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B. Base Tool Changer

QC-110 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-110 Series of Tool Changers, please click the following link: *QC-110 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 optional modules.

The locking mechanism consists of a cam, a male coupling, and chrome steel ball bearings.

Tapered pins are 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.

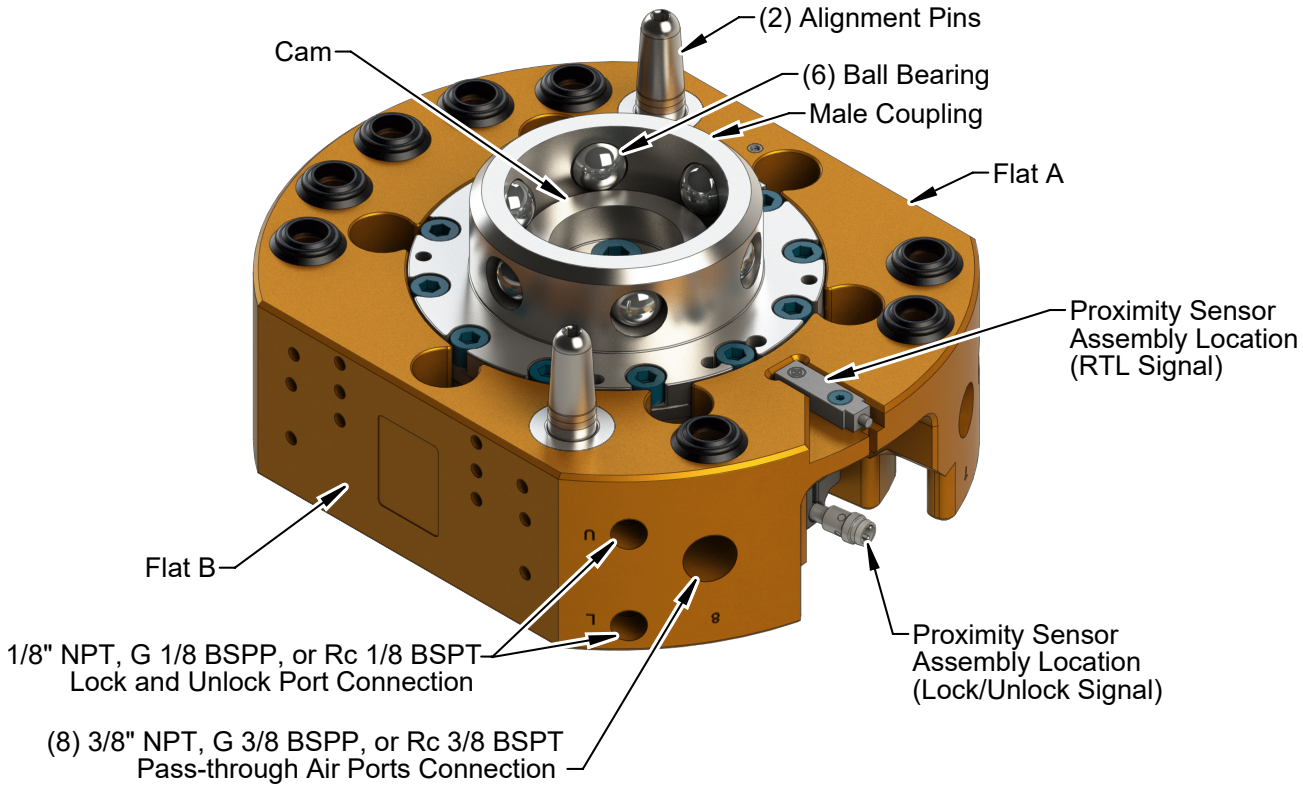
1/8 NPT, G 1/8 BSPP, or Rc 1/8 BSPT port connections are available to supply air pressure for coupling and uncoupling the Tool Changer.

There are (8) 3/8 NPT, G 3/8 BSPP, Rc 1/4 BSPT, or G 1/4 PSPP port connections available for pass-through air to tools.

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

A mounting pattern is machined into the Master plate for mounting to a robot arm or a robot interface plate.

Figure 1.1—Master Plate Assembly

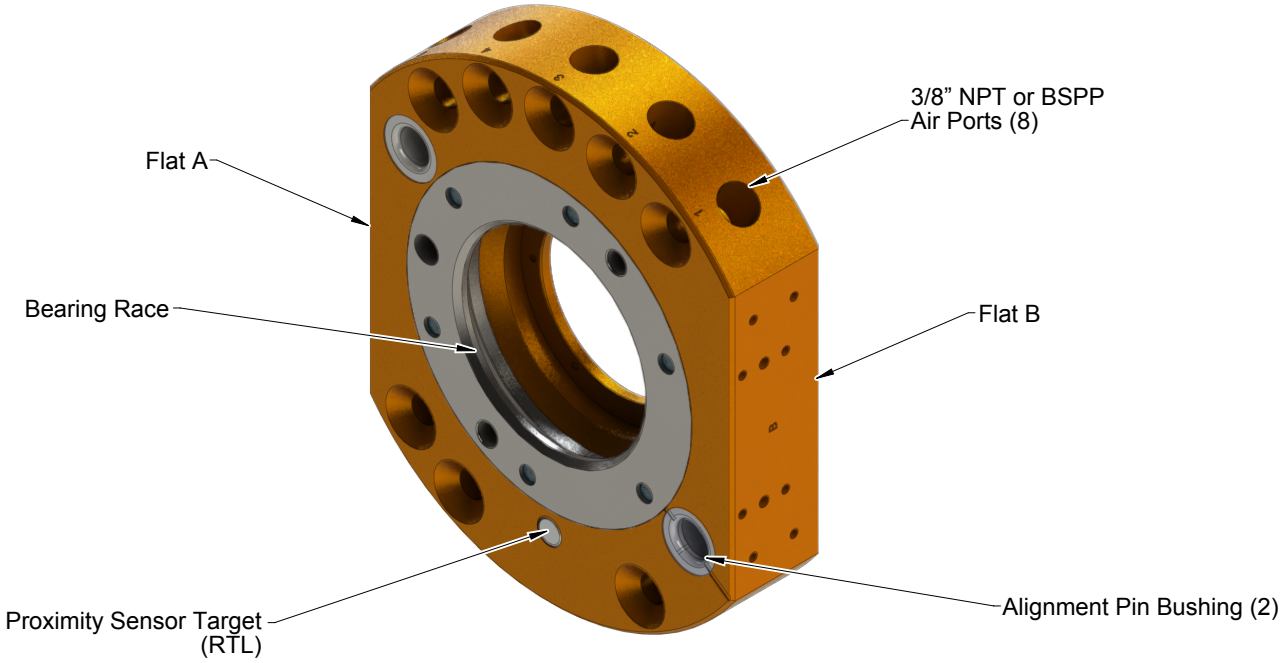


1.2 Tool Plate Assembly

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 optional modules. The Tool plate body also includes a 125 mm bolt circle (BC) machined mounting pattern for mounting to customer tooling or a tooling interface plate.

There are (8) 3/8 NPT, G 3/8 BSPP, Rc 1/4 BSPT, or G 1/4 PSPP port connections available for pass-through air to tools.

Figure 1.2—Tool Plate Assembly



1.3 Optional Modules

There are (2) flats available for mounting of the optional modules for various pass-through utilities, such as fluid/air, vacuum, and electric.

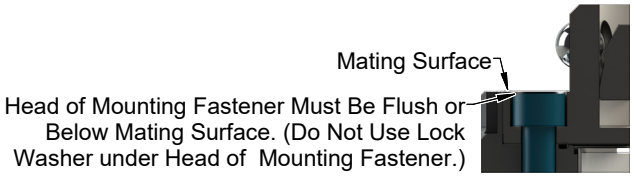
For assistance in choosing the right modules for a particular application, visit our website (*QC-110 Series)* and click on the *Compatible Modules* tab to see what is available or contact an ATI sales representative.

2. Installation

All fasteners used to mount the Tool Changer to the robot and customer tooling should be tightened to the torque value indicated in *Table 2.1*. **Furthermore, removable (blue) Loctite 242® must be used on these fasteners.** *Table 2.1* **contains recommended values based on engineering standards.**

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (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.

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



CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

CAUTION: Do not use fasteners that exceed the thread depth in the Tool Changer. Refer to *Section 8—Drawings* for details on mounting hole thread depth. Secure the Tool Changer with the proper length fasteners. This is true for both robot and tool interfaces.

Table 2.1—Fastener Size, Class, and Torque Specifications

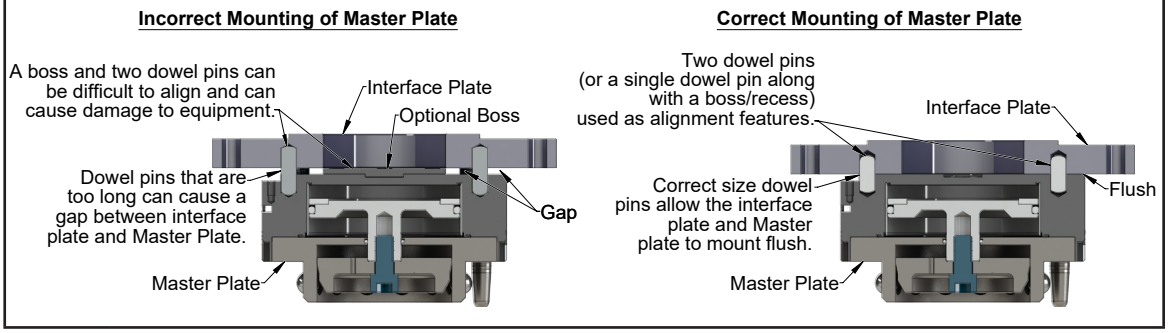
Mounting Conditions	Fastener Size & Property Class	Recommended Torque	Thread Locker
Master plate to robot interface plate (6061-T6 aluminum) Minimum thread engagement of 15 mm (0.59”) [1.5X fastener Ø]. Confirm available engagement with robot manufacturer.	M10-1.5 Class 12.9	52 N-m (38 ft-lbs.)	Pre-applied 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	75 N-m (55 ft-lbs.)	
Tool interface plate (aluminum) to Tool plate Minimum thread engagement of 15 mm (0.59”) [1.5X fastener Ø]. Do not exceed maximum available thread depth of 20 mm as shown in *Section 8—Drawings*	M10-1.5 Class 12.9	52 N-m (38 ft-lbs.)	
Optional module or adapter plate to Master or Tool plate	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*

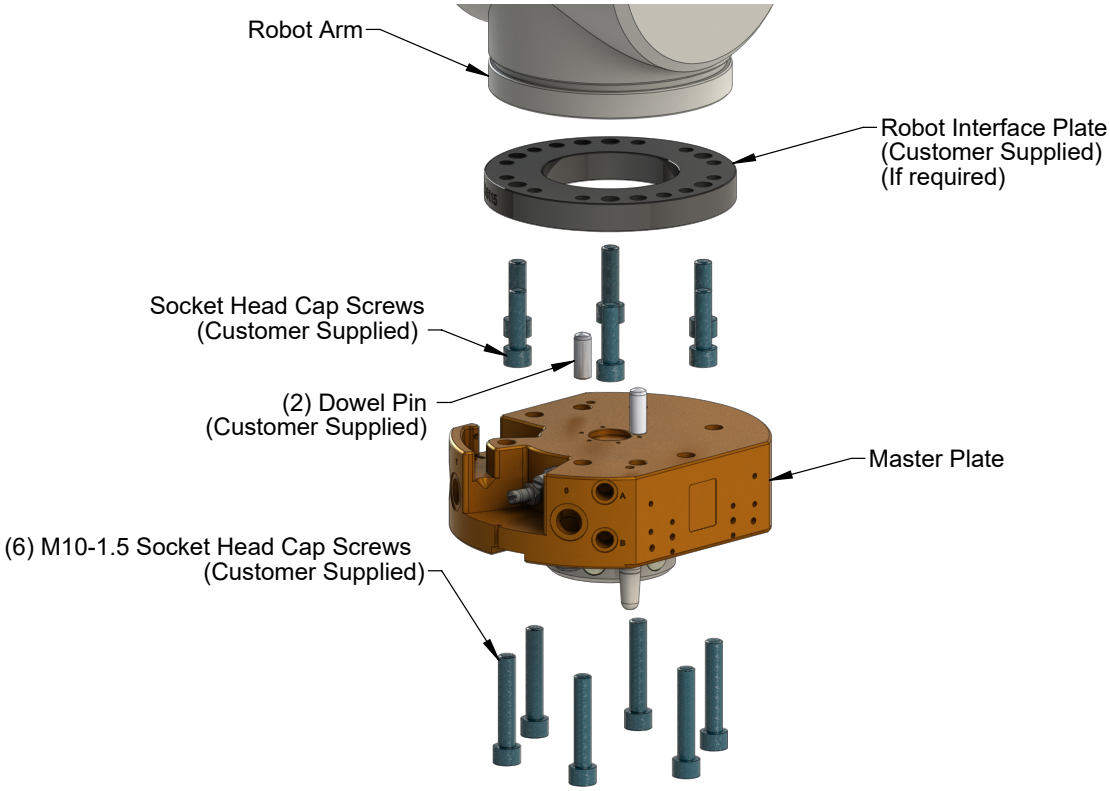
Supplies required: *Clean rag, Loctite® 242*

1. Clean the mounting surfaces.
2. If required, install the interface plate to the robot arm, align using the boss or dowel pins and secure with customer supplied fasteners.
3. Align the dowel pins to the corresponding holes in the Master plate and secure the Master plate to the robot arm or interface plate with customer supplied (6) M10 socket head cap screws. Apply Loctite 242 to threads (see *Table 2.1* for proper fasteners and torque).

NOTICE: If an ATI interface plate is used, fasteners to mount the Master plate to the interface plate is supplied with the interface plate. The fasteners to mount the interface plate or the Master plate directly to the robot are customer supplied.

4. Connect utilities to the appropriate modules and Master plate connections.

Figure 2.1— Standard Master Plate Installation



2.3 Master Plate Removal

Tools required: *8 mm hex key*

NOTICE: Depending on maintenance or repair being performed, utilities to modules and Master plate may need to be disconnected.

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 utilities from the Master plate and attached modules.
5. Remove the fasteners that secure the Master plate to the robot arm or interface plate.

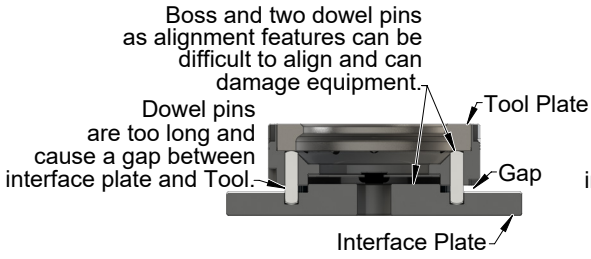
2.4 Tool Interface

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 secure the Tool plate to customer tooling. Custom interface plates can be supplied by ATI (Refer to the application drawing).

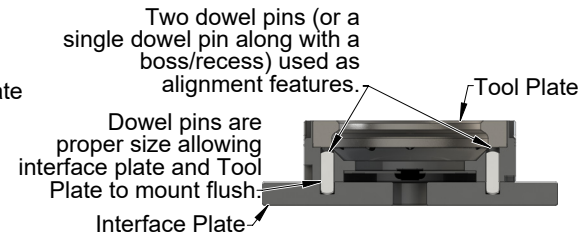
CAUTION: Do not use more than two alignment features when securing a Tool plate to an interface plate. Using more than two alignment features can cause damage to equipment. Use either two dowel pins or a single dowel pin along with a boss/recess feature to align the Tool plate with the interface plate.

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 to 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.

2.5 Tool Plate Installation

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

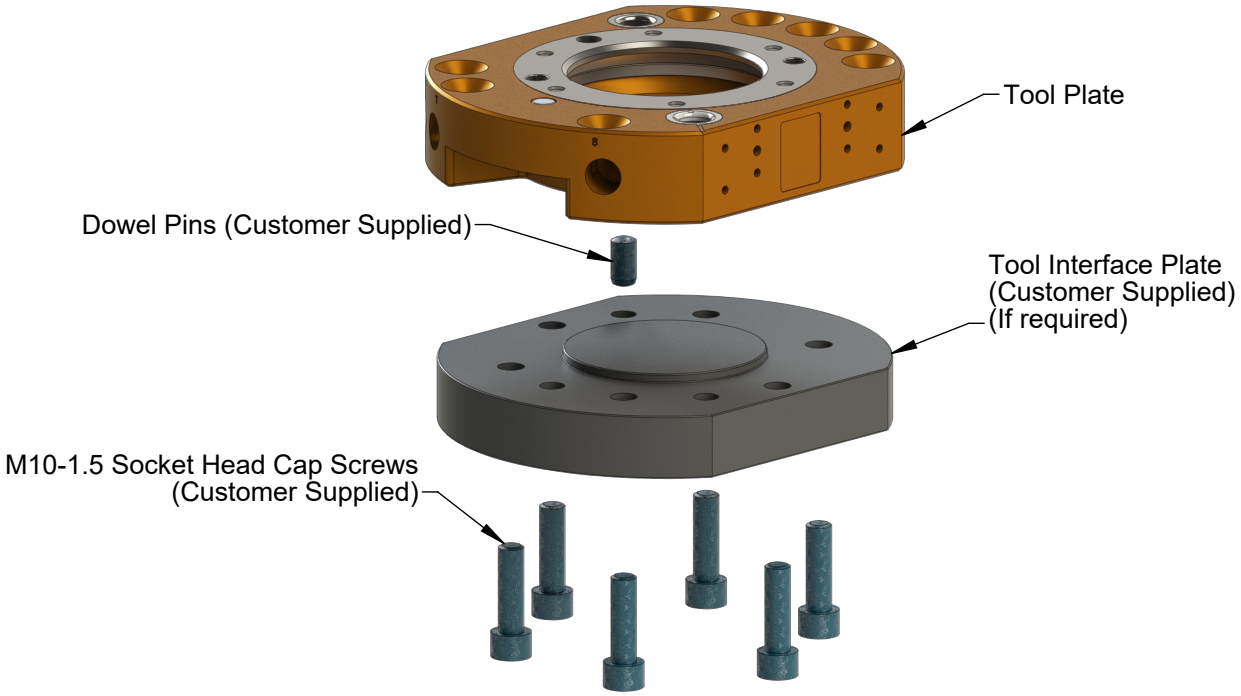
Supplies required: *Clean rag, Loctite® 242*

1. Clean the mounting surfaces.
2. If required, install the tooling interface plate to the customer tooling, align using the boss or dowel pins and secure with customer supplied fasteners.
3. 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 (6) M10 socket head cap screws. Apply Loctite 242 to threads (see *Table 2.1*).

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.

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

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. Disconnect the utilities from the Tool plate and attached modules.
5. Remove the fasteners connecting the Tool plate to the tooling or tool interface plate.

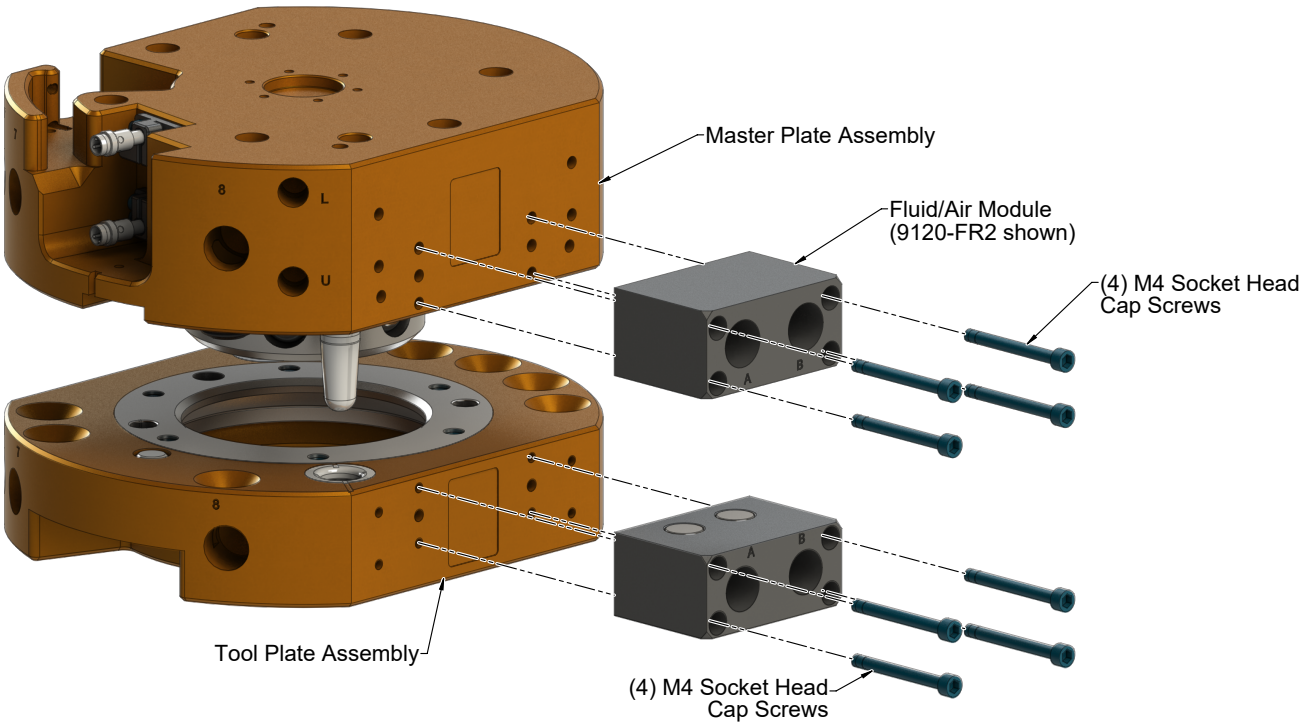
2.7 Optional Module with J16 Pattern Installation

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 2.3*.
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 2.1* for proper torque.
7. Remove the all protective caps, plugs, tape, etc from the module prior to operation.
8. After the procedure is complete, resume normal operation.

Figure 2.3—Optional Module Installation



2.8 Optional Module with J16 Pattern Removal

Tools required: *2.5 mm or 3 mm hex key*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Disconnect any cables, air line, etc.
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.

2.9 Pneumatic Connections

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.

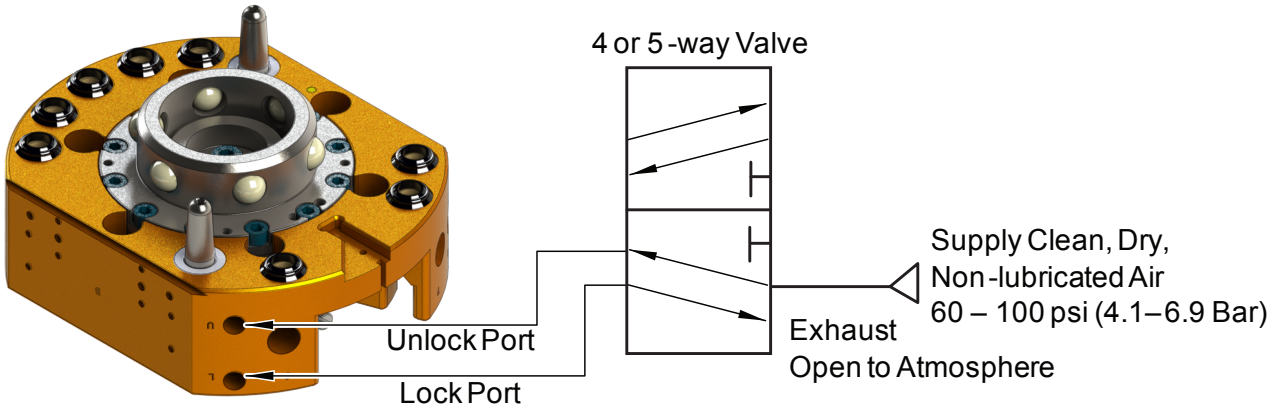
2.9.1 Valve Requirements and Connections for the Locking Mechanism

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 2.4—Lock and Unlock Pneumatic Connections



2.10 Electrical Connections

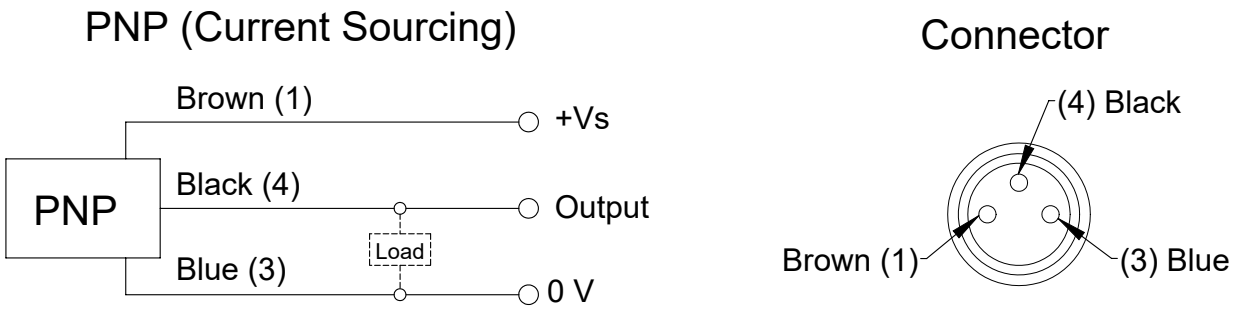
The Tool Changer is available with integrated lock/unlock sensors. If sensors are not used, plugs are provided to seal the locking mechanism. If a control/signal module is used on Flat A when ordered, the sensors are connected to the module prior to shipping.

2.10.1 PNP Type Lock and Unlock Sensors (-SD, -SFB, -SG, -SGH, -SM, -SMH, -SM1, and -ST sensor designation)

These sensors are used on 9120-110AM-000-000-SD, 9120-110AM-000-000-SFB , 9120-110AM-000-000-SG, 9120-110AM-000-000-SGH, 9120-110AM-000-000-SM, 9120-110AM-000-000-SMH, 120-110AM-000-000-SM1, and 120-110AM-000-000-ST.

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

Figure 2.5—PNP Type Lock, Unlock and RTL Sensors

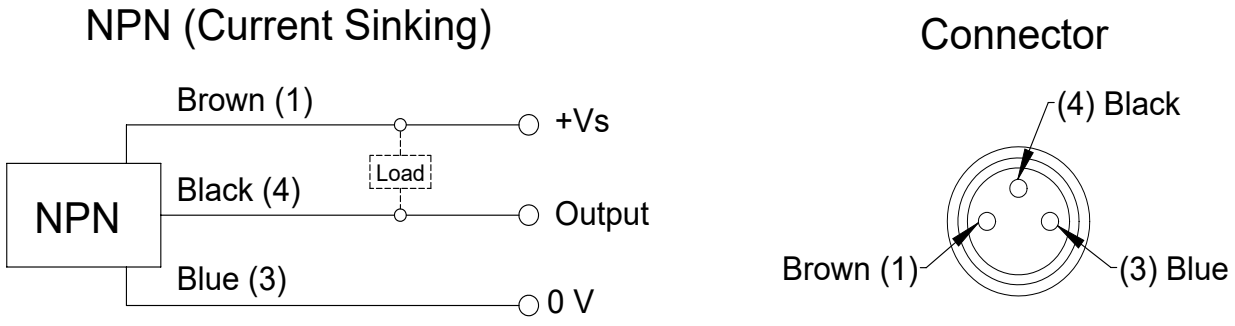


2.10.2 NPN Type Lock and Unlock Sensors (-SE, -SF, -SP, -SU sensor designation)

These sensors are used on 9120-110AM-000-000-SE, 9120-110AM-000-000-SF, 9120-110AM-000-000-SP, and 9120-110AM-000-000-SU.

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

Figure 2.6—NPN Type Lock, Unlock and RTL Sensors

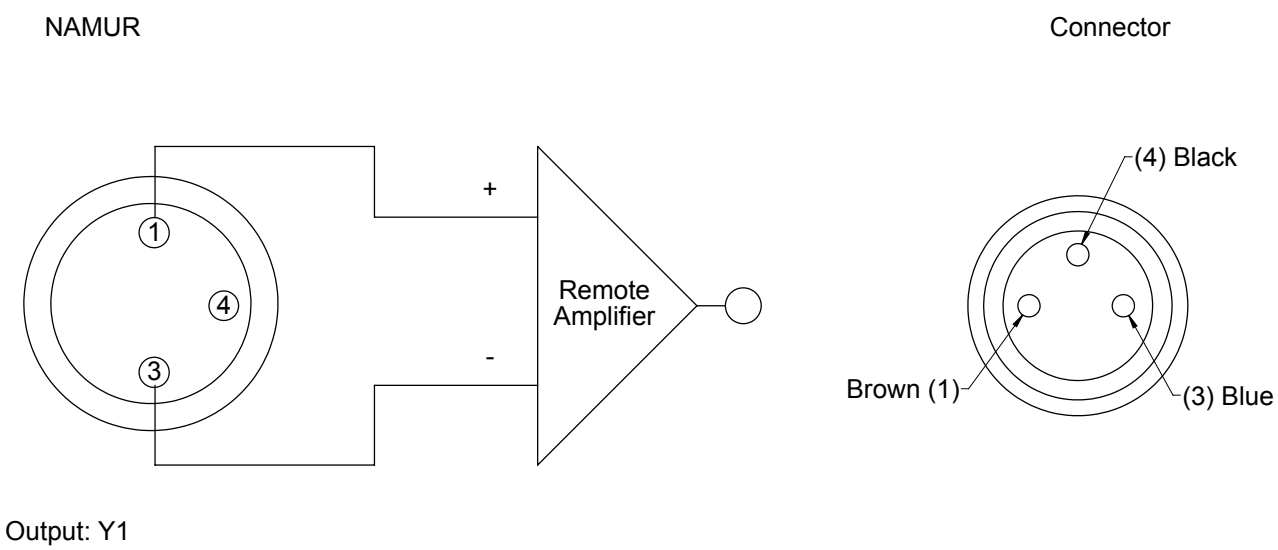


2.10.3 2-Namur Type Lock and Unlock Sensors (-SV sensor designation)

This section applies to the following part number designator: (-SV). RTL sensors are not available for this model. Example: 9120-110AM-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 2.7—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 from an air or air/valve adapter module to provide lock and unlock pressure to the locking mechanism.

CAUTION: Safe, reliable operation of the Tool Changer is dependent on a continuous supply of compressed air at a pressure of 60 to 100 psi. Robot motion should be halted if the air supply pressure drops below 60 psi.

NOTICE: All Tool Changers are initially lubricated using MobilGrease XHP222 Special grease. The end user must apply additional lubricant to the locking mechanism components and alignment pins prior to start of service (See *Section 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 should be programmed to minimize misalignment during coupling and uncoupling. Additionally, the tool stand should be durable and not allow deflection under uncoupled Tool weight that will take alignment of the Tool Changer plates outside of accepted offsets. See *Figure 3.1* and *Table 3.1* for recommended maximum allowable offsets prior to coupling. In some cases, greater offsets than shown in *Table 3.1* can be accommodated by the Master and Tool plates but will increase wear.

Locking 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

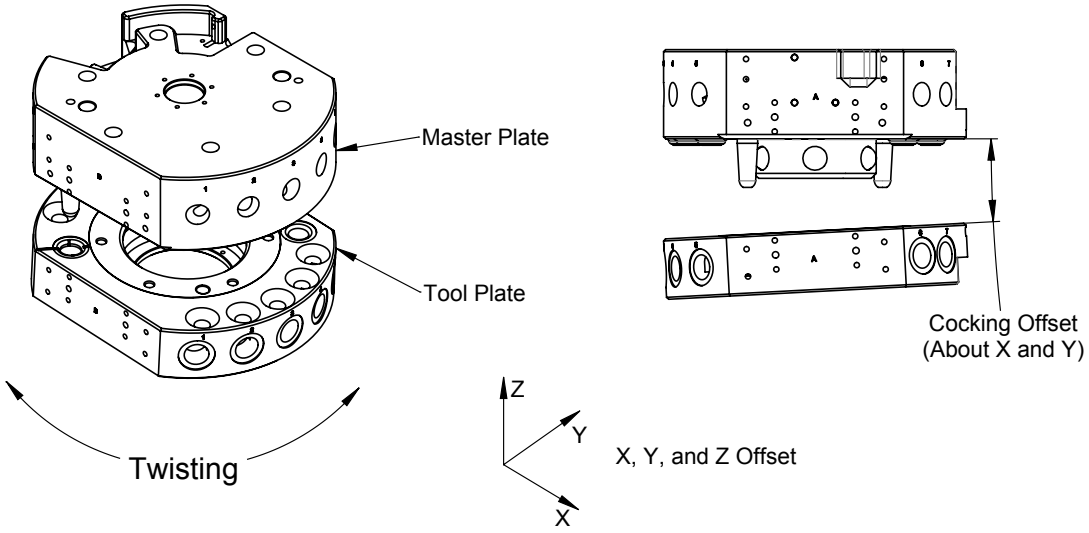


Table 3.1—Maximum Recommended Offsets Prior to Coupling				
Model	**No-Touch Zone Z Offset (Max)[1]**	**X and Y Offset (Max) [2]**	**Cocking Offset (Max)**	**Twisting Offset (Max)**
QC-110	0.12” (3 mm)	±0.04” (1 mm)	±0.7°	±1°

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

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 TSM (Tool Stand Medium) system is compatible with ATI Tool Changer sizes QC-20 to QC-110. The TSM 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/medium/MediumStand.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 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 a Tool in the tool stand is recommended. The sensor may be used prior to coupling to ensure there is a Tool properly seated in the stand. Sensors may also be used as the robot starts to move away after uncoupling. Sensors provide 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:

- 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

With regular, preventative maintenance, the Tool Changer and optional modules are designed to have a long service life. A visual inspection and preventive maintenance schedule is provided in the following table (depending upon the application). Detailed assembly drawings are provided in *Figure 5.9* of this manual. For recommended and detailed preventive maintenance steps for utility modules, refer to the ATI manual for that module.

Table 4.1—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	Weekly

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. Refer to *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 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 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 5.2.4—Lock and Unlock Sensor Replacement Procedures*.

Hoses

- ☐ Inspect hose connection for tightness and leaks. If leaking or loose secure hose connection.
- ☐ Inspect hoses for interferences, abrasions, cuts, and leaks. Replace as required.

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 (Modules)

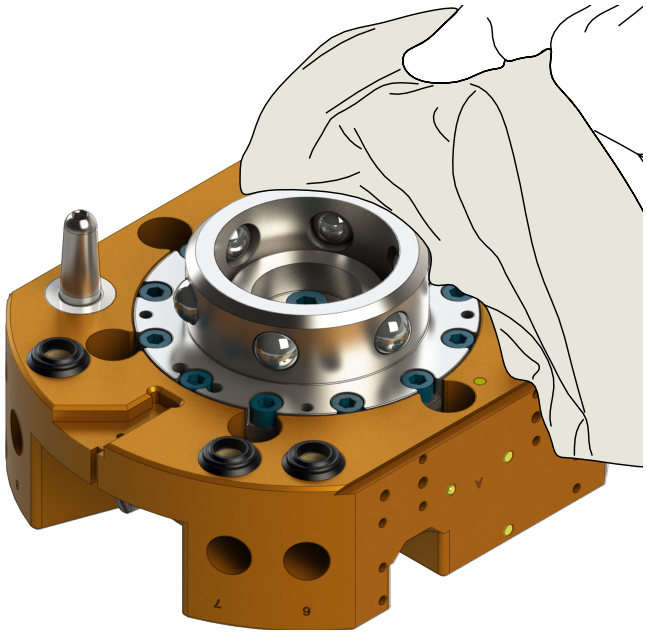
- ☐ Inspect for wear, abrasion, and cuts. Refer to *Section 5.2.1—V-ring Seal Replacement.*

4.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

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

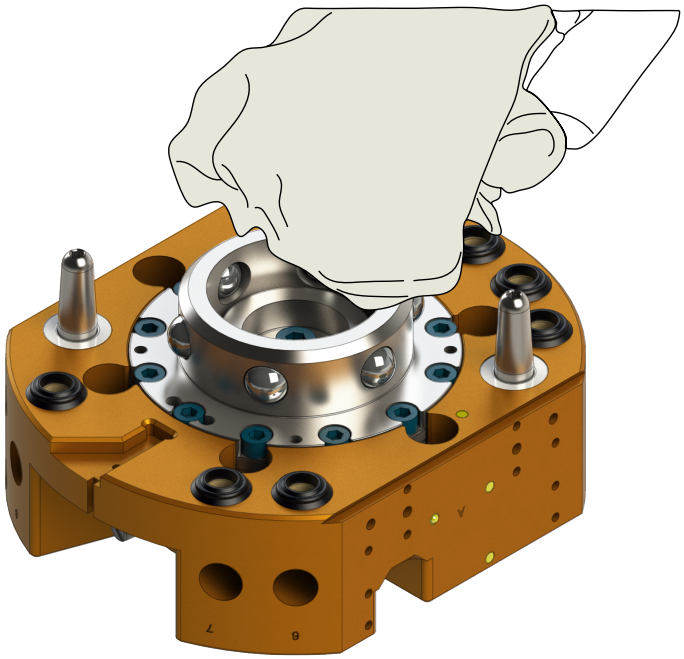
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam, and alignment pins.

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



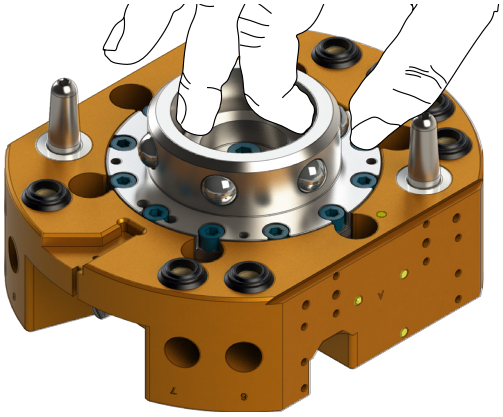
5. Use a clean rag to thoroughly remove any lubricant and debris from the inner surface of the male coupling and cam.

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



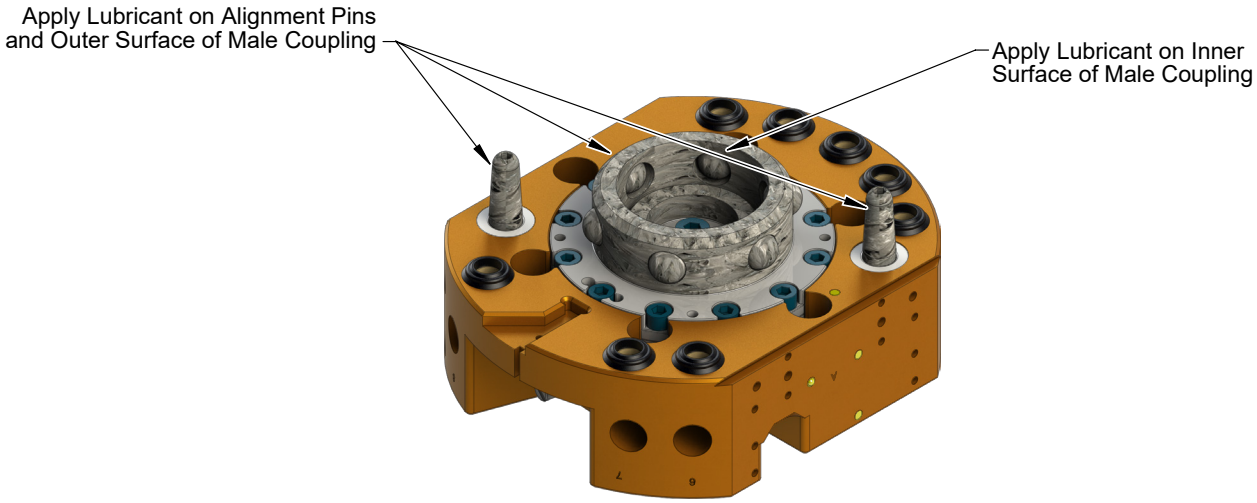
6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

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

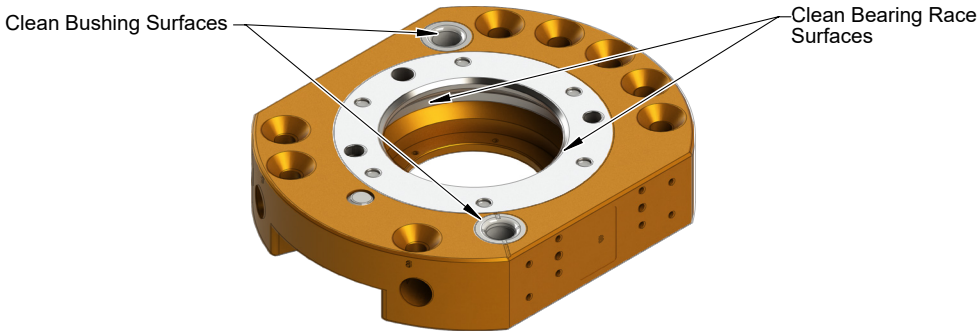


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

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

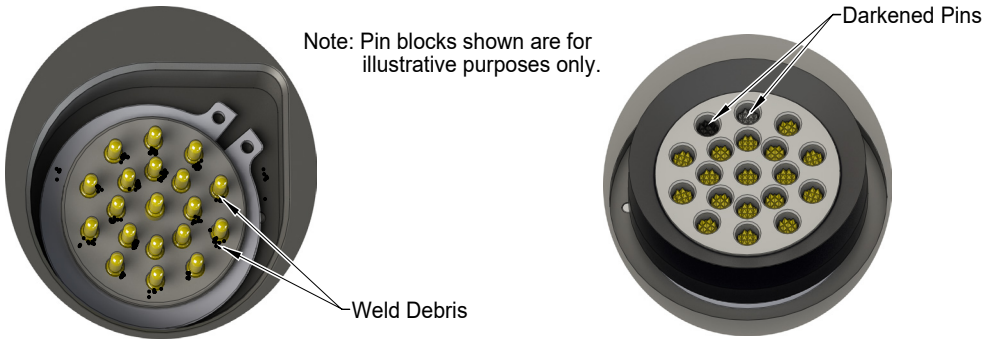


4.3 Pin Block Inspection and Cleaning

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.

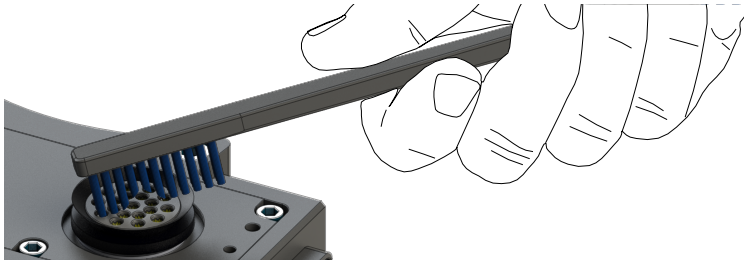
Figure 4.6—Inspect Master and Tool Pin Blocks



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).

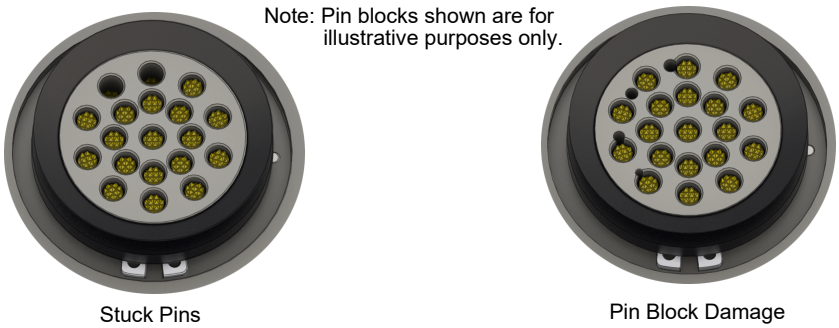
NOTICE: Do not use an abrasive media, cleaners, or solvents to clean the contact pins. Using abrasive media, cleaners, or solvents will cause damage to the contact surface, or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI Part Number 3690-0000064-60)

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

Check these conditions for all symptoms prior to troubleshooting:

- Proper pneumatic and electrical connections have been made to the Tool Changer.
- Air is supplied at a minimum of 60 psi (4.1 Bar).
- No air or vacuum can be trapped in a de-energized Lock or Unlock Port (pressure must be vented to atmosphere). Refer to *Section 2.9—Pneumatic Connections*.

Table 5.1—Troubleshooting Procedures

Symptom	Cause	Resolution
Unit will not lock or unlock	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 control/signal module is not operating correctly.	Check the troubleshooting section of the manual for the specific module.
	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.
	Ready-To-Lock (RTL) sensors not activated indicating Tool is not positioned properly.	Check that the Tool is properly seated in the tool stand. Re-teach the robot to bring the Master plate and Tool plate closer together prior to attempting to lock. Refer to *Section 5.2.5—RTL Sensor Replacement Procedures.* Check that both RTL sensors are not damaged. Replace damaged RTL sensors as necessary. Check all cables for damage and that they are connected properly to the signal control/signal module. Replace damaged cables as necessary.
Unit is locked but Lock signal does not read “on” (true).	Lock sensor/ cable is damaged.	**Units using individual Sensors:** Replace Lock sensor/cable as necessary. Contact ATI for assistance. **Units using Sensor Assemblies:** Replace the lock sensor assembly as necessary. Refer to *Section 5.2.4.1—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies).*
	Lock sensor is out of position.	**Units using individual Sensors:** Adjust Lock sensor, contact ATI for assistance. **Units using Sensor Assemblies:** Replace the lock sensor assembly as necessary. Refer to *Section 5.2.4.1—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies).*

Table 5.1—Troubleshooting Procedures		
Symptom	**Cause**	**Resolution**
Unit is unlocked but Unlock signal does not read “on” (true).	Unlock sensor/ cable is damaged.	**Units using individual Sensors:** Replace Unlock sensor/cable as necessary. Contact ATI for assistance. **Units using Sensor Assemblies:** Replace the unlock sensor assembly as necessary. Refer to *Section 5.2.4.1—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies).*
	Unlock sensor is out of position.	**Units using individual Sensors:** Adjust Unlock sensor, contact ATI for assistance. **Units using Sensor Assemblies:** Replace the unlock sensor assembly as necessary. Refer to *Section 5.2.4.1—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies).*
Units Equipped with Electrical Modules		
Loss of Communication	Debris in and around contact pins. Contact pin worn or damaged.	V-ring seal damaged allowing debris into contact pins. Replace V-ring seal, refer to *Section 5.2.1—V-ring Seal Replacement*.

5.2 Service Procedures

The following service procedures provide instructions for component replacement and adjustment.

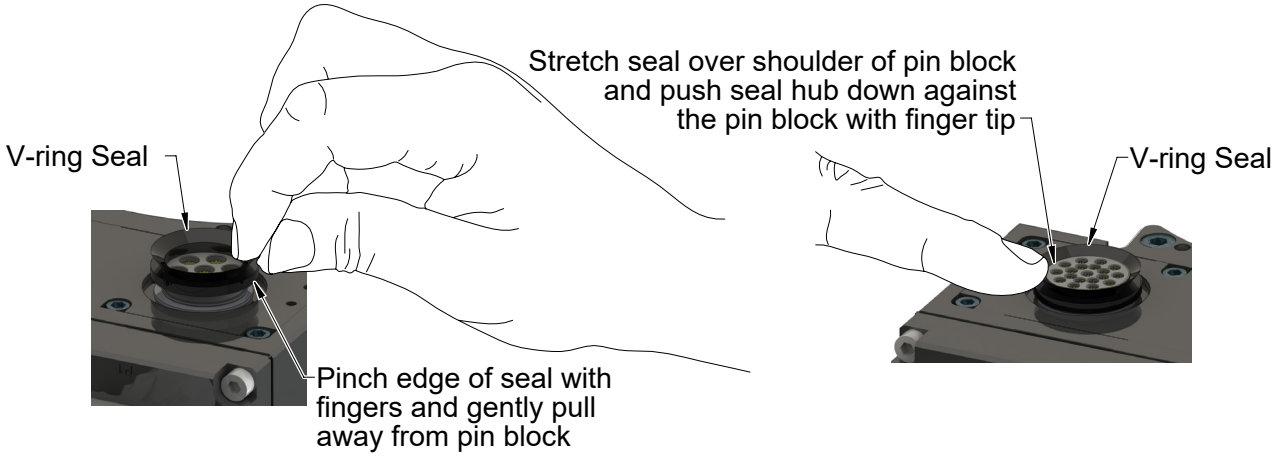
5.2.1 V-ring Seal Replacement

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 5.1—V-ring Seal Replacement



5.2.2 Alignment Pin Replacement

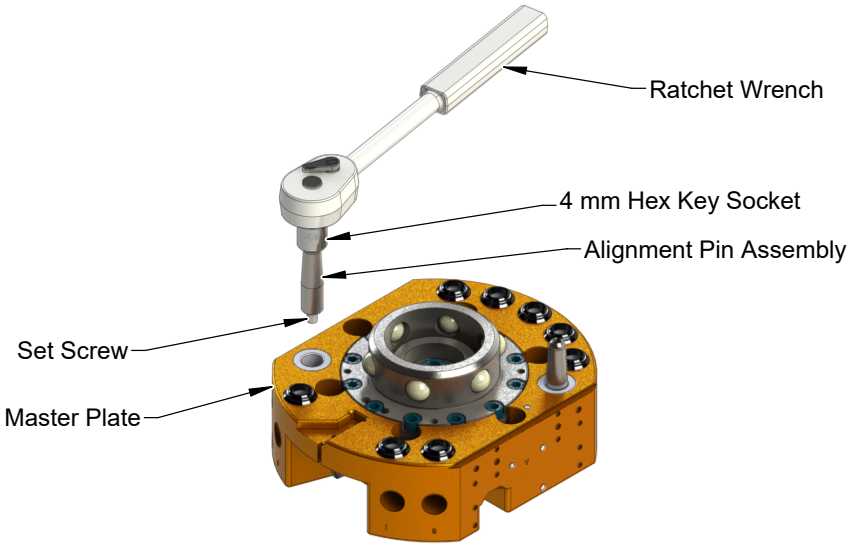
Parts required: *Refer to Section 6—Serviceable Parts*

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. Unscrew the alignment pin assembly from the Master plate using a 4 mm hex key. If alignment pin cannot be removed using the hex key in the tip, go to step 5. If alignment was remove go to step 6.

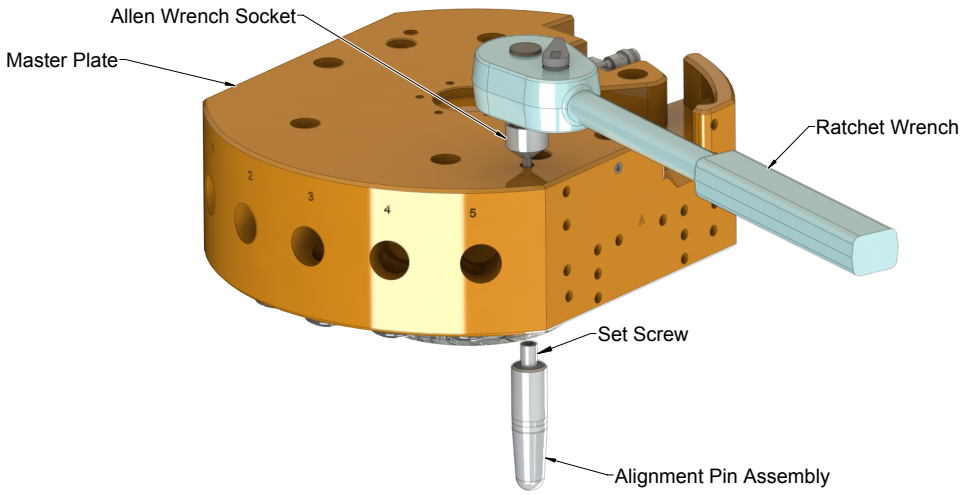
Figure 5.2—Alignment Pin Removal



5. Another approach would be to use the access hole in the back side of the Master plate. If not 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.

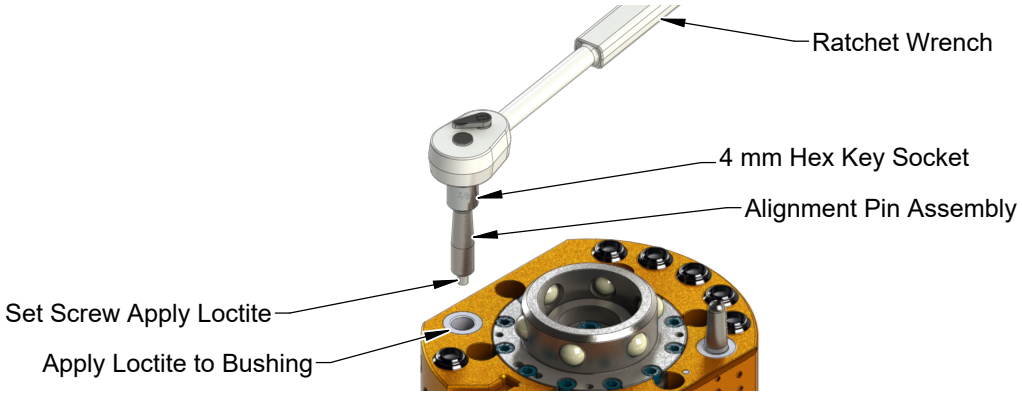
NOTICE: If for any reason the pin cannot be removed using the hex key in the tip, it may be necessary to remove it by other means, such as locking pliers.

Figure 5.3—Remove Alignment Pin From Back Side



6. Once the alignment pin has been removed, verify that the assembly (pin and set screw) are intact. If the set screw portion of the assembly did not come out, it will be necessary to remove it separately using the access hole in the back plate of the Master plate.
7. Apply Loctite 242 to the inside of the alignment pin bushing and the threads if the alignment pin.
8. Install the alignment pin assembly into the bushing on the Tool Changer. Tighten to 60 in-lbs (6.8 Nm).
9. Apply MobilGrease XHP222 Special grease to the alignment pin, refer to *Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins.*
10. If repairs are complete, return circuits to normal operation.

Figure 5.4—Alignment Pin Removal



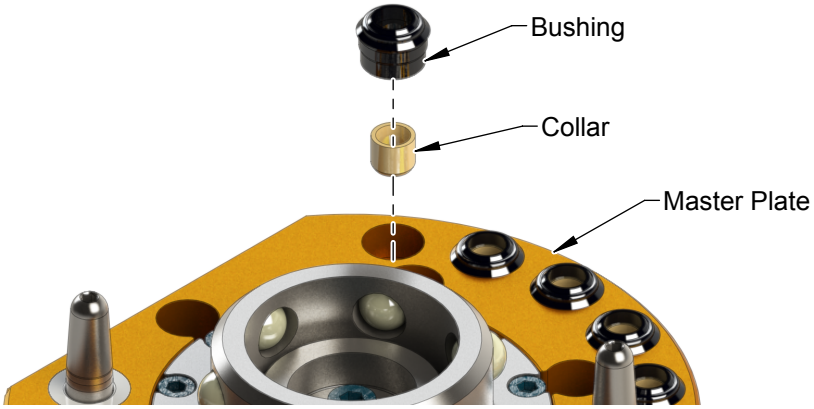
5.2.3 Rubber Bushing Replacement

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

Tools required: *Needle nose pliers*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Using needle nose pliers grasp the rubber bushing and pull it out of the Master body.
5. If the collar remains in the Master body, remove it.
6. Lightly lubricate the new rubber bushing and push into the Master body.
7. Insert the new collar into the rubber bushing; ensure the bushing is fully pressed into the body.
8. If repairs are complete, return circuits to normal operation.

Figure 5.5—Rubber Bushing Replacement

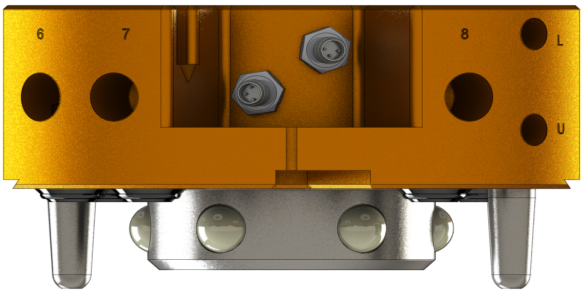


5.2.4 Lock and Unlock Sensor Replacement Procedures

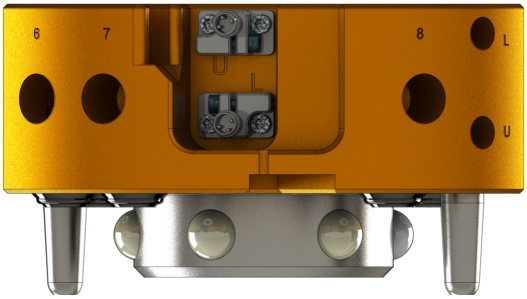
Look at the following figure below to determine what type of sensors the Tool Changer uses.

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

Figure 5.6—Determine What Type of Sensors the Tool Changer Uses:



Lock and Unlock Sensor Replacement (Units using Individual Sensors) contact ATI for assistance.

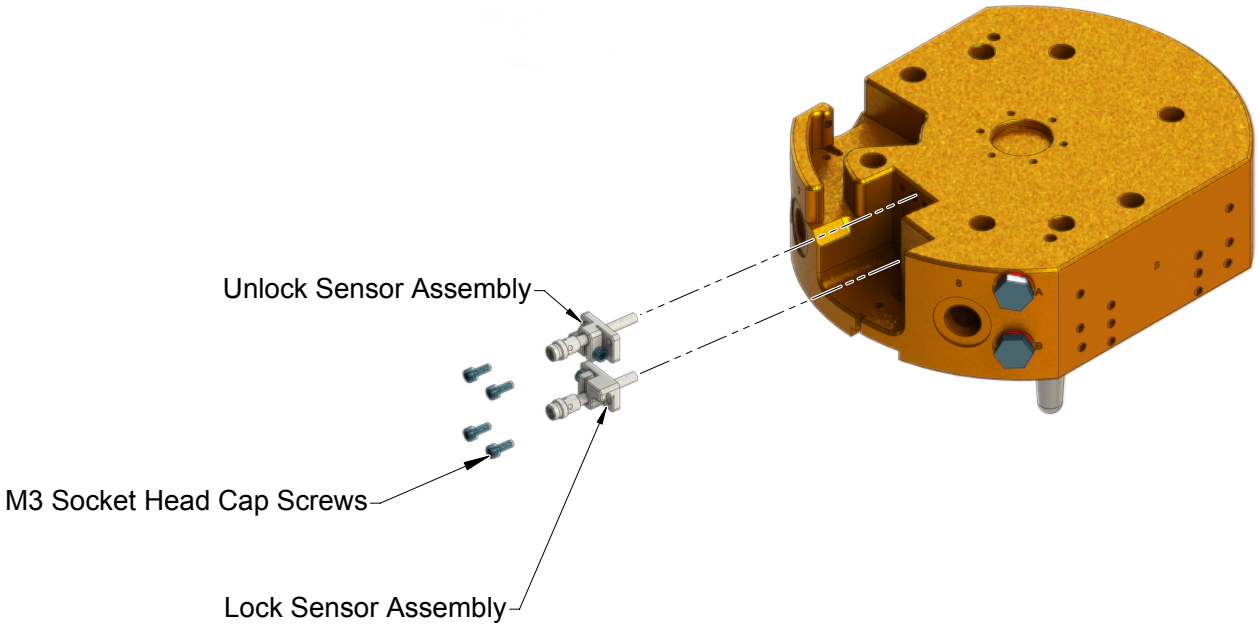


Lock and Unlock Sensor Assembly Replacement (Units using Sensor Assemblies)
Refer to *Section 5.2.4.1—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies)*

5.2.4.1 Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies)

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. If testing or replacing the Lock sensor, make sure the QC-110 is in the locked position. If replacing the Unlock sensor, make sure the QC-110 is in the unlocked position before continuing.
4. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
5. Depending on the robot and interface plate used the Tool Changer's Master plate may have to be removed. Refer to *Section 2.3—Master Plate Removal*.
6. Disconnect the Lock and/or Unlock sensor cable connectors from the Lock and/or Unlock sensor assembly.
7. Remove the (2) M3 socket head cap screws that secure the Lock and/or Unlock sensor assembly to the Tool Changer body (refer to *Figure 5.7*). Pull the sensor assembly straight out from the Tool Changer body.
8. To test the suspect sensor, reconnect the sensor cable and place a ferrous target in front of the proximity sensor to confirm that the sensor is functional. The sensor lock or unlock signal should read "on"(true) and the sensor LED should illuminate.
9. If the proximity sensor is not functioning properly, replace. Disconnect the sensor cable and discard.

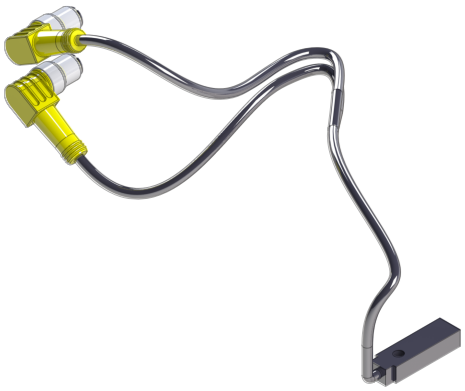
Figure 5.7—Lock and Unlock Sensor Assembly Replacement



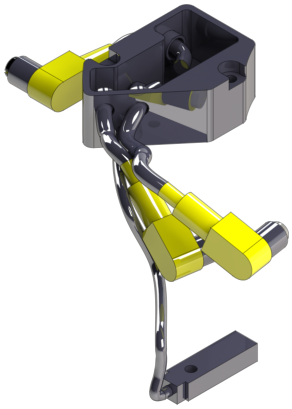
10. Insert the new Lock and/or Unlock sensor assembly into the Tool Changer body as shown in *Figure 5.7.*
11. Secure the sensor assembly using the (2) M3 socket flat head screws. Tighten to 12 in-lbs (1.4 Nm).
12. Connect the Lock and/or Unlock sensor cable connector to the proper sensor.
13. If repairs are complete, return circuits to normal operation.
14. Confirm the operation of the Unlock sensor by sending an Unlock command and then checking to see that the LED in the Unlock sensor body is on.
15. Confirm the operation of the Lock sensor by sending the Lock command to lock a Tool to the Master and then checking to see that the LED in the Lock Sensor body is on.

5.2.5 RTL Sensor Replacement Procedures

Figure 5.8—Determine What Type of Sensors the Tool Changer Uses:



Refer to *Section 5.2.5.1—RTL Flat Pack Style Sensor Replacement (Y-Style and Lead Cable).*

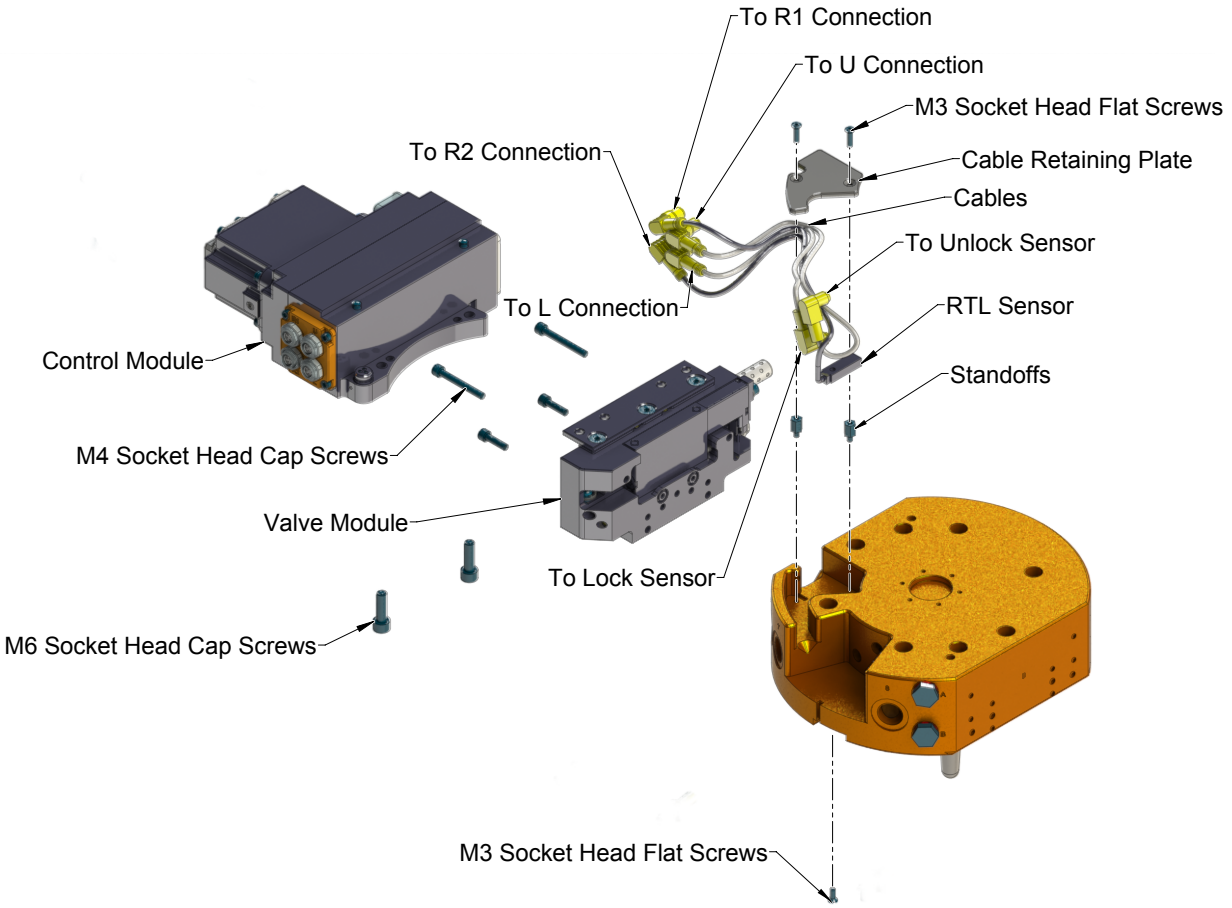


Refer to *Section 5.2.5.2—RTL Flat Pack Style Sensor Replacement (with Potted Assembly)*.

5.2.5.1 RTL Flat Pack Style Sensor Replacement (Y-Style and Lead Cable)

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. Depending on the robot and interface plate used the Tool Changer Master plate may have to be removed. Refer to *Section 2.3—Master Plate Removal*.
5. Disconnect the utilities from the control/signal module and valve module.
6. Unscrew the RTL sensor cable connectors from the control/signal module.(refer to *Figure 5.9)*
7. Remove the control/signal module from the valve module.
8. Remove the valve module from the Master plate.
9. Unscrew the M3 socket head cap screws that secure the cable retaining plate to the Tool Changer and remove the plate.
10. Unscrew the M3 socket head flat screw that secures the RTL Sensor to the Tool Changer body.
11. Discard the removed RTL sensor.

Figure 5.9—RTL Sensor with Y-Style Cable Replacement

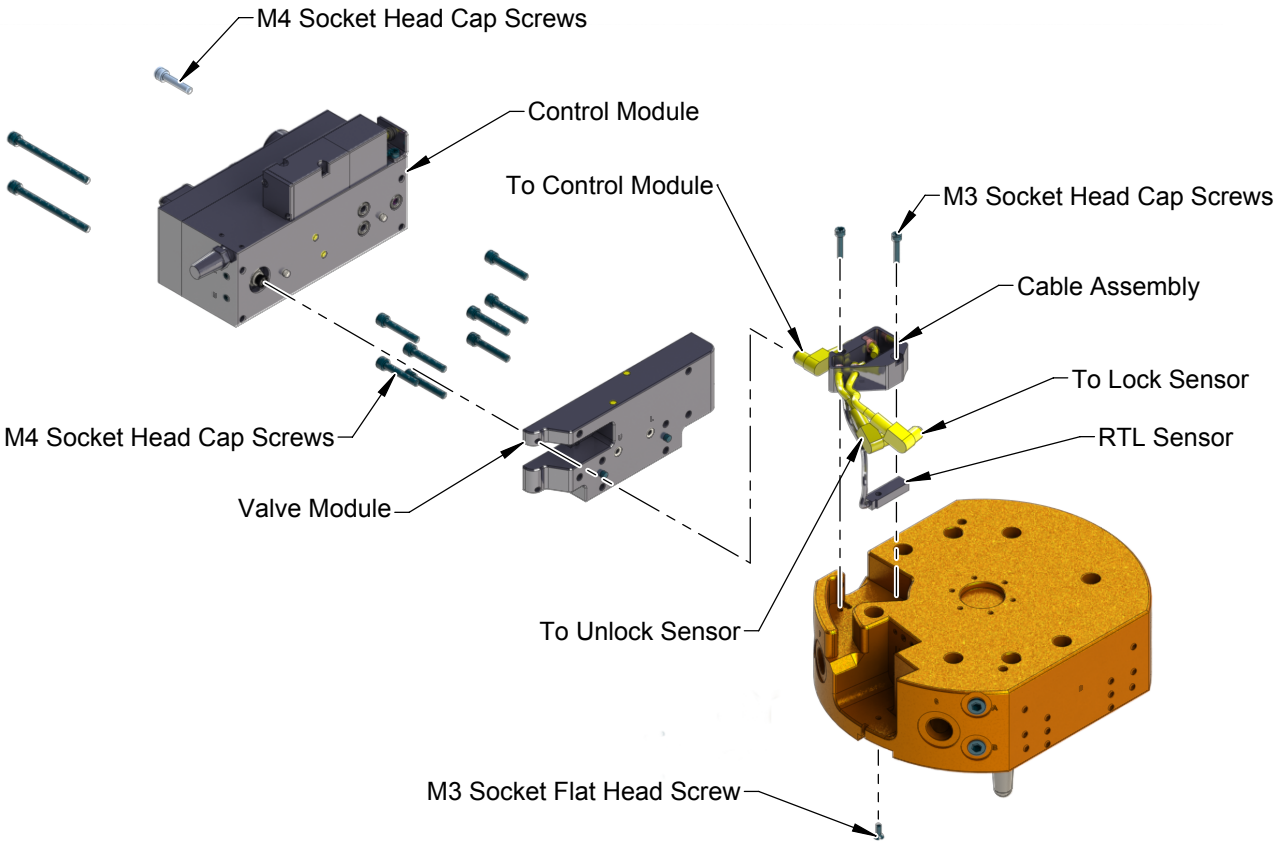


12. Install the new sensor cable into the cable channel of the Tool Changer body.
13. Install the RTL sensor to the Tool Changer body.
14. Apply Loctite 222 to the M3 socket flat head screws. Secure the sensor to the Tool Changer body and tighten to 60 in-ozs (0.4 Nm).
15. Route the sensor cable into the cable channel of the Master plate.
16. Install the cable retaining plate.
17. Apply Loctite 222 to the M3 socket head cap screws for the cable retaining plate. Tighten to contact.
18. Reinstall the valve module to the Master plate, be sure that the cables are routed through the cable channel of the valve module.
19. Reinstall the control/signal module to the valve module.
20. Apply Loctite 222 to the M3 socket head cap screws for the cable retaining plate. Tighten to contact.
21. If the Tool Changer was removed from robot or interface plate, install the Tool Changer (refer to *Section 2.2—Master Plate Installation*).
22. If repairs are complete, return circuits to normal operation.
23. 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.

5.2.5.2 RTL Flat Pack Style Sensor Replacement (with Potted Assembly)

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. Depending on the robot and interface plate used the Tool Changer Master plate may have to be removed. Refer to *Section 2.3—Master Plate Removal*.
5. Disconnect the utilities from the control/signal module and valve module.
6. Remove the control/signal module from the air/valve adapter Module (refer to *Figure 5.10)*.
7. Unscrew the Lock/Unlock/RTL sensor cable connector from the control/signal module.
8. Remove the valve module from the Master plate.
9. Disconnect the Lock and Unlock sensor cable connectors from the Lock and Unlock sensors.
10. Unscrew the M3 socket head cap screws that secure the cable assembly to the Tool Changer.
11. Unscrew the M3 socket head flat screw that secures the RTL Sensor to the Tool Changer body.
12. Discard the removed RTL sensor and cable assembly.

Figure 5.10— RTL Sensor with Cable Assembly Replacement



13. Install the new cable assembly into the cable channel of the Tool Changer body.
14. Apply Loctite 222 to the M3 socket head cap screws for the cable assembly. Tighten to contact.
15. Attach the Lock and Unlock sensor cable connectors to the Lock and Unlock sensors.
16. Install the RTL sensor to the Tool Changer body.
17. Reinstall the valve module to the Master plate, be sure that the cables are routed through the cable channel of the valve module.
18. Reinstall the control/signal module to the valve module.
19. 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).
20. If the Tool Changer was removed from robot or interface plate, install the Tool Changer (refer to *Section 2.2—Master Plate Installation*).
21. If repairs are complete, return circuits to normal operation.
22. 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.

6. Serviceable Parts

6.1 Common Parts (Alignment Pins, Rubber Bushings and Master plates)

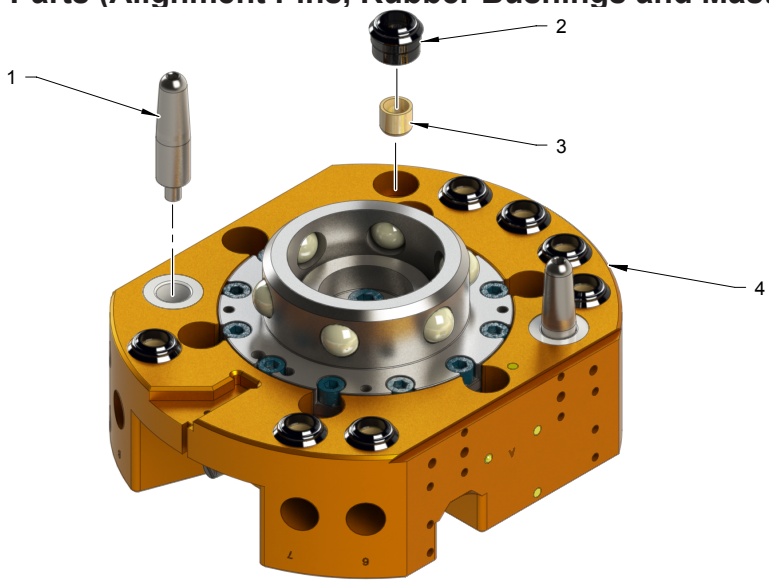


Table 6.1—Common Parts			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-2241	1/2” Two Piece Alignment Pin
2	8	4010-0000010-01	3/8” Rubber Bushing
3	8	3700-20-2000	Collar for 3/8” Bushing
4	1	9120-110xM-000-000	QC-110 Sleeveless Master Assembly, NPT
4	1	9120-110xM-000-000-E	QC-110 Sleeveless Master Assembly, Euro
4	1	9120-110xM-000-000-G14	QC-110 Sleeveless Master Assembly, BSPP 1/4” Ports (Black)
4	1	9120-110xM-000-000-R	QC-110 Sleeveless Master Assembly, R Ports
Note: x = A, B, C, D, E, or F for boss size designation.			

6.2 Current Model 9120-110xM-000-000-S0

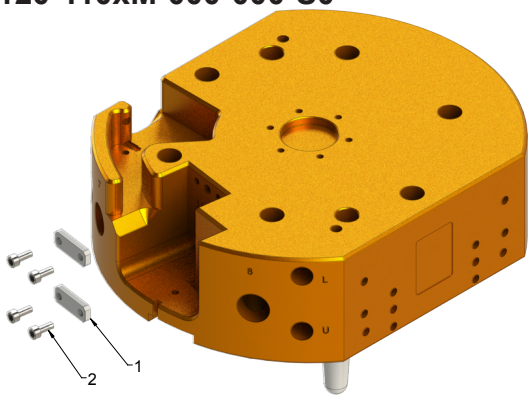


Table 6.2—9120-110xM-000-000-S0			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1983	Sensor Bore Cover Plate Assembly, SS Screws
2	4	3500-1058008-21A	M3 x 8 SHCS, SS, ND Ind. Microspheres Epoxy, Yellow. 0-3 uncoated lead thds. 5-7 coated thds
Note: x = A, B, C, D, E, or F for boss size designation.			

6.3 Current Models with PNP Sensors 9120-110xM-000-000-(SM, ST)-(RD, RD1)

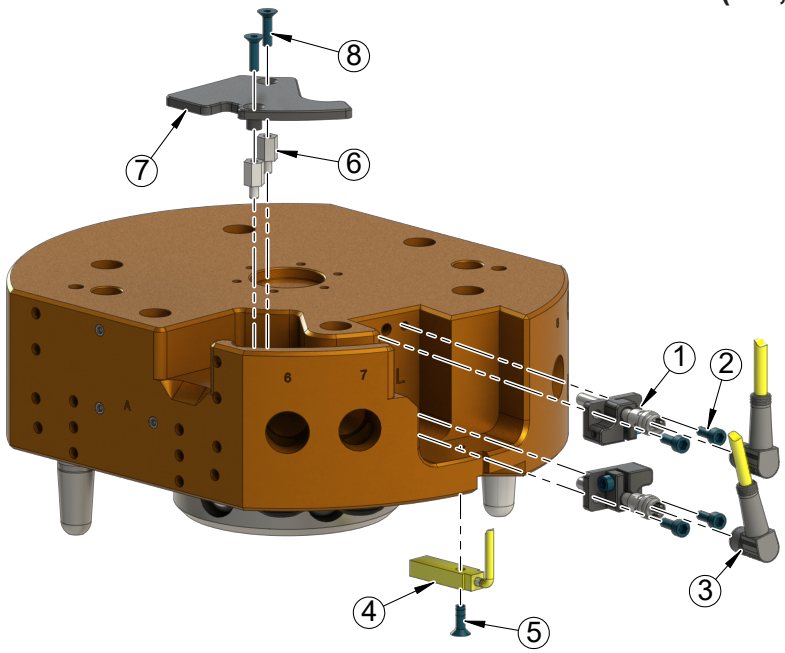


Table 6.3—9120-110xM-000-000-SM[1]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1917	PNP Lock/Unlock Sensor Subassembly with LED, item includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres

Table 6.4—Additional Parts for 9120-110xM-000-000-SM-(RD1)[1]			
Item No.	**Qty**	**Part Number**	**Description**
4	1	8590-9909999-189	PNP Prox Sensor, Flat Pack, .2m Lg, Straight Pico, Threaded Connector
5	1	3500-1258010-15A	M3 X 10 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow.
6	2	4000-0000020-00	Male / Female 6 mm Hex Standoff 8 mm Length M3
7	1	3700-20-4217	QC-110 Cable Retainer Cap
8	2	3500-1258010-11	M3-0.5 x 10 mm Socket Flat Head Cap Screw, Black Oxide

Table 6.5—9120-110xM-000-000-ST[1]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1917	PNP Lock/Unlock Sensor Subassembly with LED, item includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres
3	2	8590-9909999-63	90 Degree Cable, PKW 3Z-6/S90

Table 6.6—Additional Parts for 9120-110xM-000-000-SM-(RD) and 9120-110xM-000-000-ST-(RD)[1]			
Item No.	**Qty**	**Part Number**	**Description**
4	1	8590-9909999-150	PNP Flat Prox 5M long (no conn) Turck Bi2-Q5.5-AP6X 5M
5	1	3500-1258010-15A	M3X10 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow.
6	2	4000-0000020-00	Male / Female 6 mm Hex Standoff 8 mm Length M3
7	1	3700-20-4217	QC-110 Cable Retainer Cap
8	2	3500-1258010-11	M3-0.5 x 10 mm Socket Flat Head Cap Screw, Black Oxide

Notes:

1. x = A, B, C, D, E, or F for boss size designation.

6.4 Current Models with NPN Sensors 9120-110xM-000-000-(SP, SU)-(RD1)

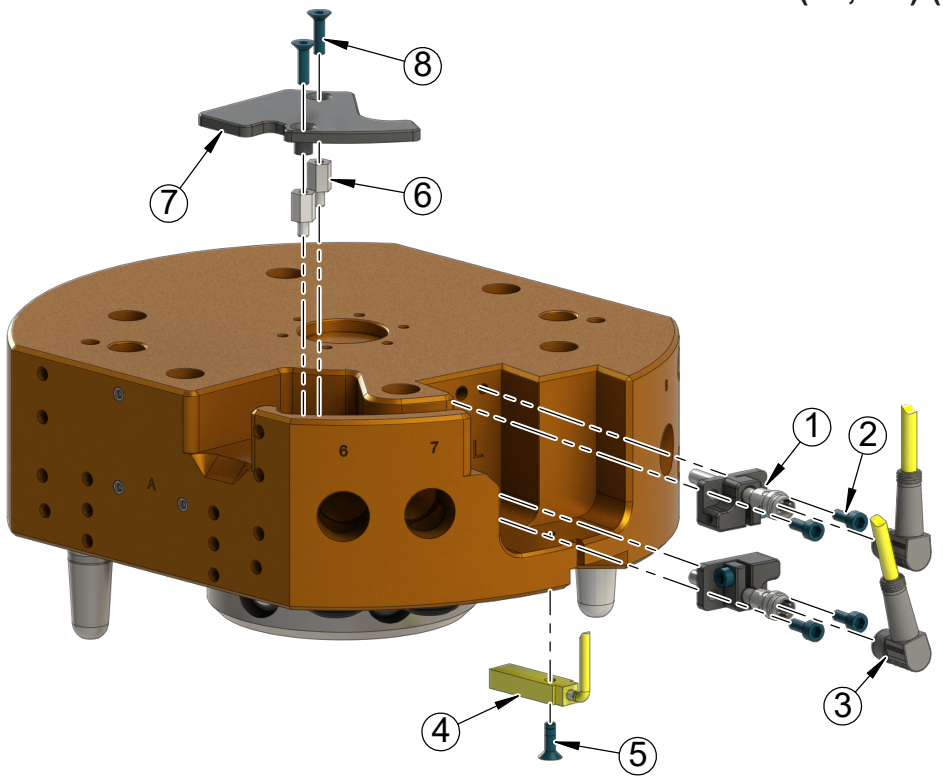


Table 6.7—9120-110xM-000-000-SP[1]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1918	NPN Lock/Unlock Sensor Subassembly, item includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres

Table 6.8— Additional Parts for 9120-110xM-000-000-SP-(RD1)[1]			
Item No.	**Qty**	**Part Number**	**Description**
4	1	8590-9909999-190	NPN Prox Sensor, Flat Pack, .2m Lg, Straight Pico, Threaded Connector
5	1	3500-1258010-15A	M3X10 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow.
6	2	4000-0000020-00	Male / Female 6 mm Hex Standoff 8 mm Length M3
7	1	3700-20-4217	QC-110 Cable Retainer Cap
8	2	3500-1258010-11	M3-0.5 x 10 mm Socket Flat Head Cap Screw, Black Oxide

Table 6.9—9120-110xM-000-000-SU[1]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1918	NPN Lock/Unlock Sensor Subassembly, item includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres
3	2	8590-9909999-63	90 Degree Cable, PKW 3Z-6/S90

Notes:

1. x = A, B, C, D, E, or F for boss size designation.

6.5 Current Model with NAMUR Sensors 9120-110xM-000-000-SV

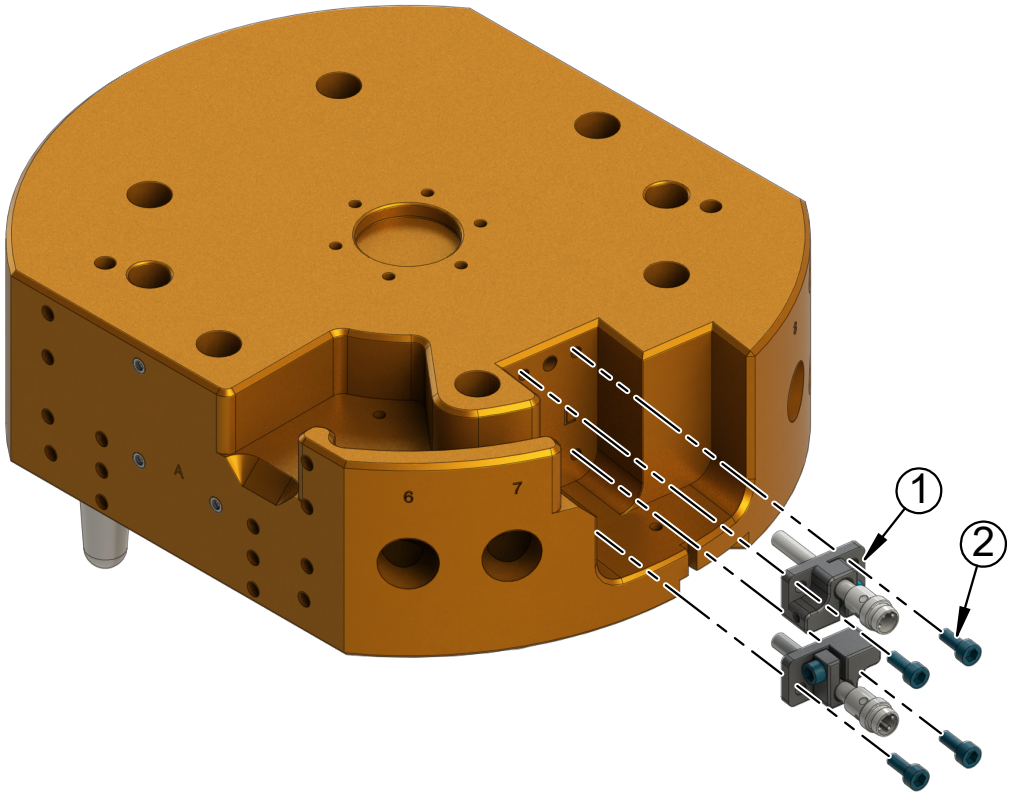


Table 6.10—9120-110xM-000-000-SV [1, 2]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-2271	Lock/Unlock Sensor Assembly, 25 Degree Orientation, NAMUR, item includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres

Notes:

1. x = A, B, C, D, E, or F for boss size designation.
2. Model not available with RTL sensor.

6.6 Current Models 9120-110xM-000-000-SM1

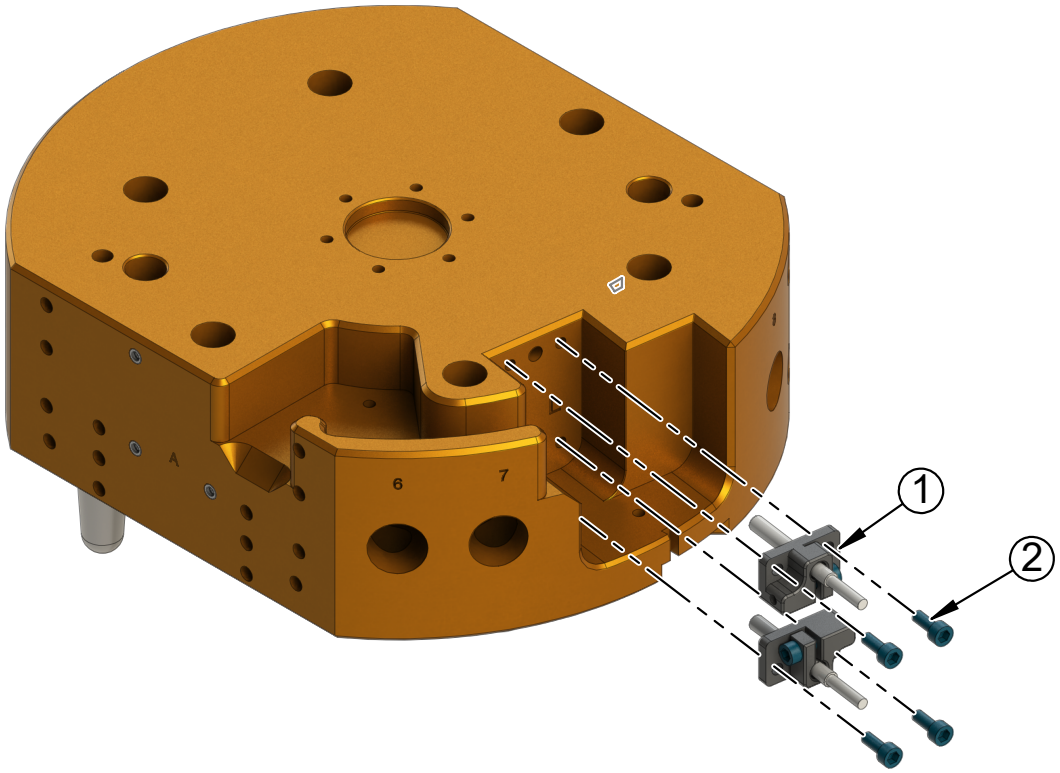


Table 6.11—9120-110xM-000-000-SM1[1]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-2402	Sensor Carrier, PNP, 4mm Smooth Barrel, .2M Hardwired, Straight M8 Connector, includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres

Notes:

1. x = A, B, C, D, E, or F for boss size designation.
2. Model not available with RTL sensor.

6.7 Discontinued Models 9120-110xM-000-000-(SD, SG, SE, SF)-(RD)

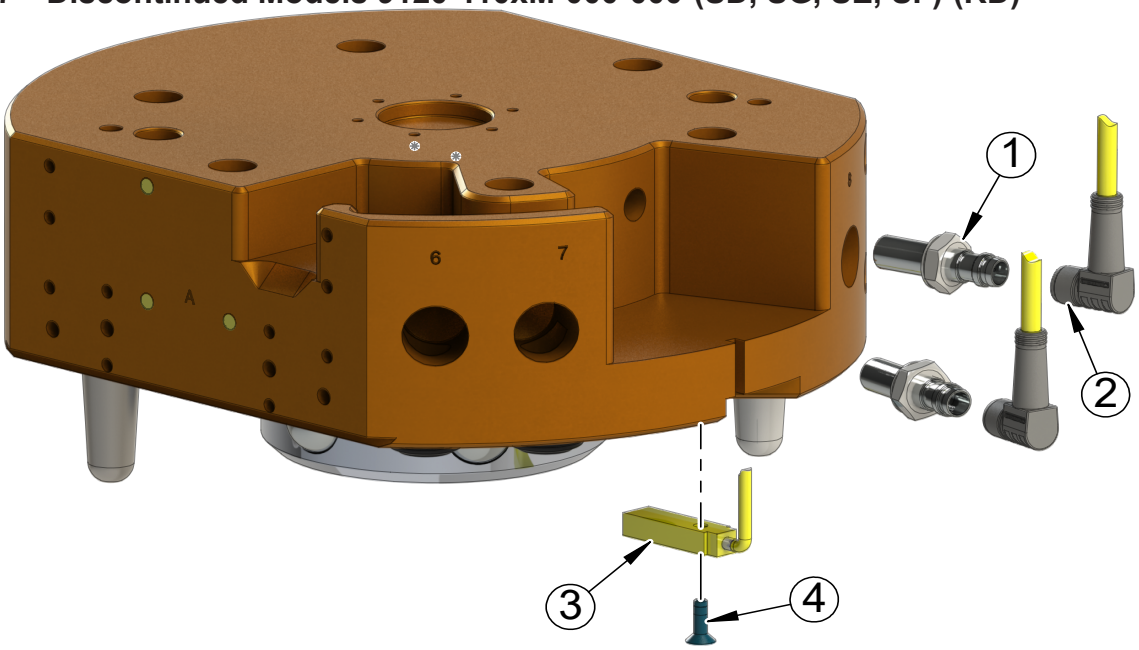


Table 6.12—9120-110xM-000-000-SD-(RD), 9120-110xM-000-000-SG-(RD)[1, 2]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	8590-9909999-34	Turck Prox (PNP True 2mm Range, Quick Disc.)
2	2	8590-9909999-63	90 Degree Cable, PKW 3Z-6/S90
3	1	8590-9909999-123	PNP Flat Pack Proximity Sensor (RTL)
4	1	3500-1258010-15A	M3X10 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow.

Table 6.13—9120-110xM-000-000-SE, 9120-110xM-000-000-SF[1]			
Item No.	**Qty**	**Part Number**	**Description**
1	2	8590-9909999-52	Baumer Prox IFRM 08N17A3/S35L (NPN, 2mm range, QD)
2	2	8590-9909999-63	90 Degree Cable, PKW 3Z-6/S90

Notes:

1. x = A, B, C, D, E, or F for boss size designation.
2. Models with -(RD) have RTL sensor.

6.8 Discontinued Models 9120-110xM-000-000-(SGH, SEH)

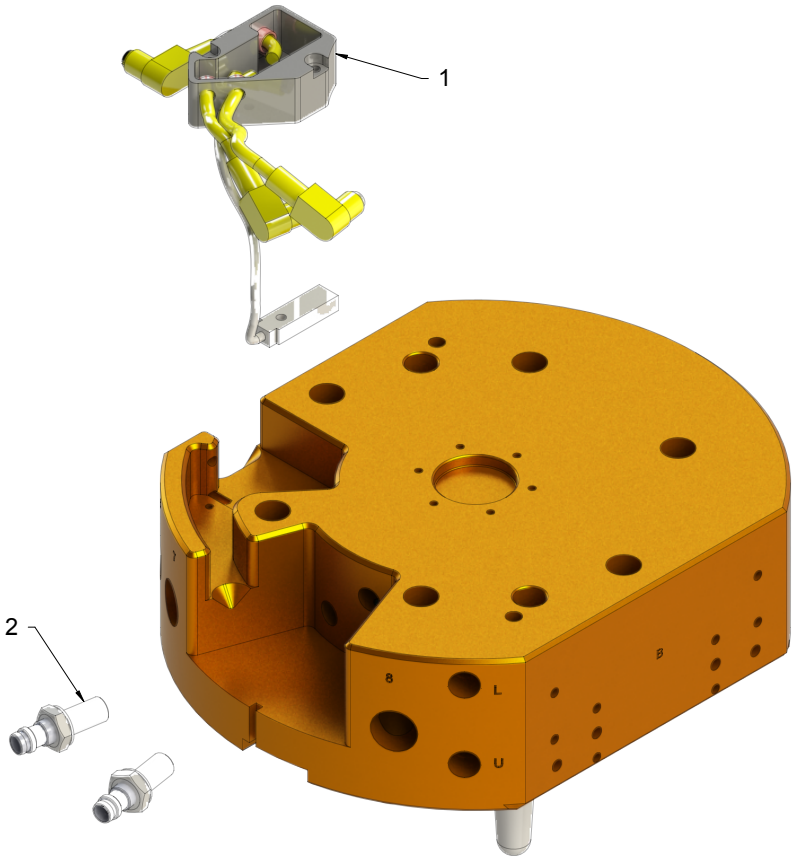


Table 6.14—9120-110xM-000-000-SGH			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9000-20-1066	PNP Flat Pack Proximity Sensor (RTL)
2	2	8590-9909999-34	Turck Prox (PNP True 2mm Range, Quick Disc.)

Table 6.15—9120-110xM-000-000-SEH			
Item No.	**Qty**	**Part Number**	**Description**
1	0	9000-20-1066	PNP Flat Pack Proximity Sensor (RTL)
2	2	8590-9909999-52	Baumer Prox IFRM 08N17A3/S35L (NPN, 2mm range, QD)

Notes:

x = A, B, C, D, E, or F for boss size designation.

6.9 Discontinued Models 9120-110xM-000-000-SMH

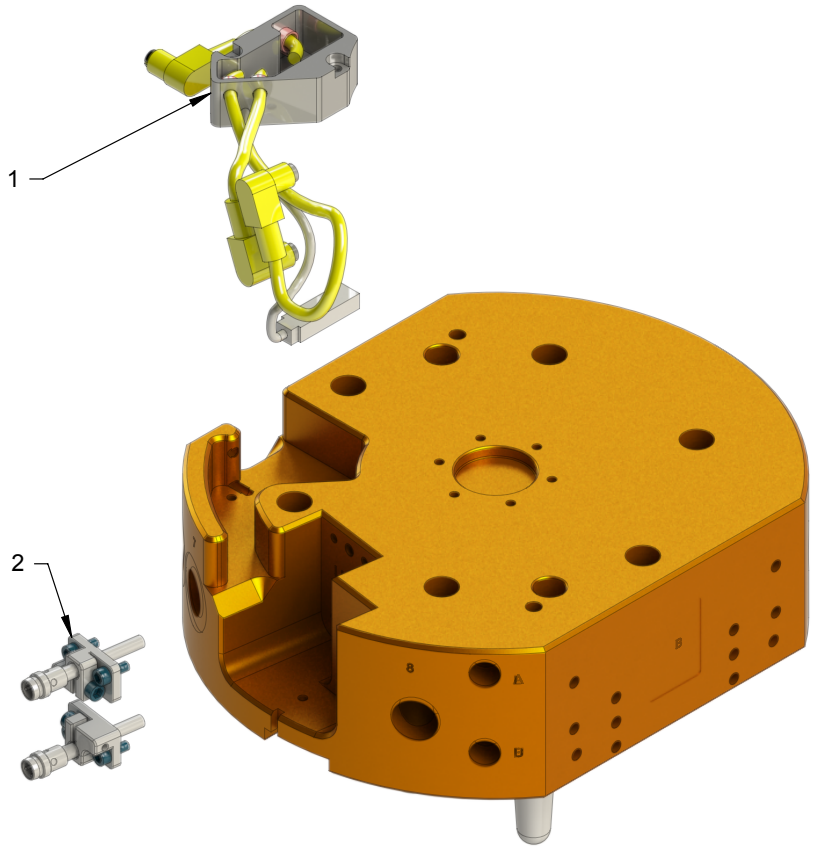


Table 6.16—9120-110xM-000-000-SMH			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9000-20-1283	Prox Cable Assembly Sleeveless QC110, Potted
2	2	9005-20-1917	PNP Lock/Unlock Sensor Subassembly with LED

Notes:

x = A, B, C, D, E, or F for boss size designation.

6.10 Discontinued Model 9120-110xM-000-000-SFB

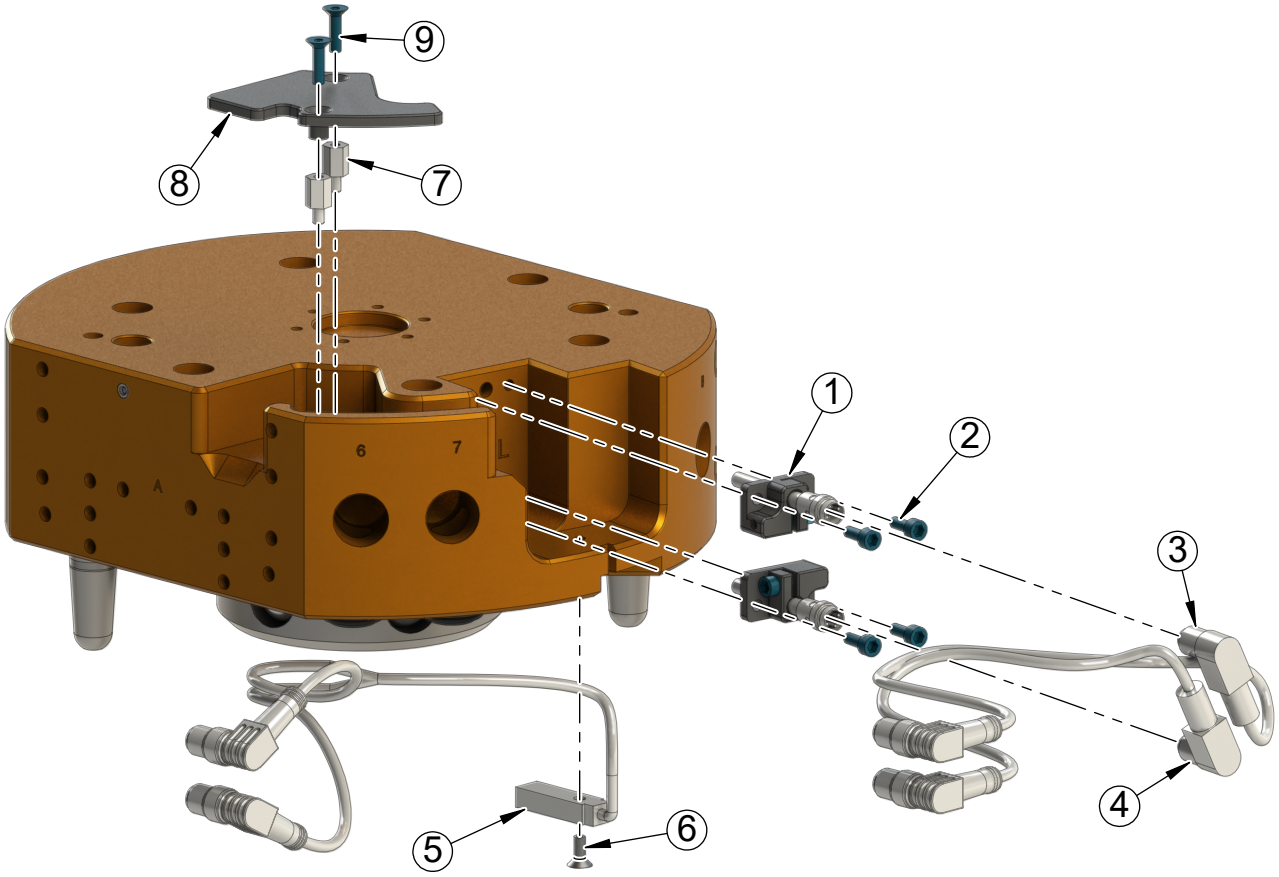


Table 6.17—9120-110xM-000-000-SFB			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1917	PNP Lock/Unlock Sensor Subassembly with LED, item includes (2) of item 2
2	4	3500-1058008-15A	M3 X 8 Socket Head Cap Screw Blue Dyed Magni-565, ND Microspheres
3	1	9120-C-3PF90-3PM90-0030	Picofast Cordset, 3-Pin Female Right Angle Threaded to 3-Pin Male Right Angle LED Threaded, 0.30 m
4	1	9120-C-3PF90-3PM90-0022	Picofast Cordset, 3-Pin Female Right Angle Threaded to 3-Pin Male Right Angle LED Threaded, 0.22 m
5	1	9120-C-FPPNP-3PM90-3PM90	Sensor Cable, Turck Flat Pack PNP Sensor to (2) 3-Pin Pico Male Right Angle LED Threaded
6	1	3500-1258010-15A	M3X10 Socket Flat Head Cap Screw, Class 10.9, Blue dyed Magni-565, ND Microspheres Epoxy, Yellow.
7	2	4000-0000020-00	Male / Female 6mm Hex Standoff 8mm Length M3
8	1	3700-20-4217	QC-110 Cable Retainer Cap
9	2	3500-1258012-15	M3 x 12 mm Socket Flat Head Cap Screw Blue Dyed Magni-565

Notes:

x = A, B, C, D, E, or F for boss size designation.

6.11 Current Models 9120-110xT-000-000

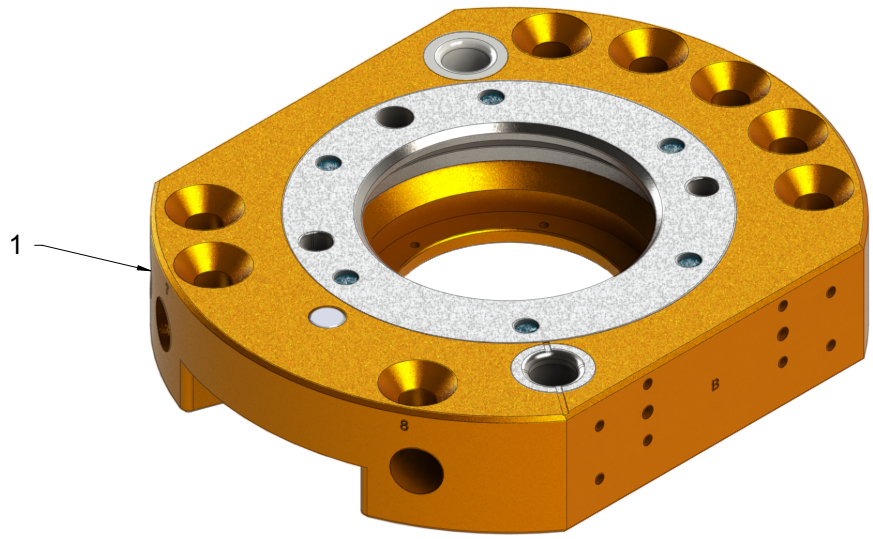


Table 6.18—9120-110xT-000-000			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-110FT-000-000	QC-110 Tool Assembly, 80mm Recess NPT
1	1	9120-110FT-000-000-R	QC-110 Tool Assembly, 80mm Recess R Port (BSPT)
1	1	9120-110FT-000-000-G14	QC-110 Tool Assembly, 80mm Recess G1/4
1	1	9120-110FT-000-000-E	QC-110 Tool Assembly, 80mm Recess BSPP (Black)

Notes:

x = A, B, C, D, E, or F for boss size designation.

7. Specifications

Table 7.1— Master and Standard Tool plates Specifications		
Recommended Max Payload	330 lbs. (150kg)	The mass attached to the Tool Changer.
Operating Temperature Range	-20–150°F (-30–66°C)	Temperature for optimal operation.
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 50 micron or better.
Coupling Force @ 80 psi	2,700 lbs (1,200 kg)	Axial holding force
Recommended Max Moment X-Y (Mxy)	6,940 in-lbs 784 (Nm)	Maximum recommended working load 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.)	13 lbs. (5.9 kg)	Master 8 lbs (3.63 kg) / Tool 5 lbs (2.27 kg)
Max. Recommended distance between Master and Tool plate	0.12” (3.0 mm)	No-Touch™ locking technology allows the Master and Tool plates to lock with separation when coupling.
Pass through Port, (Qty) Size (Cv, Min)	(8) 1/4 or 3/8 NPT, BSPT, or BSPP	Maximum pressure of 100psi (6.9bar), Nitrile seals
Mounting/Customer Interface	Master plate Tool plate	125mm BC, (6) M10 Thru Holes, (2) M10 Dowels(SF) Meets ISO 9409-1-A125

8. Drawings

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