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C. Control and Signal Modules

SA2—Control Module
SA3—Control Module (Potted version)

1. Product Overview

The control modules are required to provide a means for the customer to communicate with and control the Tool Changer.

MS-style connectors allow interfacing on the Master and Tool modules. When the Tool Changer is coupled, the Master and Tool modules communicate across their interface using a spring-loaded pin block. A flexible boot surrounds the pin block to seal the connection. This seal is water resistant but not waterproof. Several module configurations are available to provide the customer with Tool Changer I/O and various pass-through signal capabilities. Refer to *Section 7—Specifications* for the details of each available module.

The Tool-ID feature allows the customer to distinguish between the different tools being coupled by the Tool Changer. The customer may set the Tool-ID by using push button switches on the Tool modules. Refer to *Section 2.5—Setting the Tool-ID on the SA3, SA4, SA5, and SA7 Tool Module*.

The SA2 and SA3 Master modules are compatible with air adapter modules. The customer must supply the air adapter with both a Lock and Unlock air supply. The Lock and Unlock air supply must be connected to a 2-position 4-way or 5-way valve, refer to the air adapter or Tool Changer manual for detailed information.

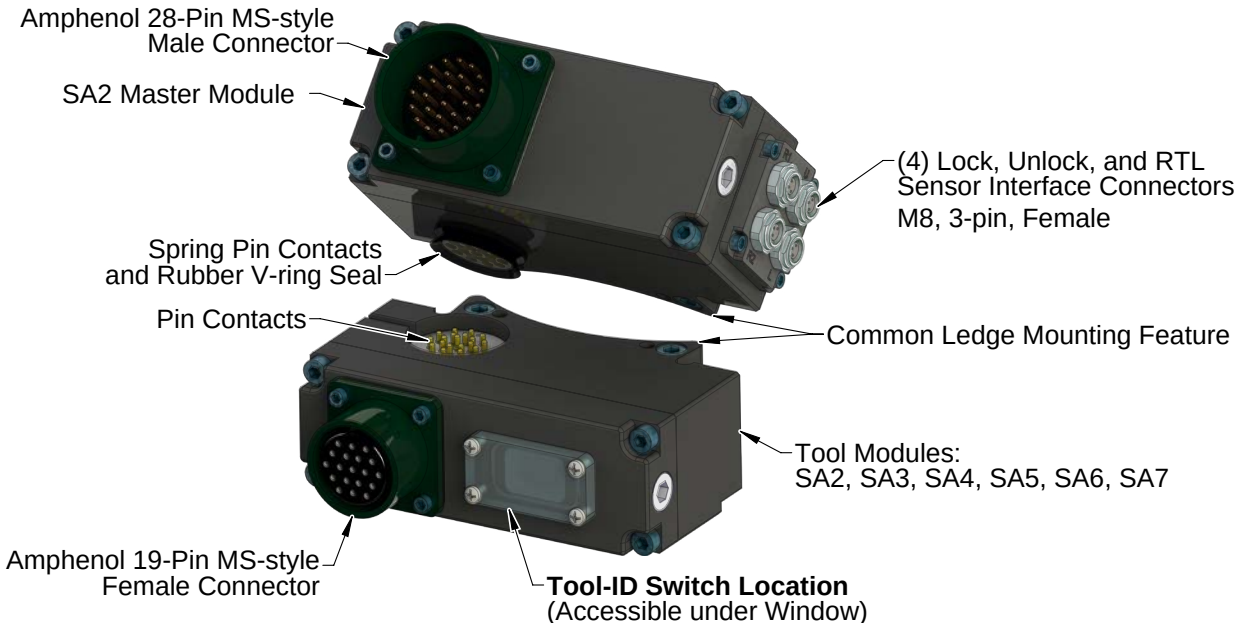
DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers,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

CAUTION: Never couple or uncouple the unit without first disconnecting and discharging the power that passes through the contacts. This is especially true if high voltage circuits are involved. Arcing and contact damage will occur if this is not observed. Always disconnect and discharge electrical power from both upstream and downstream modules.

1.1 SA2 Master

The SA2 Master module provides up to 19 pass-through signals. The Master module uses (4) M8 3-pin Pico connectors to connect to the Lock, Unlock, and RTL sensors on the Tool Changer. The customer interface connection is an Amphenol 28-Pin MS-style connector. The SA2 Master is compatible with the SA2, SA3, SA3Z1, SA4, SA5, SA6, and SA7 Tool modules.

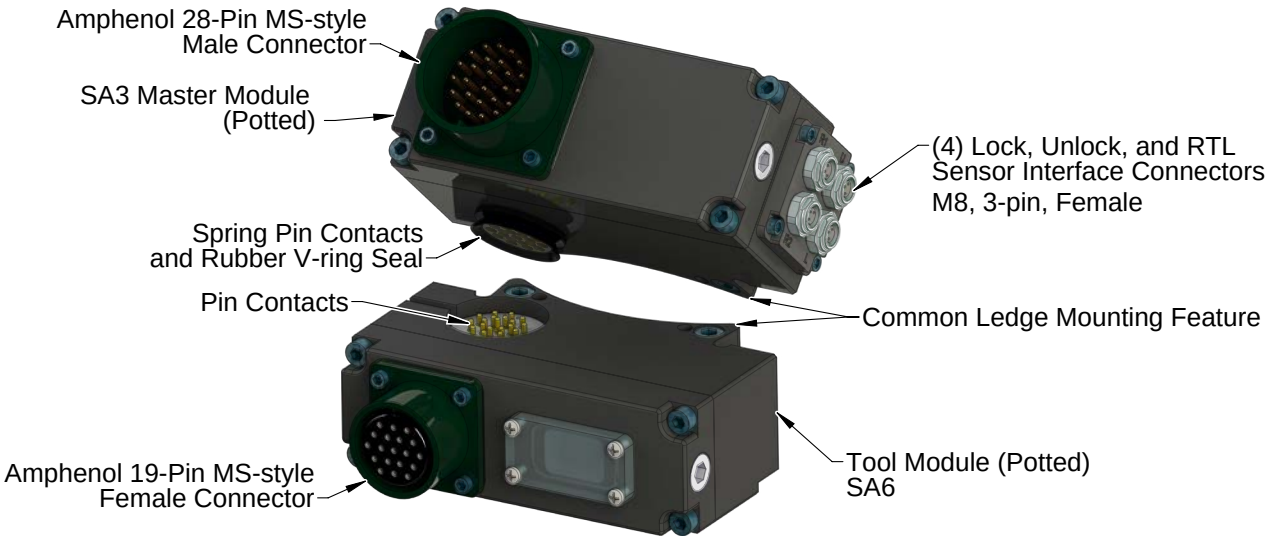
Figure 1.1—SA2 Modules



1.2 SA3 Master

The SA3 Master module is identical to the SA2 Master except that it is potted. The SA3 Master is compatible with the potted SA6 Tool module.

Figure 1.2—SA3 Modules



1.3 SA2 Tool

The SA2 Tool module provides up to 19 pass-through signals. The customer interface connection is an Amphenol 19-Pin MS-style connector. There is no Tool-ID.

1.4 SA3 Tool

The SA3 Tool module provides up to 19 pass-through signals. The customer interface connection is an Amphenol 19-Pin MS-style connector. (10) unique Tool-ID values are available (0–9). The Tool-ID is tied into 24 VDC from Pin B, refer to the details in *Section 8—Drawings*.

1.5 SA3Z1 Tool

The SA3Z1 Tool module provides up to 19 pass-through signals. The customer interface connection is an Amphenol 19-Pin MS-style connector. (16) unique Tool-ID values are available (0–F). The Tool-ID is tied into 24 VDC from Pin B, refer to the details in *Section 8—Drawings*.

1.6 SA4 Tool

The SA4 Tool module provides up to 19 pass-through signals. The customer interface connection is an Amphenol 19-Pin MS-style connector. (100) unique Tool-ID values are available (0–99). The Tool-ID is tied into 24 VDC from pin B, refer to the details in *Section 8—Drawings*.

1.7 SA5 Tool

The SA5 Tool module provides up to 19 pass-through signals. The customer interface connection is an Amphenol 19-Pin MS-style connector. (1000) unique Tool-ID values are available (0–999). The Tool-ID is tied into 24 VDC from pin B, refer to the details in *Section 8—Drawings*.

1.8 SA6 Tool

The SA6 Tool module is identical to the SA2 Tool module except that it is potted.

1.9 SA7 Tool

The SA7 Tool module provides up to 15 pass-through signals. The customer interface connection is an Amphenol 19-Pin MS-style connector. (10) unique Tool-ID values are available (0–9). The Tool-ID is tied into 0 VDC from pin A, refer to the details in *Section 8—Drawings*.

2. Installation

The control/signal modules are typically installed by ATI prior to shipment. The steps below outline the field installation or removal as required. For wiring information refer to *Section 8—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.

2.1 Master Module Installation

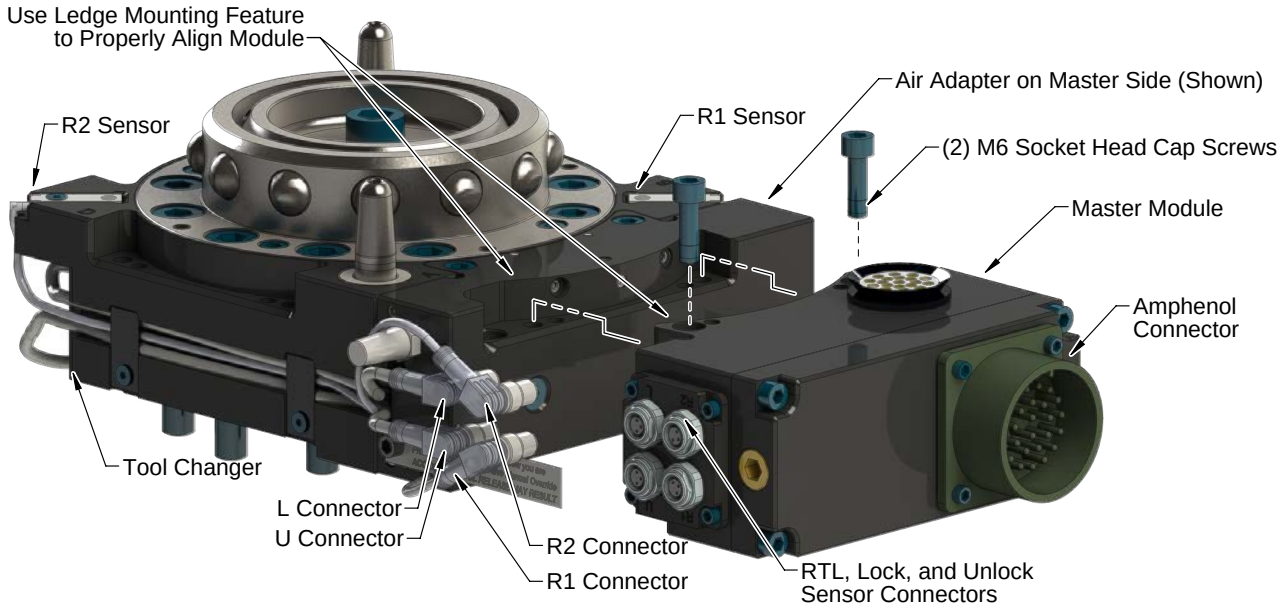
Refer to *Figure 2.1*

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. Ensure that the mounting surface is clean.
5. Place the module into the appropriate location on the air or valve adapter.
6. Apply Loctite 242 to the supplied M6 socket head cap screws.
7. Install the (2) M6 socket head cap screws and secure the module to the air or valve adapter using a 5 mm hex key. Tighten to 70 in-lbs (7.9 N-m).
8. Ensure the Lock (L), Unlock (U), RTL (R1), and RTL (R2) connectors are clean and connect the sensor cables to the control/signal module.
9. Ensure that the connectors (power, signal, auxiliary, etc.) are clean and connect the cables to the module.
10. Safely resume normal operation.

Figure 2.1—Master Module Installation and Removal



2.2 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), and RTL (R1), and RTL (R2) sensor cable connectors from the module.
6. Disconnect (for example: power, signal, auxiliary, etc.) cables from the control/signal module.
7. 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.

2.3 Tool Module Installation

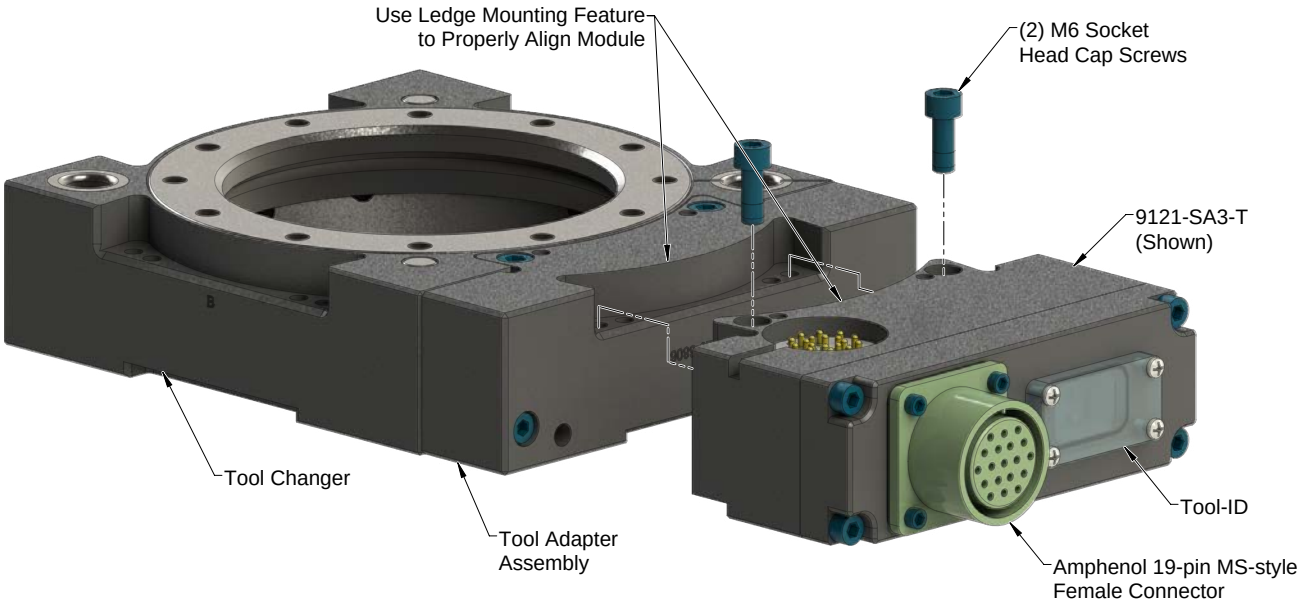
Refer to *Section 2.5—Setting the Tool-ID on the SA3, SA4, SA5, and SA7 Tool Module* or *Section 2.6—Setting the Tool-ID on the SA3Z1 Tool Module* for Tool-ID.

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. Wipe down the mounting surfaces with a clean rag.
5. Place the module onto the tool 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 tool adapter using a 5 mm hex key. Tighten to 70 in-lbs (7.9 N-m).
7. Ensure the power, signal, auxiliary, and other connectors are clean and connect cables to the module.
8. Safely resume normal operation.

Figure 2.2—Tool Module Installation and Removal



2.4 Tool Module Removal

Refer to *Figure 2.2* for Tool module removal instructions.

Tools required: *5 mm hex key*

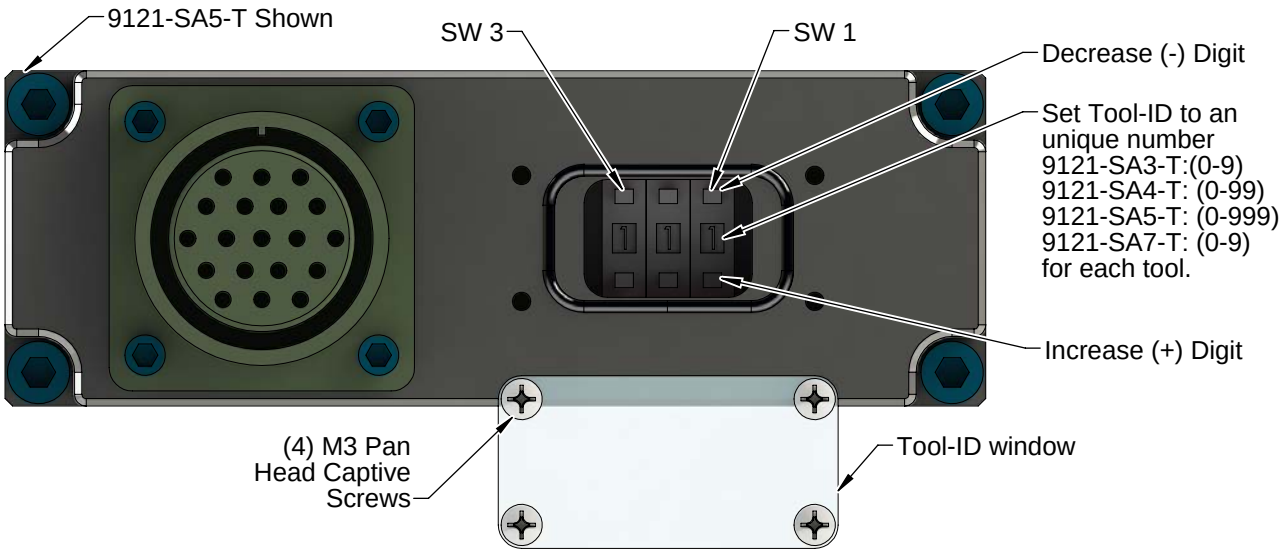
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Disconnect (for example: power, signal, auxiliary, etc.) cables from the control/signal module.
5. Support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

2.5 Setting the Tool-ID on the SA3, SA4, SA5, and SA7 Tool Module

A push button switches are provided on certain Tool modules for setting of a unique digit Tool-ID number.

1. Loosen (4) M3 pan head captive screws and remove Tool-ID window.

Figure 2.1—Set Tool-ID



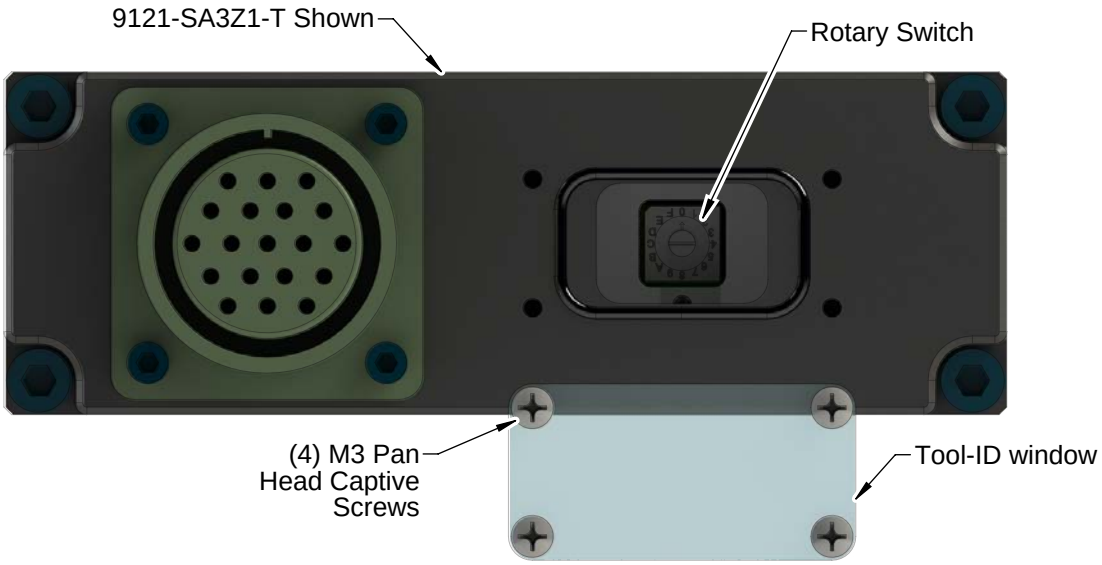
2. Use a non-conductive tool (e.g., plastic stylus) to press on the Tool-ID push buttons to increase (+) or decrease (-) the digit value. Set the Tool-ID to the desired unique digit number. Refer to *Section 8—Drawings* for Tool ID output table.
3. Re-install the Tool-ID window and tighten the (4) M3 pan head captive screws.

2.6 Setting the Tool-ID on the SA3Z1 Tool Module

The rotary switch is provided on the Tool module for setting of a Tool-ID number. Each Tool should be set to unique number from 0-F.

1. Loosen the (4) M3 pan head captive screws and remove the window.

Figure 2.2—Set Tool-ID



2. Use a flat head screw driver to turn rotary switch to the digit value from 0 to F. Set the Tool-ID to the desired unique number each Tool.
3. Re-install the window and tighten the (4) M3 pan head captive screws.

3. Operation

Various Tool Changer I/O are provided to the customer through the military-style Amphenol connector on the control/signal Master module. Lock, Unlock, and Ready-to-Lock proximity sensor inputs are provided for confirmation of the Tool Changer and locking mechanism positions. Other, customer assigned discrete I/O points are available through the connector.

NOTICE: The 0 and 24 VDC supply lines are required to be on certain pin locations of the customer interface connector. Refer to *Section 8—Drawings* for pin out information and location of the I/O signals.

Refer to the specific Tool Changer manual for conditions for coupling of the Tool Changer and *Section 3.1—Lock, Unlock, and RTL Sensor Cable LED Behavior*. When coupled, the discrete module Tool can be communicated with, Tool-ID can be read (if equipped), and attached end-effectors can be used.

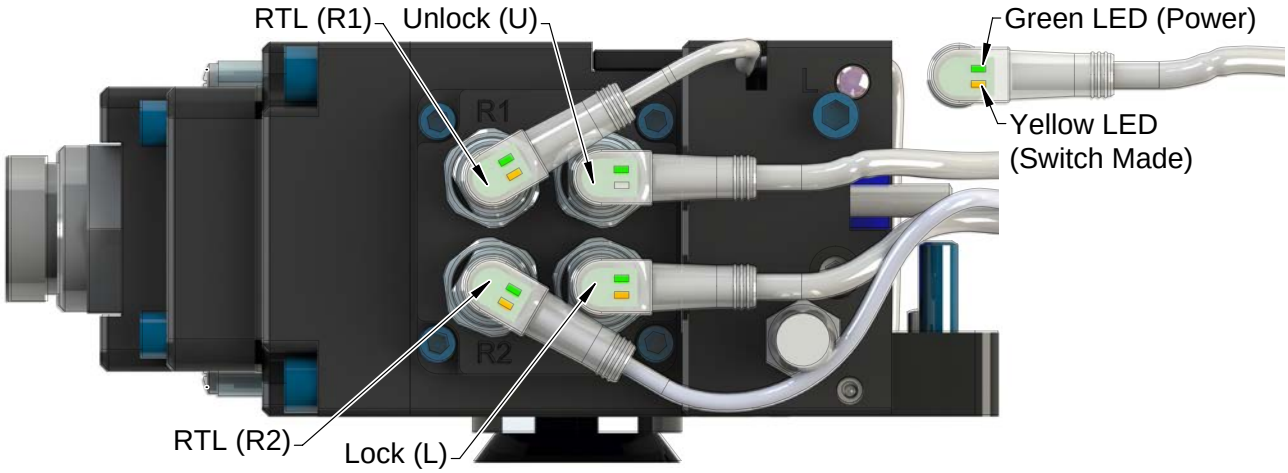
3.1 Lock, Unlock, and RTL Sensor Cable LED Behavior

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 3.1—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 3.1—Lock, Unlock, and RTL Sensor cable LED Behavior (Shown in Locked Position)



(Control module shown for reference only)

3.2 Recommended Sequence of Operations

This recommended sequence of operations procedure is a general guide when programming a robot or PLC for use with a Tool Changer and a control/signal module. This procedure is intended for "automatic" modes used during normal application processes.

1. Start→ 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 false). 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.
2. Ensure the Master is Unlocked. (The Master must be unlocked prior to entering the Tool to prevent the ball bearings from impinging on the Tool bearing race.)
   a. A pneumatic air source is sent to the "unlock" port of the Tool Changer.
   b. The "lock" port of the Tool Changer should be properly exhausted.
   c. The **Unlocked** input goes ON and remains ON, indicating that the Tool Changer locking mechanism is fully retracted and the unlock operation is complete.
3. Robot and Master move parallel towards the Tool and are 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. 'Input' power connections become available on the Tool.
   b. The **RTL1** and **RTL2** inputs are ON, indicating that it is okay to couple the Tool.
   c. Communications with downstream device(s) should now be established.
4. Couple the Tool Changer.
   a. A pneumatic air source is sent to the "lock" port of the Tool Changer.
   b. The "unlock" port of the Tool Changer should be properly exhausted.
   c. The **Unlocked** input goes OFF a short time later, indicating piston travel. Subsequently, the **Locked** input goes ON and remains ON, indicating that the coupling operation is complete.

5. Robot moves away from the tool stand with the Tool Changer coupled.

6. Normal operation:

   a. The following inputs are ON:
      i. **Locked**
      ii. **RTL1**
      iii. **RTL2**
   b. The following inputs are OFF:
      i. **Unlocked**

7. Robot moves into the tool stand with the Tool Changer coupled.

8. 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. A pneumatic air source is sent to the “unlock” port of the Tool Changer.
   b. The “lock” port of the Tool Changer should be properly exhausted.
   c. The **Locked** input goes OFF a short time later and subsequently the **Unlocked** input goes ON and remains ON, indicating that the uncoupling operation is complete.

9. 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 **RTL1** and **RTL2** inputs go OFF.
   b. ‘Input’ power connections become unavailable on the Tool.
   c. Communications with downstream device(s) should now be lost.

10. Robot and Master in free space.

    a. The following inputs are ON:
       i. **Unlocked**
    b. The following inputs are OFF:
       i. **Locked**
       ii. **RTL1**
       iii. **RTL2**

4. 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 used in dirty environments (for example: welding or deburring applications), limit the exposure of the Tool Changer. 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, perform periodic inspections to assess for unexpected damage and assure long-lasting performance. Perform the following visual inspection monthly:

- Inspect mounting fasteners to verify they are tight and if loose; then tighten to the proper torque. Refer to *Section 2—Installation*.
- Cable connections should be inspected during maintenance periods to ensure they are secure. Loose connections should be cleaned and re-tightened as appropriate. 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 any pin damage, debris or darkened pins. Refer to *Section 4.1—Pin Block Inspection and Cleaning*.
- Inspect V-ring seals for wear, abrasion, and cuts. If worn or damaged, replace. Refer to *Section 5.2.1—Seal Replacement*.

4.1 Pin Block Inspection and Cleaning

Tools required: *Nylon Brush (ATI part number 3690-0000064-60)*

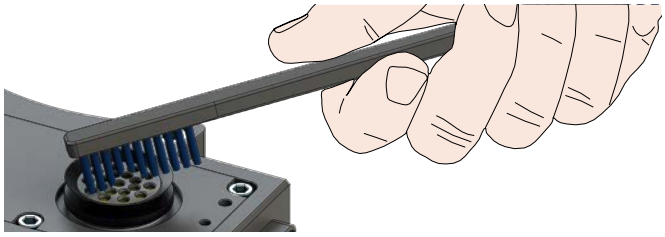
1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Inspect the Master and Tool pin blocks for debris or darkened pins.

Figure 4.1—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).

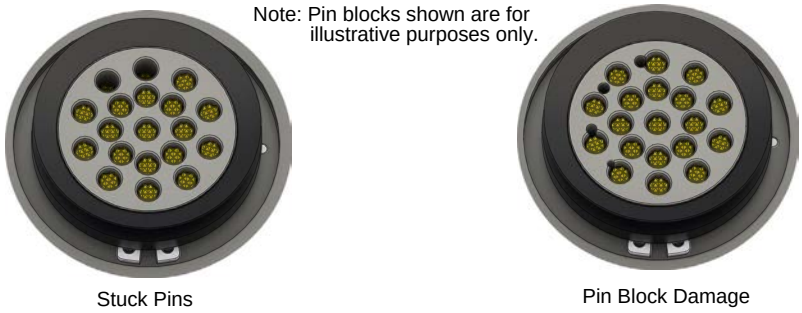
NOTICE: Do not use an abrasive media and/or cleaners or solvents to clean the contact pins. Using abrasive media and/or cleaners or solvents will cause damage to the contact surface or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI part number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

Figure 4.2—Clean Pin Blocks with a Nylon Brush



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

Figure 4.3—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.

5. Troubleshooting and Service Procedures

This troubleshooting section provides information to help diagnose conditions with the Tool Changer or control module.

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.

5.1 Troubleshooting

Refer to the following table for troubleshooting information.

Table 5.1—Troubleshooting Procedures

Symptom	Possible Cause	Correction
Unit will not lock or unlock	Verify that ball bearings are moving freely. Clean and lubricate as needed.	Verify that ball bearings are moving freely. Clean and lubricate as needed. Refer to the Maintenance section of the Tool Changer manual for instructions.
	Air supply not to specifications.	Check air supply. Refer to the Installation section of the Tool Changer manual for specifications.
	Check that exhaust port is properly vented.	Check that exhaust port is properly vented. Refer to Pneumatic Connection section of the Base Tool Changer Manual for valve requirements.
	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 trapped in the Unlock (U) air port.	Ensure that there is no air trapped in the Unlock (U) air port. Refer to the Air and Valve adapter section for pneumatic specification and requirements.
Sensors not operating properly	Sensor cables damage or incorrectly connected.	Verify that cables are connected correctly and not damaged, replace if damaged. Refer to the Troubleshooting Section of the Tool Change 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.

Table 5.1—Troubleshooting Procedures		
Symptom	**Possible Cause**	**Correction**
Loss of Communication	Damaged signal cabling	Check/Replace signal cabling upstream and downstream of Tool Changer modules.
	Worn or damaged contact pins	Inspect module contact pins for debris/wear/ damage. Refer to *Section 4.1—Pin Block Inspection and Cleaning*. V-ring seal damaged and allowing debris in the contact pins. Replace V-ring seal, refer to *Section 5.2.1—Seal Replacement*.
	Product upstream and downstream of Tool Changer failed or damaged	Check product upstream and downstream of Tool Changer for failure. This failure can “appear” to be caused by the Tool Changer or affect Tool Changer performance.

5.2 Service Procedures

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

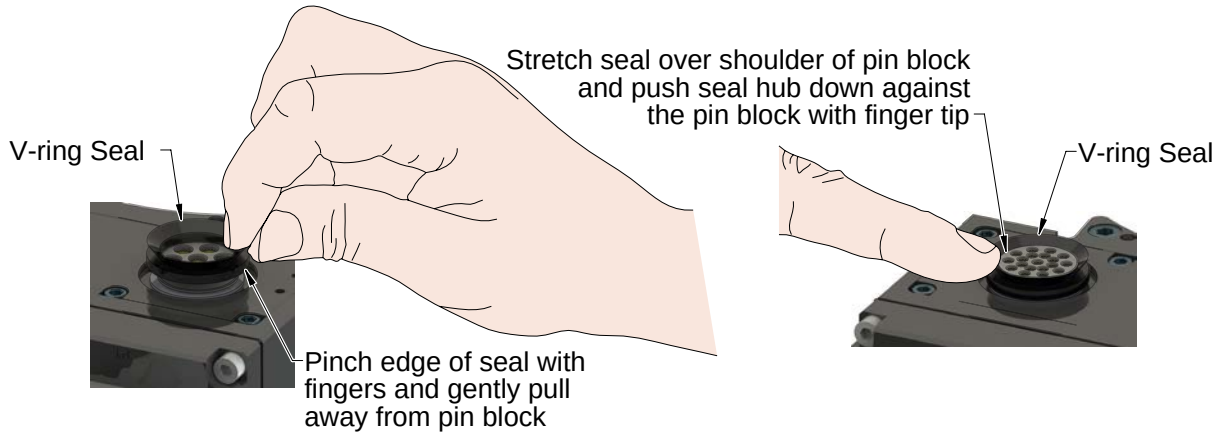
5.2.1 Seal Replacement

Parts Required: *Refer to Section 8—Drawings.*

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

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

Figure 5.1—V-ring Seal Replacement



6. Serviceable Parts

6.1 Master Module Serviceable Parts

For mounting fasteners, refer to *Table 6.1*. For additional serviceable parts, refer to *Section 8—Drawings*.

Table 6.1—Master Module Serviceable Parts			
Item No.	**Qty**	**Part Number**	**Description**
*	*	3500-1066020-15	M6X20 Socket Head Cap Screw, 12.9, ISO4762/ DIN912, ES-ATI-007, YL M-spheres/IFI 525

6.2 Tool Module Serviceable Parts

For mounting fasteners, refer to *Table 6.2*. For additional serviceable parts, refer to *Section 8—Drawings*.

Table 6.2—Tool Module Serviceable Parts			
Item No.	**Qty**	**Part Number**	**Description**
*	*	3500-1066016-15A	M6x16 Socket Head Cap Screw, 12.9, ISO4762/ DIN912, ES-ATI-007, YL M-spheres/IFI 525

6.3 Accessories

Table 6.3—Accessories			
Item No.	**Qty**	**Part Number**	**Description**
*	*	3690-0000064-60	Brush, Blue Nylon All Purpose (Contact Pin Cleaning)

7. Specifications

Table 7.1—Master Module Specifications	
9121-SA2-M	Discrete Signal Master module with 26-pin Amphenol, 19-pin Block, Supports L/U/R1/R2 Sensors **Not intended for use with an Integrated Valve**
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool Changer Control:** 24 VDC
Weight	1.5 lbs (0.7 kg)

Table 7.2—Master Module Specifications	
9121-SA3-M	Discrete, 26-pin Amphenol, 19-pin Block, Supports L/U/R1/R2 Sensors **Not intended for use with an Integrated Valve**, Potted
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool Changer Control:** 24 VDC
Weight	1.5 lbs (0.7 kg)

Table 7.3—SA2 Tool Module Specifications	
9121-SA2-T	Discrete signal module with 19-pin Amphenol, 19-pin Block, 19 Pass-Through signals - Tool Side
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum
Weight	1.3 lbs (0.6 kg)

Table 7.4—SA3 Tool Module Specifications	
9121-SA3-T	Discrete Signal tool module with 19-pin Amphenol, 19-pin Block, 15 Pass-Through's, 0-9 Tool-ID
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool-ID:** 30 V and 0.1 A
Tool-ID	10 Tool-ID Values Available (0–9), Factory Setting = 1
Weight	1.3 lbs (0.6 kg)

Table 7.5—SA3Z1 Tool Module Specifications	
9121-SA3Z1-T	Discrete Signal module w/19-pin Amphenol, 19-pin Block, 15 Pass-Throughs, 0-16 Tool-ID - Tool Side
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool-ID:** 50 V and 100 mA
Tool-ID	16 Tool-ID Values Available (0–F), Factory Setting = 1
Weight	1.3 lbs (0.6 kg)

Table 7.6—SA4 Tool Module Specifications	
9121-SA4-T	Discrete Signal module with 19-pin Amphenol, 19-pin Block, 11 Pass-Through's, 0-99 Tool-ID - Tool Side
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool-ID:** 30 V and 0.1 A
Tool-ID	100 Tool-ID Values Available (0–99), Factory Setting = 1
Weight	1.3 lbs (0.6 kg)

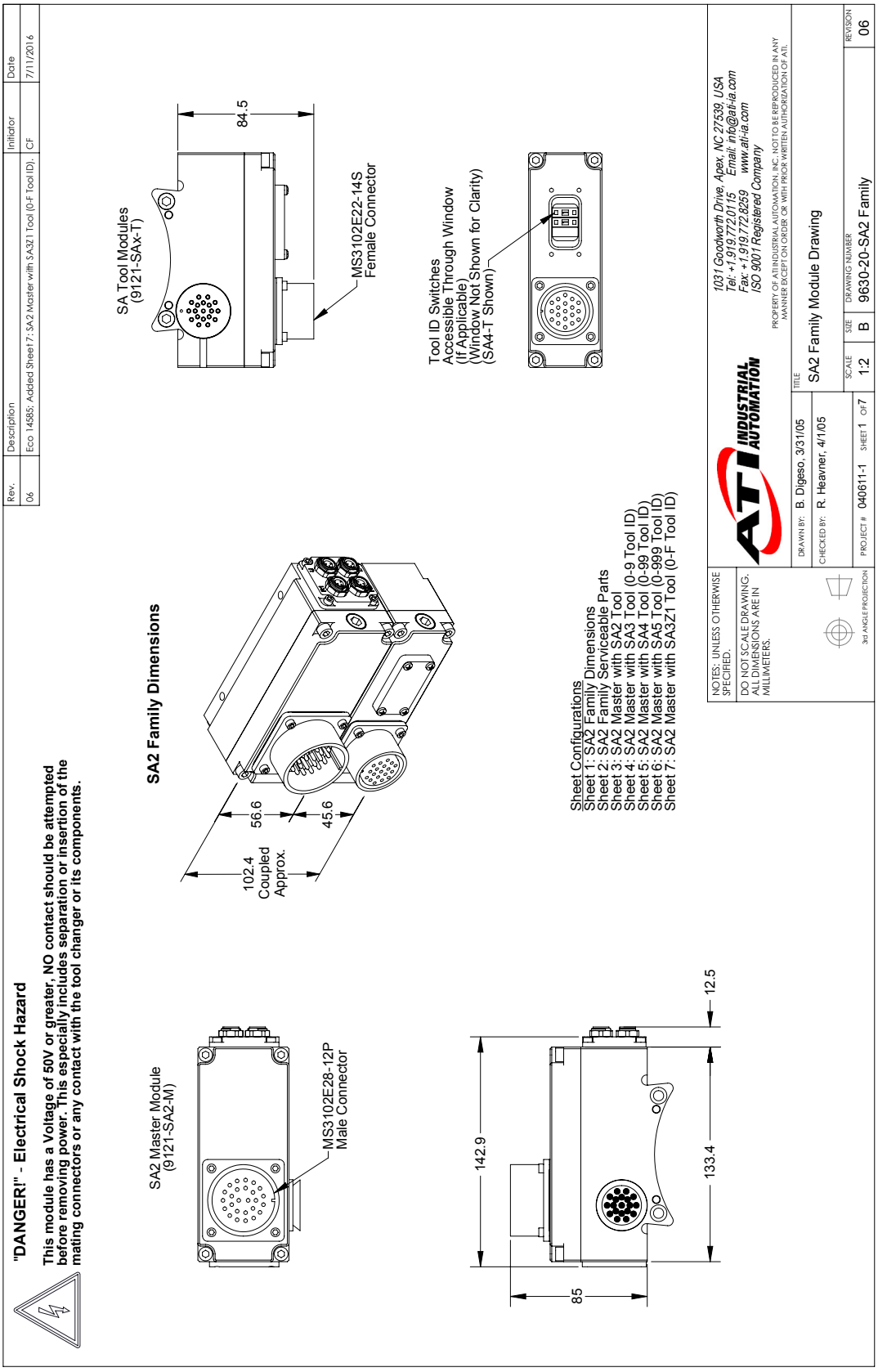
Table 7.7—SA5 Tool Module Specifications	
9121-SA5-T	Discrete Signal tool module with 19-pin Amphenol, 19-pin Block, 7 Pass-Thru's, 0-999 Tool-ID
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool-ID:** 30 V and 0.1 A
Tool-ID	1000 Tool-ID Values Available (0–999), Factory Setting = 1
Weight	1.3 lbs (0.6 kg)

Table 7.8—SA6 Tool Module Specifications	
9121-SA6-T	Discrete signal tool module with 19-pin Amphenol, 19-pin Block, 19 Pass-Thru signals, Potted
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum
Weight	1.3 lbs (0.6 kg)

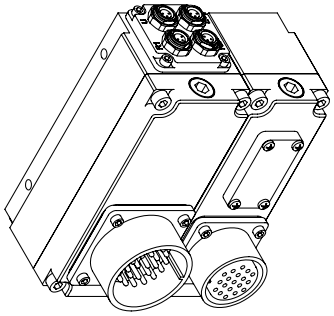
Table 7.9—SA7 Tool Module Specifications	
9121-SA7-T	Discrete Signal Tool module with 19-pin Amphenol, 19-pin Block, 15 Pass-Thru's, 0-9 Tool-ID with 0VDC Ref
Interface Connections	**Customer Interface:** 19-pin female connector for Power and Signal **Integrated Tool Changer I/O:** (4) 3-Pin M8 female connectors supporting Tool Changer Lock, Unlock, and Ready-to-Lock proximity sensors.
Electrical Rating	**Pass Through to Tool:** 5 A 250 V maximum **Tool-ID:** 30 V and 0.1 A
Tool-ID	10 Tool-ID Values Available (0–9), Factory Setting = 1
Weight	1.3 lbs (0.6 kg)

8. Drawings

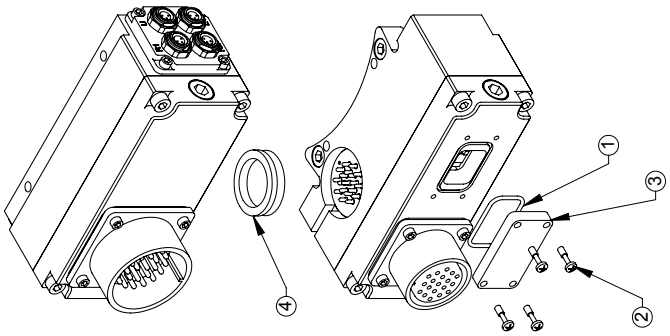
8.1 SA2 Family Drawing



Rev.	Description	Initiator	Date
	See Sheet1		



SA2 Family Serviceable Parts



ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	3410-0001092-01	O-ring AS568-023
2	4	3500-9957012-21	CAPTIVE SCREW M3 X 12 SLOTTED HEAD SS
3	1	3700-20-2696	Thick Window for DP/DE45 Master
4	1	4010-0000030-01	V-Ring Seal

NOTES: UNLESS OTHERWISE SPECIFIED.

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1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
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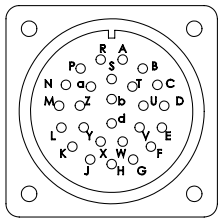
DRAWN BY: B. Digeso, 3/31/05
CHECKED BY: R. Heavner, 4/1/05
PROJECT # 040611-1 SHEET 2 OF 7

TITLE: SA2 Family Module Drawing

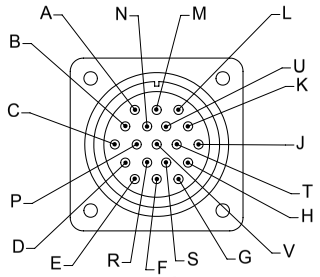
SCALE: 1:2
SIZE: B
DRAWING NUMBER: 9630-20-SA2 Family
REVISION: 06

Rev.	Description	Initiator	Date
	See Sheet1		

SA2 Master with SA2 Tool



Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1



Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1

SA2-M to SA2-T Pin Out

SA2 Master MS3102E28-12P Male Connector		SA2 Tool MS3102E22-14S Female Connector
0 Vdc Reference	A >> A	0 Vdc Reference
24 Vdc (I/P)	B >> B	24 Vdc (I/P)
available	C >> C	available
available	D >> D	available
available	E >> E	available
available	F >> F	available
available	G >> G	available
available	H >> H	available
available	J >> J	available
available	K >> K	available
available	L >> L	available
available	M >> M	available
available	N >> N	available
available	P >> P	available
available	R >> R	available
available	S >> S	available
available	T >> T	available
available	U >> U	available
available	V >> V	available
not available	W	
not available	X	
not available	Y	
RTL #1	Z	
RTL #2	a	
Lock I/P	b	
Unlock I/P	d	

Controller Outputs		
Pin:	*Signal:*	*Description:*
A	0 VDC	Voltage Reference
B	24 VDC	Voltage Supply

Controller Inputs		
Pin:	*Signal:*	*Description:*
Z	RTL #1	Ready-To-Lock Input #1
a	RTL #2	Ready-To-Lock Input #2
b	Lock	Tool Changer Lock Input
d	Unlock	Tool Changer Unlock Input

General Notes:

1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.

NOTES: UNLESS OTHERWISE SPECIFIED.

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1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
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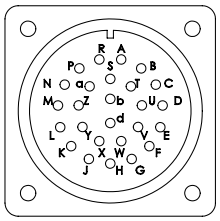
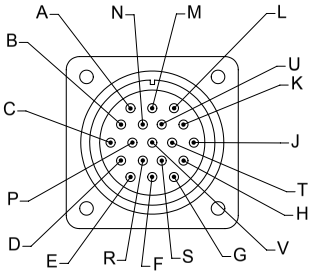
DRAWN BY: B. Digeso, 3/31/05	TITLE: SA2 Family Module Drawing				
CHECKED BY: R. Heavner, 4/1/05					
PROJECT # 040611-1 SHEET 3 OF 7	SCALE 1:2	SIZE B	DRAWING NUMBER 9630-20-SA2 Family	REVISION 06	

Rev.	Description	Initiator	Date
	See Sheet1		

SA2 Master with SA3 Tool



Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1



Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1

SA2-M to SA3-T
Pin Out

	SA2 Master MS3102E28-12P Male Connector		SA3 Tool MS3102E22-14S Female Connector	
0 Vdc Reference	A	>>	A	0 Vdc Reference
24 Vdc (I/P & Tool ID)	B	>>	B	24 Vdc (I/P & Tool ID)
available	C	>>	C	available
available	D	>>	D	available
available	E	>>	E	available
available	F	>>	F	available
available	G	>>	G	available
available	H	>>	H	available
available	J	>>	J	available
available	K	>>	K	available
available	L	>>	L	available
available	M	>>	M	available
available	N	>>	N	available
available	P	>>	P	available
available	R	>>	R	available
Tool ID, Bit Value 8	S	>> Tool ID 0-9	S	not available
Tool ID, Bit Value 4	T	>>	T	not available
Tool ID, Bit Value 2	U	>>	U	not available
Tool ID, Bit Value 1	V	>>	V	not available
not available	W			
not available	X			
not available	Y			
RTL #1	Z			
RTL #2	a			
Lock I/P	b			
Unlock I/P	d			

Controller Outputs

Pin:	Signal:	Description:
A	0 VDC	Voltage Reference
B	24 VDC	Voltage Supply

Controller Inputs

Pin:	Signal:	Description:
S	Tool ID	Bit Value 8 (See Table)
T	Tool ID	Bit Value 4 (See Table)
U	Tool ID	Bit Value 2 (See Table)
V	Tool ID	Bit Value 1 (See Table)
Z	RTL #1	Ready-To-Lock Input #1
a	RTL #2	Ready-To-Lock Input #2
b	Lock	Tool Changer Lock Input
d	Unlock	Tool Changer Unlock Input

Switch 1	Pin "S"	Pin "T"	Pin "U"	Pin "V"
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

General Notes:

1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The common for Tool ID is tied into the 24VDC line (Pin B). The Tool ID switches are Rated for service at 50V and 100 mA max. Refer to the Tool ID table for switch setup information.

NOTES: UNLESS OTHERWISE SPECIFIED.

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1031 Goodworth Drive, Apex, NC 27539, USA
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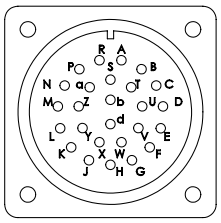
DRAWN BY: B. Digeso, 3/31/05
CHECKED BY: R. Heavner, 4/1/05
PROJECT # 040611-1 SHEET 4 OF 7

TITLE: SA2 Family Module Drawing

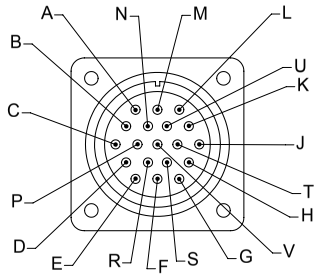
SCALE	SIZE	DRAWING NUMBER	REVISION
1:2	B	9630-20-SA2 Family	06

Rev.	Description	Initiator	Date
	See Sheet1		

SA2 Master with SA4 Tool



Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1



Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1

SA2-M to SA4-T
Pin Out

SA2 Master MS3102E28-12P Male Connector			SA4 Tool MS3102E22-14S Female Connector	
0 Vdc Reference	A	>>	A	0 Vdc Reference
24 Vdc (I/P & Tool ID)	B	>>	B	24 Vdc (I/P & Tool ID)
available	C	>>	C	available
available	D	>>	D	available
available	E	>>	E	available
available	F	>>	F	available
available	G	>>	G	available
available	H	>>	H	available
available	J	>>	J	available
available	K	>>	K	available
available	L	>>	L	available
SW2 Tool ID, Bit Value 8	M	>> Tool ID 0-9 Switch 2	M	not available
SW2 Tool ID, Bit Value 4	N	>> Tool ID 0-9 Switch 2	N	not available
SW2 Tool ID, Bit Value 2	P	>> Tool ID 0-9 Switch 2	P	not available
SW2 Tool ID, Bit Value 1	R	>> Tool ID 0-9 Switch 2	R	not available
SW1 Tool ID, Bit Value 8	S	>> Tool ID 0-9 Switch 1	S	not available
SW1 Tool ID, Bit Value 4	T	>> Tool ID 0-9 Switch 1	T	not available
SW1 Tool ID, Bit Value 2	U	>> Tool ID 0-9 Switch 1	U	not available
SW1 Tool ID, Bit Value 1	V	>> Tool ID 0-9 Switch 1	V	not available
not available	W			
not available	X			
not available	Y			
RTL #1	Z			
RTL #2	a			
Lock I/P	b			
Unlock I/P	d			

Controller Outputs

Pin:	Signal:	Description:
A	0 VDC	Voltage Reference
B	24 VDC	Voltage Supply

Controller Inputs

Pin:	Signal:	Description:
M	Tool ID	SW2 Bit Value 8 (See Table)
N	Tool ID	SW2 Bit Value 4 (See Table)
P	Tool ID	SW2 Bit Value 2 (See Table)
R	Tool ID	SW2 Bit Value 1 (See Table)
S	Tool ID	SW1 Bit Value 8 (See Table)
T	Tool ID	SW1 Bit Value 4 (See Table)
U	Tool ID	SW1 Bit Value 2 (See Table)
V	Tool ID	SW1 Bit Value 1 (See Table)
Z	RTL #1	Ready-To-Lock Input #1
a	RTL #2	Ready-To-Lock Input #2
b	Lock	Tool Changer Lock Input
d	Unlock	Tool Changer Unlock Input

Switch 1	Pin "S" "M"	Pin "T" "N"	Pin "U" "P"	Pin "V" "R"
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

General Notes:

1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The common for Tool ID is tied into the 24VDC line (Pin B). The Tool ID switches are Rated for service at 50V and 100 mA max. Refer to the Tool ID table for switch setup information.

NOTES: UNLESS OTHERWISE SPECIFIED.

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ATI INDUSTRIAL AUTOMATION
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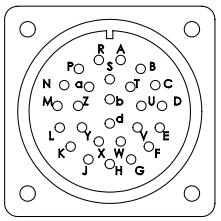
DRAWN BY: B. Digeso, 3/31/05
CHECKED BY: R. Heavner, 4/1/05
PROJECT # 040611-1 SHEET 5 OF 7

TITLE: SA2 Family Module Drawing

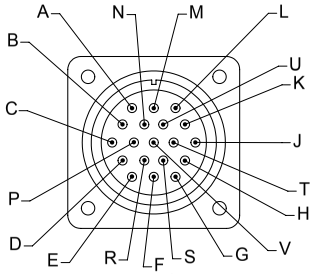
SCALE	SIZE	DRAWING NUMBER	REVISION
1:2	B	9630-20-SA2 Family	06

Rev.	Description	Initiator	Date
	See Sheet1		

SA2 Master with SA5 Tool



Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1



Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1

SA2-M to SA5-T
Pin Out

SA2 Master MS3102E28-12P Male Connector			SA5 Tool MS3102E22-14S Female Connector
0 Vdc Reference	A	>>	A 0 Vdc Reference
24 Vdc (I/P & Tool ID)	B	>>	B 24 Vdc (I/P & Tool ID)
available	C	>>	C available
available	D	>>	D available
available	E	>>	E available
available	F	>>	F available
available	G	>>	G available
SW3 Tool ID, Bit Value 8	H	>> Tool ID 0-9 Switch 3	H not available
SW3 Tool ID, Bit Value 4	J	>> Tool ID 0-9 Switch 3	J not available
SW3 Tool ID, Bit Value 2	K	>> Tool ID 0-9 Switch 3	K not available
SW3 Tool ID, Bit Value 1	L	>> Tool ID 0-9 Switch 3	L not available
SW2 Tool ID, Bit Value 8	M	>> Tool ID 0-9 Switch 2	M not available
SW2 Tool ID, Bit Value 4	N	>> Tool ID 0-9 Switch 2	N not available
SW2 Tool ID, Bit Value 2	P	>> Tool ID 0-9 Switch 2	P not available
SW2 Tool ID, Bit Value 1	R	>> Tool ID 0-9 Switch 2	R not available
SW1 Tool ID, Bit Value 8	S	>> Tool ID 0-9 Switch 1	S not available
SW1 Tool ID, Bit Value 4	T	>> Tool ID 0-9 Switch 1	T not available
SW1 Tool ID, Bit Value 2	U	>> Tool ID 0-9 Switch 1	U not available
SW1 Tool ID, Bit Value 1	V	>> Tool ID 0-9 Switch 1	V not available
not available	W		
not available	X		
not available	Y		
RTL #1	Z		
RTL #2	a		
Lock I/P	b		
Unlock I/P	d		

Controller Outputs

Pin:	Signal:	Description:
A	0 VDC	Voltage Reference
B	24 VDC	Voltage Supply

Controller Inputs

Pin:	Signal:	Description:
H	Tool ID	SW3 Bit Value 8 (See Table)
J	Tool ID	SW3 Bit Value 4 (See Table)
K	Tool ID	SW3 Bit Value 2 (See Table)
L	Tool ID	SW3 Bit Value 1 (See Table)
M	Tool ID	SW2 Bit Value 8 (See Table)
N	Tool ID	SW2 Bit Value 4 (See Table)
P	Tool ID	SW2 Bit Value 2 (See Table)
R	Tool ID	SW2 Bit Value 1 (See Table)
S	Tool ID	SW1 Bit Value 8 (See Table)
T	Tool ID	SW1 Bit Value 4 (See Table)
U	Tool ID	SW1 Bit Value 2 (See Table)
V	Tool ID	SW1 Bit Value 1 (See Table)
Z	RTL #1	Ready-To-Lock Input #1
a	RTL #2	Ready-To-Lock Input #2
b	Lock	Tool Changer Lock Input
d	Unlock	Tool Changer Unlock Input

Switch 1	Pin "S" "M" "H"	Pin "T" "N" "J"	Pin "U" "P" "K"	Pin "V" "R" "L"
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

General Notes:

1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The common for Tool ID is tied into the 24VDC line (Pin B). The Tool ID switches are Rated for service at 50V and 100 mA max. Refer to the Tool ID table for switch setup information.

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1031 Goodworth Drive, Apex, NC 27539, USA
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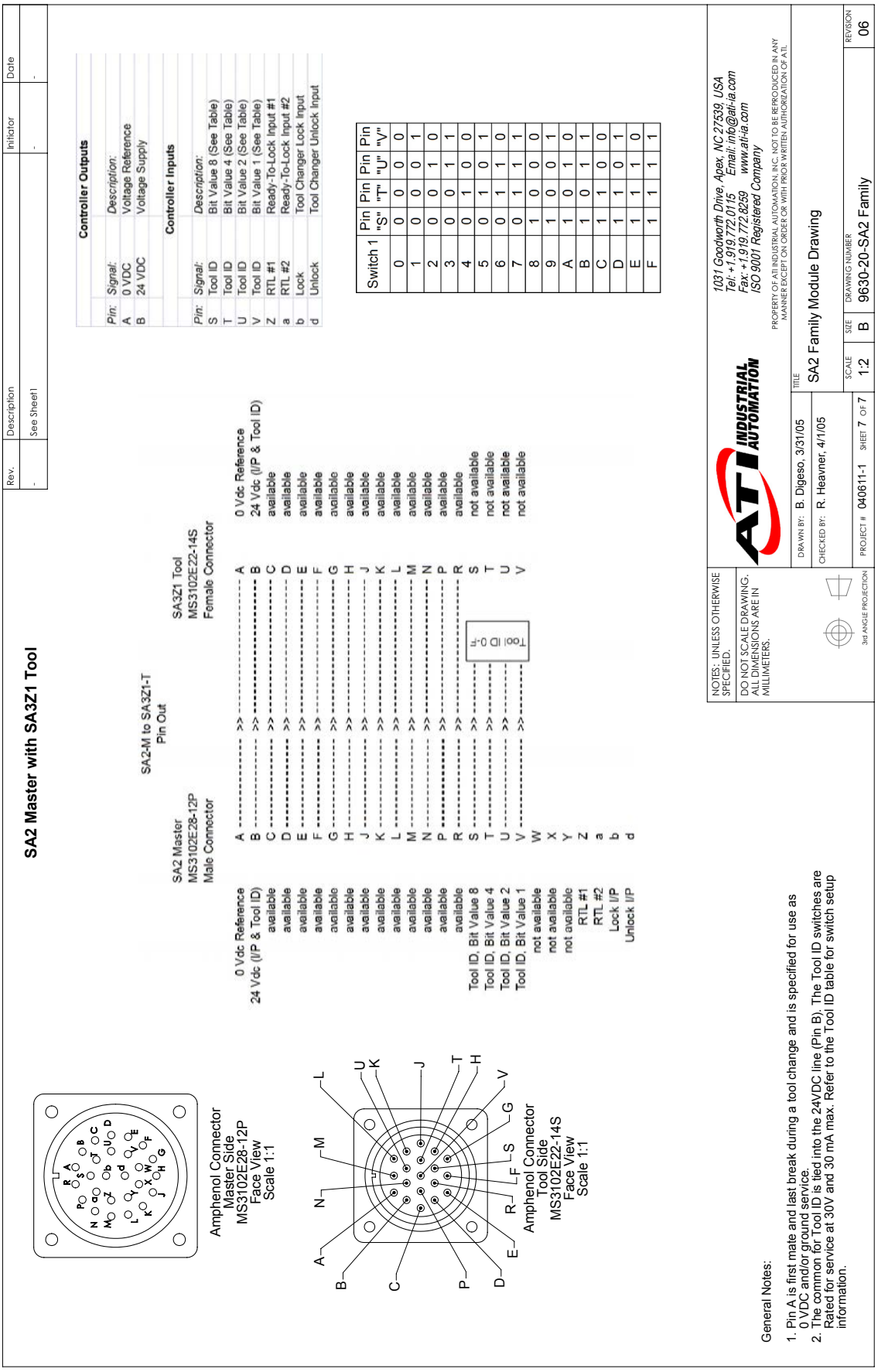
DRAWN BY: B. Digeso, 3/31/05
CHECKED BY: R. Heavner, 4/1/05
PROJECT # 040611-1 SHEET 6 OF 7

TITLE: SA2 Family Module Drawing

SCALE	SIZE	DRAWING NUMBER	REVISION
1:2	B	9630-20-SA2 Family	06


SA2 Master with SA3Z1 Tool
SA2-M to SA3Z1-T
Pin Out
SA2 Master
MS3102E28-12P
Male Connector
SA3Z1 Tool
MS3102E22-14S
Female Connector
0 Vdc Reference
24 Vdc (I/P & Tool ID)
Tool ID, Bit Value 8
Tool ID, Bit Value 4
Tool ID, Bit Value 2
Tool ID, Bit Value 1
RTL #1
RTL #2
Lock I/P
Unlock I/P
not available
Controller Outputs
Pin: Signal: Description:
A 0 VDC Voltage Reference
B 24 VDC Voltage Supply
Controller Inputs
Pin: Signal: Description:
S Tool ID Bit Value 8 (See Table)
T Tool ID Bit Value 4 (See Table)
U Tool ID Bit Value 2 (See Table)
V Tool ID Bit Value 1 (See Table)
Z RTL #1 Ready-To-Lock Input #1
a RTL #2 Ready-To-Lock Input #2
b Lock Tool Changer Lock Input
d Unlock Tool Changer Unlock Input
Switch 1 | Pin "S" | Pin "T" | Pin "U" | Pin "V"
0 | 0 | 0 | 0 | 0
1 | 0 | 0 | 0 | 1
2 | 0 | 0 | 1 | 0
3 | 0 | 0 | 1 | 1
4 | 0 | 1 | 0 | 0
5 | 0 | 1 | 0 | 1
6 | 0 | 1 | 1 | 0
7 | 0 | 1 | 1 | 1
8 | 1 | 0 | 0 | 0
9 | 1 | 0 | 0 | 1
A | 1 | 0 | 1 | 0
B | 1 | 0 | 1 | 1
C | 1 | 1 | 0 | 0
D | 1 | 1 | 0 | 1
E | 1 | 1 | 1 | 0
F | 1 | 1 | 1 | 1
Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1
Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1
General Notes:
1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The common for Tool ID is tied into the 24VDC line (Pin B). The Tool ID switches are Rated for service at 30V and 30 mA max. Refer to the Tool ID table for switch setup information.
Rev. | Description | Initiator | Date
- | See Sheet1 | - | -
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
DRAWN BY: B. Digeso, 3/31/05
CHECKED BY: R. Heavner, 4/1/05
3rd ANGLE PROJECTION
PROJECT # 040611-1 SHEET 7 OF 7
TITLE
SA2 Family Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-SA2 Family
REVISION 06
INDUSTRIAL AUTOMATION
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
ISO 9001 Registered Company
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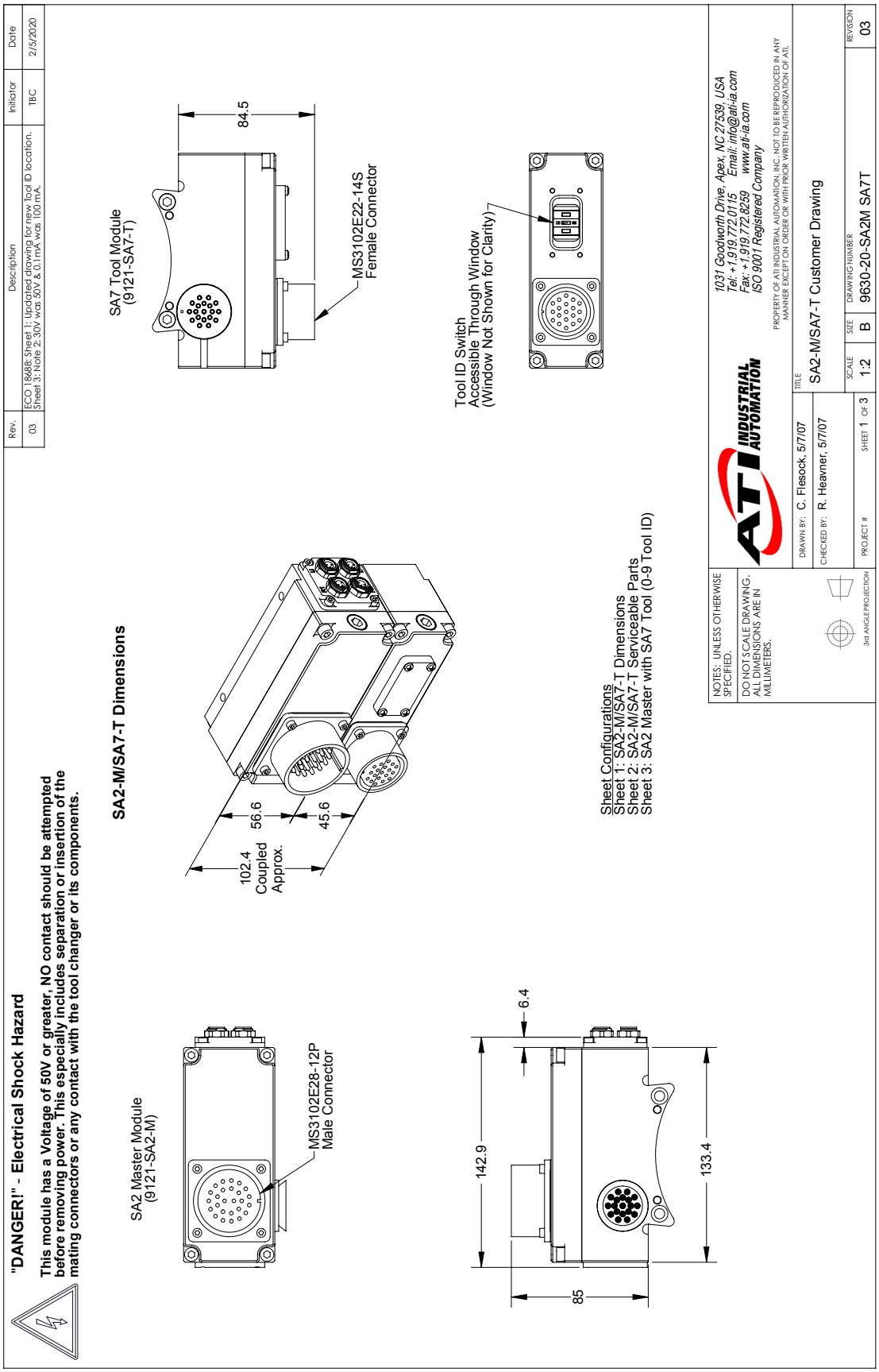
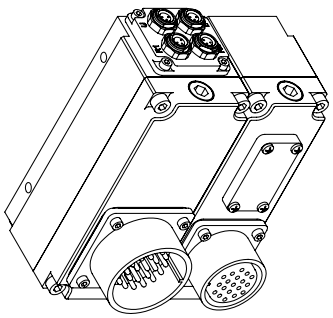
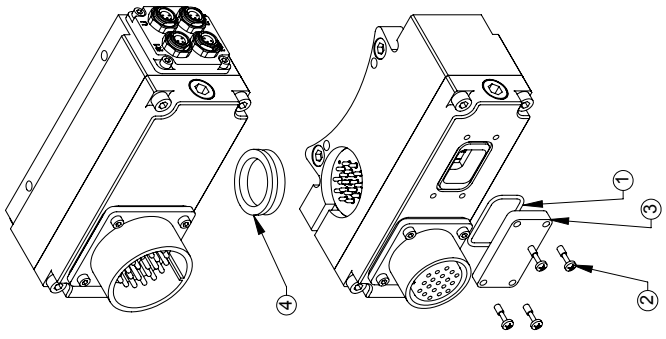
8.2 SA2M SA7T Drawing



SA2-M/SA7-T Serviceable Parts





ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	3410-0001092-01	O-ring AS568-023
2	4	3500-9957012-21	CAPTIVE SCREW M3 X 12 SLOTTED HEAD SS
3	1	3700-20-2696	Thick Window for DP/DE45 Master
4	1	4010-0000030-01	V-Ring Seal

NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.

3rd ANGLE PROJECTION

ATI INDUSTRIAL AUTOMATION
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
ISO 9001 Registered Company

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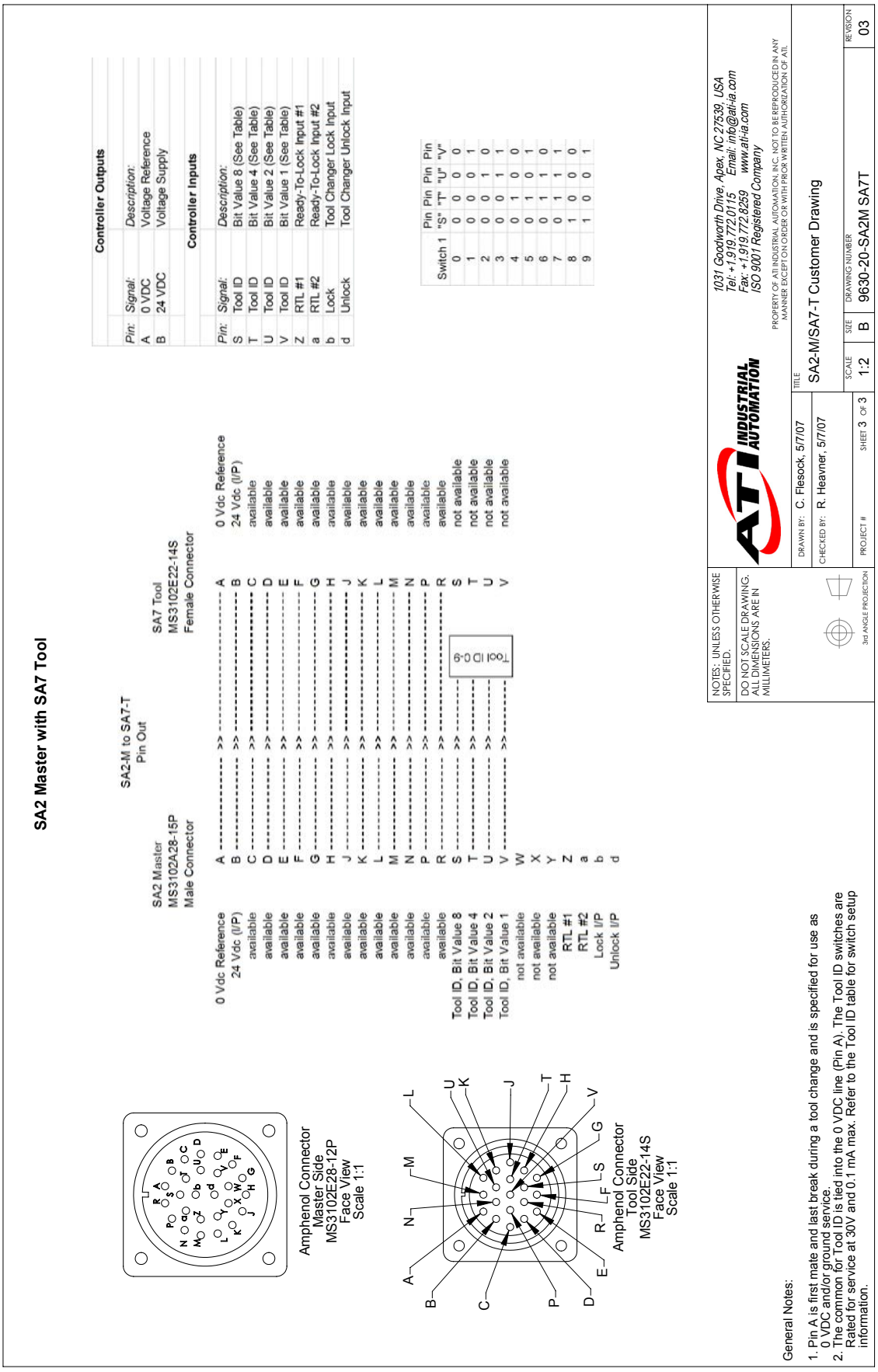
DRAWN BY: C. Flesock, 5/7/07
CHECKED BY: R. Heavner, 5/7/07
PROJECT #
SHEET 2 OF 3

TITLE: SA2-M/SA7-T Customer Drawing
SCALE: 1:2
SIZE: B
DRAWING NUMBER: 9630-20-SA2M SA7T
REVISION: 03


SA2 Master with SA7 Tool
SA2-M to SA7-T
Pin Out
SA2 Master
MS3102A28-15P
Male Connector
SA7 Tool
MS3102E22-14S
Female Connector
0 Vdc Reference
24 Vdc (I/P)
available
Tool ID, Bit Value 8
Tool ID, Bit Value 4
Tool ID, Bit Value 2
Tool ID, Bit Value 1
not available
RTL #1
RTL #2
Lock I/P
Unlock I/P
Tool ID 0-9
Controller Outputs
Pin: Signal: Description:
A 0 VDC Voltage Reference
B 24 VDC Voltage Supply
Controller Inputs
Pin: Signal: Description:
S Tool ID Bit Value 8 (See Table)
T Tool ID Bit Value 4 (See Table)
U Tool ID Bit Value 2 (See Table)
V Tool ID Bit Value 1 (See Table)
Z RTL #1 Ready-To-Lock Input #1
a RTL #2 Ready-To-Lock Input #2
b Lock Tool Changer Lock Input
d Unlock Tool Changer Unlock Input
Switch 1 Pin "S" Pin "T" Pin "U" Pin "V"
0 0 0 0
1 0 0 1
2 0 1 0
3 0 1 1
4 1 0 0
5 1 0 1
6 1 1 0
7 1 1 1
8 1 0 0
9 1 0 1
Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1
Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1
General Notes:
1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The common for Tool ID is tied into the 0 VDC line (Pin A). The Tool ID switches are Rated for service at 30V and 0.1 mA max. Refer to the Tool ID table for switch setup information.
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: C. Flesock, 5/7/07
CHECKED BY: R. Heavner, 5/7/07
PROJECT #
SHEET 3 OF 3
TITLE
SA2-M/SA7-T Customer Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-SA2M SA7T
REVISION 03
ATI INDUSTRIAL AUTOMATION
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
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