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C. Control and Signal Modules

VB5M VB2T—Discrete Control Modules w/ Integrated Valve

1. Product Overview

Note: VB5-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.

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. 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, 9121-Jxx-M. Refer to the valve adapter block manual for more information (9620-20-C-Jxx Air and Valve Adapters). Electrical interface drawings and connector details are provided in drawings in Section 8.

The VB5-M/VB2-T 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 Locked, Unlocked, and Ready-to-Lock sensor inputs (sinking-type) the VB5-M/VB2-T 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 an M12, 4-Pin 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-throw, double-pole switch is suggested.

In order to allow the tool changer to uncouple when a tool is not present (i.e. retract the locking mechanism), a relay circuit in parallel with the TSI circuit is used. 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 present, then the relay circuit is closed, thus allowing the unlock solenoid valve circuit to be completed. If the RTL sensor is high, indicating tool present, 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.

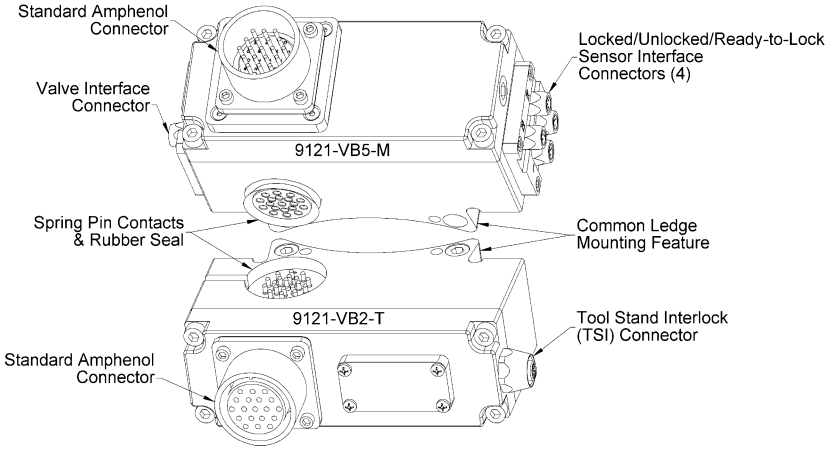


Figure 1.1—VB5-M/VB2-T Modules

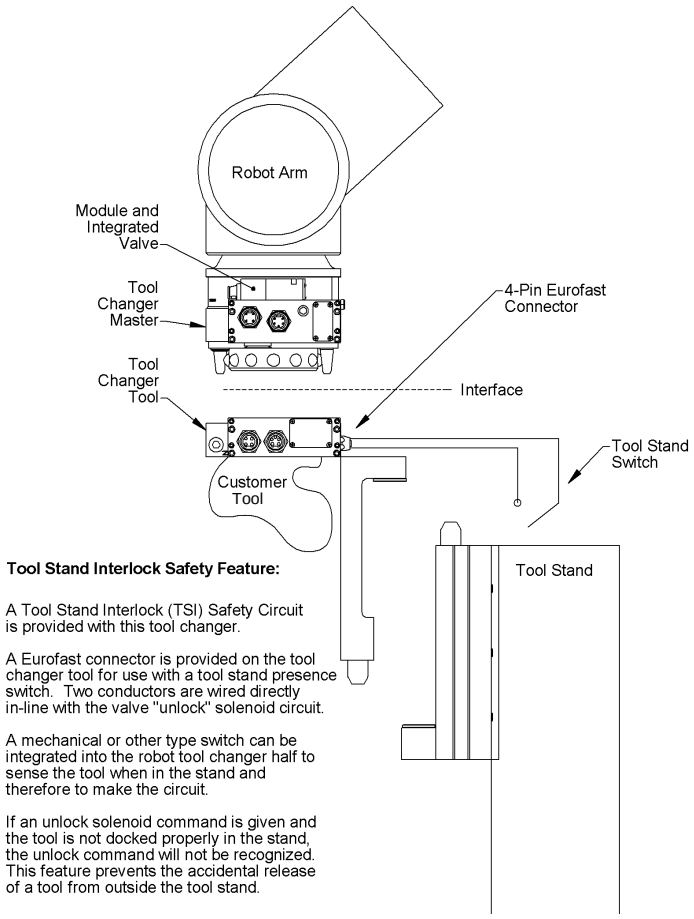


Figure 1.2—Tool Stand Interlock (TSI)

> ⚠ **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. Using the ledge feature as a guide place the module into the appropriate location on the tool changer body. Align the module with the tool changer using the dowels in the bottom of the ledge feature. Apply Loctite 242 to the supplied M6 SHCS fasteners and tighten to 110 in-lbs.
3. Typically, proximity sensor and valve cables need to be connected to the master side control module. These connections can be made after attaching the module to the tool changer body. Customer connections up to the module can also be made after the module is installed. Ensure that the connectors are cleaned prior to being secured as appropriate.

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. Also, proximity sensor and valve cables may or may not need to be disconnected.
3. Remove the socket head cap screws and lift the module from the tool changer.

3. Operation

Various tool changer I/O is provided to the customer through the military-style Amphenol connector on the control/signal master module. Locked, Unlocked, 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.

When coupled, the discrete module tool can be communicated with, downstream signals 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.

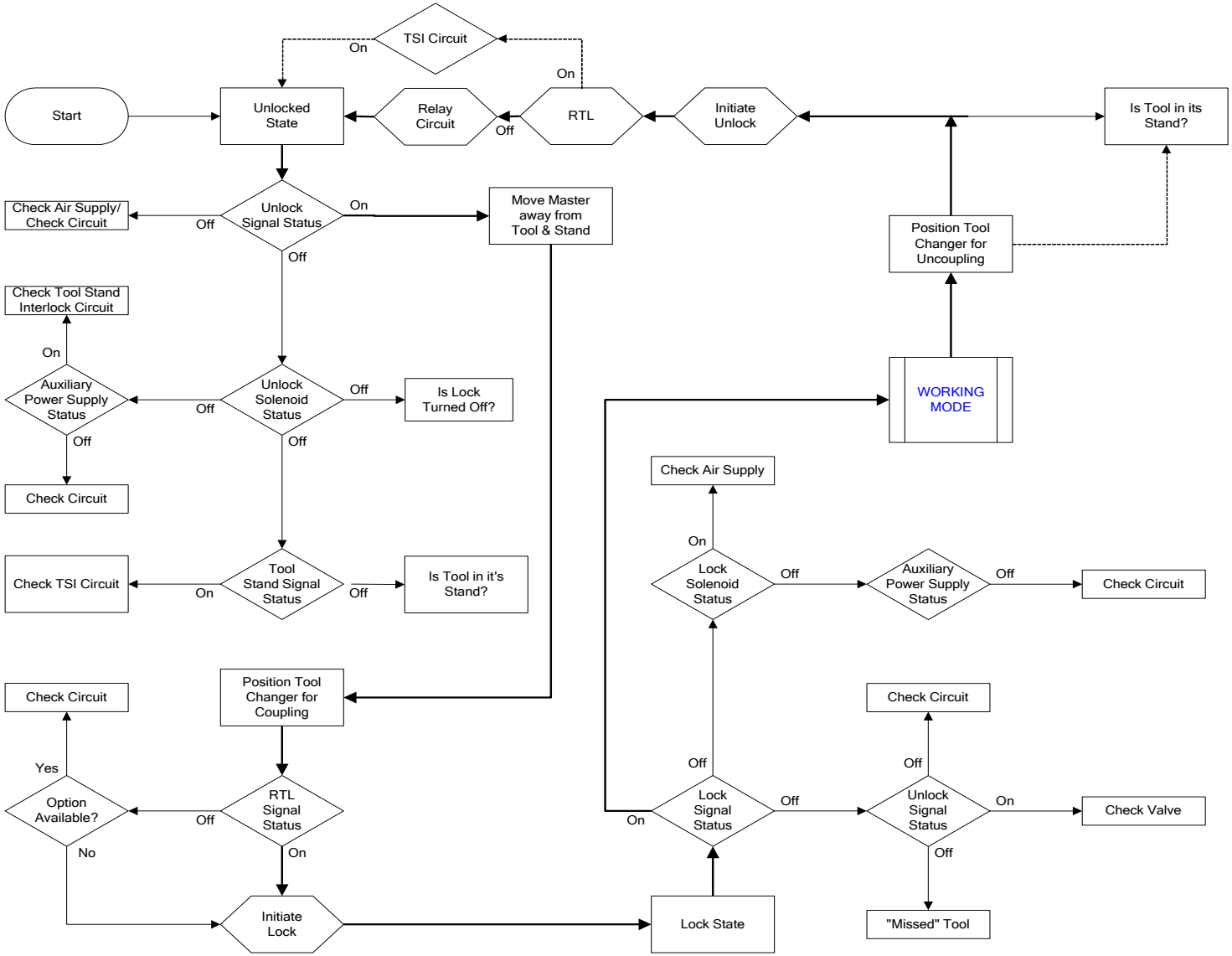


Figure 3.1—Logical Operation and Diagnostics

4. Maintenance

Contact pins on the tool module should be inspected and cleaned periodically to ensure electrical contact is maintained. A vacuum is recommended to remove and clear debris from the module mating surfaces. 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.

Cable connections should be inspected during maintenance periods to ensure they are secure. Loose connections should be cleaned and re-tightened as appropriate. Loose connections are not expected and may indicate improper routing and/or strain relieving.

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.

Detailed assembly 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). Check valve for proper operation. Verify that discrete signals are mapped and are communicating properly. 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. 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.

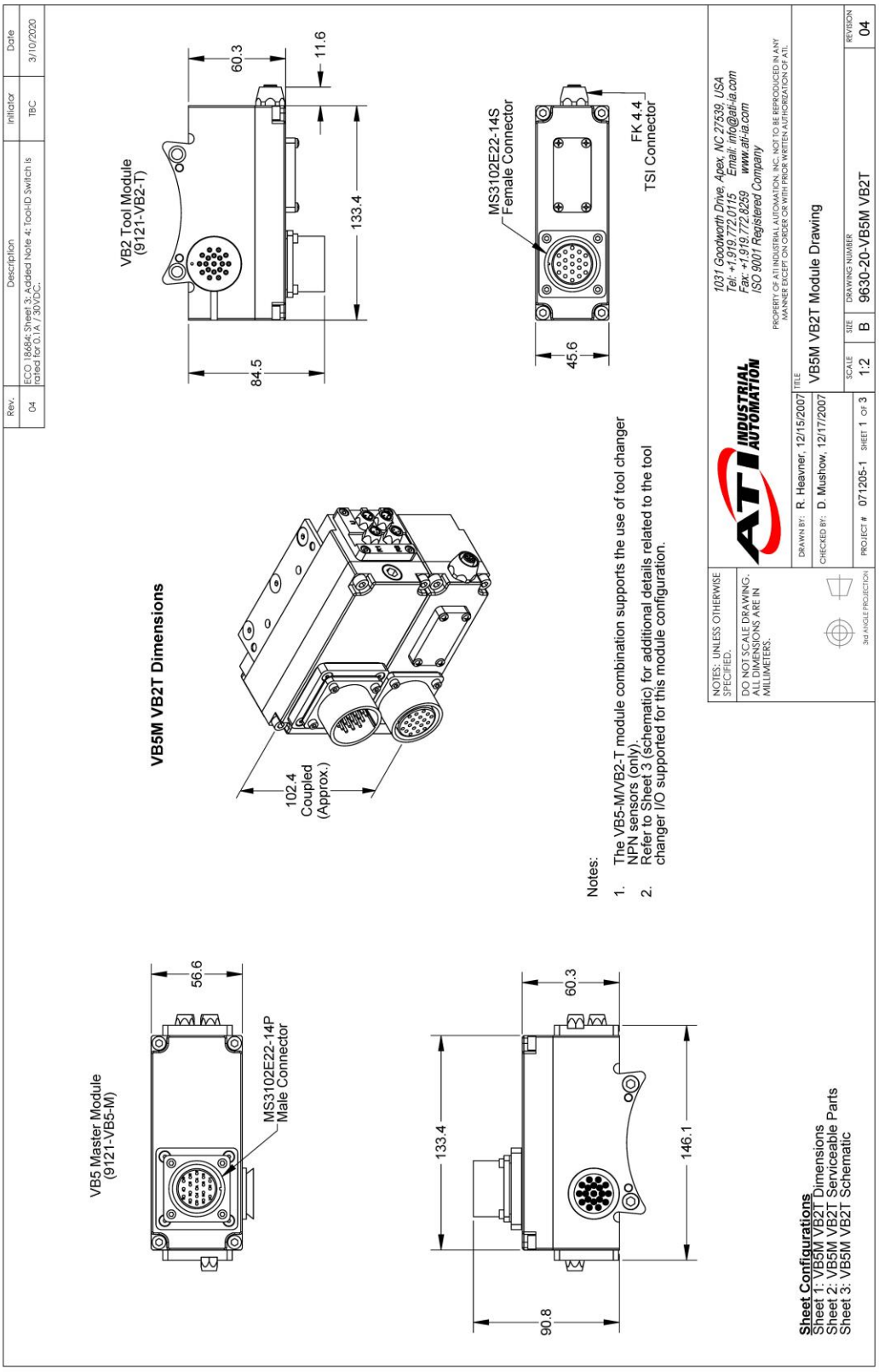
6. Recommended Spare Parts

See Drawings in Section 8.

7. Specifications

VB5-M		Master Signal Module, 19-pin block, supporting NPN-type proximity sensors and 10 pass-through signals, an integrated solenoid valve (DC Voltage, sourcing-type) and tool-side TSI circuitry for safe tool changer release. Mates with VB2-T module.
Connector	MS3102E22-14P	Male Thread, 19-Pin Bulkhead Tool Changer I/O Connection
Weight	1.5 lbs (0.7 kg)	Master side
Pass-Through Signals	10 @ 5 Amp, 250 V	Rhodium-plated, spring-loaded and No-Touch contact pins.
VB2-T		Tool Signal Module, 19-pin block, supporting 10 pass-through signals and tool-side TSI. TSI Connector pins 2 & 3 break valve unlatch solenoid circuit. Red Teach Plug 1700-0545501-01, sold separately. Mates with VB5-M.
Connector(s)	MS3102E22-14S	Male Thread, 19-Socket Bulkhead Tool Changer I/O Connection
	FK 4.4	M12, 4-Socket TSI Connection
Weight	1.3 lbs (0.6 kg)	Tool side
Pass-Through Signals	10 @ 5 amp, 250 V	Rhodium-plated contacts w/ first mate ground pin.
Jxx-M		Integrated Valve Adapter Module
	Valve Specifications	(Reference *9620-20-C-Jxx Air and Valve Adapters* for information and specifications for the integrated valve)

8. Drawings


Rev.
Description
Initiator
Date
04
ECO 18684: Sheet 3: Added Note 4: Tool-ID Switch is rated for 0.1A / 30VDC.
TBC
3/10/2020
VB2 Tool Module (9121-VB2-T)
60.3
11.6
133.4
84.5
MS3102E22-14S Female Connector
FK 4.4 TSI Connector
45.6
VB5M VB2T Dimensions
102.4 Coupled (Approx.)
Notes:
1. The VB5-M/VB2-T module combination supports the use of tool changer NPN sensors (only).
2. Refer to Sheet 3 (schematic) for additional details related to the tool changer I/O supported for this module configuration.
VB5 Master Module (9121-VB5-M)
56.6
MS3102E22-14P Male Connector
133.4
60.3
146.1
90.8
Sheet Configurations
Sheet 1: VB5M VB2T Dimensions
Sheet 2: VB5M VB2T Serviceable Parts
Sheet 3: VB5M VB2T Schematic
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: R. Heavner, 12/15/2007
CHECKED BY: D. Mushow, 12/17/2007
PROJECT # 071205-1 SHEET 1 OF 3
TITLE
VB5M VB2T Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-VB5M VB2T
REVISION 04
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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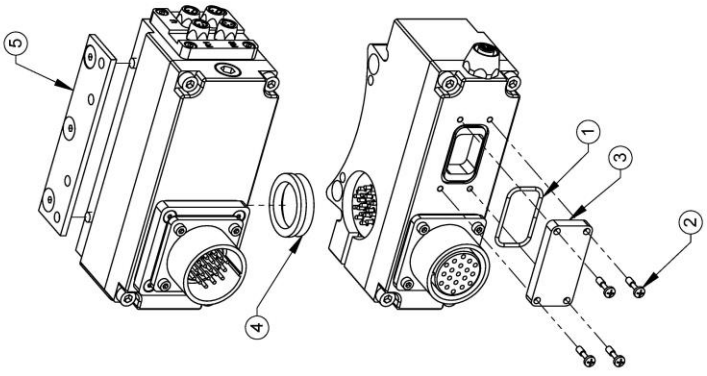
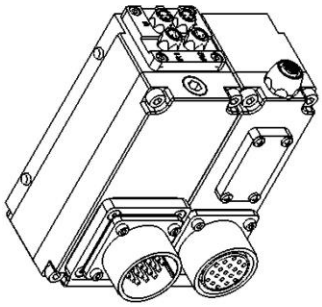
VB5M VB2T Serviceable Parts





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
5	1	9005-20-1198	Master Cleat Sub-Assembly

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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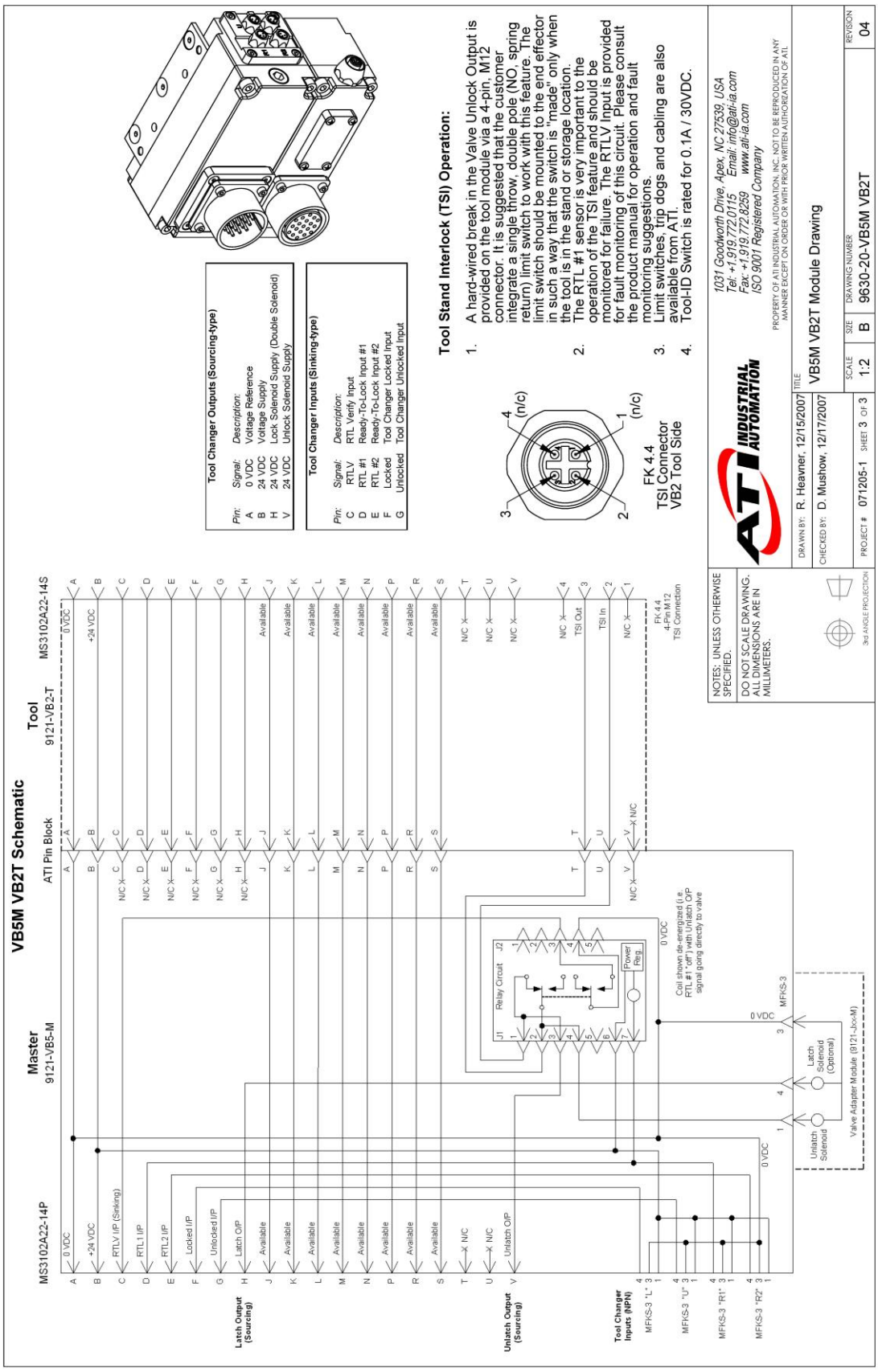
DRAWN BY: R. Heavner, 12/15/2007
CHECKED BY: D. Mushow, 12/17/2007
TITLE: VB5M VB2T Module Drawing
3rd ANGLE PROJECTION
PROJECT # 071205-1 SHEET 2 OF 3
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-VB5M VB2T
REVISION 04


VB5M VB2T Schematic
Master
9121-VB5-M
Tool
9121-VB2-T
ATI Pin Block
MS3102A22-14P
MS3102A22-14S
Tool Changer Outputs (Sourcing-type)
Pin: Signal: Description:
A 0 VDC Voltage Reference
B 24 VDC Voltage Supply
H 24 VDC Lock Solenoid Supply (Double Solenoid)
V 24 VDC Unlock Solenoid Supply
Tool Changer Inputs (Sinking-type)
Pin: Signal: Description:
C RTLV RTL Verify Input
D RTL #1 Ready-To-Lock Input #1
E RTL #2 Ready-To-Lock Input #2
F Locked Tool Changer Locked Input
G Unlocked Tool Changer Unlocked Input
Tool Stand Interlock (TSI) Operation:
1. A hard-wired break in the Valve Unlock Output is provided on the tool module via a 4-pin, M12 connector. It is suggested that the customer integrate a single throw, double pole (NO, spring return) limit switch to work with this feature. The limit switch should be mounted to the end effector in such a way that the switch is "made" only when the tool is in the stand or storage location.
2. The RTL #1 sensor is very important to the operation of the TSI feature and should be monitored for failure. The RTLV input is provided for fault monitoring of this circuit. Please consult the product manual for operation and fault monitoring suggestions.
3. Limit switches, trip dogs and cabling are also available from ATI.
4. Tool-ID Switch is rated for 0.1A / 30VDC.
FK 4.4
TSI Connector
VB2 Tool Side
Relay Circuit
Power Reg
Coil shown de-energized (i.e. RTL #1 "off") with Unlatch O/P signal going directly to valve
Unlatch Solenoid
Latch Solenoid (Optional)
Valve Adapter Module (9121-Jxx-M)
Latch Output (Sourcing)
Unlatch Output (Sourcing)
Tool Changer Inputs (NPN)
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