Table of Contents

C. Control/Signal Modules C-2
SC29—Ethernet Control/Servo Module C-2
1. Product Overview C-2
1.1 SC29 Master C-2
1.2 SC29 Tool C-3
1.3 SC30 Tool C-3
2. Product Information C-4
2.1 Tool Side TSI C-4
2.2 TSI Operational Function C-5
3. Installation C-7
3.1 Master Module Installation C-7
3.2 Master Module Removal C-8
3.3 Tool Module Installation C-9
3.4 Tool Module Removal C-9
3.5 Setting the Tool-ID on the SC29 Tool Module C-10
3.6 Setting the Tool-ID on the SC30 Tool Module C-10
4. Operation C-11
4.1 Lock, Unlock, and RTL Sensor Cable LED Behavior C-12
4.2 Recommended Sequence of Operations C-13
5. Maintenance C-15
5.1 Pin Block Inspection and Cleaning C-16
6. Troubleshooting and Service Procedures C-17
6.1 Troubleshooting C-17
6.1.1 Servo Module, Drive, or Motor Troubleshooting Procedure C-19
6.1.2 Solenoid Valve Manual Override Procedure C-20
6.2 Service Procedures C-21
6.2.1 V-ring Seal Replacement C-21
7. Serviceable Parts C-22
7.1 SC-29 Master Serviceable Parts C-22
7.2 SC-29 Tool Serviceable Parts C-23
7.3 SC-30 Tool Serviceable Parts C-24
7.4 Accessories C-24
8. Specifications C-25
9. Drawings C-27

C. Control/Signal Modules

SC29—Ethernet Control/Servo Module

1. Product Overview

The module is designed to provide control of the Tool Changer, pass electrical power and signal connections to a servo motor, and pass Ethernet field bus data to the end-of-arm tooling. Power and signal circuits are electrically isolated both from each other and the Tool Changer. The wiring has EMI/RF shielding to protect it from noise.

Compliant spring probes are provided on the Master and fixed contact pins on the Tool (refer to *Figure 1.1*). When the Tool Changer is coupled, the Master and Tool modules transfer signals and power across the spring probes and contact pins. A V-ring seal surrounds the pin blocks to seal the connections from moisture and liquid while coupled.

To avoid unintentional human contact, the Master spring pins are recessed below an insulated surface.



DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.



CAUTION: Never couple or uncouple the servo modules unless electrical power has been disconnected and discharged both upstream and downstream from the modules. Arcing and contact damage occur during coupling or uncoupling if power is not removed and discharged. Always disconnect and discharge power from upstream and downstream of the modules before coupling or uncoupling.

The modules are equipped with tool stand interlock (TSI), a safety feature that uses a physical break in the unlatch solenoid valve circuit to prevent an unintended tool release. The TSI circuit allows Tool Changer release ONLY when the Tool is in the stand or storage location. Refer to *Section 2.1—Tool Side TSI* for additional information regarding TSI.

1.1 SC29 Master

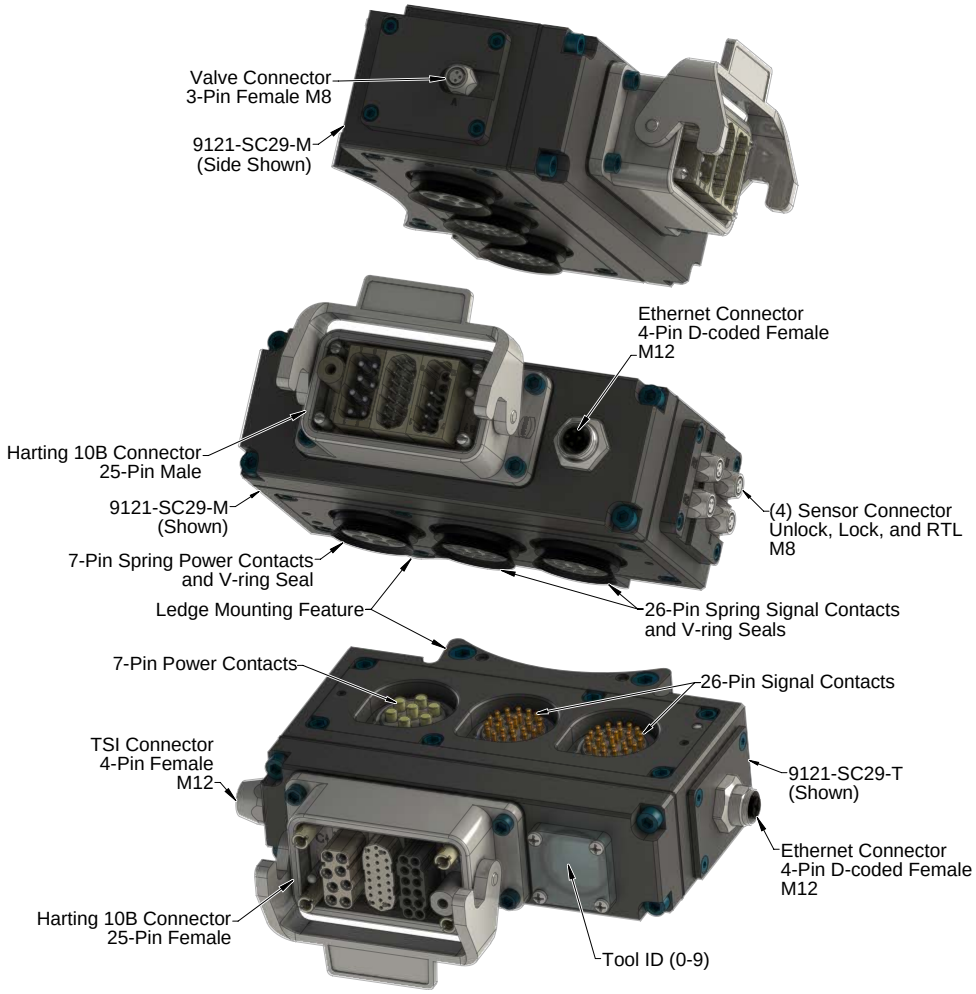
Refer to *Figure 1.1*. The SC29 Master module includes the following connectors:

- (1) Harting 10B Connector includes: 8-Pin power insert, 25-Pin signal insert, and 12-Pin I/O insert
- (1) 3-Pin M8 female valve connector
- (1) 4-Pin M12 D-coded female Ethernet connector
- (1) 3-Pin M8 female signal connector

Refer to *Section 9—Drawings* for additional information and connector details.

An electrical interface on the Master module supports a double-solenoid integrated valve (single-solenoid valve is not supported). The integrated valve can be supplied from ATI as part of the valve adapter (such as 9121-JE2-M). Refer to the valve adapter manual for more information (9620-20-C-Jxx Valve Adapters with a Double Solenoid). Electrical interface drawings and connector details are provided in *Section 9—Drawings*.

Figure 1.1—Overview of the Modules



1.2 SC29 Tool

The SC29 Tool module includes the following connectors:

- (1) Harting 10B Connector includes: 8-Pin power insert, 25-Pin signal insert, and 12-Pin I/O insert
- (1) 4-Pin M12 D-coded female Ethernet connector
- (1) 4-Pin M12 female TSI connector

Refer to *Section 9—Drawings* for information and connector details.

The Tool-ID feature on the Tool module identifies Tools by a unique value (0-9), used by the Tool Changer. Use the push button switch to set the Tool-ID.

1.3 SC30 Tool

The SC30 Tool module includes the following connectors:

- (1) 4-Pin M12 D-coded female Ethernet connector
- (1) 5-Pin Minifast female auxiliary power connector
- (1) 4-Pin M12 female TSI connector

Refer to *Section 9—Drawings* for information and connector details.

The Tool-ID feature on the Tool module identifies Tools by a unique value (0-9), used by the Tool Changer. Use the rotary switch to set the Tool-ID.

2. Product Information

This section provides more detailed information on the behavior of the Master and Tool modules.

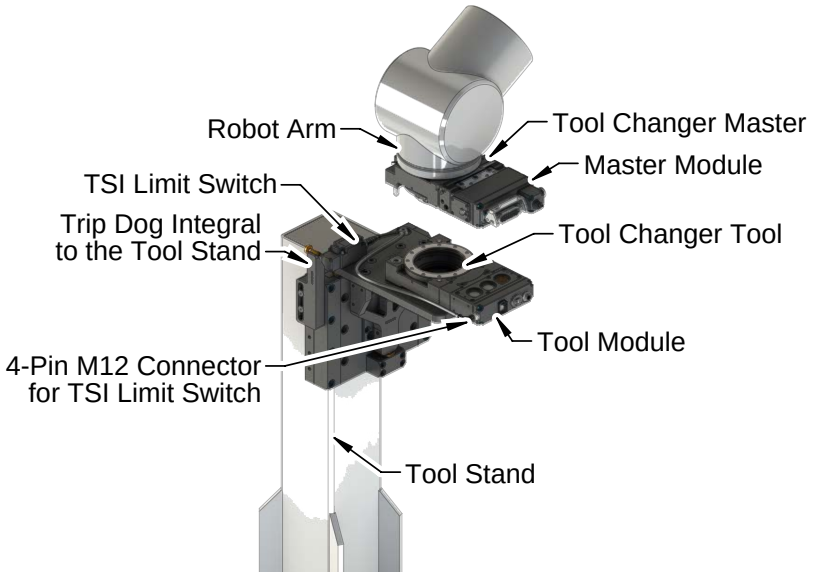
2.1 Tool Side TSI

To prevent an unintended Tool release, the electrical power to the unlatch valve circuit is switched only when a Tool mounted limit switch indicates the Tool is nested safely in the tool stand (refer to *Figure 2.1*).

A momentary action, normally open, single-pole, single-throw mechanical limit switch with spring return is recommended to work with the TSI circuit. The limit switch must be mounted to the Tool in a manner ensuring the switch is closed only when the Tool is nested in the tool stand (see *Figure 2.2* and *Figure 2.3*). The limit switch is connected to the Tool module via a 4-pin M12 female connector. A teach plug is available to override TSI during setup and maintenance.

For more information, see *Figure 2.2* and *Figure 2.3*.

Figure 2.1—Tool Stand Interlock (TSI)



CAUTION: The Master locking mechanism must be fully retracted prior to the Master entering the Tool. Failure to do so will cause ball bearings to damage the Tool bearing race. If the Tool Changer is locked, use the solenoid valve manual override on the Tool Changer to unlock before attempting to latch the Master with the Tool. Refer to *Section 6.1.2—Solenoid Valve Manual Override Procedure*.

2.2 TSI Operational Function

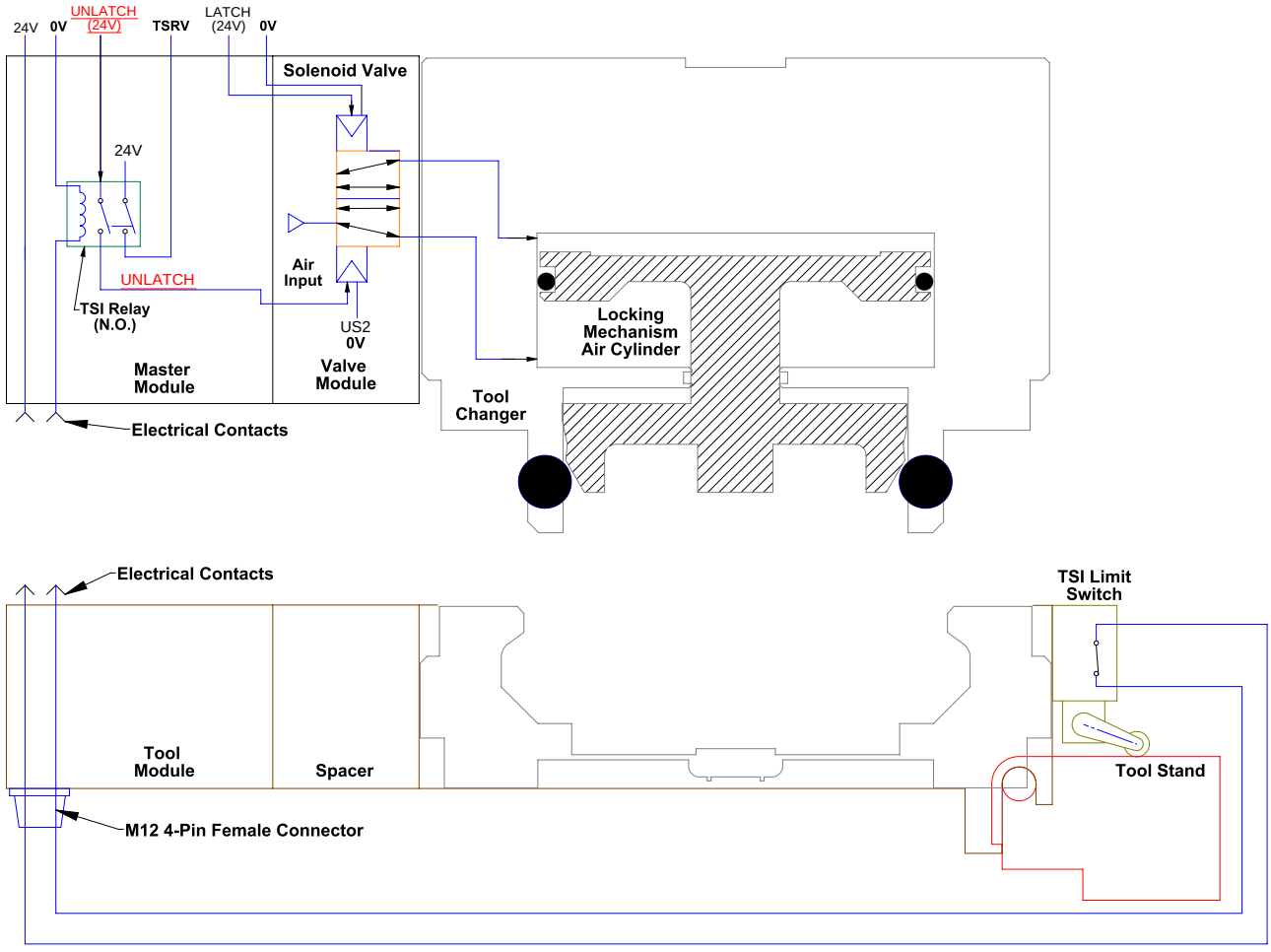
The Master is away from the tool stand and the Tool is nested safely in the tool stand. The TSI relay, located in the Master module, is driven by closure of the mechanical TSI Limit Switch located on the Tool. When closed, the relay passes the unlatch signal from the robot to the solenoid valve.

Since the Master and Tool are not coupled and the electrical contacts are not touching, it is not possible to close the TSI relay and unlock the Tool Changer locking mechanism. If an unlatch command is provided by the robot, the Tool Changer will not unlock.

If the Tool Changer is locked without a Tool, it must be unlocked using the manual override button on the valve (refer to *Section 6.1.2—Solenoid Valve Manual Override Procedure*).

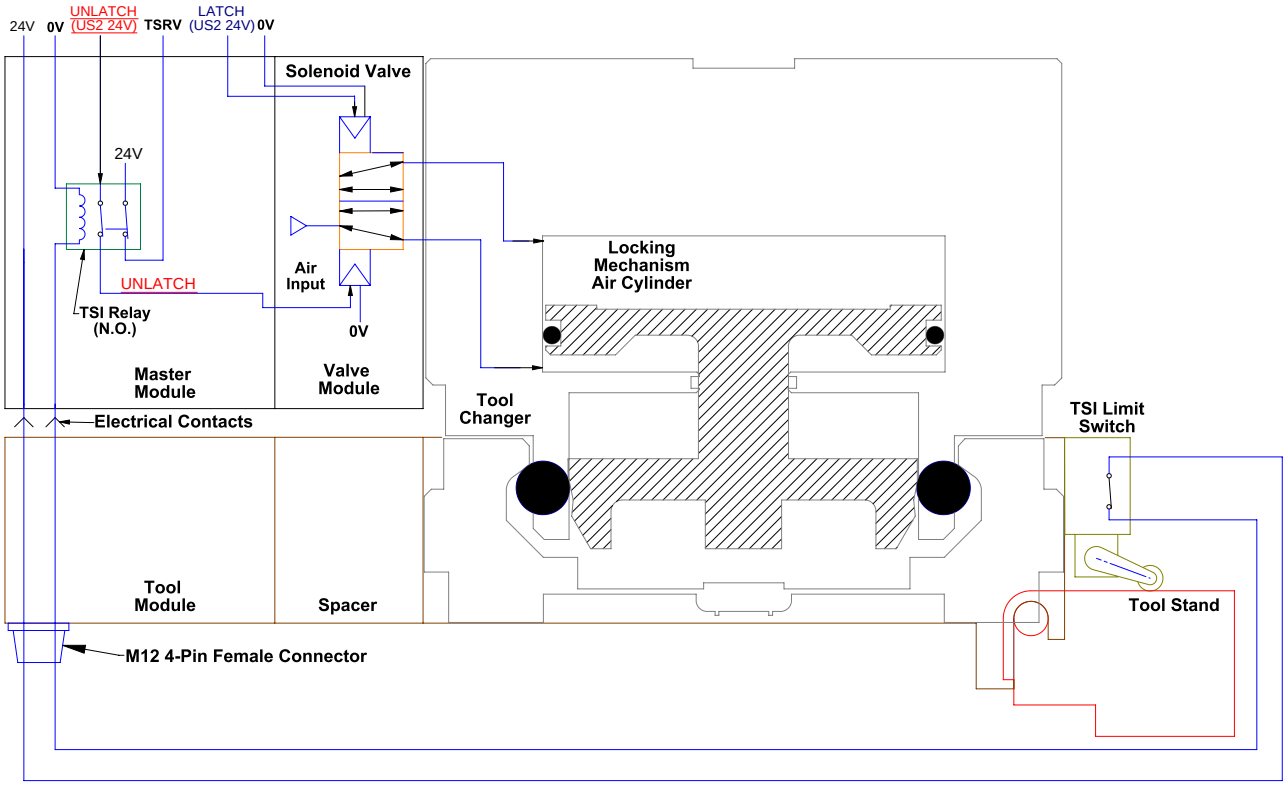
The second set of contacts on the TSI relay provides the TSRV (TSI Relay Verify) diagnostic signal (when the TSI relay is open, the TSRV signal should be low). The TSRV signal can indicate damage to the TSI relay, cable, or mechanical switch. For maximum safety, the status of the TSRV signal should be monitored as described in*Section 4.2—Recommended Sequence of Operations*.

Figure 2.2—TSI Circuit with Master Free of the Stand, Tool in the Stand



The Master and Tool are within coupling distance and the electrical contacts meet. The TSI relay closes because the TSI limit switch is actuated and the electrical contacts meet. It is now possible for the TSI relay to pass the unlatch signal from the robot to the solenoid valve.

Figure 2.3—TSI Circuit with Master and Tool Locked



3. Installation

The control/servo modules are typically installed by ATI prior to shipment. The following steps outline field installation and removal. For wiring information refer to *Section 9—Drawings*.

DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.

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 (for example: 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.

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.

3.1 Master Module Installation

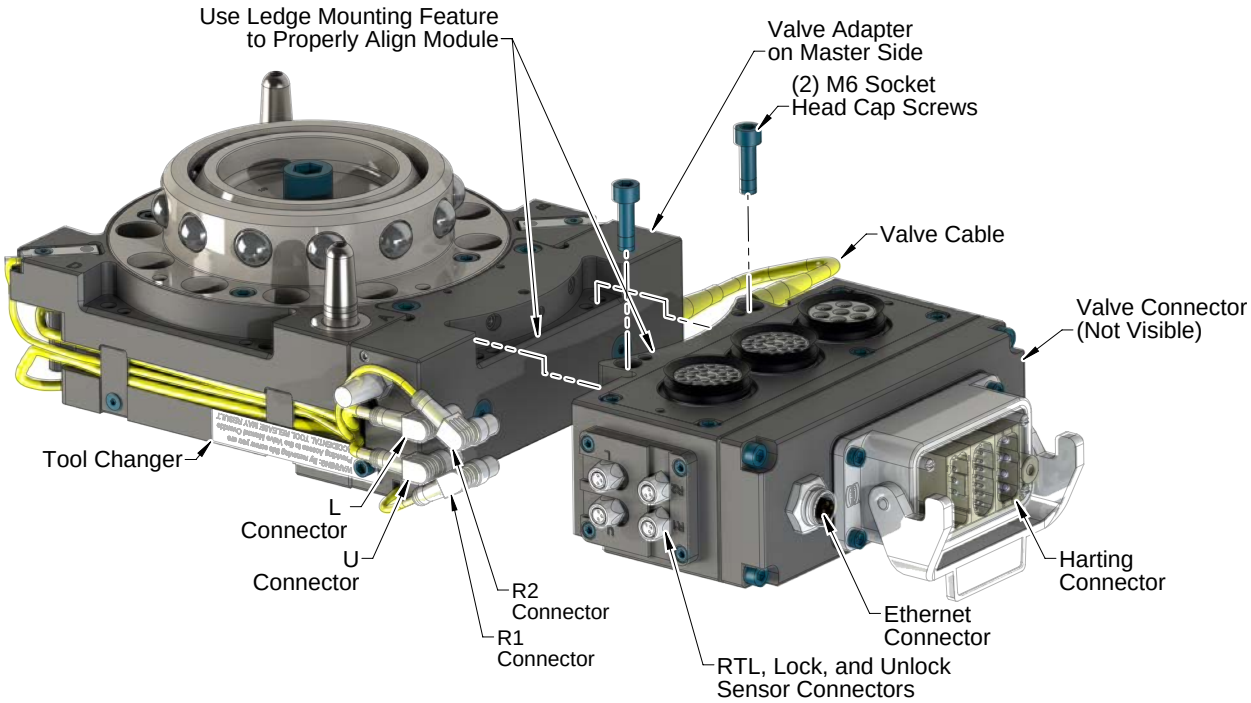
Refer to *Figure 3.1*.

Tools required: *5 mm hex key, torque wrench*

Supplies required: *Clean rag, 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 (for example: electrical, pneumatic, and hydraulic circuits).
4. Clean mounting surfaces.
5. Place the module into the appropriate location on the valve adapter.
6. Apply Loctite 242 to the supplied M6 socket head cap screws. Install the (2) M6 socket head cap screws and secure the module to the valve adapter using a 5 mm hex key. Tighten to 70 in-lbs (7.9 N-m).
7. Ensure the Lock (L), Unlock (U), RTL (R1), and RTL (R2) connections are clean and connect the sensor cables to the control/signal module.
8. Ensure the valve connector is clean and connect the solenoid valve cable from the valve adapter to the valve connector on the control/signal module.
9. Ensure the power, signal, auxiliary, and other connectors are clean and connect the cables to the module.
10. Safely resume normal operation.

Figure 3.1—Module Installation



3.2 Master Module Removal

Tools required: *5 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. Mark the Lock, Unlock, and RTL sensor cables so that the cables can be reinstalled to the appropriate sensor.
5. Disconnect the Lock (L), Unlock (U), RTL (R1), and RTL (R2) sensor cable connectors from the module.
6. Disconnect the solenoid valve cable from the module.
7. Disconnect (for example: power, signal, auxiliary, etc.) cables from the control/signal module.
8. Support the control/signal module, remove the (2) M6 socket head cap screws using a 5 mm hex key, and lower the module until it clears the guide pin.

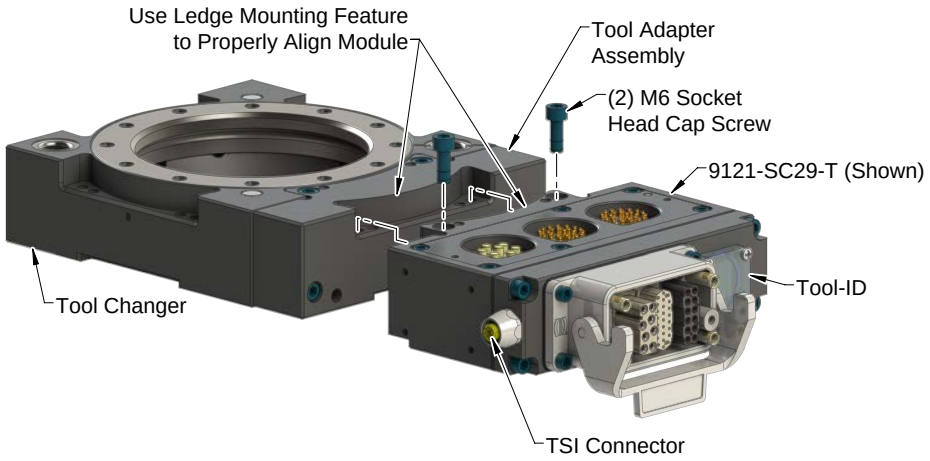
3.3 Tool Module Installation

Tools required: *5 mm hex key, torque wrench*

Supplies required: *Clean rag, 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. Clean the mounting surfaces.
5. Using the ledge feature, place the module onto the air adapter. Align the module with the air adapter using the dowels in the bottom of the ledge feature.
6. Apply Loctite 242 to the supplied M6 socket head cap screws. Install the (2) M6 Socket Head Cap Screws that secure the module to the air adapter using a 5 mm hex key. Tighten to 70 in-lbs (7.9 Nm).
7. Connect (e.g. power, signal, auxiliary, etc.) cables to the module. Ensure that the connectors are cleaned prior to being secured.
8. Connect the cable from the TSI limit switch to the control/signal module. Ensure that the connectors are cleaned prior to being secured.
9. Set the Tool-ID. Refer to *Section 3.5—Setting the Tool-ID on the SC29 Tool Module*.
10. Safely resume normal operation.

Figure 3.2—Module Installation



3.4 Tool Module Removal

Tools required: *5 mm hex key*

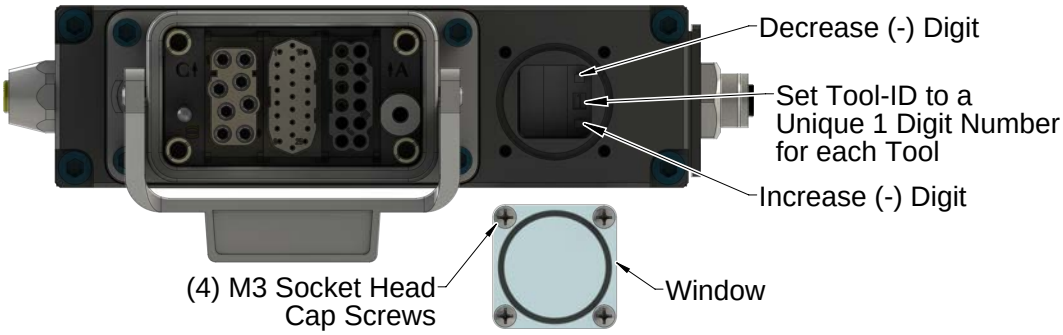
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Disconnect (for example: power, signal, auxiliary, etc.) cables from the control/signal module.
5. Disconnect the cable from the control/signal module to the TSI limit switch.
6. Support the control/signal module, remove the (2) M6 socket head cap screws using a 5 mm hex key, and lift the module from the valve adapter.

3.5 Setting the Tool-ID on the SC29 Tool Module

Tools required: *Phillips screwdriver, flat head screwdriver*

Use the push button switch on the Tool module to set Tool-ID numbers. Each Tool should be set to a unique number from the 0-9.

Figure 3.3—Tool Module Tool-ID Rotary Switch



1. Loosen the (2) M3 socket head cap screws and remove the window.
2. Use a flat head screw driver to turn the rotary switch to the digit value from the 0-9. Set the Tool-ID to the desired unique number for each Tool.

NOTICE: When replacing the window, ensure that the seal is positioned correctly to prevent fluid leakage into the module and damage to the electronics.

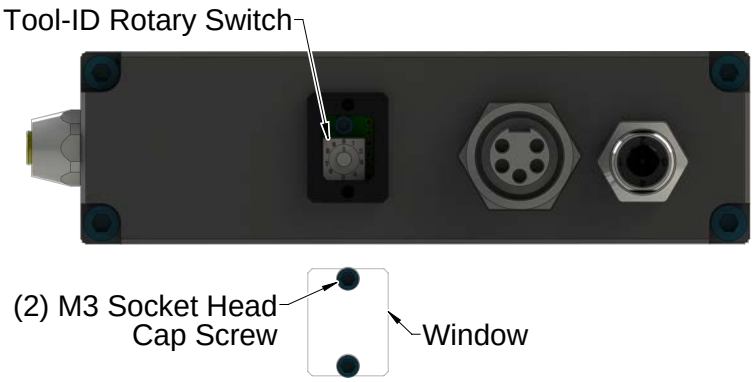
3. Re-install the window and tighten the M3 socket head cap screws.

3.6 Setting the Tool-ID on the SC30 Tool Module

Tools required: *Phillips screwdriver, flat head screwdriver*

Use the rotary switch on the Tool module to set Tool-ID numbers. Each Tool should be set to a unique number from the 0-9.

Figure 3.4—Tool Module Tool-ID Rotary Switch



1. Loosen the (2) M3 socket head cap screws and remove the window.
2. Use a flat head screw driver to turn the rotary switch to the digit value from the 0 to 9. Set the Tool-ID to the desired unique number for each Tool.

NOTICE: When replacing the window, ensure that the seal is positioned correctly to prevent fluid leakage into the module and damage to the electronics.

3. Re-install the window and tighten the M3 socket head cap screws.

4. Operation

The control/signal module controls the Tool Changer and passes electrical power, signals, and field bus data to the customer end-of-arm tooling. The control module works with specific industrial servo motors and drives, to provide a separable joint in the power and signal wiring. To maximize the service life of these components, the following points should be observed:

DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.

CAUTION: Never couple or uncouple the servo modules unless electrical power has been disconnected and discharged both upstream and downstream from the modules. Arcing and contact damage occur during coupling or uncoupling if power is not removed and discharged. Always disconnect and discharge power from upstream and downstream of the modules before coupling or uncoupling.

CAUTION: Improper cable routing can result in wires and cables being pinched in the joint between the Tool Changer plates and premature failure of the electrical connectors. Properly route and secure all cables, particularly on the Master side.

The following sections detail the functional characteristics of the module.

NOTICE: The 0 and 24 VDC supply lines are required to be on the pin locations of the customer interface connector. Refer to *Section 9—Drawings* for pin out information and location of the I/O signals.

Refer to the specific Tool Changer manual for coupling conditions of the Tool Changer and *Section 4.2—Recommended Sequence of Operations*. When coupled, the module Tool can be communicated with, Tool-ID can be read (If equipped), and attached end-effectors can be used.

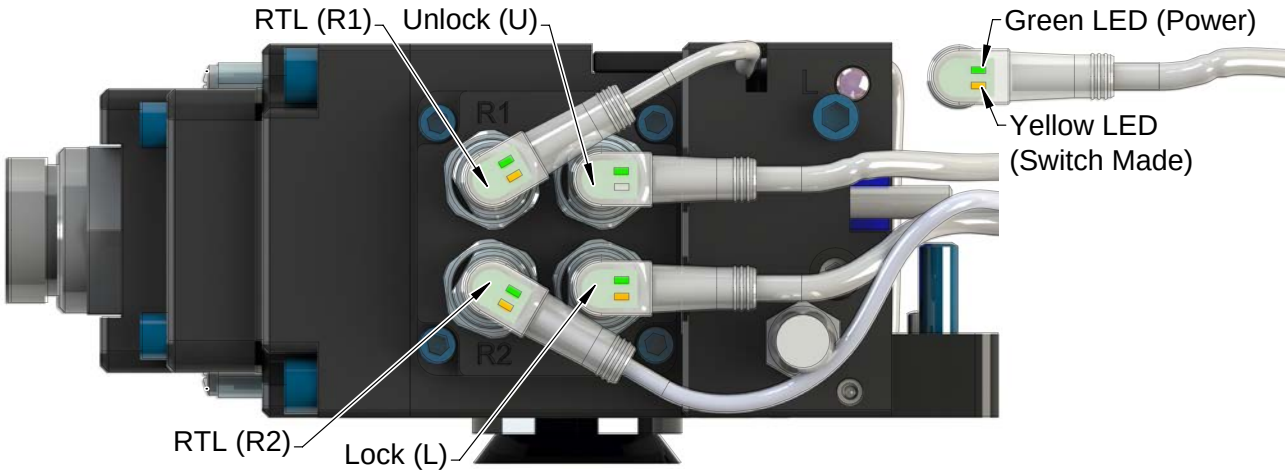
4.1 Lock, Unlock, and RTL Sensor Cable LED Behavior

The Lock, Unlock, and RTL sensor cables are equipped with two LEDs. The Green LED indicates the sensor has power and the yellow LED indicates the switch has been made. The LED behavior is affected by the control/signal module.

Table 4.1—Sensor Cable LED Behavior for Common Tool Changer Positions

Tool Changer Position	Sensor cable LED Behavior			
Unlocked (Tool Changer Master plate free of stand with no Tool plate attached)	RTL (R1) Sensor	ON OFF	ON ON	Unlock (U) Sensor
	RTL (R2) Sensor	ON OFF	ON OFF	Lock (L) Sensor
Ready to Lock (Tool Changer Master plate with Tool plate parallel and at a distance of 1.22 mm or less from each other)	RTL (R1) Sensor	ON ON	ON ON	Unlock (U) Sensor
	RTL (R2) Sensor	ON ON	ON OFF	Lock (L) Sensor
Locked (Tool Changer Master plate with Tool plate attached in fully locked position)	RTL (R1) Sensor	ON ON	ON OFF	Unlock (U) Sensor
	RTL (R2) Sensor	ON ON	ON ON	Lock (L) Sensor
Missed Tool (Tool Changer Master plate locked with no Tool plate attached)	RTL (R1) Sensor	ON OFF	ON OFF	Unlock (U) Sensor
	RTL (R2) Sensor	ON OFF	ON OFF	Lock (L) Sensor

Figure 4.1—Lock, Unlock, and RTL Sensor cable LED Behavior (Shown in Locked Position)



(Control module shown for reference only)

4.2 Recommended Sequence of Operations

This Recommended Sequence of Operations procedure is to be used as a general guide when programming a robot or PLC for use with a Tool Changer and control/signal modules. This procedure is intended for "automatic" modes used during normal application processes.

1. The robot and Tool Changer Master are free of the stand or storage location, the Tool Changer is uncoupled and the Tool Changer locking mechanism may be fully retracted (unlocked condition) or fully extended (missed Tool condition, i.e., Locked and Unlocked inputs are OFF). The Tool is by itself in the tool stand.

    a. The **RTL1** and **RTL2** inputs are OFF.
    b. The ATI Tool and any downstream device(s) are offline.
    c. The **TSRV** input is OFF.

NOTICE: If the Tool Changer is locked without a Tool, it must be unlocked using the manual override button on the valve, refer to *Section 6.1.2—Solenoid Valve Manual Override Procedure.*

NOTICE: For maximum safety, ATI strongly recommends editing the robot program to verify TSRV is OFF just before tool pick up.

2. Robot and Master move into the Tool, are parallel, and within 0.06" of the Tool (i.e., the module contact pins are touching, the **RTL** sensors have sensed the targets on the Tool).

    a. The **TSRV** input is ON.
    b. The **RTL1** and **RTL2** inputs are ON, indicating it is okay to couple the Tool.
    c. 'Input' power connections become available on the Tool.
    d. Communications with downstream device(s) should now be established.

3. Couple the Tool Changer.

    a. The **Unlatch** output turns OFF.
    b. The **Latch** output turns ON.
    c. The **Unlocked** input turns OFF a short time later, indicating piston travel. Subsequently, the **Locked** input turns on and remains ON, indicating the coupling operation is complete.

NOTICE: For maximum safety, ATI strongly recommends editing the robot program to verify the TSRV is on at tool pick up.

4. The robot moves away from the tool stand with the Tool Changer coupled.

NOTICE: For maximum safety, ATI strongly recommends editing the robot program to verify the TSRV is OFF when the tool is above the stand immediately after tool pickup.

5. Normal operation:
   a. The following inputs are ON:
      i. **Locked**
      ii. **RTL1**
      iii. **RTL2**
   b. The following input is OFF:
      i. **Unlocked**
   c. The following input is OFF:
      i. **TSRV**
6. Robot moves into the tool stand with the Tool Changer coupled.
7. Uncouple the Tool Changer. **IMPORTANT: It is critical that the Tool be nested securely in the tool stand prior to Uncoupling the Tool Changer.**
   a. The **TSRV** input is ON.
   b. The **Latch** output is made OFF.
   c. The **Unlatch** output is made ON.
   d. The **Locked** input goes OFF a short time later and subsequently the Unlocked input goes ON and remains ON, indicating the uncoupling operation is complete.
8. Robot and Master move up and away and are at a distance greater than 0.125” from the Tool (the module contact pins are no longer touching).
   a. The **TSRV** input is OFF.
   b. The **RTL1** and **RTL2** inputs go OFF.
   c. ‘Input’ power connections become unavailable on the Tool.
   d. Communications with downstream device(s) should now be lost.
9. Robot and Master are in free space.
   a. The following input is ON:
      i. **Unlocked**
   b. The following inputs are OFF:
      i. **Locked**
      ii. **RTL1**
      iii. **RTL2**

5. Maintenance

The modules are not designed to be field serviced as all point-to-point wiring connections are soldered. Component replacement is limited to the V-ring seal on the Master.

DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.

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 (for example: 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.

If the Tool Changer is being used in dirty environments (e.g., welding or deburring applications), care should be taken to limit the exposure of the Tool Changer to contaminates. Idle Tool assemblies should be covered to prevent debris from settling on the mating surface. Also, the Master assembly should be exposed for only a short period of time during Tool change and down time.

Under normal conditions, no special maintenance is necessary; however, it is recommended that periodic inspections be performed to assure long-lasting performance and to assure that unexpected damage has not occurred. Perform the following visual inspections monthly:

- Inspect mounting fasteners to verify they are tight; and If loose, then tighten to the proper torque. Refer to *Section 3—Installation*.
- Cable connections should be inspected during maintenance periods to ensure they are secure. Loose connections should be cleaned and tightened. Inspect cable sheathing for damage, repair or replace damaged cabling. Loose connections or damaged cabling are not expected and may indicate improper routing and/or strain relieving.
- Inspect the Master and Tool pin blocks for pin damage, debris or darkened pins. Refer to *Section 5.1—Pin Block Inspection and Cleaning*.
- Inspect V-ring seals for wear, abrasion, and cuts. If worn or damaged, replace. Refer to *Section 6.2.1—V-ring Seal Replacement*.

5.1 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.

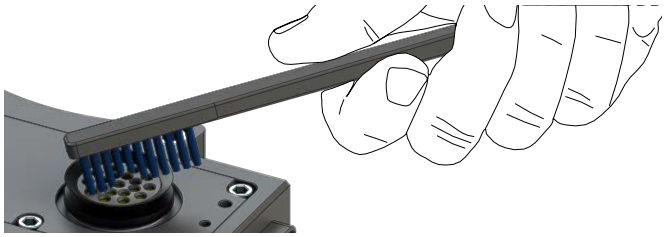
Figure 5.1—Inspect Master and Tool Pin Blocks



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).

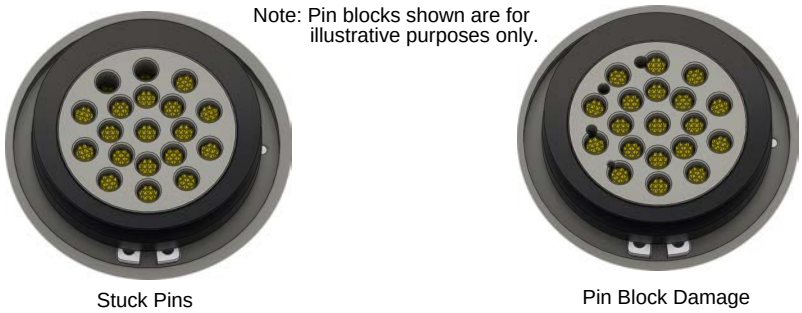
NOTICE: Do not use an abrasive media and/or cleaners or solvents to clean the contact pins. Using abrasive media and/or cleaners or solvents will cause damage to the contact surface or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI part number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

Figure 5.2—Clean Pin Blocks with a Nylon Brush



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

Figure 5.3—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

This troubleshooting section provides information to help diagnose conditions with the Tool Changer or control/signal module. The service procedures provide instructions for component replacement and adjustment.

DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.

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 (for example: 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.

6.1 Troubleshooting

Refer to the following table for trouble shooting information.

Table 6.1—Troubleshooting

Symptom	Possible Cause	Correction
Unit cannot lock or unlock.	Debris caught between the Master and Tool plates.	Clean debris from between the Master and Tool plates. Verify mounting fasteners is secure and do not protrude above the mating surfaces.
	Ball bearings are not moving freely.	Verify that ball bearings are moving freely. Clean and lubricate as needed. Refer to the Maintenance section of the Tool Changer manual for instructions.
	Master and Tool are within the specified No-Touch zone.	Verify that the Master and Tool are within the specified No-Touch zone when attempting to lock. *Refer to the Installation – tool stand Design Section of the Tool Change manual for specifications.*
	Air supply not to specifications.	Air pressure must be at the proper pressure. Refer to the Tool Changer manual for pneumatic requirements.
	Signals are mapped incorrectly.	Verify that signals are mapped and are communicating properly. Refer to *Section 9—Drawings* for electrical schematic.
	Valve adapter exhaust muffler clogged.	The valve adapter exhaust muffler may be clogged. Refer to the valve adapter manual for more information.
Tool Changer is locked without the Tool.	Robot provided a latch command to the Tool Changer without the Tool Changer coupled.	*Unlock the Tool Changer using the manual override button on the valve adapter (refer to Section 6.1.2—Solenoid Valve Manual Override Procedure*).

Table 6.1—Troubleshooting		
Symptom	**Possible Cause**	**Correction**
Sensors not operating properly.	Sensor cables are damaged or incorrectly connected.	Verify that cables are connected correctly and not damaged, replace If damaged. Refer to the Troubleshooting Section of the Tool Changer manual.
	Tool plate is not secured properly or debris is trapped between surfaces.	Ensure that the Tool plate is securely held to the Master plate, that nothing is trapped between their surfaces.
	Air trapped in the Unlock (U) air port.	Ensure that there is no air trapped in the Unlock (U) air port. Refer to Air and Valve adapter section for pneumatic specification and requirements.
	Sensor is malfunctioning.	Verify the sensors are functioning properly. Refer to the Tool Changer manual.
Loss of Communication.	Damaged signal cabling.	Check/Replace signal cabling upstream and downstream of the Tool Changer modules.
	Worn or damaged contact pins.	Inspect module contact pins for debris/wear/damage. Refer to *Section 5.1—Pin Block Inspection and Cleaning*. V-ring seal damaged and allow debris in the contact pins. Replace V-ring seal, refer to *Section 6.2.1—V-ring Seal Replacement*.
	Product upstream and downstream of the Tool Changer failed or damaged.	Check product upstream and downstream of the Tool Changer for failure. This failure can “appear” to be caused by the Tool Changer or affect Tool Changer performance.
Power or signal(s) intermittently functioning or malfunctioning.	Object trapped between modules.	Remove the object, then re-attempt coupling.
	Servo module contact pin contamination.	Ensure that the spring pins on the Master side can move freely and are not bound by debris. Clean the spring pins to restore free operation. Clean the Tool side module contacts. Refer to *Section 5.1—Pin Block Inspection and Cleaning*. Inspect the seal, replace If damaged. Refer to *Section 6.2.1—V-ring Seal Replacement*.
	Contact pin separation due to insufficient air supply to the Tool Changer.	Ensure that the Tool Changer has proper pneumatic connections and air is supplied to proper specification. Refer to the Tool Changer section of this manual for air supply requirements.
	Coupling/uncoupling Tool Changer under load.	Revise operating procedures to only couple/uncouple with power disconnected and discharged. Field replacement of the module contacts is not possible.
	Cable damage: pinched, torn, or fatigued cables.	Examine cables for damage, perform a continuity test on the cables and replace any bad cables.
	Servo module damaged.	Refer to *Section 6.1.1—Servo Module, Drive, or Motor Troubleshooting Procedure*.
	Drive or motor damaged.	Refer to *Section 6.1.1—Servo Module, Drive, or Motor Troubleshooting Procedure*.

6.1.1 Servo Module, Drive, or Motor Troubleshooting Procedure



DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.

Complete the following steps in accordance with the customer's energy control and electrical safety practices or programs for isolating hazardous energy sources (i.e. electricity, air, etc.). For troubleshooting and servo motor problems, refer to the following sequence:

1. Examine all of the cables, cable connectors, and power sources for problems and correct as necessary.
2. Use a set of test cables (power and signal) to bypass the servo modules and directly connect the drive to the motor:
   a. If the motor does not operate properly with test cables, the problem is in the drive or motor. Troubleshoot these components using that manufacturer's procedures.
   b. If the motor operates properly, go to the next step.
3. Use the test cables from step *2* to connect between the servo drive and ATI master servo module. Use a second set of test cables to connect the Tool servo module to the motor:
   a. If the motor operates properly, the problem is in the original cables, which must be repaired or replaced.
   b. If the motor does not operate properly, the problem is in the servo module:
      i. Examine the servo modules for damage to their electrical connectors and contact pins. Clean all accessible surfaces. Ensure that the spring pins on the Master side can move freely and are not bound by debris. Clean the spring pins to restore operation.
      ii. If the previous steps fail to restore proper operation, contact ATI for service.

6.1.2 Solenoid Valve Manual Override Procedure

The manual override procedure should be used when the Tool Changer is locked without the Tool plate attached. The control module safety circuit does not allow the Tool Changer to be unlatched without the Tool plate attached and the tool in the tool stand.

WARNING: Do not use the solenoid valve manual override if the tool is locked to the Master. Using the manual override will release the Tool and may cause bodily injury or damage to equipment. If the Tool is attached to the Master, it must be secured in the tool stand or in a location where the tool weight is supported before using the manual override.

CAUTION: The manual override is not intended for normal operations. Manual override is to be used in situations where no alternative is available to unlock the Master. Do not execute the Latch command unless the Master and the Tool are ready to be coupled.

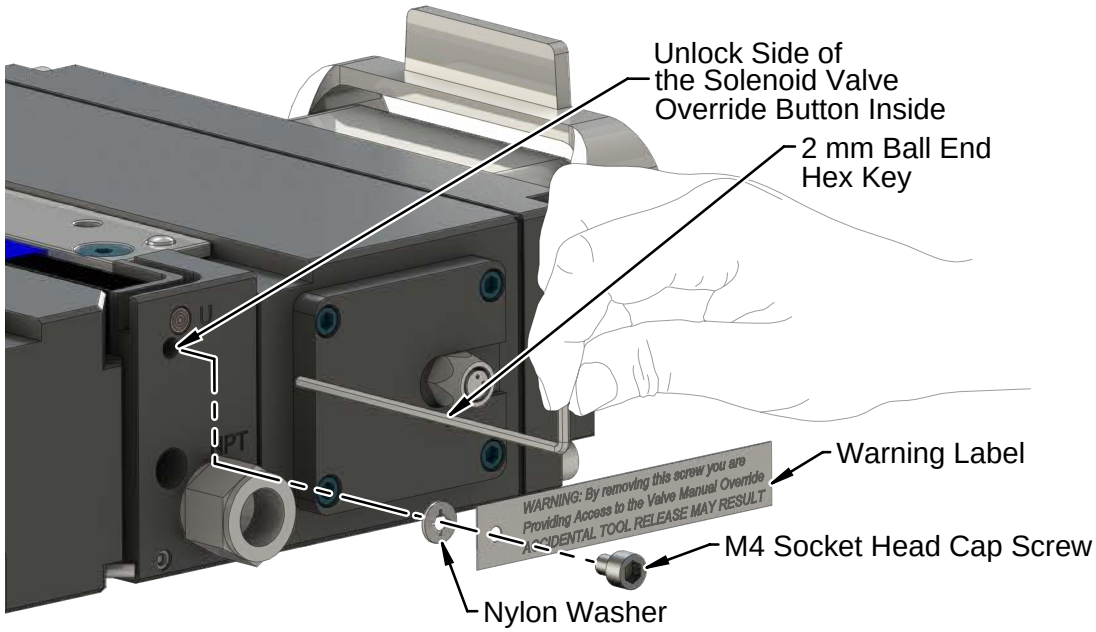
Tools required: *3 mm hex key, 2 mm ball end hex key*

1. Using a 3 mm hex key, remove the M4 socket head cap screws, warning label, and nylon washer from the Unlock side of the solenoid valve. The Unlock side is marked with a “U”.

CAUTION: Applying excess force can damage the solenoid or cause the override button to stick in one position. Actuation of valve override buttons requires about 1 mm of travel and minimal of force. Use a non-sharp object, similar to ball nose 2 mm hex key, to gently depress the override button; an air release should be heard when the solenoid is activated.

2. Insert a 2 mm ball end hex key in the unlock valve screw hole and gently depress the valve override button. An air release should be heard when the solenoid is actuated. Make sure the locking mechanism is fully retracted.
3. Using a 3 mm hex key, replace the M4 socket head cap screws, warning label, and nylon washer and tighten the screw.

Figure 6.1—Manual Override



6.2 Service Procedures

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

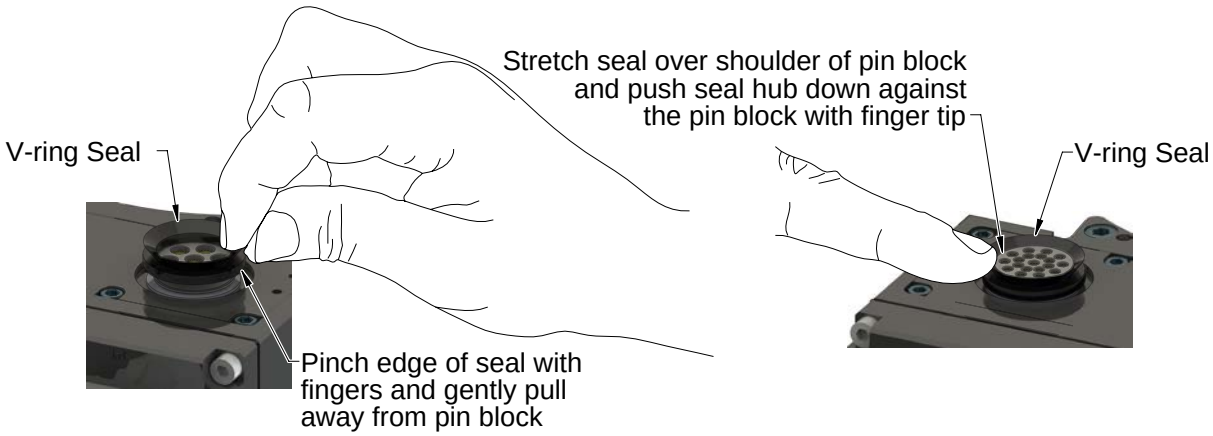
6.2.1 V-ring Seal Replacement

Parts required: *Refer to Section 7.1—SC-29 Master 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 6.2—V-ring Seal Replacement



7. Serviceable Parts

7.1 SC-29 Master Serviceable Parts

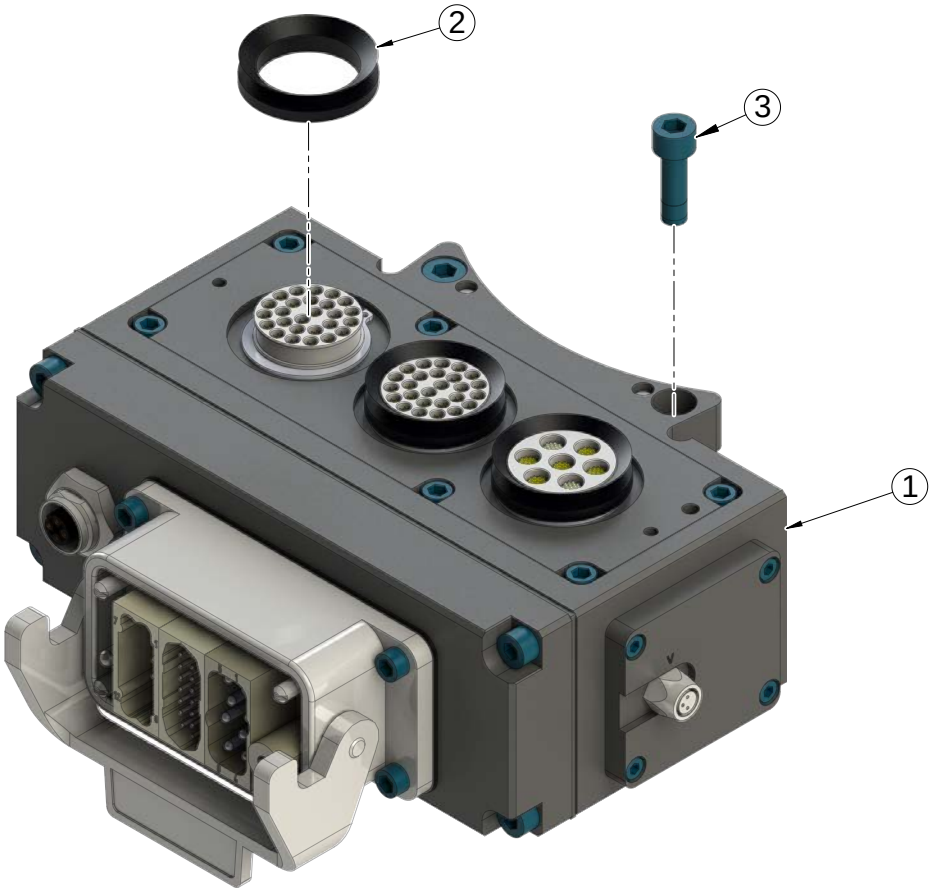


Table 7.1—Master Module			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9121-SC29-M	SC29 Master Servo Module Assembly
2	3	4010-0000030-01	V-ring Seal
3	2	3500-1066020-15A	M6X20 Socket Head Cap Screw, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525

7.2 SC-29 Tool Serviceable Parts

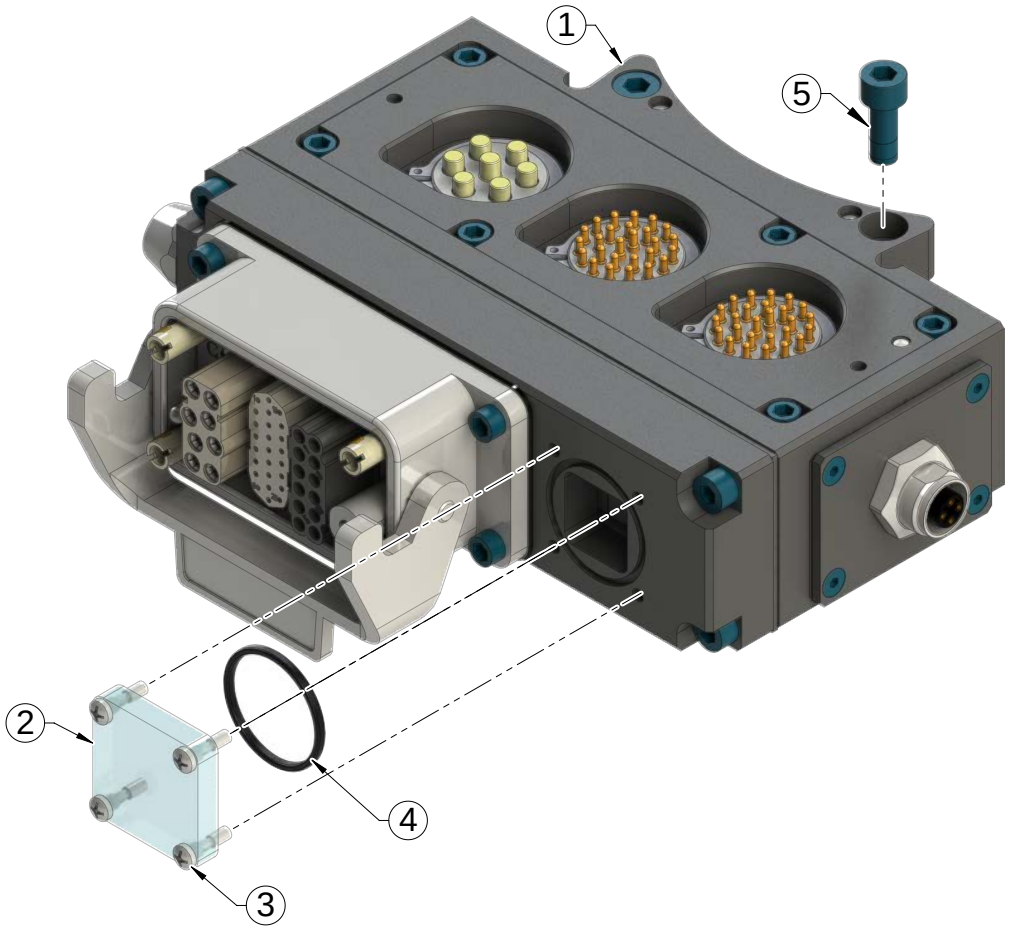


Table 7.2—Tool Module			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9121-SC29-T	SC29 Tool Servo Module Assembly
2	1	3700-20-5844	DL2 Tool ID Window
3	1	3500-9957012-21	PAN HEAD M3 CAPTIVE SCREW M3 X 12 1812-12-SS-PP-1
4	4	3410-0001008-01	O-Ring AS568A-018 Buna-N D70
5	2	3500-1066016-15A	M6x16 Socket Head Cap Screw, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525

7.3 SC-30 Tool Serviceable Parts

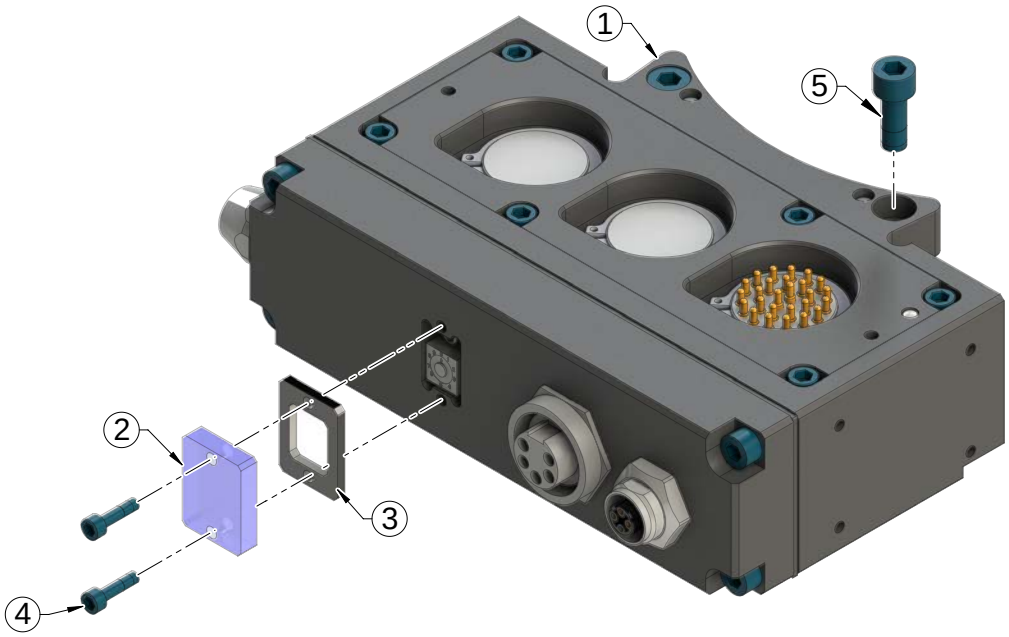


Table 7.3—Tool Module			
Item No.	**Qty**	**Part Number**	**Description**
1	1	9121-SC30-T	SC30 Tool Servo Module Assembly
2	1	3700-20-5621	K10 Tool ID Window
3	1	3700-20-5622	K10 Tool ID Gasket 70 Dur, Adhesive on the 1 Side
4	4	3500-1058010-15A	M3X12 Socket Head Cap Screw, 12.9, ISO4762/DIN912, ESATI-007, YL M-spheres/IFI 525
5	2	3500-1066016-15A	M6x16 Socket Head Cap Screw, 12.9, ISO4762/DIN912, ES-ATI-007, YL M-spheres/IFI 525

7.4 Accessories

Table 7.4—Accessories	
Part Number	**Description**
3690-0000064-60	Brush, Blue Nylon All Purpose (Contact Pin Cleaning)

8. Specifications

Table 8.1—Master Specifications	
9121-SC29-M	Harting Master Module, Supports Servo Power and Redundant Encoder and Ethernet Signals, Supports L/U/R1/R2 Sensors and Integrated Valve, Supports TSI on the Tool w/ no RTL bypass. Mates with the SC29 and SC30 Tool Modules.
Interface Connector(s)	Customer Interface: 25-pin Harting 10B male Connector for Signal and Power 4-pin female M12 D-Coded Connector for Ethernet Integrated Tool Changer I/O: (4) 3-pin female M8 Connector supporting Tool Changer Locked, Unlocked, and Ready-to-Lock Proximity sensors in series 3-pin female M8 Connector for Valve
Electrical Rating	Signal: 5 A, 250 V Motor Power: 13 A, 400 V Ethernet Signals: 2 A, 60 V Tool Changer (TSI): 4 A , 24 V Tool Changer (Tool-ID): 100 mA, 50 V Tool Changer (Valve Control): 19-29 V Sensors (Lock, Unlock, and Ready-to-Lock): 10-30 VDC operational voltage, 150 mA Operational Current
Weight	3.12 lbs (1.42 kg)

Table 8.2—Tool Specifications	
9121-SC29-T	Harting Tool Module, Supports Servo Power and Supports Servo Power and Redundant Encoder and Ethernet Signals, 0-9 Tool-ID, TSI on Tool
Interface Connector(s)	Customer Interface: 25-pin Harting 10B female Connector for Signal and Power 4-pin female M12 D-Coded Connector for Ethernet 4-pin female M12 Connector for TSI
Electrical Rating	Signal: 5 A, 250 V Motor Power: 13 A, 400 V Ethernet Signals: 2 A, 60 V Tool Changer (TSI): 4 A, 24 V Tool Changer (Tool-ID): 100 mA, 50 V
Tool-ID	10 Tool-ID Values Available (0–9), Factory Setting = 1
Weight	2.8 lbs (1.27 kg)

Table 8.3—Tool Specifications	
9121-SC30-T	Discrete Tool Module, 5-Pin Mini-Fast auxiliary Power, 4-Pin M12 D-Coded Connector with Redundant Ethernet Pass Thru, 0-9 Rotary Switch Tool ID, Supports TSI with no RTL bypass.
Interface Connector(s)	Customer Interface: 5-pin male Mini-Fast Connector for Auxiliary Power 4-pin female M12 D-Coded Connector for Ethernet 4-pin female M12 Connector for TSI
Electrical Rating	Auxiliary Power : 5 A, 250 V Signal: 5 A, 250 V Ethernet Signals: 2 A, 60 V Tool Changer (TSI): 4 A, 24 V Tool Changer (Tool-ID): 100 mA, 50 V
Tool-ID	10 Tool-ID Values Available (0–9), Factory Setting = 1
Weight	2.22 lbs (1.01 kg)

9. Drawings

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