Table of Contents

B. Base Tool Changer B-3
QC-1510 Series—Robotic Tool Changer B-3
1. Product Overview B-3
1.1 Master Plate Assembly B-4
1.2 Tool Plate Assembly B-5
1.3 Optional Modules B-5
2. Installation B-6
2.1 Master Interface B-7
2.2 Master Plate Installation B-7
2.3 Master Plate Removal B-7
2.4 Tool Interface B-9
2.5 Tool Plate Installation B-9
2.6 Tool Plate Removal B-10
2.7 Pneumatic Connections B-11
2.7.1 Valve Requirements and Connections for the Locking Mechanism B-11
2.8 Electrical Connections B-12
2.8.1 PNP Type Lock, Unlock and RTL Sensors (-SL sensor designations) B-12
2.8.2 NPN Type Lock, Unlock and RTL Sensors (-SE sensor designations) B-12
3. Operation B-13
3.1 Conditions for Coupling B-14
3.2 Fail-Safe Operation B-14
3.3 Conditions for Uncoupling B-15
3.4 Tool Storage Considerations B-15
4. Maintenance B-16
4.1 Preventive Maintenance B-17
4.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins B-18
4.3 Alignment Pin Replacement B-20
4.4 Seal Inspection and Replacement B-21
4.5 Pin Block Inspection and Cleaning B-22
5. Troubleshooting B-23
5.1 Lock and Unlock Sensor Assembly and Cable Replacement B-24
5.1.1 Control Module to Junction Module Cable Replacement B-24
5.1.2 Lock\Unlock Sensor Assemblies (L1/U1) and Cable Replacement B-25
5.1.3 Lock and Unlock Sensor Assemblies (L2/U2) and Cable Replacement B-26
5.1.4 Lock and Unlock Sensor Assemblies (L3/U3) and Cable Replacement B-27

5.2 Ready-to-Lock Sensor and Cable Replacement B-29
5.2.1 RTL Sensor Replacement (RS1/RS2) B-29
5.2.2 RTL Cable Replacement (R1 to RS1/RS2) B-29
5.2.3 RTL Sensor Replacement (RS3) B-31
5.2.4 RTL Cable Replacement (R2 to RS3) B-32
6. Serviceable Parts B-33
6.1 Common Master Parts B-33
6.2 Models 9121-1510xM-0-0-0-0-SL and 9121-1510xM-0-0-0-0-SE B-34
6.3 Cables for Models 9121-1510xM-0-0-0-0-SL and 9121-1510xM-0-0-0-0-SE B-35
6.4 Tool Plate B-36
7. Specifications B-37
8. Drawings B-38
5.1 Lock and Unlock Sensor Assembly and Cable Replacement B-24
5.1.1 Control Module to Junction Module Cable Replacement B-24
5.1.2 Lock\Unlock Sensor Assemblies (L1/U1) and Cable Replacement B-25
5.1.3 Lock and Unlock Sensor Assemblies (L2/U2) and Cable Replacement B-26
5.1.4 Lock and Unlock Sensor Assemblies (L3/U3) and Cable Replacement B-27
5.2 Ready-to-Lock Sensor and Cable Replacement B-29
5.2.1 RTL Sensor Replacement (RS1/RS2) B-29
5.2.2 RTL Cable Replacement (R1 to RS1/RS2) B-29
5.2.3 RTL Sensor Replacement (RS3) B-31
5.2.4 RTL Cable Replacement (R2 to RS3) B-32
6. Serviceable Parts B-33
6.1 Common Master Parts B-33
6.2 Models 9121-1510xM-0-0-0-0-SL and 9121-1510xM-0-0-0-0-SE B-34
6.3 Cables for Models 9121-1510xM-0-0-0-0-SL and 9121-1510xM-0-0-0-0-SE B-35
6.4 Tool Plate B-36
7. Specifications B-37
8. Drawings B-38

B. Base Tool Changer

QC-1510 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 Quick-Change 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. The Master allows for the passage of utilities to the Tool Plate.

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, 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-1510 Series of Tool Changers, please click the following link: *QC-1510 Series.*

1.1 Master Plate Assembly

The Master base assembly (Master plate) includes an anodized aluminum body, a set of hardened stainless-steel locking mechanisms, and hardened steel alignment pins (see *Figure 1.1*).

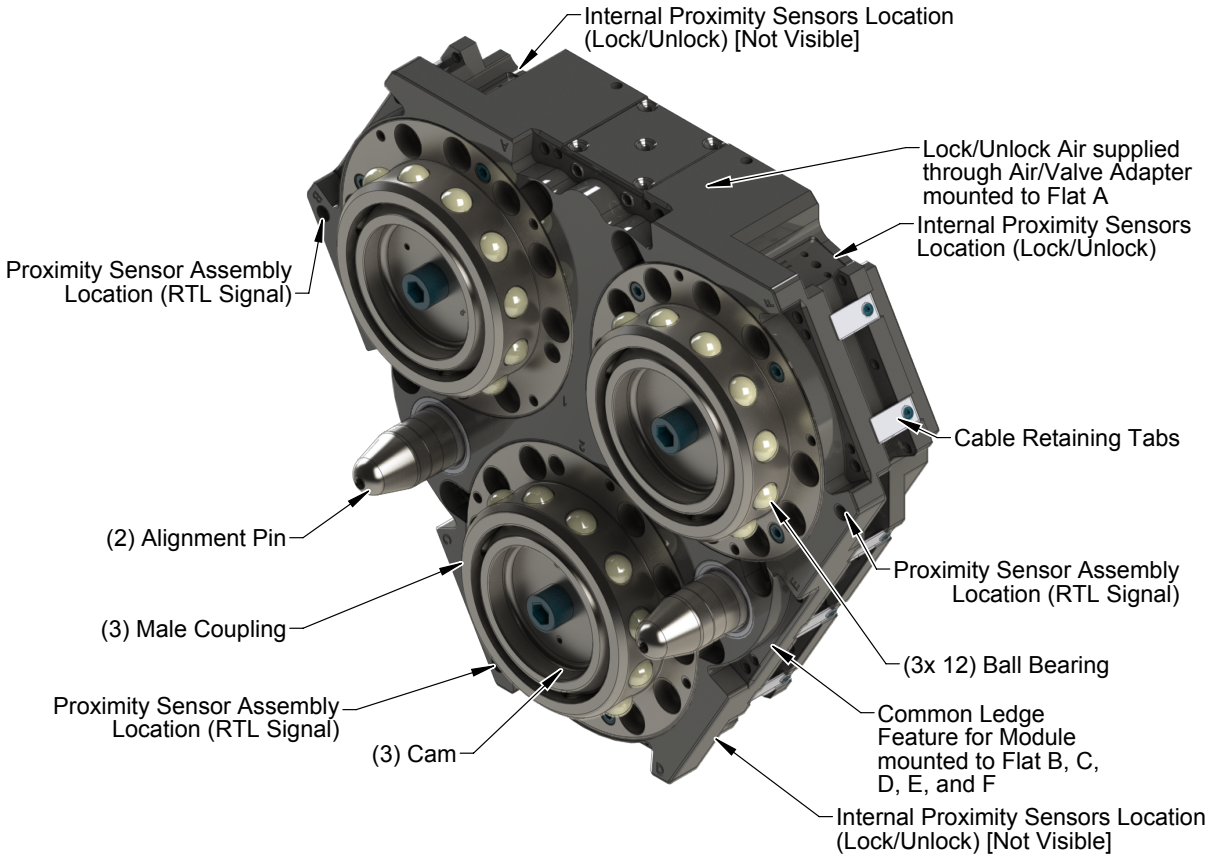
The Master plate has (6) flat sides for mounting of optional modules. Flat 'A' is dedicated for mounting of the control/signal module along with tool changer supply air that is provided through an air or valve adapter. Flats 'B', 'C', 'D','E', and 'F' are fully interchangeable and optional modules can be arranged to suit the application or robot dress, as required.

The Master plate is comprised of (3) locking mechanisms. Each locking mechanism consists of a cam, male coupling, and chrome-steel balls. Tapered pins located on the Master plate mate with holes in the Tool plate to ensure repeatable alignment during the coupling process. Extreme pressure grease is applied to the cams, male couplings, ball bearings, and pins to enhance performance and maximize the life of the Master assembly.

Proximity sensors (6 total) are designed into the body of the Master plate to verify the locked/unlocked position of each locking mechanism. Due to the multiple locking mechanism design, the proximity sensors are grouped such that (3) sensors are for Lock and (3) are for Unlock. The Lock/Unlock signal at each locking mechanism is routed to the signal junction module. The junction module provides the control/signal module with the Lock/Unlock state of the Master plate. See the cable routing illustrations in *Section 5—Troubleshooting* to understand the relationship between the sensors, junction module and control module.

Three proximity sensors are mounted in the body of the Master plate to verify Tool plate presence when coupled. The sensors provide (2) Ready-To-Lock (RTL) signals to the control/signal module. To accomplish a dual RTL signal, (2) of the sensors are wired in series. See *Section 5—Troubleshooting* for more explanation of the RTL layout.

Figure 1.1— Master Plate Assembly



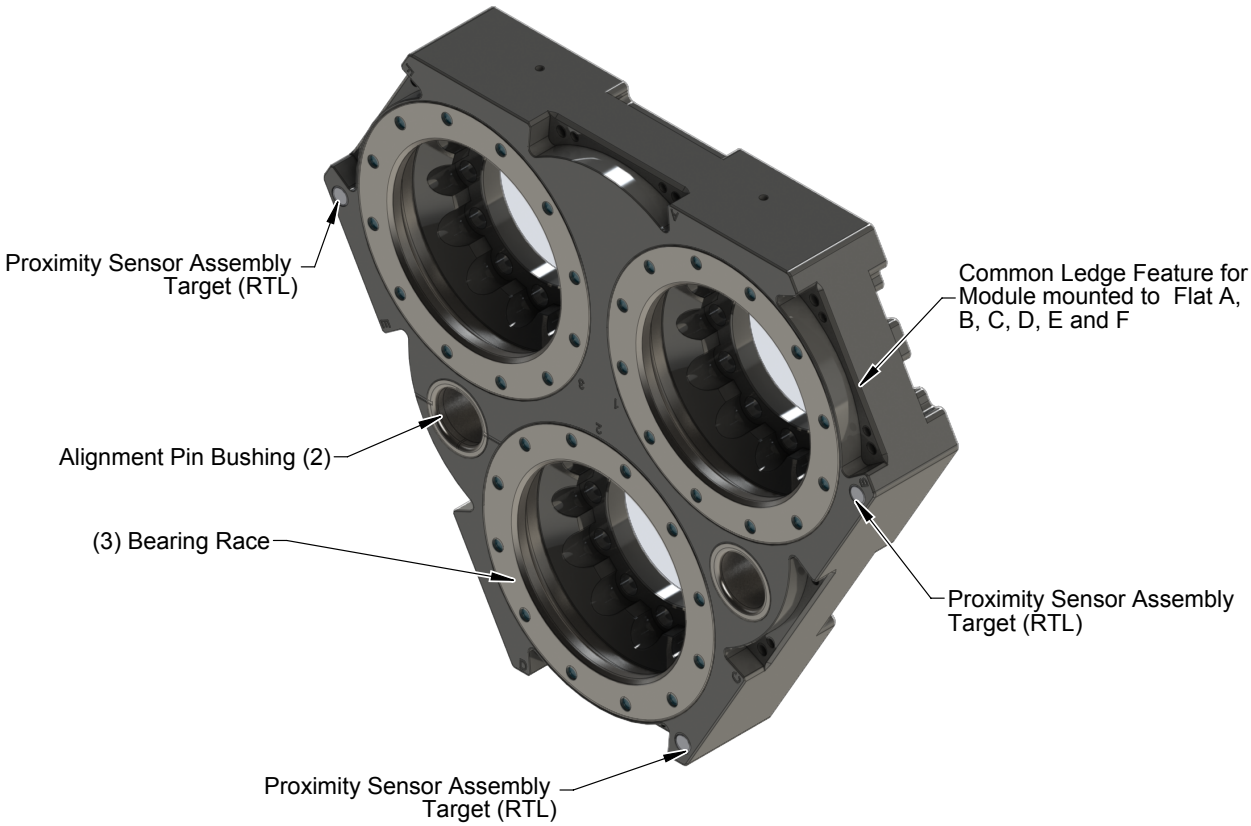
1.2 Tool Plate Assembly

The Tool Plate assembly includes an anodized aluminum body and a hardened stainless steel bearing races. The Tool Plate has (6) flat sides for mounting of optional modules.

Proximity sensor targets are mounted to the body of the Tool Plate to verify Tool Plate presence when coupled. The targets are used by the proximity sensors in the Master Plate to provide a ready-to-lock (RTL) signal.

A mounting pattern is machined into the Tool Plate for mounting to customer tooling or a tooling interface plate. Refer to *Section 8—Drawings* for details.

Figure 1.2—Tool Plate Assembly



1.3 Optional Modules

There are (6) flats available for mounting of the optional modules for support of various utility pass through, such as signal, fluid/air, and electric.

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

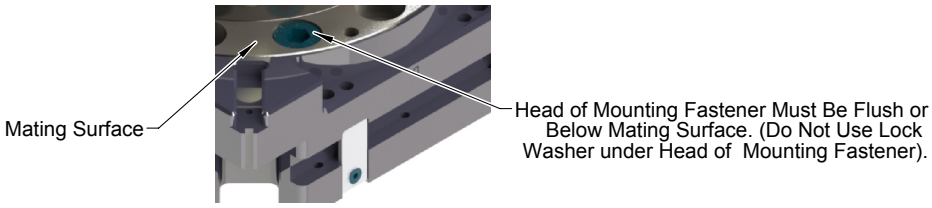
In general, flat ‘A’ is reserved for an air/valve adapter module and a control/signal module. Flat ‘D’ is reserved for a signal junction module, however, optional utility modules can still be added on flat ‘D’. Modules for flats ‘B’, ‘C’, ‘D’, ‘E’, or ‘F’ are interchangeable to suit the application or the dress-out required.

The optional modules are mounted to the Master or Tool Plate using a common ledge mounting feature. Only (2) M6 SHCS fasteners need to be unscrewed in order to remove the module from the Master/Tool Plate.

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. Refer to *Table 2.1*. **Furthermore, removable (blue) Loctite 242 must be used on these fasteners. The table below contains recommended values based on engineering standards.**

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 2.1—Fastener Size, Class, and Torque Specifications

Mounting Conditions	Fastener Size and Property Class	Recommended Torque
Master Plate to Robot Interface Plate (6061-T6 aluminum) Minimum thread engagement of 0.59" (15mm) [1.5X fastener Ø].	**M10-1.5 Class 12.9**	**55 ft-lbs (75 Nm)**
Master Plate to Robot Interface Plate (steel; USS ≥ 90KSI) Minimum thread engagement of 0.59" (15mm) [1.5X fastener Ø]. *Confirm available engagement with Robot Manufacturer*	**M10-1.5 Class 12.9**	**55 ft-lbs (75 Nm)**
Tool Plate (aluminum) to Tool Interface Plate (6061-T6 aluminum) Minimum thread engagement of 0.71" (18 mm) [1.5X fastener Ø]. *Do not exceed maximum available thread depth as shown in Section 8—Drawings*	**M10-1.5 Class 12.9**	**38 ft-lbs (52 Nm)**
Tool Plate (aluminum) to Tool Interface Plate (7075-T6 aluminum) Minimum thread engagement of 0.59" (15 mm) [1.5X fastener Ø]. *Do not exceed maximum available thread depth as shown in Section 8—Drawings.*	**M10-1.5 Class 12.9**	**38 ft-lbs (52 Nm)**

2.1 Master Interface

The Master Plate is attached to the robot arm. The Master Plate is designed with mounting features such as a 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 mounting surface of the Master Plate and robot arm or RIP are clean and free of debris.
2. 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 M10-1.5 SHCS. Apply Loctite 242 to threads (see *Table 2.1* for proper fasteners and torque).

NOTICE: If an ATI RIP is used, hardware to mount the Master Plate is supplied with the RIP.

3. Connect utilities to the appropriate module and Master Plate connections.

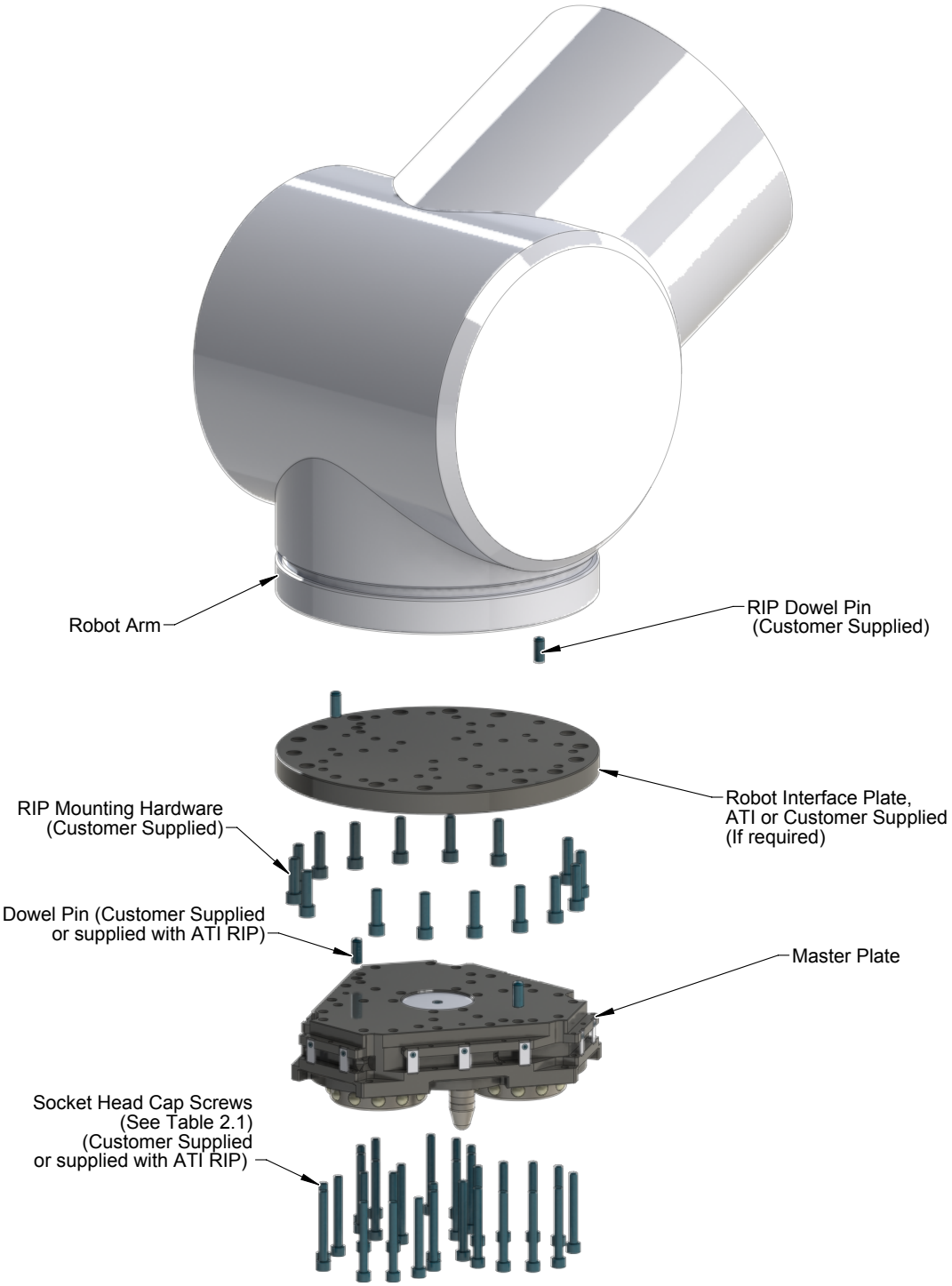
2.3 Master Plate Removal

WARNING: Do not perform maintenance or repair on Tool Changer or modules unless the Tool is safely supported or docked in the Tool Stand and all energized circuits (e.g., electrical, air, water, etc.) have been turned off. Injury or equipment damage can occur with Tool not docked and energized circuits on. Dock the Tool safely in the Tool Stand and turn off all energized circuits before performing maintenance or repair on Tool Changer or modules.

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

1. Remove the M10-1.5 SHCS connecting the Master Plate to the robot arm or RIP.

Figure 2.1— Typical Master Plate Installation



2.4 Tool Interface

The Tool Plate is attached to the 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. Most often a tool interface plate is 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 0.250" (6.3 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 the mounting surface of the Tool Plate and tool interface plate is clean and free of debris.
2. Align the dowel pins to the corresponding holes in the Tool Plate and secure the Tool Plate to the tool interface plate or customer tooling with customer supplied hardware. Apply Loctite 242 to threads (see *Table 2.1*).

NOTICE: If an ATI IP is used, hardware to mount the Tool Plate is supplied with the IP.

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

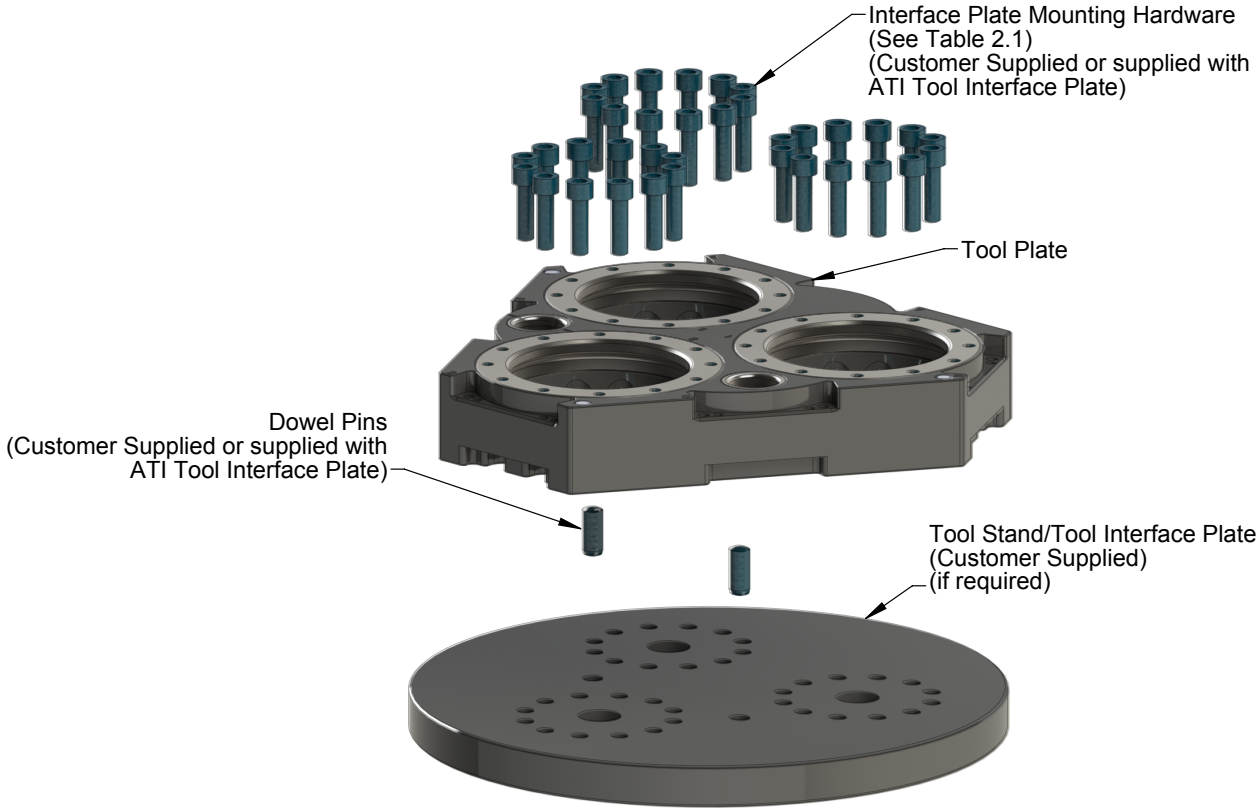
2.6 Tool Plate Removal

WARNING: Do not perform maintenance or repair on Tool Changer or modules unless the Tool is safely supported or docked in the Tool Stand and all energized circuits (e.g., electrical, air, water, etc.) have been turned off. Injury or equipment damage can occur with Tool not docked and energized circuits on. Dock the Tool safely in the Tool Stand and turn off all energized circuits before performing maintenance or repair on Tool Changer or modules.

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

1. Remove the hardware connecting the Tool Plate to the tooling or tool interface plate.

Figure 2.2— Standard Tool Plate Installation



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 70 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.

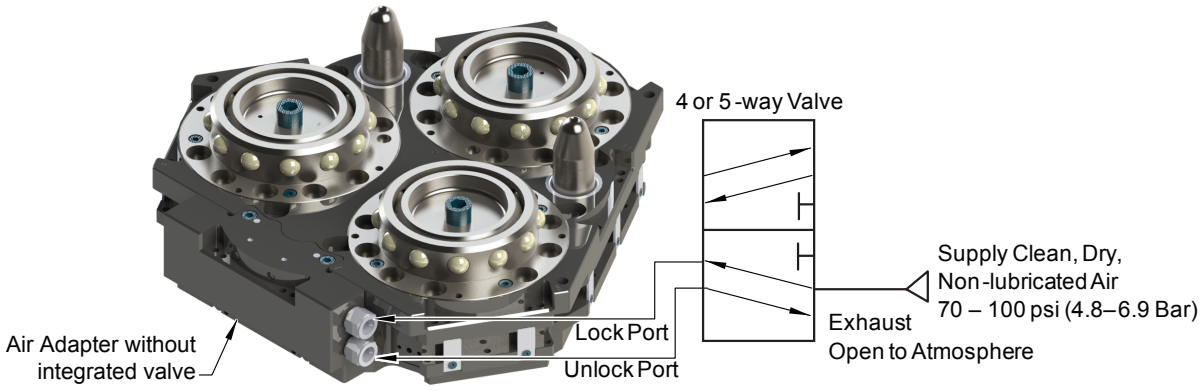
CAUTION: Do not use the Tool Changer in the fail-safe condition for extended periods of time. Do not transport the Tool Changer in the fail-safe condition. Possible damage to the locking mechanism could occur.

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 and/or uncoupling from occurring.

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 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



2.8 Electrical Connections

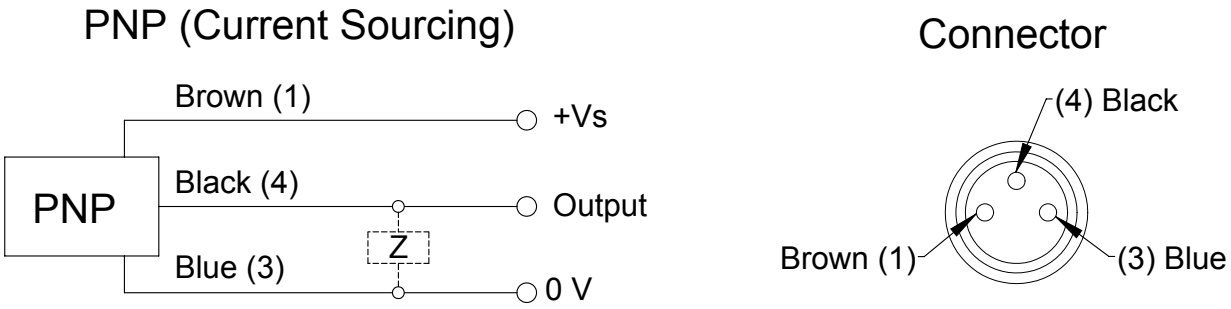
Tool Changer is available with integrated lock/unlock sensors. If sensors are not used, plugs will be provided to seal the locking mechanism. If a control/signal module is to be utilized on Flat A when ordered, the sensors will be connected to the module prior to shipping.

2.8.1 PNP Type Lock, Unlock and RTL Sensors (-SL sensor designations)

These sensors are used on 9121-1510AM-0-0-0-0-SL.

Table 2.2—PNP (Current Sourcing)	
Description	**Value**
Voltage Supply Range	10-30 VDC
Output Current	< 150 mA
Nominal Sensing Distance Sn	2.0 mm
Output Circuit	PNP make function (NO)

Figure 2.4—PNP Type Lock, Unlock and RTL Sensors

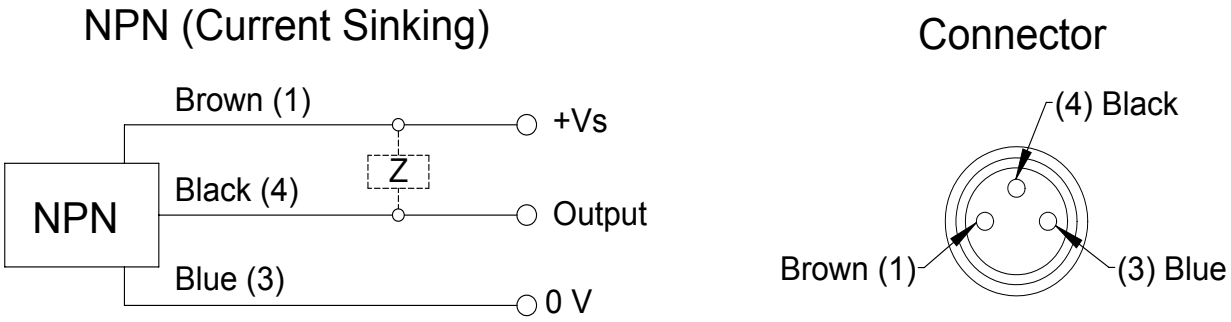


2.8.2 NPN Type Lock, Unlock and RTL Sensors (-SE sensor designations)

These sensors are used on 9121-1510AM-0-0-0-0-SE.

Table 2.3—NPN (Current Sourcing)	
Description	**Value**
Voltage Supply Range	10-30 VDC
Output Current	< 200 mA
Nominal Sensing Distance Sn	2.0 mm
Output Circuit	NPN make function (NO)

Figure 2.5—NPN Type Lock, Unlock and RTL Sensors



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 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 70 to 100 psi. Robot motion should be halted if the air supply pressure drops below 70 psi for any reason.

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

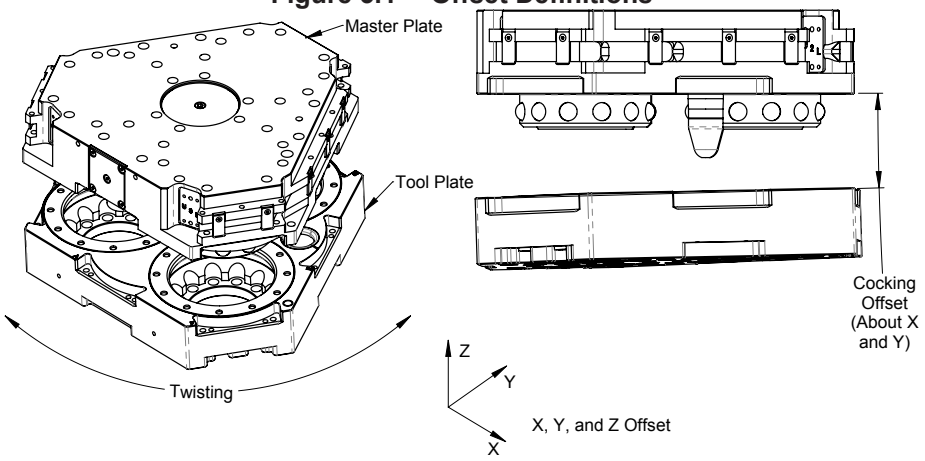


Table 3.1—Maximum Recommended Offsets Prior to Coupling

Model	No-Touch™ Zone Z Offset (Max)* (mm)	X and Y Offset (Max)† (mm)	Cocking Offset (Max) (degrees)	Twisting Offset (Max) (degrees)
QC-1510	1	2	±0.7	±1

Notes: *Maximum values shown. Decreasing actual values will minimize wear during coupling/uncoupling.

†Actual allowable values may be higher in some cases but higher offsets will increase wear during coupling.

3.1 Conditions for Coupling

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

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.

- Position the Master above the Tool and move the Master into locking position. The mating surfaces of the Master and Tool should be parallel and not touching. Make sure that the tapered alignment pins from the Master enter the alignment holes on the Tool. The alignment pins should be relatively concentric with the alignment holes such that they do not rub against the edge.
- It is recommended that the mating faces of the Master and Tool not be touching, but be within 0.04" (1 mm) of each other when coupling to minimize stress and wear on the locking mechanism. The locking mechanism allows the Master to "pull up" the Tool with relatively large gaps between the two sides.
- RTL (Ready-To-Lock) sensor and target are built into the Tool Changer must be positioned within approximately 0.065" (2 mm) of each other for the sensors to detect Tool presence. This provides the ability to sense Tool proximity to the Master prior to coupling. RTL signals are not required to couple the Tool Changer, but are recommended as a further confirmation of coupling prior to removing the Tool from the tool stand.

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 just prior to coupling. Contact may result in damage to the unit and/or the robot.

- Verify that the RTL signals are read as "on" (true), if being utilized.
- Turn the Lock output on. Air is supplied to the locking mechanism to couple the Tool Changer.
- A sufficient delay must be programmed between the Lock output being activated and reading the state of the Lock/Unlock signals, so that the coupling process is completed before checking the locked state.
- The Lock signal should read "on" (true) and the Unlock signal should read "off" (false).

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

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

3.2 Fail-Safe Operation

A fail-safe condition occurs, when there is an unintended loss of lock air pressure to the Master Plate. When air pressure is initially 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 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 stopped until air is restored. Once air pressure is reestablished to the Master Plate, the locking mechanism will energize securely locking 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 your Control and 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

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

- The Tool Changer should be positioned in the Tool Stand in the same location as that when coupling took place.
- Turn the Lock output off (for double solenoid valve versions).

> **CAUTION:** This Tool Changer may be equipped with a Tool Stand Interlock (TSI) feature that physically breaks the Unlatch solenoid circuit. Proper use of the TSI will prevent any unwanted Unlock software commands from being recognized until the circuit is made.

- Issue the Unlock output. Air is supplied to the locking mechanism to uncouple the Tool Changer.
- 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.
- 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 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 tools may be stored in a Tool Stand when not being used by the robot. The customer supplied Tool Stand should be designed to provide a 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 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 care must be taken that the necessary compliance is 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, refer to *Section 3—Operation.*

It is highly recommended that the customer provide a sensor that detects 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. Sensors 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, positioning Tool Stands in areas shielded from weld spatter, fluids, adhesives, or other debris would eliminate the 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 and all energized circuits (e.g., electrical, air, water, etc.) have been turned off. Injury or equipment damage can occur with Tool not docked and energized circuits on. Dock the Tool safely in the Tool Stand and turn off all energized circuits 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 Tools 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 *Section 8—Drawings* of this manual. Refer to module sections for detailed preventive maintenance steps for all utility modules.

Application(s)	Tool Change Frequency	Inspection Schedule
General Usage Material Handling Docking Station	> 1 per minute	Weekly
	< 1 per minute	Monthly
Welding/Servo/Deburring, Foundry Operations (Dirty Environments)	All	Weekly

Checklist

Balls/Alignment Pins/Holes/Bearing Race

- ☐ Inspect for lubrication and wear. A NLGI #2, lithium based grease with molybdenum disulfide additive is suggested for locking mechanism and alignment pin lubrication. Over time, lubricants can become contaminated with process debris. Therefore, it is recommended to thoroughly clean the existing grease and replace with new as needed. See *Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins.*
- ☐ 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. Replace worn alignment pins, refer to *Section 4.3—Alignment Pin Replacement.*
- ☐ Wear on the balls/bearing race could be an indication of excessive loading.

Mounting Hardware/Interface Connections

- ☐ Inspect for proper torque and interference or wear, abrasions, and cuts of hoses. Tighten and correct as required.

Seals (Modules)

- ☐ Inspect for wear, abrasion, and cuts.
- ☐ Exposed o-rings and rubber bushings may be subject to damage during normal operation. Replace damaged o-rings and rubber bushings as needed. Refer to *Section 4.4—Seal Inspection and Replacement*

Sensors and Cables

- ☐ Inspect sensor cables and connectors for any damage, cuts, and abrasion.

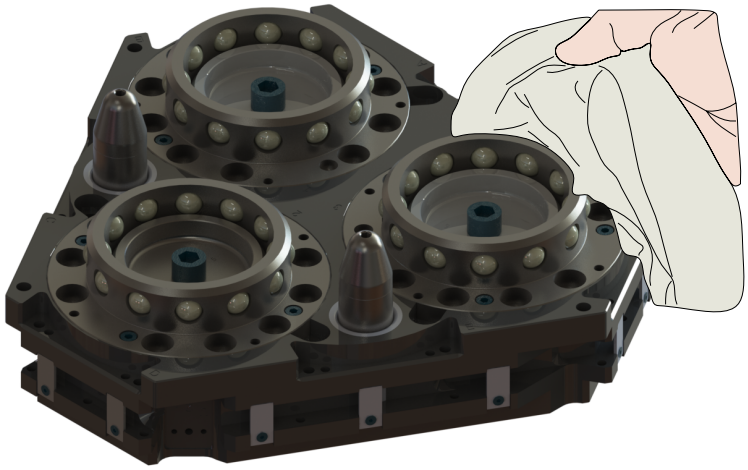
Electrical Contacts/Pin Block (Modules)

- ☐ Inspect for wear and abrasion.
- ☐ Exposed contacts may be subject to damage during normal operation.
- ☐ Clear debris from the area of the contacts using compressed air.
- ☐ Do not directly clean contacts as abrasion may occur and the performance of the contact may be compromised. Refer to *Section 4.5—Pin Block Inspection and Cleaning.*

4.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

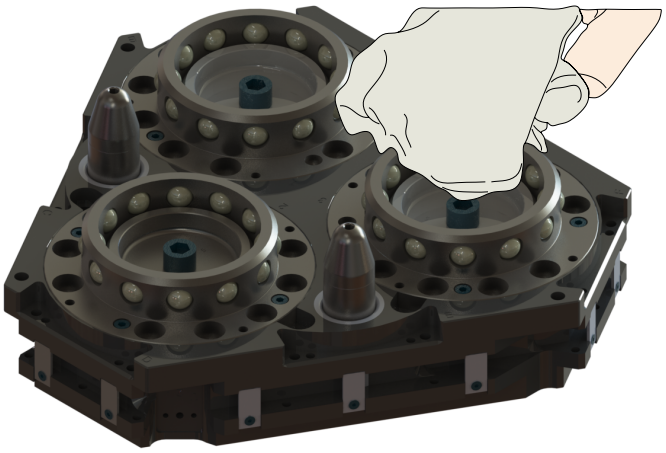
1. The locking mechanism must be in the unlock state before cleaning.
2. Use a clean rag to thoroughly remove the existing lubricant and debris from the ball bearings, the male coupling, the cam and the alignment pins.

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



3. 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

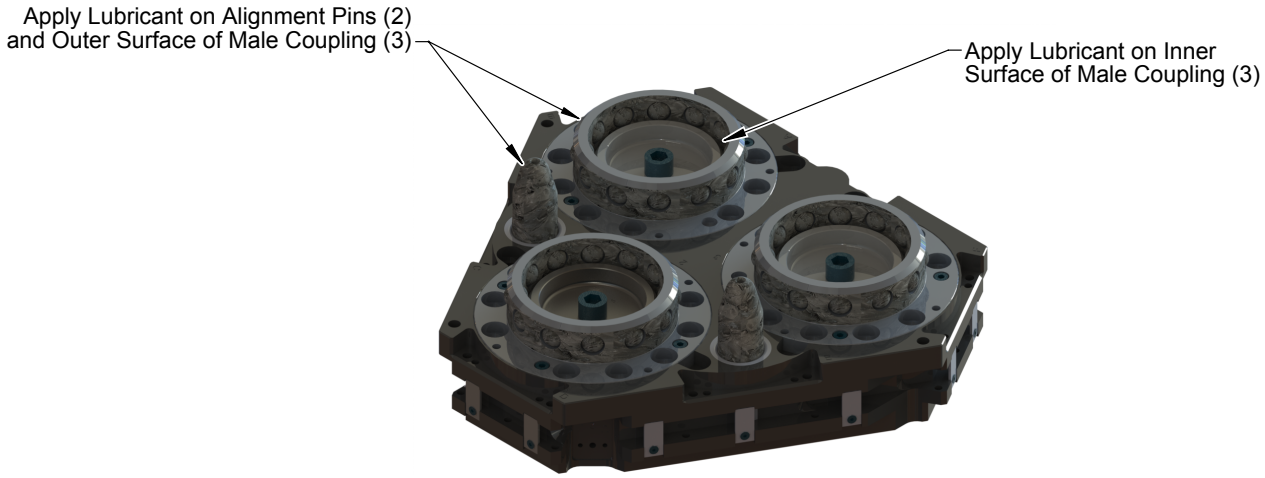


4. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 4.3— Check Ball Bearing Movement

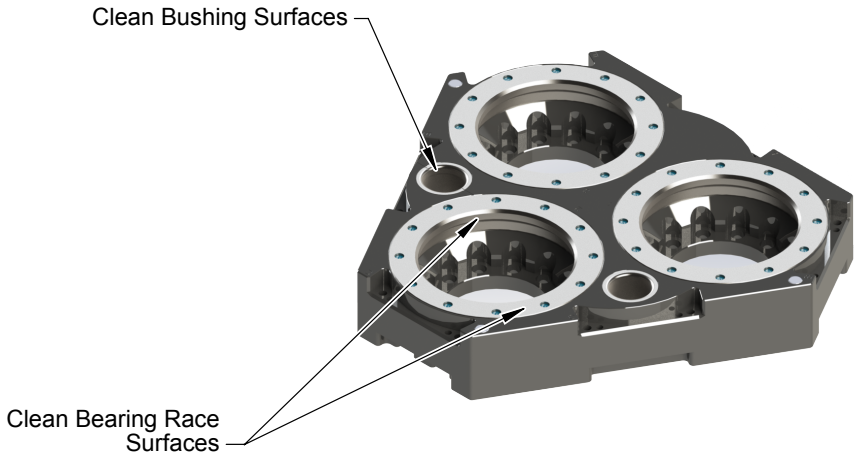
5. Apply a liberal coating of lubricant to the ball bearings, the male coupling (inside and out), and the alignment pins.

Figure 4.4— Apply Lubricant to Locking Mechanism



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

Figure 4.5— Clean Tool Plate Surfaces of Locking Mechanism



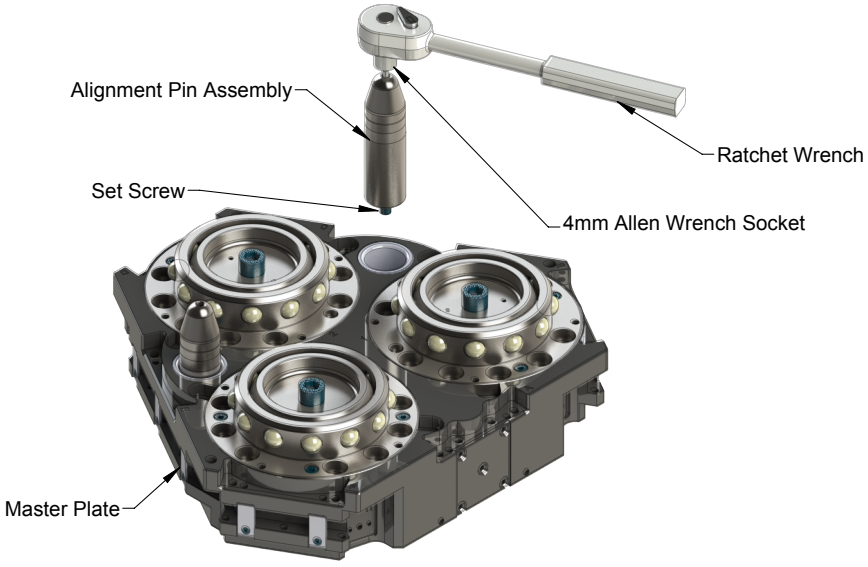
7. No application of lubrication is necessary on the Tool Plate components.

4.3 Alignment Pin Replacement

1. Unscrew the alignment pin sub-assembly from the Master Plate using a 4mm Allen Wrench (see *Figure 4.6*).

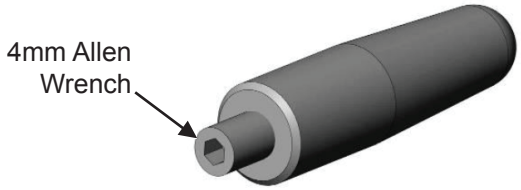
> **NOTICE:** If for any reason the pin cannot be removed using the hex socket in the tip, it may be necessary to remove it by other means, such as Vise Grip pliers.

Figure 4.6—4mm Allen Wrench



2. Another approach would be to use the access hole in the back side of the Master Plate. In this case, a 4mm Allen Wrench will be needed (see *Figure 4.7*).

Figure 4.7—4mm Allen Wrench



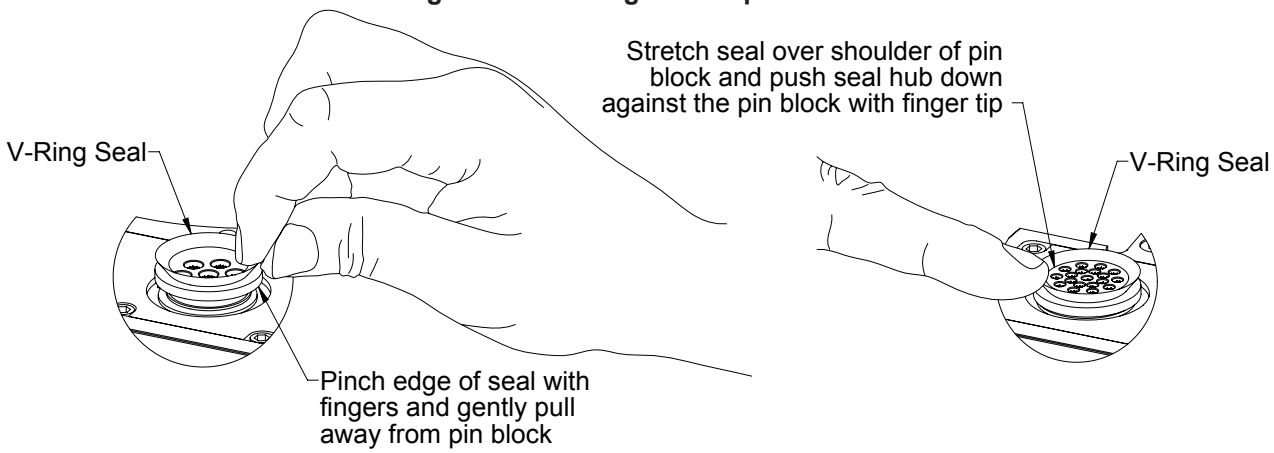
3. Once the alignment pin has been removed, verify that the sub-assembly (pin and set screw) are intact. If the set screw portion of the sub-assembly did not come out, it will be necessary to remove it separately using the access hole in the back plate of the Master Plate.
4. Apply Loctite 242 and install the Alignment Pin Assembly into the Bushing on the Tool Changer. Tighten to 60 in-lbs.
5. Apply MobilGrease® XHP222 Special grease to the Alignment Pin (see *Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins*

4.4 Seal Inspection and 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. To remove the existing seal, pinch edge of seal with fingers and gently pull the seal away from the pin block on the Master.
2. Pull the seal off the pin block.
3. To install a new seal, stretch the new seal over the shoulder of the pin block.
4. Push the seal's hub down against the pin block using finger tip.

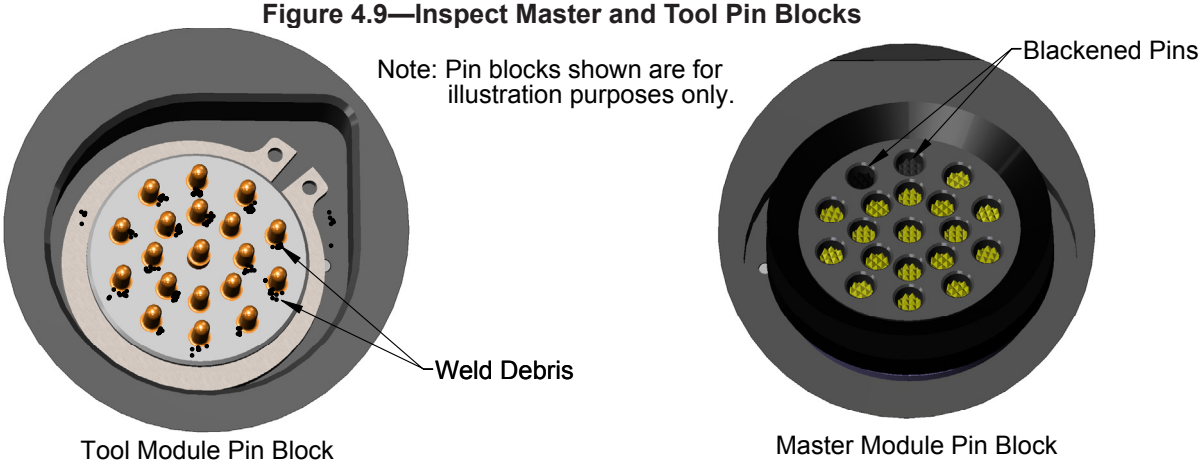
Figure 4.8—V-Ring Seal Replacement



4.5 Pin Block Inspection and Cleaning

1. Inspect the Master and Tool pin blocks for any debris or darkened pins.

Figure 4.9—Inspect Master and Tool Pin Blocks

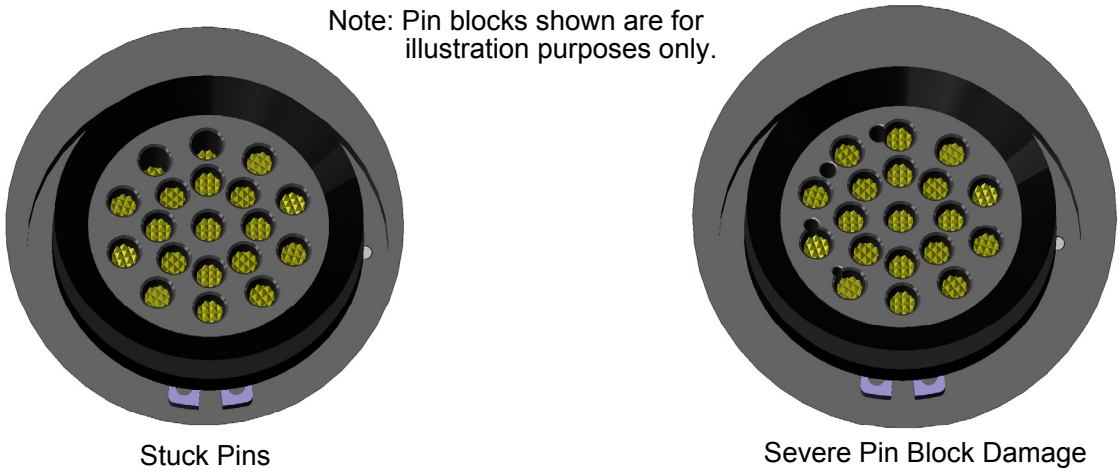


2. If debris or darkened pins exist, remove debris using a vacuum, and clean using a nylon brush (ATI part number 3690-0000064-60).

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 and non-abrasive media such as a nylon brush (ATI part number 3690-0000064-60)

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

Figure 4.10—Stuck Pin and Pin Block Damage



4. If stuck pins or severe pin block damage exists, contact ATI for possible pin replacement procedures or module replacement.

5. Troubleshooting

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 70 psi (4.8 Bar).
- No air or vacuum can be trapped in a de-energized Lock or Unlock Port (pressure must be vented to atmosphere).

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 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 2.7—Tool Stand Design.* 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—Ready-to-Lock Sensor and Cable Replacement.* 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 module. Replace damaged cables as necessary.
Unit is locked but Lock signal does not read “on” (true).	Lock sensor/cable is damaged.	Replace the lock sensor sub-assembly as necessary. Refer to *Section 5.1—Lock and Unlock Sensor Assembly and Cable Replacement.*
	Lock sensor is out of position.	Replace the lock sensor sub-assembly as necessary. Refer to *Section 5.1—Lock and Unlock Sensor Assembly and Cable Replacement.*
Unit is unlocked but Unlock signal does not read “on” (true).	Unlock sensor/cable is damaged.	Replace the unlock sensor sub-assembly as necessary. Refer to *Section 5.1—Lock and Unlock Sensor Assembly and Cable Replacement.*
	Unlock sensor is out of position.	Replace the unlock sensor sub-assembly as necessary. Refer to *Section 5.1—Lock and Unlock Sensor Assembly and Cable Replacement.*

5.1 Lock and Unlock Sensor Assembly and Cable Replacement

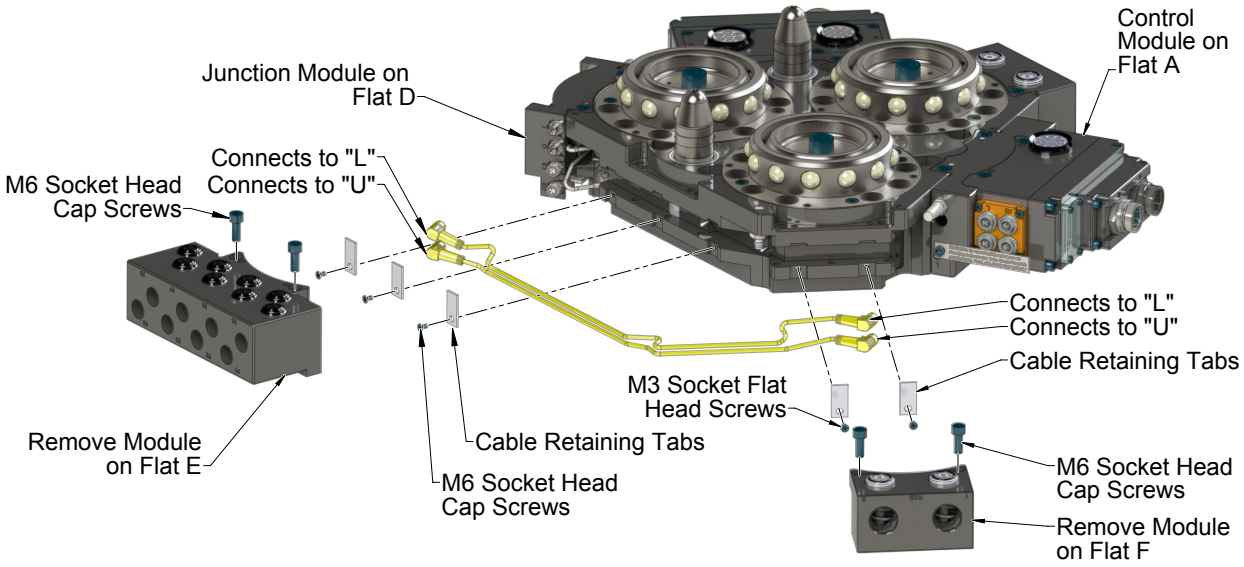
The proximity sensors are very reliable and normally do not need to be replaced. Exhaust all other possible solutions, check continuity, air supply, lubrication, and pneumatic components prior to testing or replacing the sensor

WARNING: Do not perform maintenance or repair on Tool Changer or modules unless the Tool is safely supported or docked in the Tool Stand and all energized circuits (e.g., electrical, air, water, etc.) have been turned off. Injury or equipment damage can occur with Tool not docked and energized circuits on. Dock the Tool safely in the Tool Stand and turn off all energized circuits before performing maintenance or repair on Tool Changer or modules.

5.1.1 Control Module to Junction Module Cable Replacement

1. If there is an optional module on Flat E and/or Flat F, remove the two M6 socket head cap screws securing the module(s) to the Tool Changer body. Refer to *Figure 5.1*
2. If equipped, lift off the optional modules from Flat E and/or Flat F.
3. Remove the three M3 socket flat head cap screws and three cable retaining tabs on Flat E of the Tool Changer body.
4. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat F of the Tool Changer body.
5. Disconnect the cable connectors from the Control Module on Flat A.
6. Disconnect the cable connectors from the Junction Module on Flat D.
7. Remove the cable(s) from the cable channel of the Tool Changer body. Discard the worn cable.

Figure 5.1— Control Module to Junction Module Cable Replacement



8. Route the new cable into the cable channel of the Tool Changer body.
9. Connect the cable connectors to the Junction Module on Flat D.
10. Connect the cable connectors to the Control Module on Flat A.
11. Secure the cables to Flat F using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact.
12. Secure the cables to Flat E using the three M3 socket flat head cap screws and three cable retaining tabs. Tighten to contact.

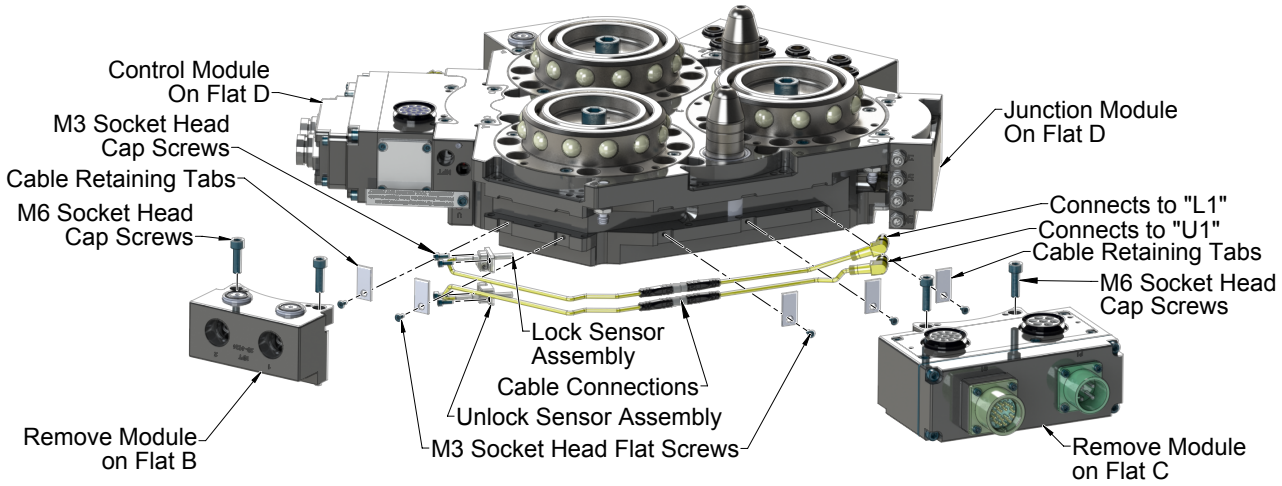
13. If optional modules were installed on Flats E and/or Flat F, install modules.
14. If fasteners do not have pre-applied adhesive, apply Loctite 242® to the M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Tool Changer body and tighten to 70 in-lbs (7.9 Nm).
15. Confirm the operation of the cables by issuing the Unlock command and then checking to see that the LED in the Unlock sensor body is on.
16. Confirm the operation of the cables 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.

5.1.2 Lock\Unlock Sensor Assemblies (L1/U1) and Cable Replacement

1. If there is an optional module on Flat B and/or Flat C, remove the two M6 socket head cap screws securing the module(s) to the Tool Changer body. Refer to *Figure 5.2*
2. If equipped, lift off the optional modules from Flat B and/or Flat C.
3. Remove the three M3 socket flat head cap screws and three cable retaining tabs on Flat C of the Tool Changer body.
4. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat B of the Tool Changer body.
5. Disconnect at the cable connections on Flat C.
6. If replacing the sensor assemblies, continue to Step *7*. If replacing the extension cables, continue to Step *14*.
7. Remove the two M3 socket head cap screws that secure the Lock and/or Unlock sensor assembly to the Tool Changer body. Pull the sensor assembly straight out from the Tool Changer body.
8. Remove the Lock and/or Unlock sensor assembly from the cable channel of the Tool Changer body. There is an O-ring around the cylinder barrel, ensure O-ring came off with old sensor before continuing. Discard the removed sensor assembly.

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

Figure 5.2— Lock and Unlock Sensor Assemblies (L1/U1) Replacement



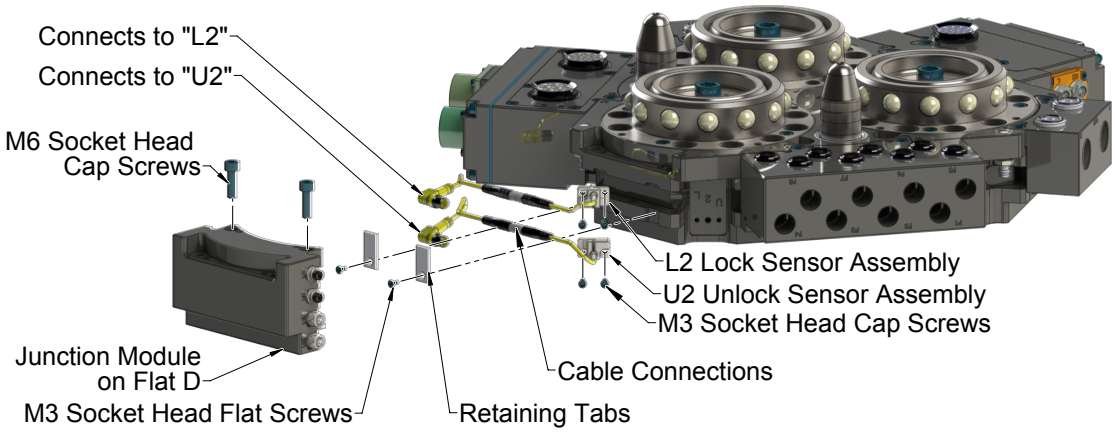
9. Install the new Lock and/or Unlock sensor assembly, routing the cable into the cable channel of the Tool Changer body.
10. Connect the Lock and/or Unlock sensor cable connectors to the proper cable connections on Flat C.
11. Insert the Lock and/or Unlock sensor assembly into the Tool Changer body as shown in *Figure 5.2*. Ensure that new O-ring is in place before inserting sensor.
12. Secure the sensor assembly using the two M3 socket head cap screws. Tighten to 12 in-lbs (1.4 Nm).
13. Secure the cables to Flat B using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact. Continue to Step *18*.
14. Disconnect the extension cable from the connectors on the Junction Module on Flat D.
15. Connect the new extension cable connectors to the proper cable connections on Flat C.
16. Connect the new extension cable connectors to the proper connections on the Junction Module on Flat D
17. Route the new extension cable into the cable channel of the Tool Changer body.
18. Secure the cables to Flat C using the three M3 socket flat head cap screws and three cable retaining tabs. Tighten to contact.
19. If optional modules were installed on Flat B and/or Flat C, install modules.
20. If fasteners do not have pre-applied adhesive, apply Loctite 242® to the M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Tool Changer body and tighten to 70 in-lbs (7.9 Nm).
21. 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.
22. 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.

5.1.3 Lock and Unlock Sensor Assemblies (L2/U2) and Cable Replacement

1. Using a pen or marker, mark the cable connections with the corresponding connectors on the Junction Module on Flat D, for ease of reassembly
2. Disconnect all the cable connections from the Junction Module on Flat D. Refer to *Figure 5.3*
3. Remove the two M6 socket head cap screws securing the Junction Module to the Flat D of the Tool Changer body.
4. Lift off the Junction Module from Flat D.
5. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat D of the Tool Changer body.
6. Disconnect the cable connections on Flat D.
7. If replacing the sensor assemblies, continue to Step *8*. If replacing the extension cables, continue to Step *12*.
8. Remove the two M3 socket head cap screws that secure the Lock and/or Unlock sensor assembly to the Tool Changer body. Pull the sensor assembly straight out from the Tool Changer body.
9. Remove the Lock and/or Unlock sensor assembly from the cable channel of the Tool Changer body. There is an O-ring around the cylinder barrel, ensure O-ring came off with old sensor before continuing. Discard the removed sensor assembly.

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

Figure 5.3— Lock and Unlock Sensor Assemblies (L2/U2) Replacement



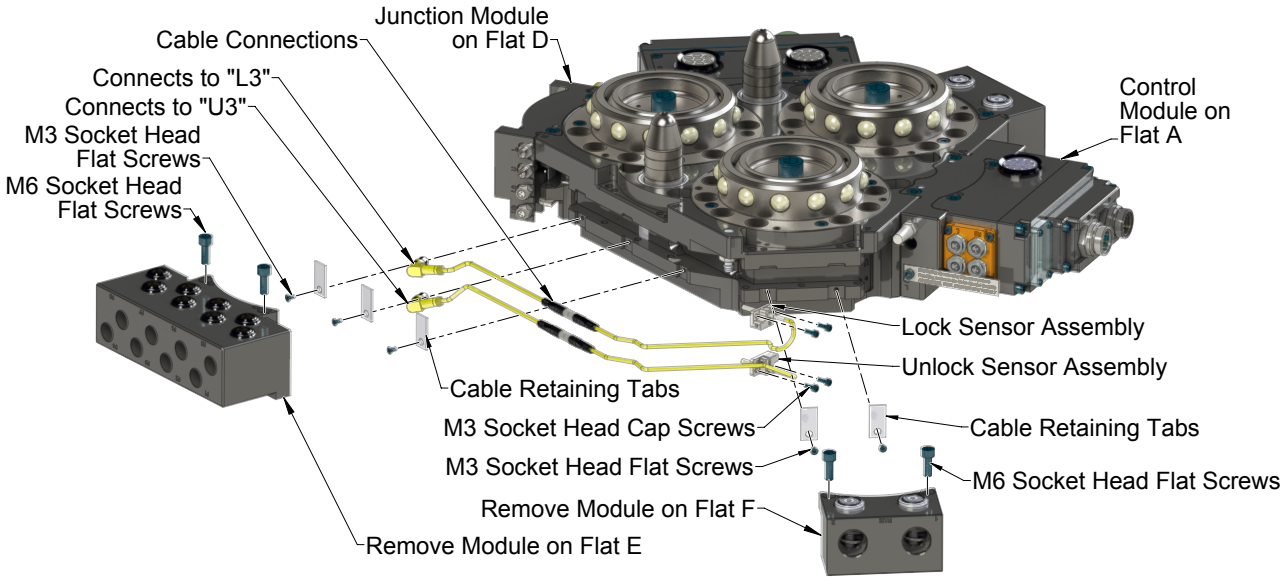
10. Insert the Lock and/or Unlock sensor assembly into the Tool Changer body as shown in *Figure 5.3*. Ensure that new O-ring is in place before inserting sensor.
11. Secure the sensor assembly using the two M3 socket head cap screws. Tighten to 12 in-lbs (1.4 Nm).
12. Connect the cable connectors to the proper cable connections on Flat D.
13. Route the cables into the cable channel of the Tool Changer body.
14. Secure the cables to Flat D using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact.
15. Install the Junction Module on Flat D.
16. If fasteners do not have pre-applied adhesive, apply Loctite 242® to the M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Tool Changer body and tighten to 70 in-lbs (7.9 Nm).
17. Connect all cable connection to corresponding connectors on the Junction Module, as previously marked.
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.

5.1.4 Lock and Unlock Sensor Assemblies (L3/U3) and Cable Replacement

1. If there is an optional module on Flat E and/or Flat F, remove the two M6 socket head cap screws securing the module(s) to the Tool Changer body. Refer to *Figure 5.4*
2. If equipped, lift off the optional modules from Flat E and/or Flat F.
3. Remove the three M3 socket flat head cap screws and three cable retaining tabs on Flat E of the Tool Changer body.
4. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat F of the Tool Changer body.
5. Disconnect the cable connectors on Flat E.
6. If replacing the sensor assemblies, continue to Step *7*. If replacing the extension cables, continue to Step *12*.
7. Remove the two M3 socket head cap screws that secure the Lock and/or Unlock sensor assembly to the Tool Changer body. Pull the sensor assembly straight out from the Tool Changer body.

8. Remove the Lock and/or Unlock sensor assembly from the cable channel of the Tool Changer body. There is an O-ring around the cylinder barrel, ensure O-ring came off with old sensor before continuing. Discard the removed sensor assembly.

Figure 5.4— Lock and Unlock Sensor Assemblies (L3/U3) Replacement



9. Install the new Lock and/or Unlock sensor assembly, routing the cable into the cable channel of the Tool Changer body.
10. Connect the Lock and/or Unlock sensor cable connectors to the proper connections on the Junction Module on Flat D.
11. Insert the Lock and/or Unlock sensor assembly into the Tool Changer body as shown in *Figure 5.4.* Ensure that new O-ring is in place before inserting sensor.
12. Connect the cable connectors to the proper cable connections on Flat E.
13. Route the cables into the cable channel of the Tool Changer body.
14. Secure the cables to Flat F using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact.
15. Secure the cables to Flat E using the three M3 socket flat head cap screws and three cable retaining tabs. Tighten to contact.
16. If optional modules were installed on Flats E and/or Flat F, install modules.
17. If fasteners do not have pre-applied adhesive, apply Loctite 242® to the M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Tool Changer body and tighten to 70 in-lbs (7.9 Nm).
18. Confirm the operation of the cables 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 cables 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 Ready-to-Lock Sensor and Cable Replacement

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

WARNING: Do not perform maintenance or repair on Tool Changer or modules unless the Tool is safely supported or docked in the Tool Stand and all energized circuits (e.g., electrical, air, water, etc.) have been turned off. Injury or equipment damage can occur with Tool not docked and energized circuits on. Dock the Tool safely in the Tool Stand and turn off all energized circuits before performing maintenance or repair on Tool Changer or modules.

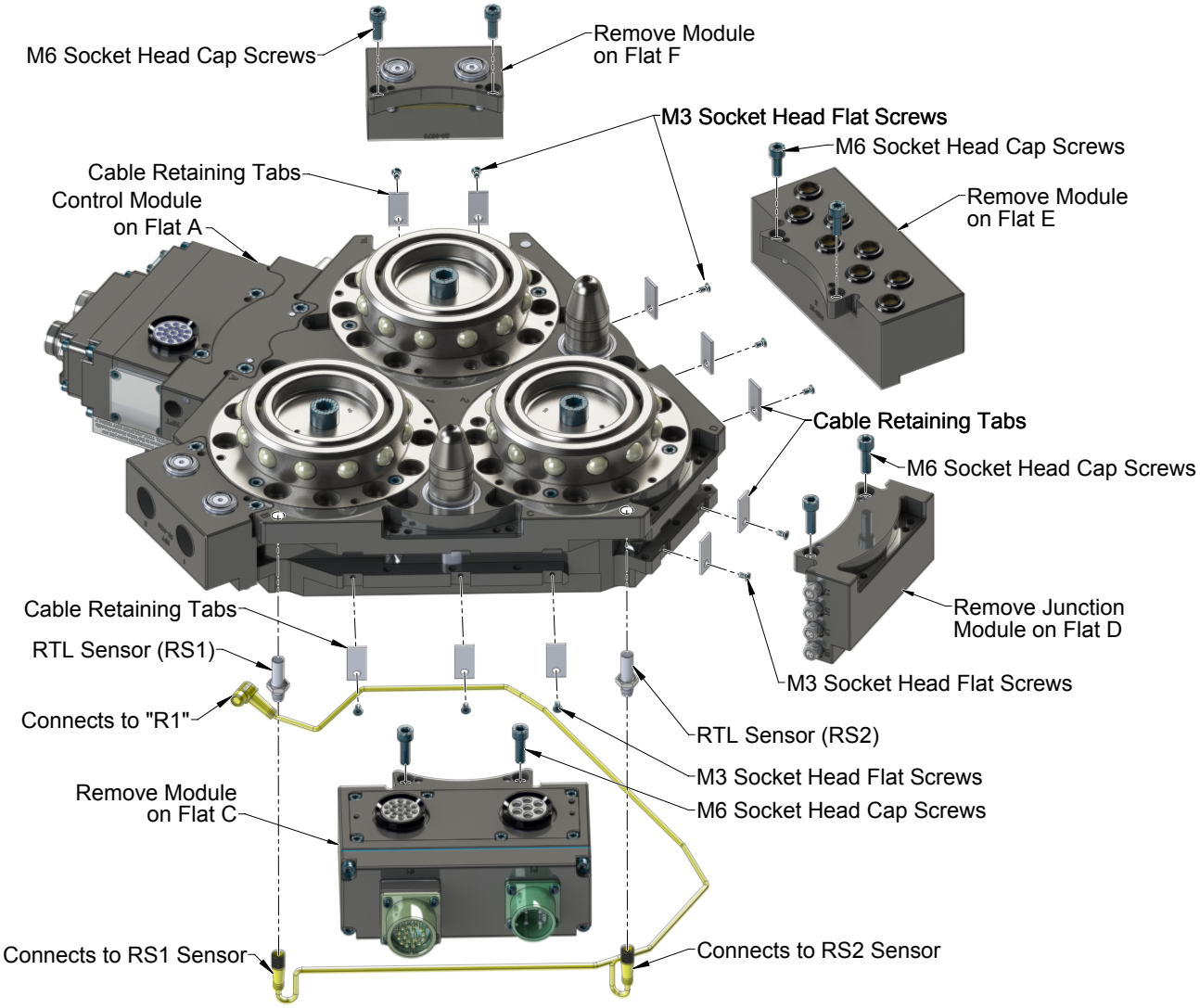
5.2.1 RTL Sensor Replacement (RS1/RS2)

1. Disconnect the RTL sensor cable from the sensor. Refer to *Figure 5.5*
2. Loosen the jam nut securing the sensor to the Tool Changer body.
3. Unscrew the RTL sensor from the Tool Changer body.
4. Discard the removed RTL sensor.
5. Apply Loctite 222® to and screw the new RTL sensor into the Tool Changer body until the face of the sensor is flush with the surrounding face of the master body.
6. Tighten the jam nut securing the sensor to the Tool Changer body. Torque to 20 in-lbs.
7. Connect the RTL sensor cables the new sensor.
8. 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.

5.2.2 RTL Cable Replacement (R1 to RS1/RS2)

1. Using a pen or marker, mark the cable connections with the corresponding connectors on the Junction Module on Flat D, for ease of reassembly
2. Disconnect all the cable connections from the Junction Module on Flat D. Refer to *Figure 5.5*
3. Remove the two M6 socket head cap screws securing the Junction Module to the Flat D of the Tool Changer body.
1. Lift off the Junction Module from Flat D.
2. If there is an optional module on Flat C, Flat E, and/or Flat F, remove the two M6 socket head cap screws securing the module(s) to the Tool Changer body.
3. If equipped, lift off the optional modules from Flat C, Flat E, and/or Flat F.
4. Remove the three M3 socket flat head cap screws and three cable retaining tabs on Flat C of the Tool Changer body.
5. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat D of the Tool Changer body.
6. Remove the three M3 socket flat head cap screws and three cable retaining tabs on Flat E of the Tool Changer body.
7. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat F of the Tool Changer body.
8. Disconnect the cable from the RS1 and RS2 Sensors.
9. Disconnect the cable from the Control Module on Flat A.
10. Remove the cable from the cable channel of the Tool Changer body. Discard the worn cable.

Figure 5.5— RTL Cable Replacement (R1 to RS1/RS2)



11. Connect the new cable connector to the Control Module on Flat A.
12. Connect the new cable to the RS1 and RS2 Sensors.
13. Route the new cable into the cable channel of the Tool Changer body.
14. Secure the cables to Flat C using the three M3 socket flat head cap screws and three cable retaining tabs. Tighten to contact.
15. Secure the cables to Flat D using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact.
16. Secure the cables to Flat E using the three M3 socket flat head cap screws and three cable retaining tabs. Tighten to contact.
17. Secure the cables to Flat F using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact.
18. If optional modules were installed on Flats E and/or Flat F, install modules.
19. Install the Junction Module on Flat D.
20. If fasteners do not have pre-applied adhesive, apply Loctite 242® to the M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Tool Changer body and tighten to 70 in-lbs (7.9 Nm).

21. Connect all cable connection to corresponding connectors on the Junction Module, as previously marked.
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.

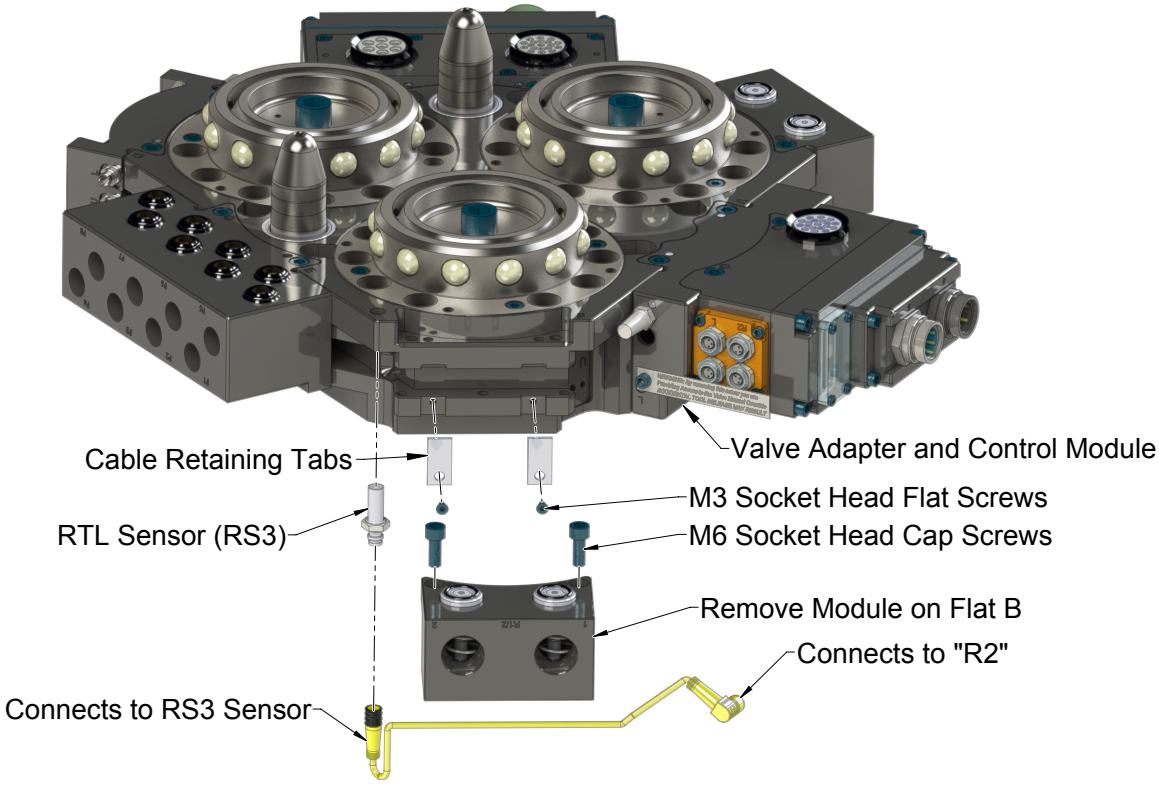
5.2.3 RTL Sensor Replacement (RS3)

1. Disconnect the RTL sensor cable from the sensor. Refer to *Figure 5.6*
2. Loosen the jam nut securing the sensor to the Tool Changer body.
3. Unscrew the RTL sensor from the Tool Changer body.
4. Discard the removed RTL sensor.
5. Apply Loctite 222® to and screw the new RTL sensor into the Tool Changer body until the face of the sensor is flush with the surrounding face of the master body.
6. Tighten the jam nut securing the sensor to the Tool Changer body. Torque to 20 in-lbs.
7. Connect the RTL sensor cables the new sensor.
8. 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.

5.2.4 RTL Cable Replacement (R2 to RS3)

1. If there is an optional module on Flat B, remove the two M6 socket head cap screws securing the module(s) to the Tool Changer body. Refer to *Figure 5.6*
2. If equipped, lift off the optional modules from Flat B.
3. Remove the two M3 socket flat head cap screws and two cable retaining tabs on Flat B of the Tool Changer body.
4. Disconnect the cable from the RS3 Sensor.
5. Disconnect the cable from the Control Module on Flat A.
6. Remove the cable(s) from the cable channel of the Tool Changer body. Discard the worn cable.

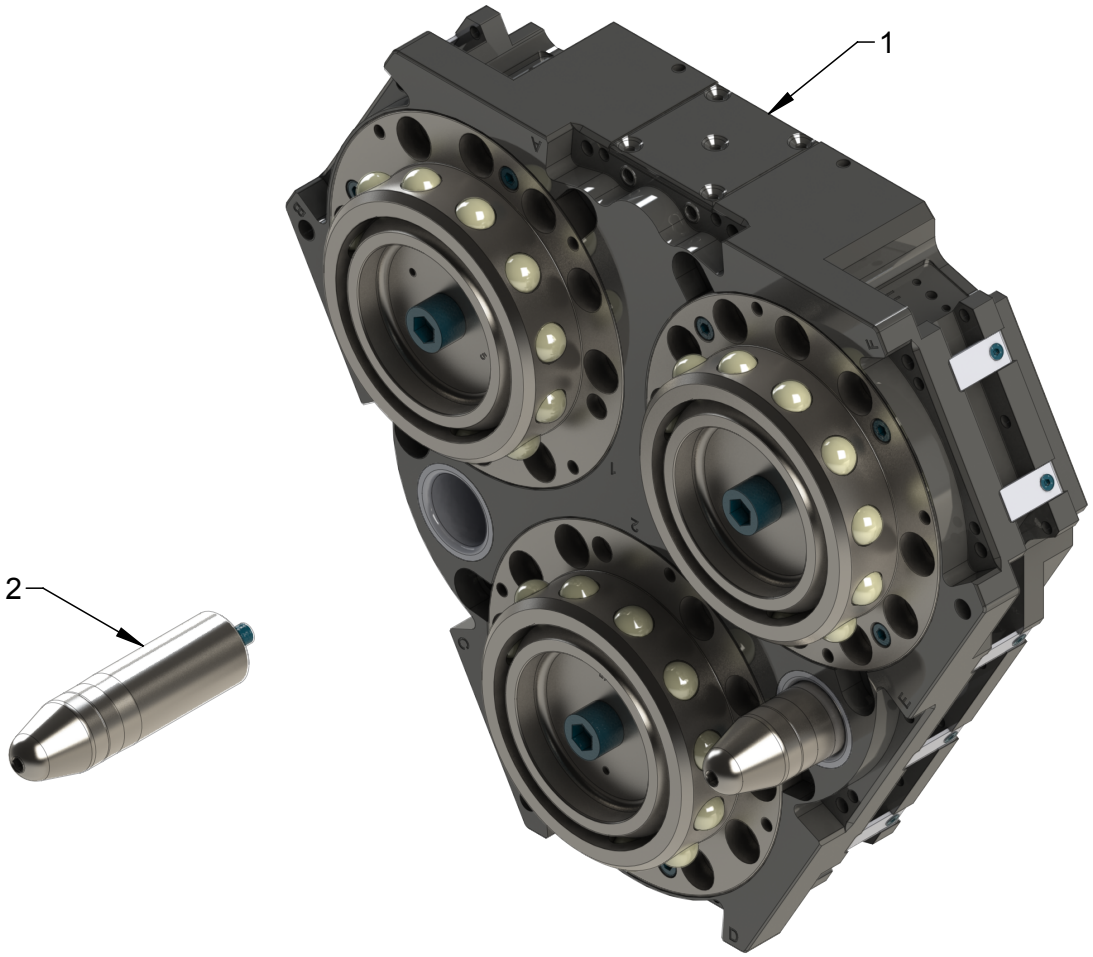
Figure 5.6— RTL Cable Replacement (R1 to RS1/RS2)



7. Connect the new cable connector to the Control Module on Flat A.
8. Connect the new cable to RS3 Sensor.
9. Route the new cable into the cable channel of the Tool Changer body.
10. Secure the cables to Flat B using the two M3 socket flat head cap screws and two cable retaining tabs. Tighten to contact.
11. If optional modules were installed on Flats B, install modules.
12. If fasteners do not have pre-applied adhesive, apply Loctite 242® to the M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Tool Changer body and tighten to 70 in-lbs (7.9 Nm).
13. 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 Master Parts



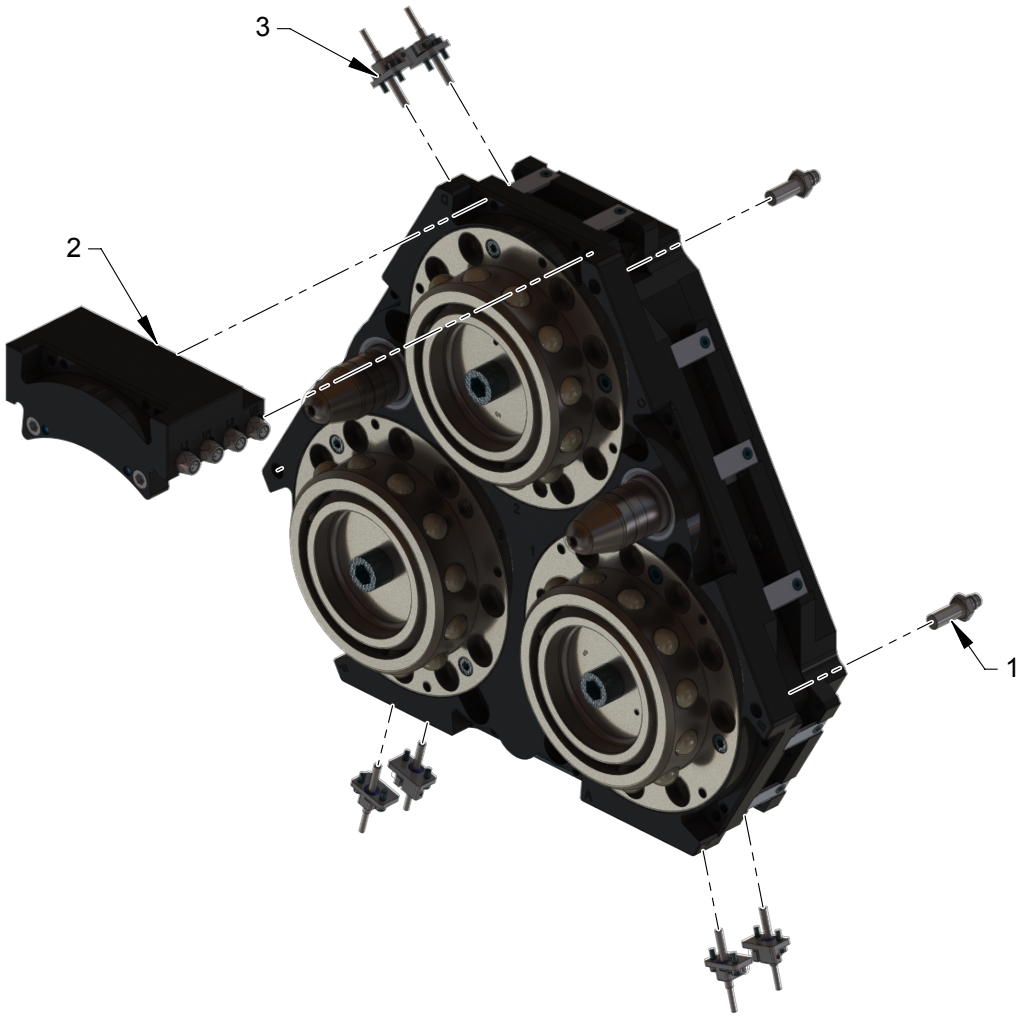
Common Master Parts

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	2	9121-1510xM-0-0-0-0	Complete QC-1510 Master Plate, No Options
2	1	9005-20-1569	Alignment Pin, Two Piece, 1-1/8” Dia., Stepped

Notes:

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

6.2 Models 9121-1510xM-0-0-0-0-SL and 9121-1510xM-0-0-0-0-SE



9121-1510xM-0-0-0-0-SL

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	3	8590-9909999-34	True 2 PNP Proximity Sensor
2	1	9005-20-1604	QC-1510 Master Junction Module Assembly,Potted
3	6	9005-20-1613	Lock/Unlock Sensor Assembly, QC-1510 (PNP)

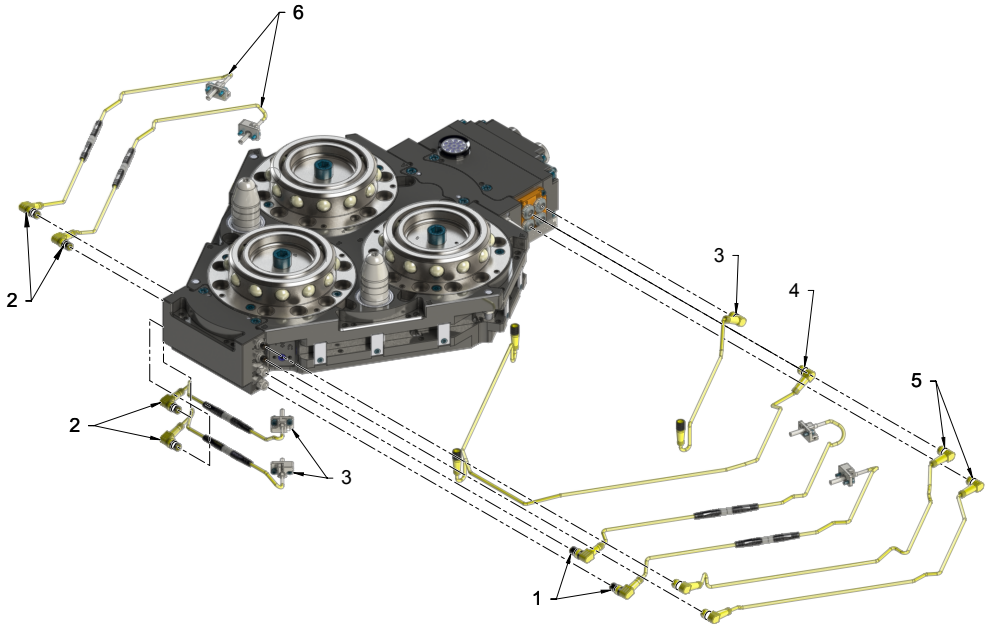
9121-1510xM-0-0-0-0-SE

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	3	8590-9909999-120	-NPN Prox (True 2mm), M8 w/ M8 conn
2	1	9005-20-1604	QC-1510 Master Junction Module Assembly,Potted
3	6	9005-20-1780	Lock/Unlock Sensor Assembly, NPN Wired .17M Straight, Male Penta

Notes:

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

6.3 Cables for Models 9121-1510xM-0-0-0-0-SL and 9121-1510xM-0-0-0-0-SE



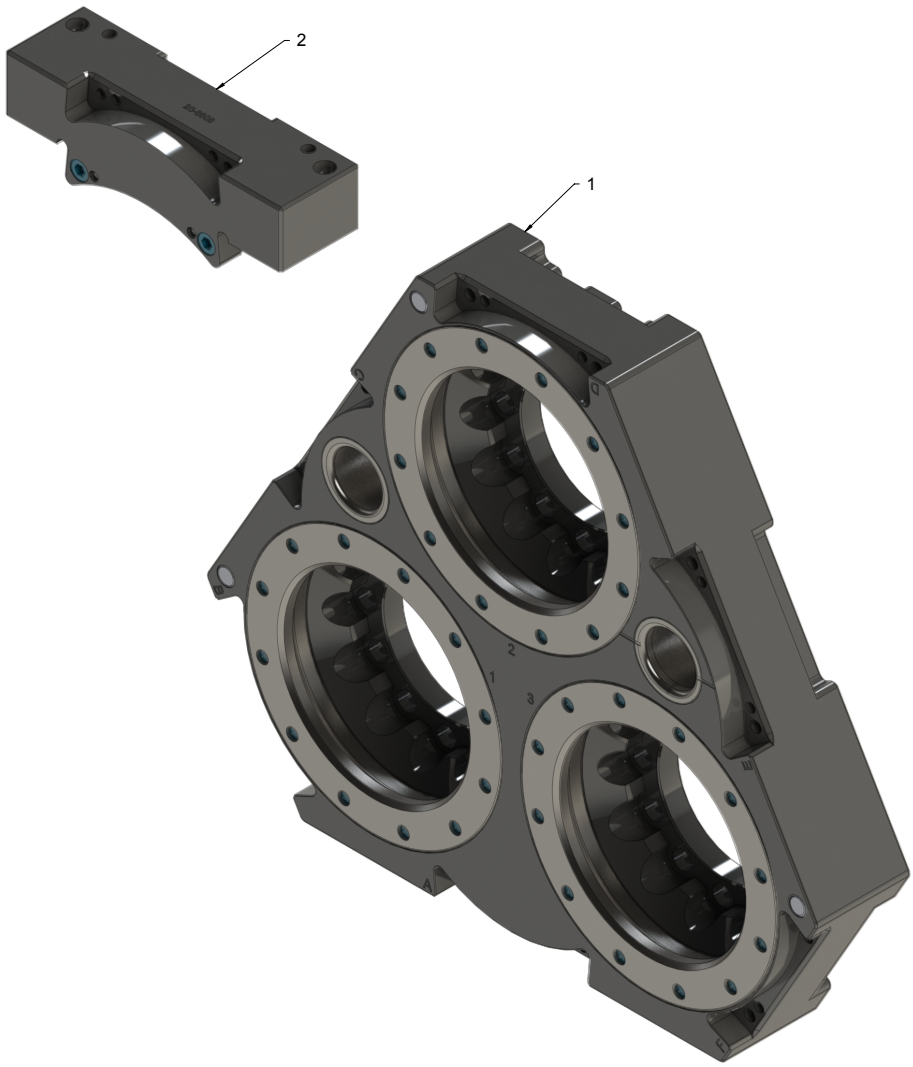
9121-1510xM-0-0-0-0-SL

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	CONNECTIONS
1	4	9120-C-3M5F-3PM90-0020	Cordset, Pentafast 3-Pin Straight Female to Picofast 3-Pin Male Right Angle Threaded to, 0.2 m	L1 to L1, U1 to U1, L3 to L3, U3 to U3
2	2	9120-C-3M5F-3PM90-0016	Cordset, Pentafast 3-Pin Straight Female to Picofast 3-Pin Male Right Angle Threaded, 0.16 m	L2 to L2, U2 to U2
3	1	9120-C-3PF-3PM90-0030	Picofast Cordset, 3-Pin Straight Female Q-Conn to 3-Pin Male Right Angle LED Threaded, 0.30 m	R2 to RS3
4	1	9120-C-3PF-3PF-3PM90	QC-1510 Picofast Cable for Series Wiring of RS1 and RS2 Sensors	R1 to RS1 and RS2
5	2	9120-C-3PF90-3PM90-0041	Picofast Cordset, 3-Pin Right Angle Female Threaded to 3-Pin Male Right Angle LED Threaded, 0.41 m	L to L, U to U
6	6	9005-20-1613	Lock/Unlock Sensor Assembly, QC-1510 (PNP)	Sensor

9121-1510xM-0-0-0-0-SE

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	CONNECTIONS
1	4	9120-C-3M5F-3PM90-0020	Cordset, Pentafast 3-Pin Straight Female to Picofast 3-Pin Male Right Angle Threaded to, 0.2 m	L1 to L1, U1 to U1, L3 to L3, U3 to U3
2	2	9120-C-3M5F-3PM90-0016	Cordset, Pentafast 3-Pin Straight Female to Picofast 3-Pin Male Right Angle Threaded, 0.16 m	L2 to L2, U2 to U2
3	1	9120-C-3PF-3PM90-0030-NPN	Picofast Cordset, 3-Pin Straight Female Q-Conn to 3-Pin Male Right Angle NPN LED Threaded, 0.30 m	R2 to RS3
4	1	9120-C-3PF-3PF-3PM90-NPN	QC-1510 Picofast Cable for Series Wiring of RS1 and RS2 NPN Sensors	R1 to RS1 and RS2
5	2	9120-C-3PF90-3PM90-0041	Picofast Cordset, 3-Pin Right Angle Female Threaded to 3-Pin Male Right Angle LED Threaded, 0.41 m	L to L, U to U
6	6	9005-20-1780	Lock/Unlock Sensor Assembly, NPN Wired .17M Straight, Male Penta	Sensor

6.4 Tool Plate



Tool Plate

ITEM NO.	QTY	PART NUMBER	DESCRIPTION
1	1	9121-1510xT-0-0-0-0	QC-1510 Base Tool Assembly, No Options
2	1	9005-20-1605	QC-1510 Tool Junction Module Adapter Assembly

Notes:

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

7. Specifications

Master and Standard Tool Plates

Recommended Max Payload	2980 lbs. (1350kg)	The mass attached to the Tool Changer.
Operating Temperature Range	-20–150°F (-30–66°C)	
Operating Pressure Range	70–100 psi (4.8–6.9 bar)	Locking mechanism supply pressure operating range. Supply to be clean, dry, and filtered to 50 micron or better.
Coupling Force @ 80 psi	21,000 lbs. (9,525 kg)	Axial holding force
Recommended Max Moment X-Y (Mxy) Recommended Max Torque about Z (Mz)	**48,000 in-lb** **5,423 (Nm)** **48,000 in-lb** **5,423 (Nm)**	Maximum recommended working load for optimum performance of the Tool Changer Maximum recommended working torque for optimum performance of the Tool Changer
Positional Repeatability	0.0006” (0.015 mm)	Repeatability tested at rated load at one million cycles.
Weight (coupled, no access.)	62 lbs. (28 kg)	Master 40 lbs (18 kg) / Tool 22 lbs (10 kg)
Max. Recommended distance between Master and Tool Plate	0.04” (1 mm)	No-Touch™ locking technology allows the Master and Tool Plates to lock with separation when coupling.
Sensor Information, signal name	L/U (Lock/Unlock) RTL (Ready-To-Lock)	Internal proximity sensors (6) with cable and connector to indicate locking mechanism position. Proximity sensors (3) with cable and connector for direct wiring to control/signal module to indicate Master and Tool mating surfaces within close proximity of each other.
Mounting/Customer Interface	Master Plate Tool Plate	See *Section 8—Drawings*

8. Drawings

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