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USER GUIDE

UGE047-0216

Servo Knife Cutters

CSC Models

Corporate Office: 724.584.5500 | Instant Access 24/7 (Parts and Service): 800.458.1960 | Parts and Service: 814.437.6861

Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date:

Manual Number: UGE047-0216

Serial Number(s):

Model Number(s):

DISCLAIMER: Conair shall not be liable for errors contained in this User Guide or for incidental, consequential damages in connection with the furnishing, performance or use of this information. Conair makes no warranty of any kind with regard to this information, including, but not limited to the implied warranties of merchantability and fitness for a particular purpose.

Table of Contents

1-1 Introduction

2-1 Description

3-1 Installation

4-1 Operation

4-1 Operation (continued)

5-1 Maintenance

6-1 Troubleshooting

A Appendix

B Appendix

C Appendix

D Appendix

Introduction

Purpose of the User Guide

This User Guide describes the Conair CSC Servo Knife Cutter and explains step-by-step how to install, operate, maintain and repair this equipment.

Before installing this product, please take a few moments to read the User Guide and review the diagrams and safety information in the instruction packet. You also should review manuals covering associated equipment in your system. This review won't take long, and it could save you valuable installation and operating time later.

How the Guide is Organized

Symbols have been used to help organize the User Guide and call your attention to important information regarding safe installation and operation.

Symbols within triangles warn of conditions that could be hazardous to users or could damage equipment. Read and take precautions before proceeding.

1 Numbers indicate tasks or steps to be performed by the user.

◆ A diamond indicates the equipment's response to an action performed by the user.

❒ An open box marks items in a checklist.

• A circle marks items in a list.

Indicates a tip. A tip is used to provide you with a suggestion that will help you with the maintenance and the operation of this equipment.

Indicates a note. A note is used to provide additional information about the steps you are following throughout the manual.

Your Responsibility as a User

You must be familiar with all safety procedures concerning installation, operation, and maintenance of this equipment. Responsible safety procedures include:

- Thorough review of this User Guide, paying particular attention to hazard warnings, appendices, and related diagrams.
- Thorough review of the equipment itself, with careful attention to voltage sources, intended use and warning labels.
- Thorough review of instruction manuals for associated equipment.
- Step-by-step adherence to instructions outlined in this User Guide.

ATTENTION:
Read This So No One Gets Hurt

We design equipment with the user's safety in mind. You can avoid the potential hazards identified on this machine by following the procedures outlined below and elsewhere in the User Guide.

DANGER: Sharp Blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out the cutter before opening the cutting chamber.
- Always wait until the cutter head has stopped completely before opening the knife guard.

CSC Cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the knife.

WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

ATTENTION:
Read This So No One Gets Hurt

WARNING: Voltage hazard

This equipment is powered by three-phase alternating current, as specified on the machine serial tag and data plate.

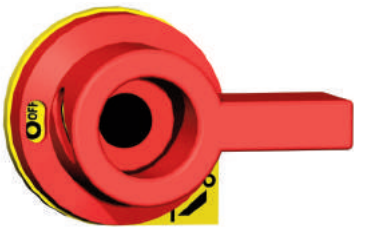
A properly sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. Improper grounding can result in severe personal injury and erratic machine operation.

Always disconnect and lock out the incoming main power source before opening the electrical enclosure or performing non-standard operating procedures, such as routine maintenance. Only qualified personnel should perform troubleshooting procedures that require access to the electrical enclosure while power is on.

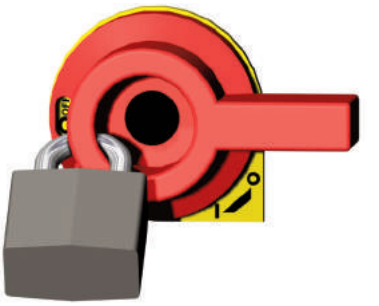
How to Use the Lockout Device

WARNING: Electrical Hazard
Before performing maintenance or repairs on this product, you should disconnect and lockout electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

WARNING: Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed and all safety guards reinstalled.



Lockout is the preferred method of isolating machines or equipment from energy sources. Your Conair product is equipped with a lockout device simlilar to the one pictured below. To use the lockout device:



1. **Stop or turn off the equipment.**
2. **Isolate the equipment from the electric power.** Turn the rotary disconnect switch to the OFF, or "O" position.
3. **Secure the device with an assigned lock or tag.** Insert a lock or tag in the holes to prevent movement.
4. **The equipment is now locked out.**

CAUTION: Moving Parts
Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed, and all safety guards reinstalled.

To restore power to the Servo Cutter, turn the rotary disconnect back to the ON position:

1. **Remove the lock or tag.**
2. **Turn the rotary disconnect switch to the ON or "I" position.**

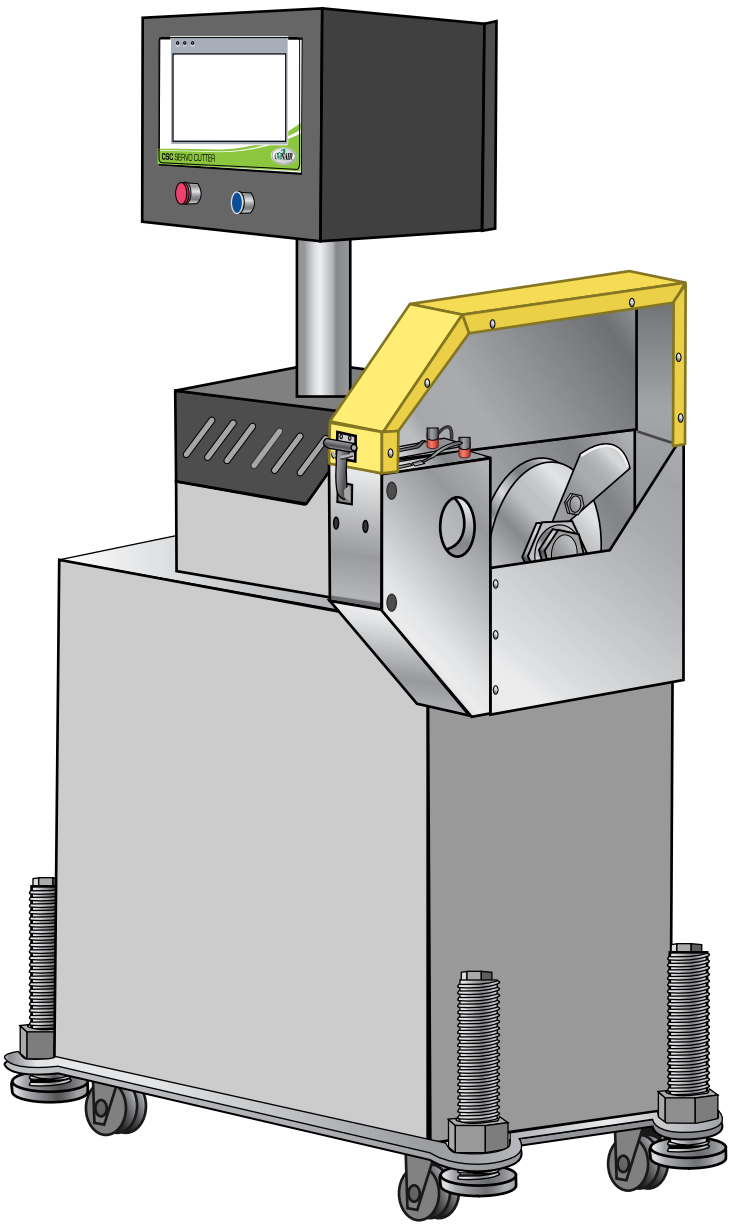
SECTION
2

Description

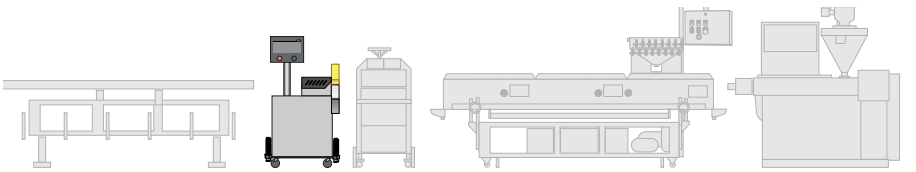
What is the CSC Cutter?

The Conair CSC Series Servo Knife Cutter is an on- or off-line cutting device capable of both on-demand and continuous cutting modes.

CSC cutters utilize a positional-controlled servo motor to achieve cut-to-part position repeatability within 0.1 millisecond.



Typical Applications



Cutter

Conair CSC Series Servo Knife Cutters can cut extrudable plastics and rubber both on- and off-line. Other extrudable materials-foods, ceramics, magnets, soaps, etc.-may also be cut depending on specific application requirements.

CSC cutters are available with different cutting capacities (2, 3, 4, and 5 inches) {5.08, 7.62, 10.16, and 12.7 centimeters} to suit your specific needs. The servo motor size and cutter head material may also be optimized for specific applications. While the standard cutter orientation is right-to-left, cutters can also be made with a left-to-right orientation (see *Specifications*).

NOTE: The illustrations in this User Guide represent the standard right-to-left configuration.

CSC cutters are limited to a specific range of product sizes based on each unit's cutting capacity. CSC cutters can operate over a range of speeds (depending on which options were purchased.) See *Specifications*.

Different materials, line speeds, temperatures and material cross-sections can result in different cutting torques. If you are changing any of these parameters, consult your Conair service personnel to be sure your equipment can handle the changes.

Contact Conair Customer Service 1 800 458 1960. From outside of the United States, call: 814 437 6861

How the CSC Cutter Works

Extruded material that has been sized and cooled enters the cutter from the upstream side. Typically, a puller is placed just before the cutter; the puller pulls the extrudate through the sizing and/or cooling tanks and feeds it into the cutter.

The positional servo motor, is direct coupled to the cutter head, or an in-line planetary gear reducer that drives the cutter head. The planetary gear reducer arrangement increases cutting torque, improves servo motor efficiency, and offers improved bearing load ratings.

Contact Conair for more information about our CSC Cutter, by phone (724)-584-5500, or info@conairgroup.com www.conair.com

The cutting knife, attached to the cutter head, is driven by the servo motor. Two cutter bushings guide and support both the extrudate and the cutting knife. The cutter head is mounted directly to the in-line planetary gear reducer shaft using a Trantorque coupling device, and may have as many as four optional blade positions.

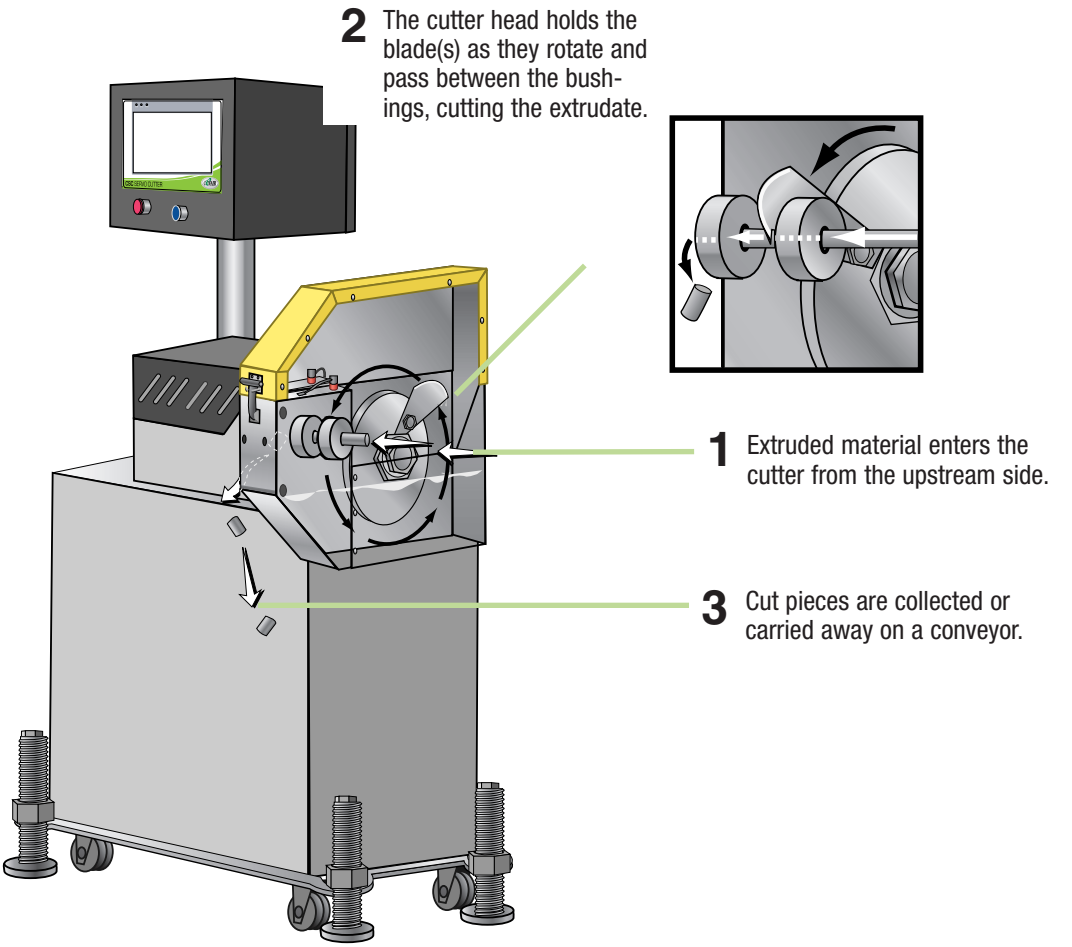
Two types of cutting modes are available. On-demand cutting modes (Timer, Encoder, End Sense) provide a single rotation cut cycle. However, in continuous cutting modes (Flywheel and optional Follower) the cutting mechanism rotates continuously.

The knife guard includes a stainless steel lower tray, which can be used for blade lubrication. The upper knife guard includes a clear polycarbonate window. This allows you to watch the cutting blade during operation.

Cut pieces are collected or carried on to further processing by an optional conveyor.

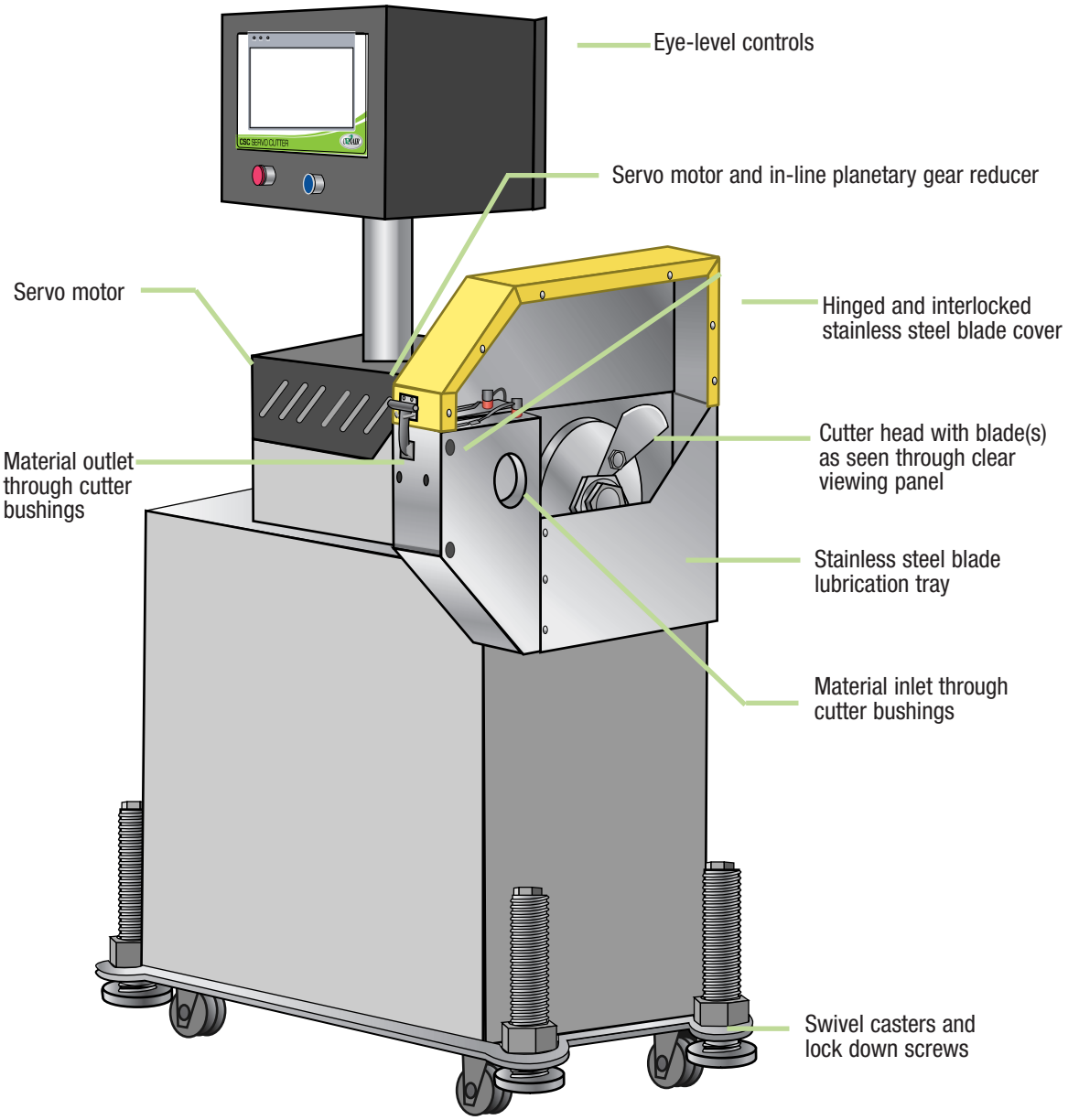
(Continued)

How the CSC Cutter Works (continued)

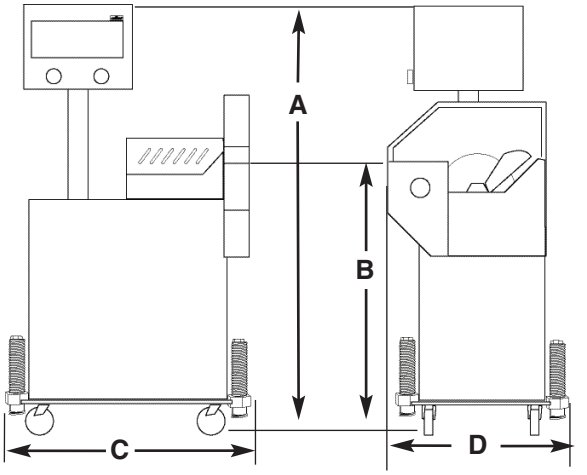


CSC Cutter Features

The CSC Cutter models have these features:



Specifications



OPTIONS

- Stainless steel cutter head
- Cutting torque horsepower upgrade (Std. on CSC4 & CSC5)
- Follower cutting mode
- Timer mode
- Variable blade speed for on-demand and fly-wheel cut modes
- Slide base system
- Electric eye and bracket for use with end sense mode
- Blade wipe system
- Bushing lubrication system
- Left to right operation
- Special paint
- Blade heater with Athena temperature control

MODELS	CSC2L	CSC3L	CSC2	CSC3	CSC4	CSC5
Performance characteristics						
Extrudate capacity inches {mm} dia.	1.25 {318}	2.25 {572}	1.75 {445}	2.75 {699}	3.75 {953}	4.75 {1207}
Blade drive motor Hp {kW}	2.7 {1.86}	2.7 {1.86}	2.7 {1.86}	2.7 {1.86}	3.8 {2.8}	3.8 {2.8}
High torque motor*	N/A	N/A	3.8 {2.8}	3.8 {2.8}	STD	STD
Feed direction	right to left	right to left	right to left	right to left	right to left	right to left
Dimensions inches {mm}						
A - Height	63 {1600}	63 {1600}	63 {1600}	63 {1600}	63 {1600}	63 {1600}
B - Height to centerline (42 ± 2)	40 {1016}	40 {1016}	40 {1016}	40 {1016}	40 {1016}	40 {1016}
C - Width	36 {914}	36 {914}	36 {914}	36 {914}	36 {914}	36 {914}
D - Depth	24 {614}	24 {614}	24 {614}	24 {614}	24 {614}	24 {614}
Weight lb. {kg}						
Installed	600 {272}	600 {272}	600 {272}	600 {272}	600 {272}	600 {272}
Shipping	700 {317}	700 {317}	700 {317}	700 {317}	700 {317}	700 {317}
Total Amps for volt/phase/frequency						
460V/1/60Hz*	8.3	8.3	8.3	8.3	N/A	N/A
230V/3/60Hz*	18	18	18	18	18	18
208V/3/60Hz*	20	20	20	20	20	20
460V/3/60Hz* (standard)	9	9	9	9	9	9
575V/3/60Hz*	7	7	7	7	7	7
Cutter head						
Aluminum 2-position	Yes	Yes	Yes	Yes	NA	NA
Stainless steel 2-position*	NA	NA	Yes	Yes	STD	STD
Cutter Control	touch screen	touch screen	touch screen	touch screen	touch screen	touch screen
Slide Base*	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*

SPECIFICATION NOTES:

* Optional

These tables define standard configurations only.

Specifications can change without notice. Contact a Conair representative for the most current information.

TPEX002-0811

Options

Contact Conair Parts 1 800 458 1960. From outside of the United States, call: 814 437 6861

Cutting torque upgrades
Several options can be used to increase the cutting torque:

- CSC-2 and 3 cutters can be upgraded from a 2.7 HP {2.0 kW} (MGE-455) to a 3.8 HP {2.8 kW} (MGE-490) servo motor. (The larger servo motor is standard on CSC-4 and 5 cutters.)

- The standard aluminum cutter-head can be replaced with a heavier stainless steel one. When this option is picked, the maximum number of cuts per minute decreases from 400 to 200. Inertia, and thus cutting torque, is increased significantly.

Follower Cutting Mode
Follower mode allows the operator to program the desired cut length and the number of blades. The controller then automatically follows the encoder and adjusts the speed of the cutter head to maintain cut length. This is known as an electronic gearlock system. The cut length accuracy is maintained even if the puller changes speed. A 6,000 pulse per revolution encoder is used for this option using the Quadrature (x-4) mode, giving 24,000 pulses per foot for extreme accuracy and repeatability.

Slide Base
This option is highly recommended for cutting flexible extrudates. While the cutter base is fixed and aligned with the puller, the cutter itself is mounted on a set of linear slides that allow as much as six (6) inches {15.24 centimeters} of movement. The cutter can be moved away from the puller for startup, then moved close to the puller to enhance delivery to the cutter bushings.

Bushing Lubrication
This is a self-contained spray system, which includes a reservoir and air inlet for operation at 20-30 psig (air source not included). A flexible nozzle directs lubricant onto the extrudate as it enters the cutter bushings. This decreases bushing drag and helps lubricate the blade. This option is particularly recommended for processing sticky/soft (low durometer) materials.

Blade Wipe
The blade wipe system keeps the cutting blade clean by removing lubricant and particles from the blade. A felt pad sandwiched between two pieces of stainless steel and mounted in the stainless steel blade lubrication tray wipes the knife before each cut.

Multiple batch and length mode
This advanced cutter control offers four preset cut lengths with individual outputs and a batch output

(Continued)

Options (continued)

End Sense
This option allows the use of an electric eye to produce a cut signal. Two types of electric eye brackets are included:

- A bracket for cutting parts 3.5-24 inches {8.89-60.96 centimeters} long. This bracket is mounted on the bushing holder, and uses a triplebeam eye with a red dot for easy setup and alignment. Coarse and fine adjustments are provided with the eye positioned above the extrudate.

✎ **NOTE:** With this bracket and eye mounting, the part must be rigid enough not to sag or flex at the cut distance.

- A bracket for cutting parts up to 10 feet {3.048 meters} long. This bracket is designed to mount on a discharge conveyor. The electric eye used with this bracket is a through beam type and can be adjusted to pick up products that are at least 0.100 inches {2.54 millimeters} high (height of piece above the conveyor).

Discharge Conveyor
A discharge conveyor offers support before, during, and after cutting, and facilitates the removal of cut parts. Discharge conveyors are available in the following sizes:

Contact Conair Parts 1 800 458 1960. From outside of the United States, call: 814 437 6861

- 6 inches wide by 6 feet long {15.25 centimeters wide by 1.83 meters long}
- 6 inches wide by 10 feet long {15.25 centimeters wide by 3.05 meters long}
- 6 inches wide by 16 feet long {15.25 centimeters wide by 4.88 meters long}

Isolation Transformer
The isolation transformer protects sensitive electronics from incoming power, which helps prevent errors caused by electrical noise. It also protects equipment from electrical noise generated by the servo motor and associated amplifier.

✎ **NOTE:** An isolation transformer will not compensate for a ground that does not meet code requirements.

✎ **NOTE:** Conair strongly recommends the use of an isolation transformer. Ensuring clean and proper power can help avoid the need for costly service calls.

Left to Right Machine Operation
This option changes the machine direction from the standard right to left extrusion flow.

Special Paint Type or Color
This option covers any change from the standard Conair paint.

Your Conair sales representative can analyze your needs and recommend the options that are right for your system.

Contact Conair Customer Service 1 800 458 1960. From outside of the United States, call: 814 437 6861

SECTION
3

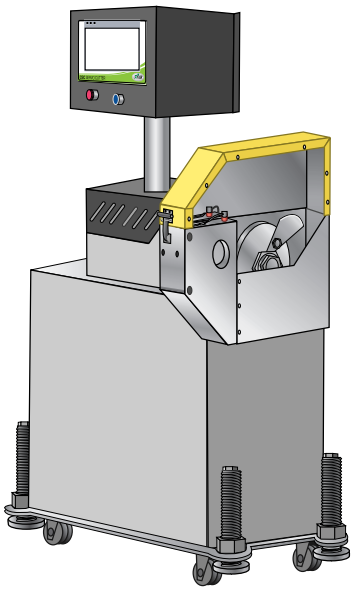
Installation

Unpacking the Boxes

The CSC Series Servo Knife Cutter typically comes fully assembled in a single crate.

⚠ CAUTION: Lifting

To avoid personal injury or damage to the cutter, lift the cutter using a forklift or hoist with straps that have been positioned at the cutter's center of gravity.



1. **Carefully uncrate the cutter and its components.**

2. **Remove all packing material, protective paper, tape, and plastic.** Compare contents to the shipping papers to ensure that you have all the parts.

3. **Carefully inspect all components** to make sure no damage occurred during shipping. Check all wire terminal connections, bolts, and any other electrical connections, which may have come loose during shipping

4. **Record serial numbers and specifications** in the blanks provided on the back of the User Guide's title page. This information will be helpful if you ever need service or parts.

5. **You are now ready to begin installation.** *See Preparing for Installation for completing the preparation steps.*

Preparing for Installation

1 Gather the following tools for installation:

- ❒ **wire strain relief**
- ❒ **16 or 18 inch {406.4 or 457.2 mm} adjustable wrench**
- ❒ **set of Allen wrenches**
- ❒ **set of feeler gauges**
- ❒ **1/2 inch open or box end wrench**
- ❒ **flashlight**

2 Plan the location. Make sure the area where the CSC Cutter is installed has the following:

❒ **A grounded power source.**
Check the cutter's serial tag for the correct amps, voltage, phase and cycles. All wiring should be completed by qualified personnel and should comply with your region's electrical codes.

❒ **Clearance for safe operation and maintenance.**
Make sure there is enough clearance around the servo cutter for maintenance and servicing. If the servo cutter has the optional slide base, be sure to check for clearance by extending the slide system in both directions

⚠ **WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.**

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

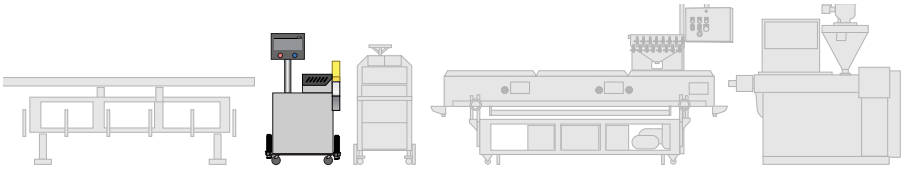
All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

Positioning the CSC Cutter

1 Move the servo cutter into position. Place the servo cutter in position downstream of the belt puller.

⚠ CAUTION: Lifting

To avoid personal injury or damage to the cutter, lift the cutter using a forklift or hoist with straps that have been positioned at the cutter's center of gravity.

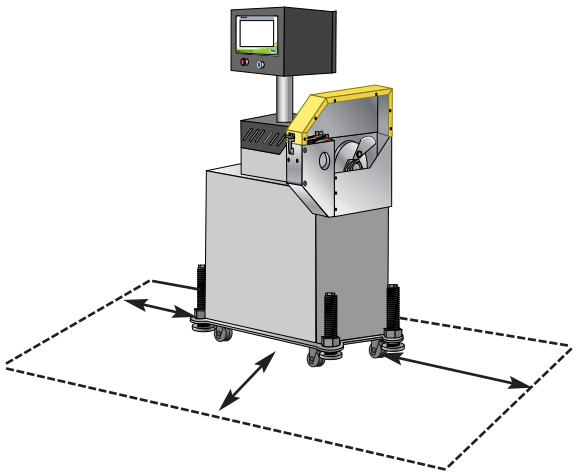


Cutter

2 Determine the best distance from the belt puller to the CSC cutter.

- **For flexible products,** the cutter should be as close as possible to the puller.
- **For rigid products,** leave enough space to allow the product to flex during the cutting cycle. In some cases, it may be necessary to allow 6-8 feet between the puller and cutter.

3 Align the cutter with the extrusion line.



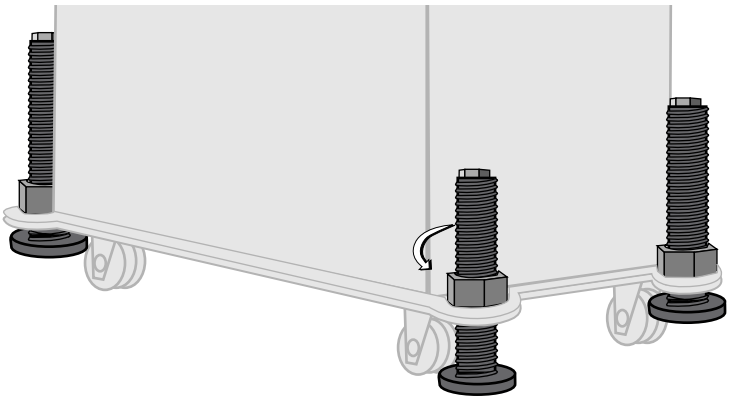
(Continued)

Positioning the CSC Cutter (continued)

4 **Measure the centerline height** of the extrudate as it exits the extrusion die. Adjust all equipment on the extrusion line (sizing tank, cooling tanks, belt puller, and cutter) to this height.

5 **Adjust the cutter's floorlock/caster assembly** to the center height of the extrusion line using a 16- or 18-inch adjustable wrench. Once the correct height is reached, adjust the pad assembly to remove the weight from the casters for operation. This minimizes machine vibration during the cutting cycle.

6 **Use a plumb line or laser to check for a straight line** from the extrusion die through each line component to the cutter bushings. Adjust as necessary.



Connecting the Main Power Source

WARNING: Electrical hazard

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

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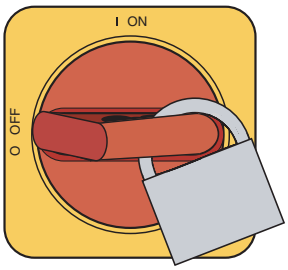
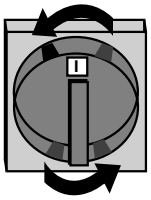
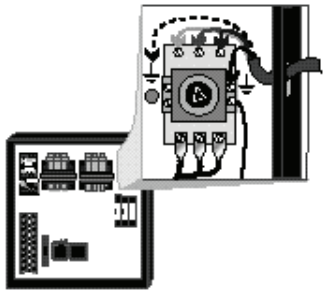


IMPORTANT: Always refer to the wiring diagrams that came with your servo cutter before making electrical connections. The diagrams show the minimum size main power cable required for your cutter, and the most accurate electrical component information.



1. **Open the servo cutter's electrical enclosure.** Turn the disconnect dial on the door to the Off or O position and open the door.
2. **Insert the main power wire** through the knockout in the side of the enclosure. Secure the wire with a rubber compression fitting or strain relief.
3. **Connect the power wires** to the terminals indicated on the wiring diagram that came with your machine.
4. **Check every terminal screw** to make sure wires are secure. Gently tug each wire. If a wire is loose, use a screwdriver to tighten the terminal.
5. **Connect the ground wire** to the grounding point shown in the wiring diagram.



Installing the Encoder (if equipped)

⚠ CAUTION: Handle with care.

The encoder is a delicate piece of equipment and must be handled gently.

Conair uses bi-directional encoders to ensure that only product that moves forward is counted. Installing the encoder consists of several parts:

- the encoder
- the measuring wheel
- the connecting cable

Encoder

Wheels

The encoder is fitted with a one (1) foot {0.31 meters} circumference wheel which rides on either the upper belt of the belt puller or (for rigid profiles and pipe) on the extrudate itself upstream of the puller.

The encoder is supplied with an integral mounting bracket. How and where you attach the encoder to the puller depends on your particular puller and application.

Connecting Cable

- If the wheel rides on the puller belt, make sure that its linear alignment is the same as the belt. Place the wheel near the center of the belt to minimize bouncing. Try to avoid cracks and other belt features that may affect accuracy.

- Make sure the location allows you to keep the wheel clean. Any small buildup on the wheel will affect its circumference and change the cut length.

After the encoder is installed, attach it to the cutter control using the supplied cable. The cable has been hard-wired to the control at the factory.

Installing Cutter Blades

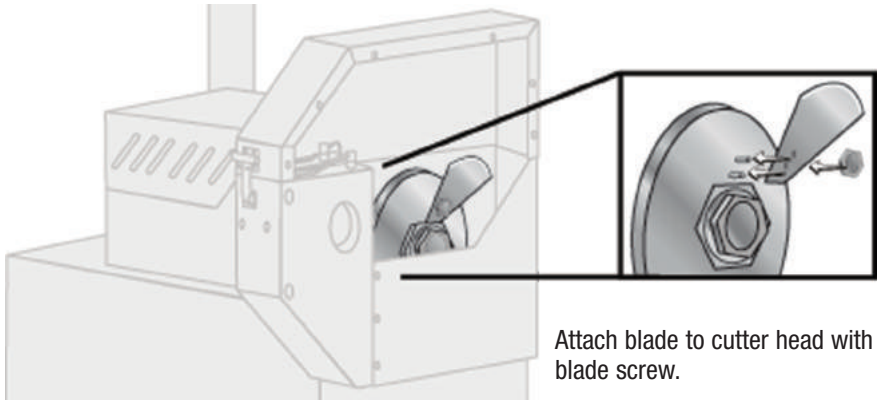
DANGER: Sharp blades

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out power to the cutter before opening the cutting chamber.
- Always wait until the cutter head has completely stopped before opening the knife guard.

CSC cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the cutter head.



Attach blade to cutter head with blade screw.

See Appendix B of this User Guide for more information about choosing the appropriate blade for your material.

Mounting the Cutter Bushings

DANGER: Sharp blades

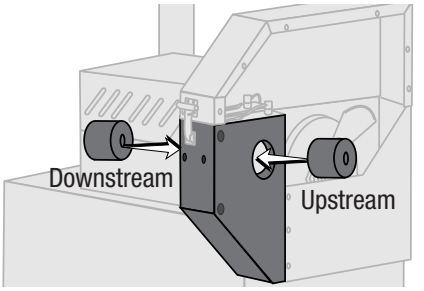
Always wear cut-resistant gloves when the cutting chamber is open and when handling blades. Never open cutting chamber without locking out the cutter power and waiting until the cutter head stops spinning.

NOTE: For more information about setting and adjusting the gap for the bushings. *See Appendix C, About Cutter Bushings.*

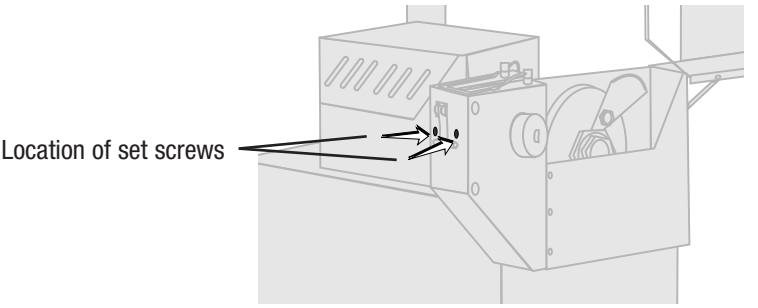
1 **Rotate the cutter head** until the blade is positioned in the gap between where the bushings go.

2 **Slide the downstream bushing into position**, positioning it up to and barely touching the blade (using a feeler gauge).

NOTE: The blade should not be deflected when positioning the bushings.



3 **Tighten the set screw** against the flat side of the bushing to hold the bushing in position.



4 **Slide the upstream bushing into position,** positioning it up to but not touching the blade (using feeler gauge).

5 **Tighten the set screw** against the flat side of the bushing to hold the bushing in position.

6 **Rotate the cutter head by hand** to make sure the bushings did not move, and the blade still passes through the gap between the bushings.

Preparing for Testing

1. **Make sure all components** are installed according to assembly drawings. Make sure that all bolts on the cutter have been tightened.

2. **Verify that the cutter is firmly locked** into position with the anchoring screws.

3. **Verify that all wiring conforms to electrical codes,** and all wiring covers are in place.

Testing the Installation

1. **Plug in the main power cord and turn on the main disconnect.** The display should fully illuminate and bootup. The power light should illuminate.

2. **Check that the E-Stop button is in the out, extended position.**

✎ **NOTE:** If the E-Stop button is pushed in, there will be no power applied to the cutting mechanism and the control will display "Faulted" until the E-Stop is returned to the out position.

3. **Make sure that the cutter guard is in place,** and that all bushings are in place. If there are no faults, the cutter head will automatically make one revolution until it finds the home position.

✎ **NOTE:** If homing continues more than one revolution, adjusting the sensor may be necessary. This machine is programmed to home one time upon power up.

4. **Open the knife guard,** the machine should fault until the guard is closed.

5. **You may press the "Manual Cut" button** to observe the knife rotation.

If the cutter is not working properly at any time, turn it off immediately and refer to the Troubleshooting section of this User Guide.

If you do not encounter any problems, proceed to the Operation section.

SECTION
4

Operation

Before Starting

Before you start daily operation of the servo cutter, you need to perform preventative maintenance. Necessary maintenance is described in the Maintenance section. *See Preventative Maintenance of this User Guide.*

> ⚠ **WARNING: Electrical hazard**
> Be sure that power to the servo cutter is OFF when doing any maintenance on the servo cutter. Follow all safety rules when performing any maintenance on this equipment.

Daily maintenance includes:

- Inspecting the cutter blades
- Inspecting the blade mounting hardware
- Making sure the cutter bushings are properly secured
- Inspecting the closure latch on the knife guard
- Checking cutter alignment with extrusion line
- Performing any floor lock adjustments as needed

These items and weekly, monthly, and semi-annual maintenance procedures are detailed in the Preventive Maintenance Schedule of the Maintenance section of this User Guide. *See Preventative Maintenance Schedule of this User Guide.*

Powering Up

1 **Plug in the power cord** to restore power after any required maintenance.

2 **Turn on the main power.** The cutter control will bootup. If there are no faults, the cutter head will automatically make one revolution until it finds the home position.

3 **Make sure the E-Stop button is in the out, extended position.**

4 **Make sure that the cutter guard is in place,** and that all bushings are in place.

5 **Press the E-Stop Reset button.** The safety circuits should reset and cutter will automatically home.

✎ **NOTE:** If "Home Runtime Failed" message is displayed. Check for malfunctions or misadjusted sensor.

If the cutter is not working properly at any time, turn it off immediately. *See the Troubleshooting section of this User Guide.*

If you do not encounter any problems, proceed to the Operation section.

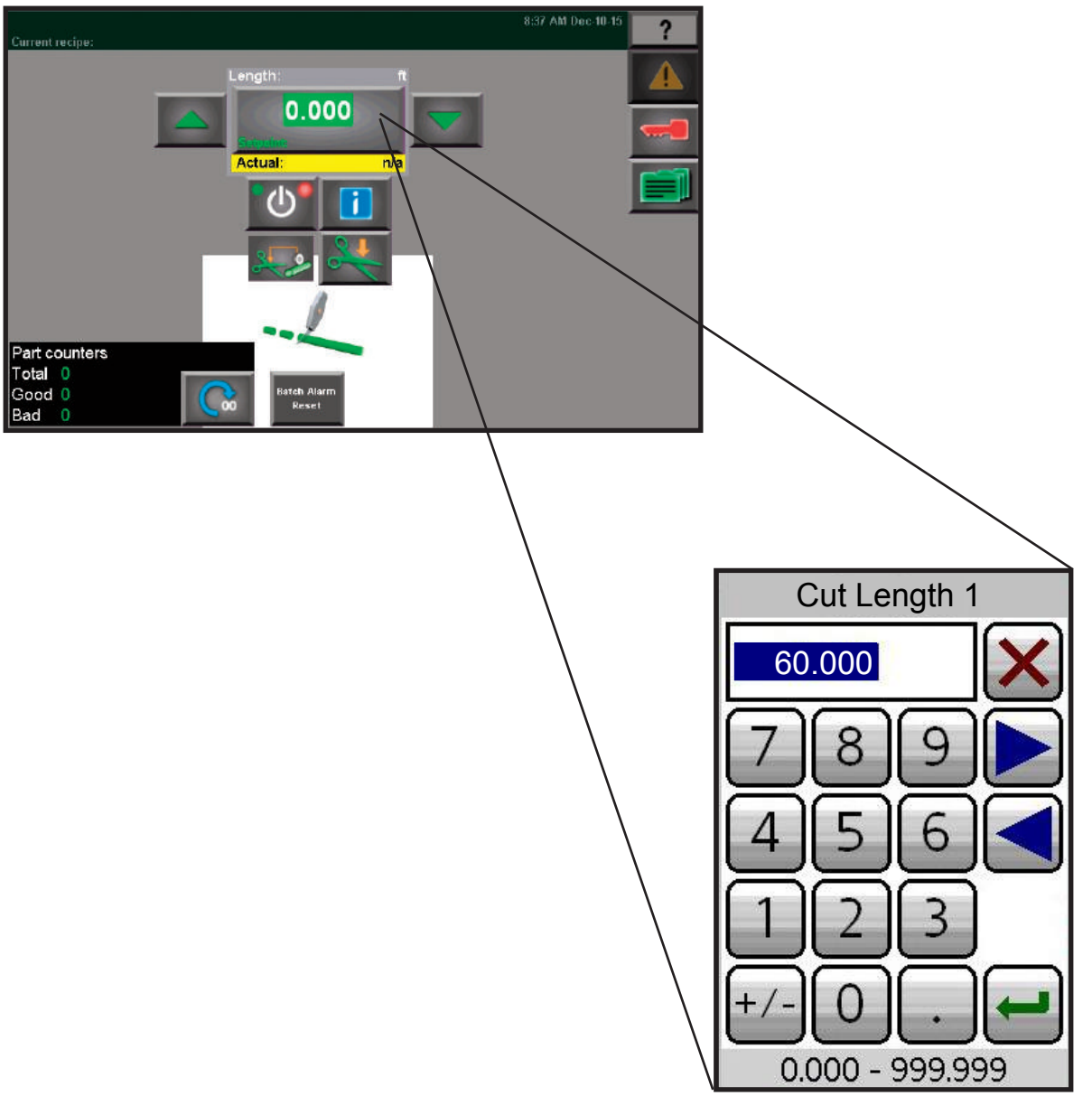
Power Up Sequence
At power up, a splash screen will briefly appear. If there are no communications problems, the Conair Servo Cutter program will begin to run.

CSC Cutter Splash Screen

This is the first screen to appear when turning the power on to the CSC Cutter.

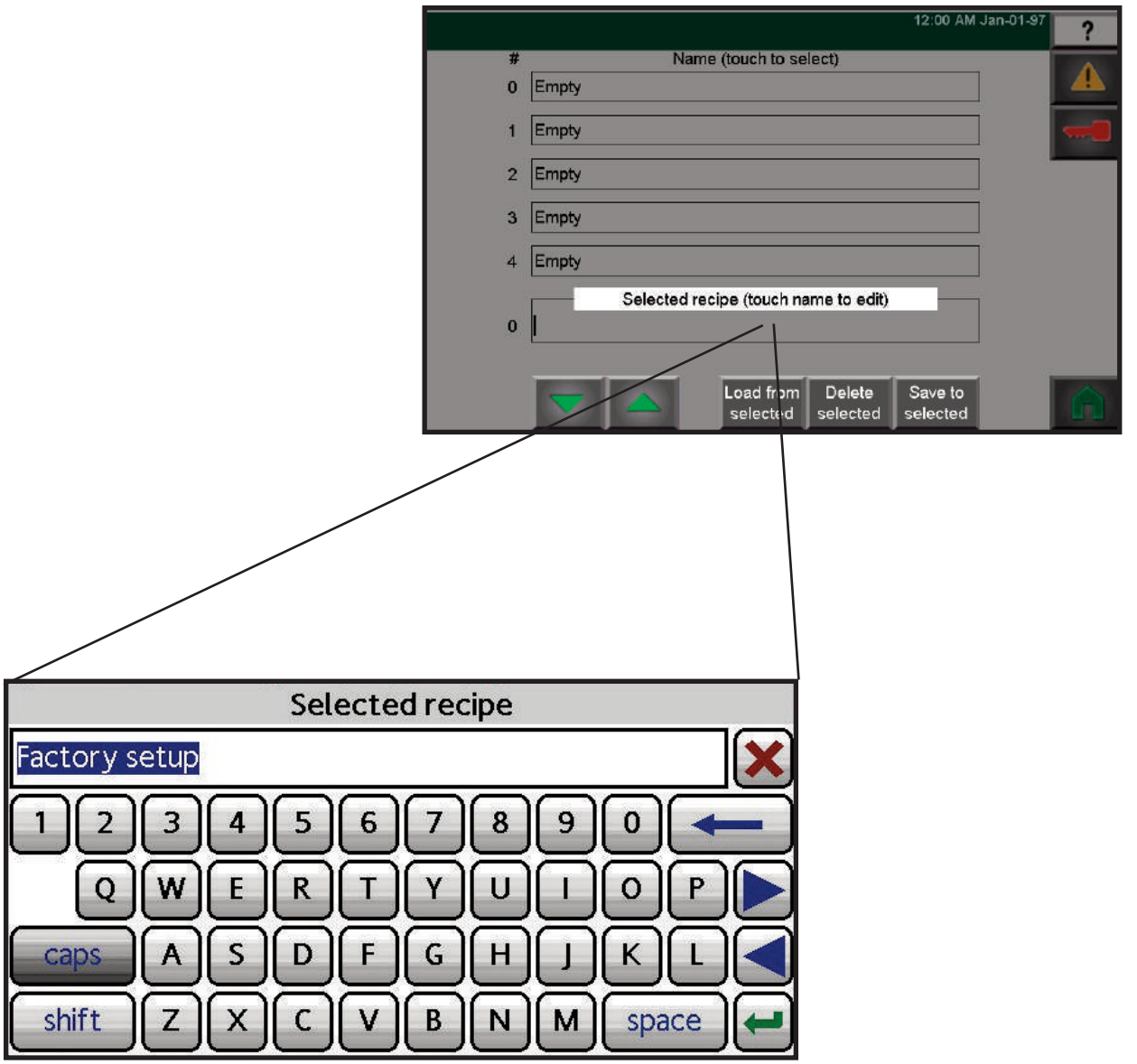
How to Navigate the Control Screens

Navigate through the CSC Control Screens by touching any black text which opens a screen or pop up window. The colored text is not selectable and represents current data being displayed.



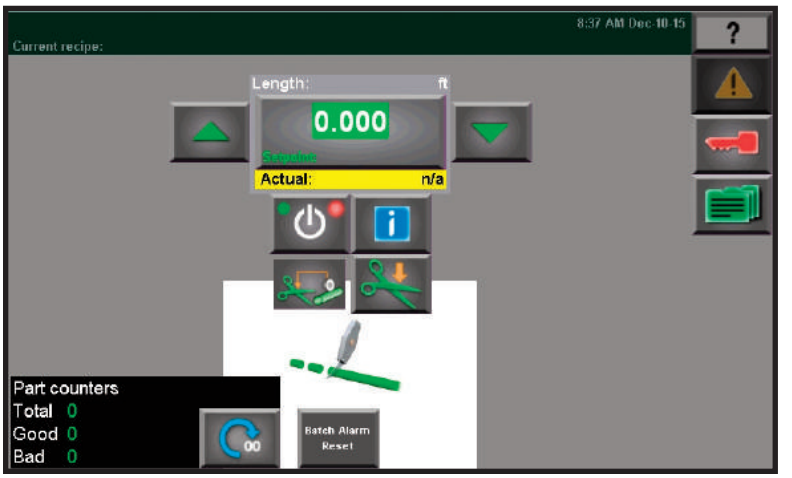
Example of Pop Up Number Pad

How to Navigate the Control Screens



Example of Pop Up Keypad

CSC Cutter Control Main Screen



The main page is displayed automatically upon power up after the system is done initializing. The main page is where most machine control functions are performed. From here the CSC Cutter can be started and stopped. Touch the start button to start the cutter. Touch the stop button to stop the cutter. The running indicator indicates current state of the cutter. This will display “Running” after touching the start button. After touching the stop button, this indicator will display “Stopping” while the cutter is decelerating to a stop. After the cutter has come to a complete stop it will display “Stopped”.

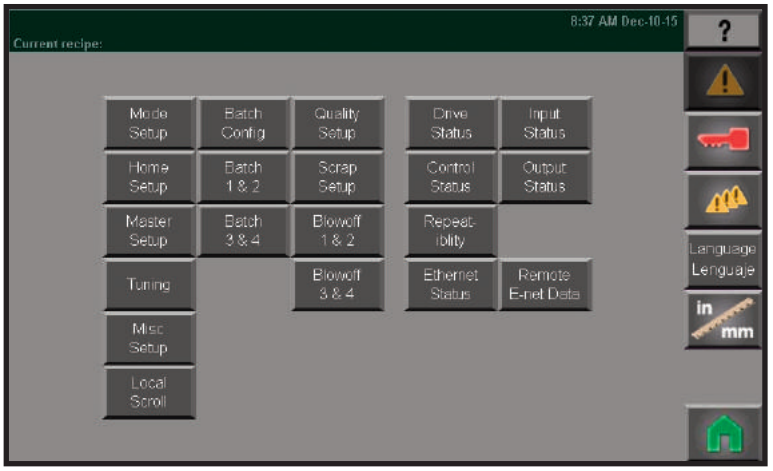
The cutter has five modes of operation. The currently selected mode is displayed directly above the running indicator. The cutter mode can only be changed when the cutter is stopped. To change the mode touch the current mode indicator. A popup window will appear allowing mode selection. The cutter is capable of two styles of cutting, “Demand” and “Continuous”. In demand the cut is triggered by one of three sources. The three sources of demand cutting are: “Encoder”, “Timer” and “End Sense”. In Continuous style of cutting, the flywheel runs at a constant speed. Depending on the cutter mode selection, the flywheel can be synchronized to the line speed. The flywheel will automatically adjust speed to maintain a constant cut length.

A manual cut button allows triggering a cut from the HMI. This is only active in the “Demand” style of cutting.

The cutter has a built in part counter. The part counter can be enabled/disabled, and turned on/off. To access this, touch the count value in the display.

Cutter flywheel speeds, accel/decel and blade count can be accessed from the main page. Touch the “Speeds” button in the cutter section.

CSC Cutter Control Menu Screen



The menu page is the root page for screen navigation. The buttons on the right column navigate as follows.

Main page: This will take you back to the main page.

Units Select page: This page allows you to set the units of measure to English or Metric.

Recipes page: This page allows access to the recipe storage system. The current setup of the machine running parameters can be save to a recipe file. The system allows storage of 100 recipes. The running parameters can be changed by loading a saved recipe file.

Security System page: This page allows access to the Security Settings.

About page: This page gives information about your CSC Control. The HMI touchscreen can be calibrated by this page. Selecting this page begins with the calibration procedure. The user is guided to touch various points on the screen to complete the procedure.

Alarms page: Displays current and previous alarms.

Language page: This page allows you to set the control language.

CSC Cutter Control Menu Screen (continued)

Cutter Batch 1 & 2 page: This page allows access to the cutter batch counters 1 & 2 parameters. Each batch counter has an associated cut length. If more than one batch counter is enabled, the cutter switches to the next batch counter enabled and switches the cut length. This allows cutting batches of different length products automatically. Each batch counter has a preset and warning preset parameter.

Cutter Batch 3 & 4 page: This page allows access to the cutter batch counters 3 & 4 parameters. Each batch counter has an associated cut length. If more than one batch counter is enabled, the cutter switches to the next batch counter enabled and switches the cut length. This allows cutting batches of different length products automatically. Each batch counter has a preset and warning preset parameter.

Cutter Batch Config page: This page allows access to the cutter batch configuration parameters. The cutter provides part batch counting and blowoff control. Up to four batches and four blowoff's are available. One batch counter is always enabled. The other three (3) can be enable/disabled from this page. Each batch counter can be assigned to any one blowoff.

Cutter Conveyor Setup page: This page allows access to the conveyor setup parameters. The cutter can control the speed of a conveyor by way of a 0 - 10 VDC analog signal. This page allows scaling of the analog signal to speed units.

Cutter Tuning page: This page allows access to the cutter servo tuning parameters. These parameters will affect how tightly the cutter servo controls the speed and position of the servo motor. These parameters are adjusted at the factory and generally do not need to be adjusted by the customer.

Cutter Master Setup page: This page allows access to the master encoder input scaling parameters. The cutter uses a quadrature encoder input signal to measure product length. These parameters scale encoder pulses to product length.

(Continued)

CSC Cutter Control Menu Screen (continued)

Cutter Home Setup page: This page allows access to the cutter flywheel homing parameters. When the cutter is first powered up a zero (home) position needs to be established for the flywheel. When the emergency stop circuit is reset and no faults exist, the cutter will automatically home. Cutters that have a gear reducer attached to the motor will use a proximity sensor as the home input. Cutters that do not have a gear reducer will use the motor encoder marker pulse as the home input. When the homing procedure begins the flywheel will turn at a slow speed until the home sensor is detected. After finding the home sensor the flywheel will move an "offset" distance and stop. This offset distance from the home sensor is the zero, or park position of the flywheel. The cutter remembers this zero position until powered down.

Repeatability page: This screen is used for diagnostic purpose to determine the repeatability and accuracy of the cutting process.

Cutter Control Status page: This page allows access to the cutter servo control module status. The current status of each control program is displayed as "running" or "stopped." The information displayed on this page is used to help troubleshoot problems encountered with the cutter.

Cutter Drive Status page: This page allows access to the cutter servo drive module status. The status of various drive conditions and power for the cutter are shown. The information displayed on this page is used to help troubleshoot problems encountered with the cutter.

Cutter Input Status page: This page allows access to the cutter servo control digital input status. The information displayed on this page is used to help troubleshoot problems encountered with the cutter.

Cutter Output Status page: This page allows access to the cutter servo control digital output status.The boxes will change to "on" when the output is triggered. Some changes will occur quickly when switching between "off" and "on." The information displayed on this page is used to help troubleshoot problems encountered with the cutter.

CSC Cutter Control Menu Screen (continued)

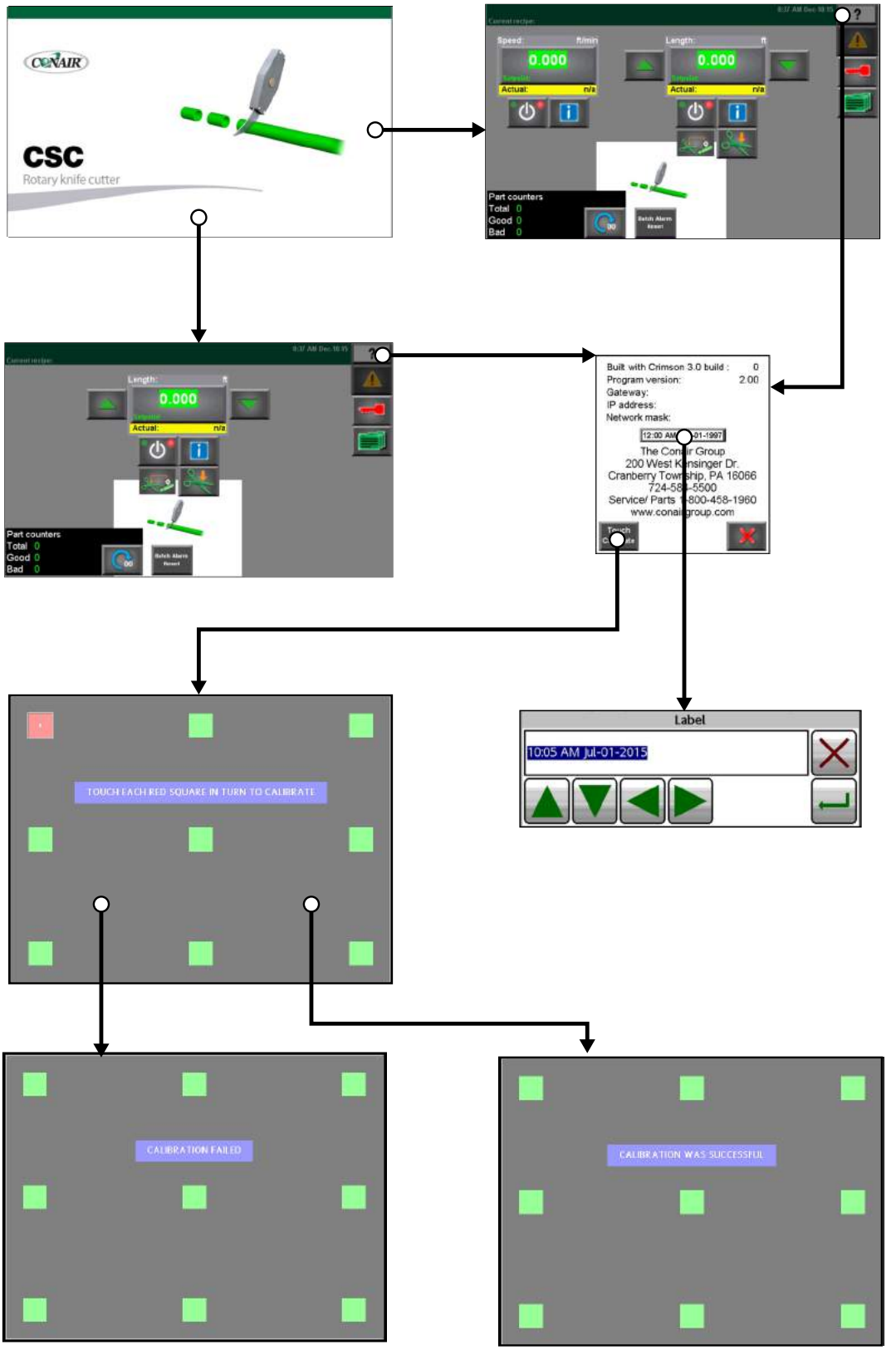
Cutter Blowoff 1 & 2 page: This page allows access to the blowoff 1 & 2 parameters. The blowoff outputs can operate in either "on demand" or "continuous" mode. "On demand" mode is active whenever the cutter is in either "Encoder", "Timer" or "End Sense" mode. "Continuous" mode is active whenever the cutter is in "Flywheel" or "Follower" mode. The blowoff's work in conjunction with the quality input. This allows good and bad product to be separated at the take away conveyor.

Cutter Quality Setup page: This page allows access to the quality input setup parameters. The quality input is a "dry contact" input from a customer supplied gauge. This input tells the cutter whether good or bad product is passing through the cutter. This input works in conjunction with the blowoffs for product separation at the conveyor. A quality mode can be set that tells the cutter that all product is "good", "bad" or "gauge". "Gauge" mode tells the cutter that the product state comes from the quality input.

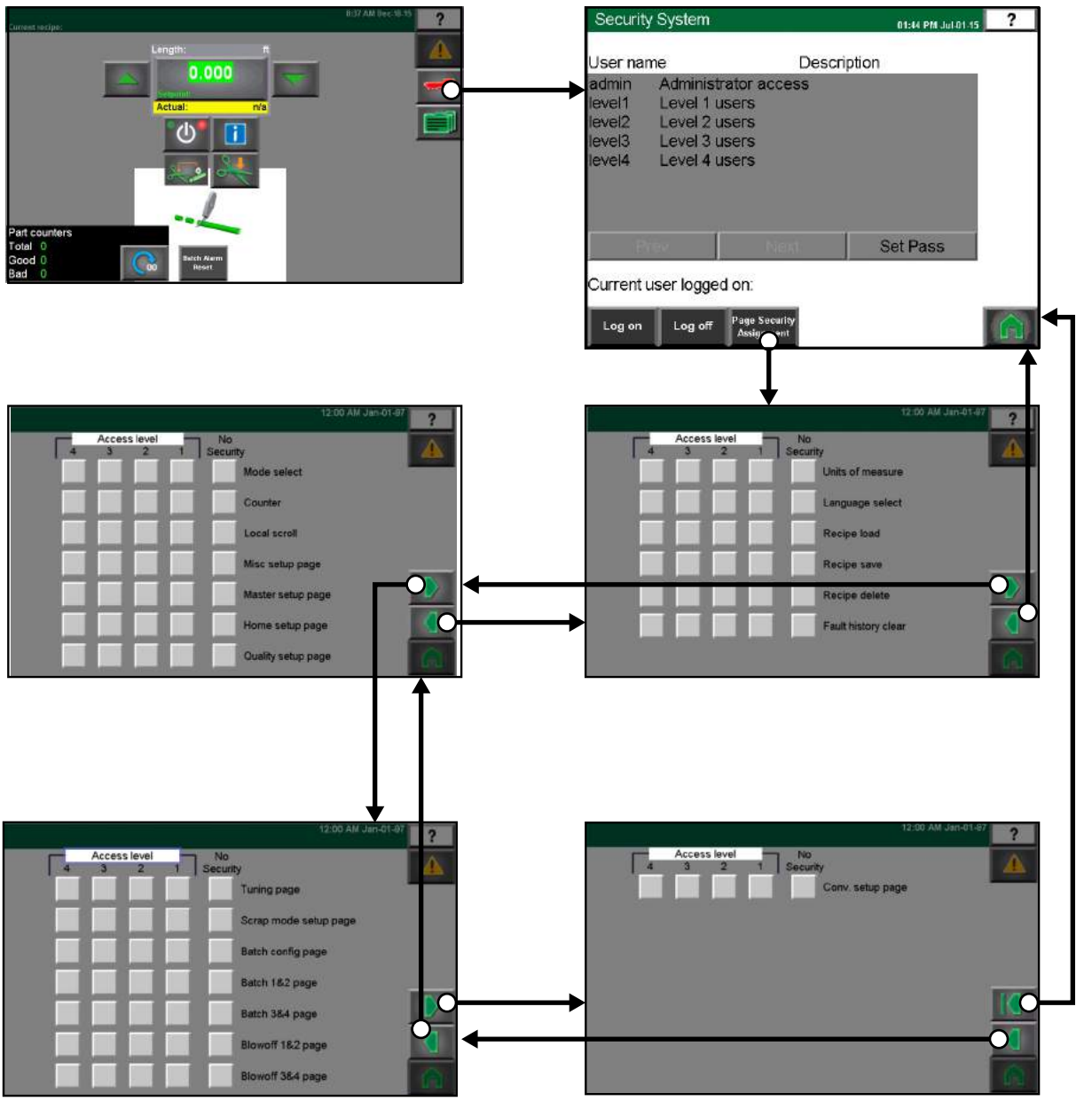
Cutter Blowoff 3 & 4 page: This page allows access to the blowoff 3 & 4 parameters. The blowoff outputs can operate in either "on demand" or "continuous" mode. "On demand" mode is active whenever the cutter is in either "Encoder", "Timer" or "End Sense" mode. "Continuous" mode is active whenever the cutter is in "Flywheel" or "Follower" mode. The blowoff's work in conjunction with the quality input. This allows good and bad product to be separated at the take away conveyor.

Scrap Mode Setup page: This page allows access to the scrap mode setup parameters. Scrap mode works in conjunction with the quality input. Scrap mode allows the cutter to make bad (scrap) product a different length than good product. The cutter can be configured to stop cutting or to cut a scrap length. Scrap mode can be turned on or off.

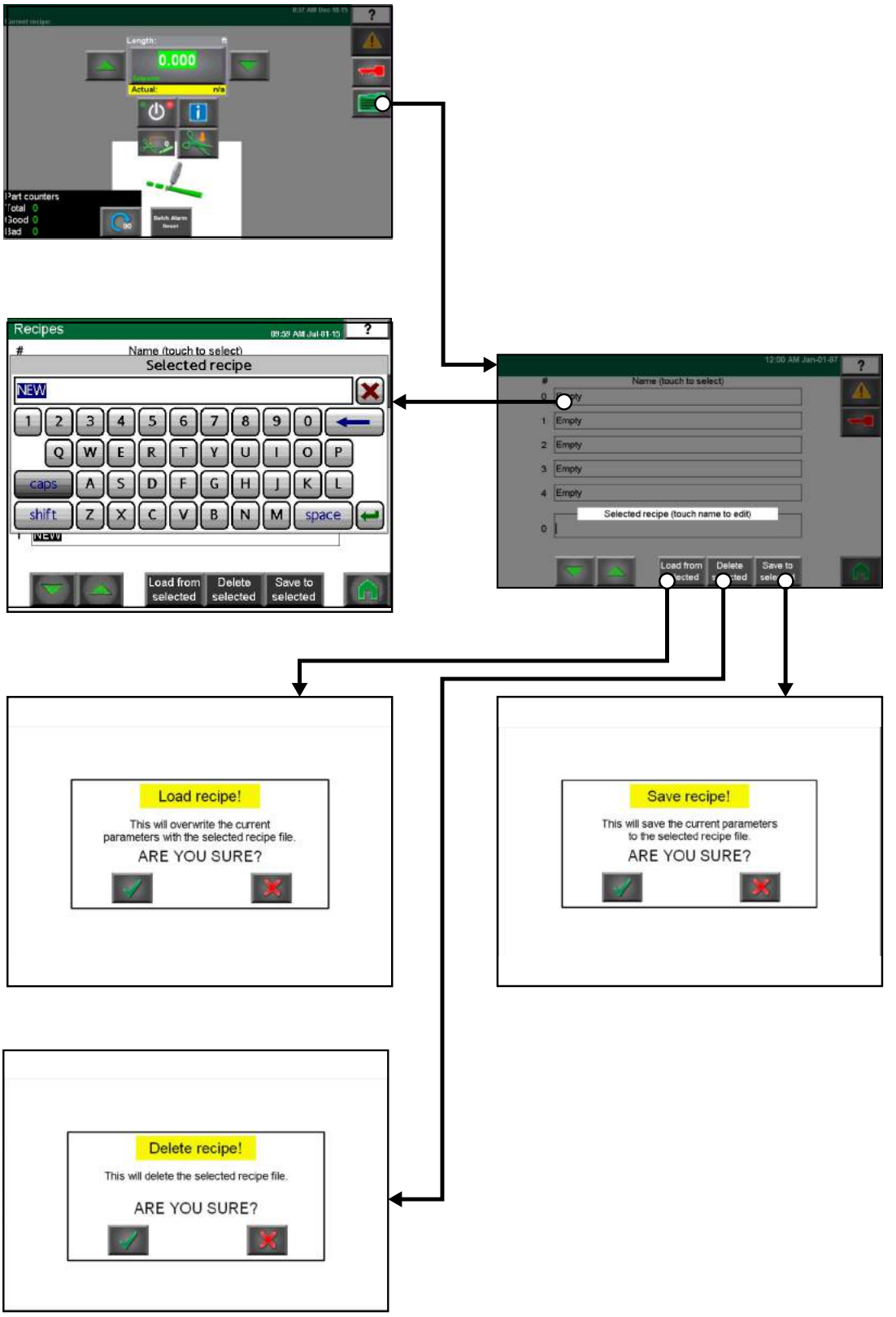
Control Function Flow Charts



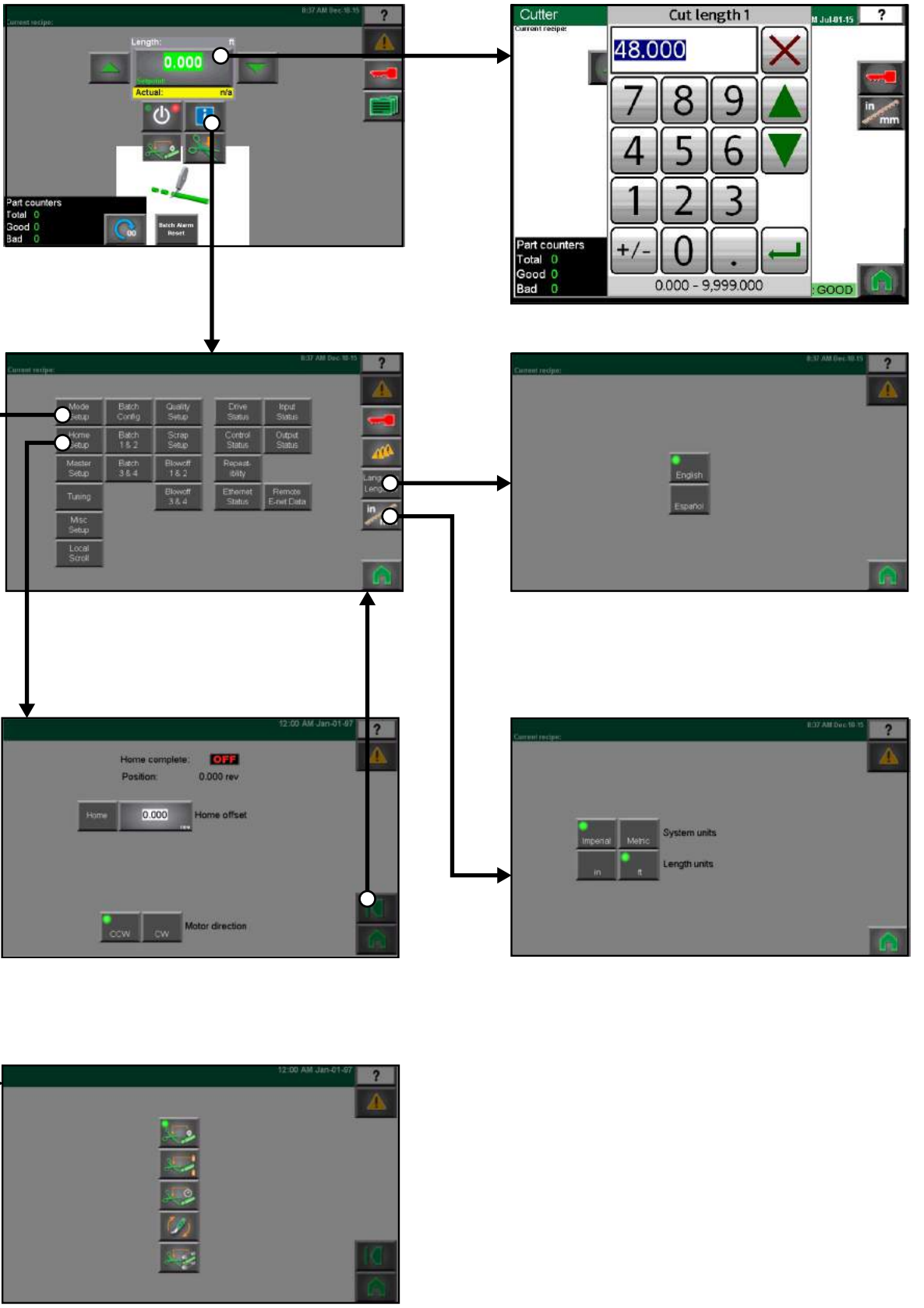
Control Function Flow Charts



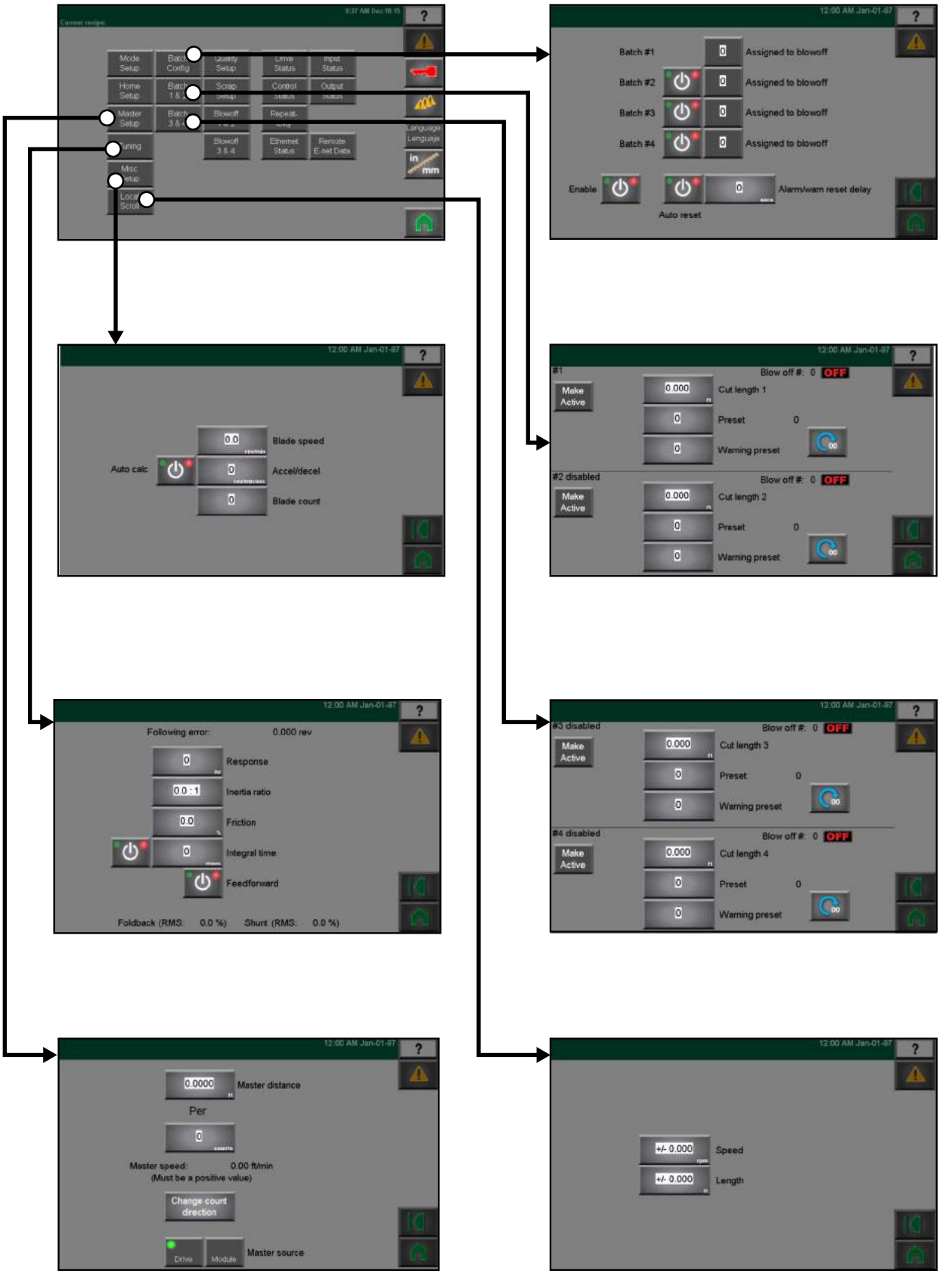
Control Function Flow Charts



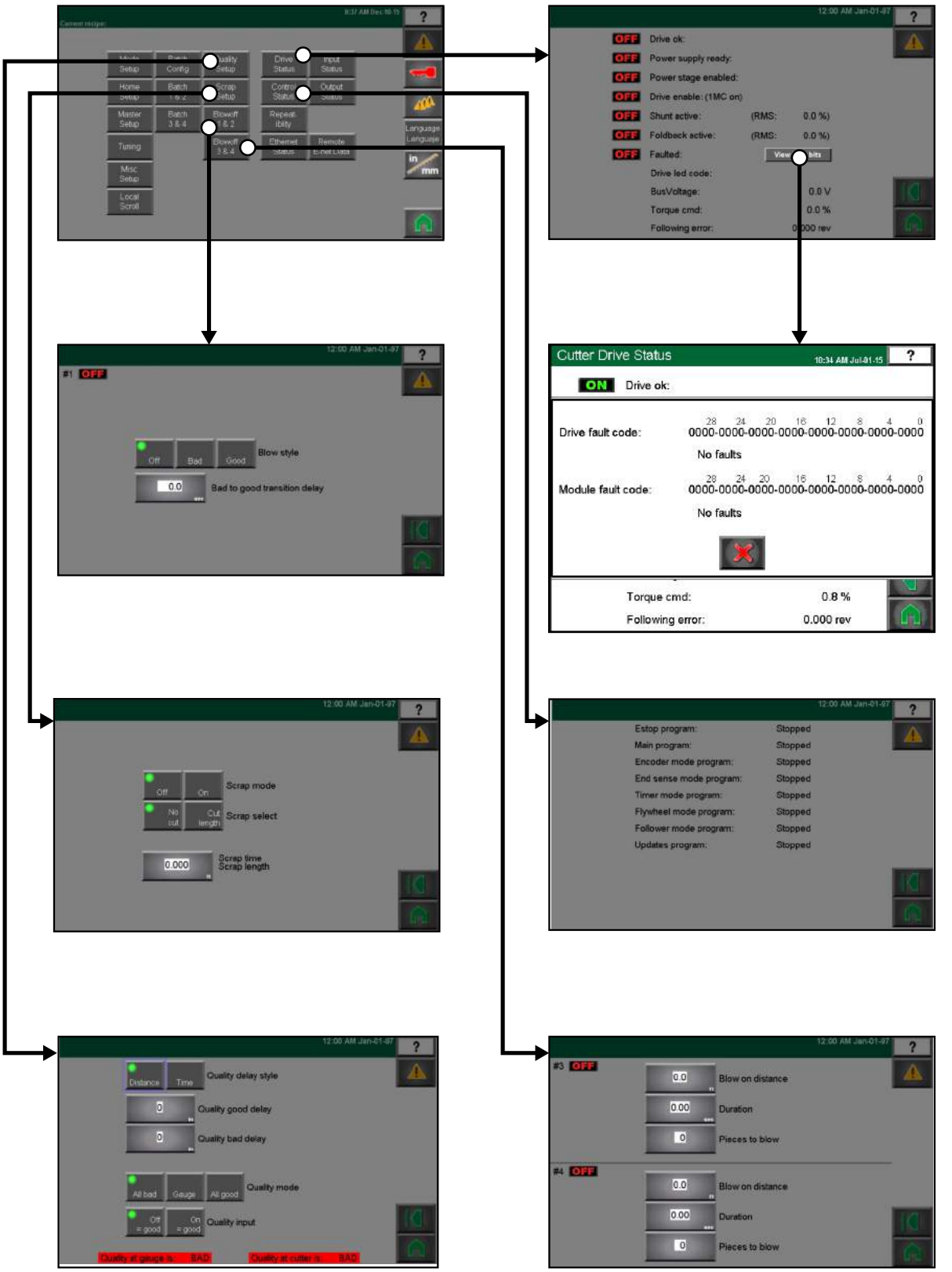
Control Function Flow Charts



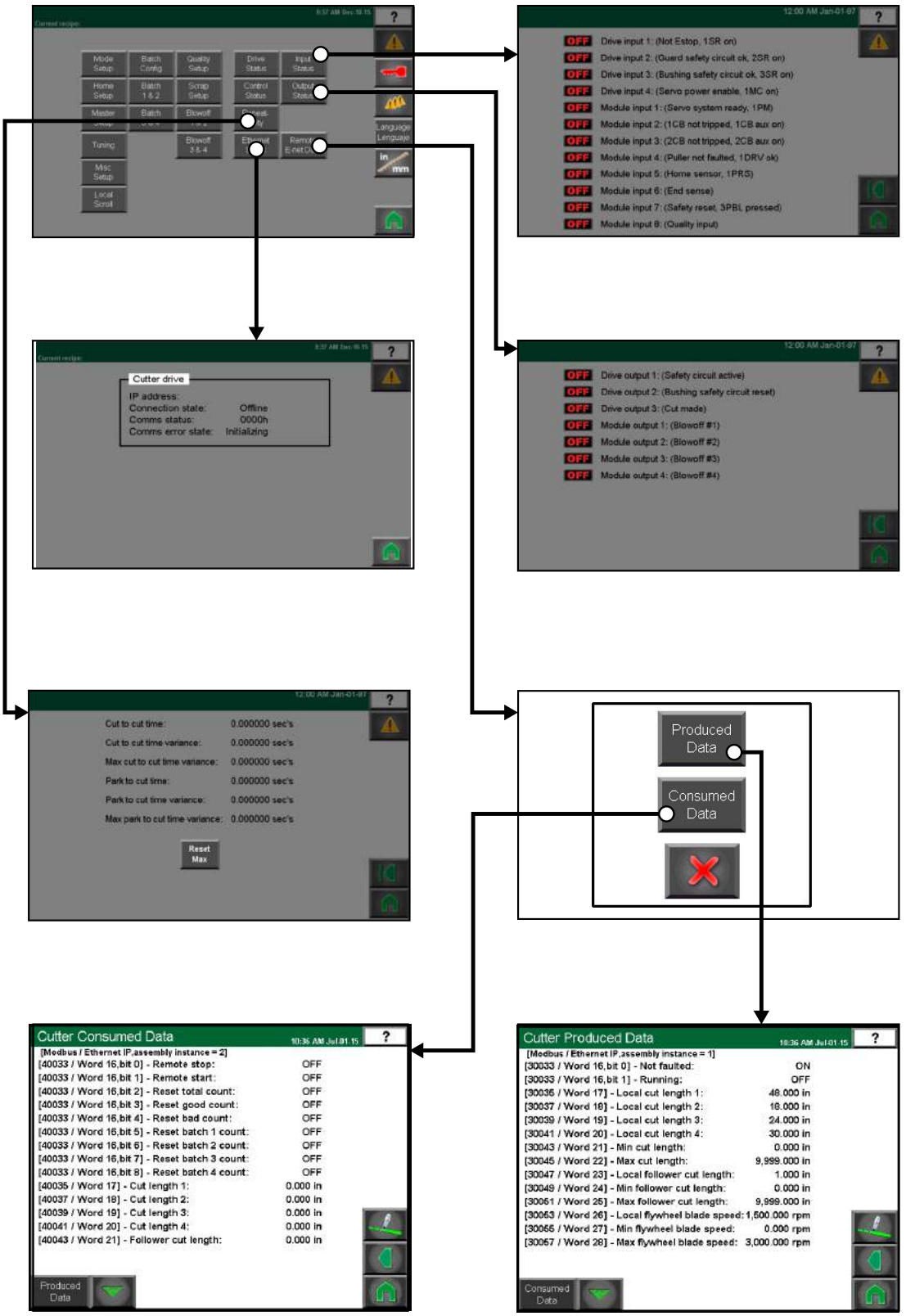
Control Function Flow Charts



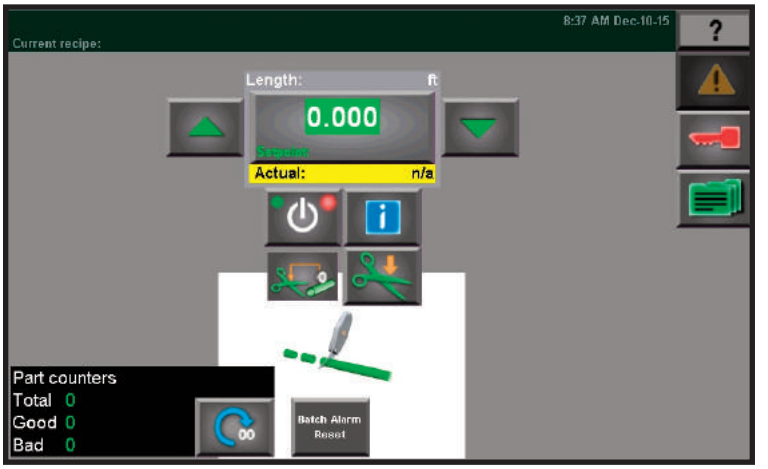
Control Function Flow Charts



Control Function Flow Charts



Control Function Descriptions

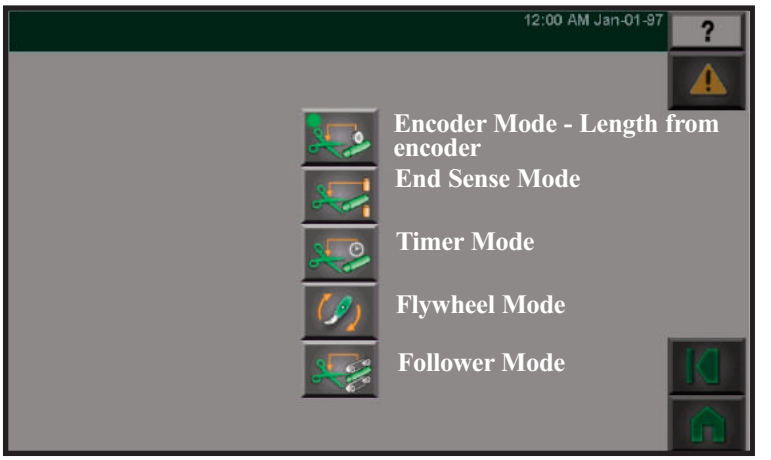


Main Page

The main page is displayed automatically upon power up after the system is done initializing. The main page is where most machine control functions are performed.

- Mode- This square will open the mode selection screen for the cutter. Mode changes can occur only when the cutter is not running.
- Part Counter- Pushing this square will open the part counter screen. This screen shows the counting of good/bad parts and has an option to reset the count.
- Cutter Start/Stop- These buttons will start or stop the cutter.
- Cut Length- Pushing the cut length number will open a key pad that will allow the entry of a desired length. At the bottom of that keypad, you will see a set of two numbers. Those numbers are the range of cut lengths that can be entered at the current puller speed.
- Man Cut- Push this button to do a manual cut of the part. The cutter must still be "ON" to cut.
- Batch Warning- A box will illuminate when the end of a batch is near. The parameters for the batch settings are in the Batch configuration and setting screens.

Control Function Descriptions



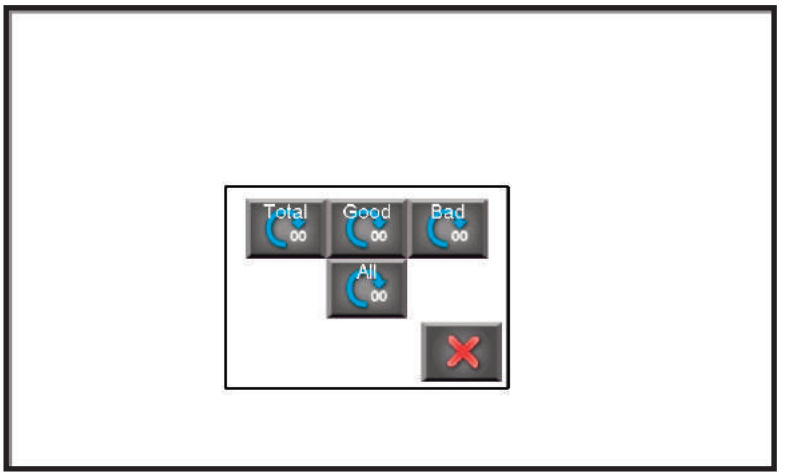
Cutter Modes Screen

This screen allows the changing of the cutter to the various modes.

- Encoder mode- a signal is obtained from the puller to control the cuts.
- Flywheel mode- the blade holder/flywheel will turn at a consistent RPM. The RPM will be entered on the main operating screen and can be changed to change the resulting cut length.
  This page shows the blade holder/flywheel will turn at a consistent RPM. The RPM will be entered on the main operating screen and can be changed to vary the resulting cut length.
  The acceptable range 0.000 - 750.000 is displayed at the bottom of the popup keypad window. Blade speed may need adjusted depending on your application (product density/hardness).
- End Sense mode- this mode uses a proximity switch, mechanical switch, or some type of sensing device that triggers the cut. This page uses a proximity switch, mechanical switch, or some type of sensing device that triggers the cut.
  Delay time that must expire after a cut is made before end sense device can trigger another cut.
- Follower mode- This mode is similar to flywheel mode, except that the operator will enter a desired length and the cutter program will do the calculations of how fast the blade holder/flywheel must turn to get the desired part length with current observed master belt speed. The program will constantly try to correct part length with any motor variations.
  This page is similar to flywheel mode, except that the operator will enter a desired length and the cutter program will do the calculations of how fast the blade holder/flywheel must turn to get the desired part length with current observed master belt speed. The program will constantly try to correct part length with any motor variations.
  The acceptable range 0.000 - 999.999 is displayed at the bottom of the popup keypad window.
- Timer mode- this mode will allow the cutting to occur on a timed basis not a length basis.
  This mode will allow the cutting to occur on a timed basis not a length basis.
  This page will allow the cutting to occur on a timed basis rather than a lenth basis.

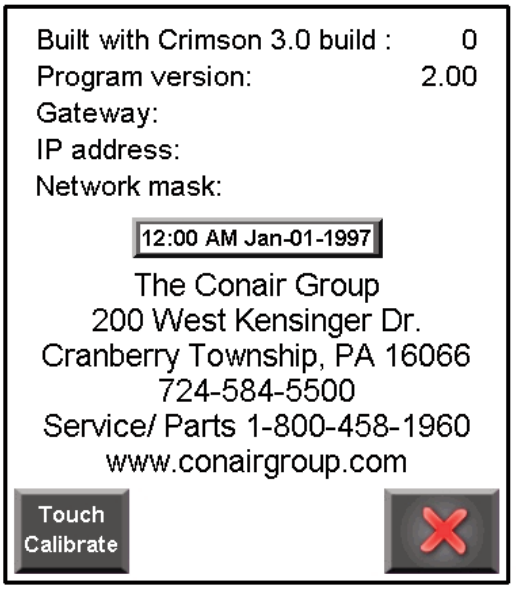
✎ **NOTE:** Notice that depending on the mode selected, the main screen varies slightly, allowing for quick changes of settings applicable to that mode.

Control Function Descriptions



Part Counter Screen

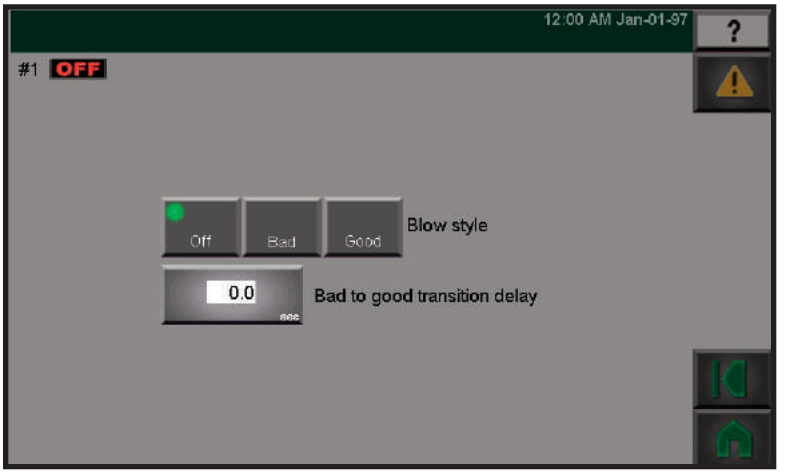
This screen will appear when the part counter box is pushed on the main operating screen. It will show the counted good and bad parts if a signal is being sent from a laser gauge system. The counter can be turned on/off here. The part count can also be reset from here. Pushing the close button will take you back to the main operating screen.



Date and Time Page

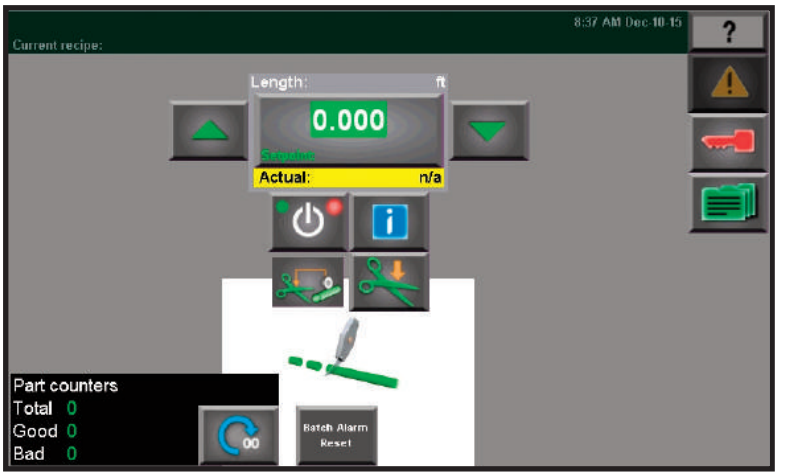
This page displays a pop up screen with the current date and time.

Control Function Descriptions



Main Parts Counter

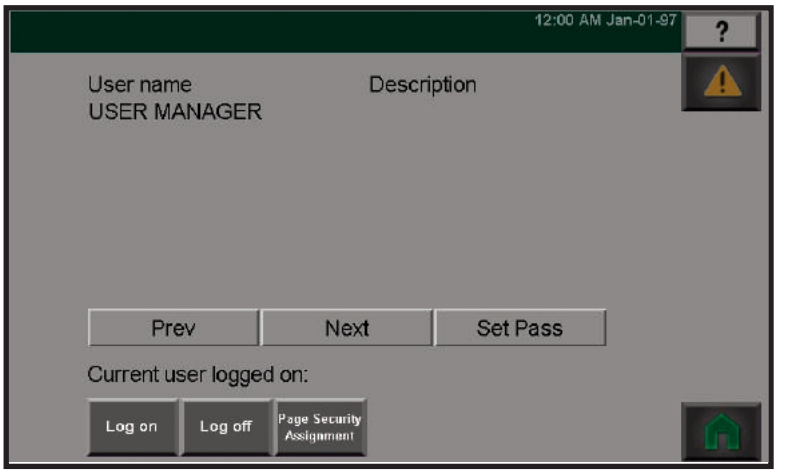
This screen will appear when the part counter box is pushed on the main operating screen. It will show the counted good and bad parts if a signal is being sent from a laser gauge system. The counter can be turned on/off here. The part count can also be reset from here. Pushing the close button will take you back to the main operating screen.



Main Cut Length

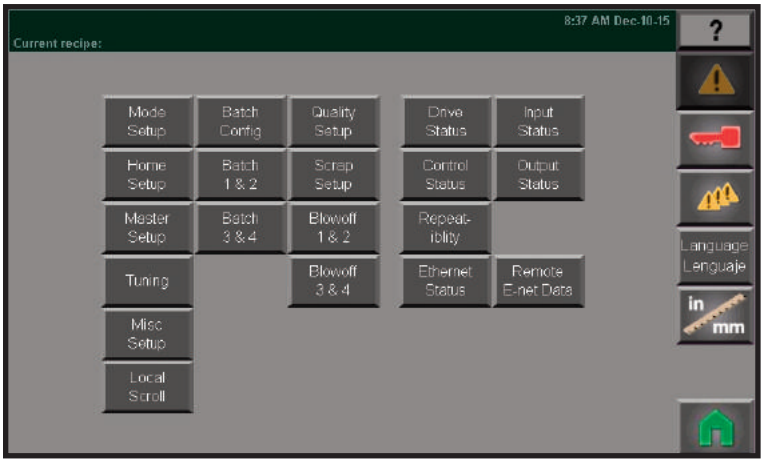
The cut length number will open a keypad that will allow the entry of a desired length. At the bottom of the keypad, there will be a set of 2 numbers. Those numbers are the range of cut lengths that can be entered at the current puller speed.

Control Function Descriptions



Security System

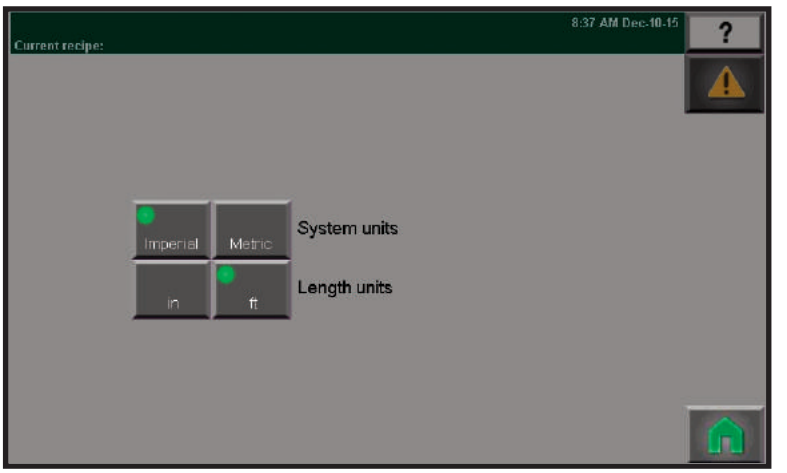
Upon pushing the System Security box, this page will appear. The User can log into or out of the system. There are five different User choices. Each User ID can be set up with specific passwords to create different levels of permission to access the programs pages. Setting the accessability of each User to the various pages can be done by pushing the Page Security Assignment.



Menu

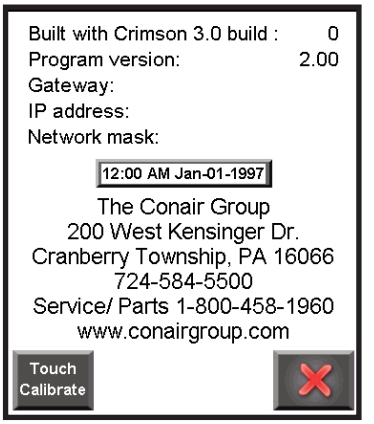
This is the general menu screen. This screen is displayed when the menu button is pushed at the lower left corner of the HMI or on the top left corner of the Main Control screen. This gives you access to all of the setup and settings screens.

Control Function Descriptions



Units Select

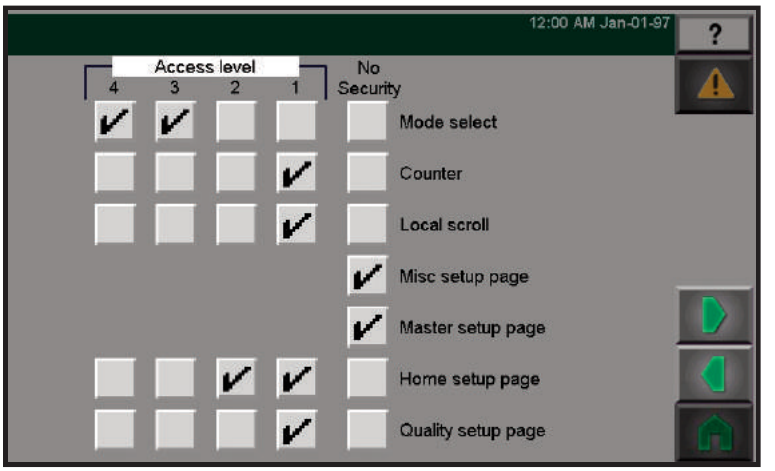
This screen is where the units can be selected between standard units and metric units. Selecting “inches” sets length units to inches and speed units to feet/min, (FPM). Selecting “centimeters” sets length units to centimeters and speed units to meter/min, (MPM).



About

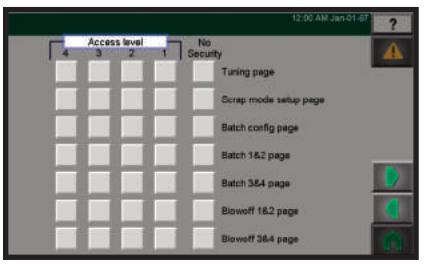
The About page gives Conair contact information if something is needed for service/parts of the equipment. At the top of this screen is the software information the program was written from. This screen displays the software usage, Conair contact information, and allows for Touch Screen Calibration.

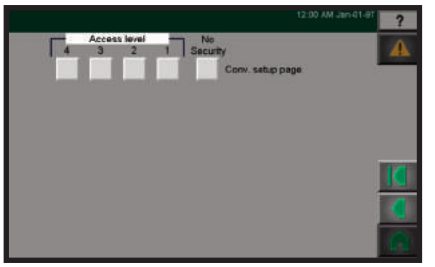
Control Function Descriptions



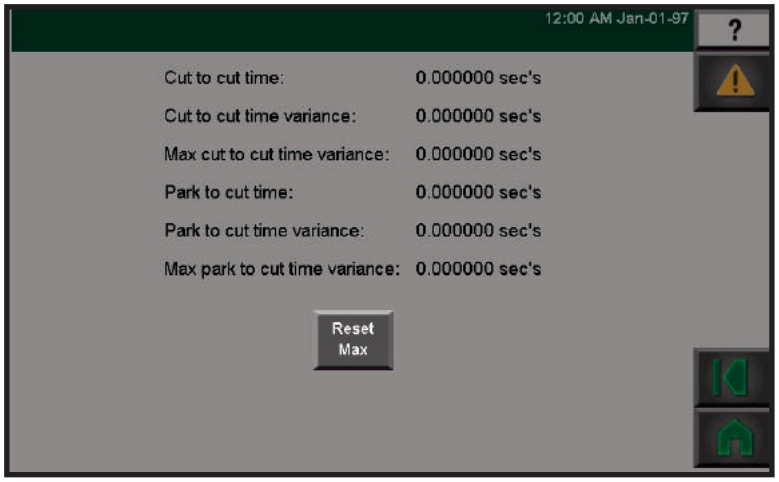
Cutter Security Assignment #1

Upon pushing the Page Security Assignment box, a screen like this, and the several screen that follow, will appear. Initially the check mark is in the No Security box of each page. By touching the check mark, it will uncheck the current box and open four additional boxes next to the existing one. Permission to access a page can be given to each user. Check/touch the box below the user to grant permission for that user to access the specific page, listed on the left side. This is where different levels of permission can be created by allowing limited access to some users and full access to others. There are security setup screens for multiple screens of the cutter here.



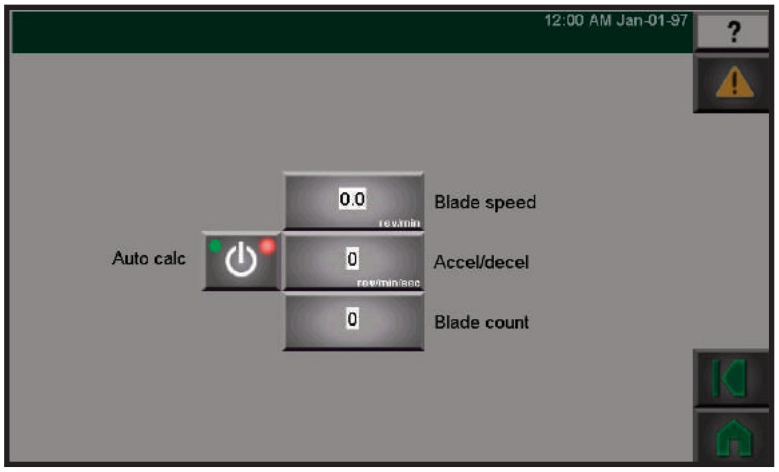


Control Function Descriptions



Repeatability

This screen is used for diagnostic purposes. It is used to determine the repeatability and sub-subsequently the accuracy of the cutting process.



Main Speeds

This screen will appear when the Misc Setup button is pushed from the menu screen.

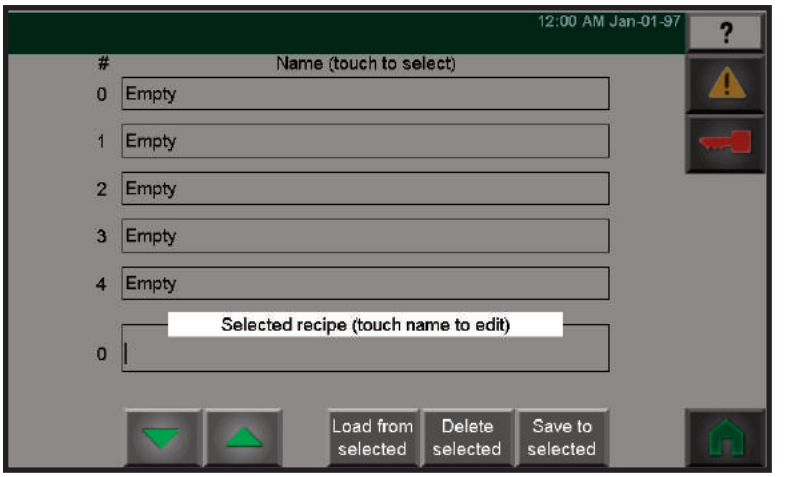
- Blade speed- the number in this box will be in RPM for when the cutter is in Encoder, End Sense, or Timed mode. It will be in CPM when the cutter is in Follower or Flywheel mode. This determines how fast the blade will rotate when cutting.
- Accel/Decel- this is how fast the blade will ramp up or down when it is in flywheel or follower mode.
- Blade count- this is where the number of blades being used is entered.
- Conveyor speed- this is where the speed of the conveyor is entered when it is being controlled by an analog output of the cutter.

Control Function Descriptions

Main Speeds Blade Speed Popup
The acceptable range 0.0 - 750.0 is displayed at the bottom of the popup keypad window for current setttings.

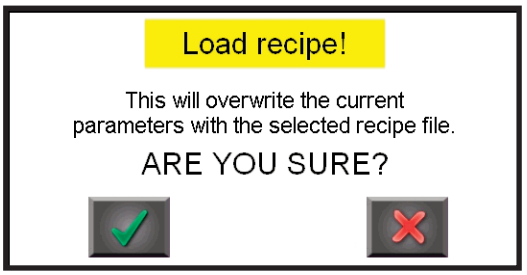
Main Speeds Accel/Decel Popup
This is how fast the blade will ramp up or down when it is in Flywheel or Follower mode. The acceptable range 0 - 14090 is displayed at the bottom of the popup keypad window for current setttings.

Main Speeds Conveyor Speed
This is where the speed of the conveyor is entered when it is being controlled by an analog output of the cutter. The acceptable range 0.00 - 500.00 is displayed at the bottom of the popup keypad window for current setttings.



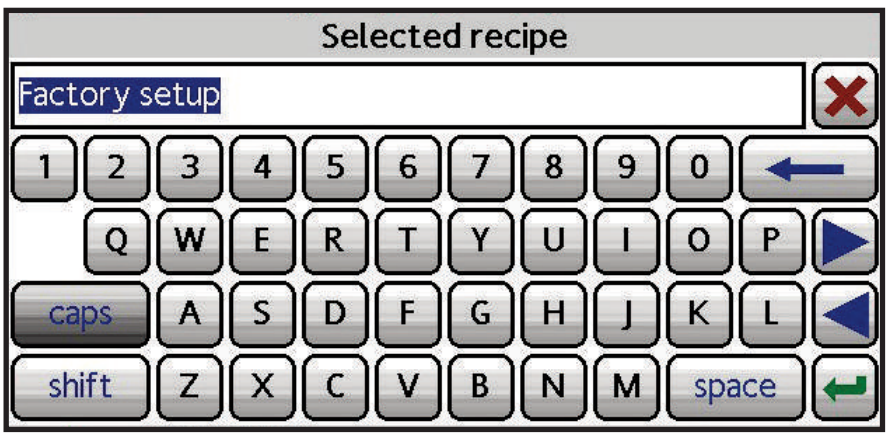
Recipes
The recipe page allows access to the recipe storage/retrieval system. Up to 100 recipe files are available and are numbered 1 thru 100. Each recipe file can be given a name up to 40 characters. Five recipe file numbers/names are displayed at once. To view other recipe file names touch the “Pg Up” or “Pg Dn” buttons. The recipe files are scrolled five at a time. Recipes can only be loaded when the macnine is in the stopped condition.

Control Function Descriptions



Recipe Load from Selected

The “Load from selected” function is only available when the cutter is stopped. This function will load the parameters from the recipe file into the active parameters.



Renaming Recipe

Touching the selected recipe name will allow you to change the name using the pop up key pad.

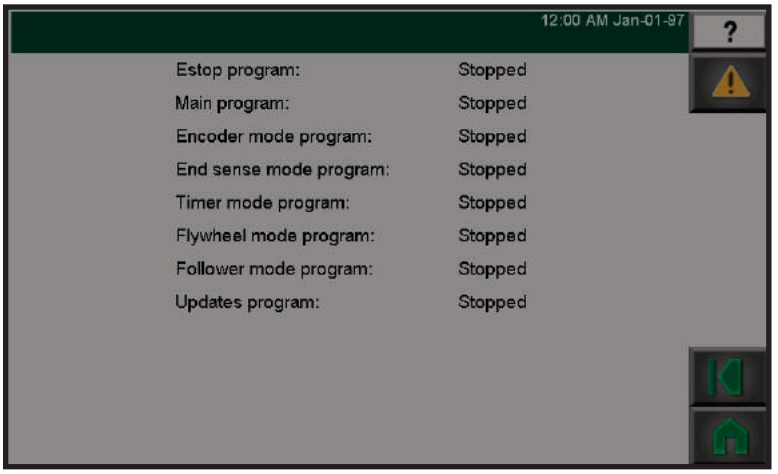
Recipe Save to Selected

Individual recipes can be saved on this screen. Up to 99 different recipes can be saved. A saved recipe will collect all set points of the current conditions of the puller and cutter when it is saved. Recipes can be saved at any time. Recipes can only be loaded when the machine is in the stopped condition. This function will save the active parameters to the selected recipe file.

Control Function Descriptions

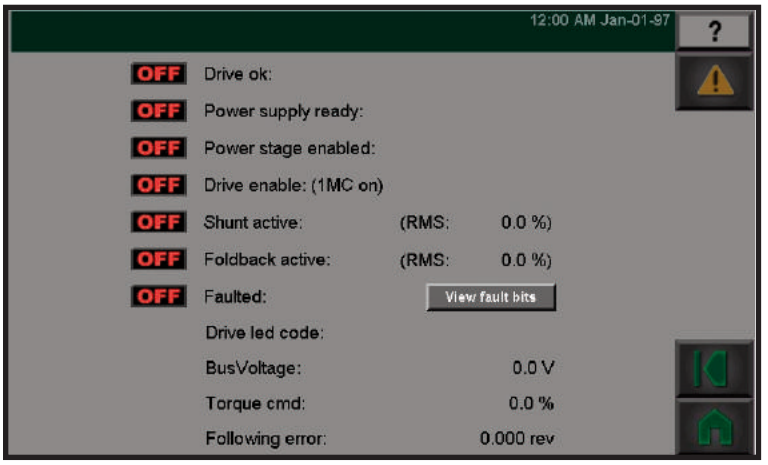
Recipe Delete Selected

The “Delete selected” function is available anytime. This function will set the name of the selected recipe file to “Empty”. The actual parameter values in the recipe file are not deleted.



Control Status

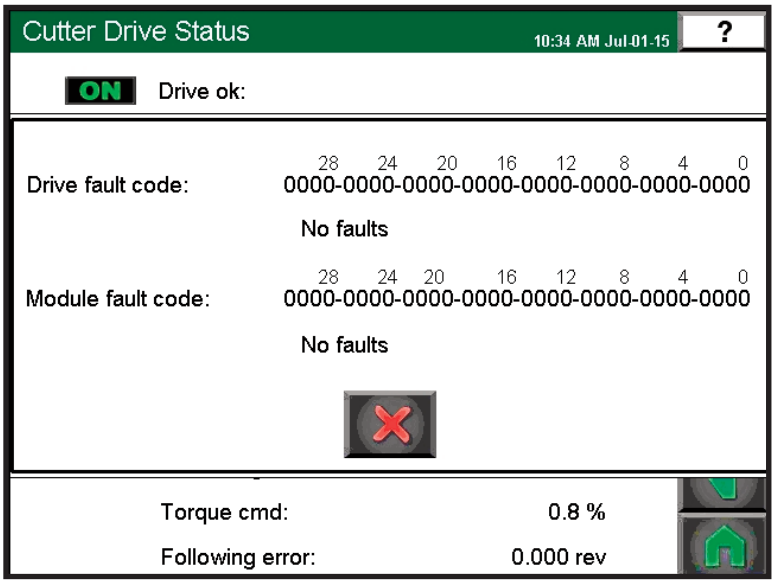
This screen is used for diagnostic purposes. The current status of each control program can be observed whether it is running or stopped.



Drive Status

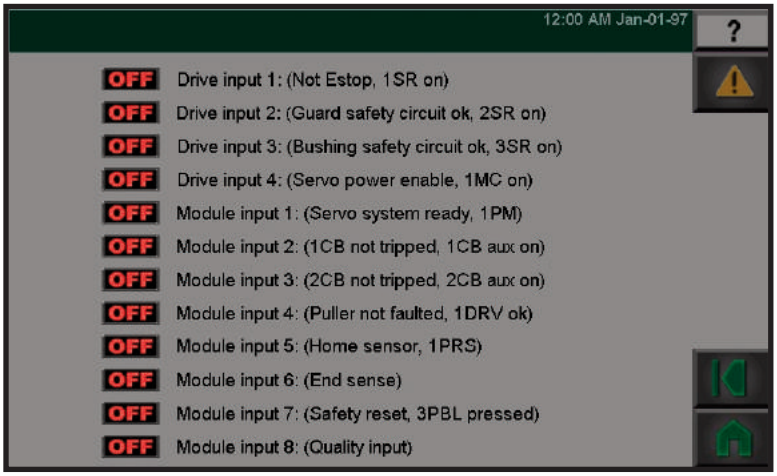
This screen is for diagnostic purposes. It shows the status of the various drive conditions and powers for the cutter. The information displayed on this page would be used to help troubleshoot problems encountered with the cutter.

Control Function Descriptions



Drive Status - View Fault Bits

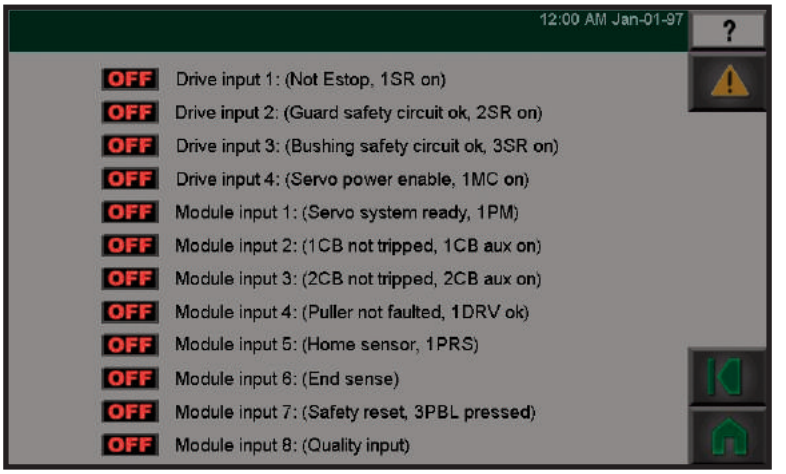
This screen is used for Troubleshooting purposes only.



Input Status

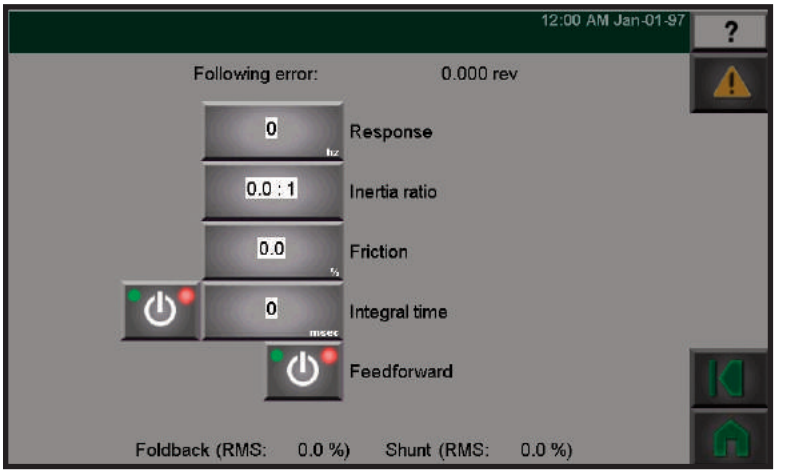
This screen is used for diagnostic purposes. It shows the status of the various inputs going to the cutter circuit. The information displayed on this page would be used to help troubleshoot problems encountered with the cutter.

Control Function Descriptions



Output Status

This screen is used for diagnostic purposes. This shows the status of the cutter outputs. The boxes will go to ON when that output signal is triggered. Some of the output changes will occur quickly when they switch from OFF to ON and back.

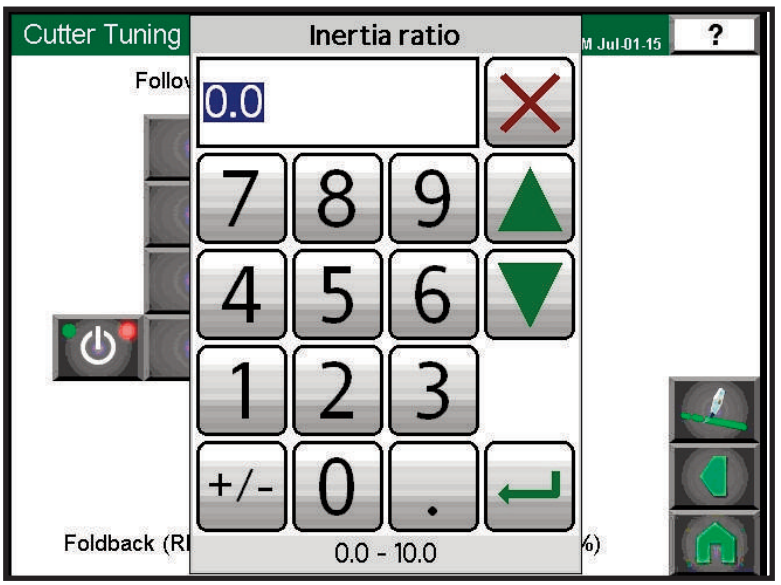


Tuning

This screen is used for the tuning of the cutter motor. The numbers are pre-entered by the factory for the existing set-up. Blade holder/flywheel changes may require some adjustment of these values in order to get the proper response from the servo. This page allows access to the cutter servo tuning parameters. These parameters will affect how tightly the cutter servo controls the speed and position of the servo motor. These parameters are set at the factory and generally do not need to be adjusted by the customer. Call Conair Customer Service for assistance if needed.

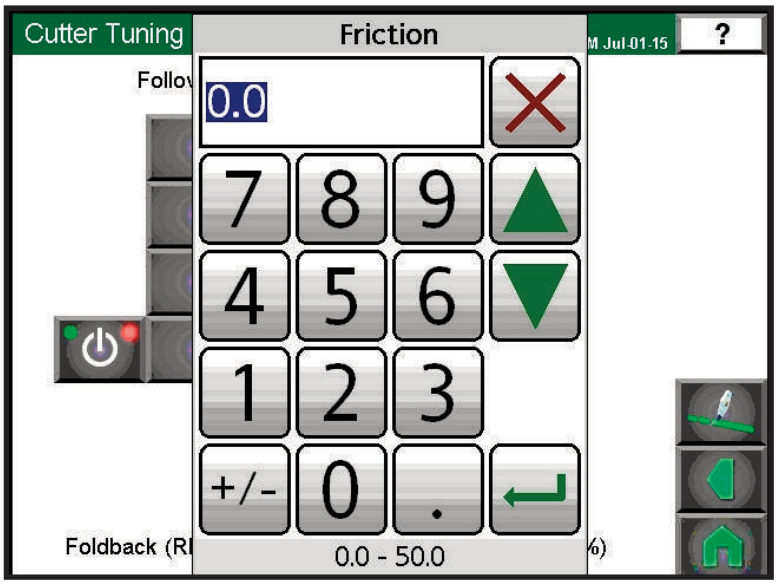
Contact Conair Customer Service 1 800 458 1960. From outside of the United States, call: 814 437 6861

Control Function Descriptions



Tuning Inertia Ratio Popup

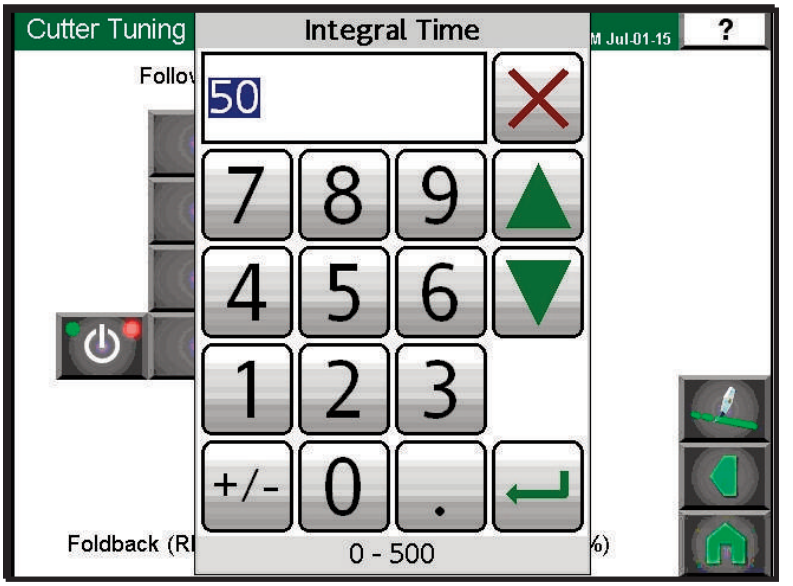
The inertia ratio specifies the load to motor inertia ratio and has a range of 0.0 - 10.0. If the exact inertia is unknown, a conservative approximate value should be used. If you enter an inertia value higher than the actual inertia, the resultant motor response will tend to be more oscillatory.



Tuning Friction Popup

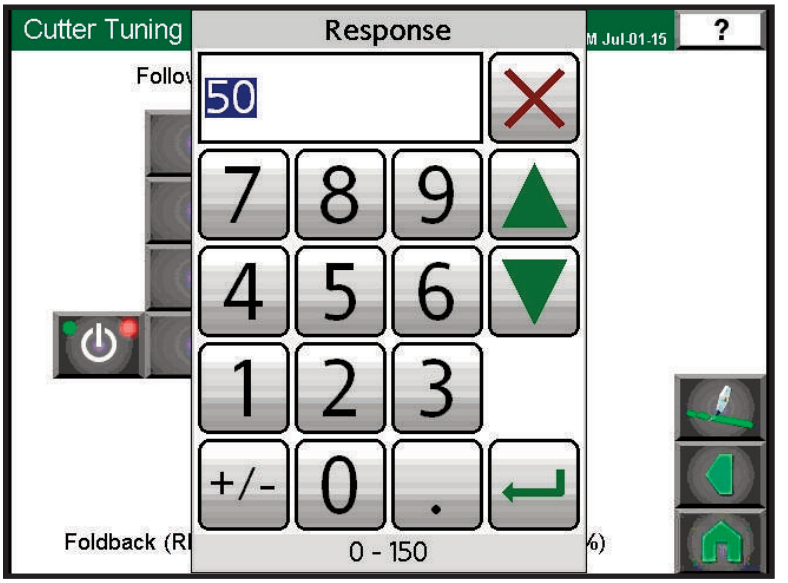
This parameter is characterized in terms of friction increase per 100 motor RPM. If estimated, always use a conservative (less than or equal to actual) estimate. If the friction is completely unknown, a value of zero should be used. A typical value used here is less than one percent.

Control Function Descriptions



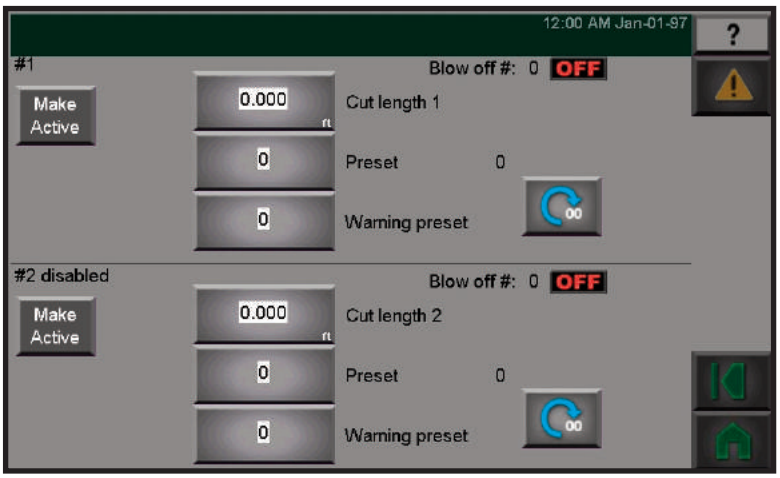
Tuning Integral Time
This is set at the factory and should not be changed. Contact Conair Customer Services if adjustments or replacements are necessary.

Contact Conair Customer Service 1 800 458 1960. From outside of the United States, call: 814 437 6861



Tuning Response Popup
The Response adjusts the velocity loop bandwidth with a range of 0 to 150 Hz. In general, it affects how quickly the drive will respond to commands, load disturbances and velocity corrections. A good value to start with (the default) is 50 Hz. The maximum value recommended is 80 Hz.

Control Function Descriptions

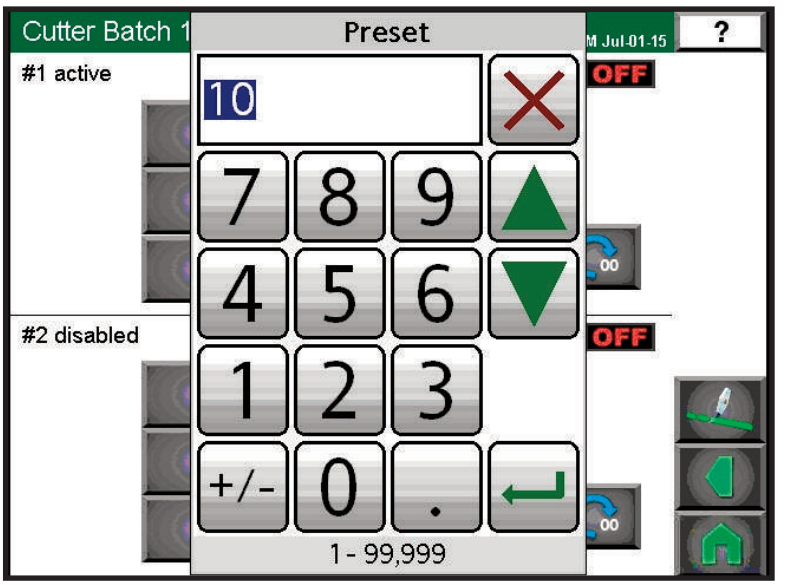


Batch 1 & 2

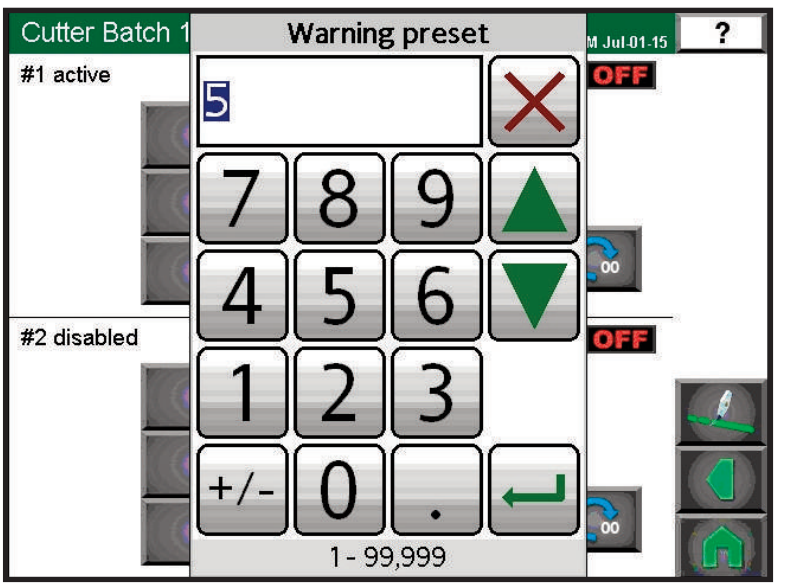
This screen is where individual batch specifics are entered. The cutter will continually follow through enabled batch sequences. The #1 batch is active all the time. It is the same part length that is entered on the main operating screen. This screen allows access to the cutter batch counters #1 and #2 parameters.

- Cut Length- Enter here the length of the part for the batch. Each batch can have the same or different cut lengths.
- Preset- this is how many parts are to be cut in this batch.
- Warning preset- this is how many parts from the end of the batch that a warning is sent to the lower right corner of the operating screen. Note: When operating the cutter, if the batch option is not being used, set the Warning Preset value higher than the Preset value. This will turn off the Batch Warning box on the main operating screen.
- Box to the right of the Preset box- this is the current number of parts that have been cut in this batch sequence.
- Reset- this will clear the current count box.

Control Function Descriptions



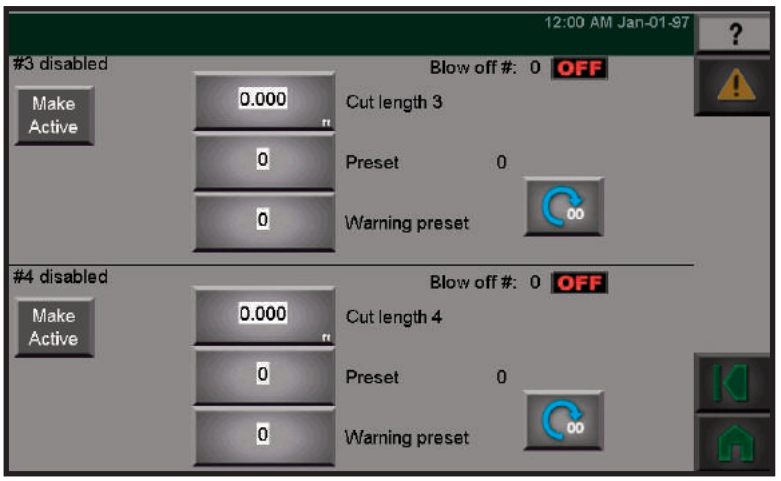
Batch 1 & 2 Preset Popup
Preset- this is how many parts are to be cut in this batch.
Box to the right of the Preset box- this is the current number of parts that have been cut in this batch sequence.
Reset- this will clear the current count box.



Batch 1 & 2 Warning Preset Popup
Warning preset- this is how many parts from the end of the batch that a warning is sent to the lower right corner of the operating screen.

NOTE: When operating the cutter, if the batch option is not being used, set the Warning Preset value higher than the Preset value. This will turn off the Batch Warning box on the main operating screen.

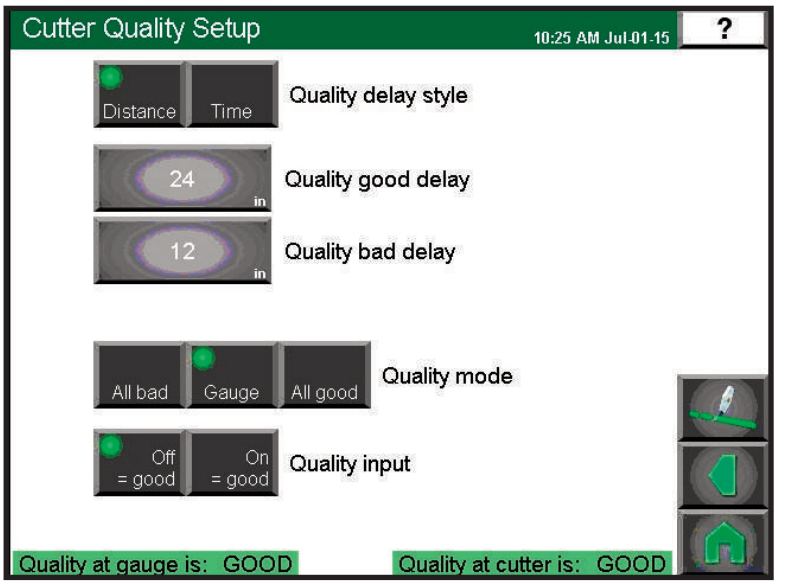
Control Function Descriptions



Batch 3 & 4

This page allows access to the cutter batch counters 3 & 4 parameters. Each batch counter has an associated cut length. If more than 1 batch counter is enabled, the cutter switches to the next batch counter enabled and switches the cut length. This allows cutting batches of different length products automatically. Each batch counter has a preset and warning preset parameter.

Control Function Descriptions



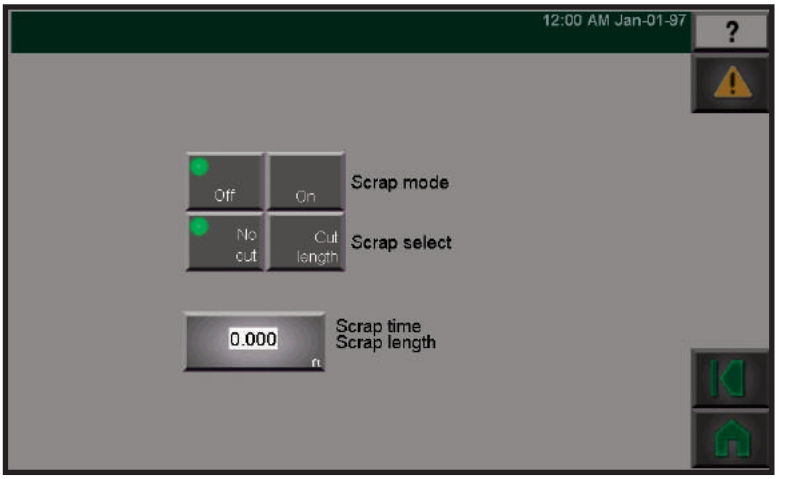
Quality Screen (Optional)
This screen allows the selection of which parts to blow off of the conveyor. This is used when the blow-off is tied to an optional laser gauging system for quality. The laser will send a signal of a good or bad part to the cutter. The blow-off sequences can be turned on/off here also. This screen allows the configuration of the input quality signal. The laser gauge will send a signal to the cutter.

- Quality good delay: This is a timer for how long of time is desired for the system to run after the laser gauge has given a "good" signal. The length of time should be sufficient for all off-spec parts to clear the conveyor
  This is the amount of time that will pass after the gauge system indicates that the part is good before the cutter starts treating the parts as good parts. This allows the clearing of bad parts from the system.
- Quality input- the selection of whether the part is good or bad when gauging systems signal is observed.
- Quality mode- select here whether the blow-off and counters treat the part as always bad, always good, or if it follows the signal from the laser gauge.

NOTE: When operating the cutter, if the batch option is not being used, set the Warning Preset value higher than the Preset value. This will turn off the Batch Warning box on the main operating screen.

Contact conair for more information about our CSC Cutter, by phone (724)-584-5500, or info@conairgroup.com www.conair.com

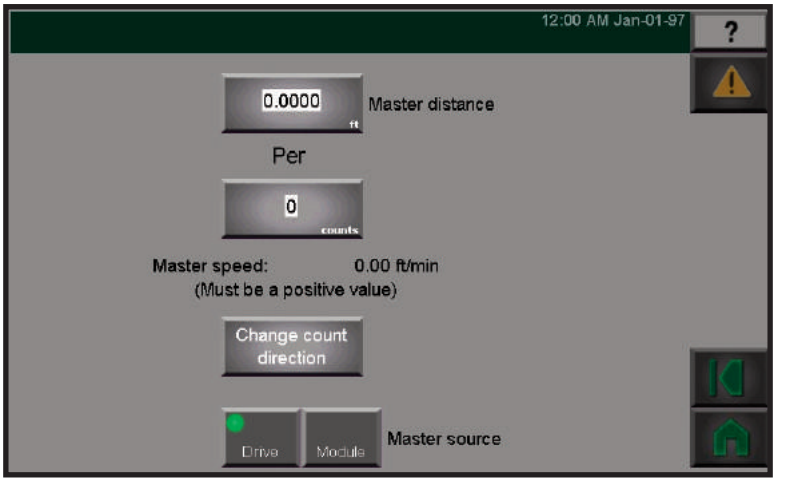
Control Function Descriptions



Scrap Setup

This page allows access to the scrap mode setup parameters. Scrap mode works in conjunction with the quality input. Scrap mode allows the cutter to make a bad scrap product a different length than a good product. The cutter can be configured to stop cutting or to cut a scrap length. Scrap mode can be turned on or off.

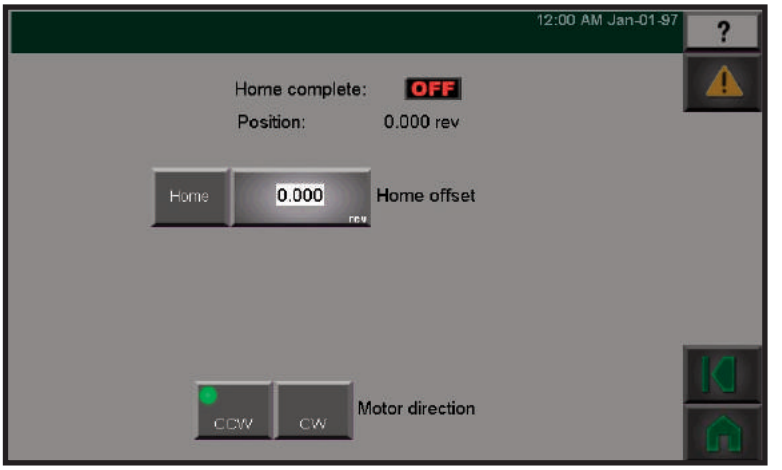
- Scrap select: When the scrap mode is turned “on”, it is here you can enter what to do when the part is off-spec. It can be “no cut” until it is back on spec, or enter a number for a cut length while the part is off-spec.



Master Setup

This page allows access to the master encoder input scaling parameters. The cutter uses a quadrature encoder input signal to measure product length. These parameters scale encoder pulses to product length. This screen is used to scale the amount of distance traveled by the belt to the number of pulses received from an encoder. Pushing the boxes with numbers will bring up a keypad for new number entry. The Change Count Direction is used to reverse the polarity of the incoming encoder pulse.

Control Function Descriptions



Home Setup

This screen is used for the positioning of the blade holder when it is at rest. To change the blade holder position when parked, do the following:

1. **Enter '0' in the Home offset box.**

2. **Push the Home button** and allow the blade holder to find its natural '0' point

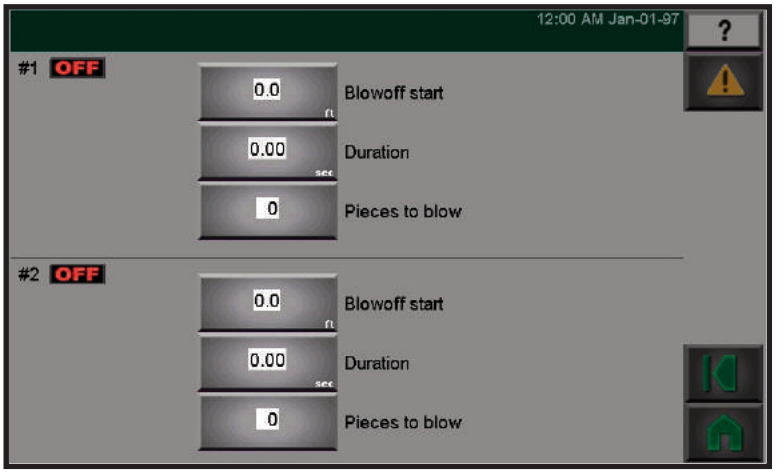
3. **Turn the blade holder to the new desired position** after the holder has found its home. A number will appear in the Position box. Enter this number into the Home Offset box.

4. **Push the home button one more time**. The blade holder will then park in the new position when it stops. (Make sure the opposite end of flywheel/blade holder is not in bushings when in Home or Park position.)

Home Setup Home Offset

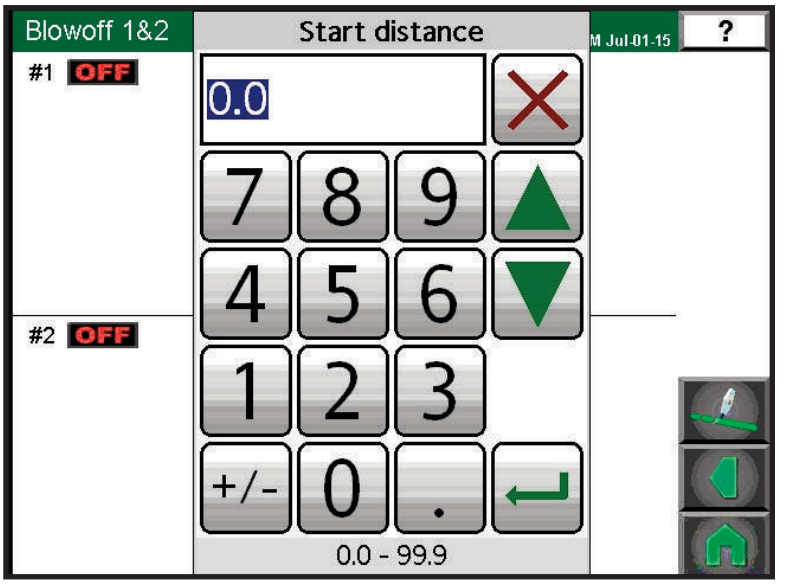
When the homing procedure begins the flywheel will turn at a slow speed until the home sensor is detected. After finding the home sensor the flywheel will move an "offset" distance and stop. This offset distance from the home sensor is the zero, or park position of the flywheel. The cutter remembers this zero position until powered down. This setting should only be changed by experienced operators.

Control Function Descriptions



Blowoff 1 & 2

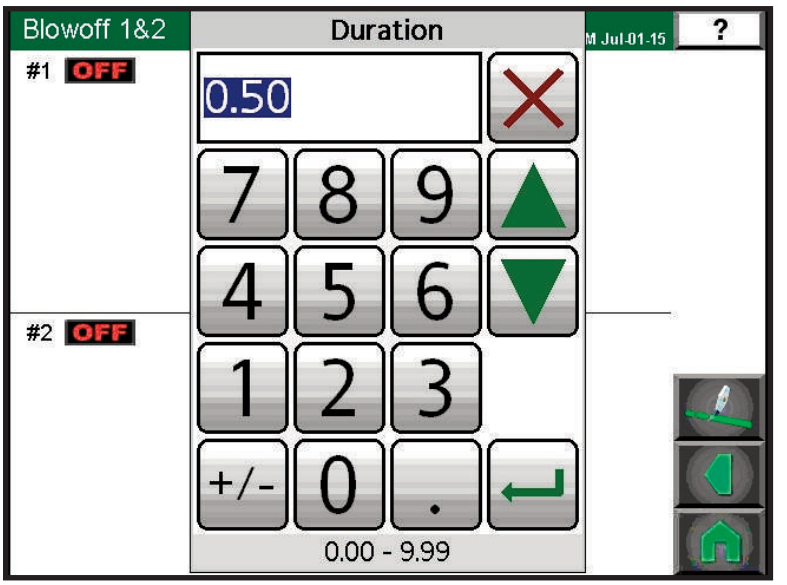
This screen allows configuration of different blow-off set-ups. Different blow-off conditions may be needed for the removal of parts when batch sequences are being used. This page allows access to the blowoff 1 & 2 parameters. The blowoff outputs can operate in either "On demand" or "Continuous" mode. "On demand" mode is active whenever the cutter is in either "Encoder", "Timer" or "End Sense" mode. "Continuous" mode is active whenever the cutter is in "Flywheel" or "Follower" mode. The blowoff's work in conjunction with the quality input. This allows good and bad product to be separated at the take away conveyor.



Blowoff 1 & 2 Blow on Distance

Blow on distance- the length of product that travels through the cutter before the blow-off turns on. This is distance traveled through the puller which may be independent of the distance traveled on the conveyor depending on conveyor speed set and length set

Control Function Descriptions



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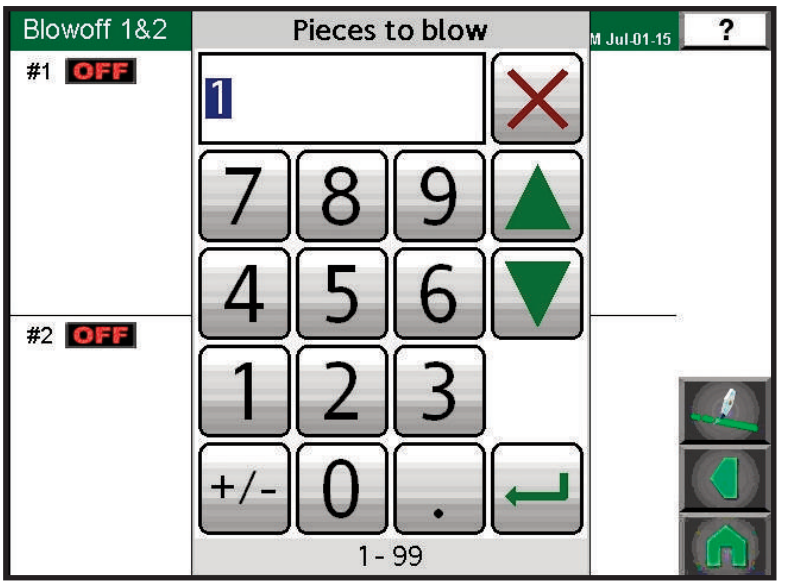
Blowoff 1 & 2 Duration

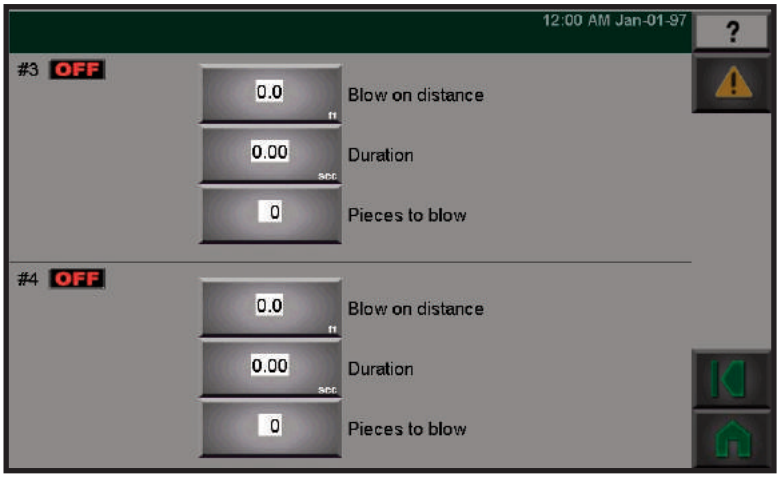
The amount of time that the blow-off air is on.



Blowoff 1 & 2 Pieces to Blow

Pieces to blow- this is how many pieces will be cut during each blow-off sequence. After this many parts are cut, the blow on distance will be activated for the proper blow-off. This is used when the parts are small and several are to be blown off at a time.

Control Function Descriptions



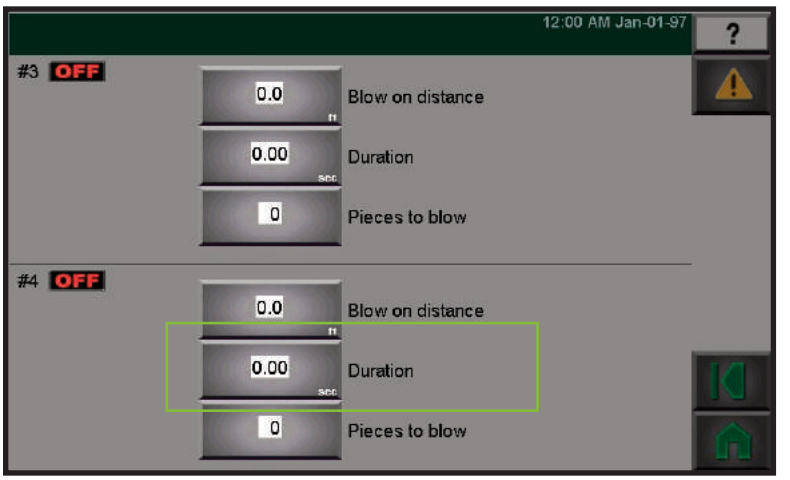
Blowoff 3 & 4

This page allows access to the Blowoff 3 & 4 parameters. The blowoff outputs can operate in either “On demand” or “Continuous” mode. “On demand” mode is active whenever the cutter is in either “Encoder”, ”Timer” or “End Sense” mode. “Continuous” mode is active whenever the cutter is in “Flywheel” or “Follower” mode. The Blowoff’s work in conjunction with the quality input. This allows good and bad product to be separated at the take away conveyor.

Blowoff 3 & 4 Blow on Distance

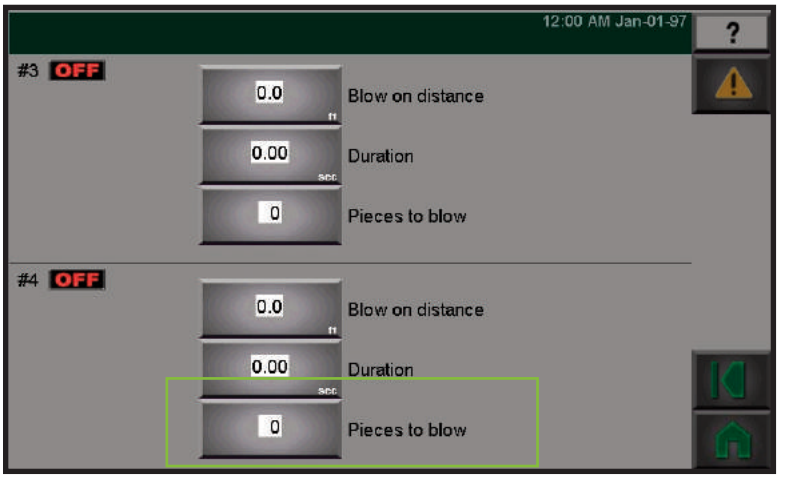
Blow on distance- the length of product that travels through the cutter before the blow-off turns on. This is distance traveled through the puller which may be independent of the distance traveled on the conveyor depending on conveyor speed set and length set.

Control Function Descriptions



Blowoff 3 & 4 Duration

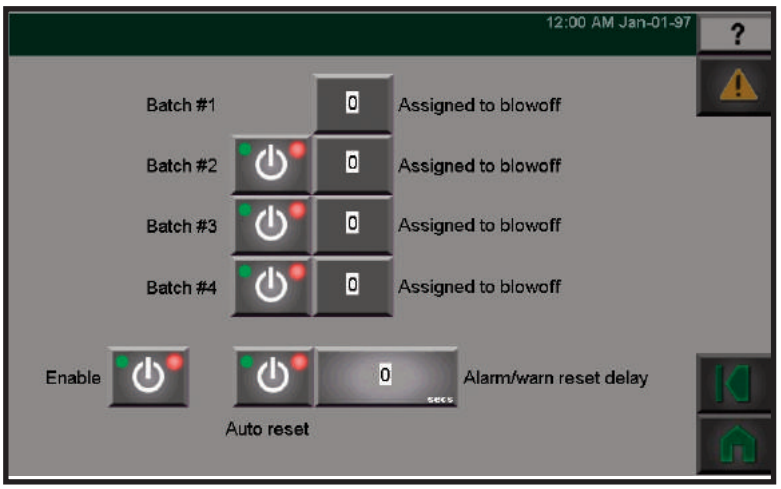
The amount of time that the blow-off air is on.



Blowoff 3 & 4 Pieces to Blow

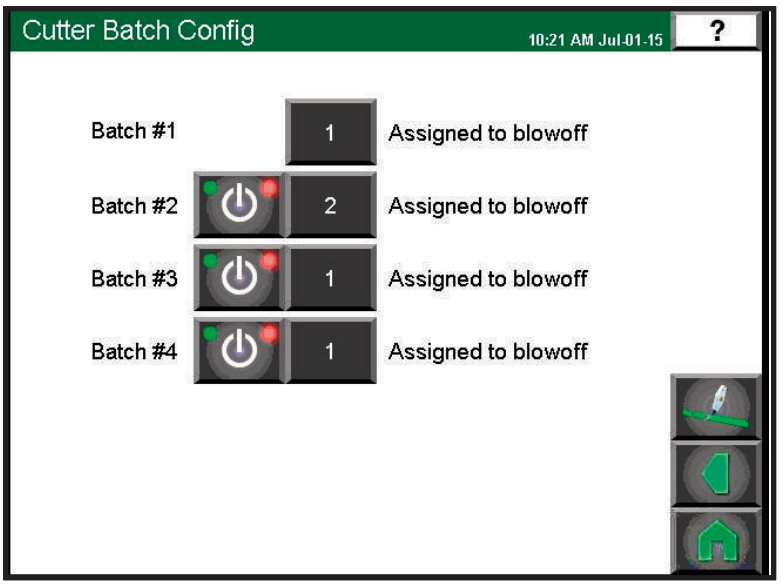
Pieces to blow- this is how many pieces will be cut during each blow-off sequence. After this many parts are cut, the blow on distance will be activated for the proper blow-off. This is used when the parts are small and several are to be blown off at a time.

Control Function Descriptions



Batch Configuration

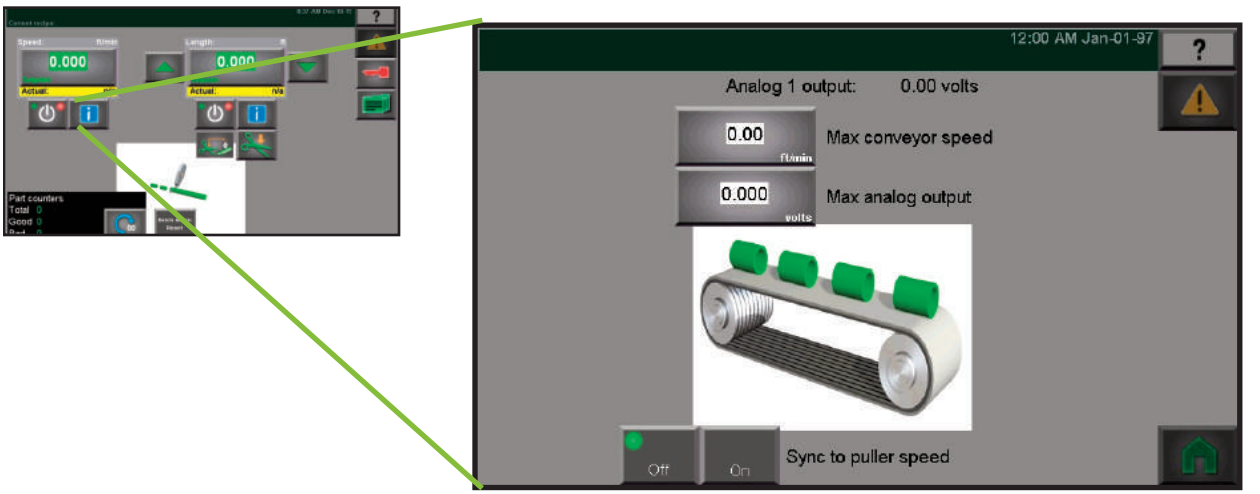
This page allows access to the cutter batch configuration parameters. The cutter provides part batch counting and blowoff control. Up to 4 batches and 4 blowoff's are available. 1 batch counter is always enabled. The other 3 can be enable/disabled from this page. Each batch counter can be assigned to any 1 blowoff.



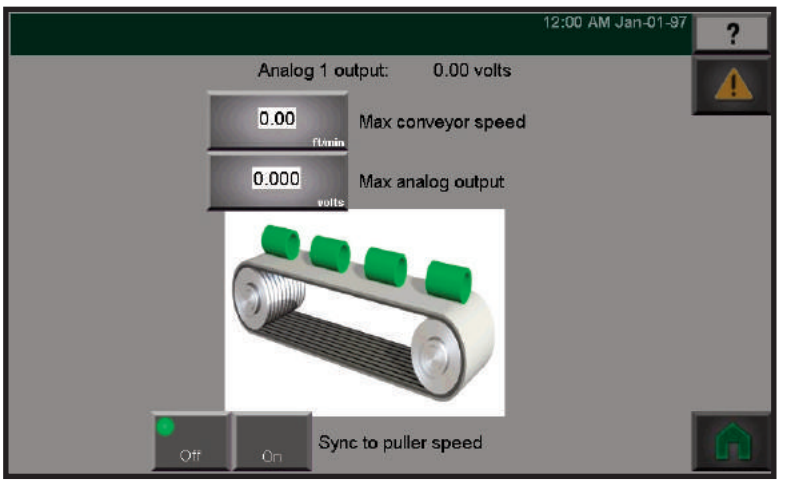
Batch Configuration Assigned to Blowoff Popup

This screen is for setting what output to control or turn on or off for given # enabled.

Control Function Descriptions



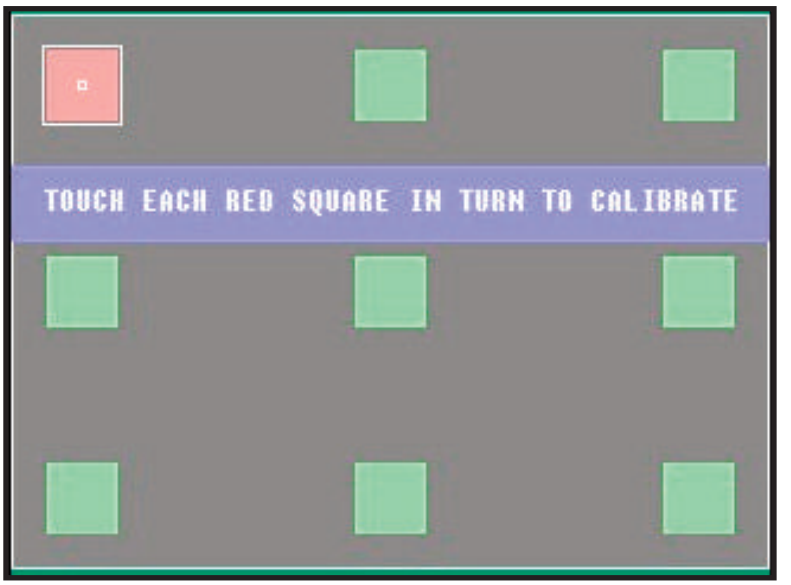
Conveyor Setup (Optional)
The conveyor is controlled with an analog output. This is where the maximum conveyor speed is inputted to coincide with the maximum analog output voltage (usually a 0 to 10 V signal).



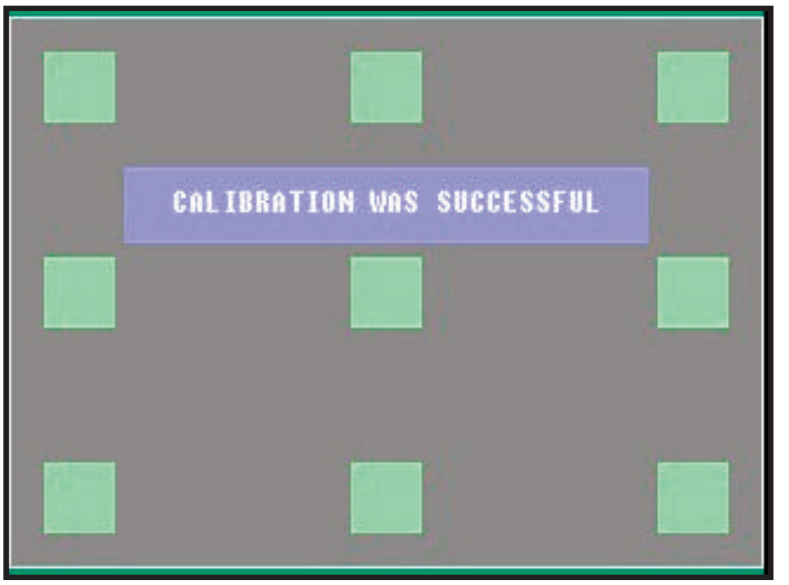
Conveyor Setup Max Conveyor Speed (Optional)
The conveyor is controlled with an analog output. This is where the maximum conveyor speed is set to coincide with the maximum analog output voltage (usually a 0 to 10 V signal).

Conveyor Setup Max Analog Output (Optional)
This page sets the voltage when measured with the meter at analog output to conveyor speed

Control Function Descriptions

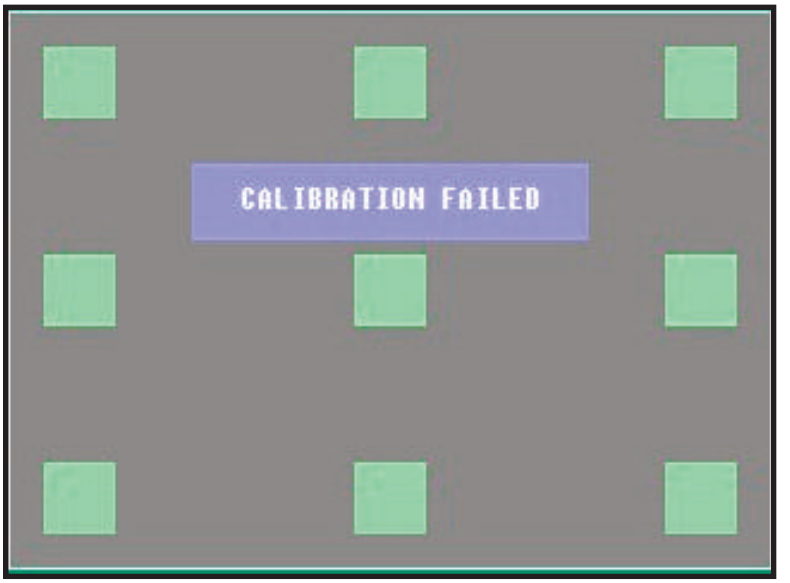


Touch Calibrate
This is the screen used to calibrate the touch locations of the HMI screen. Several squares will appear that you must touch in to align the touches with the functions for the proper operating of the HMI.



Touch Calibrate Successful
This appears when the calibration is successful.

Control Function Descriptions



Touch Calibration Failed
This screen appears when the calibration has failed. Attempt calibration again. If still unsuccessful, contact Conair Customer Services.

Contact Conair Customer Service 1 800 458 1960. From outside of the United States, call: 814 437 6861

Checking Cut Quality

1 **Press the manual cut button** and observe the movement of the cutter blade. The cutter head makes a single rotation and the blade moves through the cutter bushings without interference.

2 **Insert a piece of extrudate through the cutter bushings.**

3 **Press the manual cut button.** A single cut is made at the preset blade speed. (This works even if Cut On/Off is off.)

4 **Inspect the cut.** If necessary, adjust the blade design or blade speed. *See, All About Cutter Blades, Appendix B*.

Starting the CSC Cutter

1 If you have not already done so, **check the cutter hardware, power up the cutter, select cutting mode and blade speed, and make a test cut to check cut quality**.

2 When you are satisfied with cut quality, **press the Cut On/Off soft key.** Automatic operation will begin.

TIP: When the extrudate is running within tolerance, cut it with a knife or saw and feed it through the cutter bushings.

Making Adjustments During Operation

There are several adjustments you can make during normal cutting. These adjustments include:

- **In Timer mode,** adjust the time between cuts.
- **In Encoder and Follower modes,** adjust the length.
- **In End Sense mode,** adjust the hold-off time.
- **In Flywheel mode,** adjust blade speed.
- **Adjust blade speed in all modes except Follower.**
- **Perform a manual cut and reset the length** by pressing the manual cut button at any time during on-demand cutting. Pressing Manual Cut has no effect during continuous cutting.
- **Count the total number of cuts** by pressing the Total Part Count display field. Use the Reset button to return the count to zero. This feature is useful for collecting samples during a production run.
- **Count the batches of cuts** by selecting one of the two Batch Counter pages. Use the Reset button to return the count to zero. This feature is useful for collecting samples during a production run.
- **Stop cutting temporarily** by setting Cut On/Off to off. This allows you to view the cutting blade (through the window) or perform other tasks without shutting down the cutter.

✎ **NOTE:** Control does not allow switching modes during operation, cutter must be stopped.

Stopping the CSC Cutter

WARNING: Never stop the CSC cutter by opening the knife guard.
This can cause damage to the equipment and injury to personnel.

Use this procedure to safely stop the CSC cutter:

1 **Press Cutter Stop button on the main page** to stop cutting.

2 **Wait until flywheel comes to a stop.**

3 **Turn the rotary disconnect to the off position.**

WARNING: Never turn off the rotary disconnect first.
Doing so will turn off all power to the unit, and the cutter will not be brought to a controlled stop. For safe stopping, always follow the sequence given above.

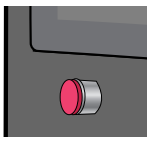
4 **Disconnect the power cord** if it is equipped with a plug on the end.

5 **Lock out the rotary disconnect.**

6 **Clean the lubricant reservoir** if you are shutting the servo cutter down for the day.

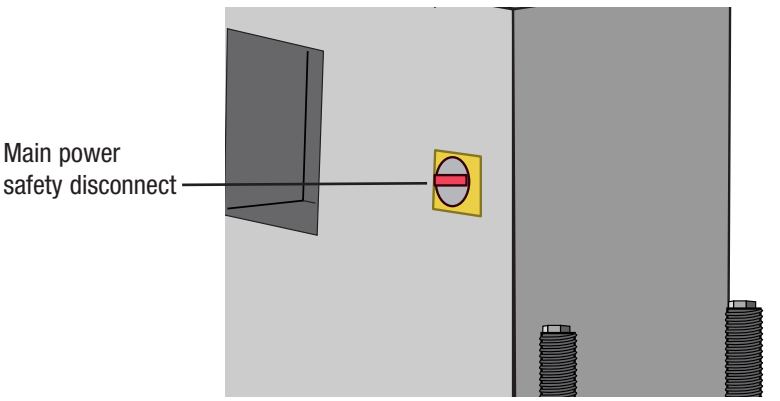
Emergency Stops

In an Emergency:



1 **Press the E-stop Button** to stop the CSC immediately.

2 **Use the rotary disconnect to turn the power of the machine off.**



SECTION
5

Maintenance

Maintenance Features

The Servo Cutter CSC models need regular, scheduled maintenance for peak performance. Among the features that require maintenance are:

- Cutter blades
- Blade mounting hardware
- Cutter bushings
- The knife guard hardware
- Cutter alignment
- Floor locks
- Lubrication tray
- Shafts of optional slide rail system
- Electrical cables
- Control panel lights

Warnings and Cautions

To maintain the best performance of the servo cutter, it must be cleaned and inspected regularly. Maintenance includes a daily, weekly, quarterly, and semi-annual (every 6 months) schedule.

Use this maintenance schedule as a guide. You may need to shorten the time of the maintenance schedule, depending on how often you use the servo cutter, and the types of material flowing through it.
Follow all precautions and warnings when working on the equipment.

⚠ WARNING: Improper Installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region.

WARNING: Voltage Hazard

This equipment is powered by alternating current, as specified on the machine serial tag and data plate. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

A properly-sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. Improper grounding can result in severe personal injury and erratic machine operation.

Lockout/Tagout:

Before performing maintenance or repairs on this product or entering blade area, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable disconnect device has been provided to isolate this product from potentially hazardous electricity.

(Continued)

Warnings and Cautions (continued)

DANGER: Sharp Blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out the cutter before opening the cutting chamber. (See Lockout/tagout below)
- Always wait until the cutter head has stopped completely before opening the knife guard.

CSC cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The cutter STOP button activates a circuit that stops the knife.

Maintenance Overview

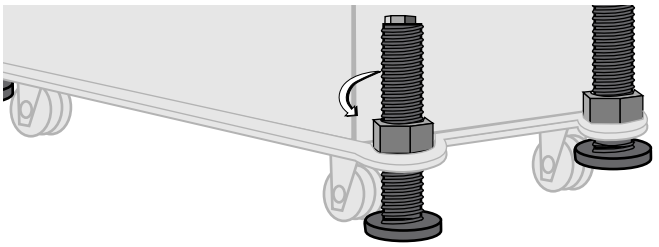
This section describes the daily, weekly, monthly and semi-annual maintenance schedules that should be performed when changing materials or lines, or when changing equipment, as well as the maintenance procedures to follow.

Cutting either flexible or rigid materials generates tremendous shock and vibration to the entire unit. Anything that can loosen, will over time.

To maintain the best performance, follow this maintenance schedule and develop an effective preventative maintenance program.

Preventative Maintenance Schedule

- **Daily**
  - ❒ **Checking cutter blade(s)**
    Clean, sharpen or replace as needed. *See Checking the Blades, in the Maintenance section of this User Guide.*
  - ❒ **Inspecting the blade mounting hardware**
    The blade securing bolt should use both a lock washer and flat washer, and be tightened enough to fully compress the lock washer. Replace the holding pins if they appear worn.
  - ❒ **Inspecting the cutter bushing screws**
    Check that the cutter bushing screws are secure. *See Inspecting Cutter Bushing Screws in the Maintenance section of this User Guide.*
  - ❒ **Checking the closure latch on the knife guard.**
    See Checking the Closure Latch, in the Maintenance section of this User Guide.
  - ❒ **Inspecting cutter alignment**
    Proper cutter alignment is critical for optimum performance. Use a plumb line or laser to check for a straight line from the extrusion die to the cutter bushings.
  - ❒ **Check floor locks**
    It is always recommended that the weight be removed from the casters for optimum stability during cutting cycles. Check to see if the floor locking mechanism is properly adjusted.

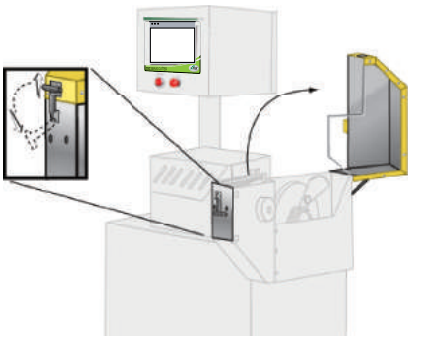


- **Weekly**
  - ❒ **Cleaning the blade lubrication tray**
    See Cleaning the Blade Tray, in the maintenance section of this User Guide.
  - ❒ **Lubricating shafts on optional slide rail system**
    See Lubricating the Slide Rail System, in the maintenance section of this User Guide.

- **Monthly**
  - ❒ **Checking hardware on the knife guard**
    Inspect the hardware on the knife guard (fasteners on hinge and the clear blade guard window). Tighten as needed.
  - ❒ **Checking bushing holder proximity switches**
    Inspect the sets screws which retain the bushing holder proximity switches for tightness. Adjust as needed. *See Adjusting the Proximity Switches, in the Maintenance section of this User Guide.*
  - ❒ **Checking the metal draw latch**
    Inspect the latch on knife guard for wear and proper tension. Readjust or replace as needed.
  - ❒ **Clean the clear blade guard window**
    Clean using glass cleaner or plain water. Other materials may cause premature loss of clarity or crazing.

(Continued)

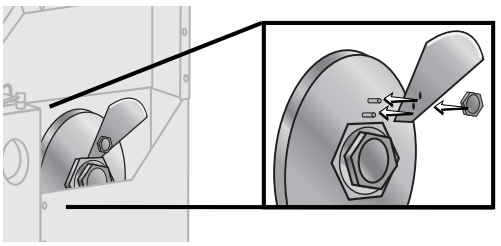
Preventative Maintenance Schedule (continued)



- **Semi-annual (every six months)**
  - ❒ **Inspecting electrical terminals**
    Check all electrical terminals for tightness; adjust as needed. *See Checking Electrical Connections, in the Maintenance section of this User Guide.*
  - ❒ **Checking torque on Trantorque coupling device**
    Check the tightness (torque) of the Trantorque coupling device with a torque gauge. This device connects the cutter head to the Micron reducer shaft. *See Checking Torque, in the Maintenance section of this User Guide.*
  - ❒ **Checking all electrical cables**
    Inspect all electrical cables for cuts and abrasions. Replace as needed.

Checking the Blades

Blades become dull over time depending on the material being cut, cut rate, blade speed, and blade material and thickness. Check blades regularly for sharpness as well as scratches, nicks, burrs, and material buildup. Clean, sharpen or replace as needed. *See Installing Cutter Blades, in the Installation section of this User Guide.*



DANGER: Sharp Blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

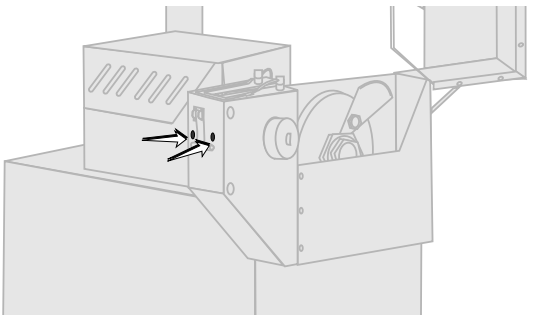
- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out power to the cutter before opening the cutting chamber.
- Always wait until the cutter head has completely stopped before opening the knife guard.

CSC cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The STOP button activates a circuit that stops the knife.

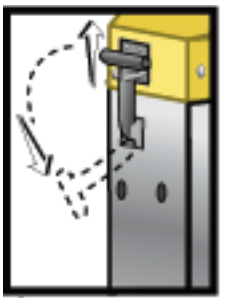
Inspecting Cutter Bushing Screws

Check the set screws that secure the cutter bushings. If bushings move during cutting, cutting blades and possibly the drive chain could be damaged.



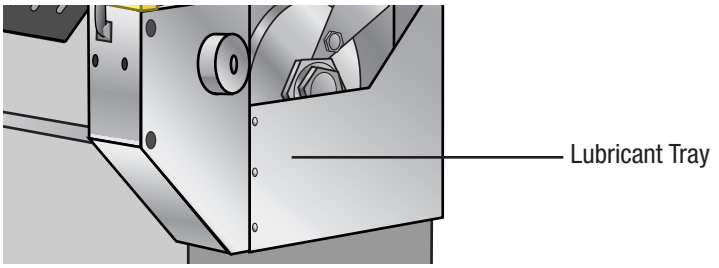
Checking the Closure Latch

Check the latch and adjust it so the knife guard closes completely. This prevents false triggering of the safety switch.



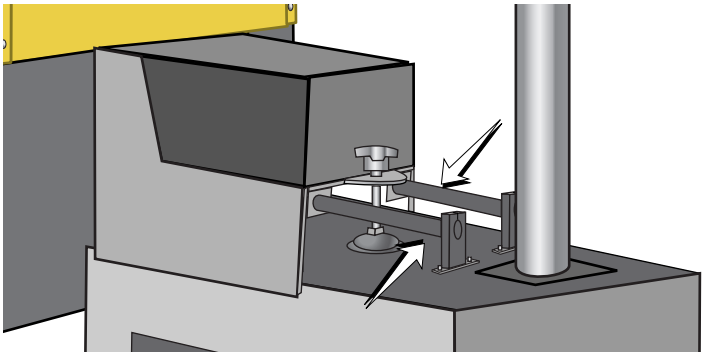
Cleaning the Blade Tray

This tray is built into the cutter assembly as a simple method of applying lubrication to your blade during cutting cycles. Depending on cut rate and type of material and lubrication, the area will need to be cleaned on a regular basis and the lubricant replaced. Open the knife guard and, using a shop vac or other similar equipment, remove all liquid and solids from the cutting chamber and around the bushings. Replace the lubricant. For more information, see the Appendix D, Blade and Bushing Lubrication.



Lubricating the Slide Rail System

Check the shafts on the slide rail system. Even though these shafts are stainless steel, it is recommended that a light oil (WD-40 or similar) be applied to the shafts as needed. Wipe off any excess.

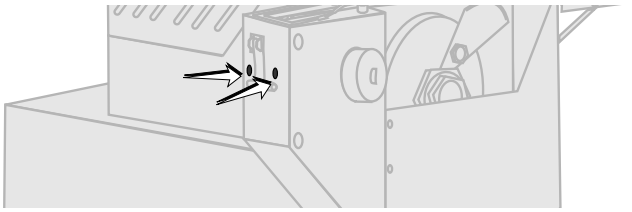


Adjusting the Cutter Proximity Switches

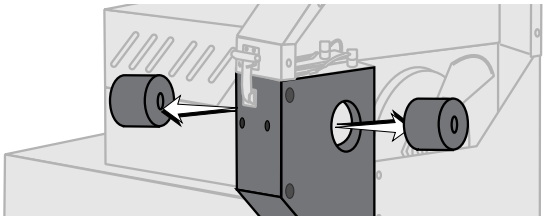
Follow all warnings and cautions listed at the beginning of the Maintenance section of this User Guide.

1 **Be sure the main power is disconnected** and the cutter is locked out.

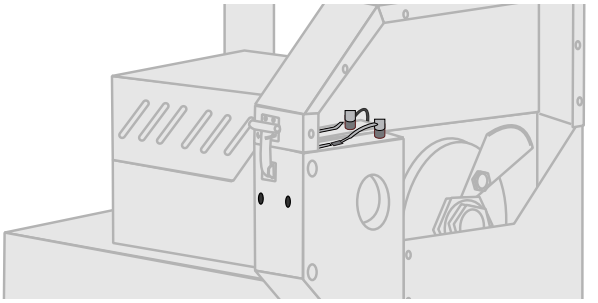
2 **Loosen the set screws** that hold the cutter bushings.



3 **Remove the cutter bushings.**



4 **Check the depth of the proximity switch** face for each bushing. It should be recessed no more than 0.010 inches, but should not interfere with the bushings themselves.



5 **Use an Allen wrench to check the tightness** of each proximity switch's retaining screw.

✎ **NOTE:** You can damage the proximity switch if you over-tighten

6 **Replace cutter bushings** and check for proper cutting blade alignment. *See Mounting the Cutter Bushings, in the Installation section and Appendix C of this User Guide.*

7 **Plug in the power cord** and turn the main power disconnect to the ON position if all other maintenance is completed.

Checking Electrical Connections

WARNING: Electrical Hazard

Before performing any work on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

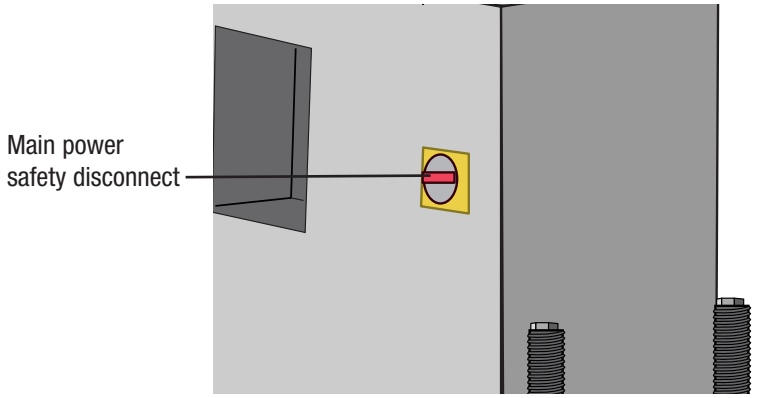
WARNING: Improper Installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

1 **Be sure the main power is disconnected and the cutter is locked out**. Always disconnect and lock out the main power source before opening the unit or servicing.

2 **Turn the main power disconnect to the OFF position** before opening the electrical enclosure on the back of the cutter, or the back of the control. This is a safety device to prevent you from opening the doors if the power is still on.



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Checking Electrical Connections
(continued)

3 Open the electrical enclosure.

4 Inspect all wires and connections. Look for loose wires, burned contacts, and signs of over-heated wires. Have a qualified electrician make any necessary repairs or replacements.

5 Close the electrical enclosure door.

6 Inspect the exterior power cords. Cords should not be crimped, exposed, or rubbing against the frame. If the main power cord runs along the floor, make sure it is not positioned where it could rest in pooling water or could be run over and cut by wheels or casters.

Checking Torque

WARNING: No Lubricants!

Do NOT use lubricants on the Trantorque coupling device.

DANGER: Sharp Blades!

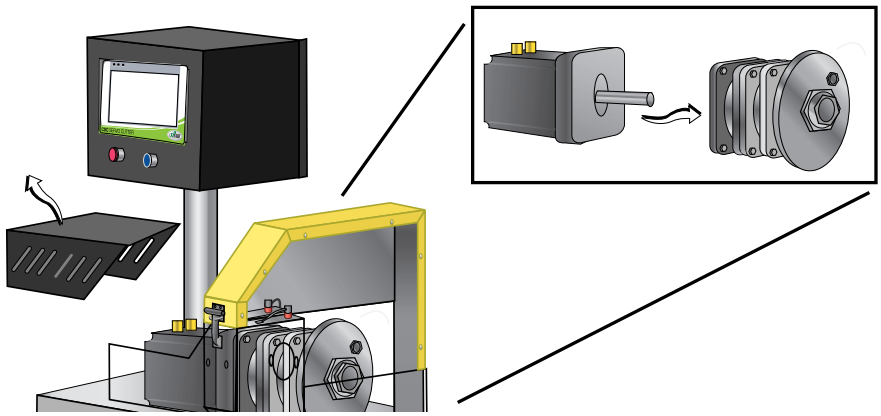
Always wear cut-resistant gloves when the cutting chamber is open and when handling blades. Never open cutting chamber without locking out the cutter power and waiting until the cutter head has stopped completely. Handle blades with care at all times.

The Trantorque coupling device connects the servo motor to the cutter head. It is important that it is tightened to the proper torque.

1 **Carefully remove the cutter blade.**

2 **Check to make sure both the shaft and component bore** of the Trantorque coupling device are completely free of paint, grease, oil, and dirt. If necessary, clean the surfaces with a non-petroleum based solvent, such as isopropyl alcohol.

3 **Use a torque wrench** to make sure the nut is tightened to the proper installation torque (2000 in-lb or 225 N-m). Do not overtighten; it can cause damage to the unit.



SECTION
6

Troubleshooting

Before Beginning

You can avoid most problems by following the recommended installation, operation and maintenance procedures outlined in this User Guide. If you have a problem, this section will help you determine the cause and tell you how to fix it.

Before you begin troubleshooting:

- ❏ Find any wiring, parts, and assembly diagrams that were shipped with your equipment. These are the best reference for correcting a problem. The diagrams will note any custom features or options not covered in this User Guide.

- ❏ Verify that you have all instructional materials related to the servo knife cutter. Additional details about troubleshooting and repairing specific components are found in these materials.

- ❏ Check that you have manual for other equipment connected in the system. Troubleshooting may require investigating other equipment attached to, or connected with the cutter.

A Few Words of Caution

WARNING: Improper installation, operation or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed and adjusted by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.

WARNING: Electrical hazard

Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

(Continued)

A Few Words of Caution (continued)

DANGER: Sharp Blades!

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

- Always wear cut-resistant gloves when the cutting chamber is open and when handling blades.
- Always lock out power to the cutter before opening the cutting chamber.
- Always wait until the cutter head has stopped completely before opening the knife guard.

CSC cutters are equipped with several safety devices to ensure safe operation. Never remove or disable these devices to sustain production. Operating without these devices can cause severe injury.

- When the knife guard is opened, the knife guard switch stops the cutter.
- Two proximity-type safety switches prevent operation unless the cutter bushings are in place.
- The Cutter STOP button activates a circuit that stops the knife.

Identifying the Cause of a Problem

The Troubleshooting section covers problems directly related to the operation and maintenance of the servo cutter. This section does not provide solutions to problems that originate with other equipment. Additional troubleshooting help can be found in the manufacturer's manuals included with this User Guide.

The main problems you will see with the servo cutter are:

- **Cutter operation problems**, which focus on problems that are clearly related to the operation of the cutter's electrical control system.

- **Plastic product quality concerns,** which deal with product characteristics that may be related to cutter operation. Of course, other sections of the extrusion line also influence the quality of the extruded product. This section does not provide solutions to problems originating with other equipment on the extrusion line.

Electrical Problems

Look in this section when you have problems such as lights on the control that are working improperly, buttons that do not execute the function properly, and when information input is not executed properly.

Symptom	Possible cause	Solution
Servo drive is without power	Safety relays are not energized	Check to see if: ❏ Bushings are in place. ❏ The blade guard is closed. ❏ E-Stop button is pushed in. ❏ Press E-Stop reset button.
	A safety switch has failed.	Check connections and replace if needed.
Pressing Start has no effect. The running indicator shows stopped.	There is a cutter fault.	Check the control and drive status pages for fault indications. Check the fault message page for fault indications.
	The safety circuit failed.	Check safety circuit, repair or replace components.

(Continued)

Electrical Problems (continued)

Symptom	Possible Cause	Solution
After pressing Start, the cutter head rotates and stops in wrong position.	The Blade Home proximity switch failed or the connection to it is loose.	Check connections and replace switch if needed.
Master safety relay does not energize.	Guard circuit is open.	Check to see if: ❏ The bushings are in place. ❏ The blade guard is closed. ❏ Loose connection to guard circuit. Tighten connection. ❏ Guard switch is bad. Replace switch. ❏ Bussing proximity is bad. Replace switch.
	E-stop button is pressed.	❏ Pull out E-stop button.
Measurement display does not change value.	Input from encoder failed.	Check encoder cable for continuity. Connect any loose wires.
	Encoder failed.	Replace encoder.

(Continued)

Electrical Problems (continued)

Symptom	Possible Cause	Solution
In encoder or timer modes, the display shows the count which resets, but a cut does not occur at the point of reset.	There is a problem with the servo amplifier.	See Checking the Servo Amplifier.
	There is a loose connection.	Check wiring for loose connections.
Blade speed does not change when new speed is entered into the control.	There is a communication failure between the control and drive.	Check for wiring for loose connections.
Cutter mode selection does not change cut mode.	There is a communication failure between the control and drive.	Check for wiring for loose connections and tighten.
The park (home) position is drifting, i.e. the blade parks further away from the original park site.	The coupling between the servo motor and the Micron reducer has slipped.	*See Checking the Motor/ reducer assembly, in the Troubleshooting section of this User Guide.*
	The Trantorque coupling has slipped.	*See Checking Torque in the Maintainance section of this User Guide.*

Product Quality Problems

Look in this section when the final product does not meet standards: has strings, burrs, cracks, or is misshaped.

Symptom	Possible Cause	Solution
Hairs or strings.	Blade speed is too low.	Increase the blade speed or decrease the blade cut path area (blade width).
	The blade is too thick.	Excessive blade thickness can cause frictional heat. Use a thinner blade.
	The blade is wrong for the application.	Change angle of the blade attack or the blade style to decrease the cut path area.
	Material is building up on the blade and wiping off on the cut site.	Use blade lubrication (water, etc.) or change lubricants. Consider a blade wiping system.
	There are imperfections on the blade.	The cutting edge should not have grind marks, burrs or other imperfections. Check the blade and replace if necessary.
	A hole or slot in the blade cut path is causing a ‘cheese grater’ effect.	Change blade design.
	The extrudate is too cold.	If the extrudate is too cold, it can fracture during cutting. Raise the extrudate's temperature.

Product Quality Problems (continued)

Symptom	Possible Cause	Solution
Burrs at cut site.	The bushings are not providing enough support during cutting.	Change bushing design to make them more supportive.
	The bushing gap is too wide.	The bushing gap should be no more than .001-.003 inches larger than the blade. Check and adjust if necessary.
	The blade speed is too low.	Low blade speeds can cause excessive blade interruption. Increase blade speed or decrease the blade cut path area.

(Continued)

Product Quality Problems (continued)

Symptom	Possible Cause	Solution
Cracks at cut site.	The extrudate is too cold.	If the extrudate is too cold, it can fracture or whiten during cutting. Raise the extrudate's temperature.
	The blade speed is too high.	High blade speeds can cause too much impact. Lower the blade speed.
	The bushings are not providing enough support during cutting.	Change the bushing design to make them more supportive.
	The cutting blade is too sharp.	A blade that is too sharp can fracture some materials, especially rigid PVC and nylons. Slightly dull the blade.
	If using Nylon, it may be cooling too quickly.	If nylon is cooled too quickly, its molecular structure may become unstable, leading to poor physical properties. Try more gradual cooling.

(Continued)

Product Quality Problems (continued)

Symptom	Possible Cause	Solution
Cut is not square.	The blade speed is too low.	Low blade speeds can cause excessive blade interruption. Increase blade speed or decrease the blade cut path area.
	The blade is misaligned.	Check that blade is 90 degrees relative to the bushing holder.
	The cutter bushings are not properly gapped.	If the cutter bushings are not properly gapped, the blade may be free to move with the extrudate. Check and adjust if necessary. *See Appendix A.*
	The knife bevel is not symmetric.	If the knife bevel is asymmetric, the blade will tend to move in the direction of the smaller bevel. Be sure that the bevel is symmetric. ✎ **NOTE:** You can use this to your advantage with some rigid products.
	For rigid products the puller is too close to the cutter.	There must be enough space between the puller and cutter to allow for extrudate stoppage that occurs during cutting. Allow enough space so no cut shock is detectable at the input to the belt puller with your fingernail.

Cutter Fault Messages

Symptom	Possible Cause	Solution
0. No Message.		
1. Waiting for the emergency stop circuit to clear.	Release the emergency stop pushbutton. Check 1SR for proper operation.	Press the E-Stop reset pushbutton.
2. Waiting for the cutter guard safety circuit to clear.	Check the cutter guard switch for proper operation. Check 2SR for proper operation.	Press the E-Stop reset pushbutton.
3. Waiting for the cutter bushing safety circuit to clear.	Check the bushing prox switches for proper operation. Check 3SR for proper operation.	Press the E-Stop reset pushbutton.
4. Waiting for 1CB not tripped input to turn on.		Turn on 1CB circuit breaker.
5. Waiting for 1MC power enable contactor on input to turn on.	Check 1MC contactor for proper operation.	Check 1MC aux contact for proper operation.
6. Waiting for the servo system ready input to turn on.		Check the servo power supply (1PM) for fault indications.
7. Waiting for the drive ok status bit to turn on.	Check the drive status page for fault indications.	View fault bits for fault indications.

(Continued)

Cutter Fault Messages (continued)

Symptom	Possible Cause	Solution
8. Waiting for the drive faults bitmap to clear.	Check the drive status page for fault indications.	View fault bits for fault indications.
9. Waiting for the module faults bitmap to clear.	Check the drive status page for fault indications.	View fault bits for fault indications.
10. Waiting for the drive enable status bit to turn on.	Check the drive status page for fault indications. Check 2MC contactor for proper operation. Check 2MC aux contact for proper operation.	Check drive enable input for presence of 24vdc.
11. Waiting for the power stage enabled input to turn on.	Check drive status page for fault indications.	Check drive enable input for presence of 24vdc.
12. Waiting for the power supply ready input to turn on.	Check the servo power supply (1PM) for fault indications. Check incoming supply voltage.	Check 24vdc supply voltage to the servo power supply (1PM).
13. Waiting for 2CB not tripped input to turn on.		Turn on 2CB circuit breaker.
14. Waiting for the puller drive healthy input to turn on.	Check the puller drive status page for fault indications.	
20. An emergency stop pushbutton was pressed.	Release the emergency stop pushbutton.	Press the E-Stop reset pushbutton.

(Continued)

Cutter Fault Messages (continued)

Symptom	Possible Cause	Solution
21. The cutter guard safety circuit was detected open.	Check the cutter guard switch for proper operation. Check 2SR for proper operation.	Press the E-Stop reset pushbutton.
22. The cutter bushing safety circuit was detected open.	Check the bushing prox switches for proper operation. Check 3SR for proper operation.	Press the E-Stop reset pushbutton.
23. 1CB circuit breaker has tripped.	Check servo drives for overload condition. Check trip setting on 1CB for proper setting.	Reset 1CB.
24. 1MC power enable contactor has turned off.	Check 1MC contactor for proper operation.	Check 1MC aux contact for proper operation.
25. The servo system ready input has turned off.	Check the cutter drive status page for fault indications. View the fault bit page for error indications.	Check the servo power supply (1PM) for fault indications.
26. The drive enable status input has turned off.	Check 2MC contactor for proper operation. Check 2MC aux contact for proper operation.	Check drive enable input for presence of 24vdc.
27. The drive has entered current foldback.	Check cutter drive train for freedom of movement. Adjust settings to reduce cut rate.	Wait for foldback RMS to fall below 50% before restarting.
28. A cutter drive fault was detected.	Check the cutter drive status page for fault indications. View fault bits for fault indications.	Check the servo power supply (1PM) for fault indications.

(Continued)

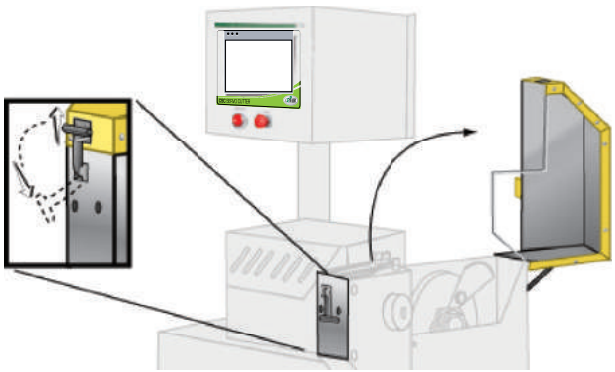
Cutter Fault Messages (continued)

Symptom	Possible Cause	Solution
29. A cutter drive fault bit was detected on.	Check the cutter drive status page for fault indications.	View fault bits for fault indications.
30. A cutter control module fault bit was detected on.	Check the cutter drive status page for fault indications.	View fault bits for fault indications.
31. 2CB circuit breaker has tripped.	Check puller drive for overload condition. Check trip setting on 2CB for proper setting.	Reset 2CB.
32. The puller drive healthy input has turned off.	Check the puller drive status page for fault indications.	

Replacing Safety and Proximity Switches

Three safety switches are included in CSC cutters: a keyed safety switch on the knife guard, and a proximity switch on each cutter bushing. A failure in any of these switches will prevent the cutter from running.

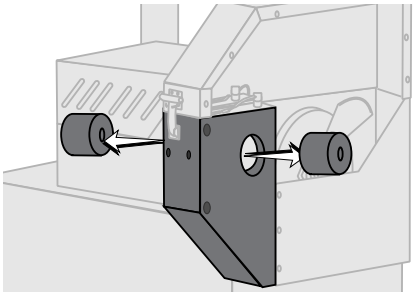
- **Safety Switch**
  If you suspect a problem with the keyed safety switch on the knife guard, check for loose or damaged wires. Replace the switch if wires appear to be undamaged.



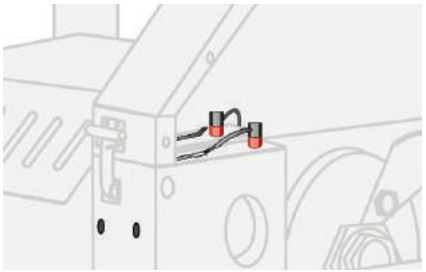
- **Proximity Switches**
  The proximity switches on the cutter bushings have LEDs that light when the bushing is sensed. If an LED does not light when both bushings are in place:

1 **Check for loose or damaged wires.**

2 **Remove the cutter bushing** and make sure the proximity switch is properly positioned, i.e. 0.010" from the bushing surface.



3 **Remove the proximity switch** by loosening the bushing retaining system. Test it by bringing an object close to the sensor when the power is turned on. If the LED does not light, replace the proximity switch.



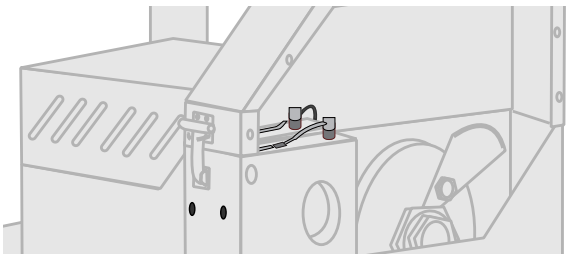
Checking the Servo Amplifier

The servo amplifier is equipped with a digital readout that can be seen through the viewing window on the electrical enclosure. This display shows amplifier status and error messages. Refer to the supplier's documentation included with this User Guide.

✎ **NOTE:** Make sure you look for servo amplifier messages before you shut off the power, because fault message will be lost.

Adjusting Proximity Switches

The home position proximity switch should be 0.010 inch from the 5/16 inch thread rod on the cutter head for proper operation.



1 Open the knife guard.

2 Locate the 5/16 inch thread rod on the cutter head. It should be 0.010 inch from the proximity switch sensor when it passes that location. If necessary, loosen the jam nuts, readjust the distance, and re-tighten the jam nuts.

DANGER: Sharp Blades!

Always wear cut-resistant gloves when the cutting chamber is open and when handling blades. Never open cutting chamber without locking out the cutter power.

Most injuries caused by knife blades occur when the cutter has been turned off. Handle blades with care at all times.

3 If the proximity switch does not sense the cutter head after this adjustment, remove the switch and test it outside the cutter. Replace if necessary.

Checking the Motor/Reducer Assembly

1 **Open the knife guard.**

2 **Remove the cutter head** by loosening the Trantorque assembly. Refer to the manufacturer's guide included with this User Guide for information about the Trantorque assembly.

3 **Locate the four bolts** holding the motor/reducer assembly to the cutter. Remove them and carefully remove the assembly from the cutter.

4 **Refer to the Micron installation** and maintenance information included with this User Guide to check and adjust the motor/reducer assembly.

Checking the Encoder

When the encoder is working properly, the measurement displayed will count up to the preset and reset to zero.

1 **Check all connections.**

2 **Check the encoder cable for damage.** If necessary, replace.

3 **Check the connector that attaches the cable to the encoder.** Internal wiring may be shorted out if this connector is not handled properly.

4 **Check the encoder itself.** There should be no play in the shaft.

Contact Conair Customer Service 1 800 458 1960. From outside of the United States, call: 814 437 6861

5 **If all else fails,** contact Conair Customer Service. *See Appendix A.*

⚠ **WARNING: Delicate equipment**

The encoder is a delicate piece of equipment. Any rough handling can damage fragile parts.

We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee. Most manuals can be downloaded free of charge from the product section of the Conair website.
www.conairgroup.com

How to Contact Customer Service

To contact Customer Service personnel, call:

✎ **NOTE:** Normal operating hours are 8:00 am - 5:00 pm EST. After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

Before You Call...

If you do have a problem, please complete the following checklist before calling Conair:

- ❒ Make sure you have all model, control type from the serial tag, and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- ❒ Make sure power is supplied to the equipment.
- ❒ Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- ❒ Check the troubleshooting guide of this manual for a solution.
- ❒ Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- ❒ Check that the equipment has been operated as described in this manual.
- ❒ Check accompanying schematic drawings for information on special considerations.

Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

Cutter Blade Selection and Use

Cutter blade characteristics such as material, design, and thickness can have a large effect on cut quality.

Blade materials

Blue tempered spring steel is most commonly used because of its cost and availability over a wide range of thicknesses (0.010-0.062 inch). It is a very tough material with an HRC value of approximately 48-51 and fair wear characteristics.

Razor blade stainless steel is becoming very popular due to its HRC value of 57-58, which leads to improved wear resistance. This material retains good toughness, but will chip or break. It is available in 0.010-0.062 inch thicknesses. Because it is non-corrosive, stainless steel is a good choice for medical cutting applications, and may even be coated with Teflon to enhance cut quality.

A-2 is a good grade of tool steel with an HRC of 60. Its minimum thickness (0.031 inch) forces the blade manufacturer to grind it down for thinner applications, which adds cost. A-2 is more wear resistant than stainless, but is also more brittle.

M-2 is an excellent grade of tool steel with an HRC of 63-66. It is one of the best materials for coating with titanium nitride for improved wear resistance. (However, coatings generally cause some slight loss of sharpness.) 0.025 inch material is available, which covers many applications without the need for secondary grinding operations.

D-2 is another excellent tool steel with an HRC range of 58-60. It is tougher than M-2 but has slightly less wear resistance. Its minimum thickness (0.035 inch) and the need for specialized grinding materials, make it a relatively expensive material. It is the material of choice for cutting Kevlar-reinforced hose.

CPM 10-V is a form of carbide developed especially for the high speed punch industry. With an HRC of 60-62 and a toughness that far exceeds D-2, it is by far the best cutting blade material. Because its minimum thickness is 0.035 inch, and it requires the use of diamond grinding wheels, CPM 10-V is the most expensive of the blade materials.

(Continued)

Cutter Blade Selection and Use (continued)

Blade Design

Straight-edge knives have a straight cutting surface. A chopping action (which has cutting forces parallel to the cut) is typically obtained with straight-edge blades.

Because the blade is mounted on a rotary arm, some slicing action (which has additional force vectors at various angles to the cutting edge) is obtained, but generally not through the entire cutting action. If a slicing action is required, the angle of attack can be modified by mounting the blade on a 30-45 degree angle as close to the cut site as possible. In many cases the bushings must be modified to allow the blade holder to have close proximity to the cut site. This offers the steepest angle of attack throughout the entire cutting process. Generally straight knives can be obtained in thicknesses from 0.004-0.060 inch depending on the application.

Curved-edge knives offer increased slicing throughout the entire cutting action. They are generally used for cutting rubber preforms, rubber hose, flexible foams, and other materials that require slicing. Blade lubrication is often used to enhance the cut and minimize blade and bushing buildup.

As a general rule, curved-edge knives offer improved cut quality on rigid materials if additional heat can be used. However if used on cold rigid materials, curved knives have a tendency to produce wavy or angled cuts.

A curved edge knife can sometimes cut larger cross section profiles and tubing with the same horsepower as a straight edge blade. However, the use of a curved blade increases product interruption. To overcome this effect, use a variable speed rotary knife cutter to vary the blade speed to obtain the desired cut quality.

Piercing blade (bat-wing, woodpecker) knives are specifically designed for cutting thin wall tubing. Their shape minimizes penetration marks caused by the flattening action of the blade prior to penetration of the extrudate. These are the most expensive type of blade, and the most susceptible to breakage. Because the point is exposed and not fully supported by the bushings, it may deflect into the bottom of the bushing bore and break off. For these reasons, piercing blade knives are usually used as a last resort.

Some rigid materials require warming when this type of blade is used because the impact of the point can cause cracking or whitening.

(Continued)

Cutter Blade Selection and Use (continued)

Blade thickness

Because material is displaced rather than removed in rotary knife cutting, think of the blade as a wedge. The thicker the blade, the greater the displacement. This displacement can cause fracture in rigid profiles and tubing, which is often observed as a whitening on all or a portion of the cut. You can reduce this fracturing by reducing the thickness of the blade. (This effect can also be minimized by heating the profile or tube. However, if heat is used to enhance cut quality, the bushings must be supportive enough to minimize distortion.)

If the cutting blade is too thin, it may actually deflect within the bushing bore. This can lead to "S" shaped cuts or premature blade breakage.

Optimizing blade speed

Flexible extrudates generally require a very fast blade speed with a slicing action for best results. This is due to the fact that even minimal interruption can cause a blade jam on a product that has little or no internal strength.

On the other hand, rigid extrudates may require different blade speeds to obtain the desired cut quality. What's needed for a particular application depends on blade style, internal heat, and blade thickness. Speeds as slow as 300 rpm may be required if a curved blade is used with little or no heat.

Improving cut quality by adding heat to certain materials

All rigid extrudates can have their cut quality improved by the addition of heat. A few of the most common materials and the respective temperatures are listed below:

Rigid PVC	110°-125° F
Styrene ABS	120°-135° F
Polypropylene	160°-200° F

It is important to remember that as the temperature approaches the glassification zone, the degree of support offered by the bushing becomes more important.

Calculating Blade Interruption

Blade interruption is the length of time which the blade interrupts the extrudate during the cutting process. Knowing blade interruption allows you to optimize blade speed and design for specific applications.

You can calculate blade interruption for your application if you know:

- the cutting blade width
- blade speed (cutter rpm)
- extrudate cross section

The rotary knife cut path circumference is fixed for each cutter model:

CSC Model	Bushing Diameter	Knife Cut Path Diameter	Knife Cut Path Circumference
2L	2.25"	14"	44.0"
2	2.25"	14"	44.0"
3L	3.25"	15"	47.1"
3	3.25"	15"	47.1"
4L	4.25"	14"	44.0"
4	4.25"	14"	44.0"
5	5.25"	15"	47.1"

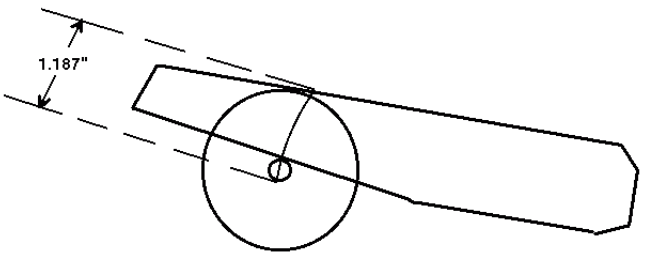
As an example, calculate the blade interruption (in milliseconds) for an CSC2 cutter running 1/4" (0.250") OD tubing. The blade speed is 718 rpm and the cutting blade is 15/16" (0.937") width at the point where it passes through the extrudate, and the cut path circumference is 44.0" for the CSC2.

Calculate the blade interruption time. The interruption time starts when the blade makes its first contact with the extrudate and ends when the blade is totally clear of the product (i.e. no longer interrupting it). Because we know the blade travel speed, we can calculate the interruption time if we know how far the blade travels during period of interruption. This distance is equal to the sum of the extrudate outer diameter and the blade width at the point of contact.

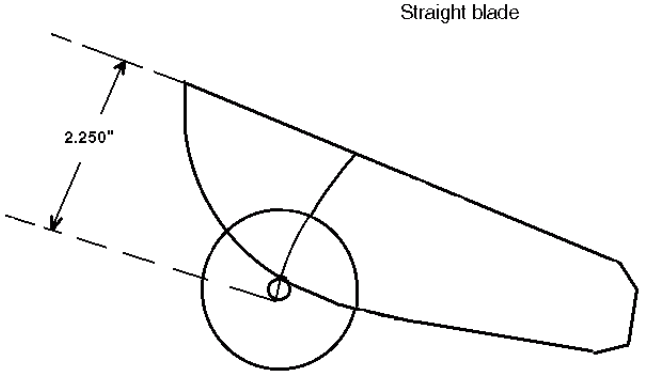
$$\text{Blade interruption time, msec} = \frac{\text{(Product OD + Blade width)}}{\text{Knife circumference}} \times \frac{60{,}000}{\text{rpm}}$$

(Continued)

Calculating Blade Interruption (continued)



Straight blade



Curved blade

To calculate interruption time:

$$\frac{(0.937 \text{ in.} + 0.250 \text{ in.})}{44.0 \text{ in.}} \times \frac{60{,}000 \text{ msec/rev}}{718 \text{ rpm}} = 2.25 \text{ msec}$$

Knowing the interruption time and the line speed, you can calculate the amount of production deflection that must be accommodated during cutting. To calculate the amount of extrudate deflection between the cutter and puller, multiply line speed by interruption time:

Blade Interruption time, msec X Line speed, fpm X $\frac{12}{60{,}000}$ = Deflection, in.

2.25 msec X 60 fpm X 0.0002 = 0.027 in.

In this example the puller and cutter must be set up to allow for 0.027" of product deflection during cutting. Failure to do this can lead to puller stoppage (which can form annular rings on the product), and poor-quality cuts (hairs or fuzz and angular cuts).

Conair Cutter Blades

Part No.	Blade Type	Bushing Size	Blade Thickness	Blade Material
3515-02285	Razor	2 inch*	0.015 in.	Stainless Steel
3515-00975	Razor	2 inch*	0.025 in.	Stainless Steel
3515-30088	Straight	2 inch	0.010 in.	Stainless Steel
3515-30096	Straight	2 inch	0.015 in.	Stainless Steel
3515-30104	Straight	2 inch	0.020 in.	Stainless Steel
3515-30016	Straight	2 inch	0.025 in.	Stainless Steel
3515-30085	Curved	2 inch	0.010 in.	Stainless Steel
3515-30072	Curved	2 inch	0.015 in.	Stainless Steel
3515-30080	Curved	2 inch	0.020 in.	Stainless Steel
3515-30032	Curved	2 inch	0.025 in.	Stainless Steel
3515-30128	Straight	3 inch	0.020 in.	Stainless Steel
3515-30024	Straight	3 inch	0.025 in.	Stainless Steel
3515-30024-1	Straight	3 inch	0.025 in.	Spring Steel
3515-30136	Straight	3 inch	0.032 in.	Stainless Steel
3515-30136-1	Straight	3 inch	0.032 in.	Spring Steel
7130320101	Curved	3 inch	0.015 in.	Spring Steel
7130320102	Curved	3 inch	0.025 in.	Spring Steel
7130320103	Curved	3 inch	0.032 in.	Spring Steel
7130320301	Straight	4 inch	0.025 in.	Spring Steel
7130320302	Straight	4 inch	0.032 in.	Spring Steel
7130320201	Curved	4 inch	0.025 in.	Spring Steel
7130320202	Curved	4 inch	0.032 in.	Spring Steel
7130320501	Straight	5 inch	0.025 in.	Spring Steel
7130320502	Straight	5 inch	0.032 in.	Spring Steel
7130320401	Curved	5 inch	0.025 in.	Spring Steel
7130320402	Curved	5 inch	0.032 in.	Spring Steel

*

Bore size = 0.025

All About Cutter Bushings

Rotary knife cutter bushings are probably the most ignored aspect of cutting. Yet, they are probably the most important ingredient to obtaining clean, square, accurate cuts with minimal jamming and broken blades.

This appendix contains information about several aspects of cutter bushings:

- bore characteristics
- bushing length
- shear surface characteristics
- the bushing gap

Cutter bushing bore size

The cutter bushing bore size affects both the cutting process and the overall extrusion process.

Bushings with relatively large bores are often used to facilitate start-up and minimize bushing inventory. While this practice is acceptable for start-up, it will lead to premature blade failure because the bushings do not properly support the blade. For optimum cut quality, make sure the bore adequately supports the tube or profile.

When the blade first makes contact with the tube or profile, it pushes the part until is assumes the size and/or shape of the bushing bore. In the case of tubes this causes two marks on the tube (penetration marks) that show where the tube flattened before the blade actually penetrated it. The tighter the bushing bore size to tube size, the closer the marks become, making them less obvious.

If the bushing bore is too tight, excessive extrudate interruption or even jamming may occur. In turn, this can cause internal air blockage in free extruded flexible materials and thus extrudate size fluctuations. In the case of rigid profiles or tubes, belt puller slippage may occur during the cutting if the bushings are improperly configured. This can cause annular rings around the extrudate and size fluctuations.

- For rigid profiles or tubes, allow 0.010-0.020 inch clearance over the OD tolerance. Anything tighter than 0.010 inch will be difficult to process. For easier startup, allow as much as 1/4 inch above a rigid profile because the blade will force the profile to the bottom of the cutting bushing where the shearing action occurs. However, if perfect squareness is required, the clearance above the profile should be minimized to prevent bowing. Supportive bushings become more important if heat is used to minimize whitening (fracturing).

(Continued)

All about Cutter Bushings (continued)

- If you are cutting a square or rectangular profile, whether rigid or flexible, a round bushing bore will not offer proper support and will often lead to an "S" shaped cut. A flat bottomed bushing will offer excellent support and enhance the shearing action of the blade.

- In the case of flexible extrudates, allow 0.010-0.050 inch clearance depending on durometer and surface; the softer durometers and tacky surfaces require the most clearance. In the case of softer durometer materials, bushing lubrication may be required to minimize drag and material build-up between the cutter bushing faces.

Cutter bushing bore surface quality

The internal surface of the cutter bushing must be smooth and glass-like when cutting flexible extrudates, otherwise excessive drag causes jamming and can lead to variations in cut-to-length accuracy.

- When cutting flexible materials, have the internal surface machined to resemble glass. In many cases, medical processors will actually have the ID of their bushings either honed or burnished for best results.

- When cutting clear extrudates, it is also very important to have a smooth internal surface to minimize scratches. In some cases it may be necessary to make a Teflon or Delrin insert to further minimize drag and/or scratching.

- Bushing lubrication can also help minimize bushing drag.

- Be sure to have a lead-in angle machined into the entrance of the upstream cutter bushing. The transition from the bore to the lead-in angle should not be abrupt as it to can cause variable drag.

(Continued)

All about Cutter Bushings (continued)

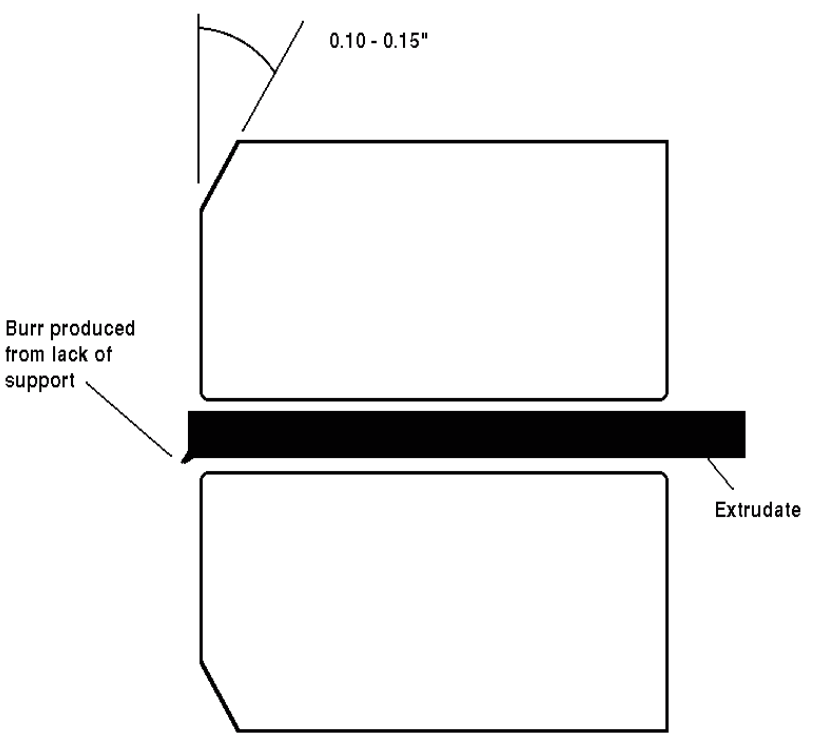
Cutter bushing shear surface quality

Similar to a dull pair of scissors, if the cutter bushing shear surface is not sharp the tube or profile is not supported to the side of the blade and the cut will not be clean. In some cases, the entrance of the downstream cutter bushing is slightly radiused to minimize jamming. While this practice helps accommodate bushing bores that are not quite aligned, it has a negative effect on cut quality.

- The shear surface of both the upstream and downstream cutter bushings should be sharp and bored to the same size.

NOTE: In high speed cutting applications, the downstream bushing is sometimes bored 0.005" larger than the upstream bushing to minimize jamming. Deburr the edge after the boring operation, but be careful to remove only the burr and not the edge.

- Leave a minimum land of 1/8 - 1/4 inches on the face of the cutter bushing beyond the bore. Angle the rest of the bushing face with a 10-15 degree lead-in.



(Continued)

All About Cutter Bushings (continued)

Cutter bushing length

⚠ **CAUTION: Blade hazard**

In order to comply with OSHA regulations, the distance from the sidewall of the cutter to the blade (through the bushing) must be long enough to prevent fingers from reaching the blade.

On flexible extrudates, it is important to minimize the length of the cutter bushings. It is very difficult to push flexible extrudates through since it tends to compress as it is pushed, causing a marginal increase in the tube diameter. For this reason, bushing lubrication may be necessary to minimize drag as the length of the bushings increase. A discharge conveyor may also be helpful in removing longer cut parts. The exit bushing may be funneled to allow the cut part to drop out faster while still maintaining minimal bushing length for safety.

- For flexibles, the upstream cutter bushing should offer total support to the extrudate as close to the nip point of the puller as possible. In this way the part is not able to move from side to side or bow from the weight of the tube, which can, in turn, cause variable drag. You use the strength of the tube to push itself.

- The bore length of the exit bushing should not be shorter than 1 1\2 times the diameter of the tube with the remainder of the bushing length being tapered. On sticky flexible extrudates, the parts will actually stick back together if the new part has to push the cut part out very far.

For rigid extrudates, the length of the cutter bushings can result in a square cut or an angular cut. The cutter bushings support the extrudate keeping it from moving from side to side and bowing from the weight of the profile itself. Many processors make their bushings short to minimize cost of EDM which is determined by depth of cut.

- For rigid extrudates, a general rule is to make the length of the cutting bushings equal to two times the largest outside dimension.

✎ **NOTE:** In the case of full profile cutter bushings where maximum support is offered, the bushing length may be shortened depending on actual clearance.

- Be sure to have a lead-in angle machined into the entrance of the upstream cutter bushing. The transition from the bore to the lead-in angle should not be abrupt as it to can cause variable drag.

(Continued)

All About Cutter Bushings (continued)

Adjusting the cutter bushing gap

If the bushing gap is too big, material is dragged down between the bushings creating a burr, especially with flexibles. This may lead to jamming within the bushings where the upstream side of the cut extrudate actually hits against the downstream bushing surface. This is especially apparent with flexibles with non-concentric walls where a slight bow is present.

- Locate the downstream bushing such that it touches the blade without deflecting it. Lock it in place and rotate the blade to check proper gap.

- Locate the upstream cutter bushing with 0.001-0.002 inch of the blade and lock it in place. Rotate the blade through the set bushings to insure proper gap.

  ✎ **NOTE:** Because blades are rarely perfectly flat, it is possible that a swishing sound will be heard.

- If hairs are present on only the upstream cut end of a tube or profile, it may be necessary to allow a 0.002-0.005 inch gap on the downstream bushing to allow the blade to slightly move with the extrudate during the cutting cycle and not cause excessive frictional heat which actually melts the extrudate.

  ✎ **NOTE:** Blade/bushing lubrication can also help to solve this problem.

Blade and Bushing Lubrication

Blade and bushing lubrication can nearly always improve the quality of cutting.

Description of the cutting process

Unlike sawing, a rotary knife cutter displaces material rather than removing it. When the knife blade first contacts the extrudate, it pushes it against the opposite side of the cutter bushings. If there is too much clearance the extrudate may crack or distort before cutting even begins. Tubing may develop two distinctive marks related to the compression of the tube.

Once the blade penetrates the part, material is displaced to either side of the blade. This displacement will vary in degree and visibility depending on the type of material, temperature, blade thickness, blade style, and blade speed. As the material is displaced, heat is generated and passed to the blade surface.

Flexible materials (flexible PVC, urethanes, and even LDPE) will generally compress during cutting, leaving little or no sign of displacement. The cut will appear uniformly glossy and free of fracture. However, a closer look will show very fine lines on the cut face. With flexible materials, these lines will typically show an arc or "S" pattern which can be attributed to compression of the part as the blade passed through.

Rigid materials such as rigid PVC and styrene will tend to fracture during cutting. The cut surface changes from glossy to dull, and finally becomes whitened and rough. Whitening occurs when cutting changes to fracturing: the cut begins to extend in front of the cutting blade, which acts as a wedge. At this point, you can only hope the fracture is controlled, allowing for a square cut.

Friction and heat during cutting

Because most rotary knife cutters don't travel with the flow of the extrusion line, forward motion is interrupted as the blade passes through the plastic tube or profile. This interruption causes friction, which generates heat in the cutting blade. As the temperature of the blade increases, plastic is melted at the cut site. This melted plastic can adhere to and coat the cutting blade, especially on the upstream side, and be transferred to the next part in the form of hairs or tissue-like film. This will be especially noticeable on the top inside of the tube or profile.

(Continued)

Blade and Bushing Lubrication

If the blade has a rough surface where the extrudate rubs against it, material will accumulate on the blade in a cheese grater fashion. This scratched material will also be passed from the blade to the next cut and be seen as hairs or flakes.

Some of the more flexible materials, such as silicones, soft urethanes and flexible PVCs, also exhibit drag against the blade during the cutting cycle. The part will actually stick to the side of the blade and drag down between the bushings. Typically a small "C" shaped tail of the tube will accumulate in the bottom of the cutting chamber. This tail actually tore off the tube rather than cut due to the excessive drag against the blade.

The generation of heat during cutting can also lead to parts that stick to each other. They may appear to be welded together, and an extra operation may be required to separate them. This can be a real problem in materials such as latex, silicone, PP, and flexible PVC.

Benefits of using lubricants

The primary benefit of using a cutting lubricant is reducing friction. If the cutting blade is coated with a film of lubricant, the coefficient of friction between the blade and the plastic tube or profile is reduced, reducing the generation of frictional heat.

Lubricants also minimize the tendency for material to stick to the blade, thus minimizing the potential for material to be wiped on the next cut part. The co-efficient of friction is reduced with varying degrees, depending on the type of lubricant, which in turn limits the increase in blade temperature. Over time this can lead to an increase in blade life because the cutting edge will last longer at cooler operating temperatures.

While lubricants can also help minimize problems caused by rough or poorly ground blades and cutter bushings, it is generally better to solve the problem than mask it with lubricants.

(Continued)

Blade and Bushing Lubrication (continued)

Common cutting lubricants

Commonly used general purpose lubricants include:

- Tap water
- Dish washing liquid (Joy, etc)
- Glycol (anti-freeze, coolant)
- Water-soluble silicone cutting oils
- Diesel fuel
- Mold release
- Mineral oil

Medical grade lubricants:

- Distilled water
- Isopropanol (isopropyl alcohol)
- Mixtures of isopropanol and water

Lubrication systems

The most basic blade lubrication system for rotary knife cutters is using a stainless steel tray filled with the lubricant. Because the cutting blade passes through the tray during every cutting cycle, the blade is lubricated before each cut. This approach limits material buildup on blade and bushing surfaces for most applications. Care must be taken to maintain the lubricant level within the tray. Clean out accumulated cut residue on a regular basis.

Spray mist systems can be used to lubricate either the blade or the extrudate as it enters the cutter bushings. These systems allow the application of a minimum amount of lubricant with good consistency. If the mist is applied to the product as it enters the cutter bushings, the lubricant will minimize the drag between the bushing bore and the tube or profile, as well as wet the blade and bushing faces. With flexible and/or sticky materials this can improve both cut quality and cut-to-length accuracy.

The last method of blade lubrication (and the oldest) is the blade wipe system. Felt, sponge, or some other absorbent material is mounted so the rotary knife blade will pass through it, with interference, before making a cut. Typically a gravity drip or wick system is used to keep the absorbent material wet with lubricant. These systems not only lubricate the blade, but also wipe off residue before each cut. However, the operator must constantly observe the condition of the pads as they wear quickly and lose their function. Another concern (especially in medical applications) is what happens to wear particles from the pads. This material frequently ends up on the blade itself, and is then transferred to the very product it is meant to protect from contamination.