MECHATECH SYSTEMS TECHNICAL VACUUM SOLUTIONS

UK MANUFACTURERS OF THE HYSCAN II, LYOSCIENCE (LS) RANGE OF FREEZE DRYERS
& BESPOKE HIGH VACUUM SYSTEMS | VACUUM PUMPS - SPARES - SERVICE

HYSCAN II Hydrogen in Aluminium Analyser

INSTALLATION AND OPERATION MANUAL

Issue **4**

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Please Read This Document before Operating the Machinery

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1. DOCUMENTATION RECORDS

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2. INTRODUCTION

2.1 Purpose

This manual provides installation and operation instructions for the *HYSCAN II*.

This manual and all accompanying documentation must be read before operating the vacuum system.

Important safety information is highlighted as **WARNING** and **CAUTION** instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS are defined below.

2.2 General safety

WARNING: Warnings are given where failure to observe the instruction could result in injury or death to persons.

CAUTION: Cautions are given where failure to observe the instruction could damage to the equipment, associated equipment or process. Refer to the accompanying manufacturers' instruction manuals for the technical data on individual components.

2.3 Unpack and inspect

Remove all packing material.

CAUTION: Remove all packing material before operating system.
If the equipment is damaged notify your supplier and the carrier in writing within three days.

2.4 Installation and Commission

2.4.1 Electrical Requirements

CAUTION: The *HYSCAN II* is factory configured for the supply stated below. Check that your voltage supply is compatible. If you operate the unit on the wrong voltage, you will damage it.

Voltage 240Vac
Frequency 50Hz
Loading/power consumption 3 KW
Earthing Class 1 (supply earth required)
Fusing 13A

Ensure that all framework panels are refitted before connecting to any services.

WARNING: Failure to refit all panels prior to connecting to mains power may result in injury or death to the operator.

2.4.2 Initial setup

I. Locate the *HYSCAN II* in the required position, by pushing it on its casters, ensuring that the floor is adequate to support the equipment and that due consideration is given to:
   a) Air flow for ventilation
   b) Adequate space for maintenance.

II. The unit is delivered under a vacuum and should always be maintained in this condition when not in use to prevent dirt and moisture entering the system. It is prepared for operation as follows:

   a) Remove all packing materials.
   b) Check that the position of the two switches on the instrument panel are:

Left hand switch	**Middle switch**
Up (between tests)	Down (test)

c) Remove the front panel of the unit and unscrew the transit bolt (if fitted) from the pump mounting plate using an M10 spanner.

d) Examine all interconnections between components to check that the mating surfaces are parallel and that the O-rings are correctly in position. Tighten any connections that may have become loose during transit.

e) Open the cable storage cover at the base of the rear panel, unscrew the transit bolt (if fitted) and uncoil the cable.

f) Check that oil is present in the pump. The oil level can be observed through the sight glass on the front of the pump and should be at least half way between the "min" and "max" lines. If oil is not present or there is insufficient oil, then Edwards Ultragrade 19 oil should be poured into the pump via the oil inlet port. Check that the oil inlet and gas ballast valves are closed before operation.

g) Replace the front panel.

h) Connect the instrument to the mains supply (see Section 2.4.1) and move the isolator switch to the "on" position (situated on the left hand side panel). Leave the unit pumping for about thirty minutes.

The digital display should light up and read 0.00 after about 10 seconds.

CAUTION: Exhaust gases must be ducted away from the surrounding atmosphere and suitably disposed.

CAUTION: Do not obstruct any vacuum pump exhaust port (refer to manufacturer's manual before operation).

3. DESCRIPTION

3.1 Background

Hydrogen is the only gas that is appreciably soluble in aluminium and its alloys. Its solubility is small when compared with that in other metals but its effects are significant on the mechanical properties and finishing characteristics of aluminium alloys. The problem with hydrogen derives from the difference in the solubility of the gas between liquid and solid aluminium at the freezing point. At this temperature, the ratio of liquid to solid solubility is approximately 20:1 and this results in the formation of hydrogen bubbles which ultimately cause porosity in castings and ingots and blisters on sheets and plate.

It is important therefore to be able to determine the hydrogen content of molten aluminium alloys before the metal is cast. This allows corrective procedures to be undertaken to minimise the hydrogen level and so improve the quality and reliability of the final product.

The instrument described here (*HYSCAN II*), measures hydrogen in molten aluminium using a reduced pressure technique developed by the BNF Metals Technology Centre for the UK Light Metal Founders' Association. *HYSCAN II* is an updated version of the instruments used for some 20 years in foundries worldwide. Current models use a programmable logic controller to undertake the control, diagnostics and measurement functions.

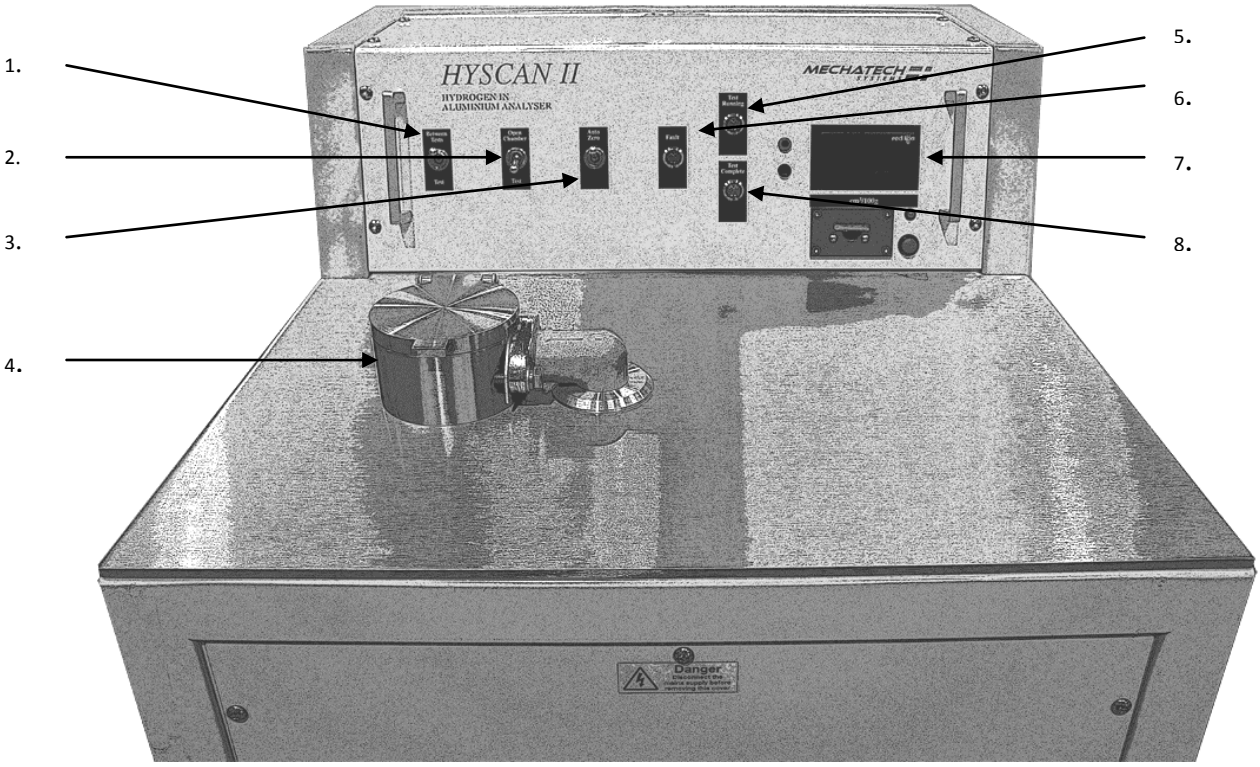
3.2 Principle

A constant mass of the melt (approximately 100g) is placed in a chamber and the pressure reduced rapidly to a predetermined value by a vacuum pump. The chamber and associated vacuum system is then isolated from the pump and the sample allowed to solidify. As the melt cools hydrogen is released and its partial pressure is measured by a calibrated Pirani gauge whose output is converted continuously to a digital display of hydrogen content.

3.3 General Description

The unit is mounted on a rigid steel frame supported by four heavy-duty castors, two of which can swivel. The vacuum system comprises a vacuum pump, trap, Pirani gauge, solenoid valves and sample chamber. The components are mounted within the frame and in operation are enclosed behind panels. The sample chamber is mounted on the top panel of the instrument and maintained at a constant 120°C by a heater coil wrapped round the base of the chamber. This temperature is regulated via a temperature controller situated on a plate near the base of the unit, adjacent to the vacuum pump. The control panel has two switches that operate the test and measure functions, a momentary switch to operate the auto zero function and a digital display of the hydrogen

content in cm^3/100g. Three LED lamps indicate the operational status of the instrument (test running, test complete, fault condition). When fitted, a printer is situated in the compartment behind the control panel. All operational and logic sequences of the instrument are controlled by a programmable logic controller (PLC) situated in a sealed metal casing below the control panel in the main body of the unit. The status of the PLC can be observed through a view port on the back panel. Power is supplied to the instrument via corrugated steel covered cable that can be stored, when the instrument is not in use, at the base of the frame. The instrument can be turned on or off with the mains isolator switch positioned near the top of the left hand side panel.



1. 'Between Tests' Test Switch
2. 'Open Chamber' Test Switch
3. Auto Zero Switch
4. Sample Pot
5. Test Running Indicator Lamp
6. Fault Indicator Lamp
7. Digital Display of Hydrogen Content
8. Test Complete Indicator Lamp

A schematic diagram of the layout is shown in Figure 1 and details of the operational functions are provided in the logic table (Table 4), in Figures 2 - 5 and the function chart (S2488A3).

4. OPERATION

4.1 Auto Zero

After having pumped the unit for about thirty minutes set the instrument zero as follows:

a) Move the middle switch to OPEN CHAMBER and the left hand switch to BETWEEN TESTS.
b) Press the auto zero switch on the front panel.
c) Move the middle switch to TEST.
d) Move the left hand switch to TEST.

The TEST RUNNING LIGHT will flash for a 3-minute duration. There is no display during this period. If the auto zero function is successful the TEST COMPLETE light will illuminate and the user can proceed with a blank test (section 4.2). If the auto zero function is unsuccessful the FAULT LED will illuminate on completion of the test. In this case either the low-pressure set points will need to be adjusted (section 5.3), the alumina desiccant will require regeneration (section 6.3) or there is a fault on the system (section 6.8).

Note: It is recommended that an auto zero test is performed prior to each sequence of hydrogen measurements.

4.2 Blank test

After successful completion of the auto zero (section 4.1) make a blank test as follows:

a) Move the middle switch to OPEN CHAMBER
b) Move the left hand switch to TEST
c) Move the middle switch to TEST.

The TEST RUNNING light will illuminate and in less than 10 seconds the panel meter will light up and display 0.00cm^3/100g. If the unit is correctly adjusted the hydrogen content will remain at 0.00cm^3/100g until the TEST COMPLETE light illuminates after five minutes.

If the display reads a non-zero value, repeat the auto zero (section 4.1). If successive zero and blank tests continue to fail the desiccant may require regeneration (section 6.3) or there may be a fault on the system (section 6.8).

If an increasing value is observed throughout the test period, then the vacuum system may not be fully sealed. Check the 'O' ring and surfaces of the sample pot. If these are satisfactory and other interconnections appear satisfactory the system may require evacuating for a more extended period to remove water vapour and adsorbed gases.

4.3 Running a test

Switch and valve positions together with a typical pressure profile are shown on the function chart (drawing S2488A3) and in Figures 2 - 5.

a) Move the isolator switch to the "ON" position (if not already in this position). The unit should be pumped for at least 10 minutes before proceeding with a test.
b) Move the middle switch to OPEN CHAMBER (up) and open the sample chamber.
c) Place a short length of pre-heated stainless steel rod into the chamber.
d) Pre-heat the ladle and dip it into the melt.
e) Stir the melt with the ladle to ensure that it is hot and that a representative sample can be taken. IT IS IMPORTANT THAT INSTRUCTIONS (f) TO (i) ARE NOW UNDERTAKEN AS QUICKLY AS POSSIBLE.
f) Fill the ladle, wipe it and carefully pour the melt sample into the chamber.
g) Remove any alloy spillage from the chamber lip before lowering the lid.
h) Move the left hand switch to the TEST position.
i) Move the middle switch to the TEST position. The TEST RUNNING light will illuminate. The hydrogen test is now underway. In less than ten seconds, the panel meter will light up and the hydrogen content displayed will increase from zero to the melt hydrogen content (in cm^3/100g). The value will remain displayed when the TEST COMPLETE light illuminates after about five minutes.
j) Move the middle switch on the front panel to the OPEN CHAMBER (up) position and the left hand switch to the BETWEEN TESTS (up) position.
k) Remove the solidified sample by applying a pair of pliers to the exposed length of stainless steel rod. (If the sample has solidified without a length of stainless steel rod in the chamber, then place a rod on the top of the solidified sample and pour a half ladle of melt into the chamber. Remove the contents after about five minutes).

At this stage another test can be initiated by repeating the procedure above from instruction (c) above.

Note 1
In normal operation the sample chamber is heated to 120°C to minimise surface adsorption of water vapour and other condensable gases. However, at the start of a series of measurements it is recommended that the first result obtained using molten aluminium should be discarded to ensure that the chamber is hot and fully ‘baked’.

Note 2
When the tests have been completed the switch positions should be as follows:

Left Hand Switch	**Middle Switch**
Up (BETWEEN TESTS)	Down (TEST)

Leave the unit operating for five to ten minutes before turning the instrument off (using the isolator switch). The unit can now be moved or stored under vacuum in the

knowledge that it will be ready for immediate use when required.

Note 3

The unit has a built-in safety device so that if the test pressure is not achieved within a pre-set time, various parts of the system will be isolated from the vacuum pump and the 'fault' LED will illuminate. In this situation the switches should first be returned to the BETWEEN TEST/OPEN CHAMBER mode. The sample should then be removed from the chamber and the chamber lip and 'O' ring examined for damage or contamination (see section 6.8 for further details).

5. CALIBRATION

5.1 General

The full calibration procedure involves admitting known volumes of hydrogen into the system and making adjustments to the potentiometers on the Pirani gauge. A supply of dry hydrogen is required and one or two calibrated gas pipettes having volumes in the range of interest to the user. The instrument will have been calibrated at the factory over the commonly used range of approximately 0 - 0.5cm^3/100g and should not need to be recalibrated on delivery. However, should the operator wish to check the calibration or to perform a calibration over a different range, it is probable that only a minor adjustment to the ATM potentiometer on the Pirani gauge will be necessary.

The full calibration procedure is described below.

5.2 Calibration procedure

a) Move the switches to the following positions

Left Hand Switch	**Middle switch**
Up (between tests)	Up (open chamber)

b) Run an auto zero test as described in section 4.1. Run a blank test as described in section 4.2 and place an ammeter across the test points adjacent to the panel display. When the test complete light illuminates the ammeter should read approximately 10.18 mA and the digital reading on the analyser should be 0.00cm^3/100g. If this is not the case refer to section 5.3.
c) Open the sample chamber lid and place the calibration plate on the sample chamber.
d) Fill the highest value calibration pipette with hydrogen as shown in Figure 6.
e) Attach the calibration pipette to the tube protruding from the centre of calibration lid as shown in figure 6.
f) Switch the left hand switch down (TEST) and middle switch down (TEST).
g) When the panel meter displays 0.00cm^3/100g open Tap A (anticlockwise for ~1.5 turns). Close tap A after about 15 seconds and note the final value on digital display and on the ammeter.
h) Adjust the ATM potentiometer on the Pirani gauge head until the hydrogen value shown on the display corresponds to the appropriate value for the pipette.
i) Move the switches on the front panel as follows:

Left Hand Switch	**Middle Switch**
Up (between tests)	Up (open chamber)

j) Remove the pipette. Fill a second pipette of lower value than the first with hydrogen and repeat instructions f) to i) above.

5.3 Low pressure Set Point

It may be necessary to adjust the low-pressure set point if it is not possible to obtain a display value of 0.00cm^3/100g (corresponding to an ammeter reading of approximately 10.18 mA across the test points) when running a blank test (see section 4.2), or if the auto zero function continually fails (section 4.1). The set point can be adjusted via two, 2 position switches mounted in a box situated adjacent to the programmable logic controller (PLC). Remove the back panel to access the switches. If a non-zero reading is displayed persistently during successive tests, record the ammeter reading given across the test points after completion of a auto zero test and set the low pressure set point switches according to the following:

mA Reading	Set point Status	Required Switch Position
< 10.18	Low	S1 on, S2 on
~ 10.18	Standard	S1 off, S2 off
>10.18	High	S1 on, S2 off
>>10.18	Very high	S1 off, S2 on

Note: If it is necessary to lower the set points to obtain a satisfactory zero, then the vacuum system should be first checked for leaks, the desiccant renewed and the system pumped out for one hour.

6. MAINTENANCE

WARNING: Ensure that the electrical supply is isolated before starting any maintenance work.

The unit has been designed to require the minimum of servicing during its working life. Nevertheless, the following simple checks are advised at frequent intervals in order to ensure optimum performance of the instrument.

6.1 Sample chamber/O ring

If the 'O' ring in the sample chamber lid is damaged, or if the surface of the sample chamber rim is scratched or pitted, it will not be possible to achieve a vacuum tight seal during testing. The 'O' ring should be regularly inspected and if it is damaged or has particulate material embedded into it, it must be replaced. Damage to the sample chamber should be removed by careful abrasion with fine abrasive paper (grade 240 to remove scratches and 800 to polish). Damage to the chamber rim can be caused by removing solidified aluminium with a screwdriver or pliers, or by tapping the ladle on the rim when pouring the sample. Care should also be taken when removing the solidified sample when the test is completed. The rod inserted into the aluminium should be gripped by pliers and removed vertically. The rim of the chamber should not be used as a levering point.

When pouring the molten alloy into the sample chamber, care must be taken to ensure that any aluminium on the outside of the ladle does not drop onto the junction between the sample chamber and the elbow. This junction is sealed with a viton 'O' ring that can be damaged by drops of molten aluminium alloy, and will then require replacement. This is achieved by removing the collars around the elbow where it passes through the top surface and unscrewing the two bolts which attach the elbow to the sample chamber. The 'O' ring, carrier and integral sintered metal filter can then be removed and replaced.

6.2 Vacuum pump

Observe the pump oil level through the window on the front panel. Top up the pump with Ultragrade 19 oil as necessary. For detailed servicing of the pump and other vacuum components, refer to the individual manuals written by BOC Edwards appended to this manual.

6.3 Regeneration of alumina desiccant

Depending on the frequency of use and ambient humidity it will be necessary to regenerate the desiccant from time to time. This should be done at least every 500 hours and when an increasing blank value is observed. Follow the instructions below to regenerate the desiccant.

a) Move the isolator switch to the off position.
b) Remove the front panel.
c) Turn the manual air admittance valve anti-clockwise to admit air to the trap and then close the valve.
d) Unscrew the three retaining nuts around the trap and remove the glass disc.
e) Remove the mesh envelope containing the desiccant from the trap, replace the glass disc and tighten the nuts.
f) Check that the manual air admittance valve is closed and switch on the mains isolator to keep the system under vacuum.
g) Either dry the desiccant in an oven at 150°C for at least one hour, or replace it with a new desiccant envelope that has been heated at 150°C for at least one hour immediately before use (see note below).
h) Quickly transfer the regenerated / new desiccant to the trap by repeating the procedure described above.
i) Check that retaining nuts are tight.
j) Replace the front panel.
k) Turn the instrument on and leave the system pumping for at least half an hour before running a zero test.

Note: If the desiccant removed from the vacuum system has an oily smell then it may have a limited service life. In this case the desiccant should be replaced with a new one.

6.4 Electrical circuits

Wiring diagrams are available from the manufacturer on request.

Further details of the electrical circuits for the pump and solenoid valves are provided in the relevant instruction manuals appended to this document.

6.5 Routine maintenance

To obtain the best performance of the instrument it is recommended that:

a) The system is kept under vacuum when not in use. This does not mean that the unit should be kept running in the ‘between tests’ mode. When it has been pumped down it can be switched off.
b) When the unit has not been used for several days it should be pumped down for about half an hour (left hand switch up, middle switch down) to ensure that the

vacuum system is clean.

c) The first test with molten aluminium should be disregarded (see section 4.3).
d) Zero and blank tests should be made at the start of a series of tests (section 4.1 and 4.2).
e) The hydrogen release profile should be observed during a series of tests. If the hydrogen level continues to rise rapidly throughout the five minute test period and does not start to level off after about 3 minutes then it is probable that the system has not sealed properly (see section 6.1).
f) The sampling procedure should be reproducible and the instrument placed as close to the sampling point as possible.

6.6 Planned maintenance

6.6.1 Monthly

a) Check the condition of the sample chamber 'O' ring. Remove and replace as necessary.
b) Check the condition of the sample chamber/elbow 'O' ring. Remove and replace as necessary.
c) Check the condition of the sample chamber sealing surfaces; if necessary remove any scratches or pitting as indicated in section 6.1.
d) Note: The paper must be used dry; do not attempt to use the abrasive in a moistened condition.
e) Check the vacuum system for leaks.
f) Check pump oil level and top up as necessary.
g) Carry out a calibration check with hydrogen.

6.6.2 Six Monthly

a) Remove particulate material from the analyser, especially around all electrical connections.
b) Strip and clean the vacuum system.
c) Replace 'O' rings, carriers and clamps where necessary.
d) Replace air admittance valve filter (valve V3).
e) Replace main cooling fan filter.
f) Replace sintered bronze disc filter, carrier and "O" ring.
g) Remove scratches or damage to the sealing surfaces of the sample chamber (see section 6.1).
h) Drain and replace the oil in the vacuum pump.
i) Replace the desiccant with a re-generated desiccant.
j) Check all electrical connections to ensure that they are secure.
k) Check all mechanical fixings to ensure that they are secure.
l) Carry out a calibration check with hydrogen and make the necessary adjustments.

6.6.3 Yearly

Remove vacuum pump and return to Mechatech Systems Ltd for servicing.

It is recommended that all vacuum gauging and sensors fitted to this unit be returned to Mechatech Systems Ltd (or a relevant competent body) for service and calibration at least every 12 months. The time interval between services must to be reviewed by the customer during the units operating life.

6.7 Recommended Spares

Table 1: Recommended Spare Parts List

Description	Part No	Qty
Active Pirani Gauge Head	QRP 69	1
KF25 O rings	QRP 13	1 Pk
KF10 O rings	QRP 14	1 Pk
KF25 Clamp	QRP 15	1
KF10 Clamp	QRP 16	1
Sample Pot O Rings	QRP 24	5
Ladles	QRP 51	5
Calibration Pipette	QRP 62A	1
Ultragrade 19 Oil	QRP 25C	2 litres
O rings, Carrier and Filter	QRP 27	5
Alumina desiccant envelopes	QRP 21	5
Sets of Rods	QRP 58	5
KF25 Blanking Plate	QRP 59	1
KF10 Blanking Plate	QRP 60	1

6.8 Fault Diagnosis

6.8.1 Leak in vacuum system

The most common fault that is encountered with the instrument is a leak in the vacuum system. The presence of leaks will be indicated by various fault conditions (see below) or by a continuing increase in reading on the display throughout a test. Leaks usually occur either at the 'O' ring/sample chamber interface due to damage or contamination of the 'O' ring, from damage to the sample chamber lip (section 6.1) or at the outlet connection to the elbow joint at the side of the sample chamber. Leaks may also occur between component interconnections if the instrument has been moved over very rough surfaces or has been mishandled during transit. A leak can be detected by systematically blanking off individual sections of the vacuum system; the following tests will help identify the problem area.

a) Place an ammeter across the test points
b) In the between test/test mode record the mA reading when stable.
c) Put the test/open chamber switch to open chamber. This closes valve V2. Record the mA reading across the test points when stable. If the reading is significantly lower than in b) above, the leak is probably between valve V2 and the sample chamber and the 'O' rings and mating surfaces through to the sample chamber should be checked. If the readings are similar, then a leak may be present in the section from V2 to the pump.

Note: When dismantling the vacuum system, the unit should be switched off otherwise the Pirani gauge head may be damaged and the pump oil contaminated.

6.8.2 Replacement of 'O' rings

All 'O' rings except two are manufactured from nitrile rubber. The two exceptions, which are made of viton, are used for sealing the hot surfaces of the sample chamber lid and the elbow connection to the vacuum system. The outlet from the sample chamber to the vacuum system is protected by a sintered bronze filter to ensure metallic particles do not penetrate the vacuum system.

When replacing 'O' rings vacuum grease must not be used.

6.8.3 Replacement of Pirani gauge

In the event that the Pirani gauge requires replacement, the instrument should be switched off, the manual air admittance valve opened and the old gauge head removed by unscrewing the clamping ring and disconnecting the lead from the head. Retain the centring ring and replace with the new gauge making sure that the 'O' ring and the mating surfaces are clean and undamaged. Before switching on the instrument, make sure that the manual air admittance valve has been closed.

6.8.4 Identification of faults

The red (fault) LED on the front panel will illuminate when the instrument is in a fault condition. The fault can be identified more specifically by examining the status of the output LEDs on the PLC (viewed through the perspex window on the back panel of the instrument). The red LED on the front panel will also illuminate if there is a large leak in the vacuum system. This condition is non-latching and the LED will extinguish when the leak has been sealed.

The following tables provide details of how to detect and rectify faults that may occur over the lifetime of the instrument. Many of these faults can be avoided if the recommended maintenance procedures have been adopted (section 6).

Table 2: Identification of faults

Probable Fault	**PLC Output LED on**	**Suggested Action**
1) Leak in vacuum system (see section 6.8.1) 2**)** Saturated desiccant (see section 6.3)	8 or 9	1) a. Check sample chamber for scratches, pitting or particulate contamination. Remove any scratches by careful abrasion with fine emery paper. b. Check 'O' ring in sample chamber lid for damage or contamination. Replace as necessary. Use Viton 'O' rings c. Check all component interconnections. d. Leak in sample chamber body – replace. e. Failure of bellows between pump and valve V1. f. Valve V3 not closing. 2) Remove desiccant, dry or replace.
Overload tripped	5	Reset overload
Valve V3 not opening		Check electrical connections and fuses. Replace as appropriate.
a) Valve V2 not opening b) Valve V1 not opening c) Pump not working	5,6,or 7	a) Check fuses on valve boards and all electrical connections. b) As in B above.

6.8.5 Assistance from manufacturer

In the event that a fault occurs in the unit, the manufacturer may be contacted by fax on 01454 414723 (UK), +44 1454 414723 (international) or by telephone 01454 414723 (UK), +44 1454 414723 (international). For speedy advice please indicate which PLC output LED (5 to 9) is illuminated.

6.8.6 List of associated documents

Manufacturer's literatures for all major components have been included.

a) RV3, RV5, RV8 and RV12 Rotary Vane Pumps (A652 01 880)
b) PVEK valves (C411 02 885)
c) Active Pirani Gauge (D021 71 885)
d) IT20K, IT100, IT300 and IT800 inlet traps. (A441 01 880)
e) AV5A & AV10K air admittance valves (C350 03 880)
f) Panel meter CUB 4I, Red Lion
g) Alphanumeric printer (where fitted) IPP144-40

7. TECHNICAL SPECIFICATIONS

Table 3: Technical Specifications

FUNCTION	PERFORMANCE
Vacuum Pump	Refer to manufacturers manual
Measurement time	5 min
Power requirement a) Supply UK b) Supply Europe	 230V, 50Hz, 1 ph, 110V, 50/60Hz, 1 ph,
Dimensions (w x h x d) overall	600 x 1070 x 710 mm (approx inc. handle)
Weight (overall)	120 Kg
Measurement time	5 min
Sample weight	100g
Range	Up to 1.00cm3/100g
Sensitivity	0.01cm3/100g
Accuracy	Less than 5% difference between instrument method and vacuum sub-fusion method
Optional accessories	Printer (serial via RS232)
Spares	Spares kit or individual items available

8. ENVIRONMENT SPECIFICATIONS

- Temperature Operation 12 to + 40°C
- Temperature Storage -30 to +70°C
- Humidity Operation 5 to 90% RH (non condensing)
- Protection IP22

9. SCHEMATICS

9.1 Figure 1: Schematic of component layout

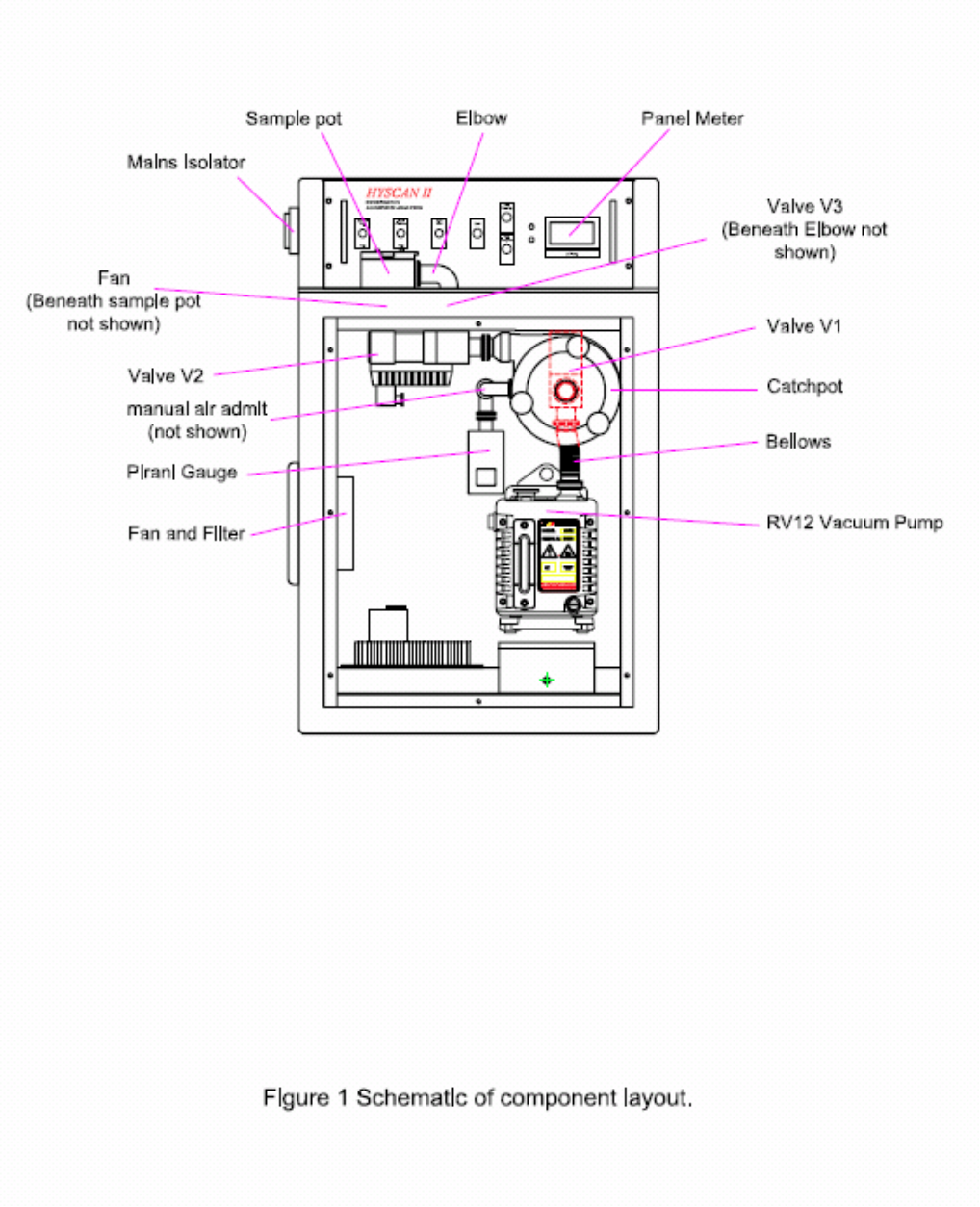
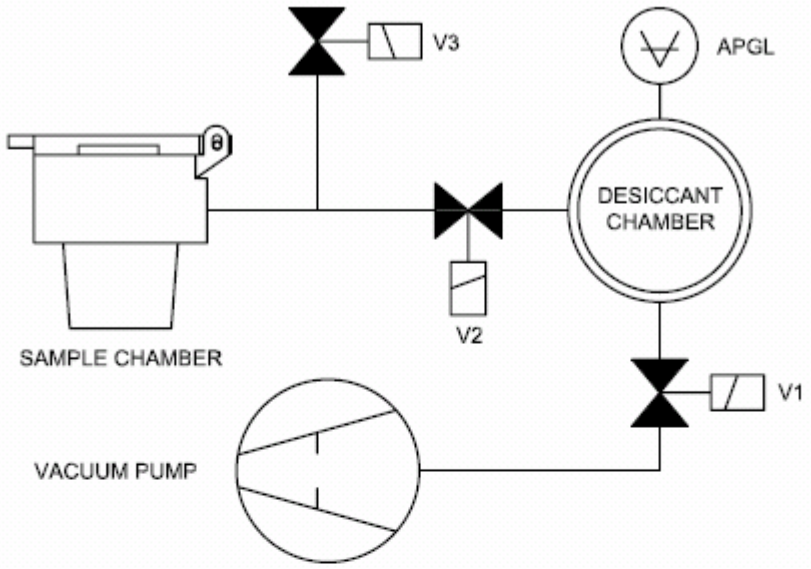


Figure 1 Schematic of component layout.

9.2 Table 4: Schematic and logic diagrams

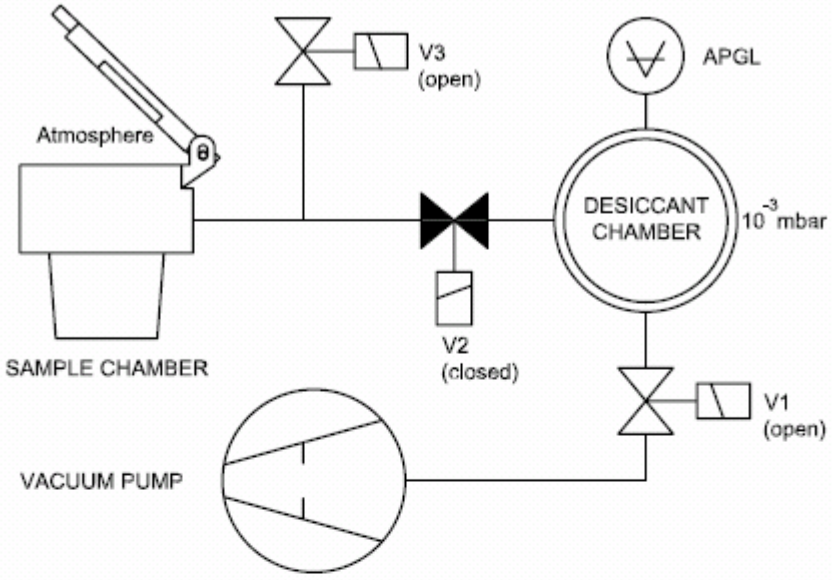


Left hand switch	Right hand switch	V1	V2	V3	Green LED	Yellow LED
TEST	**TEST** > 0.1 mbar **TEST** < 0.1 mbar Test time > 5 min	1 0 0	1 1 1	0 0 0	1 1 0	1 1 0
TEST	Open chamber	1	0	1	0	0
BETWEEN TESTS	Open chamber TEST	1 1	0 1	1 0	0 0	0 0

0 Valve closed or LED off
1 valve open or LED on

Table 4: Schematic and logic diagrams

9.3 Figure 2: Operation stage 1

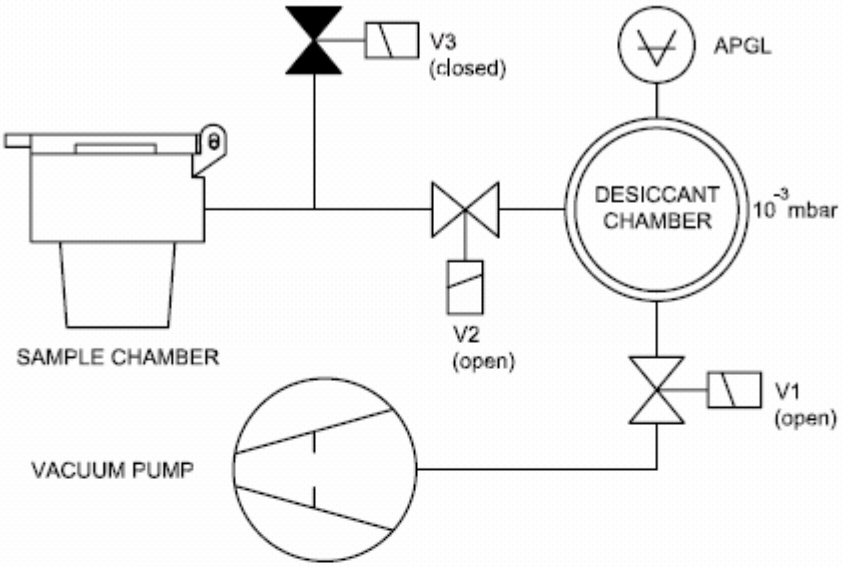


Switch positions at **BETWEEN TESTS** and **OPEN CHAMBER**

Sample chamber open ready to receive molten alloy

Figure 2 : Operation stage 1

9.4 Figure 3: Operation stage 2



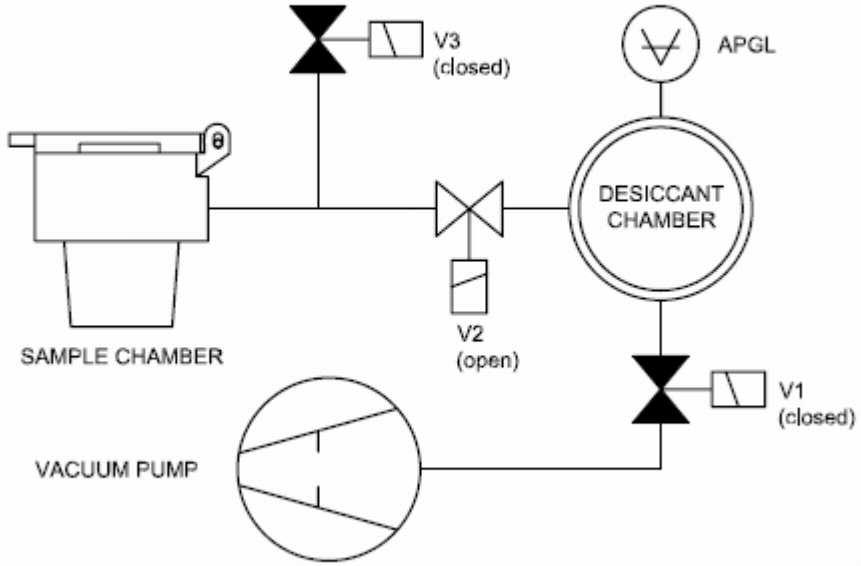
Molten alloy in sample chamber, lid closed.

Switch positions at **TEST** and **TEST**

V3 closes. V2 and V1 are open until 10 mbar is achieved after approximately 10 seconds. Then V1 closes

Figure 3 : Operation stage 2

9.5 Figure 4: Operation stage 3



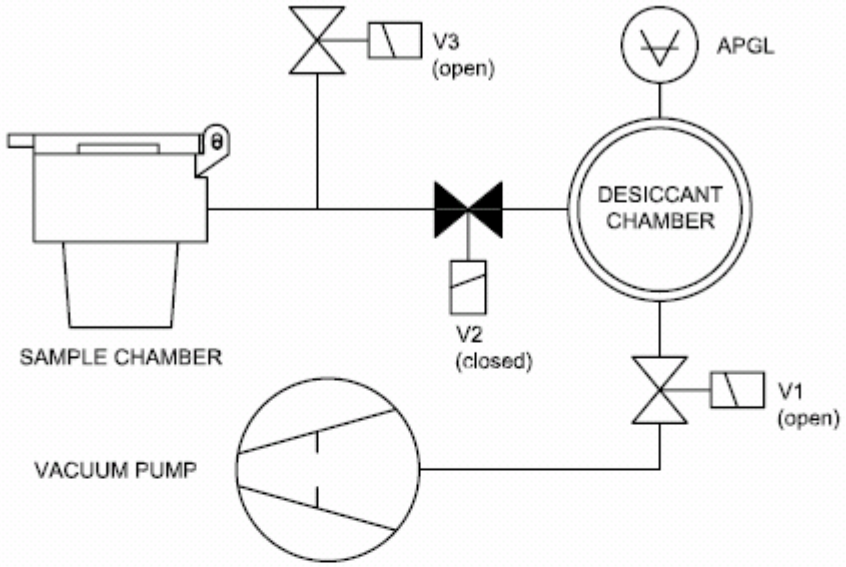
Molten alloy in sample chamber, lid closed.

Switch positions at **TEST** and **TEST**

Hydrogen raises system pressure as it is released from the molten sample

Figure 4 : Operation stage 3

9.6 Figure 5: Operation stage 4



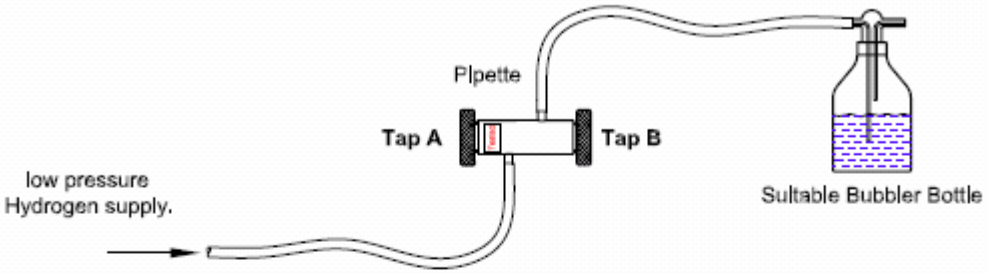
After 5 minutes test is complete and all Hydrogen has been released.

Switch positions at **BETWEEN TESTS** and **OPEN CHAMBER**

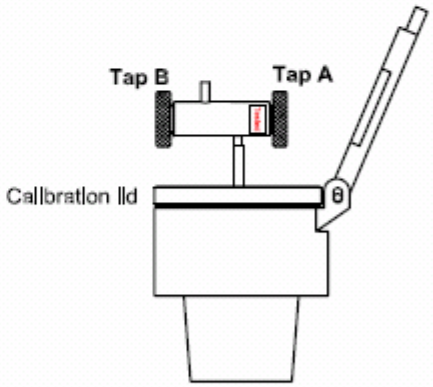
V2 closes, V1 and V3 opens,
Remove sample fromchamber,
system ready fo next test.

Figure 5 : Operation stage 4

9.7 Figure 6: Pipette filling and use of calibration lid



1. Identify the end of the pipette with the 'Tested' label attached (Tap'A' as above)
2. Using Ø5.0 I/D silicone rubber tube connect Pipette to Hydrogen source as shown.
3. Connect other side of pipette to a Bubbler bottle or similar.
4. Open taps 'A' and 'B' (1.5 turns anti-clockwise from closed position)
5. Allow Hydrogen to flow through pipette (and Bubbler Bottle) for approx 10 seconds to ensure all air has been expelled and replaced with Hydrogen.
6. Close tap 'A' fully clockwise. Do not over tighten.
7. Close tap 'B' fully clockwise, Do not over tighten,

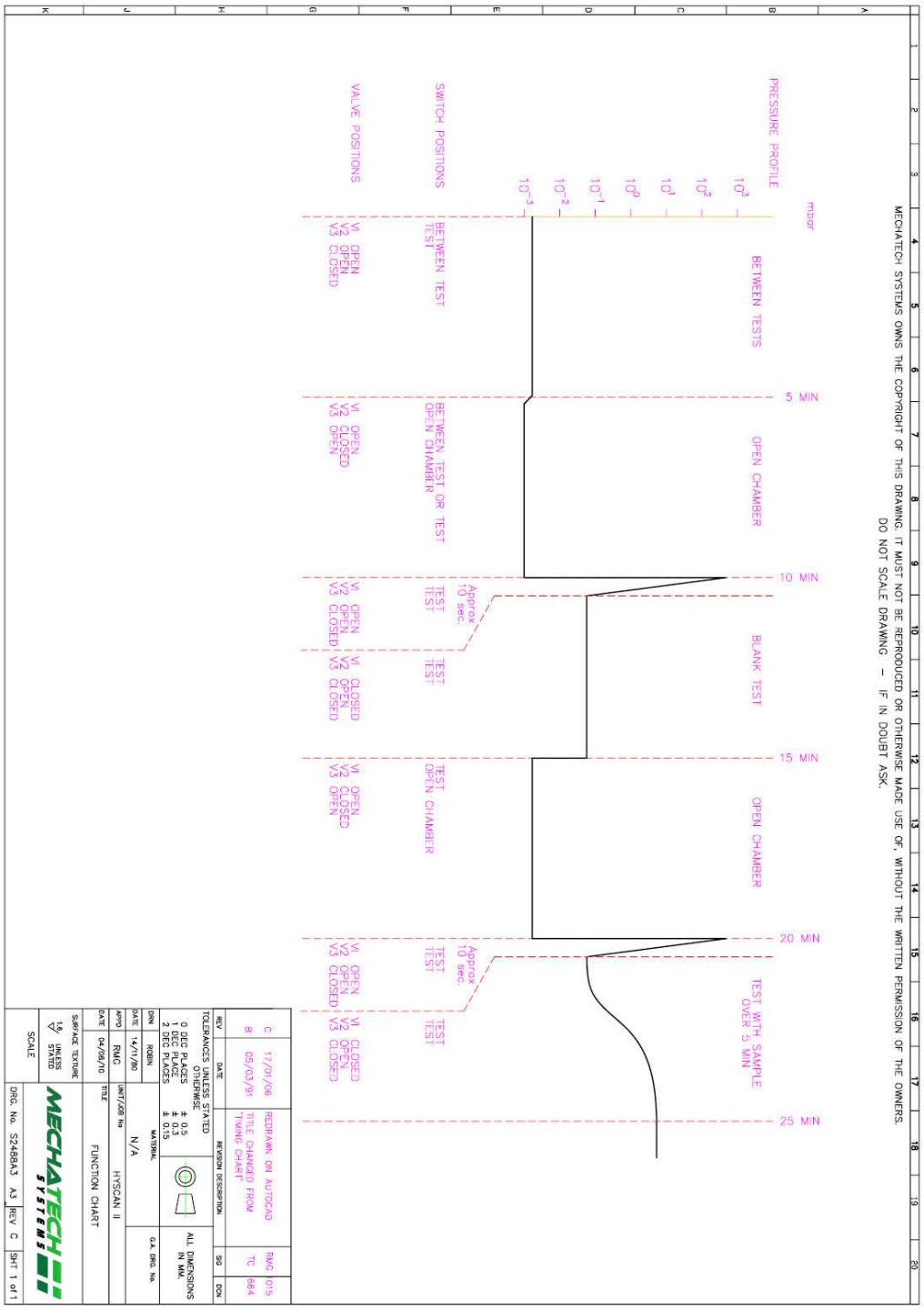


1. Connect tap'A' side of pipette to the calibration lid using supplied silicon tube.
2. Move switches to positions **TEST** and **TEST,**
3. When **Test Running** LED illuminates open tap 'A' 1,5 turns anti-clockwise,
4. After ~15 seconds close tap 'A'

Figure 6 : Pipette filling and use of calibration lid.

10. CHART

10.1 Function chart



11. HYSCAN II PRINTER OPTION

The printer is an optional accessory that is factory fitted if required. Manufacturer's instructions for the printer are included with this manual. The printer will provide data on time, date, test number and hydrogen content.

The procedure for changing the printout of time (hour only) is given below.

1. Move front panel switches to the following positions:

LEFT HAND SWITCH	**MIDDLE SWITCH**
Up (between tests)	Down (test)

2. Depress the AUTO ZERO button until all three front panel LED's illuminate (approximately 2 seconds). Release the AUTO ZERO button immediately after the LED's illuminate.

The internal clock will then advance by exactly 1 hour and the new time will be printed. All future print outs given after completion of a test will display the new time.

Repeat (2) as necessary until the desired time is obtained.

12. HYSCAN II SPARES

Part no	Description	No per pack
QRP-03C	V2 modified PV25EKA valve 220-240V 1 PH 50/60HZ	1
QRP-13	KF25 O rings	Pack of 5
QRP-14	KF10 O rings	Pack of 5
QRP-15	KF25 Clamp	1
QRP-16	KF10 Clamp	1
QRP-21	Alumina desiccant envelopes	Pack of 5
QRP-24	Sample Pot O Rings	Pack of 5
QRP-25C	Ultragrade 19 Oil	2 x 1 litre
QRP-27	O rings, Carrier and Filter	Pack of 5
QRP-50	Sample pot	1
QRP-51	Ladles	Pack of 5
QRP-56	Band heater	1
QRP-58	Set of Rods	Pack of 25
QRP-59	KF25 blanking plate	Pack of 5
QRP-60	KF10 blanking plate	Pack of 5
QRP-62A	Calibration pipette	1
QRP-68	Hyscan II digital display	1
QRP-69	Active pirani gauge head	1
QRP-81	Hyscan II toggle switch (Between Tests/Open Chamber) pk 1	1
QRP-82	Hyscan II toggle switch for ‘Auto Zero’	1

Supplier

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