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C. Control and Signal Modules

VB8—Discrete Control Module Supporting Integrated Valve

1. Product Overview

Note: VB8-M supports the use of NPN sensors only.

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

MIL-5015 type connectors 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. Refer to Section 7 for the specifications of each available module

An electrical interface is provided on the Master module for support of an integrated solenoid valve (DC Voltage, **sourcing-type**). The integrated valve can be supplied from ATI as part of the valve adapter block (such as 9121-JR2-M). Refer to the valve adapter block manual for more information (9620-20-C-Jxx Air and Valve Adapters with Valve Signal Pass Thru). Electrical interface drawings and connector details are provided in drawings in Section 8.

The Tool-ID feature allows the customer to distinguish between the different Tools that are being coupled by the Tool Changer. Setting of Tool-ID is facilitated using push button switches provided on the Tool modules.

The VB8 modules are designed with special features to afford the user the opportunity to operate the Tool Changer in the safest manner possible. In addition to providing the standard Lock, Unlock, and Ready-to-Lock sensor inputs (**sinking-type**) the VB8 modules are outfitted with patented Tool Stand Interlock (TSI) technology. The TSI feature consists primarily of a physical break in the unlock solenoid valve circuit. The broken circuit is made available to the customer via a TSI connector on the Tool module. Using this connector, a mechanical switch and trip dog can be integrated by the customer to allow the unlock solenoid valve circuit to be completed only when the Tool is in the Tool Stand (see Figs. 1.1 and 1.2). A momentary action single-pole, single-throw switch is suggested.

In order to allow the Tool Changer to uncouple when a Tool is not present, a relay circuit in parallel with the TSI circuit is utilized. This relay circuit is located in the Master module and is triggered by the RTL sensor. If the RTL sensor is low, indicating no Tool Presence, then the Relay circuit is closed, thus allowing the unlock solenoid valve circuit to be completed. If the RTL sensor is high, indicating Tool Presence, then the relay circuit is open and the TSI circuit on the Tool-side must be closed in order to complete the unlock solenoid valve circuit.

Monitoring of the Relay circuit is achieved through the RTLV input (**sinking-type**). Refer to Table 3.1 for suggested fault monitoring conditions.



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

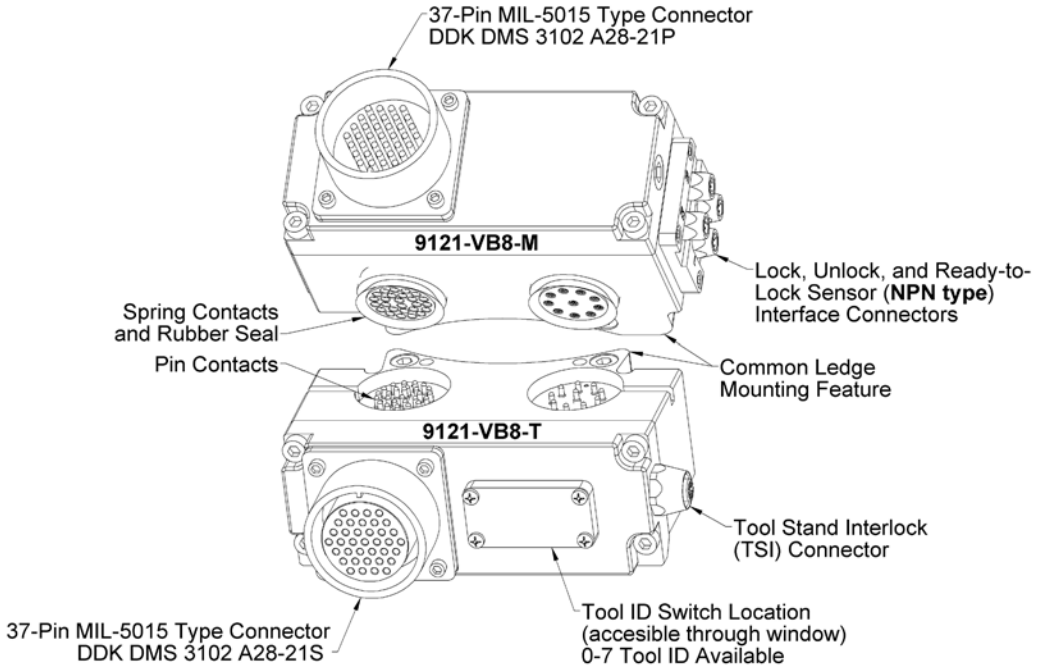


Figure 1.1—VB8 Modules

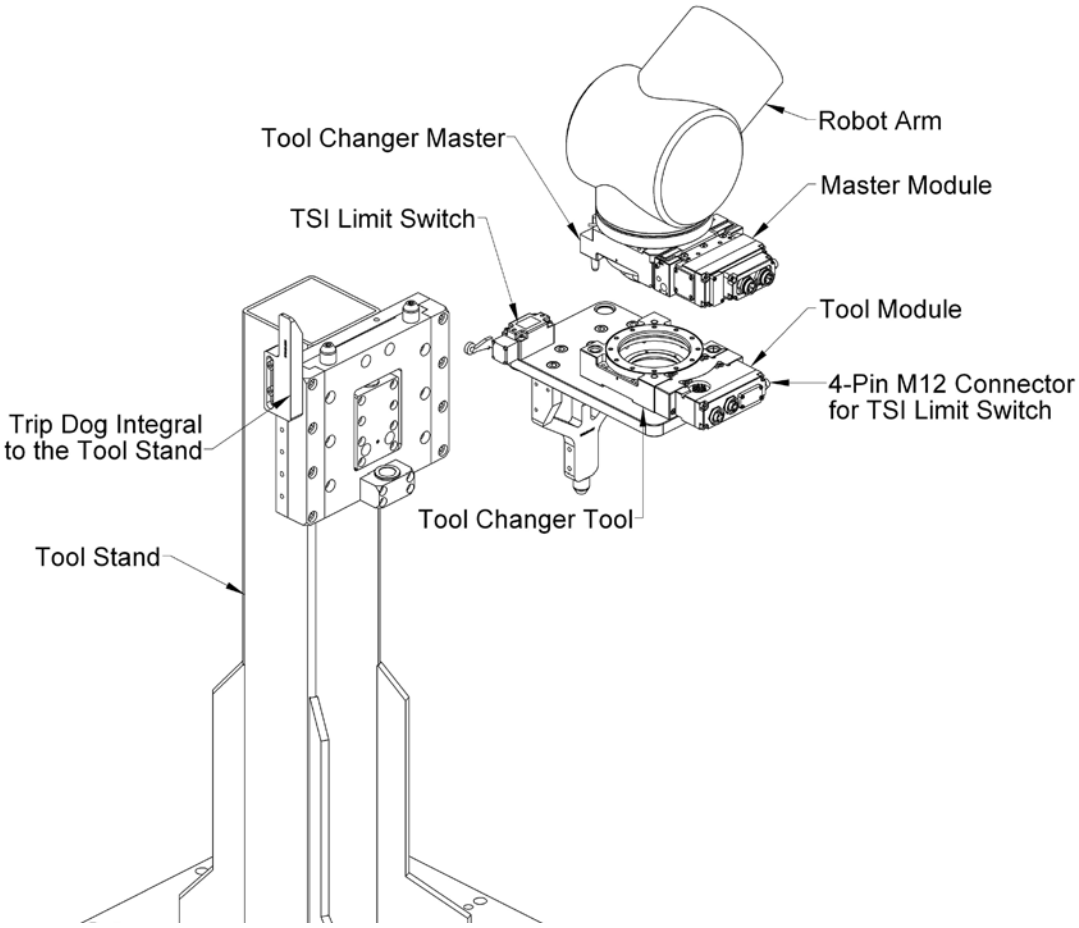


Figure 1.2—Tool Stand Interlock (TSI)

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.

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.

2.1Installing

DANGER: For electrical modules using > 60VDC or 42VAC, NO contact should be attempted before removing power. This includes attaching and disconnecting cables to mating connectors or any contact with the Tool Changer or its components. Arcing and damage will occur if this is not observed. Remove power before attaching, disconnecting any cables or attempting any maintenance of Tool Changer.

1. It may be necessary to clean the mounting surface on the Tool Changer prior to installing the module in order to remove any debris that may be present.
2. Align the module to the holes in the Tool Changer mounting surface using the dowels that are pressed into the module housing. Push the module flush with the Tool Changer surface.
3. Apply Loctite-222® (or similar) thread locker to the socket head cap screws and tighten using a hex key.
4. Typically, proximity sensor cables are connected to the Master control module. These connections need to be made once the module has been attached to the Tool Changer body.

2.2Removal

DANGER: For electrical modules using > 60VDC or 42VAC, NO contact should be attempted before removing power. This includes attaching and disconnecting cables to mating connectors or any contact with the Tool Changer or its components. Arcing and damage will occur if this is not observed. Remove power before attaching, disconnecting any cables or attempting any maintenance of Tool Changer.

1. All customer connections and proximity sensor cables up to the Master module need to be disconnected.
2. Remove the socket head cap screws and pull the module off the Tool Changer. Retain the fasteners for re-installation.

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

3. Operation

Various Tool Changer I/O is provided to the customer through the military-style DDK connector on the control/signal Master module. Lock, Unlock, and Ready-to-Lock proximity sensor inputs (**sinking-type**) 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 (**sourcing-type**) need to be provided to the discrete control module to actuate the solenoid valve 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 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.

Table 3.1 is provided below with suggested fault monitoring conditions for the TSI circuitry.

Sensor/Input1	State 1	Sensor/Input2	State 2	Comment
RTL1	OFF	Tool Module	Present*	RTL Not Operating Properly**.
RTL1	OFF	RTLV	ON	Relay or RTL1 Not Operating Properly**.
RTL	ON	RTLV	OFF	Relay or RTL1 Not Operating Properly.

***** Tool Module Present as evidenced by ability to read Tool-ID

** Dangerous situation where an unintentional Unlock command could result in Tool release.

Table 3.1—Fault Monitoring

A pushbutton switch is provided on the Tool module for setting of a Tool-ID number. The pushbutton switch included with the module incorporates 0-9 switch positions. However, in the VB8 modules only the 0-7 switch positions are unique. **Therefore, positions 8 and 9 of the Tool-ID switch should NOT be used.** Refer to the drawings in Section 8 for further details.

3.1Operation Flow Chart

Refer to the flow chart Figure 3.1 for a logical description of the Tool Changer, lock/unlock procedure and diagnostic checks.

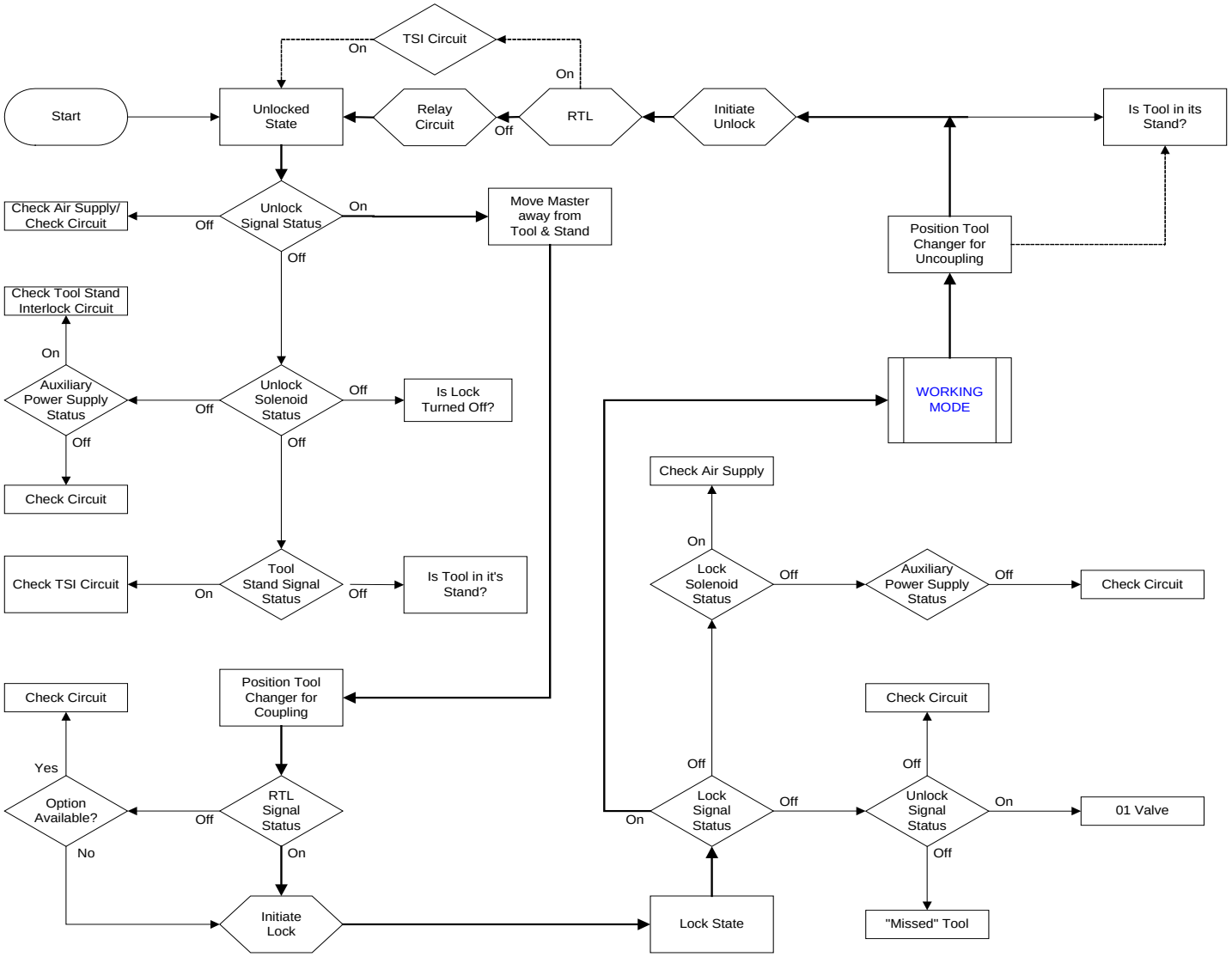


Figure 3.1—Logical Operation and Diagnostics

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.

DANGER: For electrical modules using > 60VDC or 42VAC, NO contact should be attempted before removing power. This includes attaching and disconnecting cables or any contact with the Tool Changer or its components. Arcing and damage will occur if this is not observed. Remove power before attaching, disconnecting any cables or attempting any maintenance of Tool Changer.

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. 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.

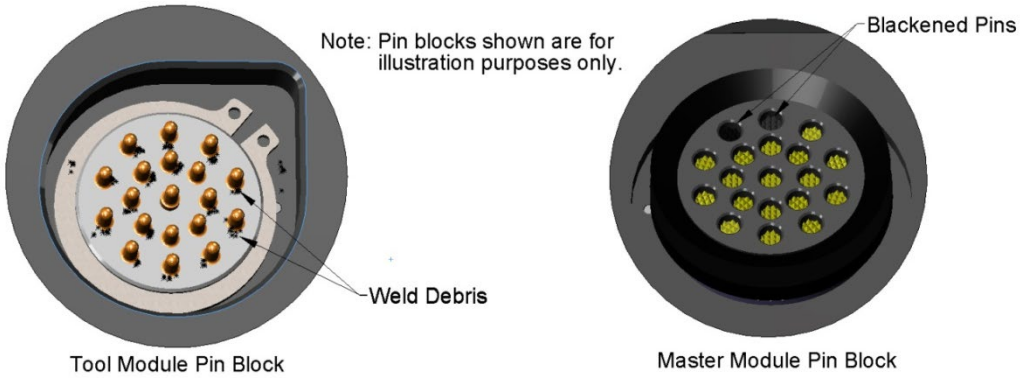
Inspect the Master and Tool pin blocks for any pin damage, debris or darkened pins. Refer to *Section 4.1—Pin Block Inspection and cleaning.*

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

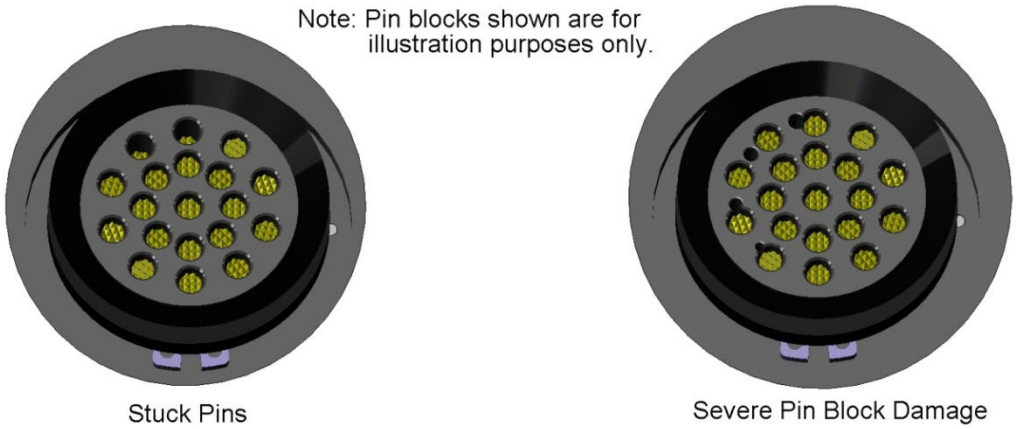


If debris or darkened pins exist, remove debris using a vacuum, and clean using a nylon brush (ATI part number 3690-0000064-60).

> **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



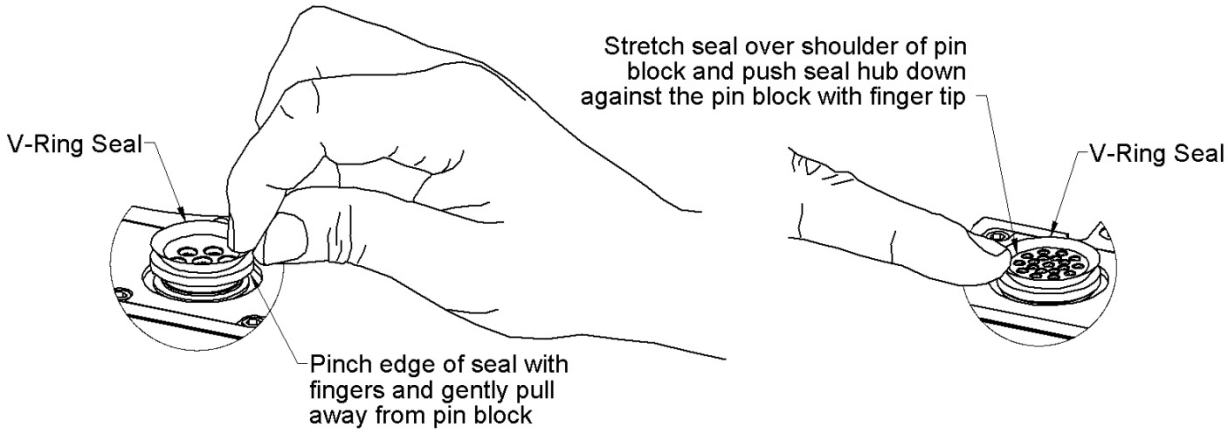
If stuck pins or severe pin block damage exists, contact ATI for possible pin replacement procedures or module replacement.

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. *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 muffler).	Check that exhaust port is properly vented (check muffler). *Refer to Air and Valve adapter section for information.*
	Incorrect valve operation.	Check valve for proper operation. *Refer to Air and Valve adapter section for information.*
	Discrete signals are mapped incorrectly.	Verify that discrete signals are mapped and are communicating properly. *Refer to Section* **Error! Reference source not found.—Error! Reference source not found.** *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. *Refer to the Installation – Tool Stand Design Section of the Tool Change manual for specifications.*
	TSI switch is damaged or not operating correctly	Check TSI switch and cable for damage. Monitor the TSI input that it function as described in *Section* **Error! Reference source not found.—Error! Reference source not found.**.
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.*
	Sensors are set correctly.	Verify that the sensors are set correctly. *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.
	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.*
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.
	Product up- and downstream of Tool Changer failed or damaged	Check product up- and downstream of Tool Changer for failure. This failure can “appear” to be caused by the Tool Changer or affect Tool Changer performance.

6. Recommended Spare Parts

See Drawings in Section 8.

7. Specifications

9121-VB8-M	Discrete Signal Master Module with 37-Pin DDK Connector (male contacts), 19-pin Block, supports **NPN** type L/U/R1/R2 sensors and Integrated Valve Pass Through (requires **sourcing-type** Single or Double Solenoid Valve). Supports Tool Stand Interlock on Tool-side and Works w/VB8 Tool Module.
Connector(s)	DDK DMS 3102 A28-21P 37-pin Connector. 13A maximum current rating.
Weight	1.75 lbs (0.79 kg).
Pass-Through Signals	(1) 26-Pin Block w/ Precious metal-plated, spring-loaded, No-Touch contact pins. 5A Maximum current rating, 250V. (1) 10-Pin Block w/ Precious metal-plated, spring-loaded, No-Touch contact pins. 5A Maximum current rating, 250V.

9121-VB8-T	Discrete Signal Tool Module with 37-Pin DDK Connector (female contacts), 25-pin pass-through, and internal Tool-ID (0-7). Mates with VB8-M. Supplied with TSI Connector with pins 2 to 3 breaking solenoid circuit. Red Teach Plug (1700-0545501-01) sold separately.
Connector	DDK DMS 3102 A28-21S 37-Socket Connector. 13A maximum current rating.
Weight	1.55 lbs (0.70 kg).
Pass-Through Signals	Twenty-five (25) available pass-through signals (including 24V and 0V). Precious metal-plated contacts w/ first mate ground pin. 5A Maximum current rating, 250V.
Default Settings	Tool-ID set to 1. Note: Tool-ID positions 8 and 9 are NOT unique (refer to drawings in Section 8 for details).

8. Drawings

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