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Glossary

Term	Definition
Application Processor 1 (AP1)	A board inside the Master module which controls solenoid outputs, monitors function of the unlatch valves for pressure and position, safety checking and diagnostics, reports sensor status, protects outputs against short circuit overload, detects and reports status of the 24V power supply, and provides cross monitoring of the pressure processor board.
Application Processor 2 (AP2)	A board inside the Master module which controls Unlatch Valve 2, reports the pressure inside the valve module, and provides cross monitoring of the Application Processor 1.
doLatchTool	The output supplied to the ATI Master module to couple the Tool Changer.
diOkToUnlatch	Indicates it is safe to proceed with an unlatch request.
diSafeSWMissing	An input indicating the TSI Safety Switch is bypassed with jumper plug.
doTCFaultReset	An output supplied to the ATI Master to clear all applicable error conditions.
diToolLatched	A proximity sensor input indicating that the coupling mechanism is in the Locked position.
diToolPresent	A hard connect input (sourced from the Tool) indicating the Master and Tool are electrically connected to each other.
diToolUnlatched	A proximity sensor input indicating that the coupling mechanism is in the Unlocked position.
doUnlatchTool	The output supplied to the ATI Master module to uncouple the Tool Changer.
EOAT	End Of Arm Tool (end effector).
Error on Latch Output	An input indicating a short circuit overload condition exists with the Latch Output.
Error on Unlatch Output	An input indicating a short circuit overload condition exists with the Unlatch Output.
Ethernet Switch	An Ethernet network component connecting multiple communication partners.
EtherNet/IP™	EtherNet/IP™ (Ethernet Industrial Protocol) is a fieldbus communication network, used mostly by devices in industrial settings, that communicates using Ethernet. EtherNet/IP™ is a trademark of ControlNet International Ltd. used under license by ODVA®.
Everything is OK	Everything is OK indicates that there are no detected errors in general, not just errors that affect unlatch. The spec says (AP1 Safety Error and AP2 Safety Error can be replaced with the single status “System is Unsafe”): The “Everything Is OK” status bit is high as long as none of the following errors are active: AP1 Safety Error, AP2_Safety_Error, “UNSAFE UNLATCH” error, “UNSAFE Latch” error, Motion not verified, Pressure Too High, Pressure Too Low, US1_Power_Present (this is an error when US1_Power_Present is low), Switched_Power_Good (this is an error when Switched_Power_Good is low).
Input Power Available	An input indicating input 24 VDC is present.
Unsafe Latch	An input indicating that an Latch command was received but not all conditions have been met, which could result in an unsafe Tool release and was therefore not processed.
Lock/Unlock Sensor Fault	An input indicating that the Locked and Unlocked inputs are high at the same time.
Output Power Available	An input indicating output 24 VDC is present.
Ready To Lock (RTL)	A proximity sensor that senses when the Master and Tool are close enough to couple. Used as a visual indicator for programming. Refer to *Section 4.1—Lock, Unlock, and Read-To-Lock (RTL) Sensor Cable LED Behavior*.
SSO1 and SSO2	Inputs from a safety switch, which are high when the Tool Changer is in the stand.
Tool Power is On	The “Tool Power is ON” bit is ON when the Arc Prevention Circuit has activated and is passing power to the Tool side. If this bit is low there will be neither input/logic power nor output power available on the Tool.
Tool-ID	Inputs from the Master node reporting the values from the Tool-ID switches on Tool module.
Tool Stand Interlock (TSI)	The tool stand interlock feature that only allows Tool release while in the stand or storage location. The TSI circuit consists of a TSI switch and relays.
TSI Safety Switch	A non-contact RFID switch is installed on the EOAT and is used to indicate that the EOAT is in the stand or storage location.
TSI Relay	A relay present in the ATI Master module that is driven by the closure of the TSI safety switch, therefore completing the TSI circuit and allowing the Tool Changer to be unlatched.

Term	Definition
Unsafe Unlatch	An input indicating that an Unlatch command was received but not all conditions have been met, which could result in an unsafe Tool release and was therefore is not processed.
V1Relay and V2Relay	Inputs from relays which should mirror the status of safety switch inputs SSO1 and SSO2.

C. Control and Signal Modules

DKL, DKLZ1—EtherNet/IP™ Control/Signal Module

1. Product Overview

The Master modules enable the customer to control and communicate with the Tool Changer through a network using an EtherNET/IP interface.

An EtherNET/IP node is established on the Master module, but not on the Tool module. Control of the Tool Changer is realized through the Master Node along with the reporting of various Tool Changer inputs and outputs (I/O). The Tool module supports Tool-ID reported through the Master and functions as a pass-through for EtherNET/IP network and power to downstream equipment.

The Master module is to be used with a valve adapter that contains dual double solenoid valves, for Latch/Unlatch control of the Tool Changer. The user is required to provide a pneumatic supply source to the Tool Changer. Refer to the appropriate valve adapter or Tool Changer manual for requirements.

In addition to supporting the standard Tool Changer input signals (Locked, Unlocked, etc.) the modules also support advanced diagnostic and fault reporting. Refer to *Figure 2.4.*

A Minifast connector is provided on the Master and Tool modules for interfacing with power. The power source for input and output power must be capable of outputting an operating voltage (reverse polarity protected, regulated) of 24 +/- 15% VDC. A D-coded M12 connector is provided on the Master and Tool modules for interfacing with EtherNET/IP. When the Tool Changer is coupled, the Master and Tool modules pass signals via spring loaded pin blocks. Flexible V-ring seals surround the pin blocks and are water resistant but are not water proof. Refer to *Figure 1.1*.

The Master/Tool modules has a safety circuit to allow the Tool Changer to be operated in the safest manner possible. To avoid unintentional Tool release, the power for the unlatch valve is routed through a safety switch connector. A safety switch must be connected to support this function. Refer to *Section 2.2—Safety System* for detailed information regarding the safety features of the EtherNET/IP control/signal modules.

1.1 DKL Master Module

The DKL-M allows a shorter amount of time for latch and unlatch operation to complete than the DKLZ1-M. The Master module has an integrated 4-pin valve signal pin block to provide the latch and unlatch signals to the solenoid valves. The Master module is equipped with (4) 3-pin M8 connectors for the RTL sensors (R1 and R2), Lock (L), and Unlock (U) sensor connections.

The Master module has integrated 3-pin M8 valve adapter proximity sensor and 4-pin M8 valve adapter pressure sensor connectors as part of the safety functionality.

The Master module also incorporates ATI's exclusive Arc Prevention Circuit which extends the life of all electrical power contacts by eliminating arcing caused by inductive loads and high inrush current during coupling/uncoupling. Refer to *Section 2.3—Arc Prevention Circuit* for additional information regarding the Arc Prevention Circuit.

The Master module provides status LEDs to visually indicate its operation.

An electrical interface is provided on the Master module for two integrated double solenoid valves (DC Voltage, sourcing type). The integrated valve is supplied from ATI as part of a dual double solenoid valve adapter. Refer to the Valve Adapter Manual for more information (9620-20-C-Jxx Valve Adapters with Dual Double Solenoid, Valve Pass-through, Proximity and Pressure Sensors). Electrical interface drawings and connector details are provided in drawings in *Section 9—Drawings*.

1.2 DKLZ1 Master Module

The DKLZ1-M allows 8 seconds for latch and unlatch operation to complete instead of the 1.5 seconds allowed by the DKL-M. The Master module has an integrated 4-pin valve signal pin block to provide the latch and unlatch signals to the solenoid valves. The Master module is equipped with (4) 3-pin M8 connectors for the RTL sensors (R1 and R2), Lock (L), and Unlock (U) sensor connections.

The Master module has integrated 3-pin M8 valve adapter proximity sensor and 4-pin M8 valve adapter pressure sensor connectors as part of the safety functionality.

The Master module also incorporates ATI's exclusive Arc Prevention Circuit which extends the life of all electrical power contacts by eliminating arcing caused by inductive loads and high inrush current during coupling/uncoupling. Refer to *Section 2.3—Arc Prevention Circuit* for additional information regarding the Arc Prevention Circuit.

The Master module provides status LEDs to visually indicate its operation.

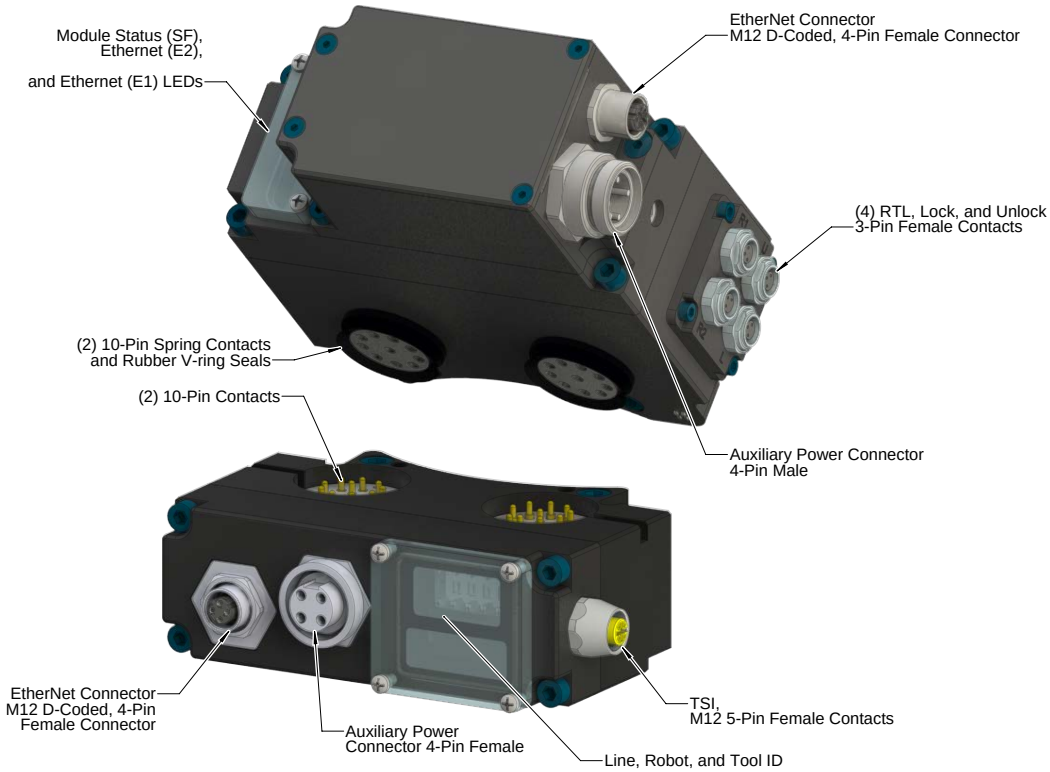
An electrical interface is provided on the Master module for two integrated double solenoid valves (DC Voltage, sourcing type). The integrated valve is supplied from ATI as part of a dual double solenoid valve adapter. Refer to the Valve Adapter Manual for more information (9620-20-C-Jxx Valve Adapters with Dual Double Solenoid, Valve Pass-through, Proximity and Pressure Sensors). Electrical interface drawings and connector details are provided in drawings in *Section 9—Drawings*.

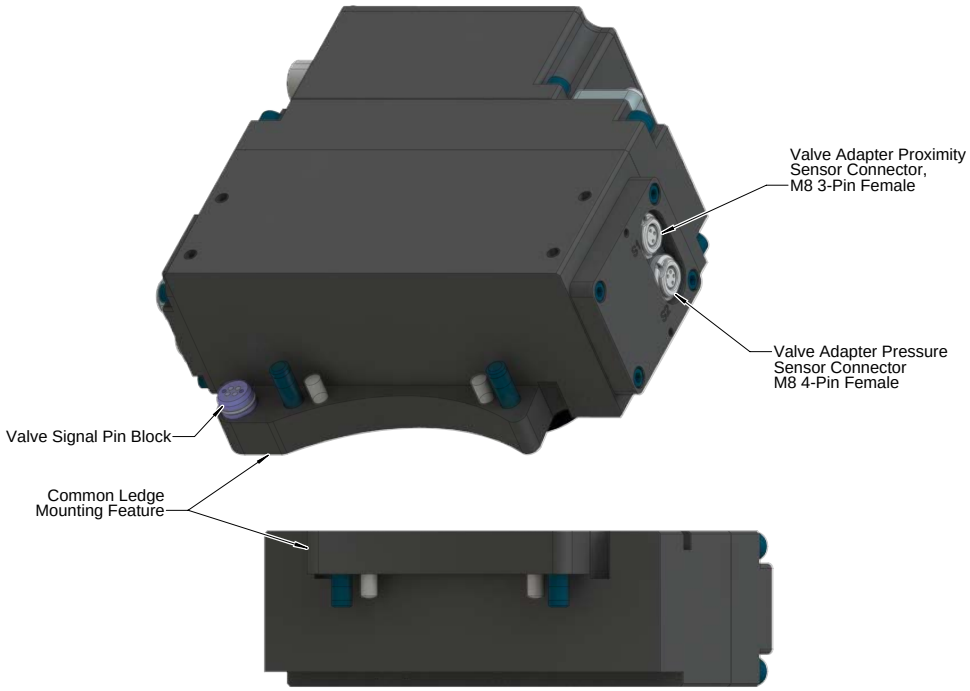
1.3 DKL Tool Module

The Tool module requires a JR4-T Spacer module to align the Master and Tool modules and mounts to the Tool plate of the Tool Changer. A 5-pin M12 connector provides connection to the non-contact safety switch that is integrated into the safety circuit.

The Tool module has a series of push button 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 2.5—Software* for EtherNET/IP bitmap and detailed I/O information.

Figure 1.1—Modules





2. Product Information

Prior to using the Tool Changer and the EtherNET/IP modules, several hardware settings must be configured. Communicating with the EtherNET/IP modules requires knowledge of EtherNET/IP standards and operation.

2.1 Master Module Information

The module operates as a Server on the EtherNET/IP network. It supports Class 3 Connected Explicit Messaging, UCMM Explicit Messaging, and Class 1 Connected Cyclic I/O Messaging. The Master Node does not support any client functionality.

2.1.1 Class 1 Connection Information

Table 2.1 lists the Class 1 Connection Information for the Master module.

Table 2.1—Class 1 Connection Information

	Instance	Size in Bytes	32 bit "Run/idle" Header
Configuration	1	0	No
Input	101	16	Yes
Output	100	8	Yes

Note:

1. *For scanners that do not support Run/Idle Header in Target to Originator (T->O) data, the output IO size will be 12 bytes. The first 4 bytes are the header, which can be ignored.*

2.1.2 Integrated Web Server

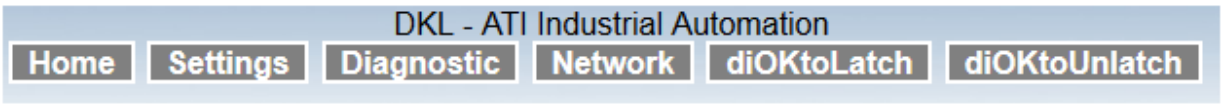
The module's integrated web server hosts the following webpages:

- **Home** - The 'Home' page is the first that comes up. It reports the MAC address of the module. Refer to *Figure 2.1*.
- **Settings** - This page is used to change settings IP address, mask, gateway, or mode. Refer to *Figure 2.3*.
- **Diagnostics** - This page contains Device Information, EtherNET/IP Status, and the entire Master module I/O map. Refer to *Figure 2.4* and *Figure 2.5*.
- **Network** - This page contains Network Switch Configurations (Robot and Tool side ports) and Network Counters. Refer to *Figure 2.6*.
- **diOktoLatch** - This page contains status of conditions that are contained in the diOktoLatch bit. Refer to *Figure 2.7*.
- **diOktoUnlatch** - This page contains status of conditions that are contained in the diOktoUnlatch bit. Refer to *Figure 2.9*.

A web browser, such as Microsoft Edge® or , is required to access the web server. The module's web pages use simple HTML and do not require any plug ins. To access the 'Settings' page, an username and password are required therefore a laptop is required. Username and password are provided in *Section 2.1.3—Setting Page Password Prompt*.

To bring up the main page of the web server, type "http://" and then type the module's IP address into the browser's address field and then press Enter.

Figure 2.1—Master Module Integrated Web Server Home Page



DKL Toolchanger

Welcome to the administration interface of your ATI Industrial Automation DKL device

Here you can set different operating parameters and execute remote functions.

Device Information

Property	Value
MAC Address:	00:02:a2:3a:43:65

Back to Top

2.1.3 Setting Page Password Prompt

The first time the Settings tab is selected, a pop up window will appear that prompts for the user name and the password. The user name is **admin** and the password is **admin**.

Figure 2.2—Password Prompt

2.1.4 IP Address Configuration

The Master module IP address settings are only loaded upon power up, consequently the Master module must be power cycled for new IP address setting changes to be used. There are four ways the Master module IP address can be configured. Also, see *Section 2.1.8—Master Module DIP Switches*.

The Master module default settings are:

- DHCP disabled
- IP address is set to 192.168.1.54. The subnet mask is 255.255.255.0 and the Gateway is set to 0.0.0.0.
- Last octet set by Master module dip switches

NOTICE: When replacing the window, ensure that the seal is re-positioned correctly to prevent fluid ingress.

The plastic window will have to be removed to access the DIP switches, as shown in *Section 9—Drawings*.

NOTICE: If the DIP switches 1-8 are all set to ON position (DIP switches value of 255) the switch settings will be set to the default settings.

NOTICE: If DIP switch 9 and/or all 1-8 are in ON position, the IP address will be set to the default settings. The settings will revert back to the previously stored settings when switches 1-9 are all in OFF position.

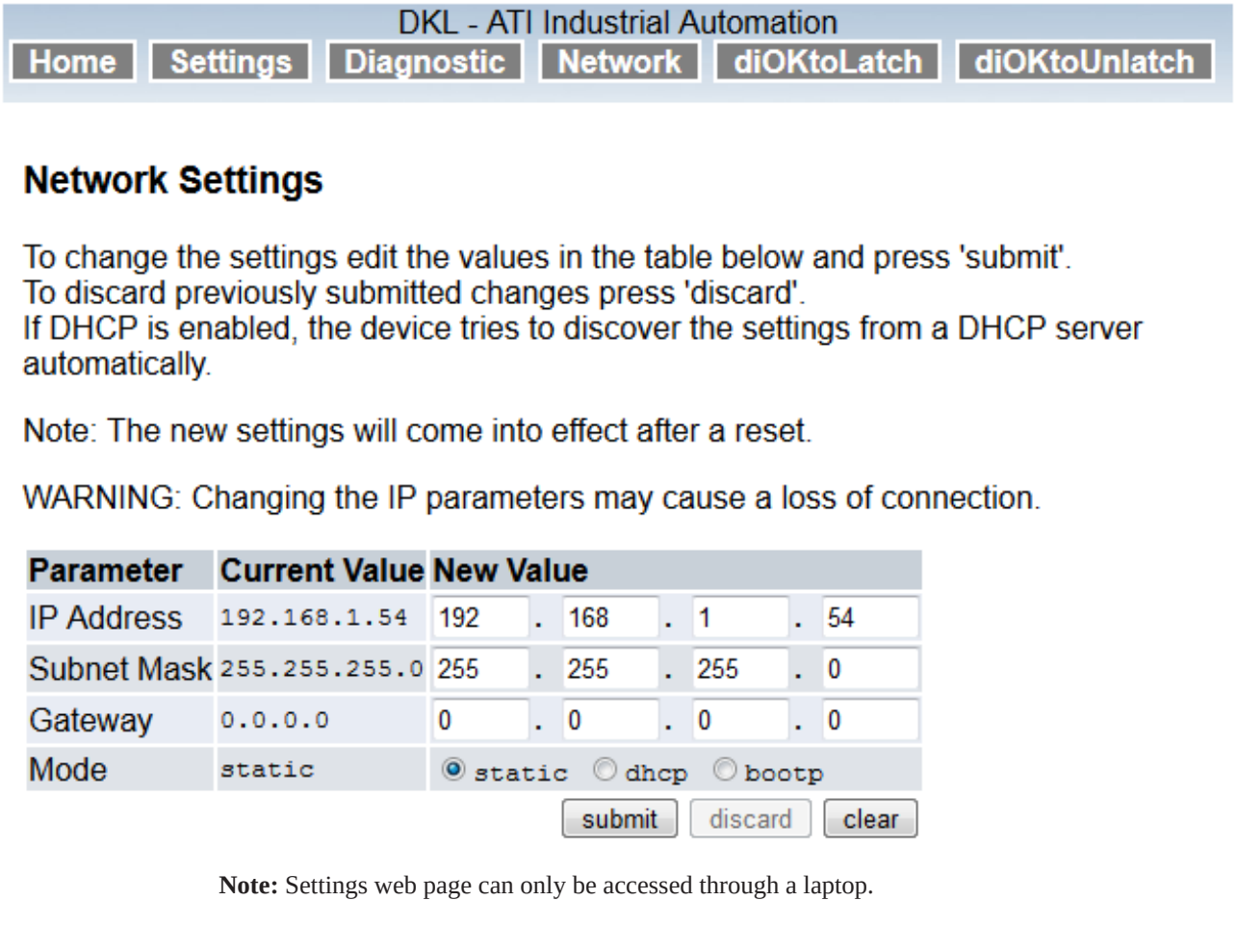
Method 1 (Laptop Only): The Master module Settings web page allows the user to change the first three octets of the IP address to a stored value and the last octet of the IP address be set by the module's DIP switches 1–8 at power up (DIP switch 9 must be set to the OFF position and the mode on the Settings page is set to "Static"). Refer to *Figure 2.12* for an example of DIP switch settings.

Method 2 (Laptop Only): Manually enter the entire IP address to a stored static value on the Master module Settings web page (DIP switches 1-9 must be set to the OFF position and the mode on the Settings page is set to "Static").

Method 3: Set IP address to 192.168.1.54 (default setting) by setting DIP switch 9 to ON. If DIP switch 9 is set to ON during power up, the IP address will be set to the 192.168.1.54, regardless of the DHCP server, manual entered webpage IP Address, or DIP Switch 1-8 settings. The gateway will be set to the default value of 0.0.0.0, and the subnet mask to the default value of 255.255.255.0.

Method 4: Let a DHCP server automatically assign an IP address at each power up (DIP switch 9 must be set to OFF). If used, this option can be enabled in the Master module Settings page (set the mode to "dhcp"). To use this method, a DHCP server must be present in the network. If no DHCP server is responding within 30 seconds after power up, the Master module will use the static IP address that is stored on the network settings page of the web server, regardless of the value of DIP switches 1–8 for the last octet.

Figure 2.3—Master Module Settings Page



Note: Settings web page can only be accessed through a laptop.

2.1.5 Ethernet Switch Settings

The Master module has an integrated Ethernet switch. The Master module is shipped with the following switch settings:

Robot Side Port:

Auto Negotiation:	Enabled
Speed:	100 MPS
Duplex:	Full Duplex
Auto-MDIX :	Enabled
MDI Setting:	MDI

Tool Side Port:

Auto Negotiation:	Disabled
Speed:	100 MPS
Duplex:	Full Duplex
Auto-MDIX:	Disabled
MDI Setting:	MDI-X

Notes:

Auto-MDIX = Auto Crossover

MDIX = Crossover

These settings support EtherNET/IP Quick Connect.

On the module's Diagnostics page of the web server (see *Figure 2.4*), the Master module displays the current device information, device state, and network information. The webpage must be refreshed to reflect current status. When errors are reported, they are displayed in red just below the ATI banner. Refer to *Figure 2.5*.

Under the "Device Info" header, the current Tool-ID, Pressure Reading, and Firmware Versions are displayed.

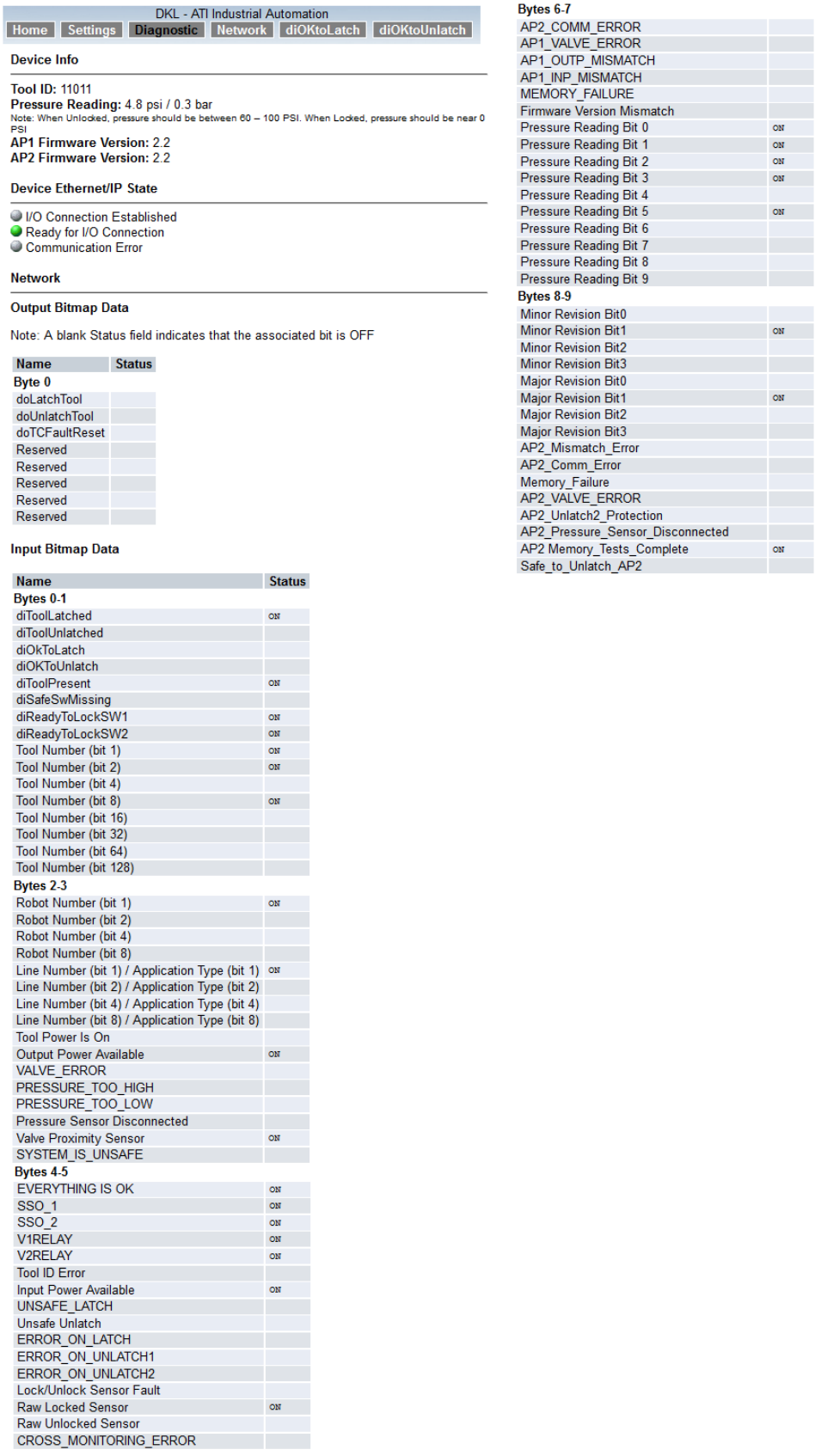
Under the "Device EtherNET/IP State" header, "I/O Connection Established", "Ready for I/O Connection", and "Communication Error" are displayed.

Table 2.2—Device EtherNET/IP State LED's

LED	Meaning	Color	State
I/O Connection Established	Shows whether the device is connected to and communicating on the EtherNET/IP network	Green	In Communication state
		Gray	Not in Communication state
Ready for I/O Connection	Shows whether the device has been started correctly and can accept a new slave configuration	Green	Device ready
		Gray	Device not ready
Communication Error	Shows whether an error occurred while trying to communicate with the device	Red	Error
		Gray	No error

Under the "Network" header, the status of bitmap data is displayed.

Figure 2.4—Master Module Diagnostics Page



DKL - ATI Industrial Automation

Home | Settings | Diagnostic | Network | diOKtoLatch | diOKtoUnlatch

Device Info

Tool ID: 11011
Pressure Reading: 4.8 psi / 0.3 bar
Note: When Unlocked, pressure should be between 60 – 100 PSI. When Locked, pressure should be near 0 PSI
AP1 Firmware Version: 2.2
AP2 Firmware Version: 2.2

Device Ethernet/IP State

- I/O Connection Established
- Ready for I/O Connection
- Communication Error

Network

Output Bitmap Data

Note: A blank Status field indicates that the associated bit is OFF

Name	Status
Byte 0	
doLatchTool	
doUnlatchTool	
doTCFaultReset	
Reserved	
Reserved	
Reserved	
Reserved	
Reserved	

Input Bitmap Data

Name	Status
Bytes 0-1	
diToolLatched	ON
diToolUnlatched	
diOkToLatch	
diOKToUnlatch	
diToolPresent	ON
diSafeSwMissing	
diReadyToLockSW1	ON
diReadyToLockSW2	ON
Tool Number (bit 1)	ON
Tool Number (bit 2)	ON
Tool Number (bit 4)	
Tool Number (bit 8)	ON
Tool Number (bit 16)	
Tool Number (bit 32)	
Tool Number (bit 64)	
Tool Number (bit 128)	
Bytes 2-3	
Robot Number (bit 1)	ON
Robot Number (bit 2)	
Robot Number (bit 4)	
Robot Number (bit 8)	
Line Number (bit 1) / Application Type (bit 1)	ON
Line Number (bit 2) / Application Type (bit 2)	
Line Number (bit 4) / Application Type (bit 4)	
Line Number (bit 8) / Application Type (bit 8)	
Tool Power Is On	
Output Power Available	ON
VALVE_ERROR	
PRESSURE_TOO_HIGH	
PRESSURE_TOO_LOW	
Pressure Sensor Disconnected	
Valve Proximity Sensor	ON
SYSTEM_IS_UNSAFE	
Bytes 4-5	
EVERYTHING IS OK	ON
SSO_1	ON
SSO_2	ON
V1RELAY	ON
V2RELAY	ON
Tool ID Error	
Input Power Available	ON
UNSAFE_LATCH	
Unsafe Unlatch	
ERROR_ON_LATCH	
ERROR_ON_UNLATCH1	
ERROR_ON_UNLATCH2	
Lock/Unlock Sensor Fault	
Raw Locked Sensor	ON
Raw Unlocked Sensor	
CROSS_MONITORING_ERROR	

Bytes 6-7

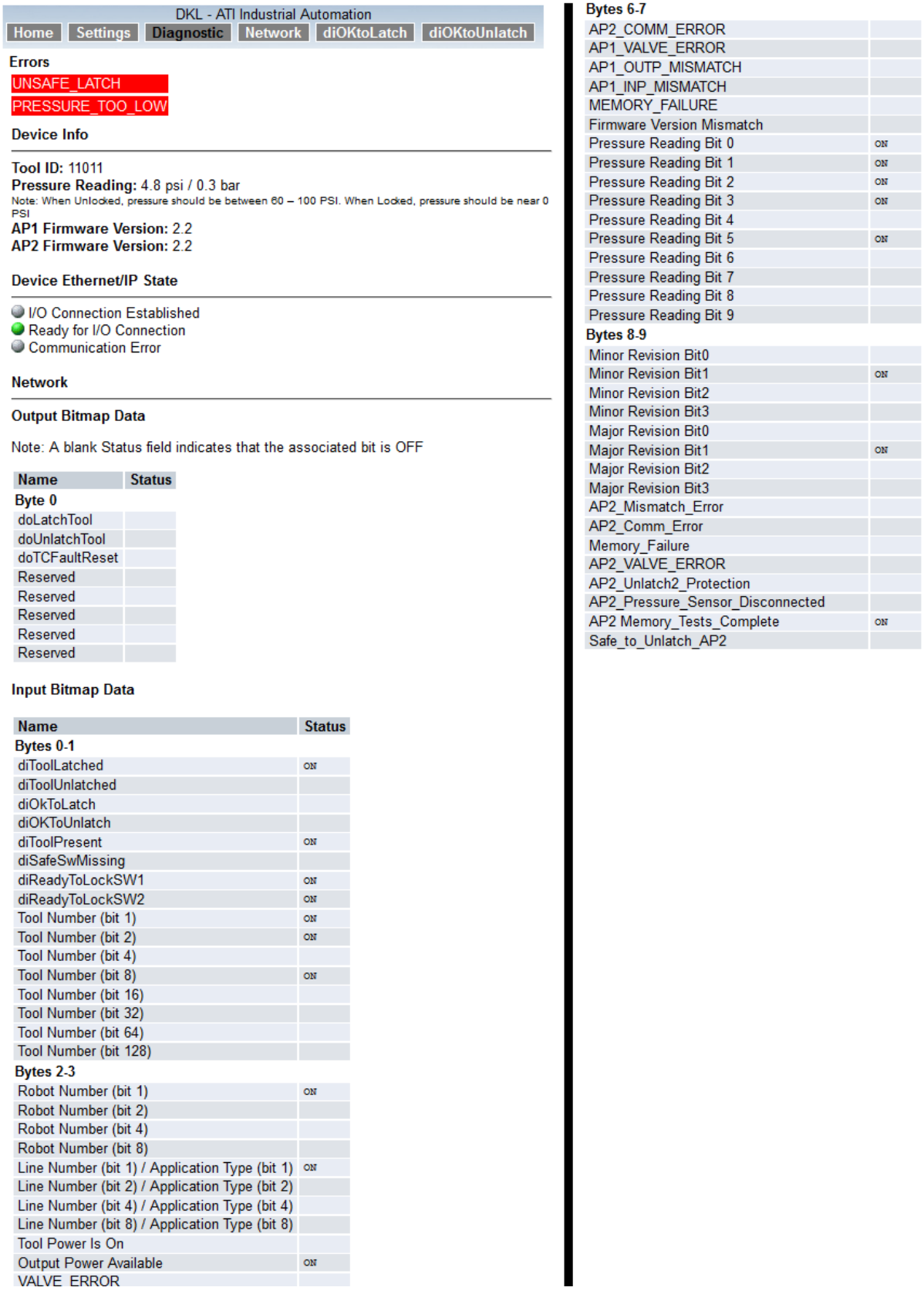
AP2_COMM_ERROR	
AP1_VALVE_ERROR	
AP1_OUTP_MISMATCH	
AP1_INP_MISMATCH	
MEMORY_FAILURE	
Firmware Version Mismatch	
Pressure Reading Bit 0	ON
Pressure Reading Bit 1	ON
Pressure Reading Bit 2	ON
Pressure Reading Bit 3	ON
Pressure Reading Bit 4	
Pressure Reading Bit 5	ON
Pressure Reading Bit 6	
Pressure Reading Bit 7	
Pressure Reading Bit 8	
Pressure Reading Bit 9	

Bytes 8-9

Minor Revision Bit0	
Minor Revision Bit1	ON
Minor Revision Bit2	
Minor Revision Bit3	
Major Revision Bit0	
Major Revision Bit1	ON
Major Revision Bit2	
Major Revision Bit3	
AP2_Mismatch_Error	
AP2_Comm_Error	
Memory_Failure	
AP2_VALVE_ERROR	
AP2_Unlatch2_Protection	
AP2_Pressure_Sensor_Disconnected	
AP2 Memory_Tests_Complete	ON
Safe_to_Unlatch_AP2	

Note: Webpage must be refreshed to reflect current status.

Figure 2.5—Master Module Diagnostics Page (Errors Displayed)



DKL - ATI Industrial Automation

Home | Settings | Diagnostic | Network | diOKtoLatch | diOKtoUnlatch

Errors

UNSAFE_LATCH
PRESSURE_TOO_LOW

Device Info

Tool ID: 11011
Pressure Reading: 4.8 psi / 0.3 bar
Note: When Unlocked, pressure should be between 60 – 100 PSI. When Locked, pressure should be near 0 PSI
AP1 Firmware Version: 2.2
AP2 Firmware Version: 2.2

Device Ethernet/IP State

I/O Connection Established
Ready for I/O Connection
Communication Error

Network

Output Bitmap Data

Note: A blank Status field indicates that the associated bit is OFF

Name	Status
Byte 0	
doLatchTool	
doUnlatchTool	
doTCFaultReset	
Reserved	
Reserved	
Reserved	
Reserved	
Reserved	

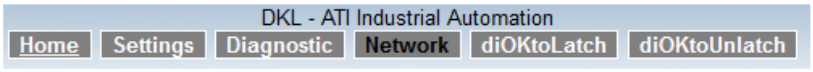
Input Bitmap Data

Name	Status
Bytes 0-1	
diToolLatched	ON
diToolUnlatched	
diOkToLatch	
diOKToUnlatch	
diToolPresent	ON
diSafeSwMissing	
diReadyToLockSW1	ON
diReadyToLockSW2	ON
Tool Number (bit 1)	ON
Tool Number (bit 2)	ON
Tool Number (bit 4)	
Tool Number (bit 8)	ON
Tool Number (bit 16)	
Tool Number (bit 32)	
Tool Number (bit 64)	
Tool Number (bit 128)	
Bytes 2-3	
Robot Number (bit 1)	ON
Robot Number (bit 2)	
Robot Number (bit 4)	
Robot Number (bit 8)	
Line Number (bit 1) / Application Type (bit 1)	ON
Line Number (bit 2) / Application Type (bit 2)	
Line Number (bit 4) / Application Type (bit 4)	
Line Number (bit 8) / Application Type (bit 8)	
Tool Power Is On	
Output Power Available	ON
VALVE_ERROR	

Bytes 6-7	
AP2_COMM_ERROR	
AP1_VALVE_ERROR	
AP1_OUTP_MISMATCH	
AP1_INP_MISMATCH	
MEMORY_FAILURE	
Firmware Version Mismatch	
Pressure Reading Bit 0	ON
Pressure Reading Bit 1	ON
Pressure Reading Bit 2	ON
Pressure Reading Bit 3	ON
Pressure Reading Bit 4	
Pressure Reading Bit 5	ON
Pressure Reading Bit 6	
Pressure Reading Bit 7	
Pressure Reading Bit 8	
Pressure Reading Bit 9	
Bytes 8-9	
Minor Revision Bit0	
Minor Revision Bit1	ON
Minor Revision Bit2	
Minor Revision Bit3	
Major Revision Bit0	
Major Revision Bit1	ON
Major Revision Bit2	
Major Revision Bit3	
AP2_Mismatch_Error	
AP2_Comm_Error	
Memory_Failure	
AP2_VALVE_ERROR	
AP2_Unlatch2_Protection	
AP2_Pressure_Sensor_Disconnected	
AP2 Memory_Tests_Complete	ON
Safe_to_Unlatch_AP2	

Note: Webpage must be refreshed to reflect current status.

Figure 2.6—Network Page



Network Switch Configuration

Robot Side Port

Property	Value
Auto-Negotiation	Yes
Duplex Operation	-
Port Speed	-
MDI Setting	Auto MDI-X

Tool Side Port

Property	Value
Auto-Negotiation	No
Duplex Operation	Full
Port Speed	100 MBit/s
MDI Setting	MDI-X

Network Counters

Interface Counters

Property	Value
Bytes Received	97587
Unicast Packets Received	370
Non-unicast Packets Received	0
Inbound Packets Discarded	0
Inbound Packet Errors	0
Inbound Unknown Protocol	68
Bytes Sent	295348
Unicast Packets Sent	558
Non-unicast Packets Sent	0
Outbound Packets Discarded	3
Outbound Packet Errors	0

Media Counters

Property	Value
Alignment Errors	0
FCS Errors	0
Single Collisions	0
Multiple Collisions	0
SQE Test Errors	0
Deferred Transmissions	0
Late Collisions	0
Excessive Collisions	0
MAC Transmit Errors	3
Carrier Sense Errors	0
Frame Too Long	0
MAC Receive Errors	0

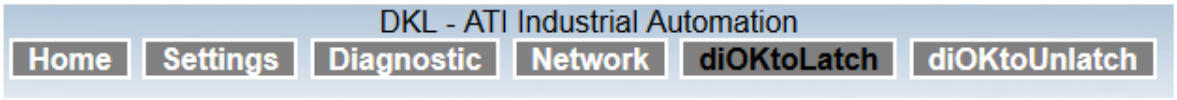
Back to Top

Note: Webpage must be refreshed to reflect current status.

2.1.6 diOktoLatch

This page contains status of preconditions and the required status of the conditions for the diOktoLatch bit to be ON. If the status required for Input or Output bit is ON then the status should be ON. If the status required for the Input or Output bit is OFF then status should be blank indicating the status is OFF. Green signifies condition has met requirement and red signifies condition has not met requirement (refer to *Figure 2.7* and *Figure 2.8*).

Figure 2.7—diOktoLatch Page



diOKtoLatch Status: ON

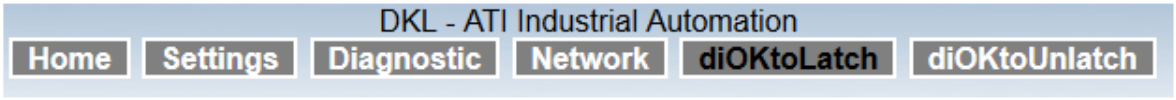
Note: A green Status field indicates that the bit status matches the Status Required field

Property	Status Required	Status
SYSTEM_IS_UNSAFE	OFF	OFF
Input Power Available	ON	ON
Output Power Available	ON	ON
PRESSURE_TOO_HIGH	OFF	OFF
PRESSURE_TOO_LOW	OFF	OFF
diToolLatched	OFF	OFF
doLatchTool	OFF	OFF
doUnlatchTool	OFF	OFF
AP2_Safety_Error	OFF	OFF

Back to Top

Note: Webpage must be refreshed to reflect current status.

Figure 2.8—diOktoLatch Page (Errors Displayed)



diOKtoLatch Status: OFF

Note: A green Status field indicates that the bit status matches the Status Required field

Property	Status Required	Status
SYSTEM_IS_UNSAFE	OFF	ON
Input Power Available	ON	ON
Output Power Available	ON	ON
PRESSURE_TOO_HIGH	OFF	ON
PRESSURE_TOO_LOW	OFF	OFF
diToolLatched	OFF	OFF
doLatchTool	OFF	OFF
doUnlatchTool	OFF	OFF
AP2_Safety_Error	OFF	ON

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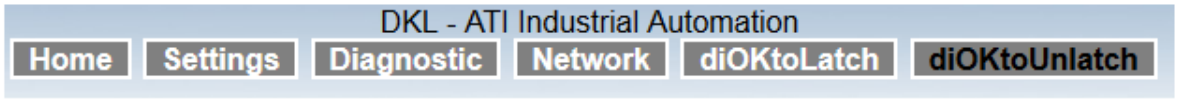
Note: Webpage must be refreshed to reflect current status.

2.1.7 diOKtoUnlatch

This page contains status of preconditions and the required status of the conditions for the diOKtoUnlatch bit to be ON. If the status required for Input or Output bit is ON then the status should be ON. If the status required for the Input or Output bit is OFF then status should be blank indicating the status is OFF. Green signifies condition has met requirement and red signifies condition has not met requirement (Refer to *Figure 2.9* and *Figure 2.10*).

Figure 2.9—diOktoUnlatch Page



diOKtoUnlatch Status: ON

Note: A green Status field indicates that the bit status matches the Status Required field

Property	Status Required	Status
AP1 Memory_Tests_Complete	ON	ON
AP2 Memory_Tests_Complete	ON	ON
V1RELAY	ON	ON
V2RELAY	ON	ON
SSO_1	ON	ON
SSO_2	ON	ON
AP2 V1Relay	ON	ON
AP2 V2Relay	ON	ON
diToolUnlatched	OFF	OFF
Unlatch_Valve_Control_2	OFF	OFF
AP2_Safety_Error	OFF	OFF
doLatchTool	OFF	OFF
doUnlatchTool	OFF	OFF
Input Power Available	ON	ON
Output Power Available	ON	ON
PRESSURE_TOO_HIGH	OFF	OFF
PRESSURE_TOO_LOW	OFF	OFF
SYSTEM_IS_UNSAFE	OFF	OFF

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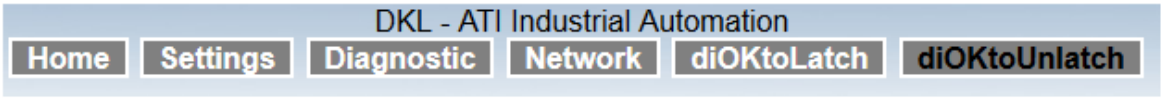
Note: Webpage must be refreshed to reflect current status.

Figure 2.10—diOktoUnlatch Page (Errors Displayed)



diOKtoUnlatch Status: OFF

Note: A green Status field indicates that the bit status matches the Status Required field

Property	Status Required	Status
AP1 Memory_Tests_Complete	ON	ON
AP2 Memory_Tests_Complete	ON	ON
V1RELAY	ON	OFF
V2RELAY	ON	OFF
SSO_1	ON	OFF
SSO_2	ON	OFF
AP2 V1Relay	ON	OFF
AP2 V2Relay	ON	OFF
diToolUnlatched	OFF	OFF
Unlatch_Valve_Control_2	OFF	OFF
AP2_Safety_Error	OFF	ON
doLatchTool	OFF	OFF
doUnlatchTool	OFF	OFF
Input Power Available	ON	ON
Output Power Available	ON	ON
PRESSURE_TOO_HIGH	OFF	ON
PRESSURE_TOO_LOW	OFF	OFF
SYSTEM_IS_UNSAFE	OFF	ON

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Note: Webpage must be refreshed to reflect current status.

2.1.8 Master Module DIP Switches

The Master module has 10 DIP switches which have the following functions:

DIP 1 through 8:	Last octet of the Master module's IP address.
DIP 9:	Set Master module IP address settings to the default values.
DIP 10:	Must always be in the OFF position

Figure 2.11—EtherNET/IP Master Module LEDs and DIP Switches

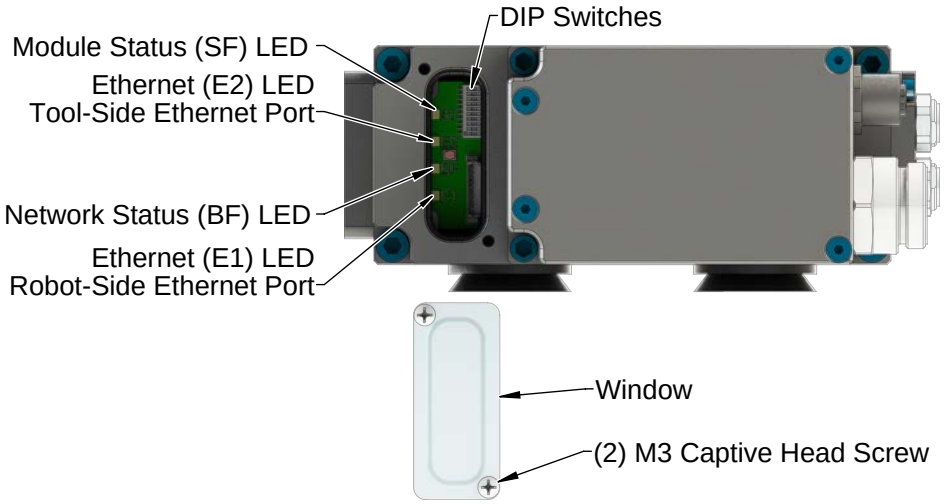
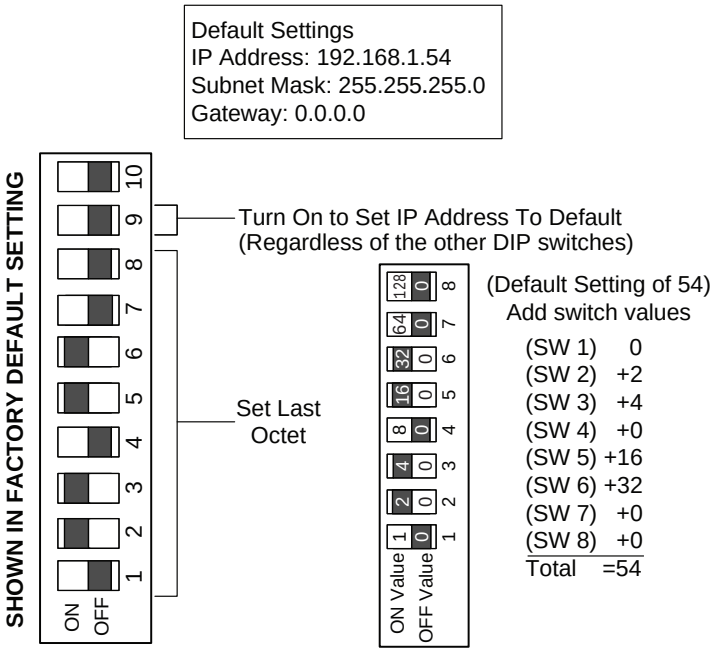


Figure 2.12—EtherNET/IP Master Module DIP Switch Settings



2.1.9 Master Module LEDs

When the modules are coupled and functioning properly, the Master module LEDs should display as shown in *Figure 2.13* with the E1 and the E2 LEDs blinking based on the EIP communication.

Figure 2.13—LED Display of Properly Functioning Coupled Modules

Module Status (SF) status LED is identified on the module as “SF”. It provides device status for power and proper operation. Refer to *Table 2.3* for an outline of this LED’s operation.

Network Status (BF) status LED is identified on the module as “BF”. It provides EtherNET/IP status information. Refer to *Table 2.4* for an outline of this LED’s operation.

Table 2.3—Module Status (SF) LED

Status	LED	Note
No Power	Off	No power applied. Check if voltage is 24VDC.
Operational	Green	Normal operation
Fault	Red	After power up, if data exchange between netIC and microcontroller are not completed or during operation if data exchange times out.
Fault	Red blinking	Communication error with Tool module

Table 2.4—Network Status (BF) LED

Status	LED	Note
Off Line	Off	Device not on line. Device may not have an IP address or it may be powered off.
Operational	Green	Normal operation
Not Ok	Red	No configuration
Not Ok	Red blinking	No data exchange (module is offline)

The Ethernet LEDs are provide information about link status and activity on the ports of the integrated Ethernet switch. The Ethernet 1 (E1) LED displays the status of the robot side Ethernet port. The Ethernet 2 (E2) LED displays the status of the Tool side Ethernet port.

Table 2.5—Master Module Ethernet 1 (E1) and Ethernet 2 (E2) LEDs

Status	LED Function	Note
No Link	Off	The Master module has no connection to the Ethernet.
Link	Green	The Master is connected to the Ethernet but there is currently no data exchange activity.
Active RX/TX	Blinking Red	There is sporadic data exchange activity with the Ethernet.
EtherNET/IP connection established	Red	There is continuous data exchange activity with the Ethernet.

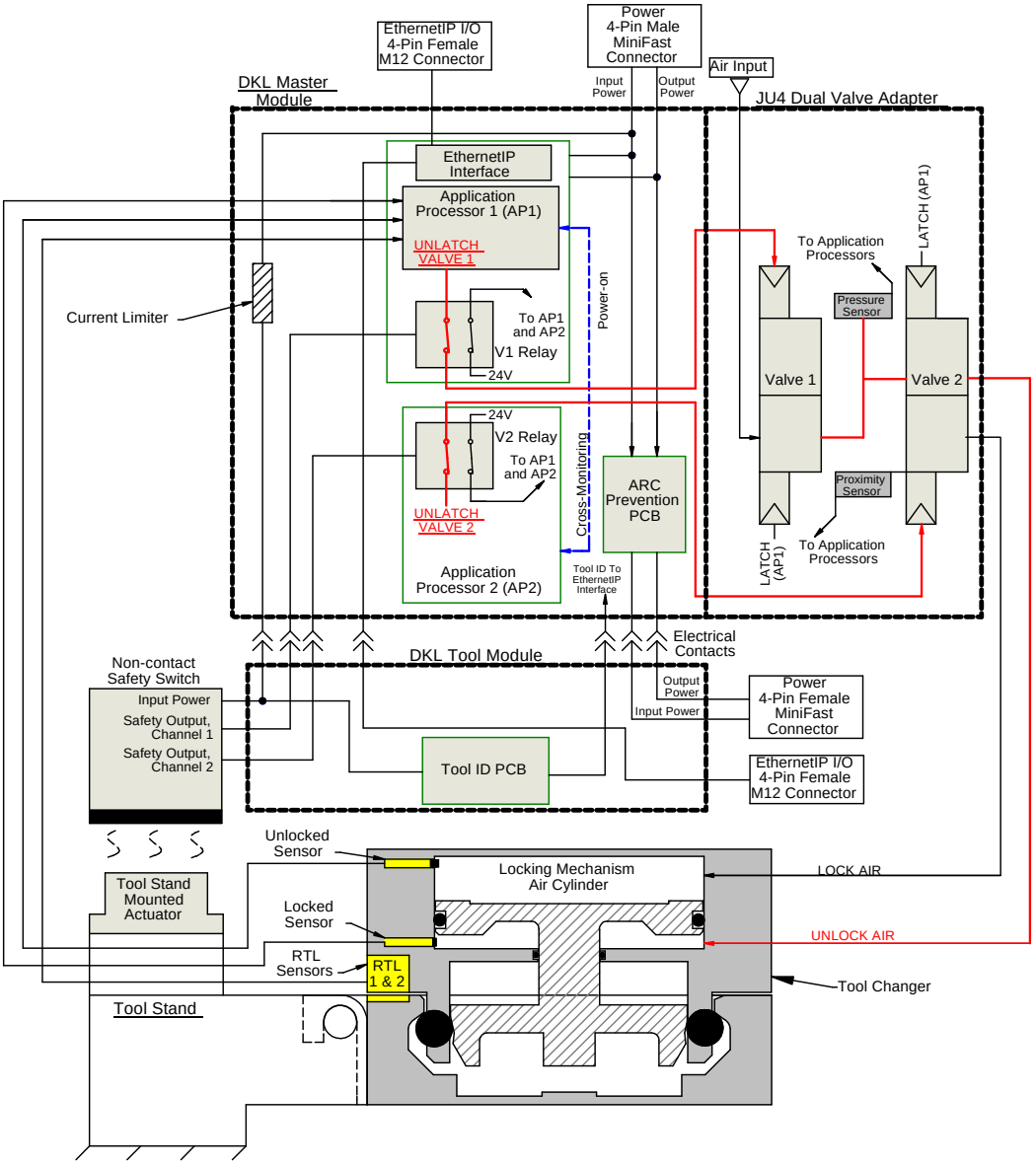
2.2 Safety System

The safety system is designed to avoid unintentional Tool release, by integrating a non-contact safety switch, two pneumatically interconnected solenoid valves, dual relays, and two cross monitoring processors into the safety circuit.

The two cross monitoring processors in the Master module will determine, based on the status of all the safety related inputs and outputs, when it is safe to execute an Unlatch command. The processors are linked by hardwired I/O. If one processor detects a condition that differs from the other processor, its control logic will declare a fault preventing the unlatch output. When the Tool is positioned safely in the tool stand or storage location, the safety switch outputs will close the V1 and V2 relays allowing the Unlatch command to pass from the Application Processors to the solenoid valves.

A second set of contacts on the V1 and V2 relays also provide diagnostics to the Application Processors. The dual valve adapter is equipped with two double solenoid valves. Valve adapter pressure and proximity sensor outputs are evaluated by the Application Processors for diagnostic purposes.

Figure 2.14—Safety Circuit Diagram

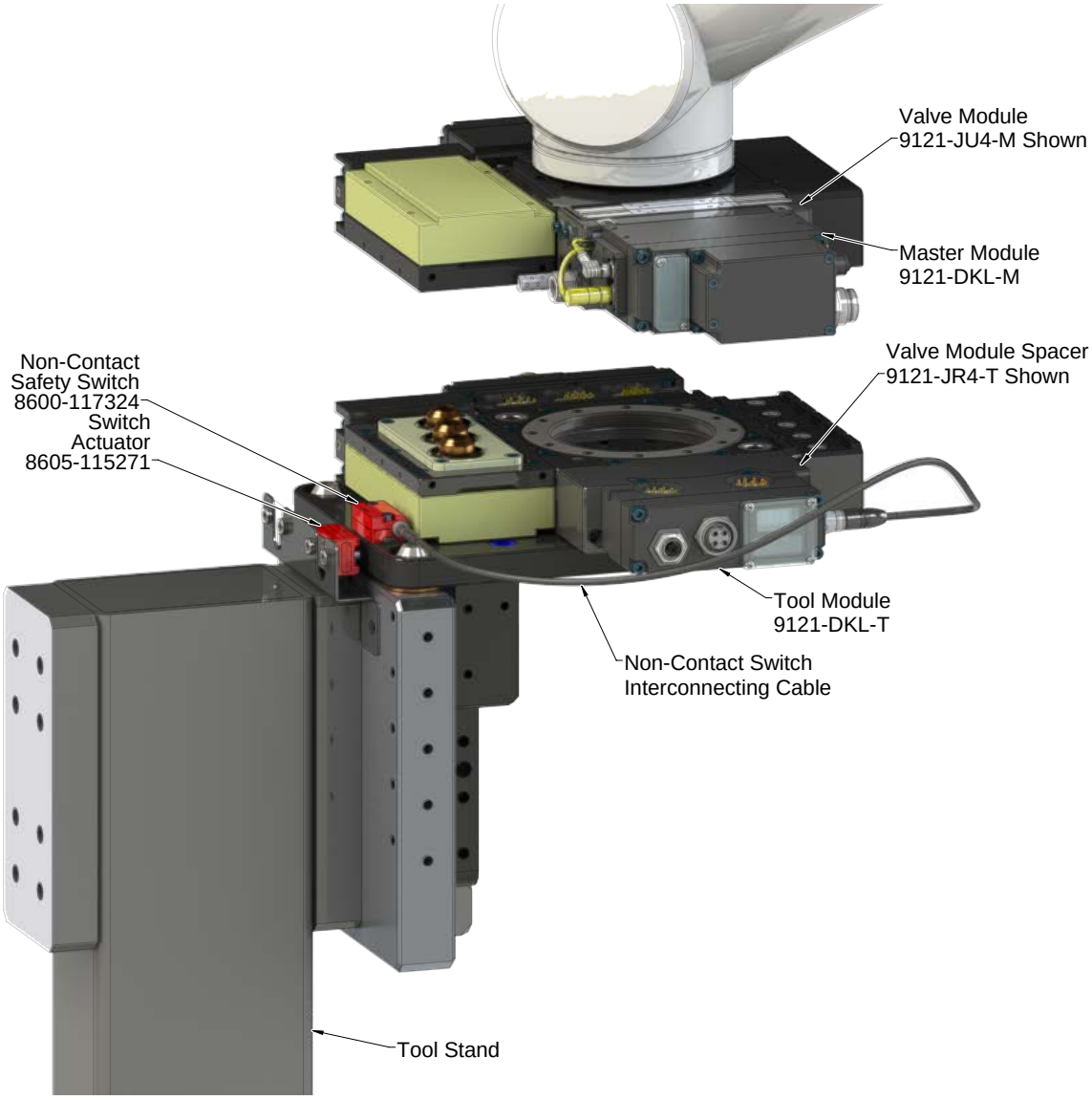


The safety switch (not included with module) is connected to the Tool side module and the actuator is mounted to the tool stand. The safety switch is connected to the Tool module by a five conductor M12 cable.

Refer to the Dual Double Solenoid Valve Adapter Manual (9620-20-C-Jxx Valve Adapters with Dual Double Solenoid, Valve Pass-through, Proximity and Pressure Sensors) for detailed information on the dual double solenoid valve functionality.

CAUTION: It is required to use a PLe rated non-contact safety switch such as the Euchner with the module. Use of unapproved switches will void the PLd safety rating. Contact ATI before using another safety rated switch.

Figure 2.15—Safety Switch



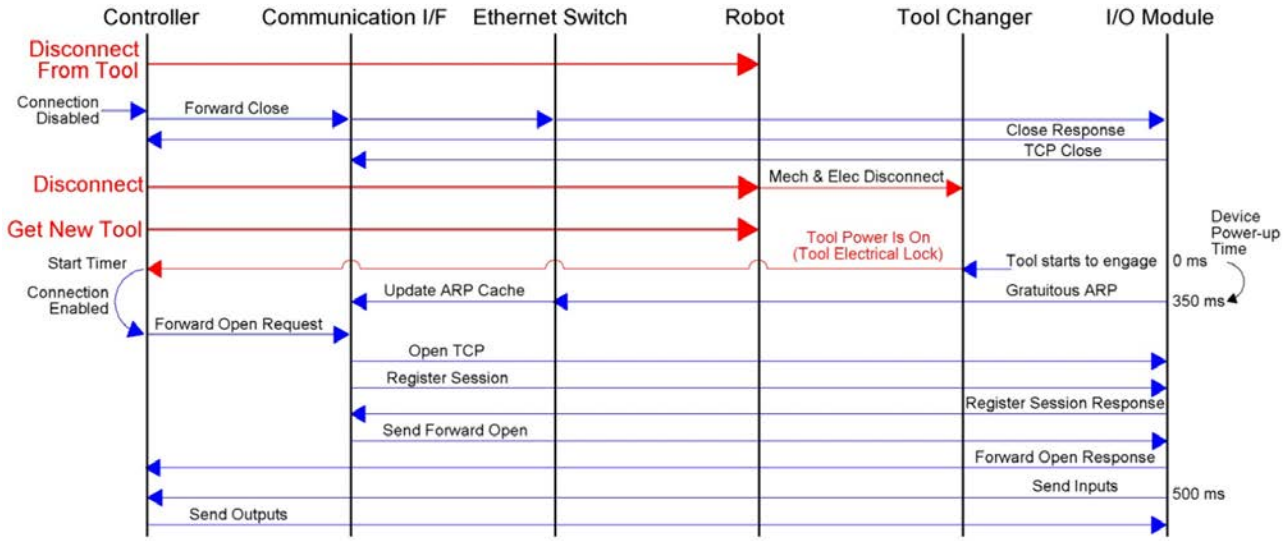
2.2.1 Using EtherNET/IP™ Quick Connect

Using EtherNET/IP Quick Connect requires that the Tool Changer reports to the PLC when it is making electrical contact between Master and Tool before the PLC can start communicating to any downstream nodes.

The “Tool Power is On” signal for EtherNET/IP Quick Connect indicates to the controller that all electrical connections to the Tool side devices are made and power is applied. This signal comes from the Tool Changer. The Master module reports “Tool Power is On” in the bitmap (Byte 3, bit 0 - refer to *Section 2.5—Software*).

In *Figure 2.16* actions shown in red are the typical application actions but may vary and are outside the scope of the manual. Refer to section E-3 of the ODVA EtherNET/IP specification (Edition 1.14) for specific requirements and actions of the controller.

Figure 2.16—Quick Connect Sequence Diagram



2.3 Arc Prevention Circuit

The Master module incorporates ATI's exclusive Arc Prevention Circuit. The Arc Prevention Circuit extends the life of all electrical power contacts by eliminating arcing caused by inductive loads and high inrush current during coupling/uncoupling. The Arc Prevention Circuit makes it possible to couple/uncouple without switching power off and prevents damage to the contacts.

In the Master module, the Arc Prevention Circuit controls the ON/OFF status of the following two power signals:

-Input (and Logic) power

-Output power

The behavior of the Arc Prevention circuit is more fully described in the following sections.

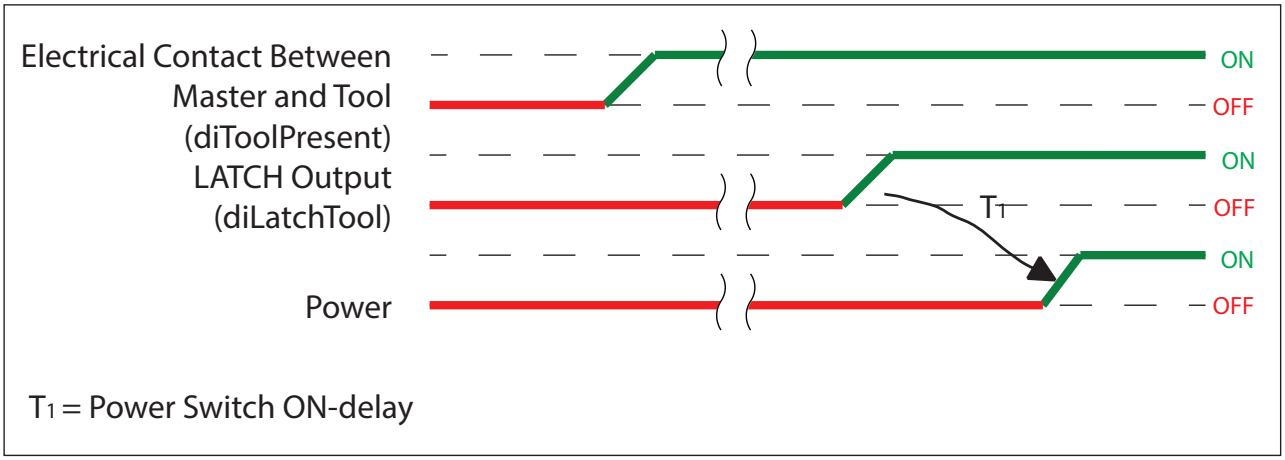
2.3.1 Arc Prevention Circuit Behavior during Coupling

The behavior of the Arc Prevention circuit during coupling can be more clearly understood by referring to *Figure 3.2*, which shows the power on timing diagram for the Arc Prevention Circuit. Starting at the top of the diagram, the LATCH command is issued thus initiating locking of the Master and Tool.

When the robot and Master approach the Tool for pick up, electrical contact between the Master and Tool pin contacts occurs. Soon after the LATCH command is turned ON, the Arc Prevention Circuit will turn on input and output power. The time delay between when the LATCH output is turned ON to when power is actually available to the EOAT (time T_1 in the diagram) is less than 100 ms.

Important: The Arc Prevention Circuit will only allow power to pass to the Tool after the LATCH command has been issued and the Master and Tool module's electrical contacts are fully engaged.

Figure 2.17—Power-On Timing



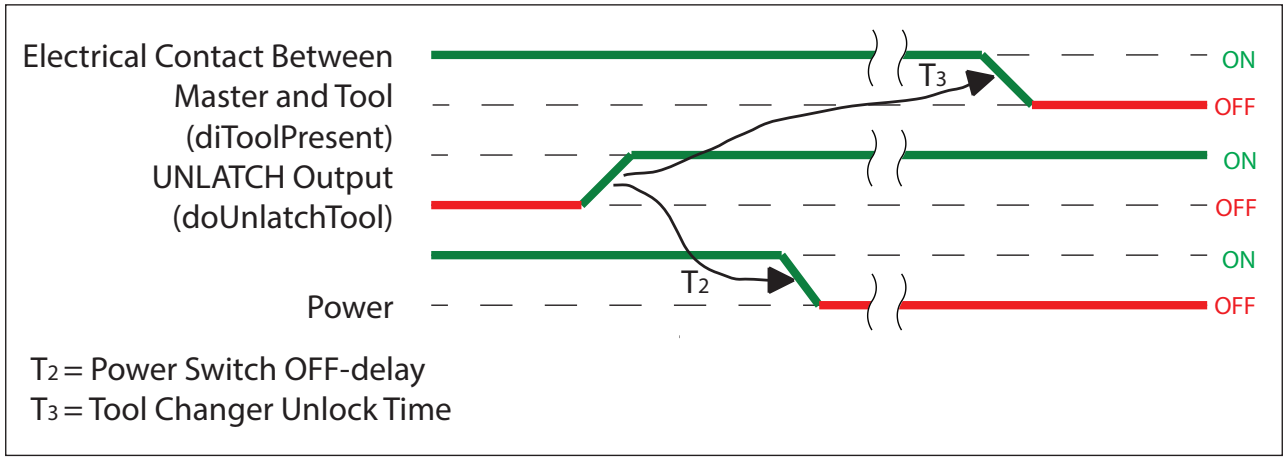
2.3.2 Arc Prevention Circuit Behavior during Uncoupling

The behavior of the Arc Prevention Circuit during uncoupling can be more clearly understood by referring to *Figure 2.18*, which shows the power-off timing diagram for the Arc Prevention Circuit. Starting at the top of the diagram, the UNLATCH command is issued thus initiating uncoupling of the Master and Tool.

Immediately after the UNLATCH command is issued, the Arc Prevention Circuit will turn off input and output power. The power-off time delay between the UNLATCH command and the switching off of power (designated T_2 in the diagram) is less than 500 ms.

Some time after power is turned off and the Master and Tool begin to separate, electrical contact between Master and Tool Pin Contacts will be lost. This occurs with a delay, designated T_3 in the diagram, after the UNLATCH command is issued. The magnitude of time T_3 is a function of many factors, including the weight of the EOAT, the friction between Master and Tool alignment pins, etc. but is usually not shorter than 100 ms.

Figure 2.18—Power-Off Timing



2.4 Tool Module

In addition to providing Tool-ID and Tool side TSI, the Tool module also functions as a pass-through for EtherNET/IP and auxiliary power signals to downstream equipment. For more details refer to *Section 9—Drawings.*

2.4.1 Tool-ID

The Tool-ID for a particular Tool is established from the setup of (5) push button switches. To set the Tool-ID refer to *Section 3.6—Setting the Tool-ID.*

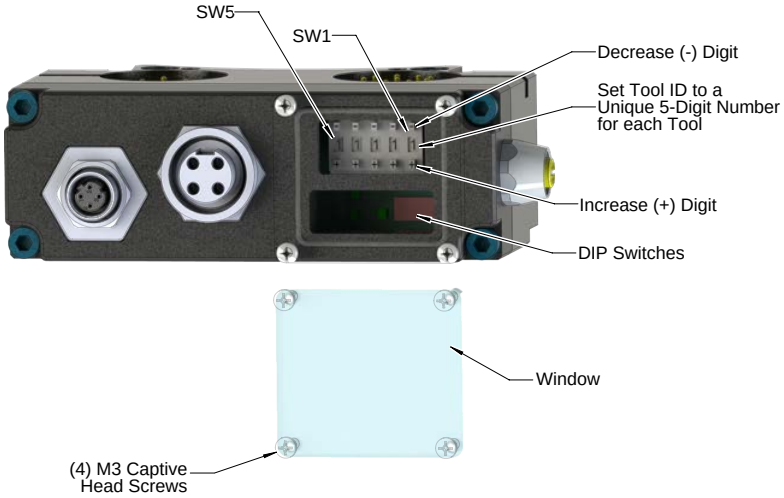
Switch Designation:

SW5 - Line/Application Type Number (0-9)

SW4 - Robot Number (0-9)

SW3-1 - Tool Number (0-255)

Figure 2.19—Tool-ID Switch Settings



2.4.2 Tool Module DIP Switches

The Tool module has 10 DIP switches which should not be changed:

DIP switches 1-10: Must always be in the OFF position

2.5 Software

The EDS file for the Master node is available from the ATI website (*www.ati-ia.com/download/edsfiles*) or by e-mail. Reference the part number given below:

Master module Node EDS File 9031-20-1063

An I/O bitmap for the Master node is provided in the following table. The default setting from the factory for the Master module is IP Address 192.168.1.54.

Table 2.6—I/O Bitmap, Robot Inputs from ATI Master

Byte	BitNumber	Name	Description/Function
0	0	diToolLatched	Tool Changer is locked
	1	diToolUnlatched	Tool Changer is unlocked
	2	diOkToLatch	Latch conditions are met. Refer to *Section 4.2.3—diOkToLatch*.
	3	diOkToUnlatch	Unlatch conditions are met. Refer to *Section 4.2.4—diOkToUnlatch*.
	4	diToolPresent	Indicates Master and Tool are in electrical contact.
	5	diSafeSwMissing	Indicates Safety Switch jumper plug is installed or switch cable damage.
	6	diReadyToLockSW1	Ready to Lock proximity sensor 1
	7	diReadyToLockSW2	Ready to Lock proximity sensor 2
1	0	Tool Number (bit 1)	The “Tool Number” is created by combining the values of switches 3, 2, 1, into a single number from 0-255 with switch 3 used as the 100s digit, switch 2 as the 10s digit, and switch 1 as the 1s digit. If the number so constructed is greater than 255, this field shall be reported as 255.
	1	Tool Number (bit 2)	
	2	Tool Number (bit 4)	
	3	Tool Number (bit 8)	
	4	Tool Number (bit 16)	
	5	Tool Number (bit 32)	
	6	Tool Number (bit 64)	
	7	Tool Number (bit 128)	
2	0	Robot Number (bit 1)	Robot Number
	1	Robot Number (bit 2)	
	2	Robot Number (bit 4)	
	3	Robot Number (bit 8)	
	4	Line Number (bit 1) / Application Type (bit 1)	Line Number
	5	Line Number (bit 2) / Application Type (bit 2)	
	6	Line Number (bit 4) / Application Type (bit 4)	
	7	Line Number (bit 8) / Application Type (bit 8)	

Notes:

These bits are mapped for customer use.

These bits are located on diagnostic web page.

The pressure reading is a 10-bit ADC. To convert the ADC counts to PSI, multiply the ADC counts by 0.1173. Example: 692 counts x 0.1173= 80 PSI

Table 2.6—I/O Bitmap, Robot Inputs from ATI Master			
Byte	**BitNumber**	**Name**	**Description/Function**
3	0	Tool Power Is On	Indicates Arc Prevention Circuit is turned ON and power is provided to the Tool
	1	Output Power Available	Output supply voltage on the robot side is within the allowable range (20.4V <= US2<= 28.8V)
	2	VALVE_ERROR	Valve or pressure sensor fault
	3	PRESSURE_TOO_HIGH	Pressure sensor reports an unlatch pressure higher than the maximum system rating (Reset with “doTCFaultReset” output bit or with next unlatch command that progresses to turning on UNLATCH_ VALVE_CTRL1 (in order to supply air to the pressure sensor).)
	4	PRESSURE_TOO_LOW	Pressure sensor report an unlatch pressure lower than the minimum system rating (Reset with “doTCFaultReset” output bit or with next unlatch command that progresses to turning on UNLATCH_ VALVE_CTRL1 (in order to supply air to the pressure sensor).)
	5	Pressure Sensor Disconnected	The pressure sensor is either disconnected or the cable is broken
	6	Valve Proximity Sensor	Shows status of valve position.
	7	SYSTEM_IS_UNSAFE	Any APx_COMM_ERROR, APx_MISMATCH_ ERROR, APx_SAFETY_ERROR, SSO_FAULT sets this bit. Cannot be reset except by power cycle.
4	0	EVERYTHING IS OK	Overall Status Bit. Is high as long as there is no error.
	1	SSO_1	Input from safety switch that indicates it is safe to unlatch the Tool. Should always agree with SSO_2
	2	SSO_2	Input from safety switch that indicates it is safe to unlatch the Tool. Should always agree with SSO_1
	3	V1RELAY	Indicates that safety switch has activated safety relay 1. Should agree with SSO_1.
	4	V2RELAY	Indicates that safety switch has activated safety relay 2. Should agree with SSO_2.
	5	Tool-ID Error	Tool-ID Communication Timeout
	6	Input Power Available	Input supply voltage (US1) on the robot side is within the allowable range (20.4V <= US1<= 28.8V)
	7	UNSAFE_LATCH	User attempted to latch when unsafe. Reset at next rising edge of latch command.

Notes:

These bits are mapped for customer use.

These bits are located on diagnostic web page.

The pressure reading is a 10-bit ADC. To convert the ADC counts to PSI, multiply the ADC counts by 0.1173. Example: 692 counts x 0.1173= 80 PSI

Table 2.6—I/O Bitmap, Robot Inputs from ATI Master			
Byte	**BitNumber**	**Name**	**Description/Function**
5	0	Unsafe Unlatch	Unlatch Rejected Due to Unsafe Condition Present
	1	ERROR_ON_LATCH	Overload or short circuit on Latch Output
	2	ERROR_ON_UNLATCH1	Overload or short circuit on Unlatch1 Output
	3	ERROR_ON_UNLATCH2	Overload or short circuit on Unlatch2 Output
	4	Lock/Unlock Sensor Fault	Lock & Unlock Inputs are On at the same time or swapped lock & unlock sensors or bad sensors or no latch/unlatch motion.
	5	Raw Locked Sensor	Direct mirror of locked proximity sensor.
	6	Raw Unlocked Sensor	Direct mirror of unlocked proximity sensor.
	7	CROSS_MONITORING_ERROR	Safety System detected mismatch. Logical OR of the APx_INP_MISMATCH, APx_OUTP_MISMATCH, and AP2_COMM_ERROR bits.
6	0	AP2_COMM_ERROR	AP1 lost communication to AP2
	1	AP1_VALVE_ERROR	Valve 2 opening or closing at the wrong time.
	2	AP1_OUTP_MISMATCH	AP1 detects that AP2 has come to a different decision than AP1 regarding a safety-critical motion, or AP1 sees Unlatch_valve_control_2 is different than expected.
	3	AP1_INP_MISMATCH	AP1 detects that AP2 reports different input values than AP1 sees.
	4	MEMORY_FAILURE	N/A
	5	Firmware Version Mismatch	N/A
	6	Pressure Reading Bit 0	Lower 2 bits of the 10bit pressure sensor reading
	7	Pressure Reading Bit 1	
7	0	Pressure Reading Bit 2	Highest 8 bits of the 10bit pressure sensor reading
	1	Pressure Reading Bit 3	
	2	Pressure Reading Bit 4	
	3	Pressure Reading Bit 5	
	4	Pressure Reading Bit 6	
	5	Pressure Reading Bit 7	
	6	Pressure Reading Bit 8	
	7	Pressure Reading Bit 9	

Notes:

☐ These bits are mapped for customer use.

▭ These bits are located on diagnostic web page.

The pressure reading is a 10-bit ADC. To convert the ADC counts to PSI, multiply the ADC counts by 0.1173. Example: 692 counts x 0.1173= 80 PSI

Table 2.6—I/O Bitmap, Robot Inputs from ATI Master			
Byte	**BitNumber**	**Name**	**Description/Function**
8	0	Minor Revision Bit0	uC firmware revision
	1	Minor Revision Bit1	
	2	Minor Revision Bit2	
	3	Minor Revision Bit3	
	4	Major Revision Bit0	
	5	Major Revision Bit1	
	6	Major Revision Bit2	
	7	Major Revision Bit3	
9	0	AP2_Mismatch_Error	N/A
	1	AP2_Comm_Error	N/A
	2	Memory_Failure	N/A
	3	AP2_VALVE_ERROR	N/A
	4	ERROR_ON_UNLATCH2	N/A
	5	AP2_PRESSURE_ SENSOR_ DISCONNECTED	N/A
	6	Memory_Tests_Complete	N/A
	7	Safe_to_Unlatch_AP2	N/A
10	0	SSO_2	N/A
	1	V1Relay	N/A
	2	V2Relay	N/A
	3	SSFAULT	N/A
	4	Unlatch_Valve_Control_2	Overload on Unlatch 2 output was detected.
	5	Valve_Position	A reading of “one” means that valve is in the “Latch” position. A reading of “zero” means that valve is in the “Unlatch” position.
	6	AP2_Version_Error	N/A
	7	AP2_Safety_Error	N/A
11	0	Minor Version Number of AP2 [0:4]	AP2 Firmware Revision Number
	1		
	2		
	3		
	4	Major Version Number of AP2 [0:4]	
	5		
	6		
	7		

Notes:

☐ These bits are mapped for customer use.

▭ These bits are located on diagnostic web page.

The pressure reading is a 10-bit ADC. To convert the ADC counts to PSI, multiply the ADC counts by 0.1173. Example: 692 counts x 0.1173= 80 PSI

Table 2.6—I/O Bitmap, Robot Inputs from ATI Master			
Byte	**BitNumber**	**Name**	**Description/Function**
12	0	AP1 MEMORY_TESTS_ COMPLETE	N/A
	1 - 7	Reserved	Reserved
13 to 15	0 - 7	Reserved	Reserved

Notes:

These bits are mapped for customer use.

These bits are located on diagnostic web page.

The pressure reading is a 10-bit ADC. To convert the ADC counts to PSI, multiply the ADC counts by 0.1173. Example: 692 counts x 0.1173= 80 PSI

Table 2.7—I/O Bitmap, Robot Outputs to Master Module			
Byte	**BitNumber**	**Name**	**Description/Function**
1	0	doLatchTool	Latch Tool Plate
	1	doUnlatchTool	Unlatch Tool Plate
	2	doTCFaultReset	Reset errors, allows affected I/O to be reactivated
	3	Reserved	(Reserved)
	4	Reserved	(Reserved)
	5	Reserved	(Reserved)
	6	Reserved	(Reserved)
	7	Reserved	(Reserved)
2 to 8	-	(Reserved)	

CAUTION: Do not issue **doTCFaultReset** until the cause of the error is corrected. Issuing the **doTCFaultReset** without correcting the cause of the error may result in injury to personnel or damage to equipment**.** When an error condition is detected, correct the cause of the error before issuing the fault reset, **doTCFaultReset**.

3. Installation

The control/signal modules are typically installed by ATI prior to shipment. The following procedure outline the installation and removal procedures. For wiring information refer to *Section 9—Drawings*.

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

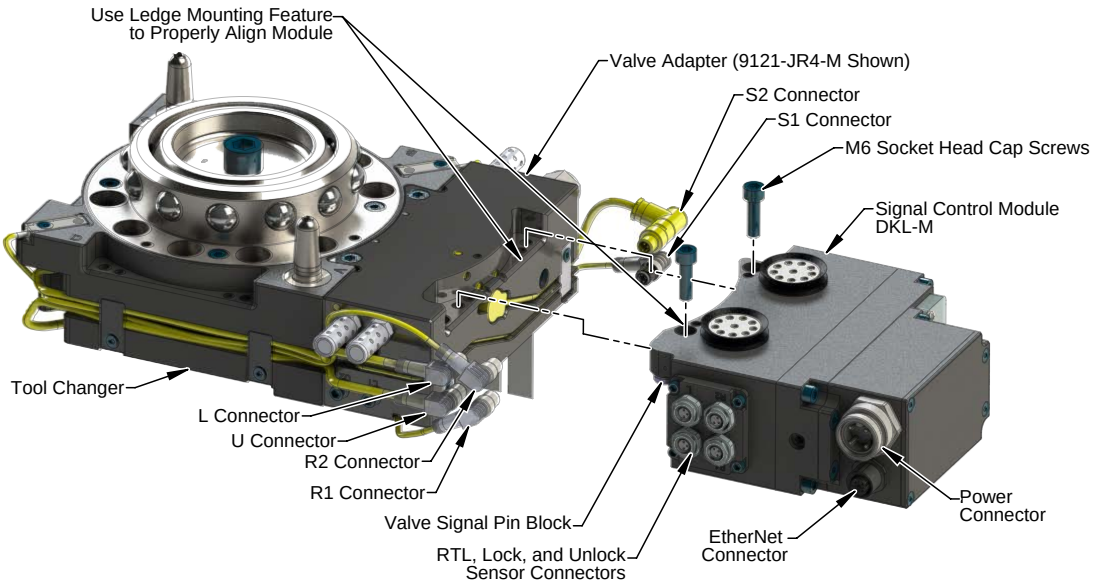
3.1 Master Module Installation

Tools required: *5 mm hex key*

Supplies required: *Clean rag, Loctite® 242*

1. Uncouple the Master and Tool plates.
2. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
3. Wipe down the mounting surfaces with a clean rag.
4. Using the ledge feature, place the module into the appropriate location on the valve adapter. Align the module with the valve adapter using the dowels in the bottom of the ledge feature. Refer to *Figure 3.2*.
5. Apply Loctite 242 to the supplied M6 socket head cap screws. Using a 5 mm hex key, install the (2) M6 socket head cap screws securing the module to the valve adapter and tighten to 70 in-lbs (7.9 Nm).
6. Connect the valve adapter proximity sensor cable to (S1) and valve adapter pressure sensor cable to (S2) connections on the Master module.
7. Set the DIP switches. If necessary, default IP address setting is 192.168.1.54. Refer to *Section 2.1.8—Master Module DIP Switches*.
8. Connect the (L) Lock, (U) Unlock, and (R1 and R2) RTL sensor cable connectors to the Master module.
9. Connect the power cable and EtherNET/IP cable connectors to the Master module.
10. After a few seconds, it should be operating on the network.
11. Safely resume normal operation.

Figure 3.1—Master Module Installation



3.2 Master Module Removal

Tools required: *5 mm hex key*

1. Uncouple the Master and Tool plates.
2. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
3. Disconnect the (L) Lock, (U) Unlock, and (R1 and R2) RTL sensor cable connectors from the Master module.
4. Disconnect the power cable and EtherNET/IP cable connectors from the Master module.
5. Disconnect the valve adapter Proximity Sensor Cable from (S1) and valve adapter Pressure Sensor Cable from (S2) connections on the Master module.
6. Support the control/signal module and remove the (2) M6 socket head cap screws and lower the module until it clears the guide pin. Refer to *Figure 3.1*.

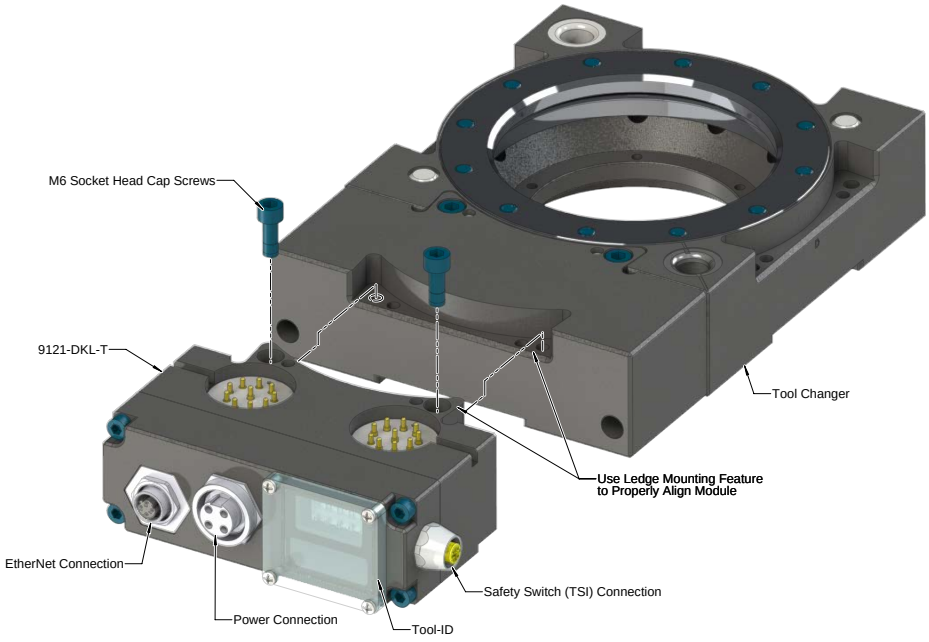
3.3 Tool Control/Signal Module Installation

Tools required: *5 mm hex key*

Supplies required: *Clean rag, Loctite 242*

1. Uncouple the Master and Tool plates.
2. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
3. Wipe down the mounting surfaces with a clean rag.
4. Using the ledge feature, place the module into the appropriate location on the valve adapter spacer. Align the module with the valve adapter spacer using the dowels in the bottom of the ledge feature. Refer to *Figure 3.2*.
5. Apply Loctite 242 to the supplied M6 socket head cap screws. Using a 5 mm hex key, install the (2) M6 socket head cap screws securing the module to the valve adapter spacer and tighten to 70 in-lbs (7.9 Nm).
6. Connect the safety switch cables to the Tool module.
7. Connect the power cable and EtherNET/IP cable connectors to the Tool module.
8. Set the Tool-ID. Refer to *Section 3.6—Setting the Tool-ID.*
9. Safely resume normal operation.

Figure 3.2—Tool Module Installation



3.4 Tool Control/Signal Module Removal

Tools required: *5 mm hex key*

1. Uncouple the Master and Tool plates.
2. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
3. Disconnect the safety switch cables from the Tool module.
4. Disconnect the power cable and EtherNET/IP cable connectors from the Tool module.
5. Support the Tool module and remove the (2) M6 socket head cap screws and lift up on the module until it clears the guide pin. Refer to *Figure 3.2*.

3.5 Utility Schematic

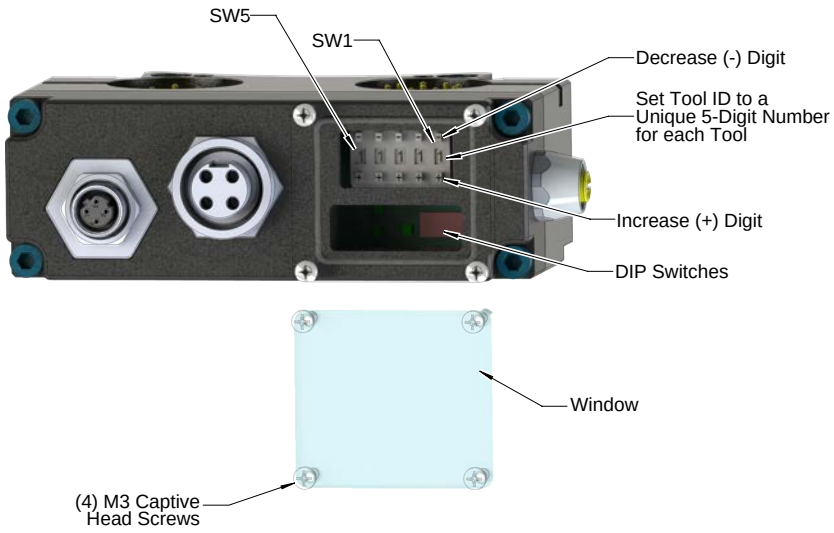
Refer to drawings in *Section 9—Drawings* of this manual for customer interface and wiring details for the Master/Tool modules.

3.6 Setting the Tool-ID

Tools required: *Phillips screwdriver*

(5) push button switches are provided on the Tool module for setting of a Tool-ID number. Each Tool must have a unique 5 digit Tool-ID number.

Figure 3.3—Setting the Tool-ID



Switch Designation:

SW5 - Line/Application Type Number (0-9)

SW4 - Robot Number (0-9)

SW3-1 - Tool Number (0-255)

1. Loosen the (4) M3 pan head captive screws and remove the Tool-ID window.
2. Use a non-conductive tool (for example: plastic stylus) to press on the Tool-ID push buttons to increase (+) or decrease (-) the digit values.

NOTICE: When replacing the window, ensure that the seal is re-positioned correctly to prevent fluid ingress.

3. Re-install the Tool-ID window and tighten the M3 pan head captive screws.

4. Operation

A recommended Sequence of Operations is provided in *Section 4.4—Recommended Sequence of Operation* 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 control/signal modules. This procedure is intended for “automatic” modes used during normal application processes.

DANGER: This module has a voltage of 50V or greater; always remove power before contacting the module. Arcing and damage occur if power is not removed from the module during maintenance or service. Always remove power before attaching or disconnecting cables, separating or inserting the mating couplers, or making any contact with the Tool Changer or Utility Coupler.

CAUTION: Improper cable routing can result in wires and cables being pinched in the joint between the Tool Changer plates and premature failure of the electrical connectors. Properly route and secure all cables, particularly on the Master side.

The following sections detail the functional characteristics of the module.

NOTICE: The 0 and 24VDC supply lines are required to be on certain pin locations of the customer interface connector. Refer to *Section 9—Drawings* for pin out information and location of the I/O signals.

Refer to the specific Tool Changer manual for coupling conditions of the Tool Changer and *Section 4.4—Recommended Sequence of Operation*. When coupled, the module Tool can be communicated with, Tool-ID can be read (if equipped), and attached end-effectors can be used.

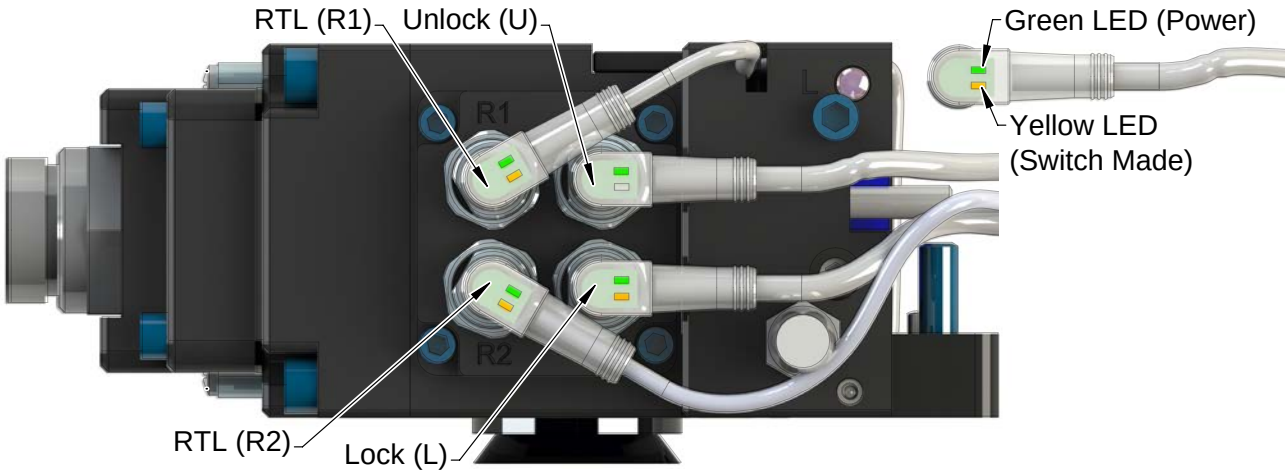
4.1 Lock, Unlock, and Read-To-Lock (RTL) Sensor Cable LED Behavior

The Lock, Unlock, and RTL sensor cables are equipped with (2) LEDs. The green LED indicates the sensor has power and the yellow LED indicates the switch has been made, The LED behavior is affected by the control/signal module. The behavior shown is specific for the Tool Changer with a control/signal module equipped with RTL sensors wired in series.

Table 4.1—Sensor Cable LED Behavior for Common Tool Changer Positions

Tool Changer Position	Sensor Cable LED Behavior			
Unlocked (Tool Changer Master plate free of stand with no Tool plate attached)	RTL (R1)	OFF OFF	ON ON	Unlock (U)
	RTL (R2)	ON OFF	ON OFF	Lock (L)
Ready to Lock (Tool Changer Master plate with Tool plate parallel and at a distance of 1.22 mm or less from each other)	RTL (R1)	ON ON	ON ON	Unlock (U)
	RTL (R2)	ON ON	ON OFF	Lock (L)
Locked (Tool Changer Master plate with Tool plate attached in fully locked position)	RTL (R1)	ON ON	ON OFF	Unlock (U)
	RTL (R2)	ON ON	ON ON	Lock (L)
Missed Tool (Tool Changer Master plate locked with no Tool plate attached)	RTL (R1)	OFF OFF	ON OFF	Unlock (U)
	RTL (R2)	ON OFF	ON OFF	Lock (L)

Figure 4.1—Lock, Unlock, and RTL Sensor Cable LED Behavior (Shown in Locked Position)



(Control module shown for reference only)

4.2 Inputs

The following describes the most critical inputs from the ATI Master module.

4.2.1 diToolLatched

A proximity sensor input indicating that the coupling mechanism is in the Lock position. The “diToolLatched” bit in the bitmap will only be set on if the LOCKED sensor input is on.

4.2.2 diToolUnlatched

A proximity sensor input indicating that the coupling mechanism is in the Unlocked position. The bit “diToolUnlatched” in the bitmap will only be set on if the UNLOCKED sensor input is on.

4.2.3 diOkToLatch

The diOkToLatch bit indicates when the preconditions for latching the Tool Changer have been met. The preconditions include:

- No Errors
- Input and Output Power within operating range (20.4-28.8V).
- Air pressure within operating range (60-100 psi).
- doUnlatchTool is off
- doLatchTool is off
- diToolLatched is off

4.2.4 diOkToUnlatch

The diOkToUnlatch bit indicates when the preconditions for unlatching the Tool Changer have been met. The preconditions include:

- No Errors
- Input and Output Power within operating range (20.4-28.8V).
- Air pressure within operating range (60-100 psi).
- doUnlatchTool is off
- doLatchTool is off
- diToolUnlatched is off
- The Tool is in the tool stand as indicated by SSO1, SSO2, V1RELAY, and V2RELAY bits are on

See Notes section of *Table 2.6* for pressure determination.

4.2.5 diToolPresent

An input indicating the Master module is electrically connected to the tool.

- Required for Arc Prevention Circuit and Tool-ID.

4.2.6 diSafeSWMissing

An input indicating the TSI Safety Switch is bypassed with jumper plug or cable is damaged.

4.2.7 diReadyToLockSW1 and diReadyToLockSW2

Proximity sensor inputs that indicate the Tool Changer master is close to the tool. It is recommended that these inputs be used to indicate when it is okay to couple the Tool Changer. These proximity sensors are installed in the Master body and sense targets in the Tool body that indicate the Master is adjacent to the tool (within ~ 0.06” or 1.5 mm).

4.2.8 Tool Power Is On

The Tool Power Is On bit indicates the Arc Prevention circuit has power to the tool side.

4.2.9 Output Power Available

An input indicating the presence of Output Power at the ATI Master module. Power must be between 20.4V and 28.8V otherwise the Tool Changer will NOT unlatch.

4.2.10 EVERYTHING IS OK

Everything is OK indicates that there are no detected errors in general, not just errors that affect unlatch. The spec says (AP1 Safety Error and AP2 Safety Error can be replaced with the single status “System is Unsafe”):

The “Everything Is OK” status bit is high as long as none of the following errors are active: AP1 Safety Error, AP2_Safety_Error, “UNSAFE UNLATCH” error, “UNSAFE Latch” error, Motion not verified, Pressure Too High, Pressure Too Low, US1_Power_Present (this is an error when US1_Power_Present is low), Switched_Power_Good (this is an error when Switched_ Power_Good is low).

4.2.11 V1 Relay and V2 Relay

V1 Relay is a normally open relay driven to closure by Channel 1 of the Safety Switch (SSO1). Similarly, the V2 Relay is driven to closure by Channel 2 of the Safety Switch (SSO2). Both of these inputs must be on when the Tool Changer is in the tool stand, otherwise the Tool Changer will NOT unlatch.

4.2.12 Input Power Available

An input indicating the presence of Input and Logic Power at the ATI Master module. Power must be between 20.4V and 28.8V otherwise the Tool Changer will NOT unlatch.

4.2.13 SSO 1 and SSO 2

Discrete inputs from the safety switch, which are on when the Tool Changer is in the stand.

4.3 Error Conditions

The following describes the reported error conditions and explains how to reset the condition.

4.3.1 VALVE ERROR

If the module detects an error in the function or position of either valve, a VALVE_ERROR bit is set. Reference the 9620-20-C-Jxx Valve Adapters with Dual Double Solenoid, Valve Pass-through, Proximity and Pressure Sensors for potential valve failure modes.

The error condition can be reset with the doTCFaultReset.

4.3.2 PRESSURE TOO HIGH

The valve adapter operating pressure is 60 to 100 psi. If the module detects the air pressure is too high then the PRESSURE TOO HIGH bit will be set. The error can be reset by supplying air at the correct pressure and then applying the doTCFaultReset. See Notes section of *Table 2.6* for pressure determination.

4.3.3 PRESSURE TOO LOW

The valve adapter operating pressure is 60 to 100 psi. If the module detects the air pressure is too low then the PRESSURE_TOO_LOW bit will be set. The error can be reset by supplying air at the correct pressure and then applying the doTCFaultReset. See Notes section of *Table 2.6* for pressure determination.

4.3.4 PRESSURE SENSOR DISCONNECTED

The PRESSURE_SENSOR_DISCONNECTED bit indicates that the pressure sensor is disconnected and/or the sensor cable is damaged.

If the pressure sensor is left disconnected then a SYSTEM_IS_UNSAFE error will be generated. The error condition can be reset with the doTCFaultReset.

4.3.5 SYSTEM IS UNSAFE

An error has occurred that could cause an unsafe unlatch if the error is not fixed. Refer to *Table 4.2* for the errors that will trigger a SYSTEM_IS_UNSAFE error.

4.3.6 TOOL-ID ERROR

The Tool-ID is available to the Master within 250 ms from the time the changer is coupled; otherwise a TOOL-ID ERROR is set in the bit map. If the Master and Tool are coupled and the Tool-ID fails to be reported, a TOOL-ID ERROR is set.

The error condition can be reset with a rising edge of TOOL PRESENT or the doTCFaultReset.

4.3.7 UNSAFE LATCH

A LATCH command is only be performed if the following conditions are true:

- Output Power available
- LATCH command is received
- UNLATCH bit is off
- Input Power Present is true
- PRESSURE_TOO_HIGH and PRESSURE_TOOL_LOW are false
- SYSTEM_IS_UNSAFE bit is off

If the LATCH command is received and the above conditions are not all met, the UNSAFE_ LATCH error bit is set. This error condition will be reset when a new LATCH command is received and the diOkToLatch conditions are met.

4.3.8 UNSAFE UNLATCH

The UNSAFE_UNLATCH bit will be set when the user sends an unsafe unlatch command This condition is monitored immediately after the UNLATCH command and will disable the Unlatch and turn off Unlatch immediately. If UNLATCH is inadvertently held on during a power cycle the UNSAFE_UNLATCH error will be generated. This error bit will be reset when a new UNLATCH command is received (UNLATCH command removed and reapplied) and the diOkToUnlatch conditions are met or with the rising edge of the doTCFaultReset.

4.3.9 ERROR ON LATCH

This bit indicates that a short circuit or overload condition on the LATCH output has been detected.

The error condition can be reset with the doTCFaultReset.

4.3.10 ERROR ON UNLATCH1

This bit indicates that a short circuit or overload condition on the UNLATCH output to Valve 1 has been detected.

The error condition can be reset with the doTCFaultReset.

4.3.11 ERROR ON UNLATCH2

This bit indicates that a short circuit or overload condition on the UNLATCH output to Valve 2 has been detected.

The error condition can be reset with the doTCFaultReset.

4.3.12 LOCK/UNLOCK SENSOR FAULT

This error bit will be set if the Locked and Unlocked Sensors are on at the same time. If the condition is not true then the bit is automatically reset.

4.3.13 CROSS MONITORING ERROR

The (2) Application Processors monitor the various safety related inputs and outputs. If the processors are not in agreement on the status of these inputs and outputs the CROSS_MONITORING_ERROR bit will be set.

The error condition can be reset with the doTCFaultReset.

4.3.14 AP2 COMM ERROR

This bit indicates that the (2) Application Processors in the Master module have stopped communicating.

The error condition can be reset with the doTCFaultReset.

Table 4.2—Error Conditions

Error Bit	Error description	TRIGGERS SYSTEM_IS_UNSAFE ERROR	Reset with
VALVE_ERROR	Valve module pressure and/or position error	Yes	doTCFaultReset
PRESSURE_TOO_HIGH	Air supply to valve adapter above 100 psi	No (Yes only during Unlatch)	doTCFaultReset
PRESSURE_TOO_LOW	Air supply to valve adapter below 60 psi	No (Yes only during Unlatch)	doTCFaultReset
PRESSURE_SENSOR_DISCONNECTED	Pressure Sensor not connected	Yes	doTCFaultReset
TOOL_ID_ERROR	TOOL-ID timeout error	No	Rising edge of TOOL_PRESENT; Power Cycle
UNSAFE_LATCH	Latch requested under unsafe conditions	No	Rising edge of LATCH or doTCFaultReset
UNSAFE_UNLATCH	Unlatch requested under unsafe conditions	No	Rising edge of UNLATCH or doTCFaultReset
ERROR_ON_LATCH	Short circuit detection on LATCH output	No (Yes only during Latch)	doTCFaultReset
ERROR_ON_UNLATCH1	Short circuit detection on UNLATCH output to Valve 1	No (Yes only during Unlatch)	doTCFaultReset
ERROR_ON_UNLATCH2	Short circuit detection on UNLATCH output to Valve 1	No (Yes only during Unlatch)	doTCFaultReset
LOCK/UNLOCK SENSOR FAULT	LOCKED and UNLOCKED Sensor on at the same time	No (Yes only during Unlatch)	doTCFaultReset
CROSS_MONITORING_ERROR	Application Processor safety related inputs and outputs do not match	Yes	doTCFaultReset
AP2_COMM_ERROR	Communication failure between Application Processor 1 and 2	Yes	doTCFaultReset

CAUTION: Do not issue **doTCFaultReset** until the cause of the fault/error is corrected. Issuing the **doTCFaultReset** without correcting the cause of the fault/error may result in injury to personnel or damage to equipment**.** When an error condition is detected, correct the cause of the error before issuing the fault/error reset, **doTCFaultReset**.

4.4 Recommended Sequence of Operation

The following conditions have to be met before the programing can take place:

- Input and Output Auxiliary 24VDC power is available and within acceptable range (20.4 - 28.8VDC).
- Air is supplied to the integrated valve and within acceptable range (60 - 100 psi).

1. 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 is fully retracted (unlocked condition). The Tool is by itself in the Tool stand. No error or fault conditions exist.

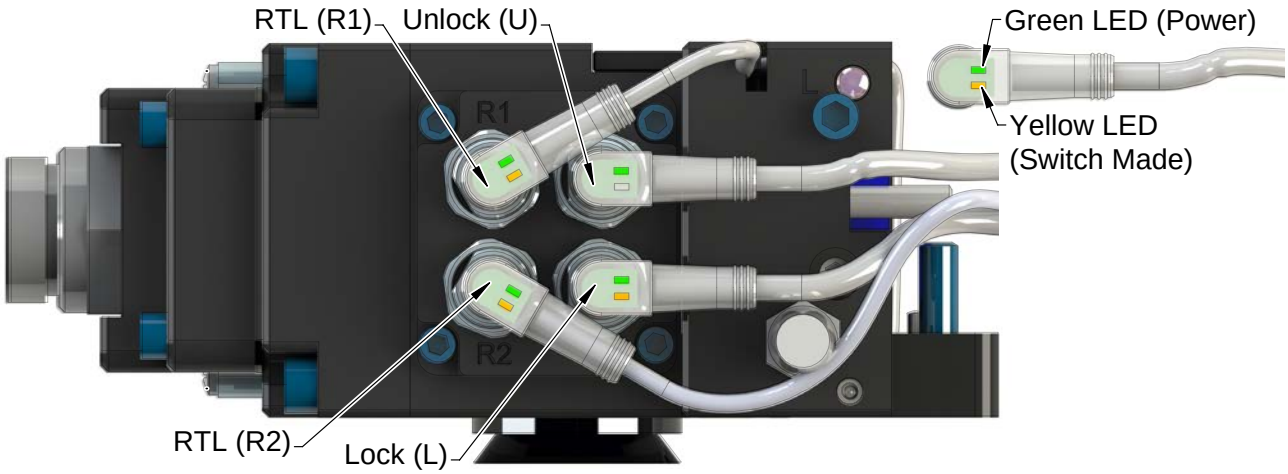
   a. The **diToolPresent** is OFF.
   b. The **diToolUnlatched** is ON.
   c. The **diToolLatched** is OFF.
   d. The ATI tool and any downstream device(s) are offline.
   e. Tool-ID invalid (all 1→ 0xFF255)
   f. The **doUnlatchTool** and the **doLatchTool** are OFF.
   g. diOkToUnlatch is OFF.

> **CAUTION:** The Master locking mechanism must be fully retracted prior to the Master entering the Tool. Failure to do so will cause ball bearings to damage the Tool Bearing Race. If the Tool Changer is locked or in a missed tool condition, use the solenoid valve manual override procedure (refer to the 9620-20-C-Jxx Valve Adapters with Dual Double Solenoid, Valve Pass-through, Proximity and Pressure Sensors manual) to unlock the Tool Changer before attempting to latch Master with Tool.

2. Robot and Master move into the Tool, are parallel and within 0.06” to 0.15” of the Tool (for example: the module contact pins are touching but the Ready-to-Lock (**RTL)** sensors have not yet sensed the targets on the Tool).

   a. The **diReadyToLockSW1** and **diReadyToLockSW2** inputs are ON, indicating that it is ok to couple the tool.

Figure 4.2—Lock, Unlock, and RTL Sensor Cable LED Behavior (Shown in Locked Position)



   b. The **diToolPresent** is ON, indicating that it is ok to couple the tool.
   c. **diOkToLatch** is ON.

3. Couple the Tool Changer.
   a. Turn **doLatchTool** ON.
   b. The **diToolUnlatched** goes OFF a short time later, indicating piston travel. Subsequently, the **diToolLatched** is ON, indicating that the coupling operation is complete.
   c. Once the **diToolLatched** is ON, turn the **doLatchTool** OFF.
   d. Power becomes available to tooling. Shortly thereafter, communications should be established with downstream devices.
4. Robot moves away from the tool stand with the Tool Changer coupled.
   a. The Tool Stand Interlock (TSI) **Safety Switch** is deactivated.

CAUTION: Check that the **diOkToUnlatch is** OFF at this time. This is a critical part of the safety system.

5. Normal operation
   a. The following inputs are OFF:
      i. diToolUnlatched
      ii. diOkToUnlatch
   b. The following inputs are ON:
      i. diToolLatched
      ii. diToolPresent
      iii. diReadyToLockSW1
      iv. diReadyToLockSW2
   c. The following output is OFF:
      i. doToolUnlatch
      ii. doToolLatch
6. Robot moves into the tool stand with the Tool Changer coupled.
   a. When the Tool is returned to the stand, the TSI **Safety Switch** is activated.
   b. diOkToUnlatch is ON, indicating that it is safe to uncouple the Tool Changer.
7. Uncouple the Tool Changer.
   a. Turn **doUnlatchTool** ON.
   b. Power and communication is lost with downstream device(s).
   c. The **diToolLatched** is OFF a short time later and subsequently the **diToolUnlatched** is ON, indicating that the uncoupling operation is complete.
   d. Once the **diToolUnlatched** is ON, turn the **doUnlatchTool** OFF.
8. Robot and Master move to free space (>0.15” from the Tool).
   a. The **TSI Safety Switch** is deactivated.
   b. The following inputs are OFF:
      i. diOkToUnlatch
      ii. diToolLatched
      iii. diToolPresent
      iv. diReadyToLockSW1
      v. diReadyToLockSW2
   c. The following inputs are ON:
      i. diToolUnlatched
      ii. Tool-ID invalid (all 1→ 0xFF255)
   d. The following outputs are OFF:
      i. doToolLatch
      ii. doToolUnlatch

5. Maintenance

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(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

If the Tool Changer is used in dirty environments (for example: welding or deburring applications), 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, perform periodic inspections to assess for unexpected damage and assure long-lasting performance. Perform the following visual inspection monthly:

- Inspect mounting fasteners to verify they are tight and if loose, then tighten to the proper torque. Refer to *Section 3—Installation*.
- Cable connections should be inspected during maintenance periods to ensure they are secure. Loose connections should be cleaned and retightened. Inspect cable sheathing for damage, repair or replace damaged cabling. Loose connections and/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 5.1—Pin Block Inspection and Cleaning*.
- Inspect V-ring seals for wear, abrasion, and cuts. If worn or damaged, replace. Refer to *Section 6.2.1—Seal Replacement*.

5.1 Pin Block Inspection and Cleaning

Tools required: *Nylon Brush (ATI part number 3690-0000064-60)*

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. Inspect the Master and Tool pin blocks for debris or darkened pins.

Figure 5.1—Inspect Master and Tool Pin Blocks

5. If debris or darkened pins are present, use a vacuum to remove the debris, and clean using a nylon brush (ATI part number 3690-0000064-60).

NOTICE: Do not use an abrasive media and/or cleaners or solvents to clean the contact pins. Using abrasive media and/or cleaners or solvents will cause damage to the contact surface or cause pins to stick. Clean contact surfaces with a vacuum or non-abrasive media such as a nylon brush (ATI part number 3690-0000064-60).

Figure 5.2—Clean Pin Blocks with a Nylon Brush

6. Inspect the Master and Tool pin blocks for stuck pins or pin block damage.

Figure 5.3—Stuck Pin and Pin Block Damage

7. If pins become stuck or if there is damage to the pin block, contact ATI for either a possible pin replacement procedure or module replacement.
8. Safely resume normal operation.

6. Troubleshooting and Service Procedures

The following section provides troubleshooting information to help diagnose conditions with the Tool Changer and service procedures to help resolve these conditions.

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (for example: electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

6.1 Troubleshooting

Troubleshooting information is provided in the following table:

Table 6.1—Troubleshooting

Symptom	Possible Cause	Correction
Unit will not lock or unlock	Debris caught between the Master and Tool plates	Clean debris from between Master and Tool plates. Verify mounting fasteners are secure and does not protrude above the mating surfaces.
	Ball bearings are not moving freely	Verify the ball bearings are moving freely. Clean and lubricate as needed. *Refer to the Maintenance section of the Tool Changer manual for instructions.*
	Air supply not to specifications	Check air supply (60-100 psi). *Refer to Pneumatic Connection section of the Tool Changer Manual for specifications.*
	Exhaust port is not properly vented	Check exhaust ports are properly vented. *Refer to Pneumatic Connection section of the Tool Changer Manual for valve requirements.*
	Incorrect valve operation	Check valve for proper operation. *Refer to Pneumatic Valve Adapter Manual.*
	Signals are mapped incorrectly	Verify signals are mapped and are communicating properly. Refer to *Section 2.5—Software* for software.
	Master and Tool are not within the specified No-Touch zone	Verify the Master and Tool are within the specified No-Touch zone when attempting to lock. *Refer to the Operation Section of the Tool Changer manual for specifications.*
Sensors not operating properly (but EtherNET/IP is operating correctly)	Sensor cables damage or incorrectly connected	Verify cables are connected correctly and not damaged, replace if damaged. *Refer to the Troubleshooting Section of the Tool Changer manual.*
	Sensor is malfunctioning	Verify the sensors are set correctly. *Refer to the Troubleshooting Section of the Tool Changer manual.*
	Tool plate is not secured properly or debris is trapped between surfaces	Ensure the Tool plate is securely held to the Master plate, that nothing is trapped between their surfaces.
	Air trapped in the unlock (U) air port	Ensure there is no Air trapped in the unlock (U) air port. *Refer to Pneumatic Connection section of the Tool Changer Manual for valve requirements.*

Table 6.1—Troubleshooting		
Symptom	**Possible Cause**	**Correction**
Loss of communication	Damaged signal cabling	Check/replace signal cabling upstream and downstream of Tool Changer modules.
	Worn or damaged contact pins	Inspect module contact pins for debris/wear/damage. Contact ATI for contact pin replacement.
	Product upstream and downstream of Tool Changer failed or damaged	Check product upstream and downstream of Tool Changer for failure. This failure can “appear” to be caused by the Tool Changer or affect Tool Changer performance.
Loss of Tool-ID	**diToolPresent** off	Verify **diToolPresent** is **On**.
No power on the Tool side	Latch command not issued	Verify that the Latch command has been issued.
	Tool Power is On bit	Verify **Tool Power is On** is **On**.
	diToolPresent off	Verify **diToolPresent** is **On**.
Loss of auxiliary power on the Tool side	Input power loss	Loss of Input (Logic) power on the Master side will cause loss of Output (Auxiliary) power to the Tool. The Arc Prevention Circuit relies on Input power to operate. Restore Input power to the Master to restore Output power to the Tool.

6.2 Service Procedures

The following service procedures provide instructions for inspection, adjustment, test or replacement of components.

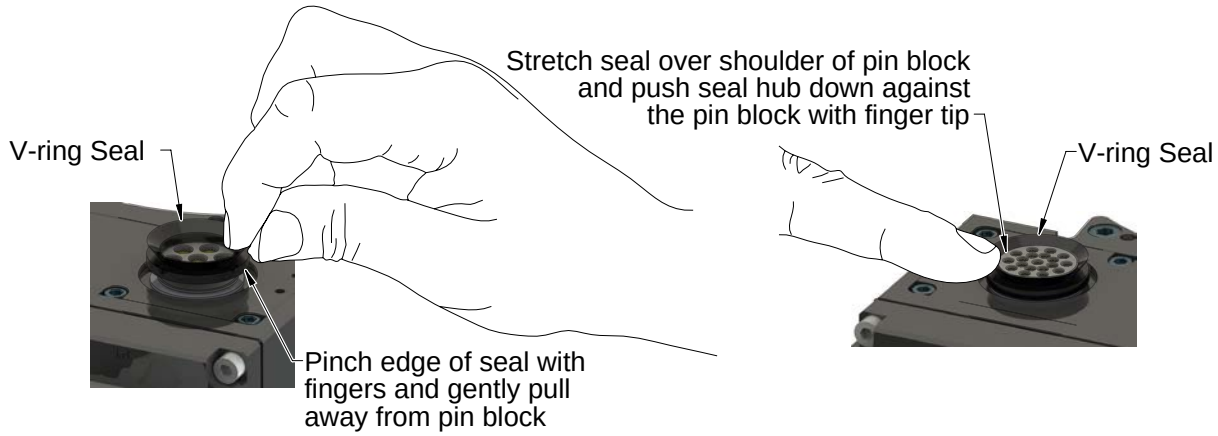
6.2.1 Seal Replacement

Part Required: *Refer to Section 9—Drawings.*

The seal protects the electrical connection between the Master and Tool module. Replace the seal if it becomes worn or damaged.

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (for example: electrical, pneumatic, and hydraulic circuits).
4. To remove the existing seal, pinch the edge of the seal and pull the seal away from the pin block on the Master module.
5. To install a new seal, stretch the new seal over the shoulder of the pin block.
6. Push the seal hub down against the pin block.
7. Safely resume normal operation.

Figure 6.1—V-ring Seal Replacement



7. Serviceable Parts

Refer to *Section 9—Drawings.*

Table 7.1—Master Module Mounting Fasteners	
Part Number	**Description**
3500-1066020-21A	M6 x 20 Socket Head Cap Screw, SS, ND Microspheres, 0-3 uncoated lead thds. 5-7 coated thds. IFI525

Table 7.2—Tool Module Mounting Fasteners	
Part Number	**Description**
3500-1066016-21A	M6 x 16 Socket Head Cap Screw, DIN 912 A4 S/S (316) ND Ind. Microspheres Epoxy, Yellow. 0-3 uncoated lead thds. 5-7 coated thds.

Table 7.3—Accessories	
Part Number	**Description**
3690-0000064-60	Brush, Blue Nylon All Purpose (Contact Pin Cleaning)

8. Specifications

Table 8.1—DKL Master Module	
9121-DKL-M	EtherNET/IP Master Module with Integrated Ethernet Switch, 4-Pin Female M12 D-Coded connector for EtherNET/IP communication, 4-Pin Male MiniFast Connector for Input and Output Power, TSI on the Tool, Arc Prevention applied to Input and Output power. Lock, Unlock, and RTL sensing with LED cables on the Master. 0-99255 Tool-ID from the Tool Module also supported.
Power Supply Requirements	The power sources for input and output power must be capable of outputting an operating voltage (reverse polarity protected, regulated) of 24 +/- 15% VDC.
Factory Default Configuration	I/P Address: 192.168.1.54 Subnet Mask: 255.255.255.0 Gateway: 0.0.0.0 **Note:** The DKL-M DKL-T modules conform to the EtherNET/IP Adaptation of CIP Specification, Edition 1.12; © 2011, ODVA The DHCP option is factory set to “disabled”
Connector(s)	Auxiliary Power: 4-pin MiniFast, male Ethernet: 4-pin M12 D-coded, female Integrated Tool Changer I/O: (4) M8, 3-pin female connectors supporting Tool Changer Locked, Unlocked, and Ready to Lock proximity sensors. Integrated Connection to Valve Adapter Diagnostic Sensors: M8, 3-pin female connectors supporting Valve Adapter proximity sensor M8, 4-pin female connectors supporting Valve Adapter pressure sensor Integrated Connection to valve adapter: 4-pin block
Pass-through Power	5A, 20-29VDC
Current Draw	Power: 180mA @ 24VDC, Master only (Unlocked sensor “ON”, Locked) Valve Power (switched Auxiliary Power): 250mA @ 24VDC (Solenoid Valve) (only when locking or unlocking Tool Changer).
Temperature	32°F to 120°F (0 to 49°C).
Weight	2.40 lbs (1.09 kg)

Table 8.2—DKLZ1 Master Module	
9121-DKLZ1-M	Master side EtherNET/IP™ Module with Integrated Ethernet Switch, 4-Pin Female M12 D-Coded connector for Ethernet communication, 4-Pin Male MiniFast Connector for Input and Output Power, TSI on the Tool, Arc Prevention applied to Input and Output power. Lock, Unlock, and RTL sensing with LED cables, 0-99999 Tool ID from the Tool Module also supported, Lock/Unlock Timeout Extended to 8 Seconds. **ISO13849 PLd CERTIFICATION PENDING**.
Power Supply Requirements	The power sources for input and output power must be capable of outputting an operating voltage (reverse polarity protected, regulated) of 24 +/- 15% VDC.
Factory Default Configuration	I/P Address: 192.168.1.54 Subnet Mask: 255.255.255.0 Gateway: 0.0.0.0 The DHCP option is factory set to “disabled”
Connector(s)	Auxiliary Power: 4-pin MiniFast, male Ethernet: 4-pin M12 D-coded, female Integrated Tool Changer I/O: (4) M8, 3-pin female connectors supporting Tool Changer Locked, Unlocked, and Ready to Lock proximity sensors. Integrated Connection to Valve Adapter Diagnostic Sensors: M8, 3-pin female connectors supporting Valve Adapter proximity sensor M8, 4-pin female connectors supporting Valve Adapter pressure sensor Integrated Connection to valve adapter: 4-pin block
Pass-through Power	5A, 20-29VDC
Current Draw	Power: 180mA @ 24VDC, Master only (Unlocked sensor “ON”, Locked) Valve Power (switched Auxiliary Power): 250mA @ 24VDC (Solenoid Valve) (only when locking or unlocking Tool Changer).
Temperature	32°F to 120°F (0 to 49°C).
Weight	2.40 lbs (1.09 kg)

Table 8.3—DKL Tool Module	
9121-DKL-T	EtherNET/IP™ Module with 4-Pin Female M12 D-Coded connector for Ethernet communication, 4-Pin Female MiniFast Connector for Input and Output Power, 5-pin M12 connector for TSI switch, Tool-ID 0-99999, supports Arc Prevention on the Master - Tool side.
Factory Default Configuration	(5) Tool-ID switches, each reading a (0–9) position (all factory set to Tool Position 1)
Connector(s)	Auxiliary Power: 4-pin Mini, female Ethernet: 4-pin M12 D-coded, female Connection to Safety Sensor: 5-pin M12, female connector supporting connection to Safety Switch
Pass-through Power	5A, 20-29VDC
Tool-ID	(5) Push button switch reading 0–9 positions (Refer to I/O map).
Temperature	32°F to 120°F (0 to 49°C).
Weight	1.49 lbs (0.68 kg)

9. Drawings

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