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C. Control and Signal Modules

VA6-M, SAx-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.

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—Specifications* for the specifications of each available module.

The VA6 Master module provides discrete signal pass-through capability. When this product is specified, the customer is responsible for supplying pneumatic Lock and Unlock signals to the air adapter block for Tool Changer coupling. Refer to the air adapter block manual for more information (9620-20-C-JXX Air-Valve Adapters with Valve Signal Pass Thru).

An electrical interface is provided on the VA6 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 VA6 Master module is used with the SA series Tools. Electrical interface drawings and connector details are provided in drawings in *Section 8—Drawings*.

The VA6 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.

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.

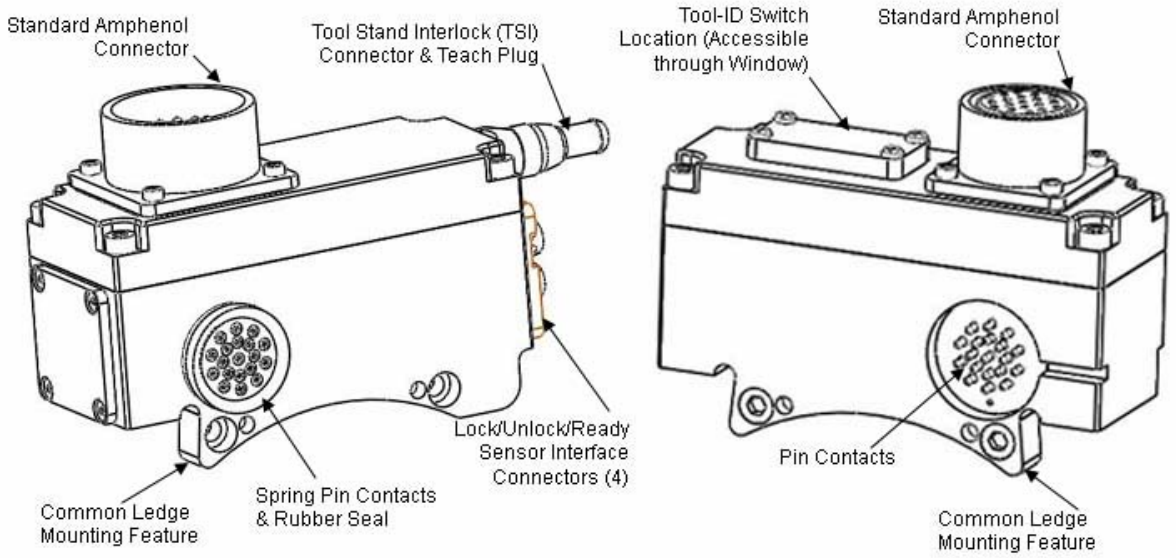


Figure 1.1—VA6 Master and SAx Tool Modules

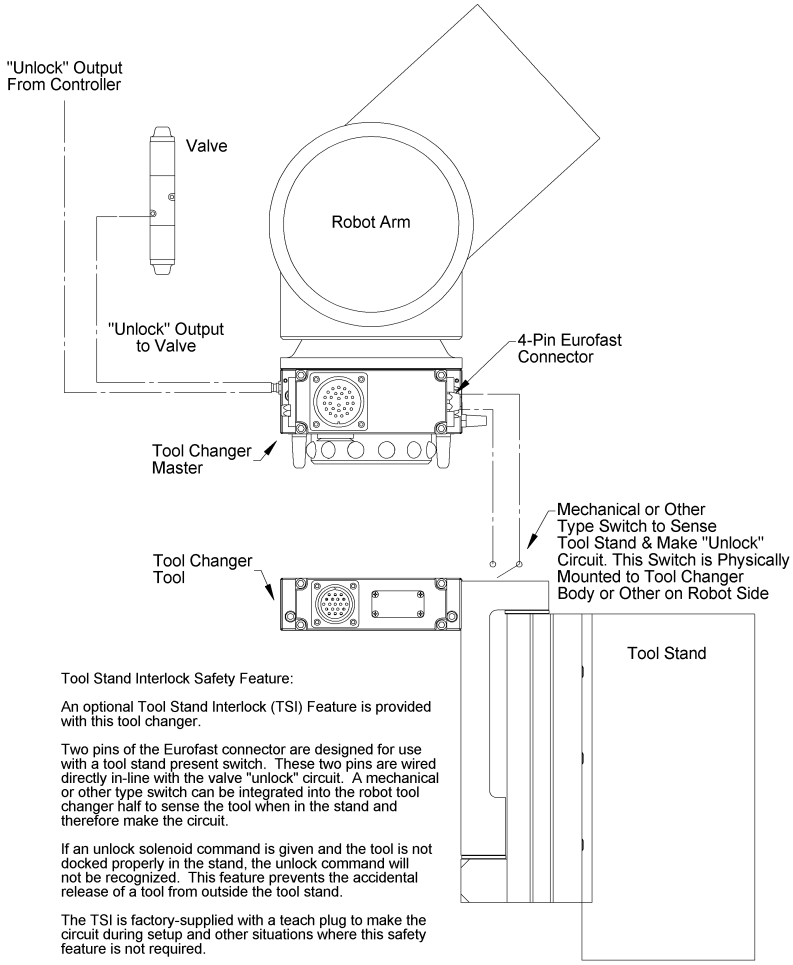


Figure 1.3—Tool Stand Interlock (TSI)

CAUTION: The Tool Changer is equipped with Tool Stand Interlock (TSI). Special procedures are required to uncouple 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 with power or air on. Injury or equipment damage can occur with power or air on. Turn off power and air 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 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 are 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 (VA6 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.

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

3.1 Operation Flow Chart

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

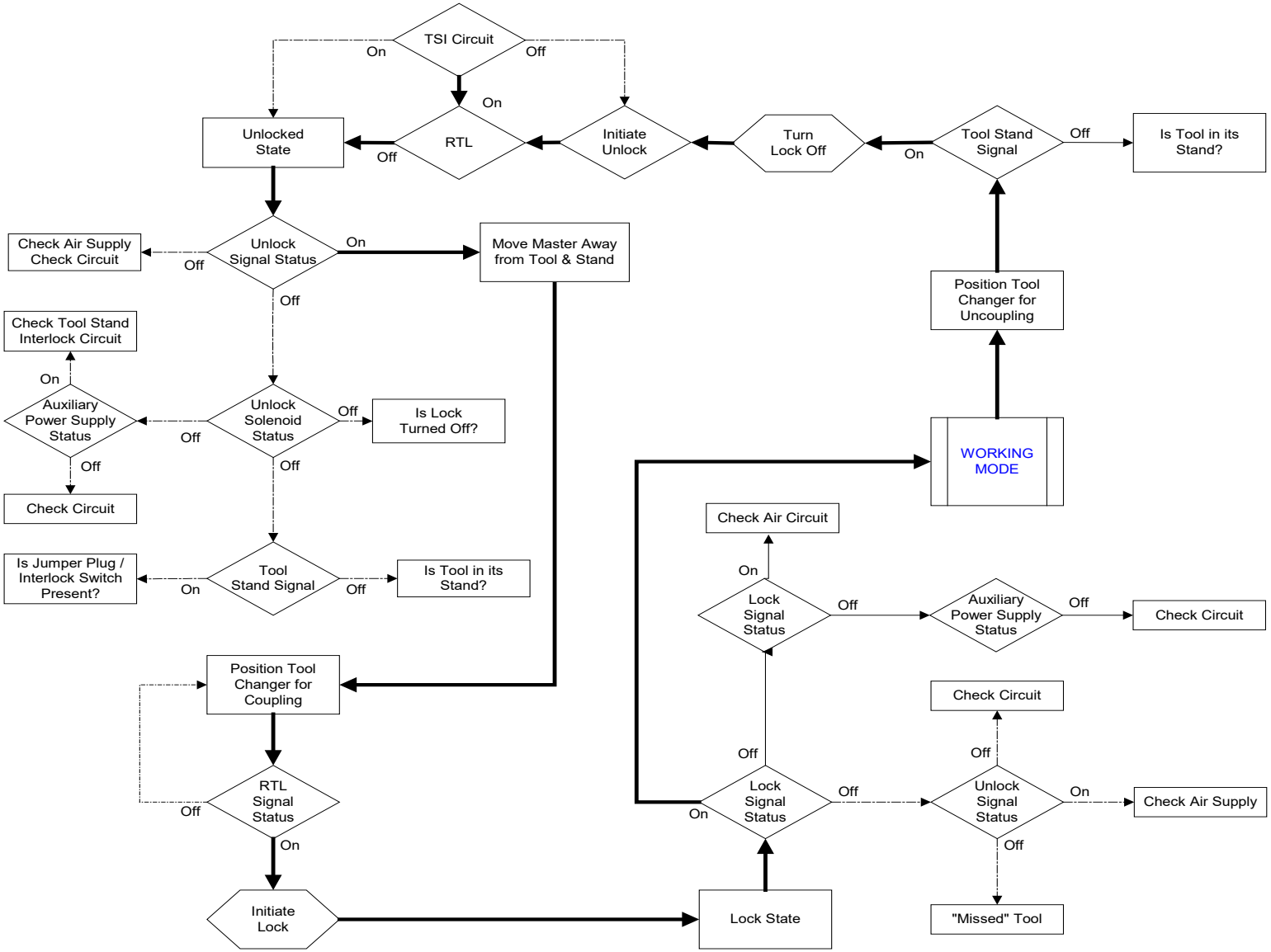


Figure 3.1—Logical Operation and Diagnostics

4. Maintenance

Contact pins on the 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—Drawings* 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—Drawings*.

7. Specifications

VA6-M Discrete, 26 Pin Amphenol, 19 Pin Block, Supports L/U/R1/R2 Sensors with Integrated Valve Pass Through

VA6-M Supports TSI on the Master-side and Works with SA Series Tools Mates with SA2, SA3, SA4, SA5, and SA6 Tools.

Connector	MS3102E28-12P	
Weight	1.5 lbs (0.7 kg)	Master-side
Pass-Through Signals	19@5A, 250 V	Rhodium-plated, spring-loaded and No-Touch contact pins.

SA2-T Tool Discrete signal module with 19-pin pass-through, Signal module with NO internal Tool-ID. Mates with VA6-M. Supplied with TSI Connector. Pins 1 to 4 (TSI circuit) made with use of Yellow Teach Plug 1700-0535501-01, sold separately.

Connector	MS3102E22-14S	
Weight	1.3 lbs (0.6 kg)	Tool-side
Pass-Through Signals	19@5A, 250 V	Rhodium-plated contacts w/ first mate ground pin.

SA3-T Tool Discrete signal module with 15-pin pass-through, Signal module w/ internal Tool-ID, 0-9. Mates with VA6-M. Supplied with TSI Connector. Pins 1 to 4 (TSI circuit) made with use of Yellow Teach Plug 1700-0535501-01, sold separately.

Connector	MS3102E22-14S	
Weight	1.3 lbs (0.6 kg)	Tool-side
Pass-Through Signals	15@5A, 250 V	Rhodium-plated contacts w/ first mate ground pin.

SA4-T Tool Discrete signal module with 11-pin pass-through, Signal module w/ internal Tool-ID, 0-99. Mates with VA6-M. Supplied with TSI Connector. Pins 1 to 4 (TSI circuit) made with use of Yellow Teach Plug 1700-0535501-01, sold separately.

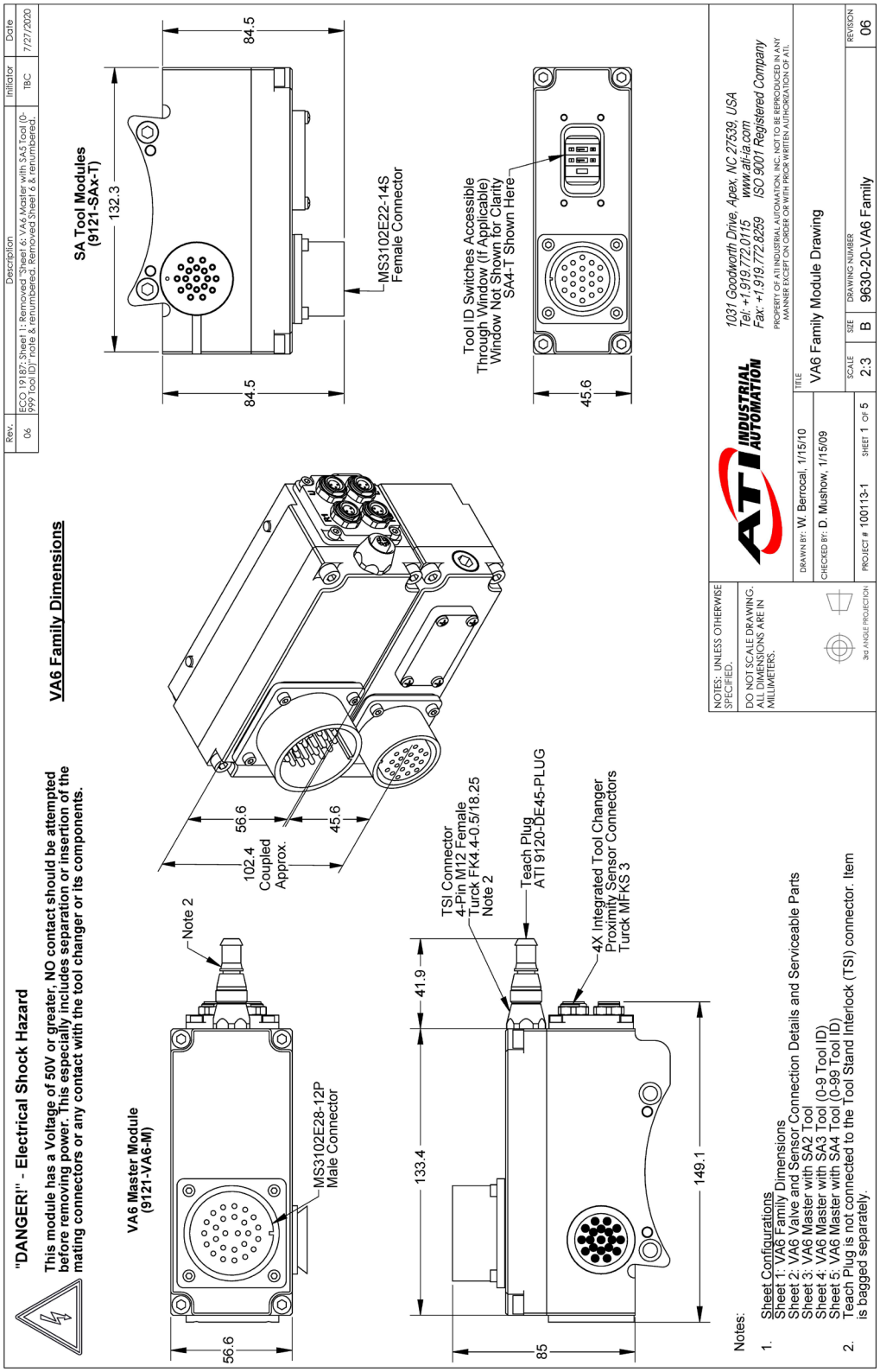
Connector	MS3102E22-14S	
Weight	1.3 lbs (0.6 kg)	Tool-side
Pass-Through Signals	11@5A, 250 V	Rhodium-plated contacts w/ first mate ground pin.

SA5-T Tool Discrete signal module with 7-pin pass-through, Signal module w/ internal Tool-ID, 0-999. Mates with VA6-M. Supplied with TSI Connector. Pins 1 to 4 (TSI circuit) made with use of Yellow Teach Plug 1700-0535501-01, sold separately.

Connector	MS3102E22-14S	
Weight	1.3 lbs (0.6 kg)	Tool-side
Pass-Through Signals	17@5A, 250 V	Rhodium-plated contacts w/ first mate ground pin.

SA6-T Potted version of SA2-T

8. Drawings


Rev.
Description
Initiator
Date
06
ECO 19187: Sheet 1: Removed "Sheet 6: VA6 Master with SA5 Tool (0-999 Tool ID)" note & renumbered. Removed Sheet 6 & renumbered.
TBC
7/27/2020
"DANGER!" - Electrical Shock Hazard
This module has a Voltage of 50V or greater, NO contact should be attempted before removing power. This especially includes separation or insertion of the mating connectors or any contact with the tool changer or its components.
VA6 Family Dimensions
SA Tool Modules (9121-SAx-T)
132.3
84.5
84.5
MS3102E22-14S Female Connector
Tool ID Switches Accessible Through Window (If Applicable) Window Not Shown for Clarity SA4-T Shown Here
45.6
VA6 Master Module (9121-VA6-M)
Note 2
MS3102E28-12P Male Connector
56.6
102.4 Coupled Approx.
56.6
45.6
TSI Connector 4-Pin M12 Female Turck FK4.4-0.5/18.25 Note 2
Teach Plug ATI 9120-DE45-PLUG
4X Integrated Tool Changer Proximity Sensor Connectors Turck MFKS 3
41.9
133.4
149.1
85
Notes:
1. Sheet Configurations
Sheet 1: VA6 Family Dimensions
Sheet 2: VA6 Valve and Sensor Connection Details and Serviceable Parts
Sheet 3: VA6 Master with SA2 Tool
Sheet 4: VA6 Master with SA3 Tool (0-9 Tool ID)
Sheet 5: VA6 Master with SA4 Tool (0-99 Tool ID)
2. Teach Plug is not connected to the Tool Stand Interlock (TSI) connector. Item is bagged separately.
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
INDUSTRIAL AUTOMATION
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 www.ati-ia.com
Fax: +1.919.772.8259 ISO 9001 Registered Company
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DRAWN BY: W. Berrocal, 1/15/10
CHECKED BY: D. Mushow, 1/15/09
PROJECT # 100113-1
SHEET 1 OF 5
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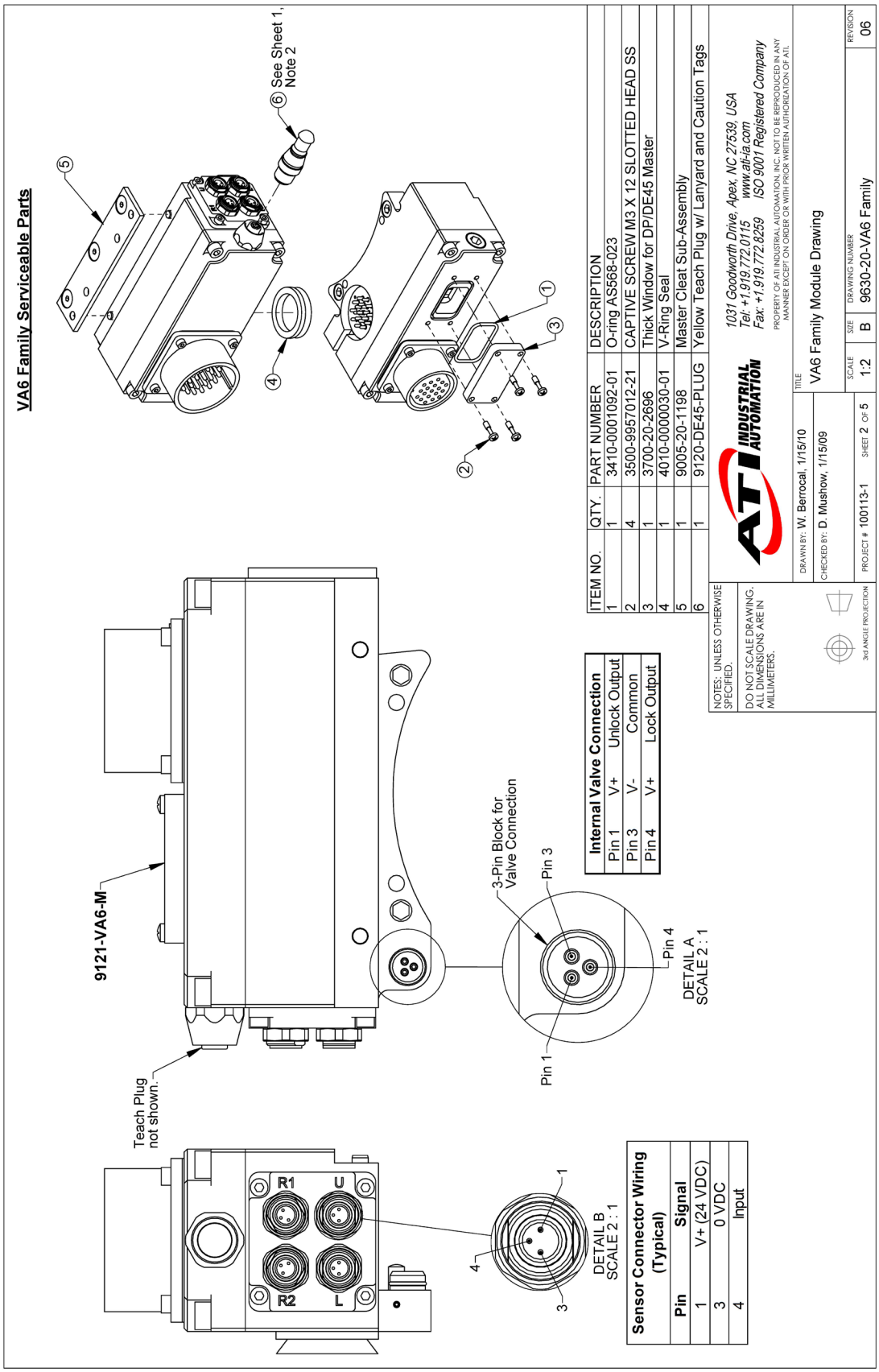
VA6 Family Module Drawing
SCALE 2:3
SIZE B
DRAWING NUMBER 9630-20-VA6 Family
REVISION 06


VA6 Family Serviceable Parts
See Sheet 1, Note 2
9121-VA6-M
Teach Plug not shown.
3-Pin Block for Valve Connection
Pin 1
Pin 3
Pin 4
DETAIL A SCALE 2 : 1
DETAIL B SCALE 2 : 1
R1
U
R2
L
Internal Valve Connection
Pin 1 V+ Unlock Output
Pin 3 V- Common
Pin 4 V+ Lock Output
Sensor Connector Wiring (Typical)
Pin Signal
1 V+ (24 VDC)
3 0 VDC
4 Input
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
6 1 9120-DE45-PLUG Yellow Teach Plug w/ Lanyard and Caution Tags
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
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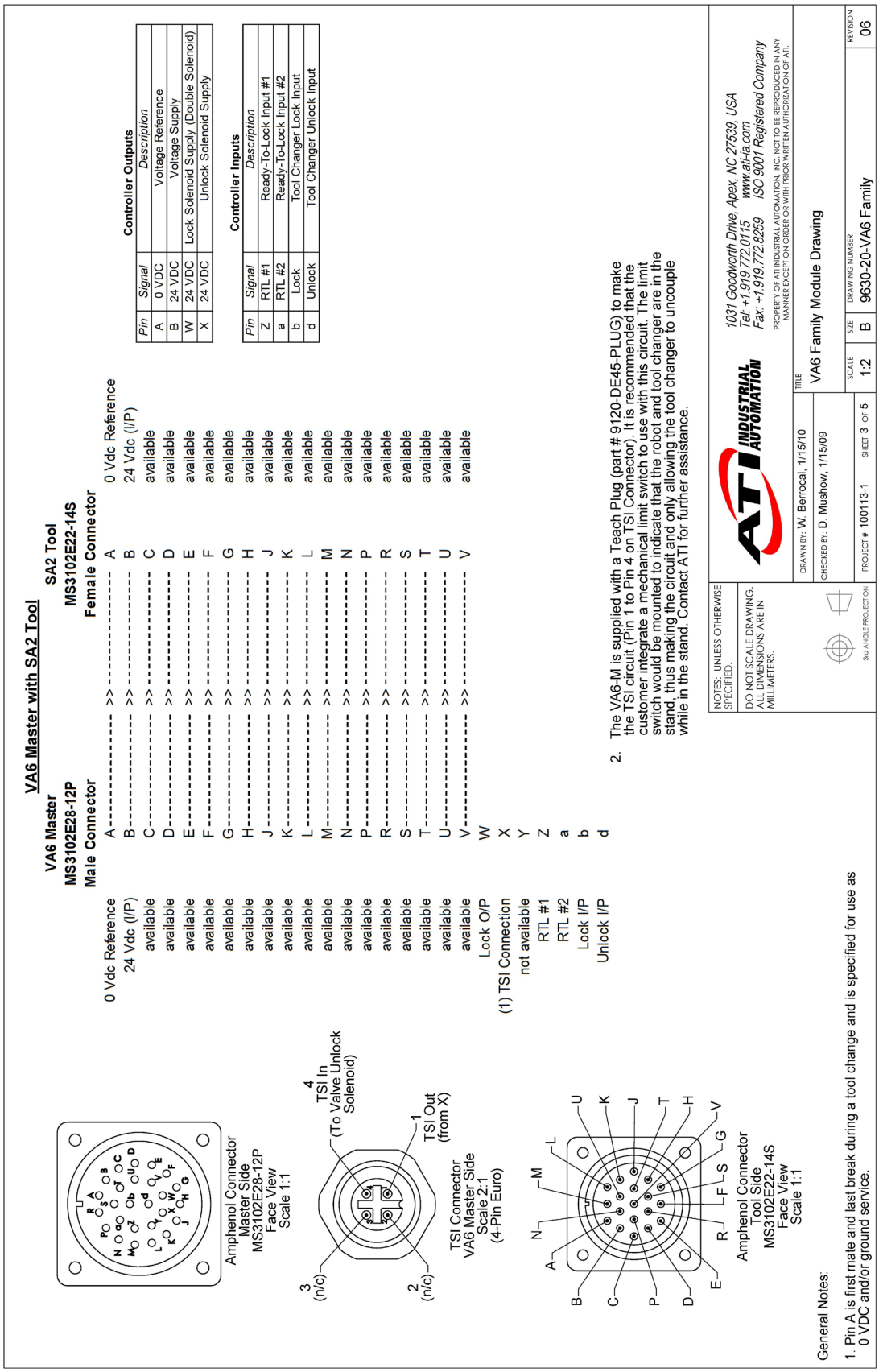
CHECKED BY: D. Mushow, 1/15/09
PROJECT # 100113-1 SHEET 2 OF 5
3rd ANGLE PROJECTION
TITLE
VA6 Family Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-VA6 Family
REVISION 06


VA6 Master with SA2 Tool
VA6 Master
MS3102E28-12P
Male Connector
SA2 Tool
MS3102E22-14S
Female Connector
0 Vdc Reference A ---------- >> ---------- A 0 Vdc Reference
24 Vdc (I/P) B ---------- >> ---------- B 24 Vdc (I/P)
available C ---------- >> ---------- C available
available D ---------- >> ---------- D available
available E ---------- >> ---------- E available
available F ---------- >> ---------- F available
available G ---------- >> ---------- G available
available H ---------- >> ---------- H available
available J ---------- >> ---------- J available
available K ---------- >> ---------- K available
available L ---------- >> ---------- L available
available M ---------- >> ---------- M available
available N ---------- >> ---------- N available
available P ---------- >> ---------- P available
available R ---------- >> ---------- R available
available S ---------- >> ---------- S available
available T ---------- >> ---------- T available
available U ---------- >> ---------- U available
available V ---------- >> ---------- V available
Lock O/P W
(1) TSI Connection X
not available Y
RTL #1 Z
RTL #2 a
Lock I/P b
Unlock I/P d
Controller Outputs
Pin Signal Description
A 0 VDC Voltage Reference
B 24 VDC Voltage Supply
W 24 VDC Lock Solenoid Supply (Double Solenoid)
X 24 VDC Unlock Solenoid Supply
Controller Inputs
Pin Signal Description
Z RTL #1 Ready-To-Lock Input #1
a RTL #2 Ready-To-Lock Input #2
b Lock Tool Changer Lock Input
d Unlock Tool Changer Unlock Input
Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1
4
TSI In
(To Valve Unlock
Solenoid)
3
(n/c)
1
TSI Out
(from X)
2
(n/c)
TSI Connector
VA6 Master Side
Scale 2:1
(4-Pin Euro)
Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1
General Notes:
1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The VA6-M is supplied with a Teach Plug (part # 9120-DE45-PLUG) to make the TSI 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 would 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.
NOTES: UNLESS OTHERWISE SPECIFIED.
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3rd ANGLE PROJECTION
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CHECKED BY: D. Mushow, 1/15/09
PROJECT # 100113-1
SHEET 3 OF 5
TITLE
VA6 Family Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-VA6 Family
REVISION 06
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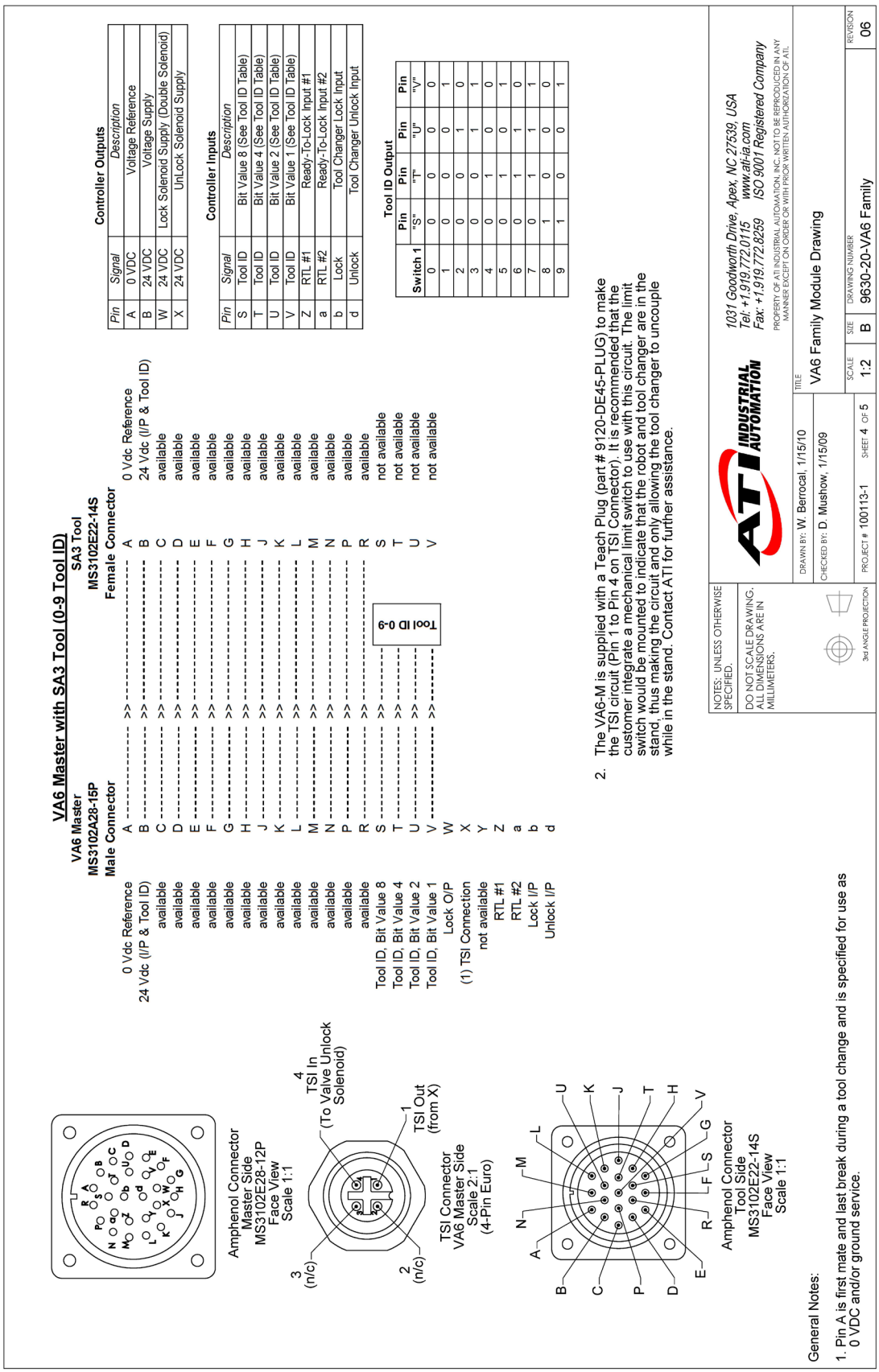
VA6 Master with SA3 Tool (0-9 Tool ID)
VA6 Master
MS3102A28-15P
Male Connector
SA3 Tool
MS3102E22-14S
Female Connector
0 Vdc Reference
24 Vdc (I/P & Tool ID)
available
Tool ID, Bit Value 8
Tool ID, Bit Value 4
Tool ID, Bit Value 2
Tool ID, Bit Value 1
Lock O/P
(1) TSI Connection
not available
RTL #1
RTL #2
Lock I/P
Unlock I/P
Tool ID 0-9
not available
Controller Outputs
Pin | Signal | Description
A | 0 VDC | Voltage Reference
B | 24 VDC | Voltage Supply
W | 24 VDC | Lock Solenoid Supply (Double Solenoid)
X | 24 VDC | UnLock Solenoid Supply
Controller Inputs
Pin | Signal | Description
S | Tool ID | Bit Value 8 (See Tool ID Table)
T | Tool ID | Bit Value 4 (See Tool ID Table)
U | Tool ID | Bit Value 2 (See Tool ID Table)
V | Tool ID | Bit Value 1 (See Tool ID Table)
Z | RTL #1 | Ready-To-Lock Input #1
a | RTL #2 | Ready-To-Lock Input #2
b | Lock | Tool Changer Lock Input
d | Unlock | Tool Changer Unlock Input
Tool ID Output
Switch 1 "S" | Pin "T" | Pin "U" | Pin "V"
0 | 0 | 0 | 0
1 | 0 | 0 | 1
2 | 0 | 1 | 0
3 | 0 | 1 | 1
4 | 0 | 1 | 0
5 | 0 | 1 | 0
6 | 0 | 1 | 1
7 | 0 | 1 | 1
8 | 1 | 0 | 0
9 | 1 | 0 | 1
Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1
4
TSI In
(To Valve Unlock
Solenoid)
1
TSI Out
(from X)
3
(n/c)
2
(n/c)
TSI Connector
VA6 Master Side
Scale 2:1
(4-Pin Euro)
Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1
General Notes:
1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The VA6-M is supplied with a Teach Plug (part # 9120-DE45-PLUG) to make the TSI 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 would 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.
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3rd ANGLE PROJECTION
DRAWN BY: W. Berrocal, 1/15/10
CHECKED BY: D. Mushow, 1/15/09
PROJECT # 100113-1
SHEET 4 OF 5
TITLE
VA6 Family Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-VA6 Family
REVISION 06
INDUSTRIAL AUTOMATION
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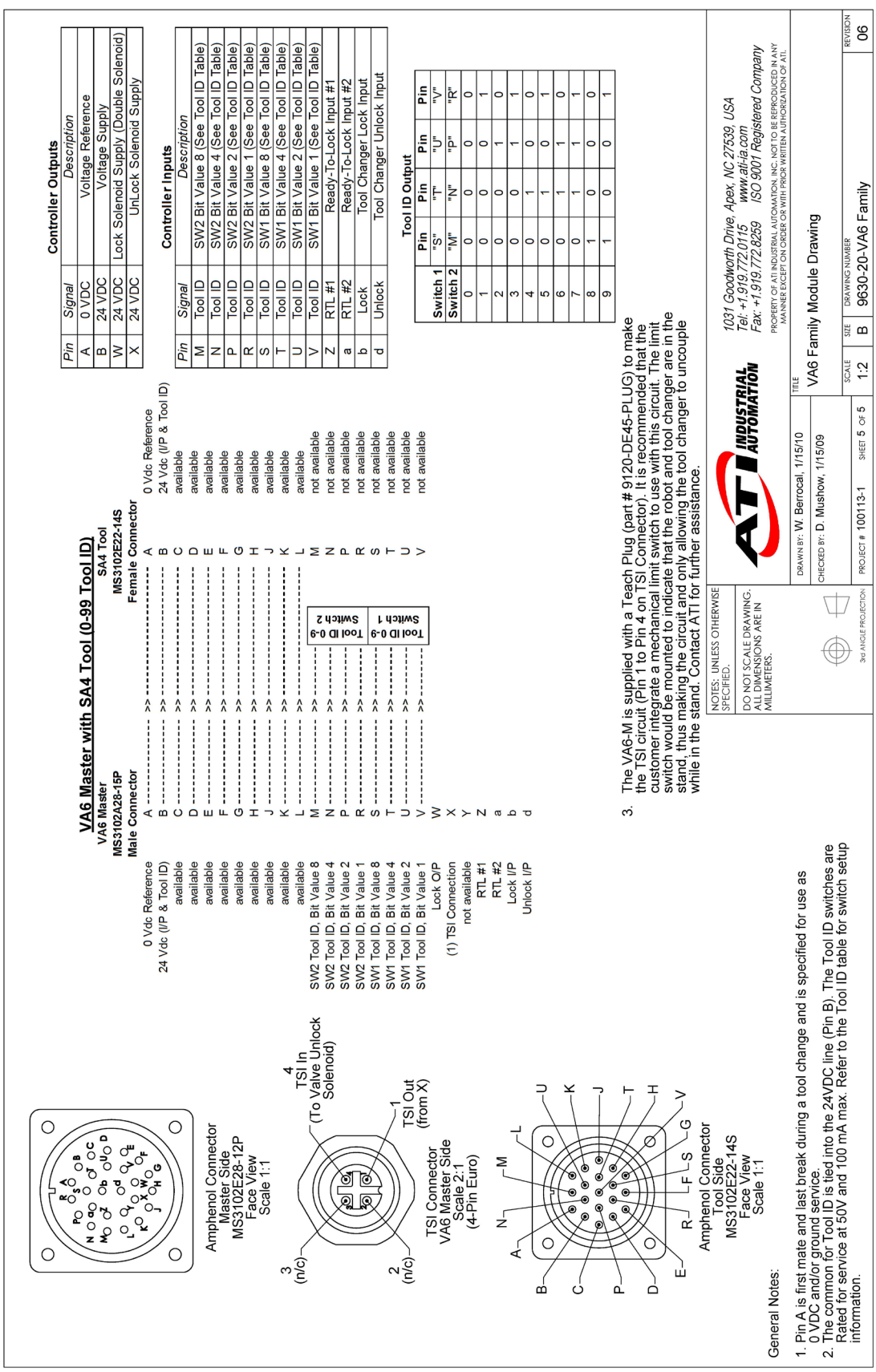
VA6 Master with SA4 Tool (0-99 Tool ID)
VA6 Master
MS3102A28-15P
Male Connector
SA4 Tool
MS3102E22-14S
Female Connector
0 Vdc Reference
24 Vdc (I/P & Tool ID)
available
available
available
available
available
available
available
available
available
available
SW2 Tool ID, Bit Value 8
SW2 Tool ID, Bit Value 4
SW2 Tool ID, Bit Value 2
SW2 Tool ID, Bit Value 1
SW1 Tool ID, Bit Value 8
SW1 Tool ID, Bit Value 4
SW1 Tool ID, Bit Value 2
SW1 Tool ID, Bit Value 1
Lock O/P
(1) TSI Connection
not available
RTL #1
RTL #2
Lock I/P
Unlock I/P
Tool ID 0-9
Switch 1
Tool ID 0-9
Switch 2
0 Vdc Reference
24 Vdc (I/P & Tool ID)
available
available
available
available
available
available
available
available
available
available
not available
not available
not available
not available
not available
not available
not available
not available
Amphenol Connector
Master Side
MS3102E28-12P
Face View
Scale 1:1
4
TSI In
(To Valve Unlock
Solenoid)
3
(n/c)
1
TSI Out
(from X)
2
(n/c)
TSI Connector
VA6 Master Side
Scale 2:1
(4-Pin Euro)
Amphenol Connector
Tool Side
MS3102E22-14S
Face View
Scale 1:1
General Notes:
1. Pin A is first mate and last break during a tool change and is specified for use as 0 VDC and/or ground service.
2. The common for Tool ID is tied into the 24VDC line (Pin B). The Tool ID switches are Rated for service at 50V and 100 mA max. Refer to the Tool ID table for switch setup information.
3. The VA6-M is supplied with a Teach Plug (part # 9120-DE45-PLUG) to make the TSI 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 would 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.
Controller Outputs
Pin | Signal | Description
A | 0 VDC | Voltage Reference
B | 24 VDC | Voltage Supply
W | 24 VDC | Lock Solenoid Supply (Double Solenoid)
X | 24 VDC | UnLock Solenoid Supply
Controller Inputs
Pin | Signal | Description
M | Tool ID | SW2 Bit Value 8 (See Tool ID Table)
N | Tool ID | SW2 Bit Value 4 (See Tool ID Table)
P | Tool ID | SW2 Bit Value 2 (See Tool ID Table)
R | Tool ID | SW2 Bit Value 1 (See Tool ID Table)
S | Tool ID | SW1 Bit Value 8 (See Tool ID Table)
T | Tool ID | SW1 Bit Value 4 (See Tool ID Table)
U | Tool ID | SW1 Bit Value 2 (See Tool ID Table)
V | Tool ID | SW1 Bit Value 1 (See Tool ID Table)
Z | RTL #1 | Ready-To-Lock Input #1
a | RTL #2 | Ready-To-Lock Input #2
b | Lock | Tool Changer Lock Input
d | Unlock | Tool Changer Unlock Input
Tool ID Output
Switch 1 | Pin "S" | Pin "T" | Pin "U" | Pin "V"
Switch 2 | "M" | "N" | "P" | "R"
0 | 0 | 0 | 0 | 0
1 | 0 | 0 | 0 | 1
2 | 0 | 0 | 1 | 0
3 | 0 | 0 | 1 | 1
4 | 0 | 1 | 0 | 0
5 | 0 | 1 | 0 | 1
6 | 0 | 1 | 1 | 0
7 | 0 | 1 | 1 | 1
8 | 1 | 0 | 0 | 0
9 | 1 | 0 | 0 | 1
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: W. Berrocal, 1/15/10
CHECKED BY: D. Mushow, 1/15/09
PROJECT # 100113-1
SHEET 5 OF 5
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TITLE
VA6 Family Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-VA6 Family
REVISION 06