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B. Base Tool Changer

QC-160 Series—Robotic Tool Changer

1. 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.

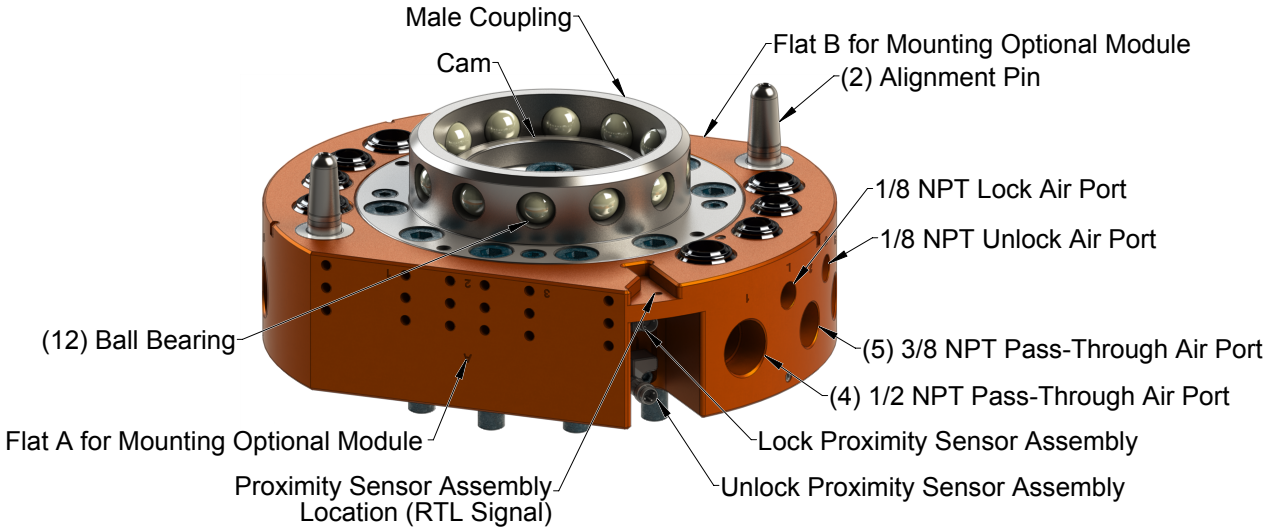
For the most current product information and specifications on the QC-160 Series of Tool Changers, please click the following link: *QC-160 Series*

1.1 Master Plate Assembly

The Master plate assembly includes an anodized aluminum body, a hardened stainless-steel locking mechanism, and hardened steel alignment pins. The Master plate has (2) flat sides for mounting of the optional modules. The locking mechanism consists of a cam, a male coupling, and chrome-steel ball bearings. A 125 mm BC mounting pattern is machined into the Master plate for mounting to a robot arm or an interface plate. Refer to *Section 8—Drawings* for mounting details.

1/8 NPT or G 1/8 BSPP port connections are available to supply air pressure for coupling and uncoupling the Tool Changer. The Master plate assembly is equipped with (5) 3/8 NPT or G 3/8 BSPP and (4) 1/2 NPT or G 1/2 BSPP pass-through air ports.

Figure 1.1— Master Plate Assembly (9120-160AM-000-000-SM Shown)



Tapered pins located on the Master plate mate with bushings in the Tool plate 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.

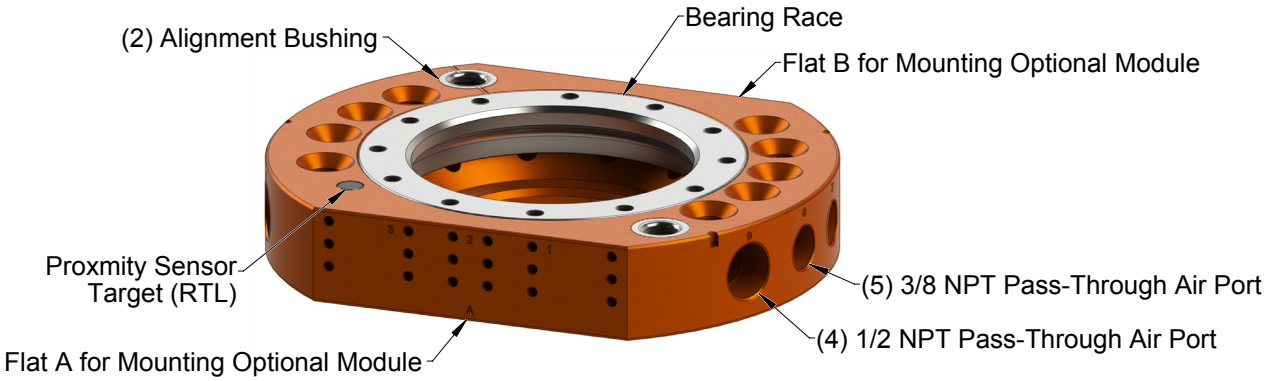
Proximity sensors are designed into the body of the Master plate to detect Lock and Unlock positions of the locking mechanism. The sensors provide “lock” and “unlock” position signals to the customer’s process controller, the sensors can be ordered separately. A proximity sensor can be installed into the body of the Master plate to verify Tool plate presence when coupled. The sensor provides a ready-to-lock (RTL) signal to the customer’s process controller, the RTL sensor can be ordered separately.

1.2 Tool Plate Assembly

The Tool plate assembly includes an anodized aluminum body and a hardened stainless-steel bearing race. The Tool plate has (2) flat sides for mounting of the optional modules. The Tool plate body also includes a 125 mm BC mounting pattern for direct customer tool mounting. Refer to *Section 8—Drawings* for mounting details. A bolt down Tool plate is available for the QC-160 but reduces the capacity. Contact ATI for specification.

The Tool plate assembly is equipped with (5) 3/8 NPT or G 3/8 BSPP and (4) 1/2 NPT or G 1/2 BSPP pass-through air ports. If equipped a proximity sensor target is included in the Tool plate for use with an RTL sensor.

Figure 1.2—Tool Plate Assembly (9120-160FT-000-000 Shown)



1.3 Optional Modules

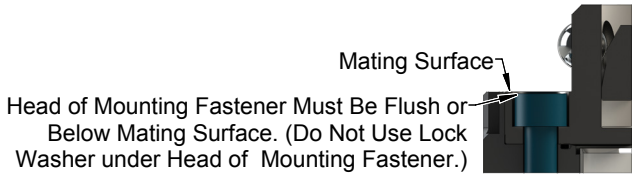
There are (2) flats available for mounting of the optional modules for support of the various utility pass-through, such as signal, fluid/air, and electric. Flats A and B have center or dual module mounting for up to (4) modules without adapters.

For assistance in the choosing the right modules for your particular application, visit our website (*QC-160 Series)* to see what is available or contact an ATI Sales Representative.

2. Installation

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 in *Table 2.1*. **Furthermore, removable (blue) Loctite 242 must be used on the these fasteners.** *Table 2.1* **contains recommended values based on the engineering standards.**

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.



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 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.

Table 2.1—Fastener Size, Class, and Torque Specifications

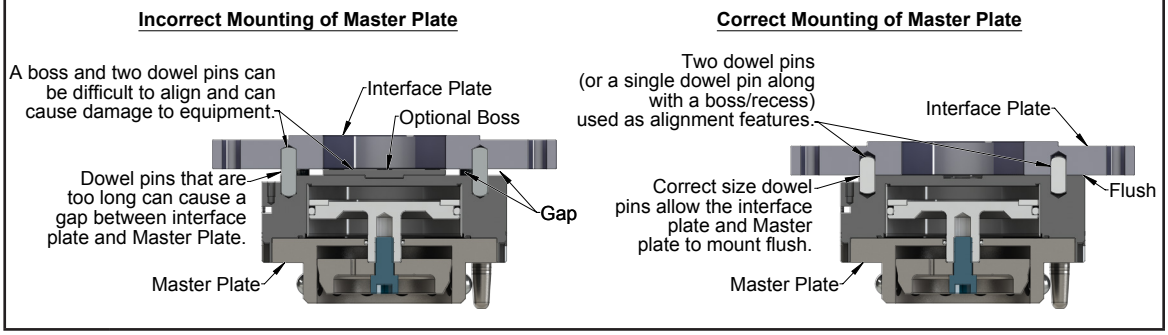
Mounting Conditions	Fastener Size & Property Class	Recommended Torque	Thread Locker
Master plate to Interface plate (6061-T6 aluminum) Minimum thread engagement of 15 mm (0.59") [1.5X fastener Ø]. Confirm available engagement with Robot Manufacturer	M10-1.5 Class 12.9	55 ft-lbs. (75 N-m)	Pre-applied adhesive or 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 Class 12.9	55 ft-lbs. (75 N-m)	
Tool Interface Plate (6061-T6 aluminum) to Tool plate (6061-T6 aluminum) Minimum thread engagement of 15 mm (0.59") [1.5X fastener Ø]. Do not exceed maximum available thread depth of the 17.5 mm as shown in *Section 8—Drawings*	M10-1.5 Class 12.9	38 ft-lbs. (52 N-m)	
Tool plate (6061-T6 aluminum) to Tool Interface Plate (6061-T6 aluminum) Minimum thread engagement of 0.59" (12 mm) [1.5X fastener Ø].	M8-1.25 Class 12.9	20 ft-lbs (27 N-m)	
Optional Module or adapter plate to Master or Tool plate, Supplied Fasteners	M4 x 0.7 Class 12.9		Pre-applied Adhesive or Loctite 222
	Socket Head Cap	20 in-lbs (2.26 Nm)	
	Socket Flat Head Cap	15 in-lbs (1.69 Nm)	

2.1 Master Interface

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.



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.

2.2 Master Plate Installation

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

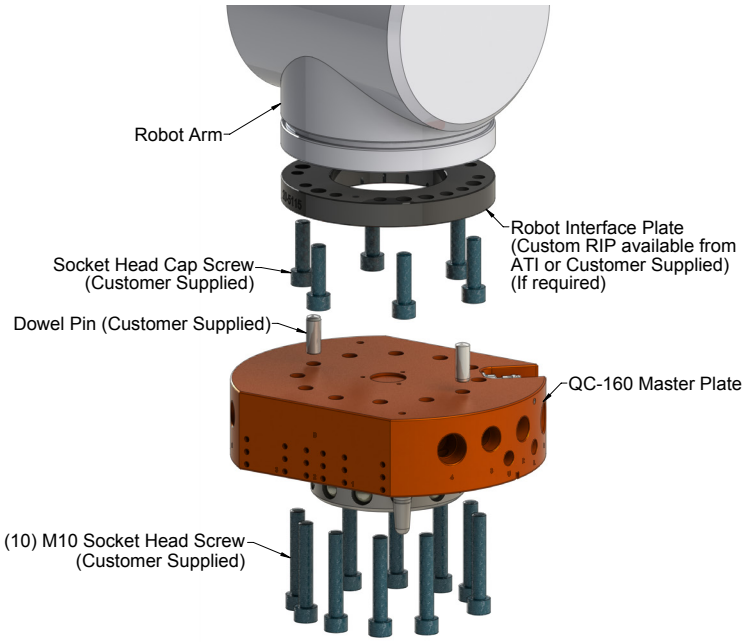
Supplies required: *Clean rag, Loctite 242*

1. Clean the mounting surfaces.
2. If required, install the interface plate to the robot arm, align using the boss and dowel pin or (2) dowel pins. Secure with customer supplied fasteners.

NOTICE: If an ATI interface plate is used, fasteners to mount the Master plate to the interface plate is supplied with the interface plate.

3. Align the dowel pins to the corresponding holes in the Master plate and apply Loctite 242 to threads of (10) M10 socket head cap screws.
4. Secure the Master plate to the robot arm or interface plate with the (10) M10 socket head cap screws using an 8 mm hex key. (see *Table 2.1* for proper torque).
5. Connect utilities to the appropriate modules and the pneumatic connections to the Master plate.
6. If equipped, connect the Lock, Unlock and RTL sensor connections.

Figure 2.1—Typical Master Plate Installation



2.3 Master Plate Removal

Tools required: *8 mm hex key*

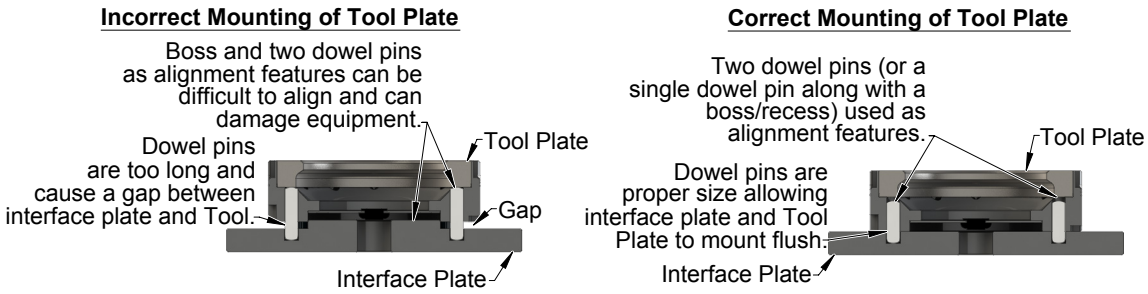
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. If needed, disconnect all utilities (e.g. electrical, air, water, etc.). Note: support the Master plate while removing the fasteners.
5. Remove the customer supplied (10) M10 socket head cap screws connecting the Master plate to the robot arm or interface plate using an 8 mm hex key.
6. Remove the Master plate.

2.4 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 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.



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.

2.5 Tool Plate Installation

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

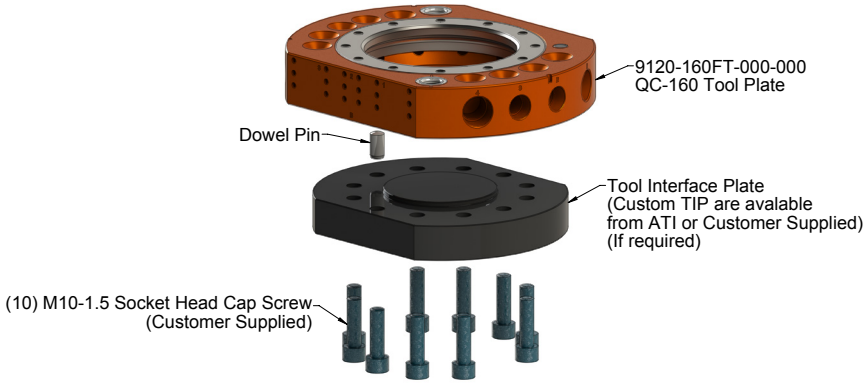
Supplies required: *Clean rag, Loctite 242*

1. Clean the mounting surfaces.
2. Align the dowel pins to the corresponding holes in the Tool plate and secure the Tool plate to the tool interface plate or customer tooling with customer supplied customer supplied (10) M10 socket head cap screws using an 8 mm hex key. Apply Loctite 242 to threads (see *Table 2.1*).

NOTICE: If an ATI Interface Plate is used, fasteners to mount the Tool plate is supplied with the Interface Plate.

3. Connect utilities to the appropriate module and Tool plate connections.
4. If the installation is complete, the Tool plate may be put into normal operations.

Figure 2.2— Standard Tool Plate Installation



2.6 Tool Plate Removal

Tools required: *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 (e.g. electrical, air, water, etc.).
4. If needed, disconnect all utilities (e.g. electrical, air, water, etc.).
5. Remove the customer supplied (10) M10 socket head cap screws connecting the Tool plate to the tooling or tool interface plate using an 8 mm hex key.
6. Remove the Tool plate.

2.7 Bolt Down Tool Plate Installation

Tools required: *6 mm hex key, torque wrench*

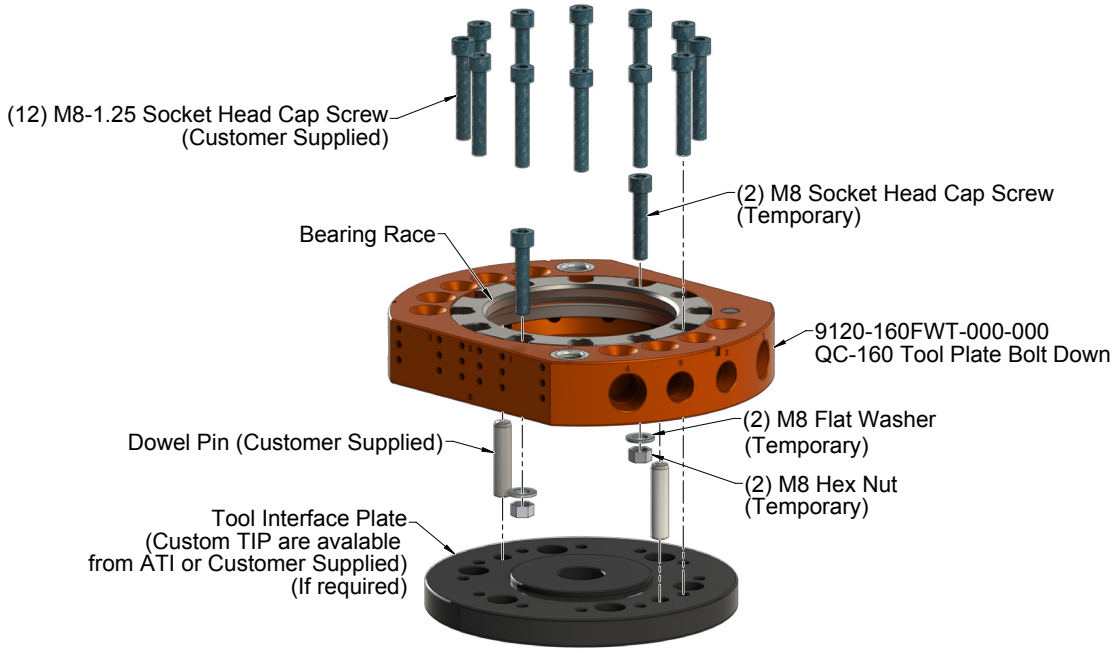
Supplies required: *Clean rag, Loctite 242*

1. Clean the mounting surfaces.
2. If required, install the tooling interface plate to the customer tooling, align using the boss or dowel pins and secure with customer supplied fasteners.
3. Remove the (2) temporary M8 socket head cap screws, M8 flat washers, and M8 hex nuts, securing the Bearing Race to the Tool plate.
4. Align the dowel pins to the corresponding holes in the Tool plate, apply Loctite 242 to threads and secure the Tool plate to the tool interface plate or customer tooling with customer supplied fasteners. Refer to *Table 2.1* for proper torque.

NOTICE: If an ATI tool interface plate is used, fasteners to mount the Tool plate to the tool interface plate may be supplied with the tool interface plate. The fasteners to mount the tool interface plate or the Tool plate directly to the customer tooling is customer supplied.

5. Connect utilities to the appropriate module and Tool plate connections.

Figure 2.3— Bolt Down Tool Plate Installation



2.8 Bolt Down Tool Plate Removal

Tools required: *6 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 (e.g. electrical, air, water, etc.).
4. If needed, disconnect all utilities (e.g. electrical, air, water, etc.).
5. Remove the customer supplied (12) M8 socket head cap screws connecting the Tool plate to the tooling or tool interface plate using a 6 mm hex key.
6. Remove the Tool plate.

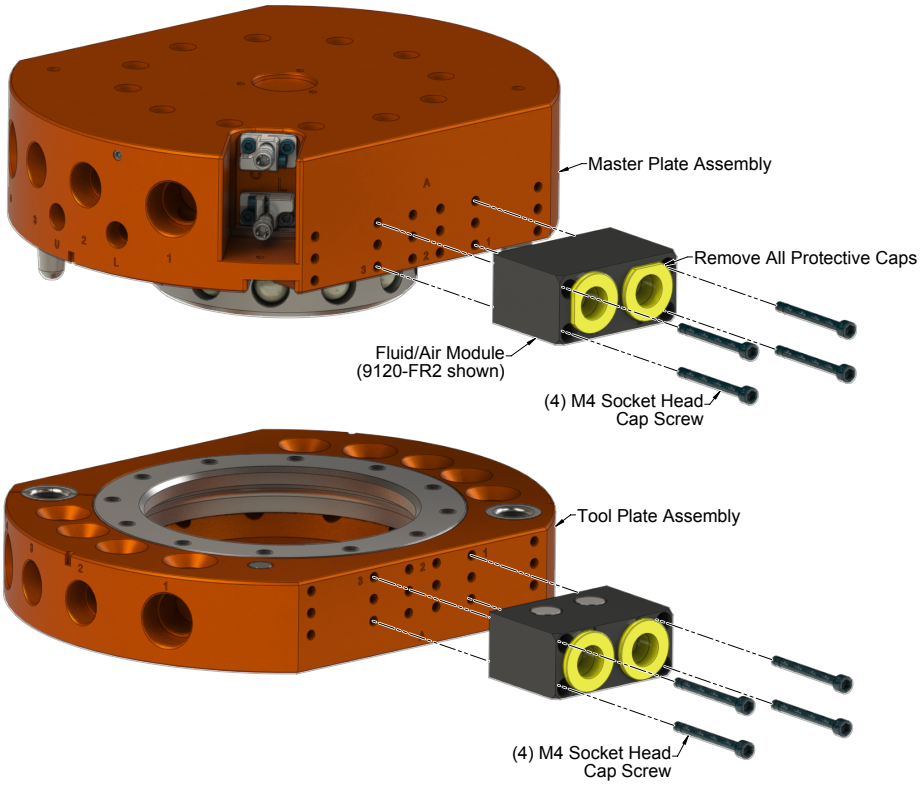
2.9 Optional Module with J16 Pattern Installation

Tools required: *2.5 mm or 3 mm hex key, toque 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 (e.g. electrical, air, water, etc.).
4. Make sure mounting surfaces of the Tool plate, Master plate, and modules are clean and free of the debris. Align optional module on the Master or Tool plate as shown in *Figure 2.4*.
5. Apply Loctite 222 to (4) M4 mounting fasteners.
6. Secure module with (4) M4 mounting fasteners using a 2.5 mm or 3 mm hex key. Refer to *Table 3.1* for proper torque for your specific mounting fasteners.
7. Remove the all protective caps, plugs, tape, etc from the module prior to operation.
8. Safely resume normal operation.

Figure 2.4—Optional Module Installation



2.10 Optional Module with J16 Pattern Removal

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 (e.g. electrical, air, water, etc.).
4. Disconnect any cables, air line, etc. If required.
5. Supporting the module, remove the (4) M4 mounting fasteners using a 2.5 mm or 3 mm hex key.
6. Remove the module from the Master and/or Tool plate.

2.11 Pneumatic Connections and Valve 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.

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.

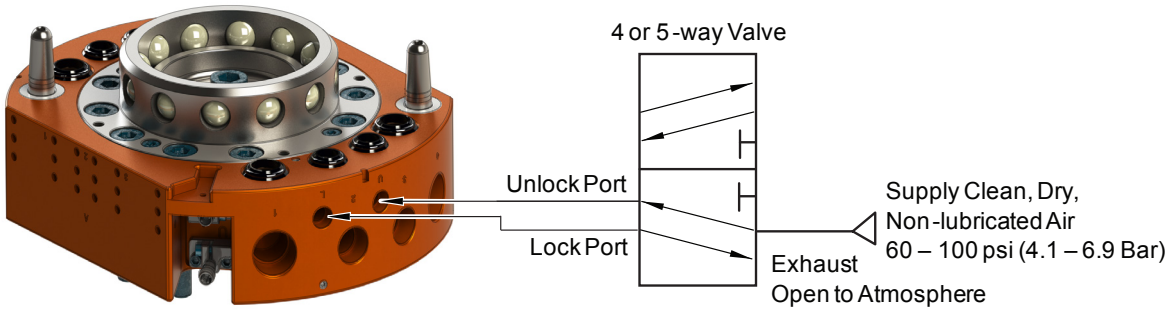
2.11.1 Valve Requirements and Connections for the Locking Mechanism

NOTICE: No valve is required when using a valve adapter module. The valve adapter module has an integrated solenoid valve and only requires the customer to supply a single air source to the valve adapter.

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 (i.e., 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 2.5—— Lock and Unlock Pneumatic Connections



2.12 Electrical Connections

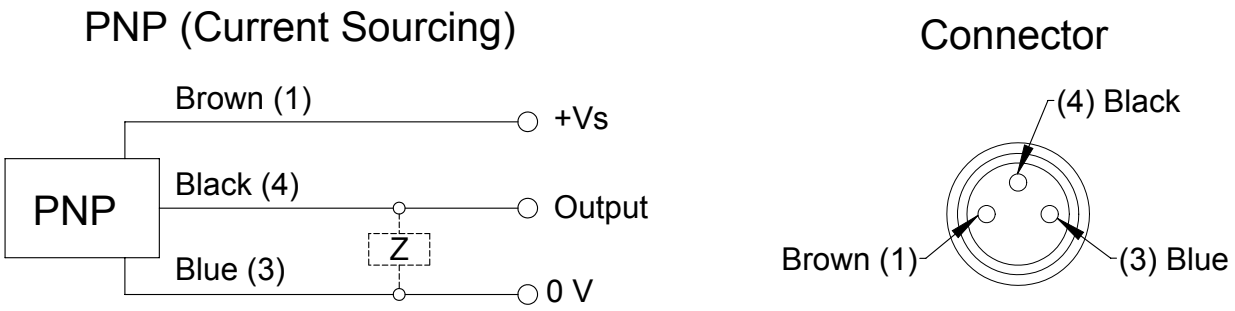
The Tool Changer is available with integrated lock/unlock sensors. If the sensors are not used, plugs will be provided to seal the locking mechanism.

2.12.1 PNP Type Lock and Unlock Sensors (-SM and -ST sensor designation)

This section applies to the following part number designators: (-SM), (-SM-E), (-SM-RD), (-SM-RD-E), (-SM-RD1), (-SM-RD1-E), (-ST), (-ST-E), (-ST-RD), (-ST-RD-E). If equipped the RTL sensors will be the same type as the Lock and Unlock sensors. The (-RD or -RD1) designation is for models with optional RTL sensor. Example: 9120-160AM-000-000-SM-RD

Table 2.2—PNP (Current Sourcing)	
Description	**Value**
Voltage Supply Range	10-30 VDC
Output Circuit	PNP make function (NO)

Figure 2.6—PNP Type Lock, Unlock and RTL Sensors

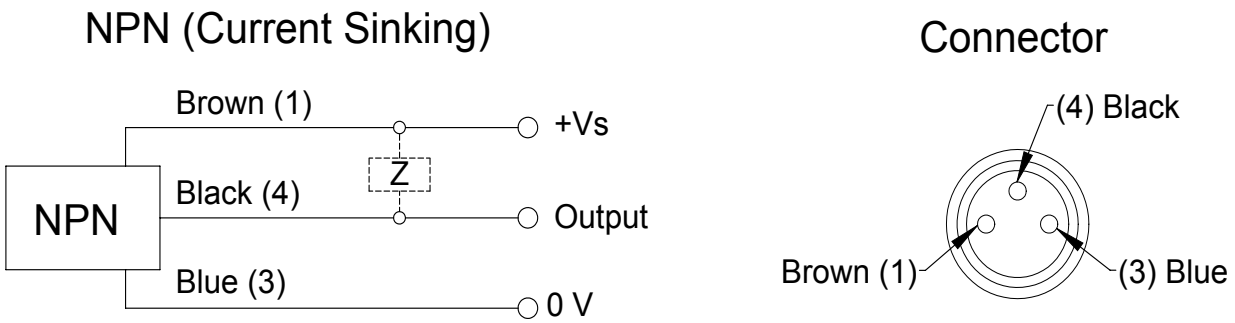


2.12.2 NPN Type Lock and Unlock, Sensors (-SP and -SU sensor designation)

This section applies to the following part number designators: (-SP), (-SP-E), (-SP-RD), (-SP-RD-E), (-SP-RD1), (-SP-RD1-E), (-SU), (-SU-E), (-SU-RD), (-SU-RD-E)., (-SU-RD1) If equipped the RTL sensors will be the same type as the Lock and Unlock sensors. The (-RD or -RD1) designation is for models with optional RTL sensor. Example: 9120-160AM-000-000-SP-RD

Table 2.3—NPN (Current Sinking)	
Description	**Value**
Voltage Supply Range	10-30 VDC
Output Circuit	NPN make function (NO)

Figure 2.7—NPN Type Lock, Unlock and RTL Sensors

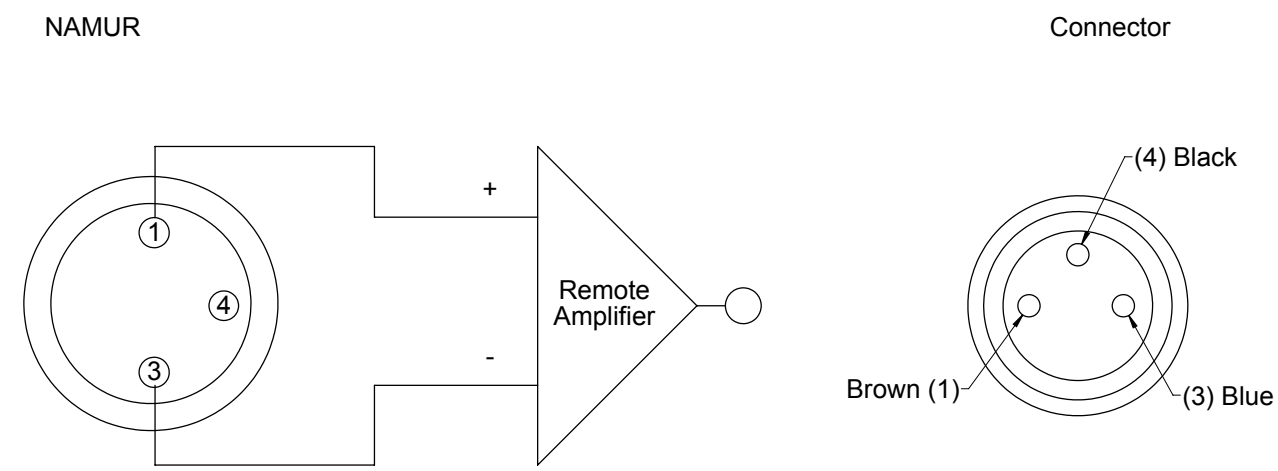


2.12.3 Namur Type Lock and Unlock Sensors (-SV sensor designation)

This section applies to the following part number designator: (-SV). RTL sensors are not available for this model. Example: 9120-160AM-000-000-SV

Table 2.4—PNP (Current Sourcing)	
Description	**Lock and Unlock Sensors**
	Value
Voltage Supply Range	5-30 VDC
Operating Current	Remote
Non-Actuated Current Consumption	≥ 2.1 mA
Actuated Current Consumption	≤ 1.2 mA
Nominal Sensing Distance Sn	1.0 mm
Output Circuit	2-Wire DC NAMUR

Figure 2.8—NAMUR Type Lock and Unlock Sensors



Output: Y1

3. 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 the compressed air at a pressure of 60 to 100 psi. Robot motion should be halted If the air supply pressure drops below 60 psi 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 the service (See *Section 4.2—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 must be programmed to minimize misalignment during coupling and uncoupling. The tool stand must be durable and not allow deflection under uncoupled Tool weight that will take alignment of the Tool Changer plates outside of the accepted offsets. See *Figure 3.1* and *Table 3.1* for recommended maximum allowable offsets prior to coupling. Greater offsets than shown in *Table 3.1* 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 3.1*) but not touching the Tool plate. As locking occurs, the Master plate should draw the Tool plate into the locked position.

Figure 3.1— Offset Definitions

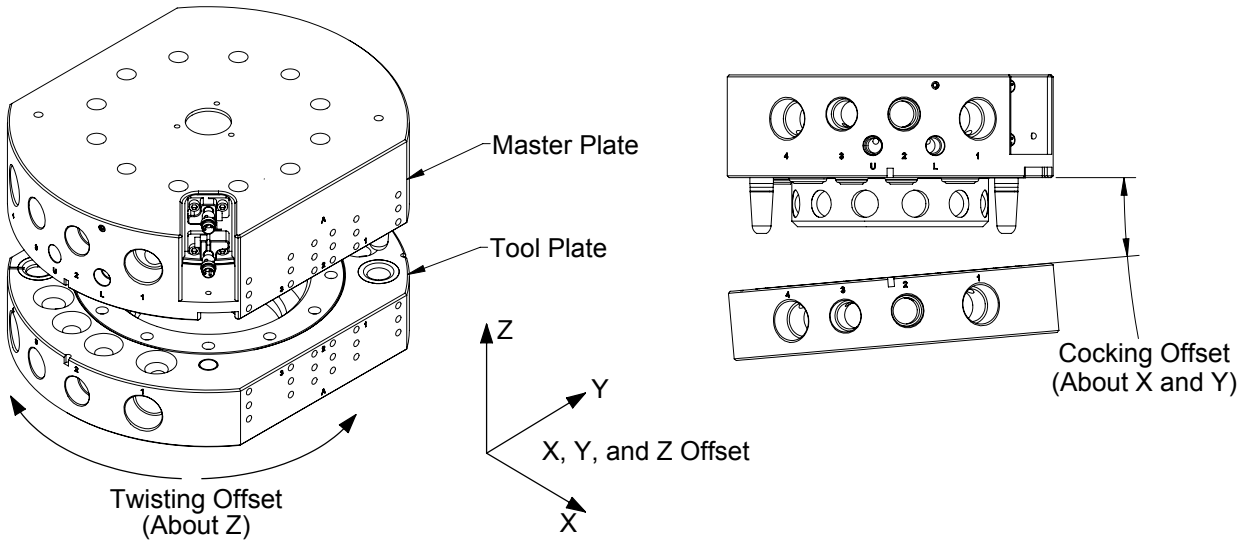


Table 3.1—Maximum Recommended Offsets Prior to Coupling

Model	No-Touch Zone Z Offset (Max)[1]	X and Y Offset (Max)[2]	Cocking Offset (Max)	Twisting Offset (Max)
QC-160	+2.5	±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.

3.1 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.

3.2 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.

3.3 Conditions for Uncoupling

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.

3.4 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.

3.5 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 TSL (Tool Stand Large) system is compatible with ATI Tool Changer sizes QC-150 and larger. The TSL systems can be equipped with horizontal modules, clamp modules, and different types of tool sensing. Visit the ATI Web Site *http://www.ati-ia.com/products/toolchanger/toolstand/large/LargeStand.aspx* for products available or contact ATI for assistance.

If the customer is supplying the tool stand, it must provide a fixed, repeatable, level, and stable position for tool pick-up and drop-off. The tool stand must 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.

Ideally, the Tool should be hanging 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, "horizontal-position" tool stands cause more wear on the locking mechanism and locating features of the Tool Changer and tool stand.

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 vital in Tool pick-up and drop-off.

A sensor that detects the presence of the Tool in the tool stand is recommended. 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.

Proximity sensors should be positioned 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.

Tool stands debris shields can cover Tools and modules to protect them in dirty environments, such as grinding or welding. Alternatively, positioning tool stands in areas shielded from weld spatter, fluids, adhesives, or other debris would eliminate the need for debris shields.

4. 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 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:

1) Placement of the tool stands away from the debris generators.
2) Covers incorporated into the tool stands.
3) Guards, deflectors, air curtains, and similar devices built into the EOAT and the tool stand.

4.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule is provided in following table. Refer to module sections for detailed preventive maintenance steps for all utility modules.

Table 4.1—Maintenance Schedule

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

- ☐ Inspect fasteners for proper torque, interferences, and wear. Tighten and correct as required. Refer to *Table 2.1.*

Ball Bearings/Alignment Pins/Bushings/Bearing Race

- ☐ Inspect for wear and proper lubrication. MobilGrease XHP222 Special a NLGI #2 lithium complex grease with molybdenum disulfide additive 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 4.2—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. Check tool stand for wear and alignment problems. To replace worn alignment pins, refer to *Section 5.2.5—Alignment Pin Replacement.*
- ☐ Inspect for wear on the ball bearings/bearing race, may be an indication of the excessive loading.

Sensors and Cables

- ☐ Inspect sensor cable connectors for tightness, if loose tighten connections.
- ☐ Inspect sensor cables and connectors for any damage, cuts, and abrasion. Refer to *Section 5.2.1—Lock and Unlock Sensor Replacement* and *Section 5.2.2—RTL Sensor Replacement Procedures.*

Electrical Contacts/Pin Block (Modules)

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

Seals

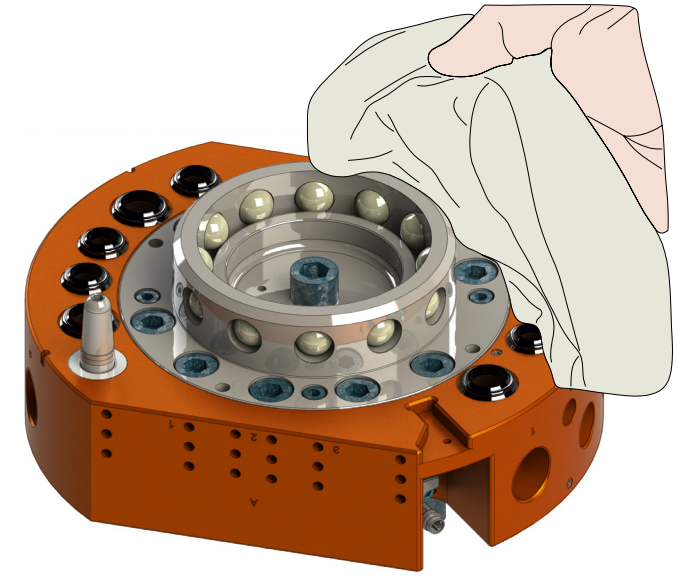
- ☐ Inspect for wear, abrasion, and cuts. Refer to *Section 5.2.4—Seal Inspection and Replacement.*

4.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

Supplies required: *Clean rag, MobilGrease® XHP222 Special Grease*

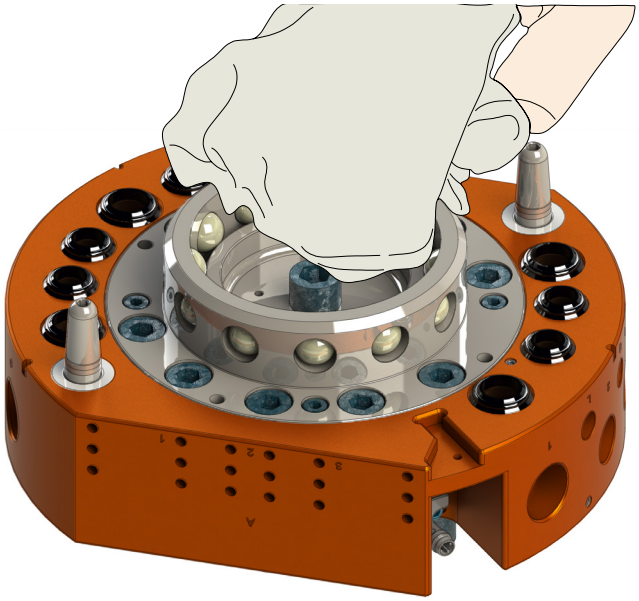
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam, and alignment pins.

Figure 4.1—Cleaning Ball Bearings and Outer Surfaces of Male Coupling



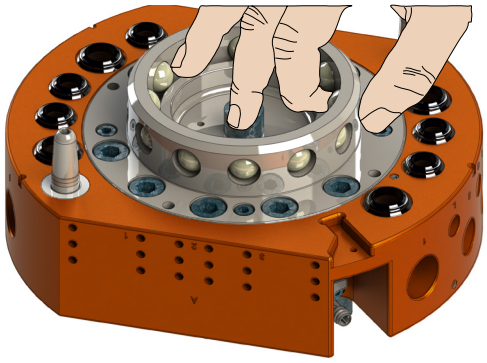
5. Use a clean rag to thoroughly remove any lubricant and debris from the inner surface of the male coupling and cam.

Figure 4.2—Cleaning Ball Bearings, Cam and Inner Surfaces of Male Coupling



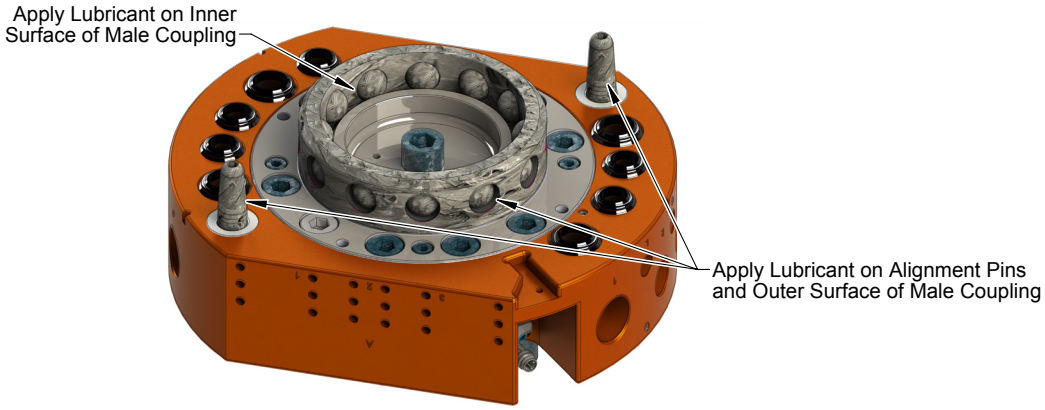
6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 4.3—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 4.4—Apply Lubricant to Locking Mechanism

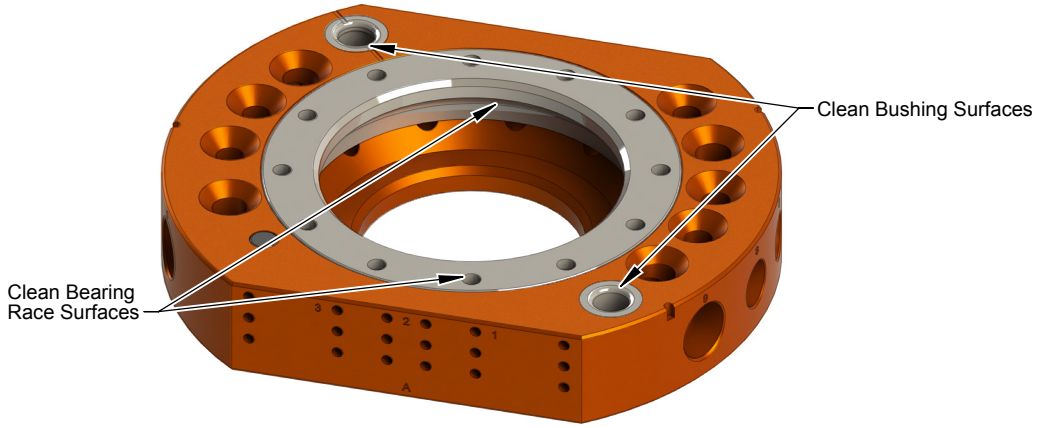


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

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

9. After the procedure is complete, resume normal operation.

Figure 4.5—Clean Tool Plate Surfaces of locking Mechanism

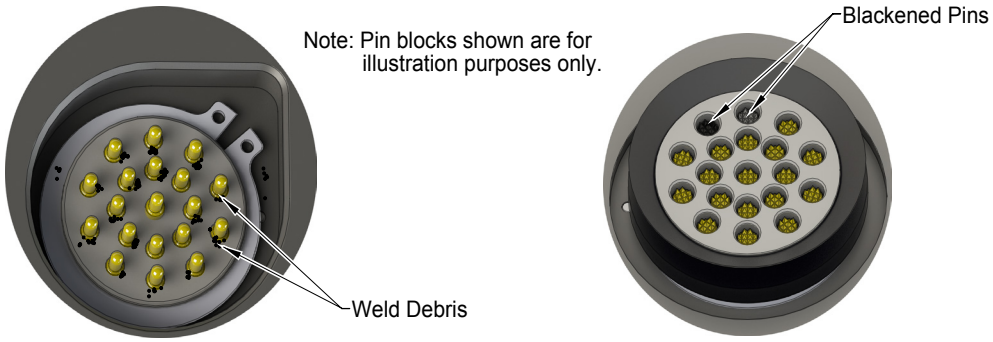


4.3 Pin Block Inspection and Cleaning

Tools required: *Nylon Brush (ATI Part Number 3690-0000064-60)*

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

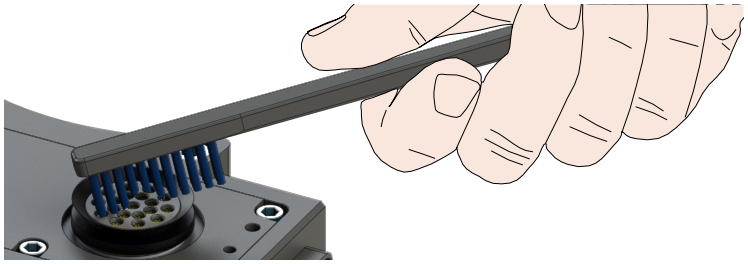
Figure 4.6—Inspect Master and Tool Pin Blocks



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).

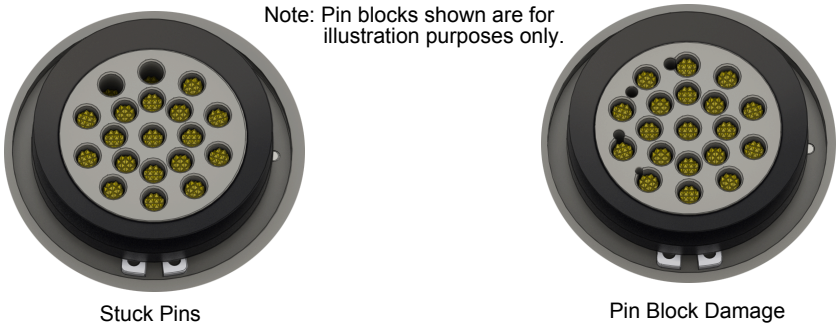
NOTICE: Do not use an abrasive media, cleaners, or solvents to clean the contact pins. Using abrasive media, cleaners, or solvents will cause damage to the contact surface, or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI Part Number 3690-0000064-60)

Figure 4.7—Clean Pin Blocks with a Nylon Brush



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

Figure 4.8—Stuck Pin and Pin Block Damage



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

5. Troubleshooting and Service Procedures

The following section provides troubleshooting and service information to help diagnose conditions and repair the Tool Changer or control/signal module.

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 circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

5.1 Troubleshooting Procedures

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

Table 5.1—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 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 2.11—Pneumatic Connections and Valve Requirements.*
	Air pressure trapped in the de-energized Lock or Unlock ports.	Air pressure must be vented to the atmosphere properly, refer to *Section 2.11—Pneumatic Connections and Valve Requirements* or refer to the troubleshooting section of the air/valve adapter manual for more information.
	Pneumatic connections loose or damaged, solenoid cable damaged.	Refer to the air/valve adapter manual for more information.
	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 4.2—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 3.5—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 5.2.1—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 5.2.1—Lock and Unlock Sensor Replacement.*
Units Equipped with Electrical/Servo/Control/Signal Modules		
Loss of Communication	Debris in the and around contact pins. Contact Pin worn or damaged.	Inspect V-ring seal for damage, replace damaged seal. Refer to *Section 5.2.4—Seal Inspection and Replacement.*
	Cable connections loose or cables damaged.	Check that cable connection are secure and cables are not damaged.

5.2 Service Procedures

The following service procedures provide instructions for component replacement.

5.2.1 Lock and Unlock Sensor Replacement

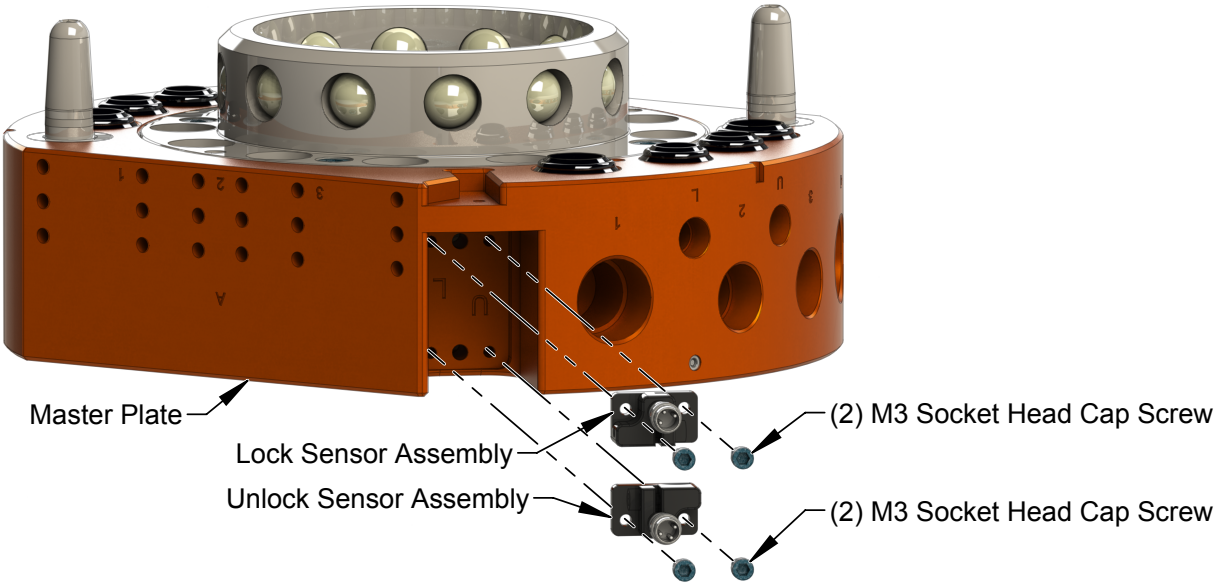
Parts required: *Refer to Section 6—Serviceable Parts*

Tools required: *2.5 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 (e.g. electrical, air, water, etc.).
4. Disconnect the Lock and/or Unlock sensor cable connectors from the Lock and/or Unlock sensor assembly.
5. Remove the (2) M3 socket head cap screws that secure the Lock and/or Unlock sensor assembly to the Tool Changer body.
6. Pull the sensor assembly straight out from the Tool Changer body. Discard the removed sensor.

> **CAUTION:** The Lock and Unlock sensor assemblies are precision aligned and permanently assembled at the factory. Do not attempt to disassemble and rebuild.

Figure 5.1— Lock and Unlock Sensor Assembly Replacement



7. Insert the new Lock and/or Unlock sensor into the Tool Changer body as shown in *Figure 5.1*. Make sure the O-ring is in place and seated properly on the back side of the sensor assembly.
8. Secure the sensor assembly using the (2) M3 socket flat head screw using a 2.5 mm hex key. Tighten to 12 in-lbs (1.4 Nm).
9. Connect the Lock and/or Unlock sensor cable connector to the proper sensor.
10. To confirm the operation of the Unlock sensor, unlock the Tool Changer and check to see that the LED in the Unlock sensor body is on. To confirm the operation of the Lock sensor, lock the Tool Changer and then check to see that the LED in the Lock sensor body is on.
11. Safely resume normal operation.

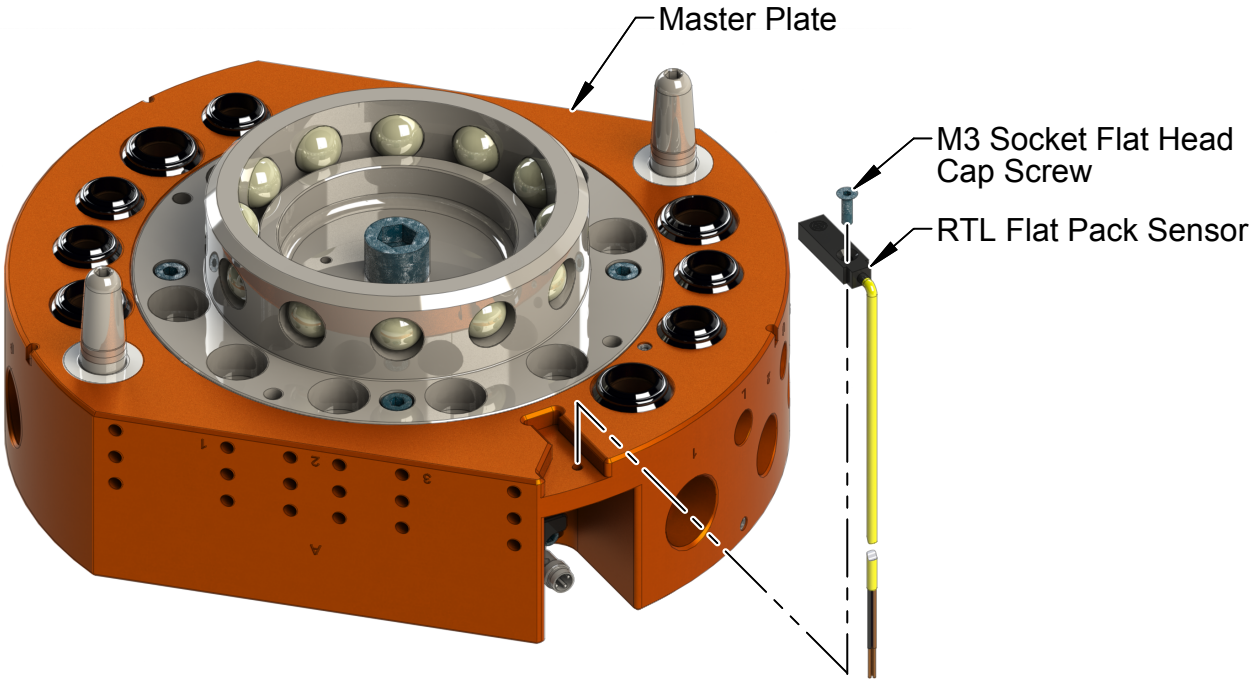
5.2.2 RTL Sensor Replacement Procedures

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

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

1. Place the Tool in a secure location.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Disconnect the RTL sensor cable.
4. Using a 2.5 mm hex key, unscrew the M3 socket head flat screw that secures the RTL sensor to the Tool Changer body.
5. Remove and discard the RTL sensor.

Figure 5.2— RTL Sensor Replacement



6. Install the RTL sensor to the Tool Changer body.
7. Apply Loctite 222 to the M3 socket flat head screws. Secure the sensor to the Tool Changer body and tighten to 60 in-ozs (0.4 Nm).
8. Connect the RTL sensor cable.
9. Confirm the operation of the RTL sensor by bringing a metallic object into close proximity to the face of the sensor and watching for the LED in the body of the sensor to light up.
10. Safely resume normal operation.

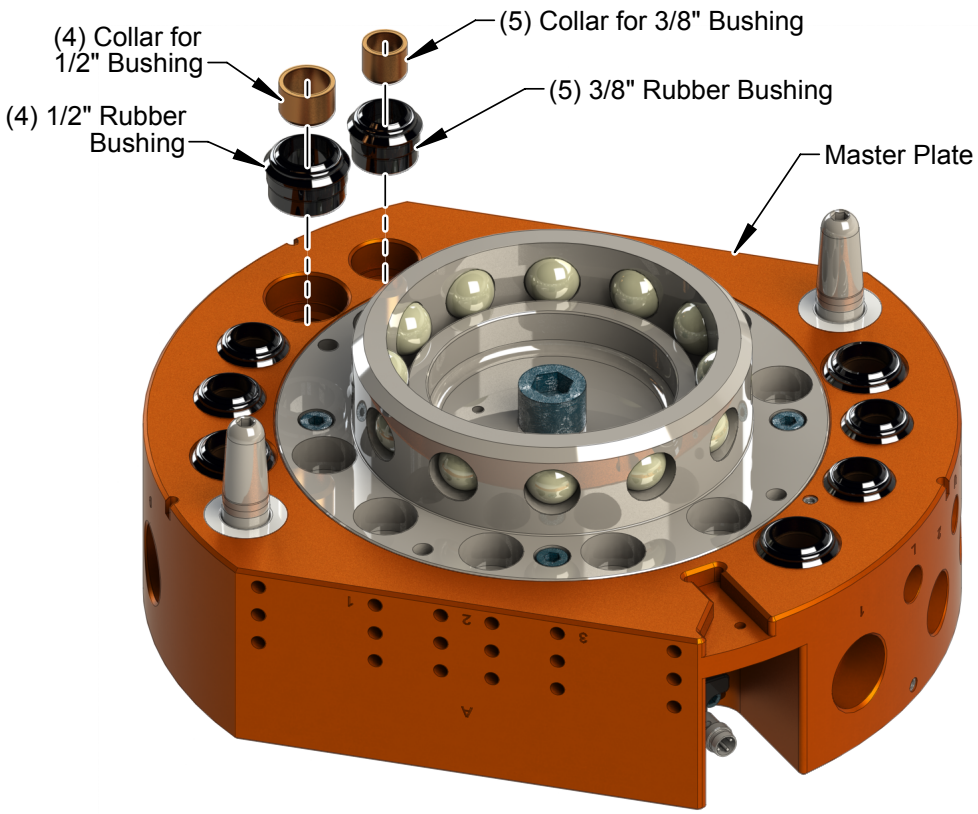
5.2.3 Rubber Bushing Replacement

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

Tools required: *Needle nose pliers*

1. Place the Tool in a secure location.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Using needle nose pliers grasp the rubber bushing and pull it out of the Master body.
4. If the collar remains in the Master body, remove the it.
5. Lightly lubricate the new rubber bushing and push into the Master body.
6. Insert the new collar into the rubber bushing, make sure the bushing is pressed all the way in.
7. Safely resume normal operation.

Figure 5.3— Rubber Bushing Replacement



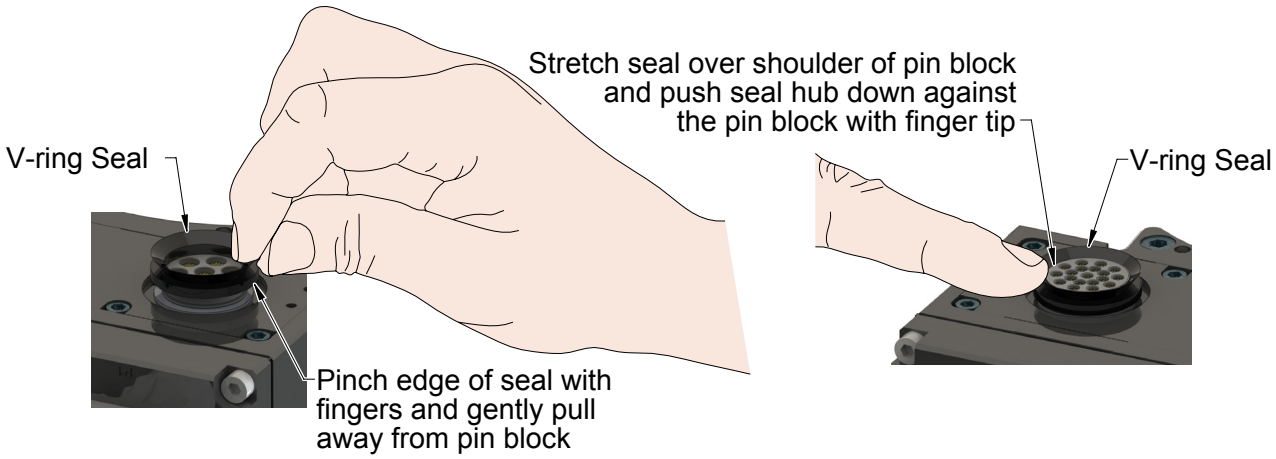
5.2.4 Seal Inspection and Replacement

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

The seal protects the electrical connection between the Master and Tool module. If the seal becomes worn or damaged, replace the seal.

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

Figure 5.4—V-ring Seal Replacement



5.2.5 Alignment Pin Replacement

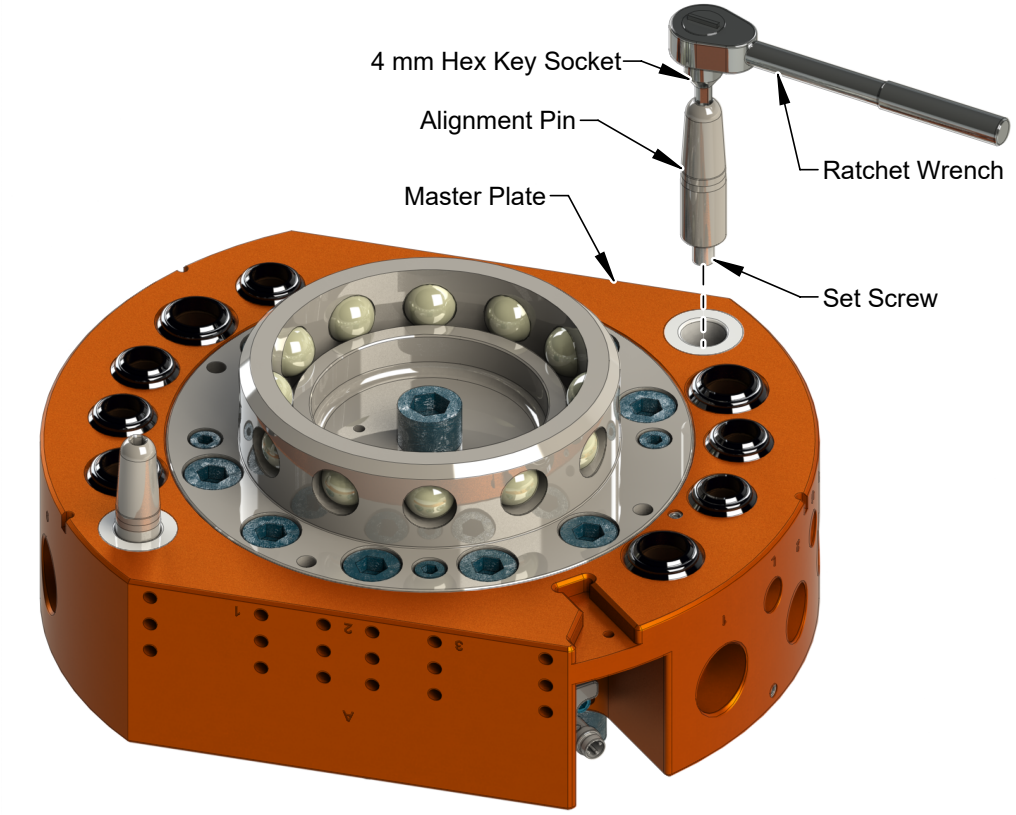
Parts required: *Refer to Section 6—Serviceable Parts*

Tools required: *3 mm and 4 mm hex key socket, torque wrench*

Supplies required: *Clean rag, MobilGrease XHP222, Loctite 242*

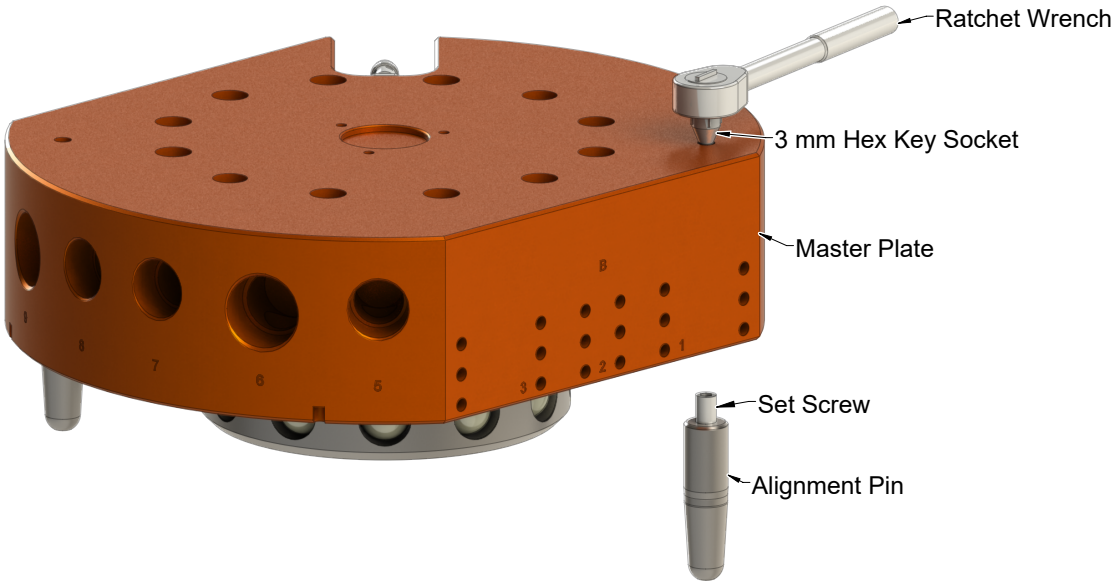
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Clean off debris and excess grease from the alignment pin.
5. Unscrew the alignment pin assembly from the Master plate using a 4 mm hex key. If the alignment pin cannot be removed using the hex key in the tip, go to step *6*. If the alignment pin was removed, go to step *7*.

Figure 5.5—Remove Alignment Pin from Tip



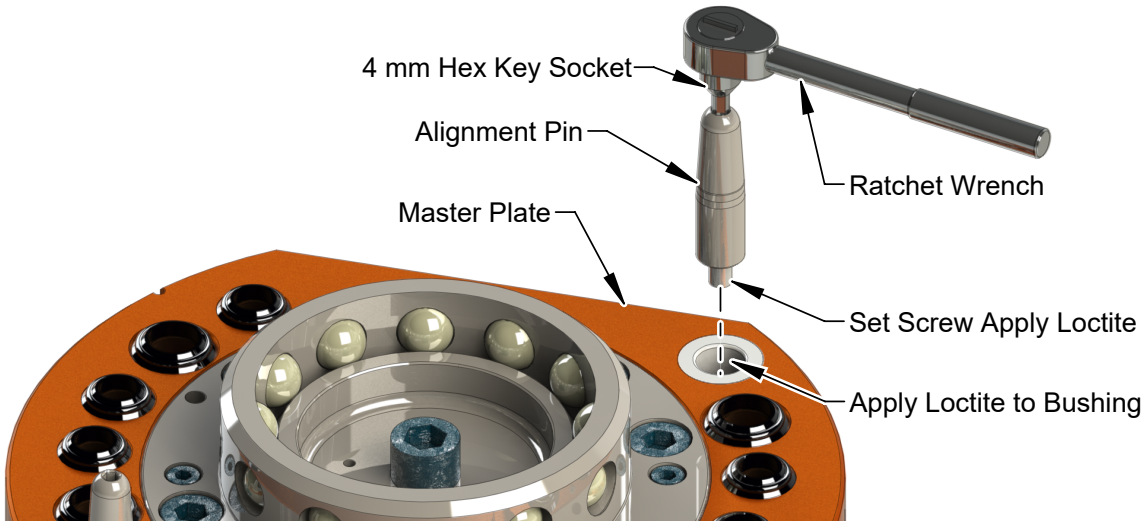
6. Another approach would be to use the access hole in the back side of the Master plate. If no,t already removed, remove the Master plate refer to *Section 2.3—Master Plate Removal*. Use a 3 mm hex key to remove the alignment pin from the back side of the Master plate by turning the set screw clockwise to drive the pin out the front of the plate. (Refer to *Figure 5.6*).

Figure 5.6—Alternative Method



7. Once the alignment pin has been removed, verify that the assembly (pin and set screw) are intact.
8. Apply Loctite 242 to the inside of the alignment pin bushing and the threads if the alignment pin.
9. Install the alignment pin assembly into the bushing on the Tool Changer. Tighten to 60 in-lbs (6.8 Nm).
10. Apply MobilGrease XHP222 Special grease to the alignment pin (see *Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins*
11. Safely resume normal operation.

Figure 5.7—Install New Alignment Pin



6. Serviceable Parts

6.1 Master Plate Common Parts

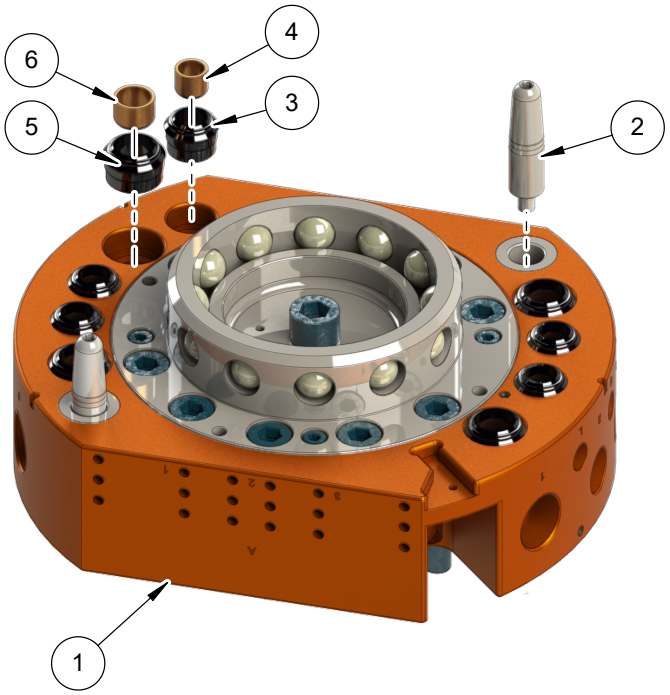


Table 6.1—Master Plate Common Parts			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-160AM-000-000	QC-160 Master Base Assembly, No Options
		9120-160AM-000-000-E[1]	QC-160 Master Base Assembly, Euro No Options
2	2	9005-20-2241	1/2” (2) Piece Pin Assembly
3	5	4010-0000010-01	3/8” Rubber Bushing. Nitrile
4	5	3700-20-2000	Collar for 3/8” Bushing
5	4	4010-0000063-01	1/2” Rubber Bushing. Nitrile
6	4	3700-20-4748	Collar for 1/2" Bushing

Note:

1. QC-160 models with -E Part Numbers are Euro products, they have black anodized bodies and BSPP pass-through air ports.

6.2 Master Plate Parts for Models with No Sensors

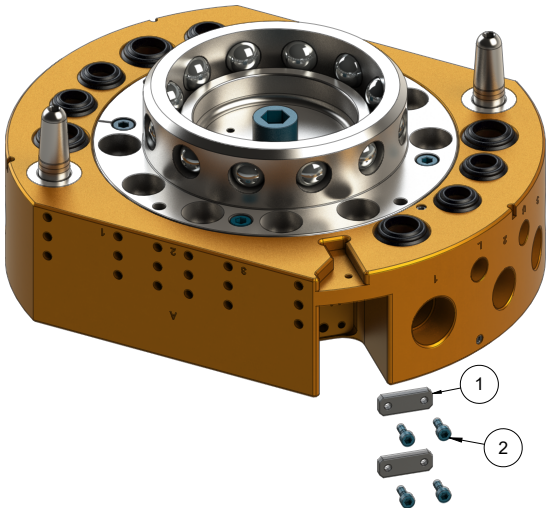


Table 6.2—Models 9120-160AM-000-000-S0(-E)			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1983	Sensor Bore Cover Plate Assembly, SS Screws (Includes (2) of item 2)
2	4	3500-1058008-21A	M3 x 8 Socket Head Cap Screws, SS, ND Ind. Microspheres Epoxy, Yellow. 0-3 uncoated lead thds. 5-7 coated thds

6.3 Master Plate Parts for Models with Lock and Unlock Sensors

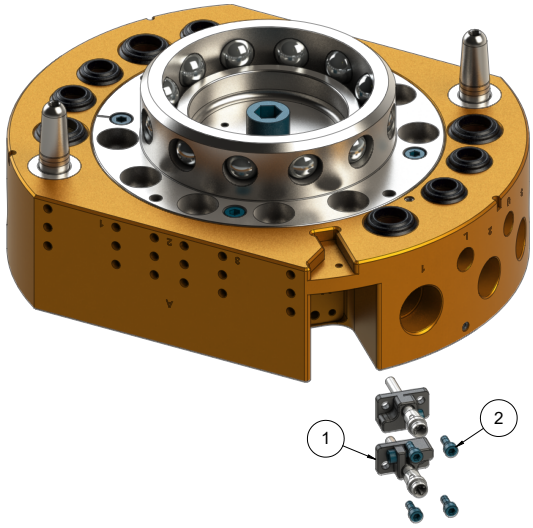


Table 6.3—Master Plate Parts for Models with Lock and Unlock Sensors			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-160AM-000-000-SM(-E)			
1	2	9005-20-1917	Lock/Unlock Sensor Assembly, QC-110 (PNP)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
Model 9120-160AM-000-000-SP(-E)			
1	2	9005-20-1918	Lock/Unlock Sensor Assembly, QC-110 (NPN)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
Model 9120-160AM-000-000-SV(-E)			
1	2	9005-20-2271	Lock/Unlock Sensor Assembly, 25 Degree Orientation, NAMUR
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525

6.4 Master Plate Parts for Models with Lock and Unlock Sensors and Cables

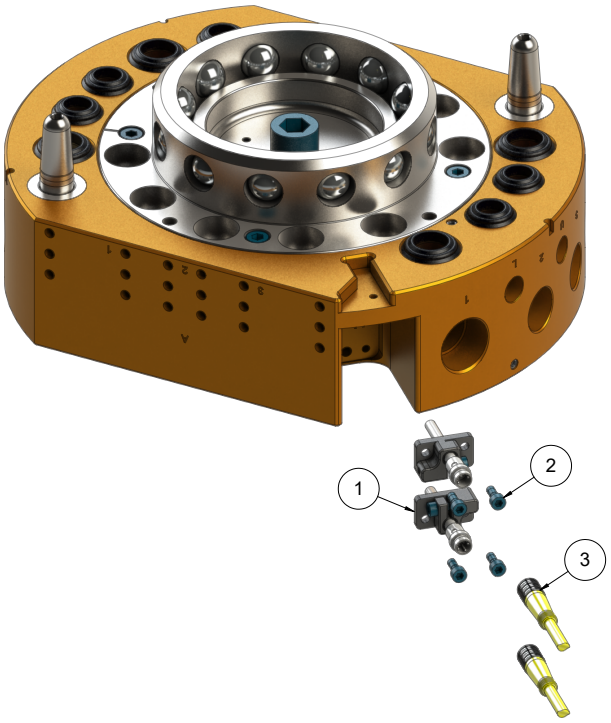


Table 6.4—Master Plate Sensor Parts			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-160AM-000-000-ST(-E)			
1	2	9005-20-1917	Lock/Unlock Sensor Assembly, QC-110 (PNP)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	2	8590-9909999-15	High-flex cable with straight screw-on connector, 5M (16.4 ft.) long with flying leads (Type - BB)
Model 9120-160AM-000-000-SU(-E)			
1	2	9005-20-1918	Lock/Unlock Sensor Assembly, QC-110 (NPN)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	2	8590-9909999-15	High-flex cable with straight screw-on connector, 5M (16.4 ft.) long with flying leads (Type - BB)

6.5 Master Plate Parts for Models with Lock, Unlock, and RTL Sensors

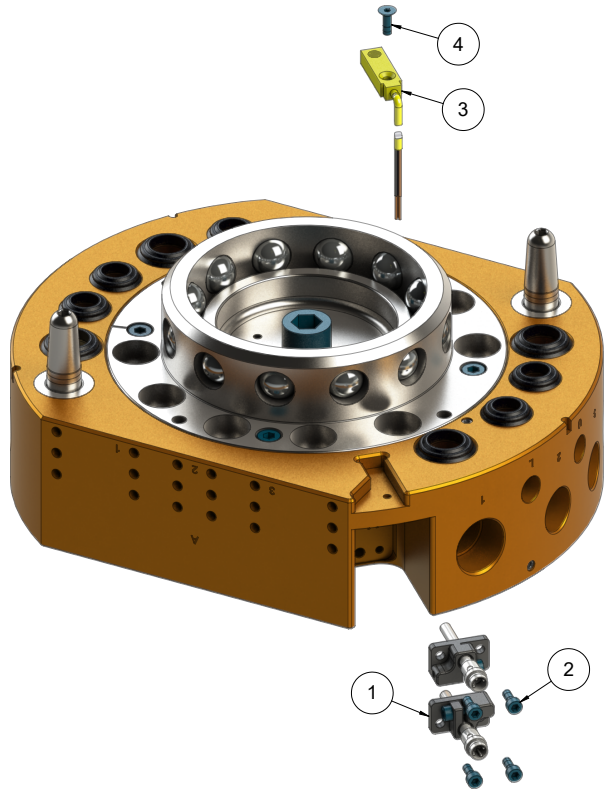


Table 6.5—Master Plate Parts for Models with Lock, Unlock, and RTL Sensors			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-160AM-000-000-SM-RD(-E))			
1	2	9005-20-1917	Lock/Unlock Sensor Assembly, QC-110 (PNP)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	1	8590-9909999-150	PNP Flat Prox 5M long (no conn) Turck Bi2-Q5.5-AP6X 5M
4	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow
Model 9120-160AM-000-000-SM-RD1(-E)			
1	2	9005-20-1917	Lock/Unlock Sensor Assembly, QC-110 (PNP)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	1	8590-9909999-189	PNP Prox Sensor, Flat Pack, .2m Lg, Straight Pico
4	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow
Model 9120-160AM-000-000-SP-RD(-E)			
1	2	9005-20-1918	Lock/Unlock Sensor Assembly, QC-110 (NPN)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	1	8590-9909999-172	NPN Flat Pack Sensor, 5 Meter, Flying Leads Bi2-Q5.5-AN6X-5M
4	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow
Model 9120-160AM-000-000-SP-RD1(-E)			
1	2	9005-20-1918	Lock/Unlock Sensor Assembly, QC-110 (NPN)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	1	8590-9909999-190	NPN Prox Sensor, Flat Pack, .2m Lg, Straight Pico
4	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow

6.6 Master Plate Parts for Models with Lock, Unlock, RTL Sensors and Cables

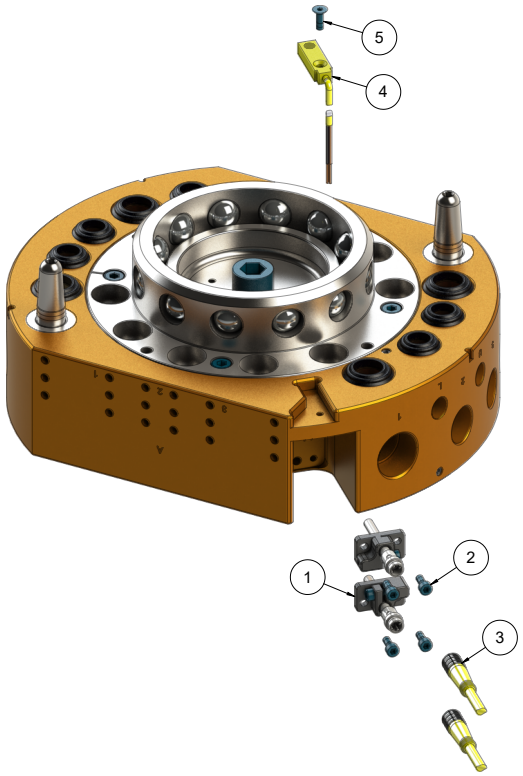


Table 6.6—Master Plate Parts for Models with Lock, Unlock, RTL Sensors and Cables			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-160AM-000-000-ST-RD(-E)			
1	2	9005-20-1917	Lock/Unlock Sensor Assembly, QC-110 (PNP)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	1	8590-9909999-15	High-flex cable with straight screw-on connector, 5M (16.4 ft.) long with flying leads (Type - BB)
4	1	8590-9909999-172	NPN Flat Pack Sensor, 5 Meter, Flying Leads Bi2-Q5.5-AN6X-5M
5	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow
Model 9120-160AM-000-000-SU-RD(-E)			
1	2	9005-20-1918	Lock/Unlock Sensor Assembly, QC-110 (NPN)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	1	8590-9909999-15	High-flex cable with straight screw-on connector, 5M (16.4 ft.) long with flying leads (Type - BB)
4	1	8590-9909999-172	NPN Flat Pack Sensor, 5 Meter, Flying Leads Bi2-Q5.5-AN6X-5M
5	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow
Model 9120-160AM-000-000-SU-RD1			
1	2	9005-20-1918	Lock/Unlock Sensor Assembly, QC-110 (NPN)
2	4	3500-1058008-15A	M3X8 Socket Head Cap Screws, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525
3	2	8590-9909999-15	High-flex cable with straight screw-on connector, 5M (16.4 ft.) long with flying leads (Type - BB)
4	1	8590-9909999-190	NPN Prox Sensor, Flat Pack, .2m Lg, Straight Pico
5	1	3500-1258010-15A	M3 X1 0 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow

6.7 Tool Plate

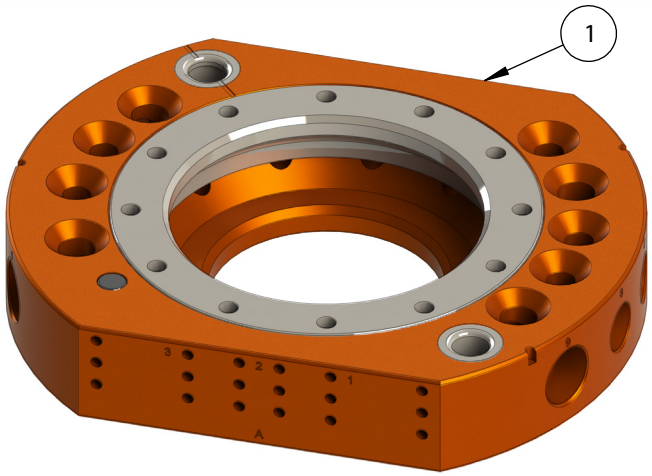


Table 6.7—Standard Tool Plate			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-160FT-000-000	QC-160 Tool Base Assembly
		9120-160FT-000-000-E[1]	QC-160 Tool Base Assembly, Euro

Note:
1. QC-160 models with -E Part Numbers are Euro products, they have black anodized bodies and BSPP pass-through air ports.

6.8 Bolt Down Tool Plate

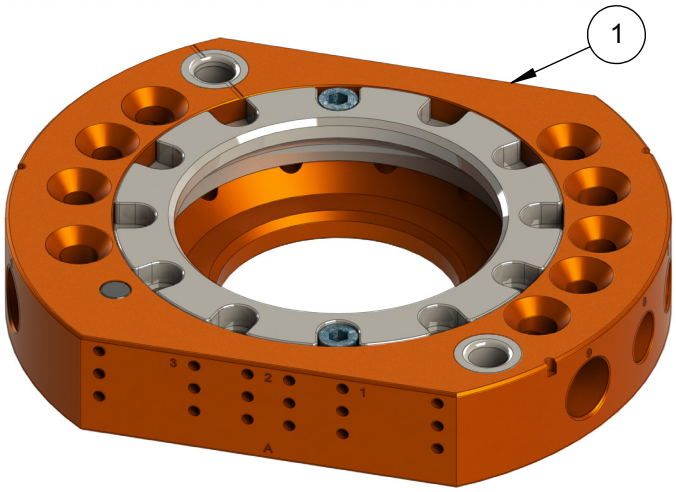


Table 6.8—Bolt Down Tool Plate			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-160FWT-000-000	QC-160 Tool Base Assembly, Bolt Down
		9120-160FWT-000-000-E[1]	QC-160 Tool Base Assembly, Euro, Bolt Down

Note:
1. QC-160 models with -E Part Numbers are Euro products, they have black anodized bodies and BSPP pass-through air ports.

7. Specifications

Table 7.1—Specifications		
Specification	**Values**	**Description**
Recommended Max Payload	600 lbs. (270kg)	The mass attached to the Tool Changer.
Operating Temperature Range	-20–150°F (-30–66°C)	Temperature Range
Operating Pressure Range	60–100 psi (4.1–6.9 bar)	Locking mechanism supply pressure operating range. Supply to be clean, dry, and filtered to 40 micron or better.
Coupling Force @ 80 psi	7,000 lbs (3,175 kg)	Axial holding force
Recommended Max Moment X-Y (Mxy)	24,000 lbf-in 2,710 (Nm)	Maximum recommended working load for optimum performance of the Tool Changer (assuming all (10) Socket Head Cap Screws are used). **NOTE: QC moment rating Mxy=12,000 in-lbs (1,355 Nm), if (6) fasteners are used on Master**.
Recommended Max Torque about Z (Mz)	20,000 in-lbs 2,260 (Nm)	Maximum recommended working torque for optimum performance of the Tool Changer
Positional Repeatability	0.0006” (0.015 mm)	Repeatability tested at rated load at one million cycles.
Weight (coupled, no access.)	20.5 lbs. (9.3 kg)	Master 14.2 lbs (6.44 kg) / Tool 6.3 lbs (2.86 kg)
Max. Recommended distance between Master and Tool plate	0.1” (2.54 mm)	No-Touch™ locking technology allows the Master and Tool plates to lock with separation when coupling.
Pass-through Port, (Qty) Size (Cv, Min)	(5) 3/8 NPT, and (4) 1/2 NPT	Maximum pressure of 100psi (6.9bar), Nitrile seals
Mounting/Customer Interface	Master plate Tool plate	125 mm BC, (10) M10 Thru Holes, (2) 10 mm Dowels(SF) 125 mm BC, (10) M10-1.5 Holes, (2) 10 mm Dowels(SF)
Bolt Down Tool Plates		
Recommended Max Moment X-Y (Mxy)	**18,000 in-lbs 2,034 (Nm)**	**NOTE: This value is lower than the standard QC-160 Tool Changer. This is the maximum recommended working load for optimum performance of the Tool Changer.**
Weight (coupled, no access.)	20.5 lbs. (9.3 kg)	Master 14.2 lbs (6.44 kg) / Tool 6.3 lbs (2.86 kg)
Mounting/Customer Interface	Bolt Down Tool plate	(12) Through-holes for M8 socket head cap screws on the BC 132.5 mm, (2) 10 mm Dowels (SF) on the BC 125 mm

8. Drawings

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