



SERVOMEX  
**ANALYZERS**  
HIGH-PERFORMANCE GAS ANALYSIS



# SERVOPRO 1440D

## QUICK START MANUAL

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Language: UK English

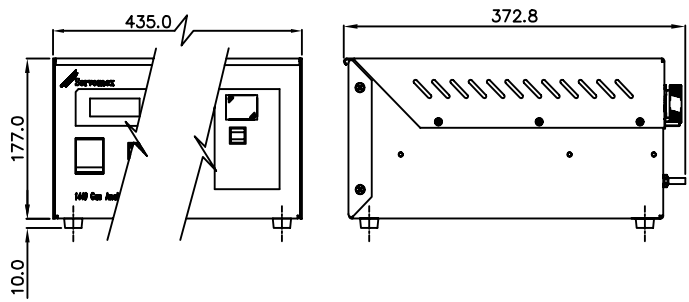
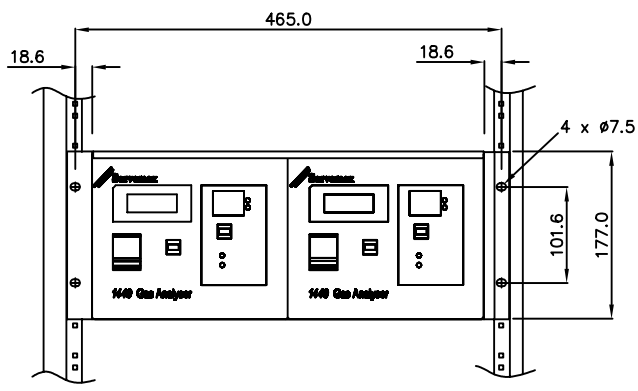
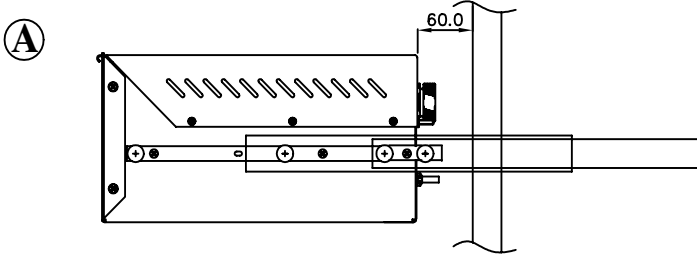


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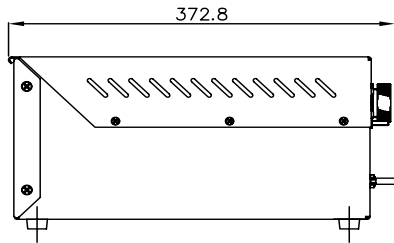
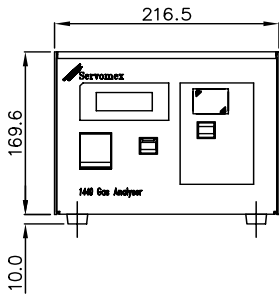
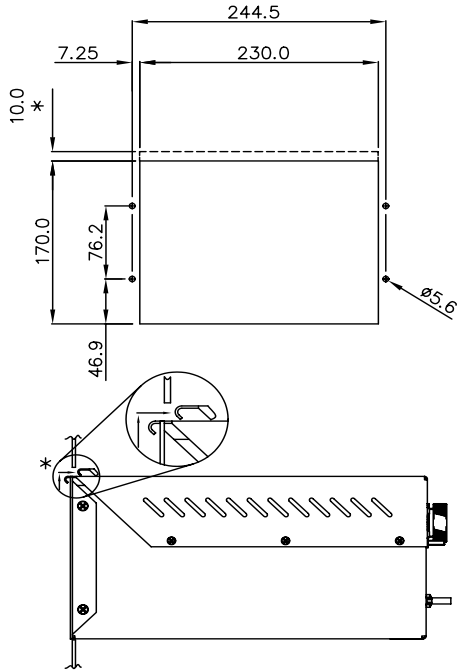
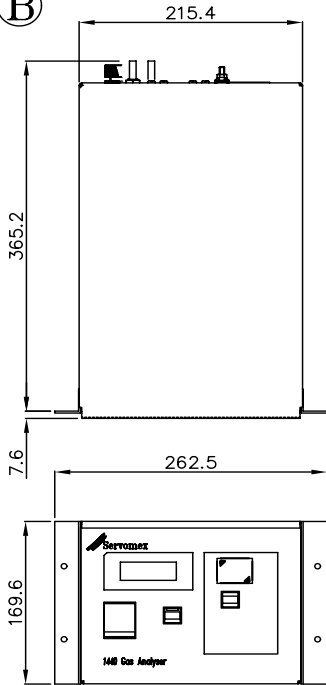
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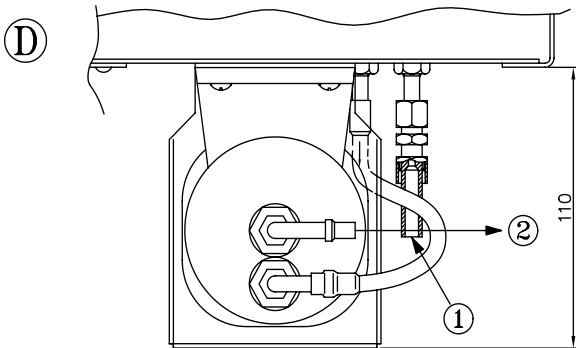
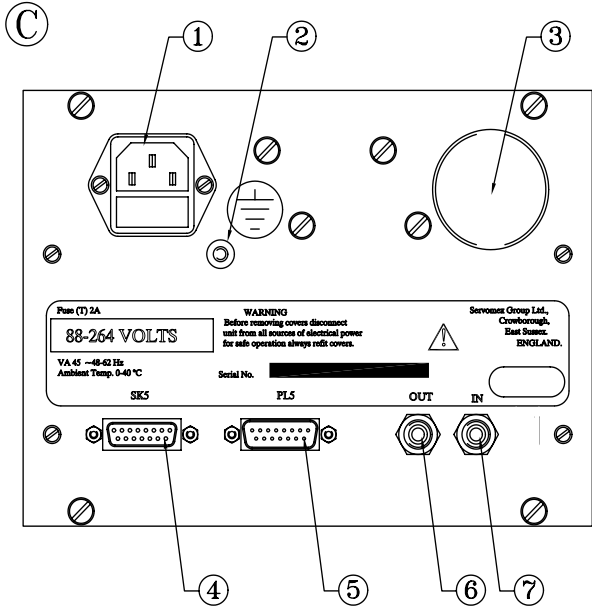


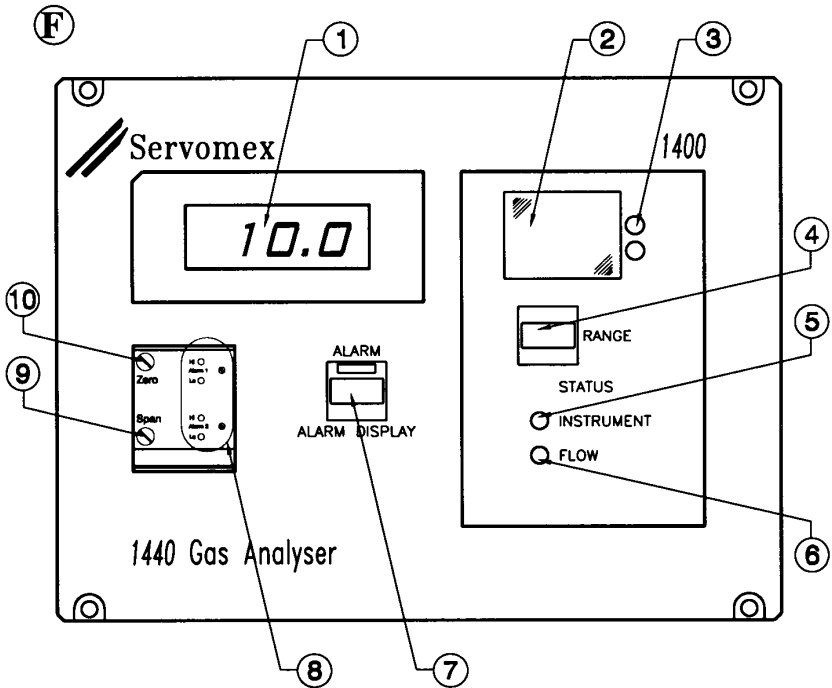
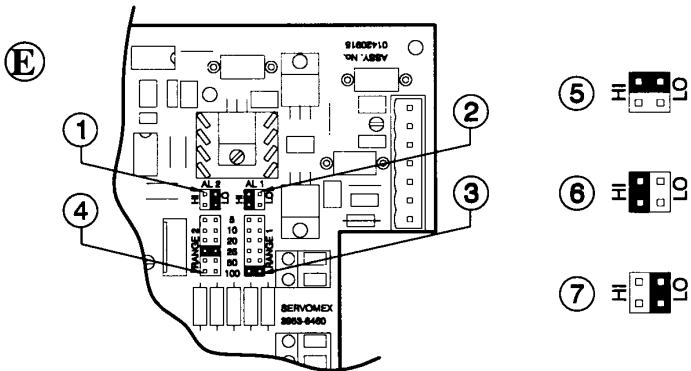
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# 1 INTRODUCTION

## 1.1 Warnings, Cautions and Notes

This publication includes **WARNINGS**, **CAUTIONS** and **NOTES**, which provide information relating to the following:

### **WARNINGS**

- Hazards which could result in personal injury or death.

### **CAUTIONS**

- Hazards which could result in equipment or property damage.

### **NOTES**

- Alert the user to pertinent facts and conditions.

## 1.2 Scope of this Manual

This manual covers installation, normal operation and routine maintenance on 1440 series analysers.

- Addresses for technical assistance and spares are given on the rear cover.
- A service manual is available for use by qualified personnel, part number 014400002D.
- For additional technical details refer to the Technical Data Sheet.

### **About this Manual**

Ref: 01440/003D/6

Order as part no.: 01440003D

## KEY TO FIGURES

### Figure A Mounting Details — Dual Unit (Dimensions in mm)

1 Details for 19" rack mounting

### Figure B Mounting Details — Single Unit (Dimensions in mm)

1 Panel cutout detail for panel mounting

### Figure C Rear Panel; Electrical and Sample Connections

1	IEC Power supply connection	5	Alarm relay output
2	Earth stud (M5)	6	Gas outlet, 6.4mm (1/4") OD
3	Automatic flow control access	7	Gas inlet, 6.4mm (1/4") OD
4	Voltage, current and range change O/P		

### Figure D Optional Back Pressure Regulator connection

1	Gas inlet, 6.4mm (1/4") OD	2	Gas outlet, 6.4mm (1/4") OD
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### Figure E Link Settings

1	Alarm 2 link location	5	Link for Alarm off
2	Alarm 1 link location	6	Link for Alarm HIGH (rising)
3	Range 1 link location	7	Link for Alarm LOW (falling)
4	Range 2 link location		

### Figure F Front Panel; Controls

1	3.5 digit LED display	6	Sample flow failure indicator
2	Range label (in integral pocket)	7	Alarm set button and LED
3	Range indicators	8	Alarm setting controls
4	Range selection switch	9	Span setting control
5	Instrument status indicator	10	Zero setting control

### **1.3 Unpacking**

- Remove the 1440 from its packing and inspect it for damage.
- If damage has occurred, inform Servomex or its agent immediately.
- Please retain all packing and shipping information for future use.

#### **NOTES**

- As standard, the Analyser will be supplied with Electrical Plugs and Sockets to facilitate user connections to the rear of the unit.

## **2 INSTALLATION**

### **2.1 Location**

The 1440 can be installed in a 19" rack (full width), flush panel mounted (single unit). or in a bench top case (with rubber feet). See Figure (A) for details of the full width 'double' analyser and Figure (B) for details of the single unit.

The location should be vibration free and subject to minimal fluctuations in ambient temperature. Avoid severe draughts.

There should be access to the rear of the analyser for gas and electrical connections.

## 2.2 Conditions for Safe Use

### WARNINGS

- The **01440D1STD** is suitable for installation in a safe non-hazardous area.
- The **01440D1STD** is not suitable for use with flammable or toxic sample gases. If your sample is such then the **01440D1FTX** Gas Analyser for Toxic/Flammable Samples must be used.
- The **01440D1FTX** is suitable for installation in a safe non-hazardous area.
- The **01440D1FTX** is suitable for toxic and flammable (but not oxygen enriched) samples to:
  - This analyser is not suitable for use with corrosive samples.
  - The auto-ignition temperature of each flammable gas in the sample must be greater than 200°C.

## 2.3 Electrical Installation

### WARNINGS

- The installer must be satisfied that the 1440 installation conforms to the relevant safety requirements, National Electrical Code and any other local regulations, and that the installation is safe for any extremes of conditions which may be experienced in the operating environment of the analyser.
- This appliance must be connected to a protective earth.
- The electrical installation must include a means of isolating electrical power by a switch or circuit breaker external to the analyser and within easy reach of the operator. It must be marked as the disconnecting device for the equipment.
- It is essential that only suitably trained and competent personnel are allowed to access hazardous live parts by removing or opening covers of the analyser.
- The interconnecting cables used for the mains supply, relay contact outputs and/or analogue output signals should be screened or provide equivalent protection.

### CAUTIONS

- The relay outputs are designed to provide 'volt free' contacts, connections to these terminals, on SK5 and PL5, should not exceed 110 V RMS or 28 V dc to earth when connected to associated equipment.

- Electrical power should be supplied at 88 to 264 V, 47 to 63 Hz. Connection is made to an IEC type connector.
- Do not exceed the maximum current output load impedance of 600 Ohms.
- All changeover contacts require a minimum of 100mA/5V DC.
- All electrical connections are made to the rear of the analyser. Refer to Figure (C) for details. Full specifications are given in the following table.

<b>Table 1. Power Connections</b>		<b>Terminal</b>
Electrical Power, 88V to 264Vac 47 / 63 Hz, 50VA maximum	Protective Earth	'E'
	Neutral	'N'
	Live	'L'

<b>Table 2. Alarm Connections</b>		<b>Terminal</b>
Concentration alarm 1 110Vac, 1A 28Vdc, 1A	Closes on Alarm 1 or Power Fail	PL5-4
	Opens on Alarm 1 or Power Fail	PL5-5
	Common	PL5-12
Concentration alarm 2 110Vac, 1A 28Vdc, 1A	Closes on Alarm 2 or Power Fail	PL5-7
	Opens on Alarm 2 or Power Fail	PL5-8
	Common	PL5-15
Flow Fail Alarm (01440D1STD Only) 110Vac, 1A 28Vdc, 1A	Closes on Flow Fail or Power Fail	PL5-1
	Opens on Flow Fail or Power Fail	PL5-2
	Common	PL5-9

<b>Table 3. Range Selected Output Connection</b>		<b>Terminal</b>
Range 1 selected 110Vac, 1A 28Vdc, 1A	Closes on Range 1 or Power Fail	SK5-2
	Opens on Range 1 or Power Fail	SK5-9
	Common	SK5-1

<b>Table 4. Analogue Output Signal Connection</b>		<b>Terminal</b>
0 to 1Vdc Oxygen or Carbon Dioxide output signal, dependant on range selected, (non-isolated), output impedance 470 Ohms typical	+ ve	SK5-15
	- ve	SK5-8
4 to 20 mA Oxygen or Carbon Dioxide output signal, dependant on range selected, (isolated), maximum load impedance 600 Ohms	+ ve	SK5-12
	- ve	SK5-5

### NOTES

- The 0-1 V output is ground referenced at the instrument. Any measuring system must be configured as Non-Referenced Differential to avoid ground loops being created.

## 2.4 Sample Gas Connection

### WARNINGS

- Verify that connections are leak free at full operating pressure before applying sample or calibration gases. As sample gasses may be toxic, flammable or asphyxiant, depending on analyser configuration.
- Consideration should be given to the toxicity, flammability and asphyxiant nature of the sample gas when selecting a vent location.

### CAUTIONS

- The sample gas must not be admitted to the analyser until a period of 1 hour has been allowed for warm up. This will prevent condensation of the sample in the measuring cell.
- The sample gas must not exceed the specified pressure or flow rate or damage could occur.
- When pressurising the sample system for the purpose of leak testing ensure that pressure is increased and decreased slowly. High internal flow rates created when the pressure is changed rapidly will damage the measuring cell.

### NOTES

- If an external sample pump is used it may be necessary to reduce pressure pulsing with a reservoir.
- The sample exhaust from the analyser should be vented freely to atmosphere. (See warning above)
- Sample inlet and outlet connection sizes and location are shown in Figure (C), for the 01440D1STD, Figure (D) for the 01440D1STD + BPR option and Figure (C) for the 01440D1FTX.
- The red 'flow' alarm indicator will flash if the sample flow falls below a satisfactory level and the relevant relay will go to the alarm condition. This alarm is automatically cleared when flow returns to normal.

<b>Table 5. 01440D — Sample Condition Requirements</b>		
<b>Dew Point</b>		At least 5°C below ambient temperature.
<b>Temperature</b>		Nominally at ambient temperature.
<b>Inlet / Outlet connections</b> <b>Note: do not restrict analyser vent</b>	<b>01440D1STD</b>	6.4mm (1/4") OD tube.
	<b>01440D1STD + BPR</b>	
	<b>01440D1FTX</b>	3.2mm (1/8") OD tube.
<b>Inlet Pressure</b>	<b>01440D1STD</b>	1 to 10psig (7 to 70 kPag).
	<b>01440D1STD +BPR</b>	17 to 20psia (120 to 140 kPaa).
	<b>01440D1FTX</b>	Typically 0.3kPag (30mmWG) at 200ml/min.
<b>Flow Rate</b>	<b>01440D1STD</b>	1 to 6l/min.
	<b>01440D1STD +BPR</b>	1 to 2l/min.
	<b>01440D1FTX</b>	USER LIMITED to 250ml/min MAXIMUM.
<b>Particulates</b>	<b>01440D1STD</b>	<3mm (micro meters), an internal, replaceable, 0.6mm filter is fitted as standard.
	<b>01440D1STD +BPR</b>	
	<b>01440D1FTX</b>	The user must fit an external filter of 0.6mm.
<b>Condition</b>	<b>01440D1STD</b>	Must not be flammable, toxic or corrosive, as well as being clean and oil free.
	<b>01440D1STD +BPR</b>	
	<b>01440D1FTX</b>	Must not be corrosive, as well as being clean and oil free.

## 2.5 Shut Down Procedure

Before removing power from the analyser, disconnect the sample gas and flush the analyser with dry nitrogen or good quality instrument air for 10 minutes.



### 3 SETTING UP

#### 3.1 Architecture

The Servomex 1440 Gas Analyser is configured from a series of modules. One of these is a dedicated oxygen unit (based on the paramagnetic principle) the others are based on an infrared bench. The ‘Infrared’ analyser ranges are specified at the time of order.

Servomex offer the following measurements in this ‘Infra Red’ configuration:

<b>Table 6. Infra Red Configurations</b>									
<b>01440D1STD and 01440D1FTX</b>					<b>Carbon Dioxide</b>				
<b>01520/...</b>	709	708	707	706	705	704	703	702	701
<b>Range 1, %</b>	0.25	0.5	1	2.5	5	10	25	50	100
<b>Range 2, %</b>	0.2	0.4	0.8	2	4	8	20	40	80
<b>01440D1FTX Only</b>					<b>Methane</b>				
<b>01521/...</b>	705	703	702	701					
<b>Range 1, %</b>	5	25	50	100					
<b>Range 2, %</b>	4	20	40	80					
<b>01440D1FTX Only</b>					<b>Carbon Monoxide</b>				
<b>01522/...</b>	707	706	704	703	702				
<b>Range 1, %</b>	1	2.5	10	25	50				
<b>Range 2, %</b>	0.8	2	8	20	40				

### 3.2 Configuration

The 1440D1STD is supplied configured as follows (refer to Figure (E)):

<b>(Link)</b>	<b>Parameter</b>	<b>Setting</b>
(AL 1)	Alarm 1	High = Nominally Full Scale
(AL 2)	Alarm 2	Low = Nominally Zero
Oxygen:	Range 1	0 – 100% Oxygen
	Range 2	0 – 25% Oxygen
Infra Red:	Range 1	Dependant on measurement option ordered, see section ‘3.1 Architecture’, above.
	Range 2	0 – 80% of Range 1

The ‘Infra Red’ range parameters must not be adjusted, however, to change other configuration parameters:

- Remove all sources of electrical power from the unit (including relay connections).
- Remove the units cover.
- Alarms and Ranges are set by links. These are located on the 01420915 control PCB towards the front of the unit, refer to Figure (E).
- The Alarm 1 and Alarm 2 may be configured to function as either HI, LO or OFF, refer to Figure (E).
- Oxygen Ranges may be selected from 0-5, 10, 20, 25, 50 and 100% Oxygen. With reference to Figure (E). Unless identical, Range 1 must be set higher than Range 2 in order to utilise the range labels supplied. The correct label should then be fixed to the label carrier (access pocket from top).
- Reassemble units.

#### NOTES

- When Alarms are set to the OFF position, the associated relays will effectively operate as ‘power failure’ alarms.

### **3.3 Alarm Set Point Adjustment**

- Open the hinged flip down panel below the analyser display — see Figure (F).
- Press and hold down the ‘Alarm’ button on the front panel; an LED beside one of the alarm setting controls will light continuously. Adjust this control until the desired alarm level is shown on the display.
- Release and press the ‘Alarm’ button again, an LED beside the other control will now illuminate. Adjust the alarm set point displayed to the desired level.

In the alarm condition, the red LED incorporated in the ‘Alarm’ button will flash. An LED beside the relevant alarm control will also flash, this will also indicate whether the alarm is configured to be a High or Low alarm. The relevant relay will also go into the alarm condition.

Alarms are cleared when the concentration returns to a non-alarming value.

### **3.4 Instrument Status Indicator**

The measuring transducer is heated. A yellow ‘Instrument’ indicator on the front panel (refer to Figure (F)) illuminates when power is first applied to the unit. This will remain on continuously during warm up. Once the transducer reaches temperature, the indicator will flash.

## 4 CALIBRATION

### 4.1 Zero and Span adjustment

The analyser should have been running for at least one hour before calibrating.

- To set the zero, introduce calibration gas (high purity nitrogen (>99.9%) recommended). Once the reading has stabilised, adjust the zero control (behind the flip down panel, see Figure (F), so that the display reads either 0.0 % oxygen or 0.0%, 0.00% or .000% depending on Infra red measurement full scale.
- To set the span, introduce span calibration gas, for oxygen units this can be good quality clean dry instrument air (nominally 20.9% oxygen), however a suitable certified calibration gas is essential for 'Infra Red' units. Once the reading has stabilised, adjust the span control (again, behind the flip down panel), see Figure (F), so that the display indicates the correct span value.

The frequency of calibration required will depend upon the operating requirement for accuracy and upon environmental conditions. The following is a guide, which can be modified in the light of operating experience in particular circumstances:

Oxygen: Weekly adjust the span; monthly adjust the zero then span

Infra Red: Weekly adjust the zero then span

## 4.2 The Effect of Background Gases on the Reading

The composition of the background gas in the sample may have an effect on the analyser reading. These effects can be compensated for, by either using the background gas as a zero or by offsetting the nitrogen zero point by the amount of error induced by the background gas. For 100% interference gases, on units zeroed on nitrogen, the errors are:

<b>Table 7. Background Gas Effects</b>				
<b>Interferent</b>	<b>% Effect on O<sub>2</sub> measurement</b>	<b>% Effect on CO<sub>2</sub> measurement</b>	<b>% Effect on CO measurement</b>	<b>% Effect on CH<sub>4</sub> measurement</b>
Carbon Dioxide (CO <sub>2</sub> )	-0.26	----	0.08	0.07
Carbon Monoxide (CO)	0.06	0.02	----	0.09
Methane (CH <sub>4</sub> )	-0.16	0.01	0.04	----
Nitrous Oxide (N <sub>2</sub> O)	-0.20	0.04	4.50	1.00
Ammonia (NH <sub>3</sub> )	-0.17	0.03	0.05	0.25
Argon (Ar)	-0.24	<p>A comprehensive list of the effects on the O<sub>2</sub> measurement, is available from Servomex, ref part no. 7986-0073.</p> <p>For more details on the effects background gasses on the Infra red measurements, please consult Servomex or your local supplier.</p>		
Helium (He)	0.32			
Krypton (Kr)	-0.54			
Neon (Ne)	0.17			
Nitric Oxide (NO)	42.96			
Nitrogen Dioxide (NO <sub>2</sub> )	16.0			
Xenon (Xe)	-1.02			

## 5 ROUTINE MAINTENANCE

Check / Replace filter elements, located in the Automatic flow control device or externally, at 3 month intervals.

### WARNINGS

- For the 01440D1FTX it is essential to check the analyser and associated sample lines/system for leaks (every 6 months is recommended period). MAX pressure that may be applied to each module is 10psig, however, this must be applied to both the inlet and outlet simultaneously to avoid damage to the measuring cell.

## 6 SPARES

The following spares are required to maintain normal operation of the analyser.

<b>Part Number</b>	<b>Description — 1440D1 Series</b>	<b>Quantity</b>
S1400990	AC supply fuse Kit 10 off (T) 2A (Used in single measurement units) 10 off (T) 3.15A (Used in dual measurement units)	1 pkt.
S1800985	AFCD filter element kit (10 off)	1 pkt.

To replace the AFCD filter element, carry out the following procedure:

- Undo the knurled screw cover of the AFCD to remove the filter element.
- Inspect the filter element and replace if necessary
- Refit the knurled filter cover.

A comprehensive list of part replacement procedures and spares, for use by qualified personnel, is available in the Service Manual, part no. 014400002D.

7 TECHNICAL SPECIFICATION

Parameter	Oxygen	Infra Red
<b>Accuracy (Intrinsic Error)</b>	±0.1% Oxygen	±1.0% Full Scale
<b>Repeatability (at the 1V output)</b>	±0.1% Oxygen	±1.0% Full Scale
<b>Linearity error</b>	±0.1% Oxygen	±1.0% Full Scale
<b>Zero Drift</b>	<±0.002% O <sub>2</sub> /hour	2% of Full Scale / week
<b>Span Drift</b>	<±0.002% O <sub>2</sub> /hour	1% of reading / day
<b>Ambient temperature coefficient, per 10°C (with back pressure regulation)</b>	±0.05% Oxygen or ±0.3% of reading* (0.025% reading/mbar)	±1.0% range or 3% of reading* (0.025% reading/mbar)
<b>Response time, T<sub>90</sub></b>	Typically less than 10 seconds	Typically less than 10 seconds
<b>At flow alarm trip level</b>	Approximately 50 seconds	Approximately 50 seconds
<b>Ambient Pressure coefficient</b>	Directly Proportional	0.15% reading/mbar
<b>Flow effect, over full inlet range</b>	<0.2% Oxygen	<1.0% reading

\*Whichever is the greater.

Parameter	Oxygen	Infra Red
<b>Ambient pressure range</b>	80 – 110 kPaa (0.8 – 1.1 bara)	90 – 110 kPaa (0.9 – 1.1 bara)
<b>(With back pressure regulation)</b>	80 – 108 kPaa (0.8 – 1.08 bara)	90 – 108 kPaa (0.9 – 1.08 bara)
<b>Material in contact with the sample:</b>	Platinum, nickel, borosilicate glass	Sapphire, epoxy resin
<b>All options</b>	Stainless steel, Viton	
<b>01440D1STD Only</b>	bonded glass fibre, nylon, neoprene, gold on silver, brass, monel, polypropylene, acetyl	
<b>Back pressure regulator</b>	Copper, PVC, PVDF, beryllium copper	
<b>Ambient temperature range :</b>		
<b>19" Rack mounted</b>	0 – 45 °C, 32 – 113 °F	
<b>Bench top case mounted</b>	0 – 40 °C, 32 – 104 °F	
<b>Relative humidity</b>	0 – 90 % non-condensing	
<b>Storage temperature</b>	–20 – 70 °C, –4 – 158 °F	
<b>Warm up time</b>	1 hour	
<b>Weight: Single unit</b>	5.5kg (12lb) typical	
<b>Double unit</b>	12kg (26lb) typical	
<b>Case rating</b>	IP 20 (IEC 529)	