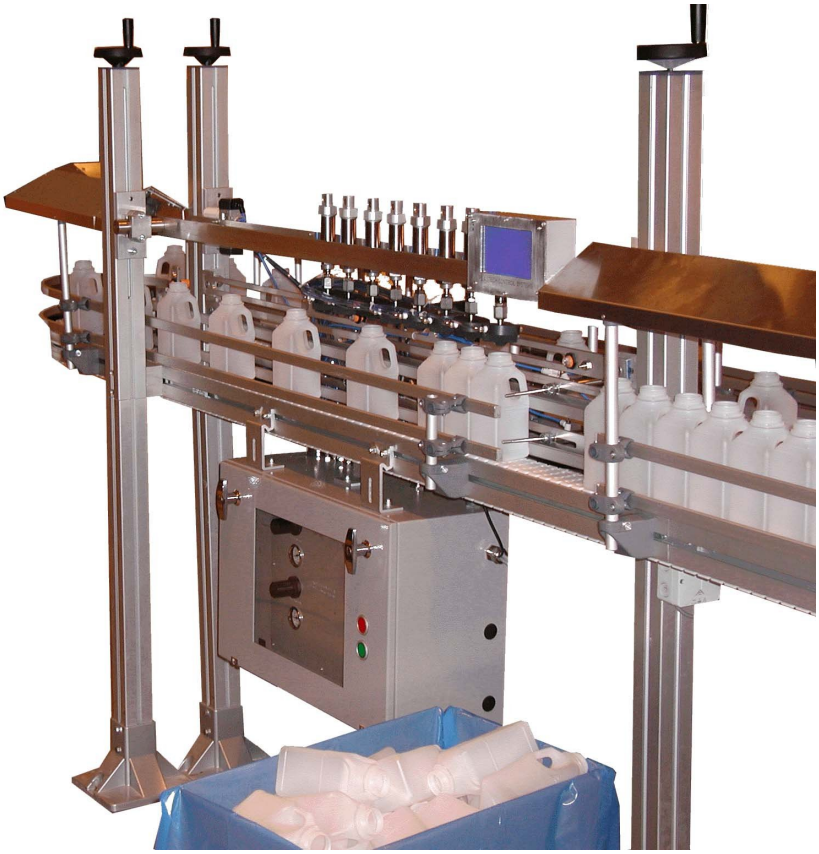

LT5

Conveyor Fed Bottle Leak Detector

User Guide

PLASTECH
CONTROL SYSTEMS

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UNRELEASED-EN

Covers Model Numbers

LT5-1
LT5-2
LT5-3
LT5-4
LT5-5
LT5-6
LT5-8
LT5-10
LT5-12

SAFETY WARNING

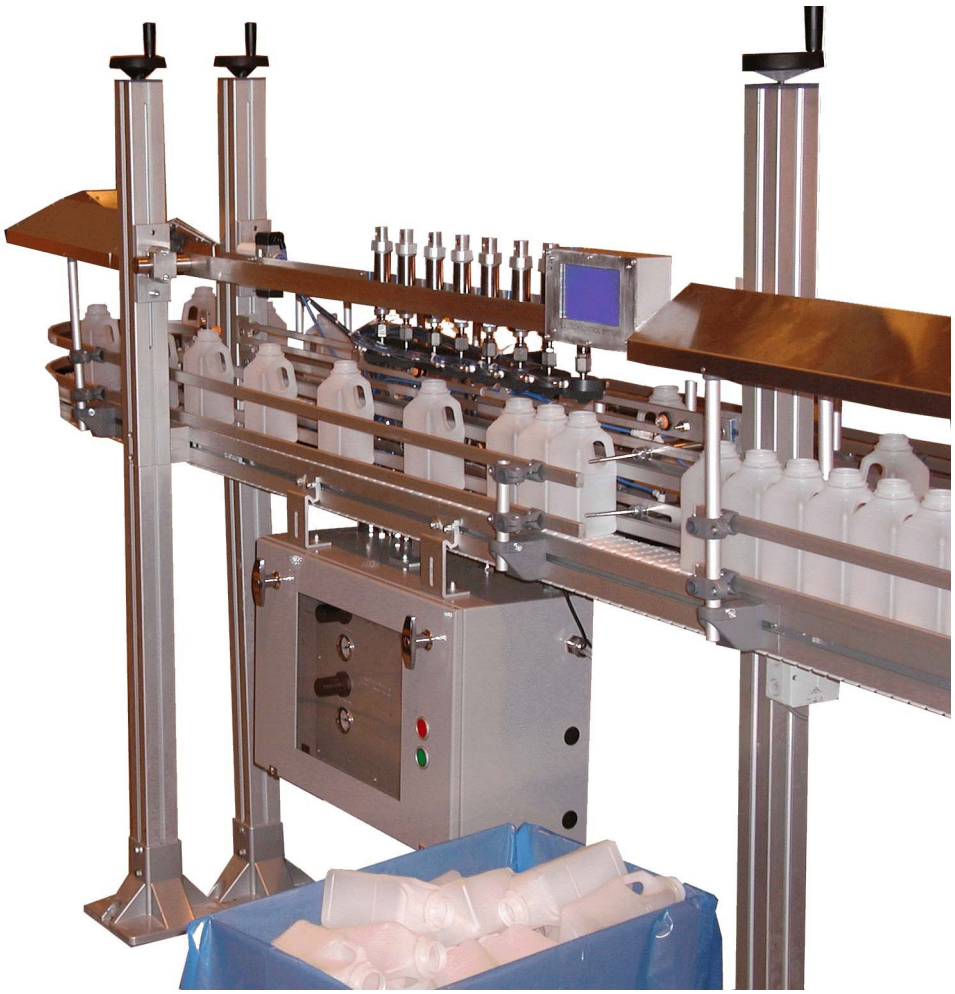
Electrical machinery contains hazardous voltages. Installation, servicing and adjustment is only to be performed by qualified personnel.
Do not tamper with this device.

Document Revision 2.0

Contents

1 Overview

The LT5 leak detector is an in-line, bottle leak detection system capable of testing from 1 to 24 bottles at a time, with throughput to 240 bottles per minute depending on the configuration (see table 2.1 on page 13).



8-Head Leak Detector,140 Bottles per Minute

The LT5 is designed for 100% leak testing of blow moulding machine output. Several options are now available to allow this system to perform a variety of important additional bottle operations.

1.1 Features

The LT5 series of leak testers have many advanced features:

- High accuracy leakage measurement

  The system uses a sensitive pressure transducer with a low noise amplifier and high speed, high-resolution analog to digital converter. This minimizes measurement errors.

- Flexible bottle transport system

  Timings can be easily adjusted to optimize bottle transport, where required, without sacrificing test time.

1.1.1 Touch-Screen Microprocessor control system

It is now cost effective to use a modern touch-screen operator interface, rather than a simple digital readout. This has many advantages:

  - Extremely flexible design. Extra features and customizations can be easily integrated into existing systems.

  - All test results, displays and counts are displayed together on the main displays page. This enables evaluation of the status of the system at a glance.

  - All settings are displayed together on a settings page, allowing easy inspection and modification.

  - All input and output states are displayed together on a diagnostics page. This allows quick faultfinding.

- The graphics based nature of the screen allows descriptive text and graphics to appear identifying all settings, results and warnings.
- Setting changes can be locked out if required.
- International - Since all information is presented on the touch screen display, it is easy to change the program to use another language (where the system is to be used in a non - English speaking country).

1.1.2 High Reliability

This is possible due to technology improvement, reduced component count, integration of all electrical functions onto the PCB, and an in-depth understanding of failure mechanisms.

1.1.3 Modular pneumatic system

Easily Customized Modular Pneumatics System

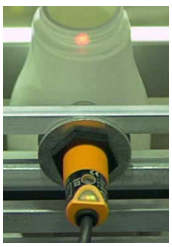
- Allows quick customization for special needs.
- Allows easy expansion of system to include extra facilities even after installation.

1.1.4 Cost Effective

The circuit cards have been designed and programmed specifically for this application. Great care has been taken to ensure that the system is easily re- programmable, expandable and reliable. This means that the performance and cost limitations of using a bought-in Programmable Logic Controller are avoided.

1.1.5 Wide Range of Options

The leak tester design is highly flexible with respect to software, electronics, pneumatics and mechanics. This allows a wide range of options (see following page) to be added at any time, even after installation.



Auto-tuned Photoswitch with Visible Spot

1.2 Options

1.2.1 Extra Test Channels

It is straightforward to add additional test channels at any time, in order to increase throughput. This allows the leak tester to keep up with ever-increasing blow molding machine speeds, without over-specifying the system at purchase time.

1.2.2 Choked Bore / Ovality Test

A probe fitted to the test head checks whether the neck is occluded or deformed.

1.2.3 Height Check

A fiber-optic sensor checks that the bottle is not too tall. This can detect folded over base flash on some bottles, as well as neck flash.

1.2.4 Auxiliary Sensors

Spare inputs are available which can be used to connect other sensors, which examine the bottle during the leak test. Examples might be label sensors, flash detection sensors or vision systems. The leak tester would fail the bottle if any of these inputs were triggered.

1.2.5 Bottle transport options

A variety of bottle transport options can be fitted to replace the standard method. It is recognised that the standard method may not always be suitable, although we have found that is the most flexible as well as the most cost effective. Options include side clamps and holding moulds.

1.2.6 Stabilization Plate / Brush

A pneumatically operated mechanism can be fitted to the infeed of the leak tester. This is only required when the conveyor is to be fed directly from the output of a blow molding machine with violent take-out movements. The plate supports the queue of bottles when push-out occurs. The plate then opens, allowing the bottles to travel down the conveyor.

1.2.7 Batch Counter / Diverter

This is a simple system intended to assist the scramble packing of bottles. A diverter mechanism at the end of the conveyor allows bottles to go into one or the other of two boxes. A preset count is entered into the system. Each time the count is reached, the diverter changes state. The bottles fall into the new box while the previous box, now full, is taken away and replaced. An optional alarm and reset button is available to alert an operator.

1.2.8 Multi-Gate Scramble Packing System

Bottles are diverted off the main conveyor into packing cartons, at a number of stations.

Having more than one packing station allows a single operator to look after several lines of production, since attention is only required periodically. A box can be changed at any time, within the time taken to fill the next two boxes.

Because the system is integrated with the leak detector, there are no problems with unexpected queuing causing a jam at the leak tester.

The number of bottles per box can be easily set to any value required.

1.2.9 Vacuum Operation

The system usually pressurizes the bottles during the leak test. However, it is possible to supply the system for vacuum operation where required.

1.2.10 Special test pressure

The system test pressure is adjustable over a limited range (see specification). If this range is not sufficient, a different transducer can be fitted to allow any test pressure desired.

1.2.11 Data logging / SPC

The standard system maintains counts of passed and failed bottles. More extensive data logging and SPC features can be implemented by exchanging the controller PCB for one with the SPC option fitted.

1.2.12 Infra Red Beam Wall Thickness Measurement

As the bottle travels along the conveyor, it passes through a modulated infra red light beam. The absorption of the beam is measured and used to test the wall

thickness. This can be used to detect wall thickness variations, blown in necks, etc. The system was designed for natural plastic (e.g. milk bottles) but may be suitable for other applications.

LT5 Main Cabinet

2 Specification

Hole Size Detected / Throughput	0.1mm / 140 bottles per minute / 8 heads.[1]
Number of Test Channels	1,2,3,4,5,6,8,10,12[2]
Leak Test Method	Ratiometric Pressure Decay, Auto-zero, Auto-Scale. Adaptive pressurisation algorithm.
Power Supply	110-120 or 220-240VAC single phase
Power Consumption	50 VA maximum[3]
Air Supply	60-150 psi (4-10 bar)
Air Consumption	1 litre per minute typical
Minimum Bottle Volume	250 cc
Maximum Bottle Volume	10 litres (2 gallons)
Test Pressure	Adjustable, 0.15 - 0.6 psi (10 - 40 mB)
Cycle Time	1.0 - 20.0 seconds
Transducer	Semiconductor strain gauge diaphragm, 0.00 - 65.00 mB, 0.02% resolution, x20 Over-pressure Protection.

2.1 Performance Table

The table below is based on real-life figures as measured on a wide range of installations, machine configurations and bottle types. Realistic values are assumed for the variables involved (conveyor speed, bottle dimensions, bottle stretch characteristics, leak tester accuracy). The sensitivity shown is conservative. However, it is likely that a particular application will encounter different values for these. For example, an unstable bottle may require a slower conveyor. We suggest that you contact the office before specifying a particular model of leak tester so that we can take all parameters into account.

In Table 2.1, the throughput in bottles per minute is shown along the top. The bottle size in litres is shown at the left hand side. For each combination of bottle size and bottles per minute, the suggested number of test heads is given.

	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
0.10	1	1	1	1	2	2	2	3	3	4	4	5	5	6	6	8	8	8	10	10
0.25	1	1	1	2	2	2	3	3	4	4	5	5	6	8	8	8	10	10	12	12
0.33	1	1	1	2	2	2	3	3	4	5	5	6	8	8	8	10	10	12	12	
0.50	1	1	1	2	2	3	3	4	4	5	6	8	8	10	10	12	12			
0.75	1	1	2	2	3	3	4	4	5	6	8	8	10	10	12					
1.00	1	1	2	2	3	3	4	5	6	8	8	10	10	12						
1.50	1	1	2	3	3	4	5	6	8	8	10	12								
2.00	1	2	2	3	4	5	6	8	8	10	12									
3.00	1	2	3	3	4	6	8	8	10	12										
4.00	1	2	3	4	5	6	8	10	12											

Table 2.1 Number of test heads required, for various container sizes and production rates (Containers Per Minute).

[1] See performance table for details.
[2] Specify when ordering
[3] excludes conveyor

1 General Machine Operation

The leak tester is automatic in operation.

To switch on Proceed as follows:

- Check air applied (pressure gauge on air inlet above 4 bar).

- Check power applied (Red light on control panel)
- Ensure all emergency stops are off (pulled out).
- Press the green start button on the control cabinet. Green lamp should come on.
- Allow bottles into the leak tester.

To Switch off

- Press the Stop button on the control panel.

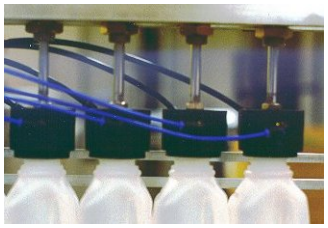
To Verify Operation

- If required, correct leak tester operation can be verified by passing a sample bottle with a test hole repeatedly through the leak tester, once for each channel.

To Clear a Bottle Jam

- Press the Stop button.
- Clear the leak tester area of bottles.
- Make sure the stop button is pulled back out, and then press the green start button.
- Allow bottles into the leak tester again.

2 Quick Set Guide



Ensure that the leak tester is mechanically adjusted so that the necks of the bottles are positioned centrally under the test heads during the test.
The sealing force of the test head on the bottle needs to be set. This can be done in one of two ways.

- For strong bottles, which can withstand a large topload force, set the test head bracket so that there is approximately 10mm clearance above the bottle when the heads are up. Adjust the Test Head pressure regulator so that the test head comes down with enough force to seal on the bottle.

- Alternatively, if the bottle is extremely lightweight, turn the pressure regulator to 2 Bar. Adjust the vertical position of the test head bracket so that when the heads are down, they compress the bottle by the amount required to get a good seal.

If the required settings for the job have not yet been established, start as follows.

Test Time	1 second
Pressurize Time	1 second
Test Pressure	30 mB
Max Leakage	15%
Start Delay	0.75 seconds
Blowoff Time	0.10 seconds
Blowoff Delay	0.10 seconds

These are the "factory set" values and are intended as a starting point. They can be quickly reached by pressing the "RESET" button as each setting is displayed.

Set the pneumatic regulator "TEST HEAD FORCE" to 1 bar.

Set the pneumatic regulator "PRESSURISATION" to 1 bar.

Send some bottles through the leak tester and make any adjustments to the guides that are required.

Note the leakage level obtained for good bottles (on the main DISPLAYS page).

Set the Reject Level (on the SETTINGS page) to a level slightly above this. About 2% above this is usually correct, but this will depend on the consistency of the results. For example, if good bottles are coming through with 8.0% pressure decay on average, set the Maximum Decay to 10.0%. If the result is always between 7.5% and 8.5%, the limit can be reduced to 9.0% to improve the test sensitivity.

3 LT5 Displays and Settings

Most information is presented on the graphical touchscreen control panel. The information is organized into several pages. Other pages can be stepped through by pressing the PAGE button. The pages specific to leak detector operation are explained in this section; other pages may be available depending on the options installed. These are discussed in the relevant sections of the manual.

3.1 Displays

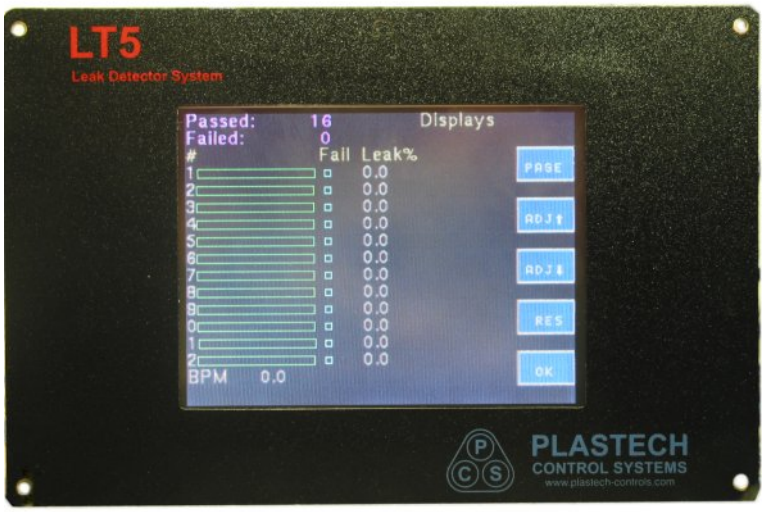


Figure 3.1 The main page displayed during operation

This is the main page displayed during normal running. The system will always show this page after power-on.

This page displays the following information:

3.1.1 Counts

These are counts of the number of bottles that have passed and failed the test.

A count can be reset to zero as follows:

- Touch the count value. It should become highlighted.
- Press the "R" (Reset) button.
- The count value will change to zero.

3.1.2 Pressure Scales

A pressure scale is displayed, in bar graph form, for each channel. This gives a quick visual indication of the actual pressure in the bottle at any instant in time. The display is scaled to the set test pressure, so that full scale always equals the set test pressure.

3.1.3 Test Result Indicator

Immediately to the right of each bargraph is an indicator light, which turns on when a bottle fails the test.

3.1.4 Leak%

To the right of the indicator light, for each channel, is displayed a number representing the precise result of the leak test. The number displayed is the percentage of the initial pressure, which has been lost during the test. This number is compared against the set limit to determine pass or fail.

3.1.5 BPM

This shows the throughput of the leak tester in Bottles Per Minute. This is updated every cycle. The value is accurate as of the start of the last cycle, and is calculated from the interval between the last two cycles.

3.2 Leak Test Settings

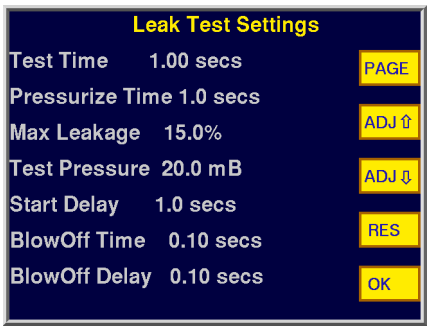


Figure 3.2 LT5 Settings

To change a setting, first highlight by touching it. Use the ``up'' and ``down'' arrows to adjust. Press ``OK'' when done.

Test Time — Controls the length of the leak test. The higher this setting, the more accurate the leak test. This should be set to as high a value as possible, consistent with bottle throughput.

Pressurize Time — Sets the maximum time for which the leak tester will attempt to pressurize a bottle under test. 1 second is normally sufficient. This can be reduced in order to reduce the overall cycle time, if required. If it is reduced too far, the machine will not have enough time to pressurize the bottles and they will be rejected.

Max Leakage — Sets the sensitivity of the test. The percentage of pressure decay measured by the test is compared with this value to determine the test result. If the decay is greater than this value, the bottle is rejected.

Test Pressure — The target pressure used to inflate the bottle. A value of 20mB is typical. Higher values can give marginally more accurate results but may distort the bottle during the test.

Start Delay — The test cycle is started when a stationary bottle is detected at test station. The time for which the bottle must be stationary can be adjusted using this setting. A higher value prevents false

starts due to a very slow conveyor, and allows time for the bottles to stabilize before the heads are brought down.

Blowoff Time — This sets the length of the pulse of air, which is used to reject the bottles. This can be adjusted to provide accurate control of the force required.

Blowoff Delay — This sets the delay after triggering the reject photoswitch, before the air jet starts. This can be used to fine-tune the direction of bottle blow-off. (So that the bottle can be cleanly knocked out of a group of bottles).

4 General Touchscreen Operation

The system is provided with a graphical touchscreen display. This allows an operator to see the state of the machine at a glance. The surface of the screen is touch sensitive allowing an operator to reset counts, view other pages and alter settings if required.

PAGE

- To change the page being displayed, touch the PAGE button on the screen.

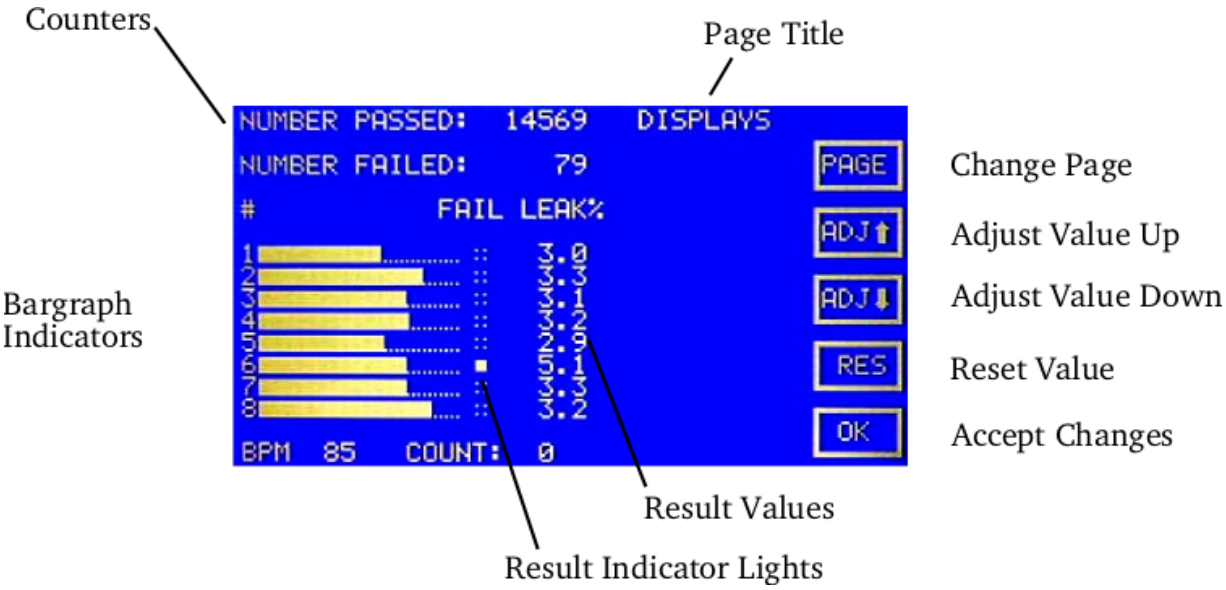


Figure 4.1 Touchscreen Display

4.1 Displays

This is a typical page displayed during normal machine operation; in this case the machine is an 8-channel leak detector. The system will always show this page after power-on. It has been designed to display all the information routinely needed by operators or quality control staff, i.e. bottle counts and test results. This example page displays the following types of information:

4.1.1 Counts

The system provides counters of various items. A count can be reset to zero as follows:

- Touch the counter value. It will become ``highlighted''.
- Press the ``RES'' (Reset) button. 

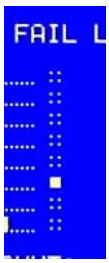
- The count value will change to zero.

4.1.2 Bargraph Scales

This type of display shows the magnitude of a value as a bargraph scale. This gives a quick graphical indication of a value, allowing rapid appreciation of trends and quick comparisons to other channels. In the above example the bargraphs show the air pressure inside 8 bottles being leak tested. (More accurate numeric displays are available on separate diagnostic pages if required.)

4.1.3 Indicators

On Screen Indicators



These are turned on and off as required, and can be used to indicate ON/OFF, ENABLED/DISABLED, PASS/FAIL type conditions. In the example the FAIL indicator turns on when a bottle fails the test.

Figure 2

4.1.4 Result Values

To the right of the indicator light, in this example is displayed a number representing the precise result of the leak test. This number is compared against the set limit to determine pass or fail.

4.1.5 Settings Pages

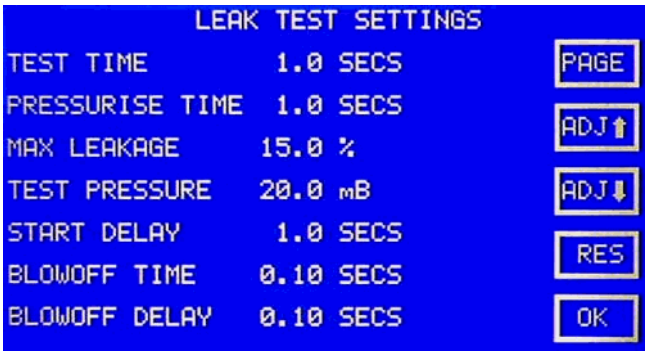


Figure 4.3 A ``Settings'' Page

Machine settings are usually grouped onto separate pages from the main display screen, so that operators do not accidentally make changes. There are two types of setting: numerical and on/off. The number displayed indicates a value of a numerical setting. The value of an on/off setting (i.e. whether it is on or off) is indicated by an indicator box. To alter a setting, proceed as follows:

- Touch the displayed setting value. The value should become highlighted.

- To increase, touch the ``Adjust Up'' button.

- To decrease, touch ``Adjust Down''.

- Alternatively, the setting can be returned to its factory set value by pressing `Reset''.

- Press ``OK'' to retain the new value.

4.1.6 Other Settings Page

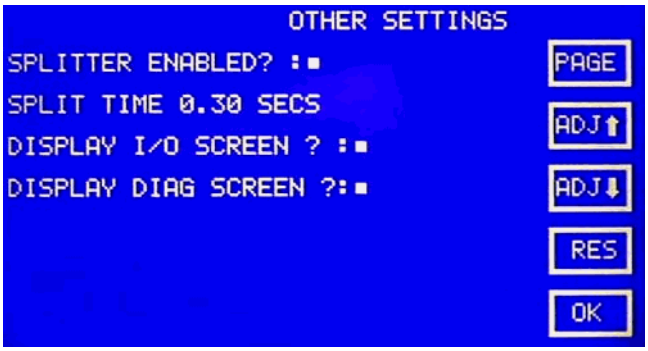


Figure 4.4 ``Other Settings'' Page

This page is used to group miscellaneous settings that may not be present on all machines. It also allows seldom-used screen pages to be switched on and off, to avoid confusion. In the example, the operator simply touches the light for ``Splitter Enabled'' to switch between the enabled and disabled states of the ``Splitter'' (shown by the indicator being on and off respectively).

The last two lines control whether the I/O Page and the Diagnostics page (see below) are displayed. Again, to enable or disable display of a page[4], simply touch the indicator box.

4.2 I/O Page

See the Machine Input / Output Sheet for details of the function of each input and output.

The state of each I/O is shown by an indicator box being lit (for on) and unlit (for off).

The state of an output or input can be over-ridden from this page as follows:

- Touch the indicator box corresponding to the input or output which requires forcing.

ADJ⬆

- To force on, press ``Adjust Up''. . The indicator will change to ``1'' to show it is forced on.

[4] Once a page has been switched on; it will not be removed from the display until the next power-up of the system.

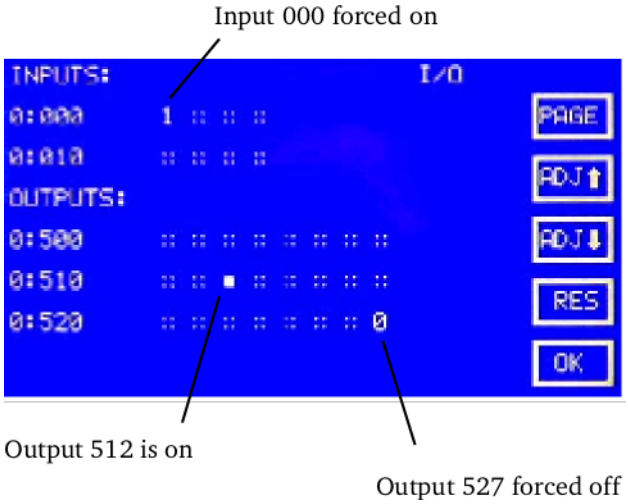


Figure 4.5

ADJ⬇

- To force off, press ``Adjust Down''. . The indicator will change to ``0'' to show it is forced off.

RES

- To reset to normal operation, press ``RES''.

Ensure that no I/O's are left forced to 0 or 1 when normal operation is to be resumed. If in doubt, power-off and on to reset the system.

5 Principle of Operation

The test cycle is normally initiated by a signal from the Test Station Photoswitch. The test head cylinder valve is turned on, bringing the test head down to seal on the bottle. At the same time, the pressurization valve is turned on, allowing the bottle to pressurize. When the pressure in a bottle rises past a threshold, the pressurization valve is turned off. After a short delay, the pressure in the bottle is measured (Pressure A). The bottle remains sealed for the remainder of the test time. At the end of the test, the pressure in the bottle is again measured (Pressure B). The test head is then retracted. The percentage of pressure decay is then calculated from the two pressure measurements. This is the result of the test. This is compared with the set limit and a pass/fail decision made.

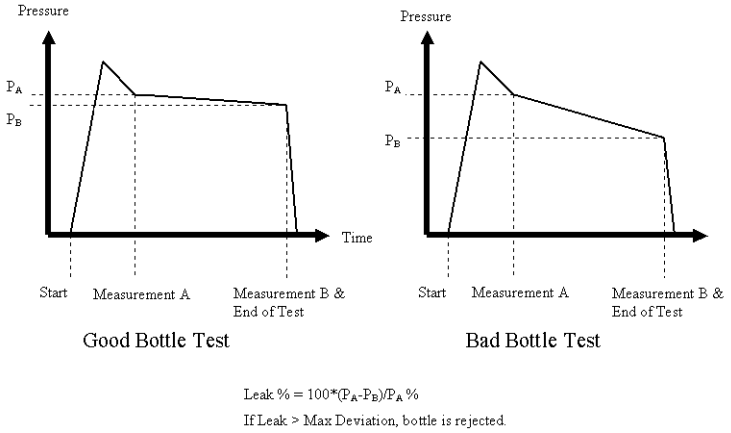


Figure 5.1 Pressure Decay Leak Detection Operating Principle

There are other checks made in order to catch exceptional conditions. For example, we reject the bottle if

- There is insufficient initial pressurization.
- The bottle collapses during the test, creating a pressure rise.

Also not shown is the automatic tuning of the pressurization valves, which removes the need for individual manual flow control adjustments on each test channel.

6 Installation

Plastech Control Systems, or our representatives normally perform installation. However, some guidelines are here provided for customers who wish to do this themselves. Contact us (or our representatives) directly for more detailed information and advice.

We assume here an installation on a pre-existing conveyor system; this is the typical case.

6.1 Initial Specification of Equipment

The customer should have specified the following information

- Supply voltage
- Number of test heads
- Right or left handed operation (do the bottles come from the right, or the left, as viewed from in front of the main control panel).

6.2 Conveyor

We recommend that a variable speed drive be fitted to the conveyor, so that bottle transport can be optimized. In general, the conveyor should be run as fast as possible while maintaining bottle stability, and taking into account other equipment on the line.

6.3 Location

Typically there will be a blow-molding machine, a conveyor system and a packaging machine or station at the end of the conveyor. The packaging system, such as a bagger or collating table, may have periods when bottles are not being removed

from the conveyor (for example, when a pack is completed). This will cause a temporary queue to form.

In general, for a variety of reasons, the leak detector should be situated as far downstream as possible, away from the blow-molding machine. This is so that the operator has the maximum amount of time to clear any problems (jams, etc.), before the leak tester infeed queue backs up into the blow molder. However, if there is any downstream equipment which generates a periodic queue, such as the bagger mentioned above, then the length of the queue should be established and the leak tester sited upstream of it. This is because the leak tester has to halt when there is a queue backed through it, which will waste test time. This is always undesirable, since it means that the test time must be set shorter than it could be, reducing test sensitivity.

6.4 Installation Layout

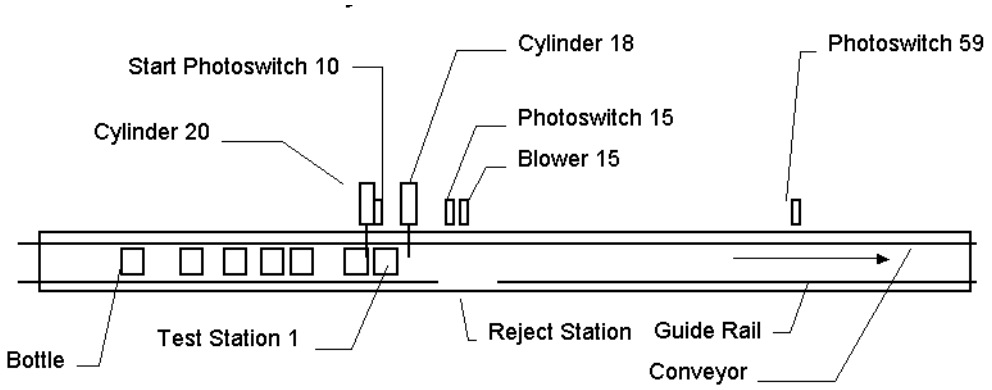


Figure 6.1 Single Channel, Left Handed Installation

6.5 Mounting

Mount the main cabinet under the conveyor. It is usually most convenient to bolt the top to the conveyor frame, with one side bolted to a conveyor support leg.

Mount the test head frame above the control cabinet.

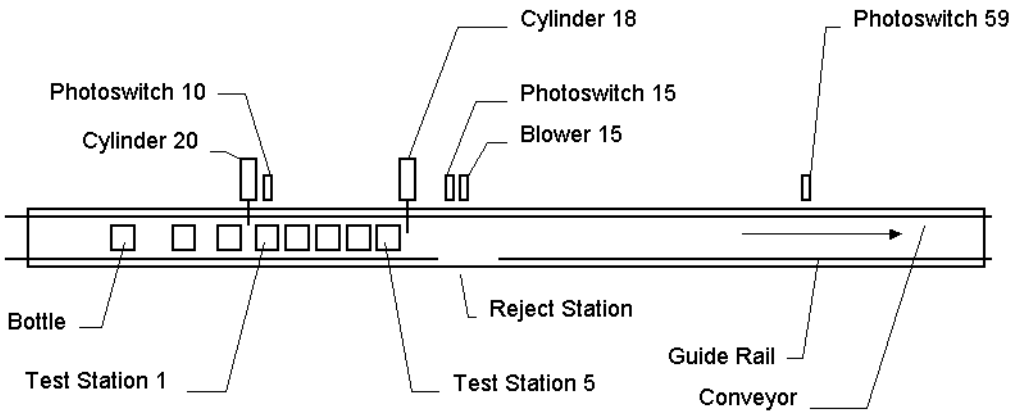


Figure 6.2 Multi Channel, Left Handed Installation (2-12 heads)

The existing guides are normally run straight through the test area, however these need to be cut at the reject station. The gap needs to be much more than the width of a bottle, since the bottle will be moving along during rejection. Often it is best to only cut the top rail (of 2), with the bottle being blown over the top of the bottom rail. The reject station is normally immediately after the test station.

Refer to the layout diagram for an outline of the main items. The leak tester can be used with the bottle stream coming either from the left, or from the right, as viewed from in front of the control cabinet. However, the correct program EPROM needs to be fitted (right or left handed). (We do not currently make this user selectable, since an incorrect setting would result in apparently correct operation except that the wrong bottle would be rejected).

An optional brake can be fitted upstream of the leak detector. Its function is to allow reliable operation even when there is a large line pressure due to an extended infeed queue (for example, after a jam, or failure of downstream equipment).

6.6 Supplies

6.6.1 Electrical

The system can operate from 115 or 230 VAC, 50VA, and single phase supplies. The operating voltage must be set by connecting the appropriate terminal of the

internal control panel mains transformer. This will normally be pre-wired according to the local mains supply standard, but should be checked during installation before applying power! The control cabinet frame must be securely earthed using the stud provided, next to the isolator.

6.6.2 Pneumatic

The system requires clean, dry air at 4-10 bar. We provide a $1/4$ inch BSP air inlet for the connection.

6.7 Piping

The valve manifold should be clearly labeled with the function of each valve; so piping up the machine[5]should be straightforward. Some notes follow:

Check that the correct program has been supplied (right or left handed, see "Initial Specification" above).

Each test head has two pipes going into it, ``sense'' and ``pressurization''. The top valve is the pressurization valve for test head 1. This is *always* the left hand test head, as viewed when in front of the control cabinet. The sense pipe from this left hand test head always goes to the left hand pressure transducer on the circuit board, via the bulkhead fittings on the top face of the control cabinet. It is very important that pressurization and sense pipes are correctly paired, since an error here will result in inconsistent pressurization of the bottles. This can be difficult to diagnose.

Make sure that piping is done with the test heads set to representative positions, and that there is enough slack to accommodate the full range of bottles that will be used with this machine.

[5] Most pneumatic piping is now done before delivery of the machine, however we have left this section in the manual for reference.

6.8 Photoswitches

The usual sensors supplied are visible light, diffuse reflective, self tuning, background suppression types. Connect these according to the wiring diagram and I/O list for your machine (Page36). The two most important ones are shown in Table 6.1.

Terminal	*Name*	*Colour*	*Sensor*	*Function Number*
000+	+24V	Brown		
000	Signal	Black	START	10
000-	0V	Blue		
001+	+24V	Brown		
001	Signal	Black	REJECT	15
001-	0V	Blue		

Table 6.1 Photosensor Wiring

The START photoswitch is mounted so that it sees the last bottle to enter the test area, before cycle start. Cycle start is triggered by the start photoswitch being on for longer than the set Start Delay.

The REJECT photoswitch is mounted just before the reject blower.

An optional downstream queue photoswitch is mounted downstream of the test area. If it is blocked at the end of the test, then the bottles are not released and the leak tester will halt until it is clear.

All these photoswitches should be positioned so as to see the gaps between the bottle necks, even when the bottles are touching.

6.9 Infeed Brake

An optional brake can be fitted upstream of the leak detector. Its function is to allow reliable operation even when there is a large line pressure due to an extended infeed queue (for example, after a jam, or failure of downstream equipment).

6.10 Testing

Correct installation should be checked, not initially by testing bottles but instead by systematically going through the I/O list and checking each function. This is important because some piping mistakes can result in apparently correct operation that is in fact unreliable.

Go through the I/O list for your machine (see table 9.1 on page 36). From the front panel, force each one on and off in turn, and check that the correct machine function operates.

When I/O testing is finished, power off the leak tester for a few seconds, to release any forced outputs.

6.10.1 Pressurization

> *Do not force on the pressurization valves when the test heads are down on a bottle, since this will result in an uncontrolled over-pressurization that may damage the transducers.*

Pressurization valve 1 (Output 500) should be the left hand test head, as viewed from in front of the control panel. Note: The pressurization and test head up/down will not operate unless the front panel pressure regulators have been set to non-zero!

6.10.2 Test Head Up/Down

Check that this operates on the appropriate output number (see table 9.1 on page 36) and set the front panel regulator as required. All heads should move up and down smoothly, together.

6.10.3 Function Valves

Check the other fitted functions as per the I/O table.

6.10.4 Transducers

Correct transducer piping can be checked as follows:

- Force the stop cylinder out
- Line up the appropriate number of bottles under the heads
- Force the test heads down
- Manually squeeze the bottles one by one. You should see pressurization on the appropriate bargraph. Bargraph 1 should be the left hand head, corresponding to pressurization valve 1.

Proceed by following “Quick Set Guide” on page 15.

7 Component Numbering Scheme

The drawings following show the layout and interconnections of the various components, electrically, pneumatically and mechanically. The component numbering system is not obvious and requires explanation.

The heart of the machine is an electronic control system with various inputs and outputs (I/O's). There are a fixed number of these for any given installation (although extra I/O's can be added). These I/O's are connected to various devices (photoswitches, valves, cylinders motors etc), which make the machine work. A controller program reads the inputs and controls the outputs according to its program. The controller card I/Os have a fixed numbering system, with inputs starting at 0000, 0001, 0002 etc and outputs starting at 0500,0501,0502 etc. The I/O's are labeled in this way on the circuit card LED's, also on the I/O page of the machine display. The function of a particular I/O number may be different depending on the configuration of machine supplied. There are so many options and configurations that it would be very wasteful to dedicate an I/O for the same function on all machines. Instead, the controller program for a particular machine configuration allocates I/O's, more or less sequentially.

To avoid having to make individual electrical, pneumatic and layout drawings for each machine combination, Universal Function Numbers have been defined. I/O numbers are related to Function Numbers by a single table in the product manual. Function specific parts (e.g. the Test Head Cylinder) are given a number according to that function (in this case, Cylinder 10). This will be the same in any PCS product that has a Test Head Cylinder; it will always be Cylinder 10, CYL10 etc. The photoswitch that actuates the test head could also be called Photoswitch 10, PS10, etc. The actual I/O number can vary between machine types (although will be the same for two machines of the same model)

8 Function Number Cross-Reference

ID	Description
1	Pressurization Channel 1
2	Pressurization Channel 2
3	Pressurization Channel 3
4	Pressurization Channel 4
5	Pressurization Channel 5
6	Pressurization Channel 6
7	Pressurization Channel 7
8	Pressurization Channel 8
9	Pressurization
10	Test Heads Down
11	Test Head Down Channel 1
12	Test Head Down Channel 2
13	Test Head Down Channel 3
14	Test Head Down Channel 4
15	Reject
16	Leak Test Reject
17	Leak Test Bottle Stop
18	Leak Test Bottle Stop 1
19	Leak Test Bottle Stop 2
20	Leak Test Bottle Separator
21	Conveyor Merge Gate
22	Brush
23	Infeed Conveyor
24	Indexing Conveyor
25	Turner
26	Turner Queue Brake
27	Collating table Infeed Stop
28	Carriage Up
29	Carriage Down
30	Carriage Forward
31	Carriage Back
32	Carriage Up-Down
33	Carriage Forward-Back
35	Flash Detection
36	Blocked Bore Channel 1
37	Blocked Bore Channel 2
38	Bottle Support
40	System
41	Emergency Stop
42	Safety OK
43	Power On
44	Machine Run
45	Machine Stop
46	Alarm
47	Motor Tacho
48	Test A
49	Turner Downstream Stop
50	Turner Upstream Stop
51	Test B
52	Update Data
53	Unused I/O
54	Reject Channel 1
55	Reject Channel 2
56	Reject Channel 3
57	Reject Channel 4
58	Short Row Stop
59	Downstream Backup
60	Diverter Mechanism
61	Leak Test Infeed Brake
62	Diverter Gate Infeed Brake
63	Diverter Gate 1
64	Diverter Gate 2
65	Diverter Gate 3
66	Main Drive
67	Blower
68	Fan
69	Busy
70	Cycle Start
71	Ready
72	Start 1
73	Start 2
74	Index Position
75	Lock Settings
76	FallenSenseTop
77	FallenSenseBottom
78	FallenSenseEject
79	SupportPlate
80	Alignment Plate
81	Holding Moulds
82	Box Inverter
83	Machine Reset
84	Test Pass
85	Test Fail
86	Vent
87	Seal Neck
88	Seal Aux
89	Leak Tester Self Test
90	Pressurization Channel 9
91	Pressurization Channel 10
92	Pressurization Channel 11
93	Pressurization Channel 12
94	Pressurization Channel 13
95	Pressurization Channel 14
96	Pressurization Channel 15
97	Pressurization Channel 16
98	Flash Detection 1
99	Flash Detection 2
100	Flash Detection 3
101	Flash Detection 4
102	Flash Detection 5
103	Flash Detection 6
104	Flash Detection 7
105	Flash Detection 8
102	Flash Detection 9
103	Flash Detection 10
104	Flash Detection 11
105	Flash Detection 12
106	Bottle Dump

9 Input / Output Listing

Table 9.1 shows the input and output allocations for the standard LT5 range of leak testers. This can be used to trace the operation when fault finding or installing the system.

9.1 Notes

- Special Inputs - Some special options may cause the I/O allocation to differ from that shown. Contact Plastech Control Systems for information on your specific configuration.
- Divertor Gate Infeed Brake - Shares function with Downstream Backup Sensor since would not normally have both.
- ``Flash Detection'' inputs also used for choked bore detection.

Table 9.1 LT5 Inputs and Outputs

Function	*Name*	*LT5-1*	*LT5-2*	*LT5-3*	*LT5-4*	*LT5-5*	*LT5-6*	*LT5-8*	*LT5-10*	*LT5-12*	*All*
	Standard Inputs										
10	Test Heads Down										000
15	Reject										001
59	Leak Test Downstream Backup										002
61	Leak Test Infeed Brake										003
	Standard Outputs										
1	Pressurization Channel 1	500	500	500	500	500	500	500	500	500	
2	Pressurization Channel 2		501	501	501	501	501	501	501	501	
3	Pressurization Channel 3			502	502	502	502	502	502	502	
4	Pressurization Channel 4				503	503	503	503	503	503	
5	Pressurization Channel 5					504	504	504	504	504	
6	Pressurization Channel 6						505	505	505	505	
7	Pressurization Channel 7							506	506	506	
8	Pressurization Channel 8							507	507	507	
90	Pressurization Channel 9								510	510	
91	Pressurization Channel 10								511	511	
92	Pressurization Channel 11									512	
93	Pressurization Channel 12									513	
10	Test Heads Down	501	502	503	510	510	510	510	514	514	
15	Reject	502	503	504	511	511	511	511	515	515	
17	Leak Test Bottle Stop	503	504	505	512	512	512	512	516	516	
20	Leak Test Bottle Separator	504	505	506	513	513	513	513	517	517	
19	Leak Test Bottle Stop 2						514	514	520	520	
61	Leak Test Infeed Brake						515	515			
	Special Inputs										
62	Diverter Gate Infeed Brake										002
76	Fallen Bottle Sense Top										012
77	Fallen Bottle Sense Bottom										013
98	Flash Detection 1										004
99	Flash Detection 2										005
100	Flash Detection 3										006
101	Flash Detection 4										007
	Special Outputs										
62	Diverter Gate Infeed Brake								521	521	516
63	Diverter Gate 1								522	522	517
64	Diverter Gate 2								523	523	520
65	Diverter Gate 3								524	524	521
89	Self Test								525	525	522
78	Fallen Bottle Eject								526	526	523
106	Bottle Dump								527	527	524

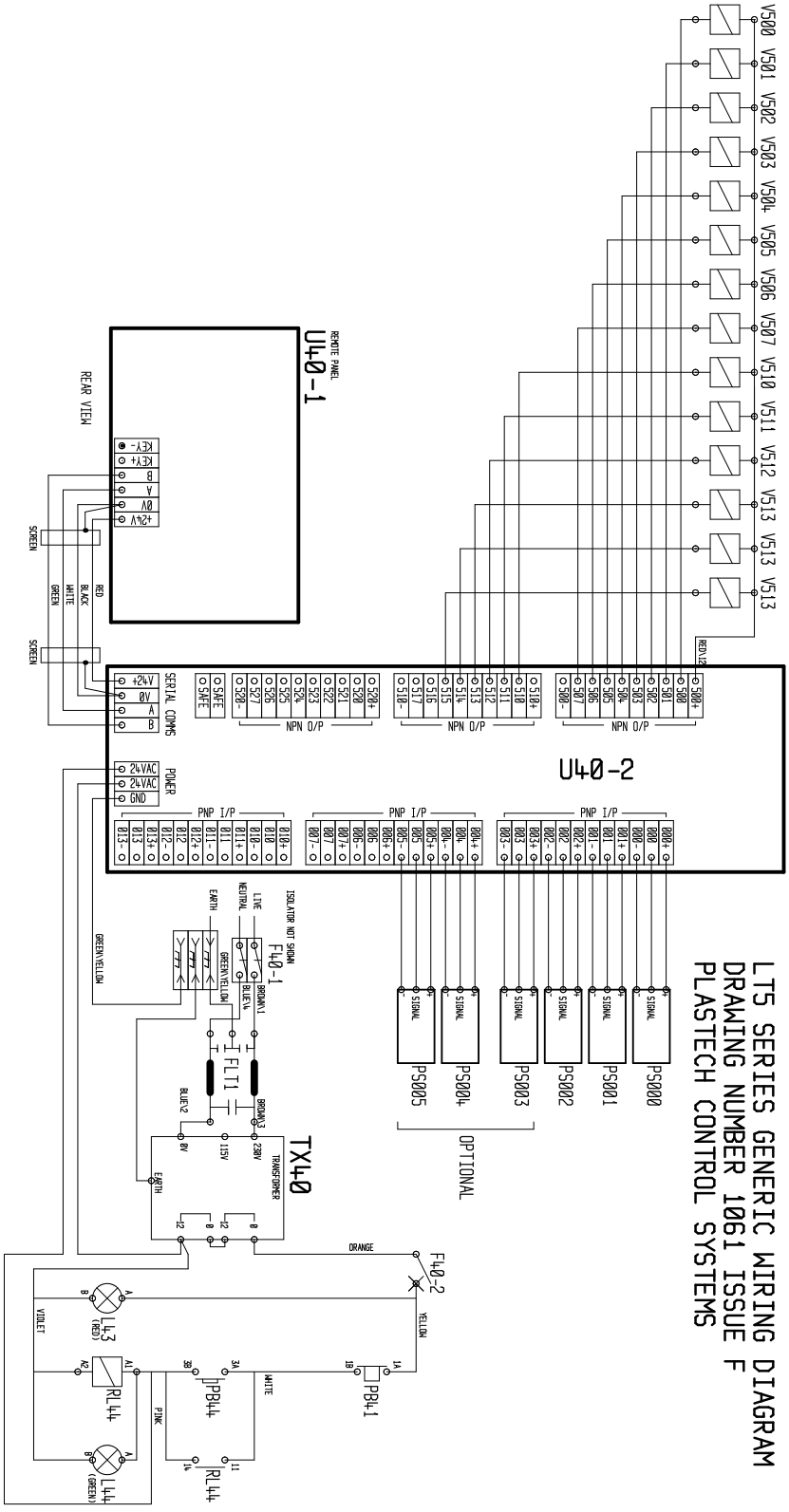


Figure 9.1 Wiring Diagram

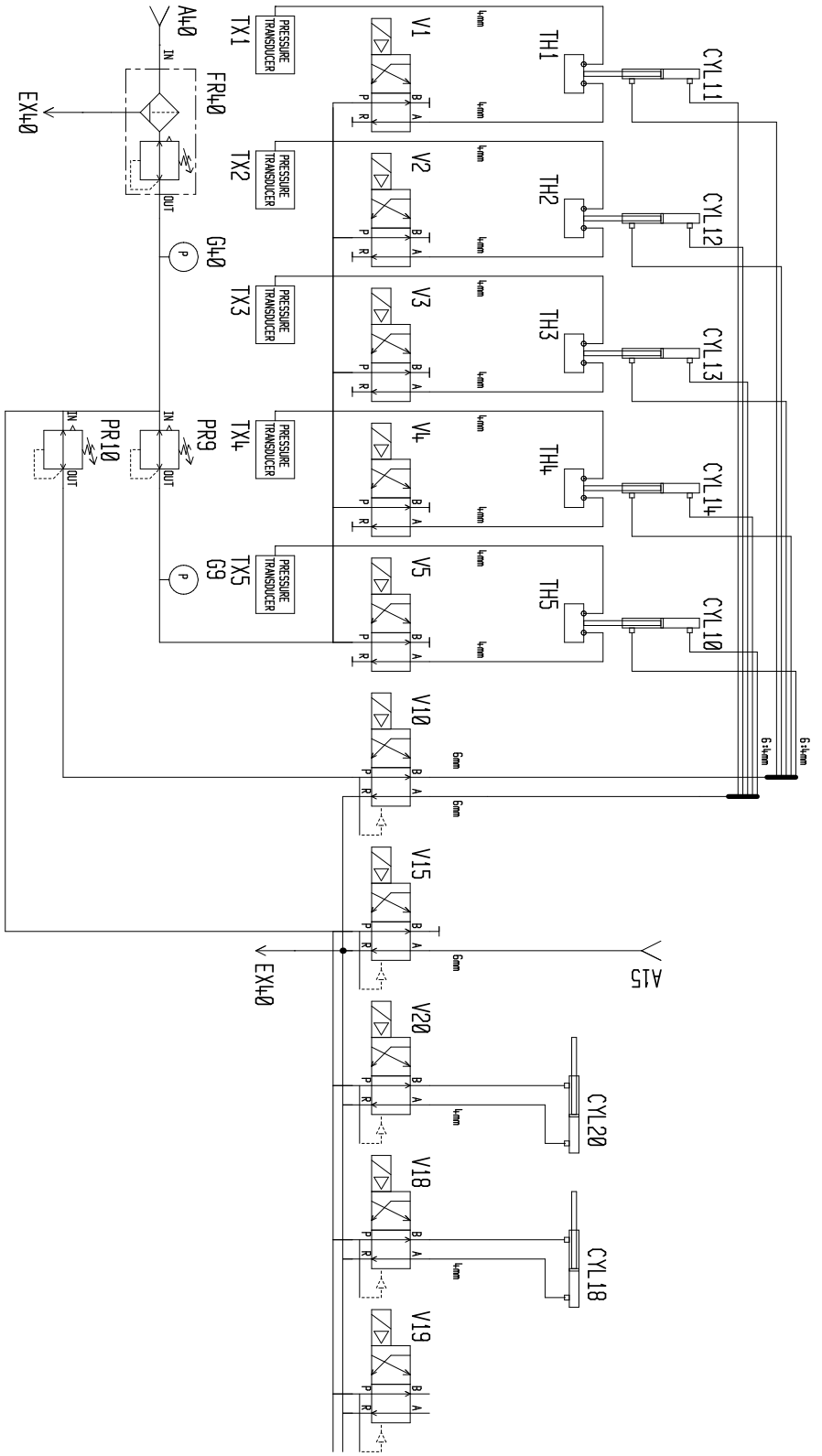


Figure 9.2 Pneumatics Diagram

10 Maintenance

10.1 Periodic Maintenance

Every week, check the condition of the test head seals. Replace any that are worn. The system will start to fail bottles if the sealing surface becomes too irregular.

Every year, or when discolored, replace the air filter in the filter-regulator assembly.

Figure 10.1

Every month, observe the operation of the machine. Note any air cylinders that are showing signs of wear, air leaks or excess "sticktion". Removing the air supply to the machine and moving by hand can check the action of the cylinders. The cylinder pistons should move easily. Replace any that are faulty.

11 Leak Detector Parts List

The following tables comprise a parts list for the machine. Spare parts can be ordered from Plastech Control Systems using the part number listed under "Part ID".

The numbers under "Ref" are the references as they appear on drawings; the numeric part identifies the function as explained earlier.

Ref	Part ID	Description	Function
PR9,10	748	Pressure regulator, 1/4 ported, low pressure	Pressurization
F40-1	73	Trip, 1A, 2 pole, type D	
9	344	Tubing, Silicone Rubber, 1.6mm wall thickness, ID 3.2	Transducer Piping
	120	Tubing, Blue, 4mm O/D, 10m	
PB41	1332	LT5-C Internal Cabinet Stop Switch Assy	
PB44	1334	LT5-C Internal Cabinet Start Switch Assy	
PB41	1335	LT5-C External Cabinet Stop Actuator	
PB44	1336	LT5-C External Cabinet Start Actuator	
L43	1337	LT5-C Power Indicator Assembly	
L44	1338	LT5-C Run Indicator Assembly	
	122	Tubing, Blue, 8mm O/D	
RL44	747	Relay, 40.31 series, SPCO, 10A, 24VAC	
	121	Tubing, Blue, 6mm O/D,10m	
EX40	968	Muffler, 3/8 ported 3.3 CV	System exhaust
F40-2	151	Trip, Type S, 1 Pole, 2 Amp	Transformer Secondary trip
FLT1	74	Mains Filter, 2A	Mains input filter
G1,2,10	282	Pressure Gauge, panel mount, 40mm dial, 4 bar	Front Panel gauges
G40	62	Pressure Gauge, screw in, 1/8 ported, 0-10 Bar	Mains Air In
PR10	748	Pressure regulator, 1/4 ported, low pressure	Test head force
PR40	281	Filter Regulator, auto drain, 1/4 ported	NR1 Main air in
SW40	76	Isolator, Mains, Interlocked	Mains Isolator
T40	1269	Transformer, 50VA, 24V, 0-115-230V Primary	Control panel transformer

Table 11.1 Control Cabinet Parts List

Ref	Part ID	Description	Function
10	833	Manifold block assy 6mm	Test Head Down
40	839	Manifold supply/exhaust assy (for R)	System Supply
10,9	810	Manifold block disc	Test Head, Pressurization
10,9	831	Supply / Exhaust Block Assy (std)	Test Head, Pressurization
15,17,20	834	Valve, common pilot	Reject, Stop, Separate
15,17,20	832	Manifold block assy 4mm	Reject, Stop, Separate
10	835	Valve, external pilot supply	Test Head Down
9	835	Valve, external pilot supply	Pressurization
40	830	Manifold DIN rail size 18 (323mm)	
40	828	Manifold End Piece U side	
40	829	Manifold End Piece D side	

Table 11.2 Valve Manifold Parts List

Ref	Part ID	Description	Function
17	859	Cylinder, ISO, Non-magnetic, 16mm bore, stroke 80mm	Stop cylinders
20	346	Cylinder, ISO, Non-magnetic, 25mm bore, stroke 25mm	Separator Cylinder
10	346	Cylinder, ISO, Non-magnetic, 25mm bore, stroke 25mm	Test Head Cylinders
15	342	Fitting, Bulkhead, Chromed, push-over, 6mm	Reject Blower
10	341	Fitting, Elbow, 1/8 : 4mm	Test Head Cylinders
9	752	Fitting, Elbow, Push Over, 1/8 : 4mm	Test Head Fitting (fill)
9	753	Fitting, Elbow, Push Over, 1/8 : 6mm	Test Head Fitting (sense)
10	751	Fitting, Manifold, 8mm : 10 x 4mm	Test Head Cylinders
40	120	Tubing, Blue, 4mm O/D	
40	121	Tubing, Blue, 6mm O/D	
40	122	Tubing, Blue, 8mm O/D	

Table 11.3 Test Fixture Parts List

Ref	Part ID	Description
40	71	PCB-T1-1 Touch Screen Controller (LT5 Machines)
40	553	PCB-P4-1-4 Display Board, 4 Channel (LT1 Machines)
40	555	PCB-4361-4110 I/O board (1-4 head machines)
40	773	PCB-8361-8330 I/O board (5-8 head machines)

Table 11.4 Circuit Boards

12 Fallen Bottle Ejection

This is very useful on lines where it is possible for a bottle to fall over. When this option is fitted, bottles are ejected off of the conveyor before they get into the leak tester, preventing a bottle jam.

The system works as follows:

The Fallen Sense Top photoswitch monitors the bottles passing by. Whenever the signal disappears, after a short set ``Fallen Sense Delay'' the Fallen Sense Bottom photoswitch signal is checked. If this signal is present, and the Top photoswitch signal is still not present, then a fallen bottle is detected and the Fallen Sense Eject Blower is turned on for the set Fallen Sense Eject Time. This ejects the bottle from the conveyor.

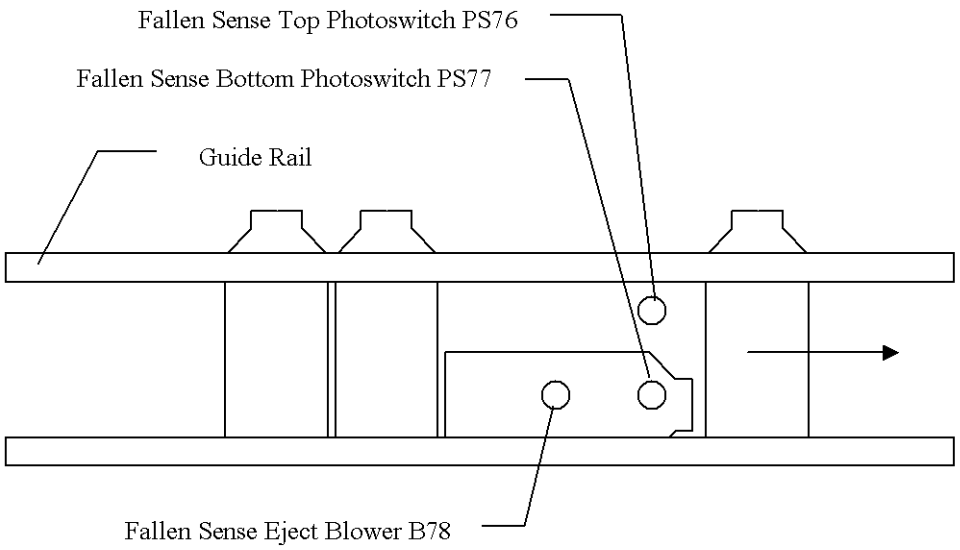


Figure 12.1 Fallen Bottle Sensing System Layout

12.1 Fallen Bottle Sensing Installation and Setting Up

The fallen bottle sensing can be anywhere, but is ideally best located immediately before the leak test area. The guide rails should be prepared so that a fallen bottle

can be ejected, while still allowing bottles to queue in a stable manner. It should normally be possible to provide a continuous lower guide rail, with the fallen bottle being blown over the top.

There are two settings involved, these are located by pressing the PAGE button on the touchscreen controller until they appear on their own page ``OTHER SETTINGS''. Adjust the horizontal position of the two photoswitches shown above so that when a single upright bottle passes, the signals go off at the same time. Adjust the vertical position so that the lower photoswitch sees a bottle in both positions (upright and fallen) while the upper photoswitch can only see upright bottles.

Set ``Fallen Sense Detect Delay'' to 0.1 seconds.

Set ``Fallen Sense Eject Time'' to 1.0 second.

At this point, fallen bottles should be detected and blown off of the conveyor. Adjust the blower as required to efficiently eject the bottle. Adjust the eject time as required to blow the bottle cleanly away without disturbing following containers.

13 Packing System Type 1

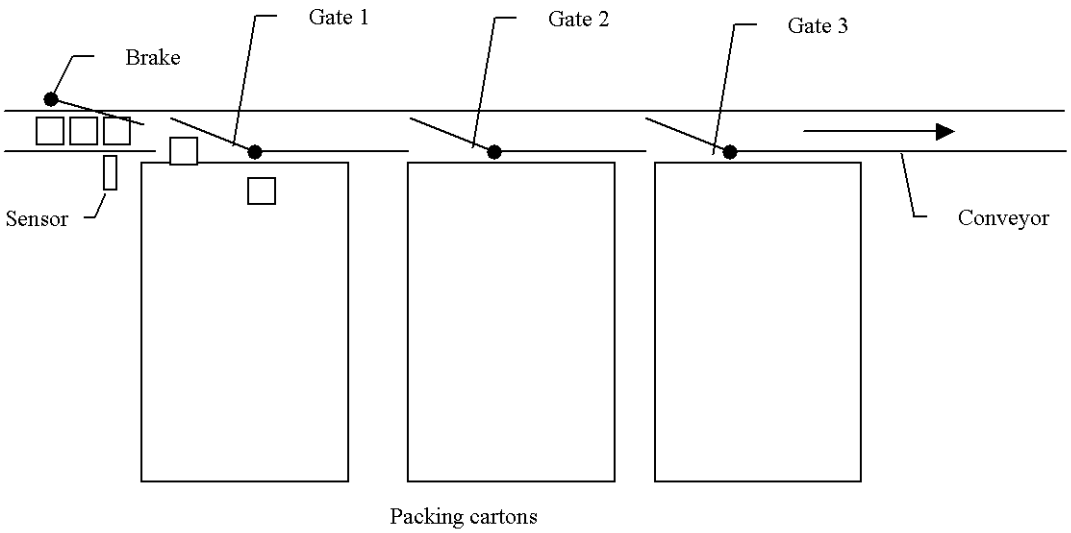


Figure 13.1 Multi-Gate Scramble-Packing System

This is an optional facility where the leak detector includes a box packing system suitable for scramble packing of bottles. Bottles are diverted off the main conveyor into packing cartons, at a number of stations.

In operation, the sensor counts bottles going past it. Bottles are fed into a packing carton gate, say gate 1. When the count reaches the preset amount, the brake operates, halting further bottles. After a set time period (to allow the bottles still on the conveyor to reach the packing carton), the current gate (gate 1) closes and the next gate (gate 2) opens. The counter is automatically reset to zero and the brake is turned off.

Having more than one packing station allows a single operator to look after several lines of production, since attention is only required periodically. A box can be changed at any time, within the time taken to fill the next two boxes.

Because the system is integrated with the leak detector, there are no problems with unexpected queuing causing a jam at the leak tester.

The number of bottles per box can be easily set to any value required.

13.1 Multi Box Pack System Settings Page

Figure 13.2

If the multi-box packing option is included, this page will become available. This collects all the settings and displays associated with the packing system. The Box Count display is also shown on the main start-up page provided the system is enabled.

13.1.1 Enable Box Packing Gates

Allows the box packing system to be switched on and off as required. Touch this display to toggle between switched on and switched off. The Box Count is displayed on the main start-up page, provided this option is switched on when the machine is powered up.

13.1.2 Box Pack Quantity

Sets the number of bottles to be packed in each box.

13.1.3 Conveyor Gate Clear Time

Sets the time in between the brake operating, and the gates switching. This time should be set so as to allow the conveyor to clear of bottles in between switching gates.

13.1.4 Box Count

This is a display of the number of bottles in the box currently being filled. It will increment as each bottle goes by the sensor, until it reaches the set Box pack Quantity. It will then be reset to zero, ready for the next box.

If required, this can manually be reset to zero even when a box is not full, so that a new box can be put in place and production stated. Touch the "BOX COUNT" display to highlight it, then touching the RESET button.

This count value also appears on the main page that is displayed after power-up.

13.1.5 Gate Number

This shows the number of the gate that is currently open.

14 Option: Test Support Plate

This consists of a thin stainless steel plate, which slides underneath the bottles during the test, to provide extra support. It is used on the occasions where the drag of a moving conveyor under the bottles would cause problems with test stability or bottle damage. (It should be noted that this is rarely the case in practice, however the option has been made available as an alternative to the more complex bottle handling arrangements possible).

When the leak tester is supplied with this option, several new settings appear on the ``Other Settings'' page of the touch panel.

``TEST PLATE ENABLED'' Touch this setting to enable / disable the operation of the plate.

There are also two delays which can usually be set to zero, but are provided for increased flexibility.

``DELAY BEFORE PLATE'' This sets the delay before the plate is activated. This delay allows the bottles to move fully into position.

``DELAY AFTER PLATE'' This is the delay after the plate has been activated, but before the test heads come down. It is set to allow time for the plate to come fully in, before the test heads come down on the bottle.

15 Wall Thickness Measurement

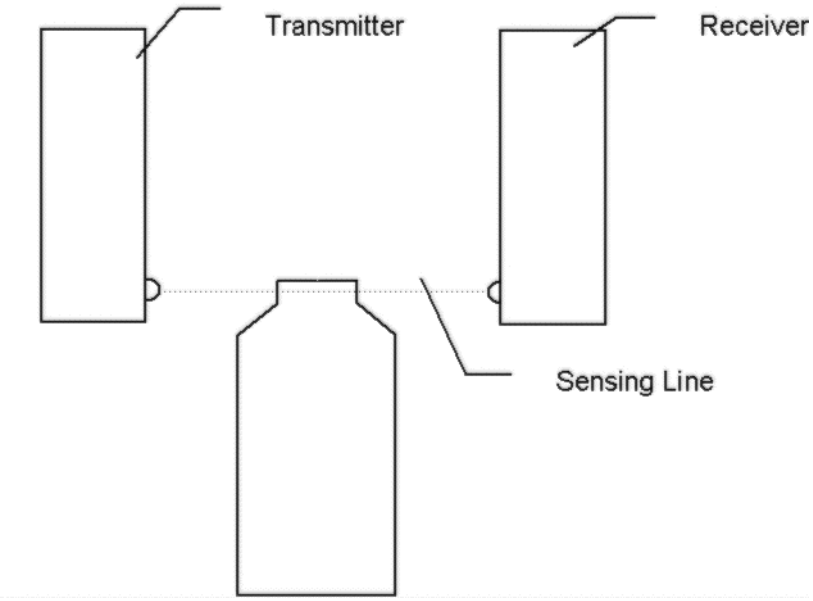


Figure 15.1 Infrared Wall Thickness Measurement

An infrared beam is set up across the conveyor, aligned with the region on interest on the bottle (the neck, for example). As the bottle travels along the conveyor, it starts to interrupt the beam. When the received light level falls below a certain threshold (1/3 of the level with no bottle) the scan is triggered. The system now continuously monitors the received light level and records the lowest level found. This corresponds to the thickest region of plastic. As the bottle moves out of the beam the received light level rises. When it rises past a certain threshold (2/3 of the level with no bottle) the test for that bottle is terminated.

- The lowest value recorded is used as the result of the test.
- The lower this value, the thicker the plastic.
- This result is compared to a set limit.
- The bottle is rejected if the value is lower than the limit, i.e. if the plastic is too thick.

To set up, align the sensors with the part of the bottle to be tested. The alignment of the transmitter relative to the receiver is not particularly critical, the beam width is about 20 degrees. However the alignment of the resulting sensing line with the bottle is critical if one is trying to look at the top of the bottle neck, for example.

Pass bottles through, and note the test results (displayed as ``Lowest Light Level'' on the neck flash detection diagnostics screen, or ``NECK'' on the main displays screen. The setting ``MIN LIGHT LEVEL'' should be set to a value just below the levels obtained for good production samples. If the setting is set too high, all bottles will be rejected. The higher the setting, the thinner the bottle necks must be to pass.

15.1 Handle Flash Detection

This is an extra facility, which can be used in conjunction with the infrared wall thickness measurement option above. At the point where the wall thickness measurement is triggered, the output from a handle flash sensor is sampled. If the sensor is active, the bottle is rejected due to handle flash. The alignment along the conveyor is critical.

The handle sensor should be positioned so that it is looking at the handle area as the bottle fully interrupts the thickness measurement beam. This position is best found by experiment.

Produced by Plastech Control Systems Ltd

Revision 2.0

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