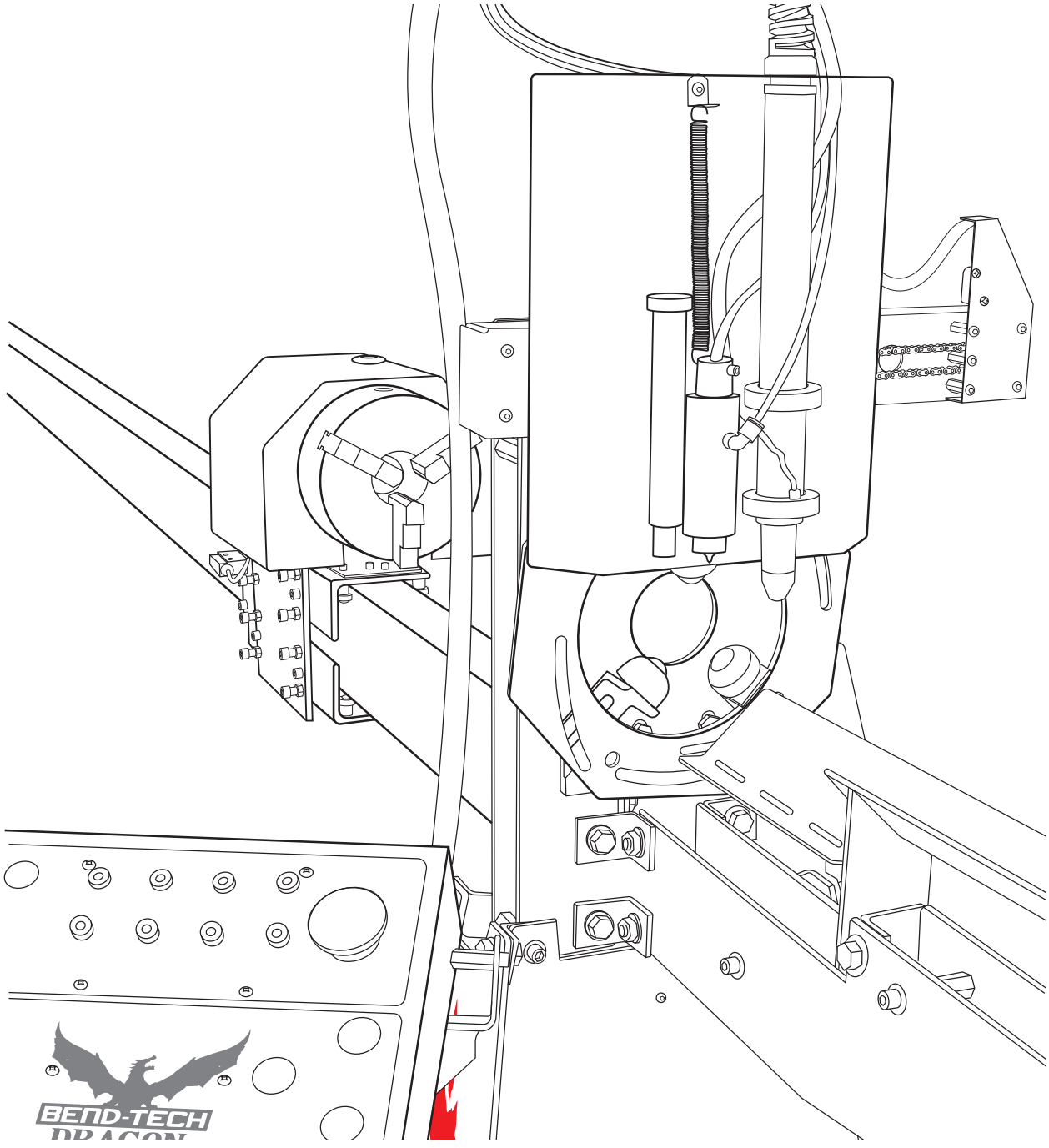
Part 1 of 1

BEND-TECH

DRAGON A150

Maintenance & Troubleshooting



Revision 1 | English

Dragon A150

Maintenance & Troubleshooting
Revision 1

English
Original Instructions

September 2020

Bend-Tech, LLC
729 Prospect Ave.
Osceola, WI 54020 USA

(651) 257-8715
www.bend-tech.com
support@bend-tech.com

Limited Warranty

Dragon software is covered by a 2-year maintenance plan from the purchase date of the Dragon A150 machine. After the 2-year maintenance plan is expired, the Customer can purchase a maintenance plan. A maintenance plan will ensure the customer always has the newest version of Dragon software. The maintenance plan is critical to keeping Dragon software updated with the newest capabilities possible, and is critical to the servicing of the machine. Bend-Tech, LLC will contact the Customer regarding updates to the maintenance plan within 1-month of expiration. Contact Bend-Tech Support to ensure software is up to date: support@bend-tech.com

Customer Service

Any questions or concerns regarding this manual can be directed to Bend-Tech, LLC representatives via the Dragon website, www.bend-tech.com. Click Contact in the menu bar for communication options and send your comments to the Dragon Customer Service department.

Online Resources

- https://www.youtube.com/user/bendtech2020
- http://www.bend-tech.com/wiki7
- http://www.bend-tech.com
- https://www.facebook.com/2020ssi
- https://www.instagram.com/bend_tech

Customer Satisfaction Commitment

Congratulations on your purchase of the world's best CNC plasma tube and pipe cutting machine, the Dragon A150. Bend-Tech, LLC places great pride in customer satisfaction and it is our promise to offer you the best support available for your Dragon A150. We recognize that our support is a key factor in your success.

Contact Us

You can contact Bend-Tech, LLC customer service at 651-257-8715. Our support hours are Monday-Friday, 8:30-5:00 CST. E-mail Bend-Tech, LLC sales at: support@bend-tech.com. Our mailing address is: Bend-Tech LLC, 729 Prospect Ave., Osceola, WI 54020, U.S.A..

Warnings

This manual contains important statements that are called out from the regular text with an associated signal word: “Danger,” “Warning,” “Caution,” or “Note.” Each of these signal words is accompanied by its own icon. These signal words and icons indicate the severity of the condition and the warning. The machine operator should familiarize themselves with these warnings and read the statements before operating the machine.

Definitions & Examples

Danger

Danger indicates a serious condition that could cause severe injury or death to the operator or bystanders if the instructions are not followed.

Example

! Danger !

Exceeding the material weight limit of the Dragon A400 can result in serious injury to the operator and/or bystanders.

Warning

A Warning indicates there is a possibility for minor injury if the instructions are not followed correctly.

Example

! Warning !

Due to the extreme temperatures that result from the plasma cutting process, parts cooled in water in the parts catcher can still be extremely hot. Always use caution when handling newly-cut parts.

Caution

Caution warns the operator that minor injury or machine damage could occur if instructions are not followed. It could also mean that not following directions could affect the overall procedure being performed.

Example

! Caution !

Exceeding the material weight limit can affect performance and possibly damage the Dragon A400.

Note

A Note gives clarification or focuses on information that is critical or unique to an operation.

Example

Water Cooling system greatly reduces smoke and vapor emitted by the machine. Bend-Tech recommends use of the Water Cooling system whenever possible.

Glossary

A150
Indicates machine with 150-lb weight limit.

Axis
A fixed reference line used by the Dragon A150.

Bend-Tech 7X
Machine design software - CAD.

BOB
Breakout Board.

Material Support Lifter
The Material Support Lifter supports material to reduce sag.

Chuck
Located on the Trolley, the Chuck holds the material so it can be moved forward, backward and rotated.

Control Box
Connects Dragon Software Suite to the Dragon A150.

Coolant Tray
Cools cut parts as they are produced.

Drive Belt
The X Motor uses the Drive Belt to power the Trolley along the Rail. The Drive Belt is mounted stationary along the length of the machine.

Drive Belt Pulley
Located on the X Motor, it works in conjunction with the Drive Belt to power the Trolley along the Rail.

E-Stop
Emergency stop.

ESS
Ethernet Smooth Stepper (Control Board).

Ethernet
System for connecting multiple computers via a Local Area Network.

Front Gate
The Gate supports the material at the front of the machine. It consists of two sets of self-centering roller jaws.

Gate Lead Screw
Controls operation and adjustment of the Gate.

Interface
Any particular screen display generated by Bend-Tech software.

Mach3
Machine driver software.

Parts Catcher
The parts catcher is placed at the front of the machine to catch parts as they are cut.

Rail
The Rail is the main structure of the Dragon A400. The Trolley rides on the Rail.

Tail
The Tail is located at the opposite end of the Head of the machine. The Tail arrives pre-assembled. The X Axis homing sensor, Drive Belt Adjustment Block and E-Stop are located at the Tail of the machine.

Toolhead
Operates the Marker, Engraver and Torch.

Trolley
The Trolley rides on the Rail, and carries the Chuck forward and backward along the length of the Rail Support Beam.

Contents

01 Introduction

Introduction

The Dragon A150 Maintenance & Troubleshooting guide contains information intended to assist the Operator in maintaining proper operation of the machine as well as solving operational issues that may arise during regular use. This guide addresses typical operations and procedures to resolve them. Should the User encounter an issue or situation that cannot be resolved using this guide, or that goes beyond the scope of this guide, please contact Bend-Tech service: support@bend-tech.com or 651-257-8715.

Dragon A150 Manufacturing Differences

The Bend-Tech Dragon A150 is continuously being updated and refined. Because of this, there can be differences from machine to machine in regard to configuration of assemblies, fasteners and ongoing refinements of mechanical operation. This guide has been assembled using the most accurate information available. However, there may be information in this guide that does not match a particular machine presently in the field. If there are concerns about a machine or about information contained in this guide, please contact Bend-Tech service: support@bend-tech.com or 651-257-8715.

How To Send A Support Session

Properly setting up a Support Session with a Bend-Tech Service Technician can be key to keeping the Dragon A150 up and running. Bend-Tech knows keeping the Dragon A150 performing optimally is critical to our customers' bottom line. We are more than happy to help, and setting up a Support Session properly allows our techs to help as quickly and efficiently as possible. Many times, if the right information is given, a Service Tech can have a solution ready before we even pick up the phone.

1. If there is a problem with a specific part design or nesting project, open the project before sending a Support Session, then keep the project open after submitting.
2. In the Bend-Tech Dragon Home interface, click the Help tab, then click Support Session.
3. Fill in Name, Email, Phone, and if you know a Service Tech or have had help with this issue before fill in that Service Tech's name.
4. Give a detailed description of the issue in the Description of Problem text box. The more information given the better our Service Techs can help.
5. If there is a file associated with the issue click the folder icon on the right-hand side and upload the design file.
6. Click Submit.

02 Cutting Issues

Cutting Issues

Maintaining the drive systems on the Dragon A150 is critical to achieving accurate cutting, engraving and marking operations. The machine has numerous chain drives and set screws that require regular maintenance. The Gate, Trolley and Toolhead also require regular maintenance to ensure proper operation.

Symptom	Cause	Corrective Action
Copes/cuts not on same rotation	Incorrect backlash	Check set screws on X and Y axis; perform backlash correction in Dragon software
	X axis chain and/or drive gear set screws	Check X chain tension; check Y chain tension
	Loose set screws	Check set screws on all drive gears
Jagged/Wavy Cuts	Rail dirty	Clean Rail with penetrating oil and clean rag
	Trolley loose on Rail	Trolley should move smoothly along the Rail with no play. Adjust Trolley roller system if necessary
	X chain chattering	Contact Bend-Tech service regarding anti-chatter kit
	Material too heavy, causing X or Y motor to skip steps	Check material weight

Symptom	Cause	Corrective Action
Jagged/Wavy Cuts	XCable too loose/too tight	Check X Cable; adjust tension if necessary
Incomplete cuts	Machine moving before Torch fires	Adjust dwell time in Lead In/Out settings
	Y Axis backlash out of adjustment	Check Y Axis chain and drive sprocket set screws
Toolhead loose	Toolhead loose on A axis mount plate	Check Toolhead A Axis play
	Trolley out of adjustment	Check Toolhead trolley play on Toolhead rail

Cut Rotation and Backlash Correction

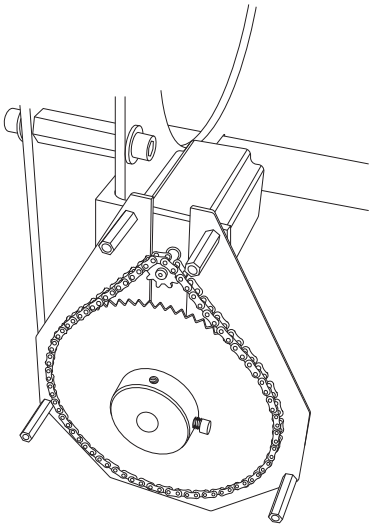
An operator experiencing cut rotation issues with the Dragon A150 machine may be required to check set screws and chains to ensure backlash settings are accurate. As a result of daily use, the machine may experience loose set screws or chains that come out of adjustment. There is also a Backlash Correction procedure in Bend-Tech Dragon software. Ensuring all set screws and chains are tight and adjusted, and Backlash Correction is performed in Bend-Tech Dragon software, will maintain cut rotation accuracy.

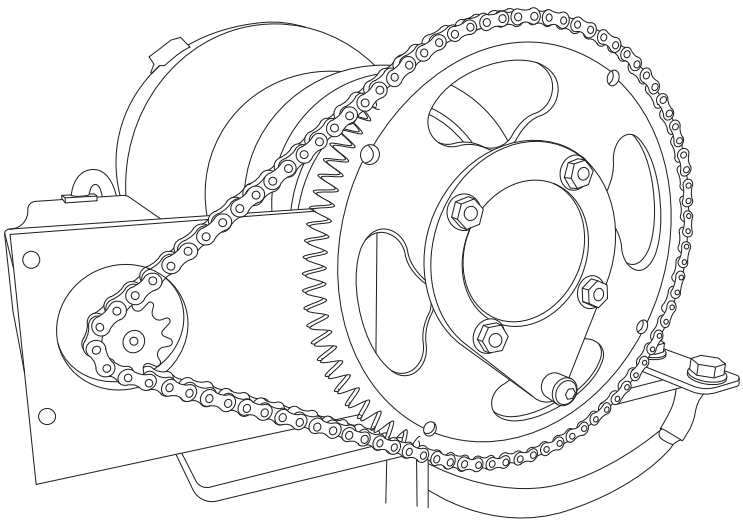
Tools Required

- 3mm Allen wrench
- 3/32 in. Allen wrench
- 5/16 in. Allen wrench
- 1/2 in. wrench
- 3/4 in. wrench (2)

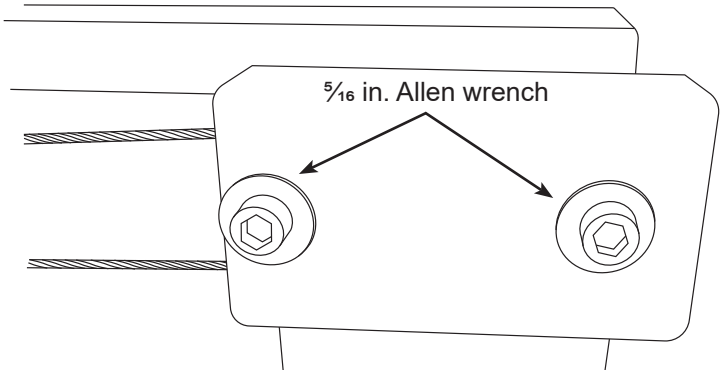
Set Screw and Chain Maintenance

1. Use a ⅛ in. Allen wrench to remove the X gear cover. Use a 5⁄16 in. Allen wrench to remove the Trolley cover.

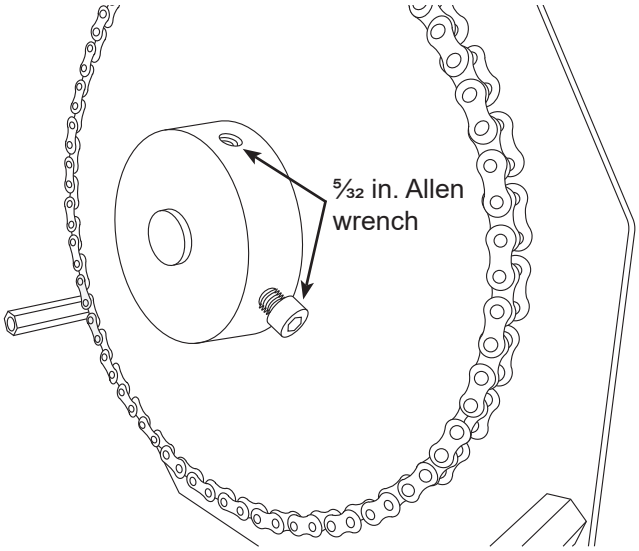


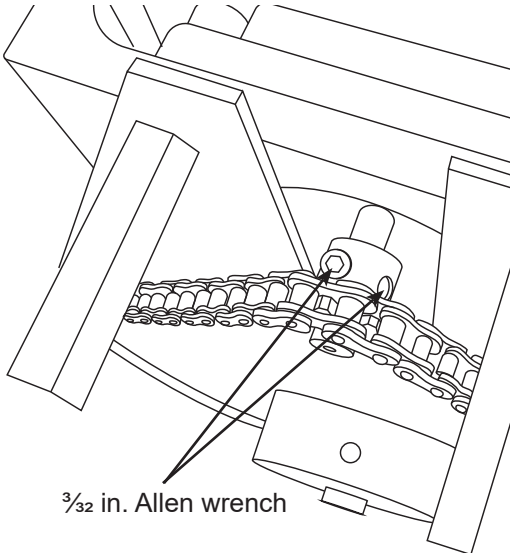


2. Using a 5⁄16 in. Allen wrench, remove the X Chain Cable Cover by removing the two screws.

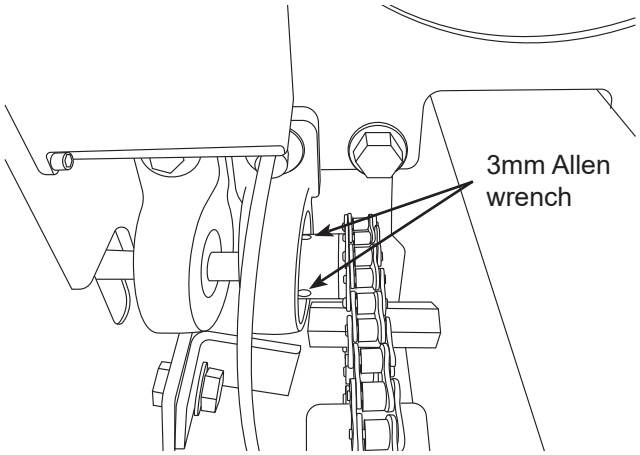


3. Using a 5⁄32 in. Allen wrench on the large sprocket and 3⁄32 in. Allen wrench on the small sprocket, ensure the X Drive Set Screws are tight.

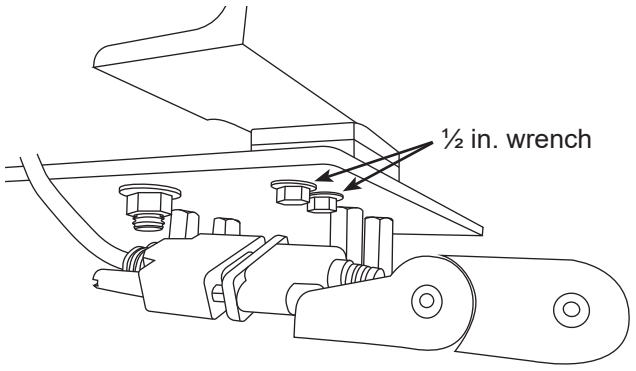




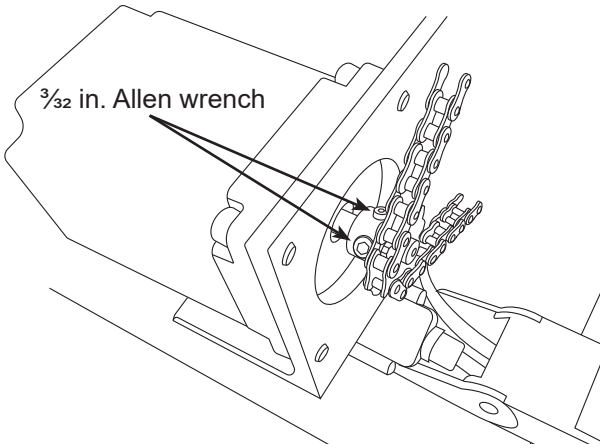
4. Using a 3mm Allen wrench, ensure the X Chain Set Screws are tight.



5. Ensure the chain is tight on the Y gear and motor. If the Y chain is loose the Operator will be required to re-tension the chain. Using a ½ in. wrench, loosen the Y motor mount bolts on the bottom of the Trolley just enough to slide the motor and mount to the outside, tensioning the chain. Holding tension steady, re-tighten the Y Motor Block Adjustment Bolts.

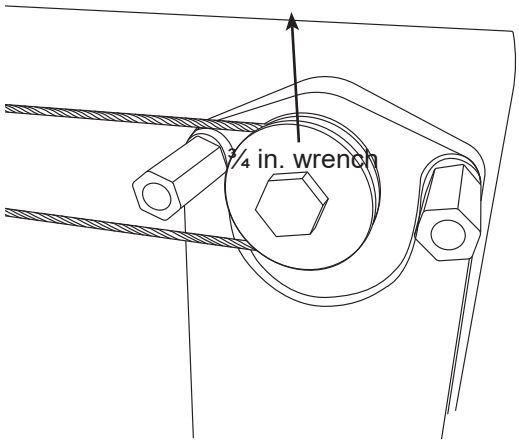


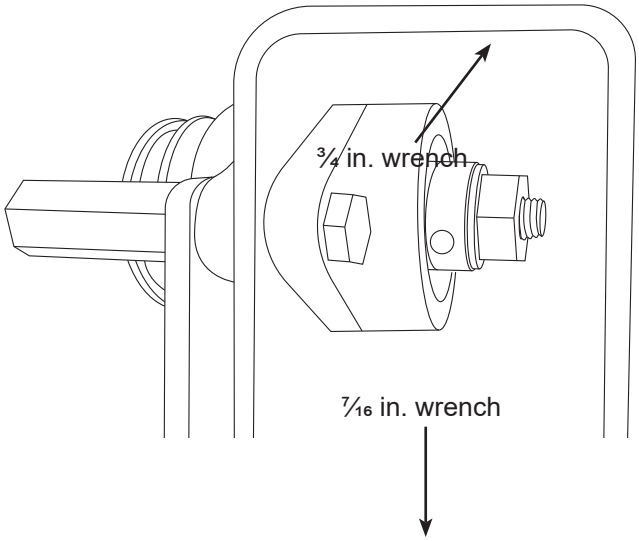
6. Using a ⅜ in. Allen wrench, ensure the Y Rotation Set Screws are tight.



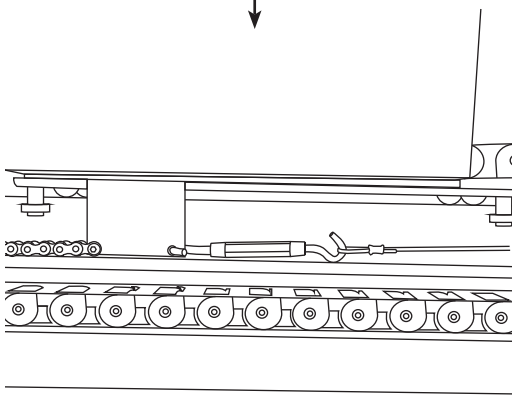
7. Remove the X chain cable pulley cover. Ensure the X chain cable pulley is tight. If the pulley is not tight, the Operator will be required to tighten the pulley to the proper tension. Set the tension for the X chain cable pulley by first loosening the nut and bolt combination that secure the pulley to the mounting block. Begin re-tensioning the pulley by first tightening the nut and bolt combination by hand. Hold the nut inside the rail with one hand while turning the bolt head with the other. With the bolt and nut combination finger tight, place a ¾ in. wrench on the nut inside the Rail and, using a second ¾ in. wrench, tighten the bolt one full turn. Reinstall the X chain cable cover.

The X chain cable pulley does not control tension on the X chain. However, it is important the X chain cable pulley be adjusted properly to ensure consistent tension on the chain.





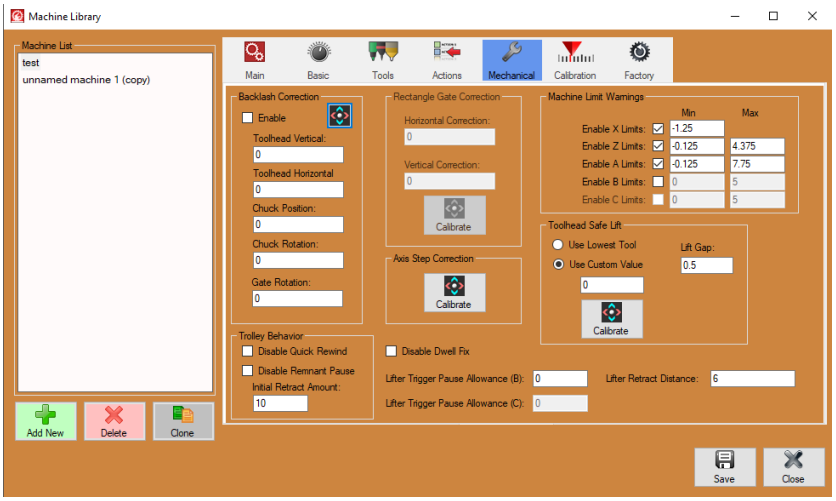
8. Ensure tension is set correctly on the X chain and cable combination. Locate the adjustment turnbuckle. Using a 7⁄16 in. wrench, loosen the adjustment turnbuckle until it can be turned by hand, without using the wrench. To set tension, tighten the turnbuckle by hand as much as possible. Once the turnbuckle cannot be turned by hand, tighten it one full rotation using a 7⁄16 in. wrench. Tension for the X chain is now set.



9. Reinstall the X gear cover

10. Reinstall the Trolley cover

In Bend-Tech Dragon software, click Machine Library and ensure the correct machine is chosen from the Machine List. Click the Mechanical icon in the menu at the top of the screen. In the Backlash Correction box click the box with the multicolored diamond-shaped icon. This will begin the Backlash Correction procedure. Follow the prompts on the screen. Do not perform backlash procedure on the Y Axis.



When the Backlash Correction procedure is complete the machine is ready to run.

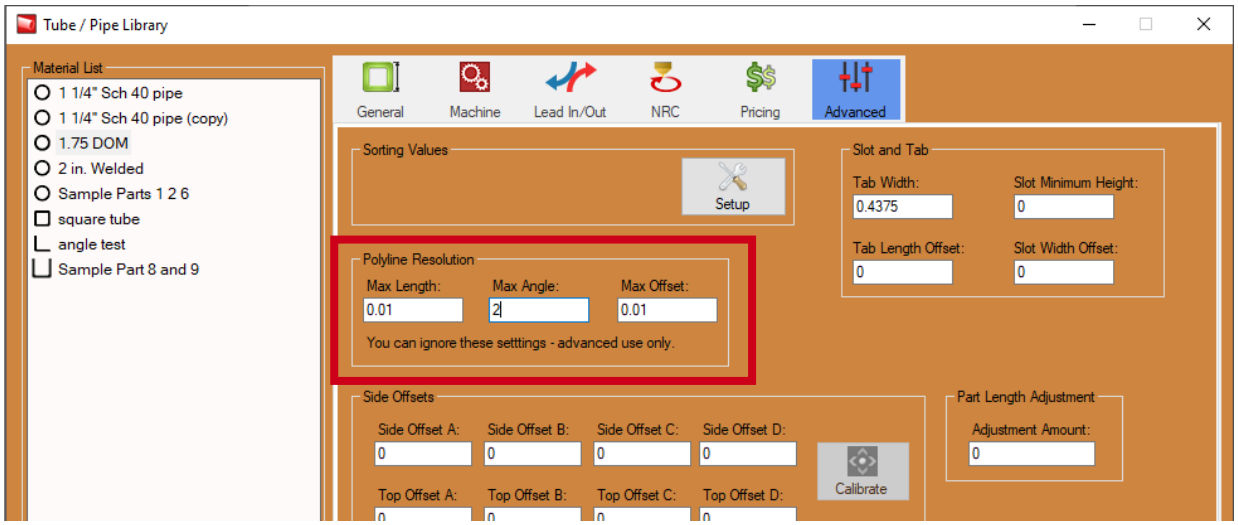
Reversing Cut Direction

Bend-Tech has had success maintaining accurate cut rotation by changing the cut direction in the part design feature. With the Dragon A150 machine, allowing the machine to operate so it rotates in the same direction throughout the job process eliminates any backlash that can occur in the chain drive system since the machine is always keeping tension in the system.

1. In Bend-Tech Dragon software, under Create New, click the type of part that will be cut on the Dragon, such as Straight Part.
2. Select Material, enter a Part Name and Tube Length.
3. Click the Cutting tab. Click Add twice to add a cope to each end of the part.
4. At the top of the main interface, select Edit Flat.
5. Click the Actions tab, under the Actions tab click Edit.
6. Click Reverse Cut. In the part display interface, the software will display the cut direction with a series of arrows. The default direction will show the cuts moving in the opposite direction. After clicking Reverse Cut, click on one of the cuts in Edit Flat to reverse its direction. To ensure most accurate cut rotation on the A150, edit the part so all cuts are in the same direction.

The part can now be Nested and sent to the machine for production.

Editing Polyline Resolution



A final way to adjust cut rotation on the Dragon A150 machine involves editing Polyline Resolution in the Advanced option in the Tube Library. While Bend-Tech does not recommend changing default Polyline Resolution settings, changing the settings slightly can result in more accurate cut rotation on the A150 machine.

1. In Tube Library, with the appropriate material chosen in the Material List, click the Advanced icon in the menu bar at the top of the interface.
2. Default Polyline Resolution settings will read as follows: Max Length: 0.1; Max Angle: 5; Max Offset: 0.01
3. Change these settings to: Max Length: 0.01; Max Angle: 2; Max Offset: 0.01.

Changing the Polyline Resolution settings will increase Nest size significantly. It is not recommended the Operator run a large Nesting Project when using these edited Polyline Resolution settings.

If the Operator is using an imported material the software may have already assigned the high resolution Polyline Resolution to the material as the default settings.

Adjusting Torch Position

In some cases the Operator can adjust the Torch position to compensate for cut rotation. This process involves trial and error regarding Torch position, but is sometimes effective in achieving more accurate cuts.

1. Ensure Torch is centered on the material.
2. Move the A axis left or right .050 in.
3. Run a test cut from this new start position and assess cut rotation. If the cuts are more accurate, move the Torch in the same direction another .050 in. If the cuts get more accurate, continue to move the Torch. If the cuts get less accurate, back up to the previous position. If moving the Torch one direction results in less accurate cuts, move it in the other direction.

03 Toolhead

Toolhead

The Toolhead on the Dragon A150 serves as the tool mount and the vehicle for engaging the tools vertically (A Axis) and horizontally (Z Axis) during the machine's operational processes. The Marker, Engraver, Torch and Laser are mounted to the Toolhead. The Toolhead is powered by the A Axis and Z Axis motors.

The Marker, Engraver and Torch are mounted left to right on the Toolhead to coincide with Bend-Tech's recommended order of operation for the Toolhead.

Symptom	Cause	Corrective Action
Jagged Cuts	Toolhead trolley out of adjustment.	Adjust the Toolhead trolley so the Toolhead rides smoothly along the rail with no play.
	A axis mount bearings out of spec.	Check Toolhead play on A axis mount plate. If there is excessive play adjust bearing center to center distance.
Torch/Engraver/Marker not contacting material, or not moving clear of material	A axis skipping steps.	Check A axis drive gear set screws. Use bonding compound to secure A axis drive gear.

Adjusting the Toolhead Trolley

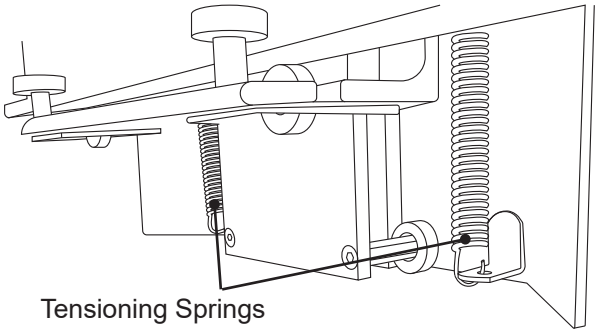
Over time, the Toolhead trolley may come out of adjustment, resulting in imprecise cuts, engraving and marking operations.

Remove the Toolhead

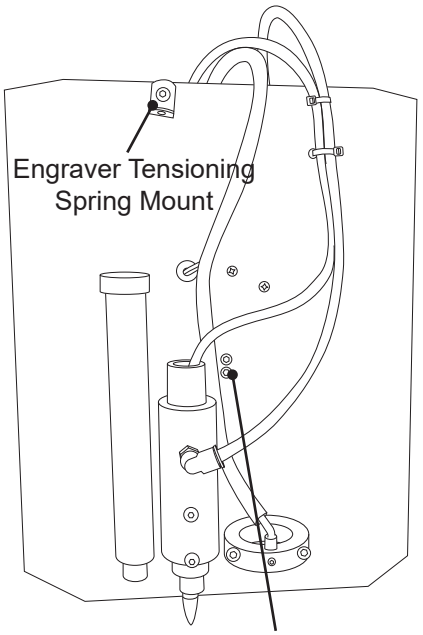
Tools Needed

- 3⁄16 in. Allen wrench
- 5⁄32 in. Allen wrench
- 1⁄8 in. Allen wrench
- 3⁄8 in. wrench
- Pliers

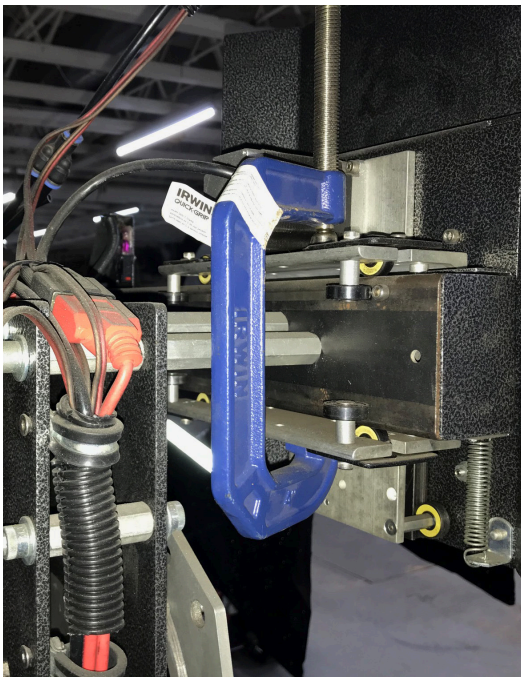
1. Remove the tensioning springs on each side of the Toolhead. The tensioning springs are located on the backside of the Toolhead. Using a pliers, grab the bottom loop on each spring. Pull down on the spring to release the loop from the tensioning spring mount.
2. Using the same method, remove the Engraver retraction spring at the front of the Toolhead.


Tensioning Springs

3. With the tensioning springs removed, the Toolhead will be resting on the Engraver tensioning spring mount at the top of the Toolhead. Place a 3⁄8 in. wrench on the nut on the backside of the Engraver tensioning spring. Holding the nut secure with the 3⁄8 in. wrench, use a 1⁄8 in. Allen wrench to remove the Engraver tensioning spring mounting screw and mount. Hold the Toolhead in place while removing the Engraver tensioning spring mount.
4. Using a 5⁄32 in. Allen wrench, remove the two Toolhead mounting screws located at the center of the Toolhead assembly. Bend-Tech recommends enlisting a helper to secure the Toolhead during this process.
5. With the Toolhead removed, loosen the four Toolhead mount plate screws roughly one full turn.



6. Using a larger C-clamp, apply the clamp to the Toolhead trolley so it puts slight pressure on both the upper and lower halves of the trolley assembly. Tighten the mount plate screws securely. Using the same process, apply a C-clamp to the other end of the trolley assembly. Adjust the C-clamps so there is enough pressure on the trolley to eliminate any play but still allow it to ride smoothly along the rail. When this is achieved, tighten the Toolhead mount plate screws, then tighten another quarter turn.
7. Reassemble the Toolhead by reversing the order of disassembly.



Toolhead Rail

Tools Needed

- Torpedo level
- Leveling foot adjustment wrench

Leveling The Toolhead Rail

For most accurate cutting the Operator should ensure the Toolhead rail is level. Leveling the Toolhead rail and the Chuck allows the machine to perform the most accurate operations possible.

1. Place a level on the Toolhead rail.
2. If the Toolhead rail is not level, adjust the machine's leveling feet to bring the Toolhead rail to level.
3. Once the Toolhead rail is level, secure the leveling feet. With the leveling feet secure, re-check to ensure the Toolhead rail is still level.

If the Dragon A150 is not equipped with leveling feet it will be necessary to shim the legs of the machine to bring it to level.

Toolhead A Axis Mounting

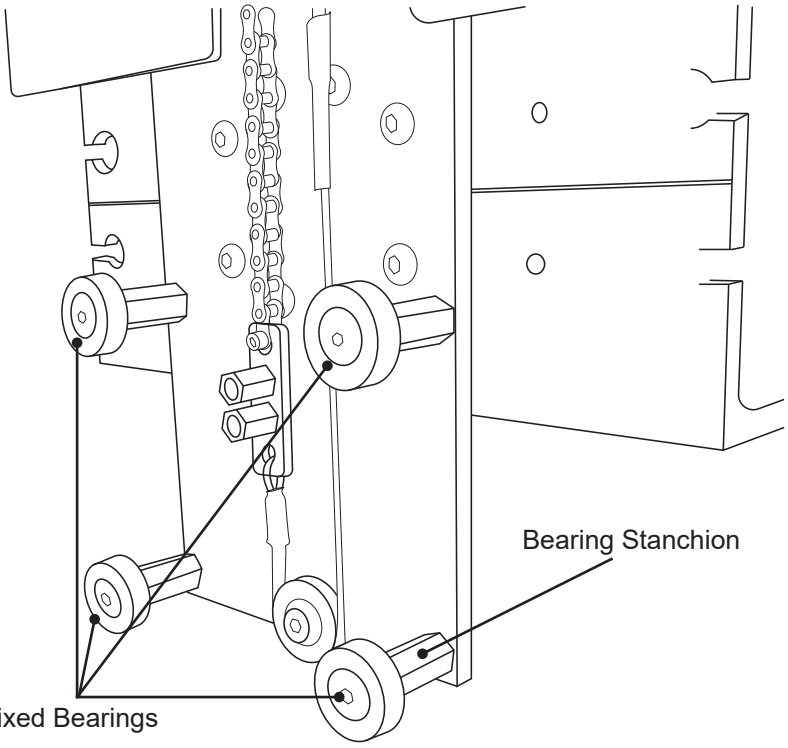
The Toolhead travels on its A axis using fixed bearings that ride on a grooved plate. In some cases, the A axis Mount Plate may have excessive play. The A Axis bearings may fall out of spec over time resulting in side-to-side play in the toolhead. Typically, the Operator can adjust the bearings to bring them back into spec. This can be achieved in one of two ways:

Method 1

After removing the Toolhead, loosen the bearing stanchions and insert a small piece of shim stock underneath the stanchion, placing the shim on the outside edge.

Method 2

The Operator can carefully bend the bearing stanchions inward a slight amount to eliminate play. Care must be taken not to damage the bearing assembly as the assembly is aluminum and can break easily.

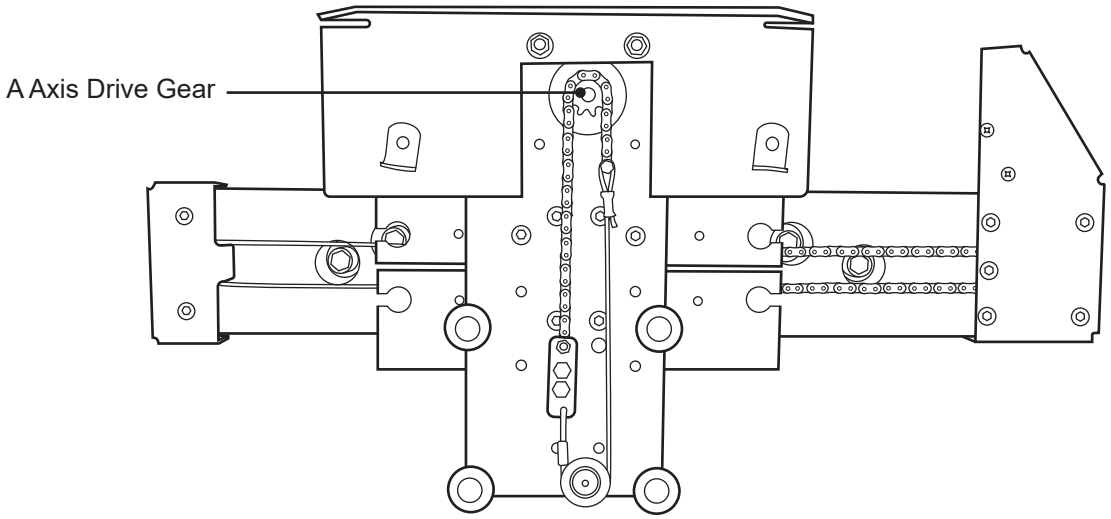


A Axis Drive Motor Set Screws

It is necessary to inspect the A axis drive motor set screws on a regular basis. If the A axis is missing steps it is possible a set screw has come loose causing the gear to slip on the shaft. Ensuring the set screw is secure is key to proper operation of the A axis.

Tools Needed

- 3⁄32 in. Allen wrench
- Loctite 609 Retaining Compound
- Loctite Blue 242



1. Remove the Toolhead as outlined in “Remove The Toolhead.”
2. Using a 3⁄32 in. Allen wrench, remove the set screw that secures the A axis drive gear to the A axis drive motor shaft. Note the position of the A axis drive chain. Slide the gear off the shaft.
3. Clean the A axis drive motor shaft and the A axis drive gear with Loctite Cleaner Degreaser or similar cleaner such as acetone.
4. Apply Loctite 609 Retaining Compound to the A axis motor shaft.
5. Ensure the A axis drive gear is positioned on the A axis drive chain in the same position from which it was removed. Slide the A axis drive gear onto the A axis drive motor shaft. Position the drive gear so it is even with the A axis cable pulley.
6. Apply Loctite Blue 242 to the A axis drive gear set screw. Thread the set screw into the drive gear and, using a 3⁄32 in. Allen wrench, tighten securely.
7. Reinstall the Toolhead.

04 Torch

Torch

While the Customer can choose any type of plasma machine desired, Bend-Tech recommends using a Hypertherm Powermax45, Powermax65 or Powermax85. Bend-Tech offers full technical support for the Hypertherm unit. Customers who choose to use a plasma machine other than Hypertherm will not receive the same level of technical support. Please refer to the Bend-Tech Dragon A150 Plasma Cutting Guide for maintenance, cutting specifications and troubleshooting.

The Hypertherm unit requires at least 110-120 psi at its air connection.

It is recommended that the air supply to the Hypertherm be equipped with a water and particulate filter, an oil filter and an oil vapor filter.

Symptom	Cause	Corrective Action
Torch Not Firing	Wires to the Torch relay have come loose	Ensure Torch wires are secure in the Torch relay
	Torch relay has failed	Replace the Torch relay
Machine starts moving before Torch fires	Incorrect or no dwell time set	In Pipe Library>Lead In/Out set Dwell Time to .75 seconds

Mounting the Torch

Bend-Tech recommends mounting the Torch wand so the edge of the ceramic body closest to the cutting nozzle is even with the bottom of the tool mount on the Toolhead. Mounting the Torch lower than this could lead to Torch collision. Mounting the Torch higher could cause problems with the Torch developing an arc on the material when the Toolhead reaches certain parts of its travel.

The Operator can verify Torch height by manually pushing down on the Engraver and observing if the Engraver engaged height is the same as Torch height.

Routing the Torch Lead

The Torch lead carries a high current load and can cause interference if routed close to other electrical cords and connections on the machine. It is important to route the Torch lead away from other cords on the machine. It is critical to route the Torch lead clear of the Ethernet cable. The Torch lead can cause connectivity issues if routed close to the Ethernet cable. Some models of the Dragon A150 are equipped with cable loops pre-installed for the purpose of securing the Torch lead.

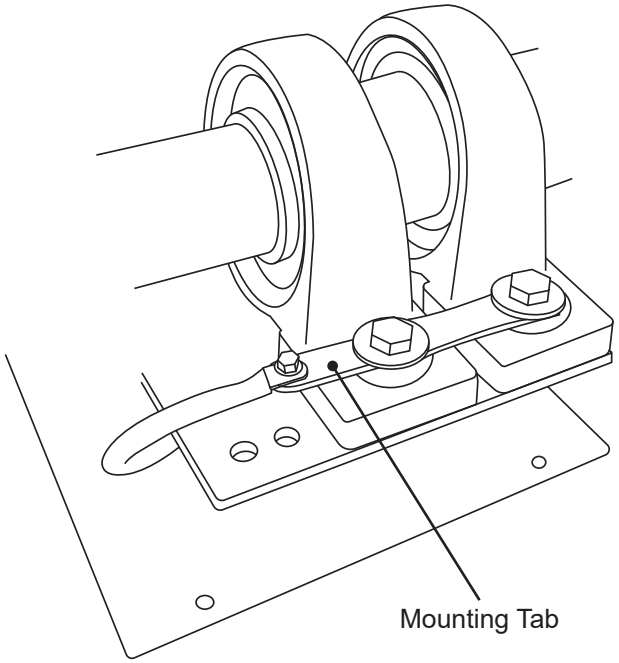
The Customer should ensure the Torch lead is secured so it is clear of the cables at the top of the Toolhead. It is recommended that the Torch lead be secured so it loops up above the components at the top of the Toolhead.

Grounding The Torch

Early Dragon A150 machines achieve Torch ground via a carbon brush rod system. Bend-Tech has found moving the ground cable location to the pillow block bearing mount results in a more consistent ground for the Torch.

Tools Required

- ¾ in. wrench
- ¾ in. socket and rachet
- Grinder/Sander
- ½ in. wrench (2)



1. Using a ¾ in. wrench and a ¾ in. socket and ratchet, remove the right side bolt on the rear pillow block bearing.
2. Using a grinding wheel or sanding disc, lightly remove the paint from the top mounting surface around the pillow block bearing mounting hole.
3. Bend-Tech can provide a mounting tab for the Torch ground cable, or the Operator can fabricate a ground cable mount using 3⁄16 in. steel.
4. Place the mounting tab over the pillow block bearing mounting hole. Using the ¾ in. wrench and ¾ in. socket and ratchet, reinstall the pillow block bearing mounting bolt that was removed in step 1.
5. Using two ½ in. wrenches, remove the Torch ground cable mounting bolt from the carbon brush rod mounting plate. Position the cable so the mounting bolt can be inserted through the new ground tab and the Torch ground cable. Using the ½ in. wrenches, secure the Torch ground cable to the grounding tab on the pillow block bearing.

Setting Torch Dwell Time

The A150 does not use an OK To Move signal. Thus, when operating the Dragon A150, it is important the Operator set Torch dwell time. If dwell time is not set, it is possible for the machine to begin operating before the Torch fires, resulting in an incomplete cut. Bend-Tech recommends setting Torch dwell time to .75-seconds.

In Tube Library, with a material selected, click Lead In/Out. In the End Cut Profiles box and/or Internal Cuts box, enter the appropriate value in the Dwell Time text box(es). Also, in Machine Library, under the Mechanical tab, ensure Disable Dwell Fix is not checked.

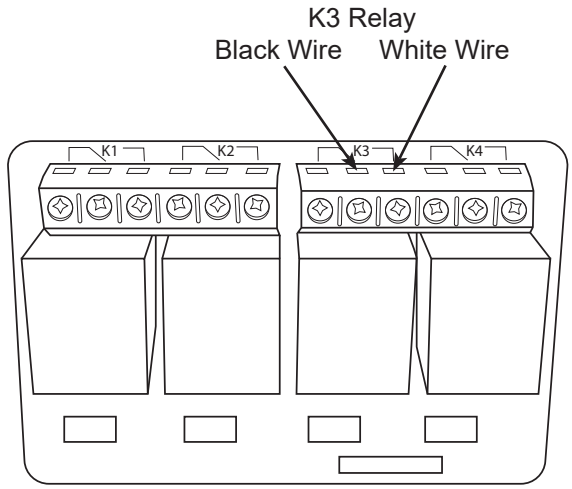
Torch Relay

Tools Required

- ⅜ in. wrench
- Phillips screwdriver (standard)
- Phillips screwdriver (small)

It is possible the wires leading to the Torch relay can come loose over time, leading to improper Torch operation. It is also possible the Torch relay can fail. In the case of a failed Torch relay the Torch will fail to ignite. If the Torch is not functioning it will be necessary for the Operator to check the Torch relay inside the Control Box.

1. Power down the machine.
2. Locate the Control Box cover plate under the Toolhead inside the front Support Leg on the machine. Using a ⅜ in. wrench, remove the four nuts that secure the Control Box cover.
3. Using a Phillips screwdriver, remove the four screws that secure the Control Box.
4. Turn the Control Box so the 4 relay modules can be accessed. The 4 relay modules are located near the cooling fan, next to where the Torch and Laser wires enter the Control Box.
5. Locate the relay in the K3 position. Ensure the white and black wires are secured in their ports. The white wire should be in the port closest to the fan, the black wire should be in the middle port.



6. With the Torch wires secure in the relay, reassemble the Control Box. Reattach the Control Box cover plate.

If the Torch still does not fire, it is possible the relay has failed. Contact a Bend-Tech representative for further assistance.

05 Engraver

Engraver

The Engraver on the Dragon A150 is powered by a single air source. The air pressure to the Engraver is controlled by a regulator located on top of the Head of the machine. Proper performance of the Engraver is dependent on air pressure. Bend-Tech recommends setting initial air pressure to 70-80 PSI.

When troubleshooting the Engraver, ensure there are no leaks at air line connections. Ensure air lines are not cracked, kinked or broken.

Symptom	Cause	Corrective Action
Engraver air cylinder not extending all the way	Air pressure too low	Increase air pressure to air cylinder
	Too much friction in actuation cylinder	Lubricate the engraver actuation cylinder with penetrating oil
Engraver sticking in air cylinder	Too much friction in the actuation cylinder	Clean engraver actuation cylinder. Lubricate the engraver actuation cylinder with penetrating oil
Engraving too light or engraver digging into material	Improper air pressure to air cylinder	Increase or reduce air pressure to achieve proper engraver actuation
	Improper air pressure to engraver	Increase air pressure to keep engraver from digging into, or hanging up on, material

06 Marker

Marker

The Marker on the Dragon A150 is held in a weighted Marker holder that operates via gravity. The weight of the holder pushes the marker down on the material to place markings. Bend-Tech has had the best luck using silver Sharpie markers or Milwaukee Inkzall markers. The Inkzall marker features a tab on the body that will need to be cut off in order to fit in the Marker holder. Bend-Tech recommends wrapping a piece of duct tape or similar tape around the marker to help hold it in the Marker holder. Ensure the Marker holder is clean. Keep it lubricated with a coating of light oil.

Symptom	Cause	Corrective Action
Writing/marking not clear or defined	X or Y Axis set screw have come loose.	Check acceleration settings in Mach3. Check set screws on X Axis.
	X backlash not set.	Check X Axis chain tension.
	X or Y motor skipping steps.	Chuck set screw not secure.
	Toolhead loose on machine.	Check Toolhead play on axis mount plate; check for play on Toolhead Rail.

07 Laser

Laser

The Laser serves as a critical tool in calibrating and ensuring the ongoing accuracy of the Dragon A150. While the Laser is a robust piece, it is a consumable and can burn out. If the Laser has stopped working it is likely because it has reached the end of its life cycle and needs to be replaced. When troubleshooting the Laser, ensure the wires are securely connected at the plug as well as inside the Control Box.

Symptom	Cause	Corrective Action
Laser not working	Laser has failed	Replace the Laser.
	Wires have come loose	Check the Laser plug; Check the Laser connections inside the Control Box.
	Laser relay has gone bad	Relay may need to be replaced, contact a Bend-Tech service tech for assistance.

Control Box Laser Connection

It is possible for the Laser wire to come loose from its connection to the 4 Relay Module. To check the Laser connection, access the Control Box as outlined in the Control Box section. In the 4 Relay Module, in the D2 Module, when viewing the module so the labeling can be read right to left, check the large red wire connection at the terminal at the top of the D2 Relay. Using a small Phillips screwdriver, ensure the wire is secure in the socket and the screw is secure.

Laser Replacement

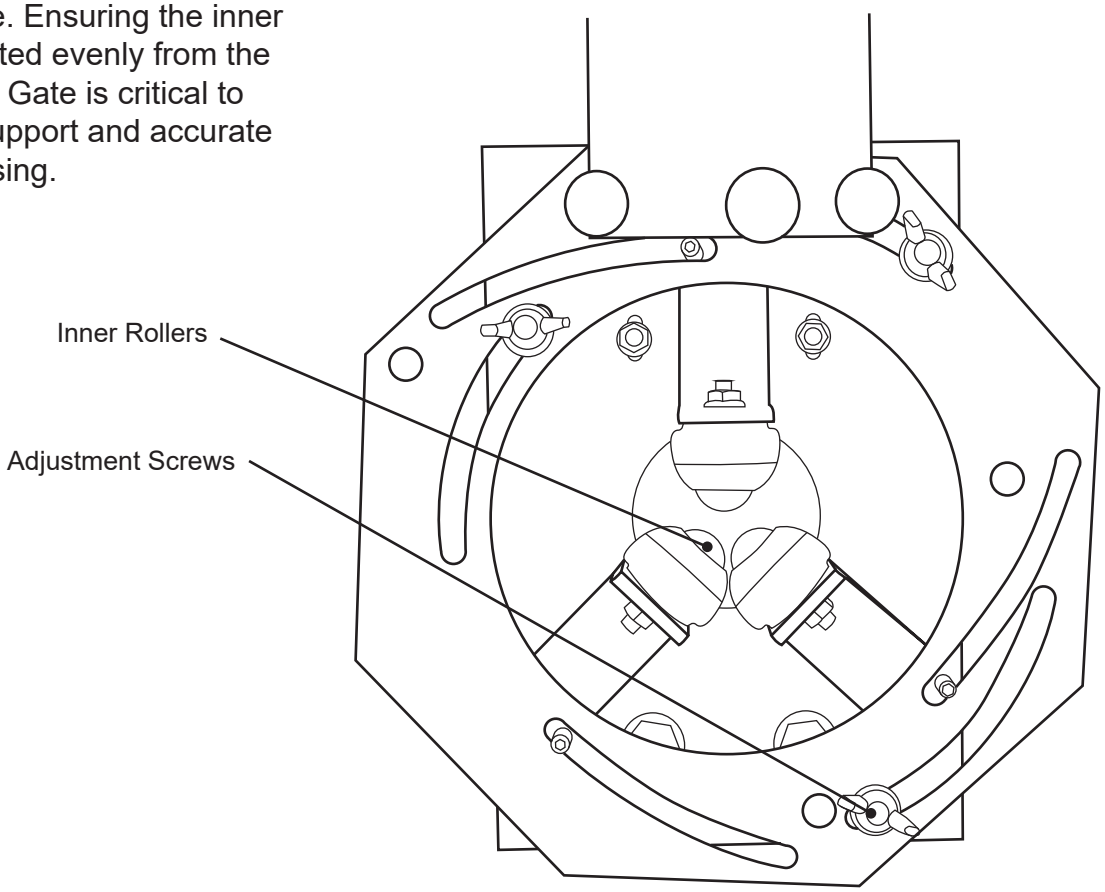
The Laser is a consumable and over time it can fail. If the Operator has determined the Laser has failed, it will be necessary to replace the Laser. The Laser is affixed to the Torch mounting collar. The Laser will connect to the Control Box via a two prong plug. The type of plug will depend on the age of the machine.

1. Loosen the set screw that secures the Laser to the Torch mounting collar. Depending on the age of the machine this may require a 3⁄32 in. Allen wrench or 5⁄16 in. wrench.
2. Remove the Laser, remove the Laser cord from the wire loom. This may require cutting zip ties that secure the loom to the machine.
3. Unplug the Laser cord from its Control Box connection.
4. Plug in the new Laser.
5. Route the Laser cord in the same fashion the old Laser cord was routed, placing the cord inside the wire loom. Reattach the wire loom to the machine with zip ties.
6. Place the Laser in its mount in the Torch mount collar. Secure with set screw.

08 Gate

Gate

The Gate on the Dragon A150 is a rotating ring design. The Gate is adjusted by loosening the thumb screws and turning the outer ring by hand. The inner rollers are adjustable to fit the diameter of the given material loaded into the machine. Ensuring the inner rollers are adjusted evenly from the centerline of the Gate is critical to even material support and accurate material processing.



Symptom	Cause	Corrective Action
Center Gate bearings sticking/Gate not turning freely	Gate dirty	Clean the Gate using brake cleaner and compressed air.
Gate not opening and closing smoothly	Gate structure worn, Gate dirty	Clean the Gate using brake cleaner and compressed air. If the Gate components are worn, consider replacing them.

Gate Wear

The Gate is constructed entirely of aluminum. The Gate Rollers are attached to aluminum mounts, which are in turn attached to the Gate assembly. Over time, the aluminum Gate Roller mounts can wear against the Gate assembly and can eventually affect the ability of the Gate Rollers to hold the material securely. In this case, the Operator will need to service the Gate assembly and possibly replace Gate components or the Gate assembly.

Gate Maintenance

Because of its proximity to the Torch, the Gate is subject to a high level of slag, debris and plasma cutting dust and fumes. It is important to keep the Gate clean to ensure it is operating as designed. Clean the Gate with aerosol brake cleaner on a regular basis. If the Gate is extremely dirty it may be necessary to wipe it down thoroughly with a rag and/or clean with a soft brush.

Gate Removal

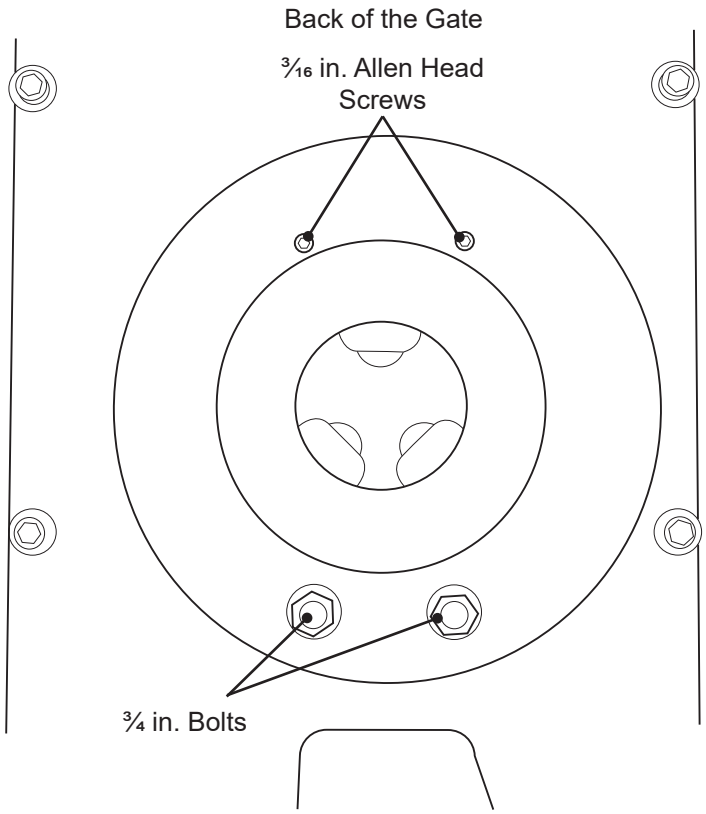
In some cases it may be necessary for the Operator to remove the Gate for servicing or replacement. The Gate is attached to the Head of the machine via four mounting bolts/screws. Depending on the machine, some Gates may have a different fastener configuration than others.

Tools Required

- ⅜ in. wrench
- ¾ in. wrench
- ¾ in. socket and rachet
- 3⁄16 in. Allen wrench

1. The rotating Gate face operates the material support bearings via a stud and groove design. On some Gates it will be necessary to remove a nut on each stud in order to remove the Gate adjustment face. If the material support bearing adjustment studs are equipped with nuts, use a ⅜ in. wrench to remove the nuts.

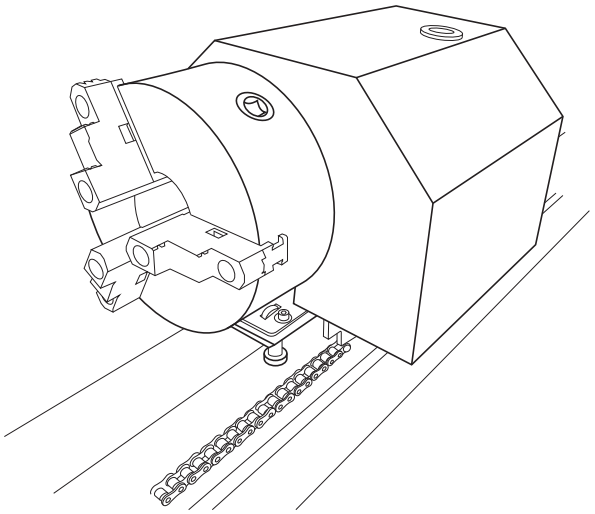
2. Remove the three thumb screws and washers from the adjustment studs. Remove the Gate adjustment plate.
3. There are two bolts and two screws that attach the Gate assembly to the Head of the machine. Place a ¾ in. wrench on the head of one of the large bolt heads at the bottom of the Gate mounting plate. Use a ¾ in. socket and ratchet to remove the nut from the mounting bolt. Repeat for the second bolt.
4. Use a 3⁄16 in. Allen wrench to remove the Allen head cap screws at the top of the Gate assembly. On some Gate designs the Allen head cap screw will thread into the Gate mounting plate. On other designs the Allen head cap screw is secured with a nut on the other side of the Gate. Use a ⅜ in. wrench to secure the nut during the Allen head cap screw removal process. Repeat for the second Allen head cap screw.
5. Remove the Gate.



09 Trolley

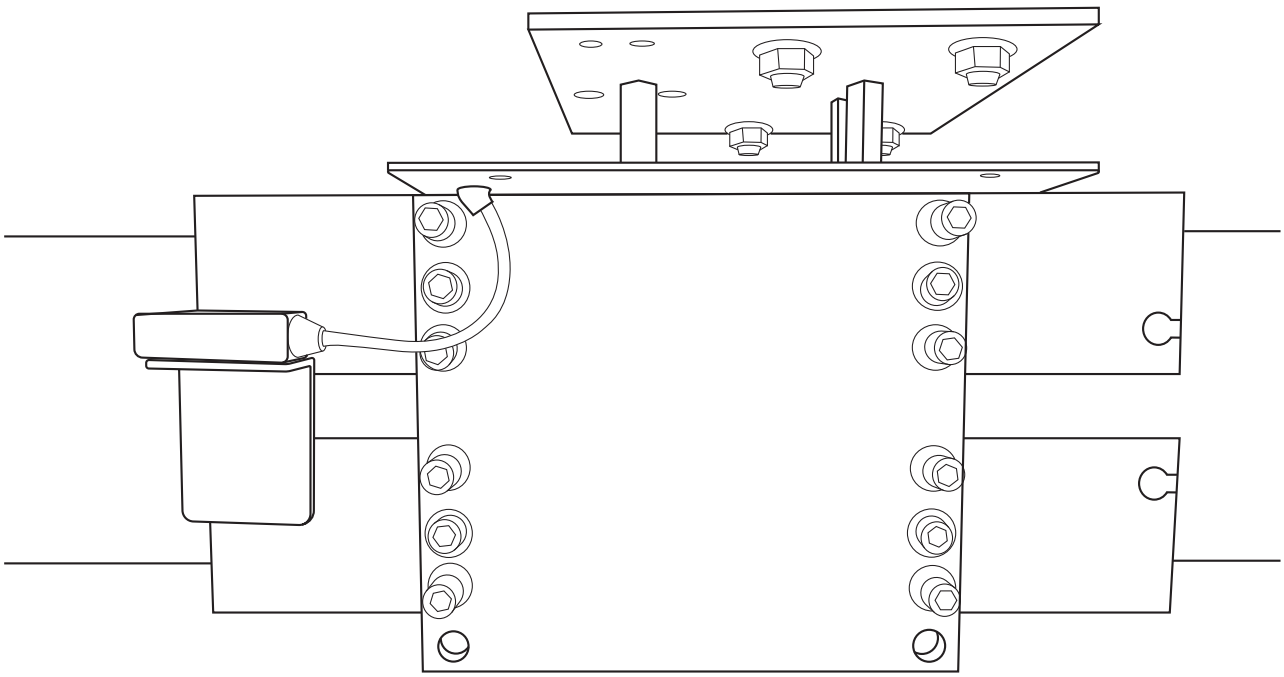
Trolley

The Trolley on the Dragon A150 rides on a steel rail. The Trolley's roller system is a two-piece design. The Trolley rides on the upper part of the roller system. The upper part of the roller system is connected to the lower part via an adjustment plate that is mounted on the right side of the assembly. When adjusted properly the Trolley should move along the Rail smoothly with no play or bind anywhere along its travel. If there is play in the Trolley the Operator will be required to adjust the Trolley assembly.



Trolley Adjustment

The Trolley adjustment plate is located under the Trolley on the right side of the Rail. There are eight socket cap screws on the Trolley adjustment plate. The four socket cap screws with nuts on the backside adjust side play. These are placed highest and lowest on the Trolley adjustment plate. The four socket cap screws without nuts adjust the up and down play on the Trolley.



Adjusting the Trolley

Tools Required

- 5⁄16 in. Allen wrench

1. Locate the Trolley adjustment plate on the right side of the Trolley assembly.
2. There are eight socket cap screws on the Trolley adjustment plate. Using a 5⁄16 in. Allen wrench, begin by loosening the four innermost socket cap screws roughly one full turn. Loosen enough to allow the adjustment of the Trolley's roller system.
3. With one hand, push up on the lower half of the Trolley roller system. Using the other hand, tighten the four socket cap screws while holding steady upward pressure on the lower half of the Trolley roller system.
4. To adjust side play, turn the outermost socket head screws clockwise to reduce side play, turn them counterclockwise to increase side play. Adjust evenly to ensure smooth operation with no side play.
5. Check play in the roller system by rocking the Trolley back and forth, and lifting up and down.
6. Adjust to ensure the Trolley moves smoothly along the length of the Rail with no play or binding.

Removing the Trolley Cover

Tools Required

- 5⁄16 in. Allen wrench

The Trolley cover is secured to the Trolley using four socket cap screws. Access the socket cap screws by reaching underneath the Trolley. There is a socket cap screw located at each corner of the Trolley. Use a 5⁄16 Allen wrench to remove the socket cap screws.

X Limit Switch

During normal use over time, it is possible for the X limit switch to fail. The X limit switch operates by making contact with a button head cap screw fastened to the rear part of the Rail. When the switch contacts the head of the button head cap screw it signals the X- limit, or X Home when calibrating the machine. The Operator can test the X limit switch by depressing it manually, if the limit lights up in Mach3 Diagnostics the X limit switch is operating properly.

Replacing the X Limit Switch

Tools Required

- Phillips screwdriver
- 11⁄16 in. wrench

If the Operator determines the X limit switch is not operating properly, it will be necessary to replace the switch. The X limit switch is a two-piece design that includes a plastic cover. The switch is mounted to the Trolley assembly.

1. Remove the outer plastic cover from the X axis limit switch.
2. Note the color of the wires and the wires location on the switch. Use a Phillips screwdriver to remove the screws mounting the wires to the switch.
3. Use an 11⁄16 in. wrench to loosen the set screw on the limit switch.
4. Remove the limit switch. Reverse the process to install the replacement switch.

10 Chuck

Chuck Overview

The Chuck assembly on the Dragon A150 is a precision piece that requires periodic maintenance to remain in operating order. The jaws on the Chuck are machined pieces that are matched to their positions in the assembly. When servicing the Chuck, always ensure the Chuck jaws are replaced in the same position from which they were removed. Failure to do so can result in inefficient operation of the Chuck and poor machine operation.

Removing and Cleaning Chuck Jaws

The Chuck jaws can be removed without removing the Chuck from the shaft.

1. Use the Chuck key to open the Chuck jaws as far as possible. When the Chuck jaws stop moving the Operator should be able to lift them out of the Chuck. If the Chuck is still mounted to the machine, ensure the Chuck jaws do not fall on the floor as they could become damaged.
2. Clean the Chuck jaws with brake cleaner and a rag. Use a soft brush to loosen dirt if needed.
3. Chuck jaws should be re-installed in the same position from which they were removed. Apply oil to the Chuck jaws upon re-installation.
4. Install the Chuck jaws on the same rotation of the Chuck key. This will ensure they are all the same distance from the center of the Chuck.

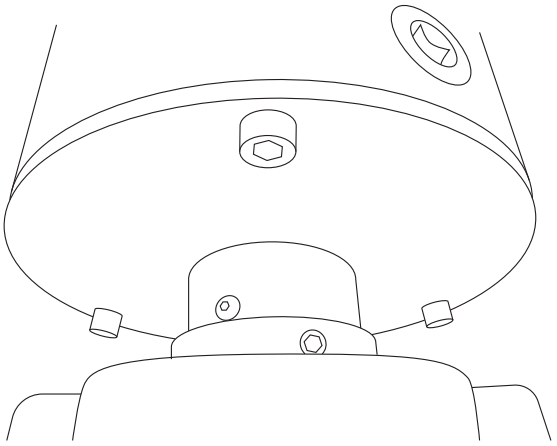
If the Chuck jaws are not installed on the same rotation of the Chuck key the Operator will be able to perform a visual inspection and determine the jaws are not installed correctly.

Tools Required

- 5⁄16 in. Allen wrench or 15mm wrench

Removing The Chuck

The Chuck is secured to the Chuck Shaft with three M10 x 1.5mm hex cap screws. Using a 5⁄16 in. Allen wrench, remove the cap screws to remove the Chuck from the Chuck shaft.



Newer machines may be equipped with bolts that require a 15mm wrench for removal.

When installing the Chuck, tighten the screws, then give each one another quarter turn.

Cleaning The Chuck

Over time, the inner mechanism of the Chuck can become dirty, causing it to operate poorly. Cleaning the inner mechanism can help the Chuck work smoothly again.

1. Remove the Chuck from the Chuck shaft.
2. Remove the Chuck jaws, noting the location of each jaw so it can be reinstalled in its original location.
3. Clean the Chuck with brake cleaner, spraying the inner mechanism as much as possible. If the Operator has access to a parts washer it is recommended the Chuck be cleaned in this manner to more effectively flush dirt and slag from inside the Chuck.
4. With the Chuck clean, lightly lubricate the inside with a quality spray lubricant.
5. Reinstall the Chuck jaws, ensuring they are installed in the same location and on the same rotation of the Chuck key.
6. Reinstall the Chuck. Tighten the Chuck mounting screws then give each screw another quarter turn.

11 X and Y Axis Maintenance

X and Y Axis Maintenance and Adjustment

Maintaining specific mechanical aspects of the Dragon A150 is critical to achieving accurate operation. The machine relies on numerous set screws and adjustments regarding its operational axes. Maintaining set screws and drive systems adjustments is critical to the accurate operation of the machine. The Operator should ensure set screws, gears and chains are kept in adjustment.

Symptom	Cause	Corrective Action
X chatter	Cause X chain drive gear	Install revised X chain drive gear; check X drive chain tension; ensure anti-chatter kit is installed.
Y motor not holding torque	Y drive chain tension too tight	Adjust Y chain motor mount plate to correct chain tension.
	Material too heavy	Check material weight, ensure it is within machine capabilities.
	Gate sticking, not functioning correctly	Check Gate, clean Gate to restore function. If necessary, service Gate to ensure all parts are operating properly.
Trolley not moving smoothly along the Rail	Trolley roller system not adjusted properly	Adjust Trolley roller system so the Trolley has no play and travels smoothly along the Rail.
	Rail dirty	Clean and wipe down Rail, coat with rustproofing oil such as WD-40 or penetrating oil.

Symptom	Cause	Corrective Action
Chuck Off center	Trolley has been bumped; Trolley adjustment has shifted alignment.	Perform Chuck alignment process.
Toolhead out of square	Uneven mounting surface; machine has manufacturing issue.	Adjust swivel levelers or shim the Head of the machine into level configuration.

Set Screw and Chain Maintenance

An Operator experiencing cut rotation issues with the Dragon A150 machine may be required to check set screws and chains to ensure backlash settings are accurate. As a result of daily use, the machine may experience loose set screws and/or chains that come out of adjustment. There is also a Backlash Correction procedure in Bend-Tech Dragon software that should be performed. Ensuring all set screws and chains are tight and adjusted and Backlash Correction is performed in Bend-Tech Dragon software will maintain optimum cut rotation accuracy.

X Gear and Chain Adjustment

Tools Required

- 3mm Allen wrench
- 3⁄32 in. Allen wrench
- 5⁄16 in. Allen wrench
- ½ in. wrench
- ¾ in. wrench (2)

1. Use a ⅛ in. Allen wrench to remove the X gear cover. Use a 5⁄16 in. Allen wrench to remove the Trolley cover.
2. Using a 5⁄16 in. Allen wrench, remove the X Chain Cable Cover by removing the two screws.
3. Using a 5⁄32 in. Allen wrench on the large sprocket and 3⁄32 in. Allen wrench on the small sprocket, ensure the X Drive Set Screws are tight.
4. Using a 3mm Allen wrench, ensure the X Chain Set Screws are tight.
5. Using a ½ in. wrench, loosen the Y motor mount bolts on the bottom of the Trolley just enough to slide the motor in toward the Chuck shaft.
6. Using a 3⁄32 in. Allen wrench, remove the set screws securing the Y motor drive gear. Remove the Y Motor drive gear.

7. Clean the Y motor drive gear shaft using acetone or similar cleaner.
8. Apply Loctite 638 Retaining Compound to the Y motor drive shaft. Install the Y motor drive gear onto the shaft. Ensure the Y motor drive gear is aligned with the gear on the Chuck shaft. If possible, use a straight edge to align the gears.
9. Apply Loctite Blue 242 to the Y motor drive gear set screws. Using a 3⁄32 in. Allen wrench, install the set screws and tighten to the shaft.
10. Ensure the chain is tight on the Y gear and motor. If the Y chain is loose the Operator will be required to re-tension the chain. Using a ½ in. wrench, loosen the Y motor mount bolts on the bottom of the Trolley just enough to slide the motor and mount to the outside, tensioning the chain. Holding tension steady, re-tighten the Y Motor Block Adjustment Bolts.
11. Remove the X chain cable pulley cover. Ensure the X chain cable pulley is tight. If the pulley is not tight, the Operator will be required to tighten the pulley to the proper tension. Set the tension for the X chain cable pulley by first loosening the nut and bolt combination that secure the pulley to the mounting block. Begin re-tensioning the pulley by first tightening the nut and bolt combination by hand. Hold the nut inside the rail with one hand while turning the bolt head with the other. With the bolt and nut combination finger tight, place a ¾ in. wrench on the nut inside the Rail and, using a second ¾ in. wrench, tighten the bolt one full turn. Adjust the X chain cable bolt by loosening it and then tightening it by hand before turning it with a wrench one full rotation. Reinstall the X chain cable cover.
12. Ensure tension is set correctly on the X chain and cable combination. Locate the adjustment turnbuckle. Using a 7⁄16 in. wrench, loosen the adjustment turnbuckle until it can be turned by hand, without using the wrench. To set tension, tighten the turnbuckle by hand as much as possible. Once the turnbuckle cannot be turned by hand, tighten it one full rotation using a 7⁄16 in. wrench. Tension for the X chain is now set.
13. Reinstall the X gear cover
14. Reinstall the Trolley cover

Backlash Correction

In Bend-Tech Dragon software, click Machine Library and ensure the proper machine is chosen from the Machine List. Click the Mechanical icon in the menu at the top of the screen. In the Backlash Correction box click the box with the multicolored diamond-shaped icon. This will begin the Backlash Correction procedure. Follow the prompts on the screen. Do not perform backlash procedure on the Y Axis.

When the Backlash Correction procedure is complete the machine is ready to run.

Additional Trolley Set Screws

There are seven set screws on the Trolley assembly in addition to the set screws on the Y motor drive gear. They are as follows:

Pillow block bearing to Chuck shaft (2)
Chuck mount to Chuck shaft (2)
Chuck Mount socket head screws (3)

It is recommended the Operator check these set screws on a regular basis. Apply Loctite Blue 242 to all set screws. Ensure set screws are secure.

Chuck Alignment

During normal operation it is possible for the Chuck to fall out of alignment on the Dragon A150 machine. If the Chuck is out of alignment it will result in imprecise machine operation. If the Chuck is out of alignment it will be necessary for the Operator to bring the Chuck back into alignment.

Aligning the Chuck

Tools Required

- ½ in. wrench
- ¾ in. wrench (2)
- 5⁄16 in. Allen wrench

1. Jog the Chuck to front of machine, approximately 1 ft. behind the Gate
2. Using a 5⁄16 in. Allen wrench, remove the four screws that secure the Chuck cover. The four screws thread in through the bottom of the Trolley plate.
3. Using a ¾ in. wrench on the bolt head and a second ¾ in. wrench on the nut, loosen the four pillow block bearing mounting bolts approximately one full turn.
4. Using a ½ in. wrench, loosen the Y axis motor mount bolts approximately one full turn.
5. Replace the Chuck cover.
6. Load a short piece of material into the machine. The material should be long enough so it reaches through the front Gate on one end, and extends through the Chuck to the end of the Chuck Shaft on the other end.
7. Tighten the Gate on the material so it moves freely with no play

8. Tighten the Chuck securely onto the material
9. At the back of the Trolley, position the material so it is centered in the rear Chuck cover opening.
10. Using a 5⁄16 in. Allen wrench, remove the four screws that secure the Chuck cover. The four screws thread in through the bottom of the Trolley plate. Ensure the material remains in the centered position.
11. Using two ¾ in wrenches, tighten Pillow block mounting bolts, then tighten another ¼ - ½ turn.
12. Pull the Y motor so the Y motor drive chain has appropriate tension. There should be minimal slack. Ensure tension is not excessive. Using a ½ in. wrench, secure the Y motor mounting bolts.
13. Place the Chuck cover on the Trolley. Using a 5⁄16 in. wrench, install the four screws that secure the Chuck cover.
14. Remove the material from the machine.

12 Center Support Lift

Center Support Lift

Dragon A150 models with a 24-foot Rail come equipped with a Center Support Lift that supports longer material, keeping it from sagging, allowing the machine to achieve accurate operation. The Center Support Lift also relieves pressure on the Chuck, Trolley and Gate, and assists in preventing potential Torch collision. The Center Support Lift is operated via compressed air. It uses a mechanical push/pull switch to engage and disengage from the material.

Symptom	Cause	Corrective Action
Gate moving too slow	Hinge dirty or spring worn out	Clean Gate hinge and lubricate with light oil
Gate not closing on material	Gate mechanism dirty	Clean gate and lubricate with light oil
	Air pressure incorrect	Ensure air pressure is sufficient to operate the Gate mechanism
	Gate mechanism worn	Inspect Gate rollers, replace if necessary.

Center Support Lift Air Cylinder

The Center Support Lift Air Cylinder actuates the Center Support Lift Gate to secure the material. Ensure the Center Support Lift Air Cylinder is properly secured to the Center Support Lift and that it's pivot points are clean and lubricated. Ensure the air lines that supply the Center Support Lift Air Cylinder are secure in their pneufit connections and that there are no leaks or kinks.

Center Support Lift Air Pressure Setting

Air pressure settings for the Center Support Lift are dependent on the operation of the mechanism. Bend-Tech recommends a starting range of 60-80psi. The Operator may need to adjust the air pressure to achieve optimum Center Support Lift operation.

Center Support Lift Air Pressure Setting	60-80PSI

Center Support Lift Actuation Switch

The Center Support Lift is actuated by a push-pull switch mounted on the side of the Rail. To engage the Center Support Lift on the material the Operator is required to pull the switch out manually. As the Trolley moves forward along the Rail during its job process, it will contact the switch, depressing the switch to initiate the Center Support Lift to retract from the material.

Symptom	Cause	Corrective Action
Center Support Lift not engaging when switch is pulled	Center Support Lift hinge dirty	Clean Gate hinge, lubricate with light oil
	Air pressure incorrect/ broken or kinked air line	Ensure air pressure is sufficient; inspect air line connections for kinks or leaks.
Center Support Lift not retracting when switch depressed	Air pressure incorrect/ broken or kinked air line	Ensure air pressure is sufficient; inspect air line connections for kinks or leaks.
	Trolley not depressing the switch	Ensure bearing contact on Trolley is engaging the switch
	Center Support Lift hinge dirty	Clean Gate hinge, lubricate with light oil
	Center Support Lift Gate not retracting	Check Gate air cylinder for proper operation; adjust Gate air cylinder pressure if necessary; inspect air lines for leaks or kinks

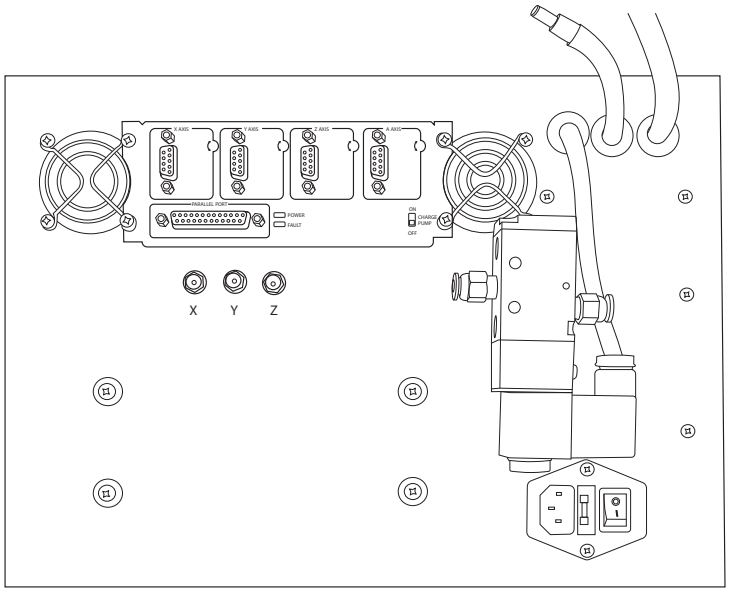
13 Control Box

Control Box

The Control Box for the Dragon A150 is mounted inside the front Support Leg under the Head of the machine. The Control Box is protected by a Cover Plate. The Cover Plate mounts to four studs on the leg of the machine. The Operator will be required to remove the Cover Plate to access the Control Box.

Accessing The Control Box

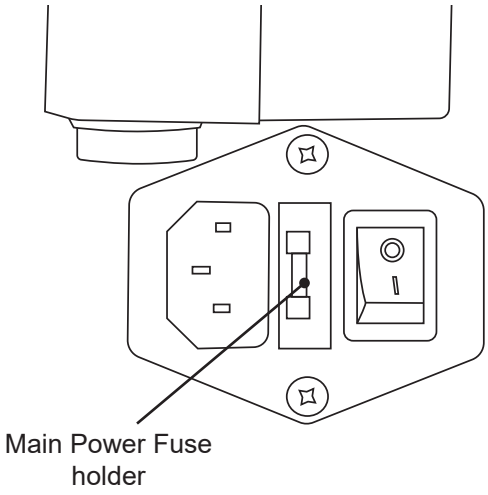
Using a ⅜ in. deep well socket or wrench, remove the four nuts that secure the Control Box Cover Plate. Remove the Cover Plate. The Operator can now access the air line manifold for the machine, the Main Power Switch, the Main Power Fuse, the Gecko Drive and Axis motor cables.



Always power down the machine before servicing the Control Box.

Main Power Fuse

The Main Power Fuse is located between the Main Power Cord and the Main Power Switch. The Main Power Fuse can be accessed without removing the Control Box cover. To access the Main Power Fuse, pull the Main Power Cord out of its socket. Using a finger, slide the Main Power Fuse holder out of the power receptacle. Inspect the Main Power Fuse. If it has failed, replace with the appropriate 10A 250VAC fuse.



Accessing Control Box Internals

There are four screws that secure the Control Box to the Control Box Housing. Using a Phillips screwdriver, remove the four screws. Carefully pull the Control Box away from the Control Box Housing. The Operator can now access the inside of the Control Box.

Gecko Drive LED Lights

It is possible for the Operator to troubleshoot the Gecko Drive and resolve problems associated with the unit. Reading the LED lights and knowing the meaning of them, as well as being able to identify other issues associated with the unit, are key to initiating successful troubleshooting.

Gecko Drive Issues

Symptom	Cause	Corrective Action
Gecko Drive unresponsive, red LED lit constantly	Gecko Drive has failed	Replace Gecko Drive
	Turn the unit off. If the green LED lights up, there is an issue in Mach3.	Go to Mach3 and check Status. Check diagnostics.
No LEDs lit	Ensure power is on. If power is on it is likely a blown fuse within the Gecko Drive.	Replace Gecko Drive.

Gecko Drive Fault Code

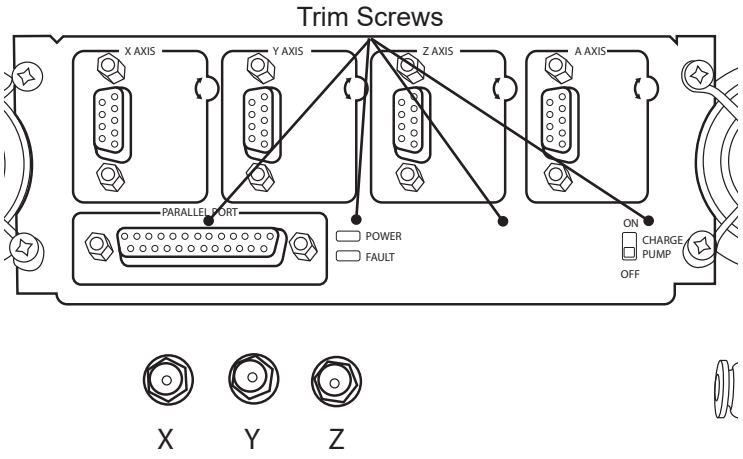
The Gecko Drive in the A150 drives the Axis motors on the machine. Occasionally the Gecko Drive can fail. If the machine is not responding the Operator can check the Mach3 interface. If Mach3 indicates the machine is working but is not responding, it is typically an indication the Gecko Drive has failed. Mach3 is sending signals to the machine but the Gecko Drive is not transmitting them to the motors.

Remove the Control Box cover and observe the Gecko Drive status lights next to the black power cord. If the light is red, check Mach3. Click the Diagnostics tab. If Mach indicates M1++ error, the Operator can conclude the Gecko Drive has failed.

Adjusting the Gecko Drive

In some instances the motors on the Dragon A150 may not be operating as smoothly as desired. It is possible to adjust the Gecko Drive and achieve smoother and quieter motor operation. If the Dragon A150 is working properly it is not necessary to adjust the Gecko Drive.

The Gecko Drive is pre-adjusted with the screws inside the trim pots set at 11 o'clock. The screws have a travel from the 8 o'clock position to the 4 o'clock position. If the motors on the machine are not operating properly Bend-Tech recommends adjusting the screws to the 8 o'clock position.



Tools Required

- ⅜ in. wrench
- Phillips screwdriver (small)

1. Power off the machine
2. Using a ⅜ in. wrench or socket and ratchet, remove the Control Box guard plate.
3. Locate the plate with the series of inputs where the Axis cables attach to the Control Box.
4. Using a small Phillips screwdriver, turn each screw counterclockwise until it reaches the 8 o'clock position. The screws are fragile, use care when turning them. Do not over turn the screws.

Replacing the Gecko Drive

If the Gecko Drive has become unresponsive it is possible it may have failed. Replacing the Gecko Drive requires accessing the Control Box as outlined earlier in this section. Once the Operator has access to the Control Box, replacement of the Gecko Drive can be performed.

Tools Required

- Flat blade screwdriver
- Phillips screwdriver (standard)
- Phillips screwdriver (small)

1. Remove the four Motor Cables from the Gecko Drive inputs. Ensure the cables are clearly marked so they can be reinstalled in their proper locations. Removal of the Motor Cables may require use of a flat blade screwdriver.
2. On the inside of the Control Box, remove the four Phillips head screws that secure the aluminum plate holding the orange wiring connectors. Ensure no wires come loose from their respective connectors.
3. Remove the four Phillips head screws at each corner of the Gecko drive. Hold the nuts on the backside of the screws with fingers.
4. With the Gecko Drive free, turn it sideways so it can be pushed through the Control Box housing and placed out of the way. Ensure no wires come loose from the Gecko Drive.
5. Install the new Gecko Drive using the four Phillips head screws and nuts.
6. Using the small Phillips screwdriver, carefully transfer each wire from the old Gecko Drive to the corresponding port in the new Gecko Drive.
7. Reinstall the Motor Cables.

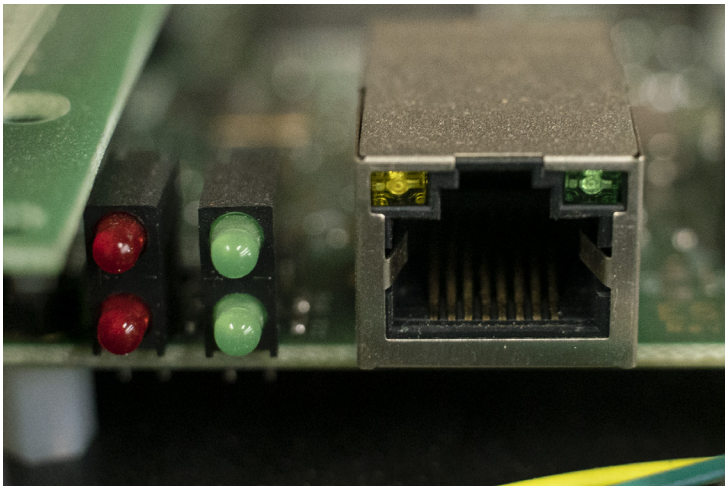
14 Operator Control Panel

Operator Control Panel

The Operator Control Panel allows the Operator to control the Dragon A150 machine. The Operator Control Panel contains the ESS board and Breakout Board. The Operator Control Panel gathers information from Bend-Tech software and sends it to the Dragon A150 machine to perform its CNC operations. Knowing the functions of the ESS board and Operator Control Panel can assist the Operator in diagnosing issues that may arise regarding the Dragon A150.

Reading ESS LED Status Codes

The port where the Ethernet cable connects to the Ethernet Smooth Stepper board inside the Operator Control Box has colored status lights. Knowing the meaning of the behavior of these status lights can help the Operator diagnose connection problems between Mach3 and the DragonA400.



ESS Board Status Lights			
Light	**Status**	**Definition**	**Solution**
Red Left	On	Machine is in emergency state (machine disabled)	Check E-stops
Red Right	Not used	N/A	N/A
Green Left	Rapid flashing	ESS/PC communication	N/A
Green Right	Two quick blinks	Waiting for communication with Mach3	This could be a normal delay in communication or it could be an issue with connectivity.
	One second on, one second off	BootP mode	Remove the small plastic jumper from the BootP pins (JP1) and power cycle the ESS.
	One long flash, two short flashes	The ESS board has lost its IP address	Run Configurator to generate IP address and power cycle the ESS board.
	Constant on	ESS mode - ESS has established communication with the computer. This is normal operating mode.	N/A

Ethernet Jack LED Lights

There are two lights at the port where the Ethernet cable connects to the ESS board. Knowing the meaning and behavior of each color of the status lights can help the Operator diagnose connection problems between Mach3 and the DragonA400.

Ethernet Jack LED		
Amber Link Light	On	Cable is connected to a device (the computer)
	Off	No connection - bad cable or Ethernet disabled on computer
Green Data Light	Flashing	Ethernet connected

Ethernet Cable and Connections

Symptom	Cause	Corrective Action
Gecko Drive unresponsive, red LED lit constantly	Bad Ethernet Jumper Cable inside Operator box	Connect Ethernet cable directly to ESS board input. If connectivity is achieved, replace Ethernet Jumper Cable.
	Wires have come loose from plug	Check wires in green Ethernet connector plug. Remove and reconnect if necessary.

If the machine is having connectivity issues and it has been determined there are no other issues, it is possible the Ethernet cable or Ethernet cable connection has failed. In this situation, the Operator can eliminate the Ethernet jumper cable and plug the Ethernet cable directly into the ESS board. If the Ethernet cable is plugged directly into the ESS board and there are still connectivity issues it is possible the ESS board has failed, or there is another connectivity problem.

The Ethernet jumper cable is connected to the ESS board via an adapter plug. It is possible for the wires to come loose in the plug, affecting connectivity. Using a small screwdriver, check the connections at the ESS board plug. Loosen the screws, remove the wires and reconnect if necessary. Ensure the wires are secure in their connections. Ensure the screws are secure in the plug.

Ribbon Cable

Ensure the Ribbon Cable is securely seated in the ESS board. The Ribbon Cable serves as the output from the ESS to the Gecko Drive. If it is not making a complete connection it can cause the machine to operate sporadically or fail to operate.

ESS Failure To Connect

The majority of connection issues are the result of improper cable routing, improper cable connection, or the computer's CPU running other programs simultaneously. Ensure the Ethernet cable is connected properly and routed clear of other cables. Ensure the computer is connected directly to the control box via the Ethernet cable. Check the computer ECU and ensure it is not running other programs while trying to connect.

Symptom	Cause	Corrective Action
ESS Failure To Connect	Control box not powered up, fuse blown, e-stop triggered	Check E-Stops, check fuses, check ribbon connection to Breakout Board, power up Control Box.
	ESS Signature Error, damaged cable	Check Ethernet cable.

Symptom	Cause	Corrective Action
ESS Failure To Connect	Electrical interference	Check cable routing. Ensure the Ethernet cable is routed clear any other cables, especially the Torch lead.
	High CPU Usage	Ensure no other programs are running on the computer. Right click on the Task Bar at the bottom of the screen, click Task Manager, click More Details at the bottom of the Task Manager window. Scroll through the Task Manager to determine if any unnecessary programs are running.
	Computer utilizing Power Saving feature	Ensure all sleep timers are turned off.
	Ethernet cable connection incorrect	Ensure the computer is connected directly to the Control Box. Ensure the Ethernet Cable is connected to its own Ethernet plug in the computer with no adapters.

Connection Lost While Machine Is Running

When the machine loses connectivity while running, it is typically because of electrical interference with the Ethernet Cable, or the computer is prioritizing memory to a different process or program.

It is possible a cable can become damaged by hot slag, or that it can become jostled by the machine's actions, and lose connection.

Symptom	Cause	Corrective Action
Connection Lost While Machine Is Running	Ethernet cable routed incorrectly. Possible Torch interference or electrical interference.	Re-route Ethernet cable away from other electrical cables.
	Computer running out of RAM.	Ensure Bend-Tech is the only program running. Close out of all other programs. Check CPU usage.

15 Limit Switch Operation

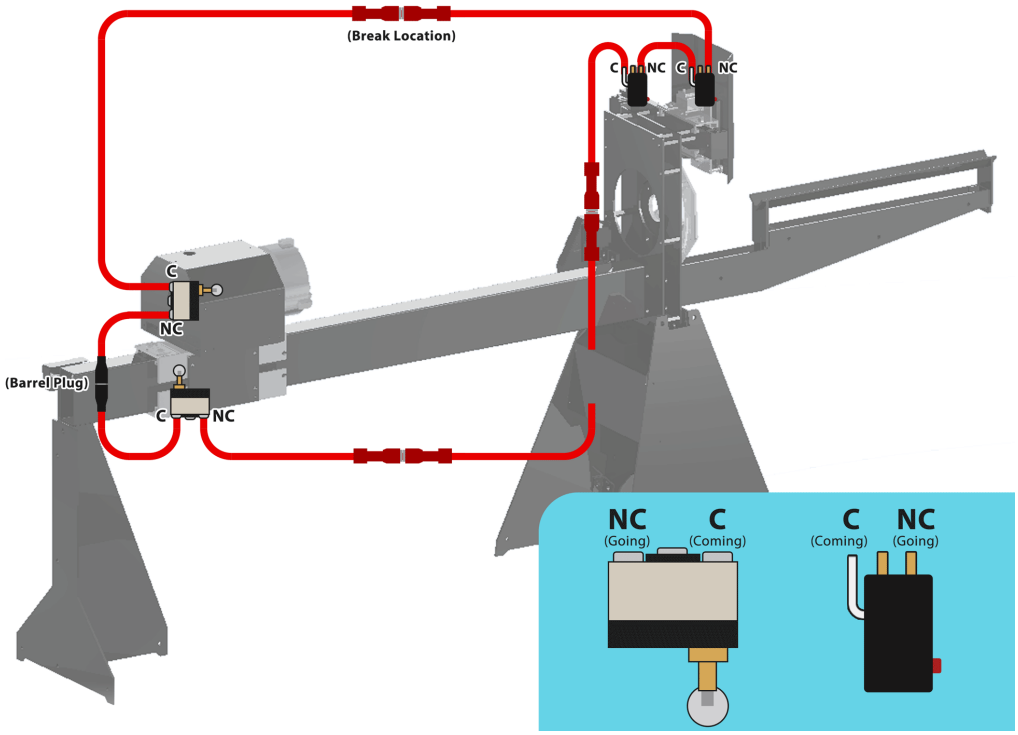
Limit Switch Operation

The Dragon A150 uses a normally closed limit switch system. There are three limit switches, they are all connected inline. There are two limit switches on the Toolhead (Z axis and A axis) and one on the Trolley (X axis). When a limit switch is triggered it opens the loop. The switches are normally closed, so when a switch is triggered it breaks the loop.

Symptom	Cause	Corrective Action
A limit switch broken	The machine lost power and the Toolhead crashed against the A axis limit switch	Replace the A limit switch
Machine wouldn't home	X axis limit switch has failed	Replace X limit switch
Mach Connection Error message	If the machine is parked on a limit switch the software will show a Mach Connection Error that reads Unable to Home All Axes.	Jog the machine off the axis limit switch
Limit switch triggered but all limit switches test OK	Possible failed Control Box	Replace Control Box; contact Bend-Tech service tech

Troubleshooting Limit Switches

Older Dragon A150 models use a normally closed limit switch system. It is possible to bypass a limit switch to determine if there is a failed limit switch in the circuit. The Operator can also test for continuity in each loop using a multimeter.



It is possible to bypass a limit switch on the A150 by rerouting the limit switch wiring to eliminate a limit switch. Unplug a limit switch from the loop and connect the wires from the limit switches on either side of that switch to “shorten” the loop. Refer to the diagram for reference.

The Operator can also use a multimeter to test each loop for continuity. If a particular loop shows no continuity it is likely the result of a failed limit switch.

Machine Control and Mach3 Indicate Homing Switch is Triggered

Machine Control and Mach3 can indicate a limit switch is triggered, but the machine is not resting on a limit switch. If the Operator tests for continuity and finds all limit switches are operational the next step is to bypass the limit switches. Connect two limit switch leads together directly at the Control Box, bypassing all limit switches. If Home lights are still lit in Machine Control and/or Mach3 diagnostics it is either a failed Control Box or Operator’s Panel.

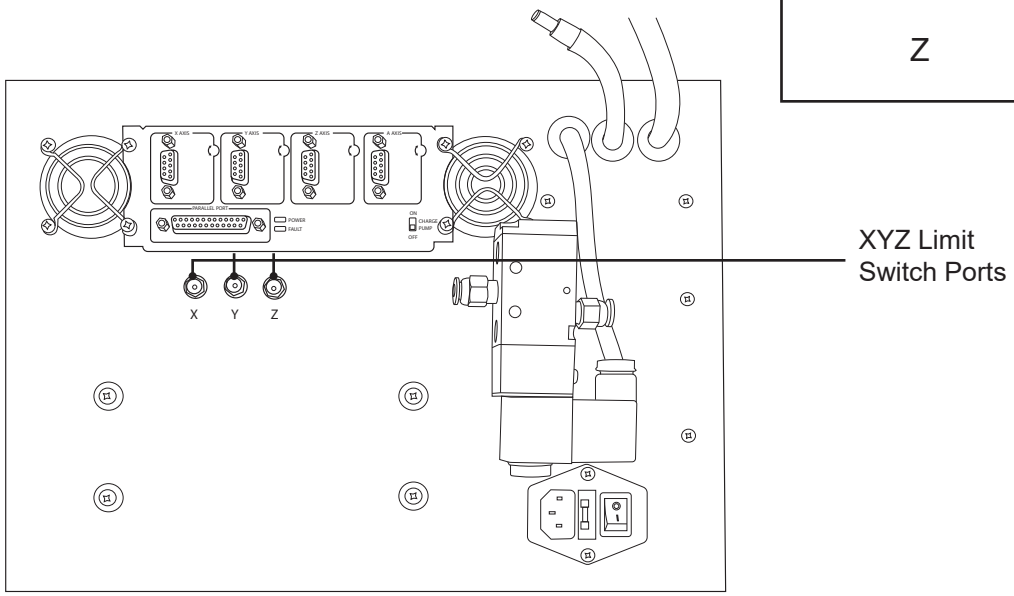
A150 Updated Limit Switches

Newer Dragon A150 models will have individual limit switches that can be diagnosed in Mach3. On newer A50 machines the Control Box will have three separate inputs for the machine's limit switches.

Diagnosing Limit Switch Issues On Newer Dragon A150 Machines

To diagnose a limit switch issue on a newer Dragon A150, in the Mach3 home interface, choose the Diagnostics tab. If a limit switch is triggered, Mach3 will indicate this in Input Signals Current State. A limit switch that is triggered will be lit in yellow in Mach3.

Machine Axis	Mach3 Input
X	M1
Y	M2
Z	M3



X and A Axis Limit Switch Failure

The X and A axes on the Dragon A150 use micro switch style limit switches. The limit switches are triggered when the Toolhead assembly makes physical contact with the limit switch. In the case of the A axis, when the A150 machine powers off suddenly such as when an E-stop is activated, the spring assemblies that help keep tension on the Toolhead will pull the Toolhead up and cause it to slam into the limit switch. This can lead to failure of the A axis limit switch. While it is possible for either switch to fail, because of the spring tension on the Toolhead it is more common for the A axis to fail.

Replacing The A Axis Limit Switch

If the Operator has determined the A axis limit switch is not functioning, replacement of the switch will require removal of the Toolhead. Bend-Tech recommends powering down the machine any time the Operator is performing a major service to one or more of its components.

Tools Required

- 3⁄16 in. Allen wrench
- 5⁄32 in. Allen wrench
- 1⁄8 in. Allen wrench
- 3⁄8 in. wrench
- Phillips screwdriver
- Pliers

1. Remove the tensioning springs on each side of the Toolhead. The tensioning springs are located on the backside of the Toolhead. Using a pliers, grab the bottom loop on each spring and pull down on the spring to release the loop from the tensioning spring mount.
2. Using the same method, remove the Engraver retraction spring at the front of the Toolhead.
3. Using a 3⁄16 in. Allen wrench, loosen the Torch mounting collar and remove the Torch wand. Set the Torch wand out of the way in a safe position where it will not fall or get damaged.
4. With the tensioning springs removed, the Toolhead will be resting on the Engraver tensioning spring mount at the top of the Toolhead. Place a 3⁄8 in. wrench on the nut on the backside of the Engraver tensioning spring. Holding the nut secure with the 3⁄8 in. wrench, use a 1⁄8 in. Allen wrench to remove the Engraver tensioning spring mounting screw and mount. Hold the Toolhead in place while removing the Engraver tensioning spring mount.
5. Using a 5⁄32 in. Allen wrench, remove the two Toolhead mounting screws located at the center of the Toolhead assembly. Bend-Tech recommends enlisting a helper to secure the Toolhead during this process.
6. Use a Phillips screwdriver to remove the two A axis limit switch mounting screws.
7. Disconnect the spade connectors that connect the sensor to the machine. Note the location of the wires before disconnecting them so they can be placed in the same position on the new sensor.
8. Using the two Phillips head screws, mount the new sensor to the Toolhead. Install the spade connectors into the locations noted in Step 7.
9. Reverse this process to reassemble the Toolhead.

Replacing the X Limit Switch

During normal use over time, it is possible for the X limit switch to fail. The X limit switch operates by making contact with a button head cap screw fastened to the rear part of the Rail. When the switch contacts the head of the button head cap screw it signals the X- limit, or X Home when calibrating the machine.

1. Remove the outer plastic cover from the X axis limit switch.
2. Note the color of the wires and the wires location on the switch. Use a Phillips screwdriver to remove the screws mounting the wires to the switch.
3. Use an 11⁄16 in. wrench to loosen the set screw on the limit switch.
4. Remove the limit switch. Reverse the process to install the replacement switch.

16 Mach3

Mach3 Machine Driver Software

The majority of Dragon A150 operation is controlled through Bend-Tech software. Bend-Tech software uses Mach3 as its CNC driver software to control the operations of the A150 and drive its various axes and other operations. While Bend-Tech is the main operating interface for the machine, it is important for the Operator to be able to interface with Mach3 and perform troubleshooting through the software. It is critical that the computer be optimized to run Mach3 and to have clear Ethernet connection between the computer (Mach3) and the Dragon A150 ESS board.

Installing Warp 9 Utility

If the ESS board is waiting for communications and the amber Link Light is on, the Ethernet port on the computer needs to be configured for use. Typically the software will display a wakeup error message that reads: “The ESS did not respond to the wakeup message. If this is a new profile, you will need to enter an IP address. Is your ESS powered and connected?”

At this point the Operator can choose to click Yes to try connecting again, click No to enter a new IP address or click Cancel to stop trying to connect to the ESS.

If it has been determined the Operator is required to run the Warp9 scu tool, contact a Bend-Tech support tech for assistance. The Warp9 Utility will optimize the connection between the computer and Mach3.

Prioritizing Mach On The Computer

It is important to optimize the computer for use in running the machine. This will result in the most efficient use of both machine and software for the user. Prioritizing Mach3 is critical to optimizing Dragon A150 performance. Follow these steps to prioritize Mach3 in the computer’s

operating system.
1. On the desktop, right click on ‘Mach3 Loader’ select ‘properties’ at the bottom

2. In the ‘Shortcut’ tab next to ‘Target:’ Copy/Paste the following:

C:\Windows\System32\cmd.exe /c start “Mach3” /AboveNormal “C:\Mach3\Mach3.exe”

3. Click ‘Apply’ and then ‘Okay’.

Mach3 Lost Communications While Operating

In some situations the SmoothStepper will lose communication with the computer. A message window will appear that says, “The SmoothStepper has failed to communicate properly for an extended amount of time.” The message will ask the Operator to exit Mach3 then cycle power on the SmoothStepper.”

It will also read, “If you unplugged the USB cable while Mach was still running, then that is likely the cause.”

Symptom	Cause	Corrective Action
Mach3 Lost Communications	Bad Ethernet Cable	Replace Ethernet cable
	Bad connection at either end of the Ethernet cable	Replace Ethernet cable, check cable connection ports
	Ethernet cable routed too close to the Torch lead or other electrical cables.	Ensure Ethernet cable is clear of other electrical leads and connections.
	Torch ground is loose at the Trolley or alligator clamp	Check Torch ground, ensure it is secure and connected.
	ESS bad	Replace ESS board
	Gecko Drive Has Failed	Replace Gecko Drive

This message will also appear if the Dragon machine was powered down and Bend-Tech Dragon software was closed out, but Mach3 was left open. When the Dragon machine is powered up the computer will display this message.

Other Mach3 Errors

Invalid Bootloader Signature

When Mach3 displays this error it means it has not been able to communicate with the ESS correctly. In the case of an Invalid Bootloader Signature message, close Mach3, cycle power to the ESS off, then back on. Restart Mach3.

CryptoMemory Error

On rare occasions Mach3 will display an error that reads, “The CryptoMemory did not provide a valid authorization.” This error indicates the ESS board is not functioning properly. Check power at the green connector on the ESS board. It should show 5VDC with no ripple. Check for ripple by changing the meter to AC volts. If power is good it is likely a bad ESS board.

Symptom	Cause	Corrective Action
Homing switch active in Mach	Homing switch triggered; homing switch failed	Check homing switches; re-route homing switch wires to bypass each homing switch until the problem switch is found.
M1++ limit switch error during operation	Faulty control box	Possible relay failure. Call Bend-Tech service technician.
Error In Mach/faulty circuit boards	Failure within Operator panel	Check to ensure ribbon cable is securely connected; check Ethernet connection; ensure Breakout Board is seated properly.
“Watchdog triggered” error	Bad cable connecting Operator Panel to Control Box	Replace 25 pin port cable
“Invalid Bootloader Signature” error	Mach3 was not shut down and has not released the ESS board.	Close Mach3, power down the machine. Power up the machine, restart dragon software, restart Mach3.

Symptom	Cause	Corrective Action
Cannot bring Mach 3 out of emergency mode:	E-stop is activated	Ensure E-stops are active
	Machine not plugged in/not getting power	Ensure machine is plugged in and has power
	Axis resting on a homing switch	Ensure no homing switches are triggered
	Breakout Board has lost connection with ESS board	Ensure Breakout Board is firmly seated on ESS board
	Check 25-pin parallel cable for connectivity	Replace 25-pin parallel cable

Bend-Tech, LLC

729 Prospect Ave. Osceola, WI 54020
1-651-257-8715

sales@bend-tech.com
www.bend-tech.com