damage to equipment. Use either two dowel pins or a single dowel pin, along with a boss/recess feature to align the Tool plate with the interface plate.

CAUTION: Do not use dowel pins that are too long or do not allow the interface plate and Tool body to mate flush. Using dowel pins that are too long will cause a gap between the interface plate and Tool body and damage the equipment. Use dowel pins that will not extend further than allowed by the Tool body.

Incorrect Mounting of Tool Plate



Correct Mounting of Tool Plate



If the customer chooses to design and build a tool interface plate, consider the following points:

- The interface plate should include bolt holes for mounting and either two dowel pins or a dowel pin and a boss for accurate positioning on the customer tooling and Tool plate. The dowel and boss features prevent unwanted rotation.
- Dowel pins must not extend out from the surface of the interface plate farther than the depth of the dowel holes in the Tool plate.
- The thickness of the interface plate must be sufficient to provide the necessary thread engagement for the mounting bolts. Fasteners should meet minimum recommended engagement lengths while not exceeding the maximum available thread depth. Use of bolts that are too long can cause damage to the tool side changer.
- The plate design must account for clearances required for Tool Changer module attachments and accessories.
- If a boss is to be used on the interface plate, a boss of proper height and diameter must be machined into the interface plate to correspond with the recess in the Tool plate.
- The interface plate must have a hole in its center for manually returning the locking mechanism to the unlocked position under adverse conditions (i.e. unintended loss of power and/or air pressure). The center access hole with a minimum diameter of 1" (25.4 mm) prevents debris from contaminating the locking mechanism. Greater protection is provided by leaving the race cover and grommet in place.

3.4 Tool Plate Installation

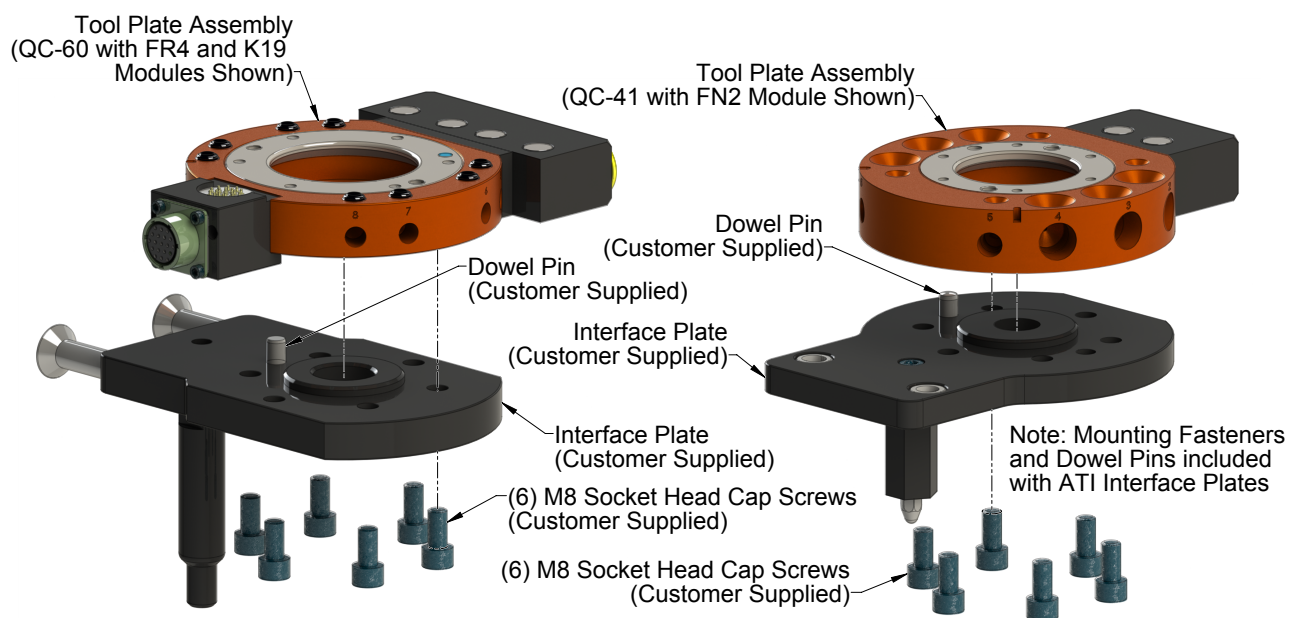
The end-effector is typically attached to the Tool plate with an interface plate. Refer to [Section 3.3—Tool Interface Plate](#) for specific requirements for your application.

Tools required: 5 mm, 6 mm, or 8 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. Using the alignment features position the tool interface plate or customer tooling to the Tool plate and secure with customer supplied mounting fasteners. Apply Loctite 242 to threads or use fasteners with pre-applied adhesive, refer to [Table 3.1](#) for proper thread engagement and torque (Note: Mounting fasteners are supplied with ATI custom tool interface plates).
6. Connect utilities to the appropriate module and Tool plate connections.
7. Safely resume normal operation.

Figure 3.3—Typical Tool Plate Installation



3.5 Tool Plate Removal

Tools required: 5 mm, 6 mm, or 8 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, air, water, etc.
4. Remove the fasteners securing the Tool plate to the tool interface plate or customer tooling.
5. Remove the Tool plate.

3.6 Optional Module Installation

The optional modules are typically installed on Tool Changers by ATI prior to shipment. Installation and removal are outlined in the following section. Tool Changers are compatible with many different types of modules. Some modules will require an adapter plate to be installed to the Tool Changer.

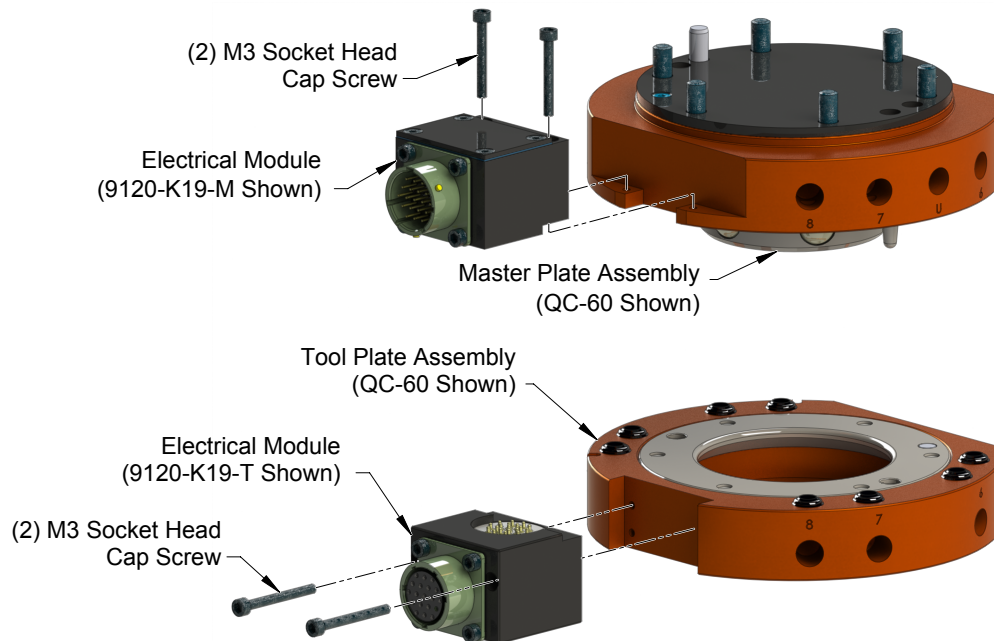
3.6.1 QC-60 Flat A Optional K Series Module Installation

Tools required: 2.5 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 222

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. Align the optional module on flat A of the Master or Tool plate.
6. If not using fasteners with pre-applied adhesive, apply Loctite 222 to M3 mounting fasteners. Secure module with (2) M3 mounting fasteners using a 2.5 mm hex key. Refer to [Table 3.1](#) for proper torque for your specific mounting fasteners.
7. Remove all protective caps, plugs, tape, etc from the module prior to operation.
8. Safely resume normal operation.

Figure 3.4—QC-60 Flat A Optional K Series Module Installation



3.6.2 QC-60 Flat A Optional K Series Module Removal

Refer to [Figure 3.4](#).

Tools required: 2.5 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 (2) M3 socket head cap screws using a 2.5 mm hex key. Note: For the module on the Master, the Master plate may have to be removed refer to [Section 3.2.2—Master Plate Removal](#).
5. Remove the module from the Master or Tool plate.

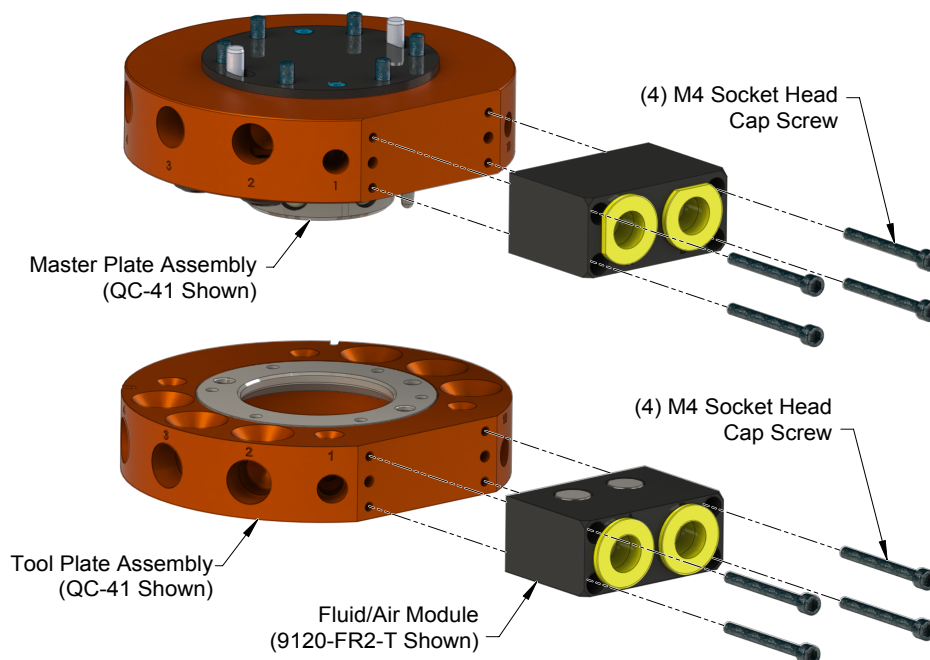
3.6.3 QC-40, QC-41, QC-43, QC-71, and QC-100 Optional Module Installation

Tools required: 3 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 222

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. Align the optional module on the Master or Tool plate as shown in [Figure 3.5](#).
6. If not using fasteners with pre-applied adhesive, apply Loctite 222 to (4) M4 socket head cap screws. Secure module with (4) M4 mounting fasteners using a 3 mm hex key. Refer to [Table 3.1](#) for proper torque for your specific mounting fasteners.
7. Remove all protective caps, plugs, tape, etc from the module prior to operation.
8. Safely resume normal operation.

Figure 3.5—Optional Module Installation



3.6.4 QC-40, QC-41, QC-43, QC-71, and QC-100 Optional Module Removal

Refer to [Figure 3.5](#)

Tools required: 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 any cables, air line, etc. if required.
5. Remove the (4) M4 socket head cap screws, and lift the module from the Master or Tool plate.

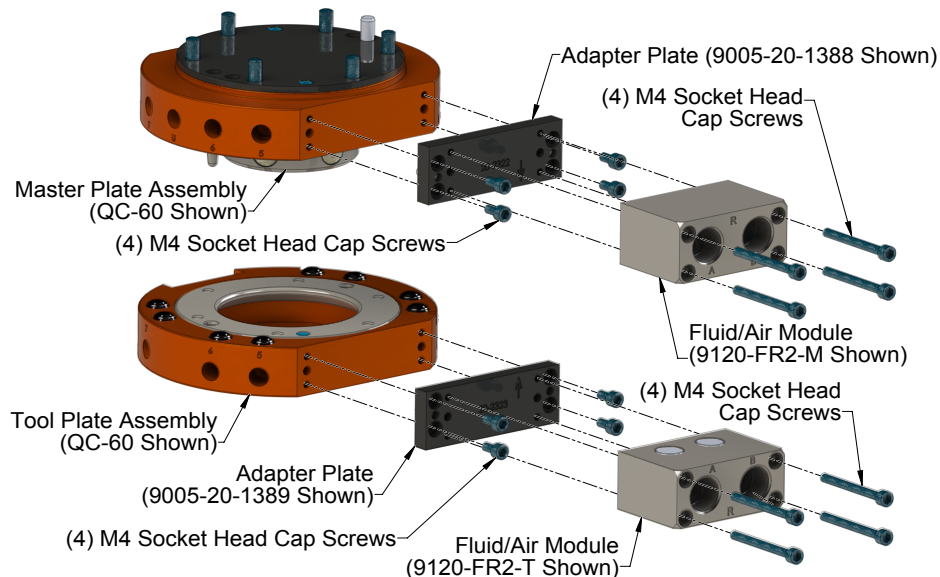
3.6.5 QC-60 Flat B Optional Module Installation

Tools required: 3 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 222

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. Align the adapter plate to Flat B of the QC-60 Master or Tool plate as shown in [Figure 3.6](#).
6. If not using fasteners with pre-applied adhesive, apply Loctite 222 to M4 socket flat head cap screws. Secure adapter plate to the Tool Changer with (2) M4 socket head cap screws using a 3 mm hex key. Tighten to 10 in-lbs (1.13 Nm).
7. Align the optional module on the adapter plate.
8. If not using fasteners with pre-applied adhesive, apply Loctite 222 to (4) M4 mounting fasteners. Secure module with (4) M4 mounting fasteners using a 3 mm hex key. Refer to [Table 3.1](#) for proper torque for your specific mounting fasteners.
9. Remove all protective caps, plugs, tape, etc from the module prior to operation.
10. Safely resume normal operation.

Figure 3.6—QC-60 Flat B Optional Module Installation



3.6.6 QC-60 Flat B Optional Module Removal

Refer to [Figure 3.6](#)

Tools required: 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 any cables, air line, etc. if required.
5. Remove the (4) M4 socket head cap screws using a 3 mm hex key and remove the module from the adapter plate.
6. Remove the (2) M4 socket head cap screws that secure the adapter plate to the Master or Tool plate and remove the adapter plate.

3.7 Installing an Optional Sensor Interface Plate

The optional sensor interface plate is typically installed on Tool Changers by ATI prior to shipment. The following steps outline installation. The sensor interface plate assembly typically includes a custom interface plate. This may replace the existing interface plate. For interface plate installation refer to [Section 3.2—Master Plate Installation and Removal](#).

The SIP assembly comes partially assembled, the Lock and Unlock sensors are assembled to the proper position in the sensor plate. There is no need to remove the sensors or adjust the position. The small detection shaft O-ring is lubricated and installed in the sensor plate.

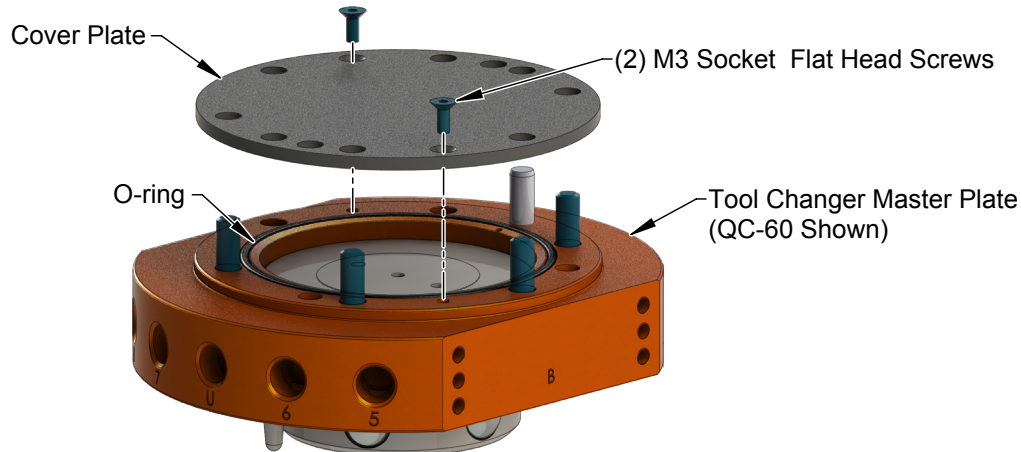
Part required: 9120-040M-SIP-yyyy, 9120-041M-SIP-yyyy, 9120-060M-SIP-yyyy, 9120-071M-SIP-yyyy, or 9120-100M-SIP-yyyy (where xxxx is the custom SIP interface plate)

Tools required: 2 mm, 2.5 mm, and 3 mm hex key, torque wrench

Supplies required: Loctite 222 and Loctite Primer 7649

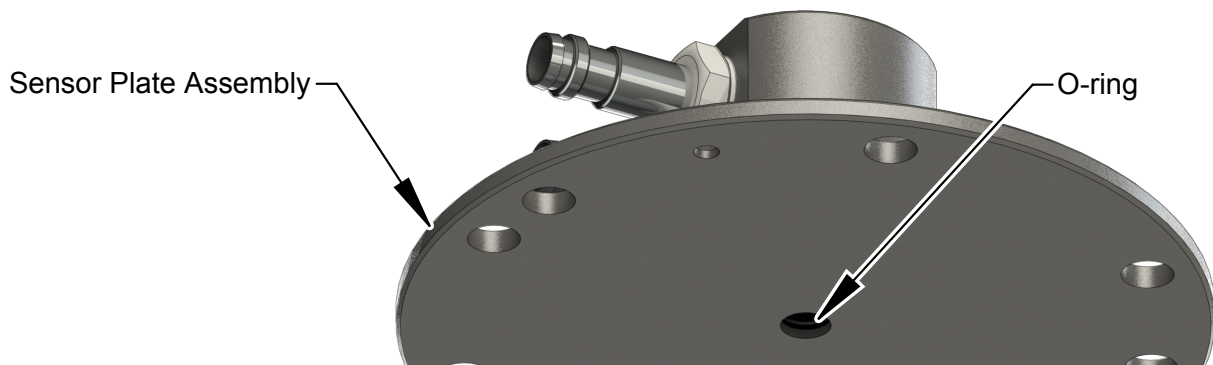
1. If the Tool Changer is in service, place the Tool safely in the tool stand and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. Turn off discharge all energized circuits (for example: electrical, pneumatic, and hydraulic).
3. Remove the Tool Changer Master plate from the robot and the interface plate, refer to [Section 3.2.2—Master Plate Removal](#).
4. If the Tool Changer has a cover plate, remove the (2) M3 socket flat head screws securing the cover plate to the Tool Changer Master plate using a 2 mm hex key. Refer to [Figure 3.7](#).
5. Lift the cover plate off of the Tool Changer Master plate.
6. Make sure the O-ring in the Master plate is present and in good condition, lubricate with Magnalube if needed.

Figure 3.7—Cover Plate Removal



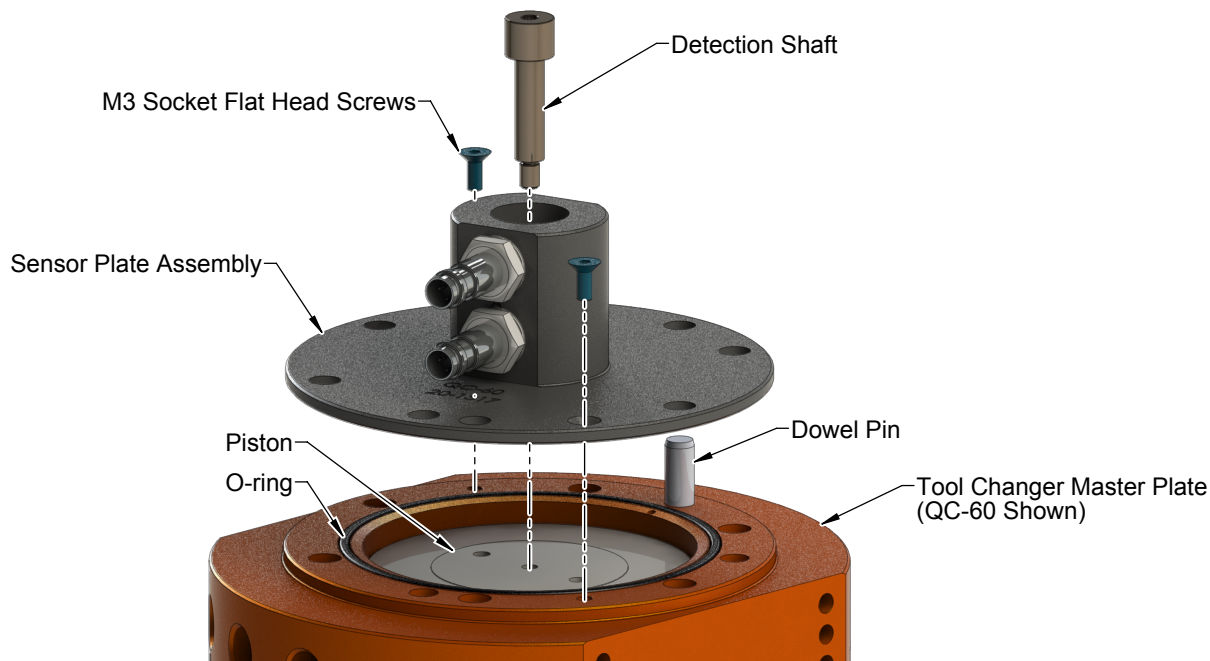
NOTICE: The sensor plate assembly comes assembled with the lock and unlock sensor installed. Do not remove the sensors, the sensors have been position properly from the factory. The sensor plate assembly has the detection shaft O-ring installed and lubricated, make sure it is present as shown in [Figure 3.8](#).

Figure 3.8— Sensor Plate Assembly with Lock/Unlock Sensors and O-ring



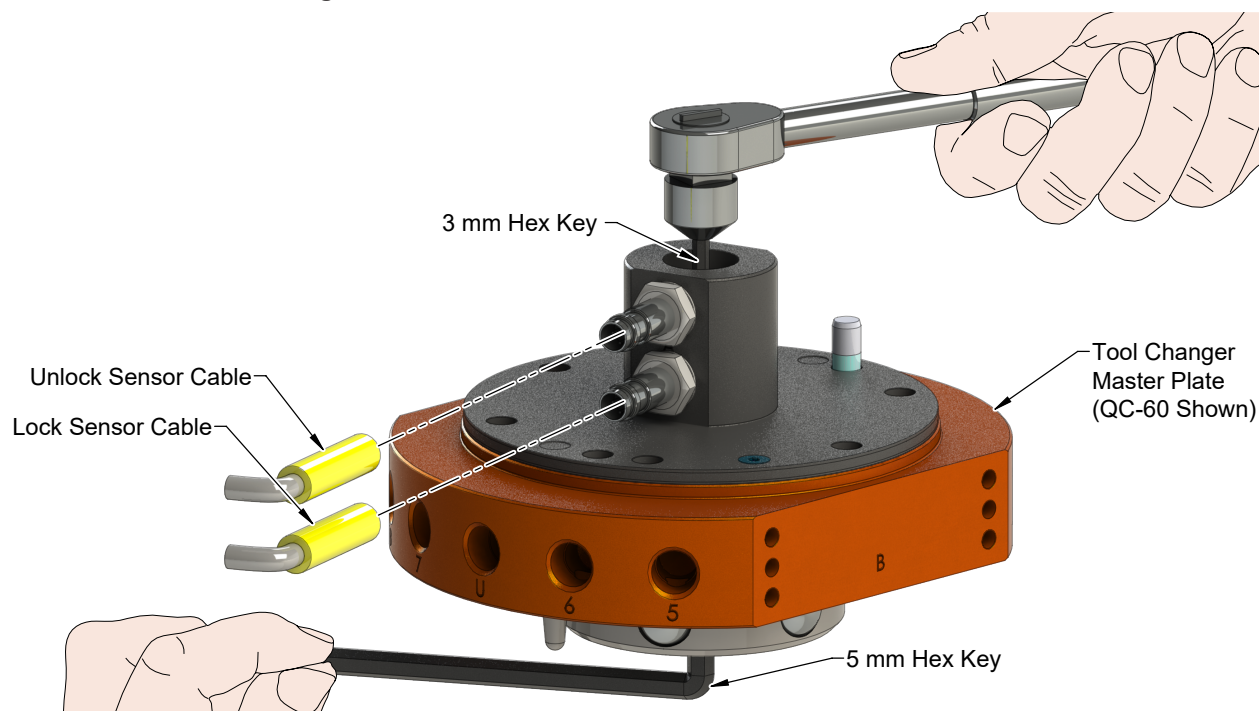
7. Apply tape over the threads of the detection shaft to protect the threads from grease contamination during assembly.
8. Lightly lubricate the detection shaft with Magnalube.
9. Carefully insert the taped detection shaft through the sensor plate assembly pushing it all the way through until it stops.
10. Remove the tape from the detection shaft and apply Loctite primer 7649 to the threads of the detection shaft and the internal threads of the piston. Allow the primer to dry.
11. Apply Loctite 242 to the threads of the detection shaft and the internal threads of the piston.
12. Assemble the sensor plate assembly to the Tool Changer Master plate using the dowel pin to align the sensor plate assembly.
13. Attach the sensor plate to the Tool Changer Master plate with the (2) M3 socket flat head screws using a 2 mm hex key. Tighten to 6 in lbs (0.68 Nm).

Figure 3.9—Sensor Interface Plate Installation



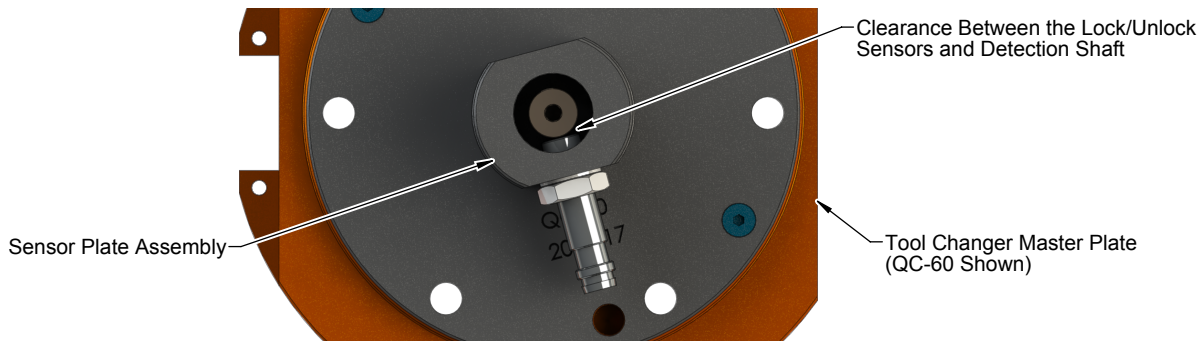
14. For a QC-40, QC-41, or QC-43, insert a 4 mm hex key into the cam of the Tool Changer plate locking mechanism to hold the piston. For a QC-60 or QC-71, insert a 5 mm hex key into the cam of the Tool Changer plate locking mechanism to hold the piston. For a QC-100 insert a 6 mm hex key into the cam of the Tool Changer plate locking mechanism to hold the piston.
15. Using a 3 mm hex key tighten the detection shaft. For QC-40, QC-41, QC-43, QC-60, or QC-71 tighten to 15 in lbs (1.69 Nm). For QC-100 tighten to 60 in lbs (6.78 Nm).

Figure 3.10—QC-11 Sensor Interface Plate Installation



16. Look straight into the sensor plate assembly and verify the detection shaft does not touch the Lock and Unlock sensors, if sensors touch adjust the sensor position. Refer to [Section 6.2.5—Proximity Sensor Adjustment, Test, or Replacement](#).

Figure 3.11—Verify Sensor and Detection Shaft Clearance



CAUTION: Do not apply Lock or Unlock air pressure to the Tool Changer prior to installing an interface plate or sensor interface plate (SIP). Applying air pressure can damage the cover plate, O-ring or may cause injury to personnel from flying debris. Always install an appropriate interface plate or SIP and have the Tool Changer mounted securely to the robot before applying air pressure. Refer to [Section 3.1—Master Interface Plates](#) and [Section 3.2—Master Plate Installation and Removal](#) for more information.

17. Connect the Lock and Unlock sensor cables and manually move the Tool Changer piston to the locked and unlocked positions. Turn the power on to the sensor, verify that the Locked signal turns ON and the sensor LED is illuminated when the Tool Changer is in the Locked position. Verify that the Unlocked signal turns ON and the sensor LED is illuminated when the Tool Changer is in the Unlocked position. If not adjust and test the sensors, refer to [Section 6.2.5—Proximity Sensor Adjustment, Test, or Replacement](#).
18. Install the new Interface Plate to the robot and the Tool Changer Master plate to the interface plate, refer to [Section 3.2—Master Plate Installation and Removal](#).
19. After installation is complete, Tool Changer may be put into normal operation.

3.8 Air Requirements

Proper operation of the locking mechanism requires a constant supply of clean, dry, non-lubricated air, with the following conditions:

- Pressure range of 60 to 100 psi (4.1 - 6.9 bar) Suggested 80 psi
- Filtered minimum: 40 microns
- Flow maximum: 1/3 CFM at 70 psi (4.8 bar), when cycled continuously

To lock or unlock the Tool Changer, a constant supply of compressed air is required. If there is a loss of air pressure in the locked state, the cam profile prevents the master plate and tool plate from unlocking, and the Tool Changer goes into the fail-safe condition.



CAUTION: Do not use the Tool Changer in a fail-safe condition. Damage to the locking mechanism can occur. Re-establish air pressure and ensure the Tool Changer is in a secure lock position before returning to normal operations.

3.8.1 Valve Requirements and Connections

A customer supplied 2-position 4-way or 5-way valve with either 4-port or 5-port configuration must be used to actuate the locking mechanism in the Master plate. It is imperative that when air is supplied to the Lock or Unlock Port on the Master plate, that the opposite port be vented to atmosphere (for example: when air is supplied to the Lock Port, the Unlock Port must be open to the atmosphere.) Failure to vent trapped air or vacuum on the inactive port may inhibit operation of the locking mechanism and prevent coupling or uncoupling.



CAUTION: The locking mechanism will not function properly when connected to a 3-way valve as this type of valve is incapable of venting trapped air or vacuum from within the Tool Changer. This could result in damage to the product, attached tooling, or injury to personnel. Connect the Lock and Unlock supply air to a 2-position 4-way or 5-way valve with either 4-port or 5-port configuration.

Figure 3.12—QC-40, QC-43 and QC-71 Lock and Unlock Pneumatic Connections

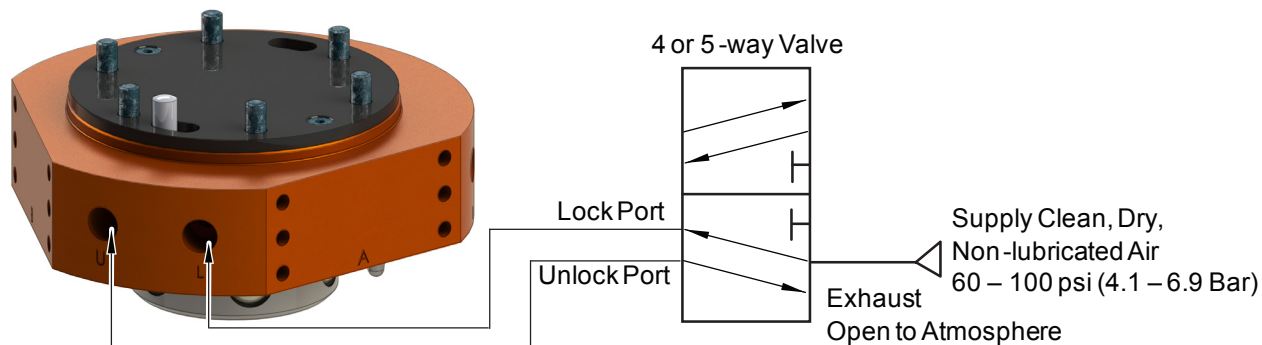


Figure 3.13—QC-41 Lock and Unlock Pneumatic Connections

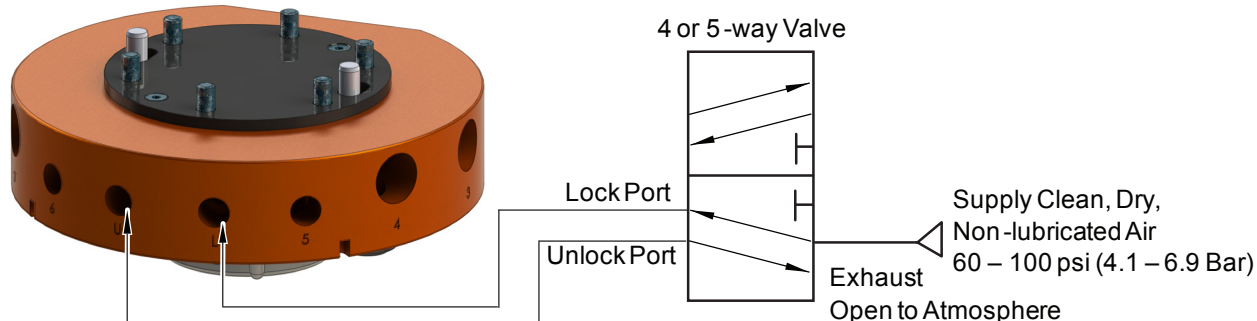


Figure 3.14—QC-60 Lock and Unlock Pneumatic Connections

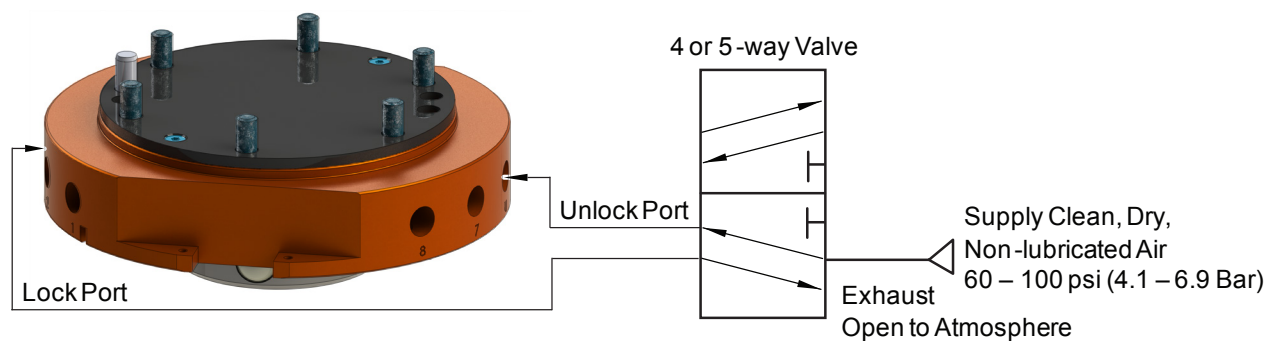
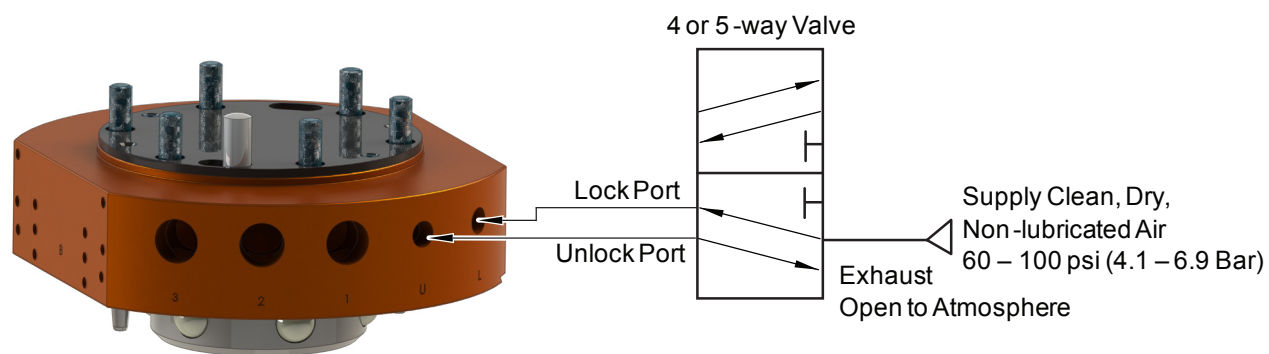


Figure 3.15—QC-100 Lock and Unlock Pneumatic Connections



3.9 Electrical Connections

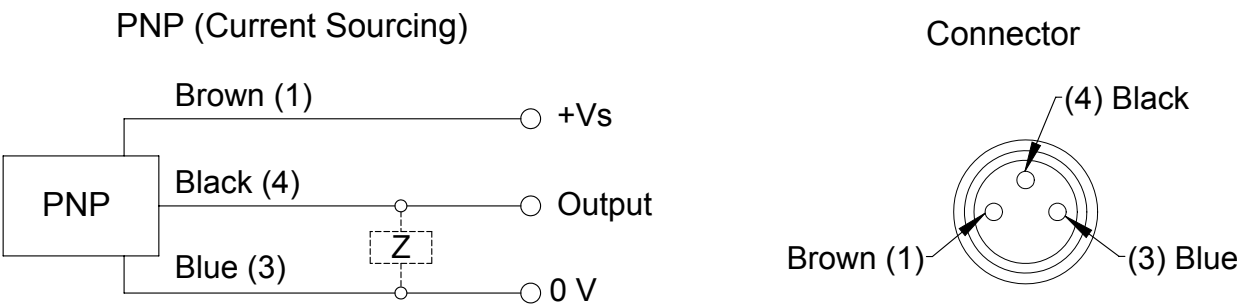
The optional lock and unlock sensors are available in PNP and NPN type.

3.9.1 PNP Type Lock and Unlock Sensors

The PNP lock and unlock sensors are 8 mm cylindrical inductive proximity sensor.

Table 3.2—PNP (Current Sourcing)	
Description	Value
Voltage Supply Range	10-30VDC
Output Current	< 100 mA
Nominal Sensing Distance Sn	0.8 mm
Output Circuit	PNP make function (NO)

Figure 3.16—PNP Type Lock and Unlock Sensors

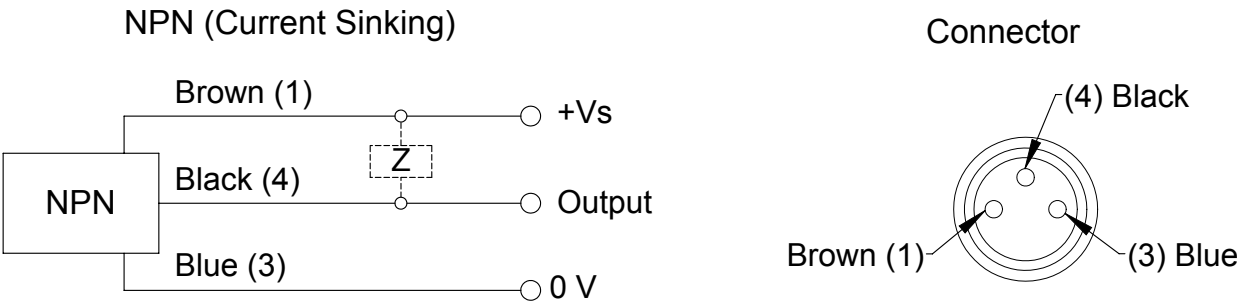


3.9.2 NPN Type Lock and Unlock Sensors

The NPN lock and unlock sensors are 8 mm cylindrical inductive proximity sensor.

Table 3.3—NPN (Current Sinking)	
Description	Value
Voltage Supply Range	10-30VDC
Output Current	< 100 mA
Nominal Sensing Distance Sn	0.8 mm
Output Circuit	NPN make function (NO)

Figure 3.17—NPN Type Lock and Unlock Sensors



4. Operation

The Master locking mechanism is pneumatically driven to couple and uncouple with the bearing race on the Tool plate. The Master plate utilizes air ports to provide lock and unlock pressure to the locking mechanism.



CAUTION: Safe, reliable operation of the Tool Changer is dependent on a continuous supply of compressed air at a pressure of 60 to 100 psi (4.1 - 6.9 Bar). Robot motion should be halted if the air supply pressure drops below 60 psi (4.1 Bar) for any reason.

NOTICE: All Tool Changers are initially lubricated using MobilGrease XHP222 Special grease. The end user must apply additional lubricant to the locking mechanism components and alignment pins prior to start of service (See [Section 5.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins](#)). Tubes of lubricant for this purpose are shipped with every Tool Changer. Note: MobilGrease XHP222 Special is a NLGI #2 lithium complex grease with molybdenum disulfide.

The robot should be programmed to minimize misalignment during coupling and uncoupling. Additionally, the tool stand should be durable and not allow deflection, under uncoupled Tool weight that will take alignment of the Tool Changer plates outside of accepted offsets. See [Figure 4.1](#) and [Table 4.1](#) for recommended maximum allowable offsets prior to coupling. In some cases, greater offsets than shown in [Table 4.1](#) can be accommodated by the Master and Tool plates but will increase wear.

Lock-up should occur with the Master plate in the No-Touch™ locking zone (see [Table 4.1](#)) but not touching the Tool plate. As locking occurs, the Master plate should draw the Tool plate into the locked position.

Figure 4.1—Offset Definitions

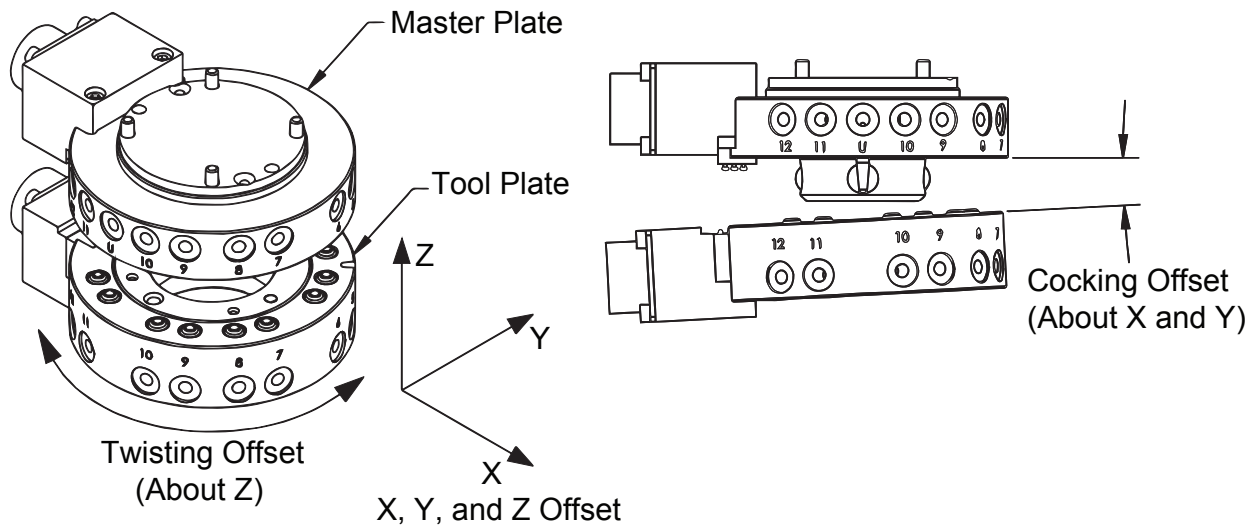


Table 4.1—Maximum Recommended Offsets Prior to Coupling

Model	No-Touch™ Zone Z Offset (Max) ¹ (mm)	X and Y Offset (Max) ² (mm)	Cocking Offset (Max) (degrees)	Twisting Offset (Max) (degrees)
QC-40, QC-41, QC-43	+3	±2	±1.0	±2
QC-60, QC-71	+3	±2	±0.6	±1
QC-100	+3	±2	±0.7	±1

Notes:

1. Maximum values shown. Decreasing actual values will minimize wear during coupling/uncoupling.
2. Actual allowable values may be higher in some cases but higher offsets will increase wear during coupling.

4.1 Coupling Sequence



CAUTION: The locking mechanism must be in the unlock position when attempting to couple the Tool Changer. Failure to adhere to this condition may result in damage to the unit and/or the robot.

1. Position the Master plate above the Tool plate with the air supplied to the Unlock Port (if equipped, the Unlock sensor indicates the Tool Changer is Unlocked).
2. Move the Master plate toward the Tool plate so that the (2) alignment pins enter the alignment holes on the opposite plate. Program the robot so that the Master plate and Tool plate are aligned axially and are parallel to each other (as closely as possible). This will minimize Tool movement and subsequent wear during lock-up.



CAUTION: No-Touch™ locking technology allows the unit to couple with a separation distance between the Master and Tool. Direct contact of the Master and Tool mating surfaces is not suggested or required prior to coupling. Contact may result in damage to the unit and/or the robot.

3. When the (2) faces are within the specified No-Touch™ distance, release the pressure from the Unlock port and supply air to the Lock port. The Tool plate is drawn toward the Master plate and coupled. Air must be maintained on the Lock Port during operation to assure rigid coupling (if equipped, the Lock sensor indicates the Tool Changer is in the Locked position).
4. A sufficient delay must be programmed between locking valve actuation and robot motion so that the locking process is complete before moving the robot.



CAUTION: If air pressure is lost during operation, ATI's patented fail-safe design prevents the Tool plate from being released. Do not use the Tool Changer in a fail-safe condition. Re-establish air pressure and ensure the Tool Changer is in a secure lock position before returning to normal operations.

4.2 Fail-Safe Operation

A fail-safe condition occurs when there is an unintended loss of lock air pressure to the Master plate. When air pressure is lost, the Tool Changer relaxes and there may be a slight separation between the Master and Tool plates. The lock sensor may indicate that the unit is not locked. ATI's patented fail-safe feature utilizes a multi-tapered cam to trap the ball bearings and prevent an unintended release of the Tool plate. Positional accuracy of the tooling is not maintained during this fail-safe condition. Do not operate the Tool Changer in the fail-safe condition. If source air is lost to the unit, movement should be halted until air pressure is restored.

After air pressure is re-established to the Master plate, the locking mechanism will energize and securely lock the Master and Tool plates together. In some cases when the load on the tool changer is significantly off center, it may be necessary to position the load underneath the tool changer or return the tool to the tool storage location to ensure a secure lock condition. If equipped, make sure the lock sensor indicates the Tool Changer is in the locked position before resuming normal operations. Consult your Control/Signal Module Manual for specific error recovery information.



CAUTION: Do not use the Tool Changer in a fail-safe condition. Damage to the locking mechanism could occur. Re-establish air pressure and ensure the Tool Changer is in a secure lock position before returning to normal operations.

4.3 Uncoupling Sequence

1. Position the Tool plate in the tool stand so that there is little or no contact force between the Tool plate and tool stand.
2. Release air on the Lock port and apply air to the Unlock Port (if equipped, the Unlock sensor will indicate the Tool Changer is in the Unlocked position).

NOTICE: The air will cause the locking mechanism to be released and the weight of the Tool plate and attached tooling will assist in its removal. The Tool weight assists in uncoupling if the Tool is released in the vertical position only.

3. A sufficient delay must be programmed between unlocking valve actuation and robot motion, so that the unlocking process is complete and the Tool plate is fully released before moving the robot.
4. Move the Master plate axially away from the Tool plate.
5. In automated Tool change applications, it is recommended that a Tool presence sensor(s) be used in the tool stand to verify that the Tool is present and that the Tool remains in place as the robot moves away after the unlocking process.

4.4 Tool Identification

When using multiple Tools, it is good practice to implement a Tool-ID system that identifies each Tool with a unique code. Tool-ID can be used to verify that the robot has picked up the proper Tool. Modules with Tool-ID are available for purchase through the ATI website. Go to http://www.ati-ia.com/products/toolchanger/tool_changer_modules.aspx for products available or contact ATI for assistance.

4.5 Tool Storage Considerations

NOTICE: Tool stand design is critical to the operation of the Tool Changer. Improperly designed tool stands can cause jamming and excessive wear of the Tool Changer components.

Tool plates with customer tooling attached may be stored in a tool stand. ATI provides compatible tool stands designed for durability, longevity, and maximum adaptability to fit most customers' applications. The ATI Tool Stand Medium (TSM) system is compatible with ATI Tool Changer sizes QC-50 to QC-110. The TSM systems can be configured in a variety of arrangements and are available with additional modular accessories such as covers and tool sensing. For products available, contact an ATI representative or refer to the following ATI webpage: <https://www.ati-ia.com/products/toolchanger/toolstand/medium/MediumStand.aspx>. Another resource is the *ATI TSM manual*: https://www.ati-ia.com/App_Content/Documents/9610-20-1114.pdf.

For some Tool Changers, ATI can provide a Teaching Aid to assist users with teaching the robot how to couple the Master with the Tool in a tool stand. For more information, refer to the *ATI Teaching Aid manual* or the ATI webpage for Teaching Aids: <https://www.ati-ia.com/products/toolchanger/TeachingAid.aspx>.

If the customer supplies the tool stand, the tool stand should include the following design considerations:

- Provide a fixed, repeatable, level, and stable position for tool pick-up and drop-off.
- Support the weight of the Tool Changer Tool plate, tool interface plate, optional modules, cables, hoses, and customer tooling without allowing deflection in excess of the offsets specified.
- (Preferred) the Tool should hang vertically in the tool stand so that gravity assists to uncouple the Tool plate from the Master plate during unlocking.
- It is possible to design tool stands that hold tools in the horizontal position, but the necessary compliance must be provided during coupling and uncoupling. In general, horizontally positioned tool stands cause more wear on the locking mechanism and locating features of the Tool Changer and tool stand. Furthermore, horizontal pick-up and drop-off of the Tool plate increases wear on the robot arm.
- A variety of methods may be used to position the Tool in the tool stand. A common method is to use tapered alignment pins and bushings. Robot programming and positional repeatability are critical aspects of successful Tool pick-up and drop-off.
- Install a debris shield to cover Tools and modules to protect them in dirty environments, such as grinding or welding. Alternatively, position tool stands in areas that are shielded from weld spatter, fluids, adhesives, or other debris.
- For proximity sensors, consider the following:
 - Install a proximity sensor that detects the presence of the Tool in the tool stand. The sensor may be used prior to coupling to ensure the Tool is seated in the stand. Sensors may also be used as the robot starts to move away after uncoupling. Sensors provide a safety measure if a Tool becomes jammed in the stand or if the Tool fails to release from the robot.
 - Position the proximity sensor so that the sensing face is vertical to prevent metal shavings, weld spatter, or other debris from falling on the sensor and creating false readings.

5. Maintenance



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 entire EOAT, the Master, the Tool and all of the modules may be necessary. Protective measures include the following:

- Placement of tool stands away from debris generators
- Covers incorporated into the tool stands
- Guards, deflectors, air curtains, and similar devices built into the EOAT and the tool stand

5.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule is provided in table below. Detailed assembly drawings are provided in [Section 9—Drawings](#) of this manual. Refer to module sections for detailed preventive maintenance steps for all utility modules.

Table 5.1—Preventive Maintenance Check List

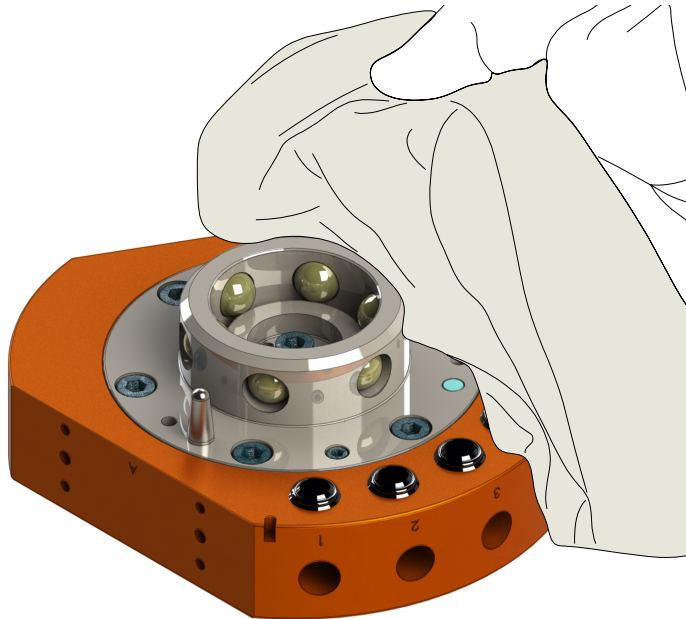
Application(s)	Tool Change Frequency	Inspection Schedule
General Usage Material Handling Docking Station	> 1 per minute	Weekly
	< 1 per minute	Monthly
Welding/Servo/Deburring, Foundry Operations (Dirty Environments)	All	Weekly
Checklist		
Mounting Fasteners/Interface Connections		
<input type="checkbox"/> Inspect fasteners for proper torque, interferences, and wear. Tighten and correct as required. Refer to Section 3—Installation .		
Balls/Alignment Pins/Holes/Bearing Race		
<input type="checkbox"/> Inspect for lubrication and wear. MobilGrease XHP222 Special grease is suggested for locking mechanism and alignment pin lubrication. 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 5.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins .		
<input type="checkbox"/> Inspect for excessive alignment pin/bushing wear may be an indication of poor robot position during pickup/drop-off. Adjust robot position as needed. Check tool stand for wear and alignment problems. The QC-100 model has replaceable alignment pins, refer to Section 6.2.4—QC-100 Alignment Pin Replacement		
<input type="checkbox"/> Inspect for wear on the ball bearings/bearing race, may be an indication of the excessive loading.		
Sensors and Cables		
<input type="checkbox"/> Inspect sensor cable connectors for tightness, if loose tighten connections.		
<input type="checkbox"/> Inspect sensor cables for any damage, cuts, and abrasion. Replace as necessary.		
Hoses		
<input type="checkbox"/> Inspect hose connection for tightness and leaks. If the leaking or loose secure hose connection.		
<input type="checkbox"/> Inspect hoses for interferences, abrasions, cuts, and leaks. Replace as required.		
Seals		
<input type="checkbox"/> Inspect for wear, abrasion, and cuts. Refer to Section 6.2—Service Procedures .		
Electrical Contacts/Pin Block (Optional Modules)		
<input type="checkbox"/> Inspect for damage, debris, and stuck/burnt pins. Clean pin blocks as required. Refer to Section 5.3—Electrical Module Pin Block Inspection and Cleaning .		

5.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

Supplies required: Clean rag, MobilGrease XHP222 Special is a NLGI #2 lithium complex grease with molybdenum disulfide

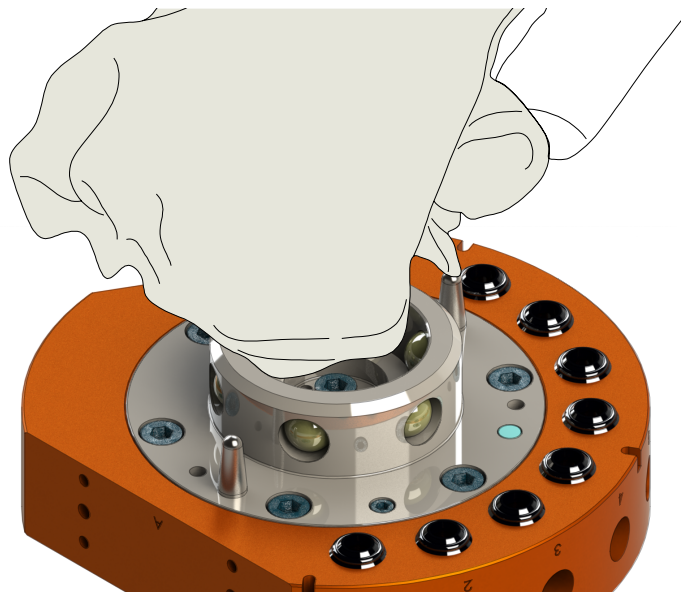
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam, and alignment pins.

Figure 5.1—Cleaning Ball Bearings and Outer Surfaces of Male Coupling



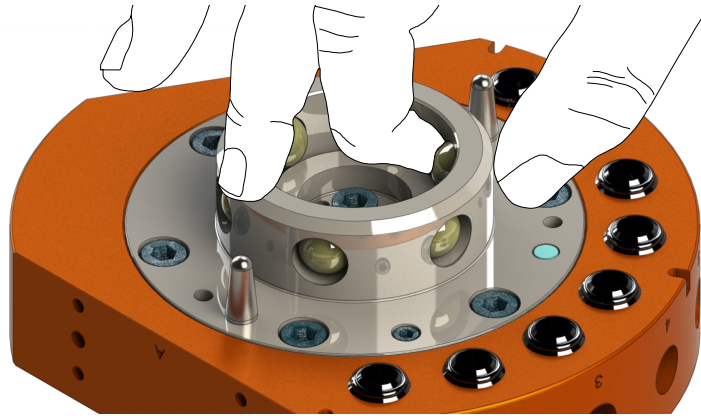
5. Use a clean rag to thoroughly remove any lubricant and debris from the inner surface of the male coupling and cam.

Figure 5.2—Cleaning Ball Bearings, Cam and Inner Surfaces of Male Coupling



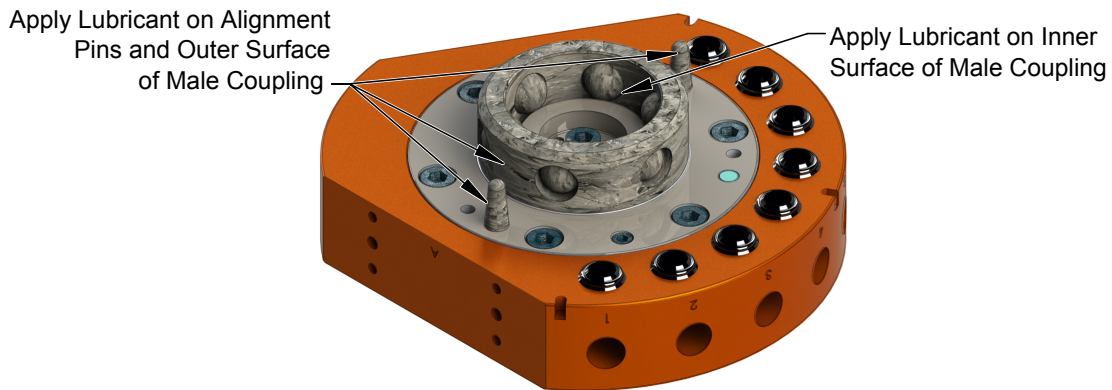
6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 5.3—Check Ball Bearing Movement



7. Apply a liberal coating of lubricant to the ball bearings, the male coupling (inside and out), and the alignment pins.

Figure 5.4—Apply Lubricant to Locking Mechanism

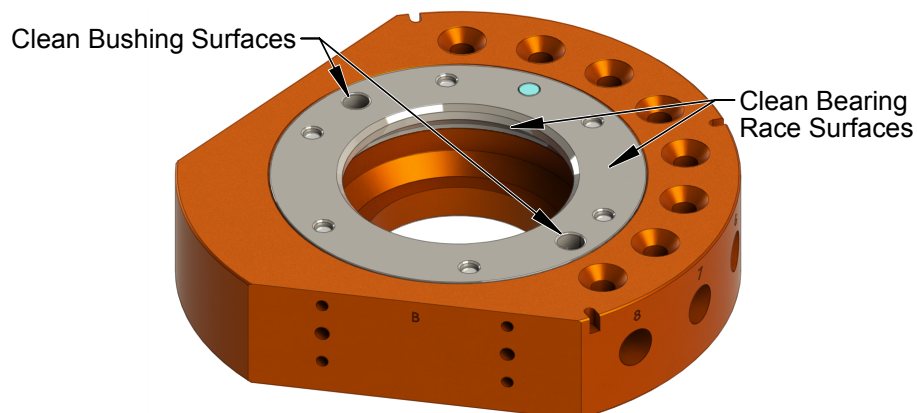


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

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

9. Safely resume normal operation.

Figure 5.5—Clean Tool Plate Surfaces of Locking Mechanism

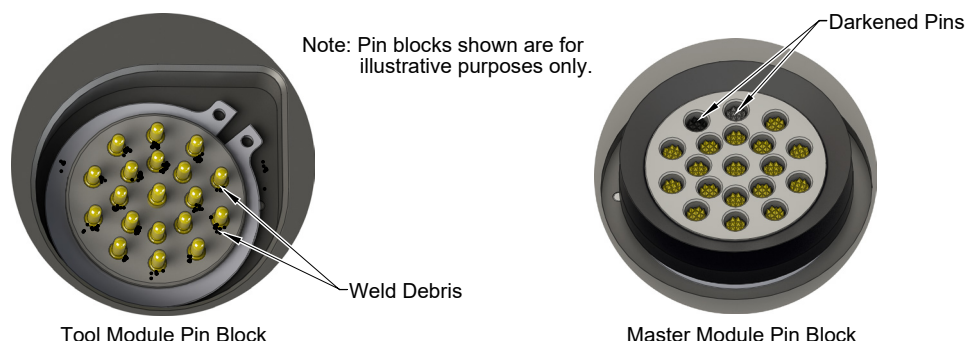


5.3 Electrical Module Pin Block Inspection and Cleaning

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.

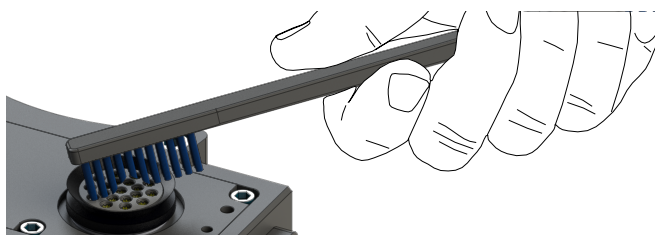
Figure 5.6—Inspect Master and Tool Pin Blocks



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).

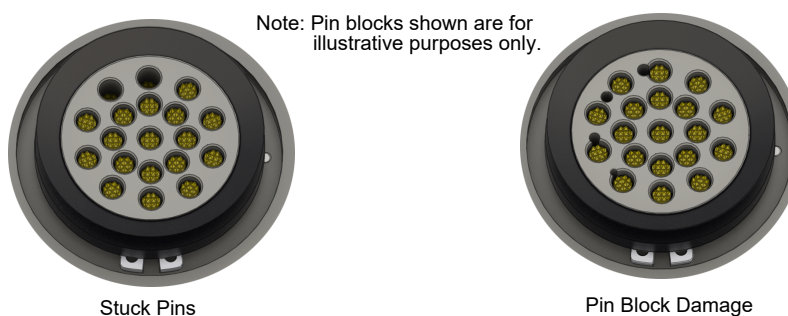
NOTICE: Do not use an abrasive media and/or cleaners or solvents to clean the contact pins. Using abrasive media and/or cleaners or solvents will cause damage to the contact surface or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI part number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

Figure 5.7—Clean Pin Blocks with a Nylon Brush



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

Figure 5.8—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.

6. Troubleshooting and Service Procedures

The following section provides troubleshooting information to help diagnose conditions with the Tool Changer and service procedures to help resolve these conditions.



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.

6.1 Troubleshooting

The troubleshooting table is provided to assist in diagnosing issues that may cause the Tool Changer not to function properly.

Table 6.1—Troubleshooting		
Symptom	Cause	Resolution
Tool Changer will not lock and/or unlock (or Lock sensor does not indicate Tool Changer is Locked)	Debris caught between the Master and Tool plates.	Clean debris from between Master and Tool plates. Verify mounting fasteners is secure and does not protrude above the mating surfaces.
	Insufficient or no air pressure supply to the lock or unlock ports.	Verify proper air pressure and pneumatic valve is supplied. Refer to Section 3.8—Air Requirements .
	Air pressure trapped in de-energized Lock or Unlock ports.	Air pressure must be vented to the atmosphere properly, refer to Section 3.8—Air Requirements .
	Pneumatic connections loose or damaged.	Inspect hose connection for tightness and leaks. If leaking or loose secure hose connection. Inspect hoses for interferences, abrasions, cuts, and leaks. Replace as required.
	The ball bearings and/or cam are not moving freely in the male coupling.	Clean and lubricate as needed to restore smooth operation (see Section 5.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins).
	The Master plate and Tool plate are not within the specified No-Touch zone when attempting to lock.	Check that the Tool is properly seated in the tool stand. Refer to Section 4.5—Tool Storage Considerations . Re-teach the robot to bring the Master plate and Tool plate closer together prior to attempting to lock.
Unit is locked but Lock signal does not read “on” (true).	Lock sensor/cable is out of adjustment or damaged.	Adjust or replace the lock sensor assembly as necessary. Refer to Section 6.2.5—Proximity Sensor Adjustment, Test, or Replacement .
Unit is unlocked but Unlock signal does not read “on” (true).	Unlock sensor/cable is out of adjustment or damaged.	Adjust or replace the unlock sensor assembly as necessary. Refer to Section 6.2.5—Proximity Sensor Adjustment, Test, or Replacement .
Units Equipped with Electrical/Servo/Control/Signal Modules		
Loss of Communication	Debris in and around contact pins. Contact Pin worn or damaged.	Inspect V-ring seal for damage, replace damaged seal. Refer to Section 6.2.3—Electrical Module Seal Inspection and Replacement
	Cable connections loose or cables damaged	Check that cable connection are secure and cables are not damaged.

6.2 Service Procedures

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

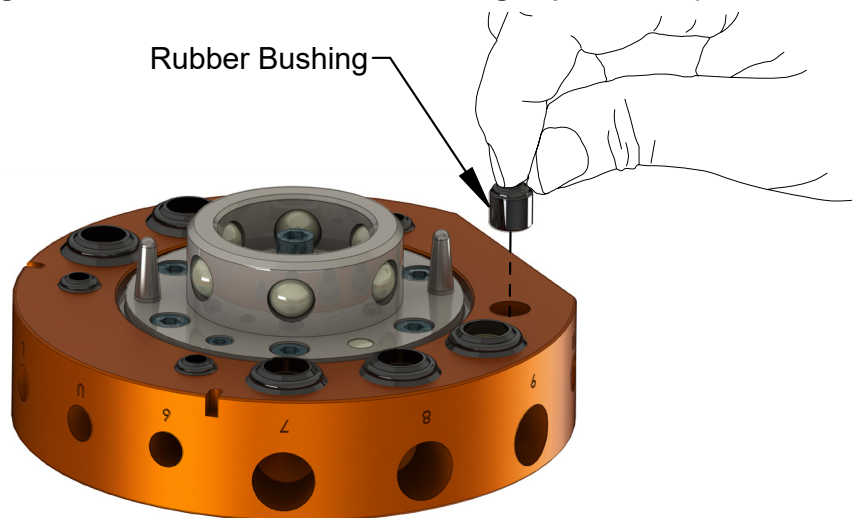
6.2.1 1/8" and 1/4" Rubber Bushing Inspection & Replacement

The rubber bushings seal the air passage from the Master plate to the Tool plate. If the bushing become cut or damaged they need to be replaced.

Parts required: Refer to [Section 8—Serviceable Parts](#)

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 damaged rubber bushing by grasping with fingers and pulling the bushing out of the body.
5. Dip new bushing in water to aid in installation.
6. Insert the beveled (chamfered) end of the rubber bushing into the bore, leaving ribbed end of the bushing facing outward.
7. Press the bushing in by hand until it is seated completely in the bore. If necessary, use a plastic or rubber soft-faced mallet to tap the bushings into place.
8. Safely resume normal operation.

Figure 6.1 —1/8" and 1/4" Rubber Bushing Replacement (QC-41 Shown)



6.2.2 3/8" Rubber Bushing Replacement

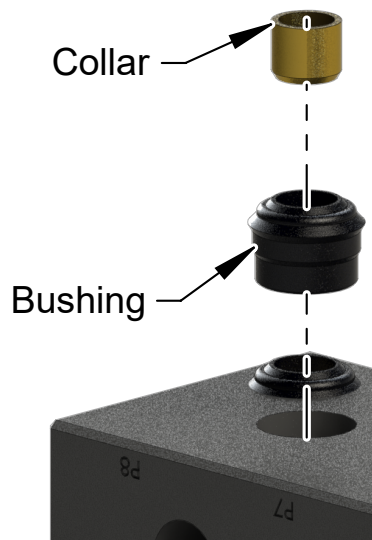
Tools required: Needle-nose pliers

Supplies required: P80 lubricant

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

9. Place the Tool in a secure location.
10. Uncouple the Master and Tool plates.
11. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
12. Remove the bushing and collar.
 - c. Use needle-nose pliers to remove the bushing from the module housing.
 - d. If the collar remains in the module housing or inside the bushing, remove the collar.
13. 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.
14. Safely resume normal operation.

Figure 6.2 —Replacing the Bushing and Collar

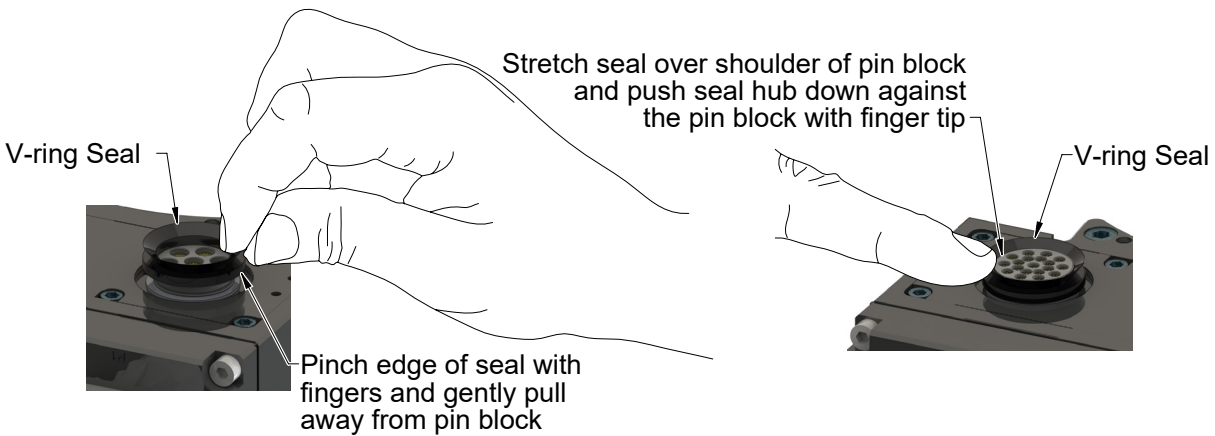


6.2.3 Electrical Module Seal Inspection and Replacement

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 6.3—V-ring Seal Replacement



6.2.4 QC-100 Alignment Pin Replacement

Excessive alignment pin/bushing wear may be an indication of poor robot position during pickup/drop-off. Adjust robot position as needed. Check tool stand for wear and alignment problems. If necessary replace the alignment pins.

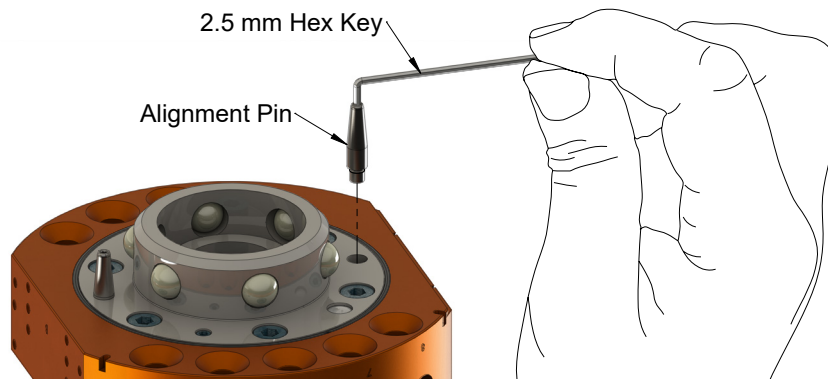
Tools required: 2.5 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 242 MobilGrease XHP222 Special is a NLGI #2 lithium complex grease with molybdenum disulfide

Parts required: Refer to [Section 8.6—Models QC-100 Serviceable Parts](#)

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 grease from the alignment pin using a clean rag.
5. Using a 2.5 mm hex key remove the alignment pin and discard
6. Apply Loctite 242 to the threads of the new alignment pin and thread into the Master plate assembly. Tighten to 18 in-lbs (2.0 Nm).
7. Apply a liberal coating of MobilGrease XHP222 Special grease to the alignment pins.
8. Safely resume normal operation.

Figure 6.4—QC-100 Alignment Pin Replacement



6.2.5 Proximity Sensor Adjustment, Test, or Replacement

The proximity sensors should not require frequent replacement. Should malfunctions occur, evaluate all other possible solutions before testing or replacing the sensor. Check continuity, air supply, lubrication, and pneumatic components.

Refer to [Figure 6.5](#).

Tools required: 2.5 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 222

Parts required: Refer to [Section 8—Serviceable Parts](#) for sensors and cables for specific model being repaired

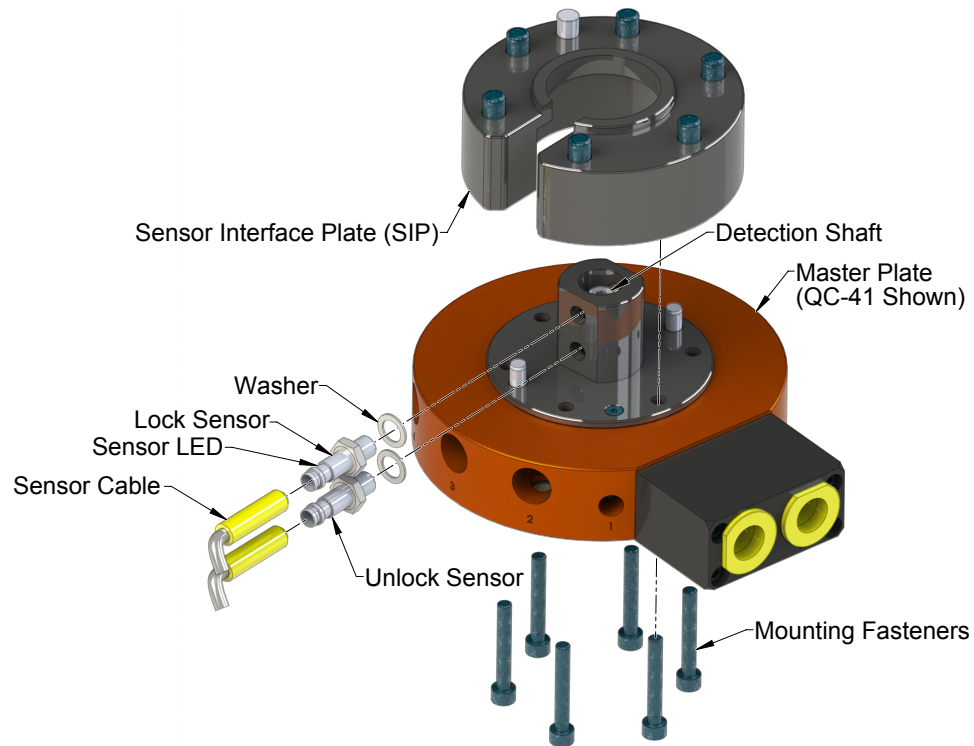
1. Place the Tool in a secure location.
2. Check the sensor cables for damage. If cable is damaged replace.
3. If you are testing the Lock sensor make sure the QC is in the locked position, if you are testing the Unlock sensor make sure the QC is in the unlocked position. Check to see the signal is ON and the sensor LED is illuminated for the sensor being tested. If sensor are not functioning replace.
4. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
5. Disconnect any cables, air line, etc. if required.
6. Remove the mounting fasteners securing the Master plate assembly to the sensor interface plate.
7. Disconnect the sensor cable.
8. Loosen the hex nut and unscrew the proximity sensor from the Master plate assembly.
9. On the new sensor, back the hex nut to the connector end of the sensor.
10. Thread the proximity sensor into the Master plate assembly until it touches the detection shaft, then back the sensor off 1/2 turn.



CAUTION: Do not operate locking mechanism with sensor touching the detection shaft. Operating the locking mechanism with the sensor touching the detection shaft will damage the sensor. Back off the sensor 1/2 turn and secure with the hex nut before operating the locking mechanism.

11. Holding the sensor in position apply Loctite 222 to the proximity sensor threads between the hex nut and the Master plate assembly. Tighten the hex nut and torque to 20 in-lbs (2.3 Nm).
12. Connect the sensor cable. When power is turned on to the sensor the LED should be illuminated and the sensor signal should be ON.
13. Attach the Master plate to the sensor interface plate using the mounting fasteners. Refer to [Table 3.1](#) for torque and thread locker specifications.
14. If required, connect other utilities to the optional modules on the Master plate.
15. Confirm the operation of the replaced sensor by providing Lock or Unlock air to the Tool Changer and checking to see corresponding sensor signal is ON and the sensor LED is illuminated.
16. Safely resume normal operation.

Figure 6.5—Replace Proximity Sensor



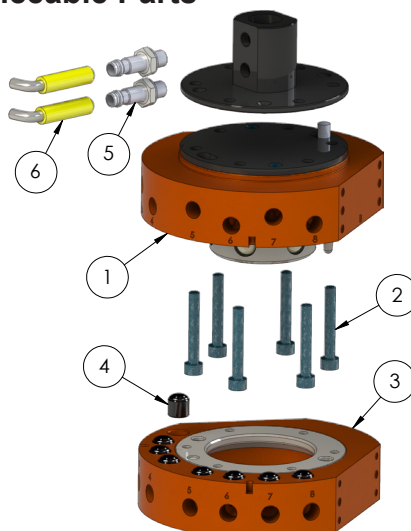
7. Specifications

Table 7.1—Tool Changer Specifications						
Specification	Tool Changer Model					
	QC-40	QC-41	QC-43	QC-60	QC-71	QC-100
Recommended Max Payload	110 lbs. (50 kg)	110 lbs. (50 kg)	110 lbs. (50 kg)	160 lbs. (75 kg)	180 lbs. (79 kg)	330 lbs. (150 kg)
Operating Temperature Range	-20–150°F (-30–66°C)	-20–150°F (-30–66°C)	-20–150°F (-30–66°C)	-20–150°F (-30–66°C)	-20–150°F (-30–66°C)	-20–150°F (-30–66°C)
Operating Pressure Range (filtered to 50 micron or better)	60–100 psi (4.1–6.9 bar)	60–100 psi (4.1–6.9 bar)	60–100 psi (4.1–6.9 bar)	60–100 psi (4.1–6.9 bar)	60–100 psi (4.1–6.9 bar)	60–100 psi (4.1–6.9 bar)
Coupling Force @ 80 psi	1000 lbs (4500 N)	1000 lbs (4500 N)	1000 lbs (4500 N)	1700 lbs (7400 N)	1800 lbs (8100 N)	2700 lbs (12000 N)
Recommended Max Moment X-Y (Mxy)	1390 lbf-in (157 Nm)	1390 lbf-in (157 Nm)	1390 lbf-in (157 Nm)	1740 lbf-in (197 Nm)	3500 lbf-in (395 Nm)	6940 lbf-in (784 Nm)
Recommended Max Torque about Z (Mz)	1910 in-lbs (216 Nm)	1910 in-lbs (216 Nm)	1910 in-lbs (216 Nm)	2600 in-lbs (294 Nm)	3500 in-lbs (395 Nm)	6940 lbf-in (784 Nm)
Positional Repeatability	0.0006" (0.0152 mm)	0.0006" (0.0152 mm)	0.0006" (0.0152 mm)	0.0006" (0.0152 mm)	0.0006" (0.0152 mm)	0.0006" (0.0152 mm)
Weight (coupled, no access.)	3.75 lbs. (1.7 kg)	4.7 lbs. (2.13 kg)	3.75 lbs. (1.7 kg)	4.4 lbs. (2.0 kg)	6.3 lbs. (2.86 kg)	11.6 lbs. (5.28 kg)
Master Weight	2.45 lbs. (1.11 kg)	3.0 lbs. (1.36 kg)	2.45 lbs. (1.11 kg)	2.9 lbs. (1.32 kg)	4.0 lbs. (1.81 kg)	7.35 lbs. (3.33 kg)
Tool Weight	1.3 lbs. (0.59 kg)	1.7 lbs. (0.771 kg)	1.3 lbs. (0.59 kg)	1.5 lbs. (0.68 kg)	2.3 lbs. (1.04 kg)	4.3 lbs. (1.95 kg)
Max. Recommended distance between Master and Tool plate	0.12" (3.05 mm)	0.12" (3.05 mm)	0.12" (3.05 mm)	0.12" (3.05 mm)	0.12" (3.05 mm)	0.28" (7.11 mm)
Pass through Port, (Qty) Connection Size Max Pressure of 100psi (6.9bar)	(8) 1/8 NPT or (8) Rc 1/8 BSPT or (8) G 1/8 BSPP	(6) 3/8 NPT & (4) 1/8 NPT or (6) G 3/8 BSPP & (4) G 1/8 BSPP	(8) 1/8 NPT or (8) G 1/8 BSPP	(8) 1/8 NPT or (8) Rc 1/8 BSPT or (8) G 1/8 BSPP	(8) 1/4 NPT or (8) G 1/4 BSPP	(8) 3/8 NPT or (8) G 3/8 BSPP
Pneumatic Lock and Unlock Port Connection size	1/8 NPT or Rc 1/8 BSPT or G 1/8 BSPP	1/8 NPT or G 1/8 BSPP	1/8 NPT or G 1/8 BSPP	1/8 NPT or Rc 1/8 BSPT or G 1/8 BSPP	1/8 NPT or G 1/8 BSPP	3/8 NPT or G 3/8 BSPP
Mounting/ Customer Interface	Refer to Section 9—Drawings					

8. Serviceable Parts

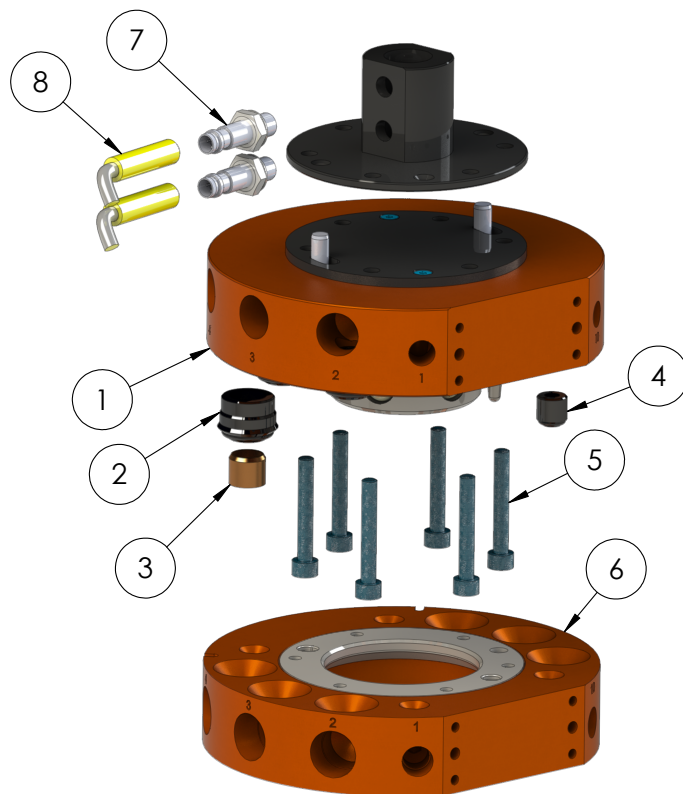
The following items are commonly used as spare parts for the QC-40 through QC-100 Tool Changers.

8.1 Models QC-40 Serviceable Parts



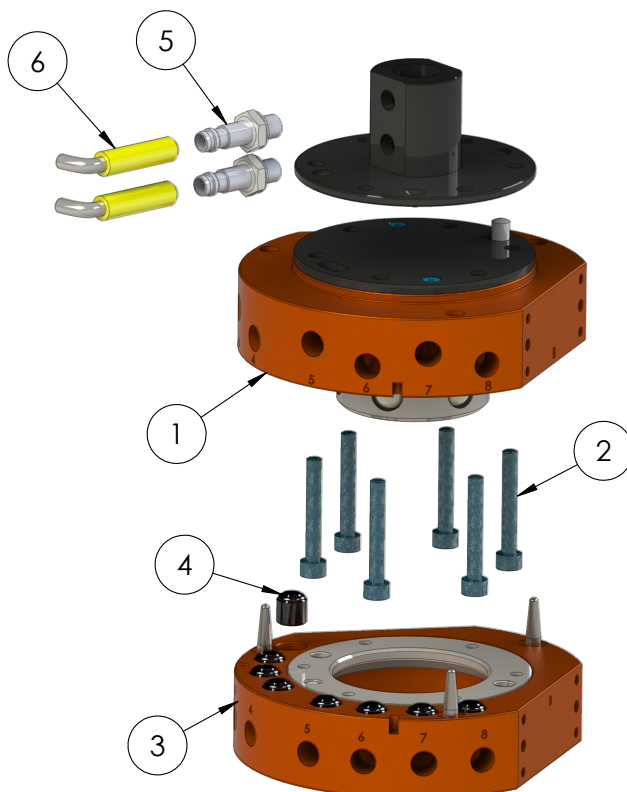
QC-40 Master Plate			
Item No.	Qty	Part Number	Description
1	1	9120-040M-000-000	QC-40 Master, no options (Orange Anodized)
		9120-040M-000-000-E	QC-40 Euro Master, no options (Black Anodized)
		9120-040M-000-000-R	QC-40 R Ported Master, no options (Orange Anodized)
		9120-040M-000-000-B	QC-40 Master, no options (Black Anodized)
2	6	3500-1064035-12	Socket Head Cap Screw, M5x35, ZN
QC-40 Tool Plate			
3	1	9120-040T-000-000	QC-40 Tool, no options (Orange Anodized)
		9120-040T-000-000-E	QC-40 Euro Tool, no options (Black Anodized)
		9120-040T-000-000-R	QC-40 R Ported Tool, no options (Orange Anodized)
		9120-040T-000-000-B	QC-40 Tool, no options (Black Anodized)
4	8	4010-0000013-01	1/8" NPT Rubber Bushing, Nitrile
QC-40 SIP Assemblies			
PNP Sensors - 9120-040M-SIP-D-yyyy and 9120-040M-SIP-G-yyyy			
5	2	8590-9909999-08	PNP Prox Switch
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
NPN Sensors - 9120-040M-SIP-E-yyyy and 9120-040M-SIP-F-yyyy			
5	2	8590-9909999-14	NPN Proximity Sensor w/ LED
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
Notes:			
1. Sensor cables for 9120-040M-SIP-D-yyyy and 9120-040M-SIP-F-yyyy models.			
2. The -yyyy specifies the Interface plate model, contact ATI sales representative for custom interface plate available.			

8.2 Models QC-41 Serviceable Parts



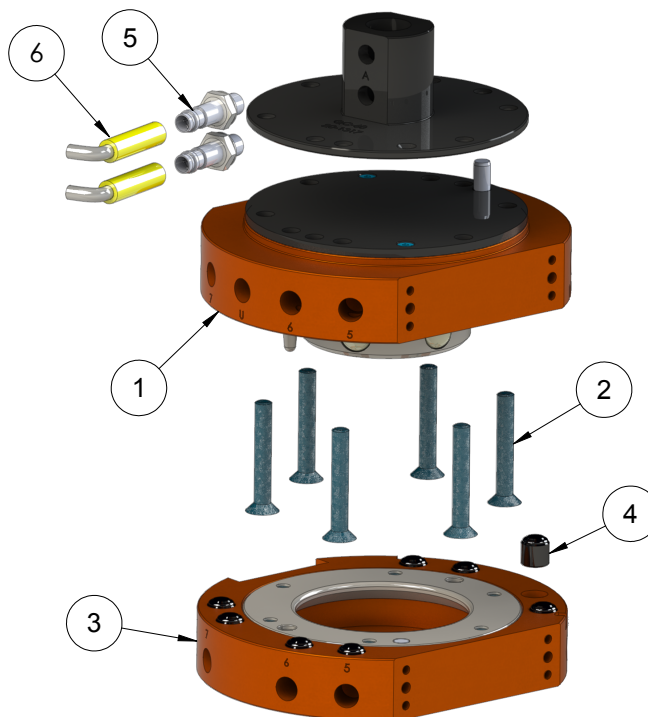
QC-41 Master Plate			
Item No.	Qty	Part Number	Description
1	1	9120-041M-000-000	QC-41 Master Assembly, No Options (Orange Anodized)
		9120-041M-000-000-E	QC-41 Euro Master Assembly, No Options (Black Anodized)
		9120-041M-000-000-B	QC-41 Master Assembly, No Options (Black Anodized)
2	6	4010-0000010-01	3/8" Rubber Bushing, Nitrile
3	6	3700-20-2000	Collar for 3/8" Bushing
4	4	4010-0000013-01	1/8" NPT Rubber Bushing, Nitrile
5	6	3500-1064035-12	M5 x 35 mm socket head cap screws Zinc
QC-41 Tool Plate			
6	1	9120-041T-000-000	QC-41 Tool Assembly, No Options (Orange Anodized)
		9120-041T-000-000-E	QC-41 Euro Tool Assembly, No Options (Black Anodized)
		9120-041T-000-000-B	QC-41 Tool Assembly, No Options (Black Anodized)
QC-41 SIP Assemblies			
PNP Sensors - 9120-041M-SIP-D-yyyy and 9120-041M-SIP-G-yyyy			
7	2	8590-9909999-08	PNP Prox Switch
8 ¹	2	8590-9909999-12	Straight Picofast Cordset, 2 Meter
NPN Sensors - 9120-041M-SIP-E-yyyy and 9120-041M-SIP-F-yyyy			
7	2	8590-9909999-14	NPN Proximity Sensor w/ LED
8 ¹	2	8590-9909999-12	Straight Picofast Cordset, 2 Meter
Notes:			
1. Sensor cables for 9120-041M-SIP-D-yyyy and 9120-041M-SIP-F-yyyy models.			
2. The -yyyy specifies the Interface plate model, contact ATI sales representative for custom interface plate available.			

8.3 Models QC-43 Serviceable Parts



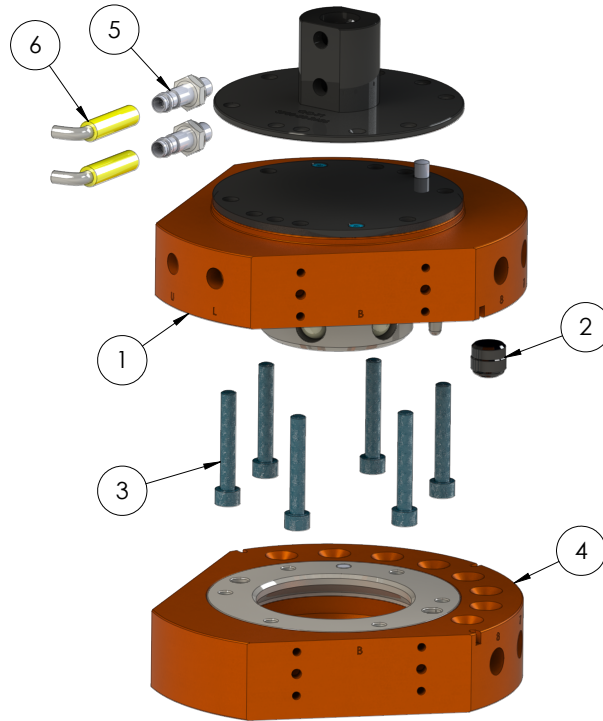
QC-43 Master Plate			
Item No.	Qty	Part Number	Description
1	1	9120-043M-000-000	QC-43 Master, no options (Orange Anodized)
		9120-043M-000-000-E	QC-43 Euro Master, no options (Black Anodized)
2	6	3500-1064035-15	M5 x 35 mm socket head cap screws, Blue Dyed Magni
QC-43 Tool Plate			
3	1	9120-043T-000-000	QC-43 Tool, no options (Orange Anodized)
		9120-043T-000-000-E	QC-43 Euro Tool, no options (Black Anodized)
4	8	4010-0000013-01	1/8" NPT Rubber Bushing, Nitrile
QC-43 SIP Assemblies (uses the QC-40 SIP Assemblies)			
PNP Sensors - 9120-040M-SIP-D-yyyy and 9120-040M-SIP-G-yyyy			
5	2	8590-9909999-08	PNP Prox Switch
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
NPN Sensors - 9120-040M-SIP-E-yyyy and 9120-040M-SIP-F-yyyy			
5	2	8590-9909999-14	NPN Proximity Sensor w/ LED
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
Notes:			
1. Sensor cables for 9120-040M-SIP-D-yyyy and 9120-040M-SIP-F-yyyy models.			
2. The -yyyy specifies the Interface plate model, contact ATI sales representative for custom interface plate available.			

8.4 Models QC-60 Serviceable Parts



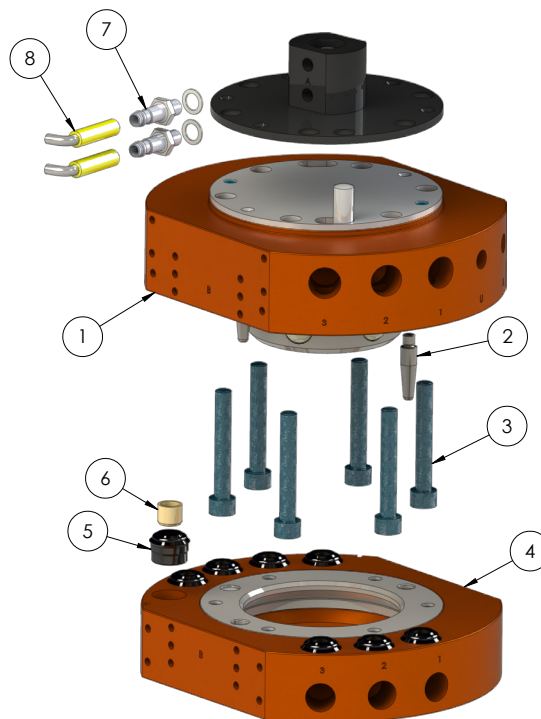
QC-60 Master Plate			
Item No.	Qty	Part Number	Description
1	1	9120-060M-000-000	QC-60 Master, no options (Orange Anodized)
		9120-060M-000-000-E	QC-60 Euro Master, no options (Black Anodized)
		9120-060M-000-000-R	QC-60 R Ported Master, no options (Orange Anodized)
		9120-060M-000-000-B	QC-60 Master, no options (Black Anodized)
2	6	3500-1266040-15	M6 x 40 mm Flat Head Socket Cap Screw, Blue Dyed Magni-565
QC-60 Tool Plate			
3	1	9120-060T-000-000	QC-60 Tool, no options (Orange Anodized)
		9120-060T-000-000-E	QC-60 Euro Tool, no options (Black Anodized)
		9120-060T-000-000-R	QC-60 R Ported Tool, no options (Orange Anodized)
		9120-060T-000-000-B	QC-60 Tool, no options (Black Anodized)
4	8	4010-0000013-01	1/8" NPT Rubber Bushing, Nitrile
QC-60 SIP Assemblies			
PNP Sensors - 9120-060M-SIP-D-yyyy and 9120-060M-SIP-G-yyyy			
5	2	8590-9909999-08	PNP Prox Switch
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
NPN Sensors - 9120-060M-SIP-A-yyyy			
5	2	8590-9909999-02	NPN Prox Switch Hardwired
NPN Sensors - 9120-060M-SIP-E-yyyy and 9120-060M-SIP-F-yyyy			
5	2	8590-9909999-14	NPN Proximity Sensor w/ LED
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
Notes:			
1. Sensor cables for 9120-060M-SIP-D-yyyy and 9120-060M-SIP-F-yyyy models.			
2. The -yyyy specifies the Interface plate model, contact ATI sales representative for custom interface plate available.			

8.5 Models QC-71 Serviceable Parts



QC-71 Master Plate			
Item No.	Qty	Part Number	Description
1	1	9120-071M-000-000	QC-71 Master Assembly, No Options (Orange Anodized)
		9120-071M-000-000-E	QC-71 Euro Master Assembly, No Options (Black Anodized)
2	6	4010-0000021-01	1/4" NPT Rubber Bushing, Nitrile
3	6	3500-1066040-12	M6 x 40 mm socket head cap screws Zinc
QC-71 Tool Plate			
4	1	9120-071T-000-000	QC-71 Tool Assembly, No Options (Orange Anodized)
		9120-071T-000-000-E	QC-71 Euro Tool Assembly, No Options (Black Anodized)
QC-71 SIP Assemblies			
PNP Sensors - 9120-071M-SIP-D-yyyy and 9120-071M-SIP-G-yyyy			
5	2	8590-9909999-08	PNP Prox Switch
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
NPN Sensors - 9120-071M-SIP-E-yyyy			
5	2	8590-9909999-14	NPN Proximity Sensor w/ LED
NPN Sensors - 9120-071M-SIP-F-yyyy			
5	2	8590-9909999-09	NPN Prox Switch
6 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
Notes:			
1. Sensor cables for 9120-071M-SIP-D-yyyy and 9120-071M-SIP-F-yyyy models.			
2. The -yyyy specifies the Interface plate model, contact ATI sales representative for custom interface plate available.			

8.6 Models QC-100 Serviceable Parts



QC-100 Master Plate			
Item No.	Qty	Part Number	Description
1	1	9120-100M-000-000	QC-100 Master, no options (Orange Anodized)
		9120-100M-000-000-E	QC-100 Euro Master, no options (Black Anodized)
2	2	3700-20-1373	Monolithic Alignment Pin, QC-100, A2
3	6	3500-1068055-15	M8 x 55 mm socket head cap screws, Blue Dyed Magni-565
QC-100 Tool plate			
4	1	9120-100T-000-000	QC-100 Tool, no options (Orange Anodized)
		9120-100T-000-000-E	QC-100 Euro Tool, no options (Black Anodized)
5	8	4010-0000010-01	3/8" Rubber Bushing. Nitrile
6	8	3700-20-2000	Collar for 3/8" Bushing
QC-100 SIP Assemblies			
PNP Sensors - 9120-100M-SIP-D-yyyy and 9120-100M-SIP-G-yyyy			
7	2	8590-9909999-08	PNP Prox Switch
8 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
NPN Sensors - 9120-100M-SIP-F-yyyy			
7	2	8590-9909999-14	NPN Proximity Sensor w/ LED
8 ¹	2	8590-9909999-07	High-flex cable w/ straight snap-on connector, 5M long flying leads (Type-BU)
Notes:			
1. Sensor cable for 9120-100M-SIP-D-yyyy and 9120-100M-SIP-F-yyyy modelss.			
2. The -yyyy specifies the Interface plate model, contact ATI sales representative for custom interface plate available.			

9. Drawings

Drawings are available on the [ATI website](http://www.ati-ia.com) or by contacting an ATI representative.