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C. Control and Signal Modules

VA8-M, SA16-T—Discrete Control Module Supporting Integrated Valve

1. Product Overview

The Discrete Control modules are required to provide a means for the customer to communicate with and control the Tool Changer. The VA8-M and SA16-T modules are specifically designed for “washdown” environments and are potted for extra protection against the negative effects of moisture intrusion.

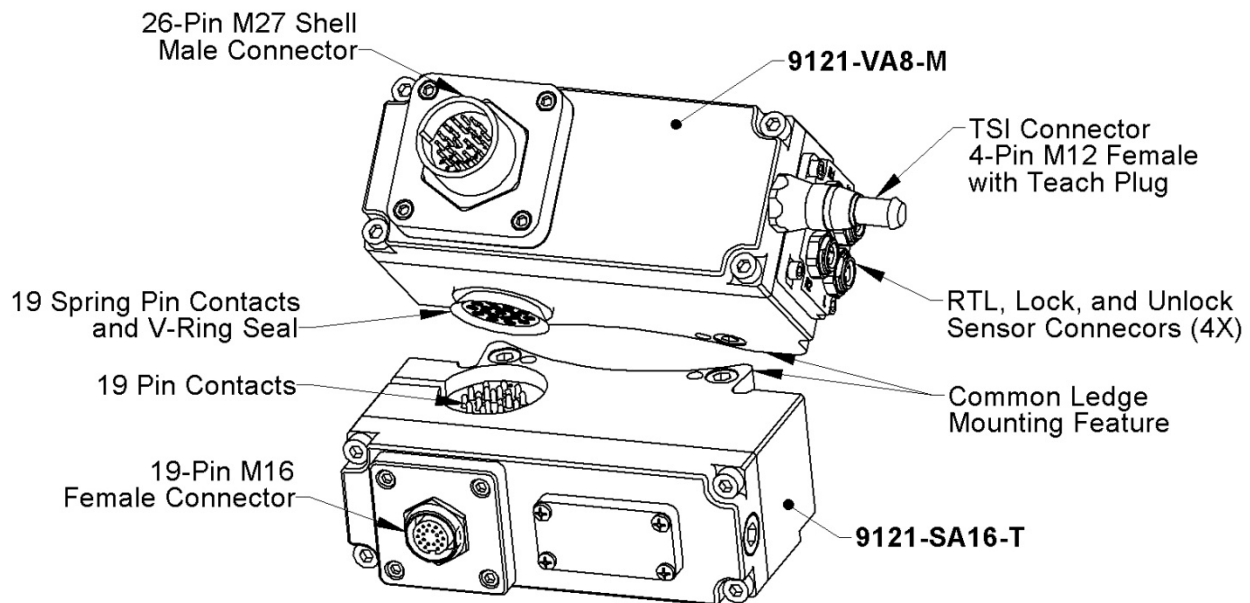
M27 Turck connectors for Master, MS-style connectors for Tool are provided for interfacing on the Master and Tool modules. When the Tool Changer is coupled, the Master and Tool modules communicate across their interface using a spring-loaded pin block. A flexible boot surrounds the pin block to seal the connection from moisture and liquid while coupled. Several module configurations are available in order to provide the customer with Tool Changer I/O and various pass-through signal capabilities. Refer to [Section 7—Specifications](#) for the specifications of each available module.

The VA8 Master module provides discrete signal pass-through capability. The VA8-M module supports the use of an integrated double solenoid valve (single solenoid valve not supported), which is provided on the valve adapter module (9121-Jxx), for Latch/Unlatch control of the Tool Changer. The user is required to provide a pneumatic supply source to the Tool Changer. Please refer to the appropriate manual for specific module and Tool Changer requirements.

An electrical interface is provided on the VA8 Master module for support of an integrated solenoid valve (DC Voltage). The integrated valve can be supplied from ATI as part of the valve adapter block, 9121-Jxx-M. Refer to the valve adapter block manual for more information. The VA8 Master module is used with the SA16-T Tool. Electrical interface drawings and connector details are provided in drawings in [Section 8—Drawings](#).

The VA8 Master module is outfitted with a Tool Stand Interlock (TSI) connector that is wired directly into the unlock solenoid valve circuit. Using this connector, a switch can be integrated that will allow the solenoid valve to uncouple the Tool Changer only when the Tool is in the Tool Stand. Otherwise, a jumper plug is factory-supplied with the connector to close the solenoid valve circuit.

Figure 1.1—VA8 Master and SA16 Tool Modules

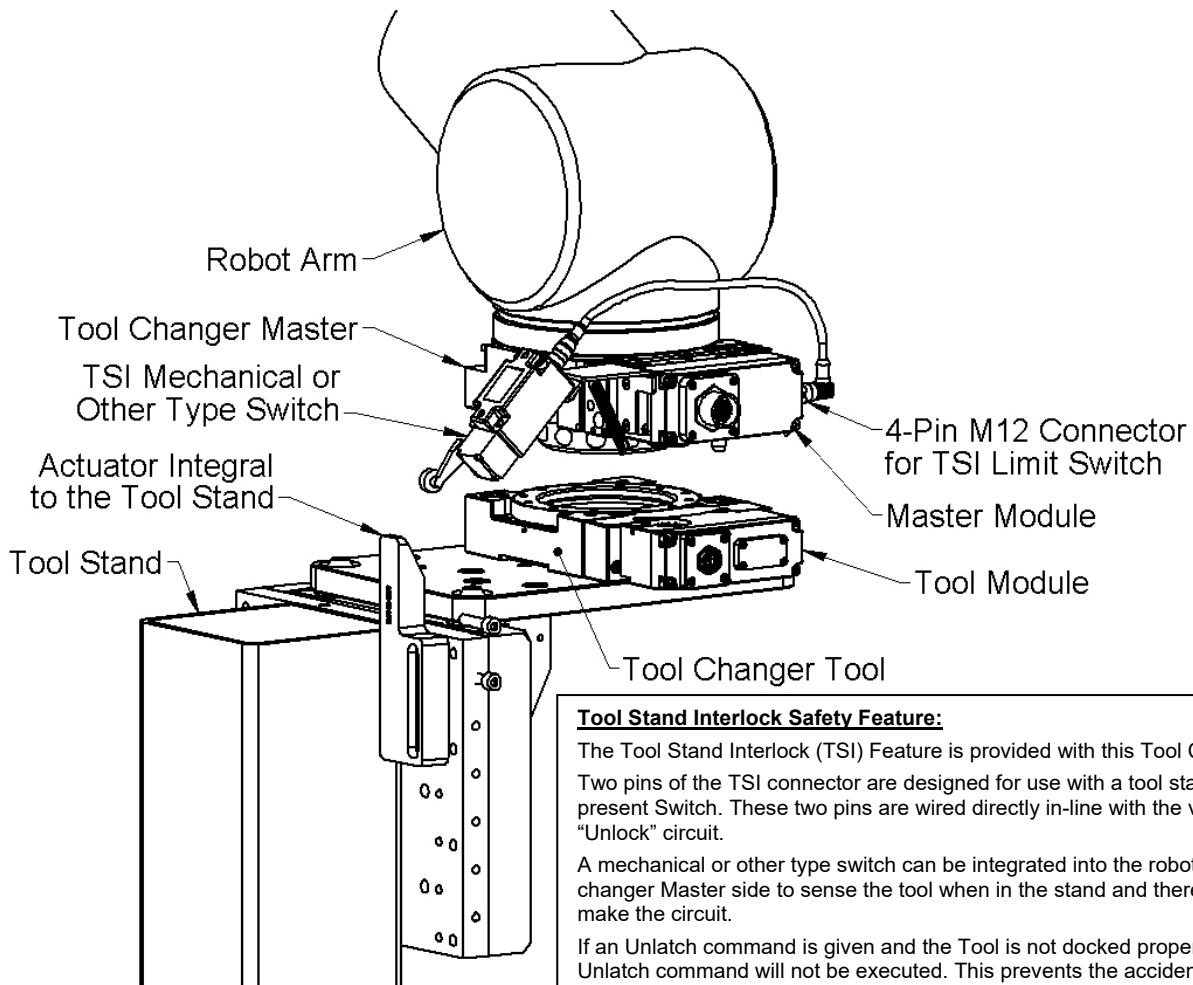


1.1 Master-side TSI with Safety Switch

To prevent an unintended Tool release, the electrical power to the unlatch valve circuit is routed through a safety switch that is mounted to the Master. Only when the tool is properly located in the tool stand will the actuator (or trip dog) mounted on the Tool Stand close the safety switch allowing the unlatch command to be executed. This insures that a Tool can only be released at the Tool Stand. Refer to the electrical schematic in *Section 8—Drawings* for a detailed description of the safety circuit.

The safety switch is connected to the Master module via a 4-pin, M12 connector that is mounted to the side of the module. A teach plug can be connected to the 4-pin, M12 TSI connector to override the TSI circuit during setup and integration.

Figure 1.2—Tool Stand Interlock (TSI)



Tool Stand Interlock Safety Feature:

The Tool Stand Interlock (TSI) Feature is provided with this Tool Changer.

Two pins of the TSI connector are designed for use with a tool stand present Switch. These two pins are wired directly in-line with the valve "Unlock" circuit.

A mechanical or other type switch can be integrated into the robot tool changer Master side to sense the tool when in the stand and therefore make the circuit.

If an Unlatch command is given and the Tool is not docked properly, the Unlatch command will not be executed. This prevents the accidental release of the Tool outside of the Tool Stand.

The TSI is factory supplied with a teach plug to override the TSI safety feature during initial setup and maintenance situations.



CAUTION: This Tool Changer is equipped with Tool Stand Interlock (TSI). Special procedures are required to unlock the Tool Changer.

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 the drawings in [Section 8—Drawings](#).

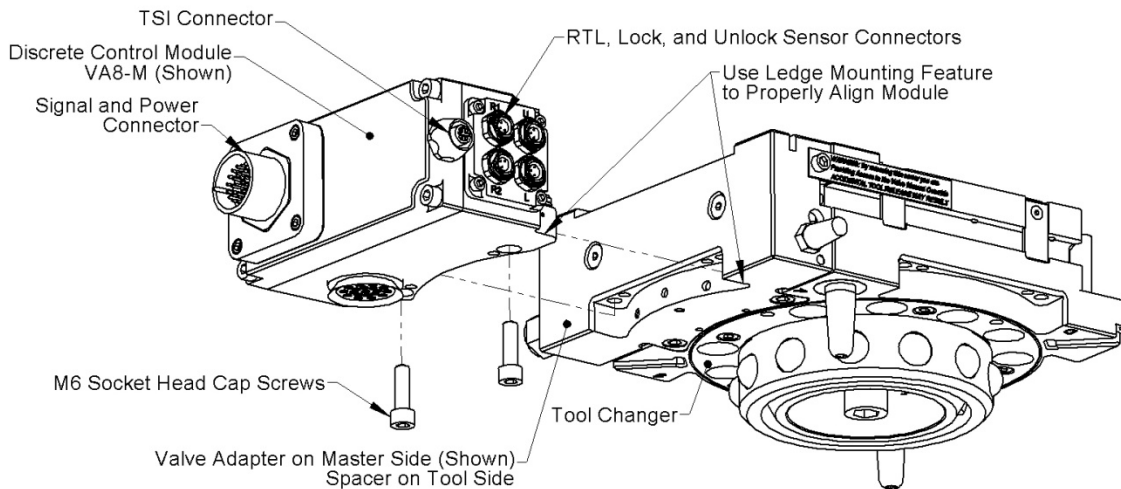


WARNING: Do not perform maintenance or repair on Tool Changer or modules unless the tool is safely supported or docked in the tool stand and all energized circuits (e.g., electrical, air, water, etc.) have been turned off. Injury or equipment damage can occur with tool not docked and energized circuits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

2.1 Installing

1. It may be necessary to clean the mounting surface on the Valve Adapter or Spacer prior to installing the module in order to remove any debris that may be present.
2. Using the ledge feature as a guide place the module into the appropriate location on the Valve Adapter or Spacer. Align the module with the Valve Adapter using the dowels in the bottom of the ledge feature. Refer to [Figure 2.1](#).
3. If fasteners do not have pre-applied adhesive, apply Loctite 242[®] to the supplied M6 SHCS fasteners. Install the two (2) M6 socket head screws securing the module to the Valve Adapter or Spacer and tighten to 40–70 in-lbs.
4. Power, signal, and sensor cables can be connected to the module after attaching the module to the Valve Adapter or Spacer. Ensure that the connectors are cleaned prior to being secured as appropriate.

Figure 2.1—Module Installation



2.2 Removal

1. Prior to removing the module, use a marker pen to scribe a line or indication between the Tool Changer and module body as a reminder where the module is to be re-installed.
2. Depending upon the service or repair being done, customer connections up to the module may or may not need to be disconnected.
3. Remove the socket head cap screws and lift the module from the Tool Changer. Refer to [Figure 2.1](#)



CAUTION: It is recommended, not to use fasteners with pre-applied adhesive more than three times. Fasteners used more than three times may come loose and cause equipment damage. Discard fasteners used more than three times and install new fasteners with pre-applied adhesive.

3. Operation

Various Tool Changer I/O are provided to the customer through the M27 Turck connector on the control/signal Master module. Lock, Unlock, and Ready-to-Lock proximity sensor inputs are provided for confirmation of Tool Changer and locking mechanism positions. Other customer-assigned discrete I/O points are also available through the connector.

Output signals need to be provided to the discrete control module to actuate the solenoid valve (VA8 version) in order to provide pneumatic pressure to lock or unlock the Tool Changer.

Note that 0 and 24 VDC supply lines are required to be on certain pin locations of the customer interface connector. Reference drawings in [Section 8—Drawings](#).

for pin out information and location of the I/O signals.

Refer to the specific Tool Changer manual for details on the operation of the Tool Changer and recommended procedure for coupling.

The following 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 VA8M SA16T control/signal modules. This procedure is intended for “automatic” modes used during normal processes.

3.1 Recommended Sequence of Operation

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 false.
 - b. The ATI Tool and any downstream device is offline.
2. Unlock the Master. (This must be done prior to the Master entering the Tool to prevent the ball bearings from impinging on the Tool bearing race.)
 - a. The **Latch** output command is made false and the **Unlatch** output command is made true.
 - b. The **Unlocked** input goes true and remains true, indicating that the Tool Changer locking mechanism is fully retracted and the **Unlatch** operation is complete.
3. Robot and Master move into the Tool and are parallel and within 0.15” to 0.06” of the Tool (i.e., the module contact pins are touching, but the **RTL** sensors have not yet sensed the targets on the Tool).
 - a. Power and I/O connections with downstream devices are established.
4. Robot and Master move within 0.06” of the Tool.
 - a. The **RTL1** and **RTL2** inputs are true, indicating that it is okay to couple the Tool.
5. Couple the Tool Changer.
 - a. The **Unlatch** output is made false and the **Latch** output is made true.
 - b. The **Unlocked** input goes false a short time later, indicating piston travel. Subsequently, the **Locked** input goes true and remains true, indicating that the coupling operation is complete.
6. Robot moves away from the Tool Stand with the Tool Changer coupled.

7. Normal operation.
 - a. The following inputs are true:
 - i. **Locked**
 - ii. **RTL1**
 - iii. **RTL2**
 - b. The following inputs are false:
 - i. **Unlocked**
 - c. The following outputs are true:
 - i. **Latch**
 - d. The following outputs are false:
 - i. **Unlatch**
8. Robot moves into the Tool Stand with the Tool Changer coupled.
9. 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 **Latch** output is made false and the **Unlatch** output is made true.
 - b. The **Locked** input goes false a short time later and subsequently the **Unlocked** input goes true and remains true, indicating that the uncoupling operation is complete.
10. Robot and Master move away from the Tool and are parallel and between 0.15" to 0.06" of the Tool.
 - a. The **RTL1 and RTL2** inputs are false.
11. Robot and Master move away from the Tool and are parallel and > 0.15" from the Tool.
 - a. Power and I/O connections with downstream devices are no longer available.
12. Robot and Master in free space.
 - a. The following inputs are true:
 - i. **Unlocked**
 - b. The following inputs are false:
 - i. **Locked**
 - ii. **RTL1**
 - iii. **RTL2**

4. Maintenance

Once installed, the operation of the control modules is generally trouble free. 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.



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

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 these conditions. 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.

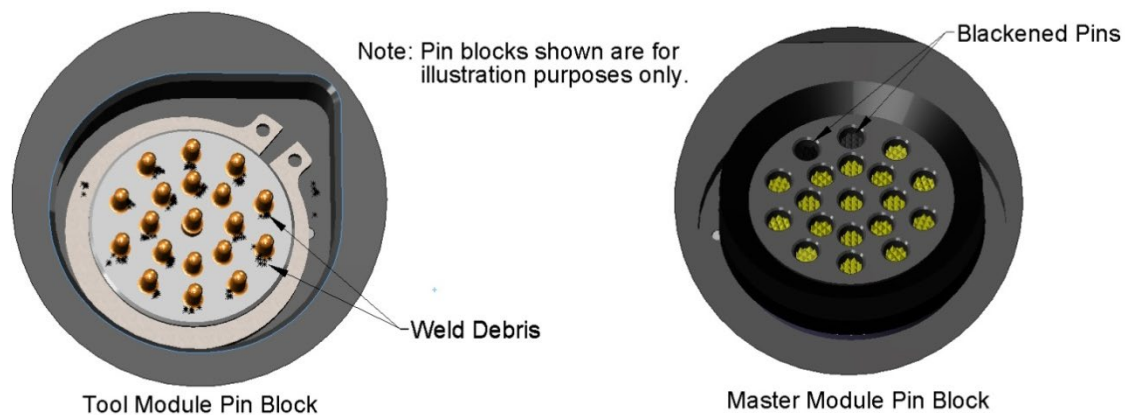
Under normal conditions, no special maintenance is necessary, however it is recommended that periodic inspections be performed to assure long-lasting performance and to assure that unexpected damage has not occurred. Perform the following visual inspection monthly:

- Inspect mounting fasteners to verify they are tight and if loose, then tighten to the proper torque.
- 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 4.2—Seal Replacement](#).

4.1 Pin Block Inspection and cleaning

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

Figure 4.1—Inspect Master and Tool Pin Blocks

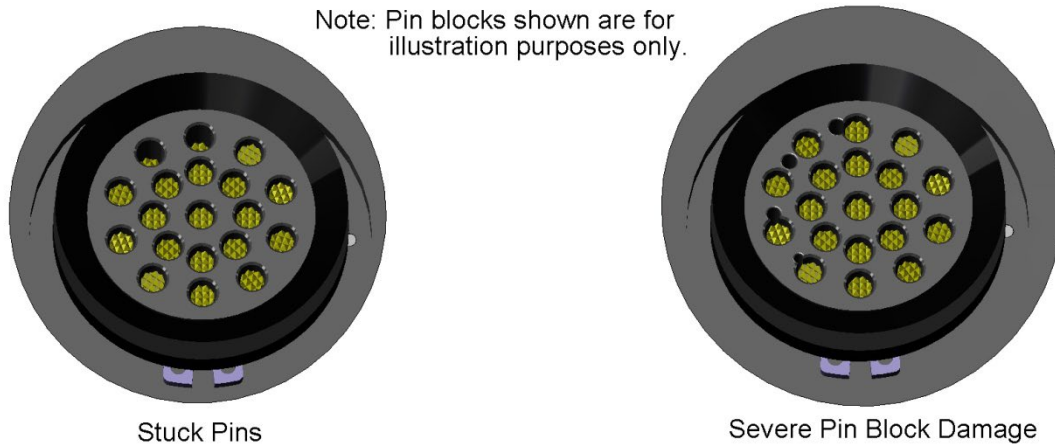


If debris or darkened pins exist, remove debris using a vacuum, and clean using a nylon brush (ATI part number 3690-0000064-60).

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

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

Figure 4.2—Stuck Pin and Pin Block Damage



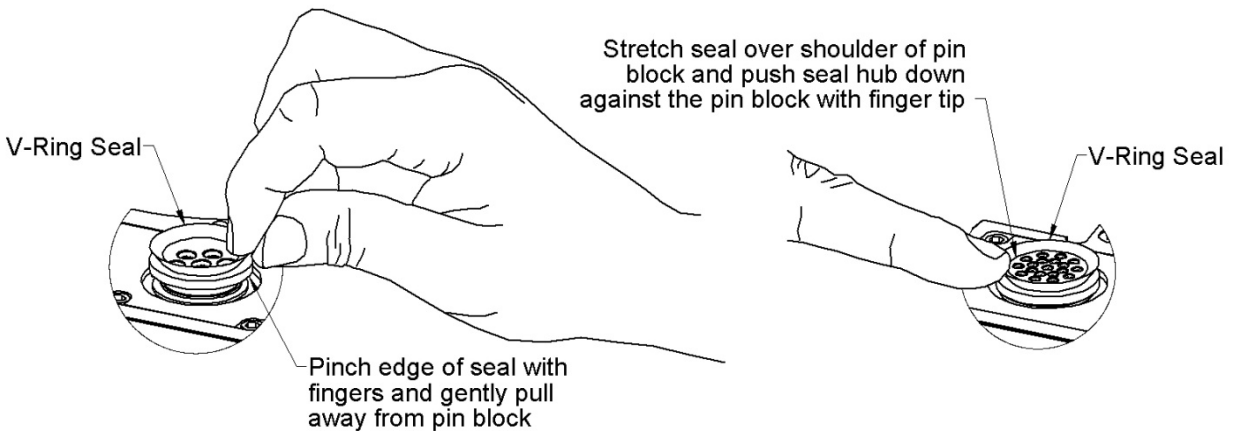
If stuck pins or severe pin block damage exists, contact ATI for possible pin replacement procedures or module replacement.

4.2 Seal Replacement

Replace the V-Ring seal:

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

Figure 4.3—V-Ring seal Replacement



5. Troubleshooting

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. <i>Refer to the Maintenance section of the Tool Changer manual for instructions.</i>
	Air supply not to specifications.	Check air supply. <i>Refer to the Installation section of the Tool Changer manual for specifications.</i>
	Check that exhaust port is properly vented (check muffler).	Check that exhaust port is properly vented (check muffler). <i>Refer to Air and Valve adapter section for information.</i>
	Incorrect valve operation.	Check valve for proper operation. <i>Refer to Air and Valve adapter section for information.</i>
	Discrete signals are mapped incorrectly.	Verify that discrete signals are mapped and are communicating properly. Refer to Section 8—Drawings for electrical schematic.
	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. <i>Refer to the Installation – Tool Stand Design Section of the Tool Change manual for specifications.</i>
	Air trapped in the Unlock (U) air port.	Ensure that there is no air trapped in the Unlock (U) air port. <i>Refer to Air and Valve adapter section for pneumatic specification and requirements.</i>
Sensors not operating properly	Sensor cables damage or incorrectly connected.	Verify that cables are connected correctly and not damaged, replace if damaged. <i>Refer to the Troubleshooting Section of the Tool Change manual.</i>
	Sensors are set incorrectly.	Verify that the sensors are set correctly. <i>Refer to the Troubleshooting Section of the Tool Change manual.</i>
	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.
Loss of Communication	Damaged signal cabling	Check/Replace signal cabling up- and down-stream of Tool Changer modules.
	Worn or damaged contact pins	Inspect module contact pins for debris/wear/damage.

6. Recommended Spare Parts

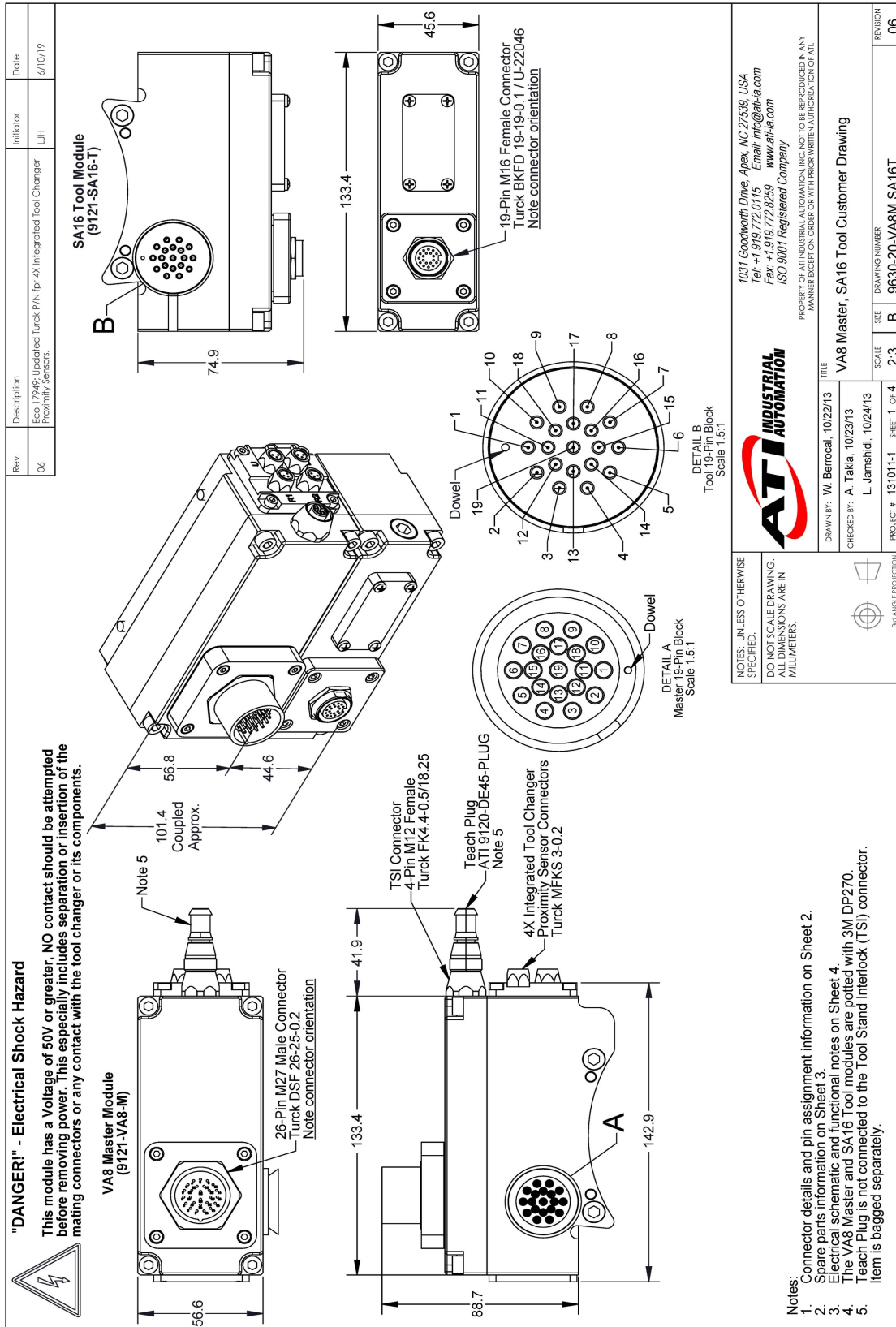
See Drawings in [Section 8—Drawings](#).

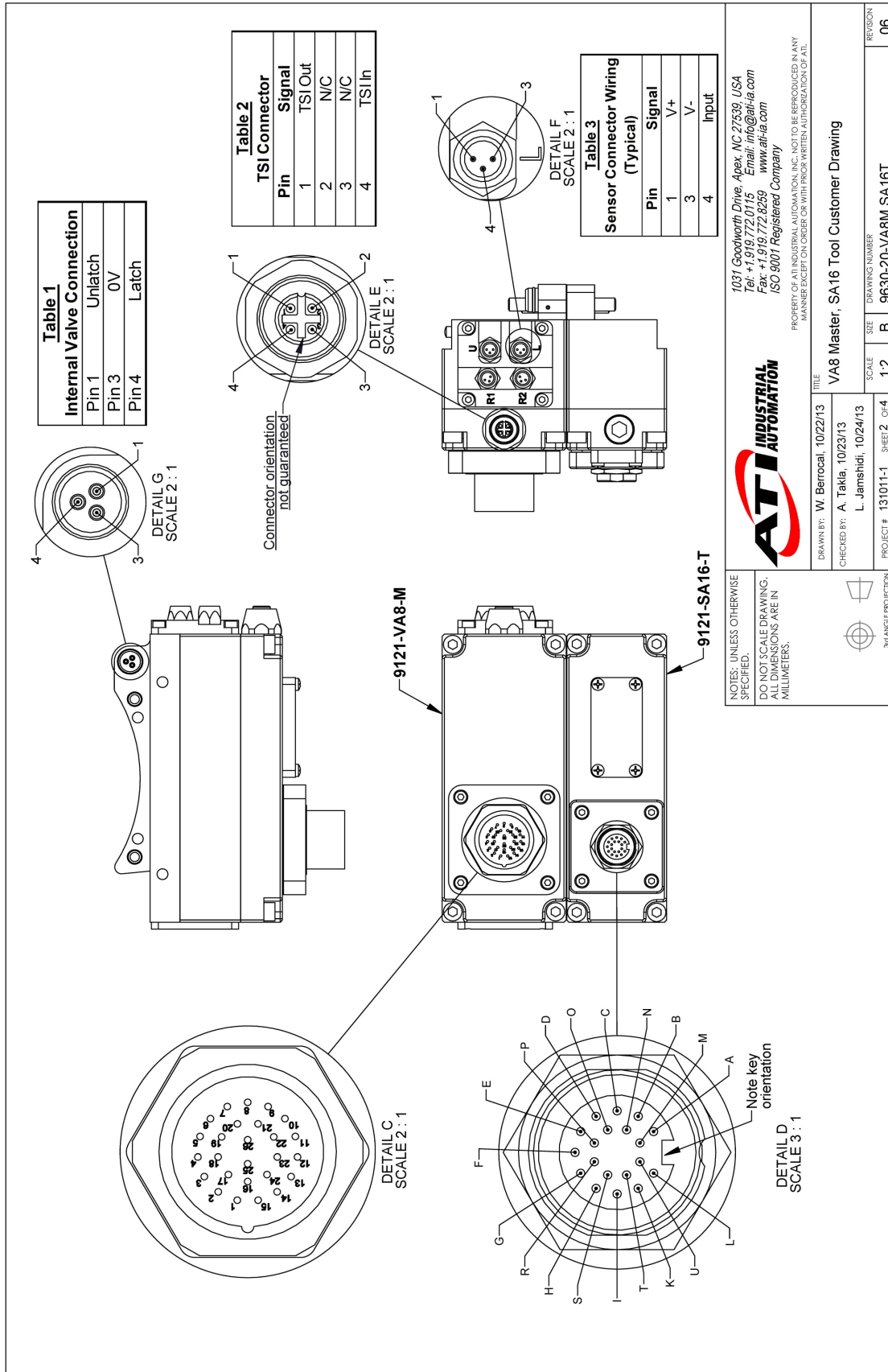
7. Specifications

9121-VA8-M	Discrete, 26 Pin Turck M27 Connector, 19-Pin Block, Supports L/U/R1/R2 Sensors with Integrated Valve Pass-Through, Potted. VA8-M Supports TSI on the Master-side and Works with SA16 Tool.
Interface Connections	<u>Tool Changer I/O</u> : Turck M27 DSF 26-25-0.2, 26-pin male connector. <u>Integrated Tool Changer I/O</u> : <ul style="list-style-type: none"> 4X M8, 3-pin female connectors supporting Tool Changer Locked, Unlocked, and Ready-to-Lock proximity sensors, PNP sensor type.
Electrical Rating	<u>Signal Pass-Through</u> : 3 Amp, 150V maximum (Signal voltage is limited by Tool signal Pass-Through limit 30V Max.) Straight through wiring, no special twisting or shielding
	<u>Tool Changer Control</u> : <ul style="list-style-type: none"> Lock, Unlock, and Ready-to-Lock sensors: 10-30 VDC operational voltage (Sensors are PNP type) <i>Note: Input Power provides power to the L, U, and RTL sensors.</i>
	<u>Valve Control Power</u> : Latch and Unlatch Valve control: 24 VDC ±20% (19-29 VDC) operational voltage.
Weight	1.50 lbs (0.68 kg)

9121-SA16-T	Discrete Signal Module with 19-Socket M16 Connector, 19-Pin Block, 19 Pass-throughs, Potted
Interface Connections	<u>Tool Changer I/O</u> : Turck M16 BKFD 19-19-0.1, 19-pin (female contacts), male bayonet connector.
Electrical Rating	<u>Signal Pass-Through</u> : 3 Amp, 30V maximum Straight through wiring, no special twisting or shielding
Weight	1.15 lbs (0.52 kg)

8. Drawings





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3/4 ANGLE PROJECTION

DRAWN BY: W. Berrocal, 10/22/13
 CHECKED BY: A. Takla, 10/23/13
 L. Jamshidi, 10/24/13

TITLE: VA8 Master, SA16 Tool Customer Drawing

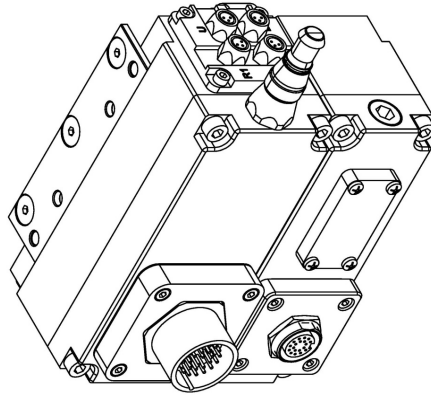
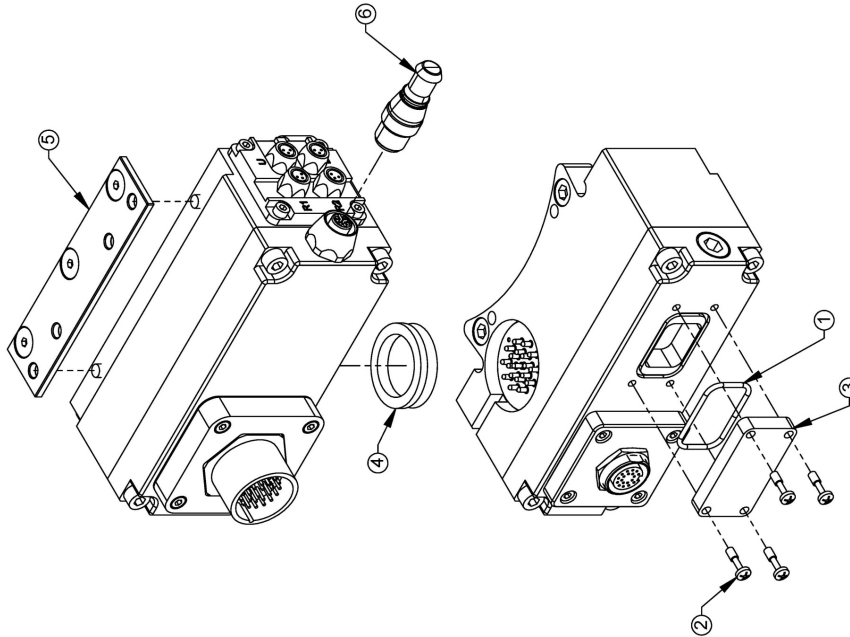
SCALE: 1:2
 SHEET 2 OF 4

PROJECT #: 131011-1

DRAWING NUMBER: 9630-20-VA8M SA16T

REVISION: 06

VA8 Master, SA16 Tool Serviceable Parts



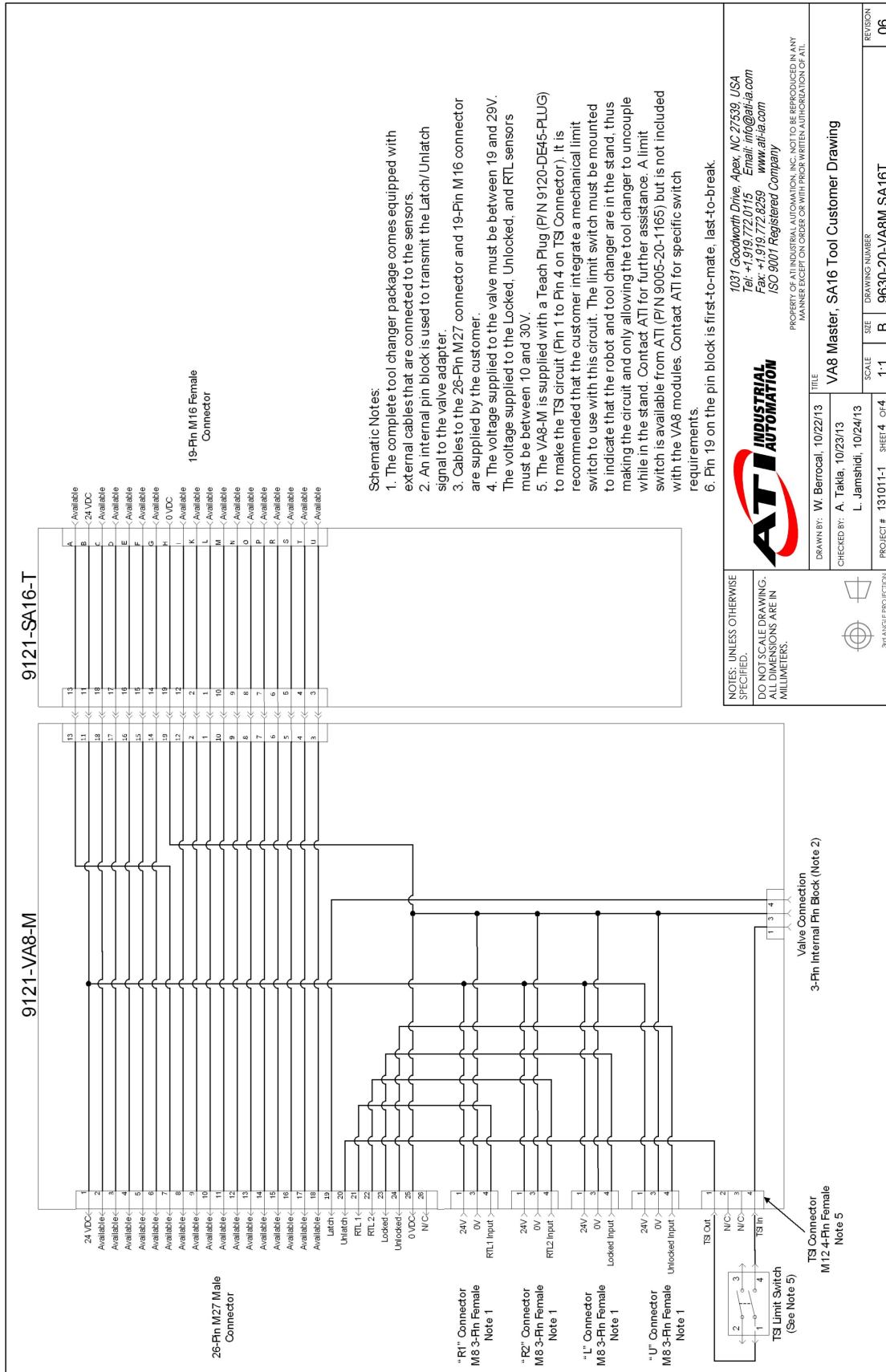
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	3410-0001092-01	O-ring AS568-023
2	4	3500-9957012-21	Captive Screw M3 x 12 Slotted Head SS
3	1	3700-20-2696	Tool ID Window/Thick Window for DP/DE45 Master
4	1	4010-0000030-01	V-Ring Seal
5	1	9005-20-1198	Master Cleat Assembly
6	1	9120-DE45-PLUG	Yellow Teach Plug w/ Lanyard and Caution Tags

NOTES: UNLESS OTHERWISE SPECIFIED,
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DRAWN BY: W. Berrocal, 10/22/13		TITLE	
CHECKED BY: A. Takla, 10/23/13		VA8 Master, SA16 Tool Customer Drawing	
L. Jamshidi, 10/24/13		SCALE	DRAWING NUMBER
PROJECT # 131011-1 SHEET 3 OF 4		1:2	B
		SIZE	REVISION
			06



- Schematic Notes:**
1. The complete tool changer package comes equipped with external cables that are connected to the sensors.
 2. An internal pin block is used to transmit the Latch/Unlatch signal to the valve adapter.
 3. Cables to the 26-Pin M27 connector and 19-Pin M16 connector are supplied by the customer.
 4. The voltage supplied to the valve must be between 19 and 29V. The voltage supplied to the Locked, Unlocked, and RTL sensors must be between 10 and 30V.
 5. The VA8-M is supplied with a Teach Plug (P/N 9120-DE45-PLUG) to make the TS circuit (Pin 1 to Pin 4 on TSI Connector). It is recommended that the customer integrate a mechanical limit switch to use with this circuit. The limit switch must be mounted to indicate that the robot and tool changer are in the stand, thus making the circuit and only allowing the tool changer to uncouple while in the stand. Contact ATI for further assistance. A limit switch is available from ATI (P/N 9005-20-1165) but is not included with the VA8 modules. Contact ATI for specific switch requirements.
 6. Pin 19 on the pin block is first-to-mate, last-to-break.

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3/8" ANGLE PROJECTION

DRAWN BY: W. Bercoai, 10/22/13
 CHECKED BY: A. Takla, 10/23/13
 L. Jamshidi, 10/24/13

TITLE: VA8 Master, SA16 Tool Customer Drawing

SCALE: 1:1
 DRAWING NUMBER: B
 PROJECT #: 131011-1 SHEET 4 OF 4

REVISION: 06