

LE750
Instruction
Manual

LE750 - Rotary Cutter Controller designed and developed by Lyons Electronics.

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Lyons Electronics has now been established for over 16 years. During that period we have been concentrating mainly on electronic control systems for the Plastics Extrusion Industry.

Units manufactured by Lyons Electronics include Rotary Cutter Controllers, High Speed Switches for controlling Vacuum, Pneumatic and Electromagnetic Clutches, Microprocessor Bubble Tubing controllers, Sequencers for synchronising complex lines, and Guillotine and Saw controllers.

All of our electronic controllers have been designed to achieve the highest accuracy's available from the equipment in which they have been installed and to be robust and reliable.

LE750 Instruction Manual

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LE750 Features

- * Light touch-sensitive membrane panel
- * Bright clear displays for easy readability
- * Rotary cutter control
- * Feed or Take-off control
- * Automatic or Manual Batch Sorting
- * 4 Lengths available with associated batches and outputs
- * 4 different cutting modes plus an option for special applications
- * 2 Tachometers to show Blade revolutions per minute and line speed in metres or feet per minute
- * 2 x 10 decade total counters
- * Ten year memory retention
- * Automatic self-testing
- * System testing for engineers
- * Synchronising to and from external controls possible
- * Dimensions - 250mm wide x 100mm high x 170mm deep.
(250mm deep with connectors attached)
Panel cut-out 225mm x 95mm
Fixing Dimensions 235mm x 60mm

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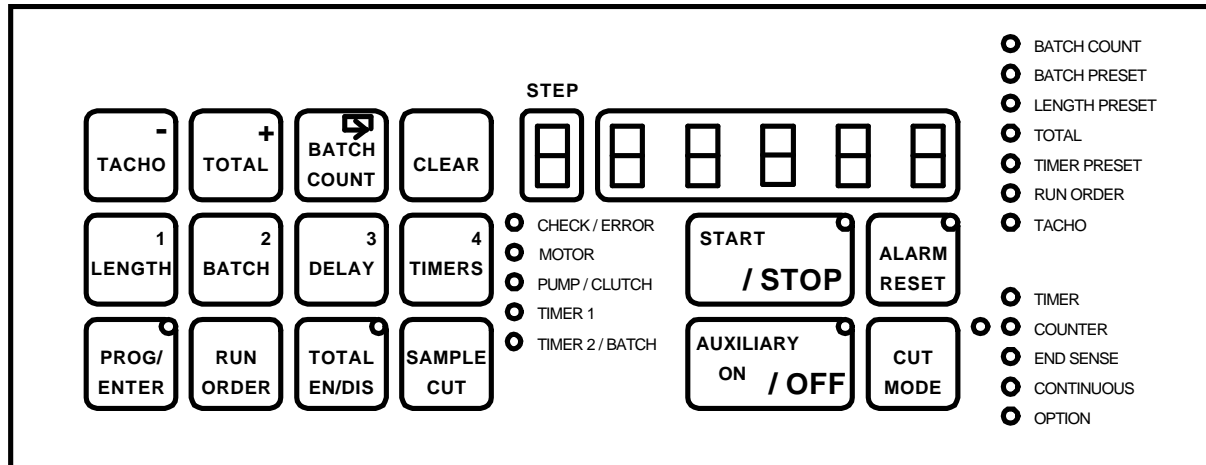
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Section 1

Introduction

The LE750 is a microprocessor-based controller for rotary cutting machines using electromagnetic, pneumatic or vacuum clutch / brake units as the cutting medium. The LE750 can also control external equipment for automatic Batch processing in synchronisation with the cut, and operate Feed or Take off systems.

The front panel consists of a sixteen key flat membrane panel, with a single 6-digit High Brightness display and various LED indicators mounted behind the panel. The panel can easily be wiped clean. The internal electronics are protected to IP50.



The 6-digit display is used to show all presets, counts, and error codes etc.. An indicator along with a value in the step window is used to indicate display source.

Displayed Parameters include: -

- 4 Lengths
- 4 Batches
- 4 Delays
- 2 Timers
- 2 Tachometers
- 2 Tachometer Sample Timers
- 2 Totals
- 1 Batch Count
- 1 Run Order
- 9 Error Codes
- 1 Dash Display
- 1 Sign-on Code
- 1 EPROM version

Other indicators are also used. Five are used to show cut mode selected. An indicator next to the counter lights or flashes when external pulses are being received on the clock input. The status of the motor, pump, timers and auxiliary are shown to confirm output condition. Program mode, start mode and Total 1 / Batch Count enable / disable status are also confirmed.

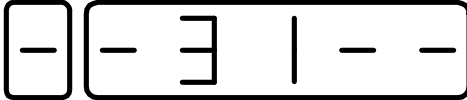
The operator can select certain default operating conditions by means of an external programmer plug-in unit.

Extensive electrical interference protection is included. All inputs and outputs are optically isolated from the microprocessor supply and balanced for common mode noise rejection (electrical noise picked up in one wire is cancelled in the second wire). Cable screening and twisted pair should be implemented. Connections are via screw terminals, which can be plugged and un-plugged without further re-wiring. Connections on the rear of the unit are for interfacing with the machine and possibly some external devices.

Section 2

Power-up Condition

STEP



When power is first applied to the controller the EPROM check-sum number will be shown. Shortly after, it will issue a beep and a sign-on message. The sign-on message indicates the version number of the supplied controller. Special versions will therefore have different version numbers to a standard unit. The message shows in the six digits of the display window and consists of 2 dashes, a 2-digit number, followed by 2 dashes.

Please quote your EPROM check-sum and version code when discussing any applications with Lyons Electronics.

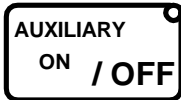
The sign-on message will show for 7 seconds, after which the previous Batch count value will be displayed. Cut mode and Total En / Dis status will be the same as it was before the last power down. The motor, pump, auxiliary and timers will all be off.

Section 3

Panel Controls



is used to start and stop the cutter. "Start" switches on the vacuum pump (if fitted), and after a 1 second delay the motor will start. "Stop" will stop the motor, and after a 20 second delay the vacuum pump will switch off. The cutter will not start if guard 1 is open, and an error 1 is indicated to show why it was not possible. The same error (error 1) will occur if a guard is opened while running, and the machine will stop automatically. The cut signal will only be issued while the motor is enabled. Motor, pump and start statuses are indicated on the front panel.



is used for starting and stopping an auxiliary device. This will usually be for controlling a feed conveyor when fitted to a combined puller / cutting machine. A guard 2 circuit is associated with this system, and as with the cutter the second guard will disable the auxiliary output and show an error 2. An indicator on the auxiliary switch shows the status of the auxiliary output.



is used to select a cutting system from the following: -

TIMER is an internal time generator, which is quartz crystal derived reading in milliseconds (1,000 pulses per second). Timing can be set from 1 millisecond to 99.999 seconds (almost 1 minute 40 seconds). The external programmer can be used to set a times 4 (x 4). Each digit would then be equivalent to 4 milliseconds, which would extend the maximum value to 399.996 seconds (almost 6 minutes 40 seconds).

Use of the timer for length cutting is popular, as no sensors are required. However, accuracy will rely heavily on the accuracy of the line speed stability. Line speed drift is a common problem on pullers without tachometer feedback. The actual product length relates to a timed interval.

COUNTER counts pulses from an external measuring device (i.e. an Encoder).

Example 1: - a 2,000 pulse per revolution encoder with a 0.5 metre circumference wheel will give 4,000 pulses per metre. A 25 metre maximum length at 0.25-mm increments will be possible. With the times 4 (x 4) selected, a maximum of 100 metres will be possible at 1-mm increments.

Example 2: - a 1,200 pulse per revolution encoder with a 12 inch circumference wheel will give .010 inch increments to a maximum length of 999.99 inches. Using the times 4 (x 4) the range will be extended to 3,999.96 inches.

Longer lengths would require a coarser resolution encoder.

END SENSE is used for cut triggering from a fixed position downstream from the cutter. End Sense is mainly used for rigid material. Triggering is possible by operating a switch, or breaking a light beam using the leading edge of the profile. A fixed anti-bounce set at 100 milliseconds is used to protect against re-triggering normally caused by material springing in front of the sensor as it is cut. Most optical sensors include anti-bounce circuitry so longer anti-bounce times can be obtained from these units if required.

A hold-off timer is also available during which period the End Sense signal is ignored. In End Sense mode the preset lengths have no function, so Length 4 preset has been made available to be used as the Hold-off timer preset, with the value relating to milliseconds of Hold-off time.

CONTINUOUS clutch will be locked on with the blade running continuously. The blade will relate to the motor revolutions per minute (or geared ratio if belts and pulleys are involved). Length control is obtained by control of the blade revolutions per minute or feed speed. Brake pulses (blade revolutions) are counted on the total and batch counters as normal.

OPTION not used at present. In future, this function could provide optical detection of a flat collar in a corrugated tube prior to the cutting position. The microprocessor would then measure the remaining distance so that the cut occurs in the centre of the collar.

The operator can change cutting modes at any time. Indication of the selected mode is shown to the right of the Cut Mode switch.



is used to reset the batch indicator (and sounder, if selected). An external reset terminal that offers the same function is available at the rear of the control unit. The alarm indicator / sounder can be operated on completion of a batch. The external programmer must initially enable it. (See Section 8 - External Programming Unit). The system also requires that lengths 2 and 4 are not in use since timer 2 shares this output although it has a higher priority over batch. The sounder will beep in time with the indicator when selected and in an alarm state. This warning indicates to the operator that the batch has been completed and is ready for packing. If required, the external programmer can select the cutter or auxiliary to switch off at this point. This can be useful when preparing kits such as medical packs with the machine powering down after each kit is completed. This option is not recommended when extruding.



will reset the counter or timer and initiate a cut. The length following will be correct and the short piece will not be counted on the batch counter. The sample is useful for checking profile dimensions particularly when producing long lengths. If it is operated just after a cut, a small piece of profile can be made available for testing without scrapping a lot of material.



will enable the Batch and Total 1 counter to count or not count. Indication within the switch shows when total 1 is enabled.



is used to show the order in which lengths will be produced. When this switch is pressed the run order is shown in the display window. This display will contain values between 0 and 4 since four different lengths are available. Zeros are allowed, but are ignored by the computer. For example- a 1 in any position with all the other digits zero means that length one only is selected. A display of 10030 will indicate that lengths one and three are in use. The computer will switch over to a new length when the previous batch completes. When Run Order is selected the step window will show a dash and the Run Order indicator on the right of the display will illuminate. The run order can be altered while in program mode (see Section 4 - Panel Control Programming).



is used to enter programming mode and to update modified values into memory. (See Section 4 - Panel Control Programming).



these keys are used to show or program the above named presets. There are two timer presets available and four presets for each of the other subjects. Each subject uses a two-key operation whereby the first key pressed selects the category of preset required, e.g. length; and the second key pressed selects the exact preset 1 to 4.

For example to show length 2: -



begins the two key selection indicating that a Length preset is to be displayed. The length-preset indicator will illuminate. The display window will show dashes because the computer is waiting for the second key press.



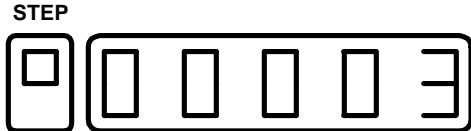
this now completes the operation and indicates to the computer that the second length preset is required. The display will now show the preset value. The step window will show a 2 and the Length Preset indicator will be lit. The display will show this value for 7 seconds before returning to Batch Count. Batch Count has the highest priority on this display after error codes.

There are two Timers, Totals and Tachometers, so if a 3 or 4 is requested a long beep from the sounder will indicate a mistake. The dashes will remain on the display until 1 or 2 is pressed.

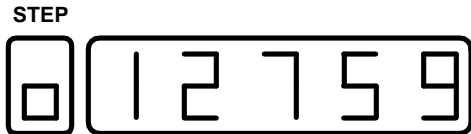


does not show a numeric value in the step window. This is because a total can be as much as 10 decades in length (9,999,999,999 maximum). Instead a small "o" is shown. If this "o" is shown in the top half of the step window, this indicates that the 5 digits displayed are the most significant. This display holds for 7 seconds so that the information can be recorded. Next, the display will select an "o" in the lower half of the step window to indicate that the least significant 5 digits of the total are being displayed. The display will now default to show the low order 5 digits until another selection is made. The 5 most significant digits are not shown if they contain zeros.

Most significant 5 decades



Least significant 5 decades



These readings indicate a total value of 312,759 pieces.

It is possible to reset Total 1 only. (See Section 5 - Unusual Key Combinations and Section 1 - Clear key and Total En / Dis key).

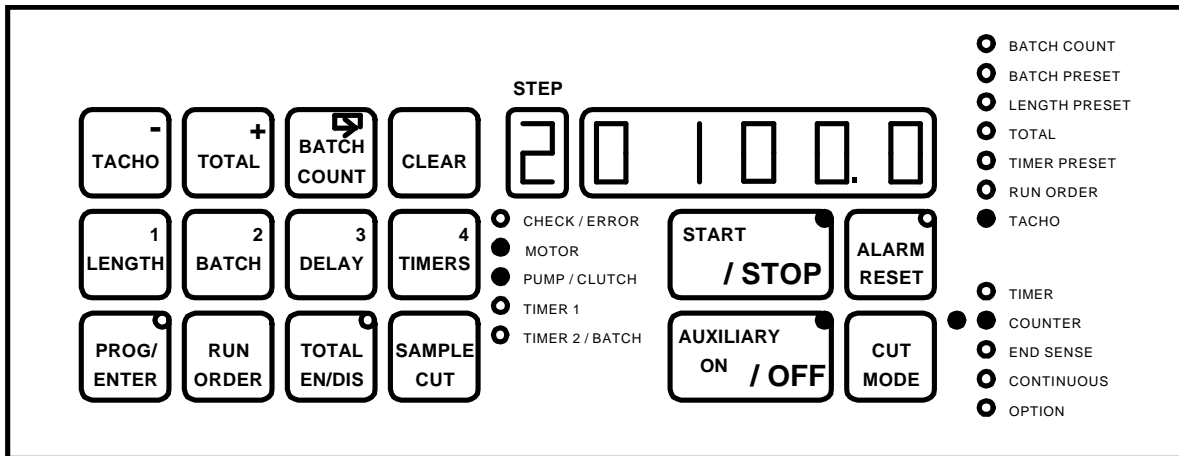
Total key functions as an add 1 ("+") operation during programming of a preset. (See Section 4 - Programming).



When selected will latch the tachometer value into the display. Batch Count will not re-appear in the display after the usual 7-second delay. This allows the operator to adjust motor speeds while monitoring the display. After the motor has been adjusted as required, the operator may press the Batch Count switch to force a return to the Batch Count display.

Tacho 2 reads pulses from an external length measuring encoder directly linked to the profile movement. The pulses are sampled for a user-defined time in order to indicate the speed of the profile. A decimal point is fixed so that the display reads in tenths of the chosen scale. For example the display may be used to indicate tenths of feet per minute or tenths of metres per minute.

Line Speed Indication



Tacho 1 is normally used to indicate blade revolutions per minute with Tacho 2 being used for profile velocity. The above example is showing that the profile is being extruded at 100.0 feet per minute.

When in the programming mode, using Tacho will select the tachometer sample timer. It is also used to reduce preset values and has a subtract 1 ("-") operation. (See Section 4 - Programming. See also Section 7 - Setting Tachometer Sample Timers).



will display the Batch Count being processed. In program mode it is used to select the next digit to be altered. (See Section 4 - Programming).



is used to reset the Batch Count. It is also used to reset the preset values to zero when in program mode. (See Section 4 - Programming. Also see Section 5 - Unusual Key Combinations).

Sounder

All keys cause the sounder to beep. An incorrect key operation will create an extended beep. The batch alarm or other alarms from incorrect running of the machine will also operate this beeper by means of pulsing or stretching the sound of the beep. A sounder output facility is available to enable louder sounders to be used in noisy environments.

Section 4

Panel Control Programming

There are two programming methods used on the LE750. Most programming is carried out via the front panel for the adjustment of presets, etc.. There is also an external programming device for setting various default characteristics. (See Section 8 - External Programming Unit).

All presets can be altered via the front panel. The available presets are - 4 Lengths, 4 Batches, 4 Delays, 2 Timers, 2 Tachometer Sample Timers, and Run Order.

In Section 3 it was explained that most of these presets require a 2 key operation before the preset value will be shown in the display. Only Run Order uses a single key operation. The key operations for programming are the same as those for preset inspection. The difference is that the Prog / Enter key has to be pressed before altering a preset, and it must be pressed again when the preset has been modified.

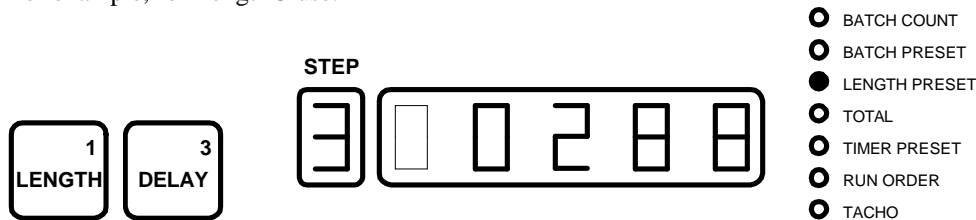
The programming sequence is as follows: -



informs the computer that the operator is about to alter a preset. Prog / Enter indicator inside the switch will light, and all 6 digits will show dashes to indicate that more key presses are expected.

Operate 1 or 2 key press sequence of the required preset.

For example, for Length 3 use: -



The required preset will now be shown in the display window. Step will show a value between 1 and 4, or for Run Order a dash will be shown. An indicator to the right of the display will show which preset has been selected. The program indicator will still be lit. There will be one digit flashing on the preset, since only one digit can be altered at a time.

Next, alter the value of the display to the required value by using: -



will reduce a flashing digit by 1. If the digit is 0 then pressing this key will change it to a 9. When programming Run Order a 4 will be selected after a 0 since this is the maximum value.



will increase a flashing digit by 1. If the digit is 9 then pressing this key will change it to a 0. When programming Run Order a 0 will be shown after a 4.



will select the next digit to be altered. When the key is pressed the current flashing digit stops flashing and the digit to the right begins. Pressing this key while the right most digit is selected will select the first digit again.



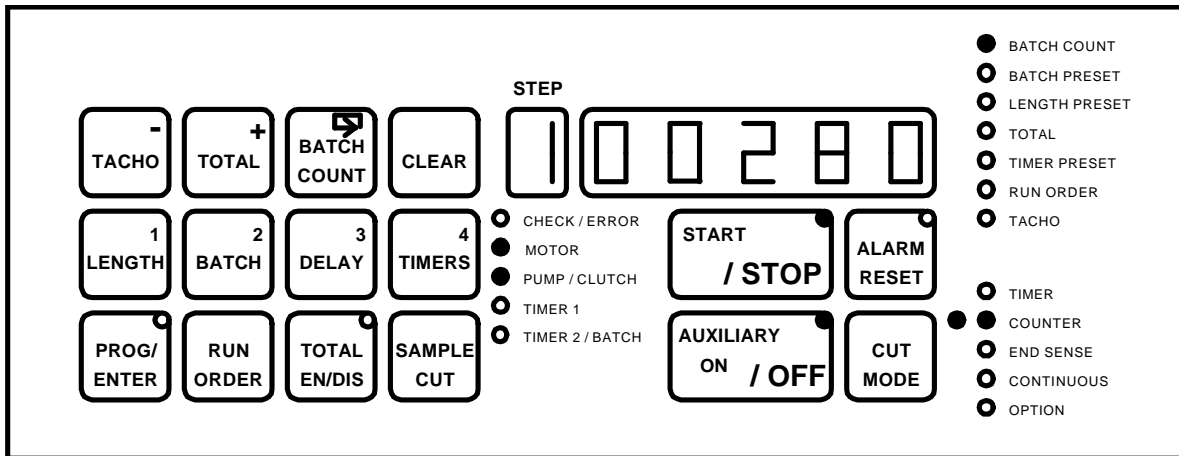
may be used to zero the display. All digits in the large window will zero whether they had been flashing or not. Use this with care - for minor trimming alterations it is unlikely that this key will be used.



this key is used after the preset has been altered to inform the computer that programming is complete. The value shown in the display is now entered into its correct preset location, and the display will revert to showing the condition of the Batch Count. The program indicator will be extinguished.

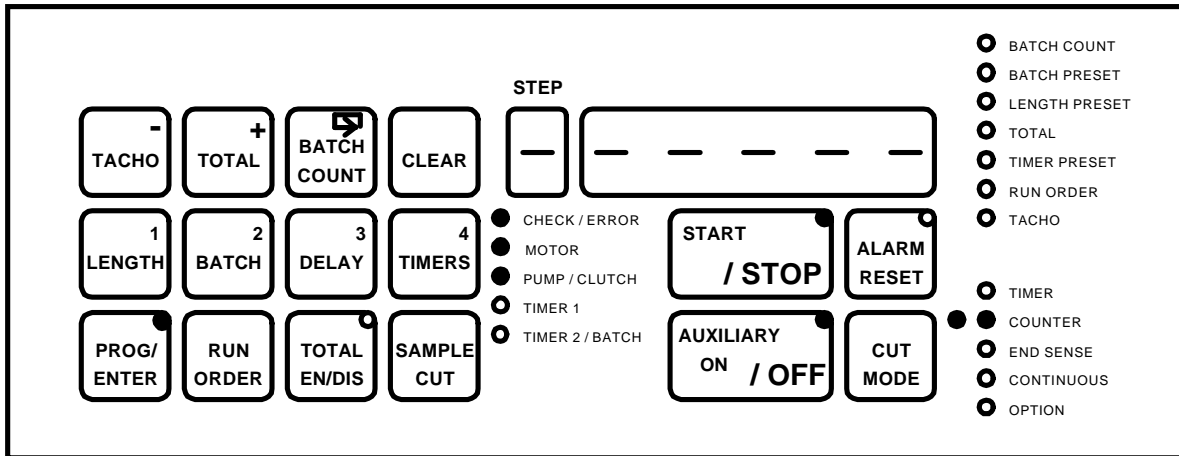
Example 1: - Modifying Length Preset 3 to 02500.

The display is presently showing Batch Count with a 1 in the Step window. The Batch Count indicator is on. Length 1 is being processed using Counter Mode (Encoder mounted on product).



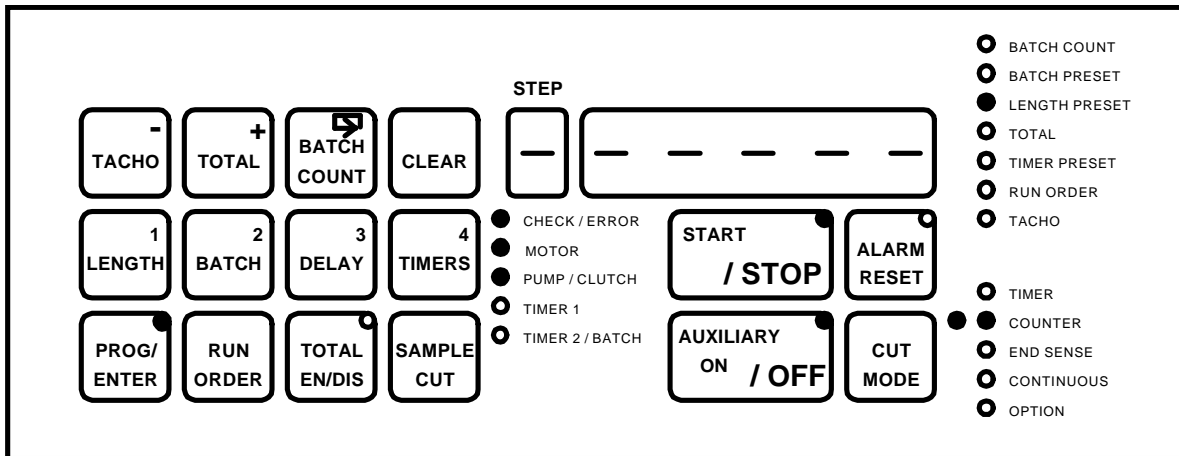
**PROG/
ENTER**

indicator will light and the display will show dashes. The Batch Count indicator will turn off.



**1
LENGTH**

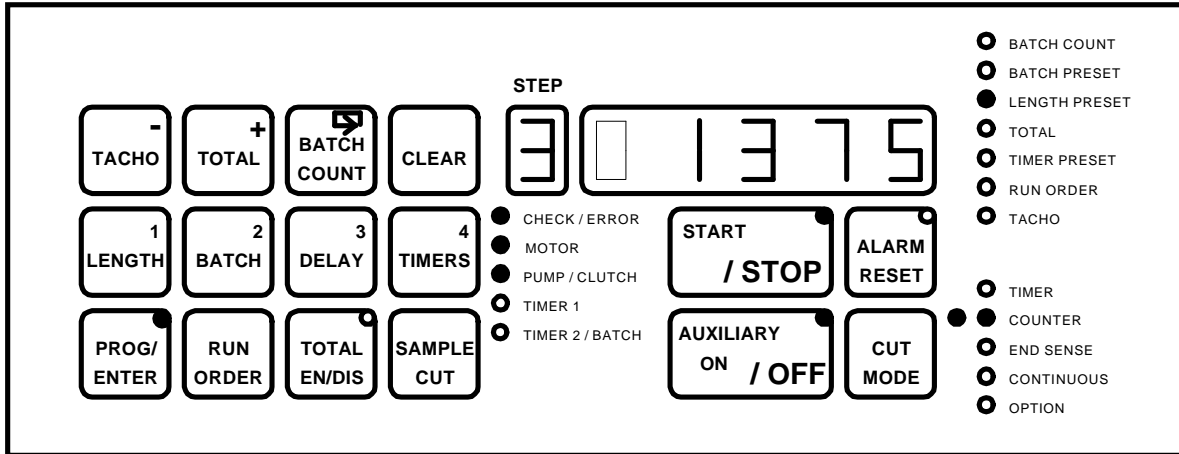
Length preset indicator will light. Dashes will still be seen in the display and the PROG / ENTER indicator will still be on.





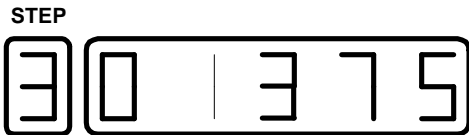
3
 DELAY

3 Informs the computer of the numeric value of the previous key press. Step will show a 3, and the Length preset indicator will be on. The display is therefore showing Length Preset 3. Prog indicator will still be on. The previous preset value of will be shown in the large display window with the first digit flashing. In this example the previous preset was 01375.



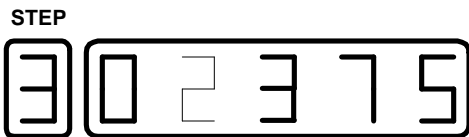
BATCH COUNT

The first digit is correct, so this key will be pressed to select the next digit to the right. The 0 stops flashing and the 1 in the next space starts flashing.



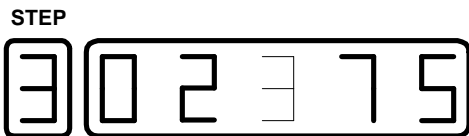
TOTAL

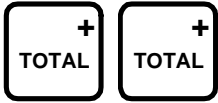
The second digit should be a 2, so this key is pressed once to change from a 1 to a 2.



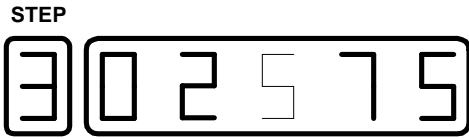
BATCH COUNT

Press this key again to select the third digit.







Increase this value to a 5.



Press to select the fourth digit. The number 7 will begin to flash. Instead of changing this value to 0

by pressing  seven times, use  three times to achieve the same result.



Select the last digit. Change 5 to 0 by using  or  five times.



If the value has not been altered correctly, press    until it is the desired value.



Programming of Length 3 is now complete. Prog / Enter indicator will extinguish, as will the Length preset indicator. The Batch Count value and indicator will re-appear.

The diagram shows a control panel with the following components:

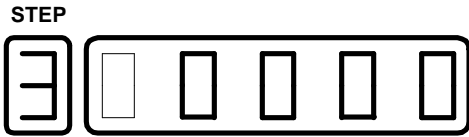
- Buttons:** TACHO (-), TOTAL (+), BATCH COUNT (arrow), CLEAR, 1 LENGTH, 2 BATCH, 3 DELAY, 4 TIMERS, PROG/ENTER, RUN ORDER, TOTAL EN/DIS, SAMPLE CUT, START / STOP, ALARM RESET, AUXILIARY ON / OFF, CUT MODE.
- STEP Display:** A digital display showing the number 100280.
- Indicator Lights:**
 - BATCH COUNT
 - BATCH PRESET
 - LENGTH PRESET
 - TOTAL
 - TIMER PRESET
 - RUN ORDER
 - TACHO
 - CHECK / ERROR
 - MOTOR
 - PUMP / CLUTCH
 - TIMER 1
 - TIMER 2 / BATCH
 - TIMER
 - COUNTER
 - END SENSE
 - CONTINUOUS
 - OPTION

Example 2: - Shorter method of replacing value 01375 with 02500 in Length preset 3.

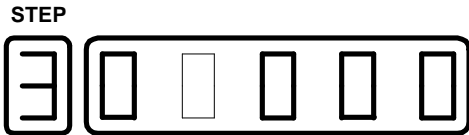
Enter programming mode, and select Length preset 3 as in the previous example.



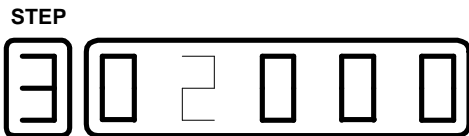
Display 01375 will now change to 00000 with the first digit flashing.



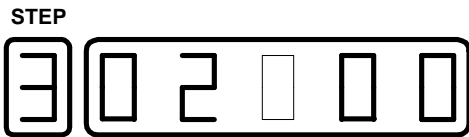
to select the second digit.



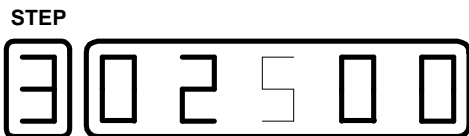
twice to show a 2 in this column.



to select the third digit.



five times to show a five in this column.



02500 is now in Length preset 3.

Preset Limits and Ranges

It is only possible to program four of the digits when altering delays, timers and Tacho sample timers. The most significant digit after the step window will be blank. The computer will not allow a value of 00000 to be entered except when setting delays and timers.

Lengths and Batches may have any value between 00001 and 99999. A small value in a length preset is allowed but may show as an error when the cutter is run due to clutch protection limits. The likely error is when the value is so short that the cutter is trying to operate at a faster cut rate than is permitted (error 4). The blade must also be able to complete a revolution before another cut command is issued.

Delays and Timers can range from between 0000 and 9999. These are normally used for controlling external equipment only, although the timing can also be used to delay a batch alarm or provide a delayed power down state. (See Section 7 - Programming Timer outputs).

Tachometer sample timers can only have a value of between 0100 and 2099. (See Section 7 - Setting Tachometer sample timers)

Run Order will contain numbers between 0 and 4 only. There are 4 possible lengths so numbers 5 to 9 are not available. (See Section 3 - Run order)

Trying to enter values outside of the allowable range results in the computer issuing an extended beep. The program mode will remain active until an acceptable value is entered.

Section 5

Unusual Key Combinations

The key operations described so far have all been fairly straightforward and work in the manner expected relating to the wording on the switches. However, functions requiring a defined key sequence are mentioned in this section.

Total 1 Reset

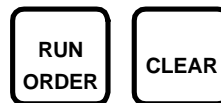
The main function of the CLEAR key is to reset the current Batch Count value to zero (00000). When in a program mode it can be used to zero the preset in order to speed up preset alterations. CLEAR can also be used to zero Total 1 as follows: -





All 10 decades of total 1 will be zeroed. The display will eventually settle showing the lower 5 digits of Total 1.

Select Next Length in Run Order (Sequence)

Selection of the next length in the Run Order sequence occurs automatically after the completion of a Batch. The computer obtains this information when investigating the Run Order preset. It may not be convenient to wait for the Batch to reach the target. Perhaps the Batch contains a large value, or a new length has been set up but the old data has to be retained.




When needing to switch to a new length it is possible to use  . This does not clear the display; it will instead make the Batch count equal to the current Batch preset. After the next cut the computer will use its automatic process to load the next length in the sequence. The Total counter has to be enabled to register the cut.

Length Programming (Trimming)

Lengths can be tricky to adjust when working with stretchy or shrinkable material so we have included a method which we call "trimming". Basically it is a method of changing a length while the machine is running without having to keep going through the programming sequence.

The program mode still has to be entered initially, and the Length (in progress) has to be entered into the display

for alteration. Alter the preset to an approximate value and instead of entering this value with the  key

use the  key instead.

Either key will place the value in the display into the selected Length preset. The difference is that after pressing the Length key the processor will still be in a programmable state. The operator should measure the length and re-adjust until it is correct. Finally, the PROG / ENTER key may be pressed to leave the programming mode.

Section 6

Single Length Setting




The rotary cutter will usually be set to cut one particular product length, perhaps in batches of 100 or 1,000 pieces for packing purposes.

Example: - An order is received for 1,000,000 pieces at 120 mm. These pieces are to be packed in groups of 50.



For this example we are assuming that an encoder measuring wheel providing 4,000 pulses per metre is fitted to the feed belts or profile. Each millimetre consists of 4 pulses, so to achieve 120 mm we will need to enter $120 \times 4 = 480$. Enter 480 into Length preset 1. Select Counter Mode using the Cut Mode key.

The batch required is 50 so enter 50 into Batch preset 1. Set Run Order to 10000 (the 1 can be entered in any combination or position; 00100 and 11110 will be equivalent).

Start the machine and concentrate on obtaining the correct profile shape. If the Batch count shows a 1 in the step

window then Length 1 is ready for running. If any other length is in progress use  followed by  followed by . After the next cut Length 1 will be ready and active. If not it may have been because the Total En / Dis function was off. Switch it on and try again.

Measure the cut pieces to see if the lengths are correct. If the material shrinks when cooled then wait before measuring. Re-adjust the length if required to compensate for material shrinkage. When altering the length it is advisable to use the trimming method mentioned in the previous section. When the lengths are correct press

 to get back to normal running mode. Reset Batch Count using  and prepare to pack the first batch. Reset Total 1. Ensure that Total 1 and Batch are enabled. Previous pieces can be discarded.

The Blade revolutions per minute and blade attack angle may have to be adjusted for the type of material being cut.

Dual Length Setting (Flip-flop)

Dual length suggests that two different lengths can be cut from the same profile. With the LE750 all four lengths can be set independently and set to operate in a sequence.

For example: - It is possible to cut 5,000 pieces at 120 mm followed by 1,000 pieces at 180 mm. Each length is adjusted individually as in the previous example using Length and Batch presets 1 and 2. Run Order must then include a 1 and a 2 to select those presets. Run Order can have 12000, 10020, or 12120 each will perform the same function.

The use of various lengths of the same profile may be required for the preparation of medical kits. Possibly the batches will be set to 1. The main use of the flip-flop action is for batch sorting i.e. in conjunction with a discharge table. Timers would be programmed to output the batches into different piles or containers. In this instance Length and Batch presets 1 and 2 will have the same values. However, the associated timers will be set differently to allow each batch to travel different distances along the table.

Section 7

Programming Timers (Output Triggering)

The timer outputs provided are ideal for downstream-of-the-cutter batch sorting. They can also be used for equipment upstream-of-the-cutter, and for triggering such items as drilling or punching machines that are working in synchronisation with the same profile. Following is an explanation of the different types of batch sorting available (upstream equipment can be set using the same principles).

Each length has an associated Delay. The length in progress will trigger the delay of the same number when each cut is made. The delay value ranges from 0000 to 9,999 milliseconds.

Length	1	triggers	Delay	1
"	2	"	"	2
"	3	"	"	3
"	4	"	"	4

At the end of the delay duration one of the two timers will be triggered. The timers are connected directly to outputs and the value depicts the duration of the timer output in milliseconds. Outputs are likely to be connected to a transistorised relay, with external load (solenoid) connected via the relay contacts.

Delay	1	triggers	Timer	1
"	2	"	"	2
"	3	"	"	1
"	4	"	"	2

It can be seen that Delays 1 and 3 trigger the same timer output. This would be used in the example of a discharge table where Timer 1 output operates the discharge solenoid. Delays 1 and 3 would then be set differently so that the batches would travel to different ends of the discharge table.

Re-Triggering Parameters

A timer will begin when an associated delay ends. The output associated with the timer will switch on at this point. When the timer ends the associated output will switch off. If a delay is not allowed to time-out then the associated output will never switch on. Likewise, the output will never switch off if the associated timer is not allowed to time-out.

Example of a product being sorted by Batch using Timer 1 output only

In this example each pulse from the external encoder equals 1 mm. Lengths of 500 mm and batches of 100 are required.

Length 1 = 00500

Length 3 = 00500

Batch 1 = 00100

Batch 3 = 00100

Delay 1 = 1000 (1 second)

Delay 3 = 2500 (2.5 seconds)

Timer 1 = 1000 (1 second)

Run Order = 13000

Example of a product being sorted by Batch using both timer outputs

In this example there are two air valves downstream of the cutter angled to blow the cut profile into boxes placed on either side of the take-off table. They are positioned in the same place with one facing towards the front and the other towards the back. The same requirements as in the previous example will be processed.

Length 1 = 00500

Length 2 = 00500

Batch 1 = 00100

Batch 2 = 00100

Delay 1 = 1000

Delay 2 = 1000

Timer 1 = 0100

Timer 2 = 0100

Run Order = 12000

In this case the timer outputs are set shorter to provide a short puff of air in order to blow the pieces into their relevant boxes. As an alternative the solenoids could both be set facing the same way but spaced apart. Delays 1 and 2 would then be set to position the batches into two different locations.

Automatic Batch Sorting

Timer 2 can also be used as a Batch output. The requirements are that switch 3 of the External Programmer should be sampled in the "off" position (See Section 8 - External Programming Unit). Also, lengths 2 and 4 must be disabled in the Run Order preset otherwise they will be given priority. The computer automatically selects Timer 2 as a Batch output when it detects that Lengths 2 or 4 will not be using it. Length 1 completing a Batch will now start Delay 2. Batch 3 will initiate Delay 4 in exactly the same way. Delays 2 and 4 trigger Timer 2 as before.

Secondary batch sorting can then be provided by the Timer 2 output. For example, previously it was shown that lengths 1 and 3 could be configured to sort a length into two different piles. Timer 2 will now be triggered by each Batch completion since Run Order does not contain a number 2 or 4. The batch can then be used to operate another intermediate discharge operation, or to step a conveyor, or to trigger an automatic packing device. It is advisable to set Delays 2 or 4 slightly longer than Delays 1 or 3 to allow the last length to drop before the batch function is operated.

Manual Batch Sorting

When material is being packed manually by an operator some indication of a completed batch could be an advantage. It may be that a container is being used to collect pieces as they drop from the cutting bush. To fill this container with 1,000 pieces, for example, may take a long time. The operator may need to carry out other tasks during this period. The external programmer may be used to set the machine for manual or automatic batch using switch 3 (See Section 8 - External Programming Unit). When set for manual operation, each completion of a batch will cause the Alarm Reset switch indicator to flash. The buzzer may also be selected to sound by setting switch 4 of the external programmer. The operator would then press the Alarm Reset to switch off the alarm after he has attended the situation.

Example: - Length 1 is being used and is cutting pieces at 100 mm; the Batch is set to 1,000. The operator sees the indicator flashing and/or hears the alarm so attends to the machine. He replaces the container, and notes the value shown in the Batch count display. The number of pieces shown on the display is surplus. This amount is simply removed and placed in the new box. The operator then resets the alarm and seals the full box.

Timer 2 / Batch will latch on in this mode so it may be used to operate a flashing beacon. The Alarm Reset key will reset the latch.

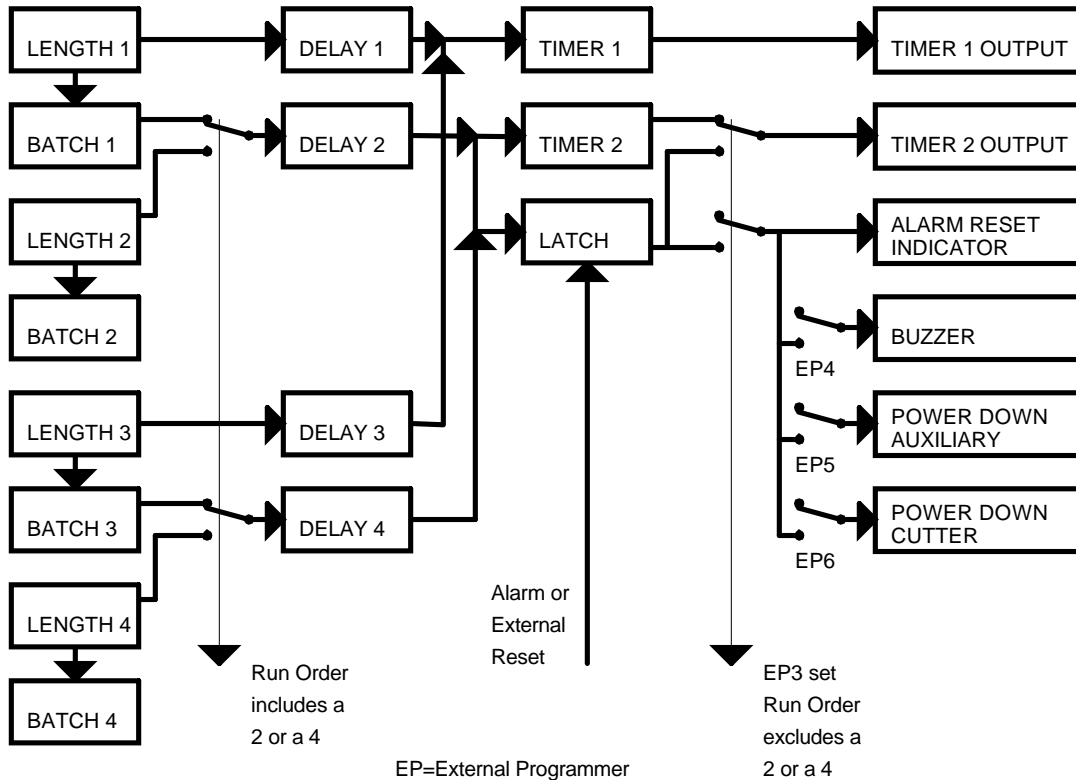
Run Order must not contain a 2 or a 4 for the same reasons discussed with the automatic batch processing example. The Batch alarm activation may be delayed by the values set in Delays 2 and 4. This too was explained in the examples on automatic batch processing.

Automatic Power Down

The external programmer can be used to switch off the cutter and/or auxiliary once the batch is complete. This can be useful when preparing medical kits from material supplied on a reel. This function is not recommended for use on extruded lines. Switches 5 and 6 in conjunction with switch 3 on the external programmer set the automatic power down. (See Section 8 - External Programming Unit).

Delays 2 or 4 should be set long enough to allow the last piece of the batch to be cut successfully before the machine powers down.

Complete Internal System Block Diagram



Setting Tachometer Sample Timers

A Tachometer is used to inform the operator of the speed of a particular device. It would be set to show meaningful units of measure. For the rotary cutter this is usually the blade revolution per minute, although the motor revolutions per minute may be preferred. Similarly, it may be required that the line speed is shown in feet or metres per minute.

The LE750 has 2 digital tachometers. Tachometer 1 is set for showing blade revolutions per minute and Tachometer 2 is set to show line speed. A cutter will most likely be set to show blade speed when supplied. This would have been factory preset to match the internal pulley ratios and should not require alteration. The feed tachometer may also be pre-set before delivery on occasions when an external encoder is supplied with the machine.

If either tachometer needs re-calibrating use the following formulae: -

Cutter Tachometer Example

The equation to calculate the sample timer is: -

$$\frac{60,000 \times B}{T \times M} = \text{Sample value}$$

T = teeth on pick up
B = Blade Revolution
M = Motor Revolution

A 60-tooth pulley is attached to the motor shaft (this also acts as a flywheel). The sensor is picking up a signal from this wheel. For each revolution of clutch output the input (motor) has to rotate twice. Set the timer up as follows: -

$$\frac{60,000 \times 1}{60 \times 2} = 500$$

The value 60,000 is used to convert a minute to milliseconds.

When the motor is rotating at 800 revolutions per minute, the blade should be rotating at 400 revolutions per minute.

$$\frac{800 \times 60}{60} = 800 \text{ pulses per second}$$

Sample timer 1 is set to 500 so Tachometer 1 display will read: -

$$\frac{800 \times 500}{1,000} = 400$$

This reading is in fact showing the amount of pulses received in 500 milliseconds but is interpreted as Blade revolutions per minute.

Feed Tachometer Example

The display should show in tenths of metres per minute or tenths of feet per minute. The equation to calculate the sample timer is: -

$$\frac{600,000}{\text{ppf or ppm}} = \text{Sample value}$$

ppf = pulses per foot
ppm = pulses per metre

Example 1

An encoder providing 4,000 pulses per metre would have a sample timer set up as follows :-

$$\frac{600,000}{4,000} = 150$$

The value 600,000 is used to convert a minute into 0.1 milliseconds to provide a conversion down to tenths.

When the line speed is running at 60 metres per minute :-

$$\frac{60 \times 4,000}{60} = 4,000 \text{ pulses per second}$$

Sample Timer 2 is set to 150 so Tacho 2 display will read :-

$$\frac{4,000 \times 150}{1,000} = 600$$

Since the point is fixed in the tens position the display will read 60.0.

This reading is in fact showing the amount of pulses received in 150 milliseconds yet is interpreted as metres per minute.

Example 2

An encoder providing 1,200 pulses per foot would have a sample timer set up as follows :-

$$\frac{600,000}{1,200} = 500$$

When the line speed is at 60 feet per minute :-

$$\frac{60 \times 1,200}{60} = 1,200 \text{ pulses per second}$$

Sample timer 2 is set to 500 so Tacho 2 display will read :-

$$\frac{1,200 \times 500}{1,000} = 600$$

Since the point is fixed in the tens position the display will read 60.0.

This reading is in fact showing the amount of pulses received in 500 milliseconds yet is interpreted as feet per minute.

Typical Tachometer Sample Timer Settings

Tachometer 1

Amount of Teeth on Motor pick-up	Blade to Motor Gear Ratio	Sample Timer
60	2 : 1	500
60	1 : 1	1,000
30	2 : 1	1,000
40	2.5 : 1	600

Tachometer 2 (showing tenths)

Pulses per Metre	Sample Timer
4,000	150
1,000	600

Pulses per Foot	Sample Timer
1,200	500
600	1,000

The microprocessor uses an averaging technique to improve the stability of the tachometer readings. The preset range is 0100 to 2099 (see Section 4 - Preset Limits and Ranges).

Section 8

External Programming Unit

The external programmer is used to set various parameters prior to machine use. The controller can be used in a variety of ways to suit most applications. To change any parameters use the following switch table. When the power is switched on, the controller checks to see if the external programmer is present. If so, it will load in the switch arrangement that has been selected. The programmer may then be removed and stored for any future alterations. If the programmer is not connected then the previous settings held in memory will be used. Mating connectors are biased to allow connection in one position only. Do not attempt to force a wrong connection.

The programmer should only be used when alterations are being made; do not leave permanently connected. Connection and disconnection should only be made with the machine fully isolated from main supply.

Switch	Off	On
1	Auxiliary guard will switch off the Auxiliary only.	Auxiliary guard will switch off the Auxiliary and Cutter.
2	Cutter guard will switch off the Cutter only.	Cutter guard will switch off the Cutter and Auxiliary.
3	Batch Alarm disabled.	Batch Alarm Enabled. Ensure Run Order does not contain a 2 or a 4.
4	Batch Alarm indicator only.	Batch Alarm indicator and buzzer. Switch 3 must be on.
5	Batch Alarm to power down Auxiliary disabled.	Batch Alarm to power down Auxiliary enabled. Switch 3 must be on.
6	Batch Alarm to power down Cutter disabled.	Batch Alarm to power down Cutter enabled. Switch 3 must be on.
7	Timer and Counter times 1 (x1).	Timer and Counter times 4 (x4).
8	Normal Mode.	Test Mode. See next section.

Example

The operator is going to pack each batch quantity manually. He wishes to be alerted after every batch is finished. The sounder will be required as the operator cannot constantly monitor the display. Only Length 1 is to be used. Set switches 3 and 4 to on with all the others off.

Test Procedures

With switch 8 "on" switches 1, 2, 3 and 5 have different functions than those listed above. Only one test program can be selected at a time. Priority is given to the order in which they are listed.

Switch 1 Test 1 Display Test

Digits count up from 0 to 9 and then show 6 pre-configured codes. The next digit is then cycled until all 6 digits have been checked. LED's are operated one at a time. The whole sequence repeats until switched off. LED's are set in a matrix of 6 by 5 so if any banks of LED's fail a common cause can easily be detected. The operator visually checks that each LED and digit segment lights up during this test.

Switch 2 Test 2 Output Sequence

Each output is operated one at a time in a sequence. The outputs will appear to pulse on then off again. The operator can quickly check to see if all of the outputs are operating as required. The stepped sequence repeats until switched off.

Sequence order :-

- 1 Motor
- 2 Pump
- 3 Timer 1
- 4 Timer 2
- 5 Auxiliary
- 6 Sound (buzzer)
- 7 Clutch
- 8 Brake

Switch 3 Test 3 External Programmer and Keyboard Test

Each switch being set to "on" in the programmer will operate the corresponding output number as follows :-

- 1 Brake
- 2 Clutch
- 3 Sound
- 4 Auxiliary
- 5 Timer 2
- 6 Timer 1
- 7 Pump
- 8 Motor

There are sixteen keys on the panel. Each key has a unique code. The operator may press each key in turn to see its unique code, which will appear, in the Step window. Any key not working will not be registered so will not produce a code. The operator can then detect any faulty keys. All odd value keys will enable the External Programmer to control outputs as mentioned above. The outputs will all switch off if an even value key is pressed. The key codes for each keypad are shown along with the description of Test 4 on the next page. Test 3 and test 4 use the same key codes.

Switches 1, 2 and 3 off Test 4 Sensors, outputs, and Keyboard Test

This mode would normally be used by a wiring technician to perform initial tests or by a technician who may have just replaced a sensor. Each input is set to operate a different LED on the front panel. Any input (sensor) not lighting the relevant LED can then be investigated for a fault. Input / LED operations are as follows :-

Inputs	LED's operated
Brake	Check / Error
Opto	Start
Direction	Motor
Tacho	Alarm Reset
Sense (Clutch on)	Pump / Clutch
Clock	Auxiliary on/off
Guard 1	Timer 1
Guard 2	Timer 2
Sync	Total En / Dis
Reset	Prog / Enter
Spare	Decimal point (10's position)

Keyboard codes will show in the step window as for Test 3, but each key will also set an output on or off as follows :-

Keyboard Controlling Outputs

Description	Output	State	Key Code
Start / Stop	Brake	On	0
Auxiliary	Brake	Off	1
Cut Mode	Clutch	On	2
Alarm Reset	Clutch	Off	3
Sample Cut	Sounder	On	4
Total En / Dis	Sounder	Off	5
Run Order	Auxiliary	On	6
Prog / Enter	Auxiliary	Off	7
Timer	Timer 2	On	8
Delay	Timer 2	Off	9
Batch	Timer 1	On	Lower o
Length	Timer 1	Off	Upper o
Clear	Pump	On	Upper -
Batch Count	Pump	Off	Middle -
Total	Motor	On	Lower -
Tacho	Motor	Off	Blank

Initialising Presets

If switch 5 of the external programmer is switched on during test 4, all presets except for Total 2 will be set to their factory default values as follows :-

Lengths and Tachometer Sample Timers	01000
Batches	00010
Delays and Timers	00100
Total 1 and Batch Count	00000
Run Order	10000

Batch Count, Cut Mode and Total En / Dis status will remain untouched.

Error Codes

Code	Caused by	Remedy
1	Guard 1 is open.	Check Guard switches and connections.
2	Guard 2 is open.	As 1.
3	Blade rotating too fast may damage clutch.	Reduce blade speed.
4	Trying to operate clutch in excess of safe limit.	Set a longer Length.
5	Blade Jammed.	Clear jam. Fault could also be caused by a fault in the High Speed Switch or clutch.
6	Clutch was triggered but did not switch on.	Check connections. Check High Speed Switch and clutch.
7	Brake was triggered but did not switch on.	As 6.
8	A signal was detected from the brake sensor when the brake was already on.	Brake not holding on. Check clutch and High Speed Switch. Occasionally, error 8 will happen just at the moment when the motor is stopping. In this instance the error may be ignored. It may be caused by the delay in braking.
9	The value in the cut preset is too short for the processor to handle. To avoid a possible lock up the processor has set the preset to an extremely high value.	Try using the sample key. This initiates a cut and re-sets the preset. If the error remains then the value is deemed too short to be processed.

External Connections Terminal Strip

Upper	Pin	Lower
Motor Relay	1	0 volts
Pump Relay	2	12 volts
HSS Brake	3	Brake Sensor -
HSS Clutch	4	Brake Sensor +
HSS Sense	5	Guard 2 -
HSS 0v	6	Guard 2 +
HSS 24v	7	Auxiliary C
Direction	8	Auxiliary E
Guard 1	9	Timer 1 C
12 volts	10	Timer 1 E
0 volts	11	Timer 2 C
Clock	12	Timer 2 E
Tacho -	13	Sound
Tacho +	14	Opt Input
12 volts	15	12 volts
0 volts	16	0 volts
Opto -	17	Sync
Opto +	18	Reset

All the terminals are isolated from the microprocessor 5-volt power supply via opto isolation circuitry.

High Speed Switch / Main Relay Connections

The first 7 terminals on the upper row are connected to the High Speed Switch and to the main relays. The High Speed Switch provides power for this section. Without this supply these outputs would not be present. Each output is via optically isolated drivers and should read 0 volts when off, or 15 volts when on. The current drive is 7-milliamp maximum each.

See Electrical Schematic drawing 1

Balanced Inputs

Balanced inputs are provided for the Tacho, Opto (End Sense) and Brake sensor. These voltages can be connected to any external supply source between 5 and 30 volts D.C.. Guard 2 is also a balanced input but is rated at 10 to 25 volts D.C.. The 12-volt supply terminals present on the rear terminal strip may be used as the supply source for these inputs. Current-limiting resistors have been selected to suit these ranges and are internally fitted.

See Electrical Schematic drawing 2

Other un-balanced inputs are referenced to the microprocessor 12-volt power supply. Current-limiting resistors have been internally fitted to suit.

Sync

This input is available to re-start the Run Order sequence. It allows an external device to be able to synchronise the cutting sequence. The sync input may initiate a cut (see Opt function), reset the batch, and load in the first length preset shown in the Run Order.

Opt

This input changes the behaviour of the Sync input. The level of the Opt input will determine whether the Sync edge will make a cut or not. With this input left open or held at 12 volts the Sync edge will initiate a cut. When connected to 0 volts no cut will occur except when the first chosen Length is complete.

Reset

An external reset is available which is used to reset the batch alarm. It has exactly the same function as the Alarm Reset on the fascia panel.

Direction

At present this input is not being used.

Balanced Outputs

Timers 1 and 2, and Auxiliary are available as optically isolated N.P.N. transistor outputs (C = Collector, E = Emitter). These can be connected to isolated circuits using a power source between 5 and 24 volts. In non-isolated applications the controllers' 12 volts may be used. Power dissipation is 150-milliwatts maximum. Larger current drive must be provided by an external amplified source. An external current limiting resistor (or load) is required which must be selected to limit the above maximum ratings.

See Electrical Schematic drawings 3A and 3B.

Transistor	Potential 3A	Potential 3B
on	v-	v+
off	v+	v-

Typical Resistive Load

5v = 500R

10v = 1K

External sounder load must be less than 100-milliamps. Suitable piezo-electric type buzzers are generally available.

Power Dissipation of 12 volt Supply

The 12 volt power supply available on the external connections is designed to supply all of the sensors required to achieve a typical cutting / packing system. The sum total of all loads connected to this supply should not exceed 300-milliamps. Relays and solenoids cannot be directly driven from any outputs or supply. To operate such devices an output needs to operate an external transistor or transistorised relay connected to a more powerful source.

See Electrical Schematic drawing 4

Cleaning

The panel of the microprocessor controller is designed as a flat membrane-type to allow for easy cleaning. A soft cloth with clean water or with a mild detergent is all that is required to clean the panel. Wipe dry afterwards. Ensure that the unit is fully isolated when carrying out this procedure. Also, make sure the unit is totally dry before applying power.