EC900 Series

INDUSTRIAL PHYSICS

SYSTECH illinois

SERIES EC900 OXYGEN ANALYZERS

(Covers MK3 USB models)

OPERATION MANUAL

Version 5.7 *02nd Mar 2022*



Industrial Physics Product Integrity Limited
17 Thame Park Business Centre
Wenman Road
Thame
Oxfordshire
OX9 3XA

www.industrialphysics.com

Table of Contents

1.0 PREFACE 1
1.1 Important 2
2.0 INTRODUCTION 3
3.0 WARRANTY 4
3.1 Instrument Warranty 4
3.2 Measuring Cells Warranty 4
4.0 ISOLATION VALVE OPERATING ORDER 5
5.0 PRINCIPLE OF OPERATION 6
6.0 TECHNICAL SPECIFICATIONS 7
7.0 INSTALLATION 10
7.1 Instrument Installation 10
7.2 Gas Installation 11
7.3 Electrical Installation 13
8.0 USING THE INSTRUMENT 14
9.0 INSTRUMENT OPERATION 15
10.0 CHANGING PROGRAMME CODES 16
10.1 Front Panel Guide 17
10.2 Data Table Programmable Functions 18
11.0 PROGRAMME CODES 21
12.0 CALIBRATION 24
12.1 Calibration with Atmospheric Air 24
12.2 Calibration with Certified Gas 25
12.3 Automatic Calibration option 26
13.0 USB and RS485 COMMUNICATIONS 28
13.1 Installing the USB Driver Software 28
13.2 Installing the COMMS UTILITY SOFTWARE 29
13.3 Determining the installed Comms Port 32
13.4 Running the COMMS Utility Software. 34
13.5 Serial Commands For Use with the EC900 36
13.6 RS485 37
14.0 OPTIONAL FACILITIES 38
14.1 Analogue Outputs (Option) 38
14.2 Alarm Trip (Option) 38
14.3 Sample Pump (Option) 39
14.4 Internal Pressure Regulator to 30bar (Option) 39
14.5 Flow Alarm (Option) 39
14.6 Solenoid Shutoffs (Option) 39
14.7 Hydrogen Configuration (Option) 39
14.8 Autocalibration (Option) 39
14.9 Other Options 40
15.0 FAULT MESSAGES 40
16.0 REPLACING THE MEASURING CELL 42

16.1 Model 910, 911 & 912 42
16.2 Model 920, 921 & 922 43
16.3 Model 9X3 43
16.4 Resetting the Calibration Range and Life Counter 45

17.0 SPARE PARTS 46

18.0 SERIAL NUMBER SUFFIX DETAILS 48

Appendix 1 Drawing Number 900 176_C 49

Appendix 2 Drawing Number 920 043_C 50

Appendix 3 Drawing Number 900 180_C 51

Appendix 4 EU Declaration of Conformity 52

Revision History

Issue	Issue Date	Changes	By
1.1	09-05-2008	Current Release Version	Jon Dawson
2.0	18-08-2009	Format changes, updated some drawings	Nick Stuart
4.0	09-08-2010	Updated to the USB comms model	Nick Stuart
4.1	19-08-2010	Added 0-10V output details.	Nick Stuart
4.2	02-06-2011	Added details for mk 6 PCB, also corrected p16.	Nick Stuart
4.3	20-12-2011	Added info regarding Auto Cal initiation. Re: CI 4162 and SPn2# value.	Nick Stuart
4.4	25-04-2012	Clarified “Delay” for alarm settings. Ref CI 4176	Nick Stuart
4.5	24-08-2012	Amended the flowmeter part numbers	Nick Stuart
4.6	15-11-2013	Added Warranty and other information regarding cells. Updated Wall mount dimensions 920 043.	Bryan Cummings
4.7	5-02-2014	ECN 1404s, All RACE™ cell instruments now have dual life displays.	Bryan Cummings
4.8	5-10-2014	Added information for EExd sensor housing	Bryan Cummings
4.9	5-5-2016	Editorial, AR0213	Bryan Cummings
5.0	5-10-2016	ECN1608s, New increased warranty cells	Bryan Cummings
5.1	20-12-2017	ECN1716s, Fault alarm changes	Bryan Cummings
5.2	17-01-2019	ECN19006s, Removal of Ex housing option	Tim Keep
5.3	12-03-2020	ECN20006 Added internal pressure regulator option	Tim Keep
5.4	14-05-2020	ECN20039 Added EU Declaration of Conformity	Tim Keep
5.5	18-May-21	ECR1304211056 Updated EU DoC & Rebranding	Tim Keep
5.6	17-Jan-22	ECR 1401221641 Updated fault relay section	Arun Kannath
5.7	02-Mar-22	ECR 0102221148 Updated Serial Commands	Arun Kannath

1.0 PREFACE

The EC900 series of oxygen analyzers exist with a number of variations, with different cabinet types and different measuring cells, these variations are covered in this manual.

We are always trying to improve our product, of which this manual is part, so we would greatly appreciate any information you can give us of any difficulties you may encounter with the analyzer or the manual.



This symbol is known as the 'Crossed-out Wheelie Bin Symbol'. When this symbol is marked on a product it means that consideration should be given to the disposal of the product, parts or accessories. Only discard electrical/electronic items in separate collection schemes which cater for the recovery and recycling of the materials contained within. Your co-operation is vital to ensure the success of these schemes and for the protection of the environment.

1.1 Important

Please read this manual before attempting to install or operate the equipment.

The equipment should be electrically connected and grounded in accordance with good standard practice.

No responsibility is accepted by Industrial Physics
for accidents resulting from improper use of this equipment.

All service and technical enquiries are covered from our factories and service centres where we will endeavour to give a quick and helpful response to all queries.

Please see our website to find your nearest service centre and local representative.

www.industrialphysics.com

2.0 INTRODUCTION

The EC900 Series of instruments may be supplied in three types of cabinet/housing and may use any one of four measuring cells, suitable for different applications.

The instrument may also be fitted with other customer specified options.

Please refer to Table 1 below, for the configuration code and an explanation of the instrument numbering system.

When particular attention should be given in this manual to a particular configuration the paragraph will be preceded with a configuration specification i.e.

EC91x = Panel/Bench mounting

EC92x = Wall mounting

EC9x1 = Trace analysis

Series EC900 Oxygen Analyzers

Configuration	EC9	X	X
Cabinet - Mounting			
Panel or bench mounting		**1**	
Wall mounting IP66		**2**	
Rack mounting (*Note 1)		**3**	
Cell Type / Range			
% analysis			**0**
Trace analysis			**1**
Ultra-low trace analysis			**2**
RACE™			**3**

Table 1 Configuration codes

*** Note: 1** A rack mounting case is 19" wide, 4U high. This provides a housing suitable for 1 or 2 analyzers.

3.0 WARRANTY

3.1 Instrument Warranty

This Instrument is guaranteed for a period of one year from its delivery to the purchaser covering faulty workmanship and replacement of defective parts. This assumes fair wear and tear and usage specified on the data sheet. It does not cover routine calibration and housekeeping.

Warranty covers parts and labour on a “return to base” basis. Any on-site warranty visits may be chargeable in terms of travel and expenses.

We maintain comprehensive after sales facilities and the instrument should be returned to our factory for repair, servicing or routine calibration if this is necessary. Service agreements are available and can include routine maintenance at the customer’s site.

The warranty does not extend to sensors overexposed to oxygen during the warranty period, or to those whose elements have been damaged by surges of undue pressure.

The type and serial number of the instrument should always be quoted, together with full details of any fault.

3.2 Measuring Cells Warranty

Please note the Warranty code against the part number of the measuring cell installed by referring to the Spare Parts section.

Code	Warranty	Typical Life and Notes
A	6 Months from the date of supply.	The measuring cell should have a life of 4+ years. The life is very much dependent on the moisture in the gas stream. The more humid the gas (as long as it is non-condensing) the longer the life. The primary reason for premature failure is exposing the cell to air, or to subject the cell to high pressure.
B	18 months from the date of supply.	Cells measuring Oxygen concentrations of less than 10% should have a lifetime of 5+ years. The life is very much dependent on the moisture in the gas stream. The more humid the gas (as long as it is non-condensing) the longer the life. The primary reason for premature failure is exposing the cell to high pressure. In typical applications in RACE instruments where frequent disturbances of the inlet gas see high Oxygen the measuring cell should have a life of 3+ years, provided that the cell is used as stipulated in the operation manual.
C	36 months from the date of supply	The measuring cell should have a life of 5+ years.
D	Cells have a full warranty of 18 months from the date of supply.	The life is very much dependent on the moisture in the gas stream. The more humid the gas (as long as it is non-condensing) the longer the life. The primary reason for premature failure is exposing the cell to air for extended periods, or to subject the cell to high pressure. The expected life of the measuring cell should be 4+ years, provided that the cell is used as stipulated in the operation manual.
WARRANTY EXCLUSION		
In some instances, cells do not achieve their expected lifetime, failing early due to misuse: isolation valves on the analyser left open causing ingress of high oxygen levels, or cell rupture caused high pressure being applied across the cell. Misuse of the measuring cell in this or any other way as outlined in this manual is not covered by the warranty.		

3.2 Measuring Cells Warranty - continued

NOTE

Most cells that do not last their expected lifetime fail because:-

1. The isolation valves on the analyzer are left open, causing ingress of high ambient oxygen levels.

2. The cell has been ruptured caused by high pressure, usually caused by the isolation valves being operated in the wrong order. Ruptured cells can be confirmed by electrolyte solution seeping from the inlet/outlet pipes or by blackening of the same pipes.

4.0 ISOLATION VALVE OPERATING ORDER.

For analyzers sampling from pressurised supplies:

When opening the cell, open the OUT valve first, followed by the IN valve
When closing, close the IN valve first, followed by the OUT valve.

For analyzer fitted with a pump:

When opening the cell, open the IN valve first, followed by the OUT valve
When closing, close the OUT valve first, followed by the IN valve.

For EC9x3 units which only have one valve on the rear panel:

For analyzers sampling from pressurised supplies:

Ensure the valve is closed. Open the valve sufficiently to have a flow of approximately 50-200 cc/min. Ensure the sample outlet is at atmospheric pressure.

For analyzers fitted with a pump *without* pressure regulator option:

Do not connect the sample inlet or outlet to any source of pressure greater than 0.5barg. The minimum sample inlet pressure is -0.3barg. Open the flow valve to obtain a flow of 50-200 cc/min. Note that the higher the vacuum of the sample inlet pressure it will be more difficult to obtain a high flow.

For analyzers fitted with a pump *and* pressure regulator option:

The pressure regulator option SPN 0905-0001 protects against inlet pressures up to 30barg (435psig) while still allowing the pump to function. The inlet can therefore be connected to pressures between -0.3barg and 30barg. Open the flow valve to obtain a flow of 50-200 cc/min. Note that the higher the vacuum of the sample inlet pressure it will be more difficult to obtain a high flow.

MISUSE OF THE CELL IS NOT COVERED BY WARRANTY

5.0 PRINCIPLE OF OPERATION

The detector contains an anode, electrolyte and an air cathode to which the diffusion of Oxygen is limited by a diffusion barrier. At the air cathode Oxygen is reduced to Hydroxyl ions which in turn oxidise the metal anode.

The following reaction takes place at the cathode:

$$O_2 + 2H_2O + 4e \rightarrow 4(OH)^-$$

and at anode

$$2Pb + 4(OH)^- \rightarrow 2Pb(OH)_2 + 4e$$

and the complete chemical reaction is represented by

$$2Pb + O_2 + 2H_2O \rightarrow 2Pb(OH)_2$$

6.0 TECHNICAL SPECIFICATIONS

Measuring Ranges: (All Auto-ranging)

EC9x0	0.3% - 100%
EC9x1 EC9x3	0.1ppm - 30%
EC9x2	0.01ppm - 1%

Calibration Ranges:

EC9x0	0.3% – 100%
EC9x1 EC9x3	0.1ppm – 30%
EC9x2	0.01ppm – 1%

Response Time:

EC9x1	90% indication in less than 30 seconds
EC9x0 EC9x2	90% indication in less than 30 seconds
EC9x3	Air to less than 20ppm in 2 minutes

Accuracy:

EC9x0 EC9x3	± 0.2% of calibrated value at 20° C ± 1% of calibrated value over temperature range
EC9x1	>10ppm ± 2% of reading at 20° C ± 5% of reading over temperature range <10ppm ± 2% of reading +0.4ppm at 20° C ± 5% of reading + 0.6ppm over temperature range
EC9x2	>10ppm ± 2% of reading at 20° C ± 5% of reading over temperature range <10ppm ± 2% of reading +0.4ppm at 20° C ± 5% of reading + 0.6ppm over temperature range

Suitable Gases:

EC9x0	All gases except corrosive gases
EC9x1 EC9x2 EC9x3	All gases except corrosive and/or acidic gases

Display:	4 Digit high visibility LED
Sample connections:	1/8” OD compression (Swagelok)
Ambient Temperature:	-5°C to 50°C (Instrument and sample gas)
Sample Gas Inlet Pressure:	Standard: 3.5 – 29 PSI (0.25barg – 2barg) 0905-0001 Option: 3.5 – 435psig (0.25barg – 30barg) Pumped: -4.35psig minimum to max (either 29psig or 435psig depending on standard or 0905-0001 option)
Power:	90-260 VAC, 40VA
Area Classification:	General Purpose
Communications:	USB 1.0 / 2.0 and RS485
Dimensions:	Refer to the drawing B900 176 at the rear of the manual Appendix 1.
Fault Alarm	Single pole rated: 200VDC Max, 0.5A Max, 10W Max.

OPTIONS

High / Low Alarms:	Two with volt free c/o contacts fully configurable over the complete oxygen range. Contact rating 3A @ 250VAC/30VDC
Analogue outputs:	Software configurable over the entire oxygen range for either: Voltage: 0-10VDC isolated Current: 4-20mA isolated Current 0-20mA isolated Option to have three separate channels.
Flow Alarm:	Thermal Mass Flow sensor
Auto Calibration:	Allows connection to a cylinder of gas with a certified level of oxygen. Analyzer will correct to recorded level at programmed intervals.
Bypass Flowmeter:	Improves the response time of the analyzer due to sample transport lag by adding a fast side stream.
Sample Pump	Allows the instrument to be used in situations where there is no pressure to the sample gas.
Stainless Steel Plumbing	Allows the instrument to be used in situations where the sample gas will react with either brass or copper fittings and pipes. Note: stainless steel flowmeter and regulator will also be required.

Pressure Regulator	For use in applications where the inlet pressure is above 2 bar or there are fluctuations in pressure.
0905-0001 Internal Pressure Regulator	Internal Pressure Regulator to 30bar (for non-corrosive gases).
Solenoid Shutoffs	Isolates the analyser at power down.
Hydrogen Configuration	For use in applications where any concentration of hydrogen is present in the sample stream.
Other Options	Particulate filters, Panel Mount brackets, Optional fittings. Please contact Industrial Physics for more details.

7.0 INSTALLATION

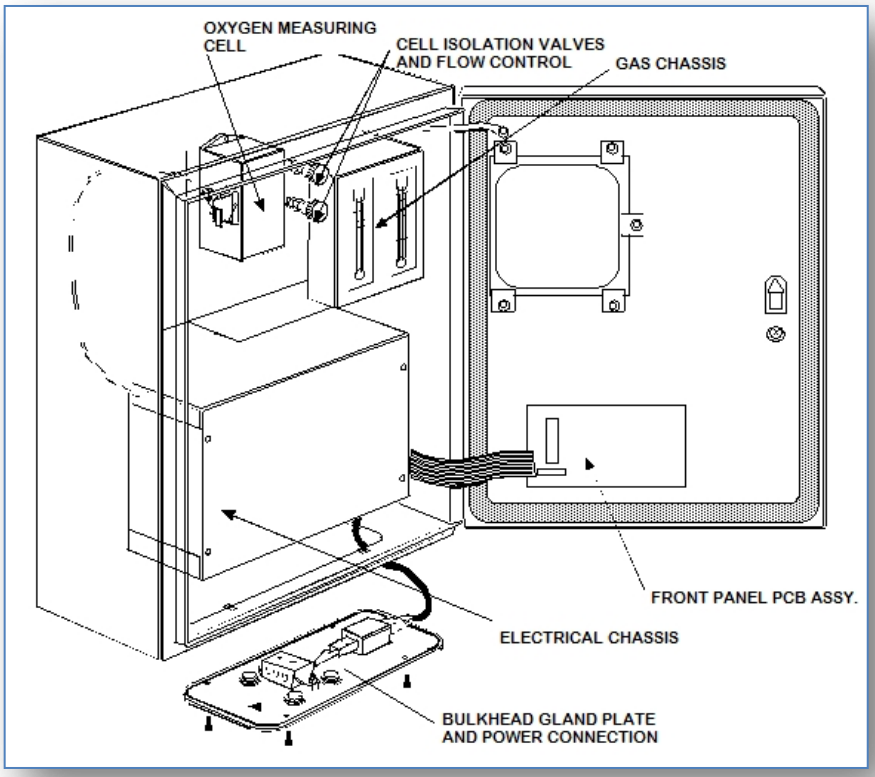
7.1 Instrument Installation

The instrument is offered in bench/panel mount, IP66 wall mounting or rack mount. Dimensional drawings should be referred to at the rear of the manual.

Please read this manual thoroughly before connecting or applying power to the unit. Industrial Physics cannot be responsible for problems arising from improper connection or operation.

Panel mount brackets may be ordered with the bench/panel mount analyzer.

A general view of the Model EC920 weatherproof instrument follows:



7.2 Gas Installation

The instrument can be used to measure different oxygen concentrations. If the application is the measurement of percent oxygen, then the instrument may be connected with plastic/nylon/ptfe tubing otherwise all fittings and sample lines to the instrument should be high integrity so ensuring no ambient air is allowed to leak into the system.

It is recommended that stainless steel or copper lines be used for the sample inlet.

If a vent line (sample outlet) is fitted, then this may be of nylon tubing or similar, but should be installed so that no back pressure may build up due to a restricted outlet.

The inlet and outlet pipe sizes are 1/8-inch compression (standard).

The two valves on the gas chassis serve to seal off the instrument from the sample and the sample inlet valve will also serve as a flow regulator valve.
Note: Instruments of type 9X3 are fitted with one valve only, see Section 4.0 Isolation Valve Operating Order.

When a pressurised supply of sample gas has been connected to the instrument, the cell outlet valve should be opened fully, and then the sample inlet valve should be opened sufficiently to obtain a desirable flow: approximately 100 - 150ml/min will be adequate.

For analyzers fitted with the pump or 0905-0001 Pressure Regulator options, the cell inlet valve should be opened fully and the cell outlet valve opened sufficiently to obtain 100 - 150 ml/min.

Too high a flow rate will pressurise the measuring cell and cause an error in the reading for some time.

Conversely, the instrument should be disconnected from the sample by reversing the above procedures. In other words at no time should the cell be pressurised with the sample inlet pressure, or by the pump. Failure to follow this procedure may result in irreparable damage to the cell.

Important

EC9x1 **EC9x2**

Sample lines and upstream pressure regulators should be thoroughly purged before connecting to the analyzer. If a bypass flowmeter and adjustment valve has been fitted to the instrument, then the purging can be achieved easily before the isolation valves are opened

EC9x3

This instrument has one valve on the rear panel:

For analyzers sampling from pressurised supplies:

Ensure the valve is closed. Open the valve sufficiently to have a flow of approximately 50-200 cc/min. Ensure the sample outlet is at atmospheric pressure.

For analyzers fitted with a pump *without* pressure regulator option:

Do not connect the sample inlet or outlet to any source of pressure greater than 0.5barg. The minimum sample inlet pressure is -0.3barg. Open the flow valve to obtain a flow of 50-200 cc/min. Note that the higher the vacuum of the sample inlet pressure it will be more difficult to obtain a high flow.

For analyzers fitted with a pump *and* pressure regulator option:

The pressure regulator option SPN 0905-0001 protects against inlet pressures up to 30barg (435psig) while still allowing the pump to function. The inlet can therefore be connected to pressures between -0.3barg and 30barg. Open the flow valve to obtain a flow of 50-200 cc/min. Note that the higher the vacuum of the sample inlet pressure it will be more difficult to obtain a high flow.

Pressure Regulation

There is no need to regulate the pressure upstream from the analyzer unless it is either above 29psi (2 Bar) or can fluctuate wildly, thereby changing the flow through the instrument. If one is measuring low ppm oxygen and a pressure regulator is necessary, then only a high-quality regulator will suffice (see spare parts.)

If however, the pressure of the sample gas is below 3.5psi (0.25 Bar) and is not enough to pass a sample through the analyzer, then a pump will be required and the same comments are applicable as above. Consult Industrial Physics for advice.

7.3 Electrical Installation

EC91x **EC93x**

The instrument is operated from AC line power, voltage of between 90 and 260 VAC, 50 – 60 Hz. Automatically sensed by the analyzer.

The IEC standard cable supplied should be connected to a captive plug with an integral earth connection and wired to a fused supply, as follows:

Brown to Live
Blue to Neutral
Green/Yellow to Earth

Note that the cartridge also contains a fuse. This fuse must be installed to ensure proper operation of the instrument. It is rated 2A @ 250V, slow-blow type. Replace only with fuses of equivalent ratings.

EC92x

Connect power in accordance with the label on the chassis.

DO NOT SWITCH ON UNTIL YOU READ THE NEXT SECTION – USING THE INSTRUMENT

8.0 USING THE INSTRUMENT

Start-Up

1. Ensure the sample gas lines have been connected and purged with the advice given in section 7, Installation.

2. Ensure that the sample pressure is within the specification limits.

3. Ensure the power supplied is correct to the configuration.

4. Apply power. All segments of the LED's on the display will light and then read the software version i.e. C2.18. If there are any faults the display will alternate between a display of oxygen and the fault message. Refer to the Section 15 for explanation of fault messages.

9.0 INSTRUMENT OPERATION





The instrument is controlled through the four-digit keypad and the LED display. Control is also possible via the USB communication port. Some parameters can only be set using the USB connection. See the section on Software and the USB port

In measurement mode the instrument displays the oxygen concentration of the sample gas. The display will auto range dependent upon the measured gas with ppm or % indicated by the LED's to theright of the digital display

To access programming mode, press the menu button on the 4-digit keypad



The LED above the button will switch on to indicate programming mode and the digital display will indicate the selected function. The menu button is used to scroll through the available parameters. When selected the display briefly shows the parameter name and then displays the current value. If no button is pressed for 5 minutes, the instrument will return to measurement mode.

10.0 CHANGING PROGRAMME CODES

Changing the programme codes in order to set up alarms, analogue outputs or other functions is simple. There are two 'pages' of information.

Page 0 contains all the functions that the user may want to change frequently, such as setting Channel 1 analogue output from 0-100ppm to say 0-10ppm.

Page 1 functions are those which will only need to be set up once on commissioning, such as setting whether the type of analogue output for Channel 1 is 4-20mA or 0-20mA.

Page 1 functions are password protected. The factory default password is 1234.

To enter page 0 functions, as displayed in 'Data Table Programmable Functions' ,

Press the 'programme' button 

The led above it will light and the display will briefly read PAGE, then 0 (to indicate you are in page 0). Press the 'programme' button again and the display will read AL1 briefly then the value. As you can see from the data table what functions are available depend on the type of instrument and the configuration.

Every time the 'programme' button is pressed a new function will be displayed briefly and then the value for that function. Note - some functions are 'read only'.

Continual pressing of the 'programme' button will eventually show –O2- and this signals the end of the Programming mode and the instrument is returned to measurement mode.

To enter page 1 functions, press the 'programme' button 

The display will briefly read PAGE then 0 (to indicate you are in page 0).

Now press 

Which is the 'digit select' button, and the display will flash.

Now press the 

Which is the 'digit Increment' button to change the display from 0 to 1.

Now press the 'enter' button, 

The display will briefly read PAS? And then 4 digits. To access page 1 you must enter a correct password. At this point the display will read 0000 or the last 4 digits entered by another user. The factory set password is 1234 so press the 'enter' button to acknowledge this number. The display will show YES, for a correct password or NO if incorrect. If you have the correct password then you will see functions of the page 1.

Note, to get out of page 1, back to page 0 and then to return to the measurement mode you must keep pressing the programme key until you get to the PAGE function and change the code from 1 to 0 using the method shown above.

10.1 Front Panel Guide

COMPONENT	FUNCTION	OPERATION
 Program Scroll	Used to scroll through the front panel menu functions.	Press to select the required data. First press displays the function code. After 1 second the data relating to the code is displayed. If the key is pressed before 1 second then the next function code is shown. Continue to press the button until all programme values have been accessed and -O2- is shown when the display will revert to the measurement of oxygen.
 Digit Select	Selects display digit to be changed.	Selection is indicated by flashing digit, first press selects D1 and successive presses select remaining digits, decimal point and % and ppm LED's.
 Digit Increment	Increments selected display digit.	Each press steps selected digit through complete numerical range. Cycles decimal point position. Toggles ppm and % LED's
 Enter/Reset	Enters new data into memory for that function.	Press once to reset the display, after 1 second the display shows STORE to indicate it has accepted the entry (otherwise it will show ERR) or other fault message.
D1 to D4	Displays 0 to 9 and/or decimal point.	Display set by selecting appropriate digit, then digit increment.
PGM LED	When on, indicates instrument in program mode.	
ALARM 1 LED	Indicates Alarm 1 status.	Illuminated indicates Relay 1 de-energised and in alarm condition.
ALARM 2 LED	Indicates Alarm 2 status.	Illuminated indicates Relay 2 de-energised and in alarm condition.
FAULT LED	Indicates fault alarm status.	Illuminated indicates fault relay energised and in alarm condition.
%	Displayed measured value is % oxygen by volume.	
ppm	Displayed measured value is parts per million by volume.	

10.2 Data Table Programmable Functions

There are two pages of programme functions. Page 0 are functions that the operator may want to change frequently, for example alarm trip levels and analogue output scales. Page 1 functions require a password to enter and have been arranged so that they will normally only require to be set up on commissioning.

A full description of the Programme Codes can be found in Section 11.

10.2.1 PAGE 0 Functions

DISPLAY	FUNCTION
PAGE	Can be 0 or 1 indicating which page to move to.
AL1*	Sets the numerical value for the first alarm point and % or ppm.
AL2*	Sets the numerical value for the second alarm point and % or ppm.
OPH1*	Sets the analogue output high value for ch. 1
OPL1*	Sets the analogue output low value for ch.1
OPH2*	Sets the analogue output high value for ch. 2
OPL2*	Sets the analogue output low value for ch.2
OPH3*	Sets the analogue output high value for ch. 3
OPL3*	Sets the analogue output low value for ch.3
SPn1 #	Shows read only value of span for cell 1 (ppm) normal value is approximately 0.280
SPn2 #	Shows read only value of span for cell 2 (%) normal value is approximately 0.3
SPHi **EC9x3**	Adjusts the calibration high point to the correct value to agree with the plant gas, air or certification cylinder. The gas should be in the range 1%-25%.
SPLo **EC9x3**	Adjusts the calibration low point to the correct value to agree with the plant gas, air or certification cylinder. The gas should be in the range of 10-1000ppm.
CAL **EC9x0** **EC9x1** **EC9x2**	Sets the calibration of the analyzer to the correct value for a known sample gas, plant gas, air or certified cylinder.
ACAL*	Sets the O_2 value for the autocalibrate function.
LIFEL	For all RACE™ cells, this shows the remaining PPM cell lifetime as a percentage.
LIFEH	For all RACE™ cells this shows the remaining % cell lifetime as a percentage.
-O2-	Final message before the instrument reverts back to oxygen measurement.

***** These functions will only be displayed and operable if the option has been purchased.
# Should you require technical assistance, please note these values for diagnostic purposes.

10.2.2 PAGE 1 Functions

DISPLAY	FUNCTION
OL*	Sets the configuration of alarm 1 and alarm 2, i.e. high/low, low/high, low/low or high/high. Also sets whether the alarms are latched or unlatched.
ALHLD*	Should the instrument be configured with alarms and automatic calibration then with this function a hold can be set on the alarms for the duration of the autocal and for a further five minutes until the process settles down to equilibrium.
ANHLD*	Should the instrument be configured with analogue outputs and automatic calibration then with this function a hold can be set on the analogue outputs for the duration of the autocal and for a further five minutes until the process settles down to equilibrium.
ANCH1*	Sets the configuration of the Analogue output for channel 1. Can be 0 = 4-20mA, 1= 0-20mA or 2=0-10V.
ANCH2*	Sets the configuration of the Analogue output for channel 2. Can be 0 = 4-20mA, 1= 0-20mA or 2=0-10V.
ANCH3*	Sets the configuration of the Analogue output for channel 3. Can be 0 = 4-20mA, 1= 0-20mA or 2=0-10V.
GAS	Sets the molecular weight of the carrier (background) gas.
FLOAL*	Sets the flow in cc/min below which the instrument will trigger a fault alarm.
Acd*	Sets the automatic unattended delay time for the autocalibrate function. A display of 0 shows the feature is switched off. Units are hours.
PASS	Sets the password to enter Page1 of the menu. Factory delivered 1234. It is recommended that if changed a note is made.
PAGE	Can be 0 or 1 indicating which page to move to.
PUnP	Switches on or off the internal pump. 0 = OFF, 1 = ON

* **T**hese functions will only be displayed and operable if the option has been purchased.

11.0 PROGRAMME CODES

OL This function returns a two digit code to read and set up the alarm configuration.

The left-hand digit sets whether alarms are high or low. See table below.

DIGIT 1	FUNCTION	
	ALARM 1	ALARM 2
0	Low	Low
1	High	Low
2	Low	High
3	High	High

The right-hand digit sets up whether the alarms are latched or unlatched.

DIGIT 2	FUNCTION	
	ALARM 1	ALARM 2
0	Unlatched	Unlatched
1	Latched	Unlatched
2	Unlatched	Latched
3	Latched	Latched

With unlatched alarms, the relay and LED will only change over for the duration of the alarm condition. For unattended operation it may be required for the operator to know that the analyzer had seen an alarm condition, even though the measured value was now normal. Latched alarms remain on until manually or remotely reset. When an alarm is set to Latched the LED will be on when in alarm condition, should the measured value go into a non-alarm condition, then the LED will flash to show that it had been in an alarm condition. (Note: the contacts on the relay will remain switched). Simply pressing the ENTER button will reset the alarm assuming the oxygen concentration has returned to a non-alarm condition. This can also be remotely reset using a USB Communications command.

Alarm relays are energized in the normal (non-alarm) condition and will change state upon the alarms condition being met or by removing power from the analzyer.

OPHx Where x=1, 2, or 3. The level of oxygen corresponding to the maximum level of the analogue output may be set in this mode. However, certain restrictions apply to different configurations.

EC9x0	not less than 1%
EC9x1 **EC9x3**	not less than 10ppm.
EC9x2	not less than 1ppm.

ACD If the auto-calibrate option is fitted, every x hours the calibration gas will automatically be fed to the measuring cell and after a few minutes the analyzer will self calibrate. ACD is set in hours. Auto calibrating on a weekly basis would mean an Acd of 168 hours. A setting of 0 turns the feature off.

LIFE The value shown is an approximation of the operational lifetime left in the cell in percent. A figure of 50 would mean that half of the life of the cell had been used. If the instrument was in servicefor 2 years, then the cell would last for approximately another 2 years. For RACE™ type instruments which utilise two measuring cells LIFEL shows the remaining life of the ppm cell and LIFEH shows thelife of the % cell.

GAS With some configurations the balance/background gas will have an effect on the calibration ofthe analyzer. An instrument set up correctly to measure oxygen in nitrogen will not read correctly on oxygen in argon. This calibration factor is due to the molecular weight of the background gas. Setting and changing the gas factor to the correct molecular weight for the background gas will always make the analyzer read correctly. The table below gives some common molecular weights; other gas molecular weights can be found from reference books.

GAS	MOLECULAR WEIGHT
Nitrogen	28.02
Argon	39.91
Helium	4.0
Hydrogen	2.02
Sulphur Hexafluoride	146.0
Ethane	30.07
Ethylene	28.05
Propane	44.0
Methane	16.04

Gas mixture molecular weights can be ascertained by a direct relationship,
i.e. a gas background of 60% helium and 40% argon will be
(0.6 x 4.0) + (0.4 x 39.91) = 2.4 + 15.96 = 18.36

ANCHx The analogue outputs are software configurable and the can be set for Voltage 0-10Volts, Current loop, 4-20mA or 0-20mA.

Set the output to the table below:
Note that each output is independent and can be set for any output type.

DIGIT	OUTPUT TYPE
0	4-20mA
1	0-20mA
2	0-10 Volts

PASS Used to enter into Page 1 of the programme menu. Here is where all the parameters for commissioning will be set.
The factory configuration password is 1234. Be sure to make a note should you want to change the password.
Should the password be lost then the password 1111 will always gain entry.

ALHLD Should the instrument be configured with alarms and automatic calibration then with this function the alarms can be suppressed for the duration of the autocal and for a further five minutes until the process settles down to equilibrium.
To turn the feature on change the code from 0 to 1. Factory configuration is 0 (off).

ANHLD Should the instrument be configured with analogue outputs and automatic calibration then with this function the analogue outputs can be suppressed for the duration of the autocal and for a further five minutes until the process settles down to equilibrium.
To turn the feature on change the code from 0 to 1. Factory configuration is 0 (off).

12.0 CALIBRATION

Calibration should be carried out using a gas which is in the same range as the gas that is being analysed.

For applications in the percentage range, the calibration may be carried out using atmospheric air.

12.1 Calibration with Atmospheric Air

EC9x0 **EC9x1**

1. Set up the instrument such that atmospheric air is circulating through the instrument, either with a pump or compressed air. Make sure the pressure is the same as the sample gas.
2. Enter the set-up mode by pressing  on the front panel of the instrument.
3. Once in the CAL mode the default value is 20.9%
4. Enter the CAL mode by pressing 
5. By pressing the ENTER button the instrument will automatically reset itself to 20.9% and continue to measure the oxygen content of the air
6. Continue pressing  to return to oxygen measurement. See Front Panel Guide

EC9x3

1. Set up the instrument such that atmospheric air is circulating through the instrument, either with a pump or compressed air. Make sure the pressure is the same as the sample gas
2. Enter the set-up mode by pressing  on the front panel of the instrument
3. Once in the SPH1 mode the default value is 20.9%
4. Enter the CAL mode by pressing 
5. By pressing ENTER the instrument will automatically reset itself to 20.9% and continue to measure the oxygen content of the air
6. Continue pressing  to return to oxygen measurement. See Front Panel Guide

12.2 Calibration with Certified Gas

EC9x0 **EC9x1** **EC9x2**

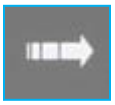
1 Connect the certified gas to the sample port ensuring the same pressure as the sample gas, in order to obtain the same flow rate as the sample gas, allow the reading to stabilise.

2 Enter the SET-UP mode by pressing 

3 Change the CAL value from the default to the value printed on the certification label on the cylinder, making sure you have changed the %/ppm LED, if appropriate

4 Pressing the ENTER button  will force the display to the value set for the certified bottle.

5 Continue pressing  To return to oxygen measurement. See Front Panel Guide.

Note:- If the CAL value is correct press  then press

 to calibrate at that level

EC9x3

1 Connect the certified gas to the sample port ensuring the same pressure as the sample gas, in order to obtain the same flow rate as the sample gas, allow the reading to stabilise

2 Enter the SET-UP mode by pressing the programme button  on the front panel of the instrument

3 If the certified gas is above 2,000ppm enter the value in SPHi. If it is below 2,000ppm enter the value in SPLo, making sure you have changed the %/ppm LED, if appropriate

4 Pressing the ENTER button  will force the display to the value set for the certified bottle

5 Continue pressing the  button to return to oxygen measurement. See Front Panel Guide

Note:- If the CAL value is correct press  then press

 to calibrate at that level.

12.3 Automatic Calibration option

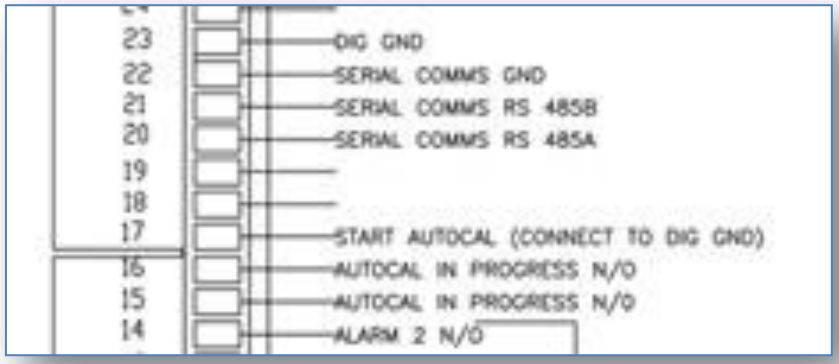
Automatic calibration can be initiated in two different ways. Either automatically after a pre-determined interval or initiated by a control signal.

1. Connect the certified gas to the 'cal gas' connection on the rear panel of the analyzer or appropriate valve connection if using remote Autocal. Ensure the pressure is set to the same pressure as the sample gas to obtain the same flow rate.

2. Set ACAL in the main menu to the oxygen value of the certified gas.

3. Set Acd in the main menu to the desired interval, in hours, for Auto-calibration. If Auto-calibration is to be initiated via a control signal then Acd should be set to zero.

4. To initiate Auto-calibration from a control signal. Referring to the diagram below, the connection on pin 17 should be shorted to ground momentarily.



A control signal provided by two volt free relay contacts on the rear of the instrument is available to indicate that there is an Auto-calibration in progress. This is between connections on 15 and 16. These will be a short circuit while Cal is in progress.

When automatic calibration is activated the instrument will sample the certified gas for 30 minutes before performing the calibration. During this time the display will read the currently measured value of the certified gas.

Following auto-calibration a fault alarm will appear if the measured value of oxygen does not achieve a certain band around the ACAL value within the settling time allowed. The acceptable band can also be modified using USB comms with the command CALBAND=x, where x=0 to 999 (default 100) expressed as a percentage of the ACAL value.

NOTE

EC9x1 **EC9x2**

Great care should be taken not to allow air to enter the analyzer. If the certified gas contains low ppm levels and air has entered the system, it could take several hours for the oxygen value to equilibrate.

The instrument will only tolerate a certain level of adjustment. If the analyzer reads 49ppm and the certified bottle is 12.6ppm, the analyzer will reject the input of a value of 12.6ppm because it considers the error to be too large. Something else is almost certain to be incorrect. Ensure the sample from the bottle is at equilibrium and there are no leaks in the connection from the certified gas cylinder to the instrument. It will take many minutes, even hours, to sweep all the air out of the pressure regulator and sample lines connected to a cylinder of a few ppm oxygen.

13.0 USB and RS485 COMMUNICATIONS

The USB port is a bi-directional high-speed communications port which allows operator intervention via a communication utility called Systech_Illinois_Client Utility. This communication utility is included on the Memory Stick supplied with the analyzer. Also supplied is a USB data connection cable.

If you do not have the Memory stick, please contact Industrial Physics. The USB data communication cable is standard USB A to USB B cable.

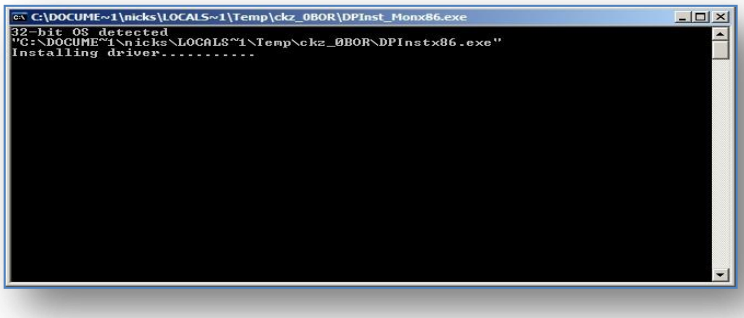
Before the USB cable is plugged into your PC you **MUST** install the necessary driver software. This is again available on the Memory Stick supplied and is called CDM20600.exe

13.1 Installing the USB Driver Software

Open Memory stick using your computers explorer and double click on autorun.exe From the memory Stick distribution screen (below); click on USB Driver Software as shown below:-



You will then be presented with the following screen. Click on the “USB Driver Software Button” and you will be presented with a window similar to the one shown here.



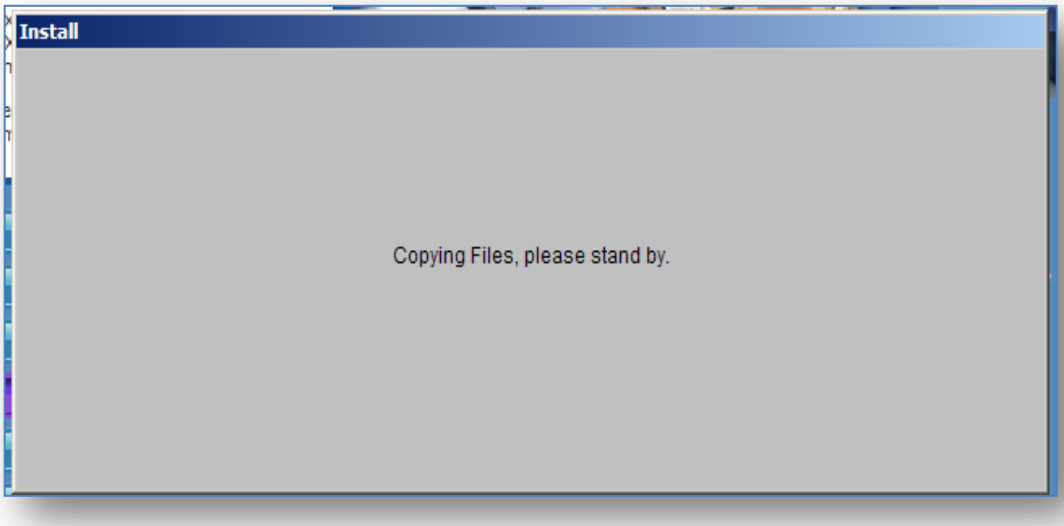
When the driver software has installed the above window will close and you will be back at the driver installation screen. Click on “Return” and continue with the next section.

13.2 Installing the COMMS UTILITY SOFTWARE

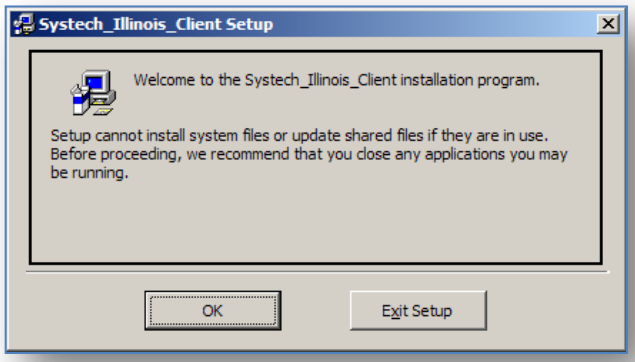
From the memory Stick distribution screen (below); click on Install Comms Client as shown below:-



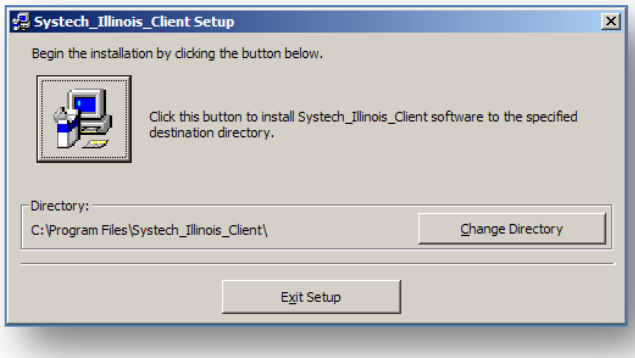
The installation program then starts with the following screen:-



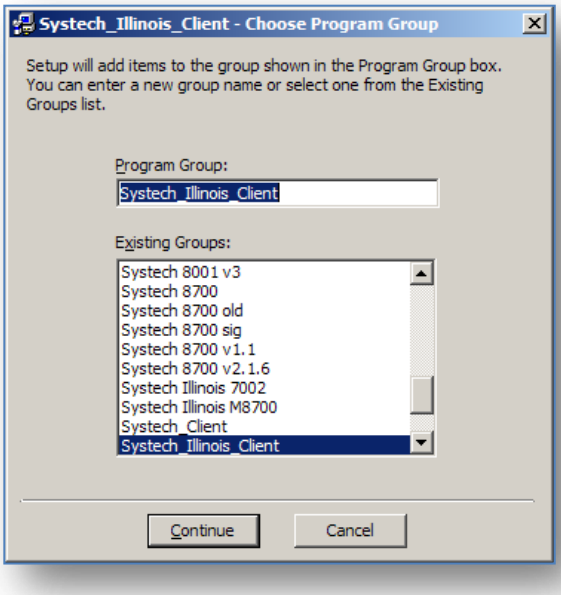
After a short amount of time the following screen is displayed:-



Click on OK, then the screen will change to this:-

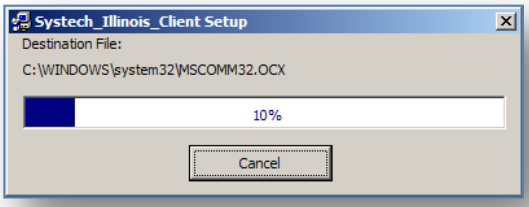


Click on the button shown above to install the Comms Utility software to the specified destination directory. You can at this point select a different folder; however Industrial Physics do not recommend this. You will then be presented with the following screen:-



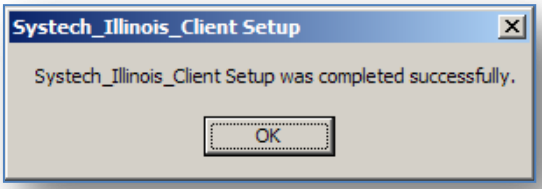
This screen allows you to select or change the program group, Industrial Physics recommends that at this point you accept the default setting and click on Continue.

Now the software will commence its installation process with the following screen:-



The blue bar shown indicates the installation progress. When it has reached 100% (which only takes a few minutes) you will be presented with this screen, which indicates that the software has been installed satisfactorily.

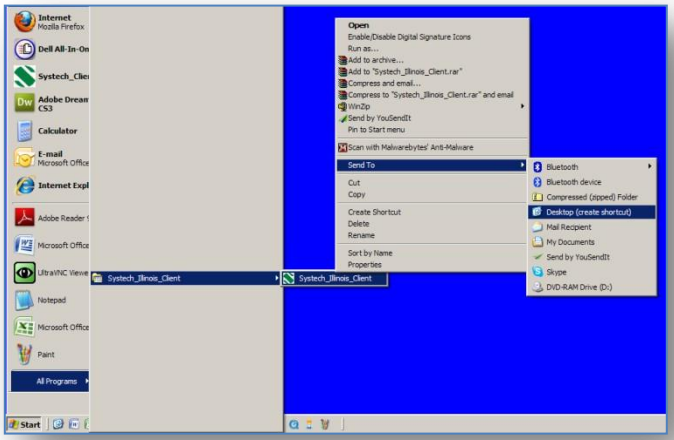
If during the installation phase you are presented with a screen that informs you that you are trying to replace a file on your computer with one that is an older version than the one you have, always keep the newer file.



Creating a Desktop Icon

If you wish to have an icon on the desktop to click in order to start the Systech_Illinois_Client follow the following steps:-

Go to “Start”, “All Programs”, “Systech_Illinois_Client”, and right click on Systech_Illinois_Client. Next click on “Send to” and then click on “Desktop (create shortcut) as shown below. There will then be an icon placed on your desktop to invoke the Systech_Illinois_Client program

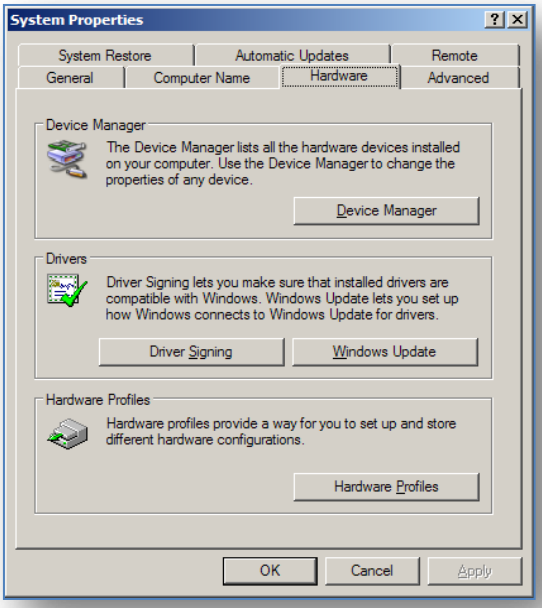


13.3 Determining the installed Comms Port.

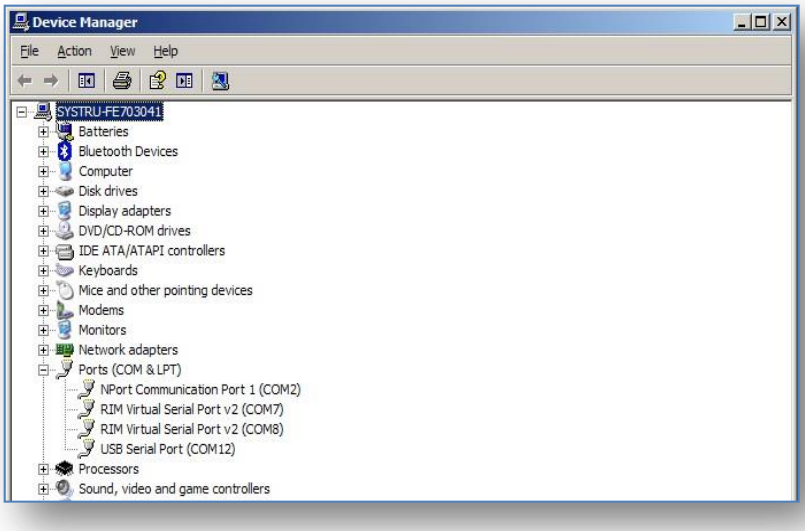
When running the software for the first time you need to determine what the comms port is that has been assigned to the instrument. Note for multiple instruments connected simultaneously each will have a different comms port allocation. In addition to this you should bear in mind that Comms Comms Utility can only access up to Com 6.

Ensure that the supplied or similar USB Cable is connected between the Computer and the analyzer.

1. Click on “Start”, “Control Panel” and “System” you should be presented with the following screen.

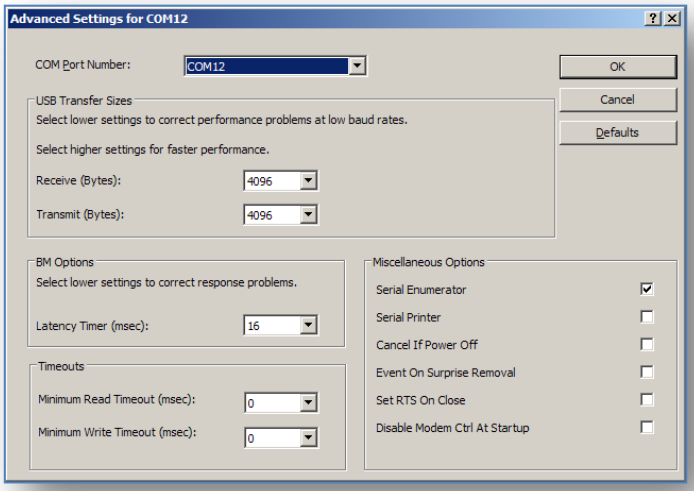


2. Click on “Hardware” and “Device Manager” again you should see a screen similar to this.

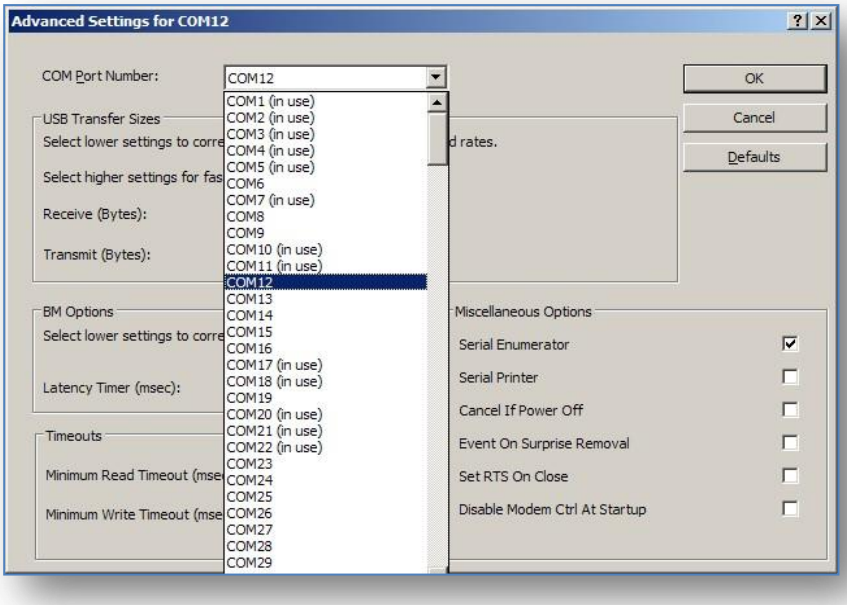


Expand out the “Ports” section and you will see an entry for “USB Serial Port” this is the 900 Series analyzer. You will note that in the illustration above it has been installed as Com12. This is not suitable for Systech_Illinois_Client as it is above Com6.

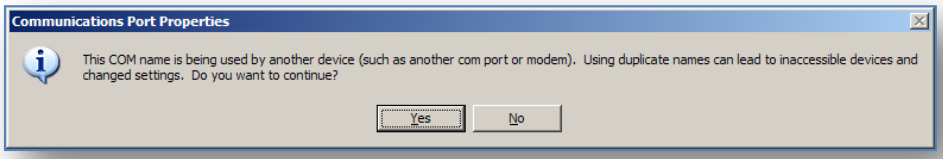
To change this Port number, Double click on “USB Serial Port”, you should be presented with the following screen.



Click on the downward arrow next to COM12, and you will get a drop-down list of all in-use and available ports. As shown here.



In this instance I know that Com1 is the only physical port installed and in use on the test PC. I will move the USB Serial Port to Com2; this will be achieved by clicking on the list above on Com2. Then Click on OK. You should (if the port is in use) get the following message.



Click on “Yes”, and then OK, then OK again, finally close the “Device Manager” and “Control Panel”. The comms port used by the 900 series Instrument will now be set to Com2.

If multiple Instruments are to be connected simultaneously then you will have to assign a comm. Port in range Com 1 to 8 for each unit. NOTE: you can only attach 8 instruments simultaneously to the PC and operate / interrogate them with Systech_Illinois_Client.

13.4 Running the COMMS Utility Software.

Ensure that the supplied or similar USB Cable is connected between the Computer and the analyzer. Using the computers Device manager, note which COMMS port is being used for the USB connection, Note it MUST be between Com1 and Com8, if it is not within this range please contact Industrial Physics for details on how to change the com port.

To Run Systech_Illinois_Client either use the SHORTCUT on the desktop or run from the START\PROGRAMS\Systech_Illinois_Client Menu.

When the Systech Illinois Comms Utility window is open you should see the following box.



First select to which port the analyzer is connected; e.g. COM 1

Type in the correct command from the analyser commands list in the ***OUTPUT (to instrument)*** window; and hit return or click on Send. If communications is OK then an answer is shown as a ***REPLY (from instrument)*** otherwise “TIMEOUT” or a “?1” is shown.
Should “?1” be shown in the reply window it means that the instrument does not understand the question. Should a “TIMEOUT” be shown in the reply it means that communications are not established

between the PC and the instrument, perhaps due to an incorrect Comms port selection, a faulty Comms cable or some other fault.

To repeat the same command at regular intervals, enter frequency of repeat interrogations in the ***Interval*** window. Note the format is hh:mm:ss

If required, check the ***SAVE REPLIES TO FILE*** box; enter a filename by either typing over DSL.Log or click on ***CHANGE FILE*** to select another.

Check the ***INC TIME/DATE*** box if you wish to save the time and date with each REPLY in the file to be saved.

Click on Start to begin interrogation of the instrument; click on Stop to end the interrogation.

Remember: - Only use the Commands on the analyzer that are listed. Other commands not listed may make changes to the analyzer that may necessitate return for non-warranty corrections or repair.

13.5 Serial Commands For Use with the EC900

COMMAND		DESCRIPTION
?		Reads measured O_2 value
VER?		Reads Version no.
TEMP?		Reads cell temperature
SERNO?		Reads instrument serial no.
LIFE?X		Reads cell life, X=1 for ppm cell, X=2 for % cell
CELL?		Reads cell type (0= RACE cell, 1 = ppm cell, 2 = % cell)
SAVESPAN=X		Saves SPAN values and resets LIFE to 100%, X= 1 for the ppm cell, X=2 for the % cell.
UNLATCH		Resets the alarm latch.
AL1?	AL1=	Reads/Sets Alarm1 set point
AL2?	AL2=	Reads/Sets Alarm2 set point
ID?	ID=	Reads/Sets instrument ID no. (0 to 9)
ANHI?1	ANHI=1_	Reads/Sets oxygen level for high analogue output 1 (20mA)
ANLO?1	ANLO=1_	Reads/Sets oxygen level for low analogue output 1 (4mA)
OL?	OL=	Sets OL parameter
ACAL?	ACAL=	Reads/Sets O2 value of calibration gas
ACD?	ACD=	Reads/Sets interval for Autocalibration (hours)
GAS?	GAS=	Reads/Sets carrier gas molecular weight
ACALMIN?	ACALMIN=	Reads/Sets duration of Autocalibration (mins)
CALBAND?	CALBAND=	Reads/Sets the band around the ACAL value
MFLO?		Reads the flow through the sample line when Flow Alarm option has been purchased

Note: For commands which return or require an oxygen value then scientific notation, with 1 = 100% should be used. For example:

100% would be 1E-00
20.9% would be 2.09E-01
0.1% (1000 ppm) would be 1.0E-03
35 ppm would be 3.5E-05
2 ppm would be 2.0E-06

13.6 RS485

RS485 communications is available simultaneously with the USB connection. There are no user selectable links that need to be changed within the instrument, all that needs to be done is to allocate an address and connect the RS485 to the instrument. The connection details are below.

Data cables should be connected to the terminal strip on the rear panel refer to drawing no. B900 076 at the end of this manual:

Terminal	Signal
A	Data +
B	Data –

To communicate with the instrument an instrument address should precede the normal USB command. Default address is 9 so sending #9'command' and the instrument will return the data, i.e. #9? carriage return will return the oxygen reading.

If there is more than one instrument connected, the instrument ID should be different for each. To set the address connect only one instrument to the RS485 and send "#9ID=x" where x = 0 to 9. It is also possible to set the instrument address using USB.

14.0 OPTIONAL FACILITIES

Series EC910 & EC930 Connections

See Drawings B 900 150A
B 900 162A.

Series EC920 Connections

See Drawing B 920 037 A

14.1 Analogue Outputs (Option)

The analogue output option provides one or three outputs, each configurable for 0-10V, 4-20mA or 0-20mA (isolated) for connection to a chart recorder, computer or other device for tracking the response of the analyzer. These signals are available at the connector on the rear panel, as labelled.

The current output (4-20mA) can drive a load of up to 500 Ohms. The voltage and current outputs may also be used simultaneously if the three channel option has been purchased so that more than one device may be driven by the analyzer.

The user may set the analogue output high and low values according to their needs by modifying OPH (output high) and OPL (output low). See section 10.2.1 Page 0 Functions for more information.

For example:

By setting OPH to 2.5% and OPL to 1%, the 10V signal is assigned to 2.5% oxygen and 0V to 1% oxygen. Likewise, the 20mA signal indicates 2.5% and 4mA is 1%. As the oxygen varies between 1 and 2.5%, the voltage and current signals will also vary. If connected to a computer then these signals can be used to trigger an alarm message based on the voltage or current level (which corresponds directly to the oxygen level).

NOTE Analogue outputs are an option which must be ordered at the time of initial purchase. If they need to be retrofitted to an existing EC900 series instrument, it must be returned to Industrial Physics for processing.

14.2 Alarm Trip (Option)

There are two volt-free alarm contacts, rated 5A/240V. Both have normally open and normally closed contacts and reference should be made to the connection diagram at the rear of this manual. The contacts are designated normally open and normally closed under normal alarm free operation, power on.

Please note that should a latched alarm position be set, the relay will not change back until it is reset, assuming the measured value has reverted back to a non-alarm value.

Alarm relays are energized in the non-alarm condition and will change state upon the alarm condition being met or by removing power to the analyzer.

14.3 Sample Pump (Option)

Please note that the optional sample pump allows ambient oxygen to permeate through the pump diaphragm thereby contaminating a closed loop system with ambient concentrations of oxygen. To avoid this situation, it is best to route the exhaust to a vent or to atmosphere rather than back into the system from which the analyzer is drawing. In non-closed loop systems this is not a problem as the pump is located downstream of the sensor.

Pumps are left in the off position by default when they leave the factory and will need to be turned on after installation. Please refer to section 10.2.2 Page 1 Functions for information about turning the pump on or off.

Please refer to section 4.0 Isolation Valve Operating Order for guidance on how to open or close valves properly to prevent damage to the sensor(s) when turning on the pump.

14.4 Internal Pressure Regulator to 30bar (Option)

The internal pressure regulator is an optional two stage regulator fitted inside the instrument in line with the sample inlet. It controls the pressure under varying conditions and allows up to 30barg (435psig) of pressure maximum at the sample inlet. It can also be used with the sample pump option to protect the system from damage in case of over pressurization.

14.5 Flow Alarm (Option)

This option incorporates a mass flow sensor in the Sample System which triggers a fault condition whenever flow drops below the set point. This set point can be changed in the menu system or through the Client software provided with the instrument. Please see section 10.2.2 Page 1 Functions or section 13.5 Serial Commands for Use with the EC900 for more information.

14.6 Solenoid Shutoffs (Option)

This option isolates the sensor(s) in the event of a loss of power. It places two shutoff solenoids in the sample pathway, one before the sensor(s) and one after the sensor(s).

14.7 Hydrogen Configuration (Option)

If your application contains the presence of hydrogen in the sample stream, then this option should be requested to ensure accurate readings.

Using this option in the absence of hydrogen will not present any problems and there is no charge for the hydrogen configuration option initially. But the replacement sensors are about 1.5% more than the standard sensors.

14.8 Autocalibration (Option)

Allows connection to a cylinder of gas with a certified level of oxygen. Analyzer will correct to recorded level at programmed intervals. See sections 10.2.1 and 10.2.2 for menu information, section 11 for Programme codes, and section 13.5 for serial command information.
To start an Auto calibration connect terminal 17 on the rear panel to a local ground momentarily.

14.9 Other Options

There are many other options for customizing your EC900 such as adding a bypass to improve response time, a pressure regulator for applications above 2 bar or for fluctuating sample pressures as well as several other plumbing options including stainless steel plumbing or various different fittings for connection to sample lines. Particulate filters and Panel Mount brackets may be purchased as well. Please contact Industrial Physics or your sales representative for more information.

15.0 FAULT MESSAGES

Certain messages may appear on the LED display of the analyzer, either in operation of the analyzer or during programming.
These messages will cause the fault alarm relay to trigger.

Code	Description
'F-th'	Thermistor open circuit, most likely cause may be the cell at the rear of the instrument has become disconnected.
'FLO'	If a flow alarm has been fitted, then a FLO error indicates a flow failure.
'Err'	When programming new values this display may appear. It indicates the user is attempting to program a number or value outside a permitted range.
'Cant'	When programming new values this display may appear. It indicates the user is attempting to program a number or value outside a permitted range.
'ACAL'	Automatic calibration fault – indicates an oxygen value outside limits (set under USB) when Autocal attempted. Requires successful calibration to clear
'CELL'	Indicates cell life below 20% and the need to replace the sensor. Note: Life indicator LIFEL and or LIFEH updates during calibration.
'bAnd'	Calibration fault. The instrument will only allow a certain band of change between a previous calibration and the next one, perhaps indicating there is an issue with the cell life or instrument not at equilibrium.
'UP'	Power supply +12/15V fault
'Un'	Power supply -12/15V fault
'U5P'	Power supply +5V fault
'CErr'	Auto Calibration Failed

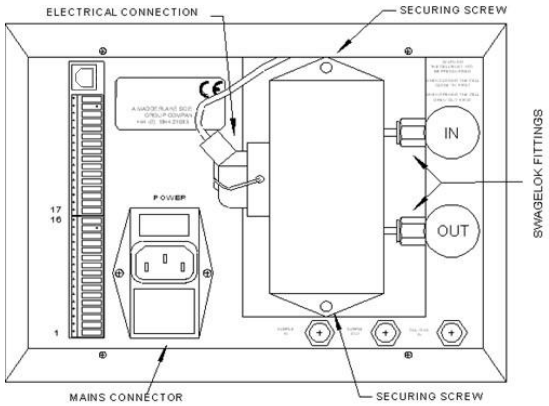
It is possible to delay the operation of the fault relay contacts following detection of an alarm condition. The LED display will indicate the fault but the fault relay contacts will only operate following the selected delay time. This feature can prevent spurious machine stoppages by confirming the fault exists before operating the relay.

The USB comms command DELAY = x (where x=0 to 255 in seconds), sets the delay time. NB Default value is 0.

Please note that a fault condition is only indicated by the FAULT LED being illuminated as a result of the fault relay being energized. This does not trigger any change in the state of analog outputs and therefore it is necessary to continuously monitor the FAULT LED for a fault indication.

16.0 REPLACING THE MEASURING CELL

16.1 Model 910, 911 & 912



1) Switch off the analyzer at the rear panel switch and remove the mains connector.

2) Fully close the sample IN valve on the rear panel, and then fully close the sample OUT valve. (N.B. This sequence is required in order to avoid pressurising the cell. When recommissioning; fully open the OUT valve before opening the IN valve to obtain the desired flow). See section 4.0 Isolation Valve Operating Order.

3) Remove the ‘d’ type electrical connection from the cell body.

4) Using a 7/16" spanner slacken the Swagelok fittings connecting the cell’s sample lines to the flow control valves.

5) Remove the two Posidrive screws from the top and bottom of the cell.

6) Slide the cell assembly to the left (seen from the rear of the instrument) to disconnect the sample lines, and withdraw the cell from the instrument.

7) Position the replacement cell in the instrument and loosely locate the two mounting screws. Do not tighten the mounting screws.

8) Slide the cell to the right ensuring the sample lines locate with the Swagelok fittings. Tighten the Swagelok fittings to finger tight and then tighten slightly with a spanner.

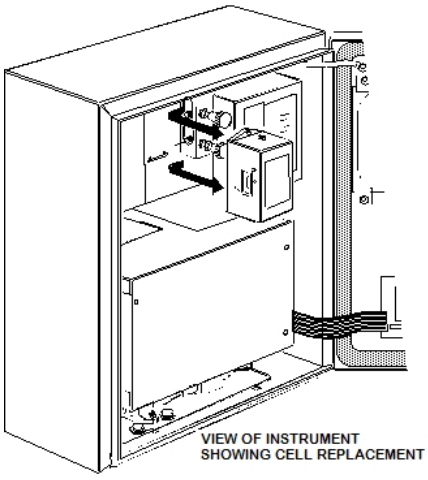
9) Fully tighten the two mounting screws.

10) Reconnect the ‘d’ type electrical connection to the cell body.

11) (A) For pressurised systems fully open the OUT valve, then open the IN valve to set the required flow rate. (B) For systems with supplied with a pump fully open the IN valve and then open the OUT valve to set the desired flow.

12) Reconnect the power supply. You will need to recalibrate the instrument after each sensor replacement. See section 12.0 Calibration.

16.2 Model 920, 921 & 922



VIEW OF INSTRUMENT
SHOWING CELL REPLACEMENT

Follow the same procedure as in 16.1 above. The only difference is the mechanical construction of the Wall mount case compared to the panel/bench mount case.

16.3 Model 9X3

RACE™ cell instruments are patented measuring cells that can exist in two constructions:

- Single RACE™ cell where the one enclosure contains two measuring cells (ppm and the % cell). Single RACE™ cell instruments can be identified by virtue that they are marked with Part Numbers 900 055 or 900 059. Replacement of these cells may be the same procedure as in 16.1 above or 16.2 above depending on the housing style.
- Dual RACE™ cell instruments where each cell is an individual cell. These type of instruments can be identified by the fact that they have just one flow valve on the rear panel instead of two, as can be shown in the picture below.



Dual RACE™ cell instruments have the ppm measuring cell on the rear of the back panel and the % cell is mounted inside the instrument.

How do I know which cell has failed?

LIFEL shows the remaining life of the ppm cell and LIFEH will show the remaining life of the % cell. Failure to calibrate the instrument on a ppm certified gas AND a LIFEL figure lower than 40% indicates that the ppm cell has failed. Failure to calibrate the instrument on air AND a LIFEH figure lower than 40% indicates that the % cell has failed. LIFEL and LIFEH readings can be obtained by referring to section 10.2.1
Note that LIFEL and LIFEH will only show correct values if the instrument has been calibrated during its use.
There are many reasons for cell failure whether premature or not so the LIFE values may not always show a true value as to how long the cell may be used.

Replacing the ppm cell:
Use the same procedure as in 16.1 or 16.2 above depending on the housing.

Replacing the % cell:
Remove the chassis from the instrument.
Pull out the customer terminal strips from their receptacles. Disconnect tubing and the power socket.
Unscrew the four screws holding the rear panel to the chassis.
Unscrew the four front panel screws holding the front panel to the chassis.
Carefully withdraw the chassis from its housing.
Locate the % measuring cell towards the rear of the chassis as shown in the picture:



Disconnect the cell from its mounting and tube connection and reconnect the new cell bending the connecting pipes to suit.

Note: Ensure all replacement cells are exchanged like for like part numbers, otherwise it may be impossible to recalibrate the instrument and make sure that the following section is completed.

Note: Following a cell change it is recommended that the instrument be allowed to warm up, and the sample lines purged before a calibration is performed.

If you are in any doubt as to how to proceed, please contact Industrial Physics for information.

16.4 Resetting the Calibration Range and Life Counter

After replacing a cell, the instrument must be calibrated to re-establish the calibration values (Span1 & Span2), which in turn will re-set the life values back to approximately 100%.
The instrument will only tolerate a certain level of adjustment during calibration.
Under normal circumstances the signal from the old cell would have reduced slowly and the relevant SPAN value would have increased during any calibration procedures, which in turn would have reduced the life value. On replacement of the cell, the strong signal from the cell will be re-established and on the first calibration attempt the value displayed could be very high and adjustment of it to the certified gas value could be rejected with “Cant” message. This is normally displayed when the value is outside 20% adjustment allowed, this however can be circumvented by making small adjustments until the required value is achieved.
Care must be taken that the high value indicated is not due to any leaks in the pipework or the fact that not enough time has been allowed for the certified gas bottle pressure regulator to purge out. It can take several minutes or even hours to sweep all of the air out of the pressure regulator and sample lines connected to a cylinder of a few ppm oxygen.
If after replacement of the cell the displayed reading is a lot lower than the certificated gas bottle connected to the analyser. This could be due to the relevant SPAN value having been reduced due to a miss-calibration before the cell was replaced.
The typical SPAN 1 & SPAN 2 values are listed below.

Cell Part #	Description	Typical Span1 value	Typical Span2 value
900 230	H2 Single RACE™ cell	1.060	0.300
900 057	H2 Trace Cell	1.060	N/A
900 047	% Cell	N/A	0.350
900 021	Trace Cell	0.246	N/A
900 220	Single RACE™ Cell	0.246	0.300
900 240	% Dual RACE™ Cell	N/A	0.300

17.0 SPARE PARTS

Part #	Description
400 006	Pcb front panel (quote serial number)
900 183	Pcb CPU (quote serial number)
900 081	Bypass flowmeter, Brass (910, 930)
900 115	Bypass flowmeter, St Steel (910, 930)
900 205	Sample flowmeter, stainless steel (910, 930)
900 206	Sample flowmeter, stainless steel (910, 930)
101 385	Bypass flowmeter, Brass (920)
900 118	Bypass flowmeter, stainless steel (920)
101 386	Bypass flowmeter, Brass (920)
900 207	Bypass flowmeter, stainless steel (920)
100 574	1/8" bulkhead (stainless steel)
100 575	1/8" bulkhead (brass)
100 549	Control valve (stainless steel)
100 715	Control valve (brass)
101 061	Pressure regulator (stainless steel)
100 499	Pressure regulator (brass)
900 116	Internal pump
900 180	Connector Transition 900MK3 0-10V

Important Note

The serial number of the instrument for which the spare parts are required must be quoted on all orders.

ELECTROCHEMICAL CELL WARRANTY (CURRENT INSTRUMENTS)				
Part No	**Used In**	**Application**	**Description**	**Warranty Code**
900 021	EC900	Trace Cell	Assy Cell Trace 900	A
900 028	EC900	Ultra-Low Trace	Assy Cell Trace Ultra Low 900	A
900 032	EC900	Ultra-Low Trace O2 in H2	Assy Cell Trace O2/H2 Ultra Low	A
900 047	EC900	Percent	Assy Cell % 900	C
900 220	EC900	Race ™	Assy Cell Race	D
900 057	EC900	Trace O2 in H2	Assy Cell Trace O2 In H2	A
900 230	EC900	Race ™ O2 in H2	Assy Cell Race O2 In H2 900	D
900 240	EC900	Percent Cell for use in Dual Race ™ St. Steel tubes	Assy Cell O2% Stainless Steel (Race).	B

Important Note

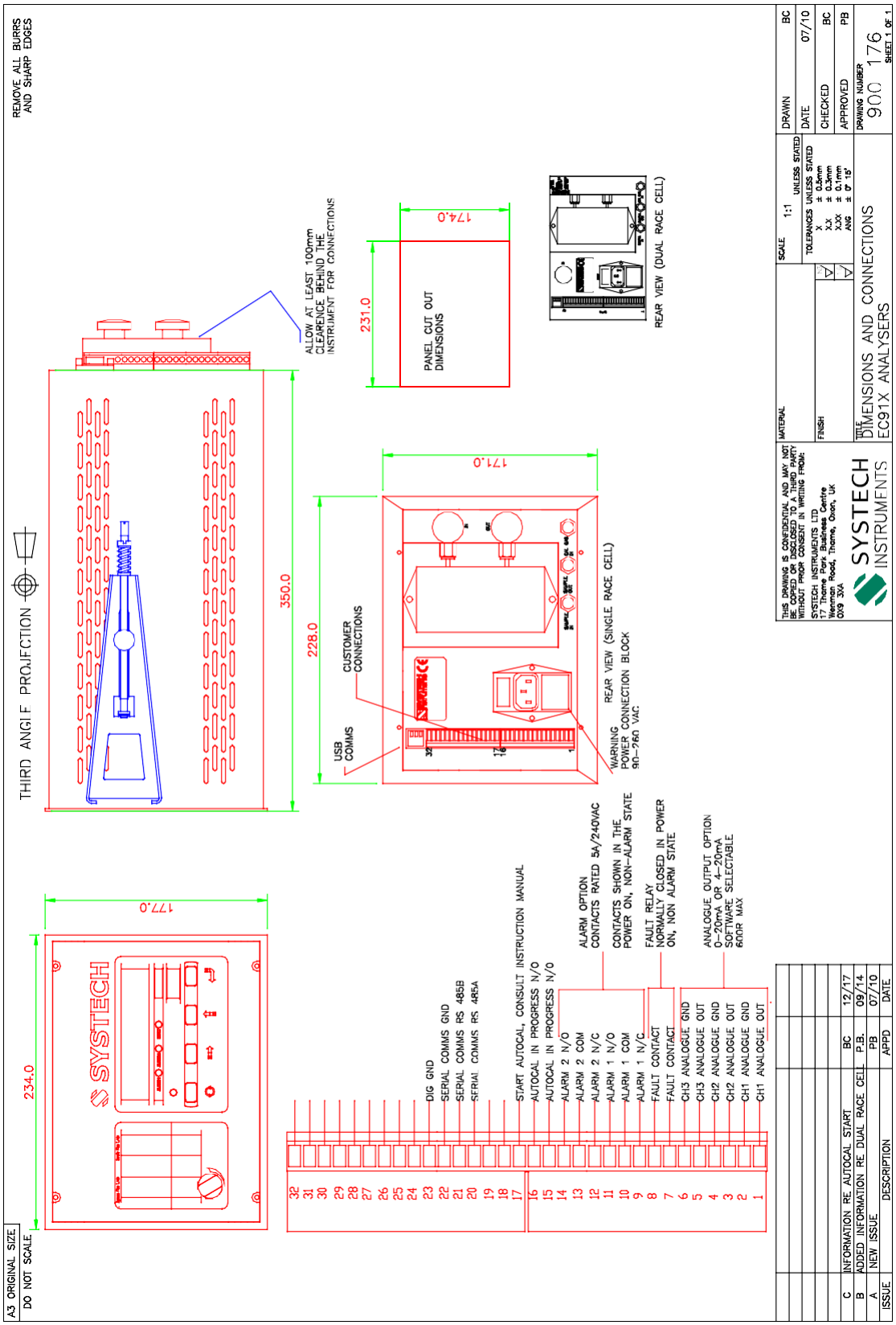
The serial number of the instrument for which the spare parts are required must be quoted on all orders.

18.0 SERIAL NUMBER SUFFIX DETAILS

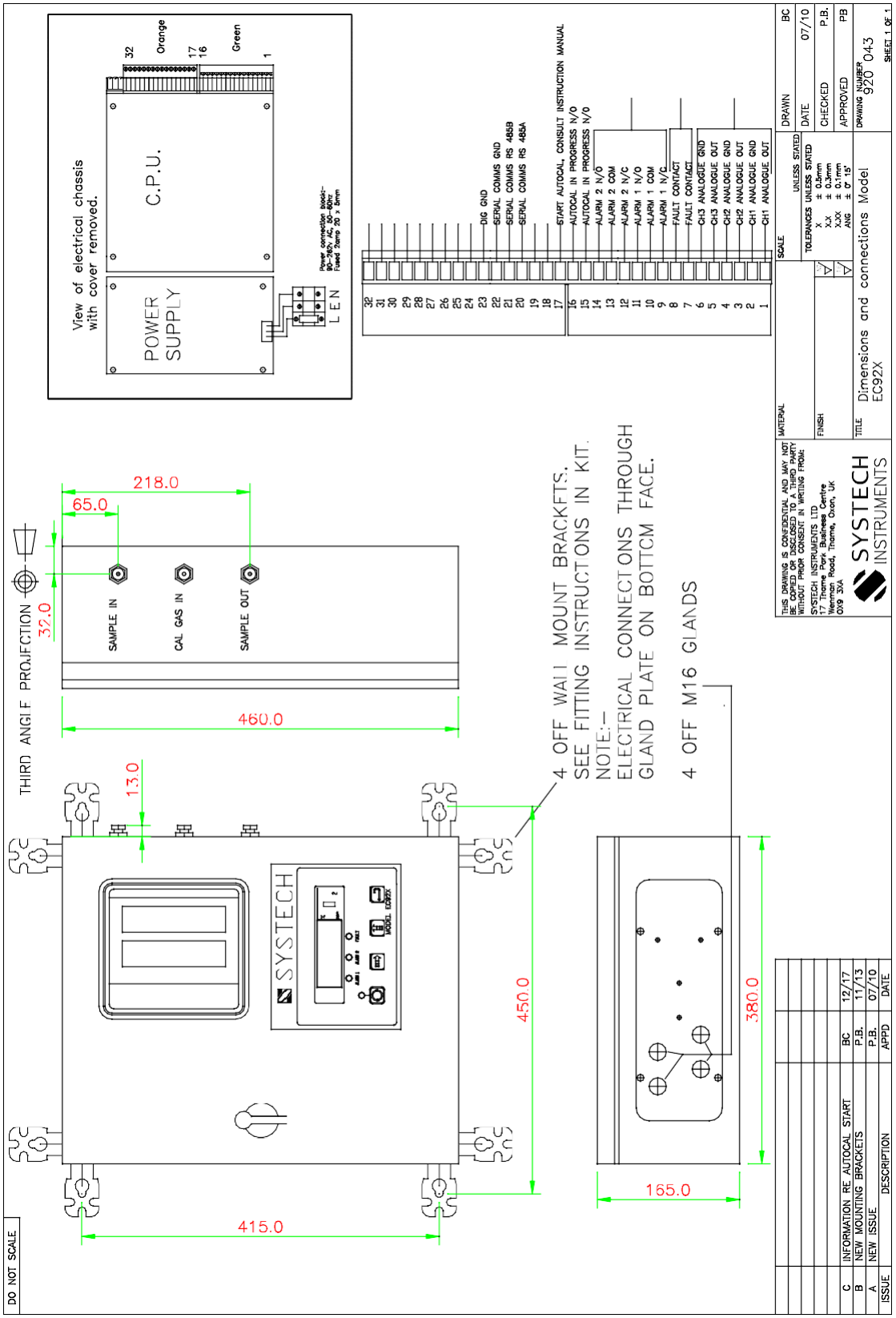
Industrial Physics have a process of continual development of their analyzers. Over the years there have been several changes in the basic instrument that have resulted in the suffix of the instrument being changed. These are as follows:

Suffix	Change Details	Change Date
A	RS485 Hardware fitted.	19/10/1999
B	5 segment display / switch PCB fitted.	28/11/2002
C	New Plastic front panel & CPU update.	01/11/2007
D	Dual race cell	
E	New PCB - MK 3 (900 172) (USB).	28/07/2010
F	New PCB - MK 3 (900 183) (USB)	25/05/2011
G	New PCB MK 4 -(900 218) - All 910's ENCO No. 1402 (EMC)	19/03/2015

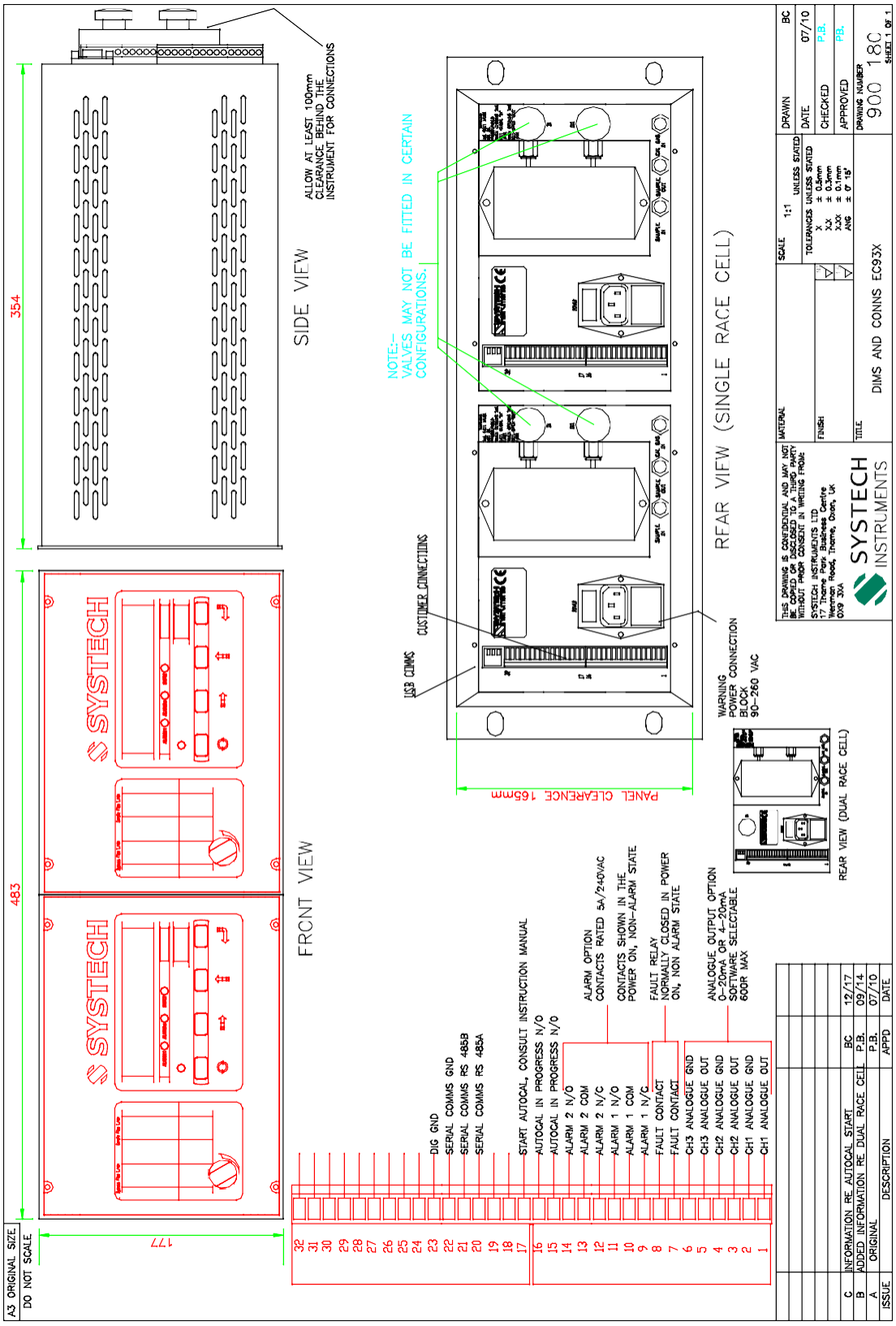
Appendix 1 Drawing Number 900 176_C



Appendix 50 Drawing Number 920 043_C



Appendix 51 Drawing Number 900 180_C



Appendix 4 EU Declaration of Conformity

DECLARATION OF CONFORMITY -
European Standards

Equipment: **Model EC900 Series**

We declare that the above equipment conforms with the following European Directives

Low Voltage Directive **2014/35/EU**

The following standards are referenced for compliance evaluation:

EN61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use

RoHS Directive **2011/65/EU**

Exclusion claimed:	Annex IV: Sensors, detectors and electrodes 1b, lead anodes in electrochemical oxygen sensors

Electromagnetic Compatibility Directive **2014/30/EU**

The following standards are referenced for compliance evaluation:

EN61326-1:2013	EMC Requirements – Equipment for Measurement, Control and Laboratory Use

CE

Signed on behalf of Industrial Physics

Leigh Butler
Managing Director UK

17 Thame Park Business Centre | Wenman Road, Thame | Oxfordshire OX9 3XA | Telephone: +44 (0)1844 216838
Fax: +44 (0)1844 217220 | info@industrialphysics.com | Website: www.industrialphysics.com