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B. Base Tool Changer

QC-850 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.

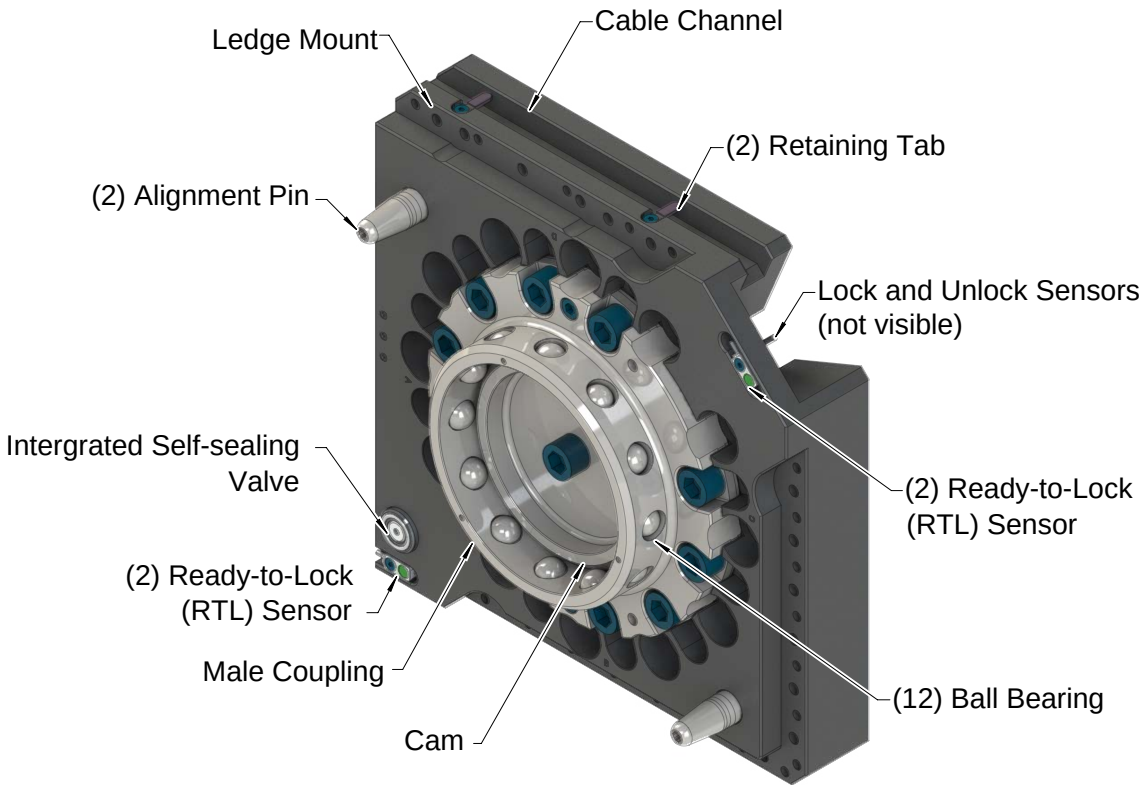
For the most current product information and specifications on the QC-850 Series of Tool Changers, please visit the ATI website: *http://www.ati-ia.com*.

1.1 Master Plate Assembly

The QC-850 Master plate assembly features:

- An anodized aluminum body
- A hardened stainless steel locking mechanism (a cam, male coupling, and chrome steel ball bearings)
- Hardened steel alignment pins that mate with bushings on the Tool plate
- Versatile ledge mounting feature
- Integrated self-sealing valve
- Proximity sensor assemblies used to verify the lock/unlock position of the piston and cam, and Tool plate presence when coupled
- Routing channels for the RTL, lock, and unlock sensor cables
- ISO 200 mm bolt direct mount pattern

Figure 1.1—Master Plate Assembly

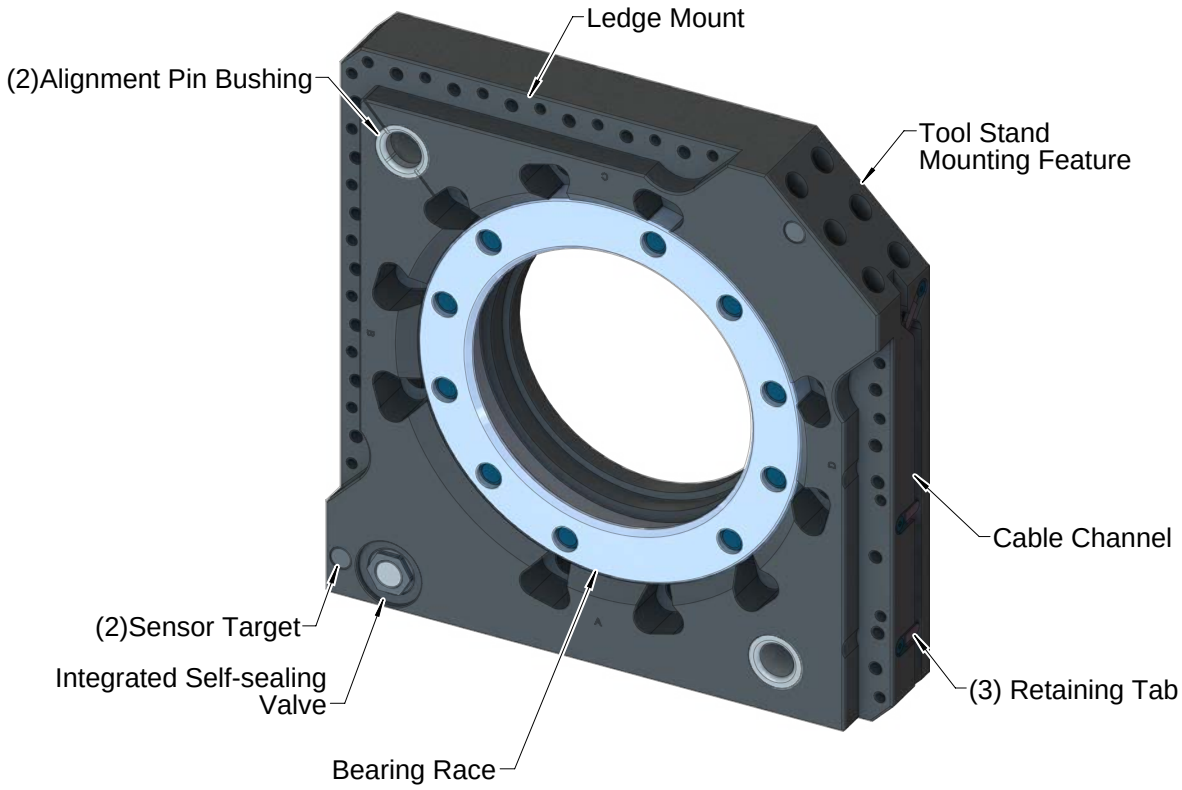


1.2 Tool Plate Assembly

The Tool plate assembly includes the following features:

- An anodized aluminum body
- A hardened stainless steel bearing race
- Alignment bushings that mate with pins on the Master plate
- Versatile ledge mounting feature
- Ferrous metal proximity sensor targets
- Integrated tool hook for simple storage solution
- Integrated self-sealing valve
- Integrated BC200 bolt pattern

Figure 1.2—Tool Plate Assembly



1.3 Optional Modules

The optional modules are mounted to the Master and Tool plate using a common ledge mounting feature and pass utilities to customer tooling.

For assistance in the choosing the right modules for your particular application, visit our website (*http://www.ati-ia.com*) to see what is available or contact an ATI sales representative.

2. Installation

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

WARNING: All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of over stressing, pullout, or kinking the lines. Failure to do so can cause critical electrical and/or pneumatic lines to malfunction and might result in injury to personnel or damage to equipment.

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.

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*.

Table 2.1—Fastener Size, Class, and Torque Specifications

Mounting Condition[1]	ISO Standard Mounting Pattern	Mounting Fasteners[1]	Material (of Robot, Interface Plate, or Customer Tooling)	Recommended Torque	Thread Locker
Master to robot	ISO 9409-1-200-10-M12	(10) M12 Class 12.9 socket head cap screws, (1) M12 dowel pin, (1) boss plate [2]	Steel	100 ft-lbs (135 Nm)	Pre-applied Adhesive or Loctite 242
	ISO 9409-1-200-10-M16	(10) M16 Class 12.9 socket head cap screws, (1) M12 dowel pin, (1) boss plate [2]			
Tool plate (bolt down) to interface plate or customer tooling	ISO 9409-1-200-10-M12	(10) M12 Class 12.9 socket head cap screws, (2) M12 dowel pin [3]	Steel	100 ft-lbs (135 Nm)	Pre-applied Adhesive or Loctite 242
Tool interface plate or customer tooling to Tool plate (bolt up)	ISO 9409-1-200-10-M12	(10) M12 Class 12.9 screws, (10) M12 hex nuts, (2) M12 dowel pin [3]	Steel	100 ft-lbs (135 Nm)	Pre-applied Adhesive or Loctite 242
	ISO 9409-1-200-12-M16	(12) M16 screws, (2) M12 dowel pin [3]	Steel	225 ft-lbs (306 Nm)	

Note:

1. For Mater and Tool plates' counterbore and thread depths, refer to *Section 8—Drawings*. For the robot and customer tooling recommended mounting specifications, refer to the manufactures' documentation.
2. For available ATI Master plate mounting fastener kits, refer to *Section 6—Serviceable Parts*.
3. Tool interface plates and fasteners are customer supplied.

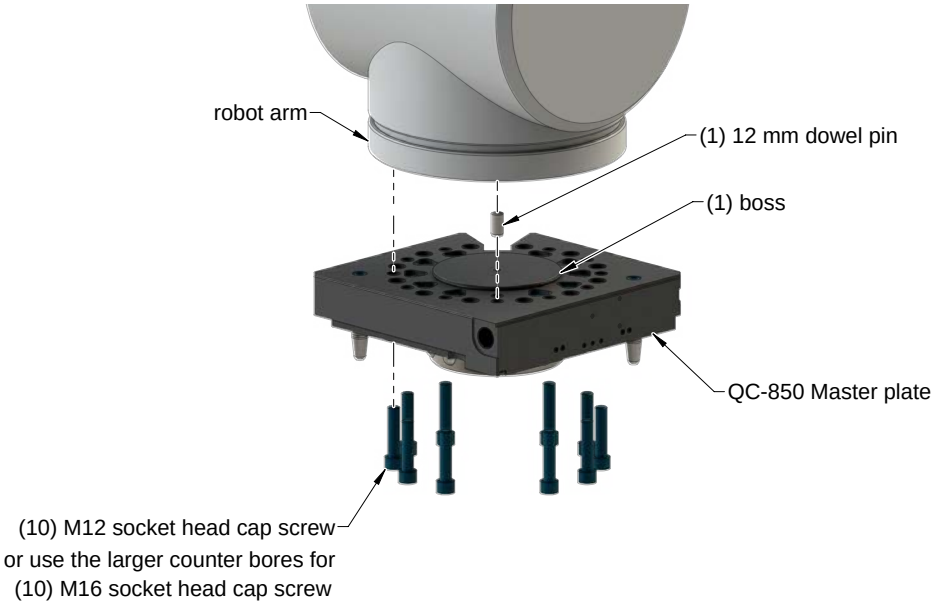
2.1 Master Plate Installation

Tools required: *10 mm hex key for M12 socket head cap screw or 14 mm hex key for M16 socket head cap screw, torque wrench*

Supplies required: *Clean cloth, Loctite 242*

1. Clean the mounting surfaces.
2. Insert a 12 mm dowel pin into the dowel pin hole on the robot mounting side of the Master plate.
3. Apply Loctite 242 to threads of the (10) socket head cap screws.
4. Using the dowel pin and boss as a guide, align the Master plate to the robot arm.
5. Use a 10 mm or 14 mm hex key to install the (10) M12 or (10) M16 socket head cap screws. Tighten to the proper torque; refer to *Table 2.1*.
6. Connect utilities to the appropriate modules and the pneumatic connections to the Master plate.
7. If equipped, connect the Lock, Unlock and RTL sensor connections.

Figure 2.1—Master Plate Installation



2.2 Master Plate Removal

Tools required: *10 mm or 14 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: power or air.
4. If needed, disconnect all utility cable and lines, for example: power or air.

NOTICE: Support the Master plate while removing the fasteners.

5. Use a 10 or 14 mm hex key to remove the (10) M12 or (10) M16 socket head cap screws.
6. Remove the Master plate.

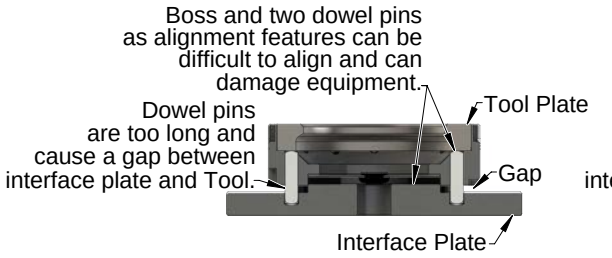
2.3 Tool Interface

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).

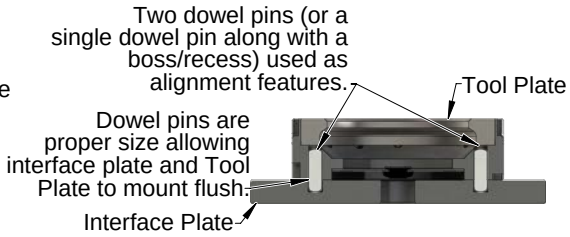
CAUTION: Do not use more than two alignment features when securing a Tool plate to an interface plate. Using more than two alignment features can cause damage to equipment. Use either two dowel pins or a single dowel pin, along with a boss/recess feature to align the Tool plate with the interface plate.

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.

Incorrect Mounting of Tool Plate



Correct Mounting of Tool Plate



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

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

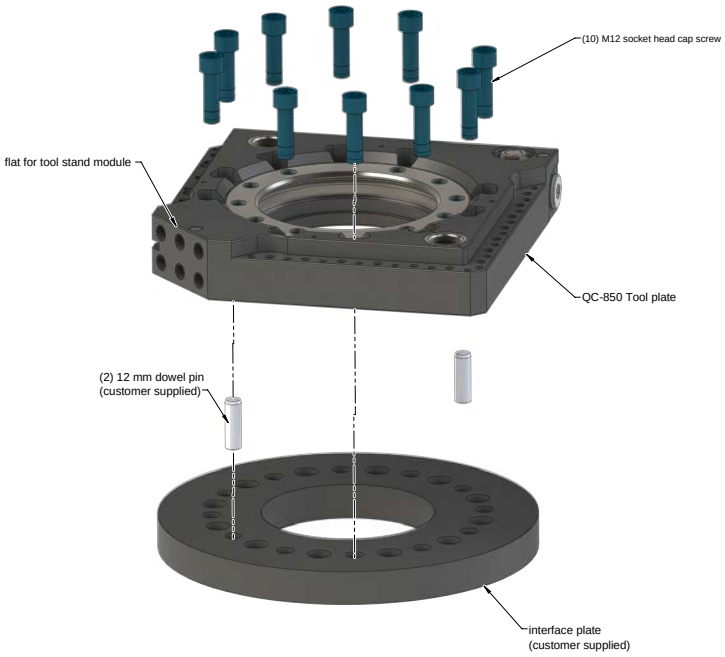
2.4 Tool Plate Installation (Bolt Down)

Tools required: *10 mm hex key, torque wrench*

Supplies required: *Clean cloth, Loctite 242*

1. Clean the mounting surfaces.
2. Insert (2) 12 mm dowel pin in the the customer tool side of the Tool plate.
3. Apply Loctite 242 to the threads of the (10) M12 socket head cap screws.
4. Use a 10 mm hex key to install the (10) M12 socket head cap screws and secure the Tool plate to the customer tooling or interface plate. Tighten per the torque value in *Table 2.1*.
5. Connect utilities to the appropriate module and Tool plate connections.
6. If the installation is complete, the Tool plate may be put into normal operations.

Figure 2.2—Bolt Down Tool Plate Installation



2.5 Tool Plate Removal (Bolt Down)

Tools required: *10 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: power or air.
4. If needed, disconnect all utility cables or lines, for example: power or air.
5. Use a 10 mm hex key to remove the (10) M12 socket head cap screws that secure the Tool plate to the customer tooling or interface plate.
6. Remove the Tool plate.

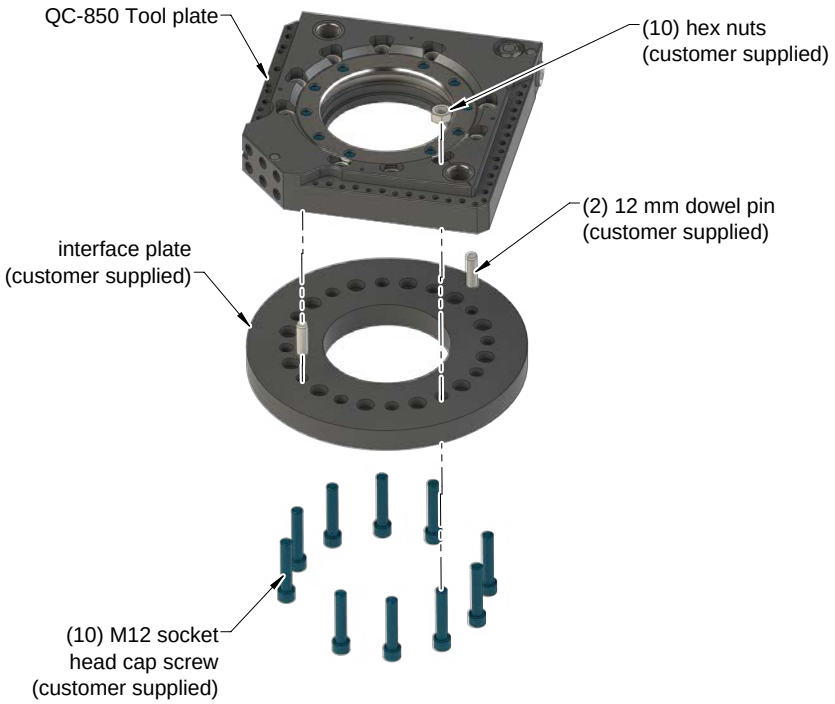
2.6 Tool Plate Installation (Bolt Up)

Tools required: *8 mm hex key for M12 socket flat head cap, 10 mm hex key for M12 socket cap head or M16 socket flat head, 14 mm hex key for M16 socket head cap, torque wrench*

Supplies required: *Clean cloth, Loctite 242*

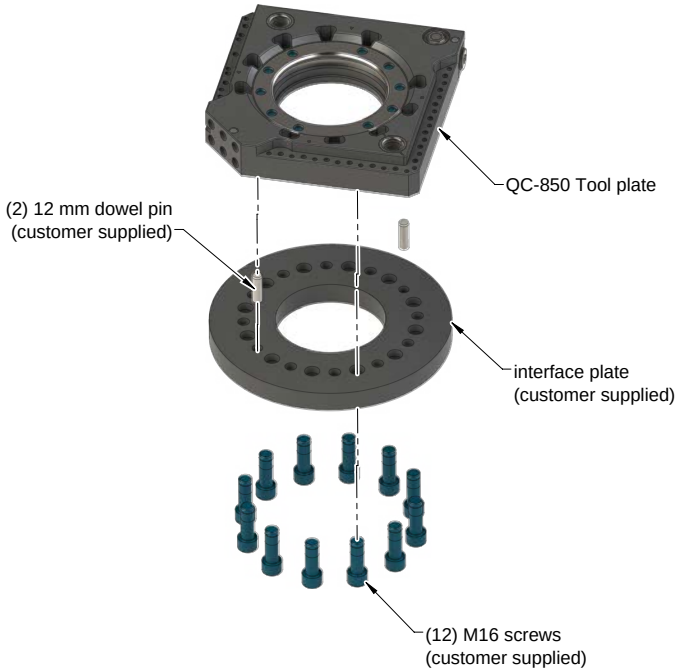
1. Clean the mounting surfaces.
2. Determine if installing with M12 or M16 screws:
   a. For M12 screw configuration:
      i. Insert (2) 12 mm dowel pin in the Tool plate (customer tooling side).
      ii. Apply Loctite 242 to the threads of the (10) M12 screws.
      iii. Start to insert the (10) M12 screws into the customer tooling or interface plate, to the Tool plate, and through the (10) hex nuts.
      iv. Use either a 8 or 10 mm hex key to tighten the screws; for the recommended torque value, refer to *Table 2.1*.

Figure 2.3—M12 Bolt Down Tool Plate Installation



b. For M16 screw configuration:
   i. Insert (2) 12 mm dowel pin in the Tool plate (customer tooling side).
   ii. Apply Loctite 242 to the threads of the (12) M16 screws.
   iii. Use either an 10 mm or 14 mm hex key to insert the screws into the customer tooling or interface plate and Tool plate; for the recommended torque value, refer to *Table 2.1*.

Figure 2.4—M16 Bolt Down Tool Plate Installation



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

2.7 Tool Plate Removal (Bolt Up)

Tools required: *8 mm hex key for M12 socket flat cap head, 10 mm hex key for M12 socket cap head or M16 socket flat head, 14 mm hex key for M16 socket head cap*

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: power or air.
4. If needed, disconnect all utilities cables and lines, for example: power or air.
5. Use a hex key to remove the (10) M12 or (12) M16 screws that secure the customer tooling or interface plate to the Tool plate.
6. Remove the Tool plate.

2.8 Pneumatic Connection and Valve Requirement For the Locking Mechanism

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

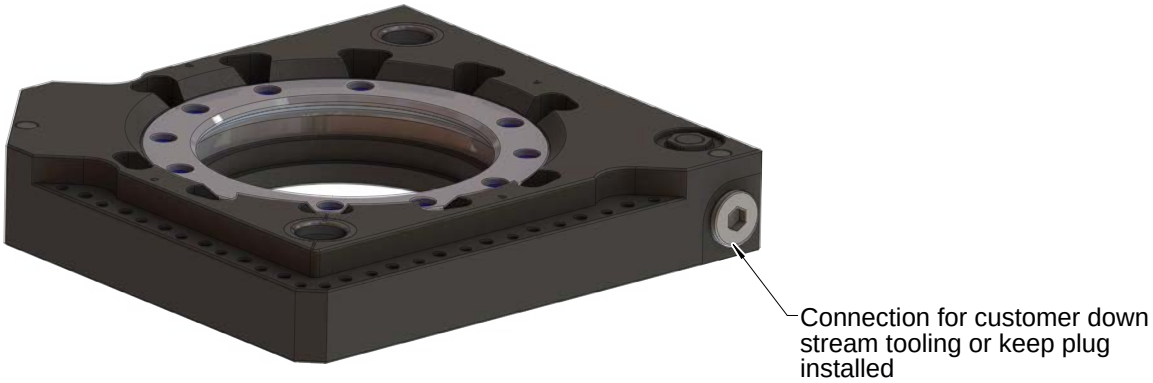
To lock or unlock the Tool Changer, a constant supply of compressed air is required. If there is a loss of air pressure in the locked state, the cam profile prevents the master plate and tool plate from unlocking, and the Tool Changer goes into the fail-safe condition.

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.

ATI or the customer must install a valve module or air adapter on Flat A of the Master Tool plate. The valve module has an internal solenoid valve; therefore, the customer does not supply an additional valve. For more information, refer to the manual for the valve module.

Figure 2.5—— Master Side Pneumatic Connections

Figure 2.6—Tool Side Pneumatic Connections



2.9 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.

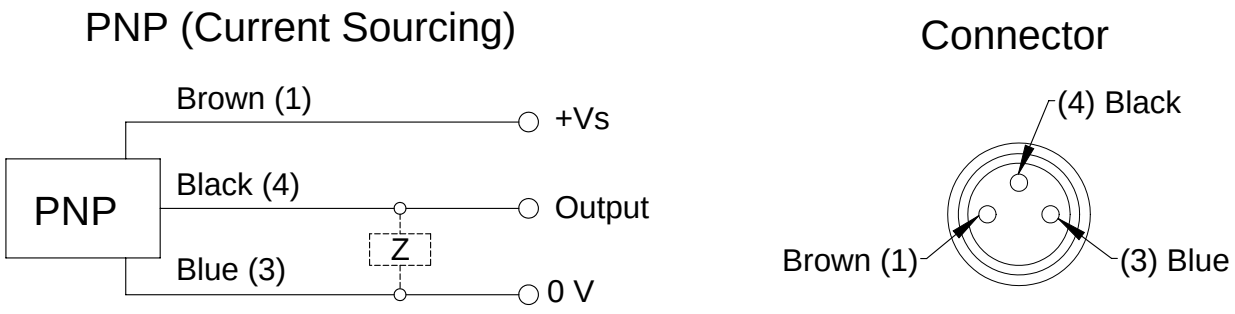
2.9.1 PNP Type Lock and Unlock Sensors (-SM and -SMA sensor designation)

This section applies to the following part number designators: (-M) (-MA). If equipped the RTL sensors will be the same type as the Lock and Unlock sensors. The (-M) designation is for models with optional RTL sensor, for example: 9128-850AM-000-000-M.

Table 2.2—PNP (Current Sourcing)

Description	Value
Voltage Supply Range	10-30VDC
Output Circuit	PNP make function (NO)

Figure 2.7—PNP Type Lock, Unlock and RTL Sensors



3. 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 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. Tubes of lubricant for this purpose are shipped with every Tool Changer. Standard Tool Changers require MobilGrease XHP222 Special (a NLGI #2 lithium complex grease with molybdenum disulfide). For custom applications, such as food grade or surgical applications, specialized lubricants might be required.

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 Tool Storage Considerations section.

Figure 2.8—Offset Definitions

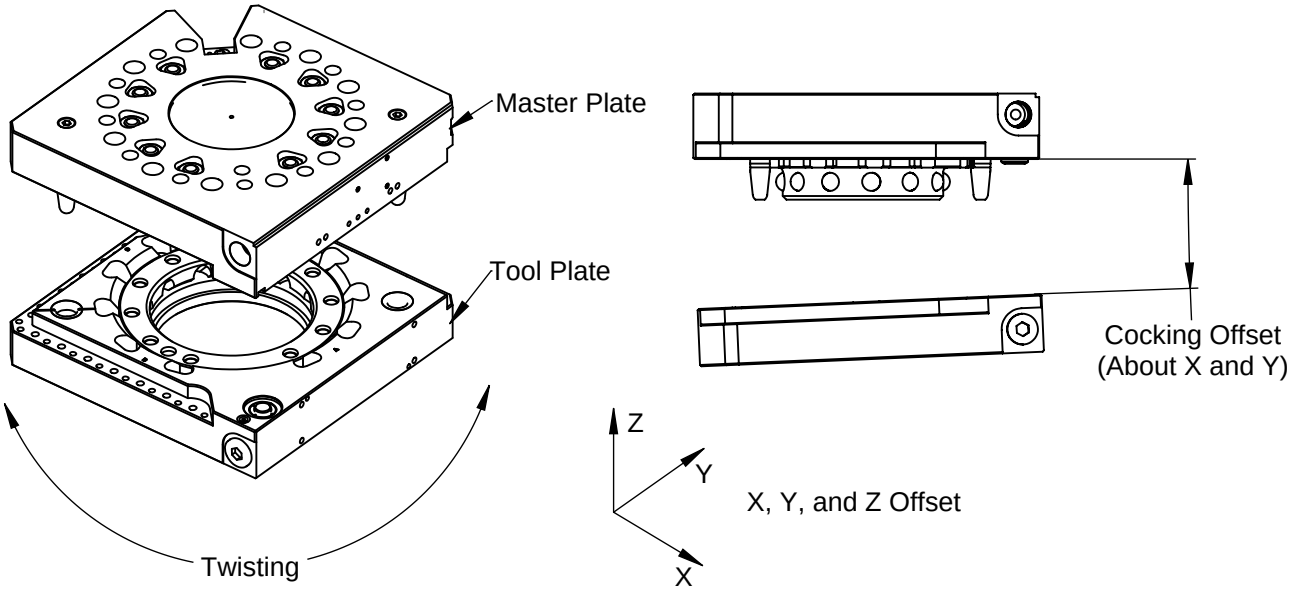


Table 2.3—Maximum Recommended Offsets Prior to Coupling				
Model	**No-Touch Zone Z Offset (Max)[1]**	**X and Y Offset (Max) [2]**	**Cocking Offset (Max)**	**Twisting Offset (Max)**
QC-850	0.06” (1.5 mm)	±0.08” (2 mm)	±0.7°	±1°

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

The following conditions should be considered when operating the Tool Changer. For more details about programming the robot, refer to the Operation section of the Control/Signal Module Manual.

CAUTION: Do not attempt to couple the Tool Changer when in locked position. 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. Always unlock the Master prior to coupling to a Tool.

1. Unlock the Tool Changer by removing air pressure from the lock port and supplying air pressure to the unlock port (if equipped, the unlock sensor indicates the Tool Changer is unlocked).

NOTICE: For Tool Changers with a control/signal module and air/valve adapters with a double solenoid valve, turn the Unlatch output ON and turn the Latch output OFF. For Tool Changers with a control/signal module and air/valve adapters with a single solenoid valve, turn the Unlatch output ON. Some control/signal modules prevent the Tool Changer from being unlocked unless the Master and Tool are coupled and nested properly in the tool stand, a manual override procedure is required to unlock the Tool Changer. Refer to your Control/Signal Module Manual for instructions.

2. Position the Master above the Tool and move the Master into ready to lock position. The mating surfaces of the Master and Tool should be parallel and not touching. Make sure that the tapered alignment pins from the Master enter the alignment holes on the Tool. The alignment pins should be relatively concentric with the alignment bushings with no contact between the two.
3. It is recommended that the mating faces of the Master and Tool not be touching but be within the No-Touch distance of each other when coupling to minimize stress and wear on the locking mechanism. The locking mechanism allows the Master to “pull up” the Tool with gaps between the two sides.

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

4. The RTL (Ready-To-Lock) sensor and target that are built into the Tool Changer must be positioned within approximately 0.05” (1.5 mm) of each other for the sensors to detect Tool presence. RTL signals are not required to couple the Tool Changer but are recommended as a confirmation of coupling prior to removing the Tool from the tool stand.

NOTICE: At this point, communication is initiated with the ATI Tool and downstream nodes. If equipped, Tool-ID and communications become available. Depending on the type of control/signal module, additional notifications such as RTLV, TSRV, TSIV, Tool Present, Unlatch Enabled, and other notifications can provide verification of properly functioning system components.

5. Couple the Tool Changer by releasing the air pressure from the unlock port and supplying air pressure to the lock port. 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).

NOTICE: For Tool Changers with a control/signal module and air/valve adapters with a double solenoid valve, turn the Unlatch output OFF and turn the Latch output ON. For Tool Changers with a control/signal module and air/valve adapters with a single solenoid valve, turn the Unlatch output OFF.

6. A sufficient delay must be programmed between locking valve actuation and robot motion so that the locking process is complete before moving the robot. If equipped with Lock and Unlock sensors, the Lock signal should read “ON” (true) and the Unlock signal should read “OFF” (false).

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. Some configurations will require a manual unlock of the Master plate before attempting coupling, refer to the Control/Signal Module Manual for instructions.

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.

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

Refer to your Air/Valve Adapter and/or Control/Signal Module Manual's Operation section for operation during coupling/uncoupling.

1. Move the robot to position the Tool plate in the tool stand. The position for coupling and uncoupling are the same.

NOTICE: Depending on the type of control/signal module, additional notifications such as TSRV, TSIV, and other notifications can provide verification of properly functioning system components.

2. Unlock the Tool Changer by releasing the air pressure from the lock port and supplying air pressure to the unlock port. The Tool Changer locking mechanism moves to the unlocked position and the Tool plate releases from the Master plate (If equipped, the unlock sensor indicates the Tool Changer is unlocked).

NOTICE: For Tool Changers with a control/signal module and air/valve adapters with a double solenoid valve, turn the Unlatch output ON and turn the Latch output OFF. For Tool Changers with a control/signal module and air/valve adapters with a single solenoid valve, turn the Unlatch output ON.

CAUTION: This Tool Changer may be equipped with a tool stand Interlock (TSI) feature that physically breaks the Unlatch solenoid circuit. Proper use of the TSI prevents unwanted Unlock software commands from being recognized until the circuit is made. Make sure the Tool Changer is positioned properly to trip actuate the TSI switch when the Tool is in the tool stand.

3. A sufficient delay must be programmed between unlocking valve actuation and robot motion so that the unlocking process is complete before moving the robot. If equipped with lock and unlock sensors, the Unlock signal should read "on" (true) and the Lock signal should read "off" (false). **Any other condition indicates a problem and the robot program should be halted.** Once the Lock and Unlock signals in the proper state, the Master plate may be moved away from the Tool plate in the axial direction.

The robot and Master plate can now proceed to another Tool plate for coupling and subsequent operations.

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: 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.

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 (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

NOTICE: The cleanliness of the work environment strongly influences the trouble free operation of the Tool Changer. The dirtier the environment, the greater the need for protection against debris. Protection of the entire EOAT, the Master, the Tool and all of the modules may be necessary. Protective measures include the following:

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

4.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule is provided in the following table. Detailed assembly drawings are provided in *Section 8—Drawings* of this manual. Refer to module sections for detailed preventive maintenance steps for all utility modules.

Table 2.4—Maintenance

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	Monthly

Checklist

Mounting Fasteners

- ☐ 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 2.8—Pneumatic Connection and Valve Requirement For the Locking Mechanism.*
- ☐ Inspect for loose alignment pins or 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 5.2.2—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 for any damage, cuts, and abrasion. Replace as necessary. Refer to *Section 5.2.1—Sensor Replacement Procedures*.

Self-Sealing Valves

- ☐ Remove and replace seals. During seal replacement, inspect self-sealing valve components; if components are damaged or worn, replace. Verify the valve stem is straight. Refer to *Section 5.2.3—Master Side Self-Sealing Valve* and *Section 5.2.4—Tool Side Self-sealing Valve*.
- ☐ Inspect sensor cables for any damage, cuts, and abrasion. Replace as necessary; refer to *Section 5.2.1—Sensor Replacement Procedures*.

Seals (Modules)

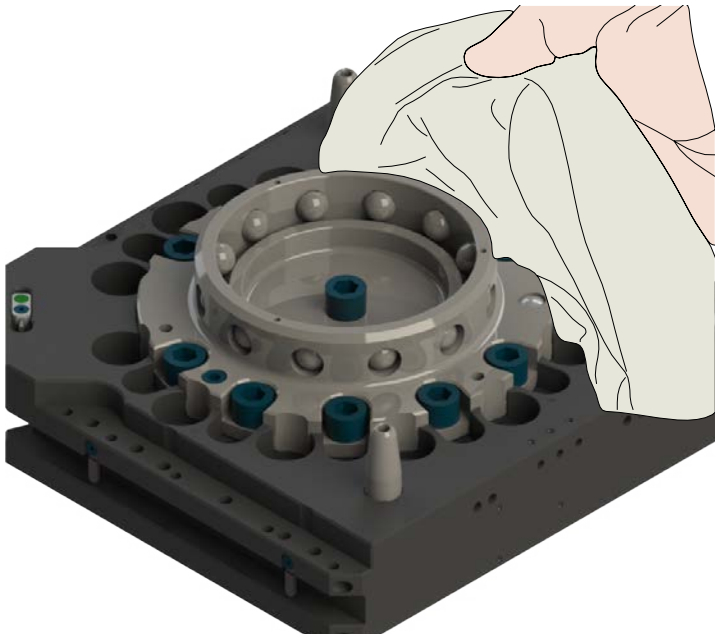
- ☐ Inspect for wear, abrasion, and cuts. Refer to *Section 5.2.5—V-ring Seal Replacement*

4.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

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

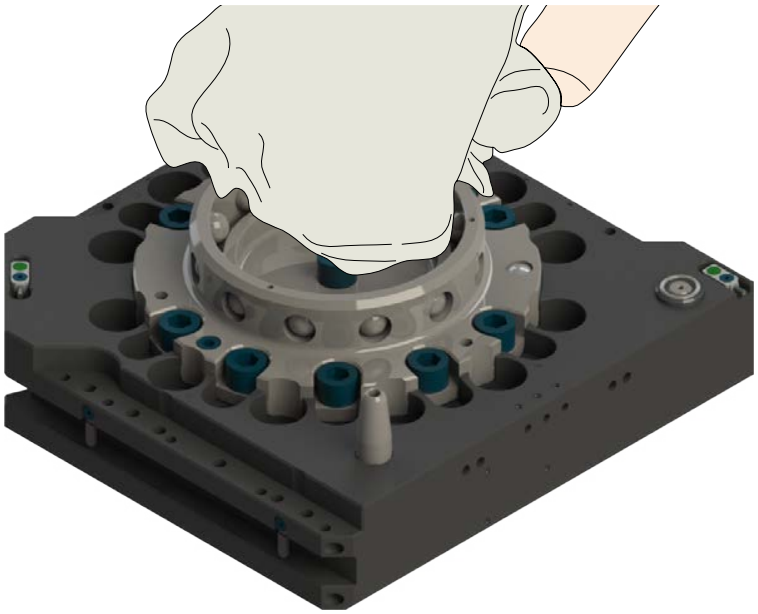
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam,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

Figure 2.9—Cleaning Ball Bearings and Outer Surfaces of Male Coupling



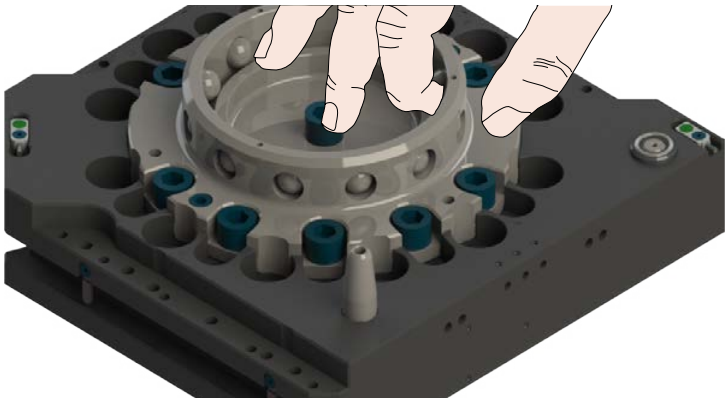
5. Use a clean rag to thoroughly remove any lubricant and debris from the inner surface of the male coupling and cam.

Figure 2.10—Cleaning Ball Bearings, Cam and Inner Surfaces of Male Coupling



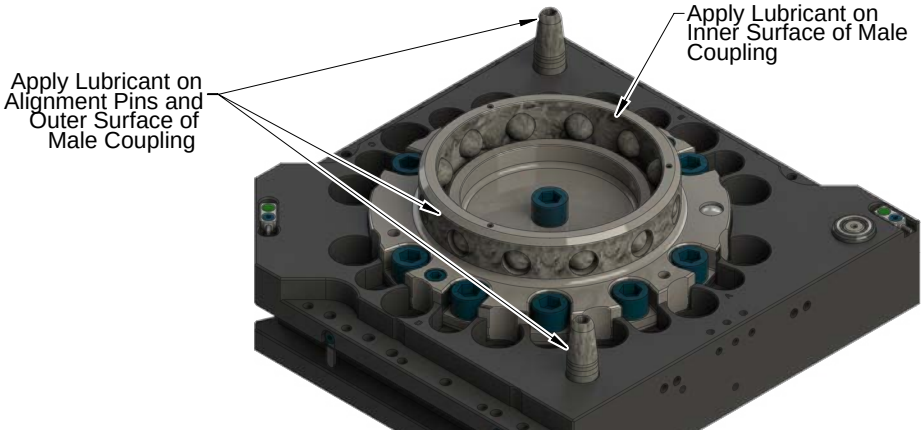
6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 2.11—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 2.12—Apply Lubricant to Locking Mechanism

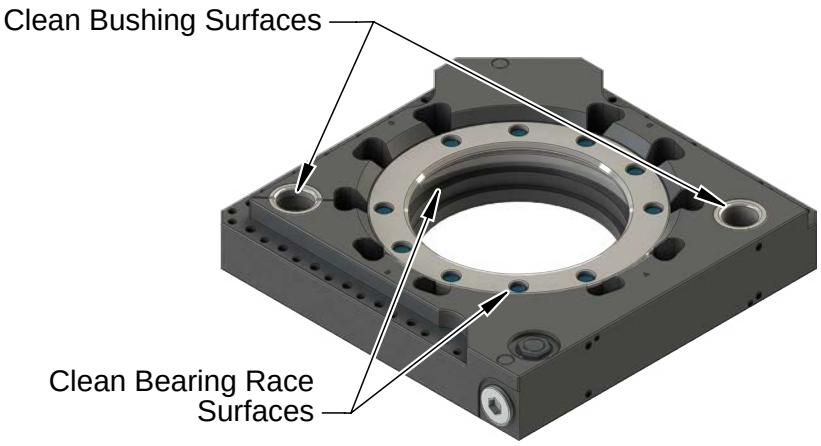


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

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

9. Safely resume normal operation.

Figure 2.13—Clean Tool Plate Surfaces of locking Mechanism



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 (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

5.1 Troubleshooting Procedures

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

Table 3.1—Troubleshooting

Symptom	Cause	Resolution
Tool Changer will not lock and/ or unlock (or lock sensor does not indicate Tool Changer is locked)	Insufficient or no air pressure supply to the lock or unlock ports.	Verify proper air pressure and pneumatic valve is supplied. Refer to *Section 2.8—Pneumatic Connection and Valve Requirement For the Locking Mechanism.*
	Air pressure trapped in the de-energized lock or unlock ports.	Air pressure must be vented to the atmosphere properly, refer to *Section 2.8—Pneumatic Connection and Valve Requirement For the Locking Mechanism* or refer to the troubleshooting section of the ATI air/valve adapter manual for more information.
	Pneumatic connections loose or damaged, solenoid cable damaged.	Refer to the ATI air/valve adapter manual for more information.
	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.
	Bent valve stem in the Master plate	Verify the Master and Tool plates are properly installed. Check the robot program includes a parallel approach trajectory during Tool Changer coupling. Replace the valve stem, refer to *Section 5.2.3—Master Side Self-Sealing Valve*.
	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.
	The control/signal module or air/ valve adapter is not operating correctly.	Check the troubleshooting section of the manual for the specific module.
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—Sensor Replacement Procedures.*
Unit is unlocked but unlock signal does not read “on”	Unlock sensor/cable is damaged.	Replace the lock sensor assembly as necessary; refer to *Section 2.8—Pneumatic Connection and Valve Requirement For the Locking Mechanism.*

Table 3.1—Troubleshooting		
Symptom	**Cause**	**Resolution**
Ready-To-Lock (RTL) does not read “on” when Master and Tool plates are mated.	Ready-To-Lock (RTL) sensors not activated indicating Tool is not positioned properly.	Re-teach the robot to bring the Master plate and Tool plate closer together prior to attempting to lock. Refer to *Section 3—Operation.* Check that both RTL sensors and cables are not damaged and sensor connection to the control/signal module or air adapter are tight. Replace damaged RTL sensors as necessary; refer to *Section 5.2.1—Sensor Replacement Procedures..*
Air Leakage from self-sealing valve.	Damaged/Worn seals	Replace the worn seals; refer to *Section 5.2.3—Master Side Self-Sealing Valve* and *Section 5.2.4—Tool Side Self-sealing Valve.*
	Debris blocking valve seal	Clean in and around the valve components. Ensure the air stream is free of large particulates, filter as necessary.
	Bent stem valve stem in the Master plate.	Verify the Master and Tool plates are properly installed. Check the robot program includes a parallel approach trajectory during Tool Changer coupling. Replace the valve stem, refer to *Section 5.2.3—Master Side Self-Sealing Valve*.
	Corrosion	Consult ATI for assistance
Reduced air flow from the self-sealing valve.	Air hose supply/return lines or connections damaged or blocked	Inspect supply/return hoses and connections for damage or blockage, clean/repair/replace as necessary.
	Valve blockage	Inspect valve components. Clean/repair as necessary; refer to *Section 5.2.3—Master Side Self-Sealing Valve* and *Section 5.2.4—Tool Side Self-sealing Valve.*
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 5.2.5—V-ring Seal Replacement*.
	Cable connections loose or cables damaged	Check that cable connection are secure and cables are not damaged.

5.2 Service Procedures

Component replacement procedures are provided in the following section.

5.2.1 Sensor Replacement Procedures

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

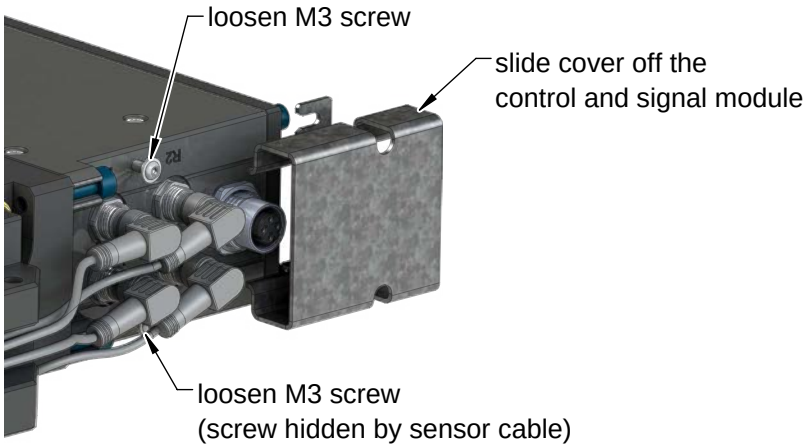
Parts required: *Refer to Section 6—Serviceable Parts*

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

Supplies required: *Loctite 222*

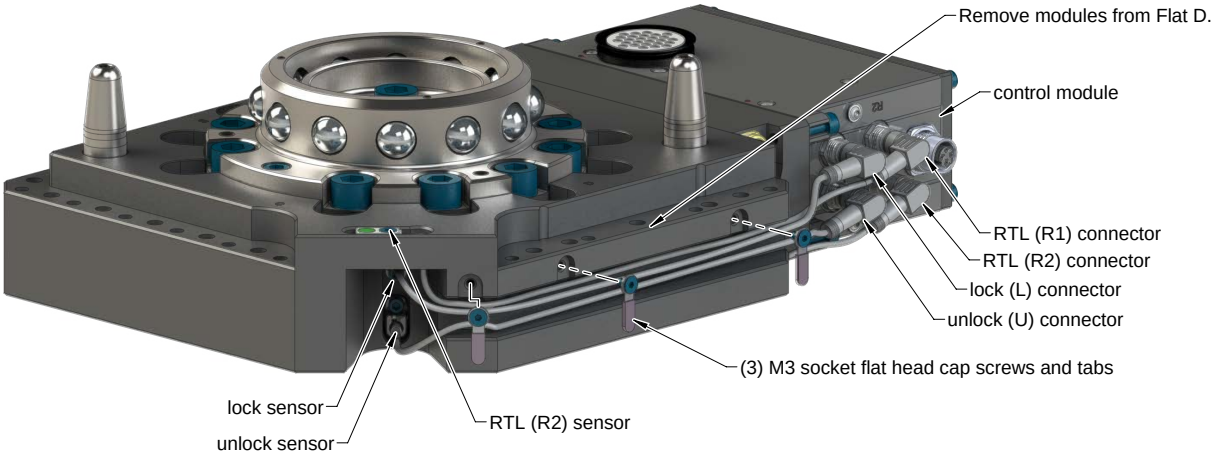
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits, for example: power and air.
4. To access the sensor connectors, remove cover on the control and signal module:
   a. Use a 2 mm hex key to loosen the (2) M3 button head screws on the control and signal module.
   b. Slide the cover off the control and signal module.
5. Detach the sensor connectors from the control and signal module.

Figure 3.1—Remove Cover



6. To replace the lock, unlock, and RTL (R2) sensors:
   a. Remove modules from Flat D (refer to the ATI module manual for removal instructions).

Figure 3.2—Remove Modules From Flat D and Tabs

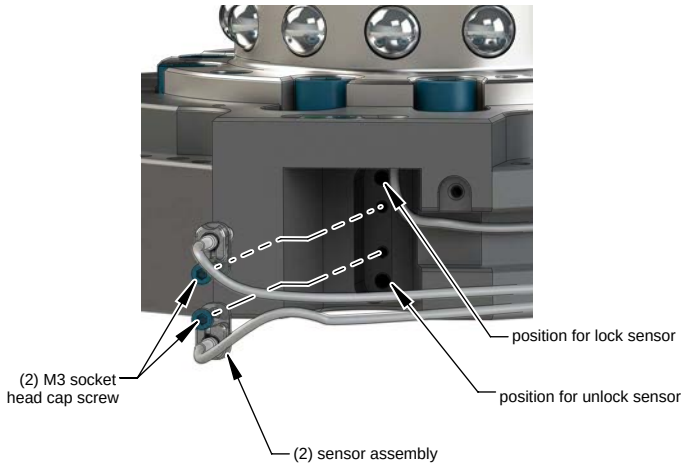


   b. Replace lock and unlock sensor assemblies:
      i. Use a 2.5 mm hex key to remove the M3 socket head cap screw.
      ii. Remove the sensor assembly.
      iii. Apply Loctite 222 to the threads of the M3 socket head cap screw.

> **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.

      iv. Secure the sensor assembly to the Master plate with a M3 socket head cap screw. Use a 2.5 mm hex key to tighten to 12 in-lbs (1.4 Nm).

Figure 3.3—Lock and Unlock Sensor Assembly Replacement



c. Replace the RTL (R2) sensor assembly

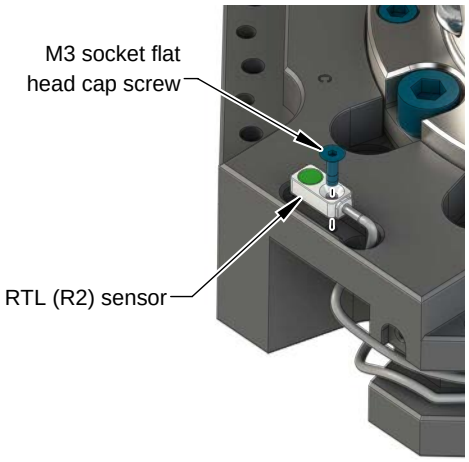
   i. Use a 2 mm hex key to remove the M3 socket flat head cap screw and remove the sensor assembly.

   ii. Apply Loctite 222 to the threads of the M3 socket flat head cap screw.

   iii. Secure the sensor assembly to the Master plate with a M3 socket flat head cap screw. Use a 2 mm hex key to tighten to 6 in-lbs (0.68 Nm).

> **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.

Figure 3.4—RTL (R2) Sensor Assembly Replacement



d. Reroute the lock, unlock, and RTL (R2) cables through the channel along Flat D.

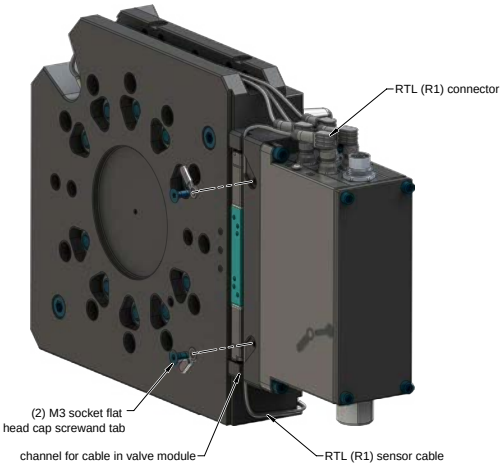
e. Attach the cable connectors to the L, U, and R2 connections on the control and signal module.

f. Verify the sensors are operating correctly.

g. Install the modules on Flat D (refer to the ATI module manual for installation instructions).

7. Replace the RTL (R1) sensor:
   a. Bend the tabs and remove the cable along the cable channel in the bottom of the valve module.
   b. Detach the RTL (R1) sensor connector from the control signal module.

Figure 3.5—Bend Tabs From the Valve Module

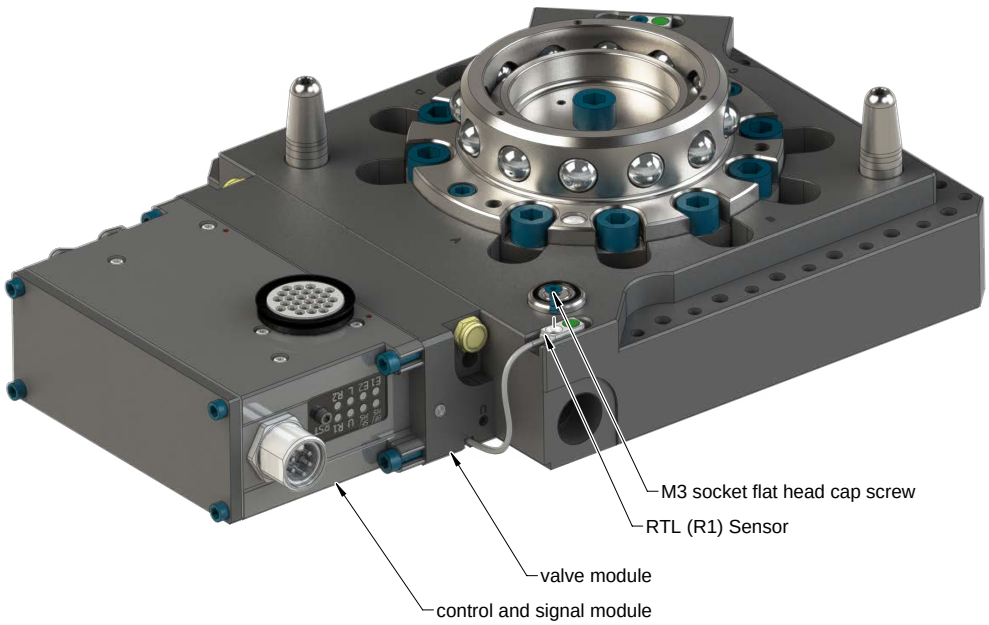


   c. Replace the RTL (R1) sensor assembly:
      i. Use a 2 mm hex key to remove the M3 socket flat head cap screw and remove the sensor assembly.
      ii. Apply Loctite 222 to the threads of the M3 socket flat head cap screw.

> 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.

      iii. Secure the sensor assembly to the Master plate with a M3 socket flat head cap screw. Use a 2 mm hex key to tighten to 6 in-lbs (0.68 Nm).

Figure 3.6—RTL (R1) Sensor Assembly Replacement



d. Reroute the RTL (R1) cable through the channel along the valve module.

e. Attach the cable connectors to the R1 connection on the control and signal module.

f. Verify the sensor operates correctly.

8. Safely resume normal operation.

5.2.2 Alignment Pin Replacement

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

Tools required: *5 mm and 6 mm hex key, torque wrench*

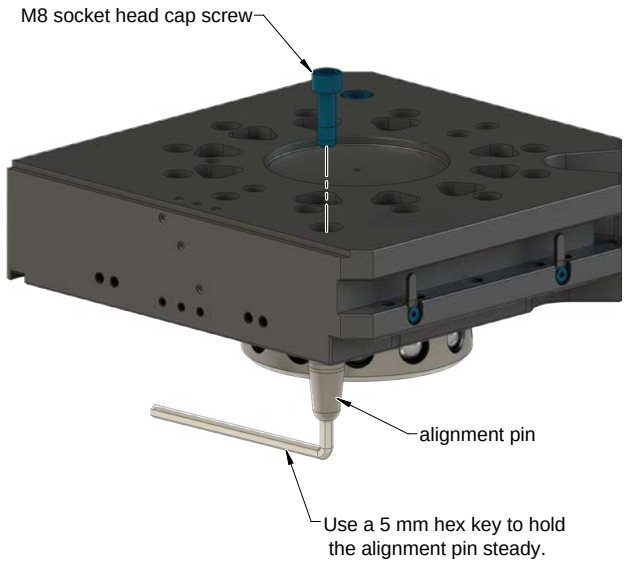
Supplies required: *Clean cloth, Loctite 242, MobilGrease XHP222*

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: power and air.

NOTICE: To assist removing the M8 socket head cap screw, users can use a 5 mm hex key to hold the alignment pin steady.

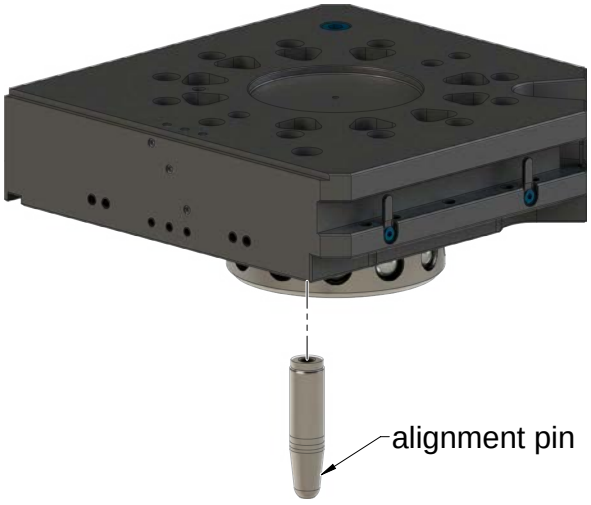
4. Use a 6 mm hex key to remove the M8 socket head cap screw.

Figure 3.7—Remove the M8 Socket Head Cap Screw



5. Remove the alignment pin.

Figure 3.8—Remove the Alignment Pin



6. Use a clean cloth to remove debris from the alignment pin bore.
7. Insert the new alignment pin.

8. Apply Loctite 242 to the threads of the M8 socket head cap screw.

> **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.

9. Use a 6 mm hex key to install the M8 socket head cap screw.
   Tighten to 10.4 ft-lbs (14.1 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.

5.2.3 Master Side Self-Sealing Valve

Parts required: *Refer to Section 8—Drawings*

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

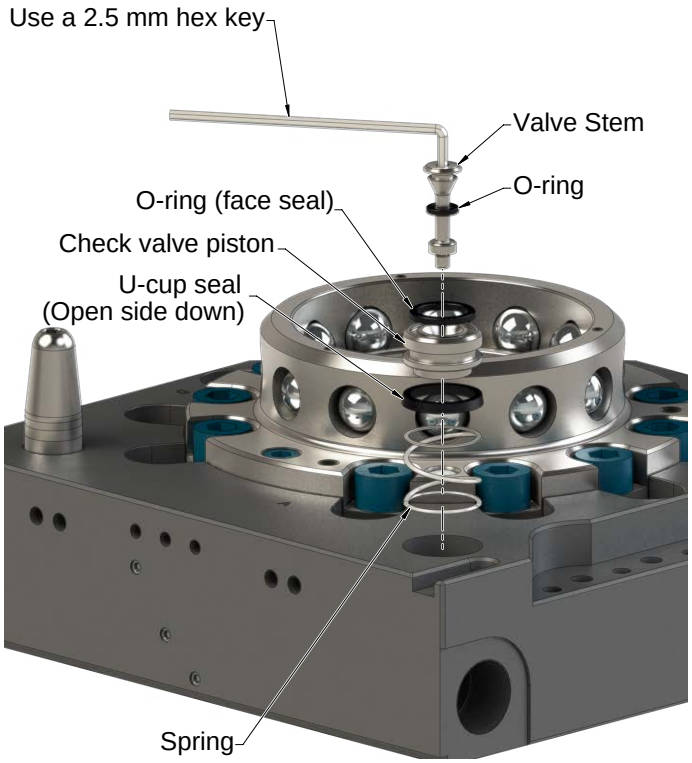
Supplies Required: *Clean cloth, Magnalube G lubricant, Loctite 7649 primer, Loctite 222*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits, for example: power and air.

NOTICE: Debris can be expelled at high velocity during the purge, take all required safety precautions.

4. Purge and disconnect all customer plumbing connections to the valve:
   a. Turn the supply line off.
   b. Cover the valve with a cloth for safety.
   c. Manually actuate the Tool Changer self-sealing valve to purge the line pressure. Note: Debris can be expelled at high velocity during the purge, take all required safety precautions.
5. (Optional) remove connections to the valve.
6. Use a 2.5 mm hex key to remove the valve stem. Do not strip the hex on the valve stem during removal.
7. Remove the check valve piston and spring.
8. Use a clean cloth to any lubrication from the check valve piston, valve stem, spring, and bore in the Master housing using a clean cloth.
9. Inspect components for signs of wear or damage:
   a. Inspect the valve stem for straightness, and replace, if bent.
   b. Inspect the o-rings and u-cup seal on the valve stem and check valve piston.
   c. Inspect the spring.
   d. Replace components that are damaged or worn.

Figure 3.9—Master Self-Sealing Valve



10. Reinstall components:

a. Install the non-lubricated O-ring (face seal) into the check valve.

NOTICE: Do not lubricate the O-ring face seal until after installation. Lubricating the O-ring before installation can cause the O-ring to blow out during coupling and uncoupling.

b. Lubricate the bore in the module housing with Magnalube G (Teflon/ Petroleum based grease).

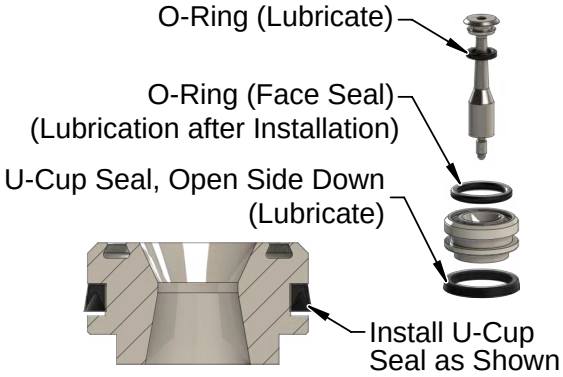
c. If replacing seals, lubricate the valve stem O-ring and the check valve piston U-cup seal with Magnalube G (Teflon/Petroleum based grease).

d. Install the O-ring on the valve stem.

e. Install the U-cup seal on the check valve.

f. Lubricate the U-cup seal. Do not get lubrication in the face seal groove of the check valve.

Figure 3.10—Master Self-Sealing Valve Installation



g. Install the spring into the bore in the module housing.

h. Seat the check valve on the spring.

i. Apply Loctite 7649 primer and then Loctite 222 to the threaded end of the valve stem.

NOTICE: To properly install the threaded end of the valve stem, the check valve must be pushed down flush with the mating surface of the Master plate.

NOTICE: Prior to screwing in the valve stem, do not damage the U-cup seal around the check valve. Use a small, flat-head screwdriver to ensure that the U-cup seal is fully located in the recess and not folded over itself.

j. Install the valve stem. Tighten the stem to 10 in-lbs (1.1 Nm).

k. Lubricate the installed O-ring (face seal) with Magnalube G (Teflon/ Petroleum based grease).

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

5.2.4 Tool Side Self-sealing Valve

Parts required: *Refer to Section 8—Drawings*

Tools required: *18 mm socket, torque wrench, open-end wrench*

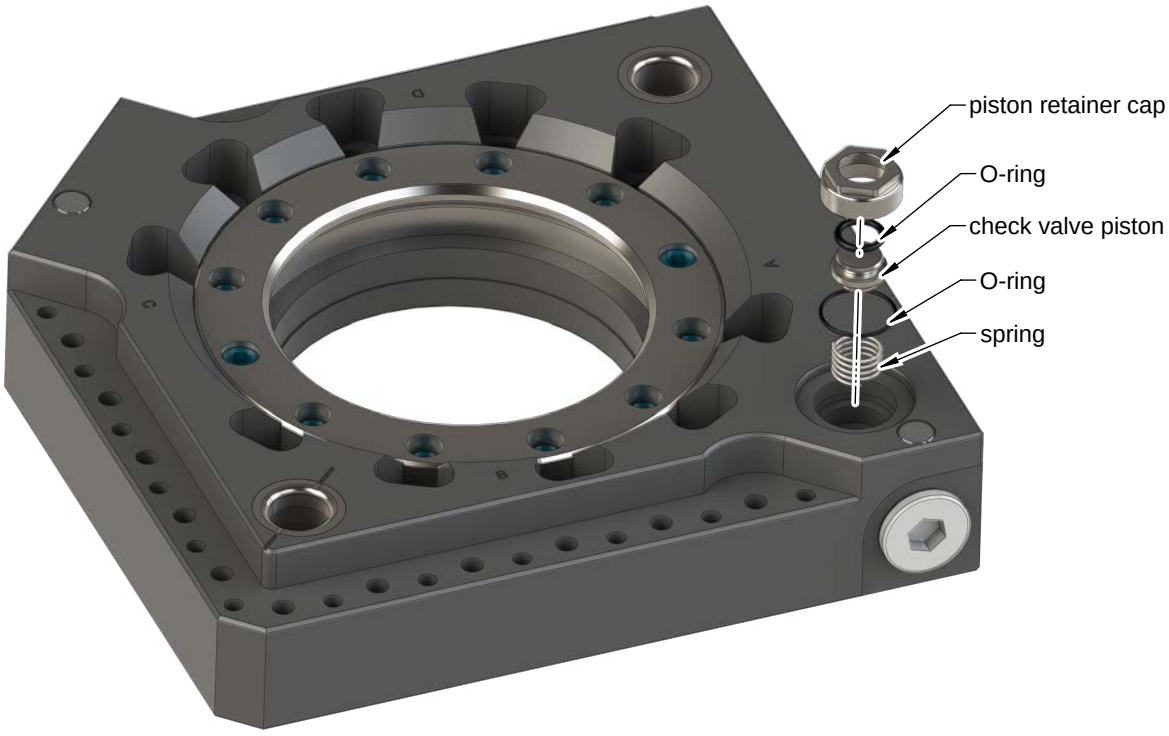
Supplies required: *Clean cloth, Magnalube G lubricant*

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: power and air.

NOTICE: Debris can be expelled at high velocity during the purge, take all required safety precautions.

4. All customer plumbing connections to the valve must be purged.
   a. Verify that the supply lines are turned off.
   b. Cover the valves with a rag for safety.
   c. Manually actuate the self-sealing valve to purge the line pressure.
5. (Optional) Disconnect connections to the valve.
6. Use an open-end wrench to remove the piston retainer cap.
7. Remove the O-rings, check valve piston, and spring from the bore of the Tool plate.

Figure 3.11—Tool Self-Sealing Valve



8. Use a clean cloth to remove lubrication from the O-rings, piston retainer cap, check valve piston, spring, and bore in the Tool plate.
9. Inspect components for signs of wear or damage:
   a. Inspect the piston retainer cap and O-ring.
   b. Inspect the check valve piston and O-ring.
   c. Inspect the spring.
   d. Replace components that are damaged or worn.

10. Install the spring into the bore of the Tool plate.
11. Lubricate both O-rings with Magnalube G (Teflon/Petroleum based grease).
12. Place the larger O-ring on the seat of the bore.
13. Install the smaller O-ring in the groove of the check valve piston.

> **CAUTION:** Do not use excess force when installing the piston retainer cap into the Tool plate. Using excessive force can damage the O-rings. Thread the piston retainer cap into the Tool plate by hand, until several threads are engaged into the bore. Then use an open-end wrench to complete the installation. Torque the plug to 10 in-lbs (1.1 Nm).

14. Carefully install the piston retainer cap.
15. Use a 18 mm socket and torque wrench to tighten the piston retainer cap to 10 in-lbs (1.1 Nm).
16. After the procedure is complete, resume normal operation.

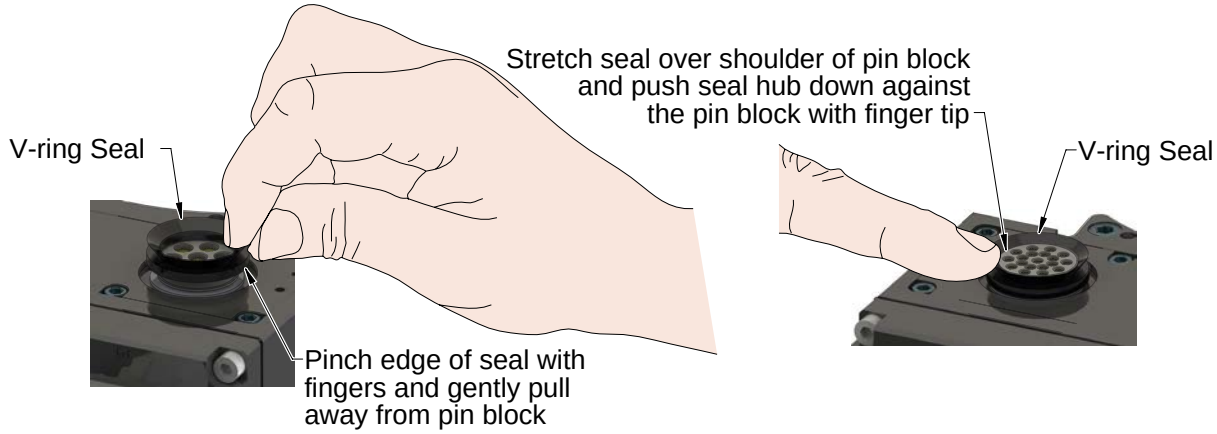
5.2.5 V-ring Seal Replacement

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

The seal protects the electrical connection between the Master and Tool module. Replace the seal if it becomes worn or damaged.

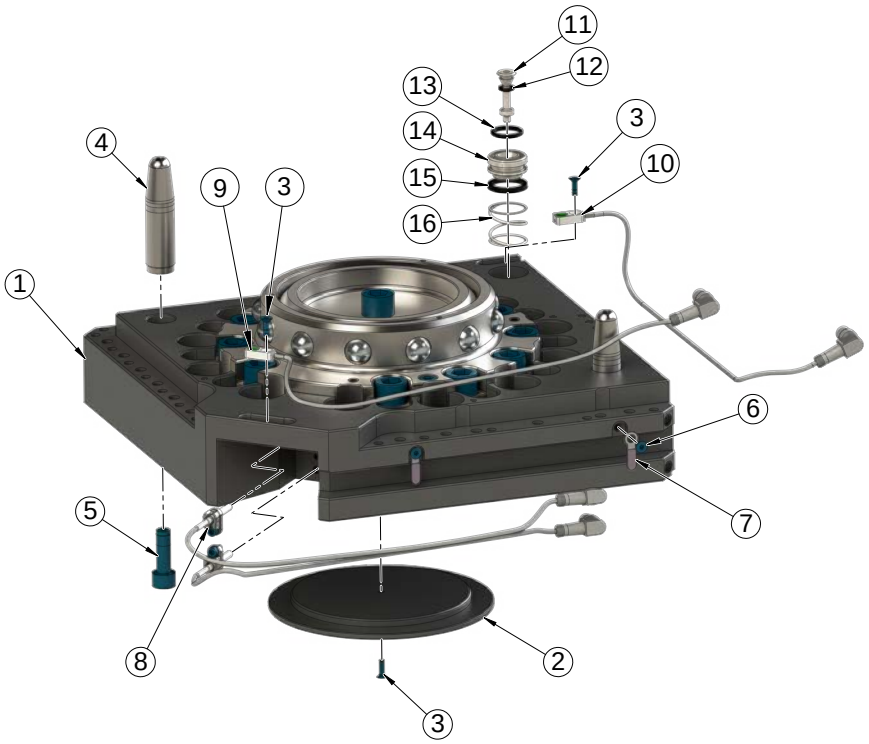
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. To remove the existing seal, pinch the edge of the seal and pull the seal away from the pin block on the 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 3.12—V-ring Seal Replacement



6. Serviceable Parts

6.1 Master Plate Assembly



6.2 Master Fastener Kits

Table 4.1—QC-850 Master Fastener Kit for ISO 9409-1-200-10-M12 Robot Mounting Pattern		
Qty	**Description**	**Part Number**
1	QC-850 Master Fastener Kit, BC 160	9128-850M-FK-E180B15A
Kit Contents		
12	M12 X 55 socket head cap screw, class 12.9, ISO4762/DIN912, ES-ATI-007, pre-applied adhesive (YL M-spheres/IFI 525)	3500-1072055-15A
1	12 mm x 24 mm dowel pin (pull out), steel 1050-1095, DIN 7979D-m6	3540-0712024-11
1	12 mm x 36 mm dowel pin (pull out), steel 1050-1095, DIN 7979D-m6	3540-0712036-11

	Table 4.2—QC-850 Master Fastener Kit for ISO 9409-1-200-10-M16 Robot Mounting Pattern	
Qty	**Description**	**Part Number**
1	QC-850 Master Fastener Kit, BC 200	9128-850M-FK-E235B15A
Kit Contents		
12	M16 X 60 socket head cap screw, class 12.9, ISO4762/DIN912, corrosion protection coating, pre-applied adhesive (YL M-spheres/IFI 525)	3500-1075060-15A
1	12 mm x 24 mm dowel pin (pull out), steel 1050-1095, DIN 7979D-m6	3540-0712024-11
1	12 mm x 36 mm dowel pin (pull out), steel 1050-1095, DIN 7979D-m6	3540-0712036-11

Table 4.3—Master Plate Serviceable Parts			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9128-850AMX[1]-0-0-0-0	QC-850 Base Master Assembly, no boss, and no options (sensors not included)
		9128-850AMX-0-0-0-0-SM	QC-850 Base Master Assembly, no boss, PNP Lock and Unlock sensors, and RTL sensors
2	1	3700-20-11515	125 mm boss
3	3	3500-1258010-15A	M3X10 socket flat head cap screw, Class 10.9, pre-applied adhesive (blue dyed magni-565, ND microspheres epoxy, yellow)
4	2	3700-20-11494	Series 8 Alignment Pin
5	2	3500-1068025-15A	M8x25 Socket Head Cap Screw, Class 12.9, ISO4762/DIN912, Corrosion protection coating, Pre-applied adhesive (YL M-spheres/IFI 525)
6	2	3500-1258006-15A	M3x6 Flat Socket Head Cap Screw, Class 10.9, ISO10642/DIN7991, ES-ATI-007, Pre-applied adhesive (YL M-Spheres/IFI 525)
7	2	3690-0000090-50	Tab/cable retainer, Vinyl coated steel
Sensor and Cable Assemblies			
8	2	9005-20-9215	Lock/unlock sensor carrier subassembly, Single-screw, 0.677” offset, PNP, 0.35 m cable with 90° M8 male 3-pin connector
9	1	8590-9909999-245	RTL (R2) Inductive sensor, 16x8x4.7 mm, PNP, 0.38 m potted cable with 90° M8 male 3-pin connector, 2.00 mm sensing distance
10	1	8590-9909999-244	RTL (R1) Inductive sensor, 16x8x4.7 mm, PNP, 0.33 m potted cable with 90° M8 male 3-pin connector, 2.00 mm sensing distance
Integrated Checked Air Valve Components			
11	1	3700-20-3488	Valve Stem
12	1	3410-0001183-01	O-ring 6 mm X 2 mm BUNA D90
13	1	3410-0001065-01	O-ring 14 mm X 2 mm BUNA
14	1	3700-20-2994	Master Check Valve Piston
15	1	3410-0001068-01	Mini U-Cup seal 18 mm inner diameter X 22 mm BUNA
16	1	3610-1907501-21	Spring, 7/8” outer diameter

Note:

1. The X in the part number designates the boss size: D = 125 mm (typical) and E = 160 mm. Contact an ATI representative for more information.

6.3 Tool Plate Assembly

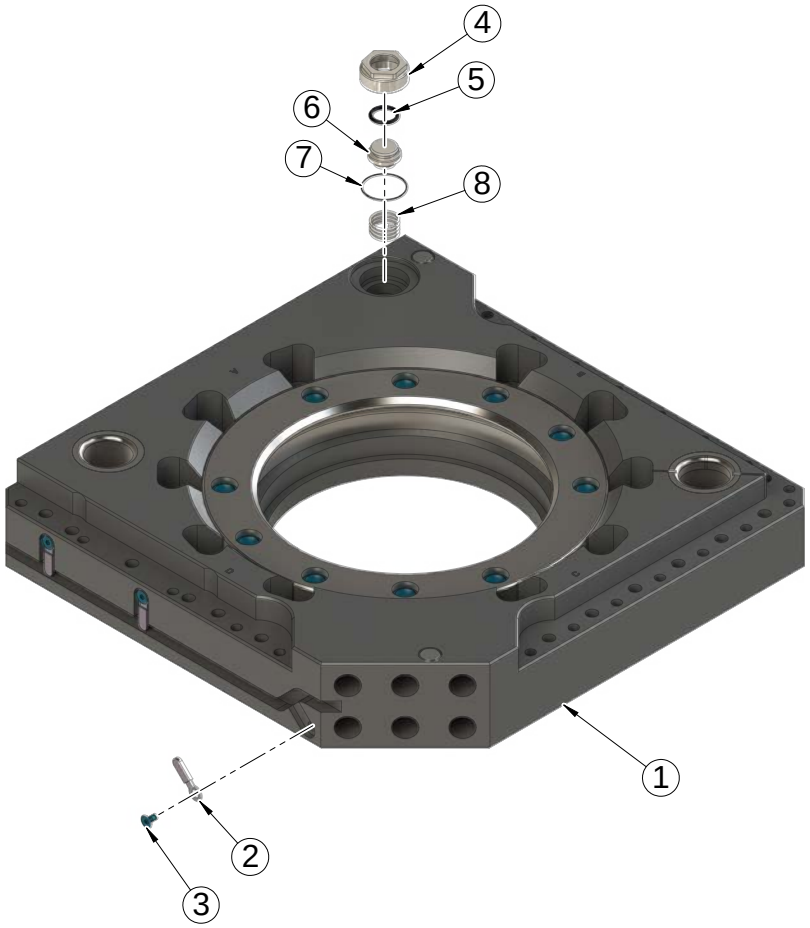


Table 4.4—Tool Plate			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9128-850DT-0-0-0-0	Tool with 125 mm Recess and no other options
2	3	3690-0000090-50	tab/cable retainer, vinyl coated steel
3	3	3500-1258006-15A	M3x6 flat socket head cap screw, class 10.9, ISO10642/DIN7991, ES-ATI-007, pre-applied adhesive (YL M-Spheres/IFI 525)
Integrated Checked Air Valve Components			
4	1	3700-20-1650	piston retainer cap, S8 tool body
5	1	3410-0001067-01	O-ring, 10 mm X 2 mm, BUNA N, DUR. 90
6	1	3700-20-2303	Tool check valve piston
7	1	3410-0001071-01	O-ring, inner diameter 18 mm X 1 mm wall
8	1	3610-6401501-21	stainless steel spring , 14 mm outer diameter

7. Specifications

Table 5.1—Master and Standard Tool Plates		
Recommended Max Payload	1540 lbs (700kg)	The mass attached to the Tool Changer.
Operating Temperature Range	-20–150°F (-30–66°C)	Optimal operating temperature range.
Operating Pressure Range	60–120 psi (4.1–7.3 bar)	Locking mechanism supply pressure operating range. Supply to be clean, dry, and filtered to 50 micron or better.
Air Port	G 1/2”	Checked air port
Coupling Force @ 80 psi	7950 lbs (3600 kg)	Axial holding force
Static Moment Capacity (X&Y)	**31,100 in-lbs (3,500 Nm)**	Maximum recommended working load for optimum performance of the Tool Changer
Static Moment Capacity (Z)	**18,660 in-lbs (2, 100 Nm)**	Maximum recommended working torque for optimum performance of the Tool Changer
Maximum Dynamic Moment (X&Y)	**62,000 in-lbs (7,000 Nm)**	Maximum tested dynamic load for the Tool Changer
Maximum Dynamic Moment (Z)	**55,780 in-lbs (6,300 Nm)**	Maximum tested dynamic load for the Tool Changer
Positional Repeatability	0.0006” (0.015 mm)	Repeatability tested at rated load at one million cycles.
Weight (coupled, no access.)	39 lbs (17.7 kg)	Master 24.9 lbs (11.3 kg) / Tool 14.1 lbs (6.4 kg)
Max. Recommended distance between Master and Tool plate	0.06” (1.5 mm)	No-Touch locking technology allows the Master and Tool plates to lock with separation when coupling.
Sensor Information, signal name	L/U (Lock/Unlock) RTL (Ready-To-Lock)	Internal proximity sensors (2) with cable and connector for direct wiring to the control/signal module to indicate locking mechanism position. Flat pack proximity sensor with cable and connector for direct wiring to control/signal module to indicate Master and Tool mating surfaces within close proximity of each other.

8. Drawings

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

Drawing for tool changer 850 is *9630-20-850.*