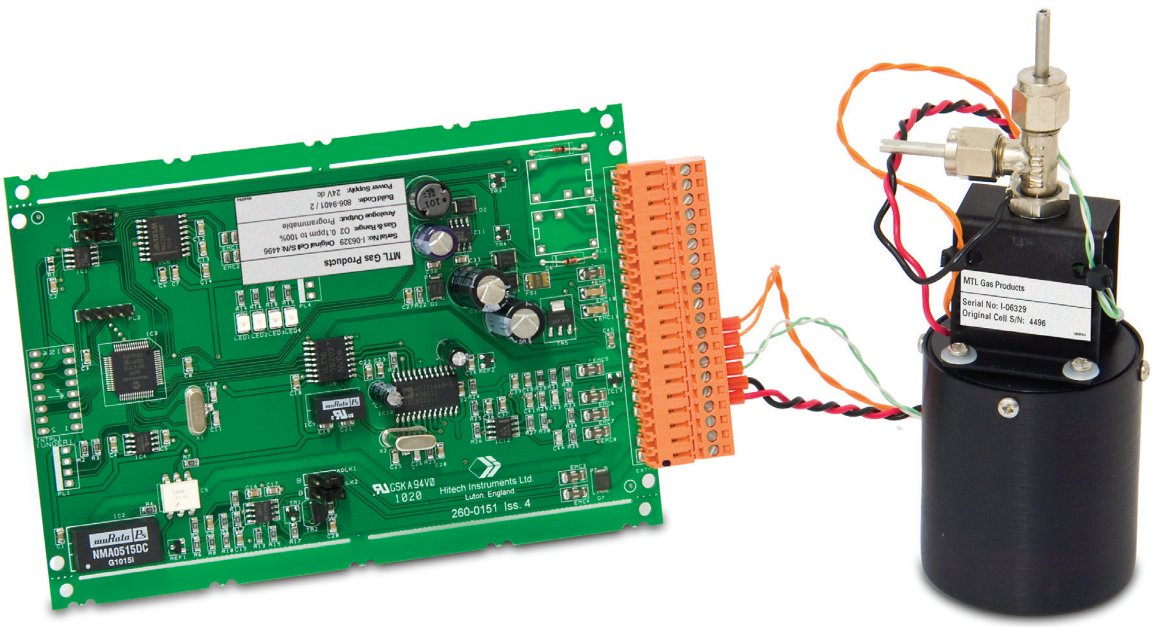
Instruction manual
MTL gas analysers & systems

January 2017
INM MTL 130-0193 Rev 5

CROUSE-HINDS
SERIES

Z530 Mk2

MTL zirconia oxygen analyser



EATON
Powering Business Worldwide

DECLARATION OF CONFORMITY

A printed version of the Declaration of Conformity has been provided separately within the original shipment of goods. However, you can find a copy of the latest version at -

http://www.mtl-inst.com/certificates

CONTENTS

THIS PAGE IS LEFT INTENTIONALLY BLANK

1 INTRODUCTION

The Z530 is a 'blind' (no display) OEM oxygen analyser comprising micro-processor based electronics mounted on a single printed circuit board, and a separate zirconia oxygen sensor, complete with its associated heater. Both parts are supplied loose (un-mounted) to enable the maximum flexibility in mounting options for the OEM. The mounting dimensions are shown later in this manual.

This product is sold as a component. All relevant standards applicable to the installation is the responsibility of the system integrator.

See specification section for full details.

1.1 Manual symbols

The following methods are used in this manual to alert the user to important information:-

WARNING

Warnings are provided to ensure operator safety and MUST be followed.

CAUTION

A Caution is provided to prevent damage to the instrument.

NOTE

These are used to give general information to ensure correct operation

1.2 Information

Waste Electrical and Electronic Equipment directive (WEEE) 2002/96/EC
(RoHS) directive 2002/95/EC

WARNING

This equipment must only be used in accordance with the manufacturer's specification, instructions for installation, use and maintenance to ensure that the protection of the operator is not impaired. It is the responsibility of the installer to ensure the safety and EMC compliance of any particular installation.

2 SPECIFICATION

2.1 Sensor

Zirconia- platinum-coated electrolyte

2.2 Range

0.000001% (0.01ppm)...100% Oxygen

2.3 Accuracy

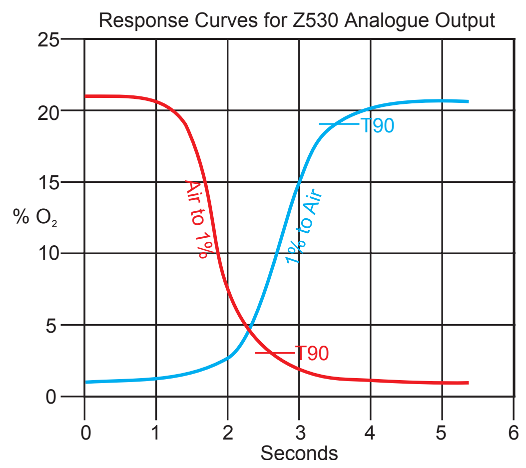
100ppm to 25%	±2% of reading or better
10- 99ppm	±1ppm
0 - 9.9ppm	±0.1ppm

2.4 Stability

Better than 2% of reading or 0.5ppm/month, whichever is greater.

2.5 Speed of response

T90: less than 4 seconds at 500ml/min sample flow – see graph for details.



2.6 Sample flow

Between 100 and 500 ml/min for optimum operation.

Note: Flow regulation and measurement is not provided as standard; it is the responsibility of the installer to provide these as required.

2.7 Sample connections

Inlet/Outlet connectors 3.125mm (1/8”) diameter stainless steel tubes

2.8 Sample inlet pressure

The pressure within the sensor is set by the back pressure at the sample outlet tube; this should be nominally atmospheric. The limits are-1 barg to +1.5 barg. See technical description section regarding errors if pressures, other than atmospheric, are applied.
The sample is heated to ~650°C in the sensor; only samples that contain non-reactive, non-corrosive gases can be applied – e.g. oxygen in nitrogen, inert gases (Group 0), carbon dioxide etc.

2.9 Sampling system material

Stainless steel, platinum, zirconia and nickel plated brass.

2.10 Analogue output - isolated

Output (programmable): †	4 to 20mA	0 to 5 volts
Isolation:	1kV *	1kV *
Maximum load:	500 ohms	–
Minimum load:	–	10 kohms
Resolution:	0.01 mA	2.5 mV
Accuracy:	+/- 0.2% of programmed range	+/- 0.2% of programmed range
Linearity:	+/- 0.5%	+/- 0.5%
Minimum under range:	3.8 mA	–
Maximum over range:	20.5 mA	–
Upper error band:	21.0 to 24.0 mA	–

† This is user programmable for full-scale values of between 1ppm and 100% oxygen and zero-scale values of between 0ppm and 90%.

* Isolation must only be considered as forming basic or function insulation as defined in BS EN 61010-1:2010

2.11 Serial communications

RS232 interface, 9600 baud, ASCII protocol (see Section 8)

2.12 Ambient operating temperature range (sensor and circuit board)

0°C to 45°C (0- 90% R.H. non-condensing)

2.13 Power requirements

24V DC +/- 10%, 24W

2.14 Dimensions

Electronic circuit board

Maximum overall: 20mm max (H), 165mm (L), 100mm (W)

Sensor/heater

Maximum overall: 68mm (H) x 150mm (L) x 55mm (W)

Lead lengths: 300mm nominal

2.15 Weight

Electronics: 75gms
Sensor: 130gms

3 INSTALLATION

3.1 Unpacking and visual checking

Take all normal precautions when opening packages. In particular, avoid the use of long bladed cutters. Check that parts are present as listed on packing note.
Search packing if any are missing.

3.2 Mounting

WARNING

The sensor heater has a hot surface that is present in normal operation. Take care when handling!

A site should be chosen where the temperature does not go outside the range specified in Section 2.12. Care should be taken to ensure that neither the electronics nor the sensor will be subjected to excessive vibration or knocks and jolts. The unit is not sensitive to tilting in any attitude. See Fig.1 for electronics dimensions and Fig. 2 for sensor/heater assembly.

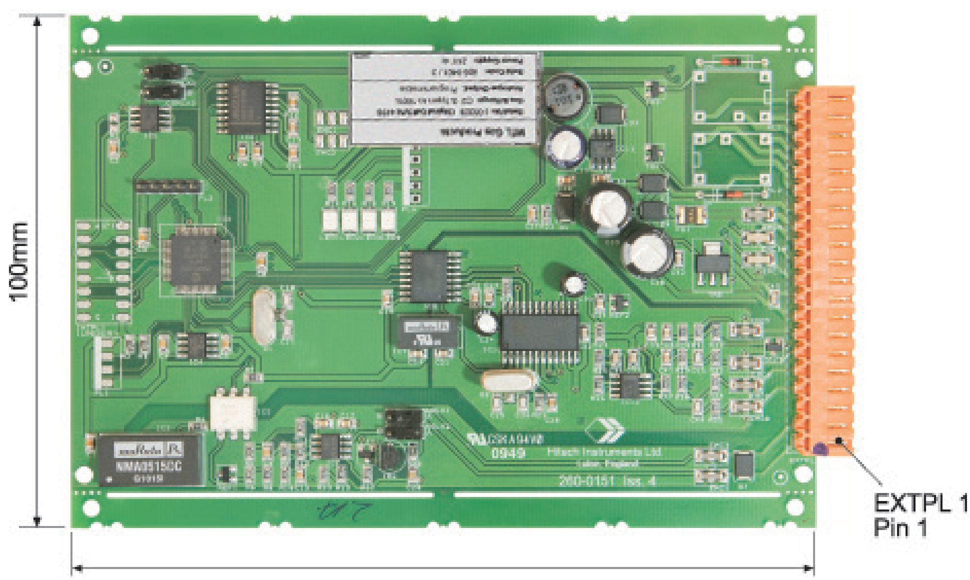


Figure 1 - Z530 circuit board

The sensor/heater assembly is shipped fully assembled. To mount it as shown in Fig. 2 the two screws attaching the sensor bracket to the end plate of the heater body, and the two screws in the upper holes must be removed. The sensor and bracket assembly must then be carefully removed. The heater and sensor assembly must then be re-assembled through the pre-drilled mounting plate as shown.

3.3 Electrical connections

3.3.1 Power supply

Power connections should be made to the circuit board as defined in Section 3.4. The power demand is approximately 24VDC 1A (max.) at turn on.

3.3.2 Circuit board electrical connections

1	+	4 to 20mA analogue output
2	–	4 to 20mA analogue output
3		N/C
4	+	Sensor Input - **Red**
5	–	Sensor Input - **Black**
6	+	Thermocouple Input - **Green**
7	–	Thermocouple Input - **White**
8		Heater Element - **Orange**
9		Heater Element - **Orange**
10		RX - RS232
11		TX - RS232
12		0V Comms
13		+24V Power
14		0V Power
15-20		N/C

NOTE

The sensor/heater assembly and the electronics are factory calibrated as a matched pair. Should they become separated, pairs can be identified by the sensor serial number marked on each one. If the sensor or the electronics are exchanged, re-calibration will be required.

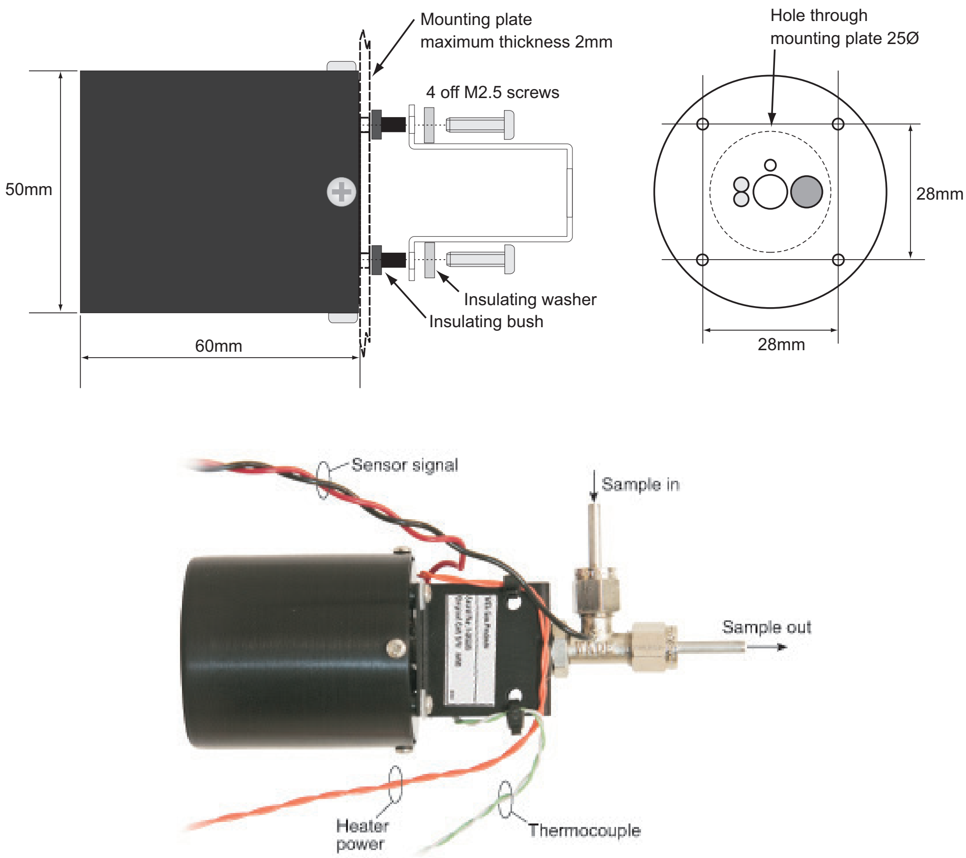


Figure 2- Sensor and Heater Assembly

3.3.3 RS232 Connection

Connect the serial RS232 interface to DTE equipment (e.g PC COM port) as shown here.
See also Section 8 - COMMUNICATION PROTOCOL

Circuit board			DTE (PC) pin no.	
Conn.	**Signal**	**Description**	**25-way**	**9-way**
10	RX	Data received by instrument	2	3
11	TX	Data transmitted from instrument	3	2
12	GND	Signal gnd	7	5

3.4 Sample connections

The sensor connections are 1/8" OD sample tubing.

The sample must be clean, non-condensing and non-corrosive.

It is advisable to fit isolation valves in the sample line to the zirconia sensor. This ensures that the process may be sealed when the sensor is changed or removed. The use of a three way valve on the inlet side of the sensor is also useful to allow standard calibration gases to be introduced.

For best accuracy the instrument should be calibrated at its normal working pressure, but the measuring cell may be pressurised to the maximum pressure specified in Section 2.10. It is factory calibrated at normal atmospheric pressure.

4 COMMISIONING

4.1 Applying power

With the analyser fully connected it may be switched on. The cell heater will begin to warm up. During this time the instrument heater status will show 'Warm-up' (via the RS232 communications) and the concentration reading will make high and low excursions. Once the correct temperature is reached, the instrument heater status will show 'Normal'. Allow a further 15 minutes before relying on the oxygen reading. The instrument is calibrated prior to shipment and may be used immediately the warm-up time has elapsed. If, however, you wish to check calibration go to section 5.

4.2 Configuration

All configuration of the instrument is via the RS232 communications. This utilises an ASCII protocol as specified in Section 8.0. Use the Configure command to set the analogue concentration range and calibrate the instrument.

4.3 Introducing the sample

To measure a flowing sample, establish a flow rate as specified in Section 2.6. The instrument should respond immediately once the instrument heater status is normal. For best results the sample exhaust gas should be vented directly to the atmosphere.

5 MAINTENANCE AND CALIBRATION CHECKS

CAUTION

Certain procedures associated with calibration maintenance can affect the output of the instrument. Any procedures used for control, or the associated control loop should be disabled before commencing calibration.

5.1 Calibration overview

The Z530 is a very stable analyser with minimal drift (see Section 2.4). The frequency of calibration checks or verifications depends upon the quality regime being operated at the installation site. Typically, monthly checks are found to be adequate.

The recommended calibration technique starts by checking or verifying the response of the analyser, then altering the calibration of the analyser only if the errors are significant. The readings may be verified by introducing a gas mixture of known concentration (i.e. a calibration gas), allowing the system to stabilise, then checking that the reading is correct.

A full calibration requires the use of two standard gases to establish two points, equivalent to 'zero' and 'span'. (A new user will find probably find it useful to read section 7, to obtain a technical description of the sensor and how it works).

The gas calibration points are referred to as "high" and "low". Air is frequently used as the "high" gas, while the "low" gas should ideally have approximately the same sort of oxygen concentration that is encountered in a 'normal' sample.

As with most instruments of this type it is important to have a reasonable difference between the two concentration calibration points - H and L. For the Z530 the recommended difference is around 0.25 decade; i.e. $\log(H/L) > \pm 0.25$. Because the most common "high" level gas is air, and in order to maintain an adequate difference in concentration, the instrument will not accept a "low" level calibration gas with a concentration greater than 10%.

5.2 Calibration gases

Because the sensor operates at high temperature, the calibration gases must not contain any flammable or reactive components. Typically this means using mixtures of oxygen with nitrogen, argon or helium; nitrogen is by far the cheapest and most obtainable. If the calibration gases used contain ppm levels of oxygen then take note of the requirements detailed below when measuring ppm gas mixtures.

5.3 Calibration gas piping and cylinder regulators

All piping should be of good quality material with sound joints and couplings.

If concentrations are being measured in ppm units, then the piping chosen must be of hard plastic or metal. Suitable plastics are Nylon 6 and rigid P.V.C., while P.T.F.E. and flexible P.V.C. are *not* regarded as suitable. Cylinder pressure regulators and gauges should also be chosen carefully. Chose regulators that have a metal diaphragm and pressure gauges that have low volume. These measures avoid contamination and the problem of cavities containing air/ oxygen, which can take several hours to purge.

5.4 Calibration procedure

> **NOTE**
>
> Calibration limits are set in the software to prevent the user from calibrating the instrument outside of the sensor's operational range. If, on pressing the Cal button, the reading returns to the original value, the calibration has been rejected, and a change of cell is recommended. Return the instrument to Eaton, as discussed in Section 6.

5.4.1 "High" point calibration

Expose the process side of the cell to air at normal ambient pressure. When the reading has stabilised, use the RS232 protocol (see section 8.0) to enter the expected high calibration reading.

Example:

For Air Calibration send "A0C2=20.9" This will calibrate the current reading to 20.9%

This command recalculates the cell offset.

5.4.2 "Low" point calibration

Change the sample gas supply to the "Low" level concentration and establish a flow of the gas through the analyser. When the reading has stabilised, use the RS232 protocol (see section 8.0) to enter the expected low calibration reading.

Example:

1% O_2 Calibration send "A0C1=1.00" This will calibrate the current reading to 1.00%

This command recalculates the cell gain (K).

5.5 Maintenance

Calibration is the only routine operation that is necessary on a regular basis. However, the response time of the measuring cell will gradually lengthen with use. When the "Air to 1%" response time reaches 10 seconds, or more, a change of cell is recommended. The instrument should be returned to your local MTL Gas sales office to enable a replacement to be fitted.

6 SPARES AND REPAIRS

Should any failure occur, the instrument should be returned to your local MTL Gas sales office for repair. When ordering spare parts or raising queries on the instrument, it is important that the serial number is quoted. This will be found on the data label attached to the circuit board, as shown here.

MTL Gas Products
Serial No: I-04810 Original Cell S/N: 4481 Gas & Range: O2 1ppm to 100% Analogue Output: Programmable
Build Code: 806-9401 / 2 Power Supply: 24V dc

7 TECHNICAL DESCRIPTION OF SENSOR

The MTL zirconia oxygen sensor (see sketch below) is an impervious tube-shaped zirconia (zirconium oxide) element with a closed end coated externally and internally with porous metal electrodes, typically platinum. At high temperatures, typically above 400°C, the zirconia becomes an oxygen ion conductor, which results in a voltage being generated between the electrodes dependent upon the differences between the partial pressures of the oxygen in the sample and the oxygen in a reference gas (generally air). The voltage generated is determined by the Nernst equation:-

$$\text{Cell output} = \frac{2.303RT}{4F} \log \frac{P1}{P2}$$

where:-

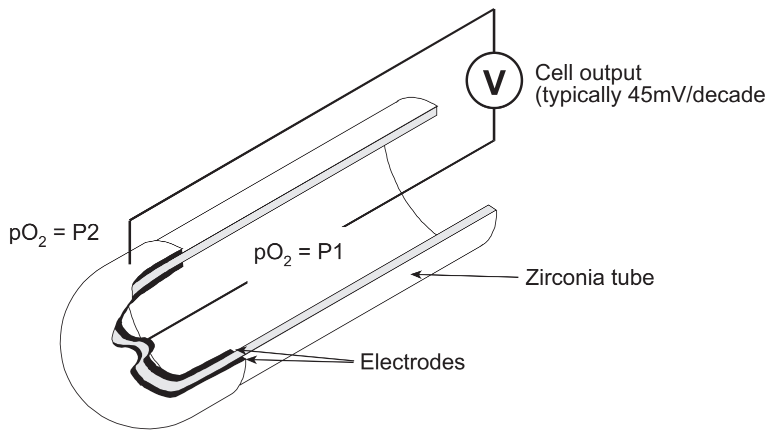
R = molar gas constant

T = absolute temperature of cell in °K

F = Faraday constant

P1 = partial pressure of oxygen in the reference (air in most cases)

P2 = partial pressure of oxygen in the sample.



Thus, with air on both sides of the cell, the output is zero (log1=0).

The reference electrode is negative with respect to the sample electrode for sample concentrations of oxygen higher than that of air and positive for concentrations less than that of air. Depending on the application either the internal or external electrode is used as the reference.

The output voltage is processed electronically to provide signals suitable for display or for process control purposes.

8 COMMUNICATION PROTOCOL

Communication parameters are 9600 Baud, 8 bits, no parity, 1 stop bit and no handshaking. The instrument is DTE. The general form of the protocol is:

1. The protocol is a single command-and-response protocol. Multiple commands cannot be sent without waiting for a response.
2. A command consists of an "address" and an "action". A command with a valid address will always receive a response even if the action is invalid.
3. A Response consists of a "tag" and "data".
4. A command message can not be more than 30 characters without a message terminator (<CR><LF>). Exceeding this length will result in an error "? 90" response.
5. A response message can not be more than 30 characters without a message terminator (<CR><LF>). Exceeding this length will be assumed to be a communications error.
6. A command message timeout is defined as 10 seconds. This is the maximum time permitted between a valid address "Ax" and the message terminator (<CR><LF>). This time is long to permit keypad entry (e.g. with HyperTerminal).
7. The response message "failure to respond" timeout is defined as 300 milliseconds. This is the maximum time from a valid command message terminator (<CR><LF>) until the first character of the response.
8. A response message line maximum duration is defined as 1 second. This is the maximum time from the first valid response character to the line message terminator (<CR><LF>).
9. A response message maximum duration is defined as 3 second. This is the maximum time from the first valid response character to the last message terminator (<CR><LF>). This is to allow multiple line responses. No card response can hold the bus for more than 3 seconds. Factory commands are the only exception.
10. Exceptions to items 7, 8 and 9 above.
    a) Starting up: The card start up is defined as taking up to 10 seconds. The card will then assert an error "? 97" in R1, R4 and R5 on the first reading after the 10 second period. Subsequent readings will show the correct values.
    b) Calibration obtains exemption from item 7 and 8 but must comply with item 9.

The general form of the response is:

1. Read whole group: 'AxP0' where x is the network address of the unit. The unit will respond when x is its own address or 0 (any unit responds to address 0), otherwise it will not respond at all. If the No Zero Param bit in sysflags is set, 'AxP' OR 'AxP0' to send all.
2. Read specific group item: 'AxPy' where y is the line (or item) number.
3. Write specific group item: 'AxPy=<new value>. The format and (where appropriate) precision of the new value is as it is displayed. With the 'verbose' flag cleared: Py itemname=value unit.
4. With the 'verbose' flag set: Py =value.
5. A read command will return 0 when it has no value to report (e.g. A0E6 returns A0E6=0).
6. A 'do now' write command (e.g. clear logs 'E6') will do nothing if set with a 0 as argument, will execute with a 1 as an argument and will ?93 any other argument. A 'do now' write command returns 0 for fail and 1 for success. E.g. A0E6=1 returns A0E6=1.

Table 1 - common groups

Send	Function	Reply (verbose)	Reply (terse)	Limits (where applicable)	Notes
AxCy	Calibration	C9 Load def=0	C9=0	0 or 1	Load defaults
		C8 Sens 2 os=0.00	C8 =0.00		N/A
		C7 Sens 2 K=1	C7 =45.0		N/A
		C6 Sens 2 H cal =100%	C6 =0		N/A
		C5 Sens 2 L cal=0%	C5 =100		N/A
		C4 Sens 1 os=0.00	C4 =0.00	Set in I3 (6dp)	Cell offset.
		C3 Sens 1 K=45.0	C3 =45.0	Set in I1,2 (4dp)	Cell slope.
		C2 Sens 1 H cal =100%	C2 =0	Zr limits	Calibrate high.
		C1 Sens 1 L cal=0%	C1 =100	Zr limits	Calibrate low.
Note:- Sending AxC1=xxx calibrates to xxx, and AxC1 RETURNS the last C1 cal value, but changes nothing. AxC9=1 makes the instrument load HARD CODED DEFAULTS. User will be asked to type 'y' to confirm, or load will be abandoned.					
AxDy	Data (read only)	D6 ADC 3 = 12345cts	D6 = 12345	0 to 16777216	ADC raw counts
		D5 ADC 2 = 12345cts	D5 = 12345	0 to 16777216	ADC raw counts
		D4 ADC 1 = 12345cts	D4 = 12345	0 to 16777216	ADC raw counts
		D3 Sens 3 = N/A	D3 =0		N/A
		D2 Sens 2 = 11.56mV	D2 =11.56		Thermocouple mV
		D1 Sens 1 = 11.55mV	D1 =11.55		Oxygen cell mV
AxEy	Error logs (read only except E9)	E9 Clear Log=0	E9=0	1 to clear logs	Clear all counters
		E8 Calibration=0	E8=0	0 to 65353	Calibration error counter
		E7 Sensor=0	E7=0	0 to 65353	Sensors error counter
		E6 AO=0	E6=0	0 to 65353	Analogue output counter
		E5 Float=0	E5 =0	0 to 65353	Float error counter
		E4 CRC=0	E4 =0	0 to 65353	EEPROM CRC error counter
		E3 Other=0	E3 =0	0 to 65353	Other error counter
		E2 Last=0	E2 =0	0 to 99	Last error code
		E1 Current=0	E1 =0	0 to 99	Current error code
AxIy	Input (Read only)	I17 R3 SP=N\A	I17 =N\A	0 to 10	
		I16 R2 BG=N/A	I16 =N/A	8 ascii characters or 0 to 10	
		I15 R2 SP=N/A	I15 =N/A	8 ascii characters or 0 to 10	
		I14 R2 MMW comp=1	I14 =1	0.10 to 5 (2dp)	
		I13 R2 RangeT =100	I13 =100	Instrument range and resolution	
		I12 R2 RangeB =0	I12 =0	Instrument range and resolution	
		I11 R2 Os Range=0	I11 =0	+/-1000 (6dp)	
		I10 R2 K Range=1	I10=0	+/-100 (2dp)	
		I9 R2 Base K =-4.7	I9=1	+/-100 (4dp)	
		I8 R1 BG=N2	I8 =N2	8 ascii characters or 0 to 10	
		I7 R1 SP=O2	I7 =O2	8 ascii characters or 0 to 10	
		I6 R1 MMW comp=1.00	I6 =1.000	0.10 to 5 (2dp)	
		I5 R1 RangeT =100	I5 = 100	Instrument range and resolution	

continued

Table 1 - common groups (continued)

Send	Function	Reply (verbose)	Reply (terse)	Limits	Notes
		I4 R1 RangeB =0	I4 = 0	Instrument range and resolution	
		I3 R1 Os Range=0.01	I3 =0.01	+/-1000 (6dp)	
		I2 R1 K Range=1	I2 =1	+/-100 (2dp)	
		I1 R1 Base K =-4.7	I1 =-4.7	+/-100 (4dp)	
AxPy	Parameters.	P9 Terse=0	P9=1	0 or 1	1 to set instrument into terse mode – 0 to set verbose
		P8 A2 Mode=1	P8 =1	0 to 3	0, 1, 2, 3 in terse - Off, High, Low, status in verbose
		P7 A2 Hyst=1.0%	P7 =1.0	1 to 10 (1dp)	Alarm hysteresis
		P6 A2 Level=5.0%	P6 =5.0	0 to 100	Alarm trip point
		P5 A1 Mode=1	P5 =1	As alarm 2	As alarm 2
		P4 A1 Hyst=1.0%	P4 =1.0	As alarm 2	As alarm 2
		P3 A1 Level=5.0%	P3 =5.0	As alarm 2	As alarm 2
		P2 4mA=0%	P2 =0		Will show 0V or 4mA depending on variant.
		P1 20mA=50%	P1 =50	0 to 100	Zero and FSD limits are interactive.
AxRy	Reading * see (8) below	R5 Comp2=N/A	R5 =0		
		R4 Temp=Normal	R4 =1		Heater state – see also heater errors.
		R3 Alarm2=Normal	R3 =0	0 to 2	Alarm state – Off, Normal, ALARM or N/A (if not fitted)
		R2 Alarm1=Normal	R2 =0	0 to 2	In terse mode alarm state is 1 in alarm and 0 for all other states
		R1 Conc=5.00%	R1 =5.00	Instrument range and resolution	Measurand Concentration
Notes on readings:- In over-range condition (110% of instrument span) xxxxx will be '+++++' (e.g. 'R1 Conc= +++++'). Similarly in under-range condition (-5% of instrument span) xxxxx will be '-----'. In the case of a system error R1 will be replaced by the error code e.g. ? 72 In verbose mode a brief fault description will be appended. 'Conc' & '%' are determined by sensor type and unit – see 'U' below. Resolution is application dependant. Where a fault is present in the secondary reading it will be indicated by a text description in verbose mode and by a code in the case of Zr units (heater does not return a numeric value in R4) or by -999 or +999 to indicate downscale or upscale failures respectively.					
AxUy	Unit (read only)	U13 Test Flags=0	U13=0	0 to 65,535	See table below for details
		U12 Factory Flags=0	U12=0	0 to 65,535	See table below for details
		U11 Output=mA*	U11=1	0 to 2	Analogue output: 0=4/20mA, 1= 0/1V, 2 = 0/5V, 3=0/20mA
		U10 Sens 2 Ch=1	U10=1	0 to 3	Sens 2 ADC chan (9)
		U9 R2 unit=mV	U9=2	0 to 255	See table for unit definitions
		U8 R2 type=T/C	U8 =14	0 to 99	See table for Sensor 2 types (8)
		U7 R1 Ch=1	U7 =1	0 to 3	Sens 1 ADC chan (9)
		U6 R1 unit=%	U6 =1	0 to 255	See table for unit definitions
		U5 R1 type=Z	U5 =13	0 to 99	See table for Sensor 1 types (8)
		U4 F/w rev=0.24	U4 =0.24		
		U3 F/w p/n=290-6031	U3 =290-6031		
		U2 S/n = I-700123	U2=I-700123	8 ascii characters	
		U1 Addr=0	U1 =0	0 to 9	Sensor Card Address

Table 2 - Error messages

Error messages

Error messages take the form '? xx' where 'xx' is a numeric code as explained below.

Code	Error	Description
90	Buffer overflow	More than 30 characters were received without message terminator (<CR><LF>). Any subsequent characters will begin a new message.
91	Timeout	10 seconds has elapsed since the last character was received without message terminator.
92	Bad opcode	Message was received correctly terminated but not understood (e.g. 'A0Q1<CR><LF>')
93	Bad operand	Message was received correctly terminated and understood but the argument was malformed or out of bounds (e.g. 'A0C2=999.9<CR><LF>').
94	Read only	An attempt was made to write to a read-only parameter (e.g. 'A0R1=1.2<CR><LF>').
97	Initialising	Sensor card is initialising asserted for 10 seconds after a reset or cold start
51-69	Configuration errors	51 Primary cell illegal for this board, 52 Secondary cell illegal for this board,
71-79	CRC error (NVRAM errors)	Error 71 - user parameters CRC error. if this area is restored user calibration etc is LOST. Error 71 will be reported in response to ANY read request until either a calibration is performed or the instrument rebooted. Error 73 & 75 automatically clear themselves so will not be seen. Errors 72, 74 & 76 will be reported in response to any read request and cannot be cleared.

Specific errors

Code	Error	Description
21-22	Calibration errors (20 is OK)	21 K out of bounds during R1 low calibration 22 offset out of bounds during R1 low calibration

Sensor specific errors – report via the reading group (ie R1, R4 or R5)

Code	Error	Description
81	O/C	Sensor open circuit
82	S/C	Sensor short circuit
83	Reversed	Sensor reversed
84	Not Normal	Sensor behaving erratically (Heater Timed Out)
85	Not responding	Drive to sensor on but shows low reading
86	Out of control	Drive to sensor off but shows high reading

AUSTRALIA
MTL Instruments Pty Ltd,
10 Kent Road, Mascot, New South Wales, 2020, Australia
Tel: +61 1300 308 374 Fax: +61 1300 308 463
E-mail: mtlsalesanz@eaton.com

BeNeLux
MTL Instruments BV
Ambacht 6, 5301 KW Zaltbommel
The Netherlands
Tel: +31 (0) 418 570290 Fax: +31 (0) 418 541044
E-mail: mtl.benelux@eaton.com

CHINA
Cooper Electric (Shanghai) Co. Ltd
955 Shengli Road, Heqing Industrial Park
Pudong New Area, Shanghai 201201
Tel: +86 21 2899 3817 Fax: +86 21 2899 3992
E-mail: mtl-cn@eaton.com

FRANCE
MTL Instruments sarl,
7 rue des Rosiéristes, 69410 Champagne au Mont d'Or
France
Tel: +33 (0)4 37 46 16 53 Fax: +33 (0)4 37 46 17 20
E-mail: mtlfrance@eaton.com

GERMANY
MTL Instruments GmbH,
Heinrich-Hertz-Str. 12, 50170 Kerpen, Germany
Tel: +49 (0)22 73 98 12- 0 Fax: +49 (0)22 73 98 12- 2 00
E-mail: csckerpen@eaton.com

INDIA
MTL India,
No.36, Nehru Street, Off Old Mahabalipuram Road
Sholinganallur, Chennai- 600 119, India
Tel: +91 (0) 44 24501660 /24501857 Fax: +91 (0) 44 24501463
E-mail: mtlindiasales@eaton.com

ITALY
MTL Italia srl,
Via San Bovio, 3, 20090 Segrate, Milano, Italy
Tel: +39 02 959501 Fax: +39 02 95950759
E-mail: chmninfo@eaton.com

JAPAN
Cooper Crouse-Hinds Japan KK,
MT Building 3F, 2-7-5 Shiba Daimon, Minato-ku,
Tokyo, Japan 105-0012
Tel: +81 (0)3 6430 3128 Fax: +81 (0)3 6430 3129
E-mail: mtl-jp@eaton.com

NORWAY
Norex AS
Fekjan 7c, Postboks 147,
N-1378 Nesbru, Norway
Tel: +47 66 77 43 80 Fax: +47 66 84 55 33
E-mail: info@norex.no

RUSSIA
Cooper Industries Russia LLC
Elektrozavodskaya Str 33
Building 4
Moscow 107076, Russia
Tel: +7 (495) 981 3770 Fax: +7 (495) 981 3771
E-mail: mtlrussia@eaton.com

SINGAPORE
Cooper Crouse-Hinds Pte Ltd
No 2 Serangoon North Avenue 5, #06-01 Fu Yu Building
Singapore 554911
Tel: +65 6645 9864 / 6645 9865 Fax: +65 6 645 9865
E-mail: sales.mtlsing@eaton.com

SOUTH KOREA
Cooper Crouse-Hinds Korea
7F. Parkland Building 237-11 Nonhyun-dong Gangnam-gu,
Seoul 135-546, South Korea.
Tel: +82 6380 4805 Fax: +82 6380 4839
E-mail: mtl-korea@eaton.com

UNITED ARAB EMIRATES
Cooper Industries/Eaton Corporation
Office 205/206, 2nd Floor SJ Towers, off. Old Airport Road,
Abu Dhabi, United Arab Emirates
Tel: +971 2 44 66 840 Fax: +971 2 44 66 841
E-mail: mtlgulf@eaton.com

UNITED KINGDOM
Eaton Electric Limited,
Great Marlings, Butterfield, Luton
Beds LU2 8DL
Tel: +44 (0)1582 723633 Fax: +44 (0)1582 422283
E-mail: mtlenquiry@eaton.com

AMERICAS
Cooper Crouse-Hinds MTL Inc.
3413 N. Sam Houston Parkway W.
Suite 200, Houston TX 77086, USA
Tel: +1 281-571-8065 Fax: +1 281-571-8069
E-mail: mtl-us-info@eaton.com

EATON
Powering Business Worldwide

Eaton Electric Limited,
Great Marlings, Butterfield, Luton
Beds, LU2 8DL, UK.
Tel: + 44 (0)1582 723633 Fax: + 44 (0)1582 422283
E-mail: mtlenquiry@eaton.com
www.mtl-inst.com

Publication No. INM MTL 130-0193 Rev 5 230117
January 2017

EUROPE (EMEA):
+44 (0)1582 723633
mtlenquiry@eaton.com

THE AMERICAS:
+1 800 835 7075
mtl-us-info@eaton.com

ASIA-PACIFIC:
+65 6645 9864 / 9865
sales.mtlsing@eaton.com