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C. Control and Signal Modules

VB11—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.

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—Specifications* for the specifications of each available module

An electrical interface is provided on the Master module for support of an integrated solenoid valve. 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—Drawings*.

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 VB11 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 the VB11 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. 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 uncouple the Tool Changer.

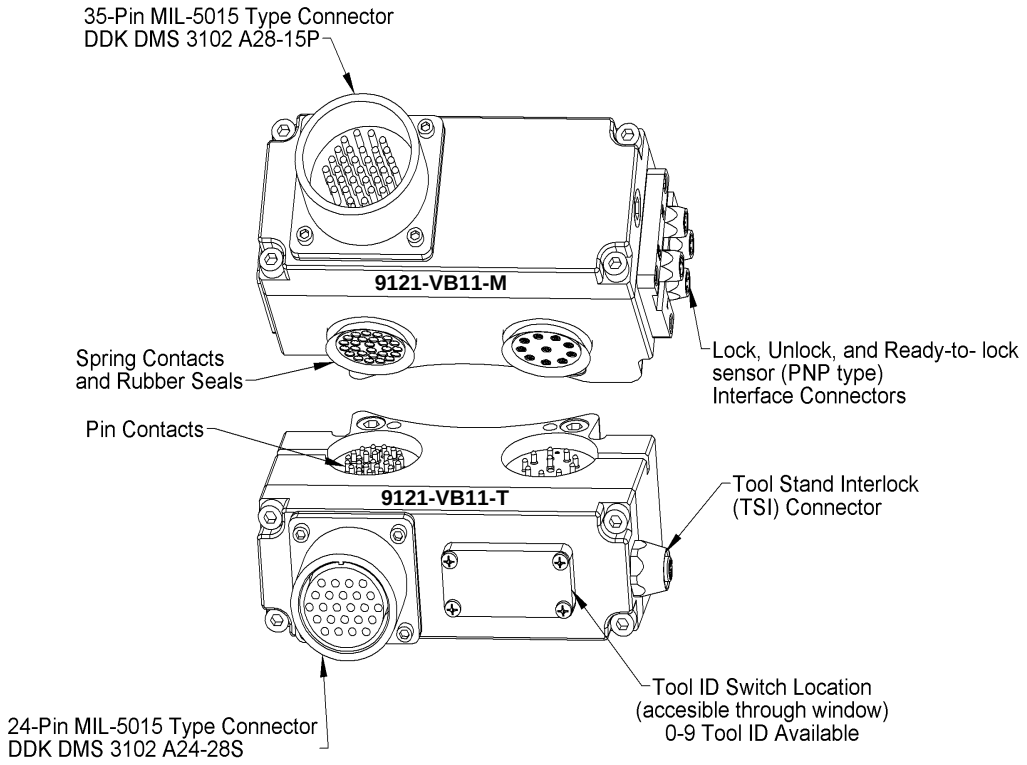


Figure 1.1—VB11 Modules

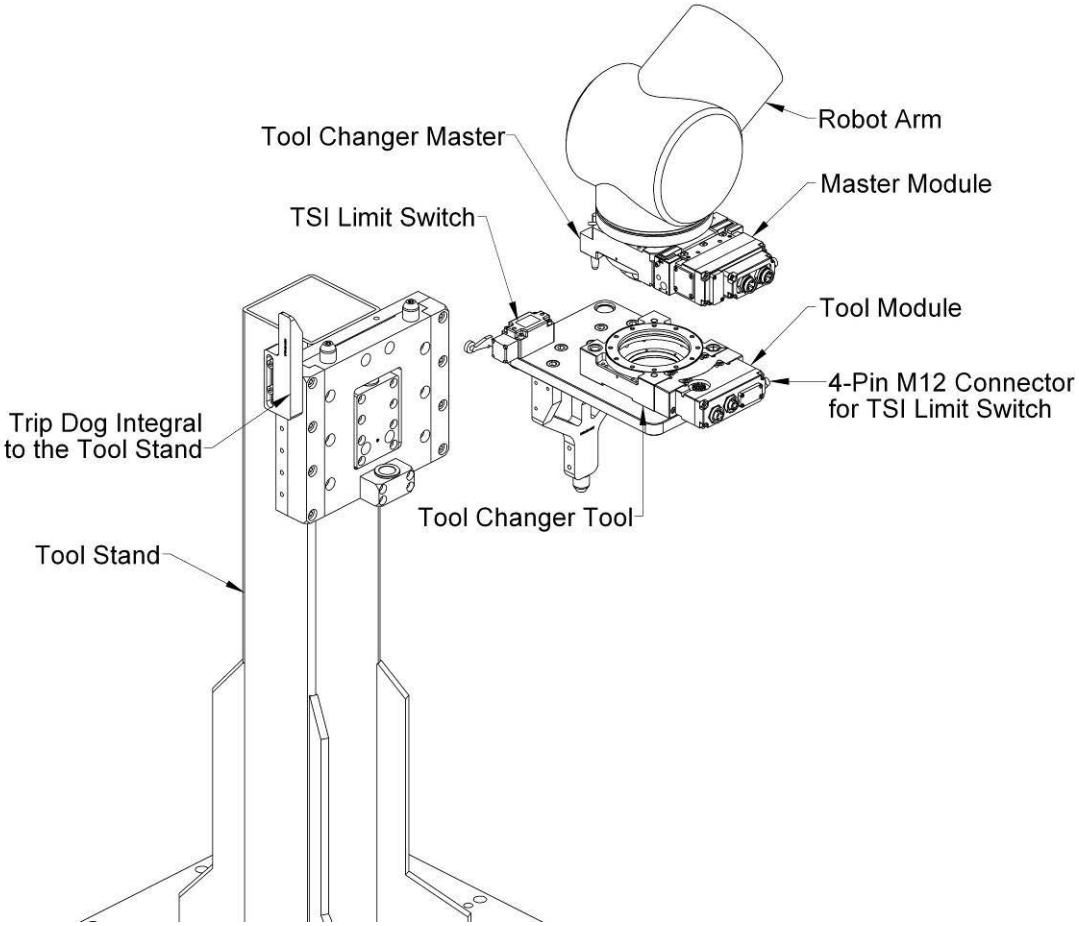


Figure 1.2—Tool Stand Interlock (TSI)

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—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.

Installing

Removal

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 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 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.

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 VB11 modules only the 0-7 switch positions are unique. Refer to the drawings in *Section 8—Drawings* for further details.

Operation Flow Chart

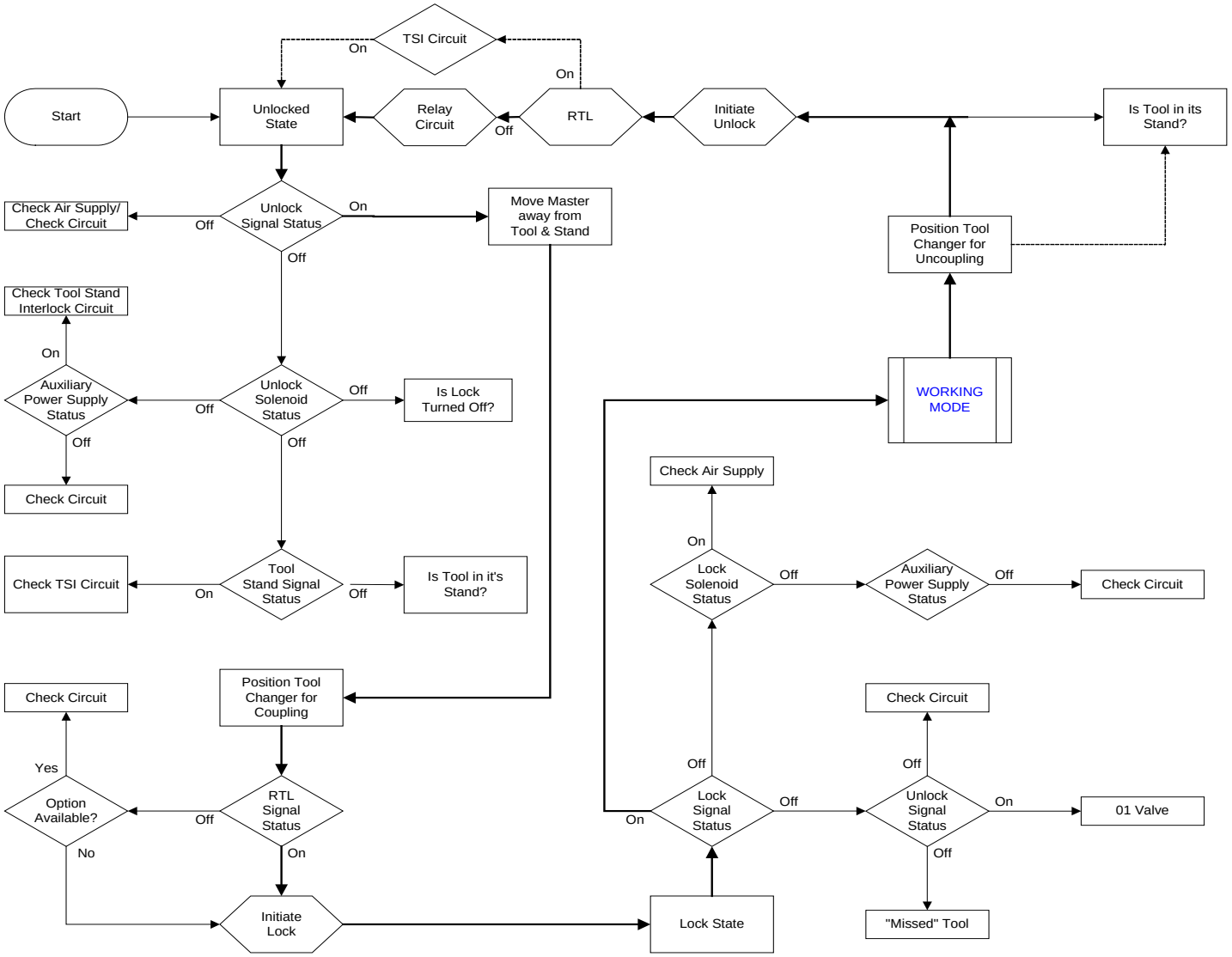


Figure 3.1—Logical Operation and Diagnostics

4. Maintenance

The VB11–M, VB11-T, and VB13-T discrete control/signal modules are designed to provide a long life with little maintenance required. 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. 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.*

Pin Block Inspection and cleaning

Seal Replacement

5. Troubleshooting

Refer to the table below for troubleshooting information:

Symptom	Possible Cause / Correction
Unit will not lock or unlock	Verify that ball bearings are moving freely. Clean and lubricate as needed. Verify air supply source and proper exhaust. Verify that discrete signals are mapped correctly and operating properly. Verify that the Master and Tool are within the specified No-Touch zone when attempting to lock. If equipped with RFID or magnetic type Safety Switch, verify that the Safety Switch and Transponder are within sensing range and operating correctly. If equipped with mechanical type Safety Switch, verify that the switch contacts trip dog and actuates the Safety Switch.
Sensors not operating properly	Verify that cables are connected correctly. Verify that the sensors are set correctly. Ensure that the Tool Plate is securely held to the Master Plate, that nothing is trapped between their surfaces, and that there is no air trapped in the Unlock (U) air port.
Loss of Discrete Communication	Check/Replace signal cabling up- and down-stream of Tool Changer modules. Inspect module contact pins for debris/wear/damage.

6. Recommended Spare Parts

See Drawings in *Section 8—Drawings*.

7. Specifications

9121-VB11-M	Discrete Signal Master Module with 35-Pin DDK Connector (male contacts), 19-pin Block, supports **PNP** type L/U/R1/R2 sensors and Integrated Valve Pass Through. (Single or Double Solenoid Valve) Supports Tool Stand Interlock on Tool-side and Works w/VB11 Tool Module.
Connector(s)	DDK DMS 3102 A28-21P 35-pin Connector.
Weight	1.70 lbs (0.77 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-VB11-T	Discrete Signal Tool Module with 24-Pin DDK Connector (female contacts), 22-pin pass-through, and internal Tool-ID (0–9). Mates with VB11-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 A24-28S 24-Socket Connector
Weight	1.45 lbs (0.66 kg).
Pass-Through Signals	Twenty-two (22) 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.

9121-VB13-T	Discrete Signal Tool Module with 24-Pin DDK Connector (female contacts), 18-pin pass-through, and internal Tool-ID (0–99). Mates with VB11-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 A24-28S 24-Socket Connector.
Weight	1.45 lbs (0.66 kg).
Pass-Through Signals	Eighteen (18) 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.

8. Drawings

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