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B. Base Tool Changer

QC-76 Series—Robotic Tool Changer

1. Product Overview

ATI Tool Changers enhance the versatility of a robot by enabling the use of multiple customer tools, such as: grippers, vacuum cup tooling, pneumatic and electric motors, weld guns, and more.

The Tool Changer consists of a Master plate, which is attached to the robot arm, and a Tool plate, which is attached to customer tooling. When the robot picks up the customer tooling, a pneumatically-driven locking mechanism couples the two plates. The patented, fail-safe locking mechanism utilizes a multi-tapered cam with ball locking technology to ensure the Tool Changer does not uncouple if air pressure falls below 60 psi (4.1 bar) during operation.

The robot can be programmed to select the desired customer tooling by coupling the Master plate to the Tool plate. Electricity, fluid, and other forces of energy transfer to the customer tooling through optional modules that are attached to the Master and Tool plates. Refer to the ATI website for compatible modules or contact an ATI sales representative for more details.

For the most current product information and specifications on the QC-76 Series of Tool Changers, click the following link: *QC-76 Series*

1.1 Master Plate Assembly

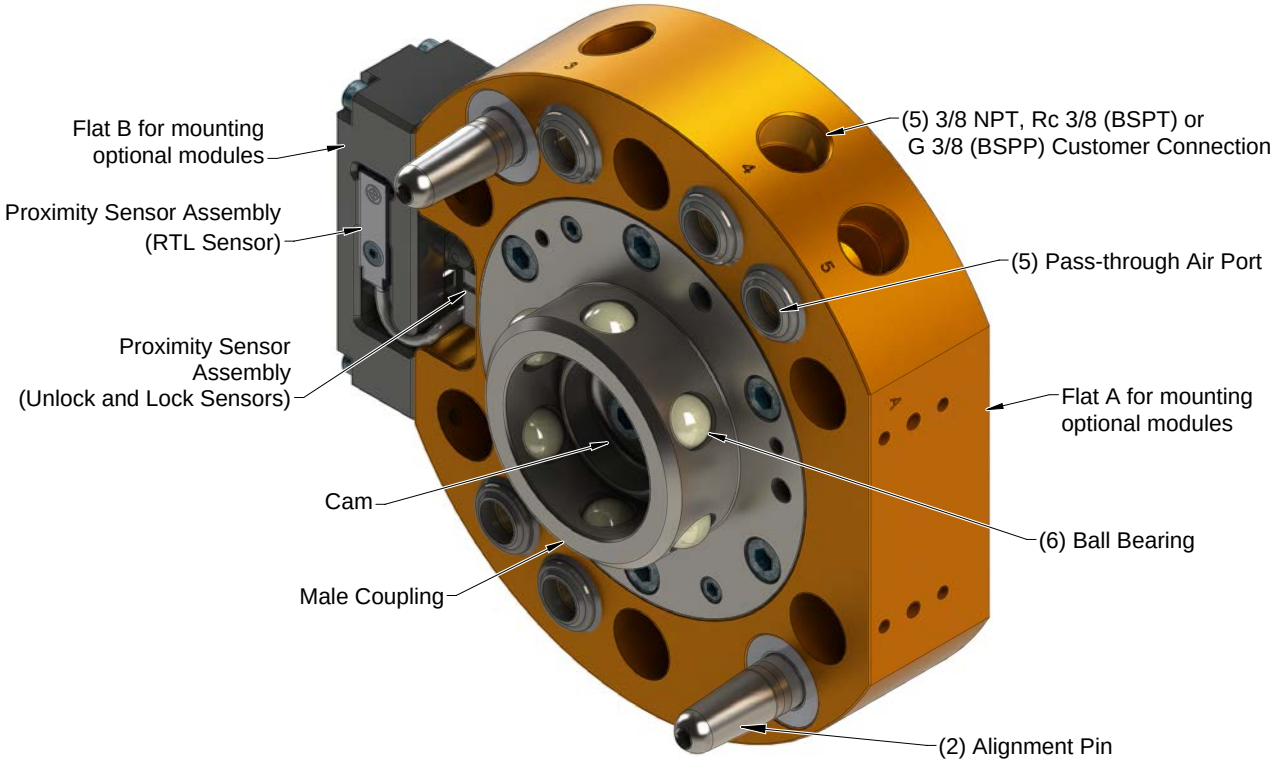
The Master plate assembly includes the following features:

- An anodized aluminum body
- A hardened stainless steel locking mechanism (a cam, male coupling, and chrome steel ball bearings)
- Hardened stainless steel alignment pins that mate with bushings on the Tool plate
- (2) flats for mounting optional modules
- (2) 1/8 NPT, G 1/8 (BSPP) or Rc 1/8 (BSPT) connections to supply pneumatic pressure for coupling and uncoupling the Tool Changer
- (5) 3/8 NPT, G 3/8 (BSPP) or Rc 3/8 (BSPT) connections to pass air and/or vacuum through the Tool Changer
- Proximity sensor assemblies are used to verify the lock/unlock position of the piston and cam
- A machined mounting pattern for mounting to a robot arm or an interface plate

An optional RTL sensor and sensor block used to verify Tool plate presence when coupled, can be ordered separately.

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.

Figure 1.1—Master Plate Assembly (Shown with Optional Sensors)



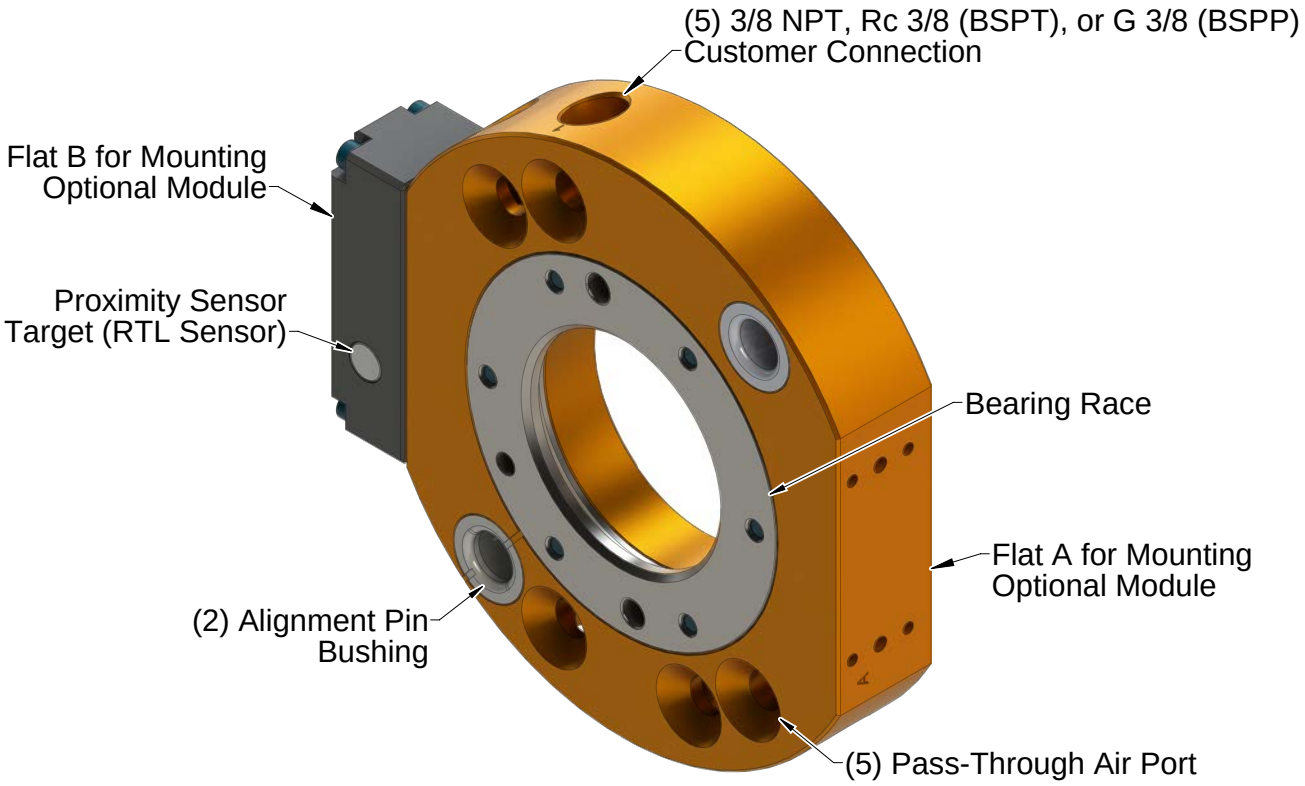
1.2 Tool Plate Assembly

The Tool plate assembly includes the following features:

- An anodized aluminum body
- A hardened stainless steel bearing race
- Alignment bushings that mate with pins on the Master plate
- (5) 3/8 NPT, G 3/8 (BSPP) or Rc 3/8 (BSPT) connections to pass air/or vacuum through the Tool Changer
- (2) flats for mounting optional modules
- A machined mounting pattern for mounting to customer tooling or an interface plate

An optional RTL sensor target and sensor block used to verify Tool plate presence when coupled, can be ordered separately.

Figure 1.2—Tool Plate Assembly



1.3 Optional Modules

There are (2) flats for mounting optional modules with the J16 mounting pattern, which pass utilities to customer tooling. The J16 mounting is a M4X0.7 thread on an 18 mm high and 50 mm wide rectangular pattern.

For assistance in choosing the modules for your particular application, visit our website (*QC-76 Series*) to see what is available or contact an ATI sales representative directly.

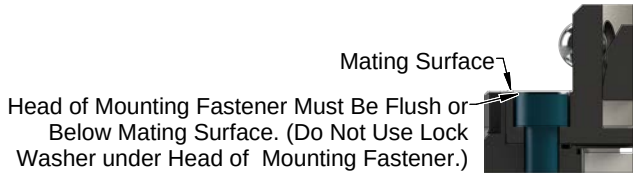
2. Installation

The Master plate of the Tool Changer mounts to the robot arm using an interface plate. Custom interface plates are available from ATI. Refer to *Section 2.1—Master Interface* for more information.

The end-effector is typically attached to the Tool plate with an interface plate. Standard and custom interface plates are available from ATI upon request. Refer to *Section 2.4—Tool Interface* for more information.

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

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



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

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

Table 2.1—Fastener Size, Class, and Torque Specifications

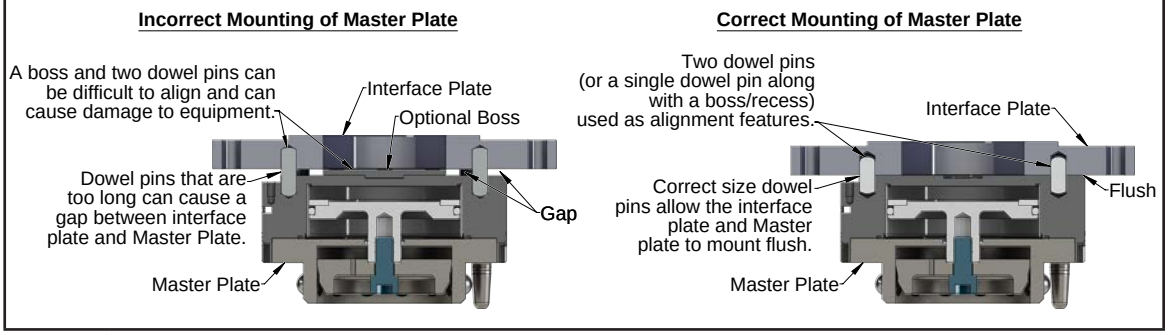
Mounting Conditions	Fastener Size & Property Class	Recommended Torque	Thread Locker
Master Plate to Robot Interface Plate (6061-T6 aluminum) Minimum thread engagement of 15 mm (0.59 in) [1.5 X fastener Ø]. *Confirm available engagement with Robot Manufacturer*	M10-1.5 Class 12.9	52 N-m (38 ft-lbs.)	Pre-applied adhesive or Loctite 242®
Master Plate to Robot (steel; USS ≥ 90 KSI) Minimum thread engagement of 10 mm (0.39 in) [1.0 X fastener Ø]. *Confirm available engagement with Robot Manufacturer*	M10-1.5 Class 12.9	52 N-m (38 ft-lbs.)	
Tool Interface Plate to Tool Plate (7075-T6 aluminum) Minimum thread engagement of 15 mm (0.59 in) [1.5X fastener Ø].	M10-1.5 Class 12.9	52 N-m (38 ft-lbs.)	
Optional Module or adapter plate to Master or Tool plate, Supplied Fasteners	M4 x 0.7 Class 12.9		Pre-applied Adhesive or Loctite 222
	Socket Head Cap	20 in-lbs (2.26 Nm)	
	Socket Flat Head Cap	15 in-lbs (1.69 Nm)	

2.1 Master Interface

The Master plate is typically attached to the robot arm. An interface plate can adapt the Master plate to a specific robot arm. Alignment features (dowel holes and bosses) accurately position and bolt holes secure the Master plate to the robot arm or an interface plate. Custom interface plates are available from ATI upon request (refer to the drawings for technical information on mounting features.)

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

CAUTION: Do not use dowel pins that are too long or do not allow the interface plate and Master body to mate flush. Using dowel pins that are too long will cause a gap between the interface plate and Master body and damage the equipment. Use dowel pins that will not extend further than allowed by the Master body.



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

- The interface plate should include bolt holes for mounting and either two dowel pins or a dowel pin and a boss for accurate positioning on the robot and Master plate. The dowel and boss features prevent unwanted rotation. Refer to the robot manual for robot mounting features.
- The thickness of the interface plate must be sufficient to provide the necessary thread engagement for the mounting bolts.
- Dowel pins must not extend out from the surface of the interface plate farther than the depth of the dowel holes in the Master plate.
- If a boss is used on the Master plate, a recess of proper depth and diameter must be machined into the interface plate to correspond with the boss on the Master plate.
- Mounting bolts that are too long can create a gap between the interface plate and the Master plate, which can damage equipment.
- The interface plate must provide rigid mounting to the Master plate.
- The interface plate design must account for clearances required for Tool Changer module attachments and accessories.

2.2 Master Plate Installation

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

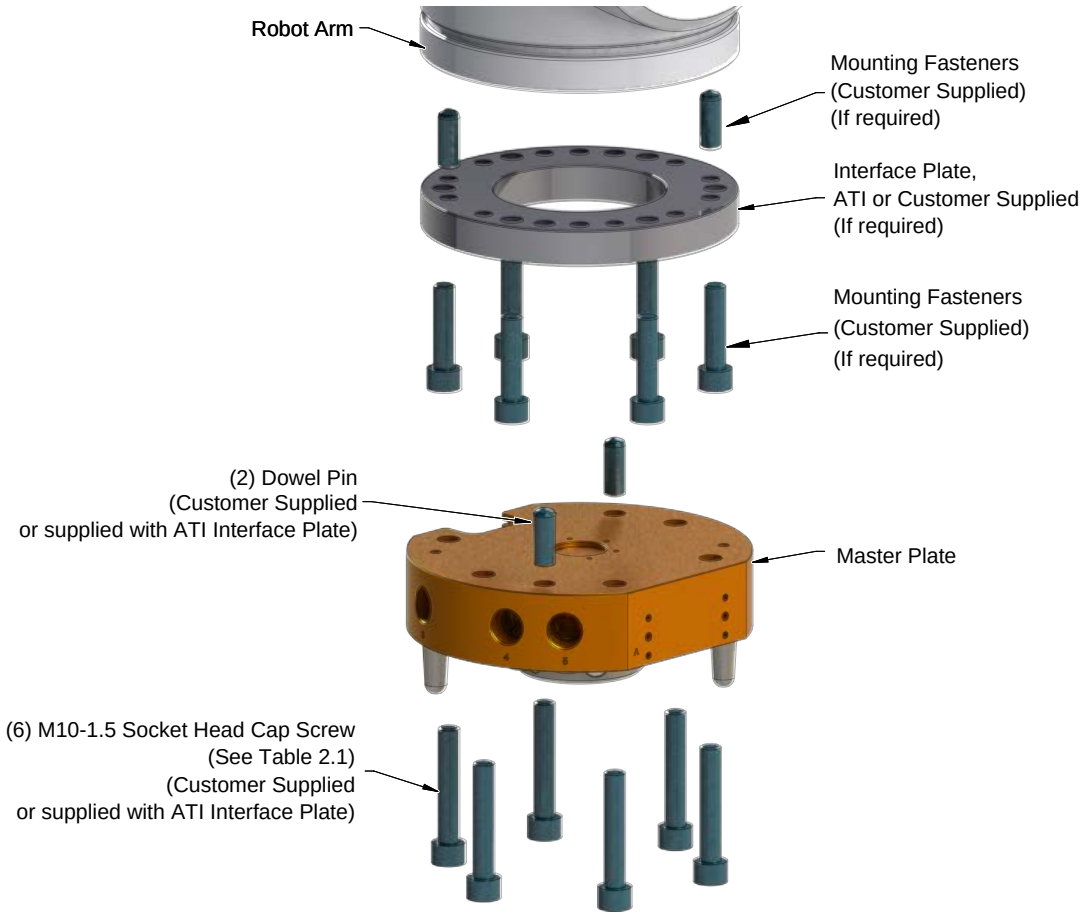
Supplies required: *Clean rag, Loctite 242*

1. Wipe down the mounting surfaces with a clean rag.
2. If required, install the interface plate to the robot arm, align using the boss or dowel pins, and secure with customer supplied fasteners.
3. Align the dowel pins to the corresponding holes in the Master plate.
4. Secure the Master plate to the robot arm or interface plate with customer supplied (6) M10-1.5 shoulder head cap screws using an 8 mm hex key.
5. For first time installation of fasteners with pre-applied adhesive, no additional Loctite is required. If fasteners are being reused, apply Loctite to threads (see *Table 2.1* for fastener specifications).
6. If equipped, connect the Lock and Unlock sensor cables, refer to *Section 5.2.1—Lock and Unlock Sensor Replacement (Quick Disconnect)* or *Section 5.2.2—Lock and Unlock Sensor Replacement (Hard Wired)*.

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

7. Connect all Lock / Unlock and pass through air connections to the Master plate. For Lock and Unlock air, refer to *Section 2.7—Optional Module Installation*.
8. Connect utilities to the optional modules and Master plate connections.
9. Safely resume normal operation.

Figure 2.1—Typical Master Plate Installation



2.3 Master Plate Removal

Refer to *Figure 2.1*.

Tools required: *8 mm hex key*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Disconnect all utilities (for example: electrical, pneumatic, and hydraulic).

NOTICE: Support the Master plate while removing the fasteners.

5. Remove the (6) M10-1.5 shoulder head cap screws connecting the Master plate to the robot arm or an interface plate, using an 8 mm hex key.

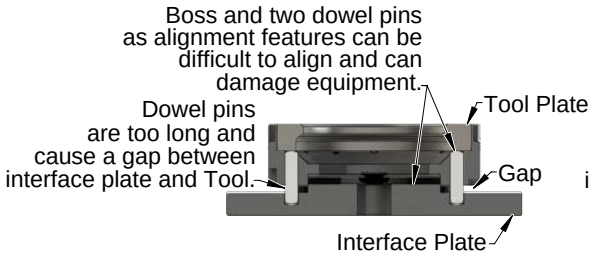
2.4 Tool Interface

The Tool plate is attached to the customer's tooling. An interface plate can adapt the Tool plate to customer tooling. Alignment features (dowel holes and a recess) accurately position and bolt holes to secure the Tool plate to customer tooling. Custom interface plates can be supplied by ATI (refer to the application drawing).

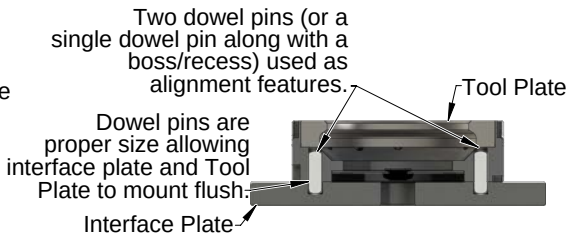
CAUTION: Do not use more than two alignment features when securing a Tool plate to an interface plate. Using more than two alignment features can cause damage to equipment. Use either two dowel pins or a single dowel pin, along with a boss/recess feature to align the Tool plate with the interface plate.

CAUTION: Do not use dowel pins that are too long or do not allow the interface plate and Tool body to mate flush. Using dowel pins that are too long will cause a gap between the interface plate and Tool body and damage the equipment. Use dowel pins that will not extend further than allowed by the Tool body.

Incorrect Mounting of Tool Plate



Correct Mounting of Tool Plate



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

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

2.5 Tool Plate Installation

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

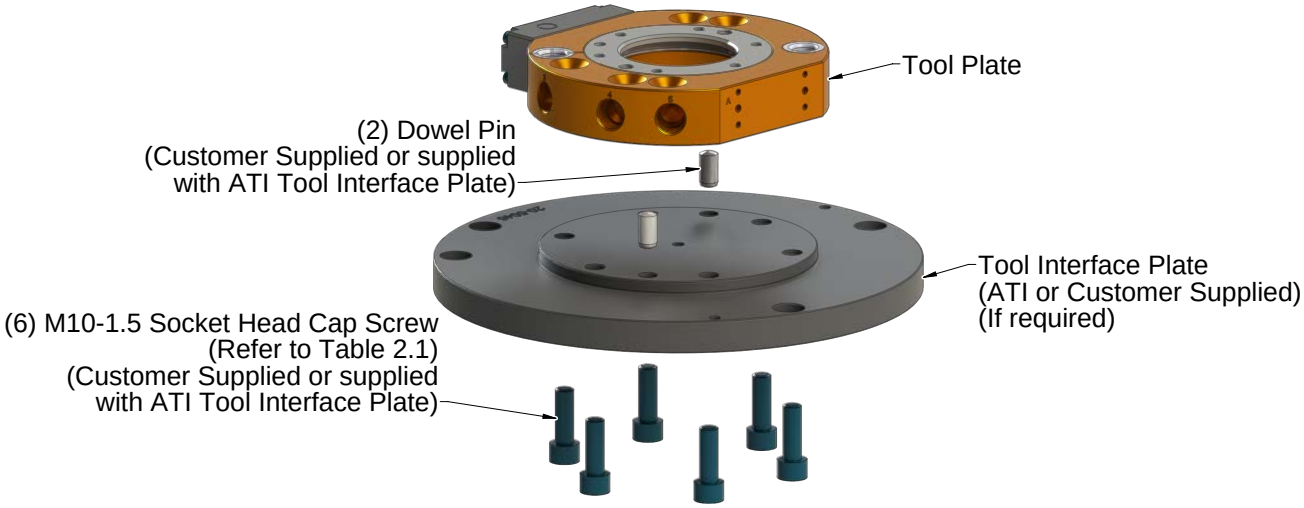
Supplies required: *Clean rag, Loctite 242*

1. Wipe down the mounting surfaces with a clean rag.
2. If required, install the tool interface plate to the customer tooling. Align using the boss or dowel pins and secure with customer supplied fasteners.
3. Install the Tool plate by aligning 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.
4. For first time installation of fasteners with pre-applied adhesive, no additional Loctite is required. If reusing fasteners, apply Loctite to threads (see *Table 2.1* for fastener specifications).

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

5. Connect utilities to the optional modules and Tool plate connections.
6. Safely resume normal operation.

Figure 2.2—Standard Tool Plate Installation



2.6 Tool Plate Removal

Tools required: *8 mm hex key*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Disconnect all utilities (for example: electrical, pneumatic, and hydraulic).
5. Remove the socket head cap screws that connect the Tool plate to the tooling or interface plate.

2.7 Optional Module Installation

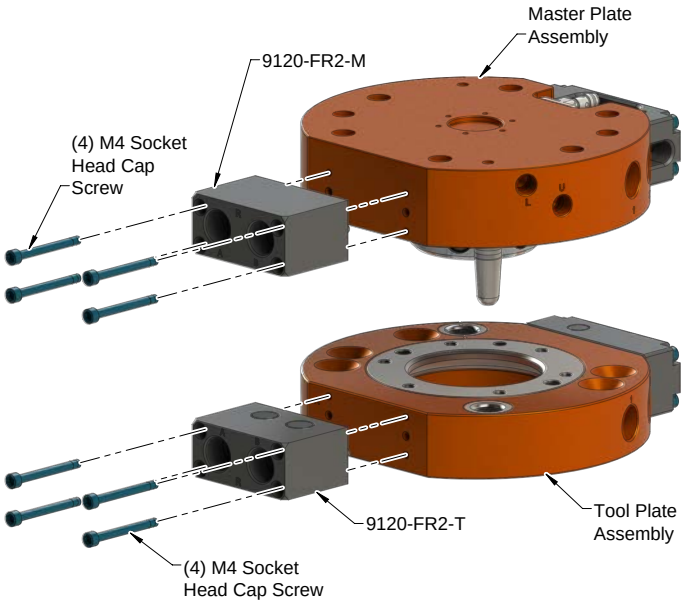
The following steps outline installation or removal as required. Some modules require an adapter plate installed to the Tool Changer.

Tools required: *2.5 mm or 3 mm hex key, torque wrench*

Supplies required: *Clean rag, Loctite 222*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Wipe down the mounting surfaces with a clean rag.
5. Align the module on the Master or Tool plate as shown in *Figure 2.3*.
6. For first time installation of (4) M4 fasteners with pre-applied adhesive no additional Loctite is required. If reusing fasteners, apply Loctite (see *Table 2.1* for fastener specifications).
7. Install the module. Secure with (4) M4 fasteners and tighten to torque (see *Table 2.1* for torque) using a 2.5 mm or 3 mm hex key.
8. Remove all protective caps, plugs, tape, and likewise from the module prior to operation.
9. If required, connect any cables, air line, etc.
10. Safely resume normal operation.

Figure 2.3—Optional Module Installation



2.8 Optional Module Removal

Tools required: *2.5 mm or 3 mm hex key, torque wrench*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. If required, disconnect any cables, air lines, etc.
5. Supporting the module and using a 2.5 or 3 mm hex key, remove the (4) M4 fasteners.
6. Remove the module.

2.9 Pneumatic Connections

Proper operation of the locking mechanism requires a constant supply of clean, dry, non-lubricated air, with the following conditions:

- Pressure range of 60 to 100 psi (4.1 - 6.9 bar) Suggested 80 psi.
- Filtered minimum: 40 microns.

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

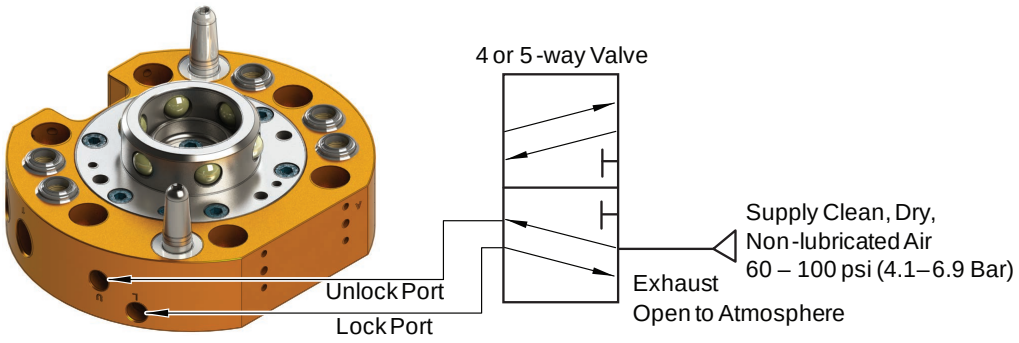
CAUTION: Do not use the Tool Changer in a fail-safe condition. Damage to the locking mechanism can occur. Re-establish air pressure and ensure the Tool Changer is in a secure lock position before returning to normal operations.

2.9.1 Valve Requirements and Connections for the Locking Mechanism

A customer supplied 2-position 4-way or 5-way valve with either 4-port or 5-port configuration must be used to actuate the locking mechanism in the Master plate. It is imperative that when air is supplied to the Lock or Unlock Port on the Master plate, that the opposite port be vented to atmosphere (for example: when air is supplied to the Lock Port, the Unlock Port must be open to the atmosphere.) Failure to vent trapped air or vacuum on the inactive port may inhibit operation of the locking mechanism and prevent coupling or uncoupling.

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

Figure 2.4—Lock and Unlock Pneumatic Connections



2.10 Electrical Connections

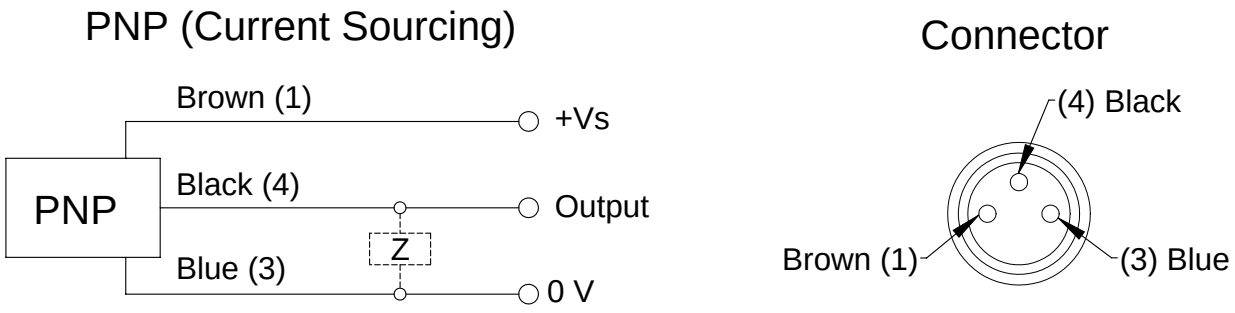
The Tool Changer is available with integrated lock/unlock sensors. If sensors are not used, plugs will be provided to seal the locking mechanism.

2.10.1 PNP Type Lock and Unlock Sensors (-SB, -SDR, -SG, -SG1, -SR sensor designation)

These sensors are used on 9120-076AM-000-000-SB, 9120-076AM-000-000-SDR, 9120-076AM-000-000-SG, 9120-076AM-000-000-SG1,and 9120-076AM-000-000-SR.

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

Figure 2.5—PNP Type Lock, Unlock and RTL Sensors

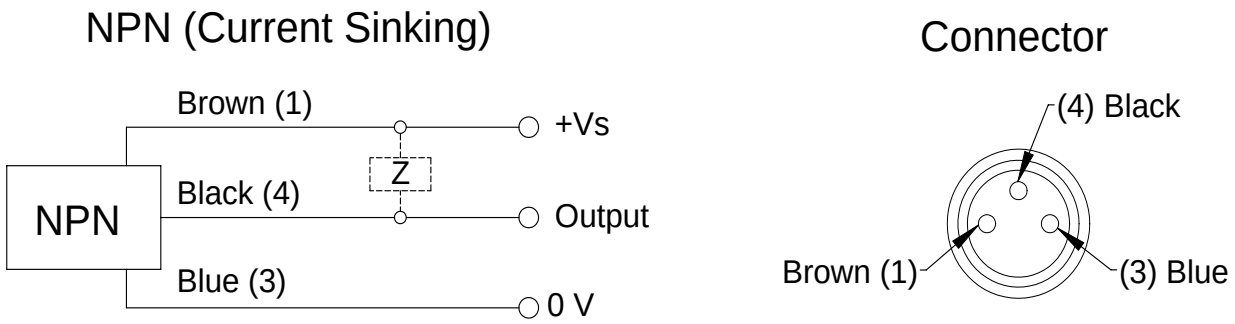


2.10.2 NPN Type Lock and Unlock Sensors (-SA, -SE, -SE1, -SFR sensor designation)

These sensors are used on 9120-076AM-000-000-SA, 9120-076AM-000-000-SE, 9120-076AM-000-000-SE1, and 9120-076AM-000-000-SFR.

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

Figure 2.6—NPN Type Lock, Unlock and RTL Sensors

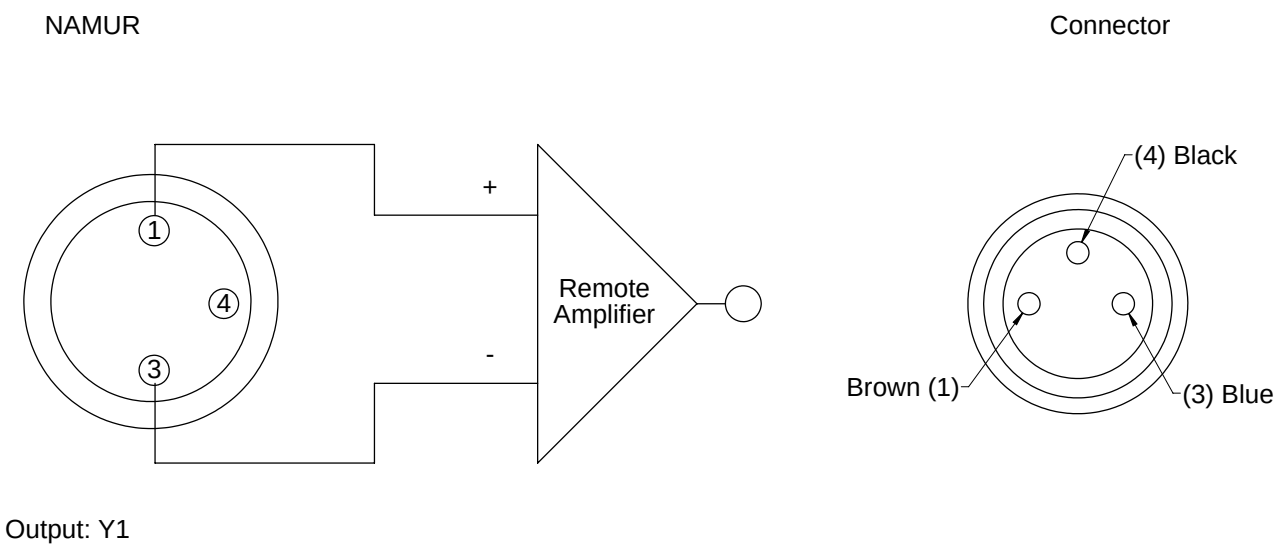


2.10.3 Namur Type Lock and Unlock Sensors (-SV sensor designation)

These sensors are used on 9120-076AM-000-000-SV. RTL sensors are not available for this model.

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

Figure 2.7—NAMUR Type Lock and Unlock Sensors



Output: Y1

3. Operation

The Master plate locking mechanism is pneumatically driven to couple and uncouple with the Tool plate bearing race.

CAUTION: Operation of the Tool Changer is dependent on maintaining an air pressure of 60 to 100 psi (4.1 - 6.9 bar). Damage to the locking mechanism could occur. Robot motion must be halted if the air supply pressure drops below 60 psi (4.1 bar).

NOTICE: All Tool Changers are lubricated prior to shipment. The customer must apply additional lubricant to the locking mechanism components and alignment pins prior to operation. Tubes of lubricant for this purpose are shipped with every Tool Changer. Standard Tool Changers require MobilGrease XHP222 Special (a NLGI #2 lithium complex grease with molybdenum disulfide). For custom applications, such as food grade or surgical applications, specialized lubricants might be required.

Coupling should occur with the Master plate in the No-Touch™ locking zone. As coupling occurs, the Master plate should pull the Tool plate into the locked position.

Program the robot to minimize misalignment during coupling and uncoupling. Greater offsets can be accommodated by the Master and Tool plates but will increase wear. Misalignments can be caused by improper tool stand design. Refer to Tool Storage Considerations section.

Figure 3.1—Offset Definitions

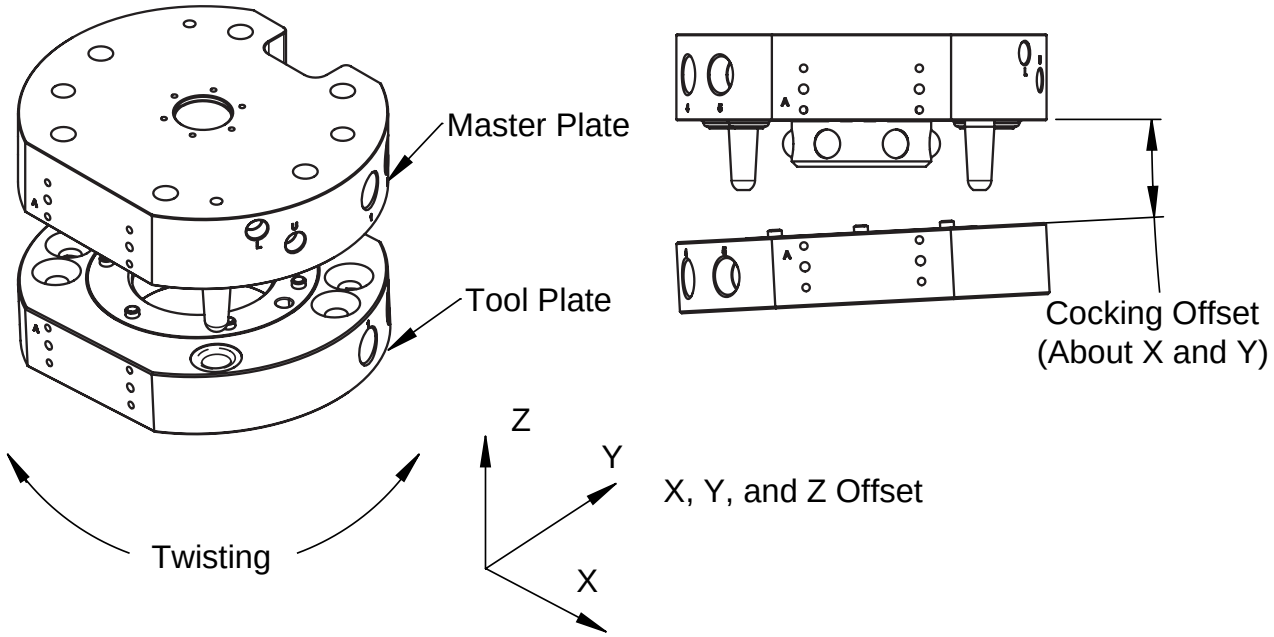


Table 3.1—Maximum Recommended Offsets Prior to Coupling				
Model	**No-Touch Zone Z Offset (Max)[1]**	**X and Y Offset (Max) [2]**	**Cocking Offset (Max)**	**Twisting Offset (Max)**
QC-76	0.08” (2 mm)	±0.04” (1 mm)	±0.7°	±1°

Notes:
1. Maximum values shown. Decreasing values minimizes wear.
2. Allowable values may be greater, but greater offsets increase wear.

3.1 Conditions for Coupling

CAUTION: The locking mechanism must be in the unlock position when attempting to couple the Tool Changer. Failure to adhere to this condition may result in damage to the unit and/or the robot.

1. Position the Master plate above the Tool plate with the air supplied to the Unlock Port (if equipped, the Unlock sensor indicates the Tool Changer is Unlocked).
2. Move the Master plate toward the Tool plate so that the (2) alignment pins enter the alignment holes on the opposite plate. Program the robot so that the Master plate and Tool plate are aligned axially and are parallel to each other (as closely as possible). This will minimize Tool movement and subsequent wear during lock-up.

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

3. When the (2) faces are within the specified No-Touch™ distance, release the pressure from the Unlock port and supply air to the Lock port. The Tool plate is drawn toward the Master plate and coupled. Air must be maintained on the Lock Port during operation to assure rigid coupling (if equipped, the Lock sensor indicates the Tool Changer is in the Locked position).
4. A sufficient delay must be programmed between locking valve actuation and robot motion so that the locking process is complete before moving the robot.

CAUTION: If air pressure is lost during operation, ATI's patented fail-safe design prevents the Tool plate from being released. Do not use the Tool Changer in a fail-safe condition. Re-establish air pressure and ensure the Tool Changer is in a secure lock position before returning to normal operations.

3.2 Fail-Safe Operation

A fail-safe condition occurs when there is an unintended loss of lock air pressure to the Master plate. When air pressure is lost, the Tool Changer relaxes and there may be a slight separation between the Master and Tool plates. The lock sensor may indicate that the unit is not locked. ATI's patented fail-safe feature utilizes a multi-tapered cam to trap the ball bearings and prevent an unintended release of the Tool plate. Positional accuracy of the tooling is not maintained during this fail-safe condition. Do not operate the Tool Changer in the fail-safe condition. If source air is lost to the unit, movement should be halted until air pressure is restored.

After air pressure is re-established to the Master plate, the locking mechanism will energize and securely lock the Master and Tool plates together. In some cases when the load on the tool changer is significantly off center, it may be necessary to position the load underneath the tool changer or return the tool to the tool storage location to ensure a secure lock condition. If equipped, make sure the lock sensor indicates the Tool Changer is in the locked position before resuming normal operations. Consult your Control/Signal Module Manual for specific error recovery information.

CAUTION: Do not use the Tool Changer in a fail-safe condition. Damage to the locking mechanism could occur. Re-establish air pressure and ensure the Tool Changer is in a secure lock position before returning to normal operations.

3.3 Conditions for Uncoupling

1. Position the Tool plate in the tool stand so that there is little or no contact force between the Tool plate and tool stand.
2. Release air on the Lock port and apply air to the Unlock Port (if equipped, the Unlock sensor will indicate the Tool Changer is in the Unlocked position).

NOTICE: The air will cause the locking mechanism to be released and the weight of the Tool plate and attached tooling will assist in its removal. The Tool weight assists in uncoupling if the Tool is released in the vertical position only.

3. A sufficient delay must be programmed between unlocking valve actuation and robot motion, so that the unlocking process is complete and the Tool plate is fully released before moving the robot.
4. Move the Master plate axially away from the Tool plate.
5. In automated Tool change applications, it is recommended that a Tool presence sensor(s) be used in the tool stand to verify that the Tool is present and that the Tool remains in place as the robot moves away after the unlocking process.

3.4 Tool Identification

When using multiple Tools, it is good practice to implement a Tool-ID system that identifies each Tool with a unique code. Tool-ID can be used to verify that the robot has picked up the proper Tool. Modules with Tool-ID are available for purchase through the ATI website. Go to *http://www.ati-ia.com/products/toolchanger/tool_changer_modules.aspx* for products available or contact ATI for assistance.

3.5 Tool Storage Considerations

NOTICE: Tool stand design is critical to the operation of the Tool Changer. Improperly designed tool stands can cause jamming and excessive wear of the Tool Changer components.

Tool plates with customer tooling attached may be stored in a tool stand. ATI provides compatible tool stands designed for durability, longevity, and maximum adaptability to fit most customers' applications. The ATI TSM (Tool Stand Medium) system is compatible with ATI Tool Changer sizes QC-20 to QC-110. The TSM systems can be equipped with horizontal modules, clamp modules, and different types of tool sensing. Visit the ATI Web Site *http://www.ati-ia.com/products/toolchanger/toolstand/medium/MediumStand.aspx* for products available, or contact ATI for assistance.

If the customer is supplying the tool stand, it must provide a fixed, repeatable, level, and stable position for tool pick-up and drop-off. The tool stand must support the weight of the Tool Changer Tool plate, tool interface plate, optional modules, cables, hoses, and customer tooling without allowing deflection in excess of the offsets specified.

Ideally, the tool should be hanging vertically in the tool stand so that gravity assists to uncouple the Tool plate from the Master plate during unlocking. It is possible to design tool stands that hold tools in the horizontal position, but the necessary compliance must be provided during coupling and uncoupling. In general, "horizontal-position" tool stands cause more wear on the locking mechanism and locating features of the Tool and tool stand.

A variety of methods may be used to position the Tool in the tool stand. A common method is to use tapered alignment pins and bushings. Robot programming and positional repeatability are vital in tool pick-up and drop-off.

A sensor that detects the presence of a Tool in the tool stand is recommended. The sensor may be used prior to coupling to ensure there is a Tool properly seated in the stand. Sensors may also be used as the robot starts to move away after uncoupling. Sensors provide safety measure if a Tool becomes jammed in the stand or if the Tool fails to release from the robot.

Proximity sensors should be positioned so that the sensing face is vertical to prevent metal shavings, weld spatter, or other debris from falling on the sensor and creating false readings.

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

4. Maintenance

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

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

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

4.1 Preventive Maintenance

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

Table 4.1—Preventive Maintenance Check List

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

Checklist

Mounting Fasteners/Interface Connections

- ☐ Inspect fasteners for proper torque, interference, or wear. Tighten and correct as required. Refer to *Section 2—Installation*.

Balls/Alignment Pins/Holes/Bearing Race

- ☐ Inspect for lubrication and wear. 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. Thoroughly clean the existing grease and replace with new. See *Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins*.
- ☐ Inspect for excessive alignment pin/bushing wear, which may be an indication of poor robot position during pickup/drop-off. Adjust robot position. Check tool stand for wear and alignment problems. Replace worn alignment pins, refer to *Section 5.2.4—Alignment Pin Replacement*.
- ☐ Inspect for wear on the balls/bearing race, which could be an indication of excessive loading.

Sensors and Cables

- ☐ Inspect sensor cable connectors for tightness, and if loose, tighten connections.
- ☐ Inspect sensor cables for any damage, cuts, and abrasion. Replace as necessary.

Hoses

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

Seals (Pass Through Air and Optional Modules)

- ☐ Inspect for wear, abrasion, and cuts. Replace damaged seals or rubber bushings as needed. Refer to *Section 5.2.5—Rubber Bushing Replacement* and *Section 5.2.6—Seal Inspection and Replacement*.

Electrical Contacts/Pin Block (Optional Modules)

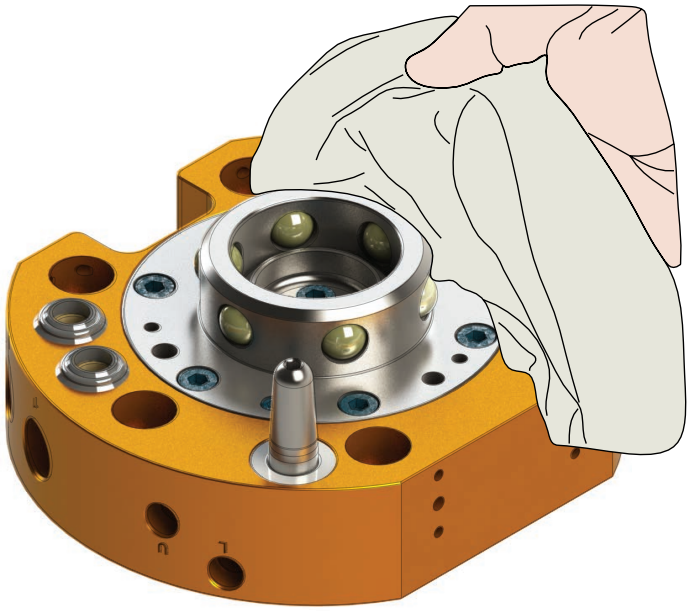
- ☐ Inspect for damage, debris, and stuck/burnt pins. Clean pin blocks as required. Refer to *Section 4.3—Pin Block Inspection and Cleaning*.

4.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

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

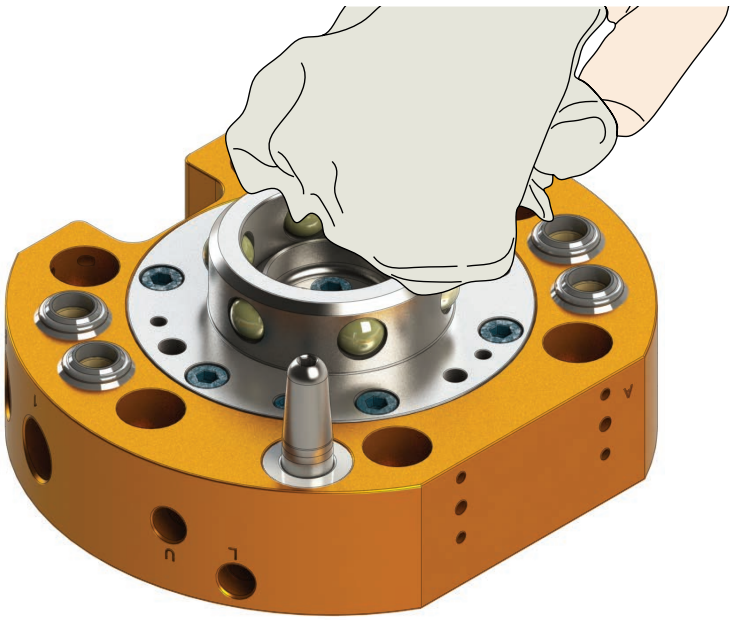
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam,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

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



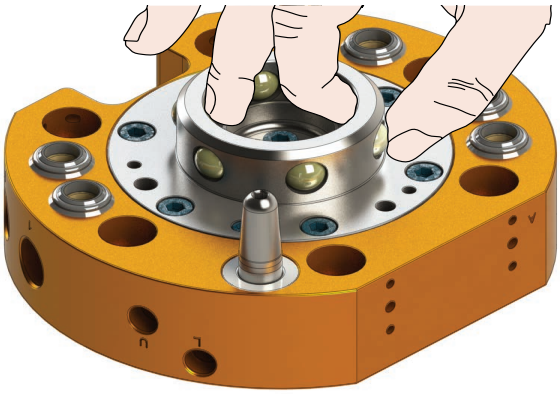
5. Use a clean rag to thoroughly remove any lubricant and debris from the inner surface of the male coupling and cam.

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



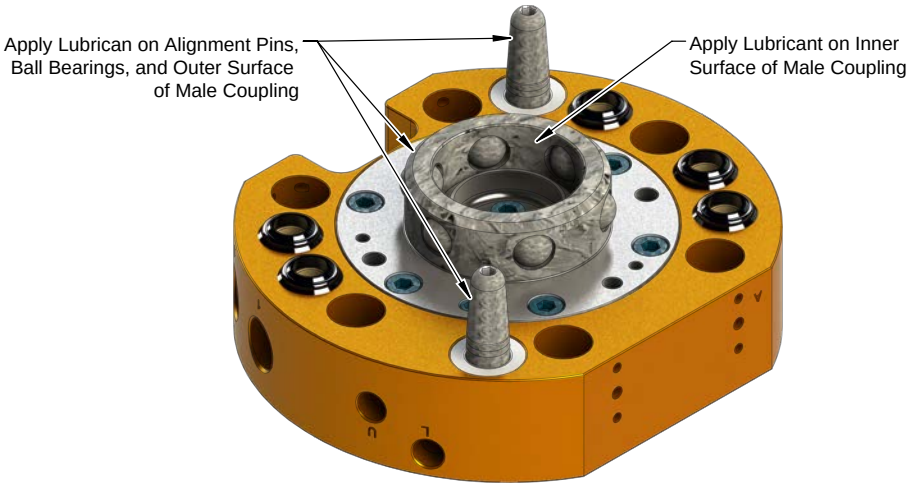
6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 4.3—Check Ball Bearing Movement



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

Figure 4.4—Apply Lubricant to Locking Mechanism

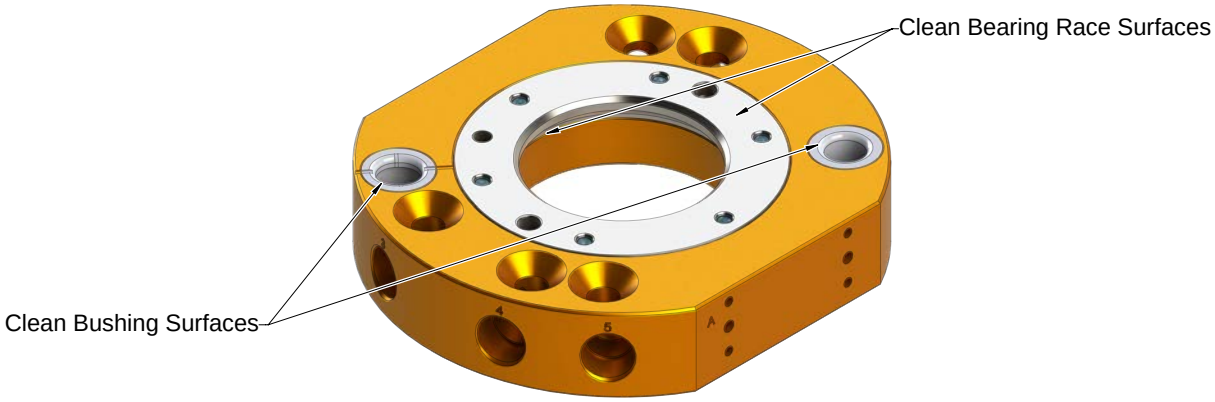


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

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

9. Safely resume normal operation.

Figure 4.5—Clean Tool Plate Surfaces of Locking Mechanism



4.3 Pin Block Inspection and Cleaning

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

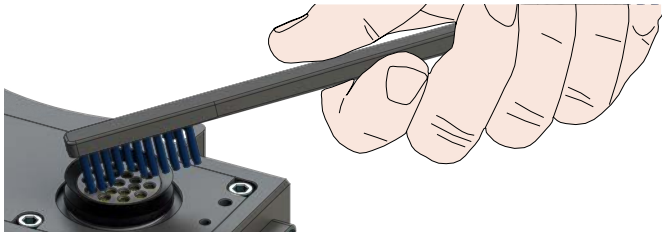
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Inspect the Master and Tool pin blocks for debris or darkened pins.

Figure 4.6—Inspect Master and Tool Pin Blocks

5. If debris or darkened pins are present, use a vacuum to remove the debris, and clean using a nylon brush (ATI Part Number 3690-0000064-60).

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

Figure 4.7—Clean Pin Blocks with a Nylon Brush



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

Figure 4.8—Stuck Pin and Pin Block Damage

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

5. Troubleshooting and Service Procedures

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

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

5.1 Troubleshooting

Check these conditions for all symptoms prior to troubleshooting:

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

Table 5.1—QC-76 Troubleshooting

Symptom	Cause	Resolution
Tool Changer cannot lock and/ or unlock (or Lock sensor does not indicate Tool Changer is Locked)	Debris caught between the Master and Tool plates.	Clean debris from between the Master and Tool plates. Verify mounting fasteners are secure and does not protrude above the mating surfaces.
	Insufficient or no air pressure supply to the Lock or Unlock ports.	Verified proper air pressure and pneumatic valve is supplied. Refer to *Section 2.9—Pneumatic Connections*.
	Air pressure trapped in de-energized Lock or Unlock ports.	Air pressure must be vented to the atmosphere properly, refer to *Section 2.9—Pneumatic Connections*.
	Pneumatic connections loose or damaged.	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.
	The ball bearings and/or cam are not moving freely in the male coupling.	Clean and lubricate as needed to restore smooth operation (see *Section 4.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins*.
	The Master and Tool plates are not within the specified No-Touch sone when attempting to lock.	Check that the Tool is properly seated in the tool stand. Refer to *Section 3.5—Tool Storage Considerations*. Re-teach the robot to bring the Master and Tool plate closer together prior to attempting to lock.
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 5.2.1—Lock and Unlock Sensor Replacement (Quick Disconnect)* and *Section 5.2.2—Lock and Unlock Sensor Replacement (Hard Wired)*.

Table 5.1—QC-76 Troubleshooting		
Symptom	**Cause**	**Resolution**
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 5.2.1—Lock and Unlock Sensor Replacement (Quick Disconnect)* and *Section 5.2.2—Lock and Unlock Sensor Replacement (Hard Wired)*.
Units Equipped with Electrical/Servo/Control/Signal Modules		
Loss of Communication	Debris in and around contact pins. Contact pin worn or damaged.	Inspect V-ring seal for damage, and if necessary, replace the damaged seal. Refer to *Section 5.2.6—Seal Inspection and Replacement*.
	Cable connections loose or cables damaged.	Check that the cable connections are secure, and cables are not damaged.

5.2 Service Procedures

Component replacement and adjustment procedures are provided in the following section.

5.2.1 Lock and Unlock Sensor Replacement (Quick Disconnect)

Proximity sensors 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.

Refer to *Figure 5.1*.

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

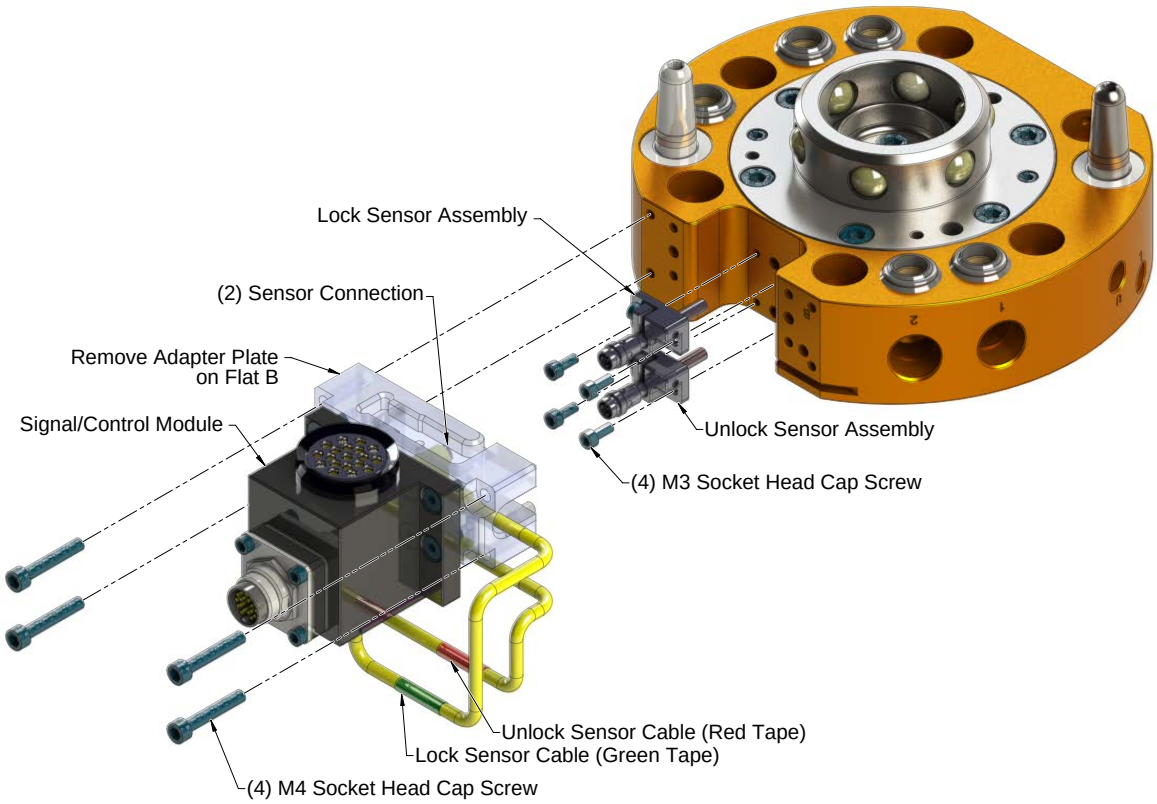
Tools required: *2.5 and 3 mm hex key, torque wrench*

Supplies required: *Clean rag, Loctite 222*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. If testing or replacing the lock sensor, make sure the QC-76 is in the locked position. If replacing the unlock sensor, make sure the QC-76 is in the unlocked position.
4. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
5. Using a 3 mm hex key, unscrew the M4 socket head cap screws that secure the adapter plate to the Tool Changer and remove the adapter plate.
6. Using a 2.5 mm hex key, remove the M3 socket head cap screws from the sensor(s).
7. Pull the sensor straight out from the Tool Changer body.
8. To test the sensor, place a ferrous target in front of the sensor to confirm that the sensor is functional. The sensor lock or unlock signal should read “on” (true) and the sensor LED should illuminate.
9. If the proximity sensor is not functioning. Disconnect the cable and replace the sensor. If the sensor is functioning, reinstall the sensor.

CAUTION: Do not attempt to disassemble and rebuild sensors. The Lock and Unlock sensor assemblies are precision aligned at the factory. Replace damaged or malfunctioning sensors.

Figure 5.1—Lock and Unlock Sensor Replacement



10. Install the new Lock and/or Unlock sensor.
11. Insert the Lock and/or Unlock sensor into the Tool Changer body as shown in *Figure 5.1.*
12. Apply Loctite 222 to the (4) M3 socket head cap screws.
13. Using a 2.5 mm hex key, secure the Lock and/or Unlock sensor with the (4) M3 socket head cap screws.
14. Connect the sensor cables.
15. Install the adapter plate.
16. Apply Loctite 222 to the M4 socket head cap screws for the adapter plate.
17. Use a 3 mm hex key to secure the M4 socket head cap screws. Tighten to contact.
18. Safely resume normal operation.
19. Confirm the operation of the Unlock sensor by issuing the Unlock command and then checking 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 that the LED in the Lock Sensor body is on.

5.2.2 Lock and Unlock Sensor Replacement (Hard Wired)

Proximity sensors 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 senor.

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

Tools required: *2.5 and 3 mm hex key, torque wrench*

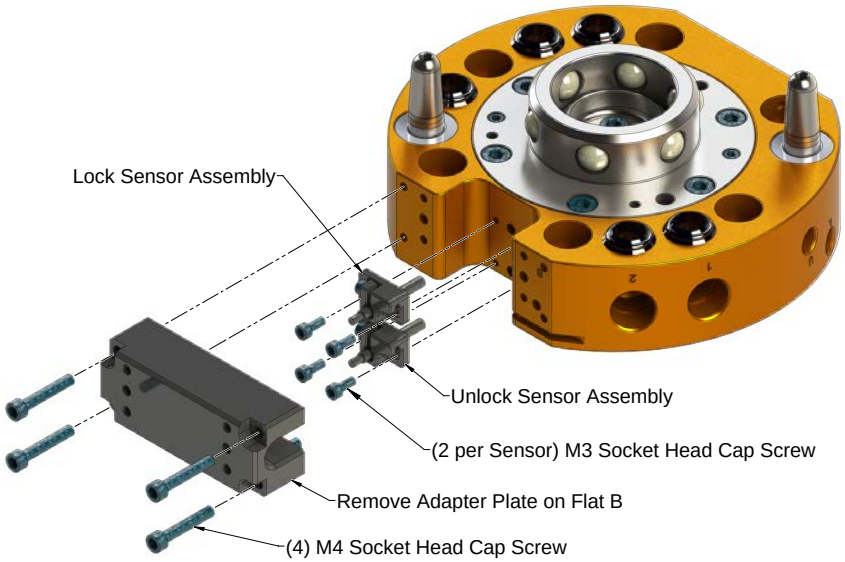
Supplies required: *Clean rag, Loctite 222*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.

3. If testing or replacing the lock sensor, make sure the QC-76 is in the locked position. If replacing the unlock sensor, make sure the QC-76 is in the unlocked position.
4. Uncouple the Master and Tool plates.
5. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
6. Using a 3 mm hex key, unscrew the M4 socket head cap screws that secure the adapter plate to the Tool Changer and remove the plate.
7. Using a 2.5 mm hex key, remove the M3 socket head cap screws from the sensor(s).
8. Pull the sensor straight out from the Tool Changer body.
9. To test the sensor, place a ferrous target in front of the 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. Disconnect the cable and replace the sensor. If the sensor is functioning, reinstall the sensor.

CAUTION: Do not attempt to disassemble and rebuild sensors. The Lock and Unlock sensor assemblies are precision aligned at the factory. Replace damaged or malfunctioning sensors.

Figure 5.2—Lock and Unlock Sensor Replacement



11. Install the new Lock and/or Unlock sensor.
12. Insert the Lock and/or Unlock sensor into the Tool Changer body as shown in *Figure 5.2.*
13. Apply Loctite 222 and secure the Lock and/or Unlock Sensor with the (4) M3 socket head cap screws using a 2.5 mm hex key.
14. Install the adapter plate.
15. Apply Loctite 222 to the M4 socket head cap screws for the adapter plate. Using a 3 mm hex key, tighten to contact.
16. Safely resume normal operation.
17. Confirm the operation of the Unlock sensor by issuing the Unlock command and then checking that the LED in the Unlock sensor body is on.
18. Confirm the operation of the Lock sensor by issuing the Lock command to lock a Tool to the Master and then checking to that the LED in the Lock Sensor body is on.

5.2.3 RTL Flat Pack Style Sensor Replacement

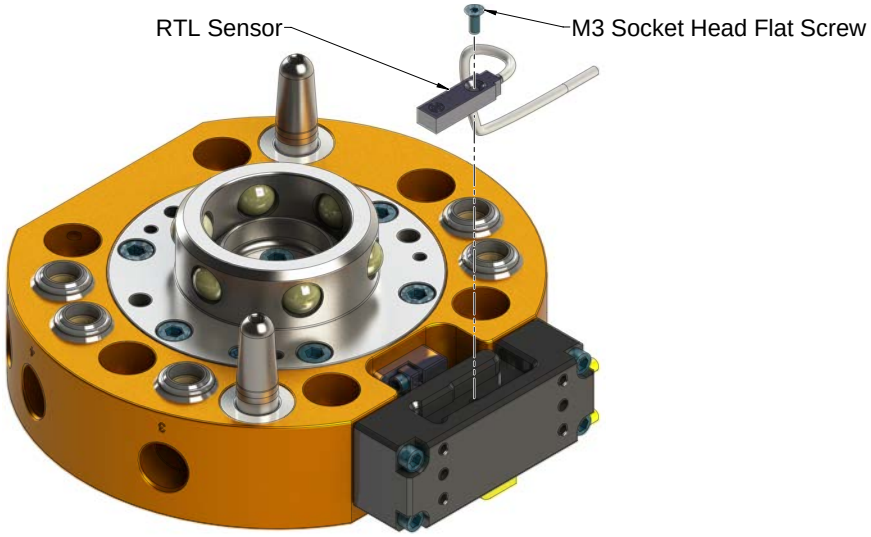
Parts required: *Refer to Section 6—Serviceable Parts.*

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

Supplies required: *Clean rag, Loctite 222*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. To test the operation of the RTL sensor, bring a ferrous target into close proximity to the face of the sensor and watch for the sensor LED to illuminate. If the sensor is not functioning properly, replace.
5. Secure the RTL Sensor to the adapter plate with the M3 socket head flat screw, using a 2 mm hex key.
6. Feed the sensor cable out between the adapter plate and the Tool plate.
7. Discard the removed RTL sensor.

Figure 5.3—RTL Sensor Replacement



8. Feed the new sensor cable in between the adapter plate and the Tool plate.
9. Install the RTL sensor to the adapter plate.
10. Apply Loctite 222 to the M3 socket flat head screws. Using a 2 mm hex key, secure the sensor to the adapter plate and tighten to 60 in-ozs (0.4 Nm).
11. Confirm the operation of the RTL sensor by bringing a ferrous target into close proximity to the face of the sensor and watching for the LED in the body of the sensor to light up.
12. Safely resume normal operation.

5.2.4 Alignment Pin Replacement

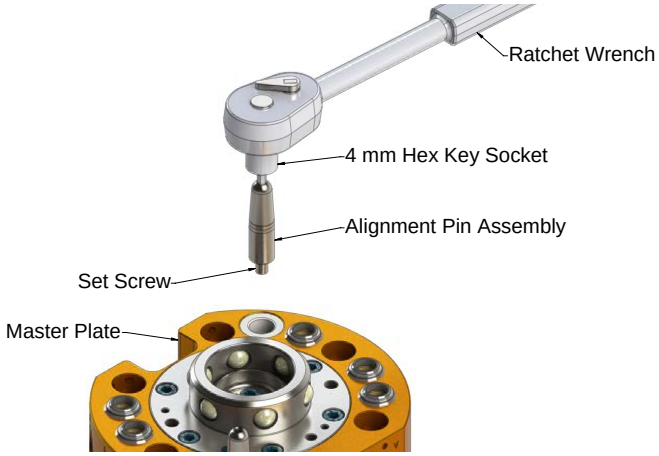
Parts required: ***Parts required:*** *Refer to Section 6—Serviceable Parts.*

Tools required: *4 mm hex key or 3 mm hex key socket, locking pliers, torque wrench*

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

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Unscrew the alignment pin sub-assembly from the Master plate using a 4 mm hex key. If the alignment pin cannot be removed using the hex key in the tip, go to step *5*. If the alignment pin was removed, go to step *7*.

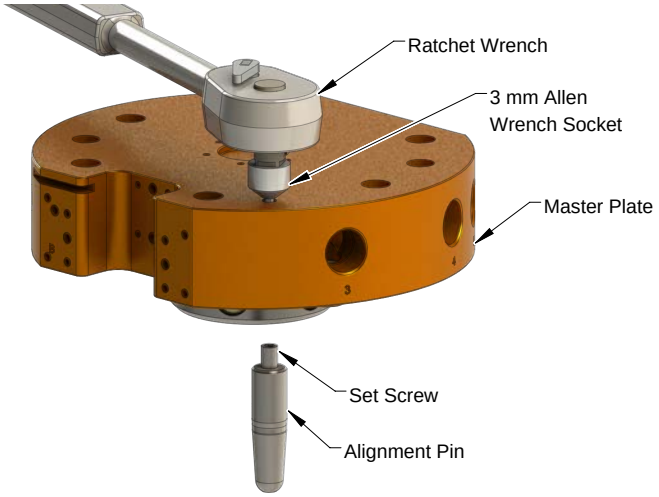
Figure 5.4—Alignment Pin Replacement



5. Alternately, 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*.
6. Use a 3 mm hex key to remove the alignment pin from the back side of the Master plate. Loosen the alignment pin by turning it clockwise, the alignment pin will be removed from the locking side of the Master plate.

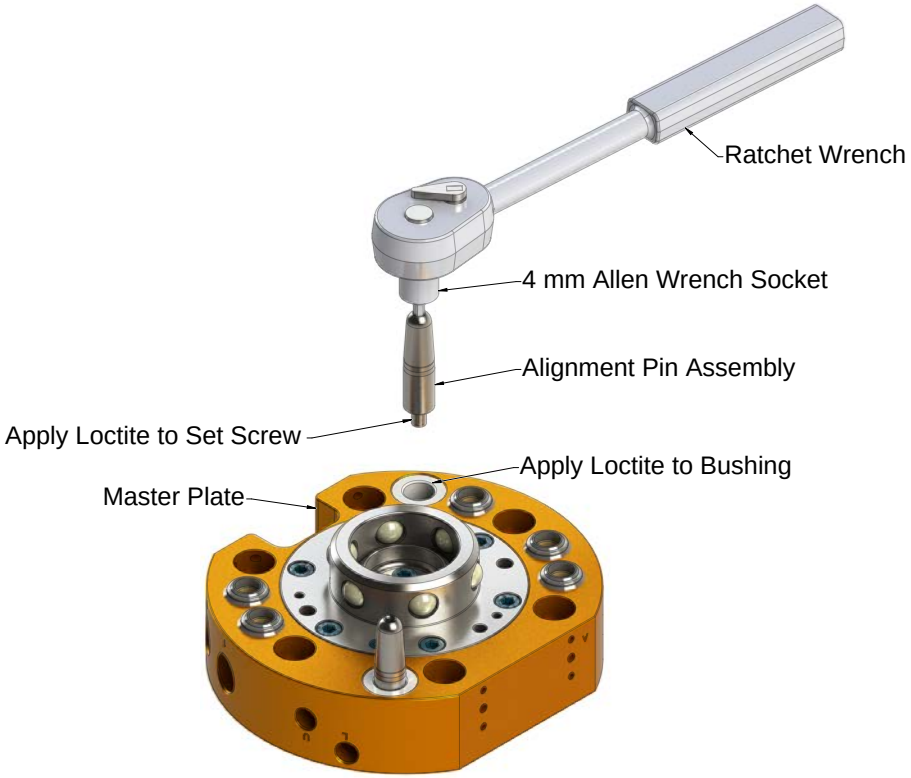
NOTICE: If for any reason the pin cannot be removed using the hex key in the tip or from the back side it may be necessary to remove it by other means, such as locking pliers.

Figure 5.5—Alternative Approach for Alignment Pin Replacement



7. With the alignment been removed, verify that the assembly (pin and set screw) are intact. If the set screw portion of the assembly did not come out, remove it separately using the access hole in the back plate of the Master plate.
8. Apply Loctite 242 to the inside of the alignment pin bushing and the threads if the alignment pin.
9. Install the new alignment pin assembly into the bushing on the Tool Changer using a 4 mm hex key. Tighten to 60 in-lbs (6.8 Nm).
10. Apply MobilGrease XHP222 Special grease to the alignment pin.
11. Safely resume normal operation.

Figure 5.6—Alignment Pin Replacement



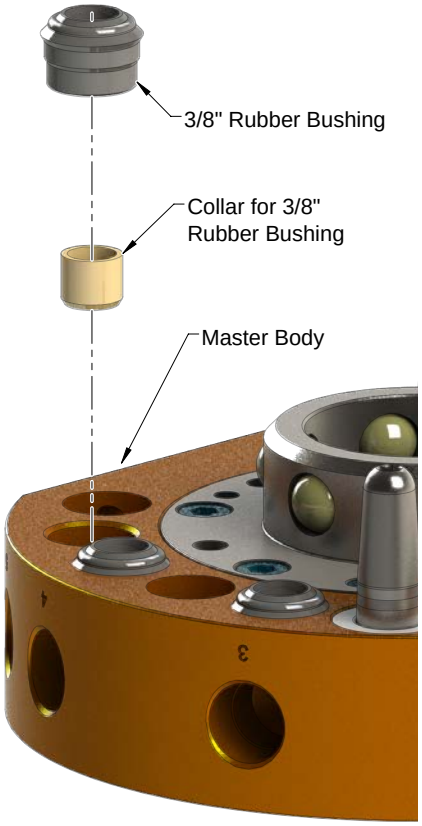
5.2.5 Rubber Bushing Replacement

Parts required: *Refer to Section 6.1—Master Plate Common Parts.*

Tools required: *Needle nose pliers*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use needle nose pliers and pull the rubber bushing out of the Master body.
5. Remove the collar if it remains in the Master body.
6. Lightly lubricate the new rubber bushing.
7. Insert the new rubber bushing into the Master body.
8. Insert the new collar into the rubber bushing, make sure the bushing is pressed in completely.
9. Safely resume normal operation.

Figure 5.7—Rubber Bushing Replacement



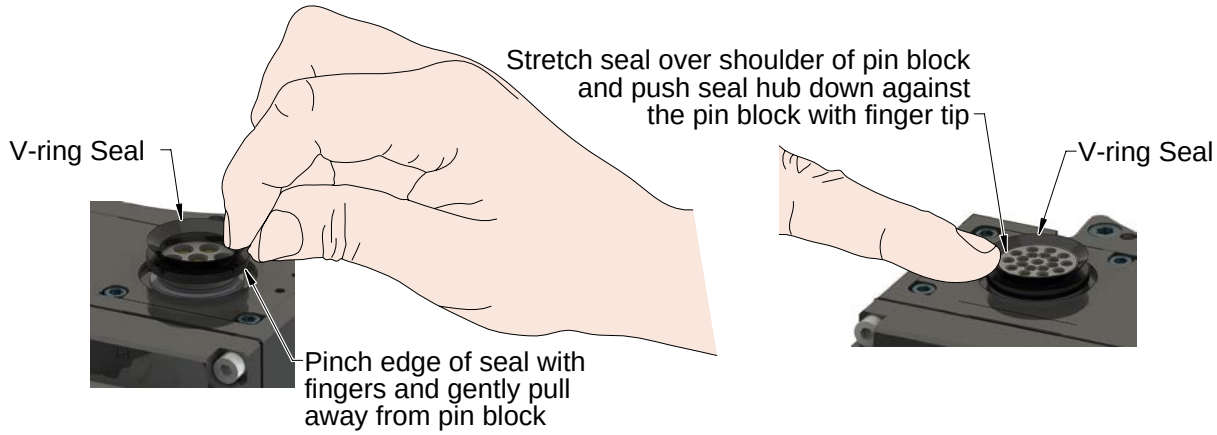
5.2.6 Seal Inspection and Replacement

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

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

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. To remove the existing seal, pinch the edge of the seal and pull the seal away from the pin block on the Master module.
5. To install a new seal, stretch the new seal over the shoulder of the pin block.
6. Push the seal hub down against the pin block.
7. Safely resume normal operation.

Figure 5.8—V-ring Seal Replacement



6. Serviceable Parts

6.1 Master Plate Common Parts

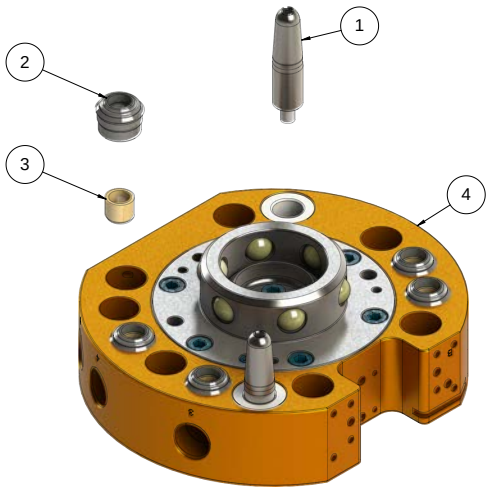


Table 6.1—QC-76 Master Plate Common Parts			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-2241	1/2” Two Piece Alignment Pin
2	5	4010-0000010-01	3/8” Rubber Bushing
3	5	3700-20-2000	Collar for 3/8” Bushing
4	1	9120-076AM-000-000	QC-76 Master Assembly, 3/8 NPT ports, No Boss, No Sensors
	1	9120-076AM-000-000-E	QC-76 Master Assembly, Euro (Black body), G 3/8 BSPP ports, No Boss, No Sensors
	1	9120-076AM-000-000-R	QC-76 Master Assembly, Rc 3/8 BSPT Ports, No Boss, No Sensors

6.2 Master Plate Without Sensors

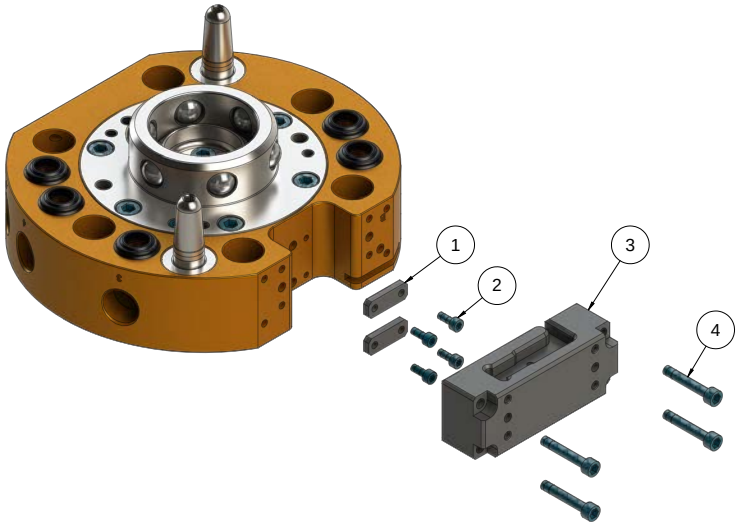


Table 6.2—9120-076xM-000-000-S0			
Item No.	**Qty**	**Part Number**	**Description**
1	2	9005-20-1983	Sensor Bore Cover Plate Assembly, SS Screws (Includes (2) of item 2)
2	2	3500-1058008-21A	M3-0.5 x 8 mm Socket Head Cap Screws, SS, Pre-Applied
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied

6.3 Master Plate with Hardwired 5m Cable Sensors without RTL Sensor Option - Models 9120-076xM-000-000-(SA and SB)

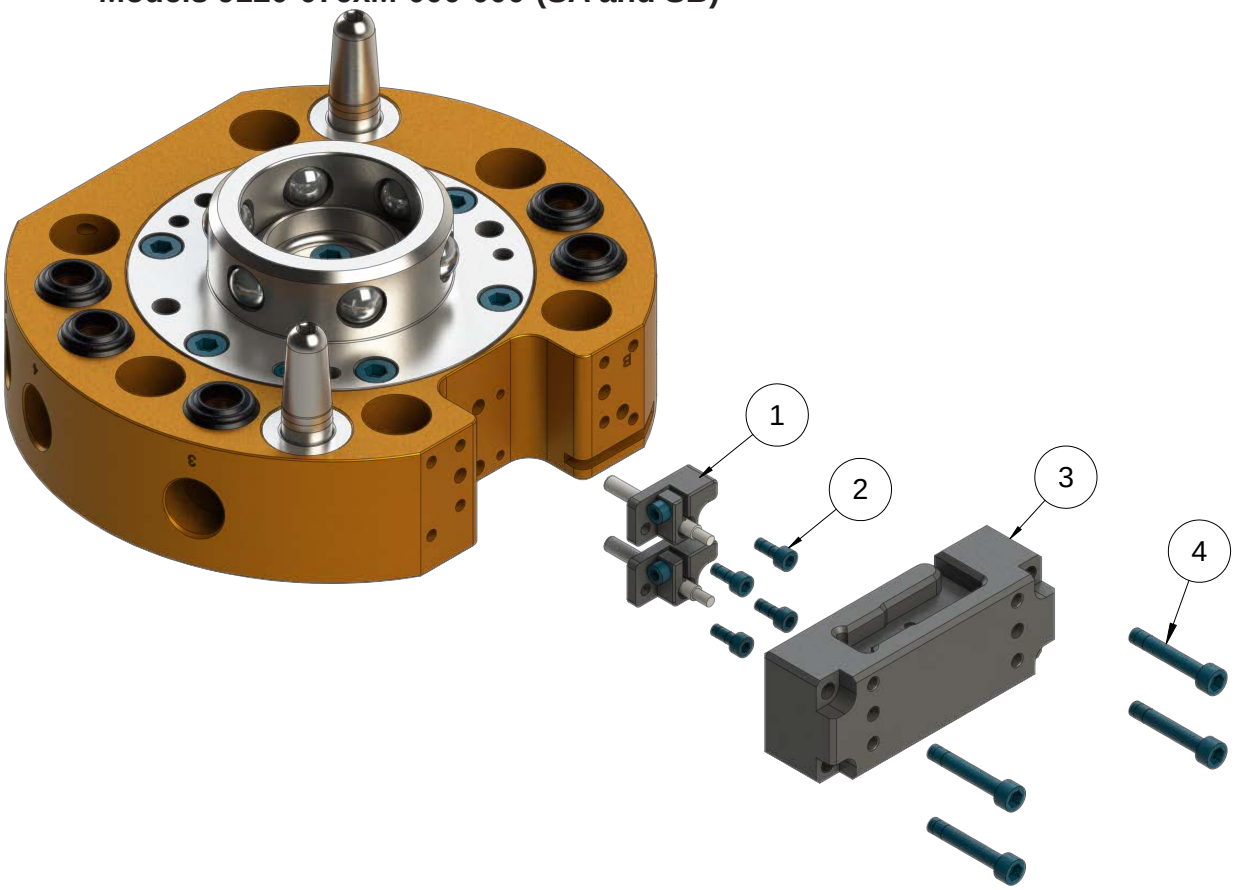


Table 6.3—Master Plate with Hardwired 5m Cable Sensors without RTL Sensor Option			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-76xM-000-000-SA			
1	2	9005-20-1630	Carrier Assembly, NPN, 5M, Flying Leads (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
Model 9120-76xM-000-000-SB			
1	2	9005-20-1483	Carrier Assembly, PNP, 5M Cable (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied

Notes:

1. Where x is the boss size = A (no boss), B (50 mm), C (56 mm), D (60 mm), E (63 mm), or F (80 mm).

6.4 Master Plate with Quick Disconnect Sensors without RTL Sensor Option - Models 9120-076xM-000-000-(SE, SFR, SG, SDR, SV)

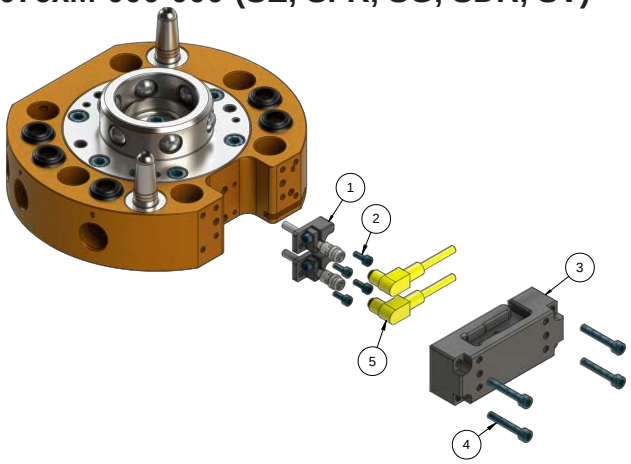


Table 6.4—Master Plate Sensor Parts for Models without RTL Sensor Option			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-76xM-000-000-SE			
1	2	9005-20-1629	Carrier Assembly, NPN Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
Model 9120-76xM-000-000-SG			
1	2	9005-20-1628	Carrier Assembly, PNP Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
Model 9120-076xM-000-000-SFR			
1	2	9005-20-1629	Carrier Assembly, NPN Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
5	2	8590-9909999-06	5 Meter 90 Degree Pico Cable
Model 9120-076xM-000-000-SDR			
1	2	9005-20-1628	Carrier Assembly, PNP Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
5	2	8590-9909999-06	5 Meter 90 Degree Pico Cable
Model 9120-076xM-000-000-SV			
1	2	9005-20-8659	Sensor Carrier Assembly, Double Screw, Prox, NAMUR, Quick Connect, .677, 90 Degree, Nitrile (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied

Notes:

1. Where x is the boss size = A (no boss), B (50 mm), C (56 mm), D (60 mm), E (63 mm), or F (80 mm).

6.5 Master Plate with Quick Disconnect Sensors with RTL Sensor Option - Models 9120-076xM-000-000-(S0, SR, SE1, SG1, SV)

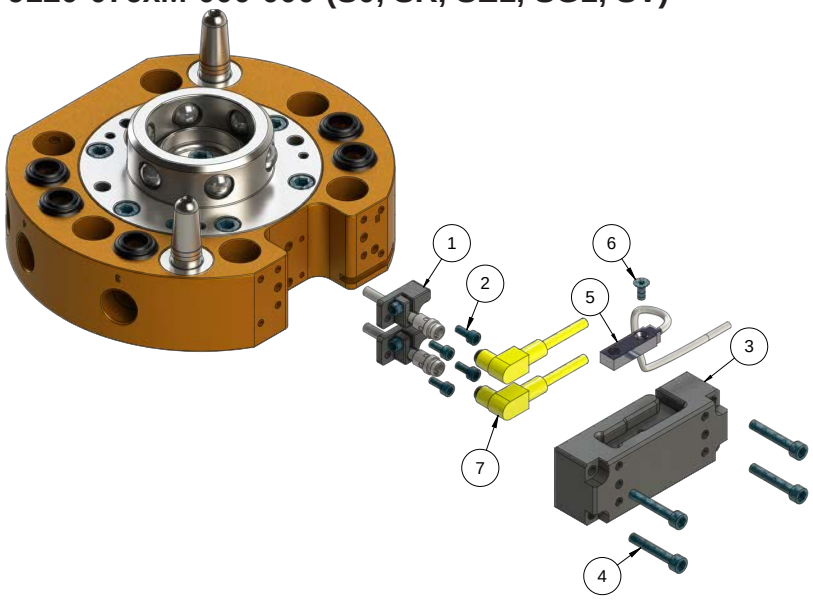


Table 6.5—Master Plate Sensor Parts for Models with RTL Sensor Option			
Item No.	**Qty**	**Part Number**	**Description**
Model 9120-076xM-000-000-SR			
1	2	9005-20-1628	Carrier Assembly, PNP Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
5	1	8590-9909999-150	PNP Flat Prox 5M long (no conn) Turck Bi2-Q5.5-AP6X 5M
6	1	3500-1258008-15A	M3 x 8 mm Socket Flat Head Cap Screw Blue Dyed Magni-565 w/ND Microspheres Epoxy
7	2	8590-9909999-06	5 Meter 90 Degree Pico Cable
Model 9120-076xM-000-000-SE1			
1	2	9005-20-1629	Carrier Assembly, NPN Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
5	1	8590-9909999-190	NPN Prox Sensor, Flat Pack, .2m Lg, Straight Pico
6	1	3500-1258008-15A	M3 x 8 mm Socket Flat Head Cap Screw Blue Dyed Magni-565 w/ND Microspheres Epoxy
Model 9120-076xM-000-000-SG1			
1	2	9005-20-1628	Carrier Assembly, PNP Quick Disconnect (Includes (2) of item 2)
2	2	3500-1058008-15A	M3 X 8 Socket Head Cap Screws Blue Dyed Magni-565, ND Microspheres
3	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option (Includes (4) of item 4)
4	4	3500-1062025-15A	M4-0.7 x 25 mm Socket Head Cap Screws, Blue, Pre-Applied
5	1	8590-9909999-189	PNP Prox Sensor, Flat Pack, .2m Lg, Straight Pico
6	1	3500-1258008-15A	M3 x 8 mm Socket Flat Head Cap Screw Blue Dyed Magni-565 w/ND Microspheres Epoxy

Notes:

1. Where x is the boss size = A (no boss), B (50 mm), C (56 mm), D (60 mm), E (63 mm), or F (80 mm).

6.6 Tool Plate Parts - Models 9120-076FT-000-000-(E, R)

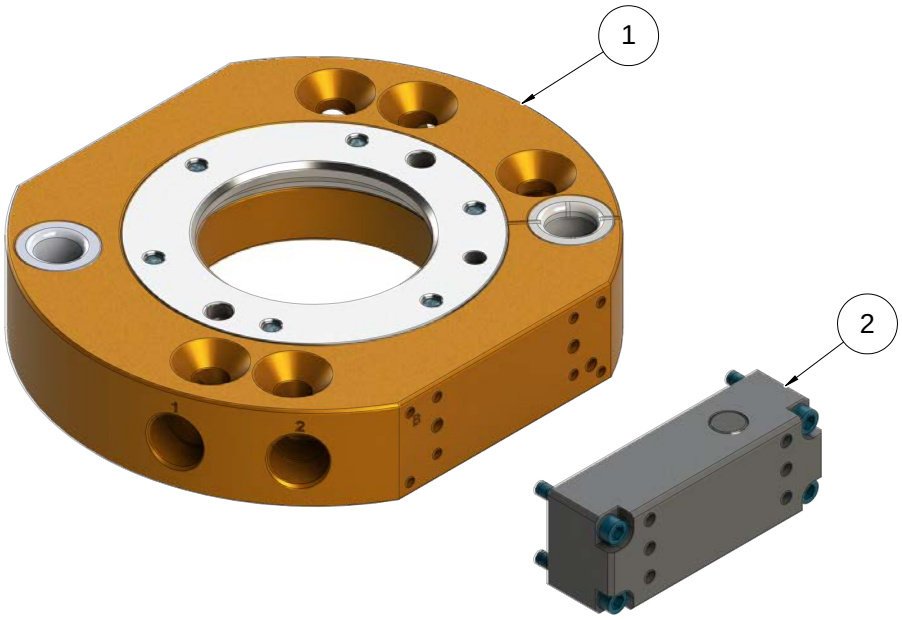


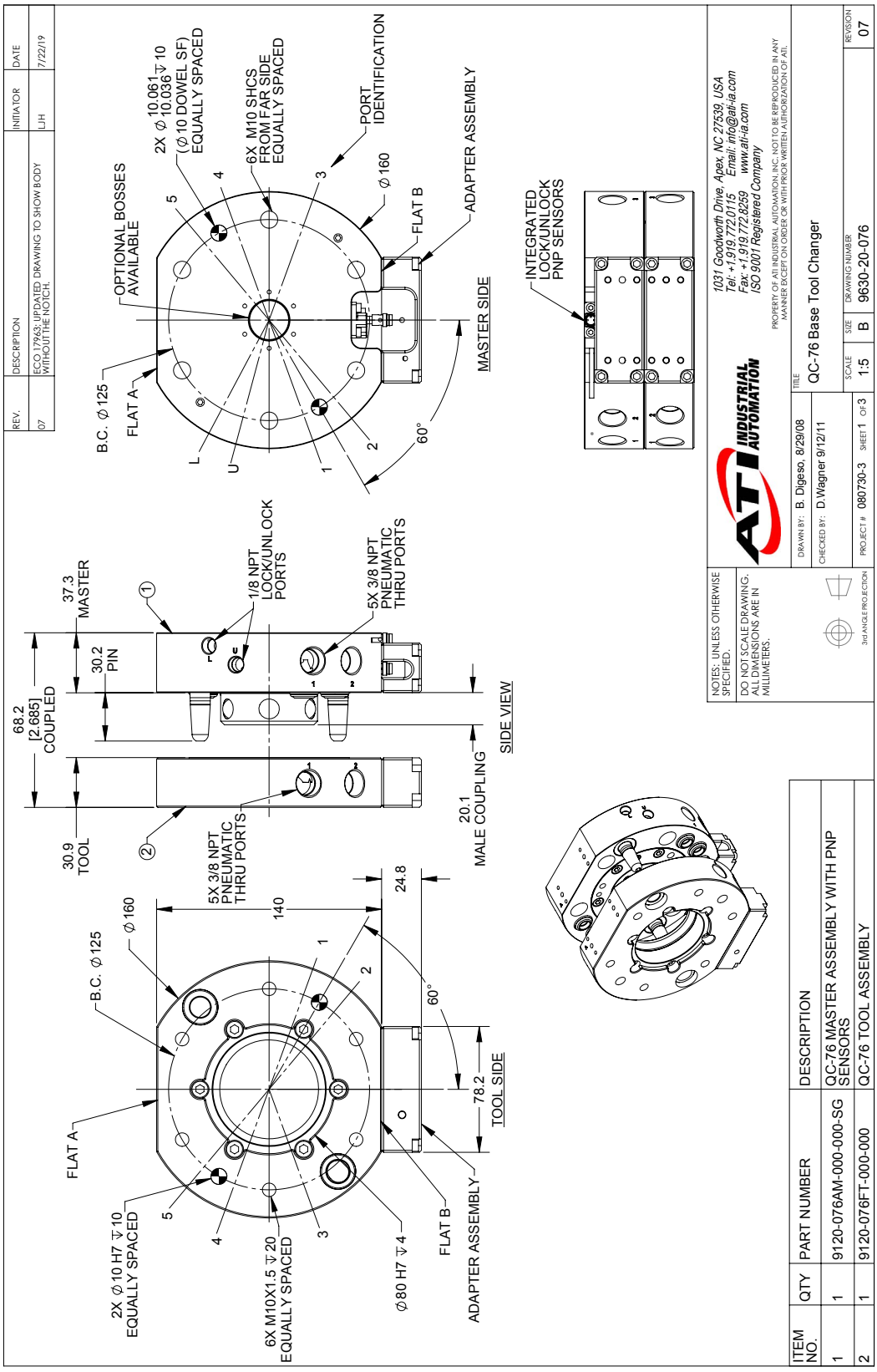
Table 6.6—Tool Plate Parts - Models 9120-76FT-000-000, 9120-76FT-000-000-E, 9120-76FT-000-000-R			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-076FT-000-000	QC-76 Tool Assembly, 3/8 NPT ports, 80 mm boss
	1	9120-076FT-000-000-E	QC-76 Tool Assembly, G 3/8 BSPP Port, 80 mm boss
	1	9120-076FT-000-000-R	QC-76 Tool Assembly, Rc 3/8 BSPT Port, 80 mm boss
2	1	9005-20-2175	Adapter Assembly, Wired Modules, RTL Option

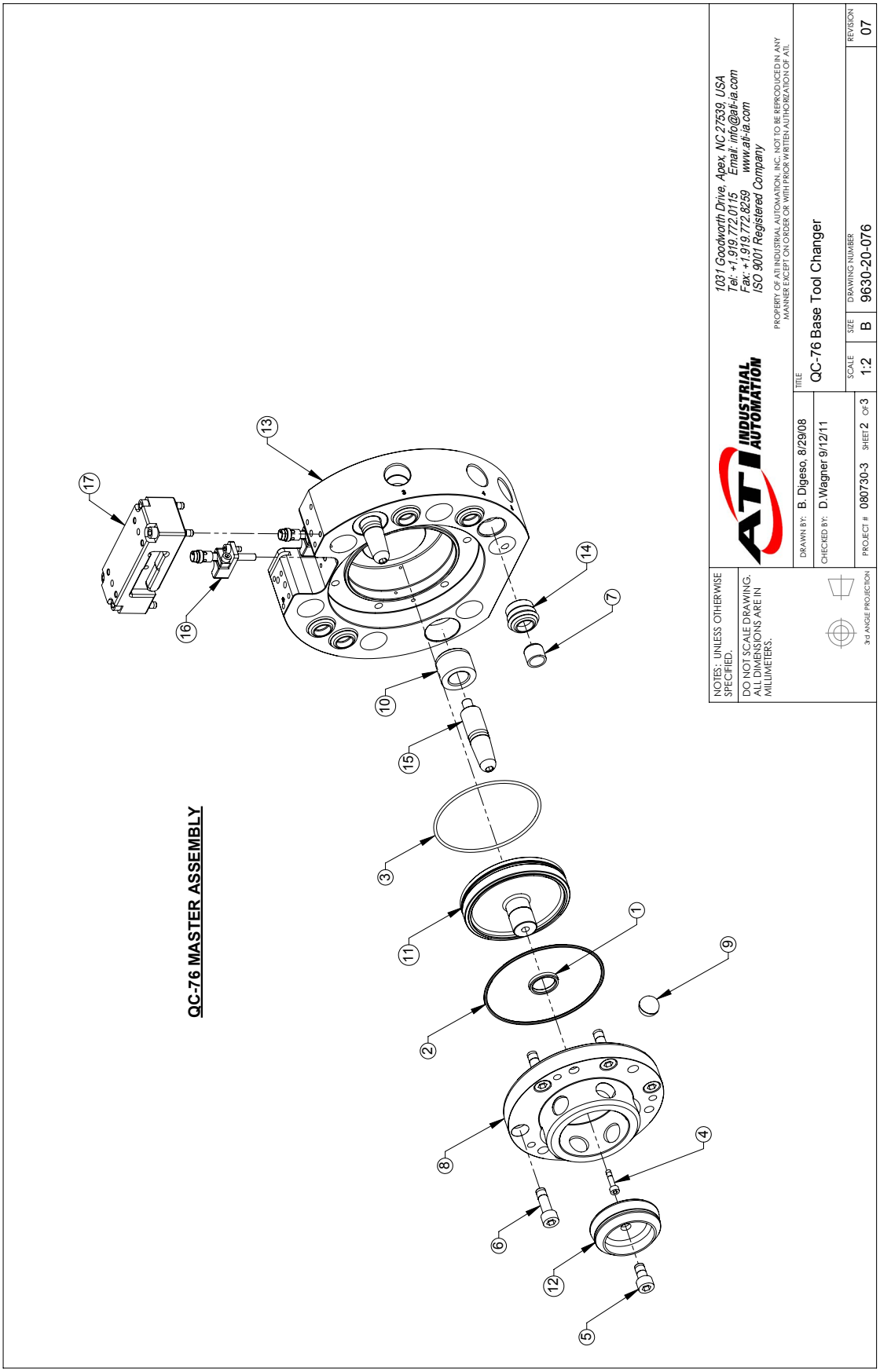
7. Specifications

Table 7.1—QC-76 Specifications		
Specification	**Value**	**Description**
Recommended Max Payload	220 lbs (100kg)	The mass attached to the Tool Changer.
Operating Temperature Range	-20–150°F (-30–66°C)	Temperature for optimal operation.
Operating Pressure Range	60–100 psi (4.1–6.9 bar)	Locking mechanism supply pressure operating range. Supply to be clean, dry, and filtered to 50 micron or better.
Coupling Force @ 80 psi	2,600 lbs. (1,179 kg)	Axial holding force
Recommended Max Moment X-Y (Mxy)	4800 lbf-in 542 (Nm)	Maximum recommended working load for optimum performance of the Tool Changer
Recommended Max Torque about Z (Mz)	6200 lbf-in 700 (Nm)	Maximum recommended working torque for optimum performance of the Tool Changer
Positional Repeatability	0.0006” (0.015 mm)	Repeatability tested at rated load at one million cycles.
Weight (coupled, no access.)	8.15 lbs (3.7 kg)	Master 4.95 lbs.(2.25 kg) Tool 3.15 lbs.(1.42 kg)
Max. Recommended distance between Master and Tool Plate	0.08 in.x (2.0 mm)	No-Touch™ locking technology allows the Master and Tool Plates to lock with separation when coupling.
Mounting/Customer Interface	Master Plate Tool Plate	Meets ISO 9409-1-A125 Meets ISO 9409-1-A125

8. Drawings

8.1 QC-76 Tool Changer, NPT




QC-76 MASTER ASSEMBLY
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115
Fax: +1.919.772.8259
ISO 9001 Registered Company
Email: info@ati-ia.com
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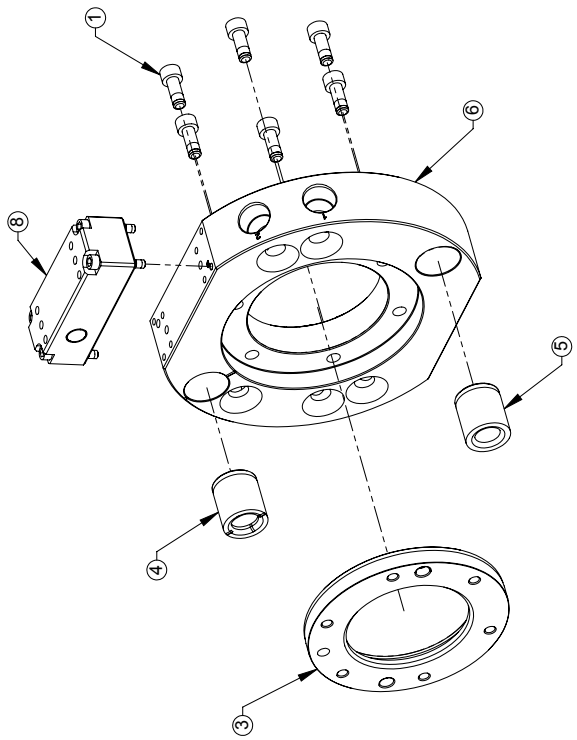
DRAWN BY: B. Digeso, 8/29/08
CHECKED BY: D.Wagner 9/12/11
TITLE
QC-76 Base Tool Changer
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-076
REVISION 07
PROJECT # 080730-3
SHEET 2 OF 3
3rd ANGLE PROJECTION

QC-76 TOOL ASSEMBLY



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3rd ANGLE PROJECTION

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CHECKED BY: D.Wagner 9/12/11
PROJECT # 080730-3 SHEET 3 OF 3

TITLE: QC-76 Base Tool Changer

SCALE 1:2 | SIZE B | DRAWING NUMBER 9630-20-076 | REVISION 07

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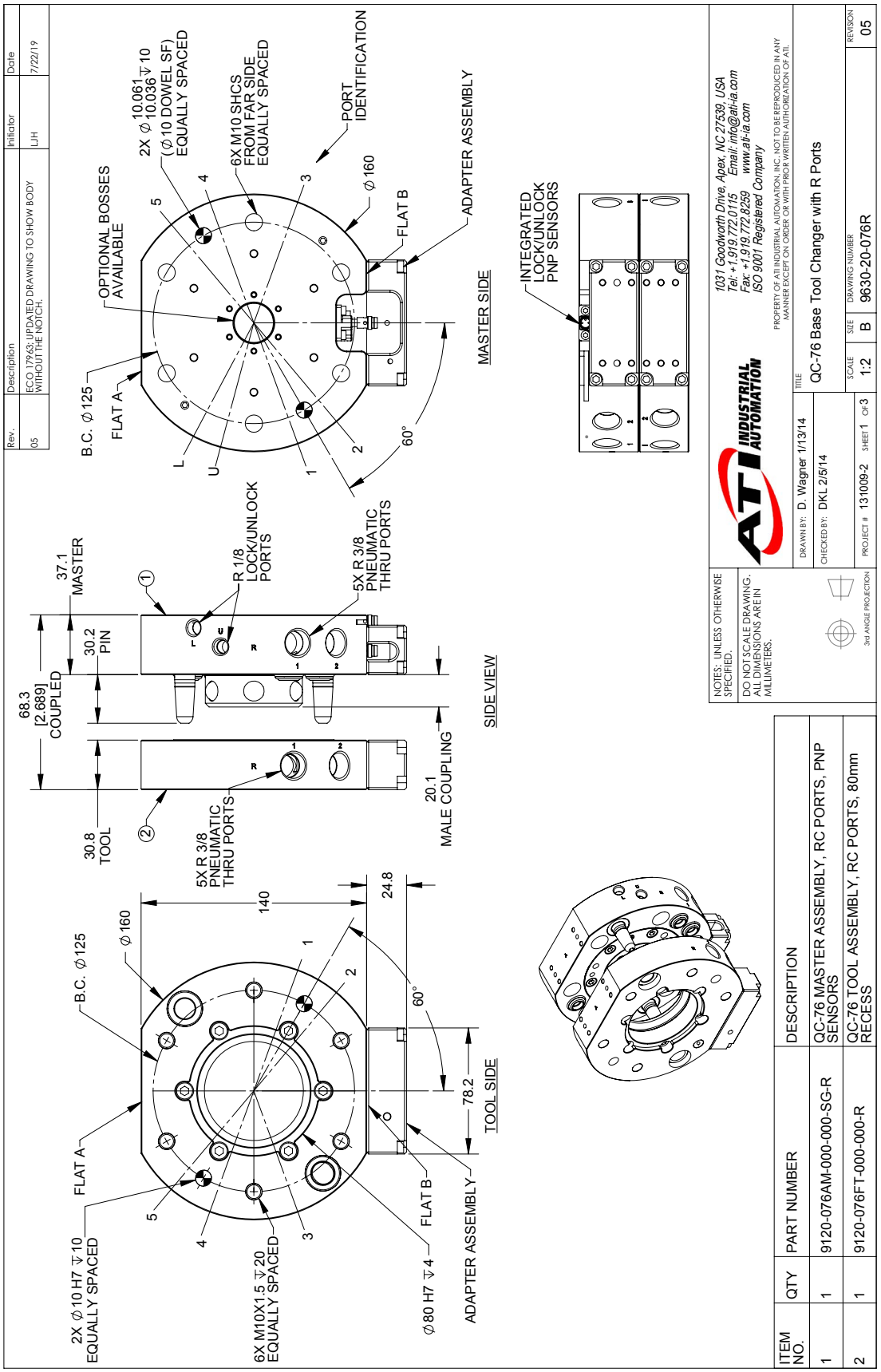
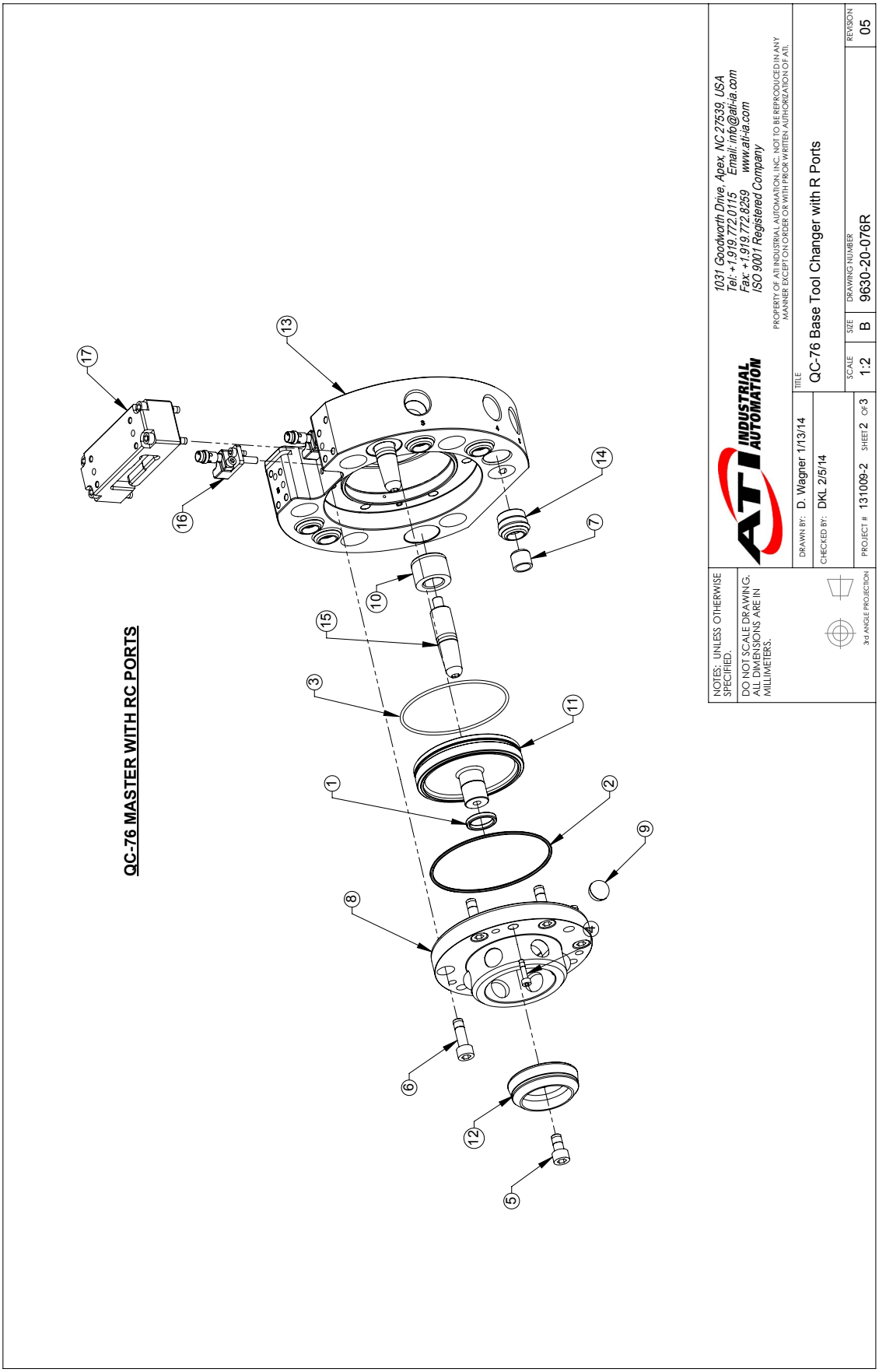
8.2 QC-76 Tool Changer, R Ports




QC-76 MASTER WITH RC PORTS
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
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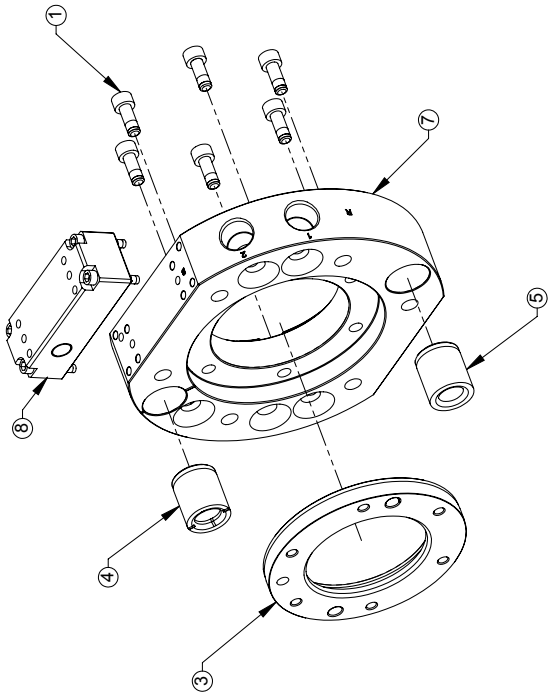
CHECKED BY: DKL 2/5/14
PROJECT # 131009-2 SHEET 2 OF 3
3rd ANGLE PROJECTION
TITLE
QC-76 Base Tool Changer with R Ports
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-076R
REVISION 05

QC-76 TOOL WITH RC PORTS



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3rd ANGLE PROJECTION

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CHECKED BY: DKL 2/5/14
PROJECT # 131009-2 SHEET 3 OF 3

TITLE
QC-76 Base Tool Changer with R Ports

SCALE 1:2 | SIZE B | DRAWING NUMBER 9630-20-076R | REVISION 05

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Fax: +1.919.772.8259 www.ati-ia.com
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