

ANALOX 1371 MK2 SURVEYOR  
CARBON DIOXIDE MONITOR  
INSTRUCTION MANUAL

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### **IMPORTANT NOTES**

Any adjustments or repairs to the ANALOX 1300 range of instruments should only be carried out by a competent electronic engineer, familiar with Instrument technology.

S.A.E.P. Ltd. WILL NOT ACCEPT RESPONSIBILITY FOR ANY EVENTS OCCURRING AS A RESULT OF UNAUTHORISED ADJUSTMENTS OR REPAIRS TO THE INSTRUMENTS.

S.A.E.P. Ltd. operate a policy of continuous improvement to their products and reserve the right to change the design, components and specification of their equipment, without prior notice.

However, the company will endeavour to keep their customers informed of any changes, which they consider to be relevant to the continued satisfactory performance of their products.

The information in this document is given in good faith and believed to be correct, at the time of publication.

The purchasers attention is drawn to our terms and conditions of sale, a copy of which is available, on request.

Further technical assistance may be obtained by contacting S.A.E.P.

### **IMPORTANT SAFETY WARNINGS**

THESE WARNINGS MUST BE READ AND UNDERSTOOD BY ALL PERSONNEL CONCERNED WITH THE INSTALLATION, OPERATION AND MAINTENANCE OF THIS INSTRUMENT.

The Instruments in the 1300 Range are NOT suitable for operation in a Hazardous Area, as defined by the British Standard BS 5345 Part 4.

### **ELECTRICAL SHOCK HAZARD WARNING.**

The electrical power used in the 1300 Range of Instruments, may be at a voltage sufficient to endanger life. Before carrying out any maintenance or repair, persons concerned must ensure that the equipment is disconnected from any Mains supply and tests made to ensure that isolation is complete.

When the supply cannot be disconnected, functional testing, maintenance or repair should only be undertaken by qualified persons, who are aware of the precautions necessary when carrying out such operation.



## 1 INTRODUCTION

The ANALOX 1371 SURVEYOR provides a clear Digital Display of Carbon Dioxide concentration in a gas sample. It can be employed either as an ambient monitor, using its internal pump to draw the sample, or as an 'On-Line' monitor if the gas to be checked is flowing through a pipe.

The Instrument uses a 'State-of-the-Art' Infra-Red Analyser, with no electro-mechanical moving parts, designed to meet the demand for accurate measurements of Carbon Dioxide, where performance and quality are essential.

Ranges of measurement available are as follows :

| Range   | Part Number       |
|---------|-------------------|
| 0-100%  | SA1 D03 BG88 N002 |
| 0-20%   | SA1 D03 BE87 N002 |
| 0 - 10% | SA1 D03 BD86 N002 |
| 0 - 5%  | SA1 D03 BC89 N002 |
| 0 - 2%  | SA1 D03 BB90 N002 |
| 0 - 1%  | SA1 D03 BA91 N002 |
| 0-0.5%  | SA1 D03 SA92 N541 |

Two completely independent, user adjustable alarm circuits are incorporated, the setpoints of which are accessible on the front panel, and adjustable over the full range of the Instrument. Both audible and visual indication is provided at the onset of an alarm condition and volt-free relay contacts are available for connection of external warning devices.

The Instrument is housed in a high impact, glass reinforced polycarbonate wall mounting case and is sealed to IP65, when the hinged transparent front cover is closed. This front cover also incorporates a simple locking device to discourage unauthorised adjustments of the front panel controls. The Instrument case has been coated with a double layer of conductive material to provide EMC Compliance - ie Immunity from external Radio Frequency Emissions and containment of any internally generated RF. Mains input filters are also fitted to avoid conducted interference.

Installation is straightforward only requiring three fixing points and all external electrical connections are made to screw terminals.

## 2 SPECIFICATIONS

### 2.1 GENERAL

|                  |  |
|------------------|--|
| Ranges Available | : 0 to 0.5%,1%, 2%, 5%, 10%, 20%, 100% CO <sub>2</sub> |
| Linearity        | : 1% FS  |
| Repeatability    | : 1% FS  |
| Resolution       | : ± 1 Digit on Display                                 |
| Zero Drift       | : 2% FSD / week max                                    |
| Response time    | : Less than 30 secs to T90                             |
| Display          | : 3 1/2 Digit LCD (1999 max reading)                   |
| Alarm Ranges     | : Adjustable over full range of Measurement            |

### 2.2 OPERATIONAL

|                     |  |
|---------------------|--|
| Ambient Temperature | : 5 to 50°C (Wider operating Temperature Units are available on request)   |
| Storage Temperature | : -20 to 70°C  |
| Analyser Temp.      | : Ambient  |
| Warm-up Time        | : 2 mins at 25°C (Typical)   |
| Temp. Co-efficient  | : Zero : 0.1% FS /°C (Typical)<br>: Span : 0.2% FS /°C (Typical)           |
| Humidity            | : 0 -90% Non-condensing  |
| Pump Flow Rate      | : 75 ml/min (4.5 l/hr)   |
| Pressure Effect     | : 0.15% of Reading per millibar  |
| Operating Pressure  | : 0.9 to 1.1 Bar ABS.  |
| Power Supplies      | : a) 230v AC 50/60Hz<br>(specified at time of order) : b) 110v AC 50/60 Hz |

: c) 12V DC

Power Consumption : 18 VA Maximum

## 2.3 OUTPUTS

Relays : Low Flow Alarm  
: SPCO Contacts NO NC COM (HI Alarm)  
: SPCO Contacts NO NC COM (LO Alarm)  
Contacts rated 7 Amp 250v AC (Resistive)  
7 Amp 30v DC

Analogue Output : 4-20mA Maximum Load 300 Ohms  
: Optional 0 to 1 Volt (Minimum Load 5K Ohms)

## 2.4 MECHANICAL

Tilt Effect : Independent

Dimensions : 296mm (W) 256mm (H) 118mm (D)

Weight : 3.2 kg

Gas Connections : Suitable for 6mmOD / 4mmID plastic Pipe

### ***NOTE : DISPLAY RESOLUTION & ACCURACY.***

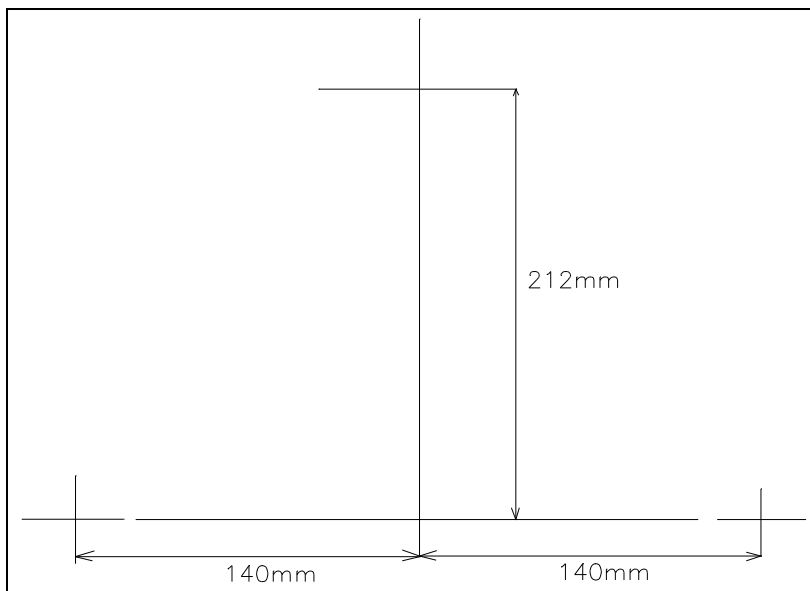
*The Digital displays used in this series of instruments are of the 3 1/2 digit type. The indicating accuracy of such a Display is limited to the resolution ie Plus or Minus the reading on the Least Significant Digit (the right most Digit). If the Quoted indicating range is 0.00 to 100.00 then when the display reads 0.00 the actual input signal could be between -0.004 and +0.004.*

*The Least Significant Digit will change from 0 to 1 when the absolute value changes from 0.004 to 0.005*

### 3 INSTALLATION AND COMMISSIONING

#### 3.1 INSTALLATION

- 3.1.1 The 1371 Surveyor should be mounted on a vertical surface using 3 off M4 machine screws or No. 8 woodscrews. Make sure that the chosen mounting position allows sufficient room on the Left of the Instrument, to permit the hinged front cover to be fully opened, and below the unit to allow cables and pipework to be correctly fitted. The Hinged front cover may be reversed if required.
- 3.1.2 Remove the two screws from the Terminal compartment cover, situated along the lower edge of the Instrument. Remove the cover taking care not to strain the connecting wires to the audible warning buzzer. These wires are connected to the Motherboard using a small 2 way plug. This may be removed by carefully releasing the locking latch on the Left of the plug.
- 3.1.3 Referring to the Figure 1 below, drill three holes in the mounting surface or fit 3 woodscrews at the hole centres.
- 3.1.4 Fix the Top screw in place but not fully screwed down - this is required to hang the Instrument from the Keyhole position on the back of the case. Hang the Instrument on the central screw and



then secure it with two screws in the slotted positions in the lower corners.

Figure 1. Fixing Centres.

### 3.2 CONNECTIONS

- 3.2.1 Connections to remote equipment, eg Flashing beacons or High powered Sounders and data recording devices are made through two cable glands, to the screw terminals in the middle area of the terminal compartment. The upper row of terminals provide connections to the alarm relay contacts and the lower row are signal input and output connections. On the 1371 Instrument, only the extreme right hand two terminals are used on the Signal terminals - these provide a 4-20mA DC output signal, representing 0 to 100% of Instrument measuring range. Optionally, a 0-1volt output can be provided instead of the 4-20mA, if this is requested when ordering.
- 3.2.2 On AC Supply versions, an AC mains supply of correct value as stated on the Internal label covering the terminals, should be connected through the left most cable gland, to the terminals marked 'L' and 'N'. The Earth lead should be fixed to the Ring connector provided on the Earthing stud, on the Left inside wall of the Terminal compartment.
- 3.2.3 On DC Supply versions, a 12V DC supply should be connected to the terminals marked '12V', '+' and '-'.
- 3.2.4 Remote gas sampling may be carried out by connecting up to about 30 metres of 4mm I.D. 6mm OD plastic tubing between the 'GAS IN' bulkhead connector and the area to be monitored.
- 3.2.5 A Pump failure or gas flow failure Alarm circuit is incorporated and this operates a relay, whose contacts are connected to a 3way screw terminal block, just to the left of the terminals described in Section 3.2.1 Under normal flow conditions, the NC and CM contacts are closed and the NO and CM contacts open. Under flow fail or power fail conditions, these contacts will change over.

### 3.3 COMMISSIONING

- 3.3.1 When the 1371 Surveyor is first switched on, it requires a period of about 40 Seconds, for the IR Transducer to settle. During this period, the Reading on the Display will be clamped to read the Full Scale Value of the particular Instrument.
- 3.3.2 When the settling time has expired, the Instrument will display the CO<sub>2</sub> concentration in the gas being drawn through the Transducer, by the sample pump.
- 3.3.4 The Alarm setpoints should be checked and adjusted if necessary, following the procedure outlined in Section 4 and a full Calibration carried out as detailed in Section 5.

## **4 OPERATION**

### **4.1 ALARM SETPOINTS**

- 4.1.1 The Instrument incorporates two completely independent alarm circuits, which may be adjusted by the user, to any point within the full range of the instrument. Both alarm circuits are configured to operate when the measured gas concentration Exceeds the setpoint - ie they are High going alarms.
- 4.1.2 When an alarm condition occurs, the appropriate Red LED (HI or LO) will start to flash, the internal Audible device will sound and the associated relay will change state. The Audible alarm may be silenced by pressing the 'MUTE' button, located just under the lower edge of the main panel. This action also changes the LED from flashing to a steady illuminated state. The relay and LED will remain in this condition, until the measured concentration falls below the alarm setpoint, at which time, the relay will revert to its normal state and the LED will be turned off.
- 4.1.3 Adjustment of the setpoints is a simple procedure. Locate the switch marked 'HI - LO' in the 'ALARM ADJUST' section of the front panel. This device is normally spring biased to its central position. To read the present setpoint for the LO alarm, press the switch to the right - the setpoint is then shown on the display. To read the present setpoint for the HI alarm, press the switch to the left - the setpoint is then shown on the display. To adjust the setpoint, hold the switch in the appropriate position and using the trimming tool provided, or a small terminal screwdriver, rotate the appropriate trimmer, 'HI' or 'LO' until the desired setpoint is indicated on the Display. Clockwise rotation increases the setpoint value. Release the switch and repeat for the other alarm if required.

## 5 CALIBRATION

### 5.1 GENERAL COMMENTS

Calibration requires gases to be fed from cylinders of certified concentration. These gases MUST NOT be delivered directly at cylinder pressure to the Instrument, otherwise the internal pump will be damaged. Scottish Anglo E.P. Ltd. supply calibration kits for the 1371 Instrument, comprising two cylinders of gas, a cylinder mounted flowmeter with control valve and suitable tubing. It is strongly recommended that this kit is used for Calibration.

**If alternative calibration equipment is used, precautions must be taken to limit the gas pressure and flowrate to a value not exceeding 1.0 Litres per Minute.**

**Under no circumstances must excessive gas pressure or flow be applied to the instrument otherwise damage to the pump and/or Transducer will be inevitable.**

### 5.2 CALIBRATION PROCEDURE

#### 5.2.1 Zero calibration

Using a Calibration Kit cylinder of 'Zero Gas' ie Nitrogen, fit the Flowmeter/control valve assembly on to the Cylinder screw connector. There may be a small escape of gas just before the assembly is fully tightened - this is quite normal. Connect the delivery tube to the small Barbed connector on the flowmeter and then to the 'GAS IN' port on the Instrument. Adjust the rotary valve on the flowmeter until the indicator ball is level with the middle graduation on the flowmeter. This produces a flow of approximately 1 Litre per minute. Allow the displayed reading to stabilise and if necessary, adjust the 'ZERO' trimmer, to the left of the display, until the Display shows '000'.

#### 5.2.2 Span Calibration

Using a Calibration Kit cylinder of 'Span Gas' having a concentration of CO<sub>2</sub> between 75% and 100% of Instrument measuring range, fit the Flowmeter/control valve as described in Section 5.2.1. Adjust the rotary valve on the flowmeter until the indicator ball is level with the middle graduation on the flowmeter. This produces a flow of approximately 1 Litre per minute. Allow the displayed reading to stabilise and if necessary, adjust the 'SPAN' trimmer, until the reading on the display is the same as the concentration of the Certified gas mixture.

5.2.3 Close the control valve, remove the plastic tubing from the instrument and the flowmeter and remove the flowmeter/control valve assembly from the gas cylinder. The control valve is not designed to provide a total gas shut-off when closed so to conserve gas supplies, it should only be fitted immediately before use.

5.2.4 It is important to realise that the Analyser in this Instrument responds to the partial pressure of Carbon Dioxide in the gas sample and that the calibration is strictly valid only at the temperature and pressure at which the calibration was done. Small changes in readings will occur as ambient pressure changes from day to day. However, these changes are limited to about 0.15% of reading per millibar pressure change and for most applications, would be insignificant.

For example, assume an Instrument is monitoring a 1% gas mixture at 1000mB pressure and is subjected to a 30 mB pressure increase over a period. This would result in a change in reading of 4.5% of the 1% reading and the Instrument indicating 1.045% .

5.2.5 If during the Calibration process, the desired readings cannot be achieved, then it is possible that the Infra-Red Transducer module requires service. To check that the Transducer module is operating correctly, proceed as follows.

5.2.6 THIS OPERATION SHOULD ONLY BE CARRIED OUT BY A COMPETENT TECHNICIAN, SINCE THERE ARE LETHAL VOLTAGES PRESENT INSIDE THE UNIT.

Open the front clear plastic cover of the Instrument. Remove the Four Corner screws in the front panel and carefully ease the front panel out of the Instrument case. The Infra-Red Transducer module is located in the lower right corner of the Instrument housing. On the top cover of the Transducer module, there is a status indicator light.

Under normal operating conditions, this light should be flashing On and Off at about a 1 second period. If the Transducer module requires service, then this light will either be Permanently ON or OFF. If this is the case, then contact either your distributor or Scottish Anglo E.P Ltd. for further Advice.

## **6 MAINTENANCE**

### **6.1 GENERAL**

Routine maintenance should be carried out at six monthly intervals to ensure continued reliable operation. The procedure detailed below should be followed and should not take more than about 20 minutes. It is strongly recommended that the procedures be carried out by a technician or engineer, familiar with Electronic Instrumentation.

Scottish Anglo E.P. Ltd offer both a full calibration service, and training service for customers' maintenance personnel. Full details are available from Scottish Anglo E.P. Ltd. Customer services Department, who may be contacted at the Address / Telephone / Fax shown on the front page of this manual.

### **6.2 CHANGING THE FILTER**

Disable the power supply to the Instrument and open the front cover. Remove the four corner screws from the front panel and carefully ease the front panel away from the Instrument case. The panel is attached to the main circuit board by some wires but it can be temporarily 'parked' in the uppermost slots on the left and right sides of the case. Locate the plastic filter unit fitted in the Gas Inlet Pipe. Carefully remove the plastic tubing from the ends of the and insert the new filter in the piping. Replace the front panel, ensuring that the wires to the front panel are not trapped between the panel and the case. The Instrument may now have its power supply restored and after initial warm-up will be ready for operation.

Replacement Filters are available from Scottish Anglo E.P. Ltd. and should be ordered as Part Number 1000-1401

A full Calibration procedure, as detailed in Section 5 should now be carried out.

*NOTE : If the Instrument is being used in a particularly dusty atmosphere, the filter may require changing more frequently.*

## 7 PRINCIPLE OF OPERATION

Most gases, when exposed to the Infra Red region of the electromagnetic spectrum, will absorb energy and produce very specific resonant molecular vibrations. These characteristic absorptions (vibrations) can then generally be used to identify individual gases.

The degree of absorption depends on the number of absorbing molecules (concentration) in an Infra Red path length between an Infra Red source and Infra Red detector. (Beer-Lambert Law)

In practical terms, the path length is chosen for the degree of absorption necessary to determine a particular band of concentration (range of measurement) and the gases can be identified by use of narrow band interference filters, tuned to an appropriate characteristic absorption wavelength.

The family of Transducers used in the ANALOX 1371 MK 2 range of Instruments are based on a measurement and reference sensor principle, utilising sample path lengths of between 1mm and 100mm in length, depending on the concentration to be measured, and wavelength selection by a carefully specified narrow band interference filter. The source is pulsed at a regular frequency to produce an Infra Red carrier signal which is attenuated by Carbon Dioxide absorption and a detection system which converts this attenuation into an electrical output.

The electrical output from the transducer is then processed by additional electronic circuits to provide indication of concentration on an LCD Display and monitoring for Alarm conditions.

## 8 WARRANTY & REPAIR

### 8.1 WARRANTY

We provide the following Warranties for the Analox 1371:

- A 1 year sensor warranty.
- A 1 year electronics warranty.

In both cases the Warranty period runs from the date of our Invoice.

We warrant that the equipment will be free from defects in workmanship and materials.

The Warranty does not extend to and we will not be liable for defects caused by the effects of normal wear and tear, erosion, corrosion, fire, explosion, misuse, use in any context or application for which the equipment is not designed or recommended, or unauthorised modification.

Following a valid Warranty claim in accordance with the above, the equipment, upon return to us, would be repaired or replaced without cost or charge but in our discretion we may elect instead to provide to you which ever is the lesser of the cost of replacement or a refund of net purchase price paid as per our Invoice on initial purchase from us.

We shall have no liability for losses, damages, costs or delays whatsoever. We shall have no liability for any incidental or consequential losses or damages. All express or implied warranties as to satisfactory or merchantable quality, fitness for a particular or general purpose or otherwise are excluded and no such Warranties are made or provided, save as set out in this Clause 7.

In order to effectively notify a Warranty claim, the claim with all relevant information and documentation should be sent in writing to:

Analox Sensor Technology Limited  
15 Ellerbeck Court  
Stokesley Business Park  
Stokesley  
North Yorkshire  
TS9 5PT

Or by e-mail to : [info@analox.net](mailto:info@analox.net)

Or by Fax to : +44 1642 713900

We reserve the right to require from you proof of dispatch to us of the notification of Warranty claim by any of the above alternative means.

The equipment should not be sent to us without our prior written authority. All shipping and Insurance costs of returned equipment are to be born by you and at your risk. All returned items must be properly and sufficiently packed.

## **8.2 REPAIR**

Apart from routine Calibration and filter changes, there are no user serviceable parts inside the Instrument. In the event of any suspected malfunction, the user should check that all controls are in their correct position and if still experiencing problems, contact Scottish Anglo E.P. or their Agent.

SAEP offer service and training courses for customers' maintenance personnel and we strongly recommend that this instrument be serviced by an SAEP trained engineer, on a 6 monthly basis. Further details may be obtained by contacting our Customer Service Department.

### 8.3 TRANSDUCER REPLACEMENT

The Infra-Red Transducer (CO<sub>2</sub> Sensor) is constructed as a complete Module which permits rapid, relatively straightforward, field replacement, in the unlikely event of the Transducer requiring service.

**It is strongly recommended that this operation is only carried out by personnel who have attended a relevant training course at Scottish Anglo, or Qualified Electronics Engineer, with guidance from Scottish Anglo E.P. Service Department.**

The procedure is as follows:

- 1 Remove power from the Instrument and open the clear plastic door cover. Remove the 4 corner screws in the instrument front panel and carefully ease the front panel away from the housing. The panel may be temporarily 'parked' in the upper pair of guide slots, located on the side members of the housing.
- 2 The Transducer is located in the lower right corner of the housing. It is a metal box measuring approximately 115mm x 65mm x 30mm.
- 3 Remove the 6mm OD plastic tubes from the gas flow adaptor, mounted on the top of the Transducer. This operation is best carried out by inserting the jaw tips of a pair of thin nosed pliers, between the end of the plastic tube and the hexagonal white part of the flow adaptor and gently levering the tube off the barbed connector.
- 4 Separate the two halves of the 'In-Line' connector located on the right of the Transducer.
- 5 The Transducer is secured to the baseplate by 4 x No 8 Self tapping screws. Remove these screws and the Transducer may then be withdrawn from the Instrument housing.
- 6 Fit the replacement Transducer and re-assemble the Instrument.
- 7 Switch on the power supply to the Instrument and allow it to operate for about 30 minutes. Carry out a full Calibration routine as detailed in Section 5 of this manual.
- 8 The original Transducer should be returned to Scottish Anglo E.P. Ltd. for further investigation.

## 9 FAULT FINDING

The list below is intended to assist in tracing elementary faults, which can probably be corrected by the user or a Technician. It is not an exhaustive list of all possible conditions. If any difficulty is experienced, contact either the agent who supplied the Instrument or Scottish Anglo E.P. Ltd. Service Department, at the address shown on the front page of this manual.

| SYMPTOM   | CORRECTIVE ACTION  |
|---|--|
| No Display or Green Light                                   | Check Mains Supply is connected / Switched On<br>Check Instrument Fuse & Replace if necessary  |
| No Display Response to Gas whilst in normal operating mode. | Check that Pump is operating (Listen close to Instrument for Buzzing sound / feel slight vibration on Instrument Housing) If obviously not operating contact Agent or SAEP. Ltd.<br>Check any external tubing to the Instrument for blockage / kinks   |
| No Display response to Calibration Gas                      | Check Calibration Gas Cylinder is not empty and that the gas in the cylinder is Carbon Dioxide (CO <sub>2</sub> ).<br>Check the flow on the flowmeter is approximately 1 Ltr/Min. If still no response, carry out procedure detailed in Section 5.2.6 of this manual & contact Agent / SAEP. Ltd |
| Alarms not Functioning                                      | Check that the ALARM INHIBIT switch on the front panel is in the Right Hand position, and the 'INHIBIT' LED is not lit. Note that the Inhibit LED will operate for about 30 Seconds after switch-on.<br>Check the Alarm Set points as detailed in Section 4 of this manual.                      |
| 'FAULT' LED Illuminated                                     | 'ZERO' adjustment control incorrectly set (Too far Anti-clockwise)<br>Carry out Calibration procedure as detailed in Section 5 of this manual<br>If this does not correct the fault, contact Agent or SAEP. Ltd.   |
| 'O.RNG' LED Illuminated (Overrange)                         | Contact Agent / SAEP. Ltd.   |

**10 SPARES**

**10.1 CALIBRATION KITS**

| Instrument Range |   | Kit Part Number |
|------------------|---|-----------------|
| 0.5% FS          | - | SA7 D03 0P5     |
| 1.0% FS          | - | SA7 D03 1P0     |
| 2.0% FS          | - | SA7 D03 2P0     |
| 5.0% FS          | - | SA7 D03 5P0     |
| 10% FS           | - | SA7 D03 10P     |
| 20% FS           | - | SA7 D03 20P     |
| 100% FS          | - | SA7 D03 100P    |

**10.2 CALIBRATION SPARES**

Gases 20 Litre Cylinder (Disposable) Test Gas

|                             |   |             |
|-----------------------------|---|-------------|
| Pure Nitrogen -             |   | SA7 L20 01  |
| 0.5% CO <sub>2</sub> in Air | - | SA7 L20 130 |
| 1.5% CO <sub>2</sub> in Air | - | SA7 L20 131 |
| 4.0% CO <sub>2</sub> in Air | - | SA7 L20 132 |
| 10% CO <sub>2</sub> in Air  | - | SA7 L20 57  |
| 50% CO <sub>2</sub> in Air  | - | SA7 L20 133 |
| 100% CO <sub>2</sub>        | - | SA7 L20 134 |

Regulator to suit 20 Ltr Cylinder SA7 FLOWIN

**10.3 OPERATIONAL SPARES**

Pack of 5 Gas Filters 1000-1401

**Comment:**  
LAST

**Comment:**  
PAGE