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F. High-Current Modules

PG3—Ground Module

1. Product Overview

The high-current modules are designed to carry power to customer tooling. They consist of the plated contacts, capable of carrying 200 Amps when coupled. The voltage should not exceed 600 Volts. Power must be off when coupling and uncoupling. Over-current protection in the primary power supply circuit is recommended. Refer to [Section 8—Drawings](#) for more information.



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.



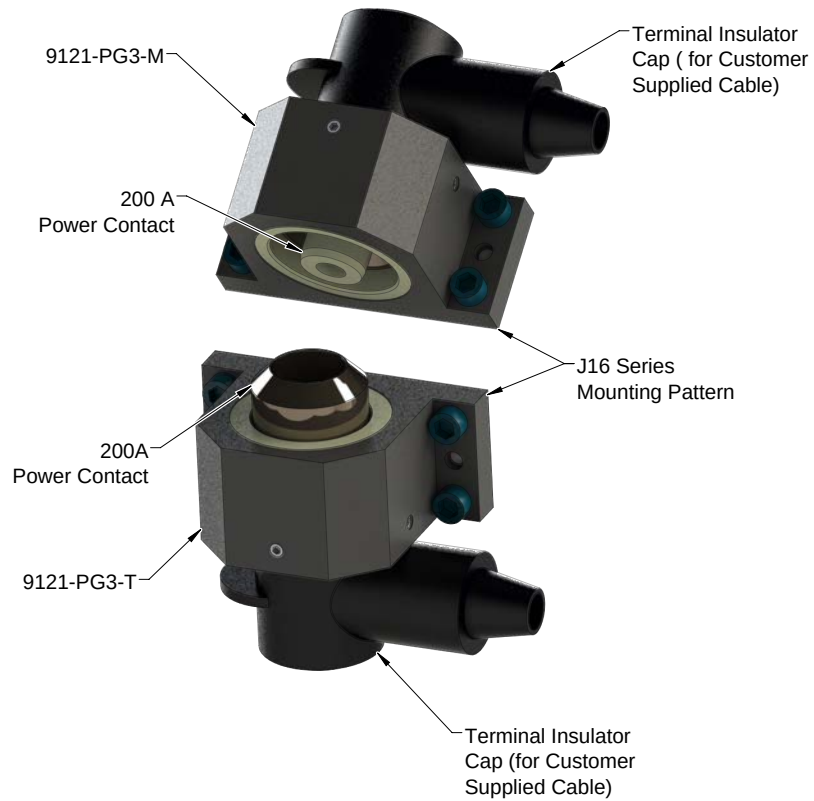
CAUTION: Do not couple or uncouple the high-current modules unless electrical power has been disconnected and discharged both upstream and downstream from the modules. Arcing and contact damage will occur. Remove power and discharge both upstream and downstream modules before coupling or uncoupling modules.

The high-current modules use cone-mating technology to transfer current from the Master to the Tool. The mating conical surfaces provide a large contact area, alignment capability, and allow efficient coupling/uncoupling without high spring forces or wear. The contact tips on either the Master or Tool can be replaced without removing the wiring.

The contact tip on the Master side are recessed the surface and contain a central insulated post. The modules were designed so that the finger of an average adult cannot touch the metallic parts.

The high current tool module provides compliant motion in the power contacts, ATI requires the use of high-flex type with fine stranding cables and proper strain relief to allow for 4 mm of the free axial motion of the Tool module's contact base.

Figure 1.1 —PG3 Modules



2. Installation

The PG3 modules have one high-current electrical contact. The prepared cable ends are fed through an optional use terminal insulator cap and into heavy gauge ring terminals. The ring terminals are then bolted to the module's contact base. For ease of cable installation, the customer may want to remove the module.

The following steps outline installation or removal. These steps also detail connecting cables to the contacts.



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.



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.



CAUTION: Do not use stiff, heavy stranded cables which can inhibit operation of the high current module. Stiff cables can prevent compliant motion of the contacts and cause an intermittent or improper power connection. Operation of the high current module requires the customer supplied cables to be high-flex type with fine stranding and sufficient strain relief to allow free cable motion.

2.1 Cable Installation

Tools required: 13 mm hex wrench, torque wrench, wire stripper, heat gun, Manual/hydraulic crimping tool
(See [Section 6—Serviceable Parts - Table 6.3](#) for recommendations.)

Supplies required: heat shrink

1. If already installed on the application, remove the module. Refer to [Section 2.4—Module Removal](#).
2. Remove the terminal insulator cap and set aside.
3. Use a 13 mm wrench to remove the M8 hex head cap screw, M8 serrated internal tooth washer, and ring terminal.

NOTICE: Use only high-flex, fine-stranded cable and allow for at least 6mm free movement below the tool side module for cable flexing.

2.1.1 Cable Preparation

- a. Select the proper size ring terminals (supplied by ATI) for the customer supplied cable.
Note: Where multiple ring terminal sizes are supplied, select the one which best fits the cable.
- b. Refer to the customer supplied crimping tool manufacturer's instructions and select the proper size hex dies for the ring terminal and cable.
- c. Refer to the wire manufacturer's instruction manual for specific wire preparation and crimping instructions.
- d. Prepare the high-flex type cable ends by stripping the insulation back to the approximate length of the crimp of the ring terminal. Avoid cutting wire strands while stripping the cable insulation.

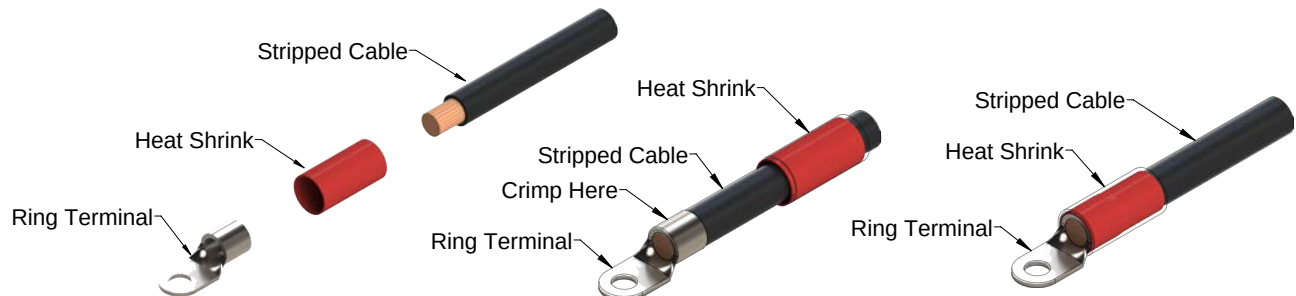
Figure 2.1—Wire Stripping

Cleanly cut insulation
back to the approximate
length of the crimp
on the terminal ring



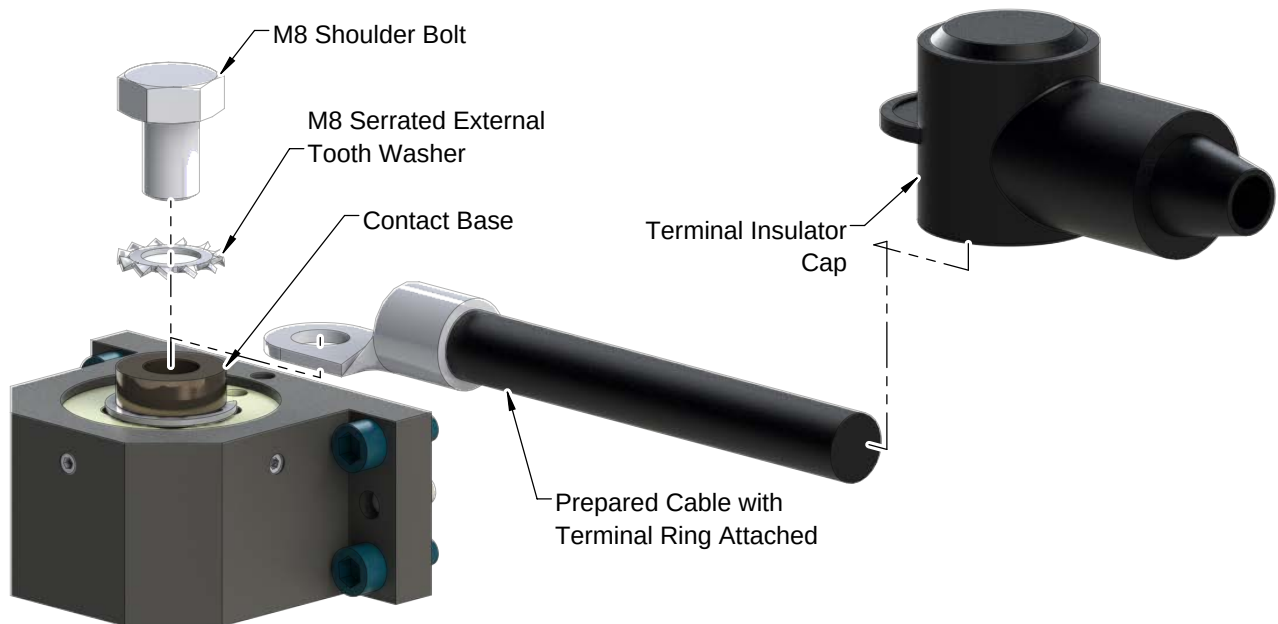
- e. Cut a piece of heat shrink long enough to cover the crimp on the ring terminal and a portion of the cable insulation. Refer to [Figure 2.2](#).
- f. Slide the piece of heat shrink onto the cable.
- g. Slide the ring terminal over the stripped end of the cable. Ensure there are no wire strands protruding from ring terminal.
- h. Following the manufacturer's instructions for the customer supplied crimp tool, crimp the ring terminal onto the cable.
- i. If the ring terminal tongue distorts during crimping, flatten and straighten it so the tongue's flat portion is parallel to the cable's center axis.
- j. Slide the piece of heat shrink tubing over the ring terminal barrel making sure it completely covers the ring terminal barrel and crimp. Shrink in place using a heat gun.

Figure 2.2 —Connecting the Ring Terminal



4. If the desired, trim the entrance of the optional terminal insulator cap to size and slide it over the cable end.
5. Set the prepared cable and terminal ring on the contact base. Refer to [Figure 2.3](#).
6. Using a 13 mm wrench, secure the terminal ring with the M8 serrated external tooth washer and M8 hex head cap screw. Tighten to 90 in-lbs (10 Nm).

Figure 2.3—Remove the Cover Plate and Terminal Rings



7. If the applicable, slide the terminal insulator cap down the cable and over the ring terminal.
8. Install the module to the application. Refer to [Section 2.3—Module Installation](#).

2.2 Cable Removal

Tools required: 13 mm hex wrench

1. Remove the module from the application. Refer to [Section 2.4—Module Removal](#).
2. Remove the terminal insulator cap from the ring terminal and slide down cable.
3. Using a 13 mm wrench, remove the M8 hex head cap screw and M8 serrated external tooth washer.
4. Remove the cable and terminal from the contact base.

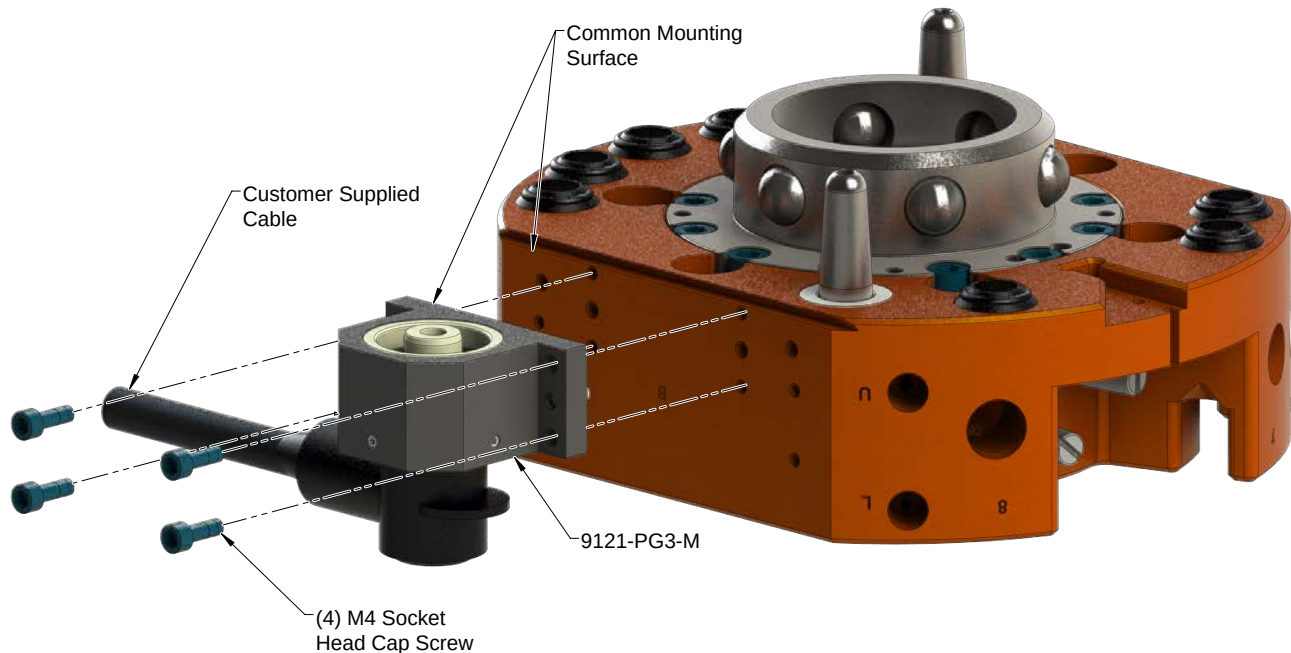
2.3 Module Installation

Tools required: 3 mm Allen® wrench, torque wrench

Supplies required: Clean rag, Loctite® 222

1. Clean the mounting surfaces.
2. Place the module on the Tool Changer or Utility Coupler body. Refer to [Figure 2.4](#).
3. Apply Loctite 222 to the (4) M4 fasteners.
4. Using a 3 mm Allen wrench, secure the module to the application. Tighten to 25 in-lbs (2.8 Nm).
5. After procedure is complete, return all circuits to normal operation.

Figure 2.4—Installation



2.4 Module Removal

Tools required: 3 mm Allen® wrenches (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 (e.g. electrical, air, water, etc.).
4. Prior to removing the module, use a marker pen to scribe a line or indication between the Tool Changer or Utility Coupler and module body as a reminder where the module is to be re-installed.
5. Remove the (4) M4 socket head cap screws, using a 3 mm Allen wrench, and remove the module from the application.

3. Operation

High-current modules are designed to carry large currents to various industrial devices, to provide a separable joint in the power wiring. To maximize the service life of these components, the following points must be observed:



WARNING: The contacts are not a switch. For safety and to prevent equipment damage, disconnect and drain all power before coupling or uncoupling the Tool Changer or Utility Coupler.



CAUTION: Do not couple or uncouple the high-current modules unless electrical power has been disconnected and discharged both upstream and downstream from the modules. Arcing and contact damage will occur. Remove power and discharge both upstream and downstream modules before coupling or uncoupling modules.



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.



CAUTION: Always protect the un-used Tool modules when not coupled to a Master module. Dust, debris, and weld spatter can contaminate the contact tips, which can cause arcing and a significant decrease in contact life.



CAUTION: Do not use stiff, heavy stranded cables which can inhibit operation of the high current module. Stiff cables can prevent compliant motion of the contacts and cause an intermittent or improper power connection. Operation of the high current module requires the customer supplied cables to be high-flex type with fine stranding and sufficient strain relief to allow free cable motion.

4. Maintenance

Under normal conditions, no special maintenance is necessary; however, it is recommended that periodic inspections be performed to assure long-lasting performance and verify that unexpected damage has not occurred. Refer to the list below for periodic maintenance items.



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.



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 or Utility Coupler is used in dirty environments (for example: welding or deburring applications), limit the exposure of the Tool Changer or Utility Coupler. 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. Perform the following visual inspection monthly:

- Inspect that mounting fasteners are tight, and If loose, tighten to torque. Refer to [Section 2.3—Module Installation](#).
- Inspect the Master and Tool contact tips and springs for any damage or debris. Refer to [Section 5.2.1—Master Module Contact Tip Replacement](#) and [Section 5.2.2—Tool Module Contact Tip and Wave Spring Replacement](#).

5. Troubleshooting and Service Procedures

The following section provides troubleshooting and service information to help diagnose conditions and repair the high-current module.



DANGER: This module has a voltage of the 50 V or greater; NO contact should be attempted before removing power. This especially includes separation or insertion of the mating connectors or any contact with the Tool Changer, Utility Coupler, or its components. Arcing and damage will occur If this is not observed. Remove the power before attaching, disconnecting any cables or attempting any maintenance of the Tool Changer or Utility Coupler.



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

5.1 Troubleshooting

The high-current modules provide a separable joint in the cabling between various power sources and various industrial devices. Failure of the industrial devices to operate for any reason must be diagnosed electrically.

Table 5.1—Troubleshooting		
Symptom	Possible Cause	Correction
Power malfunctioning.	Object trapped between modules.	Remove the object, then re-attempt coupling.
	Contact contamination due to environment.	Ensure that the spring loaded contacts on the Tool-side can move freely and are not bound by debris. Clean the spring pins to restore free operation. Clean Tool-side module contacts, refer to Section 5.2.2—Tool Module Contact Tip and Wave Spring Replacement .
	Contact pin separation.	Any contamination on the contacts should be removed using a stiff nylon brush.
		Air supplied to Tool Changer insufficient, Improper valve used. Refer to Tool Changer manual for pneumatic requirements.
	Module contact damage due to coupling/uncoupling under load.	Revise operating procedures to only couple/uncouple with power disconnected and discharged. Replace module contacts, refer to Section 5.2.1—Master Module Contact Tip Replacement for the Master module and Section 5.2.2—Tool Module Contact Tip and Wave Spring Replacement for the Tool module.
	Rigid customer cable connection to module termination.	Change to high-flex, fine strand cables to terminate to high current module. Route and properly restrain cables to allow for 4 mm of motion on the Tool side.
	Cable damage - Pinched, torn, or fatigued cables, contact base, or contact spring worn out or damaged.	Inspect cables and contact base for damage, test cables, test contact springs, refer to Section 5.1.1—Troubleshooting Sequence .

5.1.1 Troubleshooting Sequence



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.

The following sequence is recommended for troubleshooting primary current problems:

1. First examine all the cables, cable connectors, and power sources for problems and correct as necessary.
2. Use a known good cable to bypass the modules and directly connect the supply to the load.
3. If the load does not operate properly with known good cables, the problem is in the supply or load. Troubleshoot these components using that manufacturer's procedures.
4. If the load operates properly, use the known good cables from the step 2 to connect between the supply and Master module. Use a second set of the known good cables to connect the Tool module to the load.
5. If the load operates properly, the problem is in the old cables, which must be repaired or replaced.
6. If the load does not operate properly, the problem is in the high-current modules.
7. Externally, examine the modules for loose, missing, or damaged contacts replacing and tightening as necessary.
8. Remove the covers from the modules and insure that the cables have not come loose from the contact bases. Re-secure the cables as necessary. Refer to the cable installation section.
9. Use a hardwood dowel or other non-metallic, soft rod to push axially on the tool side contacts to verify free axial motion. If the springs under these contacts do not allow axial motion of the contacts, replace the springs accordingly as outlined above in the maintenance section.

If the above steps fail to restore proper operation contact ATI for service.

5.2 Service Procedures

The following service procedures provide instructions for component replacement.

5.2.1 Master Module Contact Tip Replacement

Figure 5.1 shows a module similar to PG3.

Parts required: Refer to [Section 8—Drawings](#)

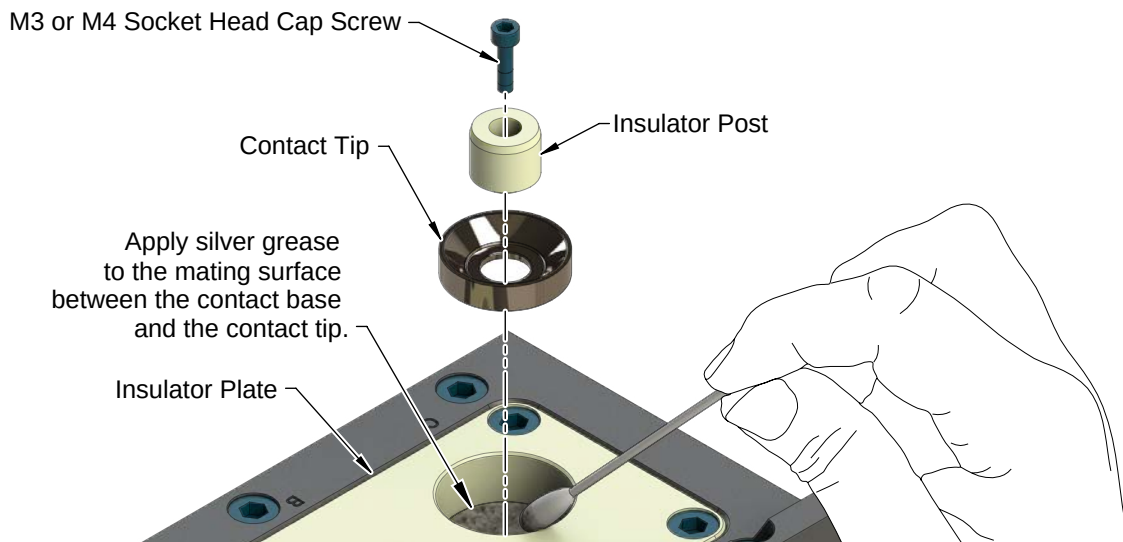
Tools required: 2.5 mm or 3 mm hex key, torque wrench

Supplies required: Non-hardening, conductive silver bearing grease (ATI #0290-70-0000-50-008, McMaster-Carr #1219K57, AI Technology #ELGR8501 or equivalent)

Removal:

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. Remove the M3 or M4 socket head cap screw from the center of the insulator post using a 2.5 mm or 3 mm hex key.
5. Remove the insulator post and the Master contact tip. Discard the contact tip.

Figure 5.1—Master Module Contact Tip Replacement



Installation:

NOTICE: Always replace Master and Tool contact tips at the same time (as pairs). Failure to change both halves of a mating pair will result in decreased life of the new component.

6. Apply a liberal amount of non-hardening, conductive silver bearing grease (ATI #0290-70-0000-50-008, McMaster-Carr #1219K57, AI Technology #ELGR8501 or equivalent) with a volume resistivity of 0.001 ohm-cm minimum to the mating surface between the contact base and the new contact tip. Insert the new contact tip into the insulator plate and reinstall the center insulator post.
7. For a M3 socket head cap screw, insert the screw into the insulator post and secure using a 2.5 mm hex key. Tighten to 10 in-lbs (1.1 Nm). For a M4 socket head cap screw, insert the screw into the insulator post and secure using a 3 mm hex key. Tighten to 12 in-lbs (1.36 Nm).
8. Safely resume normal operation.

5.2.2 Tool Module Contact Tip and Wave Spring Replacement

Figure 5.2 shows a module similar to PG3.

Parts required: Refer to [Section 8—Drawings](#)

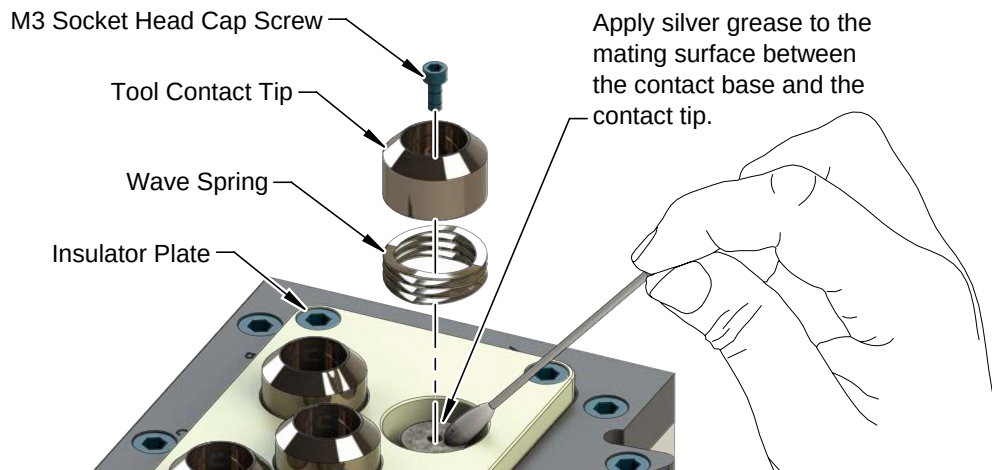
Tools required: 2.5 mm hex key, torque wrench

Supplies required: Non-hardening, conductive silver bearing grease (ATI #0290-70-0000-50-008, McMaster-Carr #1219K57, AI Technology #ELGR8501 or equivalent)

Removal:

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. Remove the M3 socket head cap screw from the center of the Tool contact tip using a 2.5 mm hex key.
5. Remove the Tool contact tip and wave spring from the insulator plate and discard.

Figure 5.2—Tool Module Contact Tip and Wave Spring Replacement



Installation:

NOTICE: Always replace Master and Tool contact tips at the same time (as pairs). Failure to change both halves of a mating pair will result in decreased life of the new component.

6. Apply a liberal amount of non-hardening, conductive silver bearing grease (ATI #0290-70-0000-50-008, McMaster-Carr #1219K57, AI Technology #ELGR8501 or equivalent) with a volume resistivity of 0.001 ohm-cm minimum to the mounting surface between the contact tip and the contact base.
7. Insert the new wave spring and contact tip into the insulator plate.
8. Insert the M3 socket head cap screw into the Tool contact tip and secure using a 2.5 mm hex key. Tighten to 10 in-lbs (1.1 Nm).
9. Safely resume normal operation.

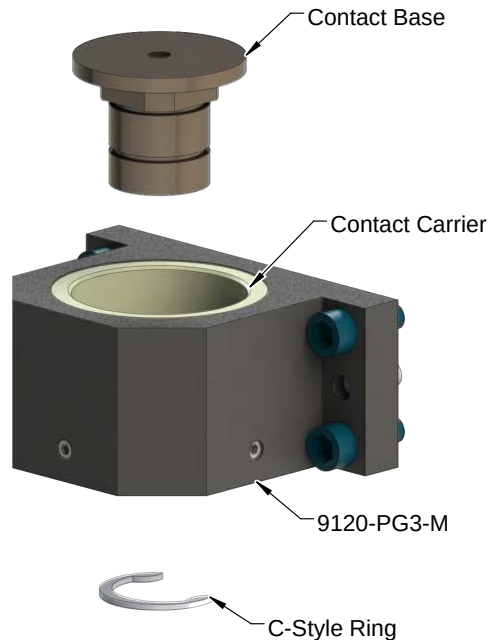
5.2.3 Master Module Contact Base Replacement

Parts required: Refer to [Section 8—Drawings](#)

Tools required: 3 mm Allen wrench (hex key), 13 mm wrench, torque wrench

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Remove the module from the Tool Changer or Utility Coupler. Refer to [Section 2.4—Module Removal](#).
5. Remove the terminal insulator cap, terminal ring and cable, as well as the M8 hex head cap screw and serrated internal tooth washer. Refer to [Section 2.2—Cable Removal](#).
6. Remove the contact tip. Refer to [Section 5.2.1—Master Module Contact Tip Replacement](#).
7. Remove the C-style ring from the contact base.
8. Lift the contact base out of the contact carrier. Discard contact base.
9. Install the new contact base into the contact carrier.
10. Place the C-style ring in the groove of the contact base.
11. Install the contact tip. Refer to [Section 5.2.1—Master Module Contact Tip Replacement](#).
12. Install the terminal insulator cap, terminal ring and cable, as well as the M8 hex head cap screw and serrated internal tooth washer. Refer to [Section 2.1—Cable Installation](#).
13. Install the module onto the Tool Changer or Utility Coupler. Refer to [Section 2.3—Module Installation](#).
14. After procedure is complete, return all circuits to normal operation.

Figure 5.3—Replacing the Master Contact Base

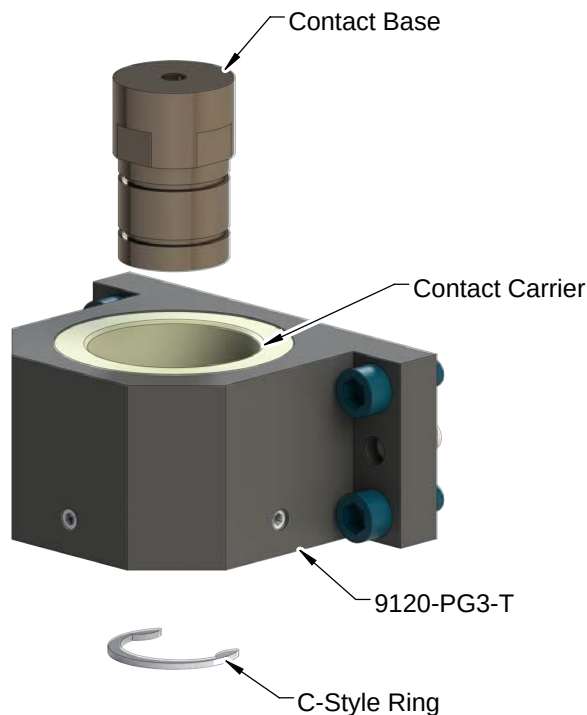


5.2.4 Tool Module Contact Base Replacement

Parts required: Refer to [Section 8—Drawings](#)

1. Place the Tool in a secure location.
2. Uncouple the Master and Tool plates.
3. Turn off and de-energize all energized circuits (e.g. electrical, air, water, etc.).
4. Remove the module from the Tool Changer or Utility Coupler. Refer to [Section 2.4—Module Removal](#).
5. Remove the terminal insulator cap, terminal ring and cable, as well as the M8 hex head shoulder screw and serrated external tooth washer. Refer to [Section 2.2—Cable Removal](#).
6. Remove the contact tip and spring. Refer to [Section 5.2.2—Tool Module Contact Tip and Wave Spring Replacement](#).
7. Remove the C-style ring from the contact base.
8. Lift the contact base out of the contact carrier.
9. Install the new contact base into the contact carrier.
10. Place the C-style ring in the bottom groove of the contact base.
11. Install the contact tip and spring. Refer to [Section 5.2.2—Tool Module Contact Tip and Wave Spring Replacement](#).
12. Install the terminal insulator cap, terminal ring and cable, as well as the M8 hex head shoulder screw and serrated internal tooth washer. Refer to [Section 2.1—Cable Installation](#).
13. Install the module onto the Tool Changer or Utility Coupler. Refer to [Section 2.3—Module Installation](#).
14. After procedure is complete, return all circuits to normal operation.

Figure 5.4—Replacing the Tool Contact Base



6. Serviceable Parts

Refer to [Section 8—Drawings](#).

Table 6.1—Master Module Mounting Fasteners	
Part Number	Description
3500-1062012-15A	M4-0.7 x 12mm Socket Head Cap Srew, Blue, Pre-Applied

Table 6.2—Tool Module Mounting Fasteners	
Part Number	Description
3500-1062012-15A	M4-0.7 x 12mm Socket Head Cap Srew, Blue, Pre-Applied

Table 6.3—Accessories	
Part Number	Description
3690-0000064-60	Brush, Blue Nylon All Purpose (Contact Pin Cleaning)
Manual/Hydraulic crimping tool (Not sold by ATI)	Elpress 2600C, Multi-Contact/Staubli 18.3710, or equivalent
Crimping dies (Not sold by ATI)	Elpress TB9-13 (16 & 35 mm ²), TB11-14.5 (25 & 50 mm ²), Multi-Contact/Staubli 18.3712 (16 & 35 mm ²), 18.3713 (25 & 50 mm ²), or equivalent(s). Other crimp tools may also produce satisfactory results.

7. Specifications

Table 7.1—Master module	
9120-PG3-M	Ground Module, J16 Mount, Master
Interface Connections	(1) Power Contact
Electrical Rating	Pass through Current: 200 A, 600 V Max.
Cable Sizes Supported	#2 AWG (Others, Contact ATI) A ring terminal is used to attach the conductor to the contact post.
Weight	0.18 kg (0.40 lb)

Table 7.2—Tool module	
9120-PG3-T	Ground Module, J16 Mount, Tool
Interface Connections	(1) Power Contact
Electrical Rating	Pass through Current: 200 A, 600 V Max.
Cable Sizes Supported	#2 AWG High-flex type with fine stranding (Others, Contact ATI) A ring terminal is used to attach the conductor to the contact post.
Weight	0.20 kg (.45 lb)

8. Drawings

Drawings are available on the [ATI website](#) or by contacting an ATI representative.