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C. Control and Signal Modules

VF2—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.

MS-style 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. 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 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). 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 (9620-20-C-Air and Valve Adapters). 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 VF2 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 VF2 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, double-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.

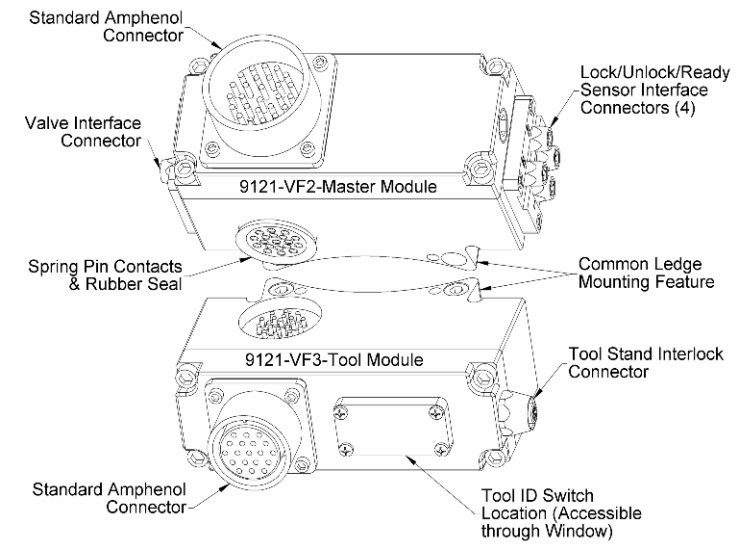


Figure 1.1—VF2 Modules

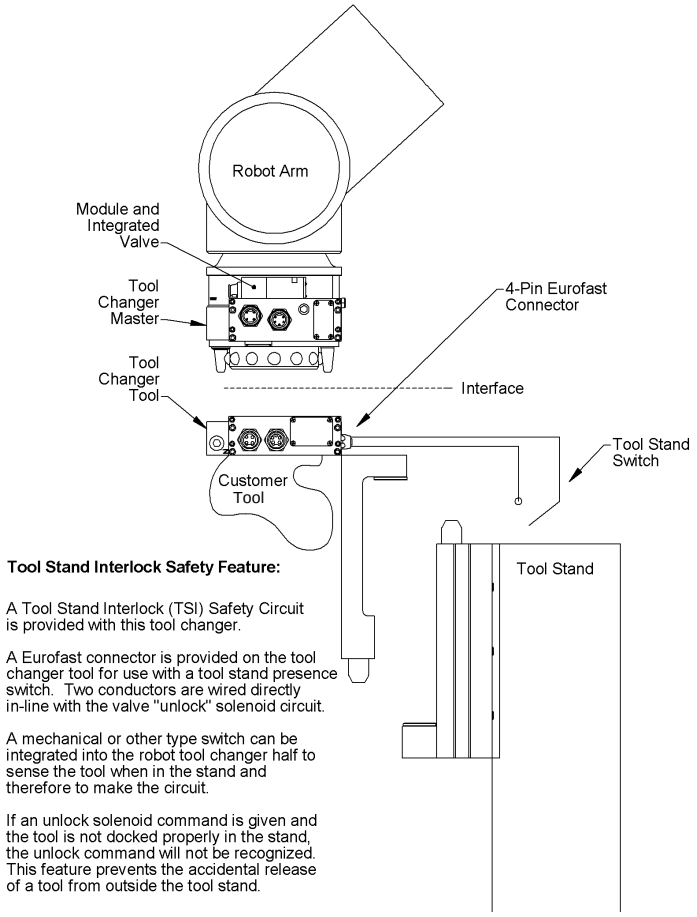


Figure 1.2—Tool Stand Interlock (TSI)

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.

DANGER: Power and air should always be removed prior to maintenance or repair.

2.1 Installing

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.

2.2 Removal

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.

3. Operation

Various tool changer I/O is 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 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 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.

When coupled, the discrete module Tool can be communicated with, Tool ID can be read, and attached end-effectors can be used.

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

Sensor/Input1	State1	Sensor/Input2	State2	Comment
RTL	Low	Slave Module	Present*	**RTL Not Operating Properly.
RTL	Low	RTLV	High	**Relay or RTL Not Operating Properly.
RTL	High	RTLV	Low	Relay or RTL Not Operating Properly.

***** Slave Module Present as evidenced by Node online or ability to read Tool ID

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

Table 3.1—Fault Monitoring

3.1 Operation Flow Chart

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

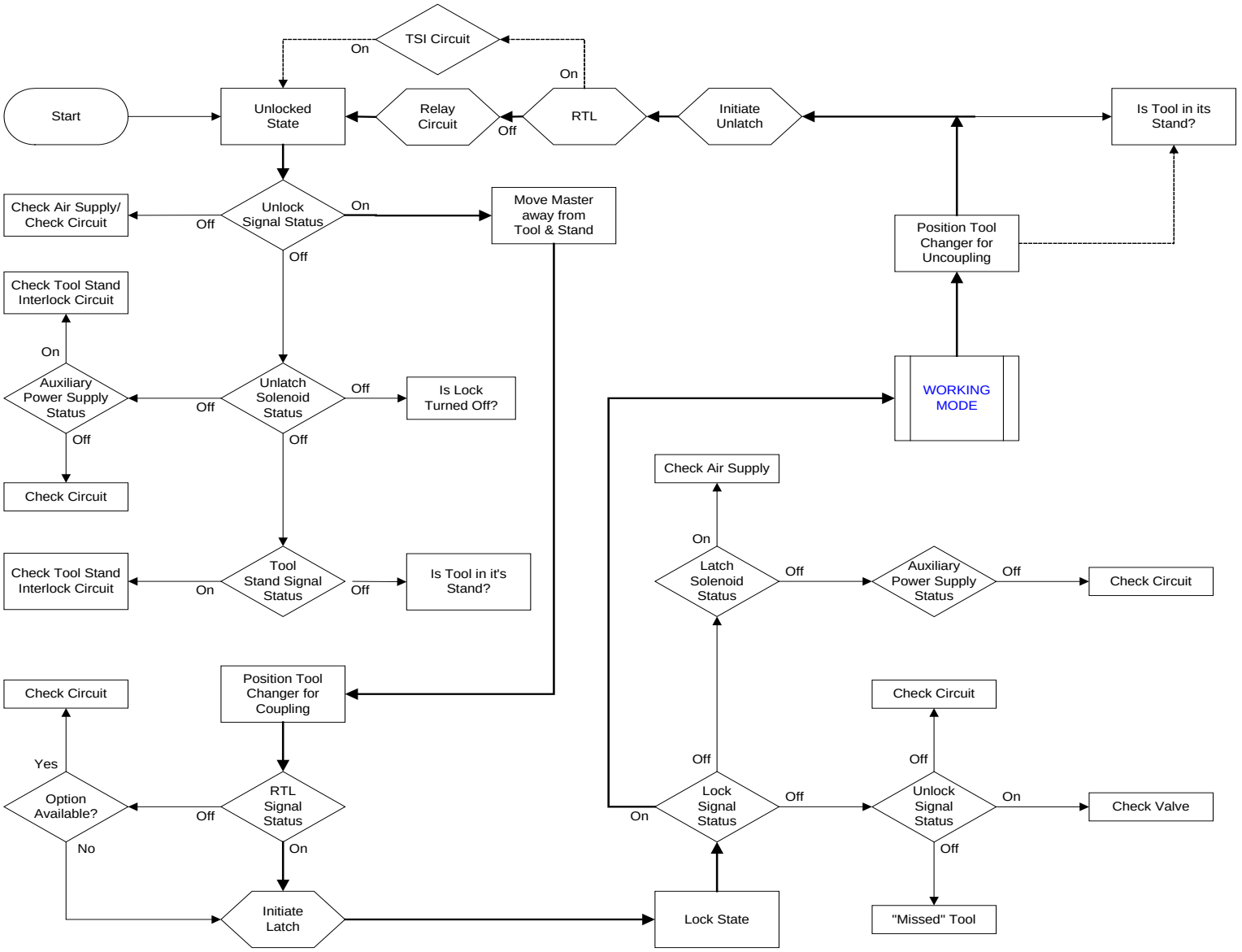


Figure 3.1—Logical Operation and Diagnostics (Shown with Double Solenoid Valve)

4. Maintenance

Contact pins on the control module should be inspected and cleaned periodically to ensure electrical continuity is maintained. Care should be taken not to bend or pull out the contacts when cleaning. Do not use an abrasive media to clean the contact pins as erosion may occur to the contact surface.

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. Unused 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. In this instance, the customer should determine a suitable inspection schedule.

Detailed drawings are provided in Section 8 of this manual.

5. Troubleshooting

Symptom	Possible Cause / Correction
Unit will not lock or unlock	Verify that ball bearings are moving freely. Clean and lubricate as needed. Check air supply. Check that exhaust port is properly vented (check muffler). Verify that discrete signals are operating correctly. Verify that the Master and Tool are within the specified No-Touch zone when attempting to lock.
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 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.

7. Specifications

VF2-M		19-pin Signal Module Supporting Integrated Solenoid Valve (DC Voltage) and TSI. Mates with VF3 Tool Sides.
Connector	MS3102E28-12P	
Weight	1.5 lbs (0.7 kg)	Master side
Pass-Through Signals	19 @ 5 Amp, 250 V	Rhodium-plated, spring-loaded and No-Touch contact pins.
VF3-T		Tool Discrete signal module with 12-pin pass-through, Signal module w/ internal Tool ID, 0-9. Mates with VF2-M. Supplied with TSI Connector with pins 2 to 3 breaking solenoid circuit. Red Teach Plug 1700-0545501-01, sold separately.
Connector	MS3102E22-14S	
Weight	1.3 lbs (0.6 kg)	Tool side
Pass-Through Signals	12 @ 5 amp, 250 V	Rhodium-plated contacts w/ first mate ground pin.

8. Drawings

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