Table of Contents

Glossary

Term	Definition
Clear Errors	An output supplied to the ATI Master node to clear Error on Latch, Error on Unlatch, and Input Power Good error conditions.
EOAT	End Of Arm Tooling
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.
Latch	An output supplied to the ATI Master to couple the Tool Changer.
Locked	A proximity sensor input indicating that the coupling mechanism is in the Lock position.
RTL (Ready-To-Lock)	A proximity sensor that indicates the Tool Changer Master is close to the Tool. This proximity sensor is installed in the Master body, senses a target in the Tool body and indicates the Master is adjacent to the Tool. In the DKP modules (2) RTL sensors are supported (RTL1 & RTL2).
Tool ID	Input from the Master node reporting the values of the Tool ID switches. The Tool ID switches reside on the Tool module and their data is transferred to the Master module via RS485.
Tool Power On	The “Tool Power ON” bit is set high when the Arc Prevention Circuit has activated power on the Tool. If this bit is low there will be neither Input/Logic Power nor Output power available on the Tool.
Tool Present	An input indicating the Master module is electrically connected to the Tool. Input/ Logic power supplied from the ATI Master through the module interface contact pins is looped through the Tool PCB to provide the voltage source to make this input high.
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 safety switch and relays.
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.
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.
TSIV	An input provided for fault monitoring of the TSI Limit Switch. It should be high when the limit switch is actuated and the Tool is in the stand or storage location. In the DKP module, a single TSI switch input is supported (TSI switch).
TSRV	An input provided for health status monitoring of the TSI Relay. This signal should mirror the TSI switch input. In the DKP module, a single TSRV input is supported.
Unlatch Enable	A virtual input used to describe the behavior of the Master module firmware in regards to allowing an Unlatch output to be processed.
Unlatch	An output supplied to the ATI Master to uncouple the Tool Changer.
Unlocked	A proximity sensor input indicating that the coupling mechanism is in the Unlock position.

C. Control and Signal Modules

DKP—Ethernet/IP Control/Signal Module

1. Product Overview

The EtherNet/IP modules enable control and communicate with Tool Changers using EtherNet/IP. It passes the Ethernet/IP network thru a managed switch to the allow control of Ethernet/IP devices on the EOAT. The DKP supports Ethernet/IP Quick Connect, allowing quick connection times between the Robot and EOAT devices.

Control of the Tool Changer is through the Master Node along with the reporting of Tool Changer I/O, such as Lock, Unlock, and Ready-to-Lock signals. The Tool side module provides Tool-ID, reported through the Master side and functions as a pass through for the EtherNet/IP network and power to downstream equipment.

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. Refer to *Section 9—Drawings*.

An electrical interface is provided on the Master module for support of a single or double-solenoid integrated valve. A 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. The Unlock signal to the solenoid valve is routed through a “Tool Stand Interlock” (TSI) safety circuit that prevents the robot from unlocking the Tool from the Master when the mated assembly is not in a tool stand. Refer to *Section 2.4—Tool Side TSI*.

1.1 DKP Master

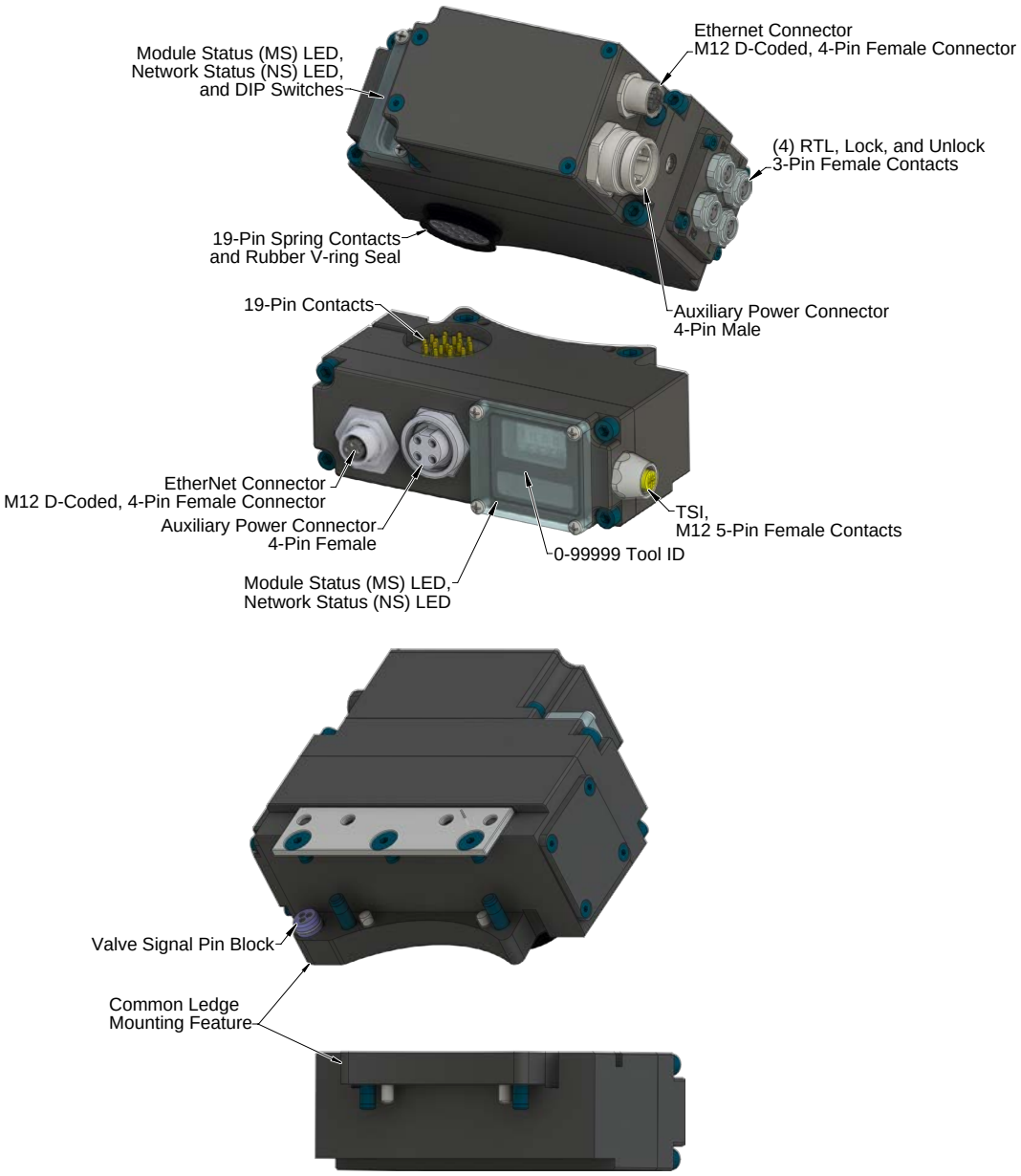
A 4-pin Mini connector provides the power supply of the EtherNet/IP interface, sensor inputs, and output power to the Tool module. A 4-pin M12 D-coded connector provides EtherNet/IP communication interfaces with the Master and downstream tooling.

The module has an integrated 3-pin valve signal pin block to provide the latch and unlatch signals to the solenoid valves. The Master module is equipped with (4) M8 3-pin connectors for the RTL sensors (R1 and R2), Lock (L), and Unlock (U) sensor connections.

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 2.2—Arc Prevention Circuit* for additional information regarding the Arc Prevention Circuit.

The module provides module and network status LED’s to visually indicate its operation. Network settings can be configured using a web browser or DIP switches on the Master module. Refer to *Section 2.1.2—Integrated Web Server* for configuration options.

Figure 1.1—DKP Modules



1.2 DKP Tool

The Tool module is equipped with a series of push button switches for setting of the Tool-ID inputs. This allows the customer to distinguish between the different Tools that are being used in a robotic cell or on a production line. See *Section 2.6—Software* for EtherNet/IP bitmap and detailed I/O information.

A 4-pin M12 D-coded connector provides EtherNet/IP communication interfaces with the downstream tooling. A 4-pin Mini connector provides on the auxiliary power to the downstream tooling.

A 5-Pin M12 female connector provides the interface for the PLe-rated two-channel non-contact safety sensor for TSI functionality. The customer must supply a Euchner CES-I-AP-M-C04-USB-117324 (ATI part number: 9120-TSL-SS-9019) safety sensor.

2. Product Information

The DKP-M and DKP-T modules employ a 4-pin Mini connector for output supply power and input/logic power, for the power supply of its EtherNet/IP interface and sensor inputs. Please refer to *Section 9—Drawings* for specific module wiring and connector interface information.

Prior to using the Tool Changer and the EtherNet/IP modules, various 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 web 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 DKP Master module.

Table 2.1—Class 1 Connection Information

	Instance	Size in Bytes
Configuration	128	0
Input	7	8
Output	37	8

2.1.2 Integrated Web Server

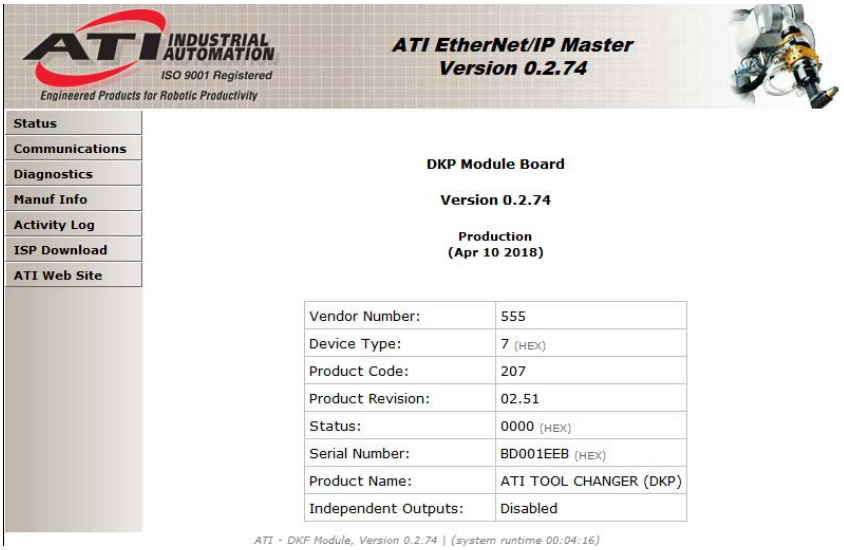
The module's integrated web server hosts several web pages. One of the pages provides configuration options for communication settings. Refer to *Figure 2.2*.

A web browser, such as Internet Explorer or Mozilla Firefox, is required to access the web server. The module's web pages use simple HTML and do not require any plug-ins.

To bring up the main page of the web server.

1. Type the module's IP address into the browser's address field and press enter, this will open the status page.

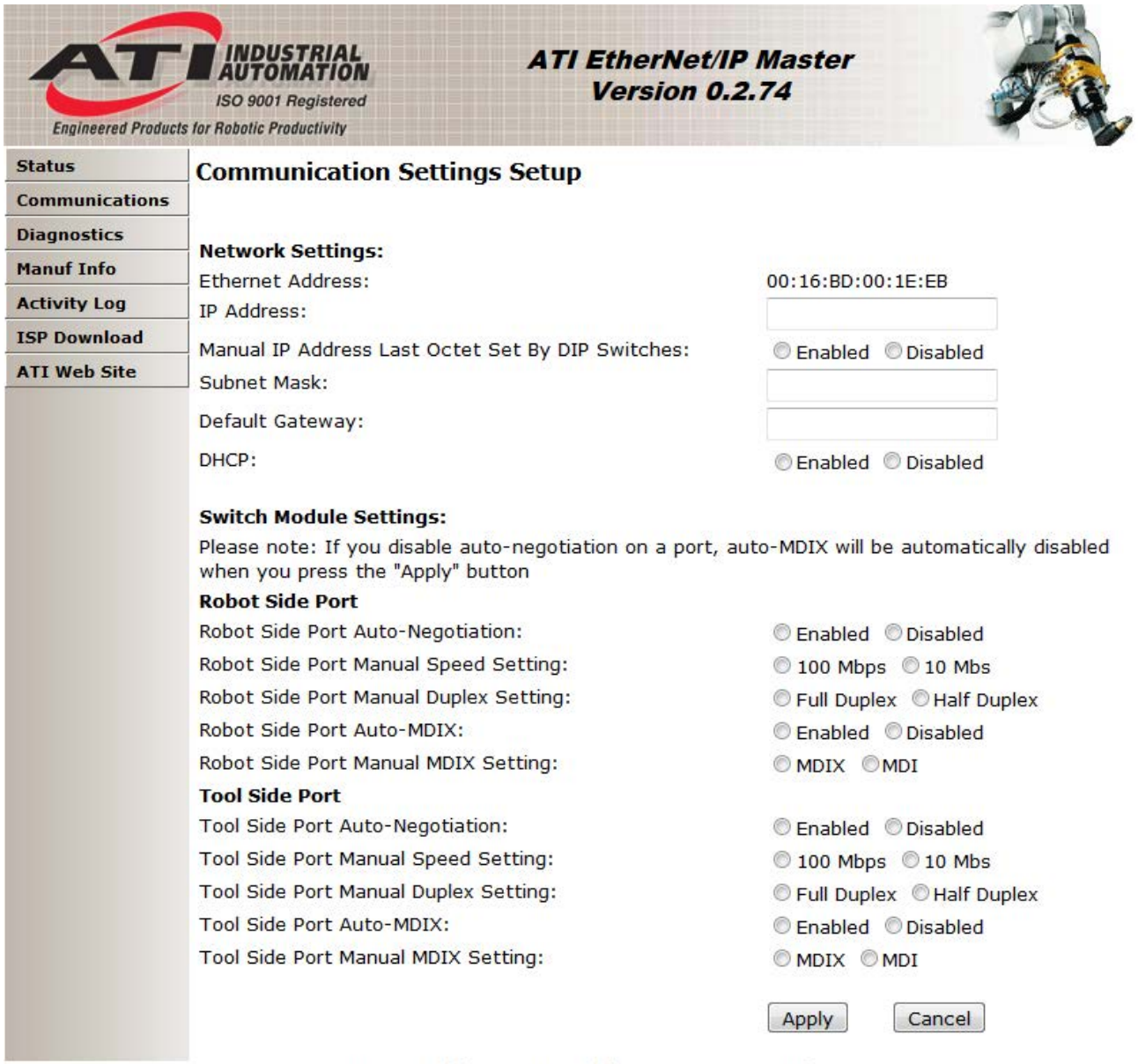
Figure 2.1—Integrated Web Server Status Page



2. Click on the "Communications" button on the menu bar to open the Communication Page. This page show you the current network setting, switch status and settings, robot and tool side port setting, and Ethernet/IP settings.

3. To change these setting click Edit at the bottom of the page. Refer to *Section 2.1.3—Network Settings* for different methods of changing the network settings

Figure 2.2—Integrated Web Server Communication Page



NOTICE: The Communication page is shown for reference only, refer to *Section 2.1.3—Network Settings* for the Network Settings defaults and *Section 2.1.4—Switch Module Settings (Ethernet Switch)* Switch Module Settings Robot and Tool side port default settings.

2.1.3 Network Settings

The Master module network settings are only loaded upon power up, consequently the module must be power cycled for new network setting changes to be used. The default settings are as follows:

- IP Address is set to **192.168.1.1**.
- The subnet mask is set to: **255.255.0.0.**
- The Gateway is set to: **0.0.0.0**.
- DHCP is **Disabled.**

There are four ways to set the modules network configurations:

1. *Section 2.1.3.1—Configure the Master Module Network Settings to the Defaults Values*
2. *Section 2.1.3.2—Configure the Master Module Network Settings Using the Values Entered into the Communication Page*
3. *Section 2.1.3.3—Configure the Master Module Network Settings Using Values Entered into the Communication Page and the last Octet of the IP address from the DIP Switches*
4. *Section 2.1.3.4—Configure the Module Network Settings Using a DHCP Server*

2.1.3.1 Configure the Master Module Network Settings to the Defaults Values

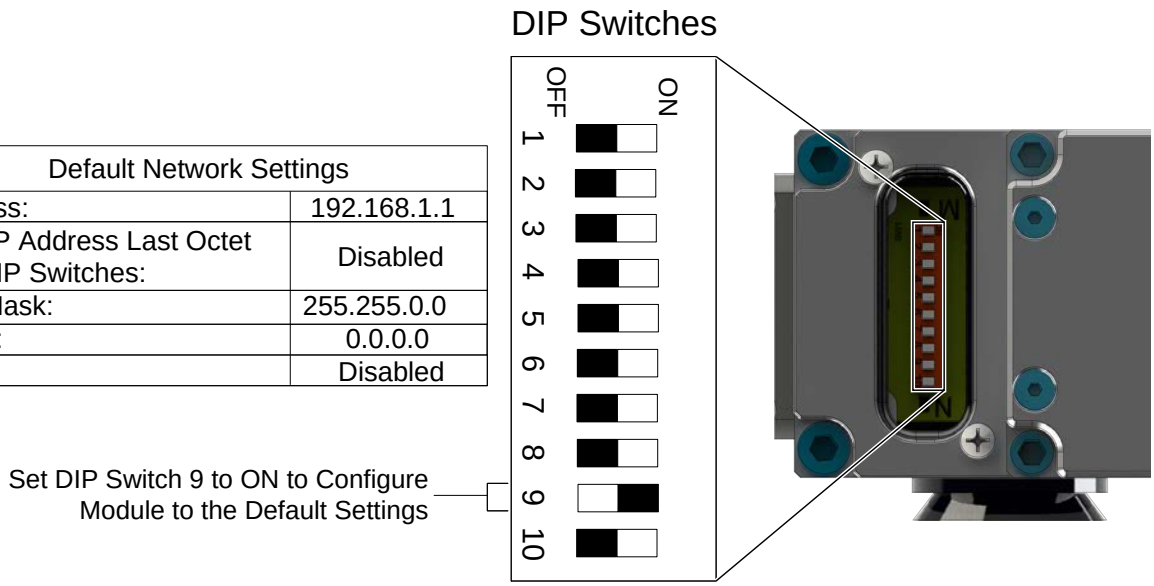
To configure the network settings to the module defaults manually, set DIP switch 9 to **ON** and power cycle the DKP master module. Refer to *Section 2.1.9—DIP Switches on the Master Module*..

This disregards the IP address manually set from the module DIP switches 1-8 and any values entered into the Communication page. The network settings are set to the module defaults after a power cycle. If values other than the default values were entered into the Communication page, the values will be restored to the default network values.

If the IP address was changed, the connection to the Integrated Web Server will be lost after the power cycle. To reconnect to the Home page, type http://192.168.1.1 into the browser's address field and then press enter.

Figure 2.3—Using DIP Switch 9 to Configure the Module to the Default Settings

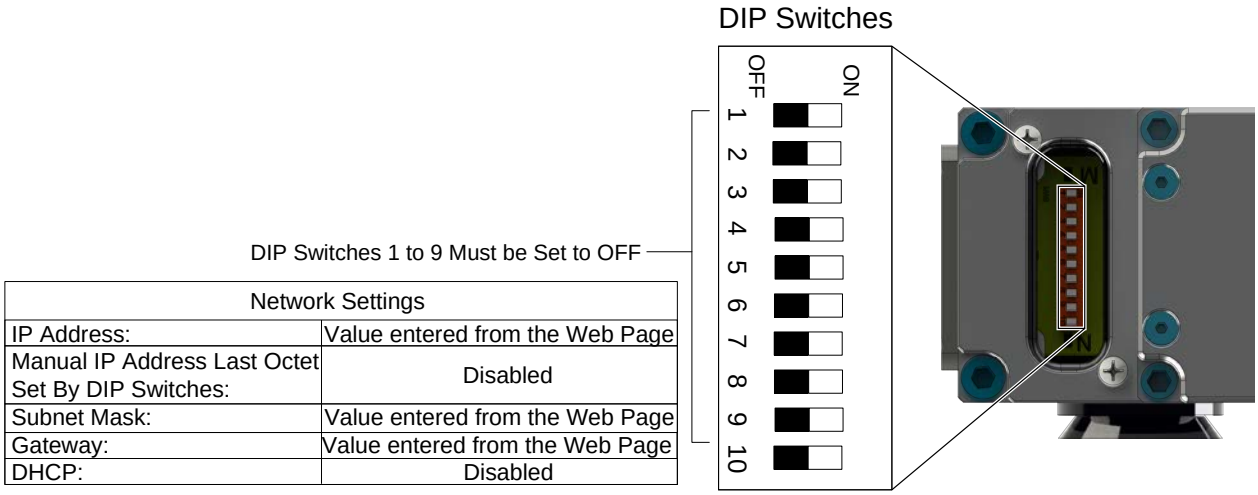
Default Network Settings	
IP Address:	192.168.1.1
Manual IP Address Last Octet Set By DIP Switches:	Disabled
Subnet Mask:	255.255.0.0
Gateway:	0.0.0.0
DHCP:	Disabled



2.1.3.2 Configure the Master Module Network Settings Using the Values Entered into the Communication Page

To configure the network settings using the values entered from the Communication page, manually set DIP switches 1 through 9 to **OFF**. Refer to *Section 2.1.9—DIP Switches on the Master Module*. This disregards the all the defaults values stored by the module. The network settings will use the values entered into the Communication page.

Figure 2.4—Using the Values entered into the Communication Page to Configure the Module



Network Settings	
IP Address:	Value entered from the Web Page
Manual IP Address Last Octet Set By DIP Switches:	Disabled
Subnet Mask:	Value entered from the Web Page
Gateway:	Value entered from the Web Page
DHCP:	Disabled

Connect to the Integrated Web Server on the DKP Master Module using a laptop and open the Communication page. Refer to *Section 2.1.2—Integrated Web Server.*

1. Enter the following values in the Communication page:
   a. In the IP Address fields enter the desired values, example: **192.168.1.8**.
   b. Manual IP address Last Octet Set by DIP Switches must be set to **Disabled,** click on the **Disabled** radio button.
   c. In the Subnet Mask field enter the desired values, example: **255.255.0.0**
   d. In the Default Gateway field enter the desired values, example: **0.0.0.0**
   e. DHCP must be set to **Disabled,** click on the **Disabled** radio button.
2. Click **Apply** at the bottom of the Communication page.
3. Power cycle the Master module.

Figure 2.5—Communication Page

If the IP address was changed, the connection to the Integrated Web Server will be lost after the power cycle. To reconnect to the Home page, type http://IP address value entered. Example: enter http://192.168.1.8 into the browser's address field and then press enter.

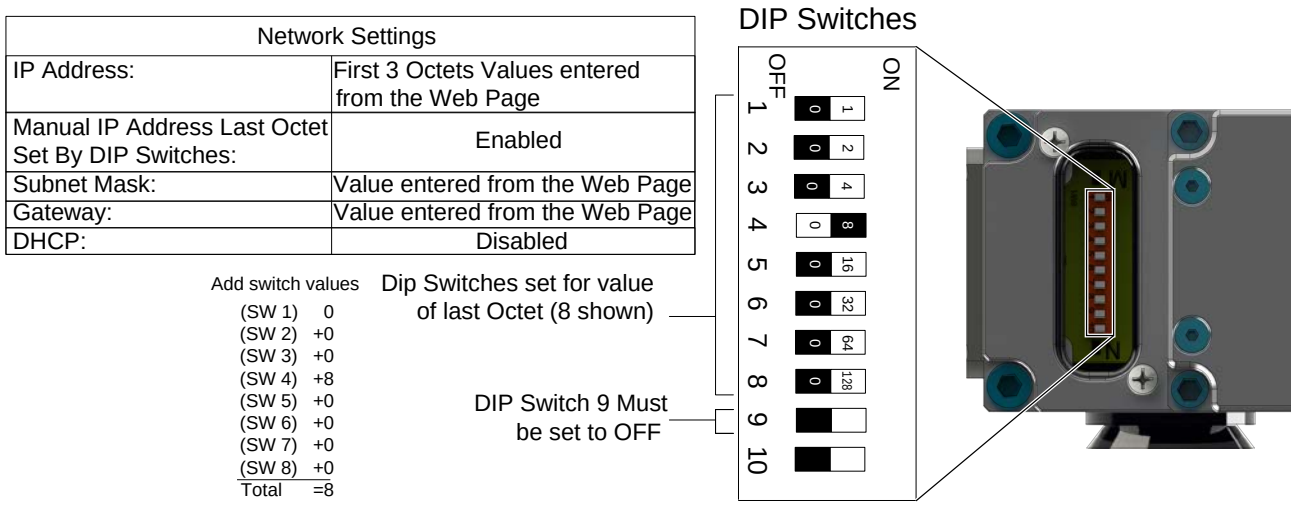
2.1.3.3 Configure the Master Module Network Settings Using Values Entered into the Communication Page and the last Octet of the IP address from the DIP Switches

To configure the network settings using the values entered in the Communication page for the Subnet mask, Gateway, Mode and the first 3 octets of the IP Address. The value for the last octet will use the value set by the DIP switches. Manually set DIP 1 through 8 to the desired values and set switch 9 to **OFF**. Refer to *Section 2.1.9—DIP Switches on the Master Module*.

NOTICE: If the DIP switches evaluate to an octet of 0 (DIP switches 1–8 all off) or 255 (DIP switches 1–8 all on), the last octet is set to 1, in order to avoid using an illegal network address.

Figure 2.6—Using the Values Entered into the Settings Page for the Module Network Settings

Network Settings	
IP Address:	First 3 Octets Values entered from the Web Page
Manual IP Address Last Octet Set By DIP Switches:	Enabled
Subnet Mask:	Value entered from the Web Page
Gateway:	Value entered from the Web Page
DHCP:	Disabled



Connect to the Integrated Web Server on the DKP Master Module using a laptop and open the Communication page. Refer to *Section 2.1.2—Integrated Web Server.*

1. Enter the following values in the Communication page:
   a. In the IP Address fields enter the desired values, example: **192.168.1.1**. Note: If a value is entered for the last Octet it will be ignored.
   b. Manual IP address Last Octet Set by DIP Switches must be set to **Enabled,** click on the **Enabled** radio button.
   c. In the Subnet Mask field enter the desired values, example: **255.255.0.0**
   d. In the Default Gateway field enter the desired values, example: **0.0.0.0**
   e. DHCP must be set to **Disabled,** click on the **Disabled** radio button.
2. Click **Apply** at the bottom of the Communication page.
3. Power cycle the Master module.

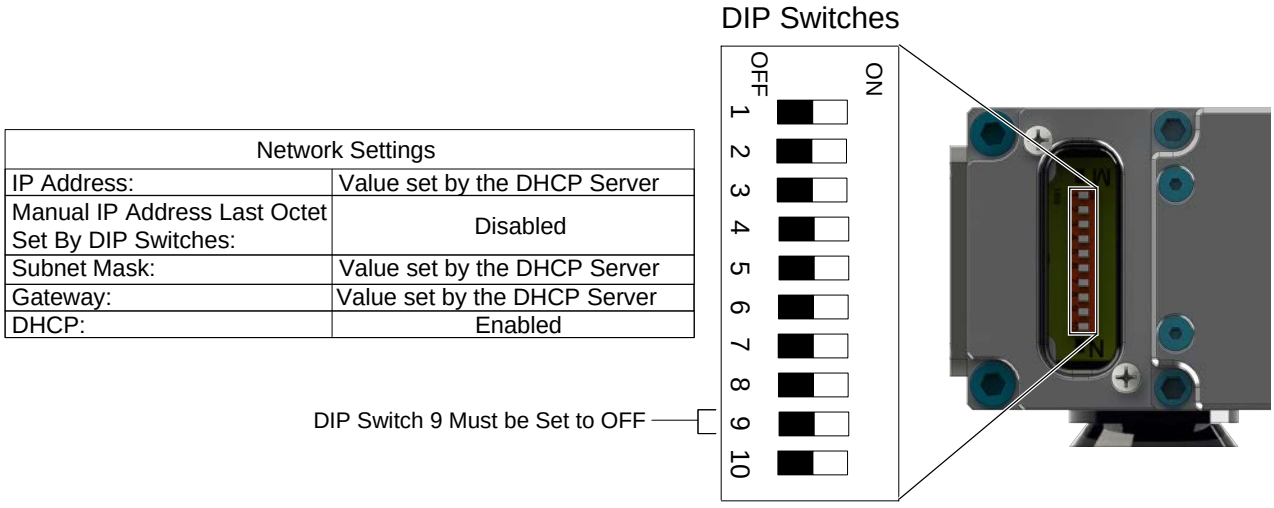
Figure 2.7—Settings Page

If the IP address was changed, after the power cycle the connection to the Integrated Web Server will be lost. To reconnect to the Home page, type http://IP address value entered. Example: enter http://192.168.1.8 into the browser's address field and then press enter.

2.1.3.4 Configure the Module Network Settings Using a DHCP Server

To configure the module to use values for the IP Address, Subnet Mask, and Default Gateway from the DHCP server, manually set DIP switch 9 to **OFF**. Refer to *Section 2.1.9—DIP Switches on the Master Module*.

Figure 2.8—Using a DHCP Server to Configure the Module Network Settings



Network Settings	
IP Address:	Value set by the DHCP Server
Manual IP Address Last Octet Set By DIP Switches:	Disabled
Subnet Mask:	Value set by the DHCP Server
Gateway:	Value set by the DHCP Server
DHCP:	Enabled

Connect to the Integrated Web Server on the DKP Master Module using a laptop and open the Communication page. Refer to *Section 2.1.2—Integrated Web Server.*

1. Enter the following values in the Communication page:
   a. In the IP Address field do not enter a value.
   Note: If value is entered it will be ignored.
   b. Manual IP address Last Octet Set by DIP Switches must be set to **Disabled,** click on the **Disabled** radio button.
   c. In the Subnet Mask field do not enter a value.
   Note: If value is entered it will be ignored.
   d. In the Default Gateway field do not enter a value.
   Note: If value is entered it will be ignored.
   e. DHCP must be set to **Enabled,** click on the **Enabled** radio button.
2. Click **Apply** at the bottom of the Communication page.
3. Power cycle the Master module.

Figure 2.9—Settings Page

A DHCP server must be present in the network. If no DHCP server is responding within 30 seconds after power-up, the Master module uses the network setting entered on the communication setting setup page.

2.1.4 Switch Module Settings (Ethernet Switch)

The modules have an integrated managed Ethernet switch where the settings of two ports can be changed from the Communication page under Switch Module Settings. The modules are shipped with the following default switch settings. The default settings support EtherNet/IP Quick Connect for downstream devices.

The Ethernet switch resets to these known default settings by setting DIP switch 9 to the ON position and performing a power cycle. This will reset the module to the default but will not change the values entered in the Communication page.

NOTICE: In order to support a standard (not Quick Connect) EtherNet/IP application Auto Negotiation and Auto Crossover must be enabled on the Robot and the Tool Side Port. Otherwise there can be communication errors.

2.1.4.1 Robot Side Port:

Robot Side Port default settings:

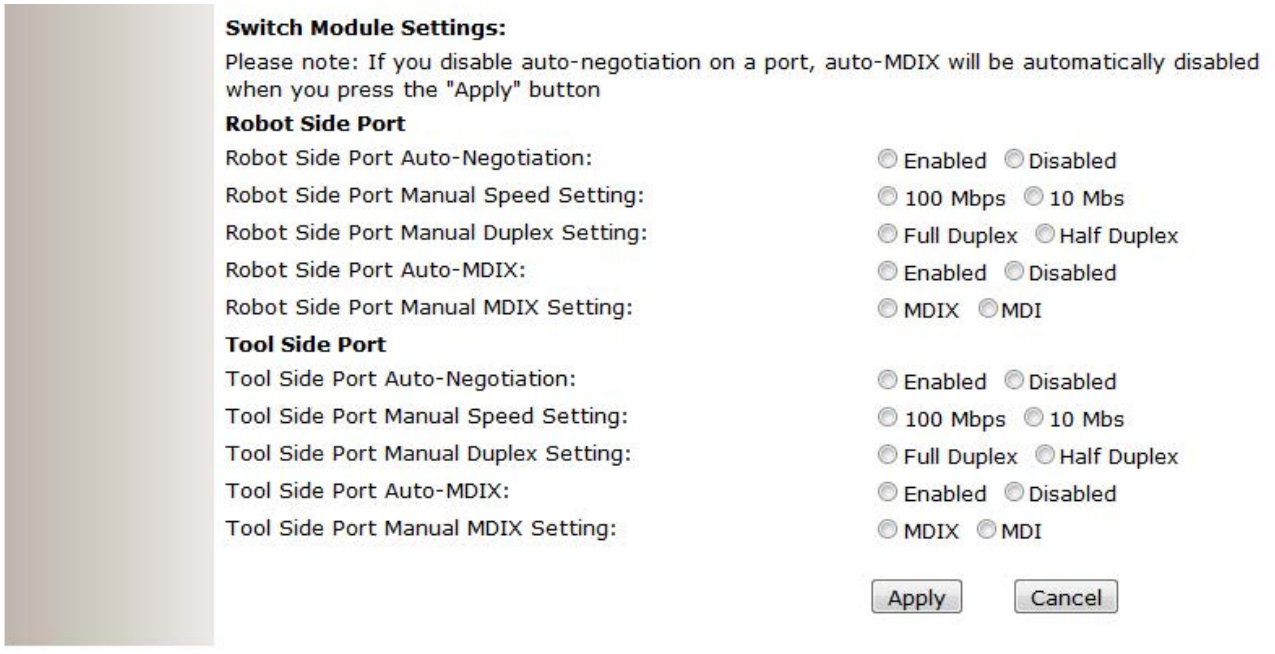
- Robot Side Port Auto-Negotiation: **Enabled**
- Robot Side Port Manual Speed Setting: **100MPS**
- Robot Side Port Manual Duplex Setting: **Full Duplex**
- Robot Side Port Auto-MDIX : **Enabled** (Auto-MDIX = Auto Crossover)
- Robot Side Port Manual MDIX Setting: **MDI**

2.1.4.2 Tool Side Port:

Tool Side Port default settings:

- Tool Side Port Auto-Negotiation: **Disabled**
- Tool Side Port Manual Speed Setting: **100MPS**
- Tool Side Port Manual Duplex setting: **Full Duplex**
- Tool Side Port Auto-MDIX: **Disabled**
- Tool Side Port Manual MDIX Setting: **MDI-X** (MDI-X = Crossover)

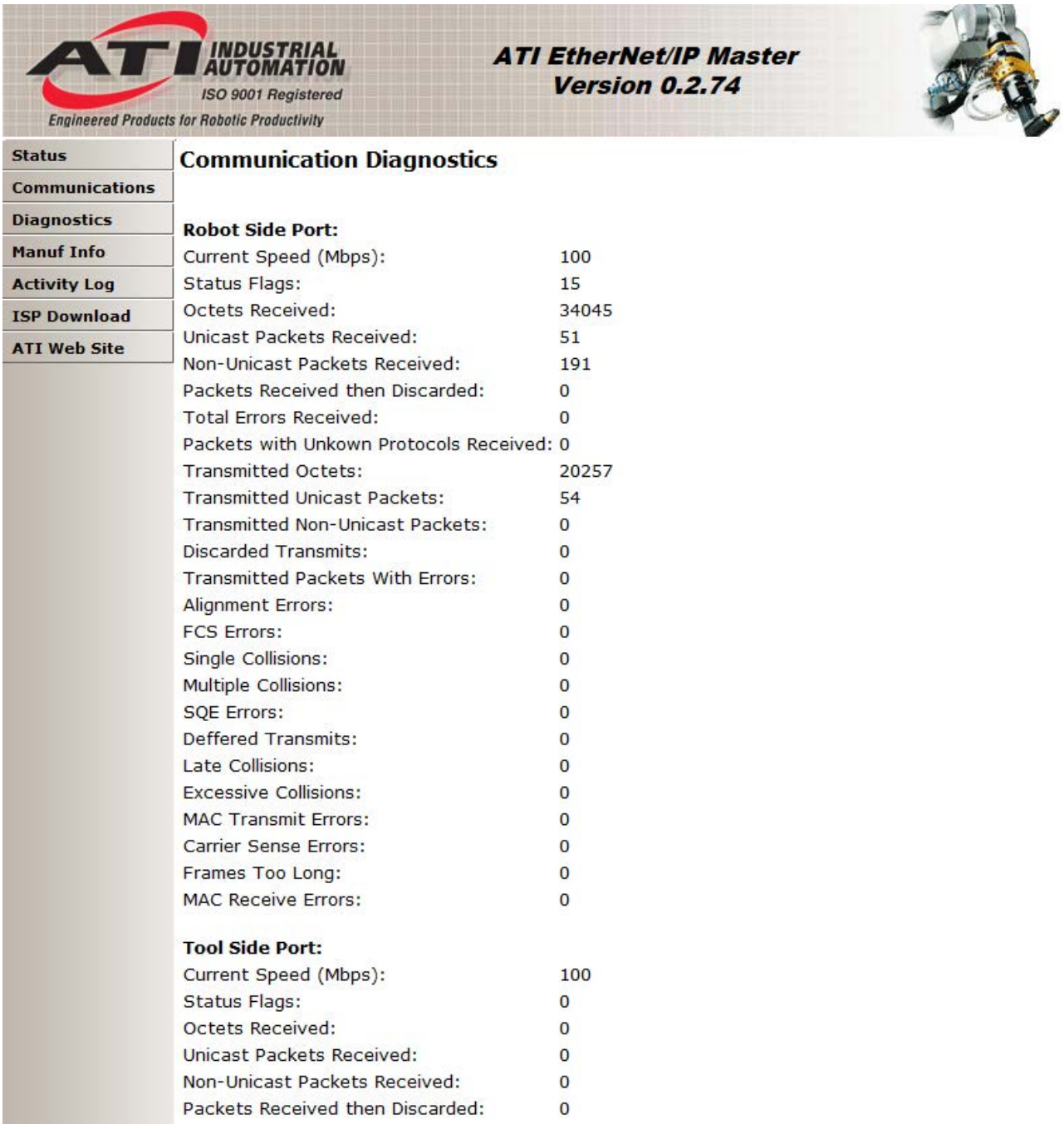
Figure 2.10—Integrated Web Server Communication Page - Switch Module Settings



2.1.5 Communication Diagnostics (Ethernet Switch)

On the Communication Diagnostics page of the web server (see *Figure 2.11*), the Master module displays the current status of the robot and tool side port settings, as well as their diagnostic counters. This is the same information is reported over the Ethernet Link Object 0xF6 in the EtherNet/IP protocol.

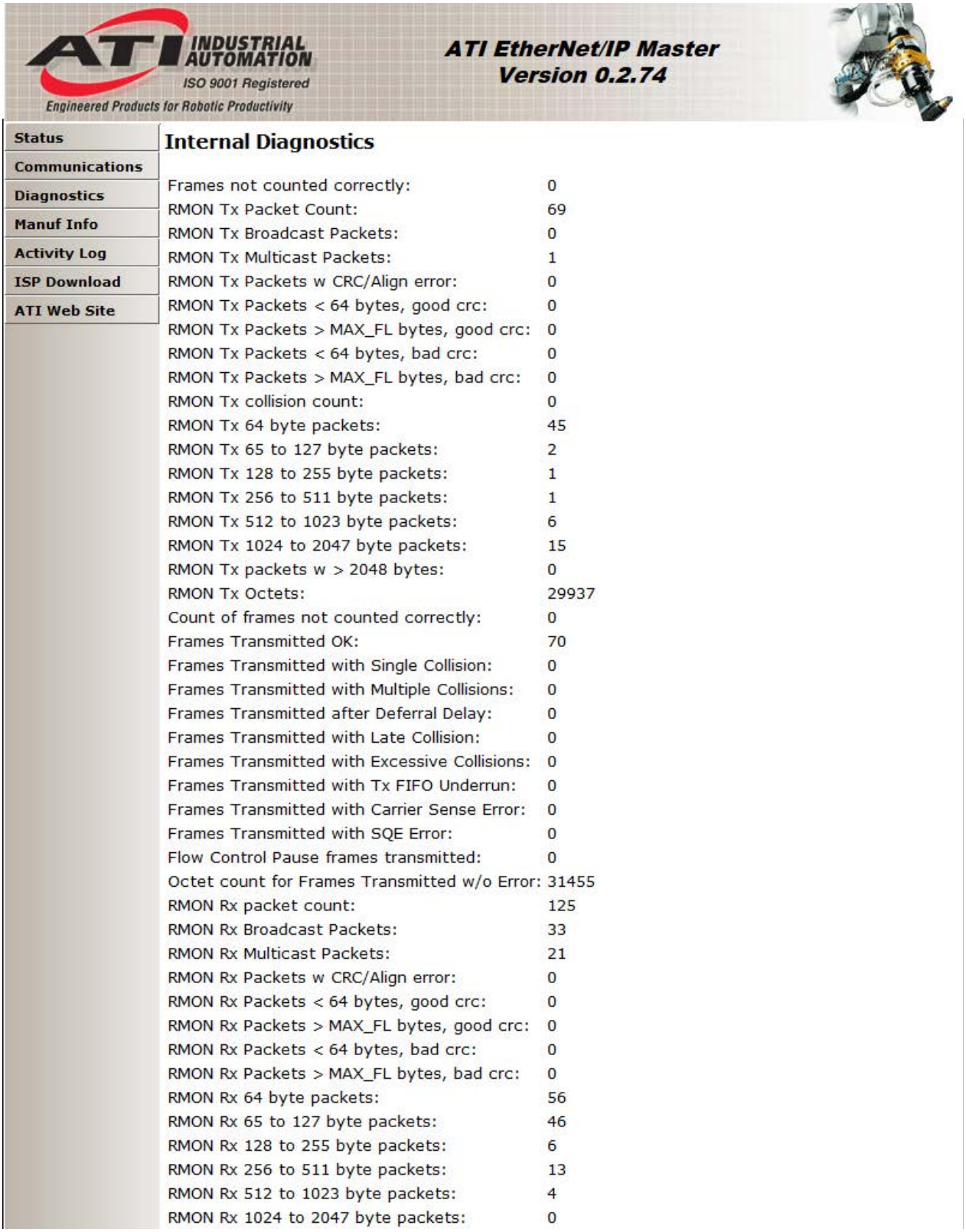
Figure 2.11—Integrated Web Server Diagnostics Page



2.1.6 Internal Diagnostics

On the bottom of the diagnostics page there is a link for Internal Diagnostics that provides reports all the available counters from the microcontroller's Ethernet interface.

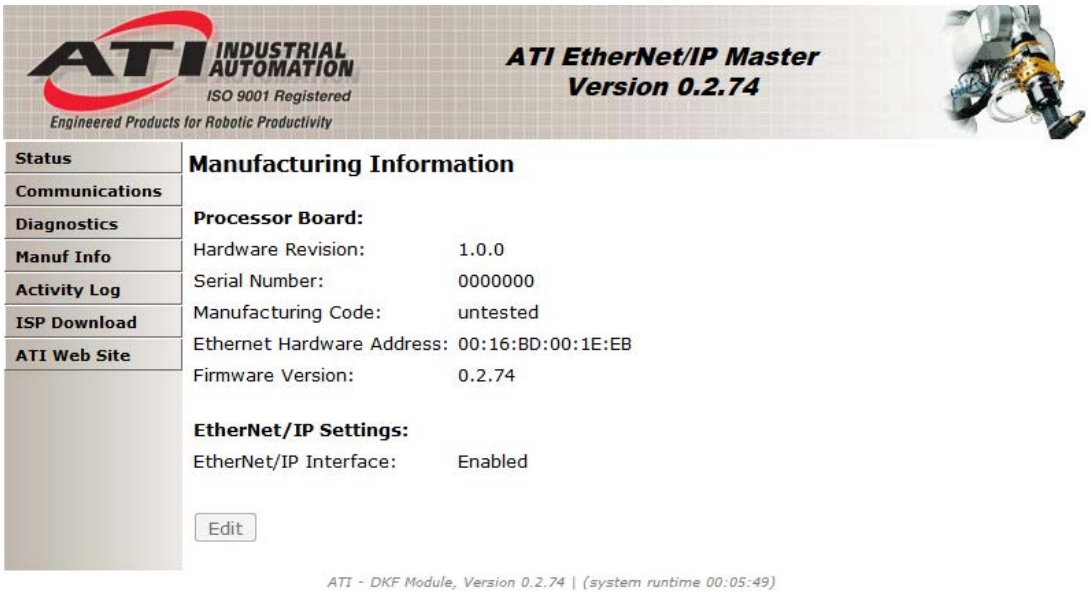
Figure 2.12—Integrated Web Server Internal Diagnostics Page



2.1.7 Manufacturing Information

The manufacturing information page provides hardware revision, serial number, firmware version and other information that may assist in troubleshooting issues.

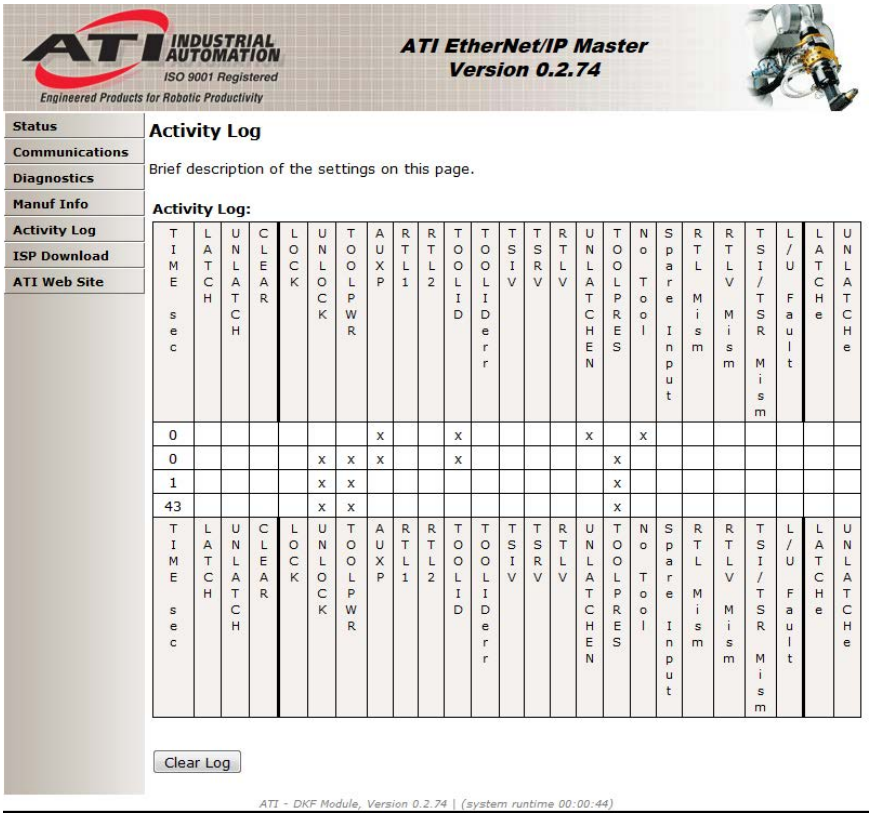
Figure 2.13—Integrated Web Server Internal Manufacturing Information Page



2.1.8 Activity Log

The activity log provides a log of errors, and states that could assist in troubleshooting issues.

Figure 2.14—Integrated Web Server Internal Activity Log Page

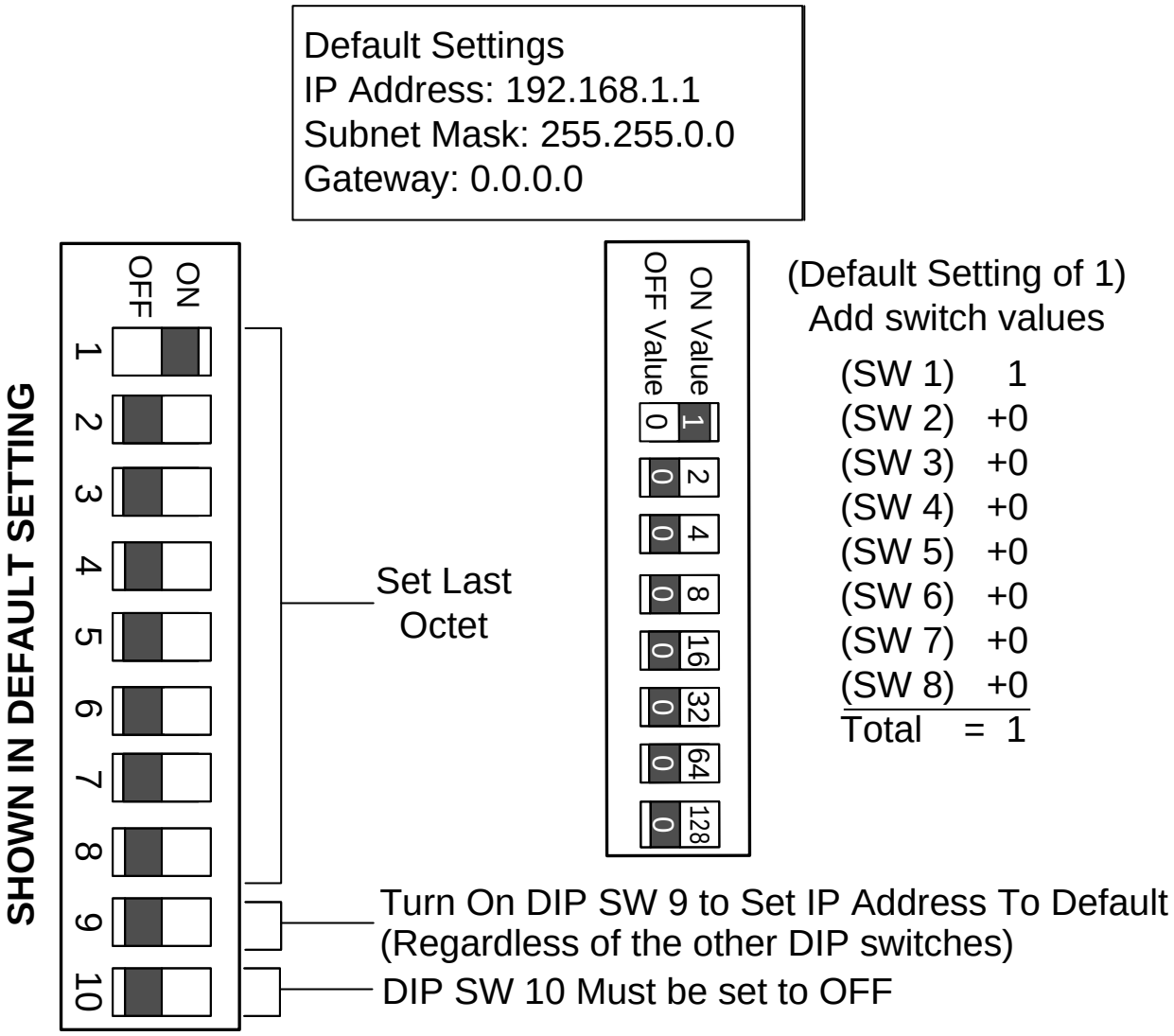


2.1.9 DIP Switches on the Master Module

The DKP-M module has 10 DIP switches with the following functions:

DIP 1 through 8:	Last octet of the DKPs IP address. See *Section 2.1.3—Network Settings* for details
DIP 9:	Set DKP-M IP address settings to the default values.
DIP 10:	Must always be in the OFF position

Figure 2.15—EtherNet/IP Master Module DIP Switch Settings



2.1.10 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 2.2* 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 2.3* for an outline of this LED’s operation.

Figure 2.16—EtherNet/IP Master Module LEDs and DIP Switch Settings

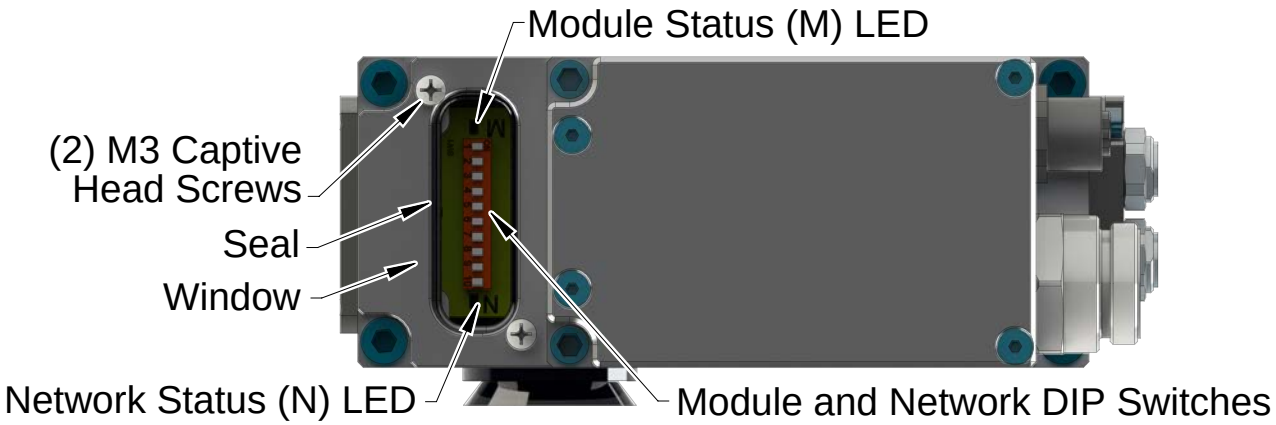


Table 2.2—Module Status LED			
Status	**LED Function**		**Note**
No Power		Off	No power applied. Check voltage is 24VDC.
Operational		Green	Normal operation.
Standby		Flashing Green	Device in Standby (The Device Needs Commissioning) – not connected to Tool Module (no Tool ID read)
Recoverable Fault		Flashing Red	Recoverable fault.
Unrecoverable Fault		Red	Unrecoverable fault.
Device Self Testing		Flashing Red/ Green	Device Self Testing.

Table 2.3—Network Status LED			
Status	**LED Function**		**Note**
No Power/ Offline/No IP Address		Off	Device not online. Device may not have an IP address or may be powered off.
Online, Not Connected		Flashing Green	Device is online but connection is not established. Device not allocated to a Master.
OK Online, Connected		Green	Device is online with connections established. Device is allocated to a Master.
Connection Timeout		Flashing Red	One or more I/Os are timed out.
Communication Faulted		Flashing Red/ Green	Communication Faulted, and Received an Identify Comm Fault Request - Long Protocol.

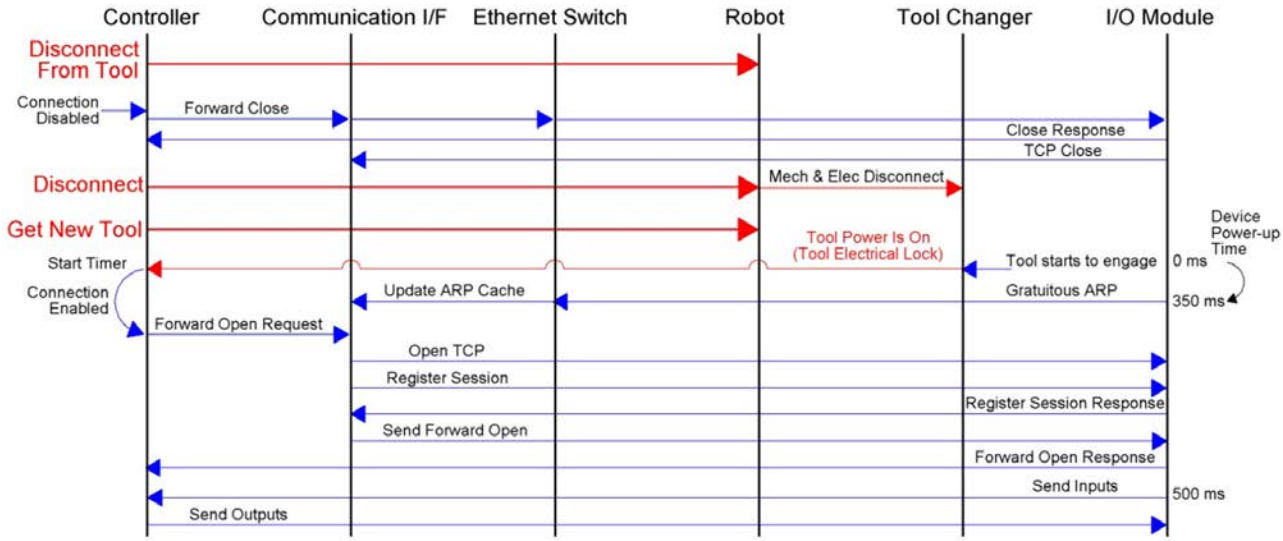
2.1.11 Using Ethernet/IP Quick Connect

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 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 DKP module reports “Tool Power ON” in the bitmap (Byte 1, bit 3 - refer to *Section 2.6—Software*).

In *Figure 2.17* 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 2.17—Quick Connect Sequence Diagram



2.2 Arc Prevention Circuit

The DKP-M 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 DKP-M module, the Arc Prevention Circuit controls the ON/OFF status of the Logic and Tooling Power V+.

The behavior of the Arc Prevention Circuit is more fully described in the following sections. *Figure 2.18*

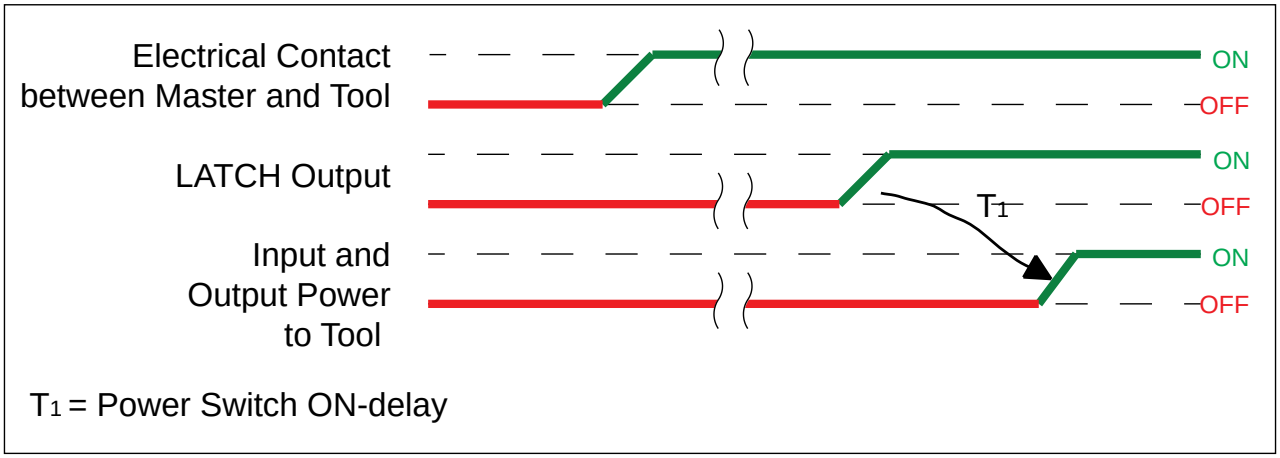
2.2.1 Arc Prevention Circuit Behavior during Coupling

The behavior of the Arc Prevention circuit during coupling can be more clearly understood by referring to *Figure 2.18*, which shows the power-on timing diagram for the Arc Prevention Circuit. Starting at the top of the diagram, electrical contact between Master and Tool pin Contacts occurs. The LATCH command is issued initiating locking of the Master and Tool.

The Arc Prevention Circuit will turn on Logic and Tooling Power. The time delay between when the electrical contacts become fully engaged 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. The Tool Power Is On (Byte 1, bit 3 - refer to *Section 2.6—Software*) indicates when this is the case.

Figure 2.18—Arc Prevention Circuit Power-On Timing



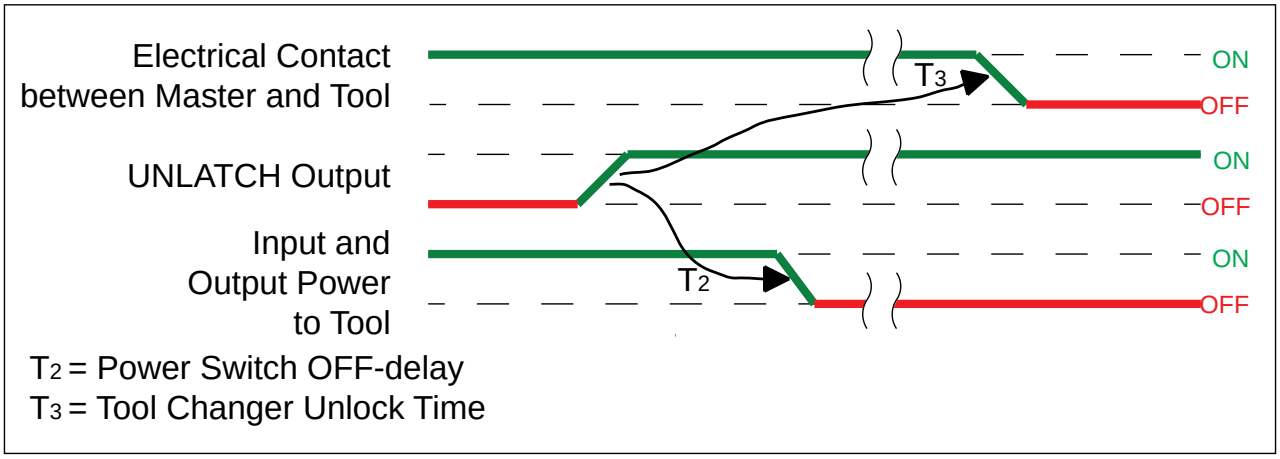
2.2.2 Arc Prevention Circuit Behavior during Uncoupling

The behavior of the Arc Prevention Circuit during uncoupling can be more clearly understood by referring to *Figure 2.19*, 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 Tooling 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 50 ms.

Sometime 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.

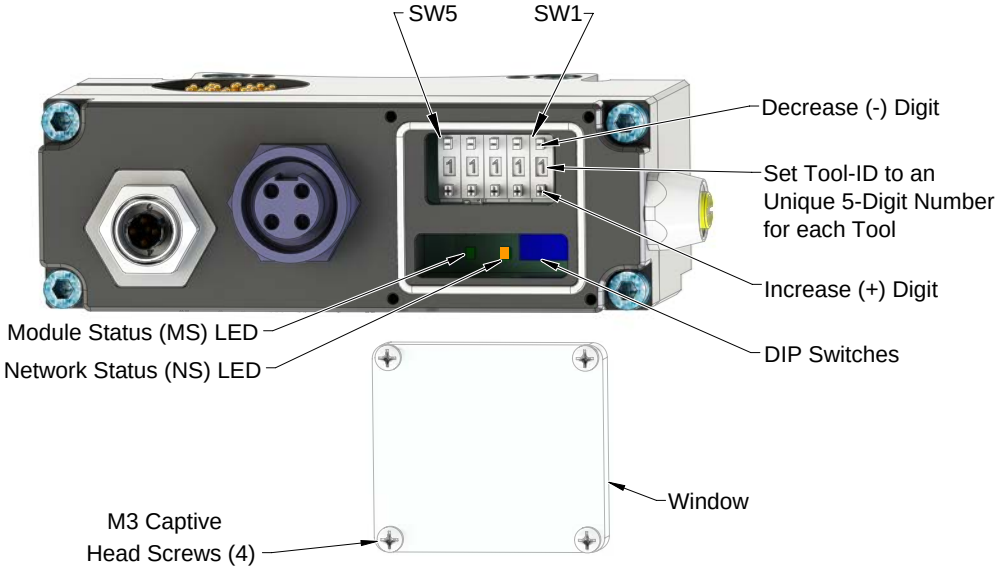
Figure 2.19—Arc Prevention Circuit Power-Off Timing



2.3 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.*

Figure 2.20—Tool-ID Switch Settings



2.3.1 Tool-ID

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 250 ms from the time the changer is coupled. The module LED will become solid GREEN when Tool-ID is reported to bitmap. Tool-ID is updated every 100 ms when Master and Tool are coupled.

(5) pushbutton switches are provided on the Tool module for setting of a Tool-ID number. For the location of the Tool-ID on the Tool module, refer to

If the plastic window and seal above the Tool-ID switches are removed, ensure the seal and window are re-positioned correctly to prevent a leakage path inside the module.

If a Tool is not present the Tool-ID returns all F's.

2.3.2 Tool Module DIP Switches

The DKP-T module has 10 DIP switches which should not be changed:

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

For the location of the DIP switches on the Tool module, refer to

2.3.3 Module Status (MS) LED

The Module Status (MS) LED indicates the status of the Tool module. In general, a combination of solid or flashing green indicates normal operation. For the location of the MS LED on the Tool module, refer to . Descriptions for each MS LED status are in the following table:

Table 2.4—Module Status (MS) LED

Status	LED Function		Note
No Power		Off	No power applied.
No Communication		Flashing Green (0.5 Hz)	The ATI Master board is not sending Tool-ID information.
Communication		Flashing Green (2.5 Hz)	The ATI Master board is sending valid Tool-ID information.

2.3.4 Network Status (NS) LED

The Network Status (NS) LED does not serve a function in the DKP Tool module. For the location of the NS LED on the Tool module, refer to . Under normal operating conditions, this LED should be orange.

2.4 Tool Side TSI

The Tool Stand Interlock (TSI) circuit ONLY allows Tool release in the stand or storage location as indicated by actuation of a customer-integrated switch. The customer must integrate a PLe-rated two-channel non-contact sensor such as a Euchner part number CES-I-AP-M-C04-USB-117324 (ATI part number: 9120-TSL-SS-9019) safety sensor for TSI functionality. The Safety Sensor is not included with the DKP but is available from ATI. The Safety Sensor is powered by INPUT V+ / INPUT V- (reference *Figure 2.21*). The safety switch should be mounted to the end effector in such a way that the switch is "made" only when the Tool is in the stand or storage location.

There is both a firmware and a hardware interrupt for the Unlatch command.

- Unlatch is enabled is reported in the bitmap in the form of the "Unlatch Enabled" bit (refer to *Section 4.2.3—Unlatch Enabled*).

The firmware controls the Unlatch Enabled bit to only allow the Tool Changer to complete the UNLATCH command if the following conditions are meet:

The Unlatch Enabled bit will be ON when the DKP module determines that the necessary preconditions for unlatching the Tool have been met.

- If TSRV and TSIV inputs are both in the OFF state, then RTL1, RTL2, RTLV1, RTLV2, and Tool Present all must also be in the OFF state for the Unlatch Enabled bit to be in the ON state. This allows the Tool Changer to Unlatch with no Tool attached (RTL Bypass).
- If TSRV and TSIV are both in the ON state then the Unlatch Enabled bit will be ON reguardless of the states of the RTL1, RTL2, RTLV1, RTLV2, and Tool Present inputs.
- If the state of TSRV and TSIV do not match (one ON or one OFF) the Unlatch Enabled bit will be in the OFF state.

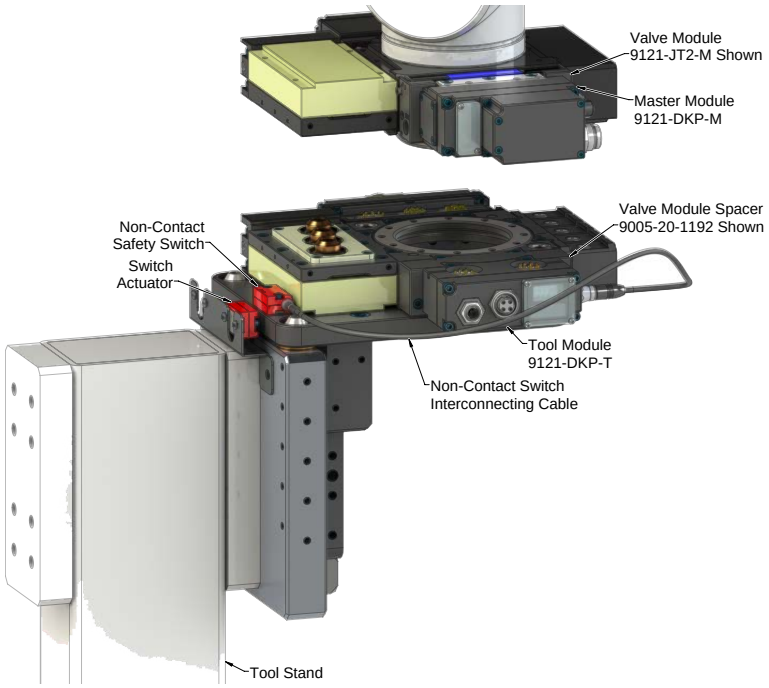
A Tool can only be released if the "Unlatch Enabled" bit is ON.

The following TSI status signals are reported in the bitmap (refer to *Section 2.6—Software*):

- TSIV: Status of the TSI switch.
- TSRV: Status of the TSI relays.

Section 4.4—Recommended Sequence of Operation describes in detail the behavior of the TSRV and TSIV bits during the operation of the Tool Changer.

Figure 2.21—Safety Switch



2.5 TSI Operational Function

The TSI system provides safe operation, by preventing the Tool Changer from unintentionally unlocking when the Tool is attached and not secured in the tool stand. The following sections describe the Tool Changer states and how the TSI system controls the unintentional unlocking of the Tool Changer.

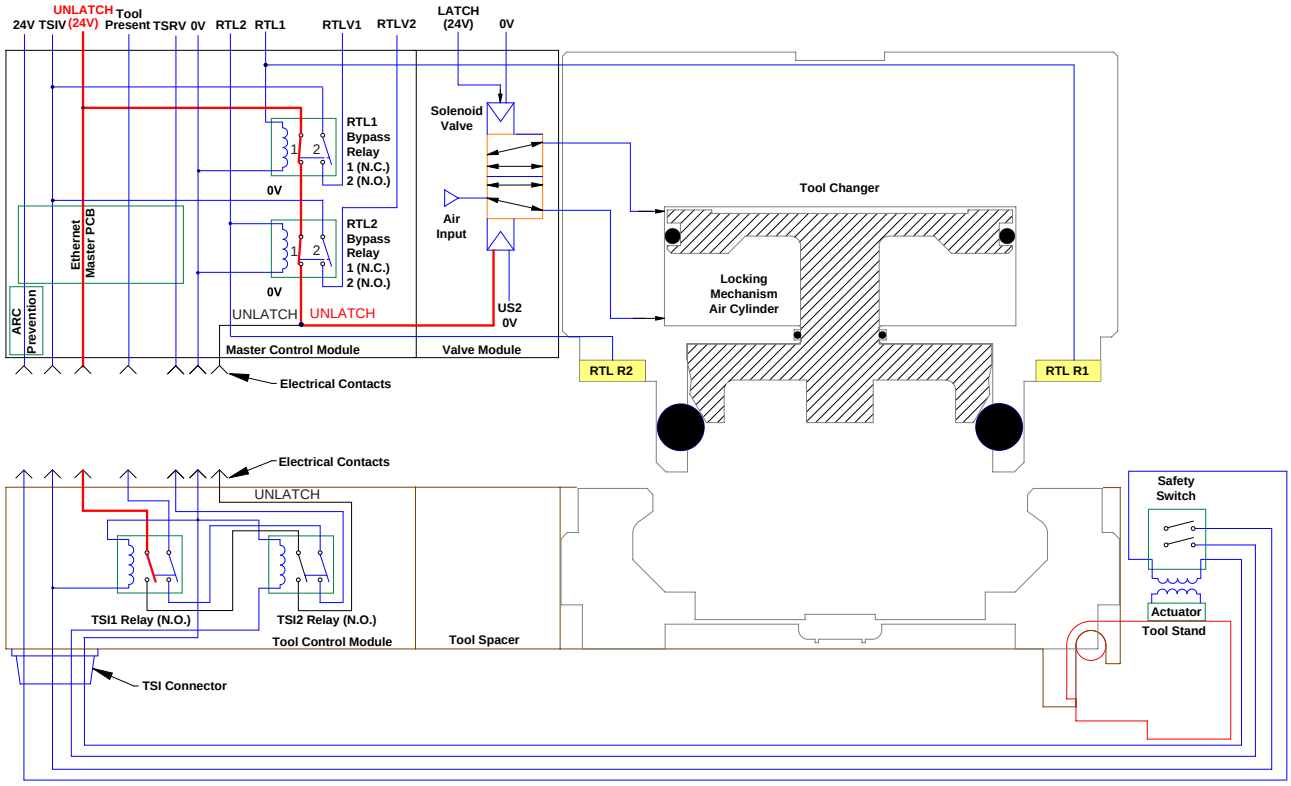
2.5.1 RTL Bypass Relay Circuit

When there is no tool present (therefore both the RTL sensors are low) the RTL Relay allows the Unlatch solenoid circuit to be completed and an Unlatch command is processed.

2.5.1.1 The Master is Free of the Stand and the Tool is in the Stand

The Master module has a normally closed RTL bypass circuit (RTL relay). If the Tool Changer is inadvertently locked without a Tool attached, the Tool Changer can still be safely unlocked automatically since no Tool is present. When a Tool is present (and therefore the RTL sensors are 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 provides the RTLV inputs for health status monitoring of the RTL Relay.

Figure 2.22—TSI Circuit with Master Free of Stand, Tool in the Stand



The RTL bypass relay has a second set of contacts that are used to provide the RTLV diagnostic signal (when the RTL bypass relay is open, the RTLV signals should be off). The RTLV signals can indicate if the RTL bypass relay is operating properly.

Figure 2.23—Fault Monitoring			
RTL1/RTL2	**RTLV1/ RTLV2**	**Tool Presence**	**Comments**
OFF	OFF	ON[1]	RTL1/RTL2 Not Operating Properly[2].
ON	ON	OFF[1]	
OFF	ON	OFF	
ON	OFF	ON	
ON	ON	ON	Operating Properly.
OFF	OFF	OFF	

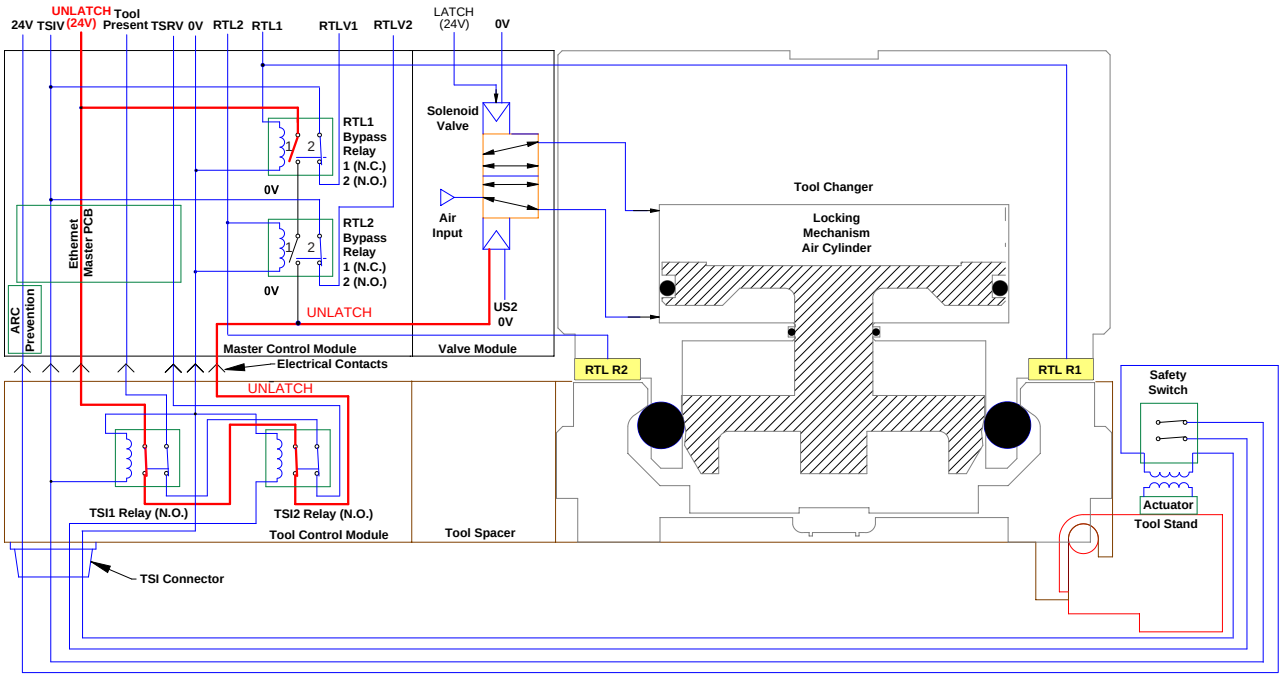
Notes:

1. Tool module present as evidenced by ability to read Tool-ID.
2. Dangerous situation where an unintentional Unlatch output signal could result in Tool release.

2.5.1.2 The Master is Coupled with the Tool and the Tool is in the Stand

The Master and Tool are coupled in the tool stand and the Master has detected a Tool is present with the RTL1 and RTL2 sensors ON. Thus opening the RTL bypass circuit and turning the RTLV1 and RTLV2 signals ON. The unlatch signal is now routed through the TSI circuit. With the Tool in the stand and the Arc Prevention board turns the power on to the Euchner safety switch. The Euchner Safety switch senses the actuator in the tool stand allowing the TSRV relay to close and no longer interrupting the unlatch signal and turning the TSIV signal ON. The second set of TSI switch contacts turn the TSRV signal ON.

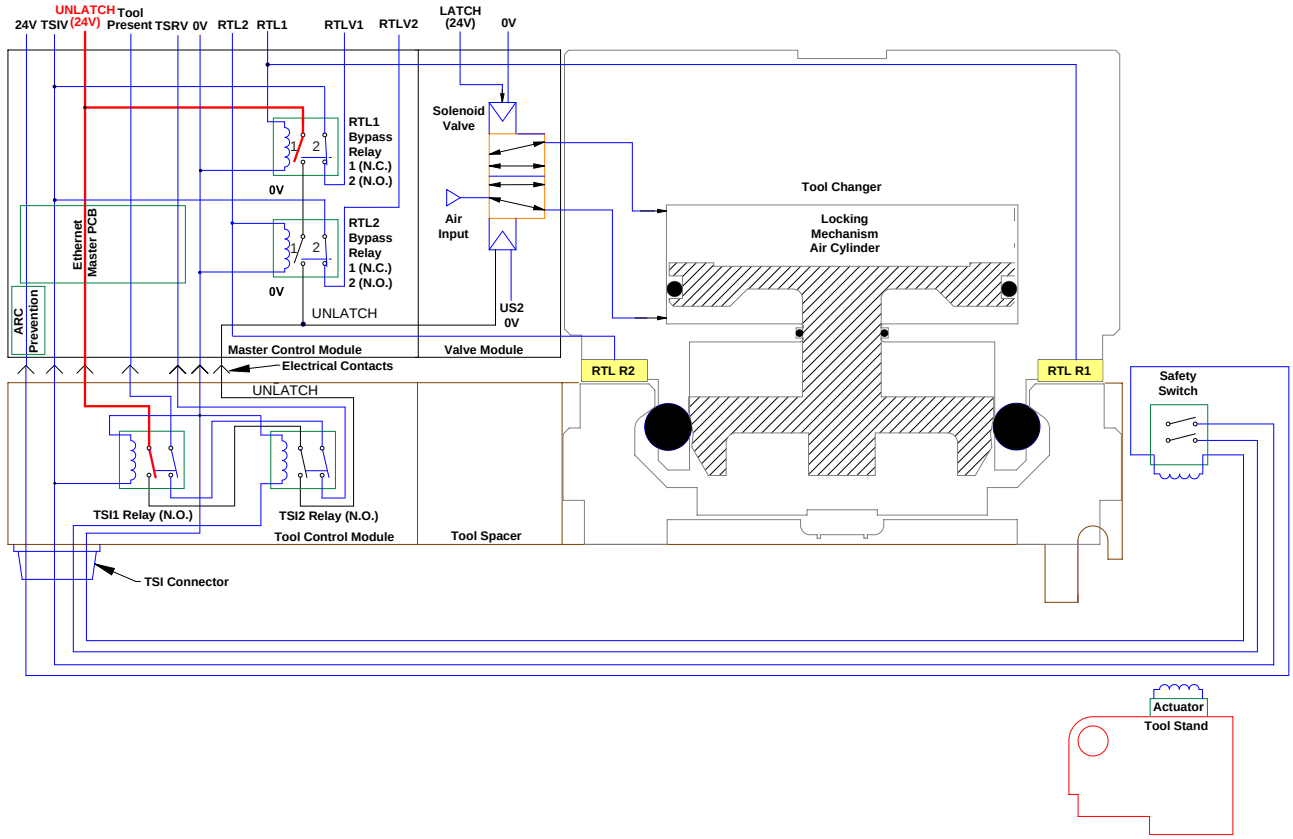
Figure 2.24—TSI Circuit with Master and Tool Locked



2.5.1.3 The Master is Coupled with the Tool and the Tool is Free of the Stand

The Master and Tool are coupled and are free of the tool stand. The RTL bypass circuit is open, as indicated by RTLV1 and RTLV2 being ON. The Euchner safety switch no longer senses the actuator in the tool stand allowing the TSI relays to open thus breaking the TSI circuit and interrupting an UNLATCH command.

Figure 2.25—TSI Circuit with Master and Tool Locked and Free of Stand



2.6 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 following part number:

DKP-M Node EDS File 9031-20-1079

An I/O bitmap for the Master node is provided in the following table: The default setting for the Master module is IP Address 192.168.1.1.

Table 2.5—I/O Bitmap, Robot Inputs from ATI Master, (9121-DKP-M)

Byte	BitNumber	Name	Description/Function
0	0	Locked	Tool Changer Lock Prox
	1	Unlocked	Tool Changer Unlock Prox
	2	Input Power Good	Sufficient Power for Inputs and Interface Logic Present
	3	Valve Power Available	Valve Power Present, refer to *Section 8—Specifications* to ensure correct power supply voltage.
	4	RTL1	Ready-to-Lock Prox1
	5	RTL2	Ready-to-Lock Prox2
	6	RTLV1	RTL Relay Verify1 I/P
	7	RTLV2	RTL Relay Verify2 I/P
1	0	Error on Latch	Short circuit overload condition exists with the Latch Output
	1	Error on Unlatch	Short circuit overload condition exists with the Unlatch Output
	2	Tool ID Error	Error communicating with the Tool Board
	3	Tool Power ON	Reflects state of the Power_ON output
	4	TSIV	TSI Swtich Verify
	5	TSRV	TSI Relay Verify
	6	Unlatch Enabled	Module is able to Unlatch when given the command, refer to *Section 4.2.3—Unlatch Enabled*
	7	Tool Present	Tool is connected to Master module
2	0	Tool ID SW 1 Bit 1	Tool-ID
	1	Tool ID SW 1 Bit 2	
	2	Tool ID SW 1 Bit 4	
	3	Tool ID SW 1 Bit 8	
	4	Tool ID SW 2 Bit 1	
	5	Tool ID SW 2 Bit 2	
	6	Tool ID SW 2 Bit 4	
	7	Tool ID SW 2 Bit 8	

Table 2.5—I/O Bitmap, Robot Inputs from ATI Master, (9121-DKP-M)			
Byte	**BitNumber**	**Name**	**Description/Function**
3	0	Tool ID SW 3 Bit 1	Tool-ID
	1	Tool ID SW 3 Bit 2	
	2	Tool ID SW 3 Bit 4	
	3	Tool ID SW 3 Bit 8	
	4	Tool ID SW 4 Bit 1	
	5	Tool ID SW 4 Bit 2	
	6	Tool ID SW 4 Bit 4	
	7	Tool ID SW 4 Bit 8	
4	0	Tool ID SW 5 Bit 1	Tool-ID
	1	Tool ID SW 5 Bit 2	
	2	Tool ID SW 5 Bit 4	
	3	Tool ID SW 5 Bit 8	
	4	Reserved	Reserved
	5		
	6	RTL1/RTL2 mismatch	Indicates the state of the RTL1 and RTL2 sensors do not match. Refer to *Section 4.3—Error Conditions* for more information.
	7	RTL/RTLV mismatch	Indicates the state of the RTL1 and RTLV1 or RTL2 and RTLV2 sensor and relay do not match. Refer to *Section 4.3—Error Conditions* for more information.
5	0	Reserved	Reserved
	1	TSIV/TSRV mismatch	Indicates the state of the TSIV and TSRV tool stand safety switch and associated relay do not match. Refer to *Section 4.3—Error Conditions* for more information.
	2	Lock/Unlock sensor fault	Indicates the Lock and Unlock sensors are both on at the same time. Refer to *Section 4.3—Error Conditions* for more information.
	3	Reserved	Reserved
	4		
	5		
	6	Always ON	This can be used to indicate when communication with the module is lost.
	7	Reserved	Reserved

Table 2.5—I/O Bitmap, Robot Inputs from ATI Master, (9121-DKP-M)			
Byte	**BitNumber**	**Name**	**Description/Function**
6 to 7	0	Reserved	Reserved
	1		
	2		
	3		
	4		
	5		
	6		
	7		

Table 2.6—I/O Bitmap, Robot Outputs to 9121-DKP-M module			
Byte	**BitNumber**	**Name**	**Description/Function**
0	0	Latch (Lock)	Latch Solenoid Valve
	1	Unlatch (Unlock)	Unlatch Solenoid Valve
	2	Reserved	Reserved
	3	Clear Errors	Reset errors, allow affected I/O to be reactivated
	4	Reserved	Reserved
	5		
	6		
	7		
1 to 7	-	Reserved	Reserved

3. Installation

The control/signal modules are typically installed by ATI prior to shipment. The following procedure outline the field installation or removal. 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.

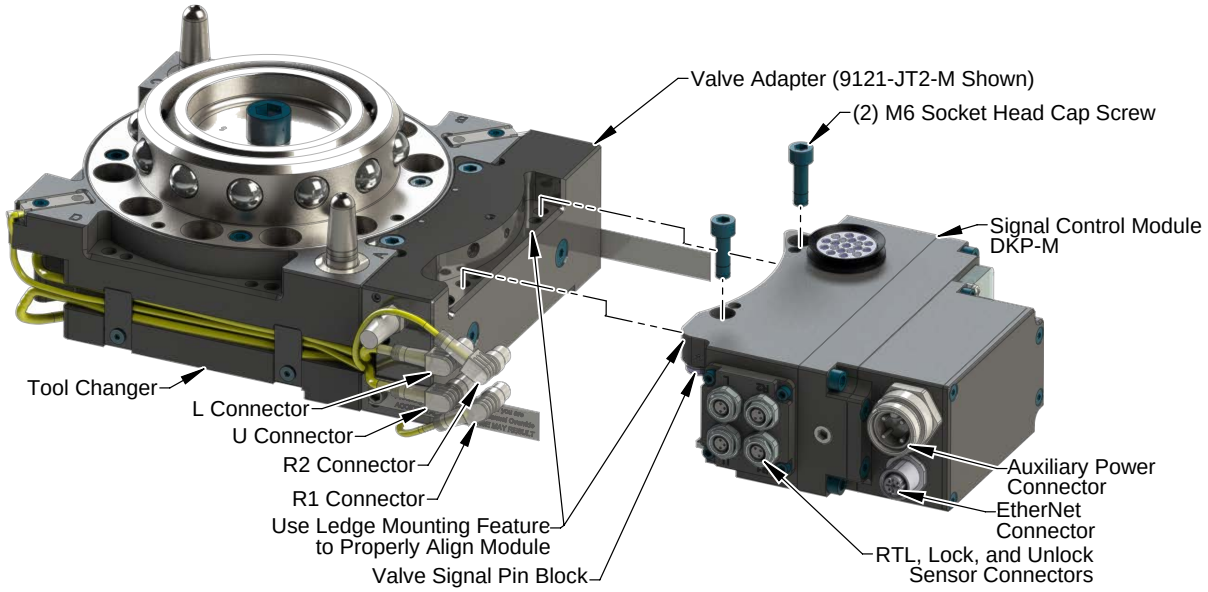
3.1 DKP-M Control/Signal Module Installation

Tools required: *5 mm hex key*

Supplies required: *Clean rag, Loctite® 242*

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. Wipe down the mounting surfaces with a clean rag.
5. 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 3.1*.
6. Apply Loctite 242 to the supplied M6 socket head cap screws. Install the (2) M6 Socket Head Cap Screws securing the module to the air adapter using a 5 mm hex key. Tighten to 70 in-lbs (7.9 Nm).
7. Set the DIP switches. If necessary, default IP address setting is 192.168.1.1. Refer to *Section 2.1.9—DIP Switches on the Master Module*.
8. Connect the (L) Lock, (U) Unlock, and (R1 and R2) RTL sensor cable connectors to the DKP-M module.
9. Connect the power cable and Ethernet/IP cable connectors to the DKP-M module.
10. After a few seconds, it should be operating on the network.
11. Safely resume normal operation.

Figure 3.1—DKP-M Module Installation



3.2 DKP-M Control/Signal Module Removal

Tools required: *5 mm hex key*

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. Disconnect the (L) Lock, (U) Unlock, and (R1 and R2) RTL sensor cable connectors from the DKP-M module.
5. Disconnect the power cable and Ethernet/IP cable connectors from the DKP-M module.
6. Support the control/signal module and remove the (2) M6 socket head cap screws using a 5 mm hex key. Lower the module until it clears the guide pin.

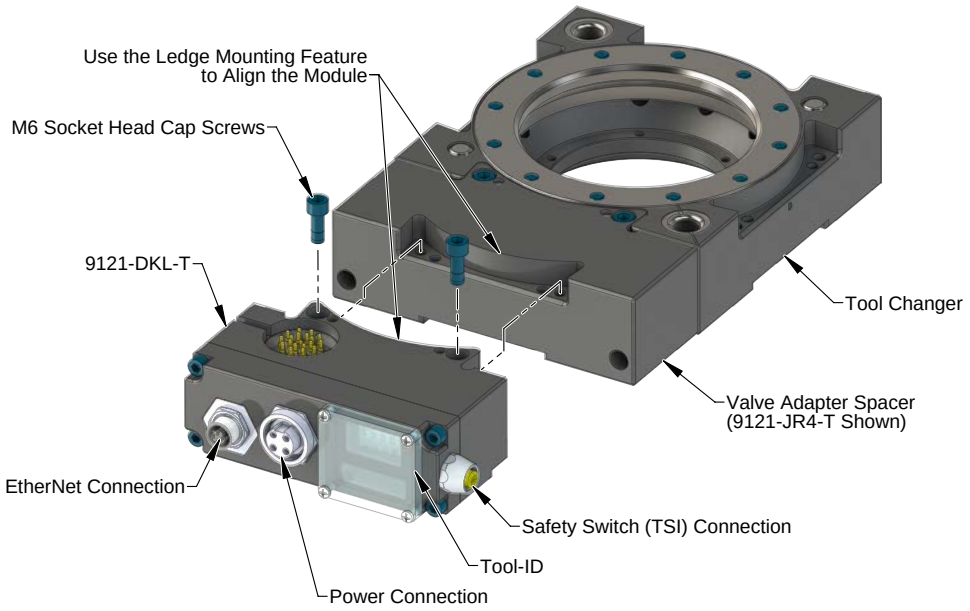
3.3 DKP-T Control/Signal Module Installation

Tools required: *5 mm hex key*

Supplies required: *Clean rag, Loctite 242*

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. Wipe down the mounting surfaces with a clean rag.
5. 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*.
6. Apply Loctite 242 to the supplied M6 socket head cap screws. Install the (2) M6 Socket Head Cap Screws securing the module to the air adapter using a 5 mm hex key. Tighten to 70 in-lbs (7.9 Nm).
7. Connect the safety switch cables to the DKP-T module.
8. Connect the power cable and Ethernet/IP cable connectors to the DKP-T module.
9. Set the Tool-ID. Refer to *Section 3.7—Setting the Tool-ID.*
10. Safely resume normal operation.

Figure 3.2—DKP-T Module Installation



3.4 DKP-T Control/Signal Module Removal

Tools required: *5 mm hex key*

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. Disconnect the safety switch cables from the DKP-T module.
5. Disconnect the power cable and Ethernet/IP cable connectors from the DKP-T module.
6. Support the control/signal module, remove the (2) M6 socket head cap screws using a 5 mm hex key and lift the module.

3.5 EtherNet/IP Configuration

Several parameters for the EtherNet/IP modules need to be configured prior to operating the Tool Changer. Please refer to *Section 2—Product Information* of this manual for detailed information on installation and operation of the EtherNet/IP modules.

CAUTION: Ethernet cabling layout is critical to the overall performance of the system. Interface connections from the controller up the robot arm to the ATI Master should be minimized (less than 3 connections, for example:). Use of hi-flex, robot rated cable is essential for long term performance.

CAUTION: Connect Earth Ground only at the power supply. Additional connections (for example: inside of the robot arm) will cause ground loops and can lead to excessive noise on the power supply. This can result in (FCS) frame checking sequence and alignment errors in Ethernet data packets.

3.6 Utility Schematic

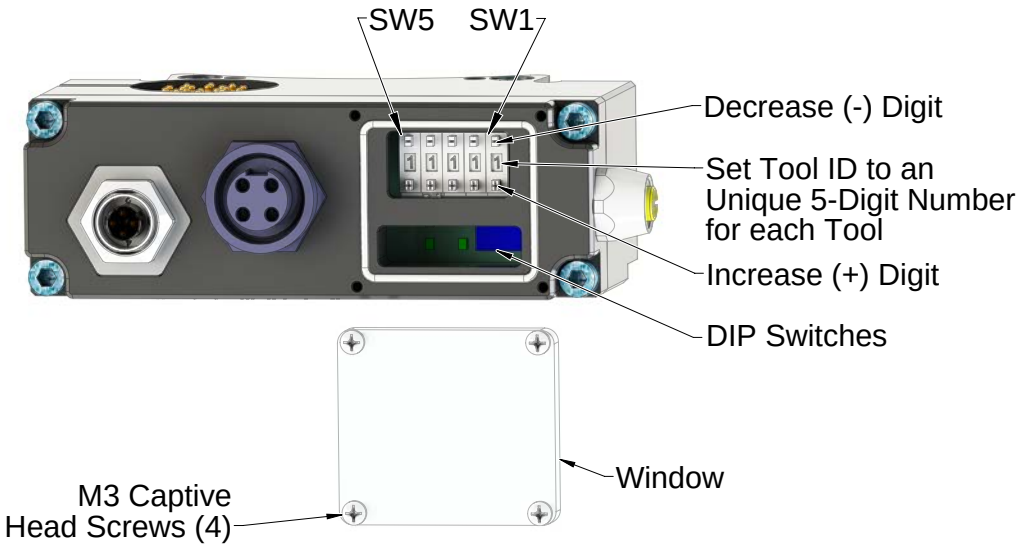
Refer to *Section 9—Drawings* for customer interface and wiring details.

3.7 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 an unique 5 digit Tool-ID number.

Figure 3.3—Setting the Tool ID



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 DKP 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.

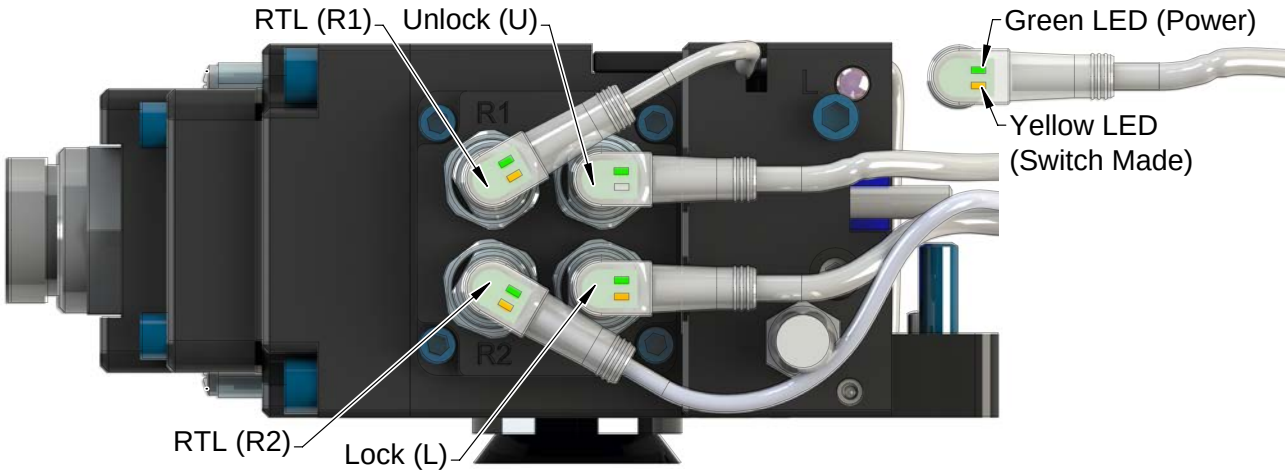
4.1 Lock, Unlock, and Read-To-Lock (RTL) Sensor Cable LED Behavior

The Lock, Unlock, and RTL sensor cables are equipped with two 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.

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) Sensor	ON OFF	ON ON	Unlock (U) Sensor
	RTL (R2) Sensor	ON OFF	ON OFF	Lock (L) Sensor
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) Sensor	ON ON	ON ON	Unlock (U) Sensor
	RTL (R2) Sensor	ON ON	ON OFF	Lock (L) Sensor
Locked (Tool Changer Master plate with Tool plate attached in fully locked position)	RTL (R1) Sensor	ON ON	ON OFF	Unlock (U) Sensor
	RTL (R2) Sensor	ON ON	ON ON	Lock (L) Sensor
Missed Tool (Tool Changer Master plate locked with no Tool plate attached)	RTL (R1) Sensor	ON OFF	ON OFF	Unlock (U) Sensor
	RTL (R2) Sensor	ON OFF	ON OFF	Lock (L) Sensor

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 Auxiliary Power Available

The DKP module continuously monitors the voltage of the Output power which is used to supply the lock and unlock solenoid valves of the Tool Changer. If the voltage stays above 21V the "Auxiliary Power Available" bit will be set high. If the voltage falls below the 21V threshold the bit will be set low. It will become high again as soon as the voltage rises above 21 V.

4.2.2 Tool Power ON

The Tool Power ON bit is set high when the Arc Prevention Circuit has activated power on the Tool side. If this bit is low there will be no power available on the Tool.

4.2.3 Unlatch Enabled

The Unlatch Enabled bit is set high when the DKP module determines that the necessary preconditions for unlatching the Tool have been met.

- If TSRV and TSIV inputs are both in the OFF state, then RTL1, RTL2, RTLV1, RTLV2, and Tool Present all must also be in the OFF state for the Unlatch Enabled bit to be in the ON state. This allows the Tool Changer to Unlatch with no Tool attached (RTL Bypass).
- If TSRV and TSIV are both in the ON state then the Unlatch Enabled bit will be ON reguardless of the states of the RTL1, RTL2, RTLV1, RTLV2, and Tool Present inputs.
- If the state of TSRV and TSIV do not match (one ON or one OFF) the Unlatch Enabled bit will be in the OFF state.

A Tool can only be released if the "Unlatch Enabled" bit is ON. Refer to *Section 2.4—Tool Side TSI.*

Table 4.2—UNLATCH Enable Logic and Truth Table

RTL1, RTL2, RTLV1, RTLV2, or Tool Present	TSIV	TSRV	UNLATCH Enabled	Status of Master Body
All inputs OFF	OFF	OFF	ON	No Tool, Master positioned in free air (RTL Bypass)
Any input ON	OFF	OFF	OFF	Tool is present, Master with Tool attached positioned in free air
All inputs OFF[1]	ON	ON	ON	No Tool, positioned in tool stand (this is a transient state which is only true just prior to RTL being made)
All inputs ON	ON	ON	ON	Tool is present, Master with Tool attached positioned in tool stand
Any State[2]	ON	ON	ON	
Any State[2, 3]	OFF	ON	OFF	Error condition. See *Section 6.1—Troubleshooting*.

Notes:

1. This state is not likely to be seen since the time it takes the connections to be made are milliseconds.
2. If any of these inputs do not match this may indicate sensor failure, cable damage, or other problem, contact ATI for assistance.
3. If the TSIV and TSRV do not match TSIV/TSRV Mismatch error will be generated. This could indicate that the Tool stand safety switch is not functioning properly, the switch cable is damaged, connections are loose, or there is a problem with module.

4.3 Error Conditions

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

4.3.1 Valve Power Available

In case of a loss of Valve Power (the “Valve Power Available” bit shall go low and go high again as soon as the failure condition is removed).

4.3.2 Input Power Good

In case of a loss of Input Power (Logic and Input Power Good bit is low,) the DKP Module Operating Software shall turn the master’s Module Status LED to blinking red but continue communication. The Input Power Failure condition shall have no effect on the master’s Network Status LED. The outputs LATCH, UNLATCH and SPARE shall be turned off.

In case of an Input Power failure condition the Input Power Good bit shall stay low until the condition is reset with the rising edge of the “Clear Errors” bit

4.3.3 RTL1/RTL2 mismatch

Location in bitmap: (byte 4 bit 6) of “Robot Inputs from ATI Master”

This error indicates the state of the RTL1 and RTL2 sensors do not match, they both should be ON or OFF at the same time. This may indicate a sensor failure. The error will clear automatically when the states agree.

4.3.4 RTL/RTLV mismatch

Location in bitmap: (byte 4 bit 7) of “Robot Inputs from ATI Master”

This error indicates the state of the RTL1 and RTLV1 or RTL2 and RTLV2 sensor and relay do not match, they both should be ON or OFF at the same time. This may indicate a sensor failure or module fault. The error will clear automatically when the states agree.

4.3.5 TSIV/TSRV mismatch

Location in bitmap: (byte 5 bit 1) of “Robot Inputs from ATI Master”

This error indicates the state of the TSIV and TSRV tool stand safety switch and associated relay do not match, they both should be ON or OFF at the same time. This may indicate the safety switch may need adjustment or has failed. It may also indicate a module fault. The error will clear automatically when the states agree.

4.3.6 Lock/Unlock sensor fault

Location in bitmap: (byte 5 bit 2) of “Robot Inputs from ATI Master”

This error indicates the Lock and unlock sensor are on at the same time. This indicates the lock or unlock sensor has failed. The error will clear automatically when the states agree.

4.3.7 Always ON

Location in bitmap: (byte 5 bit 6) of “Robot Inputs from ATI Master”

This bit is always a “1” in the firmware, but the user can configure the PLC to report the bit as a “0” if communication with the module is lost. That way their application code can check the value of the “Always On” bit to make sure they are still communicating. The PLC must be configured to report this bit appropriately.

4.3.8 Error on Latch, Error on Unlatch Output

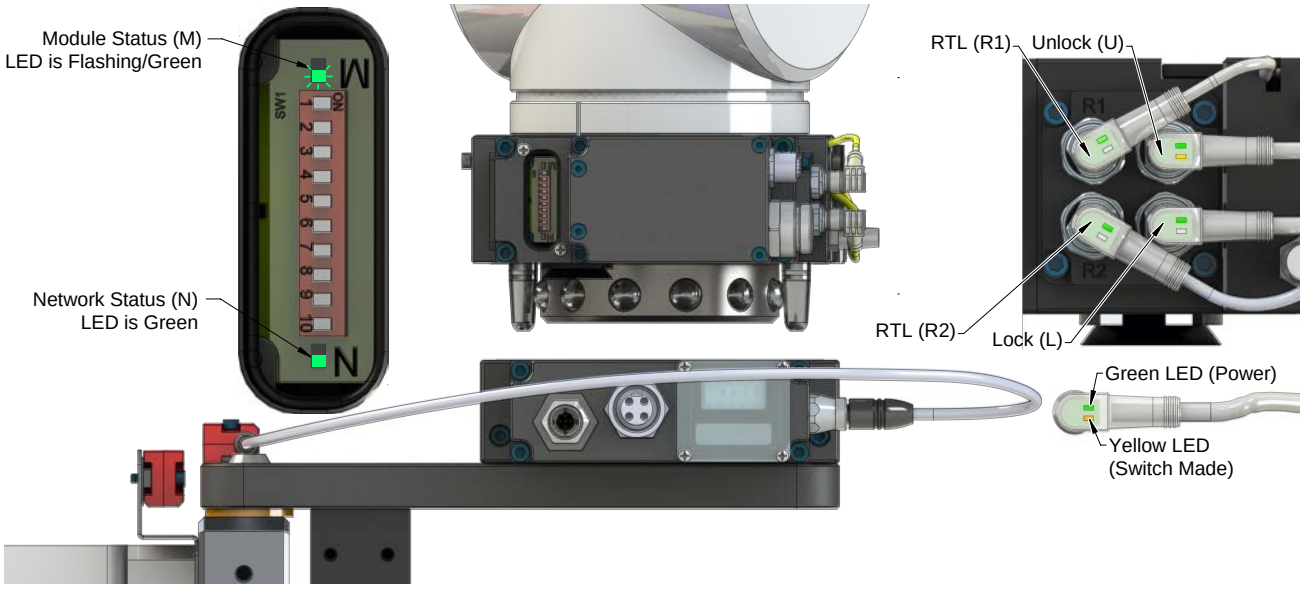
In case of an output error, the output will be shut off and will be disabled until the rising edge of the “Clear Errors” bit.

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)

Figure 4.2—LED Behavior Free of Tool



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 following inputs are ON:
        i. Unlocked
        ii. Input Power Good
        iii. Valve Power Available
        iv. Unlatch Enabled

    b. The following inputs are OFF:
        i. Locked
        ii. RTL1 and RTL2
        iii. RTLV1 and RTLV2
        iv. TSRV and TSIV
        v. Tool Present
        vi. Tool Power ON

    c. The following outputs are ON:
        i. Unlatch

    > **NOTICE:** For units with a single solenoid valve, the Unlatch output must remain ON. For units with a double solenoid valve, the Unlatch output can be turned OFF, after the Unlocked input indicates the Tool Changer is in an unlocked state.

    d. The following outputs are OFF:
        i. Latch

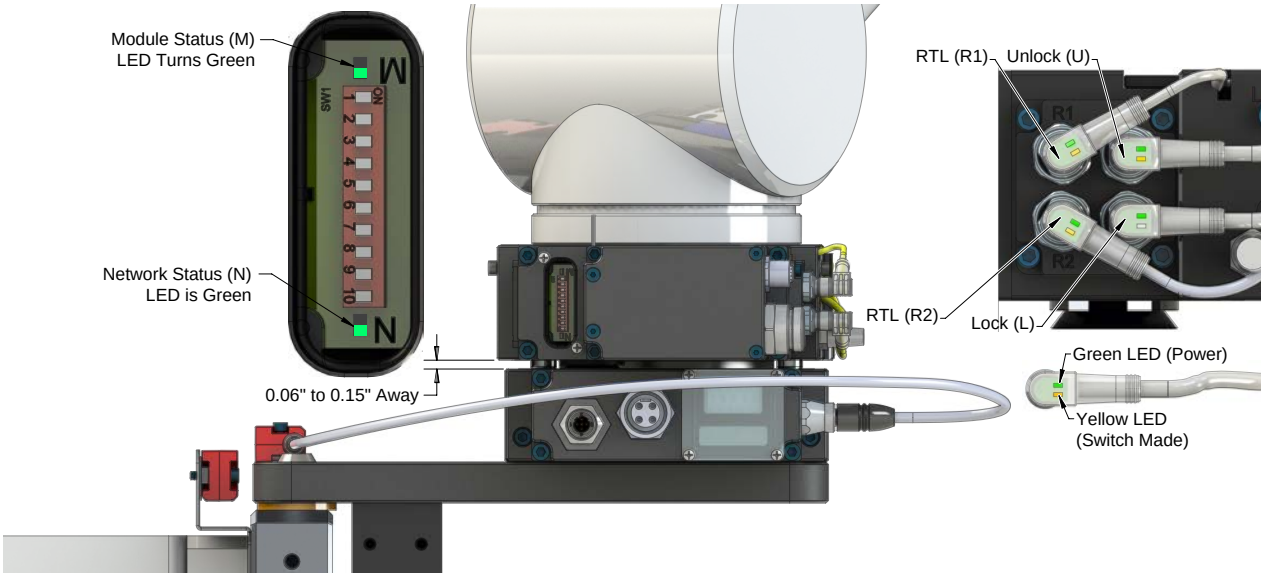
2. Unlock the Master (This must be done prior to the Master entering the Tool to prevent the ball bearings from impinging on the Tool bearing race.)

   a. For units with a double solenoid, turn the Latch output OFF

   b. Turn the Unlatch output ON.

   c. The Locked input goes OFF, and a short time later the Unlocked input goes ON, indicating that the Tool Changer locking mechanism is fully retracted and the Unlatch operation is complete. For units with double solenoid valves, after the Unlocked input turns ON the Unlatch output can be turned OFF.

Figure 4.3—LED Behavior 0.15” Away from Tool



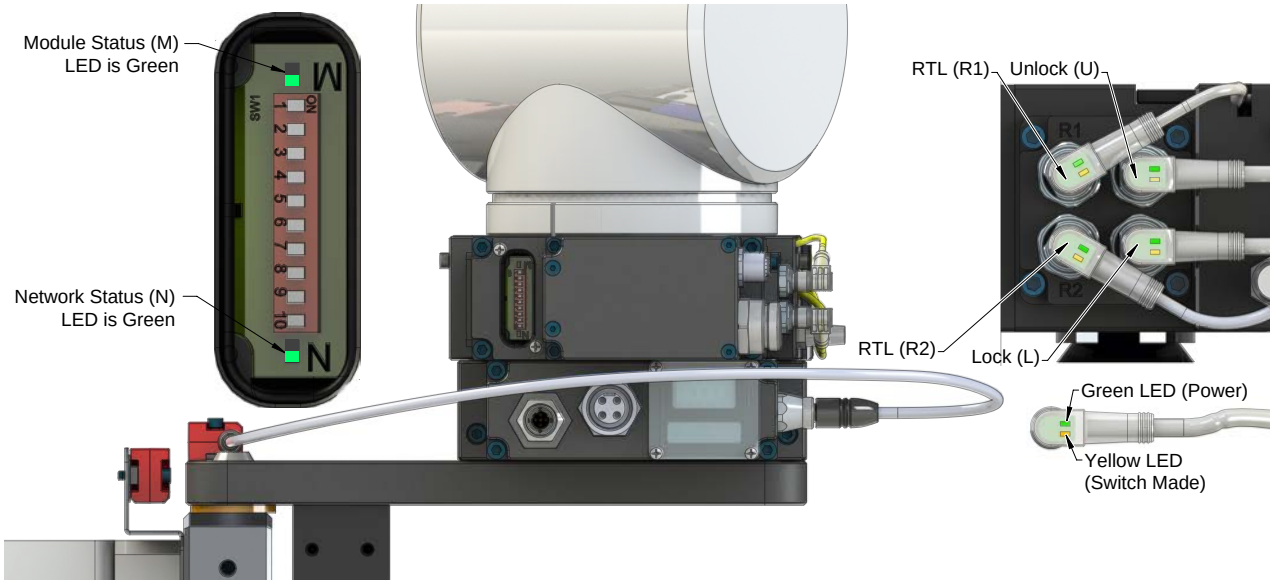
3. Robot and Master move into the tool, are parallel and within 0.15” of the tool (for example: the module contact pins are touching but the RTL1 and RTL2 sensors have not yet sensed the targets ON the tool).

   a. The Tool Present goes ON, indicating that the Master and Tool are in close proximity of each other.

4. Robot and Master move into the tool, are parallel and within 0.06” of the tool

   a. The RTL1 and RTL2 sensors are ON, indicating that its ok to couple Tool.
   b. The RTLV1 and RTLV2 inputs turn ON

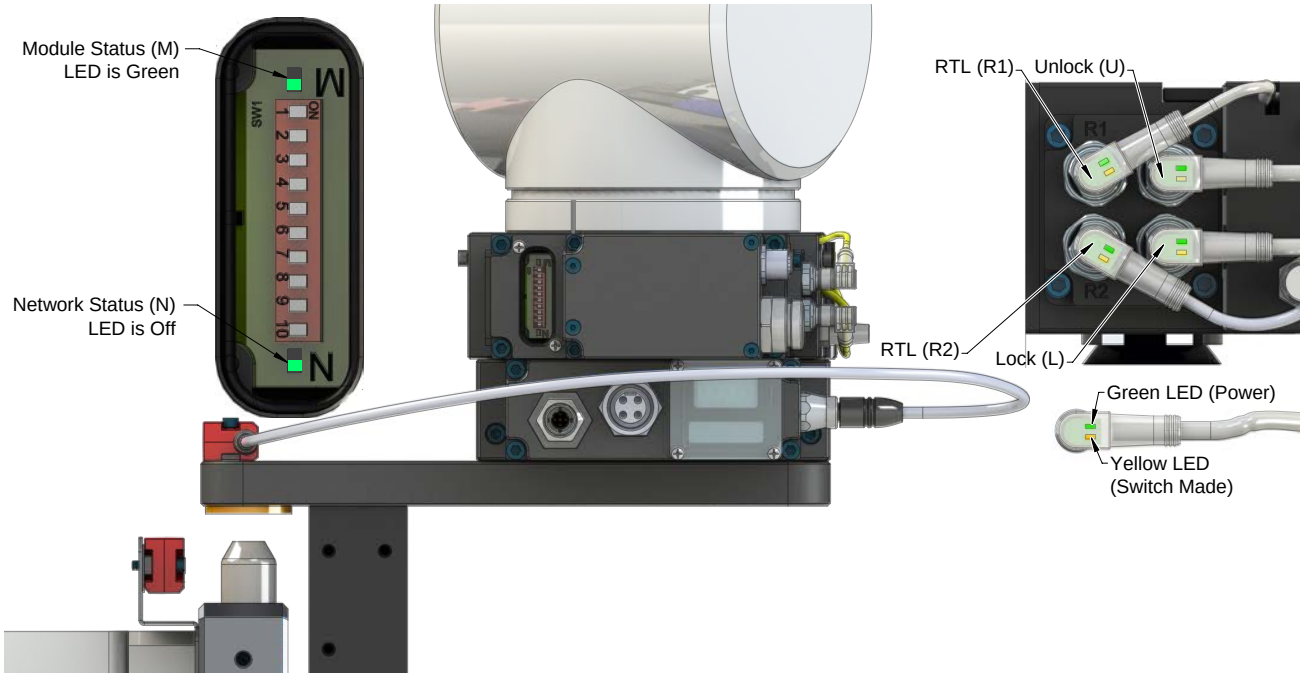
Figure 4.4—LED Behavior Coupled with Tool



5. Couple the Tool Changer.

   a. Turn the Unlatch output OFF.
   b. Turn the Latch output ON.
   c. With the Latch output made on, Power becomes available on the Tool and the bit Tool Power ON turns ON.
   d. The Unlocked input goes OFF, and a short time later the Locked input goes ON and remains ON, indicating that the Tool Changer locking mechanism is fully extended and the Latch operation is complete. After the Locked input turns ON, the Latch output can be turned OFF.
   e. Tool-ID becomes available.
   f. Sometime thereafter, communications should be established with the downstream Ethernet device(s) (The time it takes to establish connection with a downstream EtherNet/IP node depends on the power up and reconnect time of the individual EtherNet/IP equipment that is installed on the tool.)

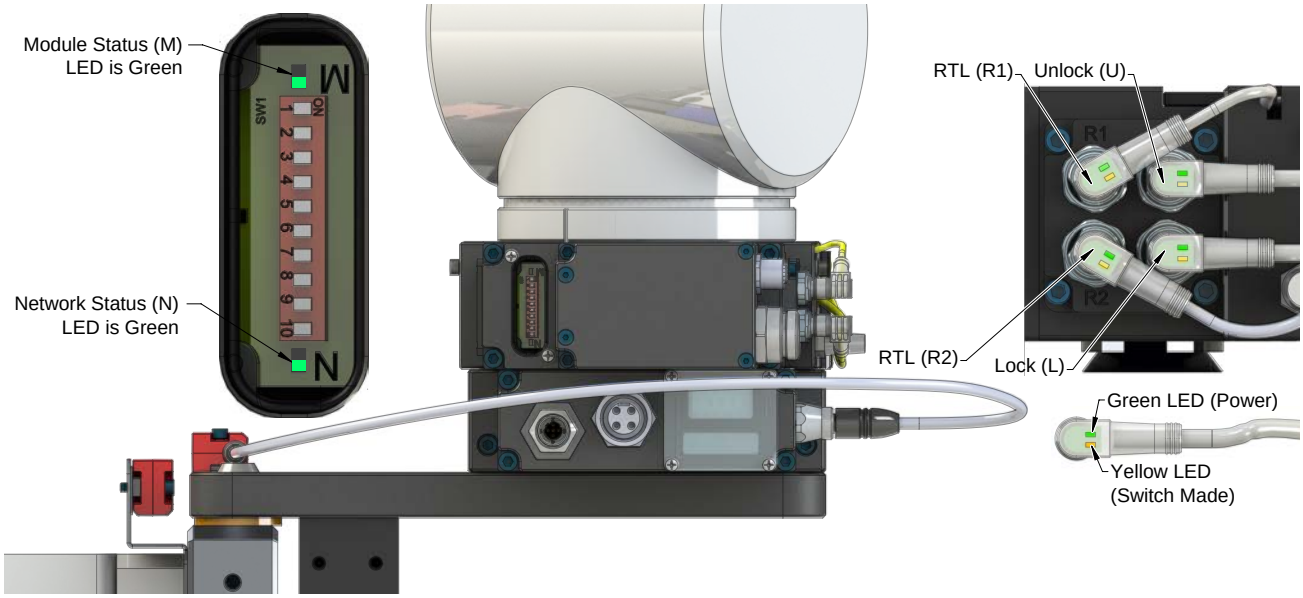
Figure 4.5—LED Behavior Coupled with Tool Away from Stand



6. Robot moves away from the tool stand with the Tool Changer coupled.
   a. The TSI Limit Switch becomes deactivated, and the TSIV and TSRV inputs turn OFF.
   b. The Unlatch Enabled input turns OFF.
7. Normal operation
   a. The following inputs are ON:
      i. Locked
      ii. Input Power Good
      iii. Valve Power Available
      iv. RTL1 and RTL2
      v. Tool Present
      vi. Tool Power ON
      vii. RTLV1 and RTLV2
   b. The following inputs are OFF:
      i. Unlocked
      ii. TSRV and TSIV
      iii. Unlatch Enabled
   c. The following outputs are ON:
      i. Latch

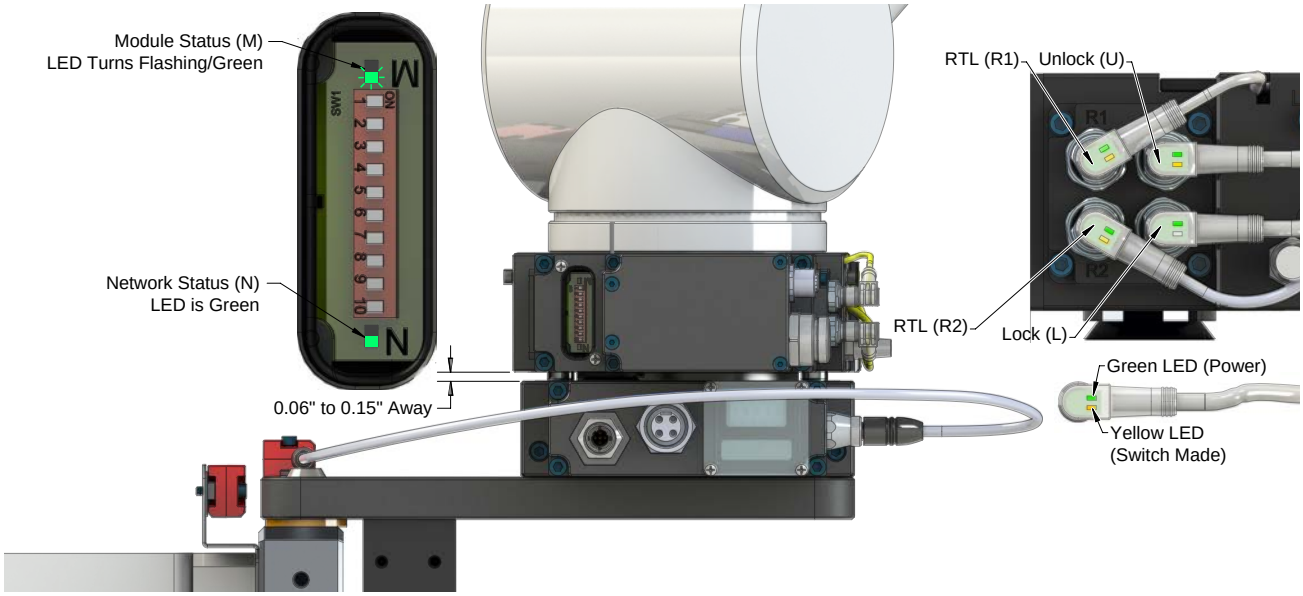
      NOTICE: The Latch output can be turned OFF, after the Locked input indicates the Tool Changer is in the locked state.
   d. The following outputs are OFF:
      i. Unlatch

Figure 4.6LED Behavior Coupled with Tool



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 becomes activated and the TSIV and TSRV input turns ON.
    b. The Unlatch Enabled turns ON, indicating that it is safe to uncouple the Tool Changer.
9. Uncouple the Tool Changer.
    a. Turn the Latch output OFF
    b. Turn the Unlatch output ON.
    c. The Locked input goes OFF, and a short time later the Unlocked input goes ON, indicating that the Tool Changer locking mechanism is fully retracted and the Unlatch operation is complete. For units with double solenoid valves, after the Unlocked input turns ON, the Unlatch output can be turned OFF.
    d. Communication is lost with downstream device(s).

Figure 4.7—LED Behavior 0.15” Away from Tool



10. Robot and Master move away from the tool, are parallel at a distance greater than 0.15” from the tool.
    a. The Tool Present, TSRV, and TSIV turn OFF.
    b. The Tool-ID becomes unavailable (all 1 → 0xFFFFF).
11. Robot and Master are in Free space
    a. The following inputs are ON:
        i. Unlocked
        ii. Input Power Good
        iii. Valve Power Available
        iv. Unlatch Enabled
    b. The following inputs are OFF:
        i. Locked
        ii. RTL1 and RTL2
        iii. RTLV1 and RTLV2
        iv. TSRV and TSIV
        v. Tool Present
        vi. Tool Power ON
    c. The following outputs are ON:
        i. Unlatch

        NOTICE: For units with a single solenoid valve, the Unlatch output must remain ON. For units with a double solenoid valve, the Unlatch output can be turned OFF, after the Unlocked input indicates the Tool Changer is in an unlocked state.

    d. The following outputs are OFF:
        i. Latch

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 re-tightened. Inspect cable sheathing for damage, repair or replace damaged cabling. Loose connections 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

Refer to the following table for trouble shooting information.

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 is 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. Refer to the Installation section of the Tool Changer manual for specifications.
	Valve adapter exhaust muffler clogged	Check exhaust port is properly vented (refer to Pneumatic Connection section of Base Tool Changer Manual for valve requirements)
	TSI switch not functioning properly	Verify the TSI switch is functioning and properly adjusted.
	Input power outside limits	Verify the input power is within limits (Valve Power Available is ON).
	Unlocked bit	Verify the Unlocked bit is ON.
	Signals are mapped incorrectly	Verify signals are mapped and are communicating properly. Refer to *Section 9—Drawings* for electrical schematic)
	Master and Tool are 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 Installation – tool stand Design Section of the Tool Change manual for specifications.
	Solenoid valve not functioning	Check exhaust port is properly vented (refer to Pneumatic Connection section of Base Tool Changer Manual for valve requirements)
	Unlatch conditions have not been met	Verify the Unlatch Enabled input is ON, refer to Section 4.2.3 Unlatch Enabled for conditions.

Table 6.1—Troubleshooting		
Symptom	**Possible Cause**	**Correction**
Sensors not operating properly (but Ethernet/ IP is operating correctly)	Tool plate is not secured properly or debris is trapped between surfaces	Ensure Tool plate is securely held to Master plate and nothing is trapped between plates
	Sensor cables damage or incorrectly connected	Verify the cables are connected correctly and not damaged, replace if damaged. Refer to the Troubleshooting Section of the Tool Changer manual.
	Sensor is malfunctioning or not functioning	Verify the sensors are set correctly and functioning. Refer to the Troubleshooting Section of the Tool Changer manual.
Loss of Communication	Damaged signal cabling	Check/Replace signal cabling up- and down-stream of Tool Changer modules.
	Worn or damaged contact pins	Inspect module contact pins for debris/wear/damage.
	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.
No Power on the Tool side	Latch command not issued	Verify the Latch command has been issued by the robot.
	Tool Power ON bit	Verify the Tool Power ON bit is ON.
	Tool Present bit	Verify the Tool Present bit is ON.

6.2 Service Procedures

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

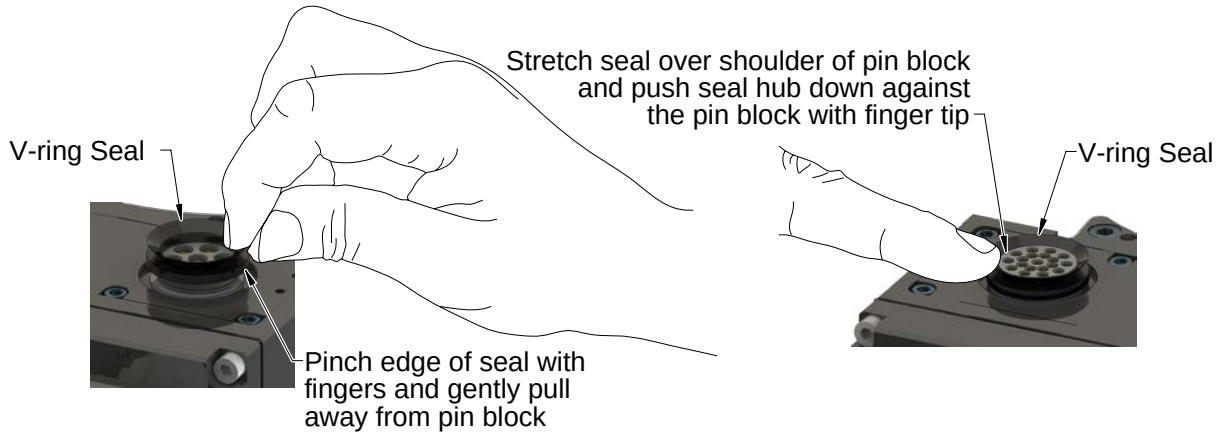
6.2.1 Seal Replacement

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.

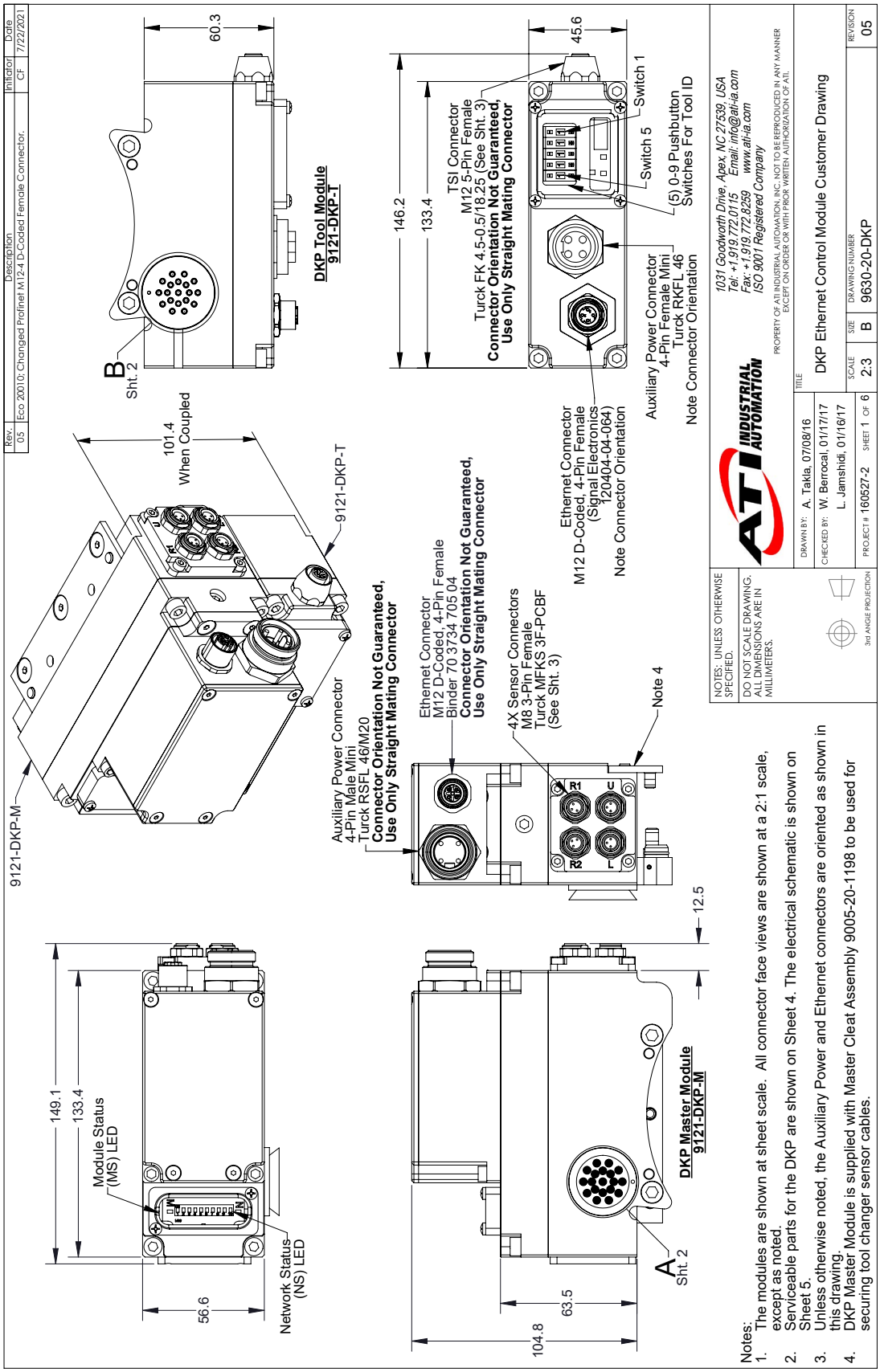
Table 7.3—Accessories	
Part Number	**Description**
3690-0000064-60	Brush, Blue Nylon All Purpose (Contact Pin Cleaning)

8. Specifications

Table 8.1—Master Module	
9121-DKP-M	Ethernet/IP Master module with integrated Ethernet switch, supports DHCP functionality and EtherNet/IP Quick Connect, Input and Auxiliary Power pass-through, TSI on Tool. M12 D-coded Female Connector for Ethernet communication, Mini 4-Pin Male Connector for Output, Input and Logic Power. Lock, Unlock and RTL sensing with LED cables on the Master and Tool-ID from the Tool module are also supported. Supports RTL Bypass. Arc Prevention Circuit applied to Auxiliary Switched and Auxiliary Unswitched. Mates with 9121-DKP-T.
Power Supply Requirements	The power sources for input and output power must be capable of outputting an operating voltage (regulated) of 24 +/- 15% VDC.
Default Configuration	I/P Address: 192.168.1.1 Subnet Mask: 255.255.0.0 Gateway: 0.0.0.0 Note: The DKP-M DKP-T modules conform to the EtherNet/IP Adaptation of CIP Specification, Edition 1.12; © 2011, ODVA The DHCP is set to “disabled”
Connector(s)	Logic and Input power: 4-pin Mini, 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: 3-pin Pin Block supporting Latch and Unlatch signals
Pass through Power	5A, 24VDC (+/- 15%)
Current Draw	Power: 180mA @ 24VDC(+/- 15%), 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	2.2 lbs (1.0 kg)

Table 8.2—Tool Module	
9121-DKP-T	Ethernet/IP Tool module supports five independent 0-9 Tool-ID switches through the Master module, Ethernet port and Auxiliary Power pass-through, TSI on Tool. M12 D-coded Female Connector for Ethernet communication, Mini 4-Pin Female Connector for Output, Input and Logic Power, M12 4-Pin Female Connector provided to support TSI on Tool.
Default Configuration	(5) Independent 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 TSI Switch: 5-pin M12, female connector supporting connection to limit safety switch
Pass through Power	5A, 24VDC (+/- 15%)
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	1.35 lbs (0.61 kg)

9. Drawings


Rev.
Description
Initator
Date
05
Eco 20010; Changed Profinet M12-4 D-Coded Female Connector.
CF
7/22/2021
60.3
B
Sht. 2
DKP Tool Module
9121-DKP-T
146.2
133.4
45.6
TSI Connector
M12 5-Pin Female
Turck FK 4.5-0.5/18.25 (See Sht. 3)
Connector Orientation Not Guaranteed,
Use Only Straight Mating Connector
Switch 1
Switch 5
(5) 0-9 Pushbutton
Switches For Tool ID
Auxiliary Power Connector
4-Pin Female Mini
Turck RKFL 46
Note Connector Orientation
Ethernet Connector
M12 D-Coded 4-Pin Female
(Signal Electronics
120404-04-064)
Note Connector Orientation
101.4
When Coupled
9121-DKP-T
9121-DKP-M
Auxiliary Power Connector
4-Pin Male Mini
Turck RSFL 46/M20
Connector Orientation Not Guaranteed,
Use Only Straight Mating Connector
Ethernet Connector
M12 D-Coded, 4-Pin Female
Binder 70 3734 705 04
Connector Orientation Not Guaranteed,
Use Only Straight Mating Connector
4X Sensor Connectors
M8 3-Pin Female
Turck MFKS 3F-PCBF
(See Sht. 3)
Note 4
R1
R2
12.5
149.1
133.4
Module Status
(MS) LED
Network Status
(NS) LED
56.6
A
Sht. 2
DKP Master Module
9121-DKP-M
63.5
104.8
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: A. Takla, 07/08/16
CHECKED BY: W. Berrocal, 01/17/17
L. Jamshidi, 01/16/17
PROJECT # 160527-2
SHEET 1 OF 6
TITLE
DKP Ethernet Control Module Customer Drawing
SCALE
2:3
SIZE
B
DRAWING NUMBER
9630-20-DKP
REVISION
05
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
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Notes:
1. The modules are shown at sheet scale. All connector face views are shown at a 2:1 scale, except as noted.
2. Serviceable parts for the DKP are shown on Sheet 4. The electrical schematic is shown on Sheet 5.
3. Unless otherwise noted, the Auxiliary Power and Ethernet connectors are oriented as shown in this drawing.
4. DKP Master Module is supplied with Master Cleat Assembly 9005-20-1198 to be used for securing tool changer sensor cables.

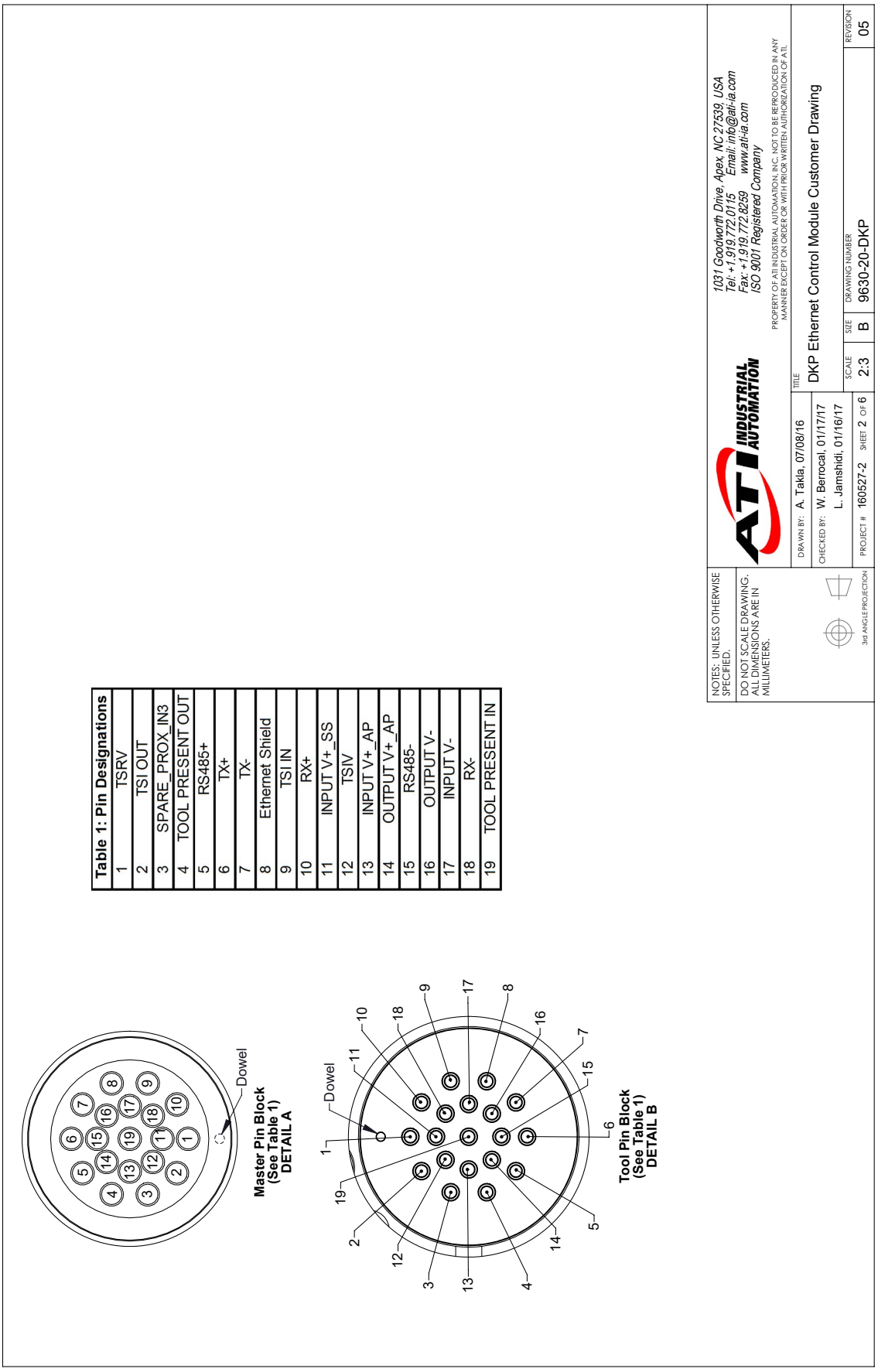
Table 1: Pin Designations
1 TSRV
2 TSI OUT
3 SPARE_PROX_IN3
4 TOOL PRESENT OUT
5 RS485+
6 TX+
7 TX-
8 Ethernet Shield
9 TSI IN
10 RX+
11 INPUT V+_SS
12 TSIV
13 INPUT V+_AP
14 OUTPUT V+_AP
15 RS485-
16 OUTPUT V-
17 INPUT V-
18 RX-
19 TOOL PRESENT IN
Dowel
Master Pin Block
(See Table 1)
DETAIL A
Dowel
Tool Pin Block
(See Table 1)
DETAIL B
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: A. Takla, 07/08/16
CHECKED BY: W. Berrocal, 01/17/17
L. Jamshidi, 01/16/17
PROJECT # 160527-2 SHEET 2 OF 6
TITLE
DKP Ethernet Control Module Customer Drawing
SCALE 2:3
SIZE B
DRAWING NUMBER 9630-20-DKP
REVISION 05
INDUSTRIAL AUTOMATION
1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
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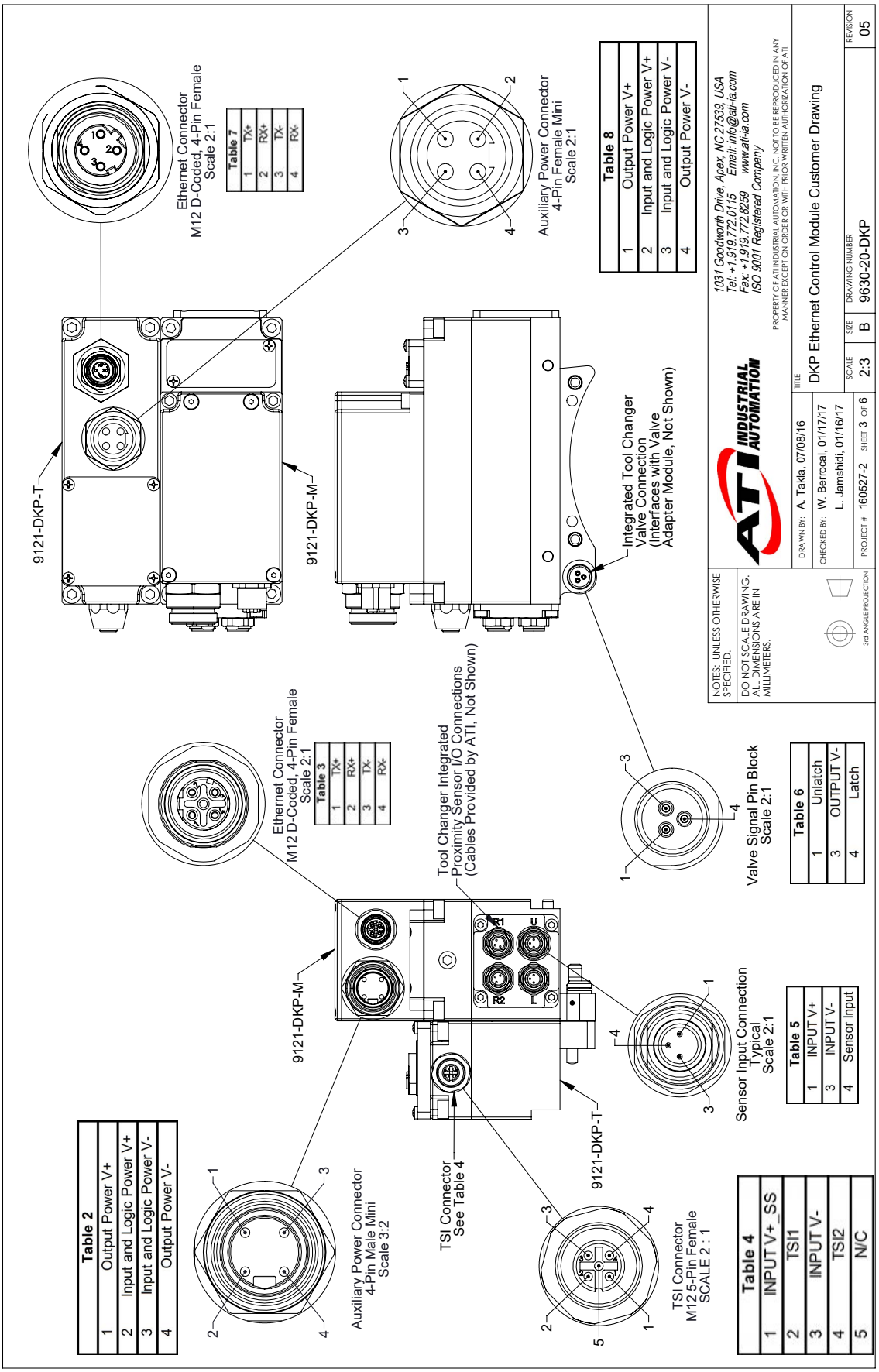
Ethernet Connector
M12 D-Coded, 4-Pin Female
Scale 2:1
Table 7
1 TX+
2 RX+
3 TX-
4 RX-
Auxiliary Power Connector
4-Pin Female Mini
Scale 2:1
Table 8
1 Output Power V+
2 Input and Logic Power V+
3 Input and Logic Power V-
4 Output Power V-
9121-DKP-T
9121-DKP-M
Integrated Tool Changer
Valve Connection
(Interfaces with Valve
Adapter Module, Not Shown)
Ethernet Connector
M12 D-Coded, 4-Pin Female
Scale 2:1
Table 3
1 TX+
2 RX+
3 TX-
4 RX-
Tool Changer Integrated
Proximity Sensor I/O Connections
(Cables Provided by ATI, Not Shown)
Valve Signal Pin Block
Scale 2:1
Table 6
1 Unlatch
3 OUTPUT V-
4 Latch
Table 2
1 Output Power V+
2 Input and Logic Power V+
3 Input and Logic Power V-
4 Output Power V-
Auxiliary Power Connector
4-Pin Male Mini
Scale 3:2
TSI Connector
See Table 4
9121-DKP-M
9121-DKP-T
Sensor Input Connection
Typical
Scale 2:1
Table 5
1 INPUT V+
3 INPUT V-
4 Sensor Input
TSI Connector
M12 5-Pin Female
SCALE 2 : 1
Table 4
1 INPUT V+_SS
2 TSI1
3 INPUT V-
4 TSI2
5 N/C
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
3rd ANGLE PROJECTION
DRAWN BY: A. Takla, 07/08/16
CHECKED BY: W. Berrocal, 01/17/17
L. Jamshidi, 01/16/17
PROJECT # 160527-2 SHEET 3 OF 6
TITLE
DKP Ethernet Control Module Customer Drawing
SCALE 2:3
SIZE B
DRAWING NUMBER 9630-20-DKP
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1031 Goodworth Drive, Apex, NC 27539, USA
Tel: +1.919.772.0115 Email: info@ati-ia.com
Fax: +1.919.772.8259 www.ati-ia.com
ISO 9001 Registered Company
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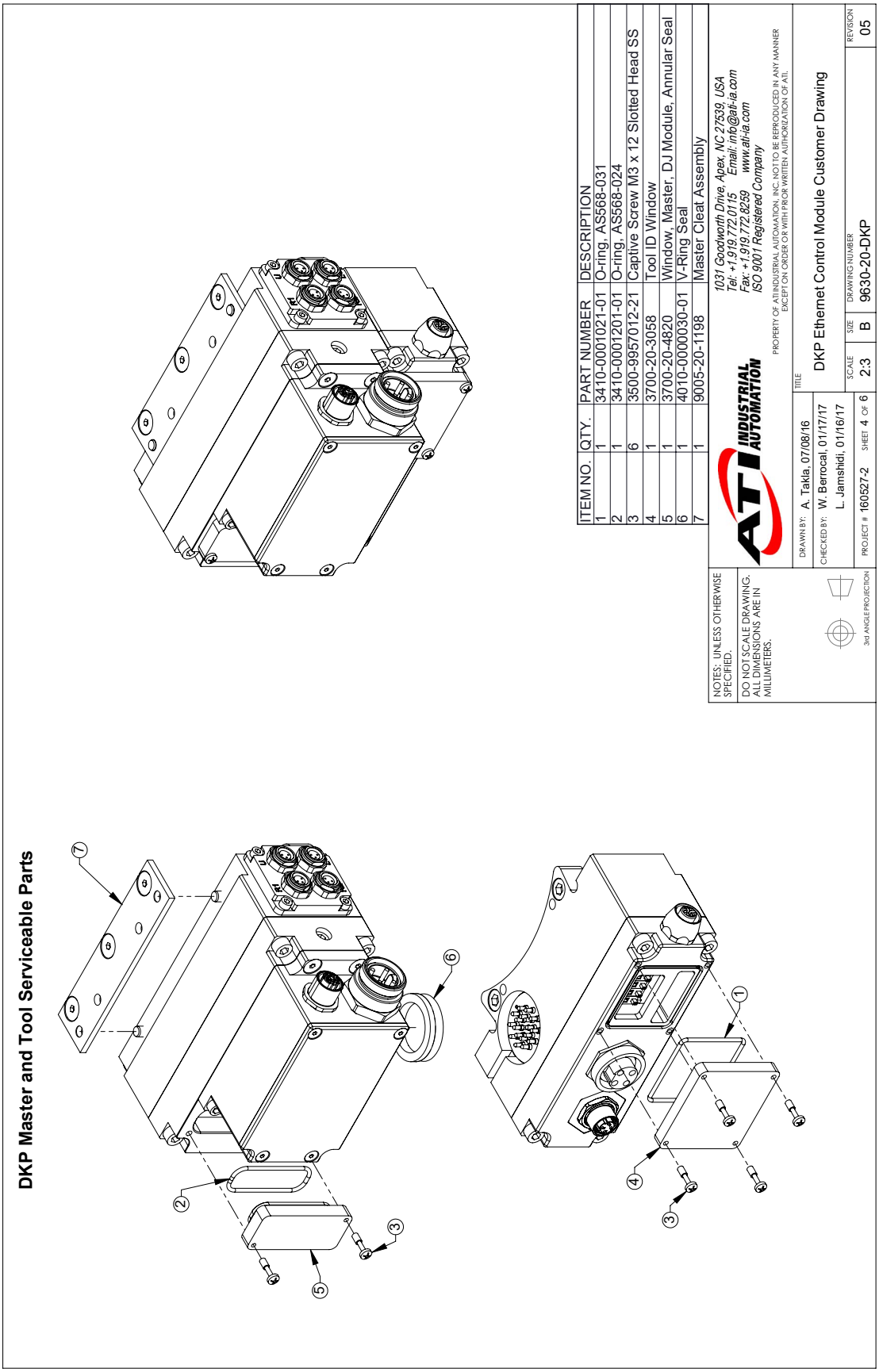
DKP Master and Tool Serviceable Parts
ITEM NO. QTY. PART NUMBER DESCRIPTION
1 1 3410-0001021-01 O-ring, AS568-031
2 1 3410-0001201-01 O-ring, AS568-024
3 6 3500-9957012-21 Captive Screw M3 x 12 Slotted Head SS
4 1 3700-20-3058 Tool ID Window
5 1 3700-20-4820 Window, Master, DJ Module, Annular Seal
6 1 4010-0000030-01 V-Ring Seal
7 1 9005-20-1198 Master Cleat Assembly
NOTES: UNLESS OTHERWISE SPECIFIED.
DO NOT SCALE DRAWING. ALL DIMENSIONS ARE IN MILLIMETERS.
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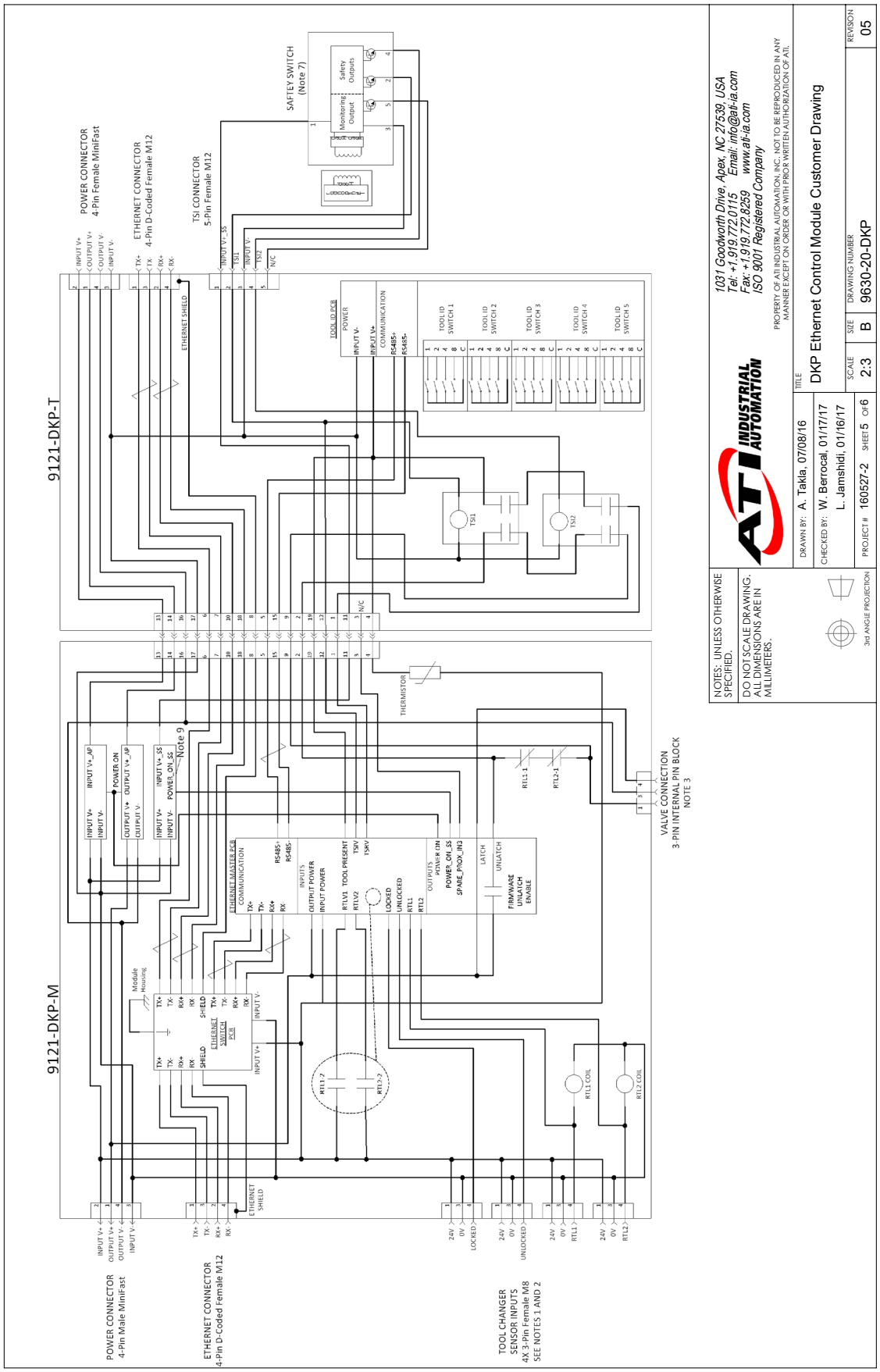
DRAWN BY: A. Takla, 07/08/16
CHECKED BY: W. Berrocal, 01/17/17
L. Jamshidi, 01/16/17
PROJECT # 160527-2 SHEET 4 OF 6
3rd ANGLE PROJECTION
TITLE
DKP Ethernet Control Module Customer Drawing
SCALE 2:3
SIZE B
DRAWING NUMBER 9630-20-DKP
REVISION 05


9121-DKP-T
9121-DKP-M
POWER CONNECTOR
4-Pin Female MiniFast
ETHERNET CONNECTOR
4-Pin D-Coded Female M12
TSI CONNECTOR
5-Pin Female M12
SAFTEY SWITCH
(Note 7)
Safety Outputs
Monitoring Output
ETHERNET SHIELD
TOOL ID PCB
POWER
COMMUNICATION
TOOL ID SWITCH 1
TOOL ID SWITCH 2
TOOL ID SWITCH 3
TOOL ID SWITCH 4
TOOL ID SWITCH 5
TS1
TS2
N/C
THERMISTOR
Note 9
ETHERNET MASTER PCB
ETHERNET SWITCH PCB
Module Housing
INPUTS
OUTPUTS
LATCH
UNLATCH
FIRMWARE UNLATCH ENABLE
RTL1-1
RTL2-1
RTL1-2
RTL2-2
RTL1 COIL
RTL2 COIL
VALVE CONNECTION
3 PIN INTERNAL PIN BLOCK
NOTE 3
POWER CONNECTOR
4-Pin Male MiniFast
ETHERNET CONNECTOR
4-Pin D-Coded Female M12
TOOL CHANGER
SENSOR INPUTS
4X 3-Pin Female M8
SEE NOTES 1 AND 2
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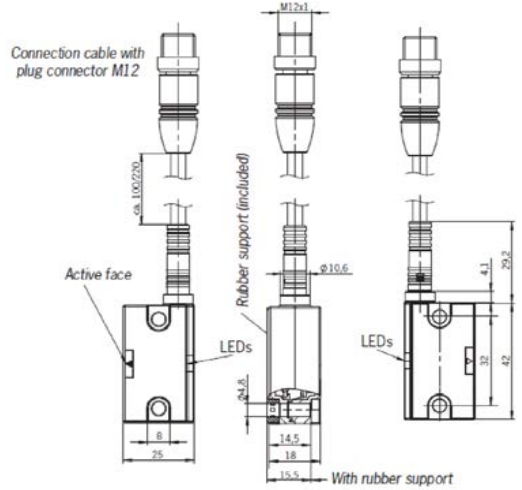
PROJECT # 160527-2
SHEET 5 OF 6
TITLE
DKP Ethernet Control Module Customer Drawing
SCALE 2:3
SIZE B
DRAWING NUMBER 9630-20-DKP
REVISION 05
3rd ANGLE PROJECTION

Notes:

1. The sensors are powered by Input power.
2. The complete tool changer package comes equipped with external cables that are connected to the sensors.
3. An internal pin block is used to transmit the Latch/Unlatch signal to the valve adapter. The DKP Master is compatible with both Single and Double Solenoid Valve Adapter Modules.
4. Cables for Ethernet and Auxiliary Power are supplied by the customer.
5. The Tool ID I/O is reported in the DKP Master Bitmap. Refer to the product manual for more information.
6. The Arc Prevention Circuit turns off Output and Input Power during coupling and uncoupling of the Tool Changer. The switching function is controlled by the POWER ON signal from the Ethernet Master PCB. The TOOL PRESENT input is used to ensure that the spring/contact pins are touching when power is turned on. Refer to the manual for additional information.
7. The DKP requires the use of a PLe-rated two-channel non-contact Safety Sensor for TSI functionality. The manufacturer of this Safety Sensor is Euchner, Safety Sensor Part No# CES-I-AP-M-C04-USB-117324/ATI PN# 8600-117324 and Euchner Actuator Part No # CES-A-BBN-C04-115271/ATI PN # 8605-115271. The Safety Sensor and Actuator are not included with the
   DKP but is available from ATI. The Safety Sensor is powered by INPUT V+_SS / INPUT V-.
8. TSI related error bits are not shown on this schematic but are reported in the DKP Master Bitmap. Refer to the product manual for details.
9. ARC PREVENTION BOARD-3 is used to switch the power to the TSI Safety Switches. The Switching function is controlled by the POWER_ON_SS from the Ethernet Master PCB Communication Board.

Safety Switch: ATI PN# 8600-117324



Actuator: ATI PN# 8605-115271

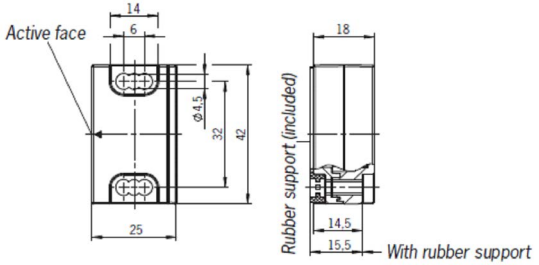


Figure 1: Euchner CES-AP-C04 Series Safety Sensor Available Separately from ATI (PN# 9120-TSL-SS-9019)

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	SCALE: 2:3	SIZE: B	DRAWING NUMBER: 9630-20-DKP	REVISION: 05	