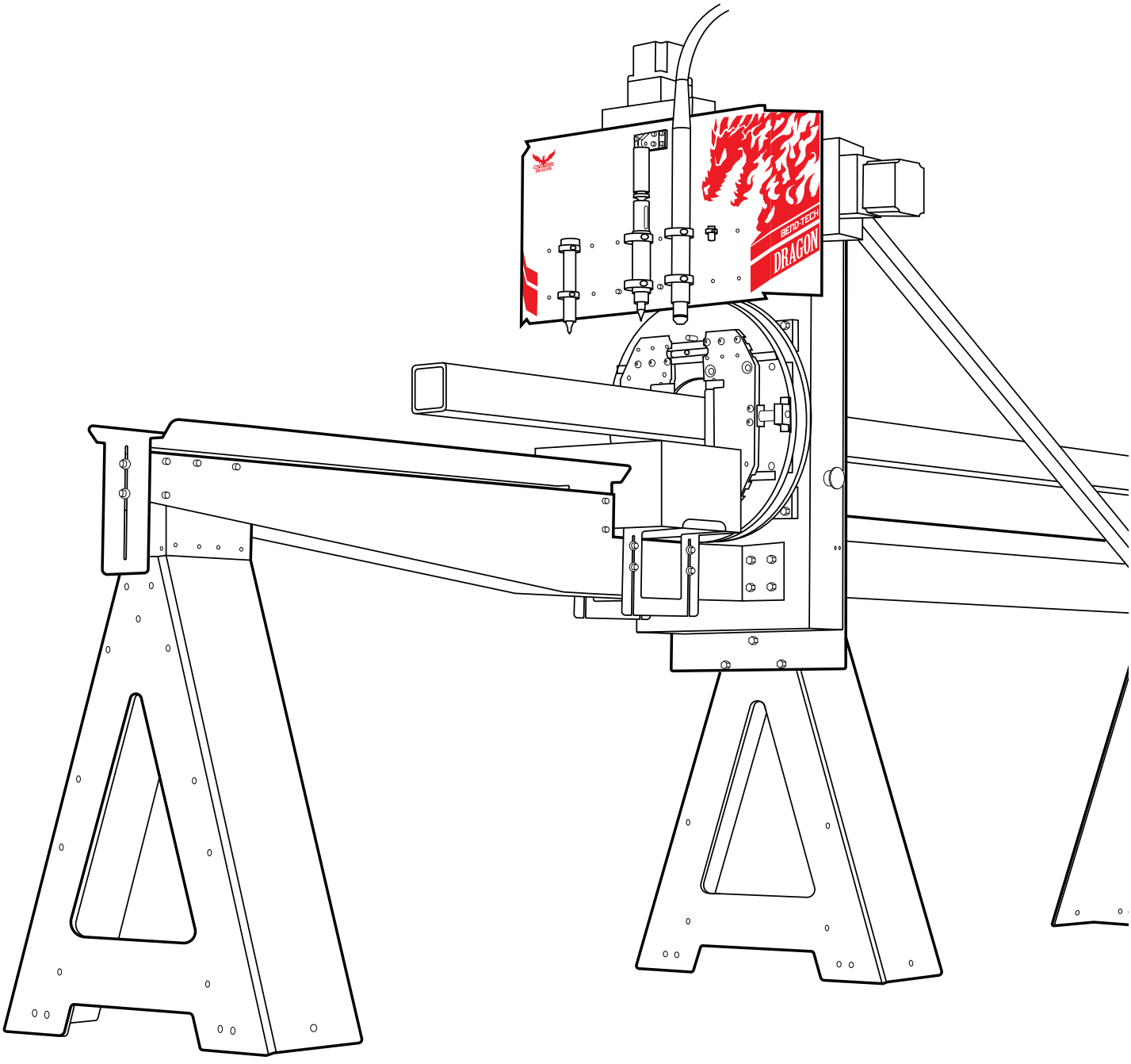
Part 1 of 2

BEND-TECH

DRAGON A400

Maintenance & Troubleshooting

Part 1: Dragon A400



Version 2 | English

Dragon A400

Maintenance & Troubleshooting

Version 2

English
Original Instructions

March 2020

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

(651) 257-8715
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Limited Warranty

Covering Bend-Tech Dragon

Bend-Tech, LLC provides a limited warranty on all new Dragon machines that are manufactured directly or under license by Bend-Tech, LLC, and sold by Bend-Tech, LLC or its approved distributors.

Warranty Coverage

Each Bend-Tech Dragon machine is warrantied by the manufacturer against defects in material workmanship for 12-months. The warranty period commences the date the Dragon machine is installed at the customer's facility.

Repair or Replacement Only

The Manufacturer's sole liability, and the Customer's exclusive remedy under this warranty shall be limited to repairing or replacing the defective part. Repair or replacement of parts is at the sole discretion of the manufacturer. The Customer is responsible for warranty parts installation. Bend-Tech does not provide warranty service labor.

Limits

This warranty does not cover components subject to wear due to normal use of the machine such as belts, lights, tooling etc. This warranty is void if Bend-Tech, LLC has determined any failure is the result of mishandling, abuse, misuse, improper installation, improper storage, improper maintenance or unauthorized modification of the machine. The warranty does not cover damage due to natural disasters, fire, flood or other external factors.

Software

Dragon software is covered by a 2-year maintenance plan from the purchase date of the Dragon A400 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 A400. Bend-Tech, LLC places great pride in customer satisfaction and it is our promise to offer you the best support available for your Dragon A400. 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

A400
Indicates machine with 400-lb weight limit.

Axis
A fixed reference line used by the Dragon A400.

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 A400.

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 A400 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.

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 A400 up and running. Bend-Tech knows keeping the Dragon A400 performing optimally is critical to our customers' bottom line. We are more than happy to help, and properly setting up a Support Session 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, E-mail, 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.

Click Submit.

02 Gate

Gate Troubleshooting

The majority of Gate issues are the result of a dirty Gate. It is important to clean the Gate on a regular basis to keep it working smoothly and properly.

In older machines it is possible for the Gate Lead Screw retaining clips to fall off. Customers with older machines who are having this issue should contact Bend-Tech regarding updating the Gate Lead Screws. Original design Gate Lead Screws have right-hand threads that place too much pressure on the lead screw clip. Updated Gate Lead Screws are designed with left-hand threads that hold pressure via the the block and threads rather than the retaining clip.

Symptom	Cause	Corrective Action
Eccentric bearing on Gate sticking	Bearings dirty.	Clean the bearings with compressed air and/or brake cleaner.
Front Gate binding	Dirty bearings or dirty bearing rotation plate.	Clean Gate using brake cleaner and/or compressed air.
	Eccentric bearing out of adjustment.	Remove Gate and adjust eccentric bearing on Bearing Rotation Plate/ Gate Ring Gear.
	C drive motor backlash out of adjustment.	Perform visual check of C Motor and drive gear. If play is observed loosen C Motor mount bracket and adjust so gear meshes smoothly around the circumference of the Gate Ring Gear.
Clip keeps falling off lead screw	Obsolete Gate lead screw design.	Contact Bend-Tech Service for an updated Lead Screw design.
Loose front Gate	Eccentric bearing has come out of adjustment.	Remove Gate and adjust eccentric bearing to eliminate play in Gate jaws.

Symptom	Cause	Corrective Action
Gate Not Operating Smoothly	Gate dirty	Clean Gate with compressed air and/or brake cleaner. If the Gate is extremely dirty use a rag or toothbrush to help clean it.
	Eccentric bearing out of adjustment	Remove Gate from machine and adjust eccentric bearing so there is no play and the Gate spins smoothly.
Play in Gate	Eccentric bearing out of adjustment	Remove Gate from machine and adjust eccentric bearing so there is no play and the Gate spins smoothly.
Gate Jaws not operating smoothly	Dirty Lead Screws	Clean Gate Lead Screws, with brake cleaner and/or compressed air. Re-lubricate.
	Dirty Gate Jaw rack	Clean Gate Jaw Rack with brake cleaner and/or compressed air.
	Rack out of adjustment	Remove the Gate and adjust Gate jaws using the eccentric bearing.
	Rack eccentric bearings dirty	Clean the bearings with brake cleaner and/or compressed air.

The Gate is exposed to Torch slag, cutting fumes and, if equipped with a Cooling System, moisture. It is important to keep the Gate clean.

03 Laser

Laser Troubleshooting

Symptom	Cause	Corrective Action
Laser not lining up with end of tube	Material length set wrong in software.	Check material length on machine, verify length is correct in software project settings.
	Chuck grip set wrong in software.	Verify the Chuck grip setting is correct in Dragon CAM > Tube Library > Machine > Chuck Grip. Click the question mark to see examples of Chuck grip settings.
	Machine not homed/ calibrated correctly.	From the Bend-Tech Dragon home interface click Machine Control, then click Home All Axis to home the Dragon A400. If it is determined the machine needs to be calibrated, the Operator can perform a full calibration by clicking into Machine Library, and in the Main interface click the Wizard icon.

Symptom	Cause	Corrective Action
Laser failure	Laser burned out.	Replace laser.
	Cable or plug issue.	Inspect cables, inspect plugs, replace if damaged.

The Laser is a consumable. If the Laser quits working it may have reached the end of its service life. Contact Bend-Tech to order a new Laser.

04 Torch & Cutting

Diagnosing Cutting and Torch Issues

Symptom	Cause	Corrective Action
Cope at both ends of the tube are not the same rotation	Material not properly secured in the Chuck.	Ensure material is tight in Chuck. If using spacers for the material ensure the measurements are correct.
	Settings in Nesting Project not correct.	Check the part in Edit Flat.
	Y Motor Backlash incorrect.	Remove Trolley Cover and observe backlash on Y Motor. If incorrect adjust on machine. Perform a Backlash Test in Machine Library > Mechanical Settings.
	Y Motor loose/Drive Gear loose.	Remove Trolley Cover and perform visual and physical check of Y Motor and Y Motor Drive Gear.
	Y Motor skipping steps.	Check Ethernet connectivity. Check to ensure Breakout Board is seated in Motor Drivers properly. Ensure consistent power to machine.

Symptom	Cause	Corrective Action
Cut quality issues	Torch consumables worn out.	Inspect Torch consumables, measure pit depth of electrode.
	Incorrect Torch height settings.	Check settings in software and Torch height on machine.
	Incorrect cutting speed.	Ensure cutting speed is correct in regard to amperage and material thickness.
	Incorrect cutting amperage.	Ensure consumables match the amperage settings on the machine. Set cut speed appropriately.
Round holes are coming out oval	Cutting speed.	Adjust material feed rate.
	Material loose in Chuck.	Ensure material is secure in Chuck.
	Gate too tight or too loose.	Ensure material moves freely in Gate with no play.
	Backlash.	Perform a Backlash Test in Machine Library > Mechanical Settings. Remove the Trolley cover and perform a visual inspection of backlash. Ensure all motors are tight.
Machine cutting and then returning to previous engraving	Order of actions incorrect in software settings.	Change order of actions Machine Library > Basic > Default Process Order.
Off center holes in rectangular material	Gate out of position.	Check homing sensors, check X backlash, re-home, load material with Gate in home position and perform side offsets calibration.
	X Axis backlash out of spec.	Remove Trolley Cover and observe backlash on X Motor. If incorrect adjust on machine. Perform a Backlash Test in Machine Library > Mechanical Settings.
	Machine not homed properly.	In the Machine Control interface click Home All Axis.
Jagged Cuts	Material feed rate too high.	Ensure consumables match the amperage settings on the machine. Set cut speed appropriately.
	Loose set screws on X or Y Axis.	Remove Trolley cover and perform inspection of X and Y Axis.
	Gate too tight on material.	Ensure material moves freely in Gate with no play.

Symptom	Cause	Corrective Action
Torch Not Firing	Hypertherm not powered on.	Check Hypertherm power switch; check power cable; check cable to Control Box.
	Torch set too high.	Check Torch height with feeler gauge; perform Torch Mount procedure.
	Improper air supply.	Check air supply, check air pressure.
	Consumables.	Remove and inspect Torch consumables. Refer to Consumables Guide.
Torch Colliding With Material	Material selected in software does not match material loaded into machine.	Check to ensure material chosen in software matches material loaded in the machine.
	Torch improperly set.	Perform Torch Mount procedure.

Grounding The Torch

It is critical the Dragon A400 Torch is grounded properly. Improper grounding can lead to numerous cutting issues. Early Dragon A400 Machines used a pair of brushes contacting the Chuck Spindle to ground the Torch. The Operator can achieve more consistent grounding by converting to a grounding tab mounted on the pillow block bearing.

Tools Needed

- ⅛ in. Allen Wrench
- Ratchet
- 12 in. extension
- 5⁄16 in. socket
- ¾ in. socket
- ½ in. wrench
- Grinder

1. Using a ⅛ in. Allen wrench, remove the rear plate from the Chuck Housing. Unscrew the red E-stop button. Reach inside the Chuck Housing and hold the E-Stop button while unscrewing the chrome retaining collar. Remove the chrome retaining collar and yellow E-stop label. Remove the E-Stop button and lay out of the way on the Trolley. Remove the Chuck Housing, leaving the Front Plate.
2. Use a ¾ in. socket to remove the rear pillow block mount bolt nearest the Y motor.

3. Use a grinder to clean any paint off the flat washer surface of the pillow block bearing.
4. Use ⅛ in. or 3⁄16 in. steel to fabricate a grounding tab as shown. The Customer can also request a grounding tab from Bend-Tech.
5. Use a 5⁄16 in. socket and extension to remove the grounding cable from the carbon brush mount. Place a ½ in. wrench on the nut to assist in removal.
6. Place a small amount of grease on the ground surface of the pillow block bearing. Place the grounding tab on the ½ in. pillow block mount bolt, then place the washer. Insert the ½ in. bolt and thread it into the mounting hole. Ensure the grounding tab is positioned so it will not interfere with the Chuck Housing.
7. Use the bolt and nut that secured the grounding cable to the carbon brush mounting system to mount the grounding cable to the grounding tab.
8. It is recommended the Operator remove the old brush grounding components from the Trolley assembly.

05 Engraver

Engraver Guide

The Engraver is mounted in the center of the Toolhead. When the Engraver is engaged, an air cylinder is pressurized and the tool is pushed down to meet the material. The pressurized cylinder allows the engraver to ride over contours in the material without damaging the tool.

Symptom	Cause	Corrective Action
Engraver digging into material or marking too light	Engraving Height set incorrectly	In Tube Library > Machine interface > Tool Heights change the Engraving Height value in the text box. It is recommended the Operator change the value by small increments.
		Perform Engraver calibration process.
	Air pressure incorrect	Set air pressure for Engraver cylinder to 7-8 psi
Engraver not turning on	No air supply	Check air lines to engraver and main air supply to machine. Ensure valve on the engraver is open. Ensure bleed valve is open.

Setting Engraver Air Pressure

The Engraver is driven by pressurized air. It uses two separate regulators located just behind the Toolhead. The right side regulator controls the Engraver and is pre-set at the Bend-Tech manufacturing facility to 70-80 PSI. The Left side regulator controls the Engraver air cylinder and is pre-set at the Bend-Tech manufacturing facility to 7-8 PSI.

Engraver Bleeder Valve

The Engraver Actuator Cylinder and air regulator also use an air bleeder screw. The bleeder screw is located on an air line extension just off the Engraver Air Regulator. Ensure the bleeder valve is open.

Engraver Air Pressure Settings	
Engraver	70-80 PSI
Engraver Actuator Cylinder	7-8 PSI

Material Support Lift

Material Support Lift Guide

Material Support Lift Settings In Bend-Tech 7x

The Material Support Lift should be calibrated before machine use. Before beginning, ensure Material Lifter is checked in the Material Support box on the Machine Library Main interface. The Material Support Lift settings Lifter Trigger (X), Lifter Trigger (B) and Lifter Offset (B) are determined during the machine calibration process. Once the Material Support Lift is calibrated, the Operator should not need to adjust these settings.

Change the Support Lifter Gap

In the Tube Library, in the Machine interface, the Operator can change the Lifter height by entering the desired value in the Support Lifter Gap text box. The Support Lifter Gap is typically set to zero. However, in the case of some larger materials, such as large square or rectangle material, the lifter may need to be set to compensate for material size. If the Material Support Lift is binding and/or skipping steps when processing large material, it may be necessary to change the Support Lifter Gap. Contact a Bend-Tech Service Tech before changing these settings.

Symptom	Cause	Corrective Action
Lifter colliding with Rail	Lifter has fallen out of adjustment	Calibrate lifter
	Lifter is out of calibration	
Lifter Not Homing	Lifter has fallen out of adjustment	
Lifter pausing at wrong time	Lifter is out of calibration	
Lifter too high, Trolley hitting Lifter as it travels down the Rail	Can out of adjustment	Call Bend-Tech service tech
Lifter bottoming out on top of housing	Can out of adjustment	

Adjusting Lifter Trigger Pause

The Lifter Trigger Pause should be enabled whenever the Material Support Lifter is in use. The Lifter Trigger Pause should be set to a parameter longer than the retraction time or the Material Support Lifter may hit the Rail.

Material Support Lift Support Retraction Settings

Function	Setting
Material Support Lift Retraction	2 seconds
Lifter Trigger Pause	2 seconds (can be more if needed to prevent Material Support Lift from hitting the rail.)

Setting Material Support Lift Actuation and Retraction Adjustment

Material Support Lift Retraction is pre-set at the Bend-Tech manufacturing facility. The retraction value is typically set to roughly two seconds. If it is determined the retraction time needs to be adjusted the Operator will be required to open the Material Support Lift enclosure and adjust the needle valves in the air cylinder.

1. Open the Material Support Lift enclosure.
2. Locate the Material Support Lift air cylinder.
3. There are two needle valves on the air cylinder. When facing the inside of the enclosure, the needle valve on the left adjusts the retraction speed of the Material Support Lift. The needle valve on the right controls the actuation speed of the Material Support Lift.
4. Adjust the needle valves as needed. Screwing the needle valve in will slow the actuation, screwing the needle out will speed up the actuation.

5. It is recommended the Operator adjust the needle valves incrementally, turning a half turn at a time in order to avoid damaging the Material Support Lift.

Disabling the Material Support Lift

In some cases the Operator may wish to disable the Material Support Lift when processing thicker material, or when there are no concerns about material sagging. In Tube Library > Machine click “Disable Support Gate” in the bottom left of the interface.

07 X Axis Motor

X Axis Motor Troubleshooting

Symptom	Cause	Corrective Action
X Axis Won't Jog	Breakout Board has come unseated from Motor Driver	Ensure Breakout Board is seated properly in Motor Drivers.
	Bad motor cable	Check motor cable. Inspect cable connections. Ensure cable connections are tight. Swap with another cable to check if X motor cable is functioning properly.
	Poor Ethernet connection	Check Ethernet cable, ensure it is connected properly and routed away from other electrical cables and devices.
X Axis Motor or Trolley Binding While Jogging At Full Speed	Rails not aligned properly	Use a tape measure to check Rail distance at different locations on the machine. Check distance where Trolley binds. Ensure Rail distance is consistent along the length of the rail.
	Improper Drive Belt tension	Move Trolley to center of Rail travel and check Drive Belt tension
	Trolley eccentric bearings not adjusted properly	Move Trolley along the Rail by hand and observe any locations where the Trolley might be binding. The Trolley should travel smoothly along the length of the Rail and should have no play side-to-side or up and down. If Trolley movement is inconsistent it may be necessary to adjust the Trolley Eccentric Bearing.

Symptom	Cause	Corrective Action
X Axis Motor Skipping Steps	Set screws between X Motor and gearbox have come loose.	Jog the Trolley and observe if the motor sound changes as it moves along the Rail. Motor RPM will fluctuate if the set screws have come loose. If set screws are loose remove the X motor and gearbox. Remove set screws, apply Loctite Blue 242 and reassemble.
	Set screws on Drive Belt Pulley have come loose	Remove Drive Belt Pulley and reinstall per Bend-Tech Drive Belt Pulley installation instructions in Drive Belt/ Pulley Troubleshooting.

Setting Rail Distance

Rail distance is set at the Bend-Tech manufacturing facility. If it is determined the Rails are out of alignment its is recommended the Customer contact a Bend-Tech service representative to discuss the alignment process: support@bend-tech.com; 651-257-8715

Adjusting Trolley Eccentric Bearings

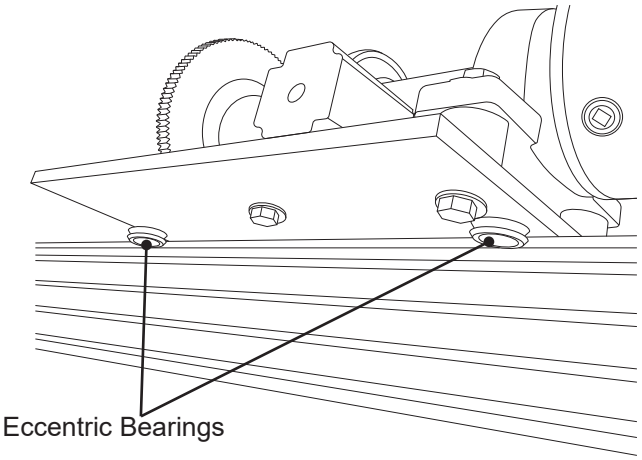
Tools needed

- ¾ in. wrench
- ¾ in. thin wrench

Locate the two eccentric bearings on the Trolley. The eccentric bearings are located on the right side (marker side of the machine) of the Trolley. The bearings on the left side of the Trolley are fixed.

Place the thin wrench supplied with the Dragon A400 on the adjustment flat of the eccentric bearing, located between the bearing and underside of the Trolley.

Use a ¾ in. wrench to loosen the front eccentric



bearing mount nut on the top side of the Trolley. Loosen the bearing mount nut just enough to allow adjustment of the bearing using the flat wrench. Adjust the bearing so the Trolley rides smoothly along the Rail with minimal effort and not side-to-side or up and down play.

Use a ¾ in. wrench to loosen the rear eccentric bearing mount nut on the top side of the Trolley. Loosen the bearing mount nut just enough to allow adjustment of the bearing using the flat wrench. Adjust the bearing so the Trolley rides smoothly along the Rail with minimal effort and no side-to-side or up and down play.

The Operator will typically need to adjust each bearing multiple times in order to achieve optimal Trolley operation.

Once the eccentric bearings are adjusted so the Trolley rides smoothly along the Rail with no side-to-side or up and down play, tighten the eccentric bearing mount nuts, then tighten another quarter turn.

08 Drive Belt

Drive Belt Troubleshooting

Symptom	Check	Possible Cause	Corrective Action
Belt running up on lip of Drive Belt Pulley	Belt Tension	Tension too high or too low.	Check belt tension, re-tension belt.
	Belt	Belt old or worn.	Replace belt.
	Idler Pulleys	Idler pulley damage, component failure.	Replace idler pulley(s).
	Drive Belt Pulley	Drive Belt Pulley has moved or come loose.	Check pulley spacing, tighten set screws, replace Drive Belt pulley bonding compound.
	Rail Straightness	Rail not straight, jostled out of position, causing belt to drift too far across Drive Pulley.	Check Rail straightness with string or laser.
	Trolley Bearings	Trolley Bearings have come loose or come out of adjustment.	Check Trolley Bearings.
	Drive Motor/Gear Box	Drive Motor or Gear Box have come loose.	Check to ensure Drive Motor and Gear Box are tight.

- Increasing tension will help the Drive Belt ride closer to the Drive Motor.
- Reducing tension will help the Drive Belt ride farther away from the Drive Motor.
- It is possible for hot slag to fall on the belt and damage the Drive Belt. This can cause tracking and tension issues.

Bonding the Drive Belt Pulley

Tools Needed

- 3⁄32 in. Allen Wrench
- Caliper
- Loctite Blue 242
- Loctite 638 Retaining Compound

In 2019 Bend-Tech began using bonding compound to help secure the Drive Belt Pulley to the Drive Motor. It is recommended that Owners having Drive Belt issues on earlier machines remove the Drive Belt Pulley and reassemble with bonding compound to secure the Drive Belt Pulley.

1. Using a ⅛ in. Allen wrench, remove the 14 Allen head screws that secure the Rear Plate on the Trolley Cover.
2. Remove the red button on the switch by unscrewing it counterclockwise. Remove the chrome plastic collar on the switch by unscrewing it counterclockwise. Remove the yellow label ring. Remove the E-stop switch from the Trolley Cover. Re-attach the yellow label ring, chrome collar and red button. Set the e-stop switch on the Trolley, out of the way.
3. Using a ⅛ in. Allen wrench, remove the 18 Allen head screws that attach the Chuck Housing to the Trolley and Front Plate. Remove the Chuck Housing and set aside.
4. Purchase Loctite 638 Retaining Compound
5. Loctite 638 Retaining Compound can tolerate a certain level of contaminants upon application. However, for best results, Bend-Tech recommends cleaning the motor shaft and Drive Belt Pulley with Loctite Cleaning Solvent and allow to dry before applying the Retaining Compound.
6. Place Retaining Compound on the motor shaft and set the pulley at .375 in. from the face of the motor gear box mount.
7. Apply Loctite 242 to the Drive Belt Pulley set screw and thread it into the pulley. Tighten the set screw down to the shaft and give another ¼ turn. Ensure Drive Belt Pulley is .375 in. from the face of the motor gear box mount.
8. Allow the Loctite 638 Retaining Compound to cure for 24-hours before using the machine.
9. Position the Trolley at the center of the Rail. Route the Drive Belt around the idler pulleys and the Drive Belt Pulley.
10. Perform the Drive Belt tensioning procedure. Set the Drive Belt tension at 120. Increase tension (up to, but not more than, 140) if the Drive Belt rides too far to the outside of the Drive Belt Pulley.

11. With the Trolley cover off, jog the Trolley up and down the Rail. Observe the Drive Belt and where it rides on the Drive Pulley. The Drive Belt will drift back and forth, but it should not contact the inside or outside Drive Pulley washers.
12. If the Drive Belt is riding too far to the inside or outside of the Drive Belt Pulley and does not correct with tension, refer to the Drive Belt Troubleshooting documentation or contact a Bend-Tech Service Technician.
13. When the procedure is complete, reattach the Chuck Housing. Rear Plate and E-stop switch.

Replacing the Drive Belt

Tools Needed

- ⅛ in. Allen Wrench
- 5⁄32 in. Allen wrench
- ¾ in. wrench
- Drive Belt tensioning tool

Materials Needed

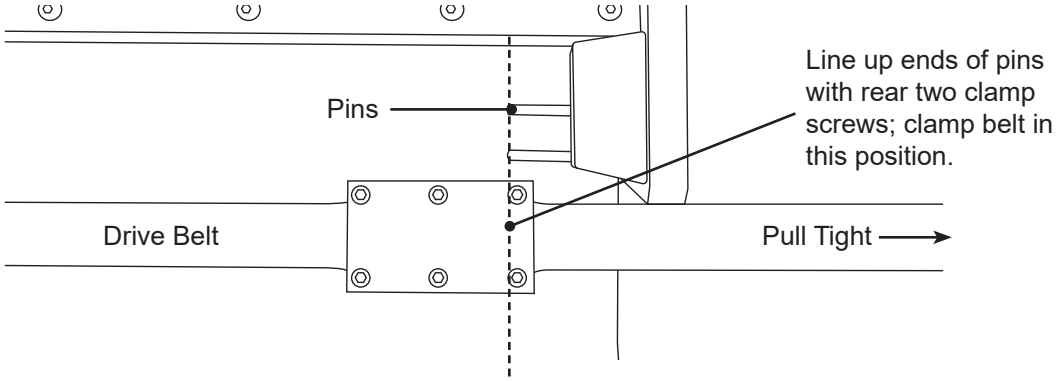
- New Drive Belt

In some cases the Drive Belt may become damaged due to component failure or if material has melted on it causing damage. In this case Drive Belt replacement may be necessary.

Drive Belt Replacement Procedure

1. Move the Trolley to the middle of Rail.
2. Using a ⅛ in. Allen wrench, remove the Trolley cover Rear Plate and Chuck Cover. Leave the Front Plate in place.
3. Using a ¾ in. wrench, remove the nuts from Belt Tensioning Block stud.
4. Using a 5⁄32 in. Allen wrench, loosen but do not remove the six Allen head screws from the front clamp block.
5. Using a 5⁄32 in. Allen wrench, loosen but do not remove the six Allen head cap screws from rear clamp block.
6. Remove the old Drive Belt.
7. The new Drive Belt will be rolled up. Before unrolling the new Drive Belt, clamp one end in front clamp block. Ensure the new Drive Belt is positioned up against outer clamp block screws. Ensure the new Drive Belt is fed all the way to the front of the clamp block.

8. Unroll the Drive Belt along the length of the machine. Take care to keep the Drive Belt from falling on the floor or becoming damaged in any way.
9. Feed the Drive Belt around the idler pulleys and Drive Belt Pulley. Ensure there's no slack in the Drive Belt.
10. Ensure the rear Drive Belt Adjustment Block screws are backed out as much as possible. Feed the Drive Belt through the clamp. Position the Drive Belt Adjustment Block so the adjustment block pins on the machine are even with the two most rearward screws on the clamp block. Hold the clamp block in place with one hand and pull the Drive Belt tight with the other hand.



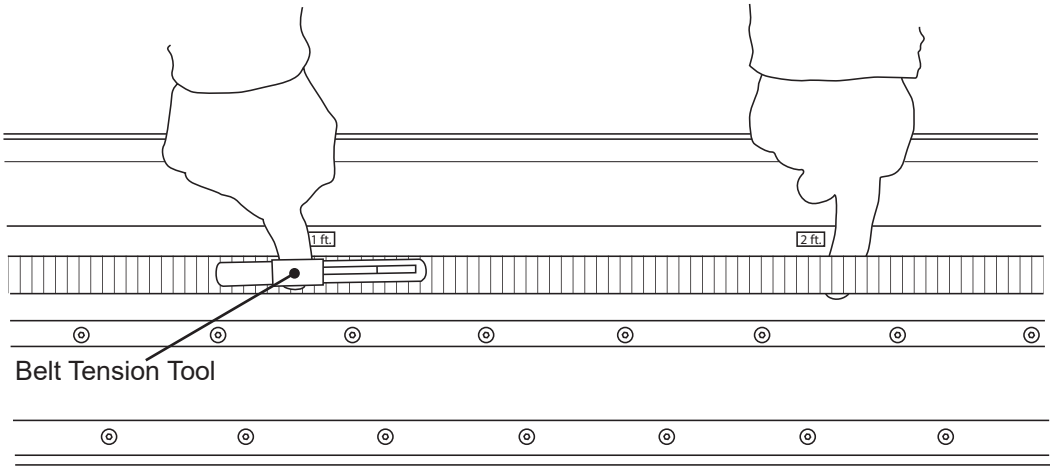
11. Hold the clamp block tight on the belt in this position. Use a 5⁄16 in. Allen wrench and tighten the clamp on the Drive Belt.
12. Feed the Drive Belt Adjustment Block stud through the hole and position the block onto the locating pins.
13. Thread the adjustment nut(s) onto the stud.
14. Perform the Drive Belt Tensioning procedure.

Checking Drive Belt Tension

The Drive Belt should already be installed and the Trolley positioned at the center of the Rail travel.

1. Lay a tape measure on the cable track with 0 on the ruler positioned where the Drive Belt enters the Drive Belt Clamp Block.
2. Using the Belt Tension Tool from the Miscellaneous box, position the tool one foot from the Drive Belt Clamp Block.
3. Place a finger under the Drive Belt two feet from the end of the Drive Belt Clamp Block.

4. Push straight down on the Belt Tension Tool with the right index finger while supporting the Drive Belt with the left hand. Do not lift on the Drive Belt, only support it so it does not contact the Cable Track Tray.
5. When the Belt Tension Tool clicks, observe where the top face of the lever crosses the plane on the body of the tool. This position indicates belt tension



Belt Tension	120 lb-ft

If the Drive Belt is tracking incorrectly on the Drive Belt Pulley call Bend-Tech Service.

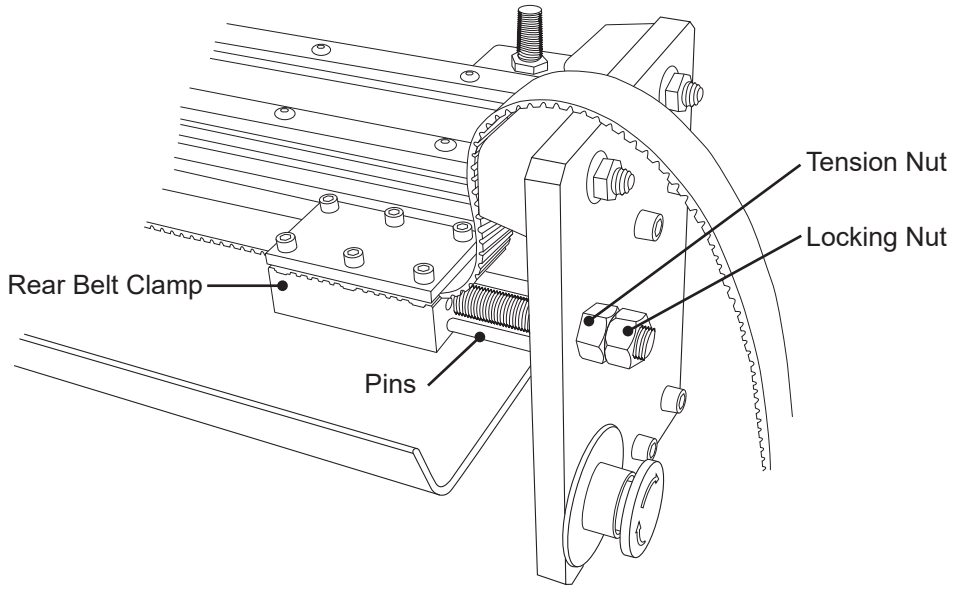
Drive Belt Tensioning Procedure

Tools Needed

- ¾ in. wrench
- ¾ in. deep well socket and ratchet
- Tape measure
- Belt tensioning gauge

Adjusting Belt Tension

1. Using a ¾ in. wrench or ¾ deep well socket, remove the lock nut from the Drive Belt Tensioning Block adjustment stud.
2. To adjust Drive Belt tension, use a ¾ in. wrench or deep well socket to turn the adjusting nut. Turn clockwise to increase tension, turn counterclockwise to reduce tension.
3. To lock in Drive Belt tension, thread the second ¾ in. nut onto the Drive Belt Tensioning Block adjustment Stud. Tighten the locking nut with a ¾ in. socket and ratchet or ¾ in. wrench against the adjustment nut by turning it clockwise.
4. Re-check Drive Belt tension.



09 Chuck

Chuck Troubleshooting

Symptom	Cause	Corrective Action
Chuck skipping steps	Breakout Board not seated in motor drivers.	Ensure the Breakout Board is fully seated in the Motor Drivers.
	Y Motor has come loose.	Remove the Chuck Housing and perform a visual inspection of the Y Motor. Check to ensure the Y Motor is secure.
Chuck not level in load position	Y gear has slipped/come loose.	Remove Chuck Housing and inspect Y gear and Y Motor drive gear. If either one is loose, re-tighten.
	Y Motor skipped steps.	Ensure the Breakout Board is firmly seated in the Motor Drivers.
		Ensure cables are in working order and not damaged.
	Y Axis not homed.	In the Bend-Tech Dragon home interface, click Machine Control. In the top right hand corner click the home icon next to the Y Axis, or click Home All Axis.

Removing and Cleaning Chuck Jaws

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.
2. Clean the Chuck jaws with brake cleaner and a rag.
3. Chuck jaws should be re-installed in the same position on the Chuck from which they were removed. The Chuck and Chuck jaws are numbered. The Operator should match the Chuck jaws to their corresponding positions on the Chuck.
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.

Removing The Chuck

The Chuck is secured to the Chuck Shaft with three M10 x 1.5mm button head cap screws. Older machines may be equipped with regular cap screws. Button head cap screws require a 6mm Allen wrench, regular cap head screws require a 5⁄16 in. Allen wrench. Remove the cap screws to remove the Chuck from the Chuck shaft.

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. Refer to *Removing the Chuck* in this chapter.
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.

10 Control Box

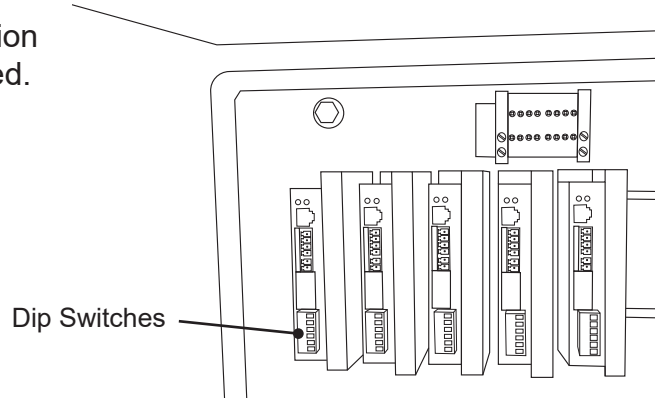
Control Box

The Operator should be familiar with the operations of the Control Box. It is sometimes necessary for the Operator to inspect or replace Control Box components. Do not attempt to service or modify the Control Box without first contacting a Bend-Tech service representative.

Replacing a Motor Driver

Symptom	Cause	Corrective Action
Motor not responding	Motor driver has failed.	Replace motor driver.

1. Power off the machine.
2. Using a large, flat blade screwdriver, open the Control Box by turning the latch counterclockwise.
3. Locate the red Breakout Board in the upper left corner of the Control Box. The Breakout Board will have a ribbon cable leading to it. Gently pry the Breakout Board out of its location and set aside. Leave the ribbon cable attached.
4. Locate the Motor Driver that needs to be replaced. From left to right, the Motor Drivers are: X, Y, Z, A, B.
5. Unplug the Motor Driver.



6. Using a 11⁄32 in. nut driver or small socket and extension, remove the top nut securing the Motor Driver. Loosen, but do not remove, the bottom nut. Lift the Motor Driver slightly upward and tilt the top out to remove.
7. Copy the dip switch settings on the old Motor Driver to the new Motor Driver.
8. Installation is the reverse of removal. During the installation process, use the bottom mounting pin with the nut still threaded onto it to locate the new Motor Driver.

Replacing the Control Box Power Switch

Symptom	Cause	Corrective Action
Machine not powering on	Control Box Power Switch has failed	Replace the Control Box Power Switch

1. The Control Box Power Switch snaps into the power receptacle assembly.
2. Power off the machine.
3. Using a large, flat blade screwdriver, open the Control Box by turning the latch counterclockwise.
4. Remove the two wires that connect to the Control Box Power Switch, noting the location of the wires so they can be re-attached to the new switch in the same location.
5. Using a small, flat blade screwdriver, pry the old switch out of its location.
6. Snap the new switch into its location.
7. Swap the wires onto the new switch, ensuring the wires are attached in the same locations.
8. Close the Control Box.

Replacing the Smoothstepper

Symptom	Cause	Corrective Action
Smoothstepper not connecting to computer	Critical failure in circuit board or circuit board component.	Replace the Smoothstepper board.

1. Using a large, flat blade screwdriver, open the Control Box by turning the latch counterclockwise.
2. The smoothstepper is located on the Control Box door. It will have three ribbon cables, an Ethernet connection and a power connection.
3. Disconnect the ribbon cables. Note the location of the ribbon cables so they can be re-installed in the same location. Unplug the Ethernet cable. Unplug the power connection.
4. Use a 7⁄32 in. nut driver or small socket to remove the nuts that secure the smoothstepper to the Control Box door.
5. Once the nuts are removed, remove the smoothstepper.

Installation is the reverse of removal.

Replacing Control Box Fuses

Symptom	Cause	Corrective Action
No power to Control Box	Blown fuse at power switch	Replace fuse
	Blown fuse inside Control Box	

1. The Main Power Fuse is a 10A, 120VAC fuse. Ensure any replacement fuses are 10A, 120VAC.
2. The Main Power Fuse is located in a slot just below the Main Power Cord. To access the Main Power Fuse, remove the Main Power Cord from its socket and use a finger to slide out the Main Power Fuse holder.
3. The power button fuse inside the Control Box is a 2A, 120VAC fuse. Ensure any replacement fuses are 2A, 120VAC.
4. The power button fuse is located in a fuse holder in the bottom right hand side of the Control Box. Twist the fuse holder to access the fuse. Remove the old fuse and insert the new fuse.

Reseating the Breakout Board

Symptom	Cause	Corrective Action
Axis is not responding, or is responding incorrectly	Breakout Board has come unseated from motor drivers.	Reseat the Breakout Board.

The Breakout Board smoothstepper facilitates communication between the computer and the motor drivers. Over time, it is possible for the Breakout Board to come unseated from the motor drivers.

1. Using a large, flat blade screwdriver, open the Control Box by turning the latch counterclockwise.
2. Locate the Breakout board in the upper left-hand corner of the Control Box.
3. Firmly push on the Breakout Board to seat it in the motor drivers

Replacing the Control Box

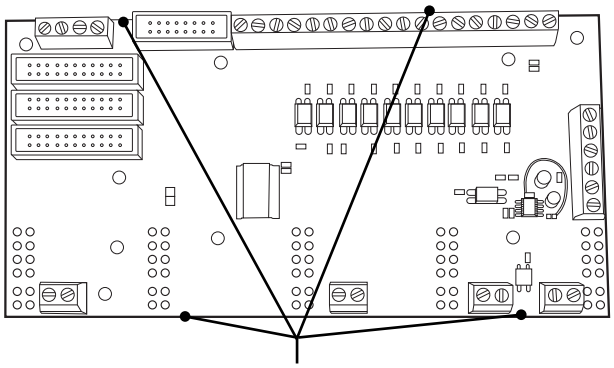
Symptom	Cause	Corrective Action
Unknown failure within Control Box	Wear, power spike, contamination	Replace the Control Box
Control Box needs to be updated	Control Box components have become obsolete, or Machine has been updated.	

Tools Needed

- 9⁄16 in. wrench
- 9⁄16 in. socket
- Ratchet and extension
- Large flat blade screwdriver

1. Break Out Board

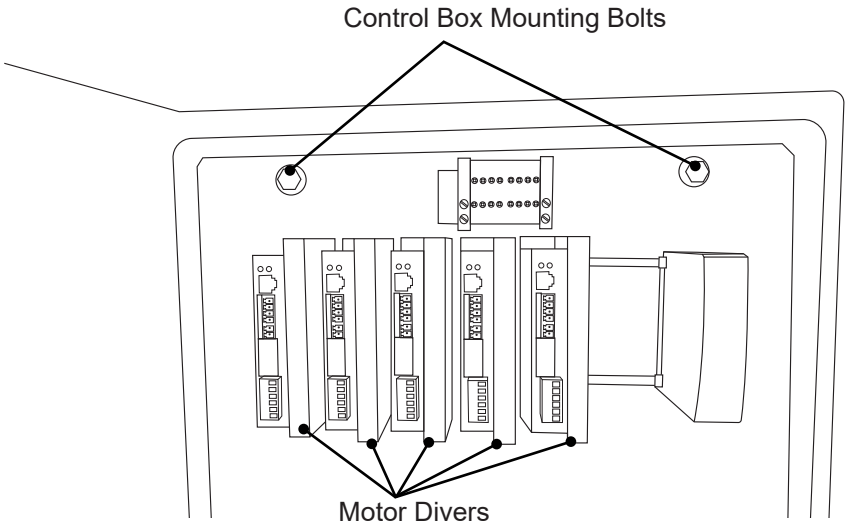
Locate the Control Box mounted on the rear of the third Rail Support Leg. Using a large, flat blade screwdriver, turn the black Control Box Door Latch located on the right hand side of the Control Box counterclockwise to open the Control Box. Locate the red Breakout Board in the upper left hand side of the Control Box. The Breakout Board will have a flat flex cable leading to it. Carefully pull the Breakout Board off the Motor Drivers. This will give access to the left hand Control Box Mounting Bolt. The Breakout Board should remain connected to the Control Box via its flat flex cable.



Hold the Breakout Board on the sides and gently pull it off the motor drivers.

2.Control Box Mounting Bolts

Control Box Mounting Bolt heads are located inside the Control Box, in the upper right and left hand corners of the Control Box. Use a ratchet with a 9⁄16 in. socket and extension to reach the bolt heads inside the Control Box. Place a 9⁄16 in. wrench on the nut located on the Mounting Bolt on the backside of the Control Box. Turn the ratchet counterclockwise to remove the Mounting Bolt. Repeat this process for the right side Mounting Bolt. Once the mounting bolts are removed, position the old Control box out of the way so the new Control Box can be mounted.



The Powered Gate Control Box will have a separate Powered Gate Driver Box attached to it. This control box contains the motor driver for the Powered Gate. The Powered Gate Driver Box is placed on top of the main Control Box once it is mounted to the third Rail Support Leg.

3. Mount New Control Box

Before mounting the new Control Box, the Installer will need to remove the red Breakout Board located in the upper left hand corner of the new Control Box. Carefully pull the Breakout Board out of its mount on the motor drivers. It should remain connected to the door of the Control Box via its flat flex cable. Using the Mounting Bolts and nuts from the old Control Box, position the new Control Box so the Mounting Bolts can be fed through the mounting holes in the Control Box and the Rail Support Leg. Once in position with a Mounting Bolt fed through both parts, thread a nut onto the Mounting Bolt and tighten finger tight. Place the 9⁄16 in. wrench on the nut and use the ratchet, extension and 9⁄16 in. socket placed on the bolt head inside the Control Box to tighten the Mounting Bolts securely.

4. Reinstall the Break Out Board

After mounting the Control Box, reinstall the Breakout Board. Position the Breakout Board over the motor drivers and, applying even pressure, carefully press the Breakout Board into its sockets on the motor drivers. Ensure the Breakout Board is fully seated on the motor drivers. Take care not to alter any of the white dip switch settings as these are preset at the Bend-Tech manufacturing facility for optimum performance.

5. Place the Powered Gate Driver Box

The Powered Gate Driver Box should be placed on top of the main Control Box. The Powered Gate Driver Box is secured with Velcro which is pre-installed on the Control Boxes.

6. Control Box Connections

Transfer all cable, wiring and compressed air connections from the old Control Box to the new Control Box. Bend-Tech recommends starting at either the top or bottom of the old Control Box and transfer each connection individually. Using this method will avoid misconnections.

11 ESS Connections

Troubleshooting the ESS Connections

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 cables and replace if damaged.
	Electrical interference.	Check cable routing. Ensure the Ethernet cable is routed clear of any other cables, especially the Torch lead.
	High CPU Usage.	Ensure no other programs are running on the computer.
	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.

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.

To check CPU usage, right click the Task Bar > Tank Manager > More Details. Scroll through to ensure no processes are using an inordinate amount of computer memory.

12 Sensors

Sensor Overview

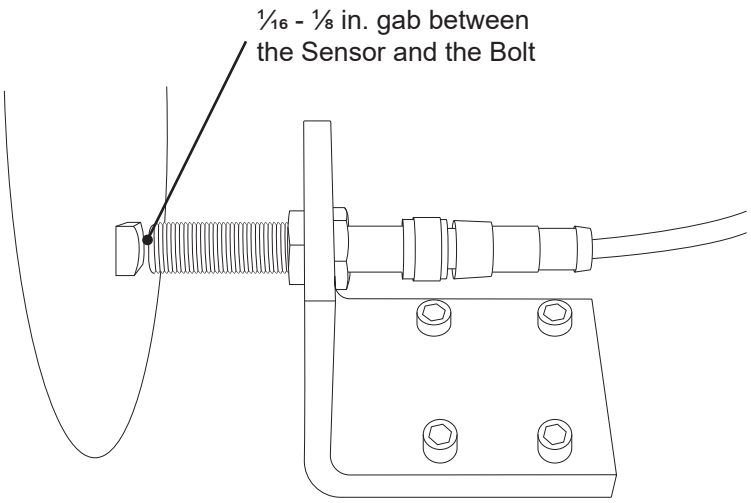
The Dragon A400 uses rugged, long-lasting proximity sensors to determine critical machine positions. Issues related to machine positioning are rarely sensor-related. Typically an issue is the result of a sensor falling out of adjustment or a cable.

Diagnosing Sensor Issues

It can be assumed there is an issue with a sensor if the machine cannot find home, or if a machine Axis experiences a collision.

Setting a Sensor

1. Disconnect the sensor cable.
2. Position the sensor bolt directly in front of the sensor. This will require jogging the machine.
3. Use a feeler gauge to check the gap between the face of the sensor and the bolt head - the gap should be between 1⁄16 - 1⁄8 in.



4. If the gap is not within spec, loosen the nuts on the sensor and adjust accordingly.
5. When the sensor gap is correct, tighten the mounting nuts.
6. Re-check to ensure the gap remained in spec during the tightening procedure.

Inspecting Sensor Cables

1. Disconnect the cable from the sensor.
2. Perform a visual inspection, ensure all contacts are in position and intact.
3. If the cable passes inspection and the sensor is still malfunctioning, the Operator can swap cables with a sensor that is known to be functioning correctly.
4. After swapping the cable, if the problem follows the cable it can be concluded that there is a problem with the cable.

Checking a Sensor

The Operator can check a sensor by placing a piece of metal, such as the blade of a screwdriver, in front of the sensor.

In the Machine Library, on the Main interface, click the Wizard icon.

Follow the prompts on the screen, the program will walk the Operator through the process of checking sensor operation.

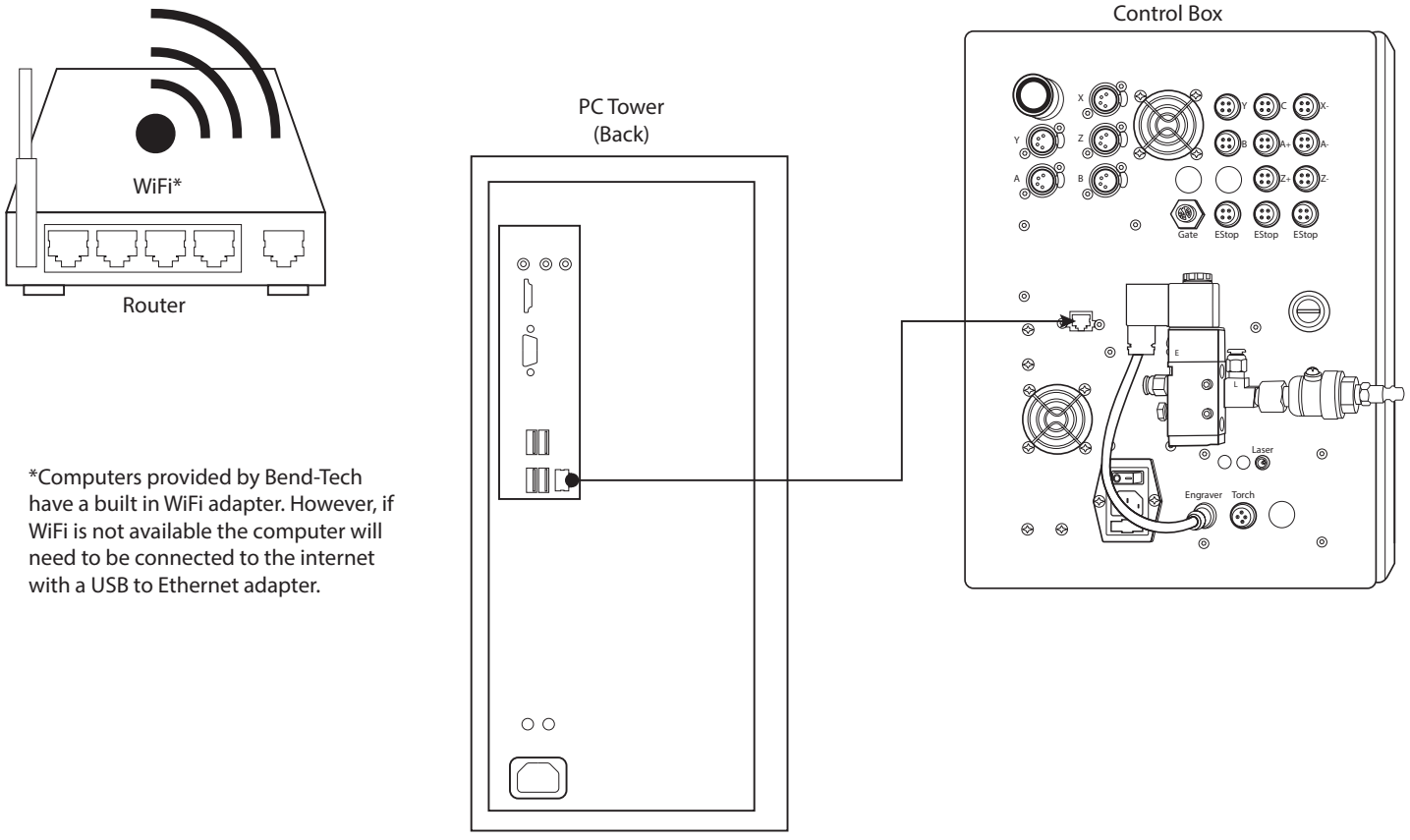
A and Z sensors

A and Z (Toolhead) negative sensors can be changed easily. However, the positive sensors require removal of the Toolhead to change. The positive sensors can be disconnected and the machine run safely without them until the Operator can schedule down time for replacement.

13 Miscellaneous

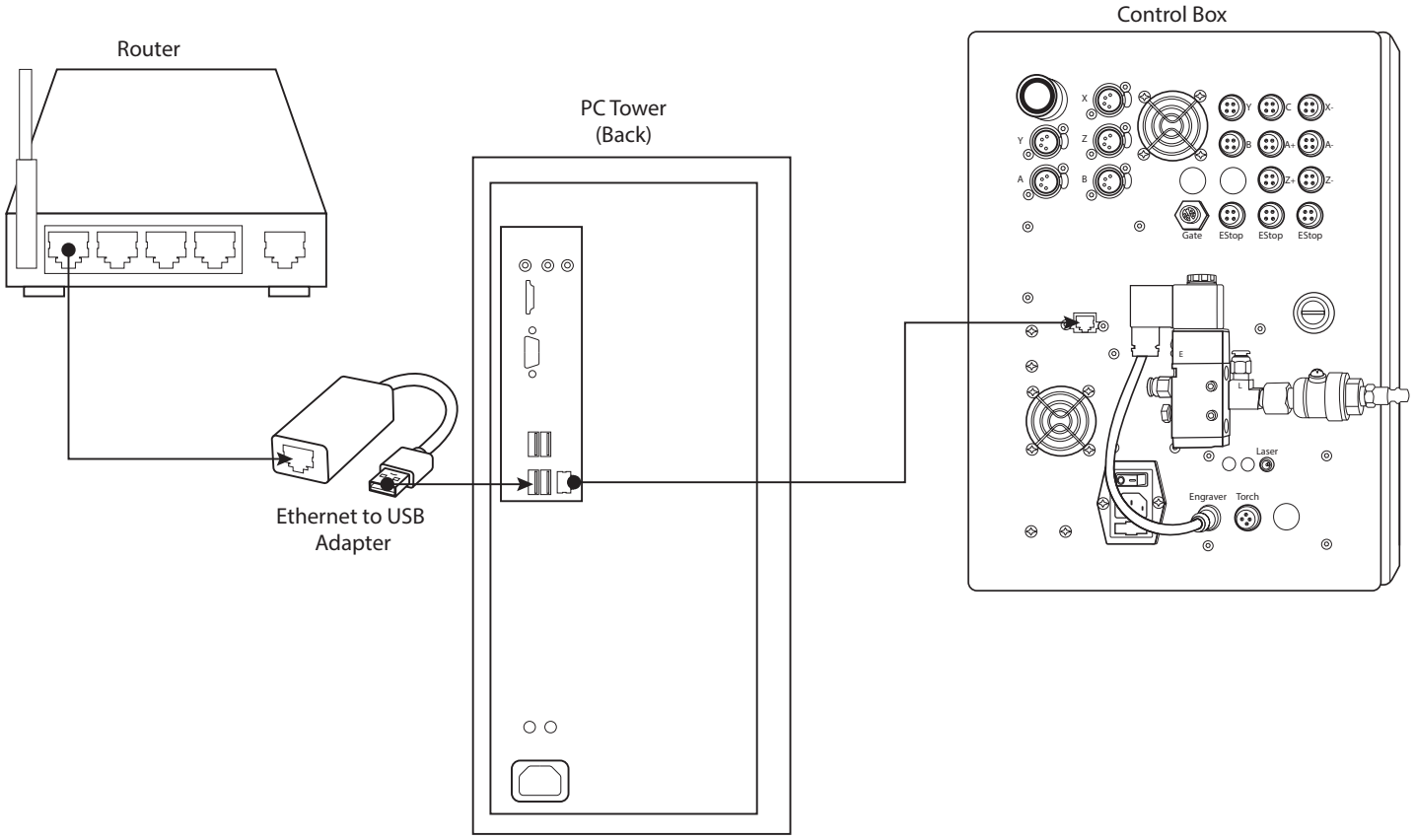
Ethernet Connections

Ensure there is a direct connection between the Ethernet port on the Control Box and the Computer.



*Computers provided by Bend-Tech have a built in WiFi adapter. However, if WiFi is not available the computer will need to be connected to the internet with a USB to Ethernet adapter.

It is OK to use a USB to ethernet adapter and connect an ethernet cable from the USB port to the router to gain internet access for computers without Wifi capabilities. This will leave the other ethernet port open for use with the Dragon machine.



***Do Not** connect the Control Box to a USB port via an adapter.*

***Do Not** Connect the Computer to the Control Box via a Router.*

Rail Alignment

Symptom	Cause	Corrective Action
Poor cutting accuracy and/or quality	Improper machine alignment.	Check Rail Beam alignment. True Rail Beam if out of spec.
Drive Belt riding up on edges of Drive Belt Pulley		

Checking Rail Beam For Straightness/Level

Ensuring the Rail Beam is straight and level is critical to accurate operation of the Dragon A400. During daily operation the machine can come out of alignment, or it can be accidentally bumped out of alignment by shop personnel. This is especially true if the machine has not been mounted to the floor of the shop.

1. Jog the Trolley to the front of the machine.
2. Use a taut string or a laser to determine if the Rail Beam is straight. The Operator can also stand at the end of the Rail Beam and sight down the Rail Beam. Any fluctuations in the Rail Beam are often visible when the Rail Beam is viewed in this manner. However, for best results, always use a string or laser.
3. To determine if the Rail Beam is level lengthwise, place a Torpedo level on each section of the Rail Beam.
4. Place a Torpedo Level across the Rails to determine of the Rail Beam is level side-to-side.

Bend-Tech recommends mounting the Dragon A400 to the floor of the shop whenever possible. Mounting the machine to the floor will help ensure the machine remains true.

Trueing the Dragon A400 Rail Beam

Tools Needed

- 9⁄16 in. wrench
- Torpedo level
- String or laser

If it is determined the Rail Beam is not true, the Operator can use the swivel levelers to align the machine.

1. If the Floor Brackets are in place, use a 9⁄16 in. wrench to loosen the floor brackets on the machine legs. Loosen the concrete anchor bolts holdig the machine to the floor.
2. To adjust the Swivel Levelers, ensure the jam nut is loose and backed off to the base of the Swivel Leveler. Place a 9⁄16 in. wrench on the hex adjustment at the base of the Swivel Leveler. When viewing from above, turn clockwise to raise the leg, turn counterclockwise to lower the leg.
3. Use a taut string or laser and a bubble level to measure adjustments to the machine. Also, the Operator can sight along the length of the Rail Beam to assist in trueing the Rail Beam.
4. Once the Rail Beam is true, tighten the Swivel Levelers. Tighten the Floor Brackets.
5. After the Swivel Levers and Floor Brackets have been tightened, re-check the Rail Beam to ensure it has remained true.

Rail Splices

Improperly spaced Rail Splices can affect Trolley movement and possibly affect cut quality. Ensure that each Rail splice intersects with the next as seamlessly as possible. Ensure that all of the Rail splices are fastened properly to the Rail.

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