Instruction manual
MTL gas analysers & systems

February 2017
INM MTL 130-0031 Rev 14

CROUSE-HINDS SERIES

# K1550

## MTL gas 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

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# 1 INTRODUCTION

The K1550 instrument is a MTL gas analyser that can be used for measuring the concentration of a variety of gases using a thermal conductivity sensor (commonly called a katharometer).

A microprocessor is used to control the instrument and its associated digital circuitry to provide a highly advanced, highly featured, user-friendly gas analyser. Gases whose concentration can be measured include- carbon dioxide, helium, hydrogen, argon, neon and some Freons.

Versions of the analyser are available that enable the instrument/sensor to be located within a flammable hazardous area.

## 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 Display

Dot Matrix LCD showing 2 or 4 lines of alphanumeric characters

## 2.2 Ranges

Carbon dioxide, argon, neon, methane, Freon: 0–20%, 0–100% or 80–100%

Hydrogen or helium: 0–5%, 0–20%, 0–100%, 80–100% or 95–100%

Consult your local MTL Gas sales office for other gases and ranges.

## 2.3 Accuracy

±2% f.s.d. depending upon span and gas

## 2.4 Repeatability

Better than 1% of f.s.d.

## 2.5 Stability

<1 % f.s.d./month

## 2.6 Sample flow

100 to 300 ml/min for optimum performance

## 2.7 Sample pressure

Absolute maximum 6 bar

The pressure applied to the cell is determined by the vent pressure which should be atmospheric for quoted accuracy

## 2.8 Sample condition

Must be non-condensing and free of particulates

## 2.9 Sample connections

Inlet and outlet 0.25" (suitable for 6mm) diameter tube. Both ports are fitted with captive seal compression fittings.

## 2.10 Speed of response

(T90): 20 secs typical

## 2.11 Analogue outputs

4 to 20mA

Programmable on most models to between 100% and 20% of the full scale of the analyser. For instruments scaled from zero – e.g. 0 to 100%, 0 to 20% etc. the 20mA point is programmable. For instruments with a live zero- e.g. 80 to 100%, the 4mA point is programmable – see Section 5.7

Maximum load on current output- 600 ohms

## 2.12 Alarm outputs

2 alarms each, user programmable for:

**Mode** - HIGH, LOW or OFF

**Level** - over full display range of instrument and

**Hysteresis** - 0% to 10% of set point.

Volt free, change-over contacts rated at 30V ac or dc, 1A, - normally energised

## 2.13 Environmental conditions

**Ambient operating temperature range**

Sensor: –10°C to 40°C

Electronics: 0°C to 40°C

(0-90% RH non-condensing)

**Storage temperature range**

–5°C to +55°C, (0-90% RH non-condensing)

**Altitude**

Up to 2000m

Pollution degree

Pollution degree 2

## 2.14 Power supply

(110 to 120V) or (220 to 240V) 50 or 60 Hz. 12VA maximum.

## 2.15 Dimensions & mounting

**Electronics/display unit** - panel mounting case with two clamps (see Figure 1)

**Remote sensor** - (see also Figure 3)

Smaller enclosure- Overall size: 200 (w) x200 (d) x 103 (h)

Larger enclosure- Overall size: 230 (w) x 205 (d) x 103 (h)

## 2.16 Enclosure material and protection

**Electronics/display unit**

Glass-fibre reinforced Noryl. When panel mounted (rear of instrument not exposed) IP40. IP30 otherwise.

**Remote sensor housing**

Grey polycarbonate

# 3 INSTALLATION

## 3.1 Unpacking and visual checking

Take all standard precautions when opening packages. In particular avoid the use of long bladed cutters. Search packing before discarding it to ensure that all of the components have been removed. Check that all pipe connections have captive seal nuts.

## 3.2 Siting

The instrument is designed to be panel mounting. See Figure 1 for details of the aperture dimensions, etc.

## 3.3 Electrical connections

Three plug-in terminal blocks are provided at the rear of the instrument. See labels for details.

**WARNING**

This instrument must be installed with a disconnecting switch close to it, within easy reach of the operator and compliant with the relevant parts of IEC 60947-1 and IEC 60947-3. It must be marked to indicate this function and show ON and OFF positions. Wiring should conform to local codes. Only the live conductor has an internal equipment fuse. European regulations recommend that fuses be fitted in both the live and neutral of the mains supply to the instrument.

**NOTE**

The Relay operation and labelling 'Normal' relates to process normal and not the electrical rest position of the relays, In process normal the relays are energised.

## 3.4 Installation requirements for EMC

To ensure compliance with the European EMC directive certain installation precautions are necessary as follows:

### 3.4.1 Routing of wires

To minimise the pick-up of electrical noise, all signal wiring should be shielded and routed away from power cables.

## 3.5 Sampling and piping

The standard connections are captive seal compression fittings suitable for 0.25" (or 6mm diameter tube on the sample inlet and sample outlet.

**NOTE**

Optimum analyser performance is achieved with the flow rate specified in Section 3.6. Consider also installing pipe work for a calibration gas inlet - this avoids the need to remove the sample connection when connecting a calibration gas. It is much more convenient to have a 'T' piece and valves installed permanently in the sample feed lines.

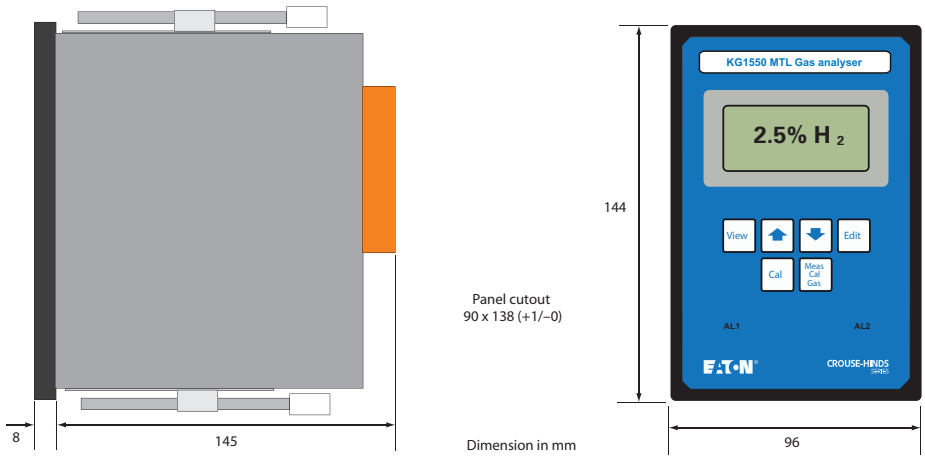



**Figure 1**- General layout

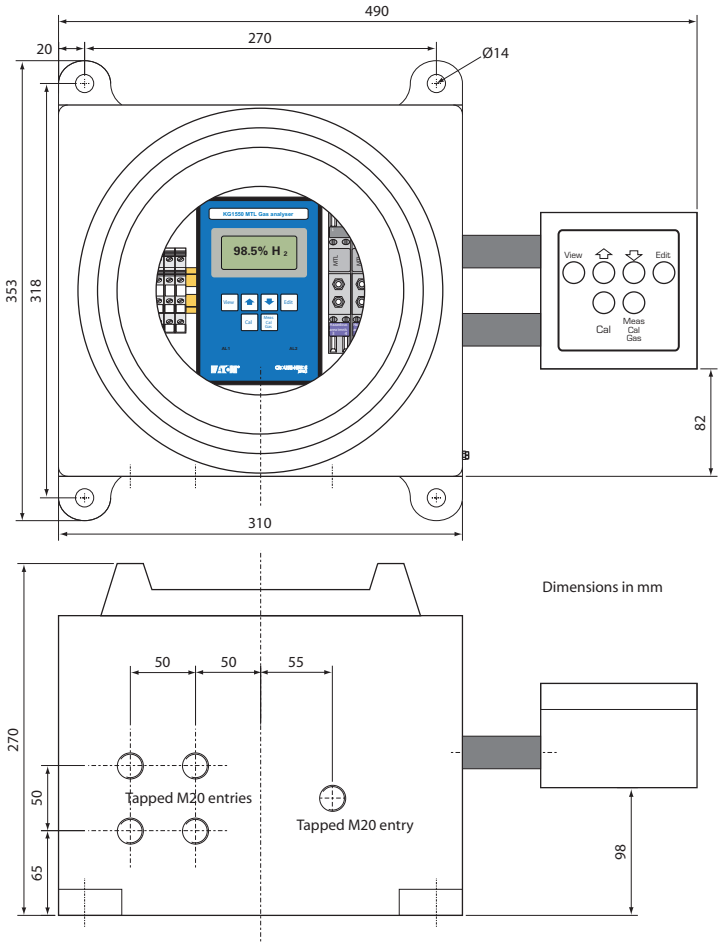



**Figure 2**- K1550 in EEx d enclosure

## 3.6 Sensor and control/display-unit connections

**CAUTION**

The sensor and control unit are matched during manufacture. Each instrument will operate correctly only with its own sensor. The sensor serial number is recorded on the test certificate supplied with the instrument.

### 3.6.1 Keyboard

The connections for the sensor are located inside the sensor enclosure on the circuit-board backplane, adjacent to the cable entry gland. The connections SIG, REF and COM correspond to the same connections on the rear of the control/display unit and should be wired accordingly.

**NOTE**

These are used to give general information to ensure correct operation

Figure 4 shows the connections between the sensor unit and the control panel for safe environments where potentially explosive atmospheres will NOT be encountered.

Figure 5 shows details of connections for installations where the control unit is mounted in a non-hazardous environment but the sensor has to be located in a hazardous area, i.e. where there is a known risk of a potentially explosive atmosphere being encountered.

Figure 6 shows the internal wiring connections for a "flameproof" Ex d enclosure where the electronic control unit also needs to be mounted in the hazardous area.

**WARNING**

For hazardous area installations it is particularly important that the installation of the shunt diode safety barriers comply fully with the appropriate requirements. Details of these requirements are supplied with the barrier units. When the remote sensor is not installed in a hazardous area, the safety barrier is not required.

**NOTE**

Some differences between sensors, enclosures, and their internal structure (e.g. plastic or stainless steel piping) will be encountered depending upon the type specified, however, this will have no effect upon the wiring connections.

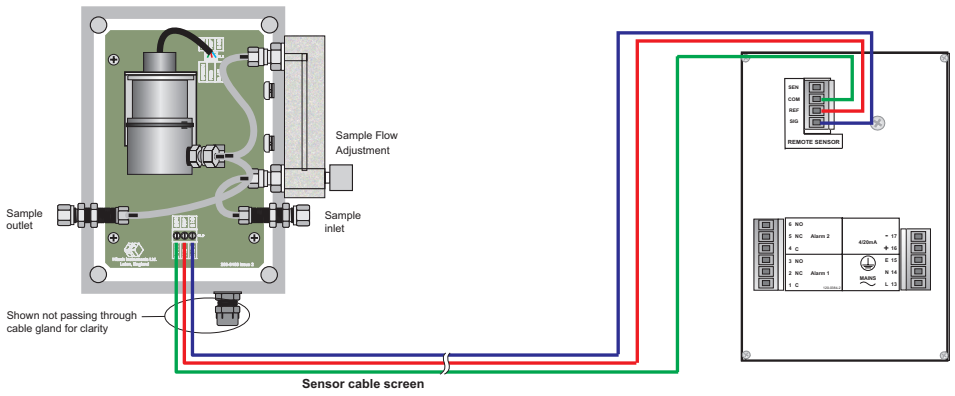



**Figure 4**- Connections for installation in non-hazardous area

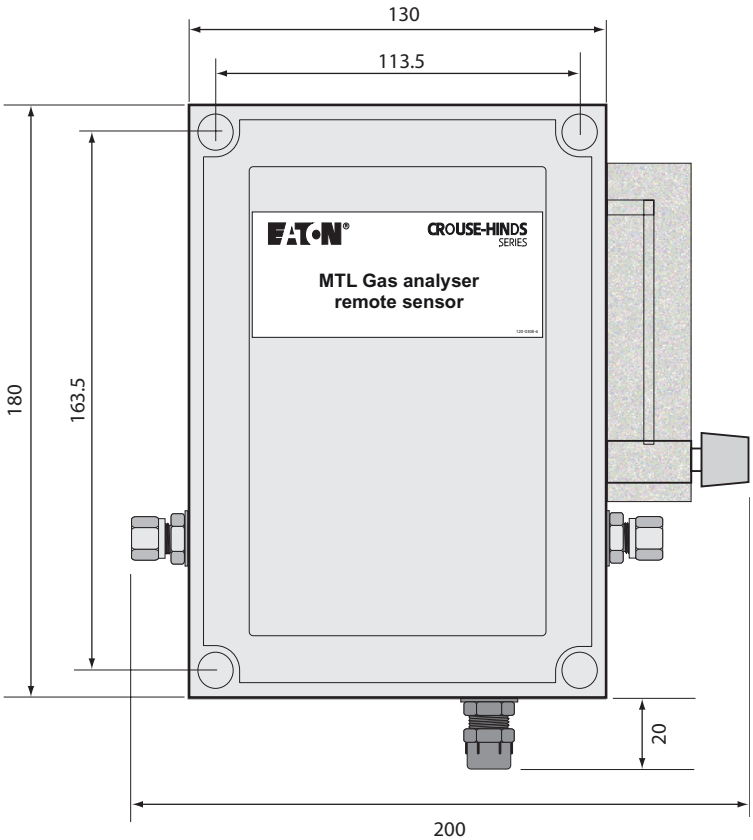
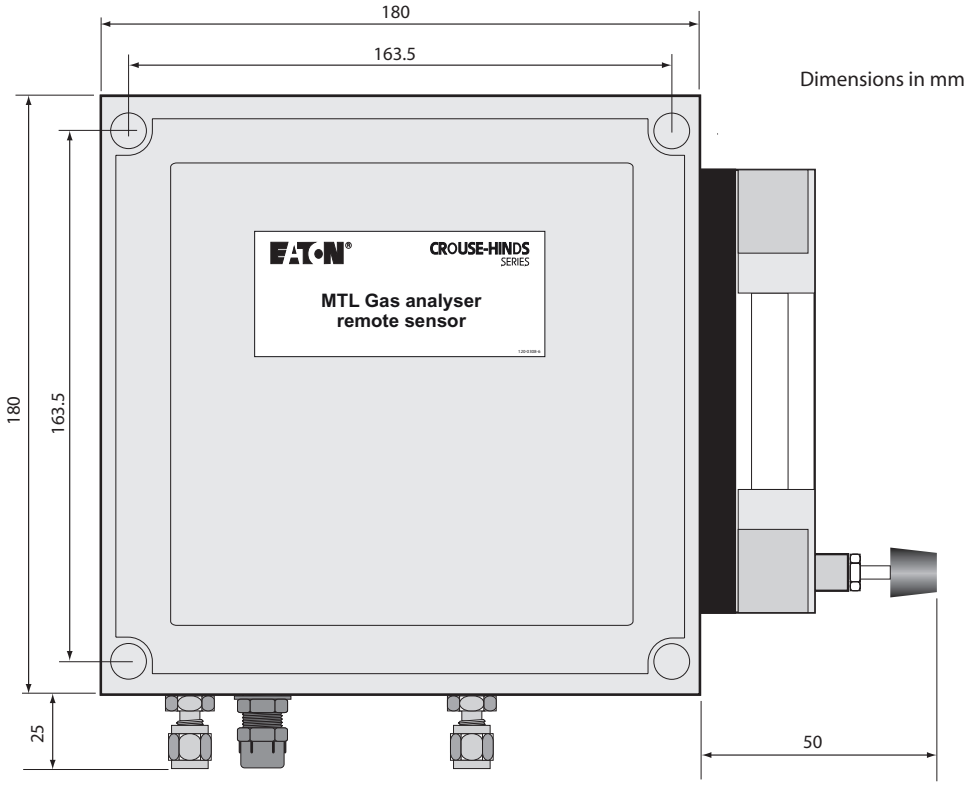



**Figure 3a**- Enclosure- nylon piping version

**Figure 3b**- Enclosure- stainless steel piping version



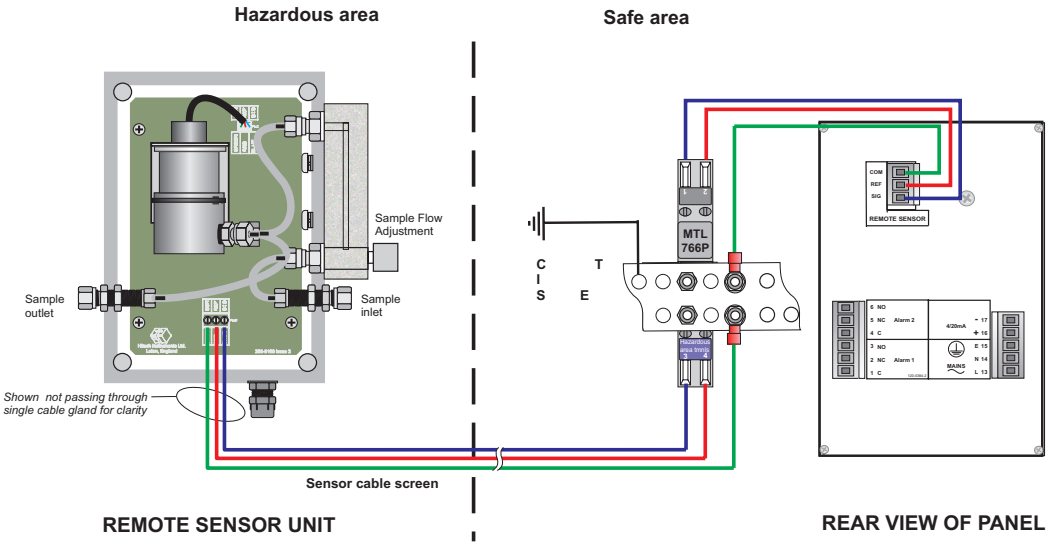



**Figure 5**- Connections when sensor is in a hazardous area

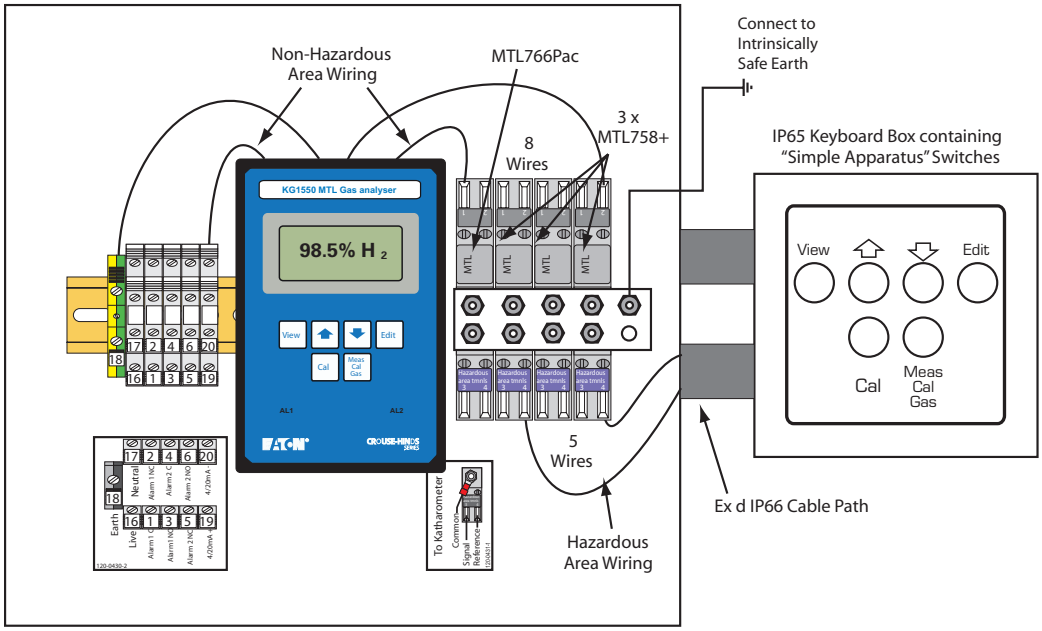



**Figure 6** - Internal wiring for K1550FX model mounted in a hazardous area

**WARNING**

All wiring for the K1550FX flameproof enclosure must enter the enclosure through suitably certified M20 cable glands in order to maintain the certification of the enclosure.

### 3.6.2 Control/display unit connections

The connections for the control/display unit are located on the rear of the case - with the exception of the K1550FX model which has the connections provided at DIN-rail mounted terminals.

**WARNING**

AC mains power (115 or 230V AC) is required to power the K1550 control/ display unit. Ensure that supplies are isolated at some external point before working on connections to the unit.

**CAUTION**

Check the supply voltage rating of the control unit before connecting it to the AC power source. The unit will be damaged by the application of a voltage exceeding the specified range.

Figure 7a shows the standard connections provided at the rear of the K1550, including the

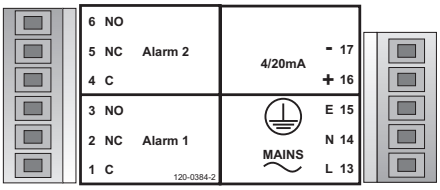



**Figure 7a**- Standard connections

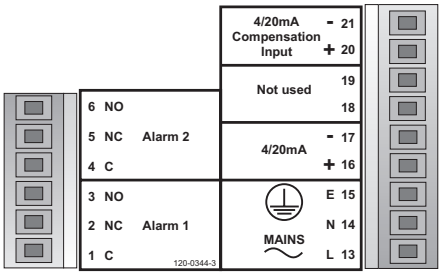



**Figure 7b**- Connections with compensation input

4/20mA analogue output (terminals 16 & 17), the alarm outputs (terminals 1-3 and 4-6) and the AC power inputs (13-15).

Figure 7b shows the additional connection points (terminals 20-21) for a 4/20mA compensation signal from an external instrument.

AC power signals should be kept apart from the input signal cabling, as much as possible, to avoid potential interference and any hazard from the high voltage cabling.

In normal operation (i.e a non-alarm state) the alarm relays are energised, providing continuity between the 'C' and 'NC' terminals.

**K1550FX model mounted in a hazardous area**

Connections to this display/control unit are provided on DIN-rail mounted terminals to the left of the display. Terminal identities are provided on a label below them- see Figure 8.

M20 threaded holes are provided in the front wall of the flameproof enclosure for these connections- see Figure 2. They must be fitted with appropriately certified cable glands or similarly approved blanking plugs for any unused ones.

Only one cable can be passed through a cable gland, so four holes are provided to accommodate:

- AC power
- 4/20mA analogue output signal
- Alarm 1
- Alarm 2

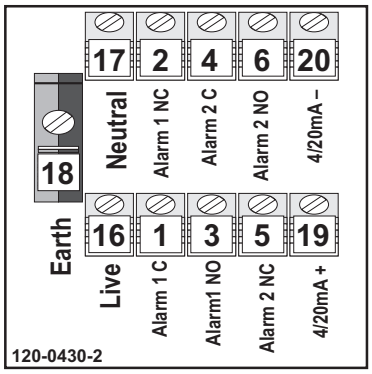



**Figure 8**- K1550FX terminals

## 4 OPERATION

### 4.1 Controls & indicators

See Figure 1 for details of the front panel.

### 4.2 Keyboard

The front panel has the following buttons.

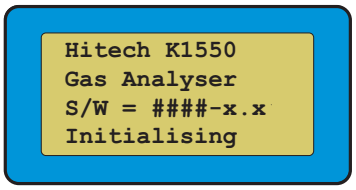
| Button | Purpose |
|---|---|
| View | used to display and edit the alarm output and calibration levels |
| ⇧ | used in the editor |
| ⇩ | used in the editor |
| Edit | used in the editor |
| Cal | used to enter calibration mode |
| Meas Cal. Gas | used to trigger a measurement in calibration mode |

## 4.3 Alarm LEDs

Two LEDs are fitted, one for each alarm. The LEDs are ON when the alarm is active and OFF when the alarm is 'normal'.

## 4.4 Initialisation

When the instrument is switched on the display will show :-




- where #### is the part No. of the software and x.x is the software version.

This display will remain for a few moments while the instrument goes through its initialisation program, after which it will change to measurement mode and display the measured values - see Figure 9.

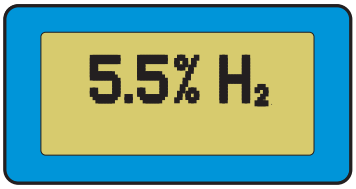



**Figure 9a**- Standard display

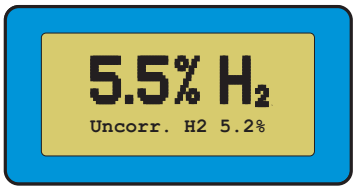


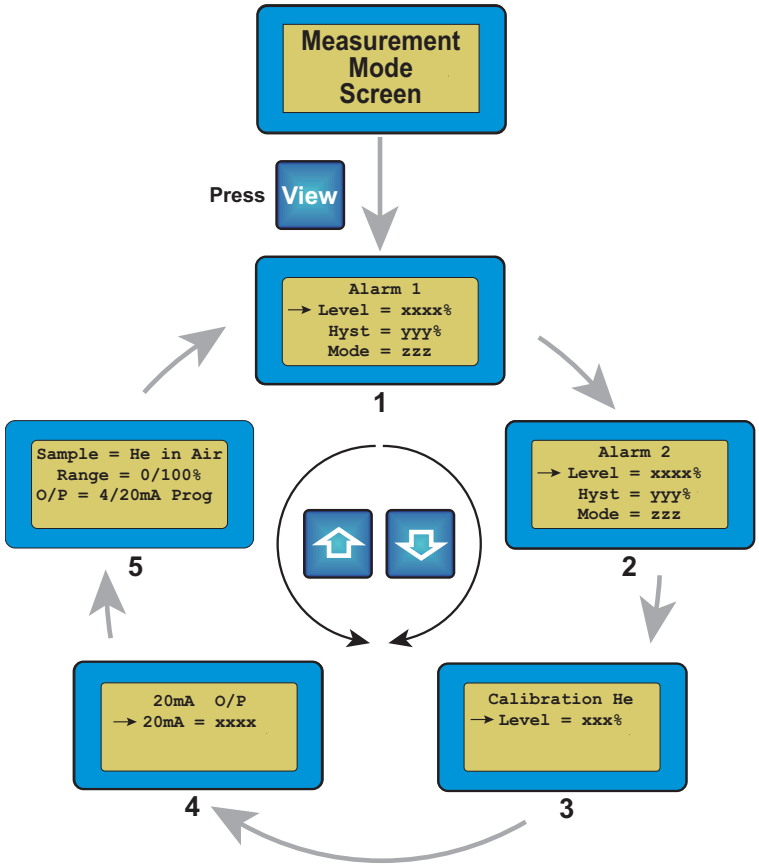

**Figure 9b**- Display with compensated input

In measurement mode the display, alarm LEDs, alarm relays and the analogue output are continually updated with the latest measured values. If an alarm level is exceeded then the appropriate relay will be de-energised and the Alarm LED lit.

In measurement mode, only the "View" and "Cal" buttons are active. Before activating either of these functions study the following sections.

## 4.5 View mode

This mode is entered by pressing the "View" button. In view mode all user defined values and the instrument data are displayed in a series of screens. The edit mode may also be entered, in which it is possible to change the settings. The screens are shown in the following diagram.




Screen 5 (in diagram above) will vary depending on whether the low scale value or the upper scale value is programmable.

The arrow pointer on the left-hand side indicates which line may be edited. The "⇧" or "⇩" buttons are used to move the arrow to the appropriate line. Scrolling downwards from the bottom line moves the display onto the next screen. Similarly scrolling upwards from the top line moves the display to the previous screen.

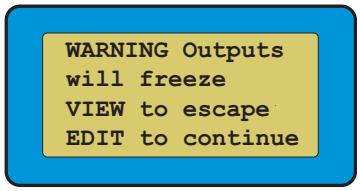
View mode may be left at any time by pressing the "View" button. The instrument will then return to measurement mode and display the measured concentrations.

**Summary: View mode (block cursor not displayed):-**

| | |
|---|---|
| ⇧ | advances to the next entry |
| ⇩ | returns to the previous entry |
| **View** | exits view mode - Returns to Measurement mode |
| **Edit** | A warning screen is displayed and the edit cursor is displayed if Edit is repressed. See below |

## 4.6 Edit mode

Any value may be changed by moving the arrow pointer to the appropriate line and pressing the "Edit" button. When the "Edit" button is pressed from view mode the following screen is displayed.




**NOTE:**
The operator should now ensure that continuing will not cause any plant malfunction or safety problems, due to locking of the outputs.

When edit mode is entered, a flashing cursor will appear on the first digit that may be altered. Use the "⇧" or "⇩" buttons to increment or decrement the digit, then press the "Edit" button to move on to the next digit. If a digit does not require a change, press the "Edit" button to move to the next. When the "Edit" button is pressed on the final digit, the display will show 'Storing Data' momentarily and then return to view mode, displaying the new parameters.

**NOTE:**
When setting alarms the maximum hysteresis that can be set is 10% of the span of the particular channel. It is important not to set the hysteresis to a level greater than the alarm point otherwise the alarm will never reset.

**Summary: Edit mode (block cursor displayed):-**

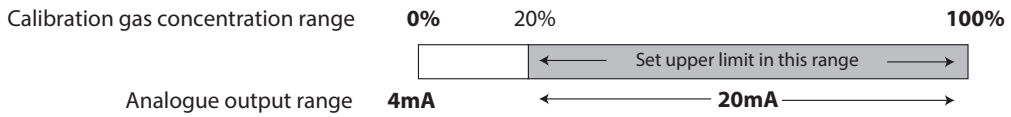
| | |
|---|---|
| ⇧ | increments the digit under the cursor |
| ⇩ | decrements the digit |
| **View** | exits edit mode - Returns to View mode |
| **Edit** | advances to the next digit, or stores the entry if the last digit has been changed. The cursor is then switched off - see above. |

## 4.7 Calibration Gas and Analogue Output Ranges

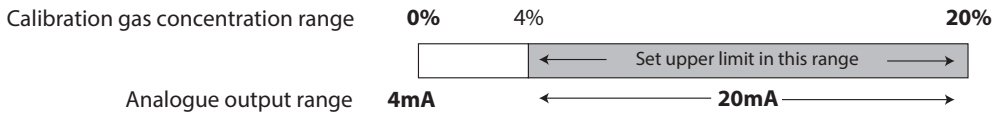
The following tables show the ranges available for editing the analogue output and calibration gases:-

## ‘ZERO START’ MODELS

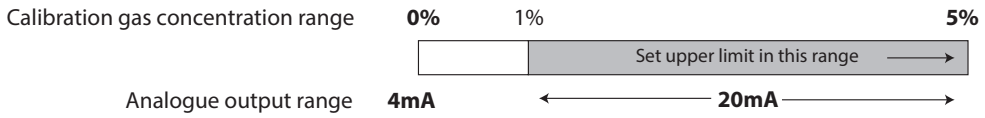
### 0 – 100% models




### 0 – 20% models

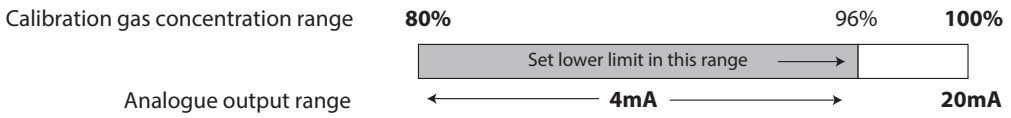



### 0 – 5% models

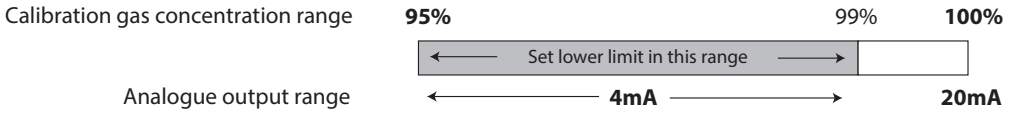



## ‘LIVE ZERO’ MODELS

### 80 – 100% models




### 95 – 100% models



# 5 CALIBRATION

## 5.1 General

The katharometer based analysers are extremely stable instruments and require only very occasional calibration. The exact calibration period depends on the type of sample and the environment in which the instrument is placed. In practice it is unlikely that check periods of less than one month will be necessary, and three to six months will be found to be more appropriate. It is also recommended that quality assurance procedures for the instrument should be written to allow **verification** as opposed to **calibration**. Verification involves checking that the instrument provides a correct analysis of a "standard" gas within the limits of the instrument; calibration should then be carried out only when a result is produced that is outside of those limits. The frequency of the verification would need to be in line with the quality regime being operated by the user.

**NOTE**

The instrument 'freezes' the analogue output and the alarms while it is being calibrated, so any control loops connected to the instrument should be disabled before proceeding. Calibration mode can only be entered by pressing the "Cal" button for approximately 5 seconds.

**WARNING**

Ensure that the process is in a safe state and that the exhaust of the standard gas is vented to a safe area.

## 5.2 Piping

The piping carrying the calibration gas must not have any leaks. The flow of this gas must be controlled and should be approximately the same as the flow rate of the sample experienced during normal process use. Metal piping is preferred as it is less prone to damage and sealing problems.

**NOTE**

Pressure regulators and gauges in the calibration gas lines probably have a certain amount of 'dead' space within them and will probably require purging for several minutes before the delivered gas matches that of the cylinder contents.

Hint: Keep the instrument in measurement mode while purging. When the reading becomes steady, the dead space can be assumed to have been purged.

## 5.3 Calibration Gas Level

A full calibration requires two standard gases. These gases are referred to as 'lower' and 'upper'. (These names are used to avoid the possible confusion caused by calling them 'zero' and 'span' on instruments with scales not starting at zero.)

The requirement for the calibration gases depends on the configuration of the instrument. The scales available for the K1550 fall into two types:-

- Zero scale point fixed at 0% (e.g. 0-5%) ('Zero start')
- Full scale point fixed at 100% (e.g. 95-100%) ('Live zero')

**Zero start** instruments require a 'lower' calibration gas of 0% concentration of Measurand, and an 'upper' calibration gas concentration appropriate to the upper range of the instrument. The upper value of the instrument must be set prior to calibration but the 'lower' value is 0%. For example, an analyser spanned 0% to 5% hydrogen in nitrogen would require a 'lower' calibration gas of 100% nitrogen and an 'upper' calibration gas of between 1% and 5% hydrogen in nitrogen.

**Live zero** instruments require an 'upper' calibration gas containing 100% of Measurand, and a 'lower' calibration gas concentration of >80% of span concentration of Measurand in carrier gas. The lower value of the instrument must be set prior to calibration but the 'upper' one is fixed at 100%. For example, an analyser spanned 95% to 100% hydrogen in nitrogen would require an 'upper' calibration gas of 100% hydrogen, and a 'lower' calibration gas of between 95% and 99% hydrogen in nitrogen.

**NOTE**

For optimum accuracy, if it is possible (within the constraints of the instrument and the calibration gas suppliers), it is advisable to calibrate at a concentration most typical of those encountered in normal instrument use.

Refer to the menu diagram in Section 5.5 and set the gas calibration level as follows:

- Press the "View" button
- Use the "⇧" or "⇩" arrows to move round to the entry for Calibration Gas
- Press the "Edit" button. Use the "⇧" or "⇩" arrows to adjust the digit, and the "Edit" button to move to each digit in turn
- When the required level is set correctly, press the "View" button to return to the measuring mode

**NOTE**

The calibration gas level should be entered before proceeding with a calibration routine.

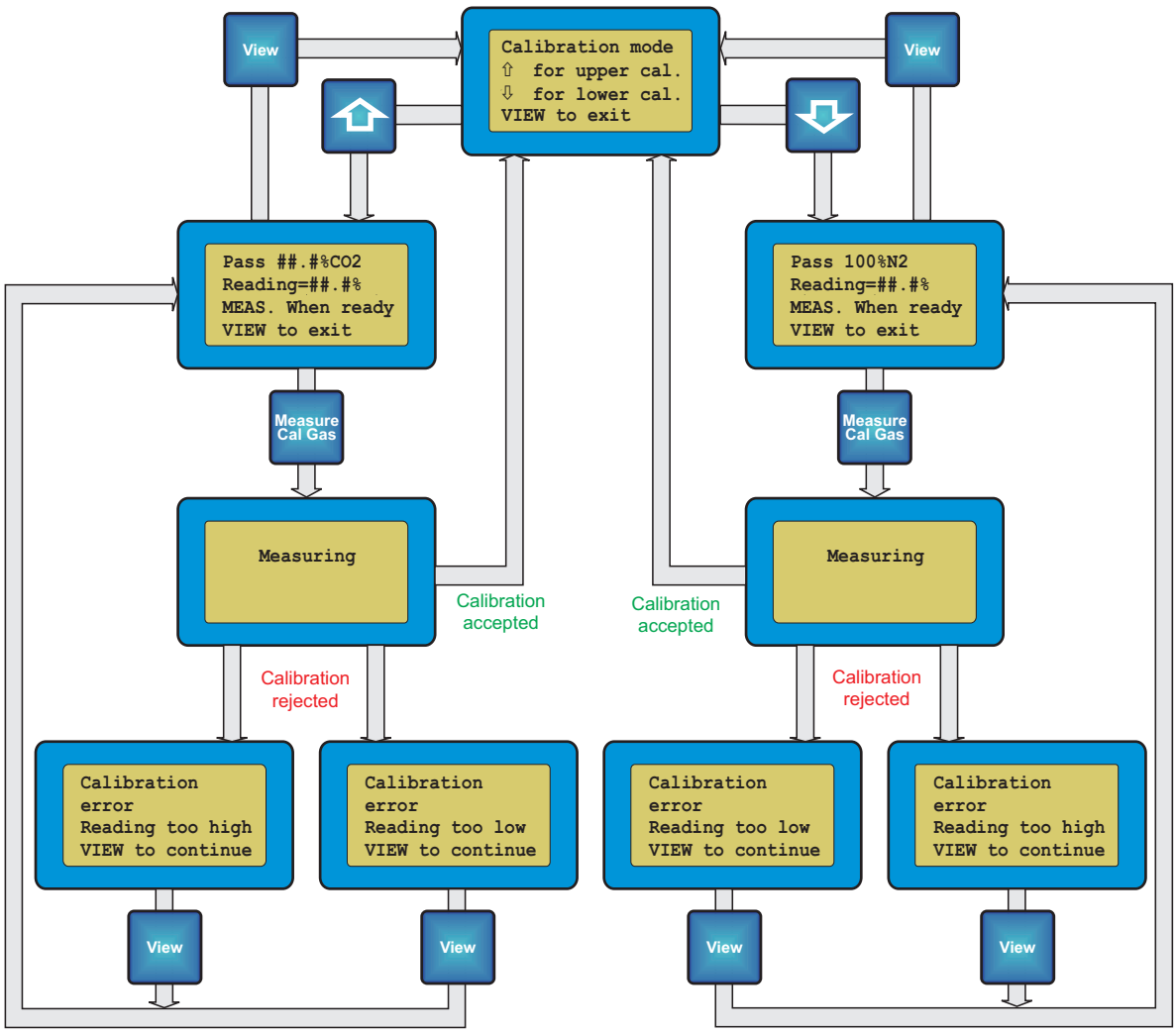
## 5.4 Calibration method

'Zero start' instruments require that the 'lower' calibration point is set first and 'live zero' instruments that the 'upper' point is set first. Screen prompts are given to confirm the gas required at the appropriate point in the calibration procedure.

**NOTE**

The analyser should be isolated from the process gas and the calibration gas introduced into the analyser at the correct flow rate.

The following diagram illustrates the calibration mode screens etc.their physical condition.


View
Calibration mode
⇧ for upper cal.
⇩ for lower cal.
VIEW to exit
View
Pass ##.#%CO2
Reading=##.#%
MEAS. When ready
VIEW to exit
Pass 100%N2
Reading=##.#%
MEAS. When ready
VIEW to exit
Measure Cal Gas
Measure Cal Gas
Measuring
Measuring
Calibration accepted
Calibration accepted
Calibration rejected
Calibration rejected
Calibration error
Reading too high
VIEW to continue
Calibration error
Reading too low
VIEW to continue
Calibration error
Reading too low
VIEW to continue
Calibration error
Reading too high
VIEW to continue
View
View
View
View

## 5.5 Compensation calibration

Instruments with compensation inputs have no calibration facility for the compensation signal.

***It is the user's responsibility to ensure the accuracy of the compensation signal.***

To calibrate such instruments, apply a calibration gas that does not contain the compensated gas component. Ensure that the compensation signal input is set to 4mA and then calibrate the instrument in the way described below.

## 5.6 Entering calibration mode

To enter calibration mode press and hold the "Cal" button for 5 seconds. The "⇧" and "⇩" arrows offer the choice of 'upper' or 'lower' point calibration options.

> **NOTE**
>
> The following sequence is for a 'zero start' instrument. For 'live zero' instruments perform the upper point calibration first.

## 5.7 Lower point calibration

Select "⇩" arrow to enter the 'lower' calibration section.

With the 'lower' calibration gas flowing, observe the reading of the measured value.

When a steady reading is obtained press the "Meas. Cal. Gas" button to instruct the analyser to measure the gas and to re-calculate the 'lower' calibration point.

If the 'lower' calibration has been accepted the analyser will display "Measuring..." and then return to the top level screen. If however the measured value is too high or low then an error message is displayed. If this occurs then the gas level and the piping should be checked.

> **NOTE**
>
> If during the calibration procedure it is necessary to change the value of the calibration gas concentration stored in the instrument, press the "Edit" button to enter that mode.

## 5.8 Upper point calibration

Select "⇧" arrow to enter the 'upper' calibration section.

Follow the procedure just described for the 'lower' point calibration, but with the 'upper calibration gas.

This completes the calibration process.

# 6 SERVICING

The katharometer sensor is non-depleting and will last indefinitely if not subjected to misuse. If a replacement is required, it must be returned to your local MTL Gas sales office, because the sensor can only be replaced with the use of specialist equipment.

**NOTE**

When ordering spare parts or raising queries on an instrument, it is important that the serial number is quoted. This will be found on the data label attached to the instrument.

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