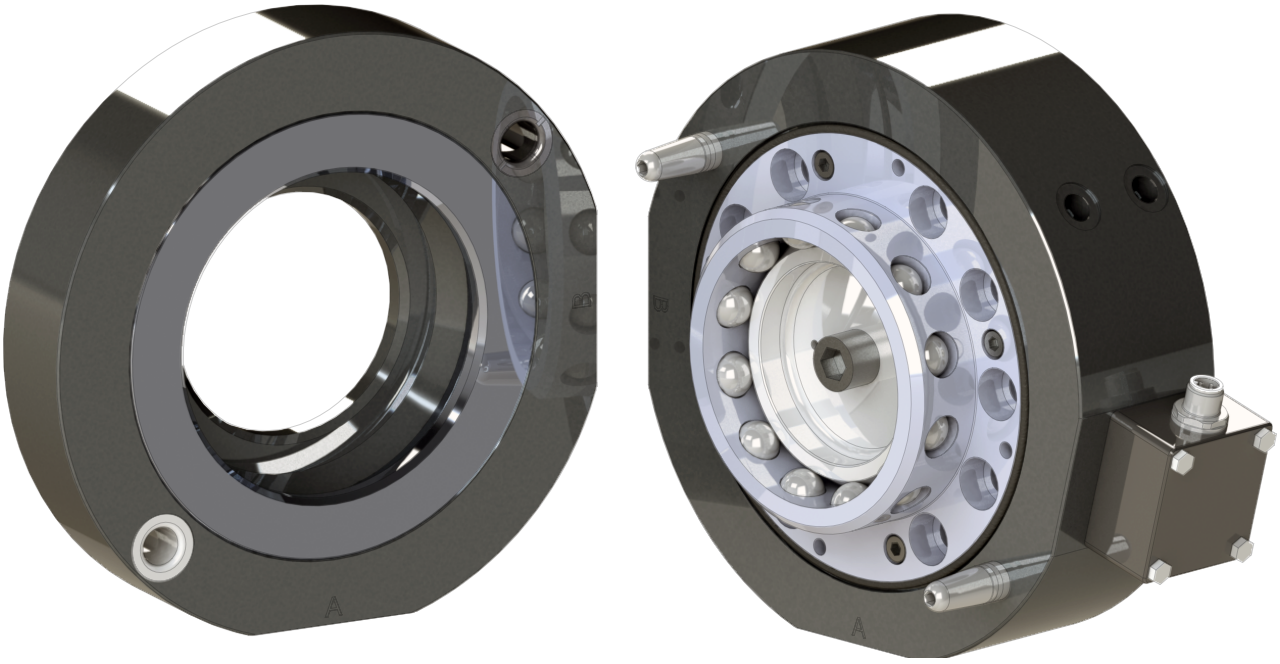
ATI INDUSTRIAL AUTOMATION

A Novanta Company

QC-161

Custom Tool Changer

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.
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.
Electrical Module	Utility modules that pass electrical power and signals through the Master and Tool modules to the end-effector.
EOAT	**E**nd **o**f the **A**rm **T**ooling – An object attached to the Tool plate that serves a function.
End-Effector	Tool used by the robot to perform a particular operation or function.
Fluid Module	Utility modules that pass fluids through the Master and Tool modules to the end-effector.
High Current Module	Utility modules that pass electrical power through the Master and Tool modules to the end-effector.
Interface Plate (IP)	An optional customized component that is used to adapt a Tool Changer to the user's robot or tooling.
Lock	The lock air pressure that is provided to the Master plate locking mechanism to force the cam to press the locking balls against the bearing race and lock the Master and Tool plates together.
Lock Port	A 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 position.
Locked	An output signal provided by a proximity sensor that indicates 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	A manual, pneumatic or electrical driven device that draws the Master and Tool plates together and secures 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 a lever, pneumatic cylinder, or an electric motor.
L/U	Lock/Unlock sensing capability that allows the customer to determine the state of the Master assembly locking mechanism.
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™	A design feature of all ATI Tool Changer products that allows the Master plate and Tool plate to couple without physical contact prior to locking.
Piston	A cylinder located in the Master plate that actuates the locking mechanism.
Tool plate	The half of the Tool Changer to which various tools or end-effectors are mounted.
Unlock Sensor	A proximity sensor that detects the position of the pneumatically actuated piston when it is in the unlocked position.

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 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. Refer to the product specifications section in this manual or contact ATI for assistance. Particular attention should be paid to dynamic loads caused by robot acceleration and deceleration. These forces can be many times the value of the static forces in the high acceleration or deceleration situations.

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 be prevented 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 the locking or unlocking in a position that would endanger personnel and/or equipment. If the Tool Changer is specified with Lock/Unlock (L/U) sensing capability, the status should be monitored and interlocks applied to prevent injury 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 the electrical and pneumatic lines must minimize the possibility of stress/strain, kinking, rupture, etc. Failure of the critical electrical or pneumatic lines to function properly may result in injury 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 the locking face of the 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 (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from the 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 the applications other than intended will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.

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 QC-161 is a custom Tool Changer for a washdown environment in a food application. The QC-161 has ingress seals at the primary customer interfaces, more corrosion-resistant parts, and less surfaces where food could become caught.

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 the air pressure falls below 4.1 bar (60 psi) 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. For assistance in selecting compatible modules, contact an ATI sales representative.

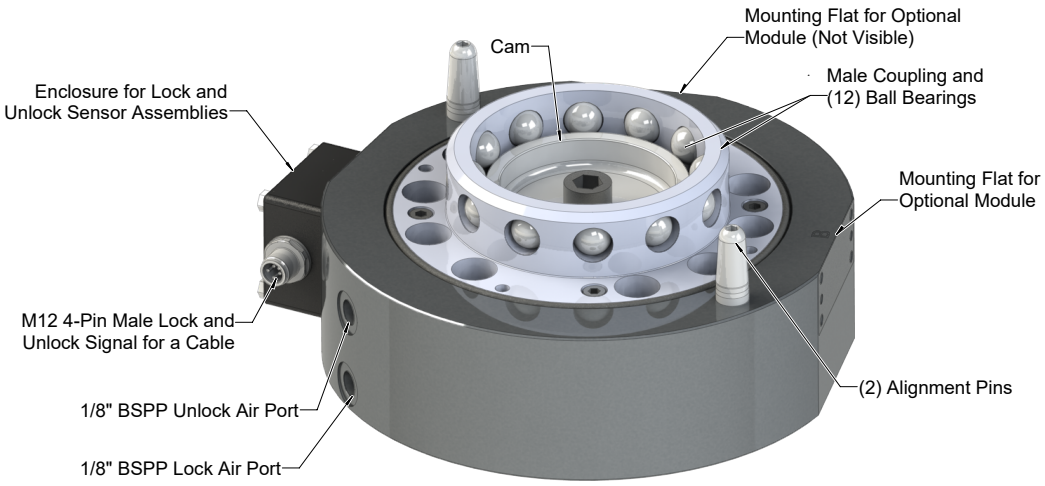
2.1 Master Plate Assembly

The Master plate assembly includes the following features:

- A stainless steel body
- A hardened stainless steel locking mechanism (cam, male coupling, and tungsten carbide ball bearings)
- Hardened steel alignment pins that mate with bushings on the Tool plate
- (2) flats for mounting optional modules or protective **cover plates**
- Proximity sensor assemblies used to verify the lock/unlock position of the piston and cam
- An ISO 9409-1-125-10-M10 mounting pattern for a robot arm or an interface plate

Non-toxic food grade grease is applied to the cam, male coupling, ball bearings, and pins to enhance performance and maximize the life of the Master plate.

Figure 2.1—Master Plate Assembly



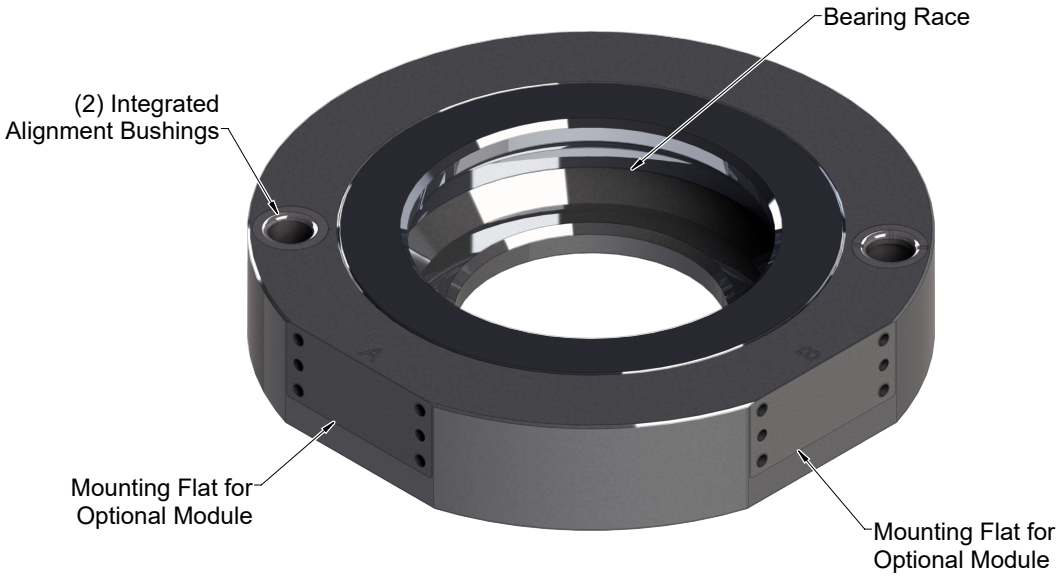
2.2 Tool Plate Assembly

The Tool plate includes a stainless steel body and a hardened stainless steel bearing race (refer to *Figure 2.2*). Alignment bushings are integrated in the Tool body to ensure proper, repeatable orientation with the Master plate.

The Tool plate assembly includes the following features:

- A stainless steel body
- A hardened stainless steel bearing race
- Alignment bushings that mate with pins on the Master plate
- (2) flats for mounting an optional modules or protective cover plates
- An ISO 9409-1-125-10-M10 mounting pattern for customer tooling or a tooling interface plate

Figure 2.2—Tool Plate Assembly



3. Installation

All fasteners used to mount the Tool Changer to the robot and customer's tooling should be tightened to the torque values indicated in *Table 3.1——Fastener Size, Class, and Torque Specifications.* **Additionally, Loctite 7649 primer and removable Loctite 242 must be used on these fasteners.**

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 (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from the 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.

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.

CAUTION: For stainless steel socket screws, use a flat hex broach (not a ball end) to tighten the fasteners. Always tighten to the specified torque.

Table 3.1—Fastener Size, Class, and Torque Specifications

Mounting Conditions	Fastener Size & Property Class (MIN)	Recommended Torque	Thread Locker
Master plate to Interface plate (6061-T6 aluminum). Minimum thread engagement of 15 mm (0.59") [1.5X fastener Ø].	M10-1.5 A2-70 / A4-70* (stainless steel)	33 Nm (24 ft-lb)	Loctite® 7649, Loctite ® 242
Master plate to Robot (steel; USS ≥ 90KSI). Minimum thread engagement of 10 mm (0.39") [1.0X fastener Ø]. Confirm available engagement with robot manufacturer.	M10-1.5 A2-70 / A4-70* (stainless steel)	33 Nm (24 ft-lb)	
Tool interface plate to Tool plate (304 SS). Minimum thread engagement of 15 mm (0.59") [1.5X fastener Ø]. Do not exceed maximum available thread depth of 17.5 mm as shown in Section 9—Drawings.	M10-1.5 A2-70 / A4-70* (stainless steel)	33 Nm (24 ft-lb)	
Optional Module or Adapter Plate to Master or Tool Plate.	M4-0.7 Socket Head Cap A2-50 / A4-50 (stainless steel)	1.69 Nm (15 in-lb)	Loctite® 7649, Loctite® 222
	M4-0.7 Socket Flat Head Cap A2-50 / A4-50 (stainless steel)	1.13 Nm (10 in-lb)	

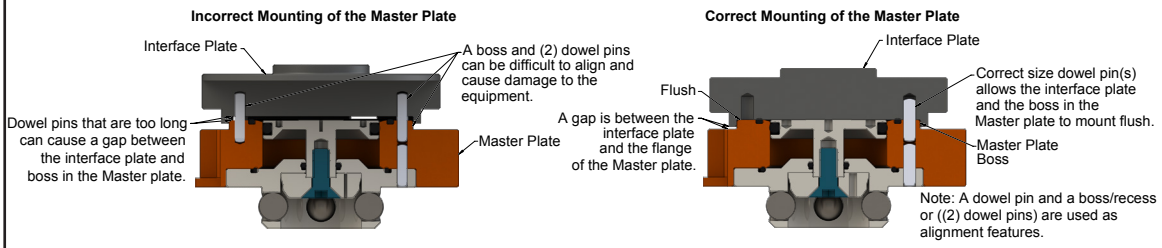
* Using less than 10 fasteners will reduce QC Moment X & Y rating. Refer to Section 9—Drawings.

3.1 Master Interface

The Master plate is typically attached to the robot arm. The QC-161 is designed to mount directly to ISO 9409-1-125-10-M10 robot wrists to minimize stack height. An interface plate can adapt the Master plate to differing specific robot arm mounting patterns. Alignment features (dowel holes and bosses) accurately position and bolt holes secure the Master plate to the robot arm or an interface plate.

CAUTION: Do not use more than two alignment features when securing a Master plate to a robot 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 robot interface plate.

CAUTION: Do not use dowel pins that are too long that will not allow the interface plate and the Master body's boss to mate flush with each other. Using dowel pins that are too long will cause a gap between the interface plate and the Master body's boss causing damage to the equipment. Use the proper size dowel pins that will not extend further than allowed by the Master body.



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 (2) dowel pins or (1) 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 farther than the depth of the dowel holes in the boss of 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 the 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.

3.2 Master Plate Installation

Refer to *Figure 3.1*.

Tools required: *8 mm flat hex key (not a ball end), torque wrench*

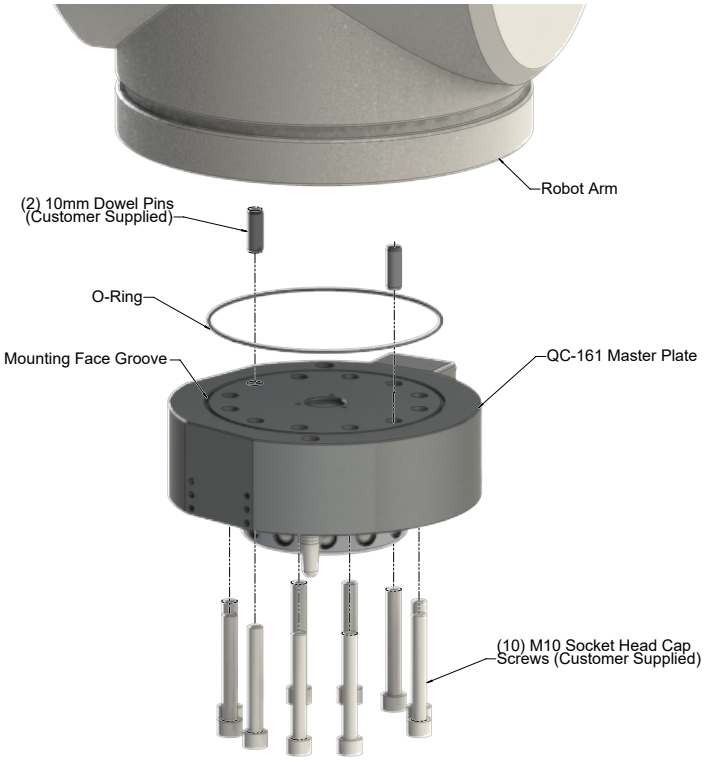
Supplies required: *Clean rag, Loctite® 7649 and 242*

1. Wipe down the mounting surfaces with a clean rag.

> **CAUTION:** The (10) M10 socket flat head cap screws are stainless steel. Use a flat hex broach (not a ball end) to tighten the fasteners. Always tighten to the specified torque.

2. If the customer-supplied (10) M10 socket head cap screws do not have a pre-applied adhesive, first apply Loctite 7649 primer, then apply Loctite 242 to the threads of the screws.
3. Align the robot wrist (or interface plate if required) with the customer-supplied dowel pins on the Master plate.
4. Install the O-ring into the QC-161 Master plate mounting face groove, ensuring the O-ring is fully seated to prevent pinching.
5. Secure the Master plate to the robot wrist with (10) M10 socket head cap screws using a 8 mm flat hex key (not a ball end). See *Table 3.1* for proper torque specifications.
6. Connect the lock and unlock air to the connections on the Master plate. For details on the lock and unlock air refer to *Section 3.8.1—Valve Requirements and Connections for the Locking Mechanism*.
7. Connect the lock and unlock sensor cable:
   a. Attach a cable to the M12 4-pin male connector. For connector information, refer to *Section 3.9—Electrical Connections*.
8. If equipped, connect other utilities to the optional modules on the Master plate.

Figure 3.1—Standard Master Plate Installation



3.3 Master Plate Removal

Tools required: *8 mm flat hex key*

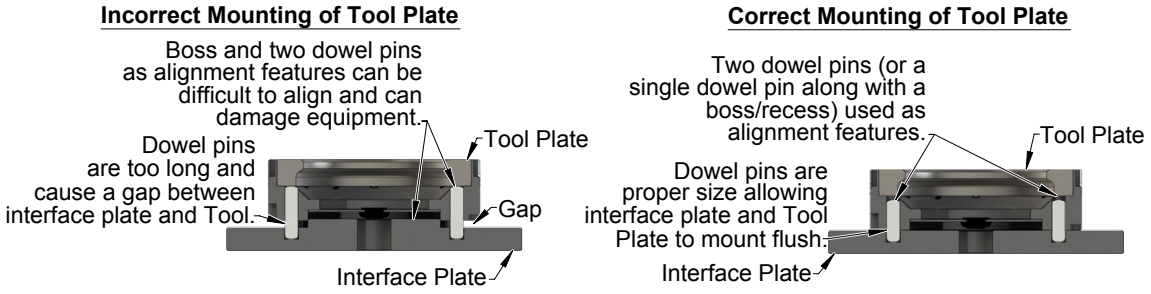
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic).
4. If equipped, disconnect all utilities (for example: electrical, pneumatic, hydraulic).
5. Disconnect the lock and unlock sensor cable.
6. Use a 8 mm flat hex key to loosen the (10) M10 socket head cap screws from the Master plate, and remove Master plate from interface plate or robot. Note: Interface plate is not required to be removed from the robot.

3.4 Tool Interface

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 secure the Tool plate to customer tooling.

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.



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 the 1" (25.4 mm) prevents debris from contaminating the locking mechanism.

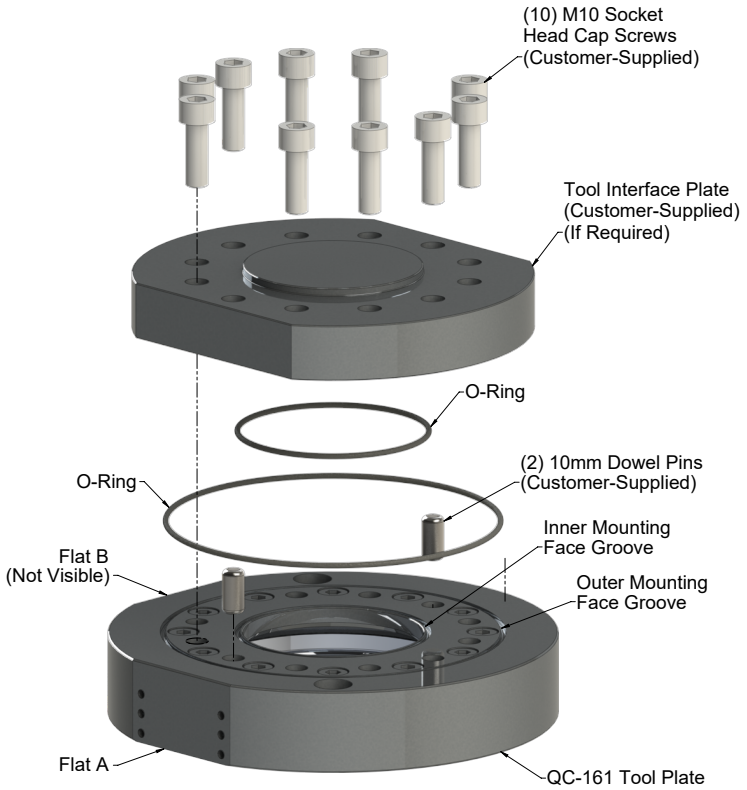
3.5 Tool Plate Installation

Tools required: *8 mm hex key, torque wrench*

Supplies required: *Clean rag, Loctite® 7649 and 242*

1. Wipe down the mounting surfaces with a clean rag.
2. If required, install the tooling interface plate to the customer tooling, align using the recess and dowel pin(s). Secure with customer-supplied fasteners.
3. Install the O-rings into the QC-161 Tool plate mounting face grooves, ensuring O-rings are fully seated to prevent pinching.
4. Align the customer-supplied dowel pins in the tool interface plate or customer tooling to the corresponding holes in the Tool plate.
5. First apply Loctite® 7649 primer, then apply Loctite® 242 to the threads of the customer-supplied fasteners, (10) M10 screws.
6. Secure the Tool plate to the tool interface plate or customer tooling with (10) M10 screws using the 8 mm hex key. See *Table 3.1* for proper torque specifications
7. Connect utilities to the optional modules on the Tool plate.
8. Safely resume normal operation.

Figure 3.2—Standard Tool Plate Installation



3.6 Tool Plate Removal

Tools required: *8 mm hex key*

1. Place the Tool in a secure location.
2. If equipped, disconnect all utilities (for example: electrical, pneumatic, hydraulic).
3. Using the 8 mm hex key, remove the (10) M10 fasteners, connecting the Tool plate to the tool interface plate.
4. Remove the Tool plate.

3.7 Optional Module

The optional modules are typically installed on the Tool Changers by ATI prior to shipment. The following steps outline field installation or removal as required. Tool Changers are compatible with many different types of modules. Some modules will require an adapter plate to be installed to the Tool Changer.

NOTICE: It is recommended to use the JPC1 cover plate if a module is not used to protect exposed fastener holes. Refer to JPC1 manual for more information: *9620-20-H-JPC1*.

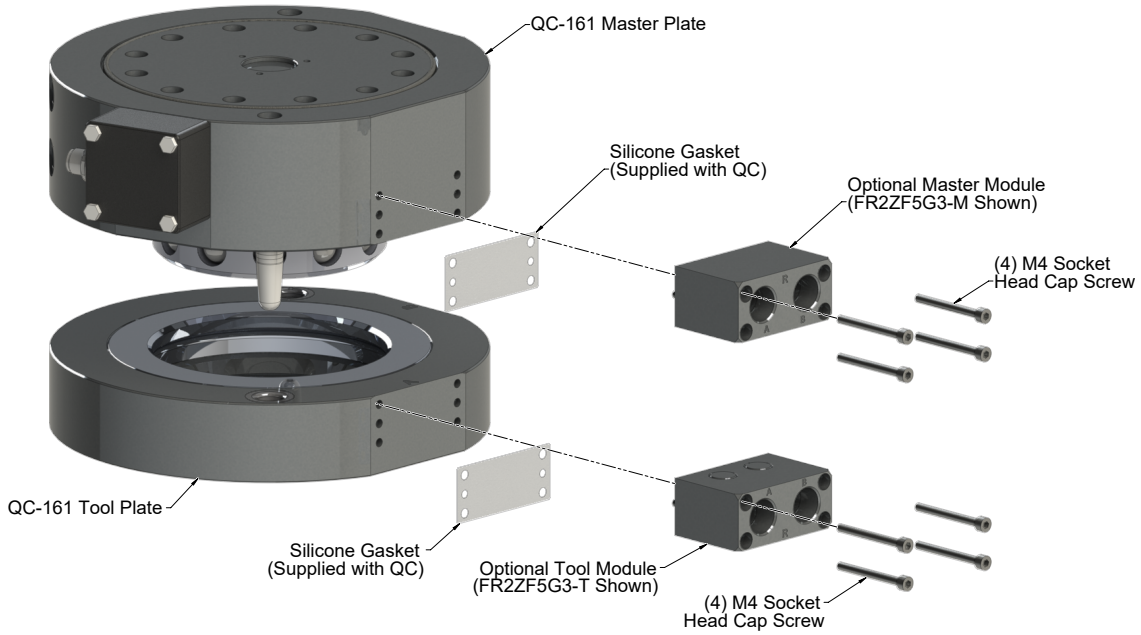
3.7.1 Optional Module Installation

Tools required: *2.5 mm or 3 mm hex key, torque wrench*

Supplies required: *Loctite® 7649 and 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. Place the silicone gasket between the optional module and Tool Changer plate.
5. Align the (2) dowel pins, if equipped, on each module to the corresponding holes on the Flat of the Master or Tool plate as shown in *Figure 3.3*.
6. If not using fasteners with pre-applied adhesive, first apply Loctite 7649 then apply Loctite 222 to the (4) mounting fasteners on each module.
7. Secure the optional modules to the Tool Changer with mounting fasteners. See *Table 3.1* for proper torque specifications.
8. Remove all protective caps, plugs, tape, etc. from the module prior to operation.
9. Connect any cables, air line, etc. (if required)
10. Safely resume normal operation.

Figure 3.3—Optional Module Installation



3.7.2 Optional Module Removal

Refer to *Figure 3.3*

Tools required: *2.5 mm or 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.
5. Supporting the module, remove the (4) M4 mounting fasteners from the each module.
6. Remove the module and gasket from the Tool Changer plate.

3.8 Pneumatic Connections

The air supply used for coupling and uncoupling the Tool Changer should be at 60 to 100 psi (4.1 - 6.9 Bar), with a setting of 80 psi suggested. The air should be filtered to ISO 8573-1:2010 [7:4:4].

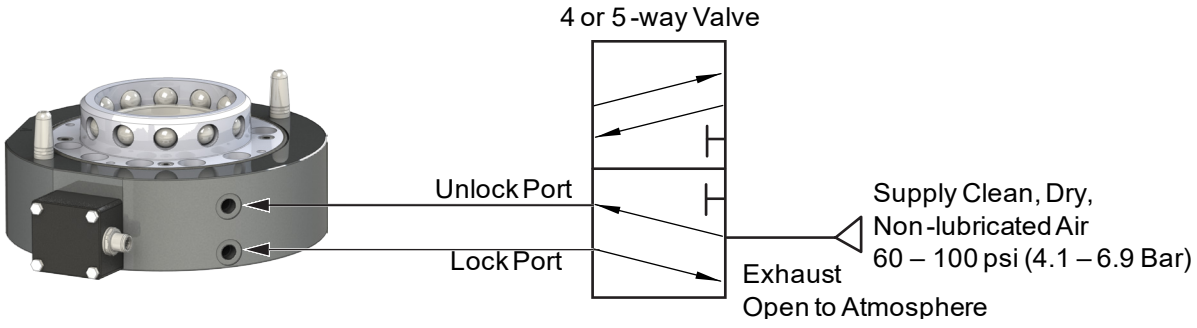
CAUTION: Do not use the Tool Changer in a fail-safe condition. Do not transport the Tool Changer in a fail-safe condition. Possible damage to the locking mechanism could occur. Re-establish air pressure to the Tool Changer before returning to normal operations.

3.8.1 Valve Requirements and Connections for the Locking Mechanism

It is required that a customer-supplied 2-position 4-way or 5-way valve 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 proper shuttling of the valve and prevent coupling/uncoupling from the occurring.

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

Figure 3.4—Lock and Unlock Pneumatic Connections



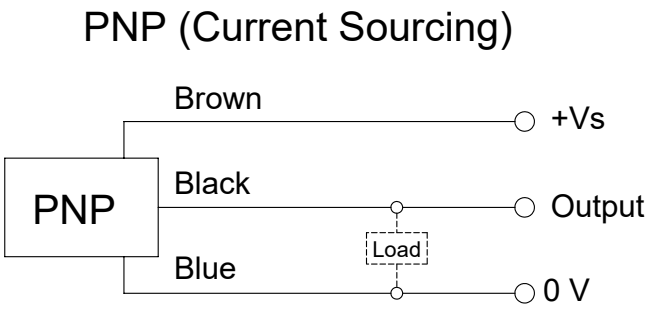
3.9 Electrical Connections

Integrated lock/unlock sensors are available. The sensor assemblies are protected within an enclosure attached to the Master plate. For the pinout and wire call-outs of the M12 4-pin connector, refer to *Section 3.9.2—M12 4-Pin Male Connector*.

3.9.1 PNP Type Lock and Unlock Sensors

Table 3.2—PNP (Current Sourcing)	
Description	**Value**
Voltage Supply Range	10-30VDC
Output Circuit	PNP make function (NO)

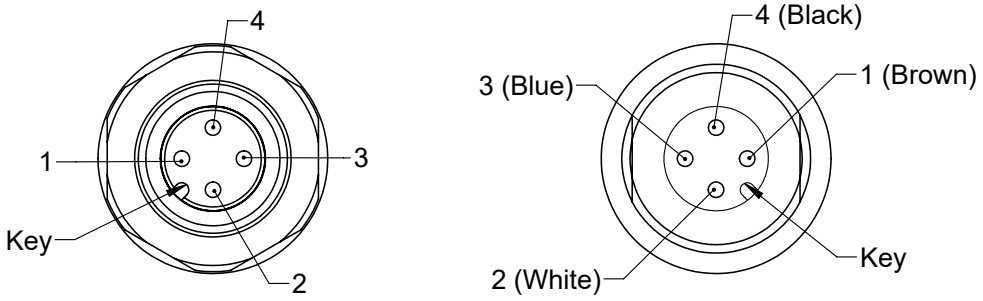
Figure 3.5—PNP Type Lock and Unlock Sensors



3.9.2 M12 4-Pin Male Connector

Table 3.3—Pin Numbers, Wire Colors, and Signals		
Pin Number	**Signal**	**Wire Color**
1	+ Vs	Brown
2	Output Circuit - Lock	White
3	Output Circuit - Unlock	Blue
4	0 V (Ground)	Black

Figure 3.6—M12 4-Pin Male Connector



4-Pin Male Connector
Face View

4-Pin Male Connector
Wire View

4. Operation

The Master plate locking mechanism is pneumatically driven to couple and uncouple with the Tool plate bearing race.

CAUTION: Operation of the Tool Changer is dependent on the maintaining an air pressure of 60 to 100 psi (4.1–6.9 bar). Damage to the locking mechanism could occur. Robot motion must be halted if the air supply pressure drops below 60 psi (4.1 bar).

NOTICE: All Tool Changers are lubricated prior to shipment. The customer must apply additional lubricant to the locking mechanism components and alignment pins prior to operation. This Tool Changer requires food grade grease.

Coupling should occur with the Master plate in the No-Touch™ locking zone. As coupling occurs, the Master plate should pull the Tool plate into the locked position.

Program the robot to minimize misalignment during coupling and uncoupling. Greater offsets can be accommodated by the Master and Tool plates but will increase wear. Misalignments can be caused by improper tool stand design. Refer to *Section 4.5—Tool Storage Considerations*.

Figure 4.1—Offset Definitions

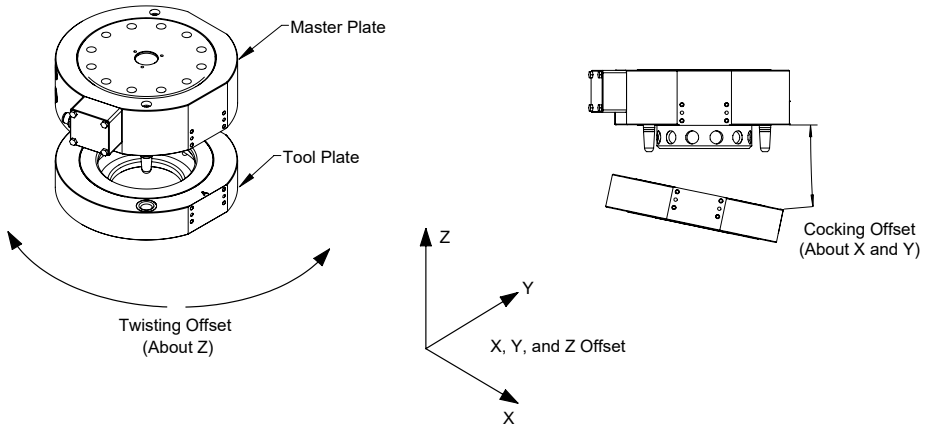


Table 4.1—Maximum Recommended Offsets Prior to Coupling

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-161	2 (0.08 in)	± 2 (0.08 in)	± 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 Conditions for Coupling

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.

NOTICE: If the locking mechanism has been actuated and both the Lock and Unlock signals are OFF, then a "missed tool" condition has occurred (for example, the Tool is not in the stand or is not positioned properly). **In this case an error should be generated and the robot program halted.** The situation requires manual inspection to determine the cause of the problem.

NOTICE: The locking mechanism must be in the unlock state before another attempt is made to couple or damage could occur to the robot and/or the Tool Changer.

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 the 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 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.

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 Conditions for Uncoupling

1. Position 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 the 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 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 in the stand prior to unlatching and the Tool remains in the stand as the robot moves away.

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: Improperly designed tool stands cause components to become stuck and causes excessive wear of components. Thus, carefully consider tool stand design for optimal operation of the Tool Changer. For assistance, contact an ATI representative.

When Tool plates are not in use, store the Tool plate with attached customer tooling 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 Large (TSL) system is compatible with ATI Tool Changer sizes QC-150 and larger. The TSL 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: *http://www.ati-ia.com/products/toolchanger/toolstand/large/LargeStand.aspx*. Another resource is the *ATI TSL manual*: *https://www.ati-ia.com/App_Content/Documents/9610-20-1058.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 (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from the 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 the tool stands away from the 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 the 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

Balls/Alignment Pins/Holes/Bearing Race

- ☐ Inspect for lubrication and wear. JET LUBE® FMG is suggested for locking mechanism and alignment pin lubrication. Over time, lubricants can become contaminated with process 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*.
- ☐ Inspect for excessive alignment pin/bushing wear, may be an indication of the poor robot position during pickup/drop-off. Adjust robot position as needed.
- ☐ Inspect for wear on the ball bearings/bearing race, may be an indication of excessive loading.

Mounting Hardware/Interface Connections

- ☐ Inspect for proper torque and interference or wear, abrasions, cuts of hoses, and electrical cables. Tighten and correct as required. Refer to *Section 3—Installation*.

Seals (Modules)

- ☐ Inspect for wear, abrasion, and cuts. Refer to *Section 6.2.3—V-ring Seal Inspection and Replacement*.

Sensor Cable

- ☐ Inspect sensor cable connector for tightness, if loose tighten connections.
- ☐ Inspect sensor cable for any damage, cuts, and abrasion. Replace as necessary. Refer to *Section 6.2—Service Procedures*.

Electrical Contacts/Pin Block (Modules)

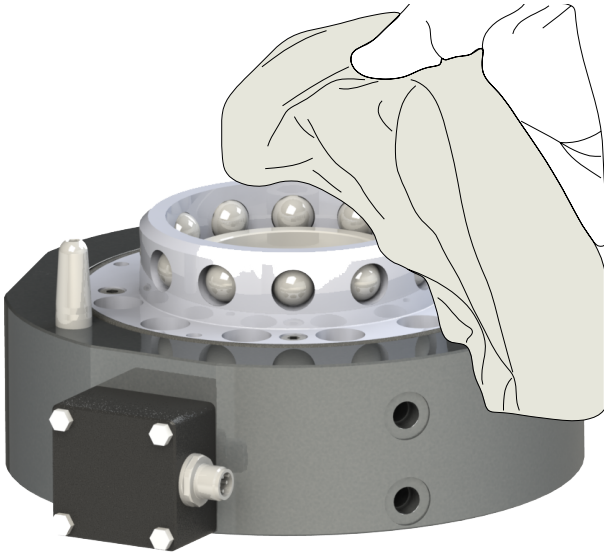
- ☐ Inspect for damage, debris, and stuck/burnt pins. Clean pin blocks as required, refer to *Section 5.3—Pin Block Inspection and Cleaning*.

5.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

Supplies required: *Clean rag, food grade grease such as JET LUBE FMG*

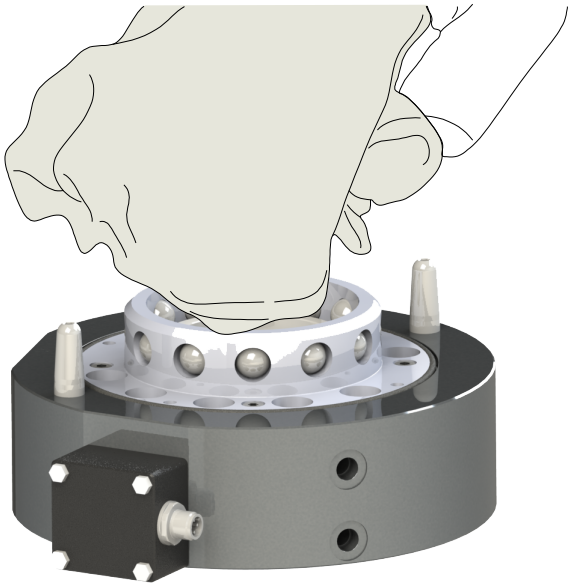
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam,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

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



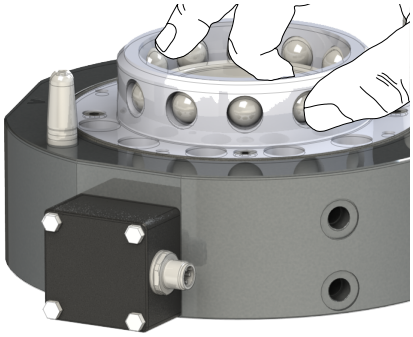
5. Use a clean rag to thoroughly remove any lubricant and debris from the inner surface of the male coupling and cam.

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



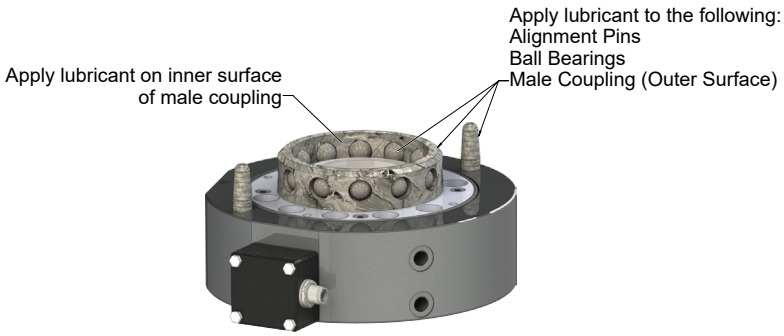
6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 5.3—Check Ball Bearing Movement



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

Figure 5.4—Apply Lubricant to Locking Mechanism

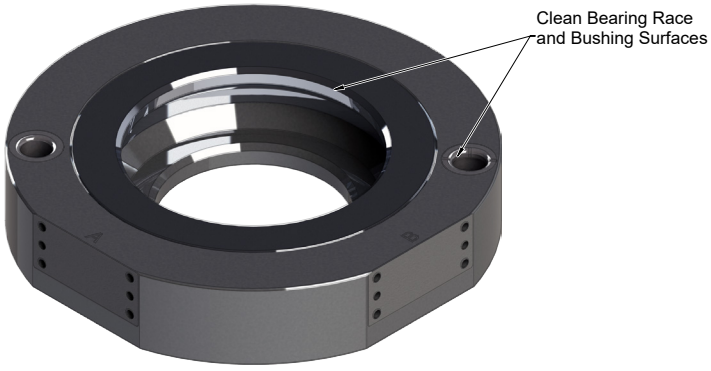


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

NOTICE: No application of the 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 Pin Block Inspection and Cleaning

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

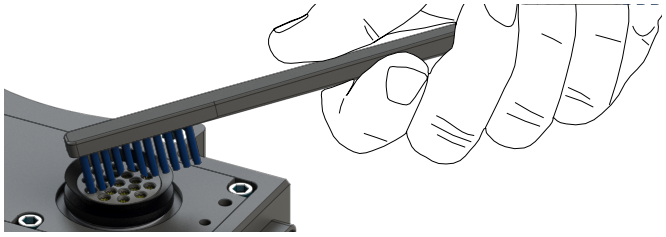
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Inspect the Master and Tool pin blocks for debris or darkened pins.

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).

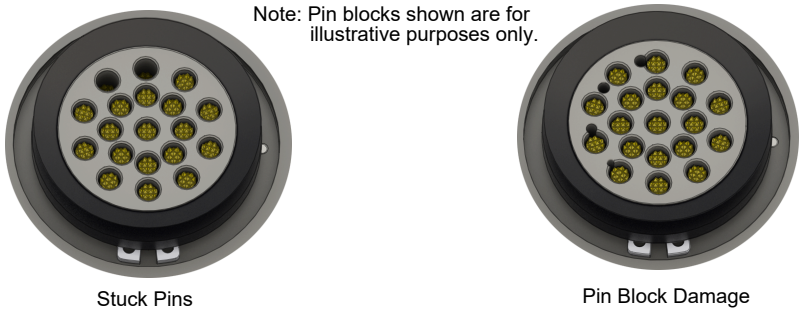
NOTICE: Do not use an abrasive media and/or cleaners or solvents to clean the contact pins. Using abrasive media and/or cleaners or solvents will cause damage to the contact surface or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI part number 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 and service information to help diagnose conditions and repair the Tool Changer.

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from the circuits in accordance with the customer's 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

Check these conditions for all symptoms prior to troubleshooting:

- Proper pneumatic and electrical connections have been made to the Tool Changer.
- Air is supplied at a minimum of the 4.1 Bar (60 psi).
- No air or vacuum can be trapped in a de-energized lock or unlock port (pressure must be vented to atmosphere).

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 the between Master and Tool plates. Verify mounting fasteners are secure and do 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—Pneumatic Connections.*
	Air pressure trapped in the de-energized Lock or Unlock ports.	Air pressure must be vented to the atmosphere properly, refer to *Section 3.8—Pneumatic Connections.*
	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".	Lock sensor/cable is damaged.	Replace the lock sensor assembly as necessary. Refer to *Section 6.2.1—Lock and Unlock Sensor Replacement.*
Unit is unlocked but Unlock signal does not read "on".	Unlock sensor/cable is damaged.	Replace the unlock sensor assembly as necessary. Refer to *Section 6.2.1—Lock and Unlock Sensor 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—V-ring Seal Inspection and Replacement.*
	Cable connection loose or cable damaged.	Check that cable connection is secure and cable is not damaged.

6.2 Service Procedures

Component replacement and adjustment procedures are provided in following section.

6.2.1 Lock and Unlock Sensor Replacement

The proximity sensors are dependable and normally do not need to be replaced. Exhaust all other possible solutions before choosing to replace the proximity sensors, including: checking continuity, air supply, lubrication, and pneumatic components prior to replacing the sensor.

Refer to *Figure 6.1*.

Parts required: *Refer to Section 7.1—Master Plate*

Tools required: *2.5 mm hex key, 7 mm wrench or adjustable wrench, torque wrench*

Supplies required: *Loctite® 7649 and 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 (e.g. electrical, air, water, etc.).
4. Remove the sensor cover:
   a. Disconnect the cable from the M12 4-pin male connector on the sensor cover.
   b. Use a 7 mm wrench to remove the (4) M4 hex head cap screws from the cover.
   c. Carefully remove the cover to access the (2) sensor connector assemblies.
   Note: the O-ring for the sensor cover may have to be repositioned into the channel of the sensor cover.
5. Disconnect the sensors and remove from the Master plate:
   a. Disconnect the sensor connectors from the connector plugs in the sensor cover.
   b. Using a 2.5 mm hex key, remove the (4) M3 socket head cap screws that secure the (2) sensor assemblies to the Tool Changer.
   c. Remove the (2) sensor assemblies. Be sure that the O-rings are removed with sensor assemblies.

CAUTION: The lock and unlock sensor assemblies are precision aligned and permanently assembled at the factory. Do not attempt to disassemble and rebuild.

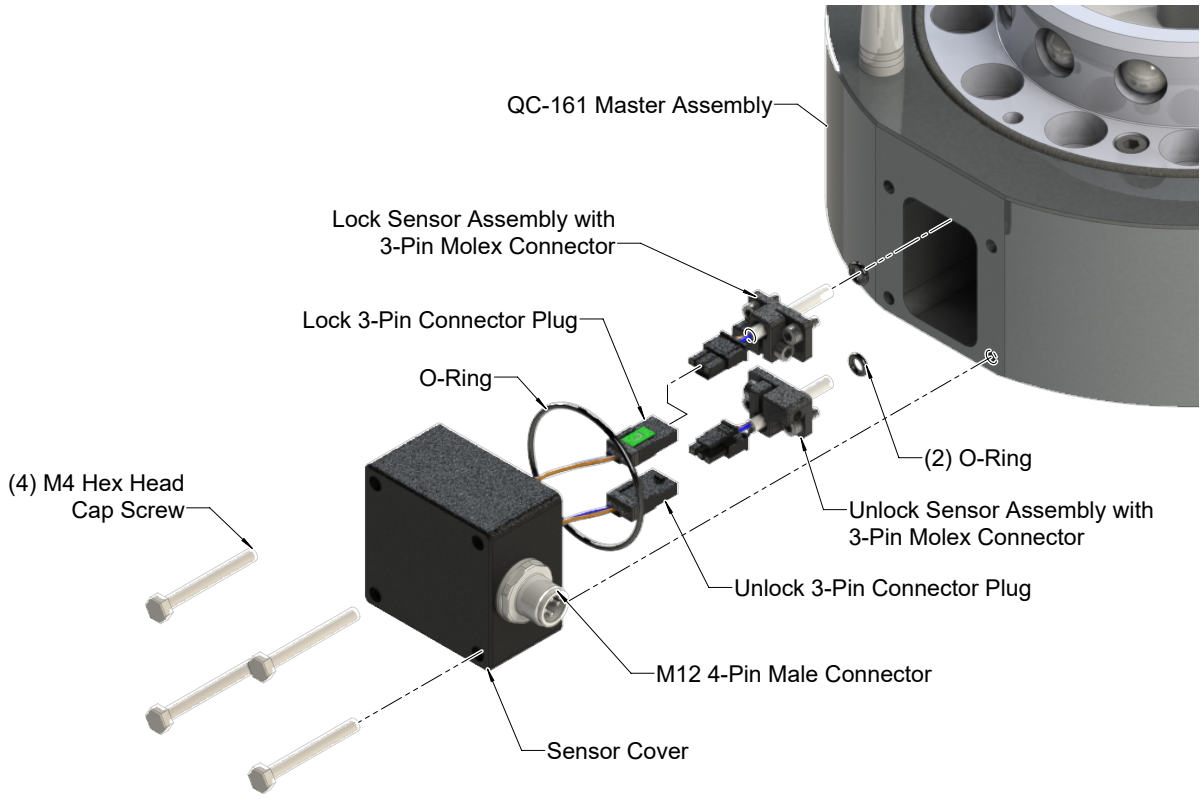
6. Install the new sensor assemblies on the Tool Changer.
   a. Be sure that new O-rings are installed around the sensor bodies.
   b. Using a 2.5 hex key, install the (4) M3 socket head cap screws that secure the sensor assemblies to the Master plate. Tighten to 1.02 Nm (9 in-lb).

NOTICE: The connector plugs inside the sensor cover are labeled 'L' for Lock and 'U' for Unlock.

NOTICE: The Lock and Unlock sensor assemblies depend on their placement in the Tool Changer Master plate. Refer to *Figure 6.1*.

7. Snap the 3-pin Lock and Unlock sensor connectors into the Lock and Unlock connector plugs in the sensor cover.
8. Position the interlocked Molex® connector assemblies on either side of the M12 connector inside the sensor cover.
9. Install the sensor cover.
   Note: the O-ring for the sensor cover may have to be repositioned into the channel of the sensor cover.
   a. Apply Loctite 7649 and then apply Loctite 222 to the (4) M4 hex head cap screws.
   b. Using a 7 mm wrench, install the (4) M4 hex head cap screws that secure the sensor cover to the Master plate. Tighten to 1.13 Nm (10 in-lb).
10. Connect a cable to the M12 4-pin male connector.
11. Safely resume normal operation.

Figure 6.1—Lock and Unlock Sensor Assembly Replacement



6.2.2 M12 Connector Assembly Replacement

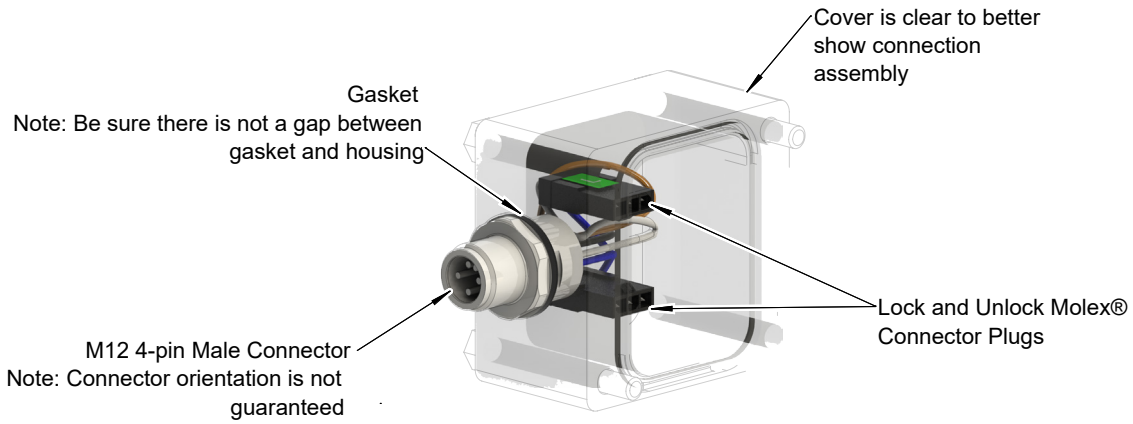
Parts required: *Refer to Section 7.1—Master Plate*

Tools required: *17 mm wrench, torque wrench*

Supplies required: *Loctite® 242*

1. Complete steps *1* through *4* from *Section 6.2.1—Lock and Unlock Sensor Replacement*.
2. Disconnect the Molex® sensor connectors from the connector plugs in the sensor cover. Refer to *Figure 6.1*.
3. Remove the M12 connector and plug connectors from the sensor cover:
   a. Use a 17 mm wrench to remove the M12 connector. The gasket should come off with the connector.
   b. Remove the M12 connector and the plug connectors out of the sensor cover.
4. Install a new M12 connector and plug connectors in the sensor cover:
   a. Slide the M12 connector and plug connectors into the sensor cover.
   b. Apply Loctite 242 to the threads of the M12 connector.
   c. Using a 17 mm wrench, tighten the M12 connector to the cover. Tighten to 1.02 Nm (9 in-lb).
5. Install the sensor cover assembly on the Tool changer; refer to step *7* from *Section 6.2.1—Lock and Unlock Sensor Replacement*.

Figure 6.2—M12 Connector and Connector Plugs In the Sensor Cover

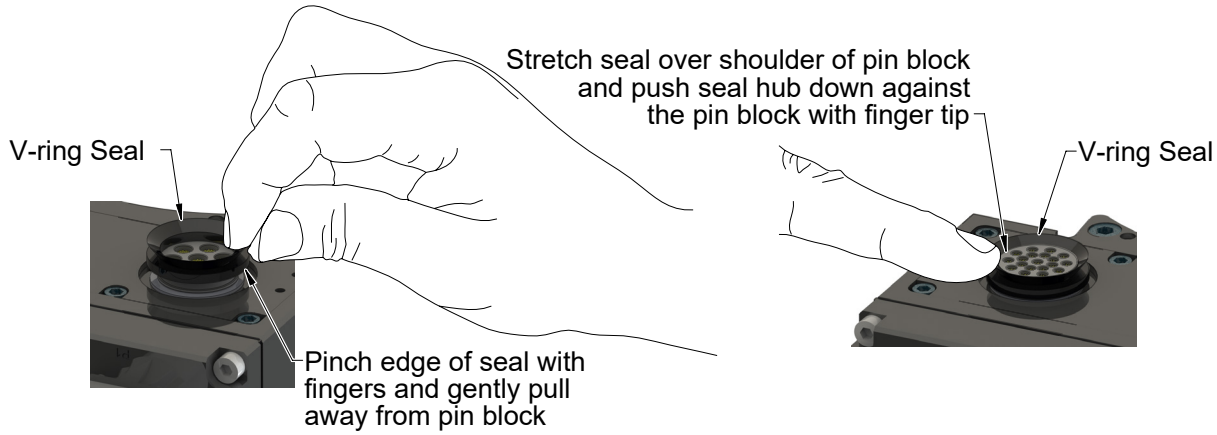


6.2.3 V-ring Seal Inspection and Replacement

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 Alignment Pin Replacement

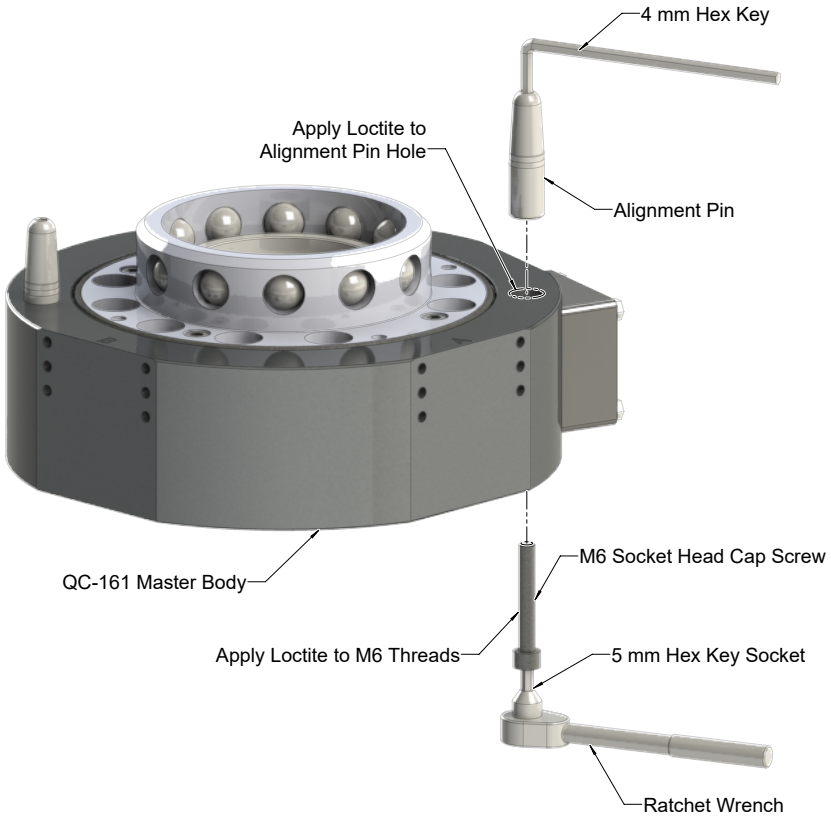
Parts required: *Refer to Section 7—Serviceable Parts*

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

Supplies required: Loctite 7649 and 242, Jet Lube Food Machine Grease (FMG)

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.). Disconnect the cable from the M12 4-pin male connector.
4. If the M6 socket head cap screw shown in *Figure 6.4* is not accessible while mounted to the robot, remove the Master plate. Refer to *Section 3.2—Master Plate Installation.*
5. Use a 4 mm hex key to hold the alignment pin in place.
6. While holding the alignment pin in place, use a 5 mm hex key socket wrench to unscrew the M6 socket head cap screw.

Figure 6.4—Alignment Pin Replacement



7. Install new alignment pin.
   a. Apply Loctite 7649 and 242 to the threads of the M6 socket head cap screw.
   b. Apply Loctite 7649 and 242 to the alignment pin hole.
   c. Insert the alignment pin into place and hold using 4 mm hex key.
   d. Screw M6 socket head cap screw into alignment pin using 5 mm hex key socket wrench. Tighten to 6.89 Nm (61 in-lb).
   e. Apply Jet Lube Food Machine Grease to the alignment pin.
8. Resume normal operation.

7. Serviceable Parts

7.1 Master Plate

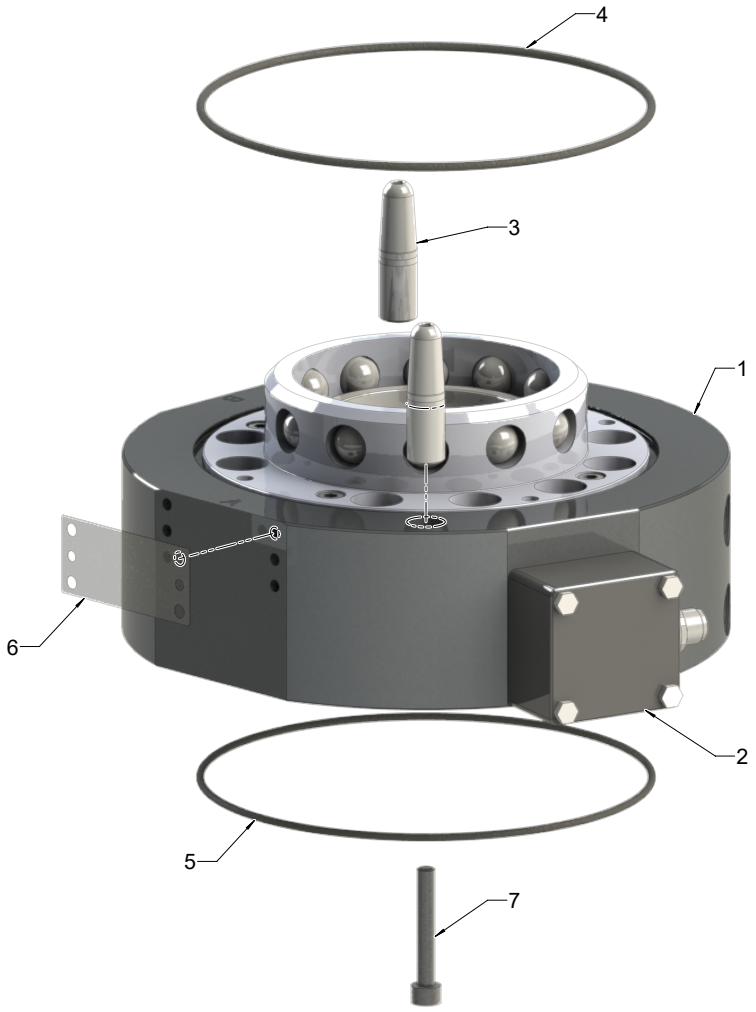


Table 7.1—QC-161 Master Plate			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-161AM-000-000-SG	QC-161 Master, Increased Corrosion Resistant Locking Mechanism, 304 SS Body, Sealed for Wash Down Environments, PNP Sensing with M12 Connector
2	1	9005-20-9273[1]	QC-161 Lock/Unlock Sensors with Cover and M12 Connector, PNP
3	2	3700-20-6711	1/2” Alignment Pin with Corrosion Resistant Plating
4	1	3410-0001579-01	O-Ring, Round, 145mm ID x 3mm, Buna-N, 70A
5	1	3410-0001578-01	O-Ring, Round, AS568-162, Buna-N, 70A
6	2	3700-20-10889	Module Gasket, J16 Style, Silicone Rubber
7	2	3500-1066040-21	M6 x 40mm Socket Head Cap Screw, 316 SS

Notes:
1. For a list of components, refer to *Table 7.2*

7.1.1 Lock and Unlock Sensor Assembly

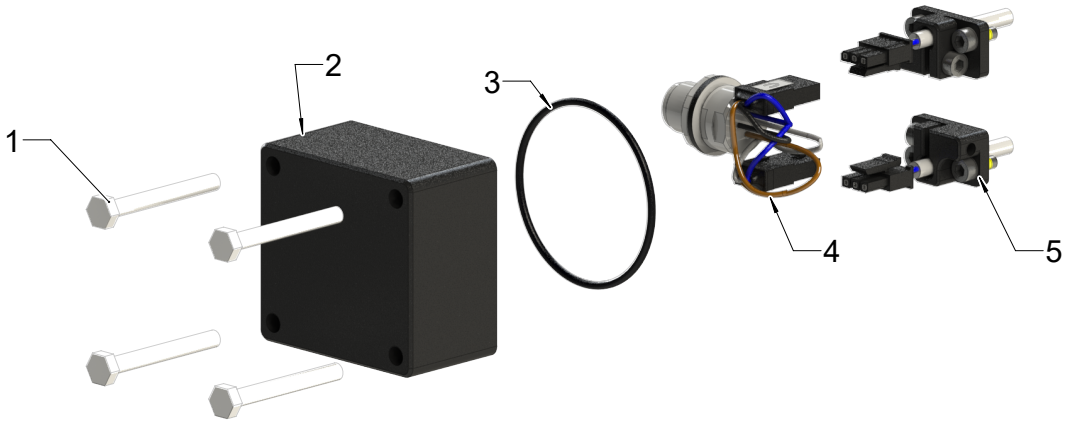


Table 7.2—Sensor Assembly Kit (P/N 9005-20-9273)			
Item No.	**Qty**	**Part Number**	**Description**
1	4	3560-0862035-23	M4 X 35 Hex Head Cap Screw, SS 18-8, Self Sealing, Viton
2	1	3700-20-11783	QC-161 Sensor Cover Block with PG9 Tapped Hole
3	1	3410-0001020-01	O-Ring, Round, AS568-030, Buna-N, 70A
4	1	9015-20-1267[1]	M12 4-Pin IP69K Connector with Lock and Unlock Molex 3-Pin Connectors.
5	2	9015-20-1266[1]	Lock/Unlock PNP Sensor Assembly with 30 mm Long Wires and Molex 3-Pin Connector.

Notes:
1. Note: See *Figure 6.1——Lock and Unlock Sensor Assembly Replacement* for Lock/Unlock Sensor Replacement instructions.

7.2 Tool Plate

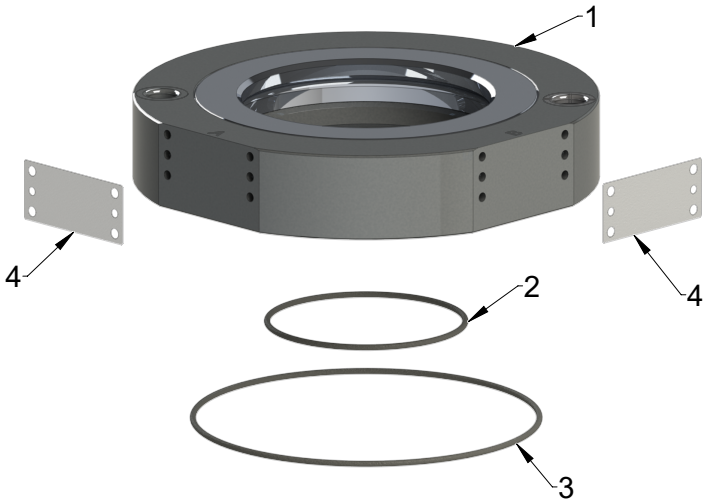
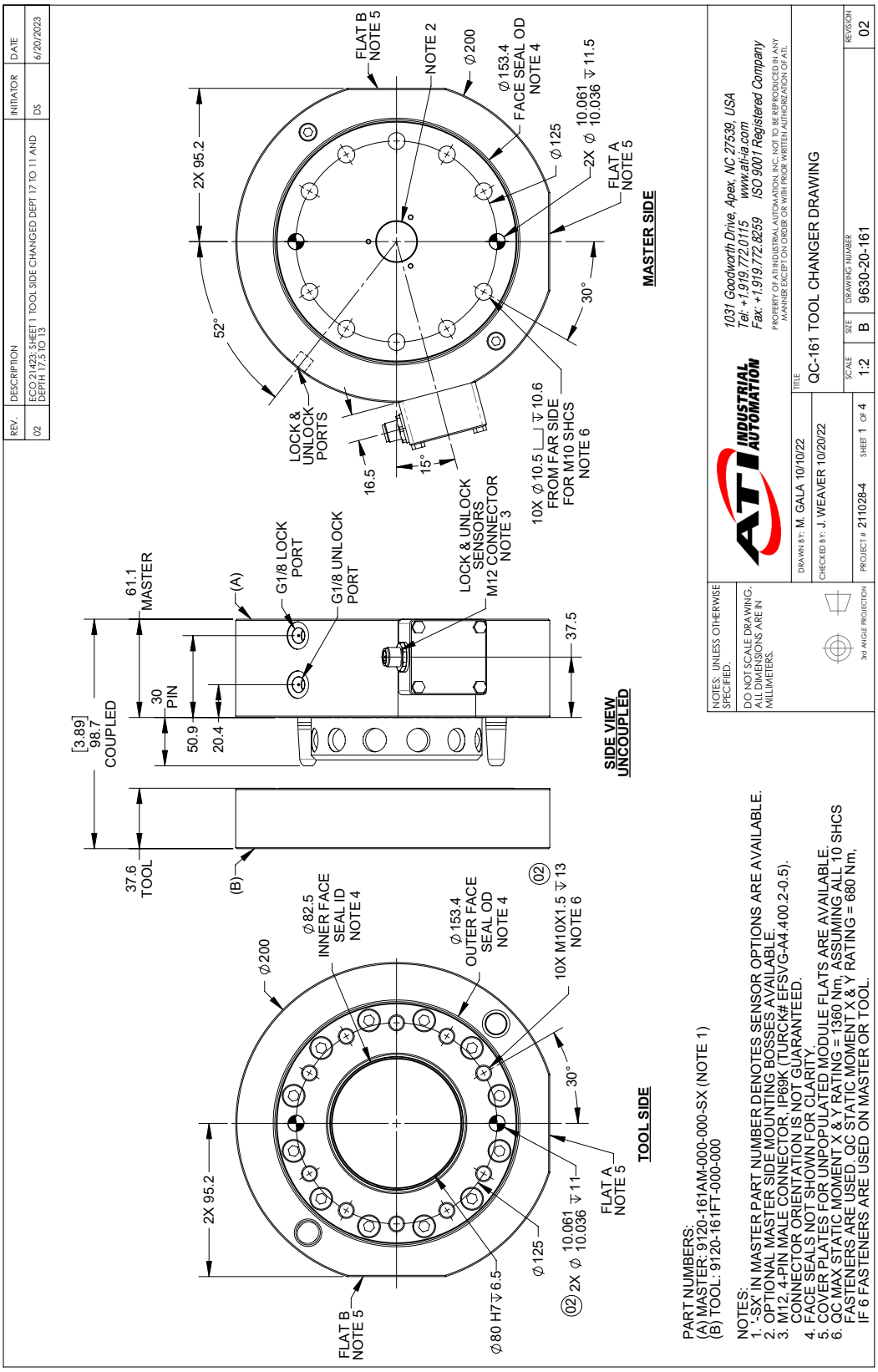


Table 7.3—QC-161 Tool Plate			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-161FT-000-000	QC-161 Tool, Increased Corrosion Resistant Locking Mechanism, 304 SS Body, Sealed for Wash Down Environments, 80mm Recess
2	1	3410-0001577-01	O-ring, Round, AS568-152, Buna-N, 70A
3	1	3410-0001578-01	O-ring, Round, AS568-162, Buna-N, 70A
4	2	3700-20-10889	Module Gasket, J16 Style, Silicone Rubber

8. Specifications

Table 8.1—QC-161 Specifications		
Specification	**Value**	**Description**
Recommended Max Payload	210 kg (463 lb)	The mass attached to the Tool Changer.
Operating Temperature Range	-30–55°C (-20–150°F)	Operational temperature
Operating Pressure Range	4.1–6.9 Bar (60–100 Psi)	Locking mechanism supply pressure operating range. Supply to be clean, dry, and filtered to 40 micron or better.
Locking Force @ 80 psi (5.5 bar)	3100 N (7000 lbs)	Axial holding force
Static Moment Capacity (X & Y)	1360 Nm (12,037 lbf-in)	Maximum recommended working load for optimum performance of the Tool Changer
Static Moment Capacity (Z)	735 Nm (6.505 lbf-in)	Maximum recommended working torque for optimum performance of the Tool Changer
Positional Repeatability	0.015 mm (0.0006”)	Repeatability tested at rated load at one million cycles.
Weight (coupled, no access.)	19.4 kg (42.8 lb)	Master 13.2 kg (29.1 lb) / Tool 6.2 kg (13.7 lb)
Max. Recommended distance between Master and Tool plate	2 mm (0.08 in)	No-Touch™ locking technology allows the Master and Tool Plates to lock with separation when coupling.
Sensor Information, Signal Name	L/U (Lock/Unlock)	Internal (2) proximity sensors assembled in and wired to the customer control for indication of the locking mechanism position.
Sensor Electrical Rating	10 VDC - 30 VDC	Lock and Unlock proximity sensor operating voltage
External M12, 4-Pin Male Connector, IP Rating	IP69K	This IP rating for the connector implies it can withstand high pressure and high temperature wash-downs.
Mounting/Customer Interface	Master plate Tool plate	See *Section 9—Drawings* See *Section 9—Drawings*

9. Drawings


REV. | DESCRIPTION | INITIATOR | DATE
02 | ECO 21423; SHEET 1 TOOL SIDE CHANGED DEPT 17 TO 11 AND DEPTH 17.5 TO 13 | DS | 6/20/2023
MASTER SIDE
SIDE VIEW UNCOUPLED
TOOL SIDE
FLAT B NOTE 5
FLAT A NOTE 5
NOTE 2
Ø200
Ø153.4 FACE SEAL OD NOTE 4
Ø125
2X Ø 10.061 10.036 ↧11.5
2X 95.2
52°
30°
LOCK & UNLOCK PORTS
16.5
15°
10X Ø10.5 ⌴ ↧10.6 FROM FAR SIDE FOR M10 SHCS NOTE 6
61.1 MASTER
30 PIN
50.9
20.4
(A)
G1/8 LOCK PORT
G1/8 UNLOCK PORT
LOCK & UNLOCK SENSORS M12 CONNECTOR NOTE 3
37.5
[3.89] 98.7 COUPLED
37.6 TOOL
(B)
Ø82.5 INNER FACE SEAL ID NOTE 4
Ø153.4 OUTER FACE SEAL OD NOTE 4
10X M10X1.5 ↧13 NOTE 6
(02)
Ø80 H7↧6.5
(02) 2X Ø 10.061 10.036 ↧11
PART NUMBERS:
(A) MASTER: 9120-161AM-000-000-SX (NOTE 1)
(B) TOOL: 9120-161FT-000-000
NOTES:
1. -SX' IN MASTER PART NUMBER DENOTES SENSOR OPTIONS ARE AVAILABLE.
2. OPTIONAL MASTER SIDE MOUNTING BOSSES AVAILABLE.
3. M12, 4-PIN MALE CONNECTOR. IP69K (TURCK# EFSVG-A4.400.2-0.5).
CONNECTOR ORIENTATION IS NOT GUARANTEED.
4. FACE SEALS NOT SHOWN FOR CLARITY.
5. COVER PLATES FOR UNPOPULATED MODULE FLATS ARE AVAILABLE.
6. QC MAX STATIC MOMENT X & Y RATING = 1360 Nm, ASSUMING ALL 10 SHCS FASTENERS ARE USED. QC STATIC MOMENT X & Y RATING = 680 Nm, IF 6 FASTENERS ARE USED ON MASTER OR TOOL.
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
INDUSTRIAL AUTOMATION
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Fax: +1.919.772.8259 ISO 9001 Registered Company
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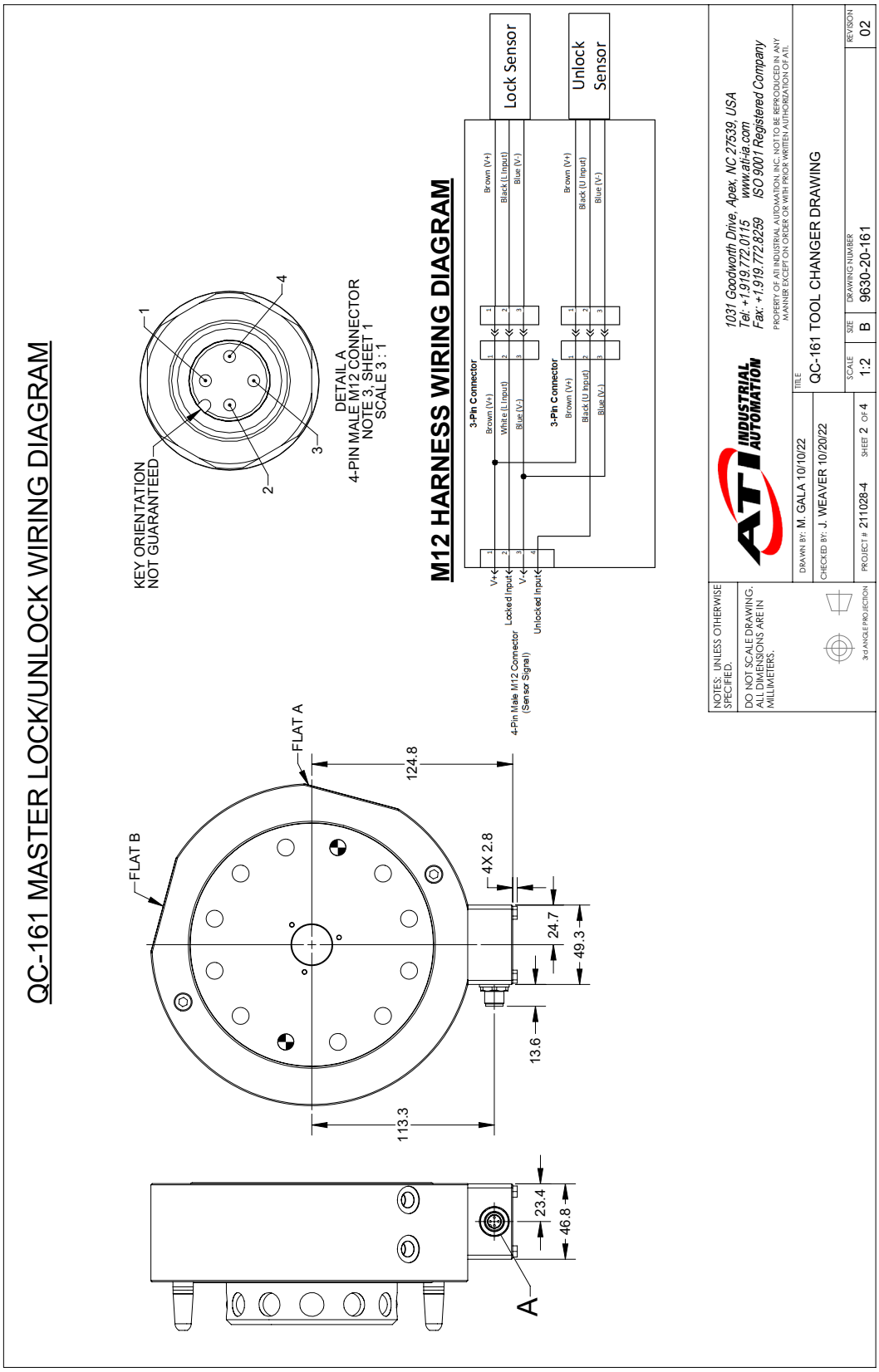
DRAWN BY: M. GALA 10/10/22
CHECKED BY: J. WEAVER 10/20/22
PROJECT # 211028-4
SHEET 1 OF 4
3rd ANGLE PROJECTION
TITLE
QC-161 TOOL CHANGER DRAWING
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-161
REVISION 02


QC-161 MASTER LOCK/UNLOCK WIRING DIAGRAM
KEY ORIENTATION
NOT GUARANTEED
DETAIL A
4-PIN MALE M12 CONNECTOR
NOTE 3, SHEET 1
SCALE 3 : 1
M12 HARNESS WIRING DIAGRAM
3-Pin Connector
Brown (V+)
White (L Input)
Blue (V-)
Black (U Input)
Lock Sensor
Unlock Sensor
4-Pin Male M12 Connector
(Sensor Signal)
Locked Input
Unlocked Input
V+
V-
FLAT A
FLAT B
124.8
4X 2.8
24.7
49.3
13.6
113.3
23.4
46.8
A
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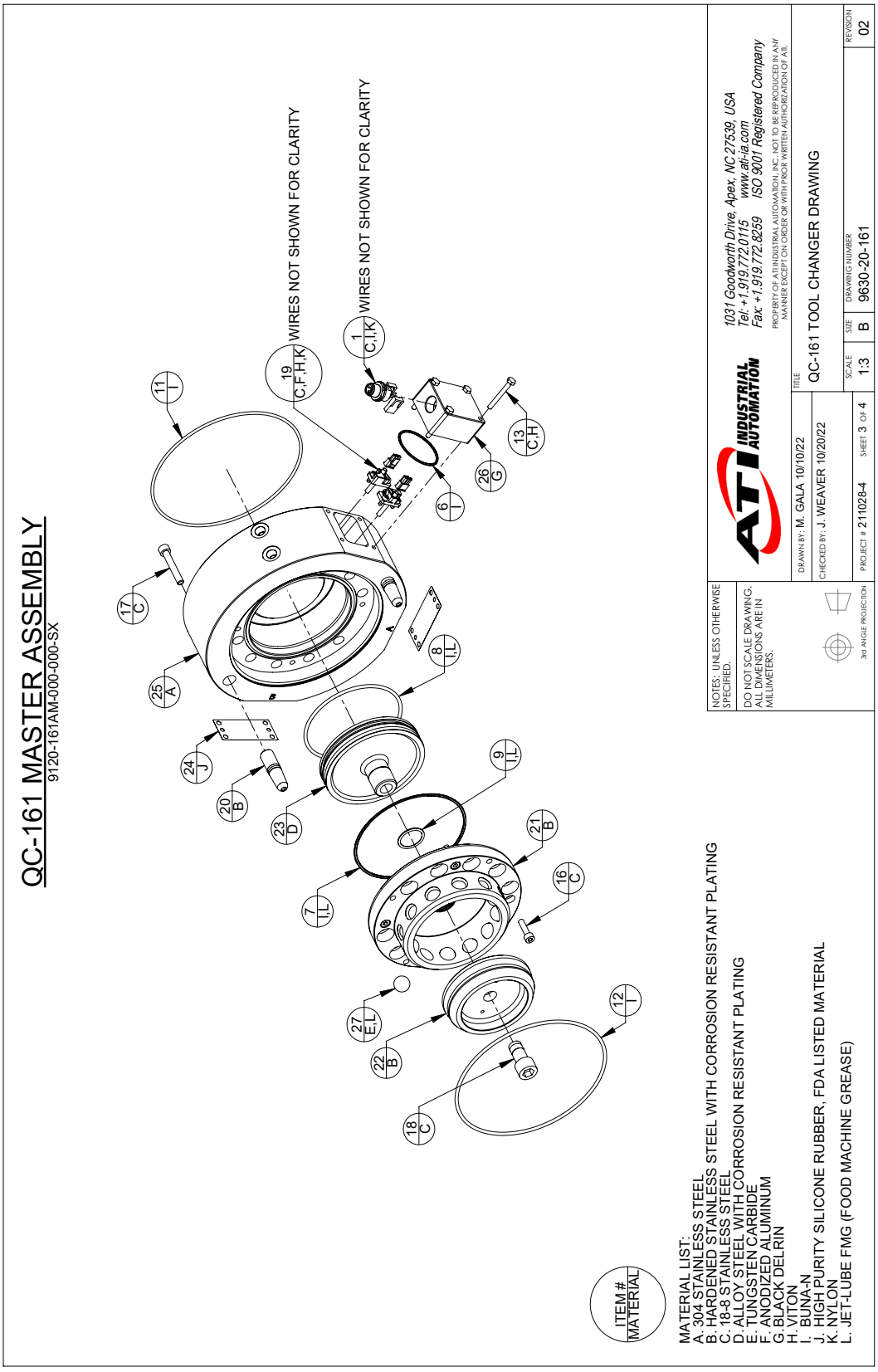
DRAWN BY: M. GALA 10/10/22
CHECKED BY: J. WEAVER 10/20/22
TITLE
QC-161 TOOL CHANGER DRAWING
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-161
REVISION 02
PROJECT # 211028-4
SHEET 2 OF 4
3rd ANGLE PROJECTION


QC-161 MASTER ASSEMBLY
9120-161AM-000-000-SX
WIRES NOT SHOWN FOR CLARITY
WIRES NOT SHOWN FOR CLARITY
MATERIAL LIST:
A. 304 STAINLESS STEEL
B. HARDENED STAINLESS STEEL WITH CORROSION RESISTANT PLATING
C. 18-8 STAINLESS STEEL
D. ALLOY STEEL WITH CORROSION RESISTANT PLATING
E. TUNGSTEN CARBIDE
F. ANODIZED ALUMINUM
G. BLACK DELRIN
H. VITON
I. BUNA-N
J. HIGH PURITY SILICONE RUBBER, FDA LISTED MATERIAL
K. NYLON
L. JET-LUBE FMG (FOOD MACHINE GREASE)
ITEM #
MATERIAL
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: M. GALA 10/10/22
CHECKED BY: J. WEAVER 10/20/22
PROJECT # 211028-4
SHEET 3 OF 4
TITLE
QC-161 TOOL CHANGER DRAWING
SCALE 1:3
SIZE B
DRAWING NUMBER 9630-20-161
REVISION 02
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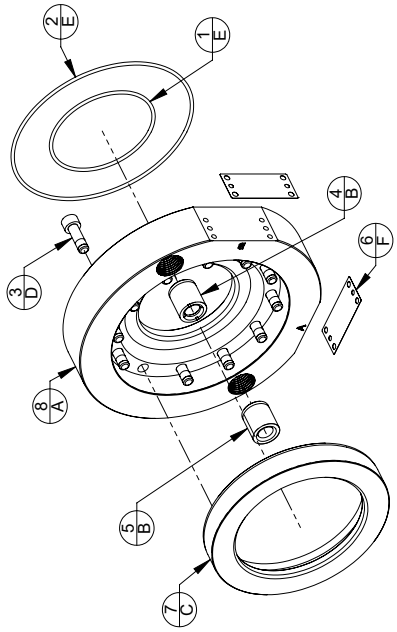
QC-161 TOOL ASSEMBLY

9120-161FT-000-000



ITEM # / MATERIAL

MATERIAL LIST:
A. 304 STAINLESS STEEL
B. HARDENED STAINLESS STEEL WITH CORROSION RESISTANT PLATING
C. PRECIPITATION HARDENED STAINLESS STEEL
D. 316 STAINLESS STEEL, BUMAX 109
E. BUNA-N
F. HIGH PURITY SILICONE RUBBER, FDA LISTED MATERIAL

NOTES: UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.

3rd ANGLE PROJECTION

DRAWN BY: M. GALA 10/10/22

CHECKED BY: J. WEAVER 10/20/22

PROJECT # 211028-4 SHEET 4 OF 4

TITLE: QC-161 TOOL CHANGER DRAWING

SCALE: 1:3 SIZE: B DRAWING NUMBER: 9630-20-161 REVISION: 02

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ATI will in no event be liable for incidental, consequential or special damages of any kind, even if ATI has been advised of the possibility of such damages. ATI's aggregate liability will in no event exceed the amount paid by purchaser for the item which is the subject of claim or dispute. ATI will have no liability of any kind for failure of any equipment or other items not supplied by ATI.

No action against ATI, regardless of form, arising out of or in any way connected with products or services supplied hereunder may be brought more than one (1) year after the cause of action accrued.

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