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Glossary of Terms

TERM		DEFINITION
Auxiliary Power Available		An input indicating the presence of Auxiliary Power at the ATI Master.
DeviceNet Power Good		An input indicating the presence of DeviceNet Power at the ATI Master.
EOAT		End-Of-Arm-Tool (end effector).
Latch		The output supplied to the ATI Master DeviceNet node to couple the Tool Changer.
Locked		A proximity sensor input indicating that the coupling mechanism is in the Locked position.
RTL		A proximity sensor input that senses when the ATI Tool is in close proximity.
RTL Relay		A relay circuit present on the ATI Master module that is driven by the RTL sensor and allows the Tool Changer locking mechanism to retract when there is no Tool present.
RTLV		An input provided for health status monitoring of the RTL Relay.
Tool Present		A hard-connect input (sourced from the tool) indicating the Master and tool should be communicating with each other.
TSI		The Tool Stand Interlock feature is a custom ATI safety solution and circuit designed to only allow Tool Changer release while in the stand or storage location.
TSI Relay		A relay circuit present on the ATI Tool module that is driven by a tool stand limit switch in order to close the TSI circuit and allow Tool Changer release.
TSIV		An input supported for monitoring of a tool stand limit switch used with the TSI circuit.
TSRV		An input provided for health status monitoring of the TSI Relay.
Unlatch		The output supplied to the ATI Master DeviceNet node to uncouple the Tool Changer.
Unlocked		A proximity sensor input indicating that the coupling mechanism is in the Unlocked position.

C. Control and Signal Modules
DJ3M DJ2T—DeviceNet Modules

1. Product Overview

1.1 DeviceNet Module Highlights

The DeviceNet modules are required to provide a means for the customer to communicate with and control the Tool Changer in a DeviceNet environment. Refer to Sections 3 and 4 of this manual for detailed DeviceNet programming information and a summary of module operational capabilities.

A single solenoid valve is provided with the Master valve adapter for Lock/Unlock control of the Tool Changer. The user is only required to provide a pneumatic supply source to the Tool Changer. Note that double-solenoid valves are not supported.

Standard Mini connectors are provided on the Master and Tool modules for interfacing with Auxiliary Power (4-Pin) and DeviceNet (5-Pin) signals. When the Tool Changer is coupled, the Master and Tool modules pass signals using a spring-loaded pin block. A flexible boot surrounds the pin block to seal the connection from moisture and liquid while coupled (See Fig. 1.1).

The DJ3-M/DJ2-T modules are designed with a *dual redundant* Tool Stand Interlock (TSI) circuit to allow the Tool Changer to be operated in the safest manner possible. In addition to supporting the standard Tool Changer input signals (Locked, Unlocked, and Ready-to-Lock proximity sensors) the modules also support advanced diagnostic and fault reporting. This greatly reduces the programming complexity on the customers' end. Refer to Sections 3 and 4 for more information on these attributes.

The Tool module employs a series of thumbwheel switches for setting of the Tool-ID input. This allows the customer to distinguish between the different Tools that are being used in a robotic cell or on a production line. The Tool-ID is reported through the Master module bitmap. See Section 3 for DeviceNet bitmap and detailed I/O information.

1.2 TSI Circuit Operation

The TSI feature provides a "hard-wired" interrupt of the Unlatch solenoid circuit and is intended to prevent release of the tool *except* when in the stand or storage location (See Fig. 1.2).

The interrupt for the Unlatch solenoid circuit is passed electrically down to the Tool Changer tool where it is wired into the TSI Relay. The second set of TSI Relay contacts sources DeviceNet power and provides the TSRV input for health status monitoring of the TSI Relay.

A double pole, single-throw limit switch (TSI Limit Switch) is integrated on the EOAT such that it is made when the tool is in the stand. One set of the TSI Limit Switch contacts sources DeviceNet power and drives the TSI Relay, thus closing the Unlatch solenoid circuit. The second set of TSI Limit Switch contacts sources DeviceNet power and drives the TSIV input. A firmware condition in the ATI Master module requires that the TSIV input be high in order to process an Unlatch command (reference the truth tables below in the Dual Redundancy Section).

On the Tool Changer Master side a parallel path is required for the Unlatch solenoid circuit so that the Tool Changer can be Unlocked (i.e.; the locking mechanism can be fully retracted) prior to entering and coupling with the tool. This is necessary when there is no tool present because the Unlatch solenoid circuit is routed through the tool and the Tool Changer could not otherwise be Unlocked.

In order to achieve this parallel path an RTL Relay is integrated into the module and is driven by the RTL sensor. When there is no tool present (therefore the RTL sensor is low) the RTL Relay allows the Unlatch solenoid circuit to be completed and an Unlatch command is processed. When a tool is present

(and therefore the RTL sensor is high) the RTL Relay is energized and the Unlatch solenoid circuit is diverted through to the tool side. The second set of RTL relay contacts sources DeviceNet power and provides the RTLV input for health status monitoring of the RTL Relay.

1.3 TSI Dual Redundancy

In a single TSI circuit the RTL sensor, RTL Relay, TSI limit switch and TSI Relay are critical components. Failure of any one of these components may result in an unsafe situation where an Unlatch command could result in Tool Changer release.

In the DJ Series module design two TSI circuits are implemented in-series electrically to provide redundancy and enhance safety. Critical component mismatch conditions are evaluated internally and faults are communicated in the bitmap. If an unsafe condition occurs then the Unlatch output is disabled so that an inadvertent tool release is avoided while in this condition.

Refer to Sections 3 and 4 for more details of how the redundant TSI circuit and associated components are being used and reported upon.

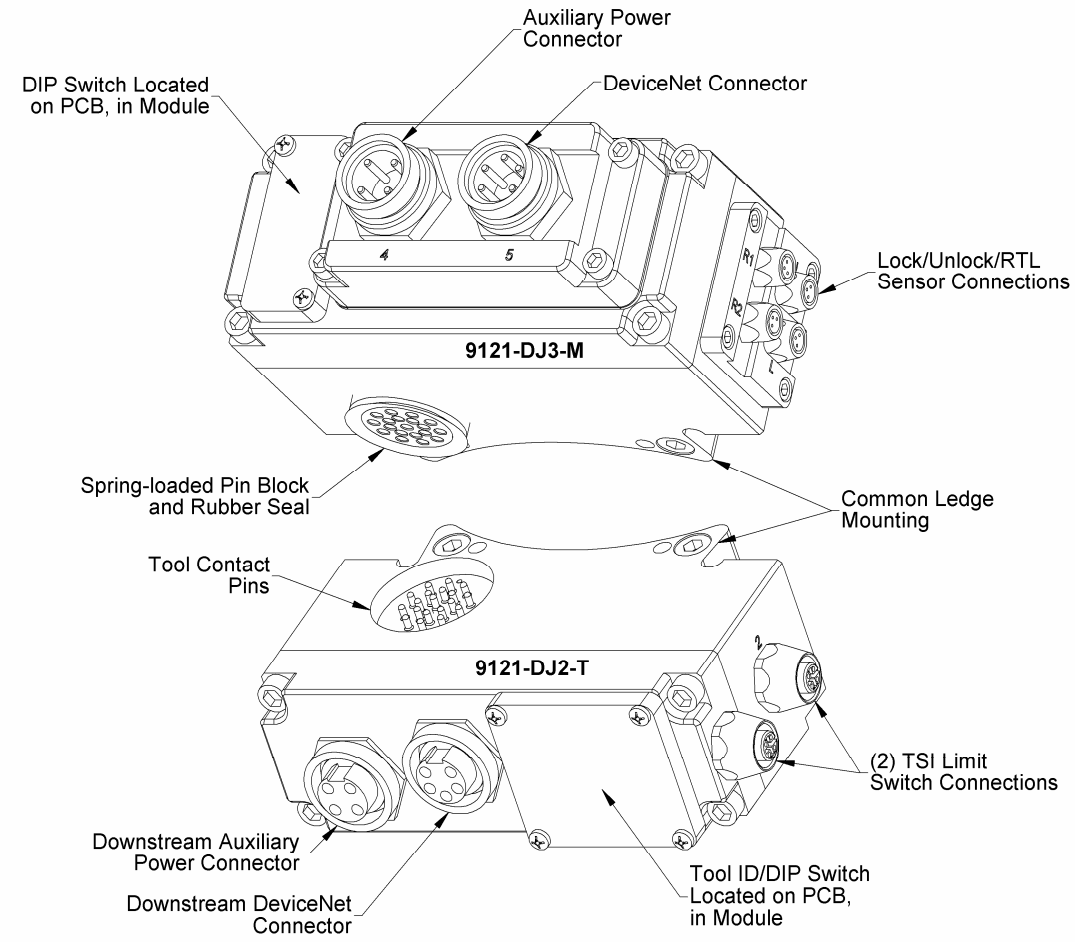
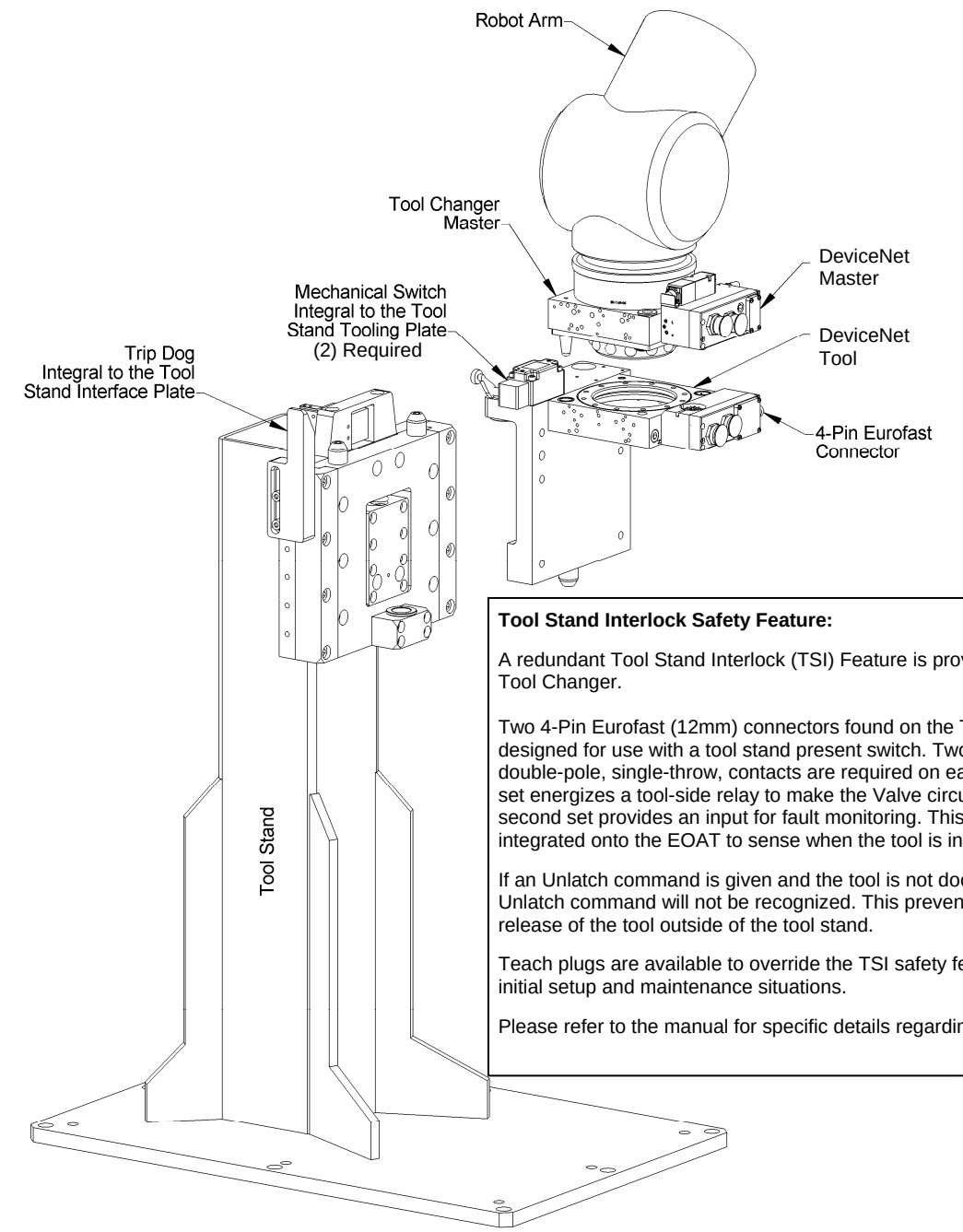


Figure 1.1—DJ3-M/DJ2-T DeviceNet Modules



Tool Stand Interlock Safety Feature:

A redundant Tool Stand Interlock (TSI) Feature is provided with this Tool Changer.

Two 4-Pin Eurofast (12mm) connectors found on the Tool module are designed for use with a tool stand present switch. Two sets of NO, double-pole, single-throw, contacts are required on each switch. One set energizes a tool-side relay to make the Valve circuit, while the second set provides an input for fault monitoring. This switch should be integrated onto the EOAT to sense when the tool is in the stand.

If an Unlatch command is given and the tool is not docked properly, the Unlatch command will not be recognized. This prevents the accidental release of the tool outside of the tool stand.

Teach plugs are available to override the TSI safety feature during initial setup and maintenance situations.

Please refer to the manual for specific details regarding the TSI feature.

Figure 1.2—Tool Stand Interlock (TSI)

⚠ **CAUTION:** This 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.

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.

2.3 DeviceNet Configuration

Various parameters for the DeviceNet modules need to be configured prior to operating the Tool Changer. Please refer to Section 3 of this manual for detailed information on installation and operation of the DeviceNet modules.

2.4 Utility Schematic

Refer to drawings in Section 8 of this manual for customer interface and wiring details for the DJ3-M/DJ2-T modules.

CAUTION: All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of stress pullout, kinking, etc. Failure of some critical electrical and/or pneumatic lines to function properly may result in injury to personnel and equipment.

3. DeviceNet Information

The DJ3-M/DJ2-T modules enable the customer to control and communicate with the Tool Changer through a network using standard DeviceNet protocol (www.odva.org). A DeviceNet node is established on the Master module, but not on the Tool. Control of the Tool Changer is realized through the Master Node along with the reporting of various Tool Changer I/O. The Tool module supports Tool-ID reported through the Master and functions as a pass-through for DeviceNet and Auxiliary Power signals to downstream equipment.

The DJ3-M/DJ2-T modules employ standard Mini connectors, 5-pin for DeviceNet communications and power and 4-pin for Auxiliary Power. Please refer to drawings in Section 9 for specific module wiring and connector interface information.

Prior to using the Tool Changer and the DeviceNet modules, various hardware settings must be configured. Communicating with the DeviceNet Modules requires knowledge of DeviceNet standards and operation.

3.1 Master Module Node

The Master Node operates as a Group 2-Only Server on the DeviceNet network. The Master Node supports Explicit Messaging, Polled, Strobe and Change of State/Cyclic communications for the predefined Master/Slave Connection set. The Master Node does not support the Unconnected Message Manager (UCMM).

MAC ID and Baud Rate settings for the Master Node are configured through a series of DIP switches. To configure the module and set the DIP switches remove the plastic window and seal as shown in the drawing in Section 8 (**When replacing the window, ensure that the seal is positioned correctly to prevent fluid leakage)**. On board termination resistance is not supported and must be provided externally. LED's are integral to the module and report network and module status.

3.1.1 MAC ID

The MAC ID is set by either hardware or software configuration. The range is 0-63. In order for the MAC ID to be set by software, DIP switch positions 1 through 8 must be on. If the MAC ID is set by software, the Baud Rate must also be set by software. Refer to Figure 3.1 for detailed information on DIP switch setup. The default MAC ID setting from the factory for the Master Node is 54.

3.1.2 Baud Rate

Baud Rate is set by either hardware or software configuration. The possible settings are 125, 250 or 500Kbps. In order for the Baud Rate to be set by software, DIP switch positions 7 and 8 must be on. See Figure 3.1 for DIP switch setup. The default Baud Rate setting from the factory for the Master Node is 500Kbps.

3.1.3 Termination Resistor

Termination resistance is not supported with the Master Node. Required termination resistance must be provided external to the module.

3.1.4 Module and Network Status LED

The module status LED is identified on the module as "MS". It provides device status for power and proper operation. Refer to Table 3.1 for an outline of this LED's operation. The network status LED is identified on the module as "NS". It provides network status for power and communication. Refer to Table 3.2 for an outline of this LED's operation.

3.1.5 Cable Drop Length Calculation

Subtract 1 foot from the DeviceNet total drop line budget for each Master node installed on the network (Note: the Master node can exceed the 24pF limit for the differential input

capacitance between CAN_H and CAN_L by up to 12pF which is equivalent to 1 foot cable).

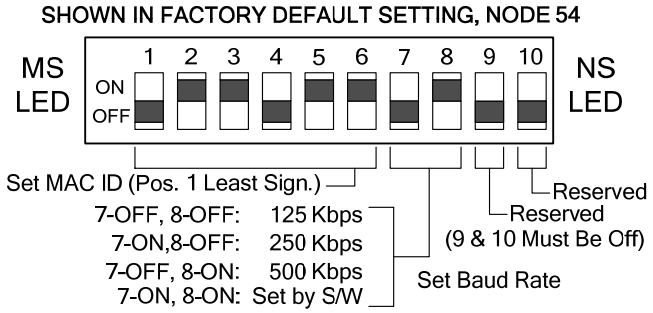


Figure 3.1—DeviceNet Master Module DIP Switch Settings

Color	State	Indication
None	Off	No Power
Red	Solid	Unrecoverable Fault
	Flashing	Recoverable Fault (Tool Connected) • Serial Communication Errors • Invalid Tool-ID • Tool Module Returns an Error Message
Green	Solid	Normal Operation
	Flashing	No Tool Connected

Table 3.1—Master Module Status LED

Color	State	Indication
None	Off	No Power
Red	Solid	Unrecoverable Fault
	Flashing	Output Error or Configuration Error
Green	Solid	Normal Runtime Operation
	Flashing	Device Is In Idle or Not Allocated to a Master

Table 3.2—Master Network Status LED

3.2 Tool Module

A DeviceNet node is ***not*** established on the Tool module. The Tool module utilizes a patented, rapid communication method to report the Tool-ID information from the pushbutton switches to the Master module as soon as the Tool Changer is coupled. Typically the Tool-ID information is available to the Master within 150ms from the time the changer is coupled.

In addition to providing Tool-ID the Tool module also functions as a pass-through for the DeviceNet network and Auxiliary Power signals to downstream equipment. Standard 4 and 5-pin female Mini connectors are provided for interfacing on the Tool module (reference drawings in Section 9).

DIP switches provided on the Tool module are set from the factory and should not have to be adjusted (See Fig. 3.2 for factory DIP switch settings, if for some reason the plastic window and seal are removed, ensure the seal and window are re-positioned correctly to prevent a leakage path to the module inside). LEDs are integral to the Tool module and report module and network status.

3.2.1 Tool-ID Switches

Five pushbutton switches are provided on the Tool module for setting of a Tool-ID number. Refer to Figure 3.3 for information about the Tool-ID switches.

3.2.2 Module and Network Status LED

The module status LED is identified on the module as "MS". It provides device status for power and proper operation. Refer to Table 3.3 for an outline of this LED's operation. The network status LED is identified on the module as "NS". The network status LED functionality is not utilized in this product, but it will operate. The network LED should be green unless the DIP switches have be changed from the factory default settings. See Table 3.4 for information about this LED's operation.

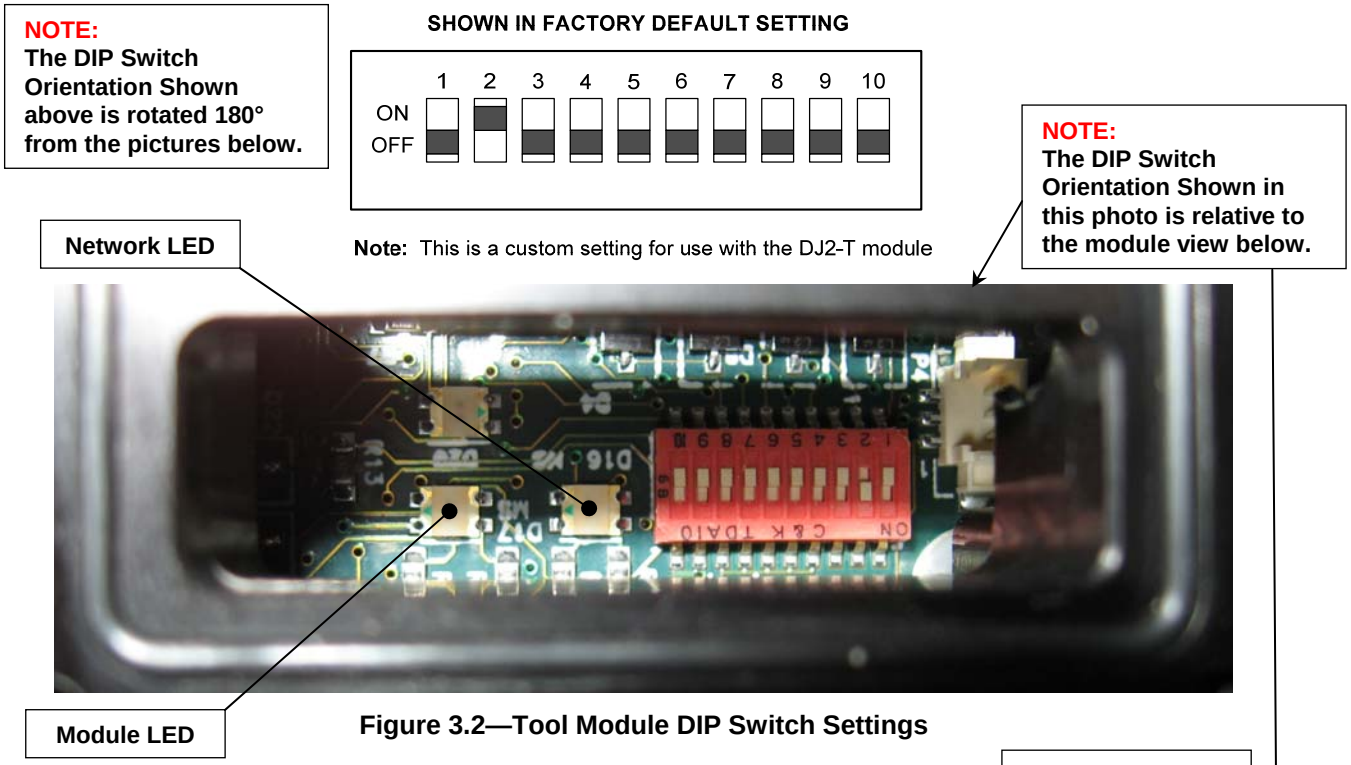
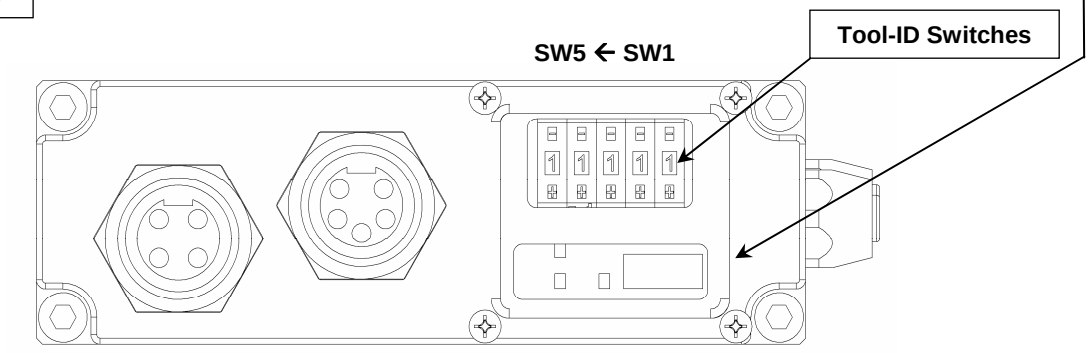


Figure 3.2—Tool Module DIP Switch Settings



(Refer to the bitmap in Table 3.5 for details of how the Tool-ID is reported)

Figure 3.3—DJ2 Tool Module, Tool-ID Switch Settings

Color	State	Indication
None	Off	No Power
Green	Flashing (0.5 Hz)	No Communications From the ATI Master Module
	Flashing (2.5 Hz)	Valid Communications From the ATI Master Module

Table 3.3—Tool Module Status LED

Color	State	Indication
None	Off	No Power
Red	Solid	Configuration Error
	Flashing	Not Applicable This Product
Green	Flashing	Not Applicable This Product
	Solid	Not Applicable This Product

Table 3.4—Tool Network Status LED

3.3 Software

A working EDS file for the Master node is available from our website (www.ati-ia.com/download/edsfiles) or by e-mail, reference the part number given below:

DJ3-M Node EDS file 9030-20-1013

An I/O bitmap for the Master node is provided in the table below. The default setting from the factory for the Master module is Node 54.

Robot Inputs from ATI Master, Node 54			
Byte	**Bit#**	**Name**	**Description/Function**
1	0	Locked	Tool Changer Lock Proximity Sensor Input
	1	Unlocked	Tool Changer Unlock Proximity Sensor Input
	2	DeviceNet Power Good	DeviceNet Power Present Input
	3	Auxiliary Power Available	Auxiliary Power Present Input
	4	RTL1	Ready-to-Lock 1 Proximity Sensor Input
	5	RTL2	Ready-to-Lock 2 Proximity Sensor Input
	6	RTLV1	RTL Relay Verify 1 Input
	7	RTLV2	RTL Relay Verify 2 Input
2	0	TSIV1	TSI Switch Verify 1 Input
	1	TSIV2	TSI Switch Verify 2 Input
	2	TSRV1	TSI Relay Verify 1 Input
	3	TSRV2	TSI Relay Verify 2 Input
	4	Tool Present	Hard-Connect Tool Present Input
	5	-	*(Reserved)*
	6	-	*(Reserved)*
	7	-	*(Reserved)*
3	0	RTL mismatch	RTL1 and RTL2 do not match
	1	TSIV mismatch	TSIV1 and TSIV2 do not match
	2	Error on Latch Output	Latch output overloaded
	3	Error on Unlatch Output	Unlatch output overloaded
	4	Error on Spare Output	Spare output overloaded
	5	RTL/RTLV Mismatch	RTL1/RTLV1 or RTL2/RTLV2 Do Not Match
	6	TSIV/TSRV Mismatch	TSIV1/TSRV1 or TSIV2/TSRV2 Do Not Match
	7	Unsafe Unlatch	Unlatch Rejected due to Unsafe Condition Present
4	0	Lock/Unlock Sensor Fault	Lock and Unlock Inputs True at Same Time
	1	Latch Not Completed	LatchProcessIncomplete, Expected Input Not Seen
	2	Unlatch Not Completed	UnlatchProcessIncompleteExpected Input Not Seen

	3	TSIV Fault	TSIV Input Stuck High
	4	RTL Fault	RTL Input Stuck High
	5	COMM Error	Tool-ID Communication Timeout
	6	-	*(Reserved)*
	7	-	*(Reserved)*
5	0	Tool-ID Switch1 Bit1	(rightmost switch)
	1	Tool-ID Switch1 Bit2	
	2	Tool-ID Switch1 Bit4	
	3	Tool-ID Switch1 Bit8	
	4	Tool-ID Switch2 Bit1	
	5	Tool-ID Switch2 Bit2	
	6	Tool-ID Switch2 Bit4	
	7	Tool-ID Switch2 Bit8	
6	0	Tool-ID Switch3 Bit1	
	1	Tool-ID Switch3 Bit2	
	2	Tool-ID Switch3 Bit4	
	3	Tool-ID Switch3 Bit8	
	4	Tool-ID Switch4 Bit1	
	5	Tool-ID Switch4 Bit2	
	6	Tool-ID Switch4 Bit4	
	7	Tool-ID Switch4 Bit8	
7	0	Tool-ID Switch5 Bit1	(leftmost switch)
	1	Tool-ID Switch5 Bit2	
	2	Tool-ID Switch5 Bit4	
	3	Tool-ID Switch5 Bit8	
	4	Unlatch Enabled	
	5	-	*(Reserved)*
	6	-	*(Reserved)*
	7	-	*(Reserved)*
8	0	-	*(Reserved)*
	1	-	*(Reserved)*
	2	-	*(Reserved)*
	3	-	*(Reserved)*
	4	-	*(Reserved)*
	5	-	*(Reserved)*
	6	-	*(Reserved)*
	7	-	*(Reserved)*

Tool-ID Data

Table 3.5—I/O Bitmap, Robot Inputs from Node 54 (DJ3-M Module)

Robot Outputs to ATI Master, Node 54			
Byte	**Bit#**	**Name**	**Description/Function**
1	0	Latch (Lock)	Latch Solenoid Valve O/P
	1	Unlatch (Unlock)	Unlatch Solenoid Valve O/P
	2	-	*(Reserved)*
	3	Clear Errors	Reset errors, allow affected I/O to be reactivated
	4	Unlatch Disabled Mode	Unlatch Output Disabled
	5	Out of Nest	Tool Changer and EOAT are Out of the Nest
	6	-	*(Reserved)*
	7	-	*(Reserved)*

Table 3.6—I/O Bitmap, Robot Outputs to Node 54 (DJ3-M Module)

4. Operation

A recommended Sequence of Operations is provided in Appendix A of this manual. This procedure is to be used as a general guide when programming a robot or PLC for use with a Tool Changer and DJ control/signal modules. This procedure is intended for "automatic" modes used during normal application processes. Recommendations for operation in “teach” or “manual” modes where the operator has the teach pendant in-hand will be addressed in a separate Troubleshooting Guide.

A thorough understanding of the advanced diagnostic and fault reporting capability is required to proficiently operate this product. Refer to document *9620-20-C-DJx Error Handling* for helpful information related to troubleshooting a fault condition and how to recover from it. Additional information is provided below in the form of truth tables to help define the behavior of the DJ3-M/DJ2-T modules.

Inputs				Output	
“Out of Nest” or “Unlatch Disabled” output bit	**RTL1**	**TSIV1**	**Disable UNLATCH Error Condition (see Table 2 for definition)**	**UNLATCH Enable**	**Status of Master Body**
0	0	0	0	1	No Tool, positioned in free air
0	0	1	0	1	No Tool, positioned in Tool Stand (this is a transient state which is only true just prior to RTL being made)
0	1	0	0	0	Tool is present, positioned in free air
0	1	1	0	1	Tool is present, positioned in Tool Stand
0	X	X	1	0	Error condition
1	X	X	X	0	Global UNLATCH Disable condition

Table 4.1—UNLATCH Enable Logic and Truth Table

Error Condition	Report update freeze immediately after UNLATCH command	Disable Unlatch and turn off Unlatch immediately	Reset with
AUX POWER failure	No	No	“Clear Errors” - Bit
LATCH output overload	No	Yes	“Clear Errors” - Bit
UNLATCH output overload	No	Yes	“Clear Errors” - Bit
SPARE output overload	No	No	“Clear Errors” - Bit
UNSAFE UNLATCH COMMAND	Yes	Yes	Cycle UNLATCH output bit or “Clear Errors” - Bit
RTL1 / RTL2 mismatch	Yes	Yes	Cycle UNLATCH output bit or “Clear Errors” - Bit
TSIV1 / TSIV2 mismatch	Yes	Yes	Cycle UNLATCH output bit or “Clear Errors” - Bit
DeviceNet Power Failure	No	Yes	“Clear Errors” - Bit
RTL/RTLV Mismatch	No	Yes	“Clear Errors” – Bit
TSIV/TSRV Mismatch	No	Yes	“Clear Errors” – Bit
Lock/Unlock Sensor Fault	No	No	Correct error
Latch Not Completed	No	No	Cycle LATCH output bit or “Clear Errors” - Bit
Unlatch Not Completed	No	No	Cycle UNLATCH output bit or “Clear Errors” - Bit
TSIV Fault	No	Yes	“Clear Errors” – Bit
RTL Fault	No	Yes	“Clear Errors” - Bit
Comm. Error	No	No	Cycle Tool Changer (unlock and lock again)

Table 4.2—Error Conditions

5. Maintenance

The DeviceNet modules are designed to provide a long life with little maintenance required.

Contact pins on the DeviceNet 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.

6. Troubleshooting

Refer to the flow chart in Figure 3.4 for troubleshooting information, as well as the table below:

Symptom	Possible Cause / Correction
Unit will not lock or unlock	Verify that ball bearings are moving freely. Clean and lubricate as needed (see Tool Changer Manual Maintenance Section). Check air supply. Check that exhaust port is properly vented (check muffler). Verify that the valve is operating properly. Verify that DeviceNet Network is operating/communicating properly. Verify that the Master and Tool are within the specified No-Touch zone when attempting to lock.
Sensors not operating properly (but DeviceNet is operating correctly).	Verify that cables are connected correctly. Verify that the sensors are set correctly (Refer to SIP Kit Installation). 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 DeviceNet Communication	Check/replace DeviceNet cabling up- and down-stream of Tool Changer modules. Inspect DeviceNet Module contact pins for debris/wear. Check nodes up- and down-stream of Tool Changer nodes for failures. These failures can “masquerade” as Tool Changer node faults. Verify proper DeviceNet Network termination. Verify overall Network topology and cable routing is within DeviceNet specifications. Lower Baud Rate if communication problems persist.

7. Recommended Spare Parts

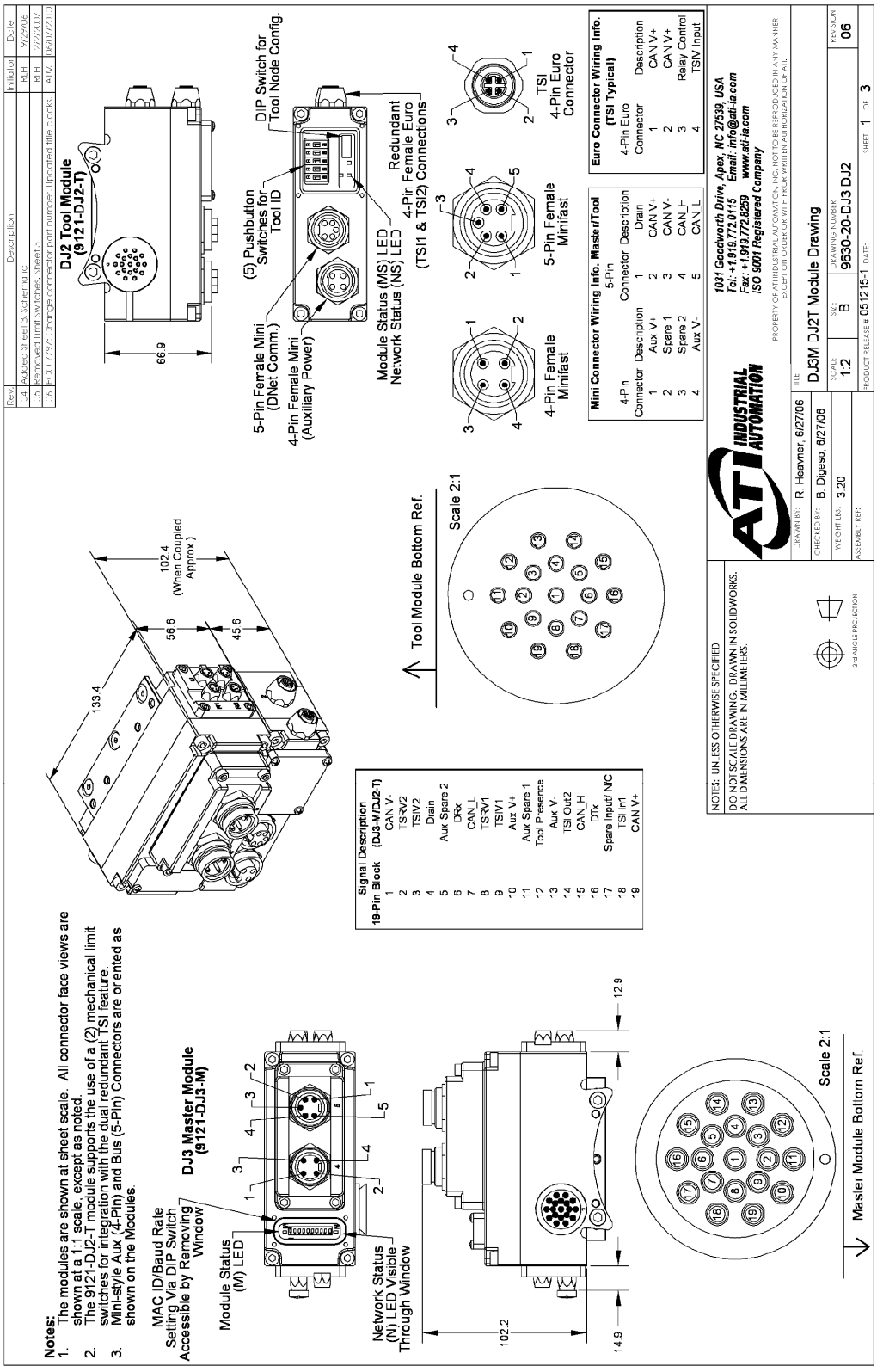
Description	Part Number
DJ3 Master Module Assembly	9121-DJ3-M
DJ2 Tool Module Assembly	9121-DJ2-T
TSI Teach Plug	9120-DC45-Plug
TSI Cables	9120-C-4EM-4EF-010 (1 Meter) 9120-C-4EM-4EF-020 (2 Meter) 9120-C-4EM-4EF-040 (4 Meter)
DeviceNet Termination Resistor for Female Mini Receptacle	9120-5MM-TR
Closure Cap for Female Mini Receptacles	3690-0000049-00

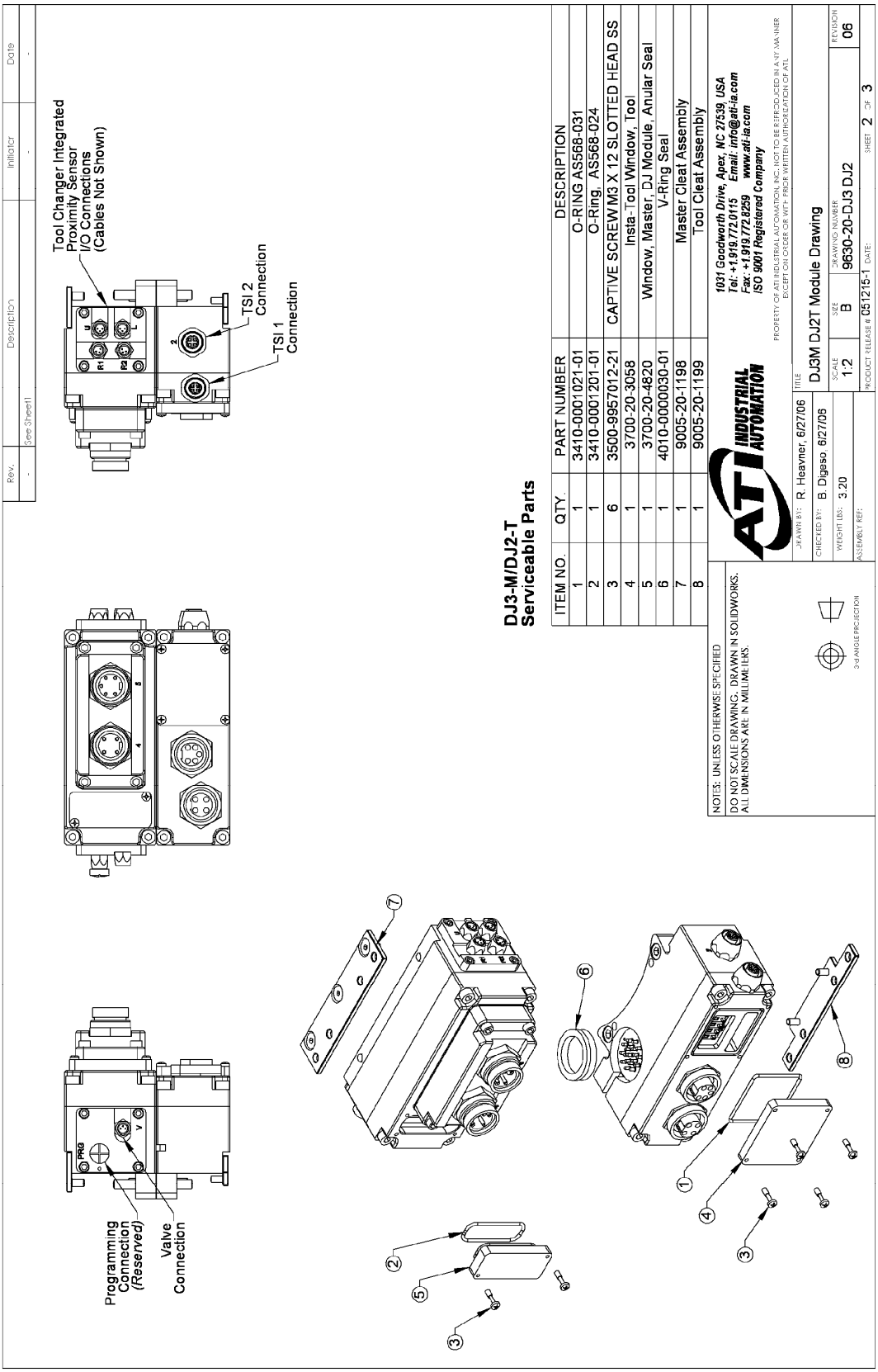
See drawings in Section 9 of this manual for spare parts directly associated with the DJ3-M/DJ2-T modules.

8. Specifications

DeviceNet Module		The DJx modules conform to the DeviceNet Specification Volume 3, Edition 1.2 (Reference Conformance Case #10423).
Master Node Factory configuration	**DJ3-M**	MAC ID 54, Baud Rate 500 Kbps, "Mini" DeviceNet (5-Pin) and Auxiliary Power (4-Pin) connectors (male) provided. Integral "Pico" (8mm, 3-Pin) connectors and cables support Tool Changer Locked, Unlocked and Ready-to-Lock proximity sensor and solenoid Valve interfaces.
Current Draw	100mA @ 24VDC	Master only (Unlocked sensor "on", Lock, RTL1, and RTL2 "off")
	(120mA @ 15VDC)	
Tool Node Factory configuration	**DJ2-T**	"Mini" DeviceNet (5-Pin) and Auxiliary Power (4-Pin) connectors (female) provided. (5) Independent Tool-ID switches, each reading a (0–9) position. Redundant "Euro" (12mm, 4-Pin) connectors for support of customer-integrated TSI Limit Switches.
Current Draw	220mA @ 24VDC	Master + Tool (Locked, RTL1, and RTL2 sensors "on", Limit Switches/ TSI Circuits made, i.e.; TSIV1, TSIV2, TSRV1, and TSRV2 "on")
	(250mA @ 15VDC)	

9. Drawings


DJ2 Tool Module
(9121-DJ2-T)
66.9
(5) Pushbutton
Switches for
Tool ID
DIP Switch for
Tool Node Config.
5-Pin Female Mini
(DNet Comm.)
4-Pin Female Mini
(Auxiliary Power)
Module Status (MS) LED
Network Status (NS) LED
Redundant
4-Pin Female Euro
(TSI1 & TSI2) Connections
4-Pin Female
Minifast
5-Pin Female
Minifast
TSI
4-Pin Euro
Connector
Mini Connector Wiring Info. Master/Tool
5-Pin
4-Pin
Connector Description
1 Aux V+
2 Spare 1
3 Spare 2
4 Aux V-
Connector Description
1 Drain
2 CAN V-
3 CAN V-
4 CAN_H
5 CAN_L
Euro Connector Wiring Info.
(TSI Typical)
4-Pin Euro
Connector Description
1 CAN V+
2 CAN V+
3 Relay Control
4 TSIV Input
Tool Module Bottom Ref.
Scale 2:1
102.4
(When Coupled
Approx.)
133.4
56.6
45.6
Signal Description
19-Pin Block (DJ3-M/DJ2-T)
1 CAN V-
2 TSRV2
3 TSIV2
4 Drain
5 Aux Spare 2
6 DRx
7 CAN_L
8 TSRV1
9 TSIV1
10 Aux V+
11 Aux Spare 1
12 Tool Presence
13 Aux V-
14 TSI Out2
15 CAN_H
16 DTx
17 Spare Input/ NC
18 TSI In1
19 CAN V+
DJ3 Master Module
(9121-DJ3-M)
MAC ID/Baud Rate
Setting Via DIP Switch
Accessible by Removing
Window
Module Status
(M) LED
Network Status
(N) LED Visible
Through Window
102.2
14.9
12.9
Scale 2:1
Master Module Bottom Ref.
Notes:
1. The modules are shown at sheet scale. All connector face views are shown at a 1:1 scale, except as noted.
2. The 9121-DJ2-T module supports the use of a (2) mechanical limit switches for integration with the dual redundant TSI feature.
3. Mini-style Aux (4-Pin) and Bus (5-Pin) Connectors are oriented as shown on the Modules.
Rev. Description Initiator Date
34 Added Sheet 3, Schematic RLH 9/29/06
35 Removed Unit Switches, Sheet 3 RLH 2/2/2007
36 ECO 7797: Change connector part number. Updated title blocks. ATW 06/07/2010
NOTES: UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING. DRAWN IN SOLIDWORKS.
ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
INDUSTRIAL AUTOMATION
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
ISO 9001 Registered Company
PROPERTY OF ATI INDUSTRIAL AUTOMATION, INC. NOT TO BE REPRODUCED IN ANY MANNER EXCEPT AS OTHERWISE AGREED TO IN WRITING BY ATI INDUSTRIAL AUTOMATION, INC.
DRAWN BY: R. Heavner, 6/27/06
CHECKED BY: B. Digeso, 6/27/06
WEIGHT LBS: 3.20
ASSEMBLY REF:
TITLE: DJ3M DJ2T Module Drawing
SCALE: 1:2
SIZE: B
DRAWING NUMBER: 9630-20-DJ3 DJ2
REVISION: 06
PRODUCT RELEASE #: 051215-1 DATE:
SHEET 1 OF 3


Tool Changer Integrated
Proximity Sensor
I/O Connections
(Cables Not Shown)
TSI 2
Connection
TSI 1
Connection
Programming
Connection
(Reserved)
Valve
Connection
DJ3-M/DJ2-T
Serviceable Parts
ITEM NO. QTY. PART NUMBER DESCRIPTION
1 1 3410-0001021-01 O-RING AS568-031
2 1 3410-0001201-01 O-Ring, AS568-024
3 6 3500-9957012-21 CAPTIVE SCREW M3 X 12 SLOTTED HEAD SS
4 1 3700-20-3058 Insta-Tool Window, Tool
5 1 3700-20-4820 Window, Master, DJ Module, Anular Seal
6 1 4010-0000030-01 V-Ring Seal
7 1 9005-20-1198 Master Cleat Assembly
8 1 9005-20-1199 Tool Cleat Assembly
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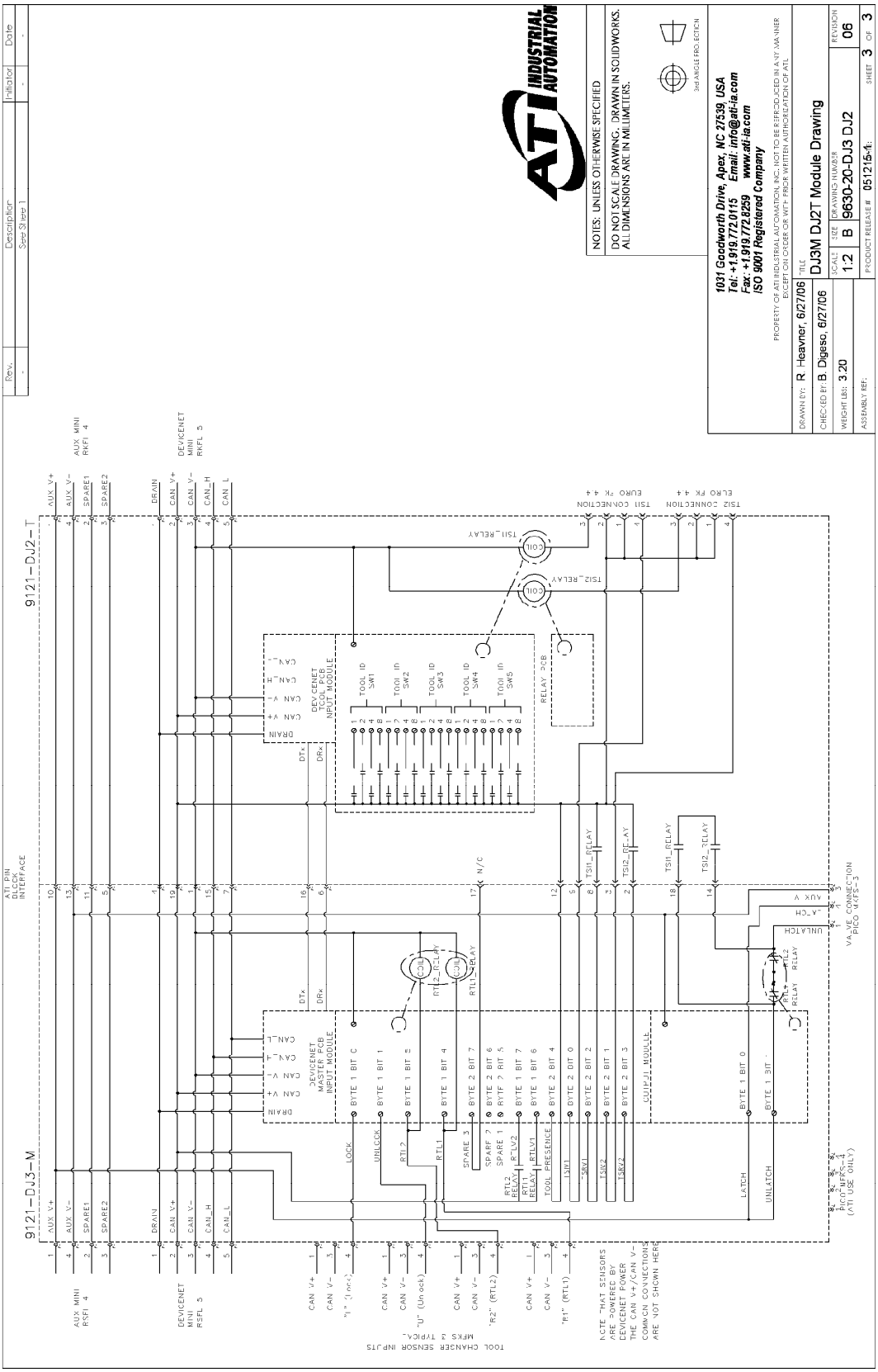
DRAWN BY: R. Heavner, 6/27/06
CHECKED BY: B. Digaso 6/27/06
WEIGHT LBS: 3.20
ASSEMBLY REF:
TITLE
DJ3M DJ2T Module Drawing
SCALE 1:2
SIZE B
DRAWING NUMBER 9630-20-DJ3 DJ2
REVISION 06
3rd ANGLE PROJECTION
PRODUCT RELEASE # 051215-1 DATE:
SHEET 2 OF 3
Rev. Description Initials Date
- See Sheet1 - -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DRAWN BY: R. Heavner, 6/27/06
CHECKED BY: B. Digeso, 6/27/06
DJ3M DJ2T Module Drawing
DRAWING NUMBER 9630-20-DJ3 DJ2
REVISION 06
SHEET 3 OF 3
9121-DJ3-M
9121-DJ2-T
DEVICENET MASTER PCB INPUT MODULE
TOOL CHANGER SENSOR INPUTS
LATCH
UNLATCH
TS1I_RELAY
TS1O_RELAY
TS2I_RELAY
TS2O_RELAY
RTL1_RELAY
RTL2_RELAY

Appendix A

Recommended Sequence of Operation for "Auto" Mode

1. **Start→** The robot and Tool Changer Master are free of the stand or storage location, the Tool Changer is uncoupled and the Tool Changer locking mechanism may be fully retracted (unlocked condition) or fully extended (missed Tool condition, i.e., **Locked** and **Unlocked** inputs are false). The Tool is by itself in the Tool Stand.
   a. The **RTL** inputs (RTL1 and RTL2) are false.
   b. The ATI Tool and any downstream DeviceNet node(s) are offline.
   c. The **DeviceNet Power Good** and **Auxiliary Power Available** inputs are true and must remain so at all times.

2. Unlock the Master. (This must be done prior to the Master entering the Tool to prevent the ball bearings from impinging on the Tool bearing race.)
   a. The **Latch** output command is made false and the **Unlatch** output command is made true.
   b. The **Unlocked** input goes true, indicating that the Tool Changer locking mechanism is fully retracted and the **Unlatch** operation is complete.

3. Robot and Master move into the Tool, are parallel and within 0.15" to 0.06" of the Tool (i.e., the module contact pins are touching, but the **RTL** sensors have not yet sensed the targets on the,).
   a. The **Tool Present** and **TSIV** input(s) go true, indicating that the Master and Tool are in close proximity of each other and verifying the operation of the **TSI Limit Switch(es)**.
   b. Communication is initiated with the ATI Tool and downstream nodes. When the **Tool Present** input goes true **Tool-ID** becomes available via InstaTool communications within 50–250ms.
   c. Shortly thereafter, communications should be established with the downstream Quick Connect-capable DeviceNet nodes.

4. Robot and Master move within 0.06" of the Tool.
   a. The **RTL** inputs are true, indicating that it is okay to couple the Tool.

5. Couple the Tool Changer.
   a. The **Unlatch** output is made false and the **Latch** output is made true.
   b. The **Unlocked** input goes false a short time later, indicating piston travel. Subsequently, the **Locked** input goes true, indicating that the coupling operation is complete.

6. Robot moves away from the Tool Stand with the Tool Changer coupled.
   a. The **TSI Limit Switch(es)** become deactivated, and the **TSIV** input(s) goes false.
   b. The **Out of Nest** output is made true when the Tool leaves the stand, disabling the **Unlatch** output.

Note: If the **Out of Nest** functionality is not used a single component failure of the limit switch in the "on" position may not be detected.

7. Normal operation
   a. The following inputs are true:
      i. **Locked**
      ii. **DeviceNet Power Good**
      iii. **Auxiliary Power Available**
      iv. **RTL** (RTL1 and RTL2)
      v. **Tool Present**
   b. The following inputs are false:
      i. **Unlocked**
      ii. **TSIV** (TSIV1 and TSIV2)

8. Robot moves into the Tool Stand with the Tool Changer coupled.
   a. When the Tool is returned to the stand, the **TSI Limit Switch(es)** become activated, and the **TSIV** input(s) goes true, indicating that it is safe to uncouple the Tool Changer.

9. Uncouple the Tool Changer.
   a. The **Out of Nest** output is made false.
   b. The **Latch** output is made false and the **Unlatch** output is made true.
   c. The **Locked** input goes false a short time later and subsequently the **Unlocked** input goes true, indicating that the uncoupling operation is complete.

10. Robot and Master move away from the Tool, are parallel and between 0.15" to 0.06" of the Tool.
    a. The **RTL** inputs are false.

11. Robot and Master move away from the Tool, are parallel and > 0.15" from the Tool.
    a. The **Tool Present** and **TSIV** input(s) are false.
    b. Communication is lost with the ATI Tool and downstream nodes.

12. Robot and Master in free space.
    a. The following inputs are true:
       i. **Unlocked**
       ii. **DeviceNet Power Good**
       iii. **Auxiliary Power Available**
    b. The following inputs are false:
       i. **Locked**
       ii. **RTL** (RTL1 and RTL2)
       iii. **TSIV (**TSIV1 and TSIV2)
       iv. **Tool Present**