APPENDIX

10.1 Oxygen Analyzer

Appendix

EC900 Process Oxygen Analysers

The EC900 offers unsurpassed accuracy, reliability and flexibility under the most demanding on-line operating conditions

Features & Benefits

- Specific to oxygen
- Ambient air or traceable gas calibration
- Microprocessor controlled functions
- Long life, maintenance-free, disposable oxygen sensors
- Fast response. Ultra fast response version also available
- Large, autoranging LED display
- Unaffected by vibration or position
- Sturdy, reliable construction with three sensor options
- Insensitive to sample flow rate - percentage through ppm
- Nitrosave flushing gas control option
- This instrument has a 36 month warranty which covers any faulty workmanship and normal component failure relating to electronic circuit cards

Conforms to European Directives:
Electromagnetic Compatibility Directive 2004/108/EC Low Voltage Directive 73/23/EEC

Unmatched in High Performan

Applications

Chemical / Petrochemical
Chemical Production
High Purity Gas Production
Hydrocarbon Refining
Natural Gas Transmission

Curing
Electron Beam
Ultraviolet

Electronics
Reflow / Wave Soldering
Solder Powder Production
Semiconductor Furnaces
Gas Quality

Metals
Heat Treating / Annealing
Steel Production
Alloys and Powdered Metals

Pharmaceutical
Inert Packaging
Vessel Blanketing
Fermentation

Process
Ceramics
Combustion Analysis
Contact Lens Manufacturing
Food Packaging
Glass Fibre Optics
Inert Gas Welding
Lamp Manufacturing

General
Controlled Environments
R & D
Glove Boxes
Oxygen Deficiency

Unmatched Performance

Systech Illinois has long been recognised worldwide as a leader in oxygen analysis.

Utilising a variety of specially engineered electrochemical fuel cells, the EC900 Oxygen Analysers are designed to monitor oxygen within most industrial gases and atmospheres. These highly advanced instruments incorporate user-friendly software and the highest quality sensors to provide accurate, reliable results.

Whatever your measuring range, the EC900 series has an analyser to suit your needs.

Cabinetry & Mounting

Three different configurations to match your needs.
- NEMA 4X / IP66 waterproof and weatherproof
- 19 in. rack mount
- Panel or bench mount
- UL and CUL approved Ex-proof

Explosion Proof Version

- UL and CSA approved
- Split architecture version for: Class I, Groups B, C& D; Class II and Class III
- Nema 4/7 rated

Operator Interface /Diagnostics

- User-friendly menu
- Read-only mode available
- Diagnostic capabilities
- Fault alarms

Optional Nitrosave Feature

- Control of Nitrogen or flushing gas
- Reduced gas consumption
- Improved productivity
- Reduced product wastage
- Better quality control
- Integrated electronics with analyser
- Control hardware available

Outputs & Alarm Options

For charting, process control, or remote monitoring.
- USB and RS485
- Analogue outputs (one or three channels)
- High / low alarms
- Fault alarms

nce On-Line Oxygen Analysis

Sensor Selection

No need to compromise! Now you can match sensor to application for the best possible reliability and performance. All sensors are manufactured to rigid tolerances and exacting production specifications.

EC920

EC930

EC910

Ex- Proof

Sampling Systems

- Bypass flowmeter
- Pressure regulator
- Sample pump
- Flow alarm

Principle of Operation

The EC900 Oxygen Analysers use a variety of electrochemical fuel cells for the detection of oxygen. When oxygen diffuses to the cathode of the cell, a current output is produced directly proportional to the concentration of oxygen in the sample gas.

Specialising in trace oxygen measurements, Systech Illinois' sensors are used in applications from ppb up to 100% oxygen. In addition, sensors can be used on gas streams such as hydrogen, combustibles, hydrocarbons and inert gases.

All Systech Illinois' sensors are easily calibrated to ambient air. For ISO purposes and in specific applications, traceable calibration gases can be used to meet the most demanding quality assurance programmes.

Trace (part per million) Sensor

The trace sensor is designed for measuring 0.1ppm – 1% oxygen in most industrial gas streams. Can be calibrated to air. This sensor when used in a normal operating range typically lasts 3 – 5 years.

Sensor RACE™

The RACE™ Sensor is a breakthrough in electrochemical technology. Our patented design* prevents the sensor from being saturated by high levels of oxygen. With TURBOPURGE™ levels as low as 20ppm can be reached from ambient air within 2 minutes. This sensor is unaffected by hydrocarbons or volatile atmospheres making it the ideal choice in applications such as wavesolder and reflow ovens.

The RACE™ Sensor is maintenance-free, requires only occasional calibration and has no caustic electrolyte to monitor or replace. The RACE™ Sensor carries a 3 year limited warranty.

Percent Sensor

The Systech Illinois percent sensor is capable of accurate measurements from 0 – 100% oxygen. Unlike most electrochemical sensors, this sensor is not affected by acid gases such as carbon dioxide.

* UK Patent no. 2324870. USA Patent no. 5929318

EC900 Process Oxygen Analysers

EC910
Bench/Panel Mount
190H x 237W x 410D (mm)
7.9 kg

EC920
IP66/NEMA 4X
Wall Mount/Weatherproof
460H x 380W x 160D (mm)
15.5kg

EC930
Rack Mount 4U - 19 inch
Houses 1 or 2 Analysers
178H x 484W x 410D (mm)
9.7kg (single unit)

Technical Specifications

Sensor Type	Trace	Race	Percent
Ranges	0.1ppm - 1%	0.1ppm - 30%	0.3% - 100%
Accuracy: >10ppm	±2% of reading at 20°C ±5% of reading over temperature range	±2% of reading at 20°C ±5% of reading over temperature range	±0.2% of calibrated value at 20°C ±1% of calibrated value over temperature range
<10ppm	±2% of reading + 0.4ppm at 20°C ±5% of reading + 0.6ppm over temperature range	±2% over temperature + 0.4ppm at 20°C ±5% over temperature + 0.6ppm over temperature range	
Response Time	90% within 30sec	Air to 20ppm within 2min	90% within 30sec
Measuring Cell Type	Electrochemical, percentage, trace and RACE™ Cell (US & UK) patents		

Operating Conditions	
Sample Inlet Pressure	0.25 - 2 Barg, 3-30psi
Sample Flow Rate	Approximately 140 cc/min
Sample Temperature	-5 to 50°C
Ambient Temperature	-5 to 50°C, RH 0-99% non-condensing
Sample Connections	1/8" OD compression fittings, as standard
Communications	USB and RS485
Unsuitable Gases	Acid gases, corrosives and solvents in significant concentration

Power Requirements	
Power Supply	115/230VAC selectable
Display Type	4-digit high-visibility LED

Options	
High/Low Alarms	2 Volt-free changeover contacts. Rated 240V 3A
Analogue Outputs	Analogue output channels: scaleable 0-10V, 4-20mA or 0-20mA all isolated. Option for one channel or three.
Autocalibrate	Provision for remote cal start and autocal in progress
Sample Stream Options	Bypass flowmeter, sample pump, flow alarm, stainless steel sample system in place of brass/copper. Sample conditioning advice available.
Nitrosave	O_2 measurement and control system EC9500.
Ex Proof	Consult factory for various configurations.

Systech Illinois have over 30 years experience of providing analysis solutions for a wide range of industries. From our manufacturing plants in the UK and U.S. we produce gas analysers for industrial process industries, headspace analysers for monitoring gas flushing of food products and our range of permeation analysers.

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SERIES EC900
OXYGEN ANALYZERS
(Covers MK3 USB models)

OPERATION MANUAL

Version 4.9 *5th May 2016*

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Table of Contents

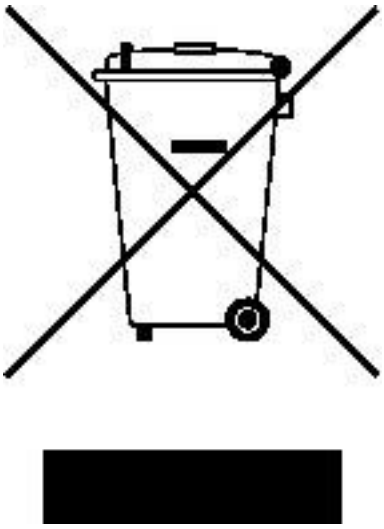
Revision History

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

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 Systech Illinois
for accidents resulting from improper use of this equipment.

All service and technical enquiries are covered from our factories in Thame, Oxfordshire, and Johnsburg, Illinois where we will endeavour to give a quick and helpful response to all queries.

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www.systechillinois.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

Cabinet - Mounting	**EC9**		
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**
Configuration code =	**EC9**	**x**	**x**

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 customers site, please contact Systech / Illinois Instruments for more details (support.uk@systechillinois.com or support.usa@systechillinois.com).

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	12 months from the date of supply.	The measuring cell should have a life of 3+ years. 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.
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 6 months from the date of supply. Between 6 months and 36 months a partial warranty applies.	A credit will be given for complete calendar months remaining up to 36 months. The credit is calculated from (36 - months in use)/30. A cell for instance that has failed after 25 months will be credited (36-25)/30 = 0.366 * the current list price. 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.

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 way 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:

Do not connect the sample inlet or outlet to any source of pressure greater than 0.5 BarG. The sample inlet should be connected to an atmospheric pressure source or no less than 0.3BarA. Open the flow valve sufficient 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:	**EC9x0**	**EC9x1**	90% indication in less than 30 seconds
		EC9x2	90% indication in less than 30 seconds
		EC9x3	Air to less than 20ppm in 2 minutes
Accuracy:		**EC9x0**	± 0.2% of calibrated value at 20° C ± 1% of calibrated value over temperature range
	EC9x1	**EC9x3**	>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

Technical Specification contd.

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:	3.5 – 29 PSI (0.25 Bar - 2 Bar) Ambient (for pump equipped systems)
Power:	90-260 VAC, 40VA
Area Classification:	General Purpose, except for explosion-proof sensor housing option, see drawing in the rear of the manual.
Communications:	USB 1.0 / 2.0 and RS485
Dimensions:	Refer to the drawing B900 176 at the rear of the manual Appendix 1.

OPTIONS

High / Low Alarms:	Two with volt free c/o contacts fully configurable over the complete oxygen range, one fault alarm. 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.
Explosion-proof (sensor housing)	Allows the mounting of the sensor parts in a certified housing in a hazardous area while the control unit of any type must be mounted in a safe area (can be set up for both pressurized and ambient pressure applications).
Pressure Regulator	For use in applications where the inlet pressure is above 2 bar or there are fluctuations in pressure.
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 Systech / Illinois Instruments for more details.

7.0 INSTALLATION

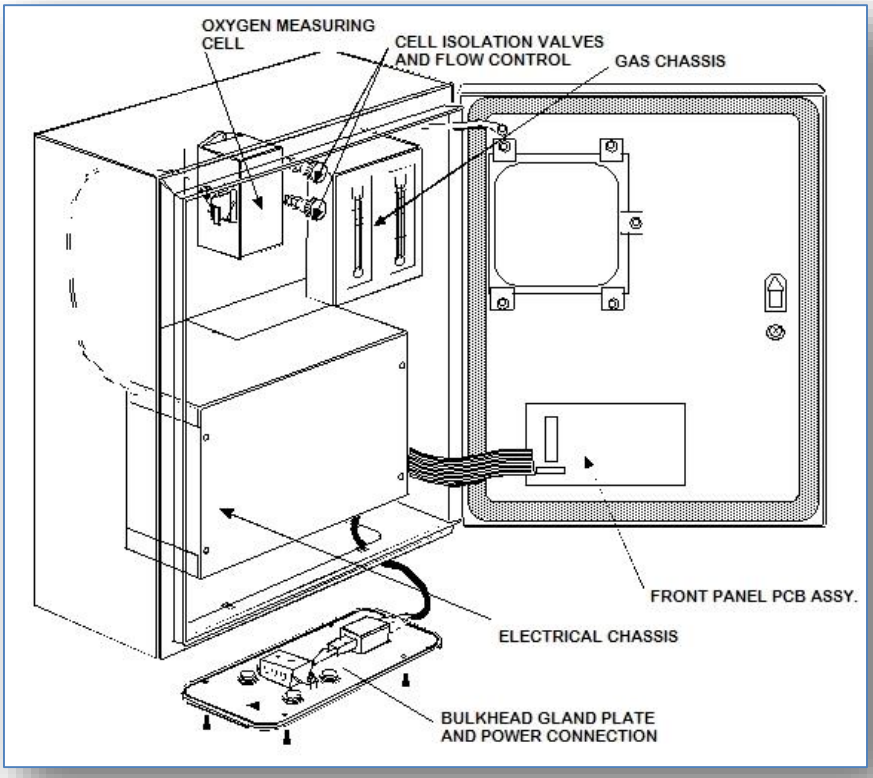
7.1 Instrument Installation

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. Systech / Illinois Instruments 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 size is 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 option, 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:

Do not connect the sample inlet or outlet to any source of pressure greater than 0.5 BarG. The sample inlet should be connected to an atmospheric pressure source or no less than 0.3BarA. Open the flow valve sufficient 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 Systech / Illinois Instruments 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.

Explosion-proof housing option: make the connections to the control unit using the connector supplied to the back panel. The cable is normally pre-connected to the hazardous area housing and after the conduit is fitted the cable gland should be filled with sealing cement and fibre supplied with the instructions supplied,

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 the right 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 

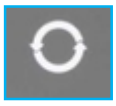
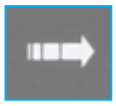
Which is the 'digit Increment' button to change the display from 0 to 1.

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 assistance from a Systech / Illinois Engineer, 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. Also can be remotely reset using a USB Comms 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 service for 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 the life of the % cell.

GAS With some configurations the balance/background gas will have an effect on the calibration of the 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.

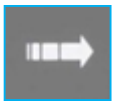
12.1 Calibration with Atmospheric Air

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

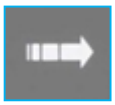
6 Continue pressing  to return to oxygen measurement. See Front Panel Guide

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**

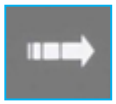
1 Connect the certified gas to the sample port ensuring the same pressure as the sample gas, in order to obtain the same flow rate as the sample gas, allow the reading to stabilise.

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

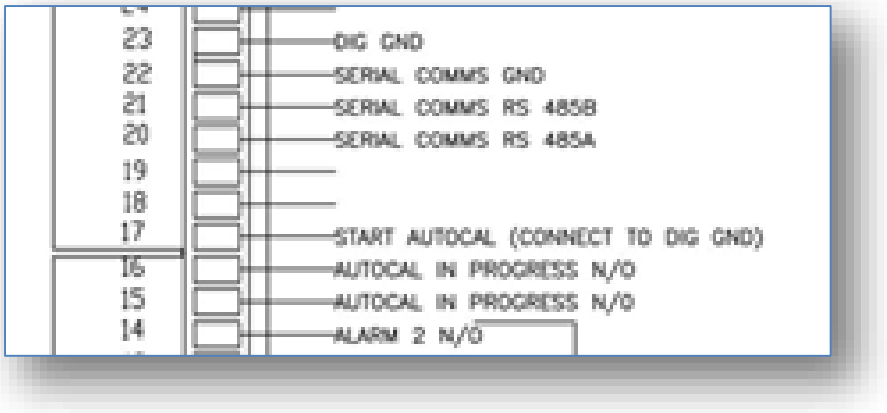
Automatic calibration can be initiated in two different ways. Either automatically after a pre-determined interval, or initiated by a control signal.

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.

The settling time can be modified via the USB connection using the command CALTIM= (See section 13.5, USB Comms Port).

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

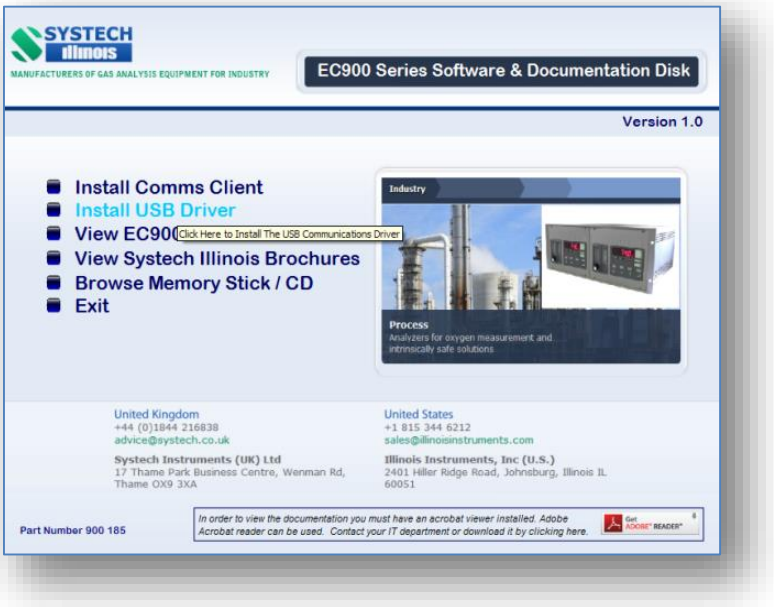
The USB port is a bi-directional high speed communications port which allows operator intervention via a communication utility called Systech_Illinois_Client Utility. This communication utility is included on the Memory Stick supplied with the analyzer. Also supplied is a USB data connection cable.

If you do not have the Memory stick, the software can be downloaded from our website, please contact Systech / Illinois Instruments at support.UK@systechillinois.com or support.USA@systechillinois.com to obtain the required customer log in details. The USB data communication cable is standard USB A to USB B cable.

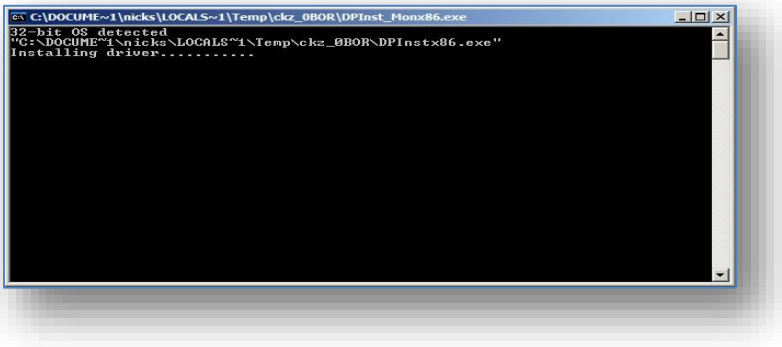
However before the USB cable is plugged into your PC you **MUST** install the necessary driver software. This is again available on the Memory Stick supplied and is called CDM20600.exe

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.

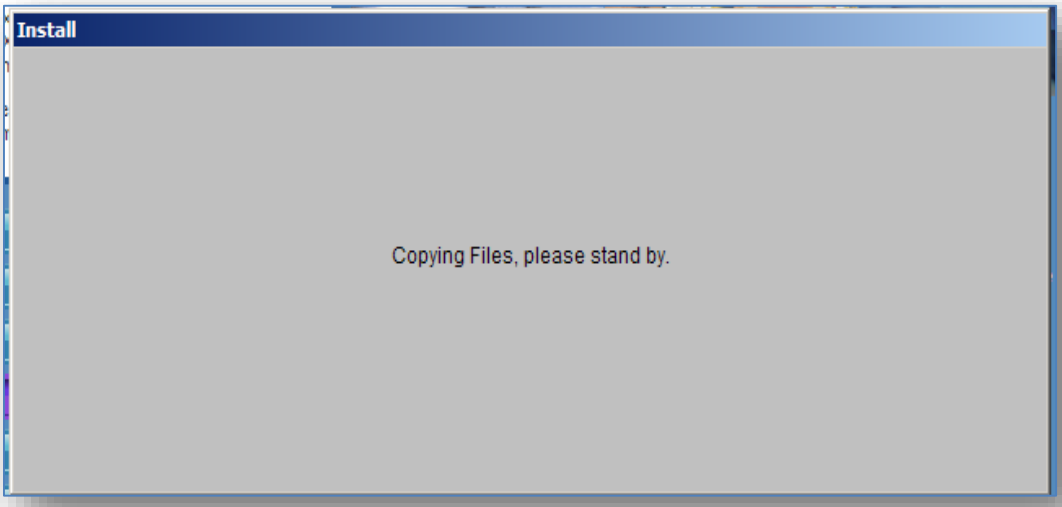


When the driver software has installed the above window will close and you will be back at the driver installation screen. Click on “Return” and continue with the next section.

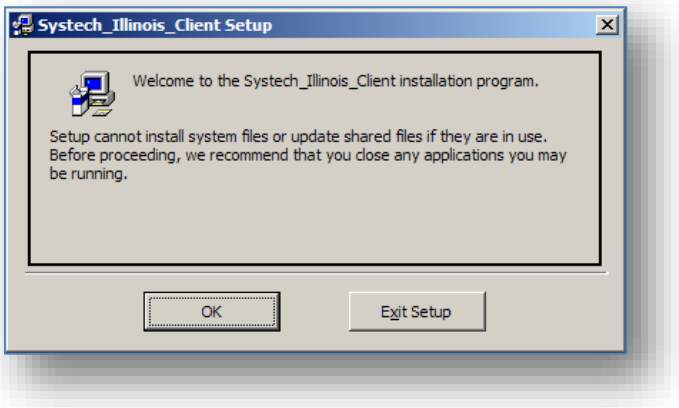
13.2 Installing the COMMS UTILITY SOFTWARE

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

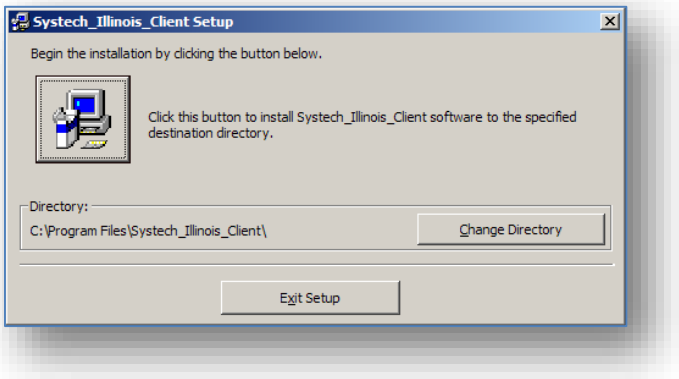
The installation program then starts with the following screen:-



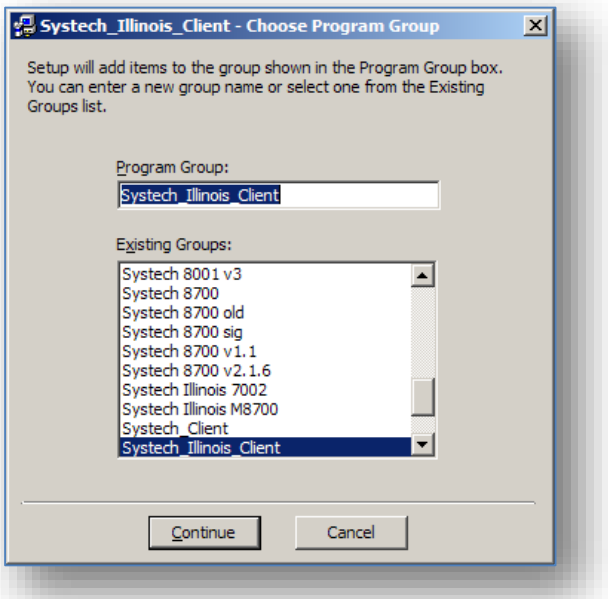
After a short amount of time the following screen is displayed:-



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

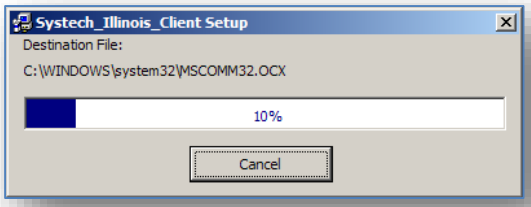


Click on the button shown above to install the Comms Utility software to the specified destination directory. You can at this point select a different folder; however Systech Illinois do not recommend this. You will then be presented with the following screen:-



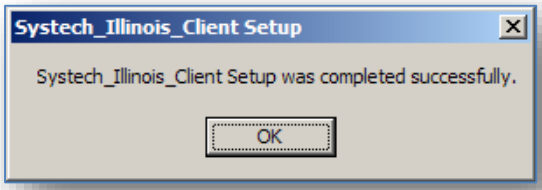
This screen allows you to select or change the program group, Systech Illinois recommends that at this point you accept the default setting and click on Continue.

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.

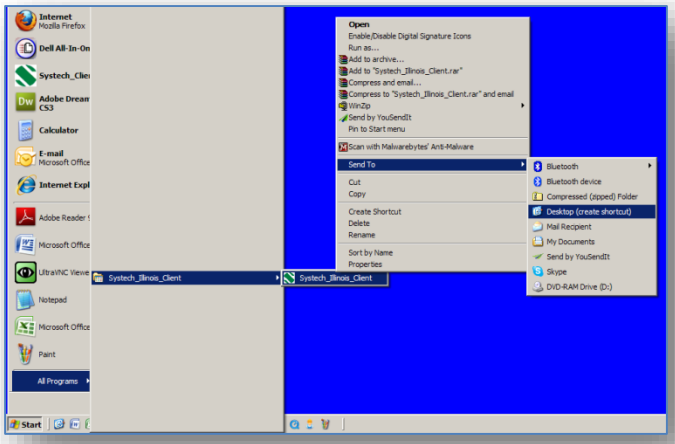
If during the installation phase you are presented with a screen that informs you that you are trying to replace a file on your computer with one that is an older version than the one you have, always keep the newer file.



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

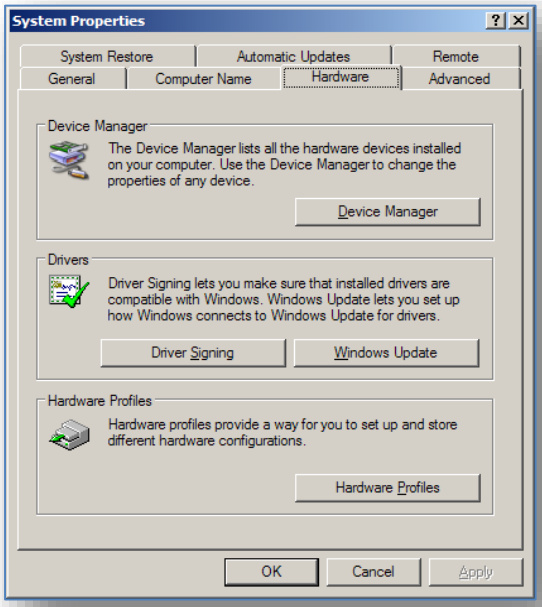


13.3 Determining the installed Comms Port.

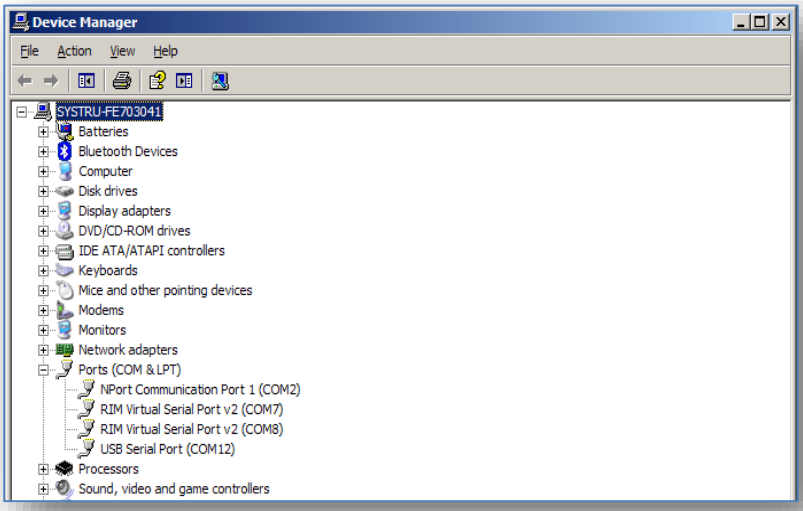
When running the software for the first time you need to determine what the comms port is that has been assigned to the instrument. Note for multiple instruments connected simultaneously each will have a different comms port allocation. In addition to this you should bear in mind that Comms Comms Utility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

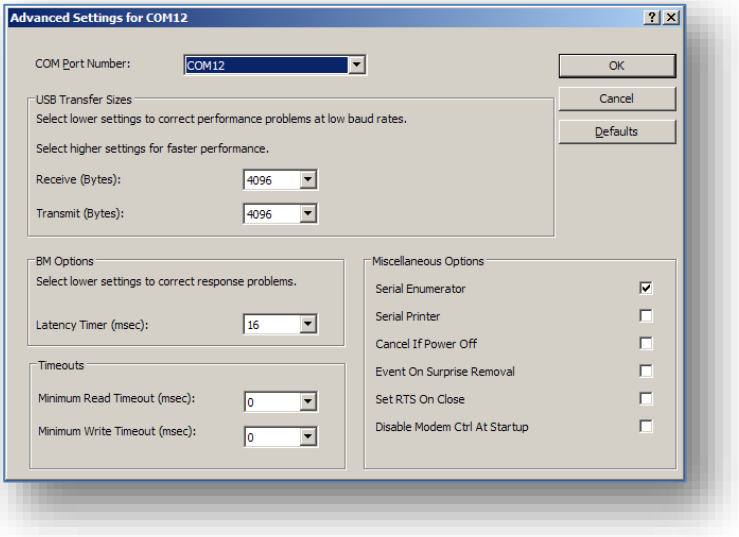


2. Click on “Hardware” and “Device Manager” again you should see a screen similar to this.

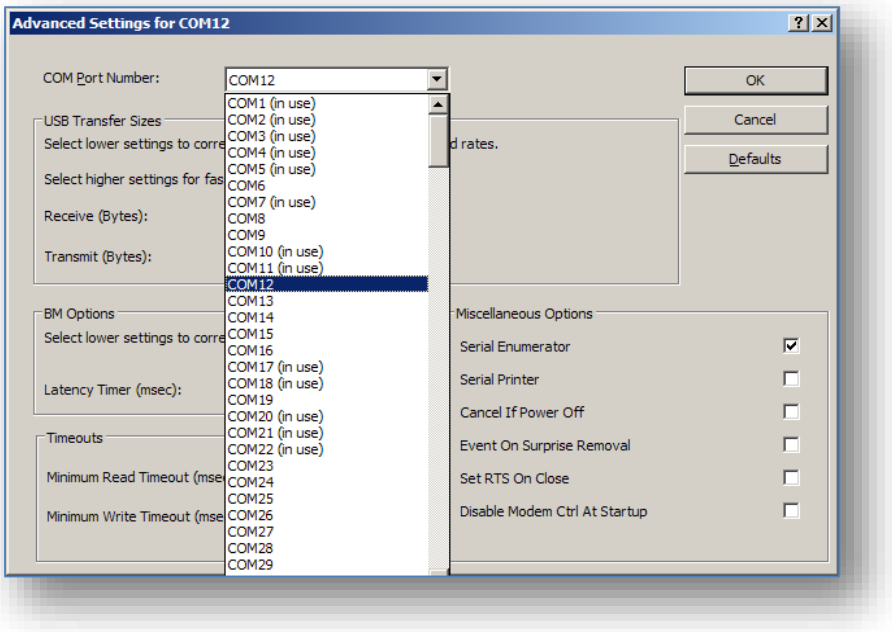


Expand out the “Ports” section and you will see an entry for “USB Serial Port” this is the 900 Series analyzer. You will note that in the illustration above it has been installed as Com12. This is not suitable for Systech_Illinois_Client as it is above Com6.

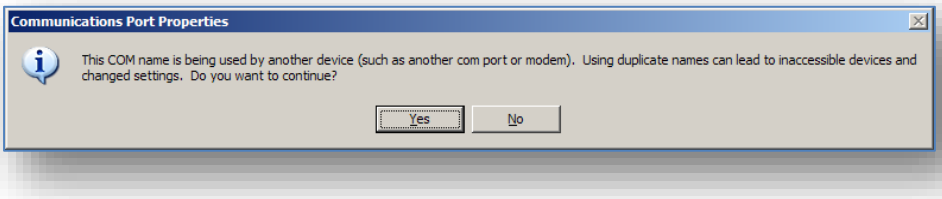
To change this Port number, Double click on “USB Serial Port”, you should be presented with the following screen.



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 Systech Illinois 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 Systech / Illinois 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
CALTIM?	CALTIM=	Reads/Sets settling time
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 Systech / Illinois 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 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.

14.5 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).

14.6 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.

14.7 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.

14.8 Explosion-Proof Enclosure (Option)

Allows the mounting of the sensor parts in a certified housing in a hazardous area while the control unit of any type must be mounted in a safe area (can be set up for both pressurized and ambient pressure applications).

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 a number of 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 your sales representative or email sales.UK@systechillinois.com or sales.USA@systechillinois.com for more information.

15.0 FAULT MESSAGES/ALARMS

Certain messages may appear on the LED display of the analyzer, either in operation of the analyzer or during programming.

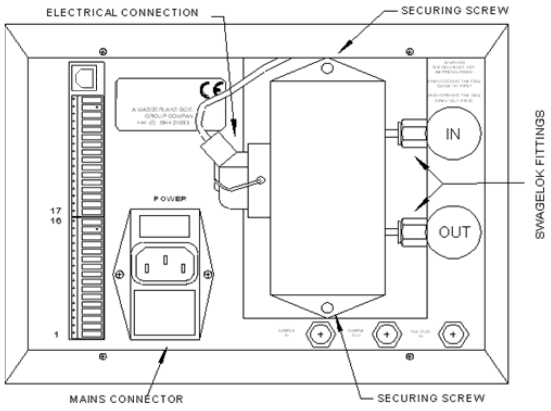
Code	Description
'F-th'	Thermistor open circuit, most likely cause may be the cell at the rear of the instrument has become disconnected.
'FLO'	If a flow alarm has been fitted, then a FLO error indicates a flow failure.
'Err'	When programming new values this display may appear. It indicates the user 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.

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.

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.

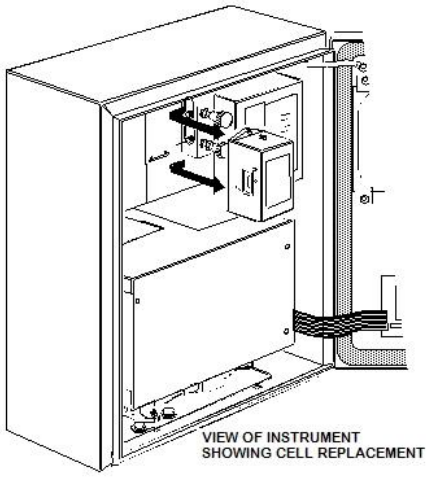
9) Fully tighten the two mounting screws.

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

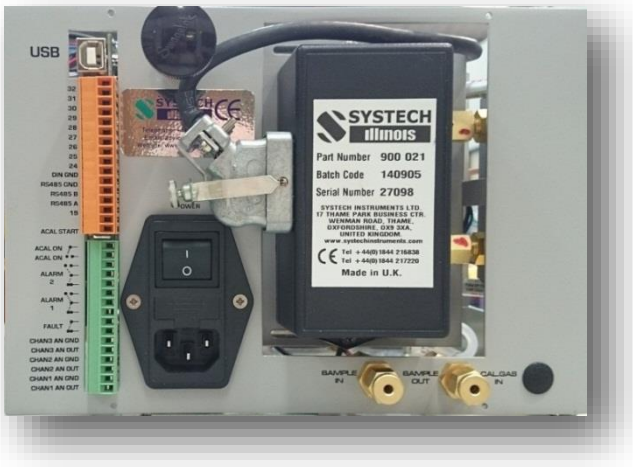


Follow the same procedure as in 16.1 above. The only difference is the mechanical construction of the Wall mount case compared to the panel/bench mount case.

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 Systech / Illinois 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
900 059	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
900 055	Single RACE™ Cell	0.246	0.300
900 168	% 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
900 055	EC900	Race ™	Assy Cell Race	D
900 057	EC900	Trace O2 in H2	Assy Cell Trace O2 In H2	A
900 059	EC900	Race ™ O2 in H2	Assy Cell Race O2 In H2 900	D
900 168	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

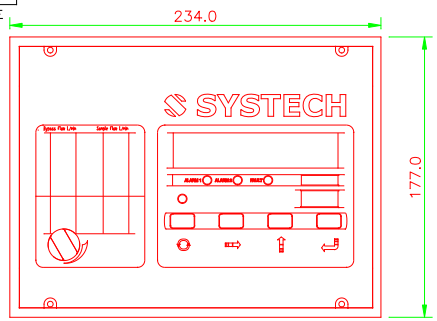
Systech Illinois have a process of continual development of their analyzers. Over the years there have been a number of changes in the basic instrument that have resulted in the suffix of the instrument being changed. These are as follows:

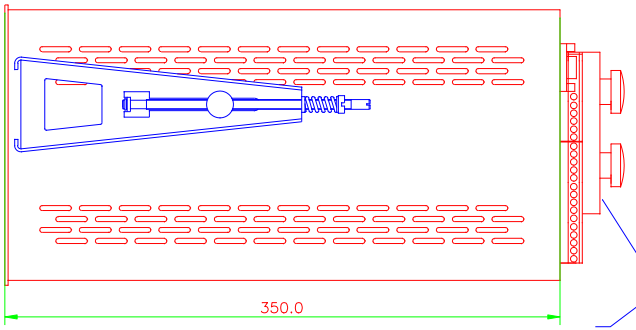
Suffix	Change Details	Change Date
A	RS485 Hardware fitted.	19/10/1999
B	5 segment display / switch PCB fitted.	28/11/2002
C	New Plastic front panel & CPU update.	01/11/2007
D	Dual race cell	
E	New PCB - MK 3 (900 172) (USB).	28/07/2010
F	New PCB - MK 3 (900 183) (USB)	25/05/2011
G	New PCB MK 4 -(900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

A3 ORIGINAL SIZE
DO NOT SCALE

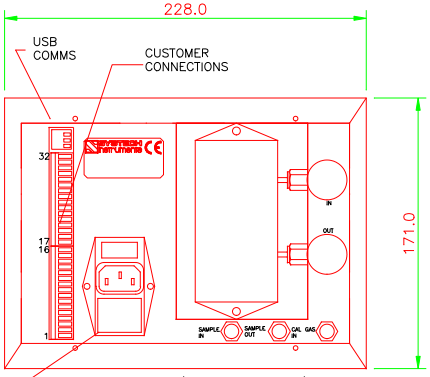
THIRD ANGLE PROJECTION

REMOVE ALL BURRS AND SHARP EDGES



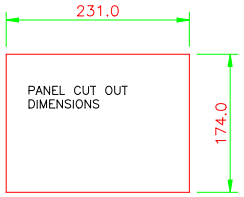


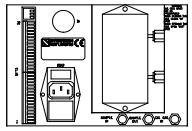
ALLOW AT LEAST 100mm CLEARENCE BEHIND THE INSTRUMENT FOR CONNECTIONS



REAR VIEW (SINGLE RACE CELL)

WARNING
POWER CONNECTION BLOCK
90–260 VAC





REAR VIEW (DUAL RACE CELL)

32	
31	
30	
29	
28	
27	
26	
25	
24	
23	DIG GND
22	SERIAL COMMS GND
21	SERIAL COMMS RS 485B
20	SERIAL COMMS RS 485A
19	
18	
17	START AUTOCAL (CONNECT TO DIG GND)
16	AUTOCAL IN PROGRESS N/O
15	AUTOCAL IN PROGRESS N/O
14	ALARM 2 N/O
13	ALARM 2 COM
12	ALARM 2 N/C
11	ALARM 1 N/O
10	ALARM 1 COM
9	ALARM 1 N/C
8	FAULT CONTACT
7	FAULT CONTACT
6	CH3 ANALOGUE GND
5	CH3 ANALOGUE OUT
4	CH2 ANALOGUE GND
3	CH2 ANALOGUE OUT
2	CH1 ANALOGUE GND
1	CH1 ANALOGUE OUT

ALARM OPTION
CONTACTS RATED 5A/240VAC

CONTACTS SHOWN IN THE POWER ON, NON-ALARM STATE

FAULT RELAY
NORMALLY CLOSED IN POWER ON, NON ALARM STATE

ANALOGUE OUTPUT OPTION
0–20mA OR 4–20mA
SOFTWARE SELECTABLE
600R MAX

ISSUE	DESCRIPTION	APPD	DATE
B	ADDED INFORMATION RE DUAL RACE CELL	P.B.	09/14
A	NEW ISSUE	PB	07/10

SYSTECH INSTRUMENTS LTD
17 Thame Park Business Centre
Wenman Road, Thame, Oxon, UK
OX9 3XA

SYSTECH INSTRUMENTS

MATERIAL

FINISH N7 18

SCALE 1:1 UNLESS STATED

TOLERANCES UNLESS STATED
X ± 0.5mm
X.X ± 0.3mm
X.XX ± 0.1mm
ANG ± 0° 15'

DRAWN	BC
DATE	07/10
CHECKED	BC
APPROVED	PB

TITLE
DIMENSIONS AND CONNECTIONS
EC91X ANALYSERS

DRAWING NUMBER
900 176
SHEET 1 OF 1

SonicWise Ultrasonics

Instruction Manual -Model SW-288H

Ultrasonic Cleaning

Ultrasonic cleaning is based on the phenomenon known as cavitations. In an ultrasonic tank, cavities (or bubbles) are formed by piezoelectric transducers attached to the bottom or sides of a cleaning tank. The piezoelectric effect occurs in a certain group of crystalline solid materials, which have no center of symmetry. When these materials are mechanically stressed, they produce an electric charge, and when an electric field is applied across two poles, the dimensions change. By applying high frequency (20-80Khz) and high voltage, these elements expand and contract rapidly at a rate proportional to the frequency of the applied voltage. As a result of the contraction and expansion, the pressure inside the liquid changes from negative to positive with respect to atmospheric pressure. During the contraction, the pressure in the liquid is negative, allowing the cavities inside the liquid to grow in size, subsequently at the next phase of expansion the pressure in the liquid becomes positive, which causes the cavities to explode internally. The creation and the implosion of cavities cause an intense scrubbing action upon a submerged object. The sizes of the bubbles are microscopic, and can therefore penetrate the smallest cracks and holes to loosen the contaminants and remove them.

All ultrasonic cleaners have three main components:

- Ultrasonic generator or power supply that converts electrical energy from the wall (120VAC/60Hz) to high voltage and high frequency, which is then applied to ultrasonic transducers.
- Ultrasonic transducers convert high voltage and frequency to mechanical vibration.
- A cleaning tank that receives the mechanical energy and causes the cleaning media pressure to rise above and bellow the atmospheric pressure, thereby causing the formation and collapse of bubbles in the liquid. This process produces an intense scrubbing action that removes sediments from the submerged parts.

Q and A

What is "cavitation"?
"Cavitation" is the rapid formation and collapse of millions of tiny bubbles (or cavities) in a liquid. Cavitations is produced by the alternating high and low pressure sound waves .During the low-pressure phase, these bubbles grow from microscopic size until, during the high-pressure phase, they are compressed and implode.

What is "degassing", and why should it be done?
"Degassing" is the initial removal of gases present in the solution. Useful cavitations occur after gasses have been removed from the cleaning solution, leaving a vacuum in the formed bubble.

When the high-pressure wave hits the bubble wall, the bubble collapses; it is the energy released by this collapse that will assist a detergent in breaking the bonds between parts and their soils.

How do I get the best ultrasonic cleaning?
There are many considerations important to ultrasonic cleaning. Optimizing these variables will produce the best cleaning. The most important decisions to be made are choosing the proper cleaning solution, cleaning at the right temperature for the correct amount of time, and choosing the right size and type of ultrasonic cleaner.

Can ultrasonic cleaning damage my parts?
With certain cautions, ultrasonic cleaning is considered safe for most parts. While the effects of thousands of implosions per second are very powerful, the cleaning process is safe since the energy is localized at the microscopic level. The most important cautionary consideration is the choice of cleaning solution. Potentially adverse effects of the detergent on the material being cleaned will be enhanced by the ultrasonics.

Why is a special solution required for cleaning?
Soils adhere to the parts... if they didn't, the soil would just fall off the parts! The purpose of the solution is to break the bonds between parts and their soils. Water alone has no cleaning properties. The primary purpose of the ultrasonic activity (cavitations) is to assist the solution in doing its job. An ultrasonic cleaning solution contains various ingredients designed to optimize the ultrasonic cleaning process. For example, increased cavitations levels result from reduced fluid surface tension. An ultrasonic solution will contain a good wetting agent or surfactant.

What cleaning solution should I use?
Modern ultrasonic cleaning solutions are compounded from a variety of detergents, wetting agents and other reactive components. A large variety of excellent formulations are available, designed for specific applications. Proper selection is crucial for acceptable cleaning activity and to preclude undesirable reactivity with the part being cleaned.

What cleaning solution shouldn't I use?
Flammables or solutions with low flash points should never be used. The energy released by cavitations is converted to heat and kinetic energy, generating high temperature gradients in the solution, and can create hazardous conditions with flammable liquids. Acids, bleach and bleach by-products should generally be avoided, but may be used with indirect cleaning in a proper indirect cleaning container, such as a glass beaker, and appropriate care. Acid and bleach will damage stainless steel tanks, and/or create hazardous conditions.

When should solutions be changed?
Cleaning solutions should be replenished when a noticeable decrease in cleaning action occurs, or when the solution is visibly dirty or spent. A fresh batch of solution at each cleaning session is usually not required.

What is the length of cleaning time?
Cleaning time will vary, depending on such things as soil, solution, temperature and the degree of cleanliness desired.

WARNING!

1. **Use a three-prong outlet with proper grounding and proper voltage.**
2. **Do not immerse this unit in liquid.**
3. **Do not operate without liquid. Always use at least FOUR inches of liquid.**
4. **Do not use flammable liquids with this cleaner.**
5. **Do not use corrosive chemicals, which are not compatible with the cleaning tank material (stainless steel, grade 304/316).**
6. **DO NOT drop or set heavy objects on the bottom of cleaning tank. Doing so may cause permanent damage to transducer elements. Instead, use a basket, a tray or other means of suspending the parts to be cleaned.**
7. **Use adequate ventilation. Keep the area around your cleaner dry and clean.**
8. **Do not disassemble the cleaner. There is high voltage inside the cleaner.**
9. **Do not place your fingers in the ultrasonic cleaning tank when it is in operation.**

OPERATING INSTRUCTIONS

1) Place your ultrasonic cleaner in a well-ventilated and level surface.
2) Fill in the tank with water or your cleaning solution. Make sure that the level of cleaning liquid is at least 4 inches above the bottom of the tank.
3) Plug in the unit to a properly grounded power outlet (120VAC 50/60Hz).
4) Push the ultrasonic switch to ON position. To start the time cycle, press RST (far right black button). The timer is set for 15 minutes. To change the time, use the RIGHT black arrow button to position for no of minutes and seconds and then press the UP-yellow arrow button. (Refer to digital timer instruction manual).
5) There is a separate ON/OFF switch provided for the heater. Temperature is set for 140 degree Fahrenheit. To change the setting, simply press the "AT" button and use the UP and DOWN arrow to set your desired temperature. (Refer to digital temperature instruction manual).
6) When starting with fresh solution, allow 3-5 minutes for the liquid to degas before submerging the basket or other parts. Degassing times vary based on the temperature level and the type of liquid being used. For maximum cleaning efficiency the cleaning liquid must contain as little dissolved gas as possible. When bubbles of gas no longer rise to the surface of the liquid, the degassing process is completed. Using appropriate detergents or chemicals may speed up the degassing process and create better cleaning results. Selecting the right cleaning liquid is very important to the overall cleaning process. There are cleaning chemicals, which are specially formulated for use with ultrasonic cleaners. Upon request, *SonicWise* will suggest a suitable cleaning solution for a particular cleaning application.

7) Place the item to be cleaned into a basket and slowly lower it into the cleaning tank. When the items are clean, slowly remove the basket from the tank and rinse the parts with clean water and dry them if necessary.

8) The cleaning time may vary depending on the following: A) the type of contamination, B) the type of solution being used, C) the temperature of the liquid, D) the density of the parts, E) the material the parts are made of, and F) the load of parts being cleaned. Cleaning time could range from one to several minutes.
9) Overloading the cleaning tank with parts will reduce the cleaning intensity and efficiency. For maximum cleaning results, it is recommended not to load the tank with more than half the volume of the cleaning liquid. It is more efficient to run several small loads than one big load.
10) The parts could be cleaned in two ways. The first way is to place the parts in a perforated basket and place the basket into the cleaning tank filled with the cleaning solution. The second is to place the parts in a separate solid tray or beaker filled with the cleaning solution and place it into the cleaning tank filled with water.
11) Ultrasonic action may damage delicate instruments and certain materials. *SonicWise* will not be responsible for any damages, which are caused by using ultrasonic action or the overall ultrasonic process.

Please email us any questions you may have on using your ultrasonic cleaner. Email address is: tech@sonicwise.com

Maintenance

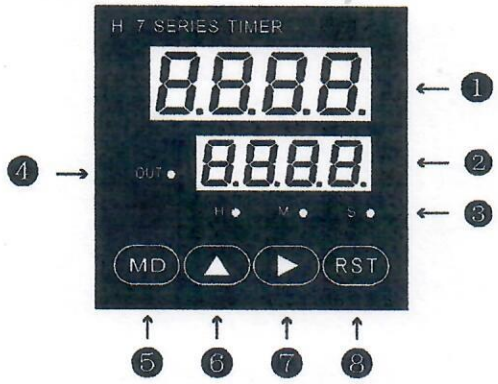
1. Check the tank for contamination whenever you change solution. If necessary, remove contaminants with a nonabrasive cloth and water.
2. Always unplug the cleaner before emptying the tank. Empty the solution into a waste disposal unit.
3. Always unplug the line cord before filling the tank. Fill the cleaner to the operating level

Please email us any questions you may have on using your ultrasonic cleaner. Email address is: tech@sonicwise.com

Digital Timer Technical Specification

Power Supply	220/110VAC±10% 50/60Hz (HP4 just for 220V power supply)
Power Consumption	≤3VA
Mounting Mode	Panel Mount
Timing Range	0.01-99.99S、0.1-999.9S、1-9999S、1-99M59S、0.01-99.99M、0.1-999.9M、
	1-9999M、1-99H59M、0.01-99.99H、0.1-999.9H、1-9999H
Timing Accuracy	±0.1%±0.05sec
Reset Mode	Panel reset, External Connection reset, Auto Reset or Power OFF Reset can be chosen
Input Signal	low level effective
Terminal Capacity	3A/250VAC or 6A/30VDC
Pulse Interference (AC)	±1.8KV
Dielectric	AC 1500V 1min
Insulation Impedance	DC 500V ≥ 100MΩ
Ambient Humidity	≤85% RH
Ambient Temperature	0～50℃

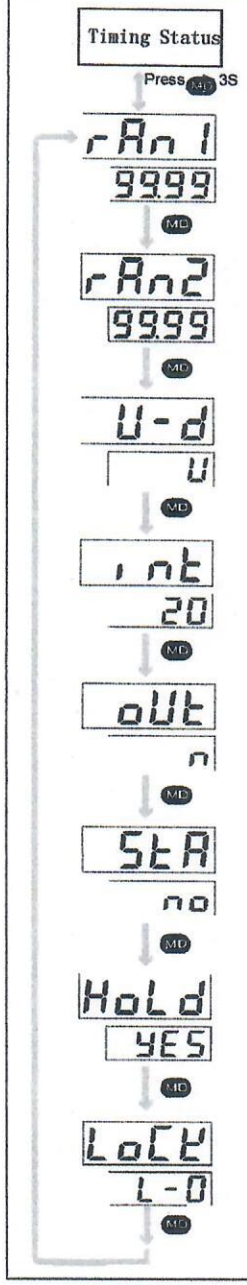
Panel Indication



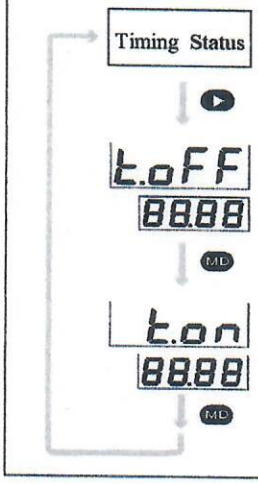
❶ :Timing Value Display Window
❷:Setting Value Display Window
❸:Hour (H), Minute (M), Second (S) Indicate Light
❹ :Relay Output Indicate Light
❺ : Function, SET Key
❻:Increase Key
❼:Right Shift Key
❽: Reset Key

Operation Sequence

- Function Menu

Menu Sepuence	Menu Function	Setting Range
	Under the condition of timing status, press MD more than 3S to enter into function menu, after parameter modification, press MD for a long time to back to timing status. If there is no any operation for more than 10S, the meter will return back to the timing status automatically (the modification will not be saved)	
	rAn1 :Timing value range choose menu, lower line LED display Max timing value, H,M,S indicate light seperately to show the relative units.	99.99S → 999.9S → 9999S → 99M59S → 99.99M → 9999H → 999.9H → 99.99H → 99H59M → 9999M → 999.9M
	rAn2 :Delay time range choose menu, lower line LED display Max delay time value, H,M,S indicate light seperately to show the relative units. (F,N mode without this menu)	99.99S → 999.9S → 9999S → 99M59S → 99.99M → 9999H → 999.9H → 99.99H → 99H59M → 9999M → 999.9M
	U-d :Timing mode choose menu	U Add Timing Mode: Timing count value increase from 0 to setting value d Minus Timing Mode: Timing count value decrease from setting value to 0
	int : Effective pulse width of Input signal choose menu.	1 : 1mS 20 : 20mS
	oUt : Output Mode choose menu	n : N Mode → F : F Mode C : C Mode ← r : R Mode
	StA : Start function	YES : With start function, after power should press or short connect PAUSE terminal, the meter start to work. no : Without start function, the meter will work after power on.
	HoLd : Power OFF data save choose menu	YES : Power Off Data save function no : Without Power Off Data save function
	LoCK : Lock key menu	L-0 : Without Lock function L-1 : Lock Panel reset L-2 : Lock setting value menu + function menu L-3 : Lock panel reset + setting value menu + function menu

● Setting Value Modify Menu

Menu Sepuence	Menu Function	Setting Range
	Under the condition of Timing status, press ▶ to enter into setting value modify menu.	
	t.oFF :Relay Timing value setting menu When Timing value≥T.off setting value, Relay ON.	The parameter can be setting freely between 0.01S-9999H according to the differnet timing range that you choosed in function menu rAn1
	t.on : Output delay setting menu, relay will reset after Relay OFF time≥T.on setting value. (N,F mode without this menu)	The parameter can be setting freely between 0.01S-9999H according to the differnet timing range that you choosed in function menu rAn2

MYPIN

TD Series Temperature Controller

Instruction Manual

Thanks a lot for selecting the product!

Before operating this instrument, please carefully read this manual and fully understand its contents. If any probroms please contact our sales or distributors whom you buy from. This manual is subject to change without prior notice.

■ Warning

Please do not turn on the power supply until all of the wiring is completed. Otherwise electrical shock, fire or malfunction may result.

Do not wire when the power is on. Do not turn on the power supply when cleaning this instrument. Do not disassemble, repair or modify the instrument. This may cause electrical shock, fire or malfunction. Use this instrument in the scope of its specifications. Otherwise fire or malfunction may result. The use life of the output relay is quite different according to is capacity and condictions. If u[illegible]put of its scope, fire or malfunction may result.

Caution

This instrument should be installed in a domestic environment. Otherwires electricla shock, fire or malfunction may result.

To avoid using this instrument in environment full of dust or caustic gas.

To avoid using this instrument in environment of strong shock or concussion.

To avoid using this instrument in environment of overflow water or explosive oil.

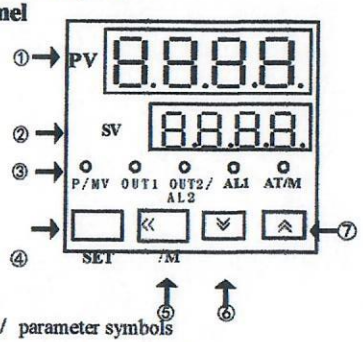
The power supply wire should not put together with large-current wire to aviod electromagnetic radiation, If it must to put together, we suggest to use a individual pipe.

In case the instrument is used in environment of strong noise, (such as motor, transformer, solenoid, etc.) A current suppresser or noise filter should be used.

Applications

TA series of temperature controller is available for many TC or RTD input, adopt some advanced techonology such multi digital filter circuit, autotune PID, fuzzy PID that make it is very precise, stable, strong anti-interference and simple operation. The instrument is widely applied to automation systems of mechanism, chemical industrial, chinaware, light industrial, metallurgy and petroleum chemical industrial. It is also applied to the production line of foodstuff, packing, printing, dry machine, metal heat process equipment to control the temperature.

■ Panel



①. PV / parameter symbols

②. SV / parameters preset value

③. Indication lamps

OUT1: Heating/Main control output lamp

On: Output Off: No output

OUT2/AL2: Colling/Alarm 2 output lamp

On: Output Off: No output

AT/M: On: manual operation Off: auto operation

Flash: under autotuning estate

P/MV: SV/MV display setting

On: MV manual output Off: SV setting

AL1: Alarm 1 lamp On: Alarm Off: No Alarm

AL2: Alarm 21 lamp On: Alarm Off: No Alarm

④. Set key Parameter Setting/Changing

⑤.Shift/Autotune key Press this key to shift digit of parameter value setting. Or hold this key for more than 3 seconds can enter/quit autotune estate. When enter autotune estate, AT lamp on. When quit autotune estate, AT lamp off.

⑥. Up key ⑦. Down key

Models

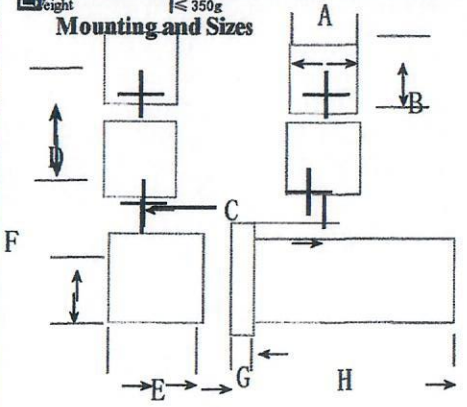
TD □□-□□□□

- Input signals:Default: K,J,T,S,Pt100/mA,IN
- AL1:R:RELAY S:SSR/Logic T:SCR
- OUT2/AL2: R:RELAY S:SSR/Logic -T:SCR N:Non
- OUT1: I:4-20mA R:RELAY S:SSR/Logic T:SCR
- Power supply:Default:90-260V AC/DC E:24VDC or 18-30V AC/DC
- Sizes: 4:48H × 48W 6:48H × 96W 7:72H × 72W 8:96H × 48W 9:96H × 96W

■ Specifications

Power supply	90~260V AC/DC 50/60Hz		
Consumption	≤5VA		
Display range	-199~1800℃		
Accuracy	0.3%F.S±2digit		
Sampling cycle	≤300ms		
Main output	RELAY: normal open AC 250V/3A DC 30V/3A COSΦ=1 SSR/LOGIC: 24V DC ± 2V/ 20mA		
Alarm	RELAY: normal open AC 250V/3A DC 30V/3A COSΦ=1 SSR/LOGIC: 24V DC ± 12V/ 30mA		
Input	T/C	K	0~999℃/0~1200℃
		J	0~999℃ /0~1200℃
		T	-150~400℃ (Special order)
		S	0~1600℃
		E	0~1000℃
	Rt	Pt100	-199~600℃
		Cu50	-50~150℃
	mV	mV	0~75mV
	mA	mA	4-20mA /0-10V
Withstand voltage strength	1500V Rms (Between power terminal and the housing)		
Insulation resistance	Min 50M Ω (500V DC) (Between power terminal and the housing)		
Environment temperature	0~50℃		
Save temperature	-10~60℃		
Environment humidity	35~85%RH		
Weight	≤350g		

Mounting and Sizes



Size / Model	A	B	C	D	E	F	G	H
TD4	44.5+0.5	45+0.5	65	65	48	48	8	80
TD6	43.5+0.5	91+0.5	65	115	48	96	12	80
TD7	91+0.5	91+0.5	115	115	96	96	12	100
TD8	91+0.5	43.5+0.5	65	115	96	48	12	80
TD9	67.5+0.5	67.5+0.5	95	95	72	72	12	100

■ Parameter Setting &Autotuning

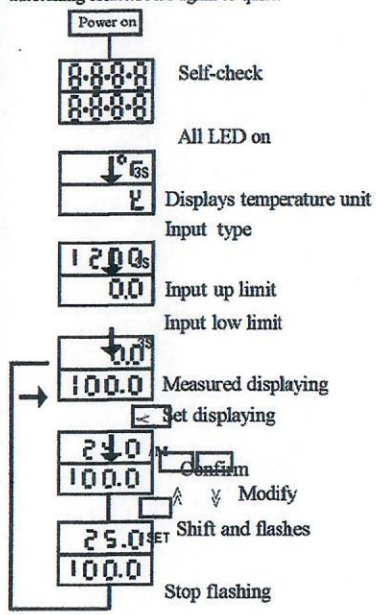
☆ Parameters setting:

A: In display estate,press SET,P/MV lamp on means SV setting, while off means MV manual output setting,but only on manual operation & input connect do MV settable. B: Press the <</M key to select the digit you want to modify; C: Press ∧ and ∨ key to modify the numerals; D: Press SET key to confirm.

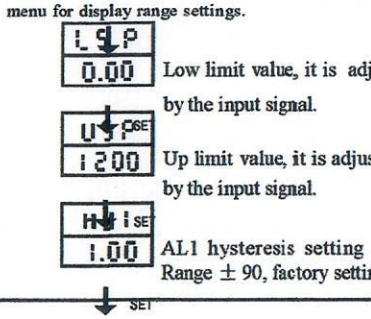
☆ In autotuning estate,output value modification is impossible.

☆ Antotuning operation.

In display estate,press SET and <</M key at the same time until AT/M lamp flahses.Then ithe instrument is under autotuning estate.Press again to quite.



In Manual operation/Non-autotune estate, press and hold ∧/∨ key for more than 3 seconds to enter/quit the below menu for display range settings.



HY2 1.00 — AL2 hysteresis setting value. Range ± 90, factory setting 1.0

SET

dP 0 — Decimal point setting: 0: No decimal 1: One decimal

SET

SCK 015 — Password setting. Factory setting 015

HOLD SET >3S

AL1 9999 — AL1 set range: –1999-9999

SET

AO1 2 — AL1 mode: 0: Deviation HI alarm 1: Deviatian LO alarm 2: Absolute value HI alarm 3: Absolute value LO alarm 4: Section outside alarm 5: Section inside alarm 6: TC broken

SET

AL2 900 — AL2 set range: –1999-9999.

SET

AO2 3

SET

① PVF 0.00 — Range: ± 100.Display value PV = Measured value - PVF

SET

InP K — Input signal selection TC: K, J, E, S RTD: Pt100, Cu50 The factory setting is K

SET

P 3.00 — Proportional band (%) range 0.1-3600. If P=OFF, it means ON/OFF control

SET

I 240.0 — Integral time range 0.1-3600. I=OFF means cancel integral time.

SET

d oFF — Derivative time range 0.1-3600. D=OFF means cancel derivative time.

SET

oUd HEAt — Control directions: HEAt: heating COOL: cooling

HYS 1.00 — Control hysteresis, range: ± 100. It is not available when P ≠ OFF

SET

LtL 020 — The output control mode ,RELAY=020, SSR\SCR=001,4-20mA=000.

SET

t-L 0.00 — High analogue output (when analogue is active)

SET

t-H 1000 — High analogue output (when analogue is active)

SET

bSL tPU — Only for 4-20mA. bSL =PID,control; bSL =tPV 4-20mA, transmit;

SET

L-F C — Temperature unit. C means C degree, F means F degree.

SET

LcK 000 — Parameter lock code setting. LcK=000 means unlocked. LcK=010 means locked.

Note:

Mamual/Auto Convertion: In display estate,press <</M to

means autotuning.

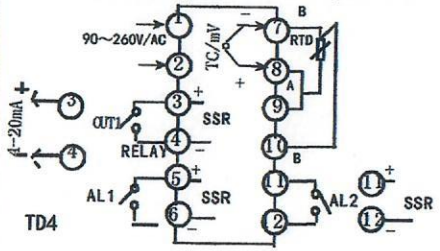
For the very first time, please press SET and <</M key until AT/M lamp flash to enter autotuning estate.In the future,if the load/control temp. point changes in small

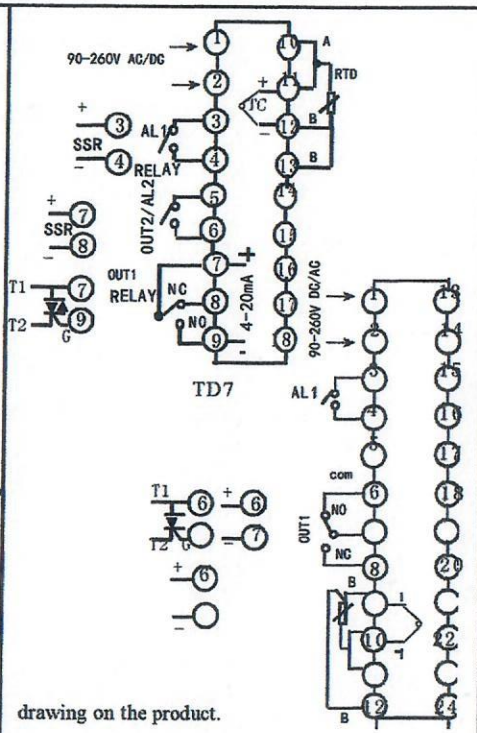
value changes within ± 30℃), the user no need to let it autotuning again. Because the instrument has recorded the previous PID parameters. When the instrument is used for huge capacity heating equipments, the user should set autotuning value lower 5%-10% than the normal control value, in order to decrease the exceed-tuning caused by control.

Normally, the control cycle of the heating equipment should be 20-30 seconds. For huge capacity heating equipments, the value should be 30-120 seconds, in order to longer the use life of the relay. For non-contact output, such as SSR control output, the value should be 1-3.

■ Terminal configurations

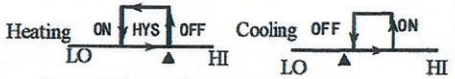
(If any changed, please refer to the product showing.)



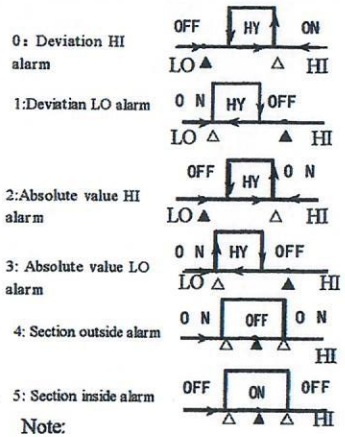


drawing on the product.

ON/OFF control: ▲ Set value



Alarm mode:▲ Set value △ Alarm value AL

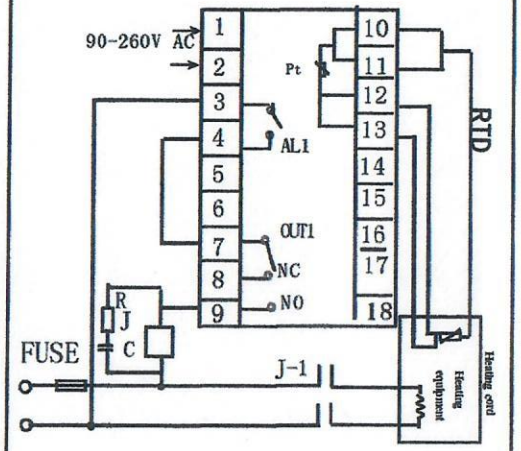


Note:

All the factory setting value of deviation alarm is 1.0.

■ Application examples

1.Relay output control (forTA9)



■ Malfunction estimate

correct. Specially pay attention to the power supply terminals and signal input ternimals.

② Incorrect Didplay: Check if the input signal is conformity with the selected symbol.

For TC input, please use the relative compensation cable.

For RTD input, please use low impedence cable. The 3 wires should at the same length.

If all above mentioned is collect , pleaase use parameter PVF to modify.

③ Incorrect Control : If the instrument has been used for a long time, the user find the temperature is hard to rise up to the set value, meanwhile the outsidesystem running well, there must be something wrong with the parameters of the instrument.

The user need to re-autotuning the instrument. If the instrument lost control, please check if the connection of the control is correct.

If external load is shorted, broken, wrong connection or components is damaged, it will cause lost control as well. When it is necessary, please push out the PCB to check the if the output terminals is damaged and not available.

④ Display malfunction: "UUUU": The input signal exeed the measured HI range .

1.0 Scope

This instruction installation, operation and troubleshooting of the Multistar D-series uninterruptible power supply (UPS). covers replacement of an infrared lamp emitter in an IR furnace chamber Applies to most RTC, LCI and TP Solar infrared furnaces.

Figure 1-1 Multistar UPS-650D

2.0 Introduction

UPS-D series can instantly switch you computer to emergency backup power and allows you to respond to brief power outages reducing possibility of data loss or downtime. It continuously conditions the power coming into your computer and acts as a power supply. This state-of-the-art UPS is specifically designed for PC users and is also suitable for computer peripherals. It is equipped with an LCD display for the working status. The UPS has a microprocessor controller that renders the product an intelligent UPS capable of self-protection and fault diagnosis. The built-in AVR functions automatically to maintain a stable voltage supply as the supply power varies. High-performance surge suppression helps to protect the furnace computer from electrical noise and damaging power surges.

3.0 Performance

Uninterruptible Power. Protects data by supplying batery backup when power fails.

Microprocessor Control. Provides diagnostics.

LCD Display and Audible Alarms. Actively informs when unit is on battery, if the battery is low, or if there is an overload condition.

Battery. Sealed lead-acid maintenance-free battery.

Automatic Detection. When the UPS is powered ON, it immediately performs an inspection of the battery capacity.

Automatic Voltage Regulation. Corrects over and under voltage conditons without draining the battery. This preserves battery resources and ensures optimum runtime during complete loss of power.

Surge Protection. Shields hardware from damage from line power surges.

Automatic Charge. The UPS charges its battery whenever it is connected to facility power.

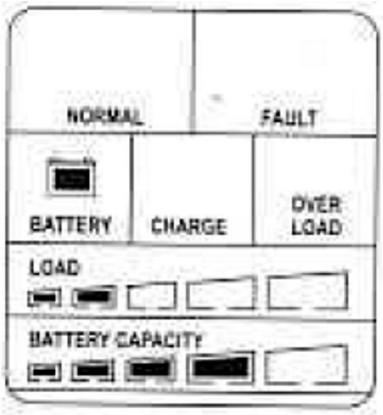
4.0 Installation

Location. Must be in a protected area with adequate airflow and free of excessive dust. Do not operate the UPS where the temperature and humidity is outside the specified limits.

Charge battery. The battery in the UPS will lose some charge when the unit is offline, even when there is no drain on the discharge side. The UPS will completely recharge after 8 hours of normal operation. Do not expect full battery run time during an extended recharge.

5.0 LCD Display

Display information and status.

LCD WINDOW	Status	LCD Display
NORMAL	Facility supply power to UPS is normal.	
FAULT	Facility supply power to ups unusual or problem has occurred	
OVERLOAD	UPS overload. The buzzer emits continuous alarms for 30 seconds	
CHARGE	Battery charge mode	
BATTERY	UPS transfer to backup or battery test mode. The buzzer emits alarm every 4 seconds.	
LOAD bar	Load capacity indicator in percent	
BATTERY CAPACITY bar	Battery capacity indicator in percent	

6.0 Operation

SWITCH ON. With facility power ON to the furnace, press and hold the POWER button more than 4 seconds until hearing one beep, switch On.

SWITCH OFF. Press and hold the POWER button less than 4 seconds until one beep is heard.

Self-Test. In normal utility power, push the POWER button less than 1 second and UPS will perform a self-test on the battery capacity. During the self-test, the UPS operates a backup mode the BATTERY and LOAD icon stay on.

SILENCE. In Back-Up mode, push the POWER button less than 1 second to silence the audible alarm.

BACK-UP(slow alarm). When in Back-Up mode, the BATTERY and LOAD icon illuminate and the UPS emist beeping sound every four seconds. The alarms stop when the UPS returns to utility power operation. Press the POWER button to stop the beeping.

LOW BATTERY (rapid alarm) In Back-Up mode, when the battery energy runs low, the UPS beeps rapidly until the UPS shuts down form battery exhaustion or return to utility power operation.

OVERLOAD (continuous alarm). When the UPS is overloaded, the OVERLOAD icon illuminates and the UPS emits a continuous alarm for 30 seconds to warn of an overload condition. Disconnect nonessential load equipment from UPS to eliminate the overload.

6.1 Battery Alarms

Battery Capacity >40%. Buzzer emits sound every 3 seconds, automatically muffles after 1 minute.

Battery Capacity <40%. Buzzer emits sound every 1 second and does not shut off.

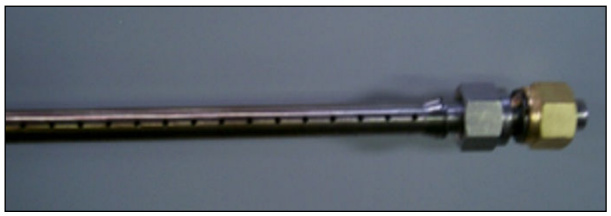
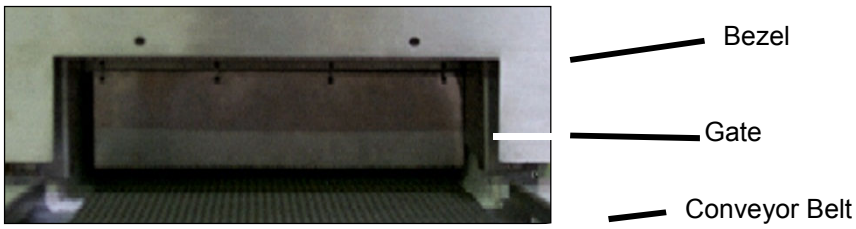
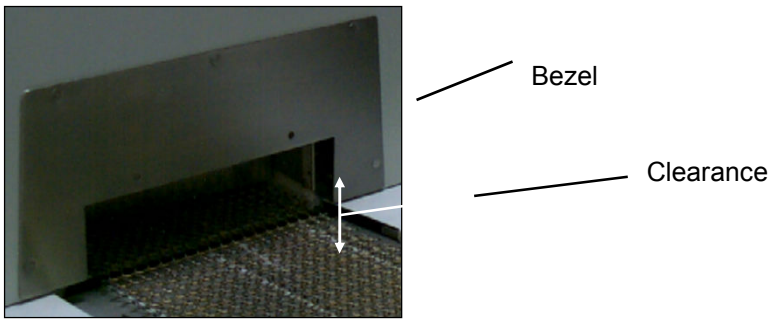
7.0 Maintenance

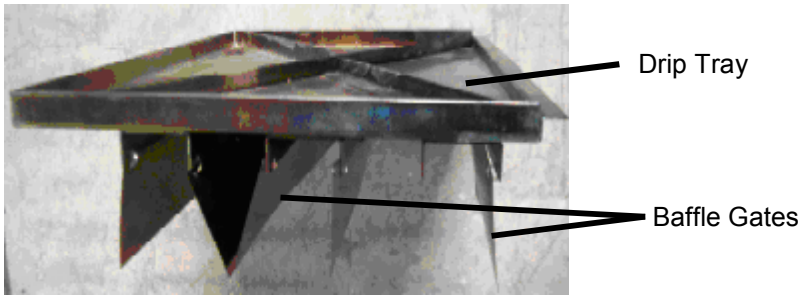
1. With normal use, a UPS battery will last 3 to 6 years depending on the number of discharges and temperature.
2. Charge the UPS's battery every 3 months during extended storage.
3. Disconnect the power during extended storage to avoid overcharge of the battery.
4. Avoid overload or short circuit although the UPS has built-in overload and short circuit protection functions.

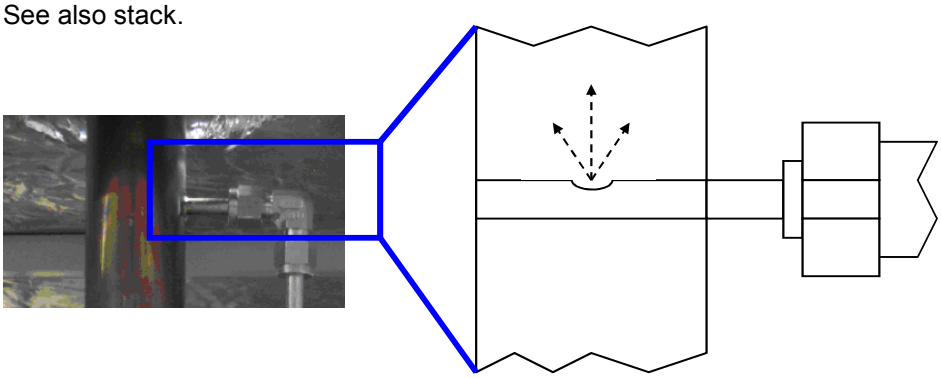
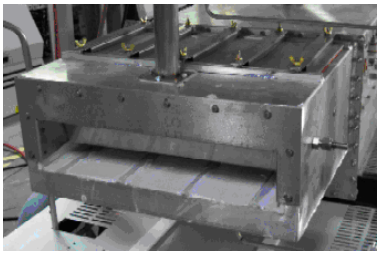
8.0 Troubleshooting

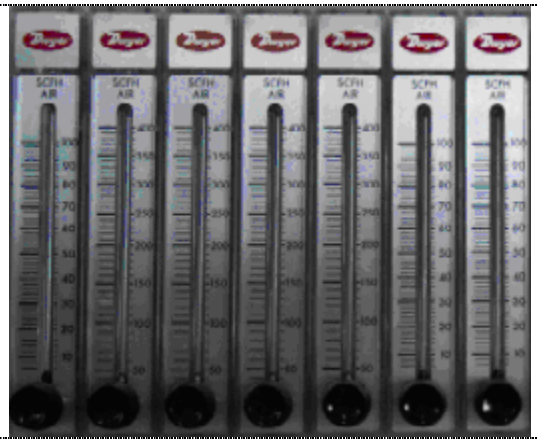
Problem	Possible Cause	Action
UPS not On. LCD not lit	POWER button not pushed or push to short.	Press the POWER button and hold more than 4 seconds.
	PCB failure	Replace the PCB, call for service.
UPS stays at battery mode	Power Cord loose.	Check the power connection.
	AC fuse burned out	Replace AC fuse
	Line voltage too high, too low or black out.	Normal condition.
	PCB failure	Replace the PCB, call for service.
Buzzer continuous beeping	Overload (>1.8A @ 230 Vac / 3.3A @ 120Vac)	Remove the non-critical loads
UPS does not provide expected run time. Low battery warning is sounded prematurely.	Battery is weak due to wear or successive main outages	Allow UPS to recharge battery for a minimum of 8 hours. If UPS sounds low battery warning prematurely when charges and retested, then battery should be replaced.

10.4 Glossary

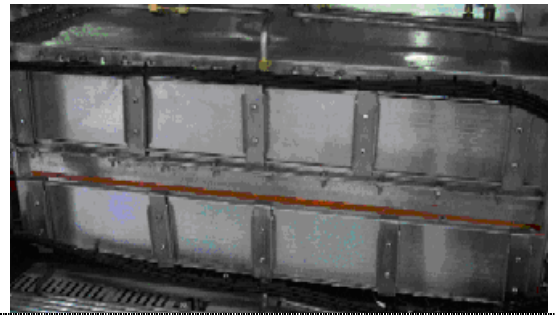
Across-the-Belt	In reference to an area perpendicular to the direction of travel through the furnace; the width of the conveyor belt.
Actual Temperature	The instantaneous temperature in the furnace as reported by the thermocouple.
Air-Rake	Long tube set across-the-belt with proportionally spaced small holes. 
Air-Regulator Tubes	Air rakes charged with air or N2 installed in the entrance and exit baffles, used in establishing a controlled atmosphere.
Blade	Hinged flaps at entrance and exit of furnace that help prevent furnace atmosphere from escaping. See also figure under Drip Trays. 
Bezel	Semi-permanent entrance guard at furnace entrance and exit. See also Gate. 
CDA	Clean dry air – filtered, dry compressed air used as process gas.
Chamber	See heating chamber.

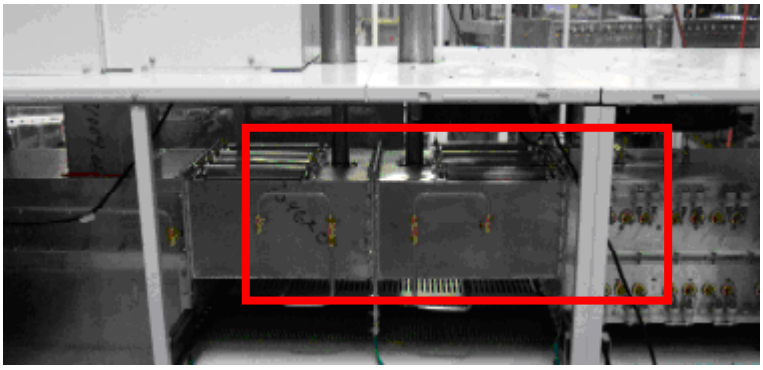
Clearance	The distance at furnace entrance between the conveyor belt and the bezel. See diagram under bezel.
Contaminants	Anything present in the process section that could negatively impact product quality including but not limited to O_2, moisture or particulate matter.
Convection	The process of heating a product via indirect transmission of heat from adjacent high-temperature air.
Controller	Control system that stabilizes temperature, monitors belt speed, alarm conditions and other functions.
Controlled Atmosphere	The atmosphere generated from the process gas, and gas flow patterns within the process section.
Cooling Section	The portion of the furnace that includes the transition tunnel, if any, exit baffle and any additional modules provided for the purpose of cooling the product.
Derivative	The calculated temperature rate of change; used in the PID equation.
Dilution Purge	The continuous process of adding clean gas while exhausting contaminated gas.
Dominant Wavelength	The wavelength of highest occurrence emitted by a radiating element at a specific temperature as described by Wein's Displacement Law.
Drip Trays	Trays positioned beneath stacks with attached baffle gates; used to catch condensation or residue produced by the process. 
Edge Heater	Heaters along edge of chamber used to maintain uniform temperature across-the-belt in a designated part of the heating chamber.

Eductor	Metered gas exit used to draw exhaust gas out of the chamber and through the stack. See also stack. 
Effluents	Contaminants expelled from a product during a thermal process. See also volatiles.
EMO	An Emergency off switch.  
Entrance Baffle	The section at the entrance of the furnace incorporating an air-regulator tube, hanging gates and an exhaust stack; used to establish a controlled atmosphere inside the process section. 
Exhaust Gas	Spent process gas.
Error	Difference between actual temperature and setpoint.
Flash	The point at which organic vapors have reached the temperature and concentration necessary for spontaneous combustion.

Flow Meter	A manually adjustable gauge to control the flow of gas or liquid process section.  used to the
FG or Forming Gas	A type of process gas that consists of any mixture of H_2 and N_2 gasses.
Furnace Length	The length of the entire furnace. The sum of the process section and any loading and unloading stations.
Gain	Term in PID equation to calculate how far temperature is from setpoint.
Gate	Plate that divides furnace into sections that can allow better control of the processing environment. See Blade and Drip Trays for picture.
H_2	Hydrogen gas.
Heat Lamp	Double ended metal sleeve clear quartz infrared (IR) heat lamp element or emitter.
Heated Length	See “Heating Chamber”, next.
Heating Chamber	Furnace area where heating takes place. Also referred to as the chamber, or heated length.
Heating Section	The portion of the furnace including the entrance baffle and the heating chamber.
Hydrogen Detector	Detect hydrogen escaping from furnace.
Integral	Mathematical operation that is one term in the PID equation.
Interlocks	Switches on some cabinet doors that stop furnace operation and removes power when doors are opened.
IR	Electromagnetic wave. Wavelengths between 0.78 and 1000 μm in the electromagnetic spectrum.

Lamp Strings	A single lamp circuit which may include one lamp, or two or more lamps in series. LA-309 Standard Power furnaces are wired with two lamps per string in zones 1 and 3. Zone 2 is wired with 3 lamps per string at all voltages above 240 Vac*. LA-309 High Power furnaces are wired with two lamps per string in all zones at all voltages above 240 Vac*. *208-240 Vac LA-309 furnaces are wired with one lamp per string in all zones.
LPM	Liters per minute. Units of flow equivalent to 2.119 CFH.
Micron	One millionth of a meter, $1.0 * 10^{-6}$ m, 1.0 μm
MMI	Man machine interface software development tool for creating user interface to PLC controller.
Module	A section of the furnace designed for a specific function; may be 15, 30, 45 or 60 inches in length.
N_2	Nitrogen gas.
O_2	Oxygen gas.
Oxygen Analyzer	Detects oxygen content at predetermined locations. Usually installed to read process gas source, and up to three locations in the heating chamber.
Phase Angle Firing	Technique that activates AC power to be applied for only certain times during AC cycle.
PC	Personal computer. The PC provides the main operator interface for operating the furnace. The PC interfaces with the PLC.
PID	Proportional+Integral+Derivative: Three-term closed loop control equation that adjusts power sent to heat lamps. See also Gain, Integral and Derivative.
PLC	Programmable Logic Controller. An industrial computer which provides input and output control of the furnace.
Plenum	Cutout area of chamber insulation where process gas is injected.

Plenum Box	Pressurized region, enclosing of heat lamps, part of the hermetic seal option.  ends
PPM	Parts per million. Useful ratio for measuring small amounts of one gas in an area dominated by another.
Process Gas	The gas used in creating a controlled atmosphere. Some examples are CDA, N_2, H_2, forming gas or other N_2/H_2 mixtures.
Process Environment	The description of the area inside the furnace at any time including the temperature, flow patterns, and the presence or absence of product, process gas, process effluents, or contaminants.
Process Section	The physical area inside the furnace from the entrance bezel to the exit bezel. The sum of the heating section and cooling section.
Profile	See Temperature Profile.
Proportional Band	The temperature range used in the PID equation in applying a portion of the available power to the heat lamps based on the deviation of the actual temperature from the setpoint.
Recipe	Instructions, including temperatures and belt speed that the furnace follows.
Resonant Frequency	The frequency at which the atomic structure of a material is easily excited into physical vibration resulting in excellent heat transfer characteristics.
SCFH	Standard Cubic Foot per Hour. Measurement for gas flow volume. Equivalent to 0.472 standard liters per minute.
SCR	Silicon Controlled Rectifier. The electronic device used to regulate power to the heat lamps through signals sent by the PLC controller.
Setpoint	The target temperature for a zone.

Sparger Tubes	Highly porous, sintered metal tube charged with process gas; typically used in controlled atmosphere cooling modules.
Stack	Exhaust stack containing eductor. See also eductor. 
STP	Standard temperature and pressure: 21.1 C (70 F) 1 Atm, 1.013 Bar (14.7 psig)
Temperature Profile	Temperature recorded over a period of time.
Thermal Process	The idealized process description for a particular product as it passes through the process section, including the product temperature profile and process environment.
Thermal Process Profile	Empirical record of the thermal process
Thermocouple	An electronic device that measures temperature.
Throat	The throat of the furnace describes the maximum height of any product allowable through the process section.
Transition Tunnel	Chamber section between heat and cooling section. 
Volatiles	Hydrocarbon based product effluents.

With-the-belt	In reference to the area of the conveyor belt that extends through the process section.
Zone	Area within the chamber where temperature can be independently controlled.