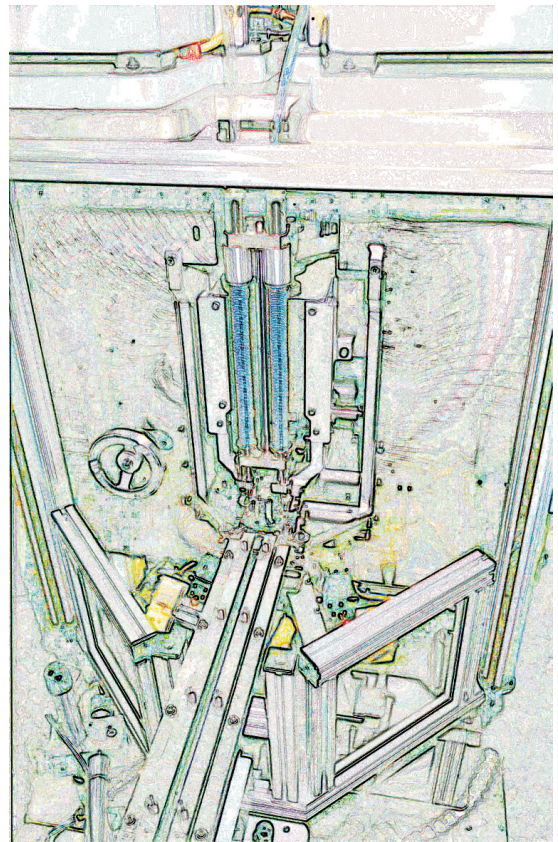
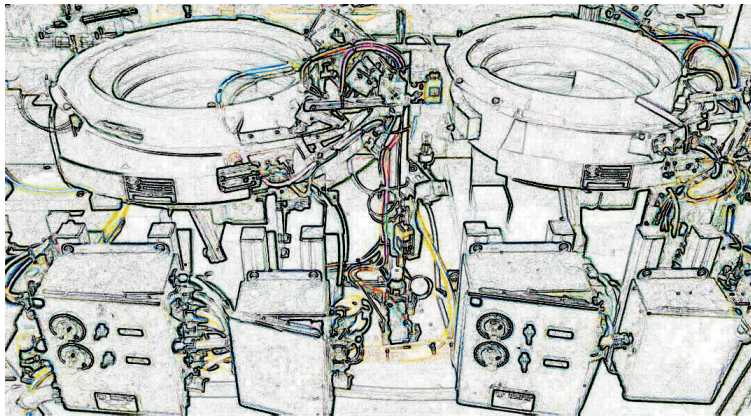
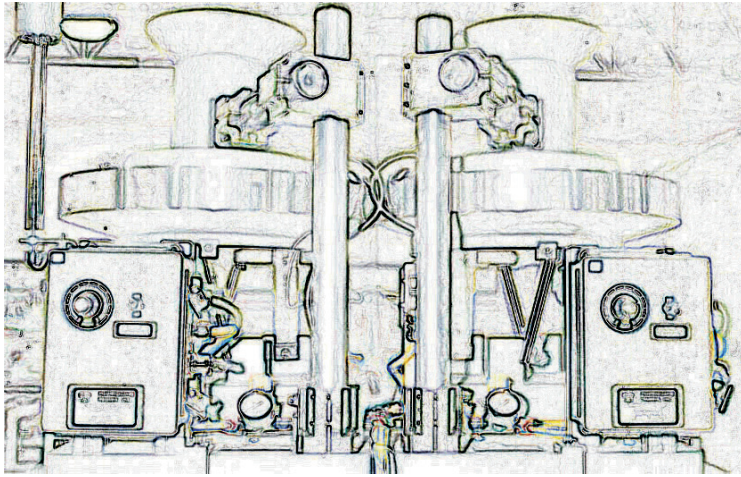


Terminal Assembly Machine

Acme Manufacturing Inc. #J9876



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Terminal Assembly Machine

Job #A9876

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Parts of this Manual

- The *Introduction* section has a brief description of the machine and its operation.
- The *Operation* section describes how to load, start and stop the machine.
- The *Maintenance* section describes periodic lubrication and other adjustments or maintenance issues.

Warranty and Terms

- A. In the event any part of the equipment shall prove defective in material or workmanship within a period of one (1) year from the date of delivery, Acme Manufacturing Inc.'s liabilities or obligations will be to repair or replace the part in question. The part in question must be returned to Acme Manufacturing Inc. for evaluation.
- B. Acme Manufacturing Inc. shall not be liable under any circumstances for any incidental or consequential damages which may arise out of the purchase or use of the subject equipment or any part thereof.
- C. Components manufactured by others and used in equipment manufactured by Acme Manufacturing Inc. shall carry only the warranty of such other manufacturers, if any, and no warranty by Acme Manufacturing Inc. for those components is either expressed or implied.
- D. If conditions arise which prevent shipment on scheduled dates, Acme Manufacturing Inc. shall not be liable for damages or pay any penalty for delay in delivery.
- E. In the event that local laws, regulations, orders, etc. require modifications of the equipment not contemplated within the specifications, then Purchaser shall pay at its expense for such modifications in addition to the purchase price.
- F. The above warranties are the only warranties and terms given. The provisions hereof shall be governed by and construed according to the laws of the State of Minnesota.




Disclaimer

Information in this document is subject to change without notice and does not represent a commitment on the part of Acme Manufacturing, Inc.

Acme Manufacturing, Inc. provides this document "as is," without warranty of any kind, either expressed or implied, including, but not limited to, the particular purpose. Acme Manufacturing, Inc. may make improvements and/or changes in this manual or in the product(s) described in this manual at any time.

This document could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes may be incorporated in new editions of the publication.

Warning Codes

Keyword	Application
	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or may result in damage to the machine.

Introduction

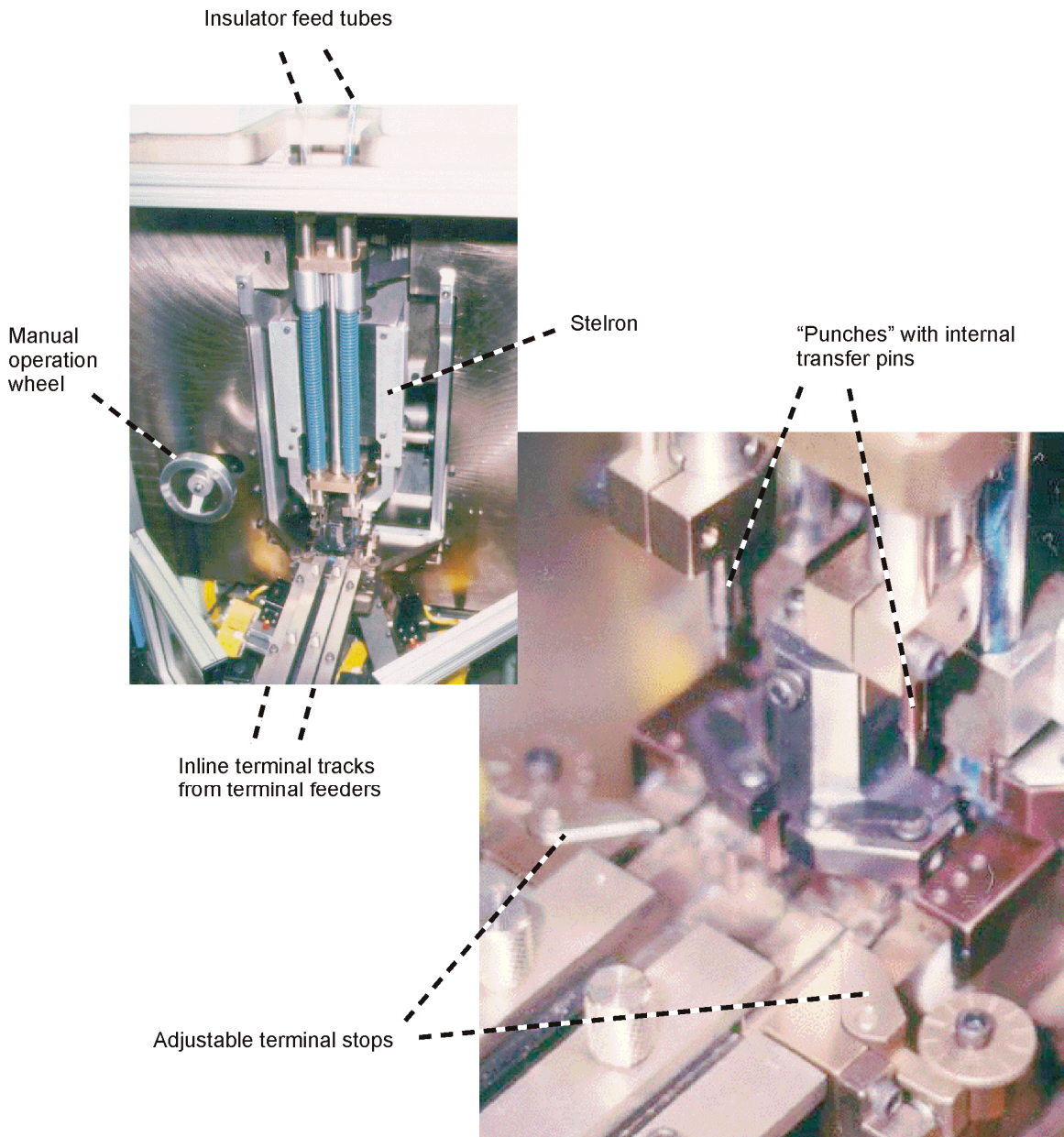
Description

The Acme Manufacturing Inc. Terminal Assembly Machine for the Wiley Company assembles terminals and insulators at speeds of up to 180 parts per minute (depending on terminal and insulator styles). Several different Size 2 terminal and insulator styles can be run with minor parts changes. The machine is based on an existing Wiley Company design, with new tooling and feeder assemblies designed and built by Acme Manufacturing Inc.

The machine consists of two terminal vibratory feeder bowls, two vibratory inline tracks, two insulator feeder bowls, and a dual gripper/press assembly for pressing the insulators onto the terminals. The line is controlled from a QuickPanel touch panel. A Sensotec monitors the punch pressure, basing good/reject decisions on whether the pressure of the last assembly was in the programmed “window.” Bad assemblies are rejected from the line.

Safety interlocks in the access doors and a light curtain protect the operators by stopping the system if a door is opened or the light curtain is “broken.” A remote *Emergency Stop* switch is also provided for rapid, emergency stopping of the line. A two-color *Stack Light* gives a visual indication of the line’s status; messages on the control panel describe any alarm conditions.

Figure 1 **Terms**



Sequence of Operation

1. Terminals are fed from the terminal feeder bowls into the two inline tracks. At the same time, insulators are fed by the insulator feeder bowls into the insulator feed tubes.
2. The last terminal in line is held in place by the adjustable stop.
3. The Stelron horizontal motion moves the transfer pins out over the barrel of the terminal(s) waiting at the terminal stop. The Stelron forward motion stops. The cam-operated rocker arm moves the terminal transfer pins down into the terminal barrel(s).
4. When the transfer pins are in the lowest position, the Stelron horizontal motion moves the terminals into the terminal jaw, sweeping the previously-assembled terminal out in the same motion. (The adjustable stop springs back into place to hold the remaining terminals in the inline track.)
5. An insulator drops into the insulator jaw.
6. The Stelron horizontal motion transfers the insulator to the punch area.
7. The insulator is pressed onto the waiting terminal.
8. The process continues.

Power and Control Specifications

Main Air Pressure (customer supplied)	80 p.s.i. minimum
Feeder Bowl air pressure	Set per manufacturer's recommendation
SV30300 Clutch air pressure	38 p.s.i.
SV30301 Brake air pressure	40 p.s.i.
SV31003 Chute Left air pressure	30 p.s.i.
SVV31002 Chute Right air pressure	30 p.s.i.
SV30302 Bowls air pressure (supply)	60 p.s.i. (or above requirements of bowl manufacturers)
Power	208 VAC, Single-Phase, 60 Hz, 30Amp
Controller:	OMRON CQM1 PLC OMRON S308 Sensor Controller
Operator Interface:	QuickPanel Jr.

Changeover

Changing the line to run different terminals and insulators

Changing the line to run different terminals and insulators *may* require:

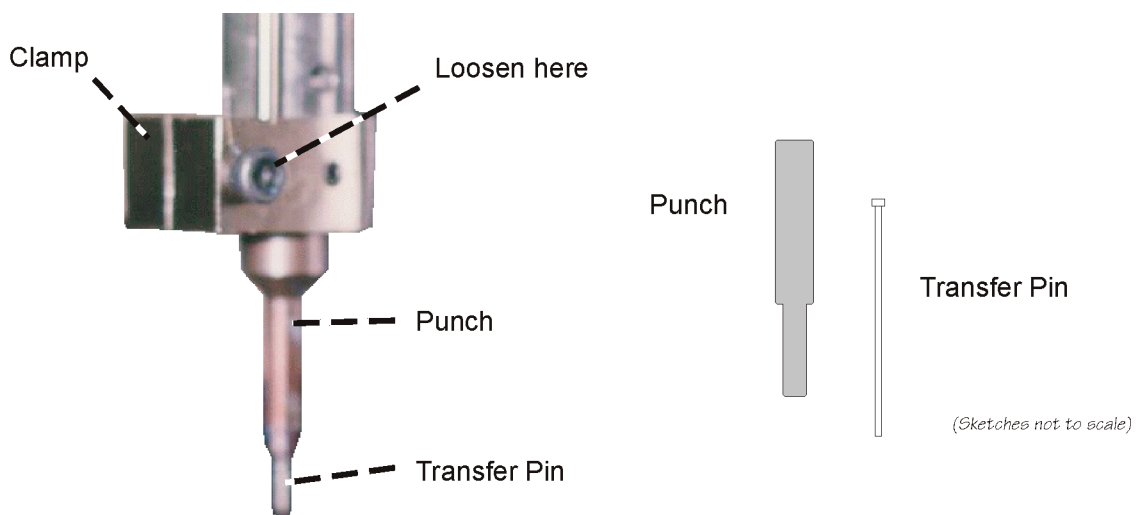
1. Changing the press punches and associated transfer pins;
2. Changing the pressure of the press;
3. Reprogramming the Sensotec for new pressure limits;
4. Adjusting the terminal stops;
5. Adjusting the feeder bowl speeds and pressures.
6. Adjust the main motor speed.

Not all areas will need to be changed or adjusted for all changes, due to the similarity of parts. Experience will dictate the changes necessary in going from one particular part to another.

Changing the Punches and Transfer Pins

The punch/transfer pin assemblies are held in place by the clamps shown in Figure 2. Manually operate the line until the punches are in an accessible position. Loosen each clamp and remove the punch and transfer pin. When installing new parts, *make sure that the transfer pin and punch are a matched set* (pin diameter matches punch internal diameter).

Figure 2 Punch Removal



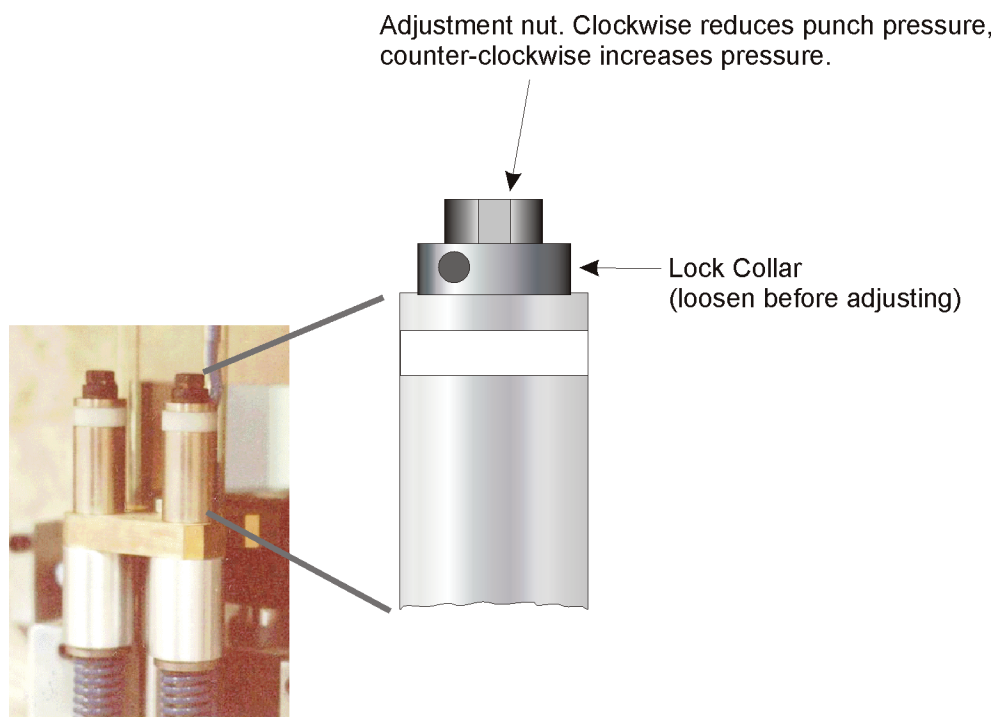
Changing Press Pressure

The pressure of the insulator press is adjusted at the top of the press assembly—see Figure 3. Loosen the locking collar, then turn the top nut as necessary:

- Turn Clockwise to reduce punch pressure.
- Turn Counter-clockwise to increase punch pressure.

Remember to retighten the locking collar.

Figure 3 Pressure Adjustment



Sensotec

The Sensotec may have to be reprogrammed for new lower and upper pressure limits (for both the left and right sides). Refer to the Sensotec manual for details.

A “good” press is one that is *over* the lower pressure limit (LED L-1 comes on for the left side, LED L-3 for the right side) and *under* the high pressure limit (LED L-2 comes on for the left side, LED L-4 for the right side).

⚠ CAUTION Before any setup procedures on the Sensotec, *make sure there is no load on the load cells*. Manually operate the machine until the punches are in the “up” position.

Figure 4 Sensotec Front Panel



Figure 5 Sensotec Setting Summary Chart

SENSOTEC SETTING
MODEL SC200

SYSTEM SETUP

Excitation = 10VDC
Software Rev = 084-1302-00 2.04
Channel 1 Type = \$60 Strain Gage
Channel 2 Type = \$60 Strain gage
Channel 3 Type = Not installed

CHANNEL #1 AND #2

Auto-Zero = Off
Fast Peak = Off
Auto-Check = Off
Power-On Cal. = On

DISPLAY SETUP

Display, Digits = Unipolar<6 digits
Display, Dec Pt. = 000000
Display, Coun-by = 000001
Display, Units = LBS
Display, Average = Off

DAC SETUP

DAC Channel = Channel 1
DAC Source = Peak
DAC Zero Scale = 5,000

Conversion Rate = 60.0
Calibration Type = MV/V CAL.

CALIBRATION DATA

Full Scale MV/V = 3.00000
Full Scale Value = 10000
Calibrate Value = 10000
Update Sig.
Fault Size Mode

LIMIT MENU

Limit Enable = ON
Limit Setpoint = 500
Limit Return Pnt = 15
Limit Energize = Signal > Setpoint
Limit Channel = Channel #1
Limit Source = Peak

MAIN SCREEN FUNCTION

UP Key = Change between modes (TK, HI, LOW)
TK = Track Mode
HI = Peak Pressure Mode
LOW = Low Pressure Mode

Test Key = Change between Channel #1 and #2

Clear = Reset Sensotec

Up & Clear = Setup Mode

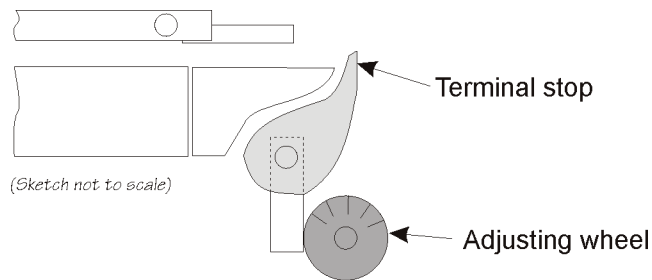
LIMITS

Limit #1=LED #1 Left Low Pressure
Limit #2=LED #2 Left High Pressure
Limit #3=LED #3 Right Low Pressure
Limit #4=LED #4 Right High Pressure

Adjusting the Terminal Stops

The Terminal Stop Cams at the end of the inline tracks may need to be adjusted to the barrel of the new terminal. For each track, place the new terminals in the track, and manually operate the machine. If the transfer pin does not go cleanly into the last terminal's barrel, the terminal stop cam may be adjusted by loosening the bolt on the adjusting wheel (Figure 5) and rotating the wheel as necessary to center the terminal barrel under the pin. Retighten the adjusting wheel locking bolt.

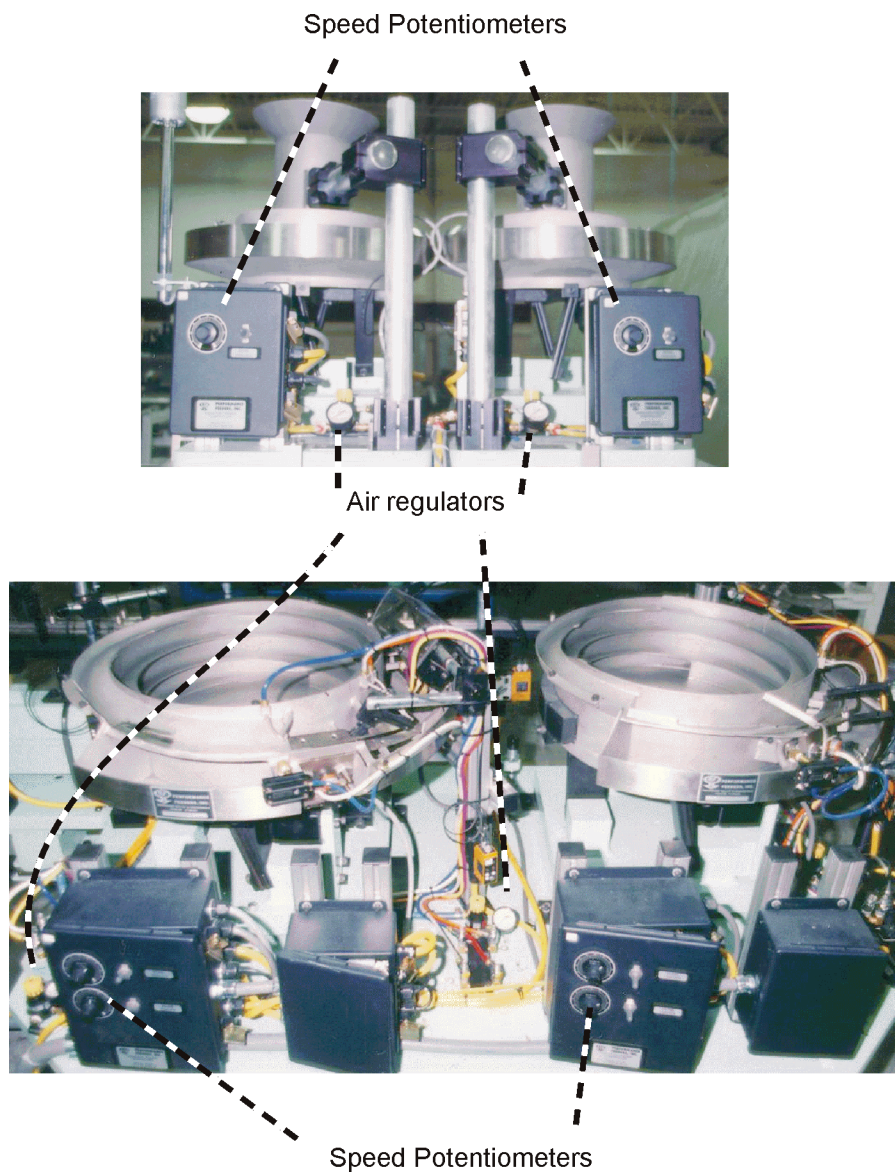
Figure 6 Terminal Stop Cam Adjustment



Adjusting Feeder Bowl Speeds and Pressures

Certain terminal or insulator types may require “fine-tuning” of the vibratory speed or air pressure settings of each feeder bowl or of the inline tracks. These settings will be dictated by experience with each part.

Figure 7 Speed Potentiometers



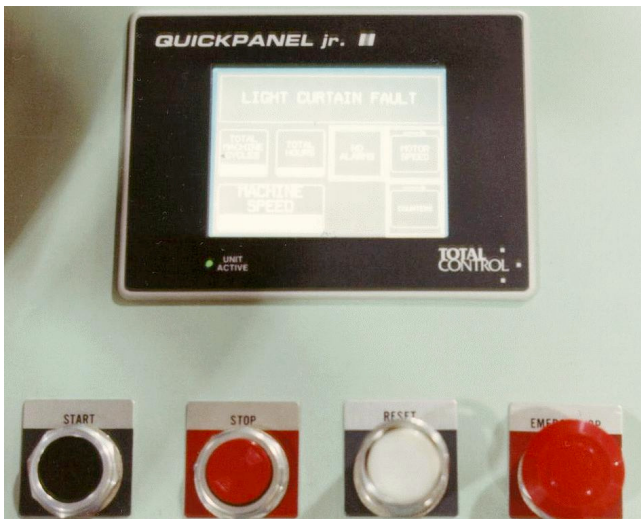
Operation

⚠ WARNING

Do not attempt to defeat the safety interlock and operate the machine with the access doors open or light curtain disabled.

Operator Controls

Figure 8 Operator's Control Panel



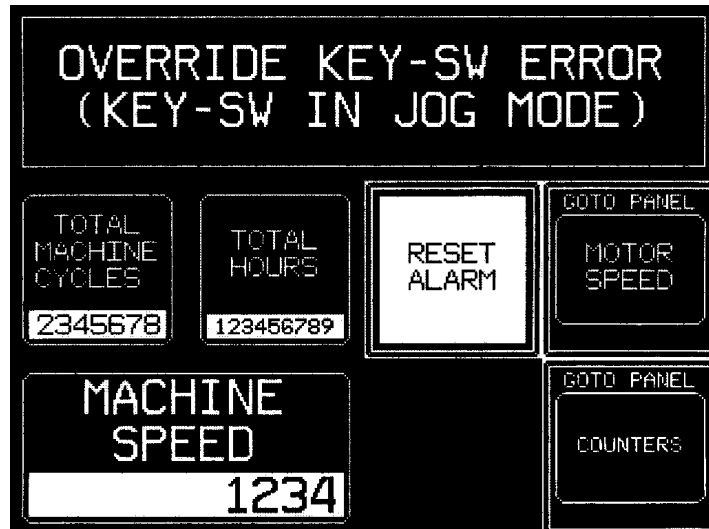
Besides the QuickPanel touchscreen, the operator's control panel has four controls:

- The START button starts the machine. The machine will run until either the STOP or EMERGENCY STOP buttons are pushed, or until a fault occurs.
- The STOP button stops the machine. It can be restarted again by pressing the START button.

- RESET is used to acknowledge alarms (as shown in the display) and reset the controller.
- The EMERGENCY STOP switch stops the machine *immediately* when pressed.

QuickPanel Screens

Main Screen



(Message area)

Displays alarms/faults and other operational messages.

Total Machine Cycles

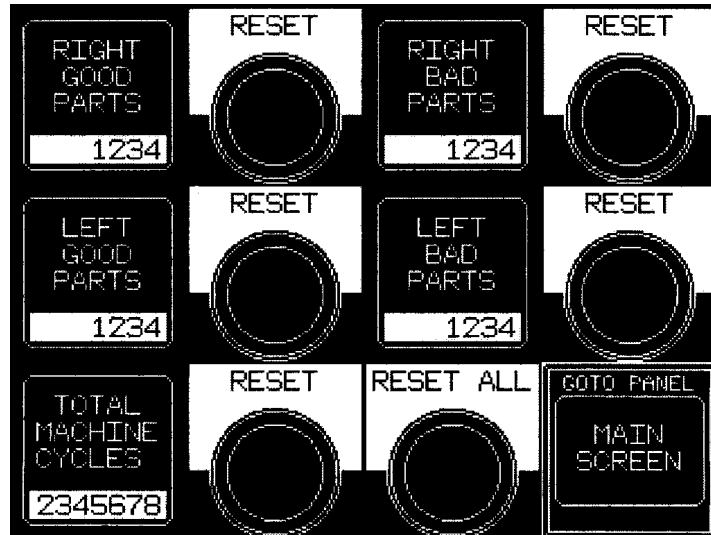
Total machine assembly cycles since this counter was last reset. (The Cycles counter can be reset on the Counters screen.)

Total Hours

Total hours of machine operation since construction, Non-resettable.

- Reset Alarm** Press to reset machine after clearing a fault. (Also a reset button even if “No Alarm” is displayed.)
- Motor Speed** Go to the Motor Speeds screen.
- Machine Speed** The current speed of the machine in parts per minute.
- Counters** Go to the Counters screen.

Counters Screen

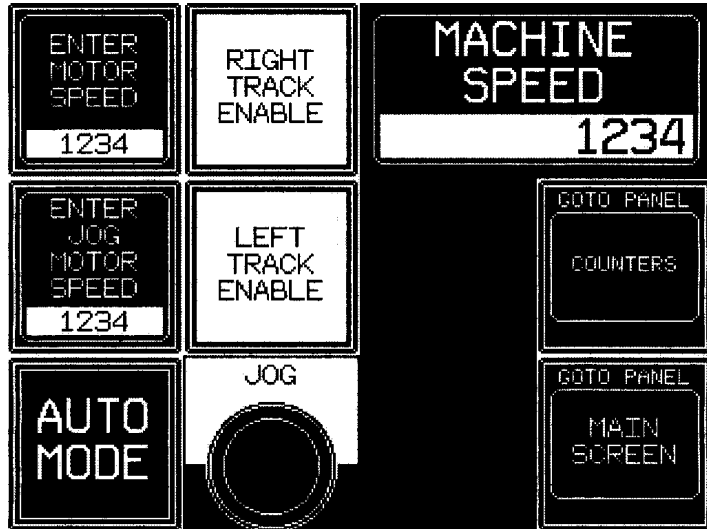


Right Good Parts Displays the number of good assemblies produced by the right side (closest to the control panel) since this counter was last reset.

Reset Reset the “Right Good Parts” counter to zero.

Right Good Parts	Displays the number of good assemblies produced by the left side (furthest from the control panel) since this counter was last reset.
Reset	Reset the “Left Good Parts” counter to zero.
Total Machine Cycles	Displays the total machine assembly cycles since this counter was last reset.
Reset	Reset the “Total Machine Cycles” counter to zero.
Right Bad Parts	Displays the number of “bad” assemblies produced by the right side (closest to the control panel) since this counter was last reset. (Bad assemblies, as determined by the Sensotec, had punch pressures <i>under</i> the lower pressure limit or <i>over</i> the high pressure limit.)
Reset	Reset the “Right Bad Parts” counter to zero.
Left Bad Parts	Displays the number of “bad” assemblies produced by the left side (furthest from the control panel) since this counter was last reset. (Bad assemblies, as determined by the Sensotec, had punch pressures <i>under</i> the lower pressure limit or <i>over</i> the high pressure limit.)
Reset	Reset the “Left Bad Parts” counter to zero.
RESET ALL	Reset all counters on this screen to zero.
Main Screen	Go to the Main screen.

Motor Speed Screen



Enter Motor Speed	Displays and allows the change of the Auto Mode motor speed.
Enter Jog Motor Speed	Displays and allows the change of the Jog Mode motor speed.
Auto Mode / Jog Mode	Toggles between Auto Mode (“Production Mode”) and Jog Mode.
Right Track Enable	Enable or Disable the right track (closest to the control panel).
Left Track Enable	Enable or Disable the right track (furthest from the control panel).
JOG	When the machine is in Jog mode, the machine will operate <i>only while this control is depressed</i> .
Machine Speed	The current speed of the machine in parts per minute.

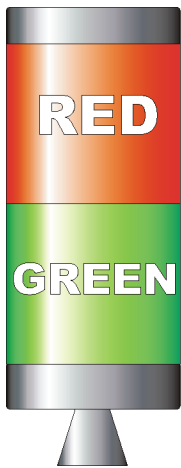
Counters Go to the Counters Screen.

Main Screen Go to the Main Screen.

Light Curtain Control

The light curtain switch has two positions, “AUTO” and “OVERRIDE JOG.” Auto is the normal mode for production, enabling the light curtain protection. “OVERRIDE JOG” *disables* the light curtain and only allows the machine to be operated in jog mode.

Light Stack



Steady: Fault stop. See the message display on the control panel.

Off: The machine is stopped.

Steady: The machine is running, system is okay.

Flashing: Parts are running low; system may stop soon if not replenished.



The system will restart automatically when parts are replenished!

Starting the Machine



Startup Condition Requirements

- Main power ON and air supply connected.
- Terminals in feeder bowls (or Left Side or Right Side disabled as appropriate).
- Insulators in feeder bowls (or Left Side or Right Side disabled as appropriate).
- All guard doors closed.
- Light Curtain switch in “Auto” mode. **Note** that every time the power is turned off, the light curtain must be reset by setting it to Reset, then to Mode 3.

Step 1. Ensure that the machine power is on and the machine air supply is connected and at the required pressure (see “Power and Control Specifications” on page 4).

Step 2. If the power had been turned off, reset the light curtain by setting it to Reset, then to Mode 3

Step 3. If one was previously pressed, pull out the EMERGENCY STOP button. Clear any alarms indicated by the control panel, then press RESET ALARM. If no alarms are indicated, press NO ALARM to clear the controller.

- Step 4.** Reset any counters as required.
- Step 5.** Press the “Start” button on the control panel.

Stopping the Machine

The machine can be stopped with the STOP button on the operator’s panel. In this case, the machine will cycle stop, and can be restarted with the START pushbutton.

Then the machine is stopped with the Emergency Stop push button, the master control relay will be de-energized, causing power to the main motor and all feeder bowls to be turned off; the Power On light will also turn off.

Restarting after an Emergency Stop

1. Make sure that the machine is safe to run again. (Take care of whatever reason the Emergency Stop switch was pushed.)
2. Pull the Emergency Stop switch back out.
3. Reset the machine by pushing the Power On button. If the light turns on, then all Emergency Stop conditions are reset. If the light does *not* come on, check the Emergency Stop button or the light current. The machine will not run if the Power On light does not come on.

Fault Stops and Recovery

The machine can stop automatically for a number of safety or operational reasons.

To restart the machine:

1. Fix the error or condition shown on the control panel's display.
2. Press RESET ALARM.
3. Restart the machine with the START pushbutton on the control panel.

If the fault has caused the Power On light to go off, follow the same procedure as “Restarting after an Emergency Stop” on page 20.

Alarms

The following is a list of the nozzle assembly machine's alarms:

Message	Procedure
RIGHT INSULATOR TUBE (OUT OF PARTS)	Refill the right insulator feeder bowl. The machine will automatically restart if the green light is blinking. If the red light is on, the time-to-refill has expired, then RESET ALARM and the Start button must be pressed to restart the machine.
RIGHT TRACK (OUT OF PARTS)	Refill the right terminal feeder bowl. The machine will automatically restart if the green light is blinking. If the red light is on, the time-to-refill has expired, then RESET ALARM and the Start button must be pressed to restart the machine.
LEFT INSULATOR TUBE (OUT OF PARTS)	Refill the left insulator feeder bowl. The machine will automatically restart if the green light is blinking. If the red light is on, the time-to-refill has expired, then RESET ALARM and the Start button must be pressed to restart the machine.

Message	Procedure
LEFT TRACK (OUT OF PARTS)	Refill the left terminal feeder bowl. The machine will automatically restart if the green light is blinking. If the red light is on, the time-to-refill has expired, then RESET ALARM and the Start button must be pressed to restart the machine.
RIGHT BAD PARTS (THREE IN A ROW)	Look for a jammed part or misfeed of insulator. Manually run the machine to take the bad part out and see what the problem is. When the problem is fixed, push the Power On button, then press RESET ALARM and Start.
LEFT BAD PARTS (THREE IN A ROW)	Look for a jammed part or misfeed of insulator. Manually run the machine to take the bad part out and see what the problem is. When the problem is fixed, push the Power On button, then press RESET ALARM and Start.
WARNING RIGHT BAD PART	There is a bad part on the right side. This message allows you to look and see what the problem might be before the machine shuts down.
WARNING LEFT BAD PART	There is a bad part on the left side. This message allows you to look and see what the problem might be before the machine shuts down.

Message	Procedure
LIGHT CURTAIN FAULT	The light curtain has been “broken” by personnel or equipment, which caused the Master Control Relay and the Power-On light to turn off. Check to make sure the machine is safe to run, then push the Power On button, then press RESET ALARM and Start.
EMERGENCY STOP FAULT	A Emergency Stop switch has been pressed. Fix the reason for the E-Stop, pull up the E-Stop switch, then push the Power On button, then press RESET ALARM and Start.
AUTOMATIC SHUT DOWN (AIR SAVER)	The machine has not been used in the last ten minutes, which caused the Master Control Relay to turn off. Check to make sure the machine is safe to run, then push the Power On button, then press RESET ALARM and Start.
RIGHT SIDE PARTS NOT EJECTING ERROR	Parts are not ejecting into the good parts box. Possible jam in the punch—eject chute area. Also check the photo eye (alignment, cleanliness). Fix the problem, then push the Power On button, then press RESET ALARM and Start.

Message	Procedure
LEFT SIDE PARTS NOT EJECTING ERROR	Parts are not ejecting into the good parts box. Possible jam in the punch—eject chute area. Also check the photo eye (alignment, cleanliness). Fix the problem, then push the Power On button, then press RESET ALARM and Start.
OVERRIDE KEY-SW ERROR (KEY-SW IN JOG MODE)	<p>⚠ WARNING The Override key switch is to be used by Authorized Personnel ONLY. Damage to equipment or personnel could result if operated by unauthorized personnel.</p> <p>⚠ WARNING When the Override key switch is on, NO SAFETY GUARDS are active in front of the machine. Damage to the machine <i>or injury to personnel</i> could result from operating the machine.</p> <p>AUTO: No override of light curtain. This is the normal mode of operation.</p> <p>JOG: Light curtain protection is overridden. Machine will operate only in Jog mode.</p>

Maintenance

⚠ WARNING

Do not attempt to defeat the safety interlock and operate the machine with the access doors open, or with the light curtain disabled.

⚠ WARNING

Unless explicitly stated otherwise, all maintenance procedures are to be performed with the machine's Main Power OFF.

PLC Battery Check

Every 50 hours of operation, the status of the PLC's battery should be checked. There is a "battery low" LED on the controller; check to see if it is lit. For safety's sake, the battery should be changed every three years. (See the PLC's manual for specific instructions on battery replacement.)

Periodic Cleaning

Proper operation of the machine requires that it be clean of dust and grease, particularly the feeder bowls and feeder tracks. Also make sure that all part-present and track-full sensors are clear of dust and grime.

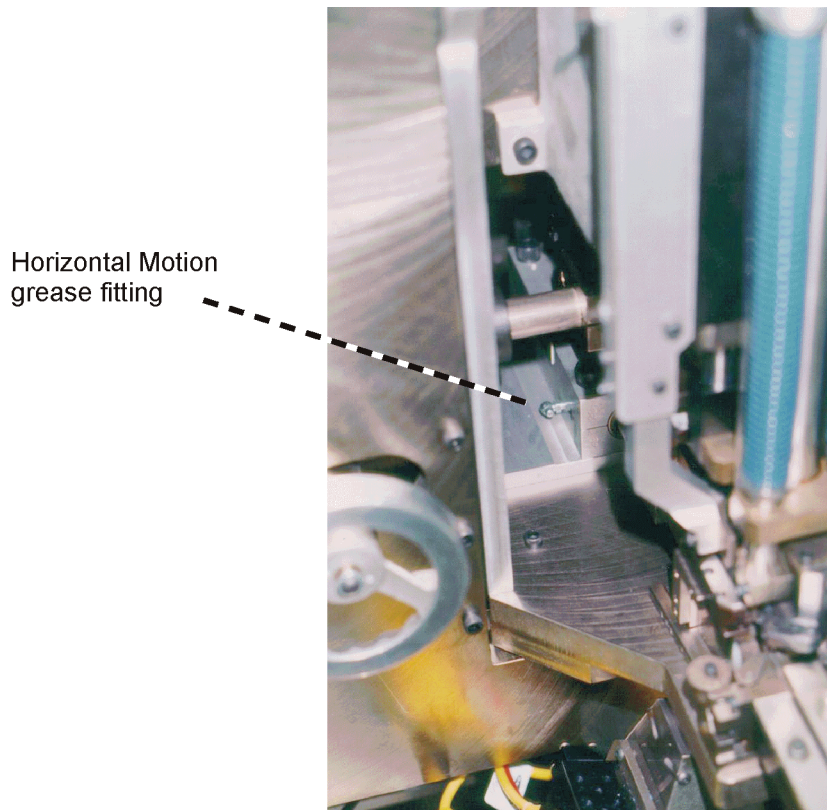
Periodic Lubrication

Every month of operation (or sooner, as experience dictates) check the oil level in the gearboxes, and lubricate the gearbox and motor as directed by their respective manufacturers.

Horizontal Motion Lubrication

Every week of operation (or sooner, as experience dictates), grease the horizontal motion of the Stelron at the grease fitting shown in Figure 9.

Figure 9 Horizontal Motion Grease Fitting

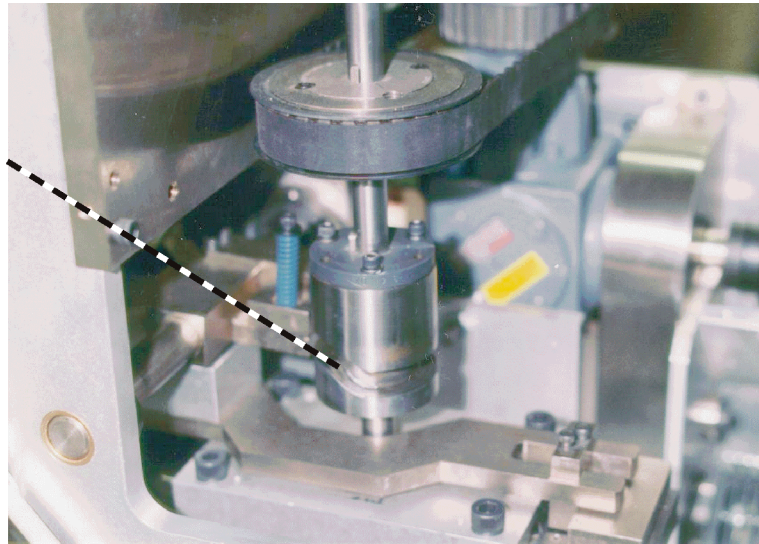


Cam Lubrication

Every week of operation (or sooner, as experience dictates), apply grease to the cam shown in Figure 10.

Figure 10 Cam Lubrication

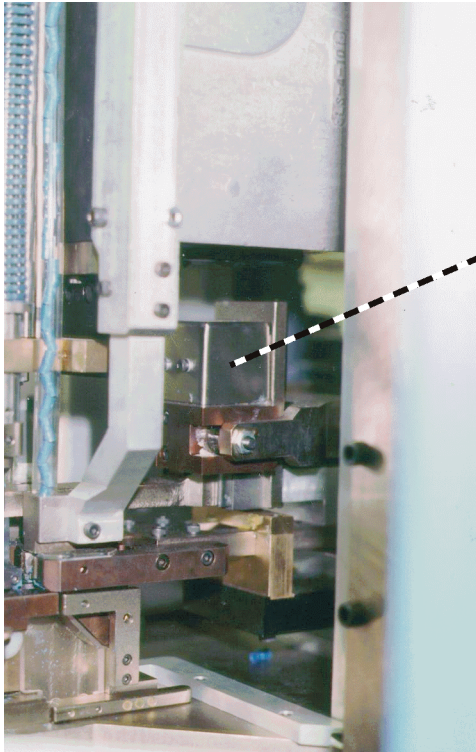
Grease this cam



Straight Cam (“Slide”) Lubrication

Every week of operation (or sooner, as experience dictates), remove the dust cover and grease the straight cam and cam roller surface as shown in Figure 11.

Figure 11 Straight Cam Lubrication

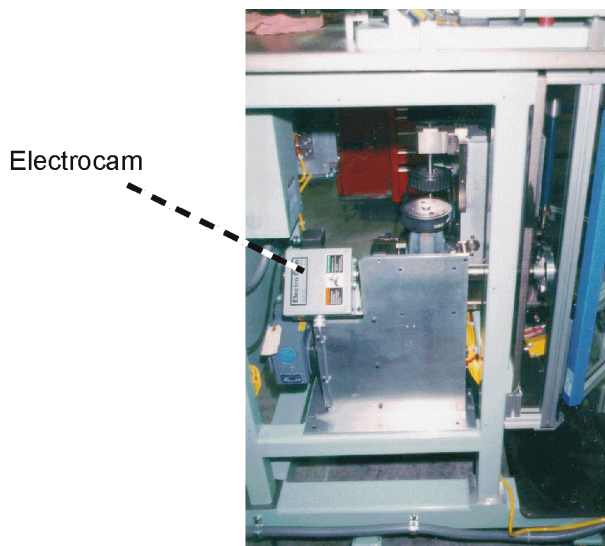


Remove this dust cover to lube straight cam and cam roller surface

Checking Machine Timing

If the machine does not seem to be operating properly, check the timing of the machine. All mechanical operations are controlled by the Electrocam, located on the left side of the machine. Remove the Electrocam's cover to view the LEDs and digital readout.

Figure 12 Electrocam Location



- Manually operate the machine until the punch is at its lowest point; this should read “000.”
- Rotate the hand wheel to test “Part Good/Part Bad.” LED #1 (far left) should come on at 105° and turn off at 345°.
- Rotate the hand wheel to test the Sensotec reset; LED #2 should come on at 130° and go off at 170°.
- Rotate the hand wheel to test the Good/Bad clock to the PLC; LED #3 should come on at 135° and go off at 220°.