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B. Base Tool Changer

QC-110 Series—Robotic Tool Changer

1. Product Overview

The Quick Change Tool Changer provides flexibility to robot applications by allowing the robot to change customer tooling (e.g., grippers, vacuum cup tooling, pneumatic and electric motors, weld guns, etc.) automatically. The Tool Changer consists of a Master plate and a Tool plate. The Master plate is attached to a robot while end-effectors such as grippers, material handlers, etc. are attached to one or more Tool plates.

The Master plate, installed on the robot arm, locks to the Tool plate with a pneumatically driven locking mechanism. This locking mechanism uses a patented, multi-tapered cam with ball locking technology and a patented fail-safe mechanism.

In operation, the robot can be programmed to select the desired customer tooling by coupling the Master plate to the Tool plate. Electrical signals, pneumatic power, vacuum, and fluids can be transferred to the customer tooling through the Master plate and Tool plate by optional modules and ports. See the respective manuals for these options for more details on their operation.

A Tool Changer enhances the flexibility and reliability of a robotic cell. Robotic Tool Changers are used in automated Tool change applications, as well as manual Tool change operations. Robotic Tool Changers also provide a method for quick Tool change for maintenance purposes.

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 (see Figure 1.1).

The Master plate has (2) flat sides for mounting of optional modules.

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

Tapered pins located on the Master plate mate with bushings in the Tool plate to ensure repeatable alignment during the coupling process. An extreme pressure grease is applied to the cam, male coupling, ball bearings, and pins to enhance performance and maximize the life of the Master plate assembly.

1/8 NPT (or BSPP) port connections are available to supply air pressure for coupling and uncoupling the Tool Changer.

There are (8) 3/8 NPT (or BSPP) port connections available for pass through air for supplying air to tools.

Proximity sensors are designed into the body of the Master plate to detect Lock and Unlock positions of the locking mechanism. The sensors provide “lock” and “unlock” signals through the control/signal Master module. For DeviceNet applications, 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 through the control/signal Master module. For non-DeviceNet control/signal module applications, the 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](image-url)
1.2 Tool Plate Assembly

The Tool plate assembly includes an anodized aluminum body and a hardened stainless-steel bearing race. The Tool plate has (2) flat sides for mounting of optional modules. The Tool plate body also includes a 125mm BC machined mounting pattern for mounting to a customer tooling or a tooling interface plate.

There are (8) 3/8 NPT (or BSPP) port connections available for pass through air for supplying air to tools.

![Figure 1.2—Tool Plate Assembly](image)

1.3 Optional Modules

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

For assistance in choosing the right modules for your 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 directly.
2. Installation

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

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

**WARNING:** Do not use lock washer 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. Make sure the mounting fasteners are flush or below the mating surfaces of the Master and Tool plates.

**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>
<thead>
<tr>
<th>Mounting conditions</th>
<th>Fastener Size &amp; Property Class</th>
<th>Recommended Torque</th>
</tr>
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<tbody>
<tr>
<td>Master plate to Robot Interface Plate (6061-T6 aluminum) Minimum thread engagement of 15mm (0.59”) [1.5X fastener Ø]. Confirm available engagement with Robot Manufacturer</td>
<td>M10-1.5 Class 12.9</td>
<td>52 N-m (38 ft-lbs.)</td>
</tr>
<tr>
<td>Master plate to Robot (steel; USS ≥ 90KSI) Minimum thread engagement of 10mm (0.39”) [1.0X fastener Ø]. Confirm available engagement with Robot Manufacturer</td>
<td>M10-1.5 Class 12.9</td>
<td>75 N-m (55 ft-lbs.)</td>
</tr>
<tr>
<td>Tool Interface Plate (aluminum) to Tool plate Minimum thread engagement of 15mm (0.59”) [1.5X fastener Ø]. Do not exceed maximum available thread depth of 20mm as shown in Section 8—Drawings</td>
<td>M10-1.5 Class 12.9</td>
<td>52 N-m (38 ft-lbs.)</td>
</tr>
</tbody>
</table>
2.1 Master Interface

The Master plate is attached to the robot arm. The Master plate is designed with mounting features such as a boss and/or bolt and dowel holes. These features are used to accurately position and secure the Master plate to the robot arm or it may be necessary for a robot interface plate (RIP) to be utilized to adapt the Master plate to a specific robot arm. Custom RIPs are available from ATI upon request. (Refer to Section 8—Drawings of this manual for technical information on mounting features.)

If the customer chooses to design and build a robot interface plate, the following should be considered:

- The interface plate should be designed to include bolt holes for mounting, dowel pins, and a boss for accurate positioning on the robot and Master plate. (Refer to robot manual.) (The dowel and boss features are important to prevent rotation.)
- The thickness of the interface plate must be great enough to provide the necessary thread engagement for the mounting bolts.
- Mounting bolts should not be too long, such that a gap is formed at the interface.
- The interface plate must be properly designed to provide rigid mounting to the Master plate.
- The interface plate design should take into account clearances required for Tool Changer module attachments and accessories.

2.2 Master Plate Installation

1. Make sure the mounting surface of the Master plate and robot arm or RIP are clean and free of debris.
2. If required, install the RIP 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 RIP with customer supplied (10) M10-1.5 socket head cap screws. Apply Loctite 242 to threads (see Table 2.1 for proper fasteners and torque).

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

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

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

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Disconnect the utilities from the Master plate and attached modules.
4. Remove the M10-1.5 socket head cap screws connecting the Master plate to the robot arm or RIP.
2.4 Tool Interface

The Tool plate is attached to customer’s tooling. The Tool plate is designed with mounting features such as a recess and/or bolt and dowel holes. These features are used to accurately position and secure the customer’s tooling. A tool interface plate may be utilized to adapt the Tool plate to customer’s tooling that is not compatible with the Tool plate mounting features. Custom tool interface plates can be supplied by ATI to meet customer’s requirements (see Figure 2.2) (Refer to the application drawing).

If the customer chooses to design and build a tool interface plate, the following should be considered:

- The tool interface plate should be designed to include bolt holes for mounting, dowel pins, and a boss that mates with Tool plate recess for accurate positioning. (The dowel and boss features are important to prevent rotation)
- The locating boss height should not exceed 0.16” (4 mm).
- The thickness of the interface plate must be great enough to provide the necessary thread engagement for the mounting bolts. Fasteners should be chosen to 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 should take into account clearances required for Tool Changer module attachments and accessories.
- The tool interface plate should be designed with a hole in its center to allow 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 should be kept small [minimum recommended hole diameter: 1” (25.4 mm)] to prevent debris from contaminating the locking mechanism while operating in dirty environments.

2.5 Tool Plate Installation

1. Make sure mounting surface of the Tool plate and tool interface plate or customer tooling is clean and free of debris.
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 fasteners. 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.
2.6 Tool Plate Removal

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

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Disconnect the utilities from the Tool plate and attached modules.
4. Remove the fasteners connecting the Tool plate to the tooling or tool interface plate.
2.7 Pneumatic Connections

The air supply used for coupling and uncoupling the Tool Changer should be clean, dry, and non-lubricated. A supply pressure in the range of 60 to 100 psi is acceptable for operation of the locking mechanism, with a setting of 80 psi suggested. The air should be filtered 50 micron or better.

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

2.7.1 Valve Requirements and Connections for the Locking Mechanism

When an air adapter module is utilized that does not contain an integrated solenoid valve, it is required that a customer supplied 2-position 4-way or 5-way valve be used to actuate the locking mechanism in the Master plate. It is imperative that when air is supplied to the Lock or Unlock Port on the Master plate, that the opposite port be vented to atmosphere (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 proper shuttling of the valve and prevent coupling/uncoupling from occurring.

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

![Figure 2.3—Lock and Unlock Pneumatic Connections](image-url)
## 2.8 Electrical Connections

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

### 2.8.1 PNP Type Lock and Unlock Sensors (-SD,-SG,-SGH,-SEH,-SMH,-STH,-SM,-SFB sensor designation)

These sensors are used on 9120-110AM-000-000-SD, 9120-110AM-000-000-SG, 9120-110AM-000-000-SGH, 9120-110AM-000-000-SEH, 9120-110AM-000-000-SMH, 9120-110AM-000-000-STH, 9120-110AM-000-000-SM, and 9120-110AM-000-000-SFB.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Supply Range</td>
<td>10-30 VDC</td>
</tr>
<tr>
<td>Output Current</td>
<td>&lt; 150 mA</td>
</tr>
<tr>
<td>Nominal Sensing Distance Sn</td>
<td>2.0 mm</td>
</tr>
<tr>
<td>Output Circuit</td>
<td>PNP make function (NO)</td>
</tr>
</tbody>
</table>

#### Table 2.2—PNP (Current Sourcing)

![Figure 2.4—PNP Type Lock and Unlock Sensors](image)

#### 2.8.2 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>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Supply Range</td>
<td>10-30 VDC</td>
</tr>
<tr>
<td>Output Current</td>
<td>&lt; 200 mA</td>
</tr>
<tr>
<td>Nominal Sensing Distance Sn</td>
<td>2.0 mm</td>
</tr>
<tr>
<td>Output Circuit</td>
<td>NPN make function (NO)</td>
</tr>
</tbody>
</table>

#### Table 2.3—NPN (Current Sinking)

![Figure 2.5—NPN Type Lock and Unlock Sensors](image)
2.8.3 2-Wire DC Type Lock and Unlock Sensors (-SK sensor designation)

These sensors are used on 9120-110AM-000-000-SK.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Supply Range</td>
<td>10-30 VDC</td>
</tr>
<tr>
<td>Output Current</td>
<td>&lt; 100 mA</td>
</tr>
<tr>
<td>Nominal Sensing Distance Sn</td>
<td>2.0 mm</td>
</tr>
<tr>
<td>Output Circuit</td>
<td>DC make function (NO)</td>
</tr>
</tbody>
</table>

![Figure 2.6—DC Type Lock and Unlock Sensors](image)
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 for any reason.

**NOTICE:** All Tool Changers are initially lubricated using MobilGrease® XHP222 Special grease. The end user must apply additional lubricant to the locking mechanism components and alignment pins prior to start of service (See Section 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.

Lock-up should occur with the Master plate in the No-Touch™ locking zone (see Table 3.1) but not touching the Tool plate. As locking occurs, the Master plate should draw the Tool plate into the locked position.

**Figure 3.1—Offset Definitions**

![Offset Definitions Diagram]

**Table 3.1—Maximum Recommended Offsets Prior to Coupling**

<table>
<thead>
<tr>
<th>Model</th>
<th>No-Touch Zone Z Offset (Max)</th>
<th>X and Y Offset (Max)</th>
<th>Cocking Offset (Max)</th>
<th>Twisting Offset (Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QC-110</td>
<td>0.12” (3 mm)</td>
<td>±0.04” (1 mm)</td>
<td>±0.7°</td>
<td>±1°</td>
</tr>
</tbody>
</table>

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:** Do not couple 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. Verify the Tool Changer locking mechanism is in the Unlocked position by removing air pressure from the Lock Port and supplying air pressure to the Unlock Port (if equipped, the Unlock sensor will indicate the Tool Changer is in the Unlocked position).

2. Position the Master above the Tool, and move the Master into the ready to lock position. The mating surfaces of the Master and Tool should be parallel and not touching. When the Master’s tapered alignment pins enter the alignment holes and bushings on the Tool, the pins should be relatively concentric (without contact) to the alignment bushings.

3. When coupled, it is recommended that the mating faces of the Master and Tool not touch but be within the No-Touch™ distance, listed in Table 3.1, of each other so that stress and wear is minimal 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. If equipped, the RTL (Ready-To-Lock) sensor and target in the Tool Changer must be positioned within approximately 0.05” (1.5 mm) of each other for the sensors to detect Tool presence. This allows detection of Tool proximity to the Master prior to coupling. RTL signals are not required to couple the Tool Changer but serve as further confirmation that the plates are coupled before 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 becomes available shortly after.

5. Couple the Tool Changer by releasing the air pressure from the Unlock Port and supplying air pressure to the Lock Port. When the Tool Changer locking mechanism moves to the locked position, the Tool plate will draw toward the Master plate and couple together. Air must be maintained on the Lock Port during operation to assure rigid coupling (if equipped the Lock sensor will indicate the Tool Changer is in the Locked position).

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). Before another attempt to couple the Tool Changer, the locking mechanism must be in the Unlock state. Otherwise, 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. Without this air pressure, the Tool Changer loses rigidity, 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 uses a multi-tapered cam to trap the ball bearings and prevent an unintended release of the Tool plate. Positional accuracy of the tooling will not be maintained during this fail-safe condition. The Tool Changer is not to be operated in the fail-safe condition. Once source air is lost to the unit, movement should be halted until air pressure is restored. When air pressure is re-established to the Master plate, the locking mechanism will energize and securely lock the Master and Tool plates together. If equipped, make sure the lock sensor indicates the Tool Changer is in the locked position before resuming normal operations. It may be necessary to consult the Control/Signal Module Manual for specific error recovery information.

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

3.3 Conditions for Uncoupling
1. Move the robot to position the Tool plate in the tool stand. The Position will be in the same location as when coupling took place.

2. Uncouple the Tool Changer by releasing the air pressure from the Lock port and supplying air pressure to the Unlock port (If equipped, the Unlock sensor will indicate the Tool Changer is in the Unlocked position).

3. A sufficient delay must be programmed between the Unlock output being activated and reading the state of the Lock/Unlock signals, so that the coupling process is completed before checking the Locked state.

4. 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 are verified to be 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. This can be used to verify that the robot has picked up the proper Tool. Modules with Tool-ID are available from ATI. Refer to our Web site http://www.ati-ia.com/products/toolchanger/tool_changer_modules.aspx for products available to your specific application or contact ATI for recommendations and assistance.
3.5 Tool Storage Considerations

**CAUTION:** Tool stand design is critical to proper operation of the Tool Changer. Improperly designed tool stands can cause misalignments that will cause jamming and/or excessive wear of Tool Changer components.

The Tool plates with customer tooling attached may be stored in a tool stand when not being used by the robot. 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](http://www.ati-ia.com/products/toolchanger/toolstand/medium/MediumStand.aspx) for products available for your specific application or contact ATI for recommendations and assistance.

If the customer is supplying the tool stand, it should be designed to provide fixed, repeatable, level, and stable positions 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 in Section 3—Operation.

Ideally, the tool should be hanging vertically in the tool stand so that gravity assists in uncoupling the Tool plate from the Master plate during unlocking. It is possible to design tool stands that hold tools in the horizontal position but care must be taken for the necessary compliance 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, refer to Section 3—Operation.

On the tool stand, it is highly recommended that the customer provide a sensor detecting the presence of a properly seated Tool in the tool stand. The sensor may be used prior to coupling to ensure there is a Tool properly seated in the stand. A sensor may also be used as the robot starts to move away after uncoupling. This provides a safety measure in the event that a Tool should become jammed in the stand or if the Tool should fail to release properly 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 may also need to incorporate means for covering Tools and modules to protect them in dirty environments, such as grinding or welding. Alternatively, placing tool stands in areas shielded from weld spatter, fluids, adhesives, or other debris eliminates a need for tool covers.
4. Maintenance

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

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

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

### 4.1 Preventive Maintenance

The Tool Changer and optional modules are designed to provide a long life with regular maintenance. A visual inspection and preventive maintenance schedule is provided in the table below depending upon the application. Detailed assembly drawings are provided in Figure 5.10 of this manual. Refer to module sections for detailed preventive maintenance steps for all utility modules.

<table>
<thead>
<tr>
<th>Application(s)</th>
<th>Tool Change Frequency</th>
<th>Inspection Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Usage Material Handling Docking Station</td>
<td>&gt; 1 per minute</td>
<td>Weekly</td>
</tr>
<tr>
<td></td>
<td>&lt; 1 per minute</td>
<td>Monthly</td>
</tr>
<tr>
<td>Welding/Servo/Deburring, Foundry Operations (Dirty Environments)</td>
<td>All</td>
<td>Weekly</td>
</tr>
</tbody>
</table>

#### Checklist

- **Mounting Fasteners**
  - Inspect fasteners for proper torque, interferences, and wear. Tighten and correct as required. Refer to “Table 2.1—Fastener Size, Class, and Torque Specifications”.

- **Ball Bearings/Alignment Pins/Bushings/Bearing Race**
  - Inspect for wear and proper lubrication. MobilGrease XHP222 Special a NLGI #2 lithium complex grease with molybdenum disulfide additive is suggested for locking mechanism and alignment pin lubrication. Over time, lubricants can become contaminated with debris. Therefore, it is recommended to thoroughly clean the existing grease and replace with new as needed. See Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins.
  - Inspect for excessive alignment pin/bushing wear, may be an indication of 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

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

3. The locking mechanism must be in the unlock state before cleaning.

4. Use a clean rag to thoroughly remove the existing lubricant and debris from the outer surface of the ball bearings, the male coupling, the cam and the alignment pins.

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

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

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

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

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

10. If repairs are complete, return circuits to normal operation.
4.3 Pin Block Inspection and Cleaning

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. Inspect the Master and Tool pin blocks for any debris or darkened pins.

**Figure 4.6—Inspect Master and Tool Pin Blocks**

4. If debris or darkened pins exist, remove debris using a vacuum, 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 erosion to the contact surface or 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**

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

**Figure 4.8—Stuck Pin and Pin Block Damage**

6. If stuck pins or severe pin block damage exists, contact ATI for possible pin replacement procedures or module replacement.
7. If repairs are complete, return circuits to 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 on Tool Changer or modules unless the Tool is safely supported or docked in the tool stand, all energized circuits (e.g., electrical, air, water, etc.) are turned off, pressurized connections purged and power discharged from circuits in accordance with the customer’s safety practices and policies. Injury or equipment damage can occur with Tool not docked and energized circuits on. Dock the Tool safely in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, verify all energized circuits are de-energized before performing maintenance or repair on 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 Quick Change.
- 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 2.7—Pneumatic Connections.

### Table 5.1—Troubleshooting Procedures

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit will not lock or unlock</td>
<td>The ball bearings and/or cam are not moving freely in the male coupling.</td>
<td>Clean and lubricate as needed to restore smooth operation (see Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins)</td>
</tr>
<tr>
<td></td>
<td>The control/signal module is not operating correctly.</td>
<td>Check the troubleshooting section of the manual for the specific module.</td>
</tr>
<tr>
<td></td>
<td>The Master plate and Tool plate are not within the specified No-Touch zone when attempting to lock.</td>
<td>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.</td>
</tr>
<tr>
<td>Ready-To-Lock (RTL) sensors not activated indicating Tool is not positioned properly.</td>
<td>Check that the Tool is properly seated in the tool stand.</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>Check that both RTL sensors are not damaged. Replace damaged RTL sensors as necessary.</td>
<td>Check all cables for damage and that they are connected properly to the signal control/signal module. Replace damaged cables as necessary.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit is locked but Lock signal does not read “on” (true).</td>
<td>Lock sensor/cable is damaged.</td>
<td><strong>Units using individual Sensors:</strong> Replace Lock sensor/cable as necessary (see Section 5.2.4.1—Lock and Unlock Sensor Replacement (with Individual Sensors with Lead Wire) or Section 5.2.4.2—Lock and Unlock Sensor Replacement (with Individual Sensors))&lt;br&gt;<strong>Units using Sensor Assemblies:</strong> Replace the lock sensor assembly as necessary. Refer to Section 5.2.4.3—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies)</td>
</tr>
<tr>
<td></td>
<td>Lock sensor is out of position.</td>
<td></td>
</tr>
<tr>
<td>Unit is unlocked but Unlock signal does not read “on” (true).</td>
<td>Unlock sensor/cable is damaged.</td>
<td><strong>Units using individual Sensors:</strong> Adjust Lock sensor using procedure in Section 5.2.4.1—Lock and Unlock Sensor Replacement (with Individual Sensors with Lead Wire) or Section 5.2.4.2—Lock and Unlock Sensor Replacement (with Individual Sensors))&lt;br&gt;<strong>Units using Sensor Assemblies:</strong> Replace the unlock sensor assembly as necessary. Refer to Section 5.2.4.3—Lock and Unlock Sensor Assembly Replacement (with Sensor Assemblies)</td>
</tr>
<tr>
<td></td>
<td>Unlock sensor is out of position.</td>
<td></td>
</tr>
<tr>
<td>Units Equipped with Electrical Modules</td>
<td>Debris in and around contact pins. Contact Pin worn or damaged.</td>
<td><strong>V-ring seal damaged allowing debris into contact pins. Replace V-ring seal, refer to Section 5.2.1—V-ring Seal Replacement.</strong></td>
</tr>
</tbody>
</table>
5.2 Service Procedures

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

5.2.1 V-ring Seal Replacement

The seal protects the electrical connection between the Master and Tool module. If the seal becomes worn or damaged it needs to be replaced.

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
3. To remove the existing seal, pinch edge of seal with fingers and gently pull the seal away from the pin block on the Master.
4. Pull the seal off the pin block.
5. To install a new seal, stretch the new seal over the shoulder of the pin block.
6. Push the seal’s hub down against the pin block using finger tip.
7. If repairs are complete, return circuits to normal operation.

Figure 5.1—V-ring Seal Replacement
5.2.2 Alignment Pin Replacement

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

3. Unscrew the alignment pin assembly from the Master plate using a 4mm Allen Wrench (see Figure 5.2). If alignment pin cannot be removed using the Allen Wrench in the tip, go to step 4. If alignment was removed go to step 5.

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

4. 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 4mm Allen Wrench to remove the alignment pin from the back side of the Master plate. (Refer to Figure 5.3).

---

**Figure 5.2—Alignment Pin**

- Ratchet Wrench
- 4mm Allen Wrench Socket
- Alignment Pin Assembly
- Set Screw
- Master Plate

**Figure 5.3—Allen Wrench**

- Master Plate
- Allen Wrench Socket
- Ratchet Wrench
- Set Screw
- Alignment Pin Assembly
5. 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.

6. Apply Loctite 242 and install the alignment pin assembly into the bushing on the Tool Changer. Tighten to 60 in-lbs (6.8 Nm).

7. Apply MobilGrease XHP222 Special grease to the alignment pin (see Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins).

8. If repairs are complete, return circuits to normal operation.

### 5.2.3 Rubber Bushing Replacement

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

3. Using needle nose pliers grasp the rubber bushing and pull it out of the Master body. Refer to Figure 5.4.

4. If the collar remains in the Master body, remove it.

5. Lightly lubricate the new rubber bushing and push into the Master body (refer to Figure 5.4).

6. Insert the new collar into the rubber bushing, make sure the bushing is pressed all the way in.

7. If repairs are complete, return circuits to normal operation.

**Figure 5.4—Rubber Bushing Replacement**

![Diagram of rubber bushing replacement]
5.2.4 Lock and Unlock Sensor Replacement Procedures

Look at the 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 5.5—Determine what type of sensors the Tool Changer uses:](image)

**5.2.4.1 Lock and Unlock Sensor Replacement (with Individual Sensors with Lead Wire)**

The Proximity sensors are very reliable and normally do not need to be replaced. Exhaust all other possible solutions, check continuity, air supply, lubrication, and pneumatic components prior to testing or replacing the sensor.

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.
2. If you are testing or replacing the Lock sensor make sure the QC-110 is in the locked position, if you are replacing the Unlock sensor make sure the QC-110 is in the unlocked position before continuing.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Disconnect any cables, air line, etc. if required.
5. 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.
6. Unscrew the M3 socket head cap screws that secure the cable retaining plate to the Tool Changer and remove the plate.
7. Loosen the M4 set screw for the sensor(s) being replaced.
8. Slide the sensor straight out from the Tool Changer body.
9. 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.
10. If the proximity sensor is not functioning properly, replace. Disconnect the sensor cable and discard.
11. Slide the new Lock and/or Unlock sensor into the Tool Changer body until it touches the inner plastic sleeve. Do not press the sensor into the sleeve. Refer to Figure 5.6.

12. Apply Loctite 222® to the M3 socket head cap screws for the cable retaining plate. Tighten to contact.

13. Tighten the M4 set screw for the replaced sensor(s) to contact.

14. Route the sensor cable into the cable channel of the Master plate.

15. Install the cable retaining plate.

16. If the Tool Changer was removed from robot or interface plate, install the Tool Changer (refer to Section 2.2—Master Plate Installation).

17. If repairs are complete, return circuits to normal operation.

18. Confirm the operation of the Unlock sensor by issuing the Unlock command and then checking to see that the LED in the Unlock sensor body is on.

19. Confirm the operation of the Lock sensor by issuing 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.
5.2.4.2 Lock and Unlock Sensor Replacement (with Individual Sensors)

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. If you are testing or replacing the Lock sensor make sure the QC-110 is in the locked position, if you are replacing the Unlock sensor make sure the QC-110 is in the unlocked position before continuing.

3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

4. Disconnect any cables, air line, etc. if required.

5. 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.

6. Unscrew the M3 socket head cap screws that secure the cable retaining plate to the Tool Changer and remove the plate.

7. Loosen the M4 set screw for the sensor(s) being replaced.

8. Slide the sensor straight out from the Tool Changer body.

9. 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.

10. If the proximity sensor is not functioning properly, replace. Disconnect the sensor cable and discard.

11. Remove and discard the jam nut from the sensor body.

12. Slide the new Lock and/or Unlock sensor into the Tool Changer body until it touches the inner plastic sleeve. Do not press the sensor into the sleeve. Refer to Figure 5.7.

13. Orient the sensor so the 90° cable connector will be positioned properly.

14. Apply Loctite 222 to the M3 socket head cap screws for the cable retaining plate. Tighten to contact.

15. Tighten the M4 set screw for the replaced sensor(s) to contact.

16. Connect the Lock and/or Unlock sensor cable connector to the proper sensor.

Figure 5.7—Lock and Unlock Sensor Replacement
17. If the Tool Changer was removed from robot or interface plate, install the Tool Changer (refer to Section 2.2—Master Plate Installation).

18. If repairs are complete, return circuits to normal operation.

19. Confirm the operation of the Unlock sensor by issuing the Unlock command and then checking to see that the LED in the Unlock sensor body is on.

20. Confirm the operation of the Lock sensor by issuing 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.

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

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. If you are testing or replacing the Lock sensor make sure the QC-110 is in the locked position, if you are replacing the Unlock sensor make sure the QC-110 is in the unlocked position before continuing.

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 Lock and/or Unlock sensor cable connectors from the Lock and/or Unlock sensor assembly.

6. 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 5.8). Pull the sensor assembly straight out from the Tool Changer body.

7. 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.

8. If the proximity sensor is not functioning properly, replace. Disconnect the sensor cable and discard.

9. Insert the new Lock and/or Unlock sensor assembly into the Tool Changer body as shown in Figure 5.8.
10. Secure the sensor assembly using the (2) M3 socket flat head screws. Tighten to 12 in-lbs (1.4 Nm).

11. Connect the Lock and/or Unlock sensor cable connector to the proper sensor.

12. If repairs are complete, return circuits to normal operation.

13. Confirm the operation of the Unlock sensor by issuing the Unlock command and then checking to see that the LED in the Unlock sensor body is on.

14. Confirm the operation of the Lock sensor by issuing 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 5.9**—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. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

3. 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.

4. Disconnect the utilities from the control/signal module and Valve Module.

5. Unscrew the RTL sensor cable connectors from the control/signal module. (refer to Figure 5.10)

6. Remove the control/signal module from the Valve Module.

7. Remove the Valve Module from the Master plate.

8. Unscrew the M3 socket head cap screws that secure the cable retaining plate to the Tool Changer and remove the plate.

9. Unscrew the M3 socket head flat screw that secures the RTL Sensor to the Tool Changer body.

10. Discard the removed RTL sensor.
11. Install the new sensor cable into the cable channel of the Tool Changer body.

12. Install the RTL sensor to the Tool Changer body.

13. 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).

14. Route the sensor cable into the cable channel of the Master plate.

15. Install the cable retaining plate.

16. Apply Loctite 222 to the M3 socket head cap screws for the cable retaining plate. Tighten to contact.

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 head cap screws for the cable retaining plate. Tighten to contact.

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

1. Dock the Tool side of the Tool Changer safely and uncouple the Tool Changer to allow clear access to the Master and Tool plates.

2. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).

3. 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.

4. Disconnect the utilities from the control/signal module and Valve Module.

5. Remove the control/signal module from the air/valve adapter Module (refer to Figure 5.11).

6. Unscrew the Lock/Unlock/RTL sensor cable connector from the control/signal module.

7. Remove the Valve Module from the Master plate.

8. Disconnect the Lock and Unlock sensor cable connectors from the Lock and Unlock sensors.

9. Unscrew the M3 socket head cap screws that secure the cable assembly to the Tool Changer.

10. Unscrew the M3 socket head flat screw that secures the RTL Sensor to the Tool Changer body.

11. Discard the removed RTL sensor and cable assembly.

12. Install the new cable assembly into the cable channel of the Tool Changer body.

13. Apply Loctite 222 to the M3 socket head cap screws for the cable assembly. Tighten to contact.
14. Attach the Lock and Unlock sensor cable connectors to the Lock and Unlock sensors.

15. Install the RTL sensor to the Tool Changer body.

16. Reinstall the Valve Module to the Master plate, be sure that the cables are routed through the cable channel of the Valve Module.

17. Reinstall the control/signal module to the Valve Module.

18. 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).

19. If the Tool Changer was removed from robot or interface plate, install the Tool Changer (refer to Section 2.2—Master Plate Installation).

20. If repairs are complete, return circuits to normal operation.

21. 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 5.2—Common Parts

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>9005-20-2241</td>
<td>1/2” Two Piece Alignment Pin</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>4010-0000010-01</td>
<td>3/8” Rubber Bushing</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>3700-20-2000</td>
<td>Collar for 3/8” Bushing</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>9120-110xM-000-000</td>
<td>QC-110 Sleeveless Master Assembly, NPT</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>9120-110xM-000-000-E</td>
<td>QC-110 Sleeveless Master Assembly, Euro</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>9120-110xM-000-000-G14</td>
<td>QC-110 Sleeveless Master Assembly, BSPP 1/4” Ports (Black)</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>9120-110xM-000-000-R</td>
<td>QC-110 Sleeveless Master Assembly, R Ports</td>
</tr>
</tbody>
</table>

Notes:

x = A, B, C, D, E, or F for boss size designation.
6.2 Models 9120-110xM-000-000-SD, 9120-110xM-000-000-SD-RD, 9120-110xM-000-000-SE and 9120-110xM-000-000-SF

Table 5.3—9120-110xM-000-000-SD, 9120-110xM-000-000-SG

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8590-9909999-34</td>
<td>Turck Prox (PNP True 2mm Range, Quick Disc.)</td>
</tr>
</tbody>
</table>

Table 5.4—9120-110xM-000-000-SD-RD, 9120-110xM-000-000-SG-RD

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>8590-9909999-123</td>
<td>PNP Flat Pack Proximity Sensor (RTL)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8590-9909999-34</td>
<td>Turck Prox (PNP True 2mm Range, Quick Disc.)</td>
</tr>
</tbody>
</table>

Table 5.5—9120-110xM-000-000-SE, 9120-110xM-000-000-SF

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8590-9909999-52</td>
<td>Baumer Prox IFRM 08N17A3/S35L (NPN, 2mm range, QD)</td>
</tr>
</tbody>
</table>

Notes:

x = A, B, C, D, E, or F for boss size designation.
6.3 Models 9120-110xM-000-000-SK

Table 5.6—9120-110xM-000-000-SK

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>8590-9909999-05</td>
<td>Prox Switch EE-X2D1-N-N</td>
</tr>
</tbody>
</table>

Notes:

- x = A, B, C, D, E, or F for boss size designation.
6.4 Models 9120-110xM-000-000-SGH and 9120-110xM-000-000-SEH

Table 5.7—9120-110xM-000-000-SGH

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>9000-20-1066</td>
<td>PNP Flat Pack Proximity Sensor (RTL)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8590-9909999-34</td>
<td>Turck Prox (PNP True 2mm Range, Quick Disc.)</td>
</tr>
</tbody>
</table>

Table 5.8—9120-110xM-000-000-SEH

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>9000-20-1066</td>
<td>PNP Flat Pack Proximity Sensor (RTL)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8590-9909999-52</td>
<td>Baumer Prox IFRM 08N17A3/S35L (NPN, 2mm range, QD)</td>
</tr>
</tbody>
</table>

Notes:

x = A, B, C, D, E, or F for boss size designation.
6.5 Models 9120-110xM-000-000-S0

Table 5.9—9120-110xM-000-000-S0

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>9005-20-1983</td>
<td>Sensor Bore Cover Plate Assembly, SS Screws</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>3500-1058008-21A</td>
<td>M3 x 8 SHCS, SS, ND Ind. Microspheres Epoxy, Yellow. 0-3 uncoated lead threads, 5-7 coated threads</td>
</tr>
</tbody>
</table>

Notes:

x = A, B, C, D, E, or F for boss size designation.
6.6 Models 9120-110xM-000-000-SMH and 9120-110xM-000-000-STH

Table 5.10—9120-110xM-000-000-SMH, 9120-110xM-000-000-STH

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>9000-20-1283</td>
<td>Prox Cable Assembly Sleeveless QC110, Potted</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>9005-20-1917</td>
<td>PNP Lock/Unlock Sensor Subassembly with LED</td>
</tr>
</tbody>
</table>

Notes:

\[ x = A, B, C, D, E, \text{ or } F \] for boss size designation.
6.7 Models 9120-110xM-000-000-SM, 9120-110xM-000-000-SP, 9120-110xM-000-000-ST and 9120-110xM-000-000-SU

<table>
<thead>
<tr>
<th>Table 5.11—9120-110xM-000-000-SM, 9120-110xM-000-000-ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5.12—9120-110xM-000-000-SP, 9120-110xM-000-000-SU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item No.</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Notes:

x = A, B, C, D, E, or F for boss size designation.
6.8 Models 9120-110xM-000-000-SFB

Table 5.13—9120-110xM-000-000-SFB

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>9120-C-FPPNP-3PM90-3PM90</td>
<td>Sensor Cable, Flat Pack PNP Sensor to (2) 3-pin Right Angle</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>9005-20-1917</td>
<td>PNP Lock/Unlock Sensor Subassembly with LED</td>
</tr>
</tbody>
</table>

Notes:

x = A, B, C, D, E, or F for boss size designation.
6.9 Models 9120-110xT-000-000

Table 5.14—9120-110xT-000-000

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>9120-110FT-000-000</td>
<td>QC-110 Tool Assembly, 80mm Recess NPT</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>9120-110FT-000-000-R</td>
<td>QC-110 Tool Assembly, 80mm Recess R Port (BSPT)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>9120-110FT-000-000-G14</td>
<td>QC-110 Tool Assembly, 80mm Recess G1/4</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>9120-110FT-000-000-E</td>
<td>QC-110 Tool Assembly, 80mm Recess BSPP (Black)</td>
</tr>
</tbody>
</table>

Notes:

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

<table>
<thead>
<tr>
<th>Table 5.15— Master and Standard Tool plates Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended Max Payload</strong></td>
</tr>
<tr>
<td><strong>Operating Temperature Range</strong></td>
</tr>
<tr>
<td><strong>Operating Pressure Range</strong></td>
</tr>
<tr>
<td><strong>Coupling Force @ 80 psi</strong></td>
</tr>
<tr>
<td><strong>Recommended Max Moment X-Y (Mxy)</strong></td>
</tr>
<tr>
<td><strong>Positional Repeatability</strong></td>
</tr>
<tr>
<td><strong>Weight (coupled, no access.)</strong></td>
</tr>
<tr>
<td><strong>Max. Recommended distance between Master and Tool plate</strong></td>
</tr>
<tr>
<td><strong>Pass through Port, (Qty) Size (Cv, Min)</strong></td>
</tr>
<tr>
<td><strong>Mounting/Customer Interface</strong></td>
</tr>
</tbody>
</table>
8.2 QC-110 Tool Changer, 1/4 BSPT Ports

Part Numbers Shown:
(A) Master: 9120-110AM-000-000-R
(B) Tool: 9120-110FT-000-000-R

Notes:
1) Center Boss inserts available.
2) Center Recess inserts available.
8.3 QC-110 Tool Changer, 1/4 BSPP Ports

Part Numbers Shown:
(A) Master: 9120-110AM-000-000-G14
(B) Tool: 9120-110FT-000-000-G14

Notes:
1. Center Recess inserts available.
2. SM in master part number indicates PNP lock/unlock sensors.

QC-110 Base Tool Changer with 1/4 BSPP Ports
QC-110 Tool Assembly