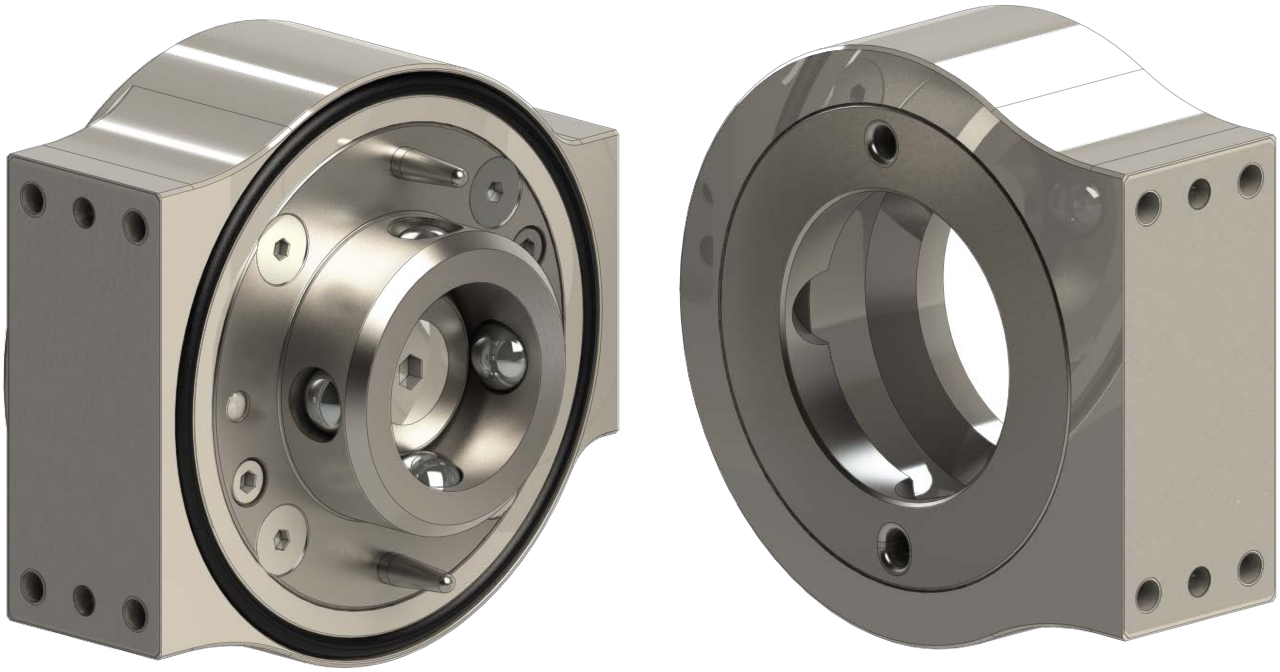
ATI INDUSTRIAL AUTOMATION

A Novanta Company

QC-24MZ1/24TZ1

Custom Tool Changer

Manual



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Engineered Products for Robotic Productivity

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Foreword

This manual contains basic information applicable to all ATI robotic Tool Changers. Certain models have their own manuals that contain more detailed information. Also, additional information about electrical, pneumatic, fluid, high-power, and high-current modules and other options are available in other manuals and documents.

Please contact ATI Industrial Automation with any questions concerning your particular model.

CAUTION: This manual describes the function, application, and safety considerations of this product. This manual must be read and understood before any attempt is made to install or operate the product, otherwise damage to the product or unsafe conditions may occur.

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Glossary

Term	Definition
Bearing Race	A steel ring in the Tool plate that is engaged by the locking balls during the coupling of the Tool Changer.
Cam	A multi tapered sliding cylinder attached to the piston that forces the locking balls outward during the locking process.
Coupling	The physical action of the locking the Master and Tool plates together. See Lock.
Electrical Module	Utility modules that pass electrical power and signals through the Master and Tool modules to the end-effector.
EOAT	**E**nd **o**f the **A**rm **T**ooling – An object attached to the Tool plate that serves a function
End-Effector	Tool used by the robot to perform a particular operation or function.
Fluid Module	Utility modules that pass fluids through the Master and Tool modules to the end-effector.
High Current Module	Utility modules that pass electrical power through the Master and Tool modules to the end-effector.
Interface Plate (IP)	An optional customized component that is used to adapt a Tool Changer to the user's robot or tooling.
Lock	The lock air pressure that is provided to the Master plate locking mechanism to force the cam to press the locking balls against the bearing race and lock the Master and Tool plates together.
Lock Port	A pneumatic port on the Master plate through which air pressure is supplied to lock the Master plate to the Tool plate.
Lock Sensor	A proximity sensor that detects the position of the pneumatically actuated piston when it is in the locked position.
Locked	An output signal provided by a proximity sensor that indicates the coupling mechanism is in the locked position.
Locking Balls	Hardened steel ball bearings used in the fail-safe locking mechanism. The locking balls are forced outward by the cam against the bearing race to pull the Master and Tool plates together.
Locking Mechanism	A manual, pneumatic or electrical driven device that draws the Master and Tool plates together and secures them in a fail-safe locked condition until the mechanism is unlocked. The locking mechanism consists of locking balls, cam, ball cage, bearing race, and either a lever, pneumatic cylinder, or an electric motor.
L/U	Lock/Unlock sensing capability that allows the customer to determine the state of the master assembly locking mechanism.
Master plate	The half of the Tool Changer that is mounted to a robot. The Master plate contains the locking mechanism.
Moment	The applied force multiplied by the distance it is from a point.
No-Touch™	A design feature of all ATI Tool Changer products that allows the Master plate and Tool plate to couple without physical contact prior to locking.
Piston	A cylinder located in the Master plate that actuates the locking mechanism.
Tool plate	The half of the Tool Changer to which various tools or end-effectors are mounted.

1. Safety

The safety section describes general safety guidelines to be followed with this product, explanations of the notifications found in this manual, and safety precautions that apply to the product. Product specific notifications are imbedded within the sections of this manual (where they apply).

1.1 Explanation of Notifications

These notifications are used in the all of ATI manuals and are not specific to this product. The user should heed all notifications from the robot manufacturer and/or the manufacturers of other components used in the installation.

DANGER: Notification of information or instructions that if not followed will result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

WARNING: Notification of information or instructions that if not followed could result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

CAUTION: Notification of information or instructions that if not followed could result in moderate injury or will cause damage to equipment. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

NOTICE: Notification of specific information or instructions about maintaining, operating, installing, or setting up the product that if not followed could result in damage to equipment. The notification can emphasize, but is not limited to: specific grease types, best operating practices, and maintenance tips.

1.2 General Safety Guidelines

Prior to purchase and installation, the customer should verify that the Tool Changer selected is rated for the maximum loads and moments expected during operation. Refer to product specifications section in the each module of this manual or contact ATI for assistance. Particular attention should be paid to dynamic loads caused by robot acceleration and deceleration. These forces can be many times the value of the static forces in the high acceleration or deceleration situations.

The customer is responsible for ensuring that the area between the Master and Tool sides is clear of foreign objects during mating and subsequent coupling. Failure to do so may result in serious injury to personnel.

DANGER: The gap between the Master and Tool sides is a pinch point. All personnel should be prevented from placing any part of their body or clothing in the gap, especially during actuation of the locking mechanism.

The customer is responsible for understanding the function of the Tool Changer and implementing the proper fasteners and/or software to operate the Tool Changer safely. The Tool Changer should be controlled such that there is no chance of the locking or unlocking in a position that would endanger personnel and/or equipment. If the Tool Changer is specified with Lock/Unlock (L/U) and Ready-to-Lock (RTL) sensing capability, the status should be monitored and interlocks applied to prevent injury to personnel and equipment.

All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of the electrical and pneumatic lines must minimize the possibility of stress/strain, kinking, rupture, etc. Failure of the critical electrical or pneumatic lines to function properly may result in injury to personnel and equipment.

All electrical power, pneumatic and fluid circuits should be disconnected during servicing.

1.3 Safety Precautions

WARNING: Remove the all temporary protective materials (caps, plugs, tape, etc.) on the locking face of the Tool Changer and modules prior to operation. Failure to do so will result in damage to Tool Changers, modules, and end-of-arm tooling and could cause injury to personnel.

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 the circuits in accordance with the customer 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: During operation, the area between the Master and Tool must be kept clear. Failure to keep area clear will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.

WARNING: The Tool Changer is only to be used for intended applications and applications approved by the manufacturer. Using the Tool Changer in the applications other than intended will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.

CAUTION: The Master plate locking mechanism must not be actuated without being mounted to the interface plate. Damage to the cover plate and O-ring may result. Always attach the Master plate to the Interface plate prior to attempting any operations**.**

2. 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 QC-24Z1 is a custom Tool Changer that is for a washdown environment in a food application. This QC-24Z1 has ingress seals at the primary customer-interfaces, more corrosion-resistant parts, and less surfaces where food could become caught.

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 the air pressure falls below 4.1 bar (60 psi) 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.

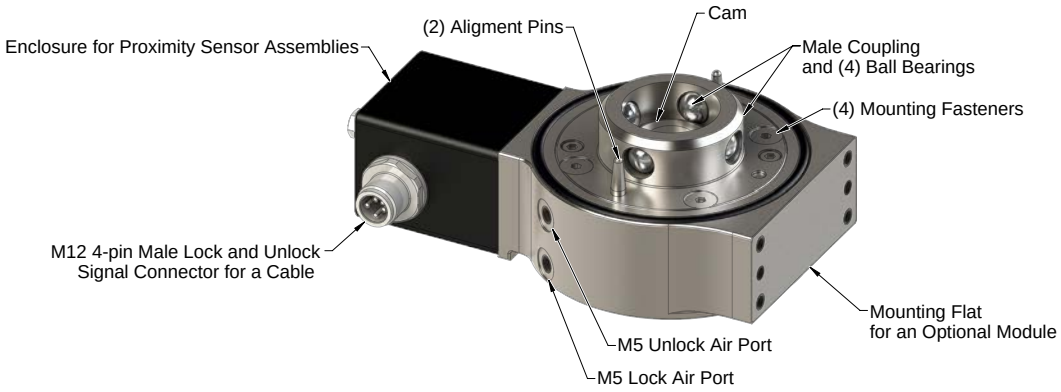
2.1 Master Plate Assembly

The Master plate assembly includes the following features:

- A stainless steel body
- A hardened stainless steel locking mechanism (a cam, male coupling, and tungsten carbide ball bearings)
- Hardened steel alignment pins that mate with bushings on the Tool plate.
- (1) flat for mounting an optional module
- Proximity sensor assemblies used to verify the lock/unlock position of the piston and cam
- A mounting pattern for a robot arm or an interface plate

Non-toxic food grade grease is applied to the cam, male coupling, ball bearings, and pins to enhance performance and maximize the life of the Master plate.

Figure 2.1—Master Plate Assembly (-SG/-SE Type Shown)



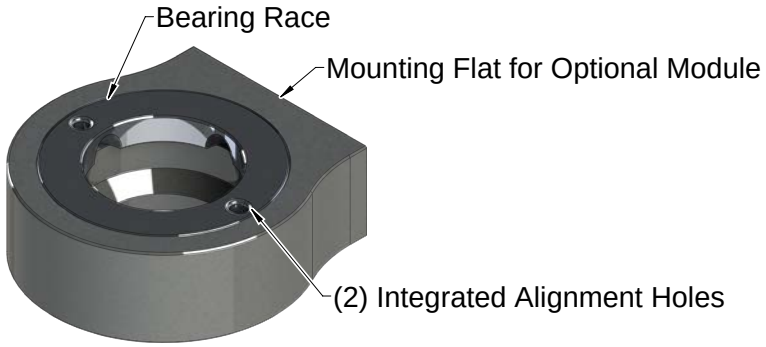
2.2 Tool Plate Assembly

The Tool plate includes a stainless steel body and a hardened stainless steel bearing race (refer to *Figure 2.2*). Alignment bushings are integrated in the bearing race to ensure proper, repeatable orientation with the Master plate.

The Tool plate assembly includes the following features:

- A stainless steel body
- A stainless steel bearing race
- Alignment holes that mate with pins on the Master plate
- (1) flat for mounting an optional module
- A mounting pattern for customer tooling or a tooling interface plate

Figure 2.2—Tool Plate Assembly



3. Installation

All fasteners used to mount the Tool Changer to the robot and customer's tooling should be tightened to the torque values indicated. **Additionally, Loctite 7649 primer and removable Loctite 222 must be used on these fasteners.**

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 the 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.

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.

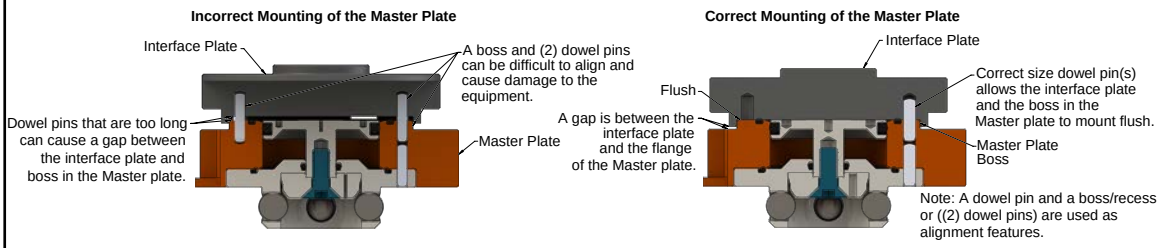
CAUTION: For stainless steel socket screws, use a flat hex broach (not a ball end) to tighten the fasteners. Always tighten to the specified torque.

3.1 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 Drawing Section for technical information on the mounting features.)

CAUTION: Do not use more than two alignment features when securing a Master plate to a robot 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 robot interface plate.

CAUTION: Do not use dowel pins that are too long that will not allow the interface plate and the Master body's boss to mate flush with each other. Using dowel pins that are too long will cause a gap between the interface plate and the Master body's boss causing damage to the equipment. Use the proper size 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 (2) dowel pins or (1) 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 farther than the depth of the dowel holes in the boss of 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 the equipment.
- The interface plate must provide rigid mounting to the Master plate.
- The interface plate design must account clearances required for Tool Changer module attachments and accessories.

3.2 Master Plate Installation

Refer to *Figure 3.1*.

Tools required: *2.5 mm flat hex broach (not a ball end), torque wrench*

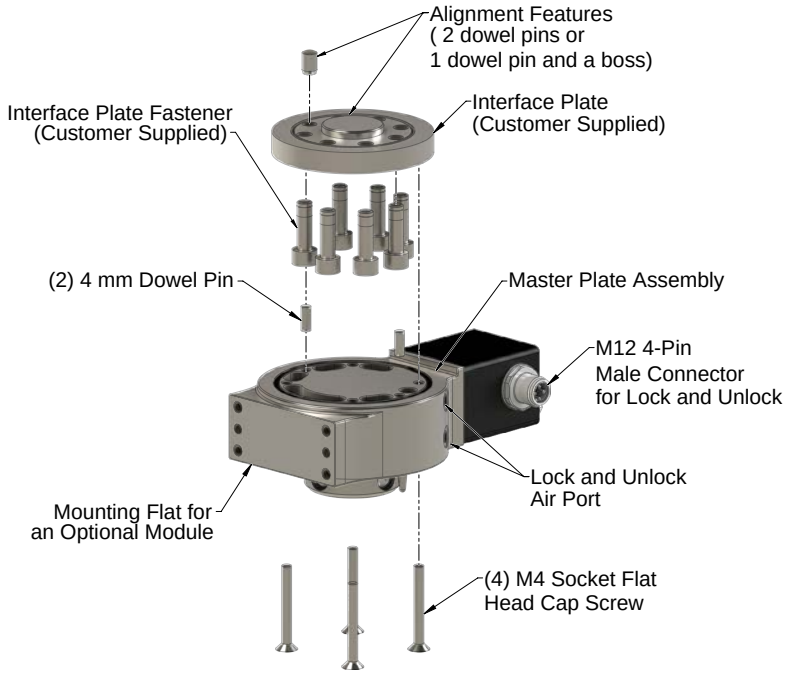
Supplies required: *Clean rag, Loctite® 7649 and 222*

1. Wipe down the mounting surfaces with a clean rag.
2. Install the interface plate to the robot arm. Align using the dowel pin(s) and secure with customer supplied fasteners.

> **CAUTION:** Because the (4) M4 socket flat head caps screws are stainless steel, use a flat hex broach (not a ball end) to tighten the fasteners. Always tighten to the specified torque.

3. If the (4) M4 socket flat head cap screws do not have a pre-applied adhesive, first apply Loctite 7649 then apply Loctite 222 to the threads of the screws.
4. Align the interface plate with the dowel pins on the Master plate.
5. Secure the Master plate to the interface plate with (4) M4 socket flat head cap screws using a 2.5 flat hex broach (not a ball end). Tighten 1.9 Nm (17 in-lbs).
6. Connect the lock and unlock air to the connections on the Master plate. For details on the lock and unlock air refer to *Section 3.8.1—Valve Requirements and Connections for the Locking Mechanism*.
7. Connect the lock and unlock sensor cables:
   a. (For -SE and -SG models) Attach a cable to the M12 4-pin male connector. For connector information, refer to *Section 3.9—Electrical Connections*.
   b. (For -SM and -SP models) Attach the cables' flying-leads to the customer interface. For wiring information, refer to *Section 3.9—Electrical Connections*.
8. If equipped, connect other utilities to the optional modules on the Master plate.

Figure 3.1—Typical Master Plate Installation



3.3 Master Plate Removal

Tools required: *2.5 mm flat hex broach*

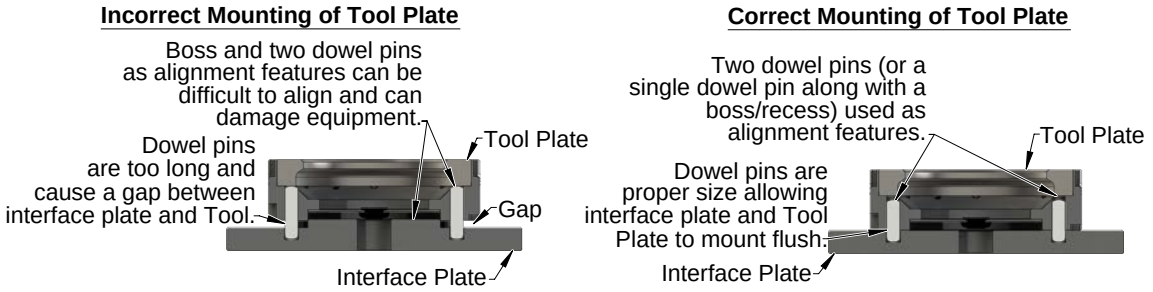
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. If equipped, disconnect all utilities (for example: electrical, pneumatic, hydraulic).
5. Disconnect the lock and unlock sensor cables.
6. Using a 2.5 mm flat hex broach, loosen the (4) M4 socket flat head cap screws in the Master plate so that the Master plate can be removed from the interface plate. Note: The interface plate is not required to be removed from the robot.

3.4 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.



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 the 1" (25.4 mm) prevents debris from the contaminating the locking mechanism.

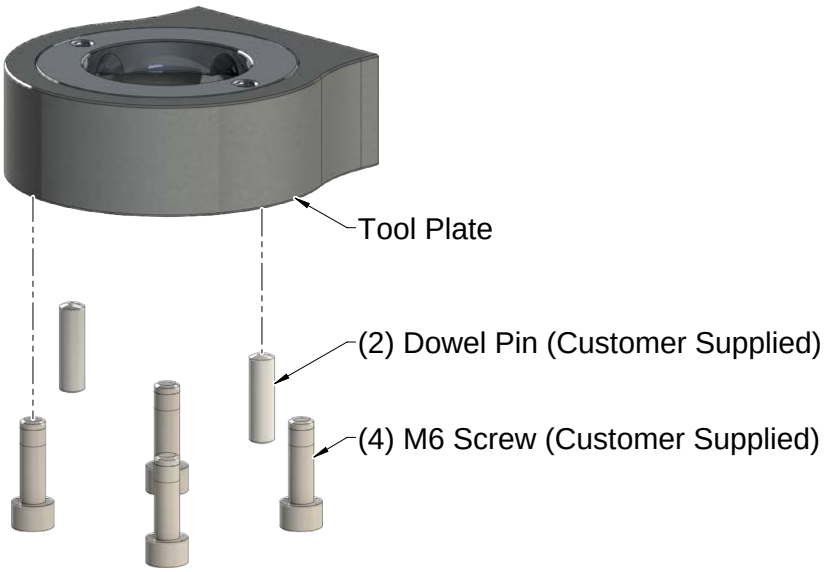
3.5 Tool Plate Installation

Tools required: *hex keys, torque wrench*

Supplies required: *Clean rag, Loctite® 7649 and 222*

1. Wipe down the mounting surfaces with a clean rag.
2. If required, install the tooling interface plate to the customer tooling, align using the boss and dowel pin(s). Secure with customer supplied fasteners.
3. Align the dowel pin in the tool interface plate or customer tooling to the corresponding hole in the Tool plate.
4. First apply Loctite® 7649 then apply Loctite® 222 to the threads of the customer supplied fasteners, (4) M6 screws.
5. Secure the Tool plate to the tool interface plate or customer tooling with (4) M6 screws using appropriate hex key.
6. Connect utilities to the optional modules on the Tool plate.
7. Safely resume normal operation.

Figure 3.2—Standard Tool Plate Installation



3.6 Tool Plate Removal

Tools required: *hex keys, wrenches, or screwdrivers*

1. Place the Tool in a secure location.
2. If equipped, disconnect all utilities (for example: electrical, pneumatic, hydraulic).
3. Using appropriate hex key, remove the (4) M6 fasteners, connecting the Tool plate to the tool interface plate.
4. Remove the Tool plate.

3.7 Optional Module

The optional modules are typically installed on the Tool Changers by ATI prior to shipment. The following steps outline field installation or removal as required. Tool Changers are compatible with many different types of modules. Some modules will require an adapter plate to be installed to the Tool Changer.

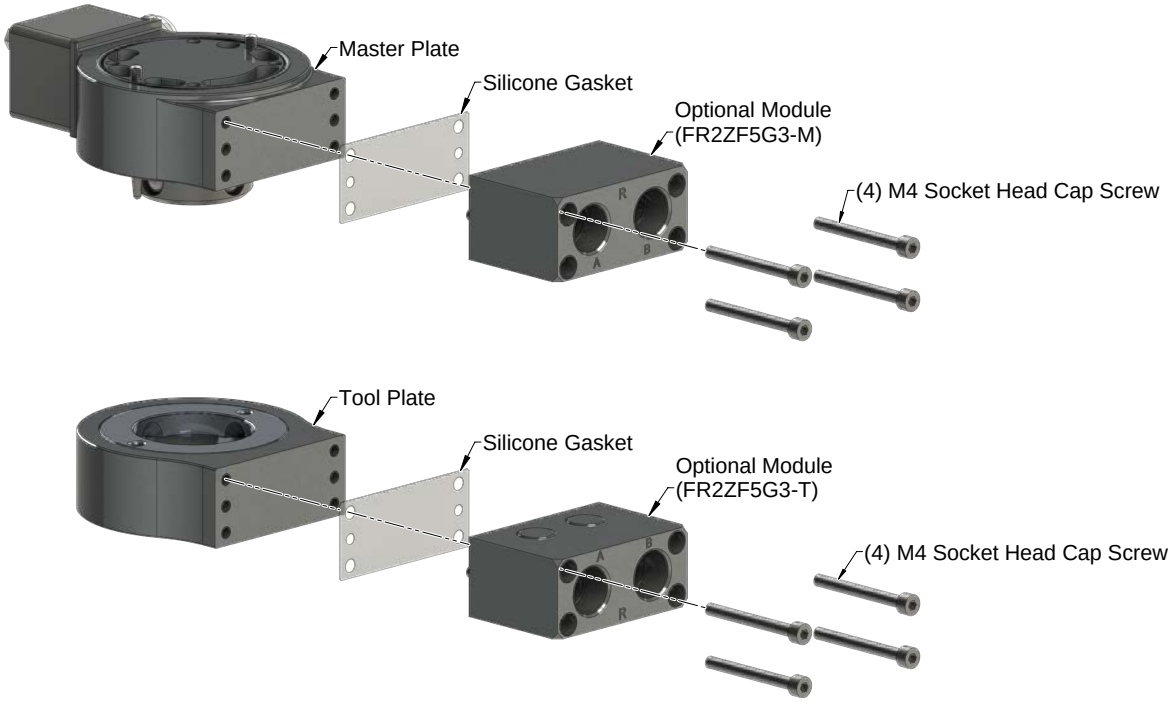
3.7.1 Optional Module Installation

Tools required: *hex keys, torque wrench*

Supplies required: *Loctite® 7649 and 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. Align the (2) dowel pins, if equipped, on the each module to corresponding holes on Flat of the Master or Tool plate as shown in *Figure 3.3*.
5. If not using fasteners with pre-applied adhesive, first apply Loctite 7649 then apply Loctite 222 to the (4) mounting fasteners on the each module.
6. Place the silicone gasket between the optional module and Tool Changer plate.
7. Secure the optional modules to the Tool Changer with mounting fasteners.
8. Remove the all protective caps, plugs, tape, etc. from the module prior to operation.
9. Connect any cables, air line, etc. (if required)
10. Safely resume normal operation.

Figure 3.3—Optional Module Installation (model shown for reference)



3.7.2 Optional Module Removal

Refer to *Figure 3.3*

Tools required: *hex keys*

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 any cables, air line, etc. If required.
5. Supporting the module, remove the (4) mounting fasteners from the each module.
6. Remove the module and gasket from the Tool Changer plate.

3.8 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 the 60 to 100 psi is acceptable for operation of the locking mechanism, with a setting of the 80 psi suggested. The air should be filtered 40 micron or better.

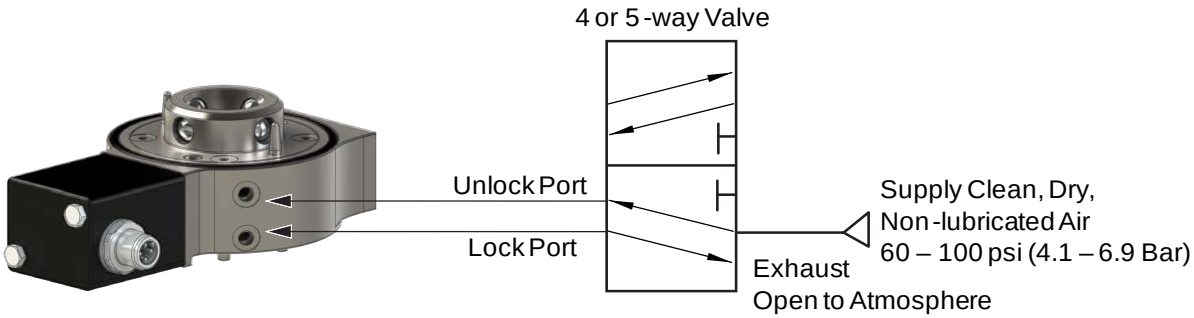
CAUTION: Do not use the Tool Changer in a fail-safe condition. Do not transport the Tool Changer in a fail-safe condition. Possible damage to the locking mechanism could occur. Re-establish air pressure to the Tool Changer before returning to normal operations.

3.8.1 Valve Requirements and Connections for the Locking Mechanism

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 (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 proper shuttling of the valve and prevent coupling/uncoupling from the occurring.

CAUTION: The locking mechanism will not function properly when connected to a single 3-way valve as this type of valve is incapable of venting trapped air pressure from the 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 3.4—Lock and Unlock Pneumatic Connections



3.9 Electrical Connections

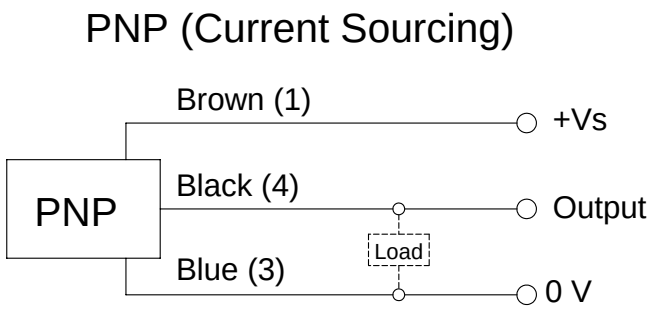
Integrated lock/unlock sensors are available. The sensor assemblies are in an enclosed box. For the pinout and wire call-outs of the M12 4-pin connector, refer to *Section 3.9.3—M12 4-Pin Male Connector (-SG or -SE designation)*.

3.9.1 PNP Type Lock and Unlock Sensors

For -SG and -SM sensors:

Table 3.1—PNP (Current Sourcing)	
Description	**Value**
Voltage Supply Range	10-30VDC
Output Circuit	PNP make function (NO)

Figure 3.5—PNP Type Lock, Unlock and RTL Sensors

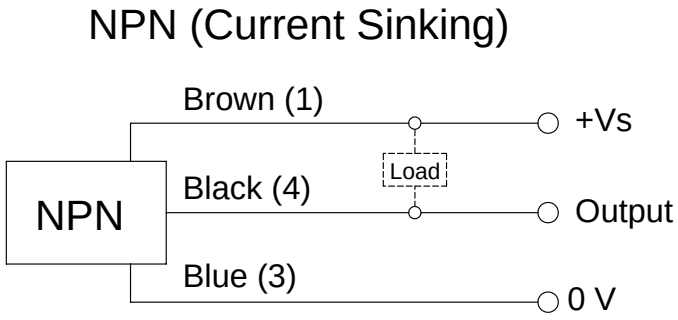


3.9.2 NPN Type Lock and Unlock Sensors

For -SE and -SP sensors:

Table 3.2—NPN (Current Sinking)	
Description	**Value**
Voltage Supply Range	10-30 VDC
Output Circuit	NPN make function (NO)

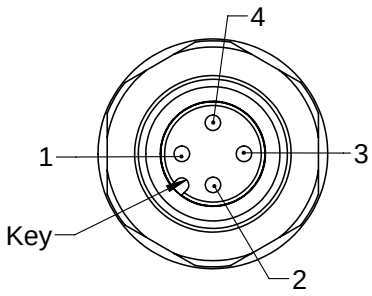
Figure 3.6—NPN Type Lock, Unlock and RTL Sensors



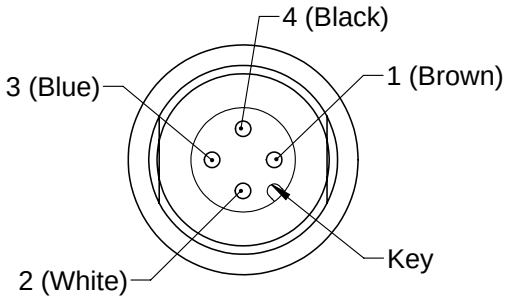
3.9.3 M12 4-Pin Male Connector (-SG or -SE designation)

Table 3.3—Pin Numbers, Wire Colors, and Signals		
Pin Number	**Signal**	**Wire Color**
1	+ Vs	Brown
2	Output Circuit - Lock	White
3	Output Circuit - Unlock	Black
4	0 V (Ground)	Blue

Figure 3.7—M12 4-Pin Male Connector



4-Pin Male Connector
Face View



4-Pin Male Connector
Wire View

4. 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 the 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 food grade grease.

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 4.1—Offset Definitions

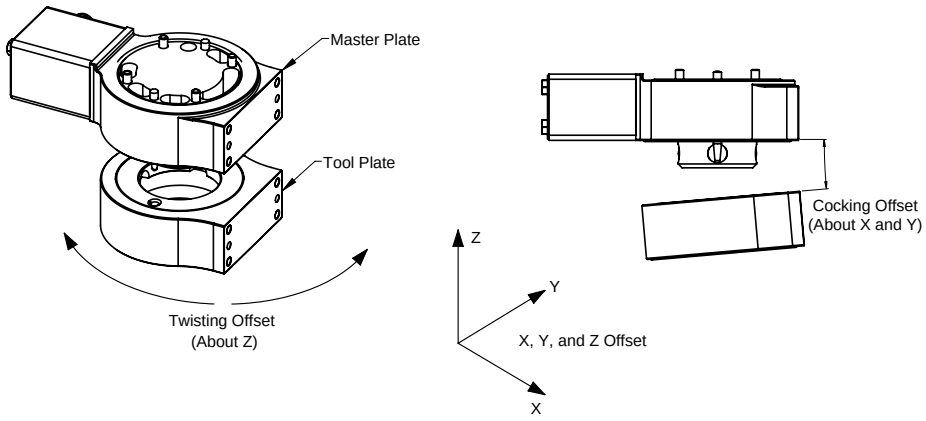


Table 4.1—Maximum Recommended Offsets Prior to Coupling

Model	No-Touch™ Zone Z Offset (Max)[1] (mm)	X and Y Offset (Max)[2] (mm)	Cocking Offset (Max) (degrees)	Twisting Offset (Max) (degrees)
QC-24Z1	2 (0.08 in)	± 1 (0.04 in)	0.8	± 2

Notes:
1. Maximum values shown. Decreasing actual values will minimize wear during coupling/uncoupling.
2. Actual allowable values may be higher in some cases but higher offsets will increase wear during coupling.

4.1 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.

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

4.2 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 the 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 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.

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.

4.3 Conditions for Uncoupling

1. Position 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 the 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 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 unlocking process.

4.4 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.

4.5 Tool Storage Considerations

NOTICE: Tool stand design is critical to 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 TSS (Tool Stand Small) system is compatible with ATI Tool Changer sizes QC-001 to QC-41. The TSS systems can be equipped with horizontal modules, clamp modules, and different types of tool sensing. Two mounting styles are available: a pin and bushing style and a pin and rack style. Visit the ATI Web Site *http://www.ati-ia.com/products/toolchanger/toolstand/small/SmallStand.aspx* for products available or contact ATI for assistance.

If the customer is supplying the tool stand, they 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, interface plate, optional modules, cables, hoses, and customer tooling without allowing deflection in the excess of the offsets.

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. "Horizontal-Position" tool stands cause more wear on the locking mechanism and locating features of both the Tool and tool stand.

A variety of the methods may be used to position Tool in the tool stand. A common method is to use tapered alignment pins and bushings. Robot programming and positional repeatability are vital in the 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 an added safety measure If the 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 the falling on the sensor and creating false readings.

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

5. 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 the 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.

5.1 Preventive Maintenance

A visual inspection and preventive maintenance schedule is provided in table below. Detailed assembly drawings are provided in*Section 9—Drawings* of this manual. Refer to module sections for detailed preventive maintenance steps for all utility modules.

Table 5.1—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

Balls/Alignment Pins/Holes/Bearing Race

- ☐ Inspect for lubrication and wear. JET LUBE® FMG 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 5.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins*.
- ☐ Inspect for excessive alignment pin/bushing wear, may be an indication of the poor robot position during pickup/drop-off. Adjust robot position as needed.
- ☐ Inspect for wear on the ball bearings/bearing race, may be an indication of the excessive loading.

Mounting Hardware/Interface Connections

- ☐ Inspect for proper torque and interference or wear, abrasions, cuts of hoses, and electrical cables. Tighten and correct as required. Refer to *Section 3—Installation*.

Seals (Modules)

- ☐ Inspect for wear, abrasion, and cuts. Refer to *Section 6.2.4—V-ring Seal Inspection and Replacement*.

Sensors and Cables

- ☐ Inspect sensor cable connectors for tightness, if loose tighten connections.
- ☐ Inspect sensor cables for any damage, cuts, and abrasion. Replace as necessary. Refer to *Section 6.2—Service Procedures*.

Electrical Contacts/Pin Block (Modules)

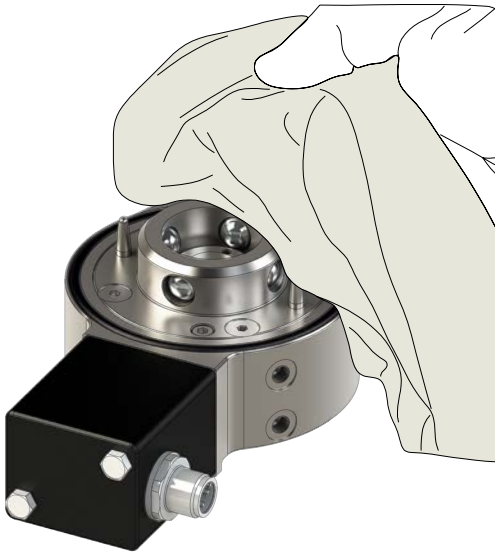
- ☐ Inspect for damage, debris, and stuck/burnt pins. Clean pin blocks as required, refer to *Section 5.3—Pin Block Inspection and Cleaning*.

5.2 Cleaning and Lubrication of the Locking Mechanism and Alignment Pins

Supplies required: *Clean rag, food grade grease*

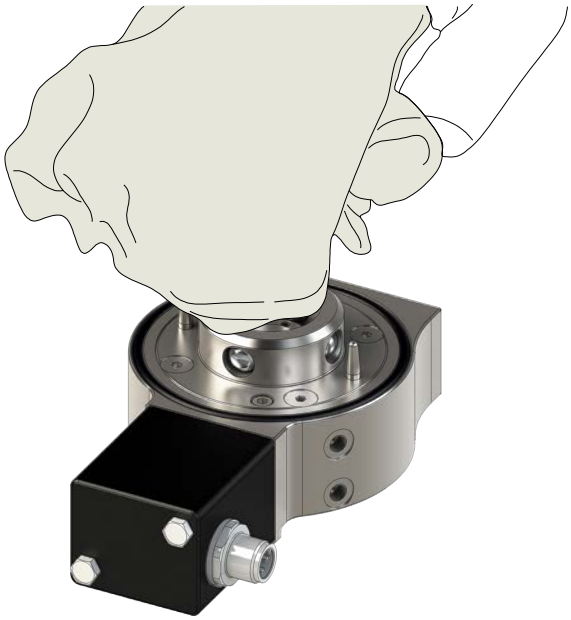
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Use a clean rag to thoroughly remove any lubricant and debris from the ball bearings, male coupling, cam,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

Figure 5.1—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 5.2—Cleaning Ball Bearings, Cam and Inner Surfaces of Male Coupling

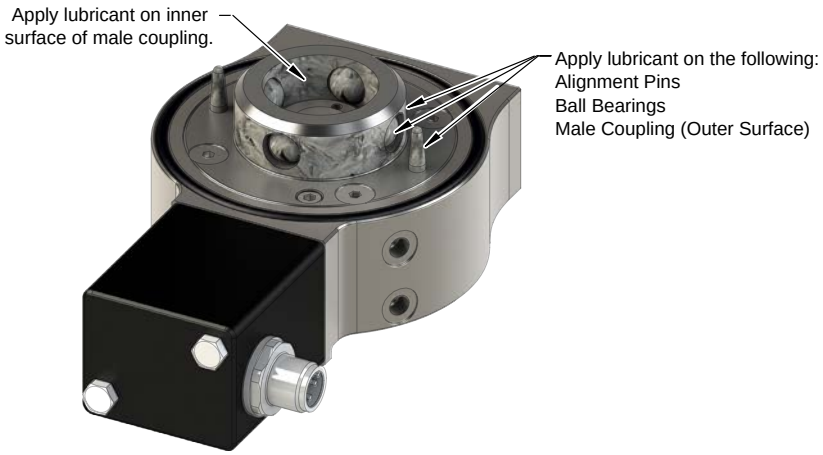


6. Check each ball bearing to make sure it moves freely in the male coupling. Additional cleaning may be necessary to free up any ball bearings that are sticking in place.

Figure 5.3—Check Ball Bearing Movement

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

Figure 5.4—Apply Lubricant to Locking Mechanism

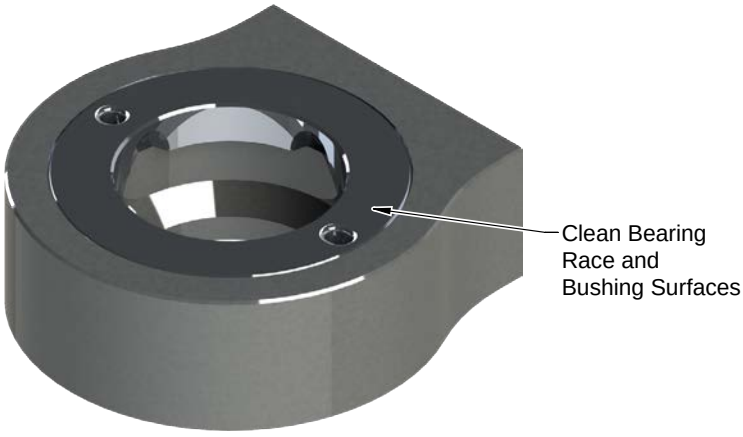


8. Use a clean rag to thoroughly remove any lubricant and debris from the Tool plate bearing race and bushings.

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

9. Safely resume normal operation.

Figure 5.5—Clean Tool Plate Surfaces of Locking Mechanism



5.3 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 5.6—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 5.7—Clean Pin Blocks with a Nylon Brush

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

Figure 5.8—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.

6. Troubleshooting and Service Procedures

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

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 the circuits in accordance with the customer's 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.

6.1 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 the 4.1 Bar (60 psi).
- No air or vacuum can be trapped in a de-energized lock or unlock port (pressure must be vented to atmosphere).

Table 6.1—Troubleshooting Procedures

Symptom	Cause	Resolution
Unit will not lock or unlock	The ball bearings and/or cam are not moving freely in the male coupling.	Clean and lubricate as needed to restore smooth operation (see *Section 5.2—Cleaning and Lubrication of the Locking Mechanism and Alignment Pins*).
	The control module is not operating correctly.	Check the troubleshooting section in the ATI 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 4.4—Tool Identification*. Re-teach the robot to bring the Master plate 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 6.2—Service Procedures*.
	Lock sensor is out of the position.	Replace the lock sensor sub-assembly as necessary. Refer to *Section 6.2—Service Procedures*.
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 6.2—Service Procedures*.
	Unlock sensor is out of the position.	Replace the unlock sensor sub-assembly as necessary. Refer to *Section 6.2—Service Procedures*.
Units Equipped with Electrical Modules		
Contamination in the electrical contacts	V-ring seal damaged.	Inspect V-ring seal for damage, replace damaged seal. Refer to *Section 6.2—Service Procedures*.

6.2 Service Procedures

Component replacement and adjustment procedures are provided in following section.

6.2.1 Lock and Unlock Sensor Replacement for -SG and -SE Models

The proximity sensors are dependable and normally do not need to be replaced. Exhaust all other possible solutions, before choosing to replace the proximity sensors, including: checking continuity, air supply, lubrication, and pneumatic components prior to replacing the sensor.

Refer to *Figure 6.1*.

Parts required: *Refer to Section 7.1—Master Plate (-SE and -SG Models)*

Tools required: *2.5 mm hex key, 7 mm wrench, adjustable wrench, torque wrench*

Supplies required: *Loctite® Primer 7649, Loctite® 222, and Loctite® 242*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Remove the sensor cover:
   a. Disconnect the cable from the M12 4-pin male connector on the sensor cover.
   b. Use a 7 mm wrench to remove the (2) M4 hex head cap screws from the cover.
   c. Carefully remove the cover to access the (2) sensor connector assemblies.
   Note: the O-ring for the sensor cover may have to be repositioned into the channel of the sensor cover.
5. Disconnect the sensors and remove from the Master plate:
   a. Disconnect the sensor connectors from the connector plugs in the sensor cover.
   b. Using a 2.5 mm hex key, remove the (2) M3 socket head cap screws that secure the (2) sensor assemblies to the Tool Changer.
   c. Remove the (2) sensor assemblies. Be sure that the O-rings are removed with sensor assemblies.

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

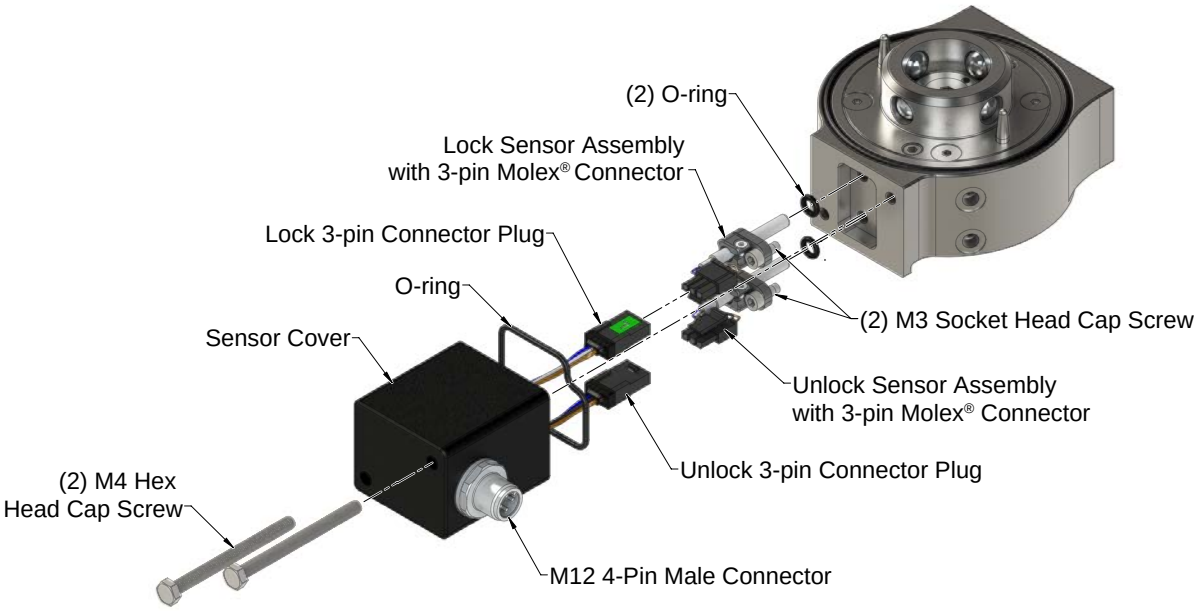
6. Install the new sensor assemblies on the Tool Changer.
   a. Be sure that new O-rings are installed around the sensor bodies.
   b. Using a 2.5 hex key, install the (4) M3 socket head cap screws that secure the sensor assemblies to the Master plate. Tighten to 1.02 Nm (9 in-lbs).

NOTICE: The connector plugs inside the sensor cover are labeled 'L' for Lock and 'U' for Unlock.

NOTICE: The Lock and Unlock sensor assemblies depend on their placement in the Tool Changer Master plate. Refer to *Figure 6.1*.

7. Snap the 3-pin Lock and Unlock sensor connectors into the Lock and Unlock connector plugs in the sensor cover.
8. Position the interlocked Molex® connector assemblies on either side of the M12 connector inside the sensor cover.
9. Install the sensor cover.
   Note: the O-ring for the sensor cover may have to be repositioned into the channel of the sensor cover.
   a. Apply Loctite Primer 7649 and then apply Loctite 222 to the (2) M4 hex head cap screws.
   b. Using a 7 mm wrench, install the (2) M4 hex head cap screws that secure the sensor cover to the Master plate. Tighten to 1.13 Nm (10 in-lbs).
10. Connect a cable to the M12 4-pin male connector.
11. Safely resume normal operation.

Figure 6.1—Lock and Unlock Sensor Assembly Replacement



6.2.2 M12 Connector Assembly Replacement

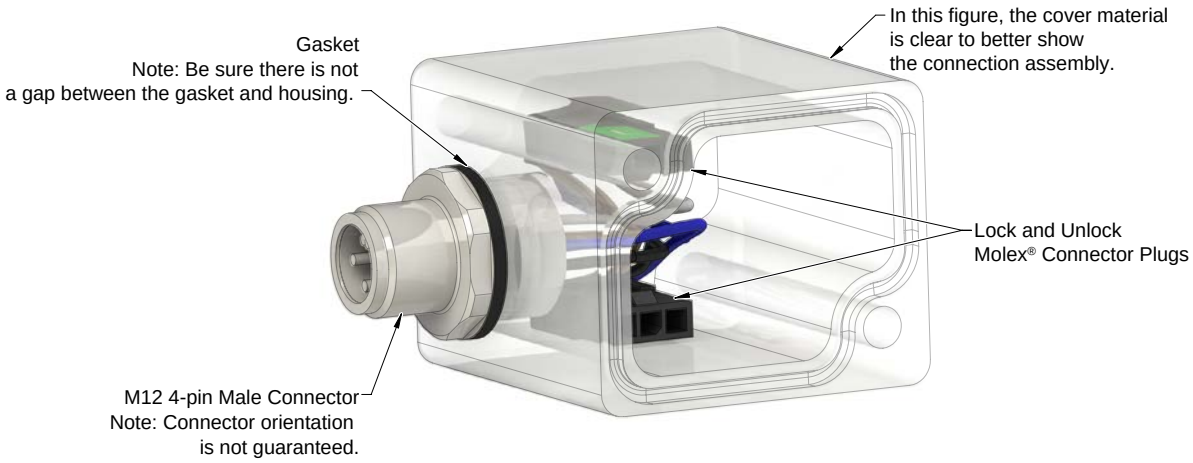
Parts required: *Refer to Section 7.1—Master Plate (-SE and -SG Models)*

Tools required: *17 mm wrench, torque wrench*

Supplies required: *Loctite® 242*

1. Complete steps *1* through *4* from *Section 7.1.1—Lock and Unlock Sensor Assembly for -SE and -SG*.
2. Disconnect the Molex® sensor connectors from the connector plugs in the sensor cover. Refer to *Figure 6.1*.
3. Remove the M12 connector and plug connectors from the sensor cover:
   a. Use a 17 mm wrench to remove the M12 connector.
   b. Remove the gasket.
   c. Slide the M12 connector and the plug connectors out of the sensor cover.
4. Install a new M12 connector and plug connectors in the sensor cover:
   a. Slide the M12 connector and plug connectors into the sensor cover.
   b. Apply Loctite 242 to the threads of the M12 connector.
   c. Using a 17 wrench, tighten the locknut that secures the M12 connector to the cover. Tighten to 1 Nm (2.2 in-lbs).
5. Install the sensor cover assembly on the Tool changer; refer to step *7* from *Section 7.1.1—Lock and Unlock Sensor Assembly for -SE and -SG*.

Figure 6.2—M12 Connector and Connector Plugs In the Sensor Cover



6.2.3 Lock and Unlock Sensor Replacement for -SM and -SP Models

The proximity sensors are dependable and normally do not need to be replaced. Exhaust all other possible solutions, before choosing to replace the proximity sensors, including: checking continuity, air supply, lubrication, and pneumatic components prior to replacing the sensor.

Refer to *Figure 6.3*.

Parts required: *Refer to Section 7.2—Master Plate (-SM and -SP Models)*

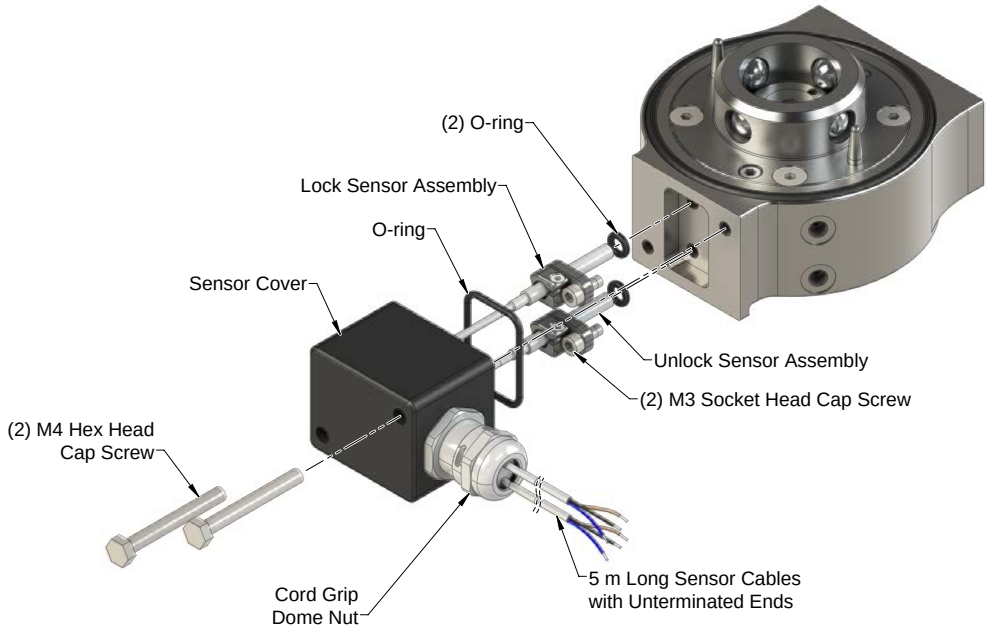
Tools required: *2.5 mm hex key, 7 mm wrench, torque wrench*

Supplies required: *Loctite 7649 and 222*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Remove the sensor cover:
   a. Disconnect the sensor cable's flying-leads for the sensor being replaced.
   b. Loosen the cord grip dome nut that provides an exit for the sensor cables.
   c. Using a 7 mm wrench, remove the (2) M4 hex head cap screws that secure the sensor cover to the Master plate.
   d. Carefully remove the sensor cover allowing the sensor cables to slide through the cord grip until the sensors can be accessed.
   Note: the O-ring for the sensor cover may have to be repositioned into the channel of the sensor cover.
5. Remove the lock and/or unlock sensor assemblies:
   a. Using a 2.5 mm hex key, remove the M3 socket head cap screw that secure the lock and/or unlock sensor assembly to the Master plate.
   b. Pull the sensor assembly straight out from the Master plate body. Be sure that the O-rings are removed with sensor assemblies.
   c. Slide the lock and/or unlock sensor cable out of the cord grip on the sensor cover. 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 6.3—Lock and Unlock Sensor Assembly Replacement



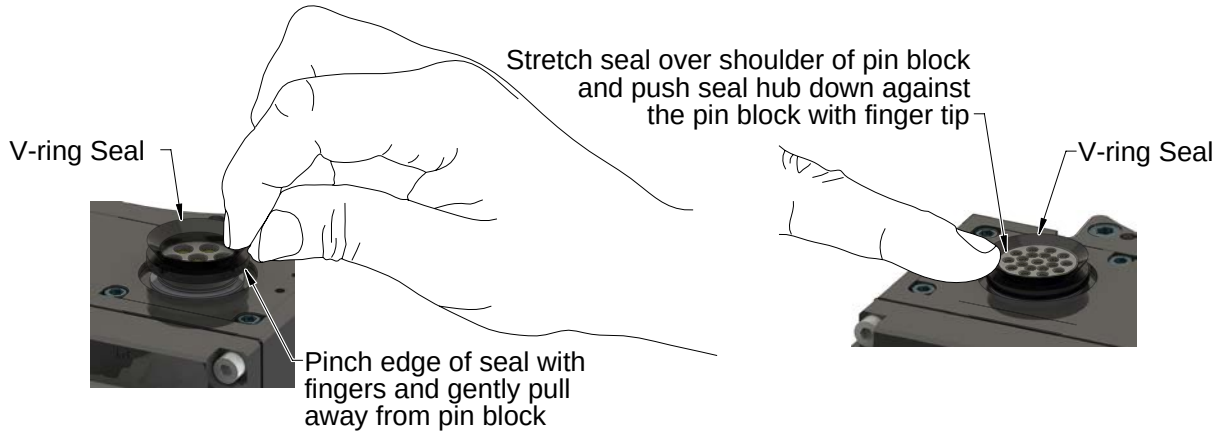
6. Install the new lock and/or unlock sensor assemblies into the Master plate:
   a. Route the new lock and/or unlock sensor cable through the cord grip on the sensor cover.
   b. Insert the lock and/or unlock sensor assembly into the Tool Changer body as shown in *Figure 6.3*. Be sure that the new O-ring is in place before inserting sensor in the Master plate.
   c. Using a 2.5 mm hex key, secure the sensor assembly with a M3 socket head cap screw. Tighten to 1.02 Nm (9 in-lbs).
7. Install the sensor cover:
   a. Carefully install the sensor cover allowing the sensor cables to slide through the cord grip until the cover in place.
   Note: the O-ring for the sensor cover may have to be repositioned into the channel in the sensor cover.
   b. Tighten the cord grip dome nut that provides an exit for the sensor cables.
   c. Apply Loctite 7649 and 222 to the (2) M4 hex head cap screws.
   d. Using a 7 mm wrench, install the (2) M4 hex head cap screws that secure the sensor cover to the Master plate. Tighten to 1.13 Nm (10 in-lbs).
8. Connect the sensor pigtail for the replaced sensor to the customer controller/inputs.
9. Safely resume normal operation.

6.2.4 V-ring Seal Inspection and Replacement

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 6.4—V-ring Seal Replacement



7. Serviceable Parts

7.1 Master Plate (-SE and -SG Models)

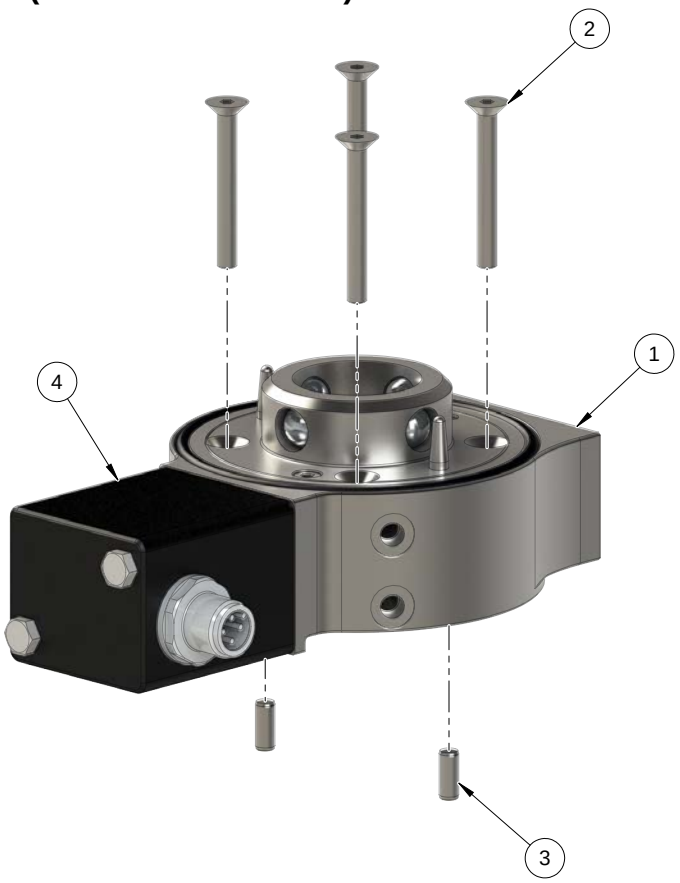


Table 7.1—QC-24MZ1 Master Plate (-SE and -SG Models)			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-024MZ1-000-SE	QC-24Z1 Master, Lock Mechanism with Corrosion Resistant Plating, 304 Stainless Steel Body, NPN Sensing with M12 Connector
		9120-024MZ1-000-SG	QC-24Z1 Master, Lock Mechanism with Corrosion Resistant Plating, 304 Stainless Steel Body, PNP Sensing with M12 Connector
2	4	3500-1262035-21	M4 X 35 Socket Flat Head Cap Screw, 18-8 Stainless Steel
3	2	3540-0104010-21	Dowel Pin, 4 mm X 10 mm, Stainless Steel 18-8, DIN 7 ISO 2338
4	1	9005-20-9260[1]	NPN Sensor Assembly Kit for 9120-024MZ1-000-SE
		9005-20-9258[2]	PNP Sensor Assembly Kit for 9120-024MZ1-000-SG

Notes:
1. For a list of components, refer to *Table 7.2*.
2. For a list of components, refer to *Table 7.3*.

7.1.1 Lock and Unlock Sensor Assembly for -SE and -SG

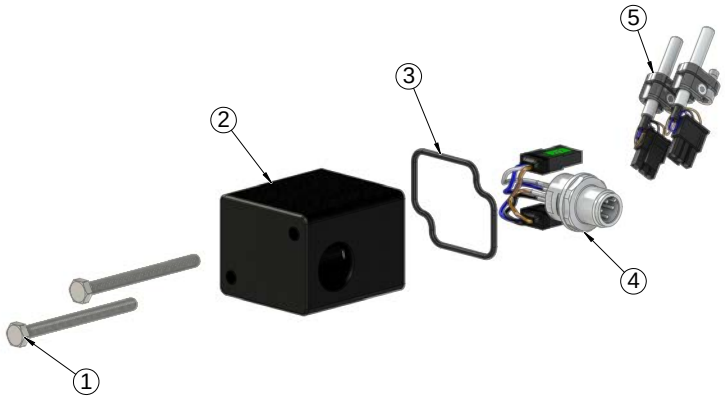


Table 7.2—Sensor Assembly Kit for -SE (P/N 9005-20-9260)			
Item No.	**Qty**	**Part Number**	**Description**
1	2	3560-0862050-23	M4-0.7 X 50 Hex Head Cap Screws, Stainless Steel, Self Sealing, Viton
2	1	3700-20-11723	QC-24Z1 Lock Unlock Sensor Connector Cover
3	1	3410-0001158-01	AS568A-028, O-ring, Buna
4	1	9015-20-1267	Lock/Unlock Connector Subassembly that contains (2) Lock and Unlock Molex 3-pin Connectors with 20-24 AWG that are wired to a M12 4-pin IP69K Connector
5	1	9015-20-1287	Lock/Unlock NPN Sensor Assembly that contains (2) Lock and Unlock Molex 3-Pin Connectors with 30 mm long 26-30 AWG wires that are routed to 4 mm NPN sensors Each sensor assembly has a M3 x 8 socket head cap screw for installing to the Tool Changer

Table 7.3—Sensor Assembly Kit for -SG (P/N 9005-20-9258)			
Item No.	**Qty**	**Part Number**	**Description**
1	2	3560-0862050-23	M4-0.7 X 50 Hex Head Cap Screws, Stainless Steel, Self Sealing, Viton
2	1	3700-20-11723	QC-24Z1 Lock Unlock Sensor Connector Cover
3	1	3410-0001158-01	AS568A-028, O-ring, Buna
4	1	9015-20-1267	Lock/Unlock Connector Subassembly that contains (2) Lock and Unlock Molext 3-pin Connectors with 20-24 AWG that are wired to a M12 4-pin IP69K Connector
5	1	9015-20-1286	Lock/Unlock PNP Sensor Assembly that contains (2) Lock and Unlock Molex 3-Pin Connectors with 30 mm long 26-30 AWG wires that are routed to 4 mm PNP sensors Each sensor assembly has a M3 x 8 socket head cap screw for installing to the Tool Changer

7.2 Master Plate (-SM and -SP Models)

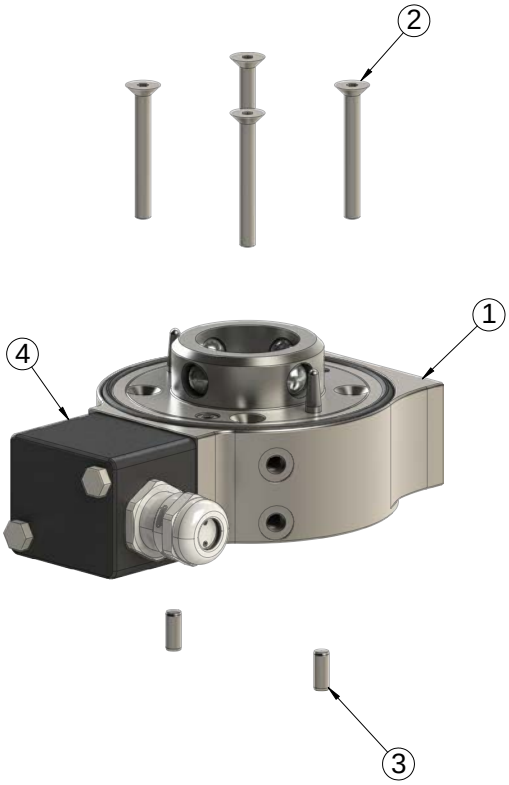


Table 7.4—QC-24MZ1 Master Plate (-SM and -SP Models)			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-024MZ1-000-SM	QC-24Z1 Master, Lock Mech with Corrosion Resistant Plating, 304 SS Body, PNP Sensing
		9120-024MZ1-000-SP	QC-24Z1 Master, Lock Mech with Corrosion Resistant Plating, 304 SS Body, NPN Sensing
2	4	3500-1262035-21	M4 X 35 Socket Flat Head Cap Screw, 18-8 Stainless Steel
3	2	3540-0104010-21	Dowel Pin, 4 mm X 10 mm, Stainless Steel 18-8, DIN 7 ISO 2338
4	1	Refer to *Table 7.5*	Lock, Unlock Sensor Assembly PNP for 9120-024MZ1-000-SM
		Refer to *Table 7.6*	Lock, Unlock Sensor Assembly NPN for 9120-024MZ1-000-SP

7.2.1 Lock and Unlock Sensor Assembly for -SM and -SP

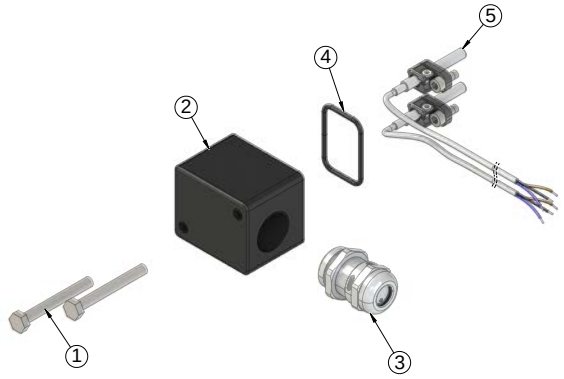


Table 7.5—Sensor Assembly -SM			
Item No.	**Qty**	**Part Number**	**Description**
1	2	3500-0862035-23	M4-0.7 X 35 Hex Head Cap Screw, SS, Self Sealing, Viton
2	1	3700-20-10867	QC-24Z1 Lock Unlock Sensor Cover Block
3		3620-5302700-20	Strain Relief, M16-1.5, Dome Top, (2) 3 mm (.12 inch) Exits, Stainless Steel
4	1	3410-0001152-01	O-ring, Buna
5	2	9005-20-8762	Sensor Carrier Assembly, Single Screw, 4 mm PNP, 5 m Potted Cable, Flying Leads, Viton, Stainless Steel Fasteners that include an M3 x 8 socket head cap screw for installing to the Tool Changer

Table 7.6—Sensor Assembly for -SP			
Item No.	**Qty**	**Part Number**	**Description**
1	2	3500-0862035-23	M4-0.7 X 35 Hex Head Cap Screw, SS, Self Sealing, Viton
2	1	3700-20-10867	QC-24Z1 Lock Unlock Sensor Cover Block
3	1	3620-5302700-20	Strain Relief, M16-1.5, Dome Top, (2) 3 mm (.12 inch) Exits, Stainless Steel
4	1	3410-0001152-01	O-ring, Buna
5	2	9005-20-8763	Sensor Carrier Assembly, Single Screw, 4 mm NPN, 5 m Potted Cable, Flying Leads, Viton, Stainless Steel Fasteners that include an M3 x 8 socket head cap screw for installing to the Tool Changer

7.3 Tool Plate

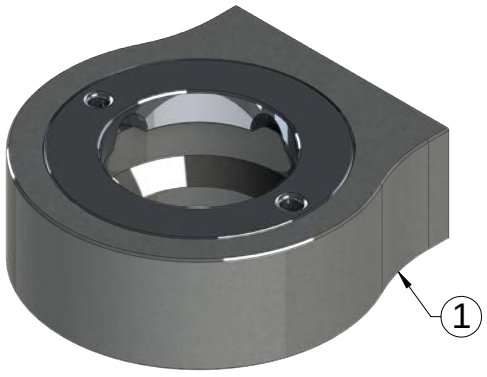
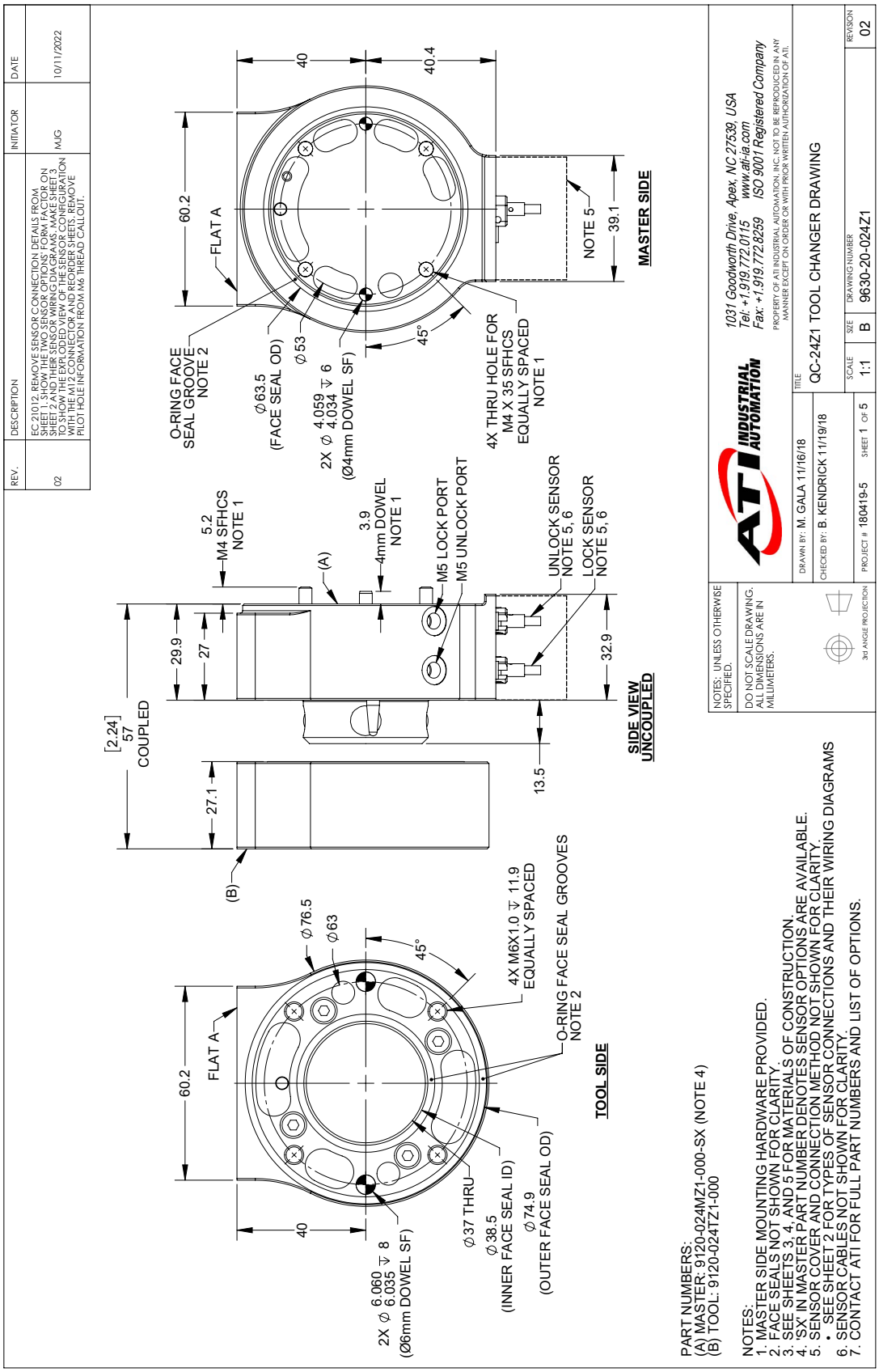


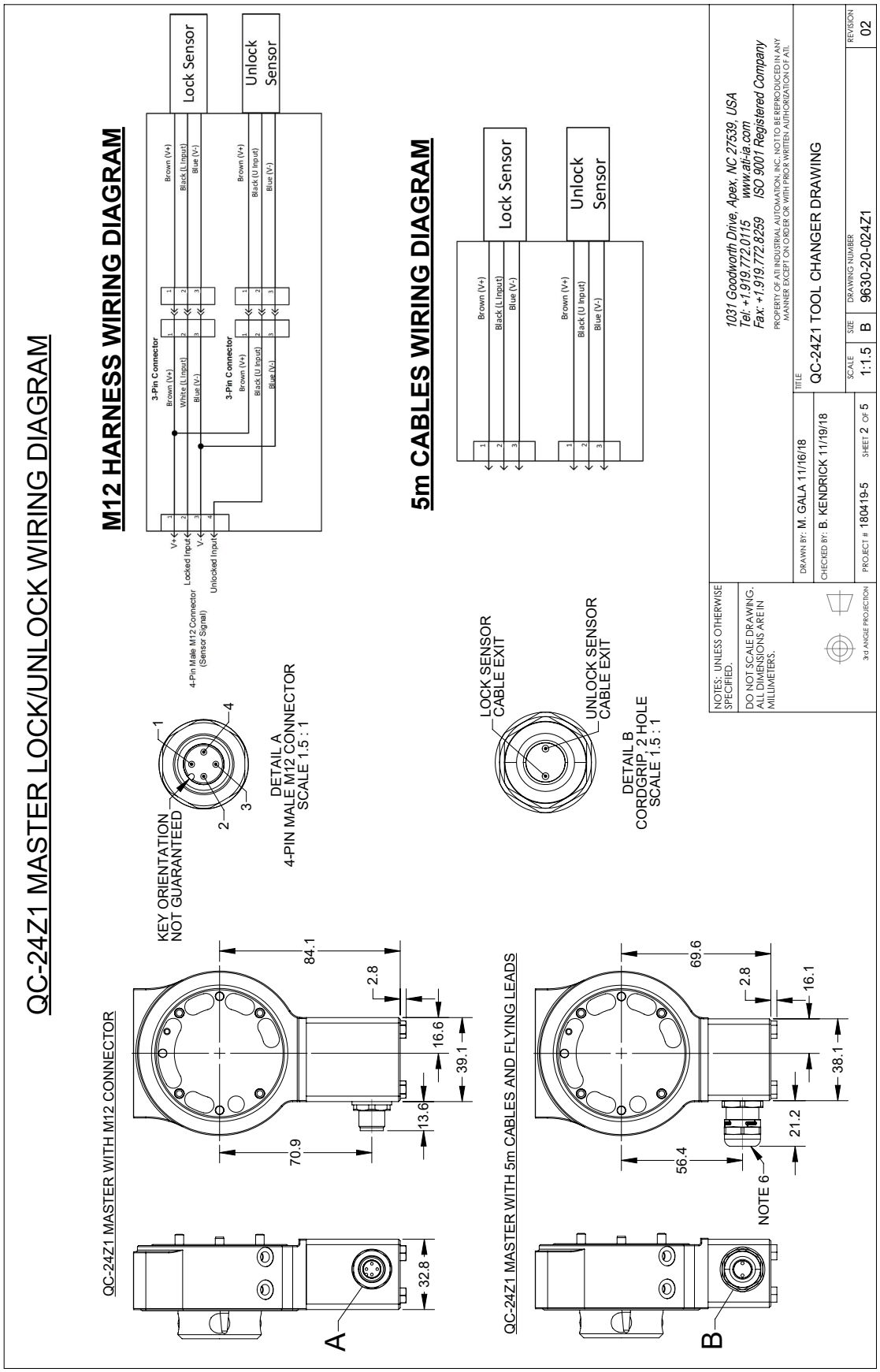
Table 7.7—QC-24TZ1 Tool Plate			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9120-024TZ1-000	QC-24Z1 Tool, 304 SS Body, Increased Corrosion Resistant Bearing Race

8. Specifications

Table 8.1—QC-24Z1 Specifications		
Specification	**Value**	**Description**
Recommended Max Payload	25 kg (55 lb)	The mass attached to the Tool Changer.
Operating Temperature Range	-25–70°C (-13–158°F)	Operational temperature
Operating Pressure Range	4.1–6.9 Bar (60–100 Psi)	Locking mechanism supply pressure operating range. Supply to be clean, dry, and filtered to 40 micron or better.
Coupling Force @ 80 psi	2300 N (520 lbs)	Axial holding force
Recommended Max Moment X-Y (Mxy)	56.5 Nm (500 lbf-in)	Maximum recommended working load for optimum performance of the Tool Changer
Recommended Max Torque about Z (Mz)	35 Nm (310 lbf-in)	Maximum recommended working torque for optimum performance of the Tool Changer
Positional Repeatability	0.015 mm (0.0006”)	Repeatability tested at rated load at one million cycles.
Weight (coupled, no access.)	1.68 kg (3.7 lb)	Master 1.04 kg (2.3 lb) Tool 0.64 kg (1.4 lb)
Max. Recommended distance between Master and Tool plate	2 mm (0.08 in)	No-Touch™ locking technology allows the Master and Tool Plates to lock with separation when coupling.
Sensor Information, Signal Name	L/U (Lock/Unlock)	Optional-(2) proximity sensors assembled in and wired to the customer control for indication of the locking mechanism position.
Sensor Electrical Rating	10 VDC - 30 VDC	Lock and Unlock proximity sensor operating voltage
External M12, 4-Pin Male Connector, IP Rating	IP69K	This IP rating for the connector implies it can withstand high pressure and high temperature wash-downs.
Mounting/Customer Interface	Master plate Tool plate	See *Section 9—Drawings* See *Section 9—Drawings*

9. Drawings


REV. | DESCRIPTION | INITIATOR | DATE
02 | EC 21012. REMOVE SENSOR CONNECTION DETAILS FROM SHEET 1. SHOW THE TWO SENSOR OPTIONS FORM FACTOR ON SHEET 2 AND THEIR SENSOR WIRING DIAGRAMS. MAKE SHEET 3 TOOL SIDE ONLY. ADD NOTE TO SHEET 2 FOR CONSIDERATION WITH THE M12 CONNECTOR AND REORDER SHEETS. REMOVE PILOT HOLE INFORMATION FROM M6 THREAD CALLOUT. | MJG | 10/11/2022
O-RING FACE SEAL GROOVE NOTE 2
Ø63.5 (FACE SEAL OD)
Ø53
2X Ø 4.059 ∓ 6 4.034 (Ø4mm DOWEL SF)
45°
4X THRU HOLE FOR M4 X 35 SFHCS EQUALLY SPACED NOTE 1
60.2
FLAT A
40
40.4
NOTE 5
39.1
MASTER SIDE
5.2 M4 SFHCS NOTE 1
3.9 4mm DOWEL NOTE 1
(A)
M5 LOCK PORT
M5 UNLOCK PORT
UNLOCK SENSOR NOTE 5, 6
LOCK SENSOR NOTE 5, 6
29.9
27
32.9
[2.24] 57 COUPLED
27.1
13.5
(B)
SIDE VIEW UNCOUPLED
Ø76.5
Ø63
45°
4X M6X1.0 ∓ 11.9 EQUALLY SPACED
O-RING FACE SEAL GROOVES NOTE 2
TOOL SIDE
60.2
FLAT A
40
2X Ø 6.060 ∓ 8 6.035 (Ø6mm DOWEL SF)
Ø37 THRU
Ø38.5 (INNER FACE SEAL ID)
Ø74.9 (OUTER FACE SEAL OD)
PART NUMBERS:
(A) MASTER: 9120-024MZ1-000-SX (NOTE 4)
(B) TOOL: 9120-024TZ1-000
NOTES:
1. MASTER SIDE MOUNTING HARDWARE PROVIDED.
2. FACE SEALS NOT SHOWN FOR CLARITY.
3. SEE SHEETS 3, 4, AND 5 FOR MATERIALS OF CONSTRUCTION.
4. 'SX' IN MASTER PART NUMBER DENOTES SENSOR OPTIONS ARE AVAILABLE.
5. SENSOR COVER AND CONNECTION METHOD NOT SHOWN FOR CLARITY.
• SEE SHEET 2 FOR TYPES OF SENSOR CONNECTIONS AND THEIR WIRING DIAGRAMS
6. SENSOR CABLES NOT SHOWN FOR CLARITY.
7. CONTACT ATI FOR FULL PART NUMBERS AND LIST OF OPTIONS.
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
INDUSTRIAL AUTOMATION
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 www.ati-ia.com
Fax: +1.919.772.8259 ISO 9001 Registered Company
PROPERTY OF ATI INDUSTRIAL AUTOMATION, INC. NOT TO BE REPRODUCED IN ANY MANNER EXCEPT ON ORDER OR WITH PRIOR WRITTEN AUTHORIZATION OF ATI.
DRAWN BY: M. GALA 11/16/18
CHECKED BY: B. KENDRICK 11/19/18
PROJECT # 180419-5 SHEET 1 OF 5
TITLE
QC-24Z1 TOOL CHANGER DRAWING
SCALE 1:1
SIZE B
DRAWING NUMBER 9630-20-024Z1
REVISION 02


QC-24Z1 MASTER LOCK/UNLOCK WIRING DIAGRAM
M12 HARNESS WIRING DIAGRAM
Lock Sensor
Unlock Sensor
3-Pin Connector
Brown (V+)
White (L Input)
Black (L Input)
Blue (V-)
Black (U Input)
4-Pin Male M12 Connector (Sensor Signal)
Locked Input
Unlocked Input
V+
V-
5m CABLES WIRING DIAGRAM
KEY ORIENTATION NOT GUARANTEED
DETAIL A
4-PIN MALE M12 CONNECTOR
SCALE 1.5 : 1
LOCK SENSOR CABLE EXIT
UNLOCK SENSOR CABLE EXIT
DETAIL B
CORDGRIP, 2 HOLE
SCALE 1.5 : 1
QC-24Z1 MASTER WITH M12 CONNECTOR
84.1
2.8
16.6
39.1
13.6
70.9
32.8
A
QC-24Z1 MASTER WITH 5m CABLES AND FLYING LEADS
69.6
2.8
16.1
38.1
21.2
56.4
NOTE 6
B
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: M. GALA 11/16/18
CHECKED BY: B. KENDRICK 11/19/18
PROJECT # 180419-5
SHEET 2 OF 5
TITLE
QC-24Z1 TOOL CHANGER DRAWING
SCALE 1:1.5
SIZE B
DRAWING NUMBER 9630-20-024Z1
REVISION 02
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 www.ati-ia.com
Fax: +1.919.772.8259 ISO 9001 Registered Company
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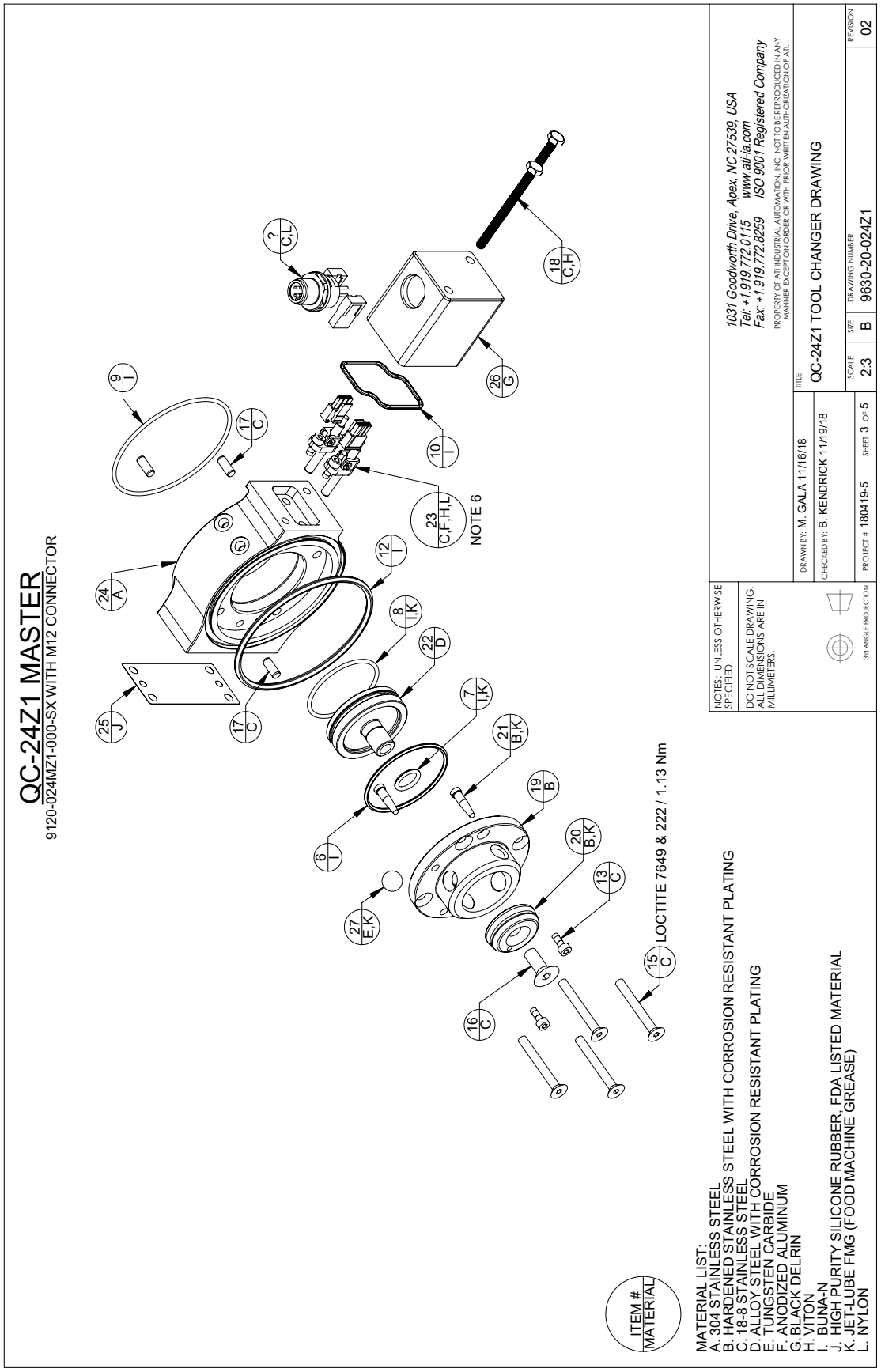
QC-24Z1 MASTER
9120-024MZ1-000-SX WITH M12 CONNECTOR
NOTE 6
LOCTITE 7649 & 222 / 1.13 Nm
ITEM #
MATERIAL
MATERIAL LIST:
A. 304 STAINLESS STEEL
B. HARDENED STAINLESS STEEL WITH CORROSION RESISTANT PLATING
C. 18-8 STAINLESS STEEL
D. ALLOY STEEL WITH CORROSION RESISTANT PLATING
E. TUNGSTEN CARBIDE
F. ANODIZED ALUMINUM
G. BLACK DELRIN
H. VITON
I. BUNA-N
J. HIGH PURITY SILICONE RUBBER, FDA LISTED MATERIAL
K. JET-LUBE FMG (FOOD MACHINE GREASE)
L. NYLON
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: M. GALA 11/16/18
CHECKED BY: B. KENDRICK 11/19/18
PROJECT # 180419-5
SHEET 3 OF 5
TITLE
QC-24Z1 TOOL CHANGER DRAWING
SCALE 2:3
SIZE B
DRAWING NUMBER 9630-20-024Z1
REVISION 02
1031 Goodworth Drive, Apex, NC 27539 USA
Tel: +1.919.772.0115 www.ati-ia.com
Fax: +1.919.772.8259 ISO 9001 Registered Company
PROPERTY OF ATI INDUSTRIAL AUTOMATION, INC. NOT TO BE REPRODUCED IN ANY MANNER EXCEPT ON ORDER OR WITH PRIOR WRITTEN AUTHORIZATION OF ATI.

10. Terms and Conditions of Sale

The following Terms and Conditions are a supplement to and include a portion of ATI's Standard Terms and Conditions, which are on file at ATI and available upon request.

ATI warrants to Purchaser that robotic Tool Changer products purchased hereunder will be free from defects in material and workmanship under normal use for a period of three (3) years from the date of shipment. The warranty period for repairs made under a Return Merchandise Authorization (RMA) shall be for the duration of the original warranty, or ninety (90) days from the date of repaired product shipment, whichever is longer. ATI will have no liability under this warranty unless: (a) ATI is given written notice of the claimed defect and a description thereof within thirty (30) days after Purchaser discovers the defect and in any event not later than the last day of the warranty period; and (b) the defective item is received by ATI not later ten (10) days after the last day of the warranty period. ATI's entire liability and Purchaser's sole remedy under this warranty is limited to repair or replacement, at ATI's election, of the defective part or item or, at ATI's election, refund of the price paid for the item. The foregoing warranty does not apply to any defect or failure resulting from improper installation, operation, maintenance or repair by anyone other than ATI.

ATI will in no event be liable for incidental, consequential or special damages of any kind, even if ATI has been advised of the possibility of such damages. ATI's aggregate liability will in no event exceed the amount paid by purchaser for the item which is the subject of claim or dispute. ATI will have no liability of any kind for failure of any equipment or other items not supplied by ATI.

No action against ATI, regardless of form, arising out of or in any way connected with products or services supplied hereunder may be brought more than one (1) year after the cause of action accrued.

No representation or agreement varying or extending the warranty and limitation of remedy provisions contained herein is authorized by ATI, and may not be relied upon as having been authorized by ATI, unless in writing and signed by an executive officer of ATI.

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Purchaser will not be liable hereunder with respect to disclosure or use of information which: (a) is in the public domain when received from ATI; (b) is thereafter published or otherwise enters the public domain through no fault of Purchaser; (c) is in Purchaser's possession prior to receipt from ATI; (d) is lawfully obtained by Purchaser from a third party entitled to disclose it; or (f) is required to be disclosed by judicial order or other governmental authority, provided that, with respect to such required disclosures, Purchaser gives ATI prior notice thereof and uses all legally available means to maintain the confidentiality of such information.