LT2

Trimmer Mount Bottle Leak Detector

User Guide

PLASTECH
CONTROL SYSTEMS

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-EN

Covers Model Numbers

LT2-1
LT2-2
LT2-3
LT2-4
LT2-1-AC
LT2-2-AC
LT2-3-AC
LT2-4-AC

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.

Contents

1 Overview

The LT2 bottle leak detector is specifically designed for indexed-conveyor deflash trimmers. It has become an industry standard, fitted to new machines by the manufacturer. It is now also available as a retrofit package for machines in the field, allowing consistent, high performance leak testing where existing solutions are ageing, unreliable or inaccurate. Customers experience dramatic production efficiency improvements after upgrading, due to the elimination of incorrect bottle rejection and machine down-time.

1.1 Benefits

- Improved Production Efficiency

  Eliminates incorrect bottle rejection without compromising test accuracy.

- Reliability

  - Interference Immunity
  - 50 million cycle rated valves
  - Output relays use AC/DC solid state switches, suitable for both AC systems and PLCs
  - Self-Diagnostics, self setting capability

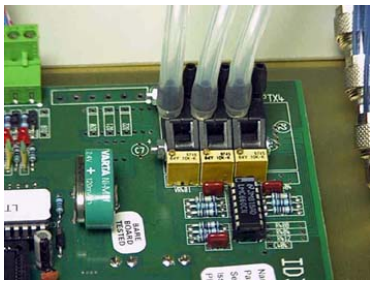
- Accuracy

  - High resolution A/D converter
  - High flow rate pneumatics to quickly achieve bottle pressurization
  - Optimized for short cycle time leak tests
  - Self tuning algorithms to continuously optimize pressurization and threshold settings
  - Adjustable Test Pressure

- Safety
  - No behind-panel access required for machine setting
- Improved Operator Interface
  - Full alphanumeric display Of Settings And Results
  - Multinational Language Displays available
  - Bargraph display of pressure, led indication of test results for each channel
  - Push Button, Front Panel Settings (changes can be locked out with optional key switch)
  - Correct Number Failed count for all trimmer configurations (does not count empty cycles)
  - Panel Mounted Pneumatic Controls
  - Alarm Output Option
- Simple Installation and Maintenance
  - Simplified machine connection - just plugs in to existing connector
  - Simplified Internal Wiring (all electrical functions integrated onto single PCB)
  - Low operating power - reduces load on system supply
  - 110VAC model as standard
  - Valves can be changed without removing pipes - all access from front of control enclosure.
  - Manual override buttons on all valves
  - Single product covers 1 and 2 channel systems
  - LED state indication on valves
- Advanced System Architecture
  - Spare I/O For Extra Functions (Handle Flash Detection, Jam detection, vision systems, alarms), brought out to standard connection
  - Serial interface available for Data Logging or PLC connection

Figure 1.1 50 Million Cycle Valves. An LT2 installation typically has to do over 10 million cycles per year!

Lockable Steel Control Cabinet. (Internal door independently locked)



1-4 Channels on the same Circuit Board

- Easy upgrade of system to include extra facilities even after installation
- Competitive Pricing

For more details contact the office, our distributors or see our web site

www.plastech-controls.com

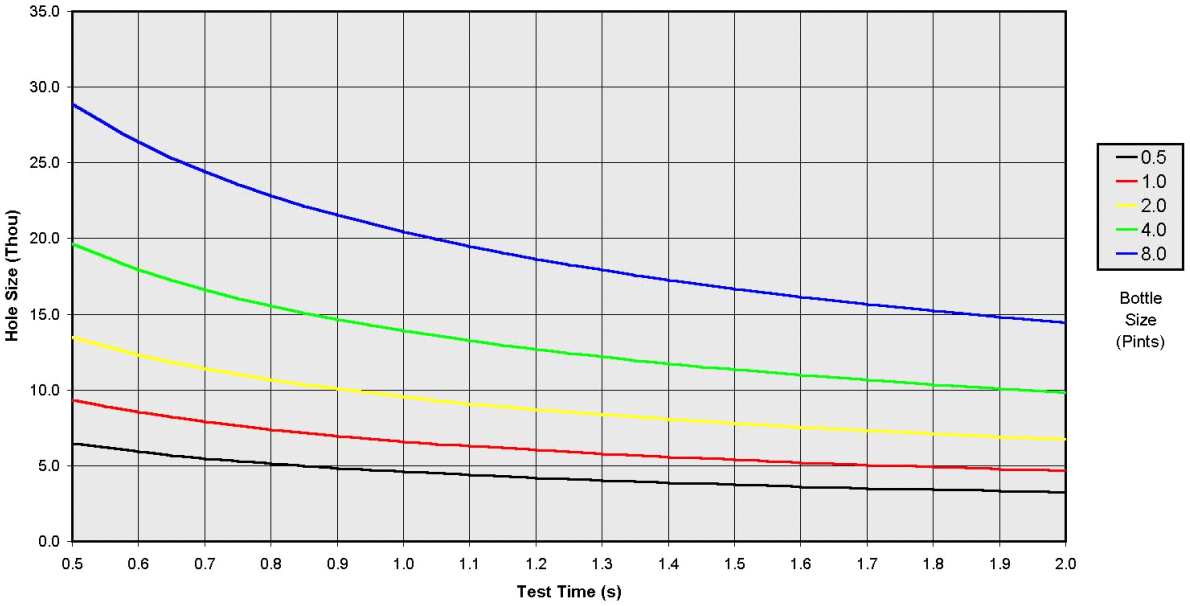
where you can obtain complete on-line sales literature, user manuals and technical documentation.

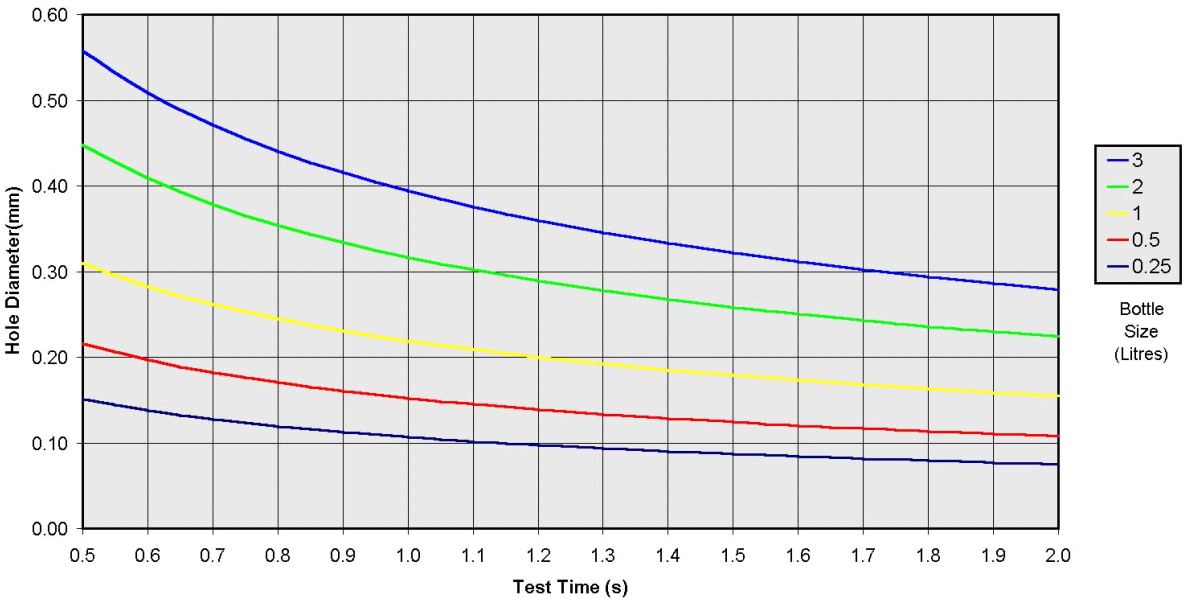
2 Specification

Hole Size Detected	0.1mm (for a 500ml/16oz) bottle and a 2 second test time). See Performance Data for other sizes.
Number of Test Channels	1,2,3 or 4 (Specify when ordering)
Cycle Time	0.5 - 20.0 seconds, adjustable
Minimum Bottle Volume	250ml / 8 oz
Maximum Bottle Volume	25 liters / 6 gallons
Test Pressure	Adjustable, 5-100mB
Power Supply	100-125VAC single phase or 23-26VDC@750mA (specify when ordering)
Power Consumption	30 VA maximum
Air Supply	60-150 psi (4-10 bar)
Air Consumption	1 liter per minute typical
Dimensions	Control system enclosure 470x300x180mm for all models (1,2,3,4 channel)
Leak Test Method	Ratiometric Pressure Decay, Auto-zero, Auto-Scale. Adaptive pressurization algorithm.
Transducer	Semiconductor strain gauge diaphragm, 0.00 - 65.00 mB, 0.02% resolution, x20 Over-pressure Protection.

2.1 Performance Graphs

These graphs show the hole size detectable for various bottle sizes and test times.





2.2 Ordering Information

The product code is specified as :

LT2-X-YY

e.g. LT2-4-DC

X = Number of heads = 1-4, YY = supply = AC or DC

3 Setting Up

1. Mechanically align the test heads with the necks of the bottles. Ensure that the test heads are correctly aligned with the bottles. It is critical that a reliable seal is achieved between the bottle necks and the test head cones. The test head cylinders will generally go to end of stroke during the test. In this state, the bottles should be slightly compressed so as to achieve a good seal, but not so compressed that there is danger of collapse.

2. Press the CHANGE PAGE button until the ``ADJUSTMENTS'' page is displayed.

3. Use the ``SELECT'' buttons to inspect the leak tester settings.

4. Cycle the trimmer. Use the ``ADJUST'' buttons to alter the "Test Time" setting. This sets the operation time for the test head cylinders. Adjust the Test Time with the machine cycling. Observe the test head movement. Set the Test Time to the largest value possible, which does not cause bottles to be dragged out of alignment at the end of the test. It is important that the test is as long as possible. A small increase in time can make a large increase in sensitivity.

5. View the ``Max Deviation'' setting. This setting controls the sensitivity of the test. If a bottle under test deviates from a good bottle, by more than this amount, it will be rejected. The lower the value, the more sensitive. Set it to an initial value of 25%. The value can be reduced from 25% when the machine is in production and the leak tester is working consistently.

6. View the ``Test Pressure'' setting. This sets the pressure used during the test. The pressure display bargraph is scaled to this value, to that full scale is equal to the set test pressure. A value of 30mB can be set at this time.

7. Set the external pneumatic pressure regulator FR40 to 3 bar. This sets the working pressure of the test head cylinders. It also acts as a pre-regulator to control the bottle pressurization.

8. Run bottles through the trimmer. Adjust the flow control restrictors RS1, 2,3,4 on the leak tester front panel. These control the initial bottle pressurization level. Adjust for each channel so that the pressure display bargraph goes about 2/3 of the way up the scale. This setting is not critical. If the restrictors are wound fully anti-clockwise and the pressurization level is not high enough, increase the external filter-regulator FR40 to 5 bar. The leak tester should now be testing bottles and rejecting those with holes.

9. Press the ``PAGE'' button until the ``DISPLAYS'' page is shown. Use the ``SELECT'' buttons to view the displays. The ``Total Passed'' and ``Total Failed'' counts can be individually set to zero using the ``RESET'' button.

10. Use the "SELECT" buttons to display "Leakage %". Start up bottle production and monitor the Leakage values. For each test cycle, a number is shown for each channel. The number is the percentage of the initial air pressure that has been lost, during the test. The higher the number, the higher the leakage. A value of 99.9% indicates that all of the air has escaped. Typically, the numbers will be around 5% for good bottles. This is due to cooling of the air within the bottle, during the test. The numbers should be the same from cycle to cycle, within about 2% (except where a bottle is leaking). If this is so, the "Max Deviation" setting can be reduced from 25% down to a lower value, and hence improve the sensitivity of the test. The minimum value that can be used is determined by the test-to-test variation in the test results, for good bottles. This value must be established for a particular bottle type, however a value of 1% is typical.

4 Operation

The unit is fully automatic in operation. When switched off, bottle testing does not occur and the bottles are blown off the trimmer as normal. When switched on, leak testing commences with each trimmer cycle. The leak tester signals the trimmer with the results of the tests, delayed by one trimmer cycle. The trimmer controller then either blows the good bottles into the conveying system, or allows the rejected bottles to fall off the end of the trimmer.

4.1 Detailed Explanation of Operating Principle

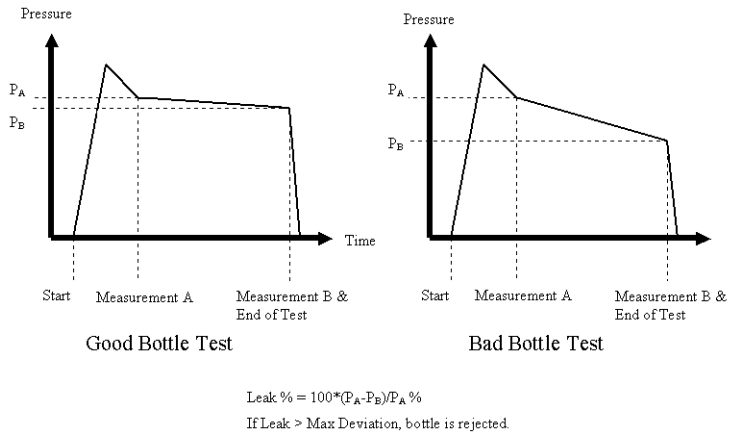


Figure 4.1 Pressure Decay Leak Detection Operating Principle

The test cycle is initiated by a signal from the trimmer. The test head cylinder valves are turned on, bringing the test heads in to seal on the bottles. At the same time, the pressurization valves are turned on, allowing the bottles to pressurize. When the pressure in a bottle rises past a threshold, the pressurization valve associated with that channel is turned off. After a short delay, the pressure in each bottle is measured (Pressure A). The bottles remain sealed for the remainder of the test time. At the end of the test, the pressures in the bottles are again measured (Pressure B). The test heads are then retracted.

The percentage of pressure decay is then calculated from the two pressure measurements. This is the result of the test.[1]

The decision of pass or fail is made as follows:

For each channel, an average is maintained of the test results (leak %) for bottles that have passed the test. When a test is performed, the result is compared with this average. If the difference (deviation) is greater than the set "Max Deviation", the bottle is rejected. If the deviation is less than the maximum, then the bottle is passed and the result is incorporated into the average.

The advantage of this technique is that slow drifts over time of airline pressure, air temperature, pneumatic settings and bottle characteristics are compensated for. If a simple fixed limit was set on the amount of "leakage" (pressure drop) allowed, then the sensitivity of the system would be limited by long term variations in the test characteristics, and the channel-to-channel mismatches.

[1] There are several other checks required in order to catch exceptional conditions. For example, we reject the bottle if there is insufficient initial pressurization, or if the bottle collapses during the test, creating a pressure rise.

5 Troubleshooting

In the unlikely event of a fault...

The LT2 series of leak testers has been designed to be extremely reliable. However we have prepared this section in case of trouble. This table has been compiled from both reported and hypothetical fault conditions. For more detailed advice and assistance please contact us directly, especially where the suggested remedy is not straightforward.

Please do not start swapping circuit boards or (especially) taking apart manifolds, unless you are sure that there is a real fault internal to the leak tester. Historically this is unlikely.

5.1 Faults Causing Good Bottles to be Rejected

Symptom	***Fault & - Remedy***
``Fail'' indicators illuminated	Worn test head seals - *Replace* Test head alignment incorrect - *Align* ``Max Deviation'' setting too low - *Adjust setting. Normal range is 0.5 to 2.0%. If you have to set it outside this range this indicates a problem with test head sealing or some other fault. Start off with a high setting, for example 20%. Check the test results (the displayed deviation values) are consistent from test to test. If so, reduce the set Max Deviation down until it is just above the maximum observed deviation for good bottles.*
``Fail'' indicators illuminated, Bottles are loose under test head.	Insufficient Sealing Force - *Move test head forward.*
``Fail'' indicators illuminated, Bottles collapse or deform during test.	Excessive sealing force - *Move test head back.*

Difficulty adjusting pressurization flow controls. Over pressurization of one channel when bottle missing from another channel.	Pressurization pipes swapped between channels - *Systematically establish the correct piping by forcing each I/O in turn and checking for correct operation. (Refer to the manual for the I/O list). WARNING: do not force on the pressurization valves with the test head down on a bottle; the transducer may be damaged.*
``Fail'' indicators illuminated & Over-pressurization Warning displayed	Pressurization flow control restrictor set too fast - *Turn clockwise.*
``Fail'' indicator illuminated only on one channel of a multi channel machine.	Worn test head seals Test head alignment Excessive sealing force - *Move test head back.* Internal leakage inside leak tester - *Establish this by connecting a temporary short length of pipe to the pressurization outlet and blowing down it (with the unit switched off). The leak tester should not allow airflow into it. Repeat for each pressurization outlet and each transducer sense fitting.* *If there is a leak, check manifold fittings, valve gasket, and the internal manifold blanking plugs. Check manifold segments aligned correctly.* *Manifold possibly split apart at pressurization valve OR Missing / leaking manifold internal blanking plug between pressurization valve and test head valves. (Modular manifold systems only!)*
Unit indicates test passed but Bottle(s) not being blown off	Test Time set too low - *Bottle blow-off is disabled by design outside of the test cycle. Make sure the test time has been set as long as possible, and that the leak tester gets its start signal as early as possible. Sometimes an external timer on the trimmer sets the reject timing, (to get a staggered blow off). Make sure that it is set to blow off the bottle within the test cycle.*
One channel falsely indicates leakage (fails to pressurize), only when other channel is empty or has very large leak.	Leaking or missing blanking plug inside manifold, between 2 pressurization valves - *Replace blanking plug.*

5.2 Faults Causing Poor Sensitivity

Symptom	*Fault & - Remedy*
Bottles with large holes rejected correctly, very small holes passed.	Pressurization flow control restrictor set too slow - *- Adjust (Turn anticlockwise). Aim to get about 2/3 pressurization on the bar graphs. If this is not possible, leave at maximum and start increasing the system pressure regulator to a maximum of 4 bar. If still not possible, start reducing the set test pressure down to a minimum of 10mB.* "Test Time" setting too low - *Adjust setting as high as possible.* "Max Deviation" setting too high - *Reduce (see setting up guide).*

5.3 Faults Causing Blank Display & No Response

Symptom	*Fault & - Remedy*
Display backlight illuminated	Circuit board fault - *repair*
No display backlight	Check unit switched on and has power. Check circuit board fuses Check circuit board power connector.

5.4 Faults Causing Intermittent Valve Operation

Symptom	*Fault & - Remedy*
Intermittent valve operation	Faulty valve connector - *Replace or repair connector*

6 Input / Output List

This list is the same for single, twin, triple and quad models. Unused functions are simply not connected.

IO	*Function*	*Description*	*Comment*
0000	70	Cycle Start	Input, isolated, 24-110V, AC/DC
0001	35	Flash Detection	Input, PNP, 24VDC
0002	35	Flash Detection	Input, PNP, 24VDC
0003	35	Flash Detection	Input, PNP, 24VDC
0004	35	Flash Detection	Input, PNP, 24VDC
0005	59	Leak Test Downstream Backup	Input, PNP, 24VDC
0500	1	Pressurization Leak Test Channel 1	Output, NPN, 24VDC
0501	2	Pressurization Leak Test Channel 2	Output, NPN, 24VDC
0502	3	Pressurization Leak Test Channel 3	Output, NPN, 24VDC
0503	4	Pressurization Leak Test Channel 4	Output, NPN, 24VDC
0504	10	Test Heads Down	Output, NPN, 24VDC
0505	53	Unused I/O	Output, NPN, 24VDC
0506	53	Unused I/O	Output, NPN, 24VDC
0507	46	Alarm	Output, NPN, 24VDC
0510	54	Reject Channel 1	Output, Voltage Free Contact
0511	55	Reject Channel 2	Output, Voltage Free Contact
0512	56	Reject Channel 3	Output, Voltage Free Contact
0513	57	Reject Channel 4	Output, Voltage Free Contact

Table 6.1 Input / Output List

7 Electrical Installation

Please refer to the external wiring diagram on page 26 and the notes below.

7.1 AC or DC?

Important:

- The leak tester *must* be configured for the correct voltage; either 24VDC or 110VAC. If 110V is connected to a 24V leak tester, it will be destroyed!
- The Leak Tester *must* be earthed! On DC systems, the externally supplied - DC rail will be internally connected to the leak tester Earth.
- All unused conductors *must* be isolated! In particular you must ensure that the external red +24V signal wire, if unused, cannot short to chassis or to other signals (see below).

The bottle trimmers for which the LT2 was designed for fall into two categories as far as their control system is concerned:

- ``AC''
  - Old trimmers
  - 110V AC supply and control systems
  - Cam-switch and relay logic
  - Rejection by direct interruption of blow-off valve solenoid signals
  - LT2 requires power supply module fitted.
  - LT2 uses normally closed reject relays.
  - Relays open for reject, inhibiting blow-off.
- ``DC''

- New trimmers
- 24V DC supply and control signals
- PLC control system
- Rejection signals go to machine PLC
- Normally Open LT2 reject relays integrated into main circuit board.
- PLC expects contact closure for ``reject''.

The LT2 external signals are ``universal'' in that they can operate with either 110VAC or 24VDC. The exception to this is the power input.

7.2 AC Systems

7.2.1 AC Power

AC systems require the power supply module (PCB-ID3-PSU) in order to convert the basic ``DC'' leak tester to use ``AC'' machine power. This is a small circuit board containing a transformer, which is mounted off the main LT2 circuit board. LT2 leak testers are normally stocked and shipped as basic ``DC'' machines. The power supply module is then typically fitted during installation (using the mounting pillars supplied with it).

The 110VAC power is then connected between the brown (live, "hot") and blue (neutral, "common") wires.

The green Earth wire and the cable shield must be securely connected to the machine frame or other designated earthing point.

7.2.2 AC Start Signal

A ``start signal'' is required that comes on at the point in the machine cycle where the bottles come to a halt at the test station. The signal is usually obtained from a platen limit switch or cam switch on the trimmer. It is extremely important that the start signal occurs immediately, so that the bottles are not waiting to be tested. This may require adjustment of the source of the signal.

The start signal should be connected so that 110VAC is put across the two start signal wires, when the bottles come to a halt on the trimmer.

7.2.3 AC Reject

The reject signals are connected to normally closed relays inside the leak tester. When the leak tester is switched off, these are closed. The signals to the trimmer bottle blow-off valves are wired through these relays, so that the relays can interrupt the blow-off valves and cause the bottles to fall off of the end of the trimmer. In effect, the wire from the blow-off valve is cut during installation and fed through the leak tester. The leak tester can then link the two ends together when the bottle passes the test, allowing the trimmer to blow the bottle up the takeout chute.

7.3 DC Systems

7.3.1 DC Power

DC leak testers require 24V DC +/- 10% power. Consumption is less than 1A.

This is connected between the brown (positive +24V) and blue (negative 0V) wires.

The green Earth wire and the cable shield should be securely connected to the machine frame or other designated earthing point.

7.3.2 DC Start Signal

A start signal is required that comes on at the point in the machine cycle where the bottles come to a halt at the test station. For DC systems this is usually provided by the trimmer PLC, however it could also be obtained from a platen limit switch or cam switch. *It is extremely important that the start signal occurs immediately*, so that the bottles are not waiting to be tested. This may require adjustment of the source of the signal.

The start signal should be connected so that 24VDC is put across the black and white wires, when the bottles come to a halt on the trimmer. The black is negative and the white is positive.

7.3.3 DC Reject

For DC systems the reject outputs are normally connected to inputs on the trimmer PLC. Alternatively they could be used to interrupt the blow-off valve signals directly as on AC systems (in which case set relays to Normally Open).

The reject output relays can be changed from normally open to normally closed using jumper links on the leak tester PCB.

7.3.4 Reject Signalling

(All models, standard firmware behaviour)

Summary: REJECT signals are normally ON and get switched OFF only *during a test, if the previous cycle was a PASS*.

Detail: The test cycle is started by a start signal ON transition and is stopped when the set test time elapses.

The reject signals are sequenced as follows.

OUTSIDE of the test cycle, the REJECT signals are turned ON.

When a start signal is received, the REJECT signals are set to reflect the previous test result. That is, the reject signals are turned OFF for a pass or else left ON for a fail.

At the end of the test, the REJECT signals are turned ON again.

When the leak tester is powered OFF, the rejects signals are OFF.

Rationale

The original LT2 model leak tester connected the reject signal to on-board relays. When fitting a leak tester, the existing trimmer blow-off valves were simply wired

through the normally-closed contacts of these relays.

- with the leak tester switched off, the blow-off valves operated normally through the normally-closed contacts (sequenced by a cam switch).
- with the leak tester ON, the reject outputs held the contacts open, inhibiting blow-off, except during the test following a PASS. The PASS bottle would then be at the reject station and could be blown up the takeout.

  For compatibility reasons, the newer LTU6000 and LTU2000 models retain this scheme. While it would be possible to issue customized firmware to change this, the scheme described has been used for the past 20 years and there are a lot of systems out there relying on it.

PLC Programming

In order to operate with the above scheme, the PLC needs to be programmed to sample the REJECT signal during the following test cycle (when the tested bottle is at the reject station). For example,

- Issue START signal (START signal ON)
- Delay 100ms
- Turn START signal OFF
- Read REJECT state
- If not REJECT, blow off bottle

7.4 Basic Signals

Refer to Figure 8.1 for the external wiring diagram.

Connection	*Wire Color*	*Comment*
Earth	Green + Shield	Connect securely to earth point
+ DC or Live AC supply	Brown	
- DC or Neutral AC supply	Blue	
Blow Off Common	Pink	
Blow Off channel 1	Yellow	
Blow Off channel 2	Orange	Twin channel units and above
Blow Off channel 3	Violet	Triple channel units and above
Blow Off channel 4	Grey	Quad channel units only
Start Signal - or AC	Black	
Start Signal + or AC	White	

Table 7.1 Basic Signals

8 Drawings

The system shown in the following drawings is a 4-channel system. Single, twin and triple channel follow the same general layout; the parts for the extra channels are simply omitted.

Figure 8.1 LT2 External Wiring Diagram

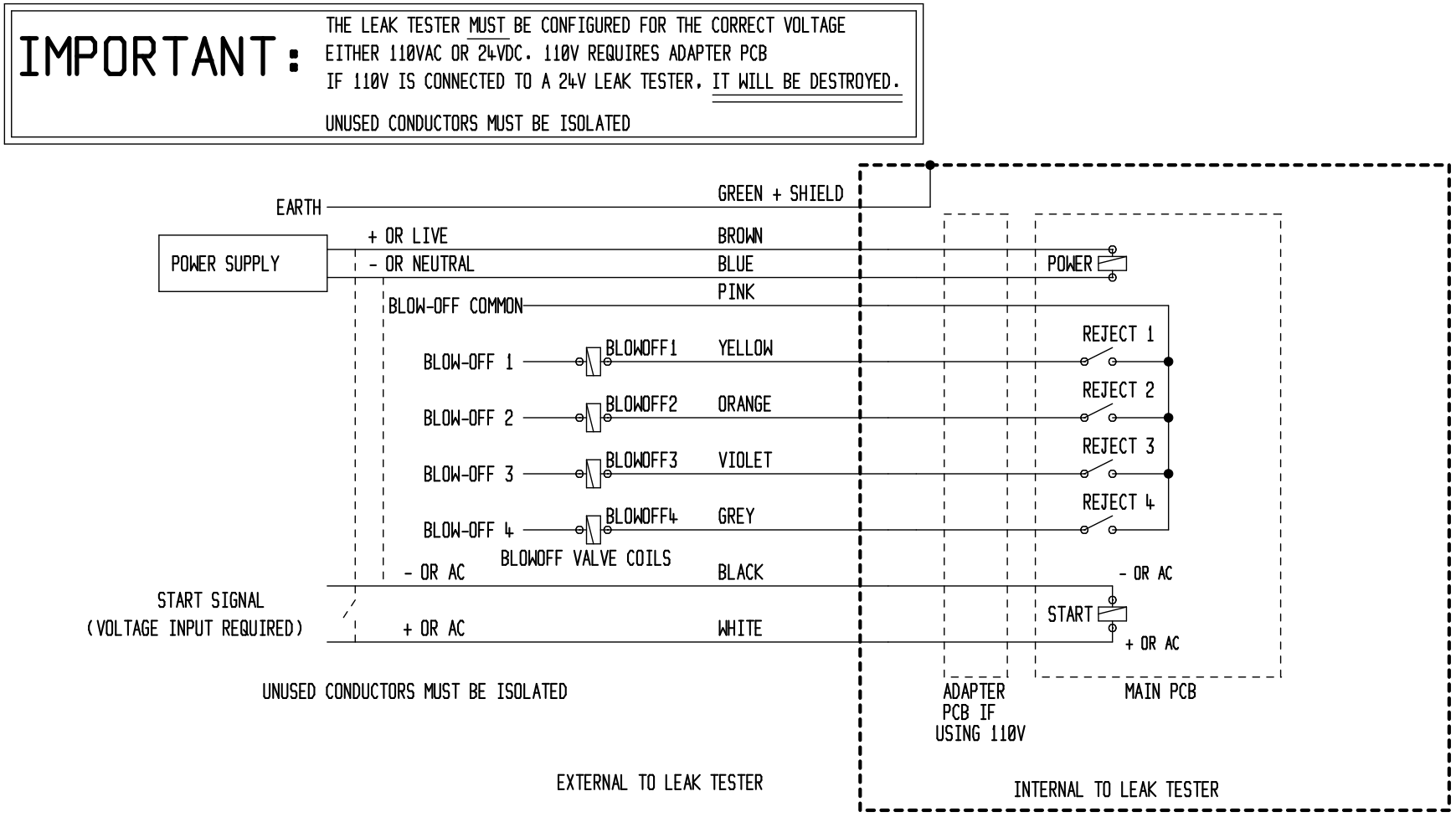


Figure 8.2 LT2 Control Cabinet Internal Wiring

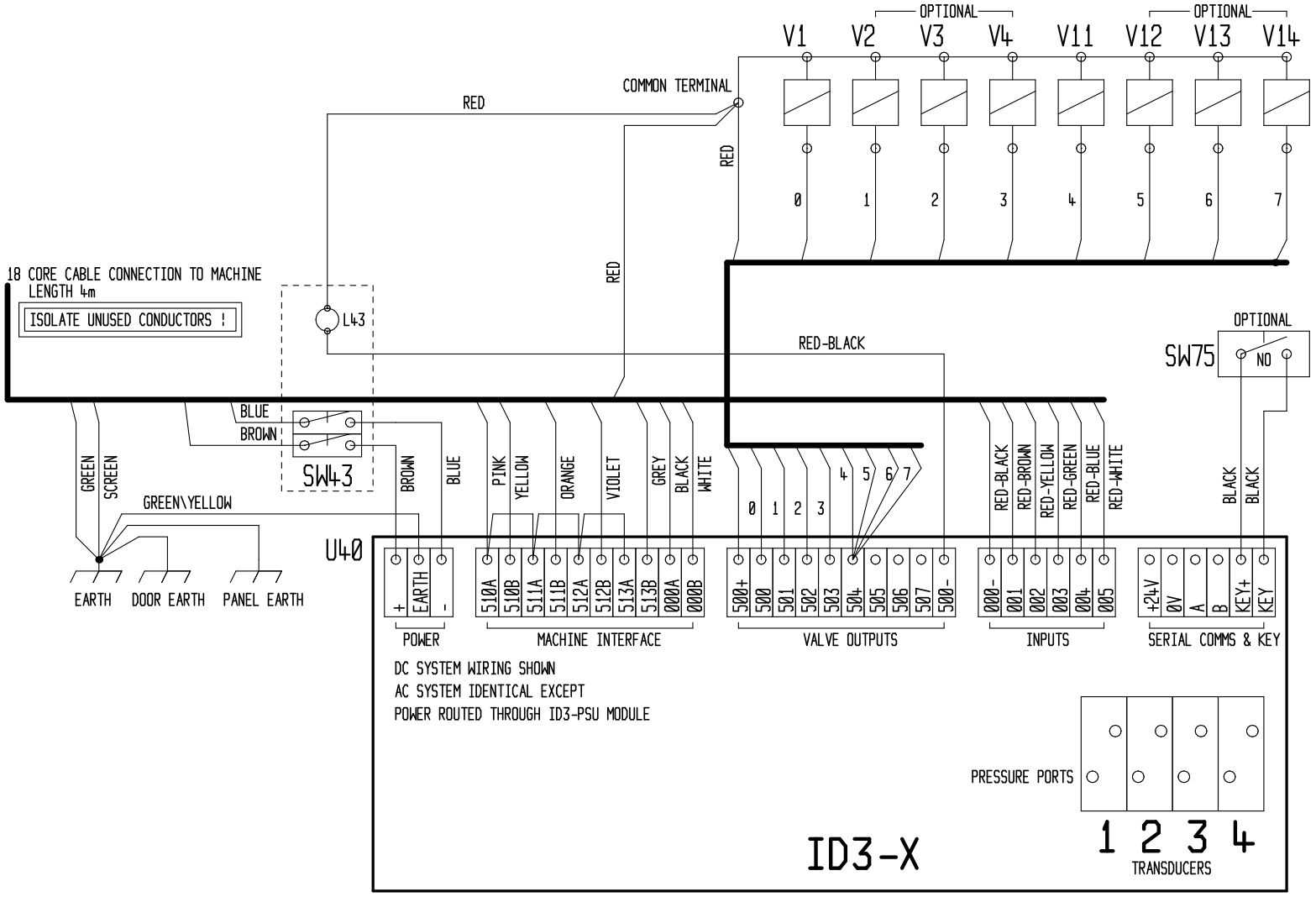


Figure 8.3 LT2 Control Cabinet Layout

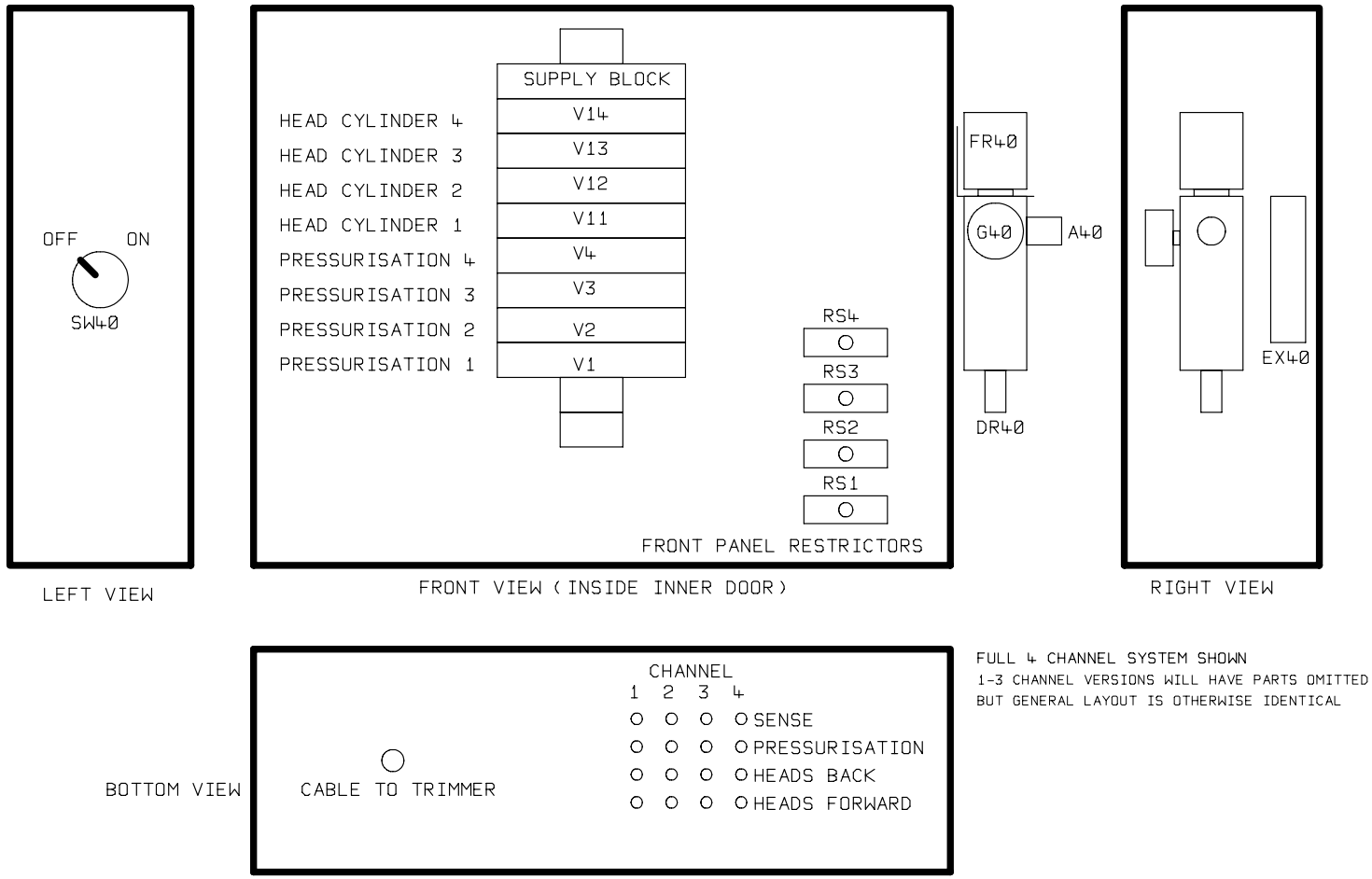
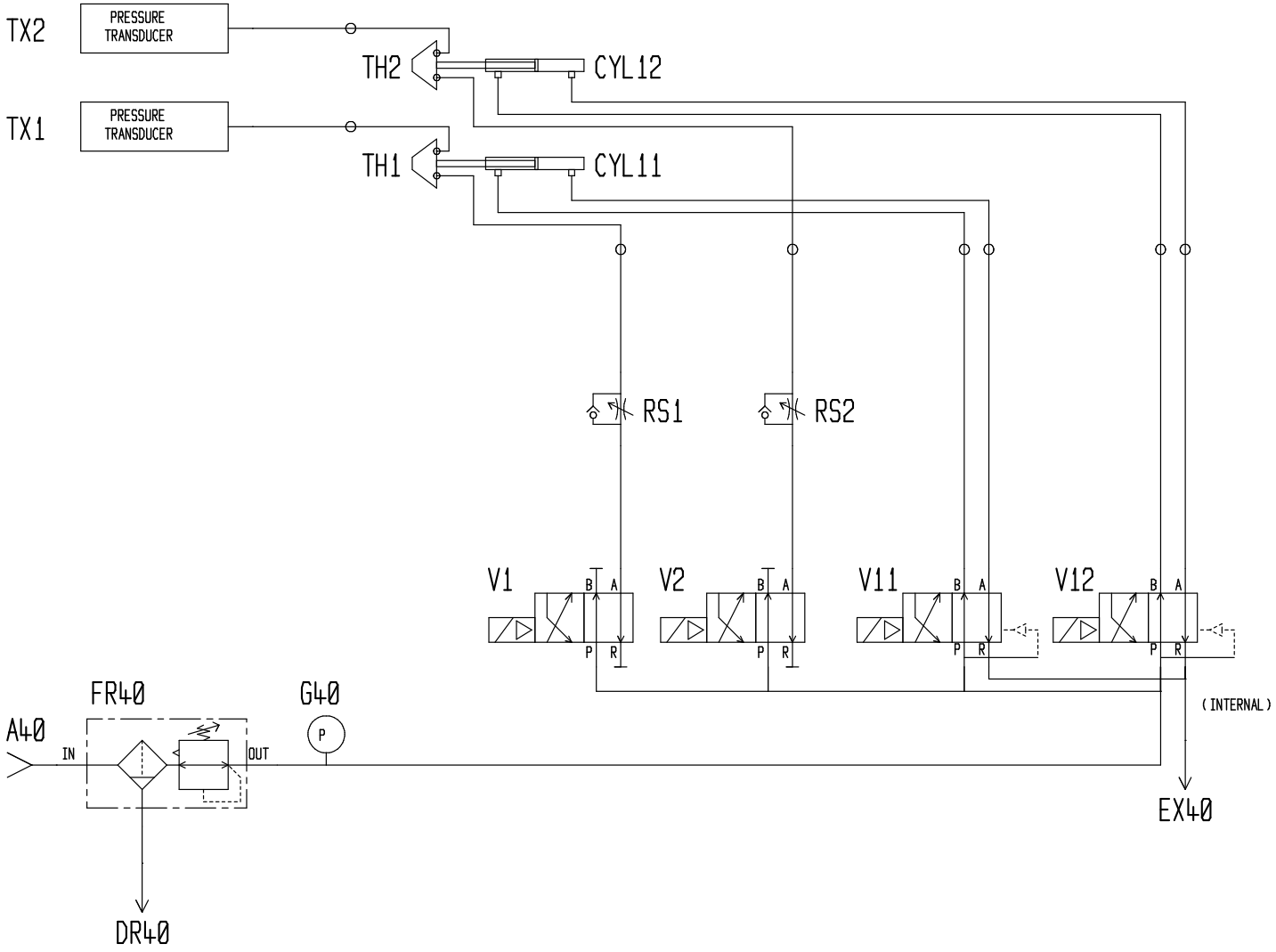


Figure 8.4 LT2 Control Cabinet Pneumatics



9 Spares

Part ID	*Description*	*Ref*	*Function*
1019	Filter Regulator, auto drain, 3/8 ported	FR40	Air In
62	Pressure Gauge, screw in, 1/8 ported, 0-10 Bar	G40	System Pressure
598	Restrictor, Panel Mount, 1/8	RS1-4	Pressurization Rate Control
783	Valve, 5-2, Common Pilot	V11-14	Test Head Cylinder Valves
812	Valve, 5-2, Independent Pilot	V1-4	Pressurization Valves
ID3-PSU	Adapter board (for 110V operation only)	U40-B	Power Supply unit
ID3-1	PCB, Complete, (single channel)	U40	Single channel DC card
ID3-2	PCB, Complete, (twin channel)	U40	Twin channel DC card
ID3-3	PCB, Complete, (triple channel)	U40	Triple channel DC card
ID3-4	PCB, Complete, (quad channel)	U40	Quad channel DC card

9.1 Notes on Spares

The "Part ID" column shows the internal Plastech Controls stock number for the part. This can be used for ordering purposes.

Cards with higher numbers of channels fitted can be used, in an emergency, as spares for lower numbers, for example an

ID3-4 can be used as a spare for ID3-1, ID3-2, ID3-3, ID3-4.

9.2 24 & 110V Operation

The LT2 Series is capable of either 24VDC or 110VAC operation. However, the correct PCB configuration must be used.

An AC leak tester can be changed to a DC model, or vice versa, by adding or removing the power supply module.

ID3-PSU PCB.

10 Special Options

10.1 Inbuilt Blow-off Valves

In most configurations, the leak tester is fitted to a trimmer machine that already has an arrangement for separating good and bad bottles. Typically, good bottles are blown up a take-out chute while bad bottles are allowed to fall off the end of the trimmer. The leak tester, when fitted, controls the signals to the existing blow-off valve(s) on the trimmer.

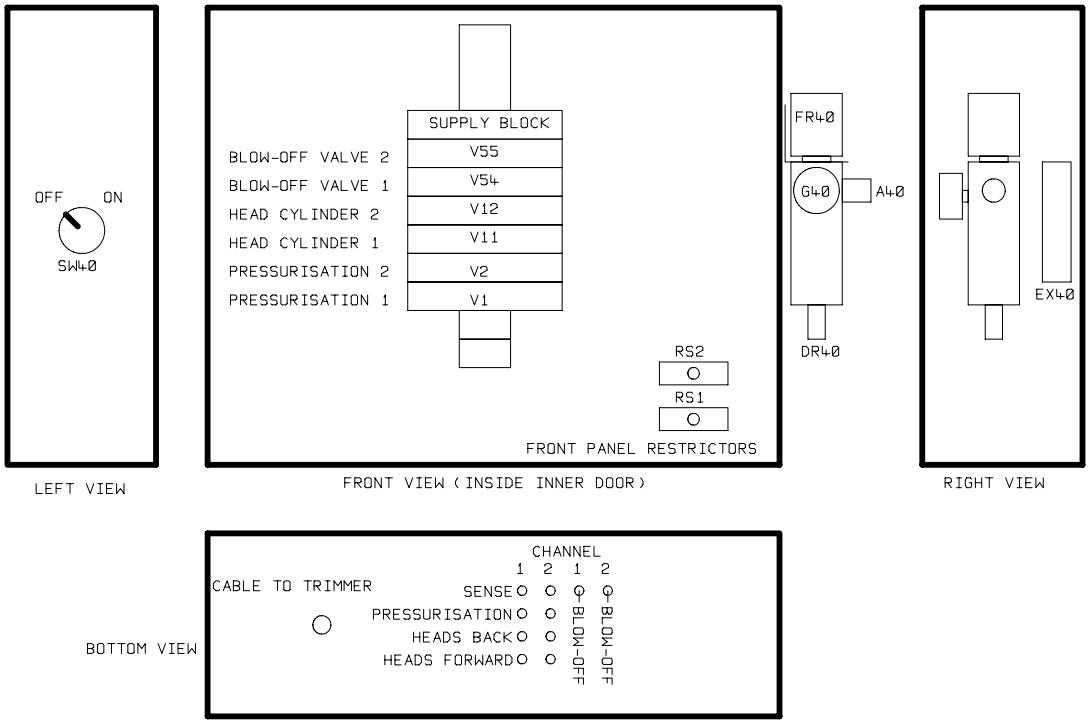


Figure 10.1 LT2-R Layout Drawing

An option is available for fitting to machines without existing blow-off valves (The -R option). The blow-off valves are integrated into the leak tester itself and controlled directly. The leak tester reject outputs are wired directly to extra internal

solenoid valves mounted on the top end of the standard leak tester manifold block.

Extra air fittings are provided on the leak tester to connect the external pipes to the blow-off nozzles.

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Revision 20

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