

***K1550, K1650, K6050 & K850
Alternator Purge Gas Analysers***

***Instruction Manual
130-0126
Issue 7***

This Manual Contains Important Health & Safety Information

OPERATING INSTRUCTIONS FOR THE K1550, K1650, K6050 and K850 ALTERNATOR PURGE GAS ANALYSERS

This manual covers versions of the K6050, K1550 and K850 gas analysers designed specifically to analyse the gas mixtures encountered when using hydrogen to purge alternator generators and similar equipment. The K1650 comprises the K1550 electronic module and zener barrier mounted onto a sub-panel suitable for convenient combined mounting. The K850 is a portable free-standing instrument with an integral sensor and the K6050 is its counterpart packaged in a rugged waterproof carrying case.

The Alternator Purge Process

Starting from air, the purge process is to first purge with carbon dioxide and then hydrogen. Once filled with hydrogen the plant can be operated and the analyser used to measure the hydrogen purity. The analysers are equipped with three ranges so that each stage of the process can be monitored.

The concentrations are calculated by measuring the thermal conductivity of the gas mixtures using the highly-stable, non-depleting Hitech katharometer sensor.

A microprocessor is used to control the instrument and its associated digital circuitry to provide a highly advanced, highly featured and user-friendly gas analyser.

Zener barriers are used to provide an intrinsically safe interface between the sensor unit and the electronics of the K1550 and K1650 so as to allow the sensor to be located in a hazardous area.

Safety and EMC

This instrument complies with the European Low Voltage directive 73/23/EEC amended by 93/68/EEC by the application of the safety standard EN61010(93). Complies with EMC directive 89/336/EMC amended by 93/68/EEC, by the application of the standards; EN50081 Part 1: 1992 (Generic Emission Standard) EN50082 Part 1: 1992 (Generic Immunity Standard). NOTE: it is the responsibility of the installer to ensure the safety and EMC compliance of any particular installation.

The following units and terms are used throughout this manual unless otherwise stated.

Linear dimensions – millimetres (mm)

Volumes – millilitres (ml)

Temperatures – degrees Celsius (°C)

Weights – grammes (g)

Times – minutes (min)

Normal = Process normal (not electrically de-energised)

SPECIFICATION

Display

Dot Matrix LCD showing 2 or 4 lines of alphanumeric characters

Ranges

1. 0 to 100% Carbon Dioxide in Air (Resolution $\pm 0.5\%$)
2. 0 to 100% Hydrogen in Carbon Dioxide (Resolution $\pm 0.1\%$)
3. 90 to 100% Hydrogen in Air (Resolution $\pm 0.1\%$)

Accuracy

Better than 1% of full scale.

Sample

Flow rate: 100 to 300 ml/min for optimum performance

Pressure: Maximum inlet pressure 6BAR. The vent pressure must be nominally atmospheric

Condition: Must be non-condensing and free of particulates

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

Speed of response

(T90) 20 secs typically.

Outputs - Signal

K1550 & K1650: 4 to 20mA proportional to 0 to 100% of selected range Maximum load 500 ohms.

K850 and K6050: 0 to 1V proportional to 0 to 100% of selected range
Minimum load 10K Ω

Outputs - Alarms (K1550 & K1650 only)

Four alarms are provided

- 1 - Carbon Dioxide in Air or 'Fault' indicator
- 2 - Hydrogen in Carbon Dioxide or 'Hydrogen Purity Range Selected' indicator
- 3 and 4 - Hydrogen in Air

Each can be configured by the user for level, function (OFF, HIGH, or LOW – see above for exceptions) and % hysteresis. Relays are normally energised and rated at 48v AC or DC at 0.5 amp. For alarm 2 'Normal' is when the hydrogen purity range is selected.

Ambient temperature

Electronics: (-)5°C to 40°C

Sensor (K1550 and K1650 only): (-)10°C to 55°C

Power supply

K1550 and K1650: 110 to 120v or 220 to 240v at 50 to 60 Hz at 12VA

K850 and K6050: Internal rechargeable battery. External switch mode supply: input 110 to 240V at 47 to 63Hz. Output 12V at 1.25A max.

Dimensions & Mounting

K850 - See Fig. 1

K6050 - See Fig. 2

K1550 – See Fig. 3

K1650 – See Fig. 4

INSTALLATION

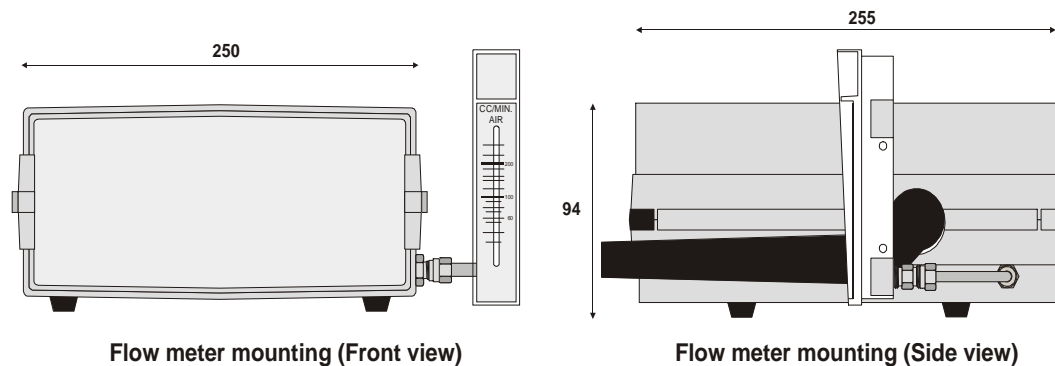
SAMPLING and PIPING

The sample must be non-corrosive and non-condensing. The sample pipe must be capable of taking the pressure of the sample gas – typically between 0.4 and 0.55Mpa. The inlet pressure limit of the analyser connections is 0.6 Mpa (6 atmospheres or 90 p.s.i.g.) The standard connections are captive seal compression fittings suitable for 0.25" (or 6mm) diameter tube on the sample inlet and sample outlet (top of flowmeter on K850 and K6050). Before connecting to the sample point ensure that the sample pipe coupling is fully tight ($\frac{3}{4}$ of a turn beyond first grip of the pipe) and that the sample flow control valve is turned fully off.

SAFETY NOTE - ENSURE THAT THE EXHAUST OF THE SAMPLE GAS IS TAKEN TO A SAFE AREA.

K850 and K6050

The instrument is supplied with a flowmeter to enable the sample flow to be monitored. Attach this as shown in the appropriate diagram below. The



optimum performance from the analyser is obtained with the flow between 100 and 300 ml/min.

Fig. 1

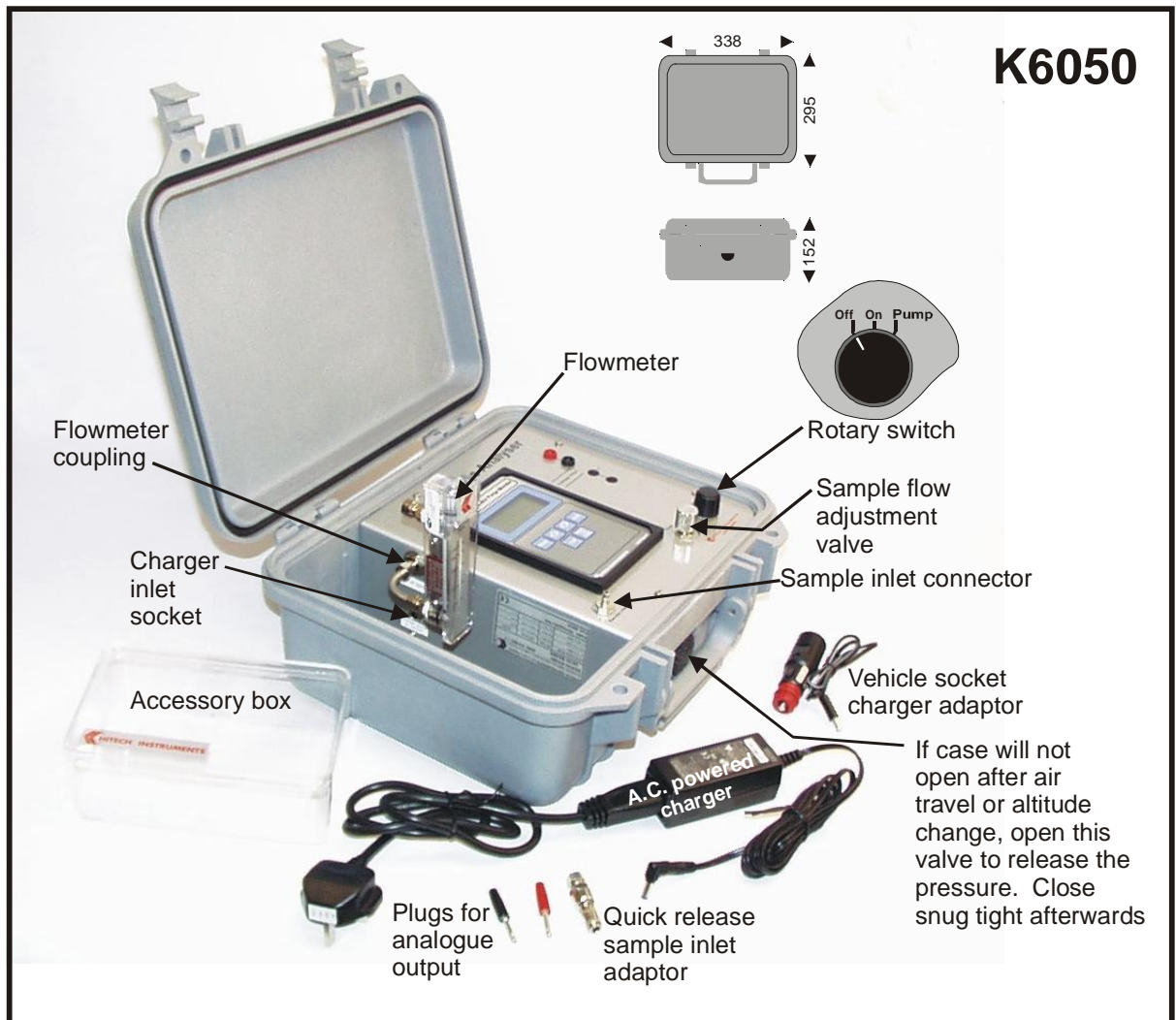


Fig. 2

K1550

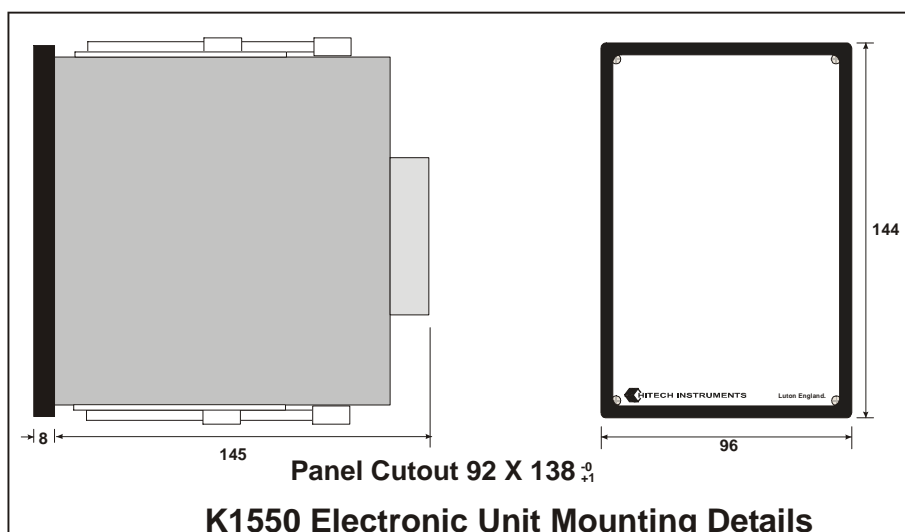


Fig. 3

Electronic Module Installation

The display/control electronics unit is designed to be panel mounting. See Fig. 3 for the details of the aperture dimensions etc.

Sensor Unit Mounting and Inter-wiring

See Fig. 4a or 4b below. This shows the K1650 but applies equally to the K1550. These instruments are intended for continuous operation and have no in-built switch; they power up immediately power is applied to supply terminals. It is usual to install a separate, dedicated external switch.

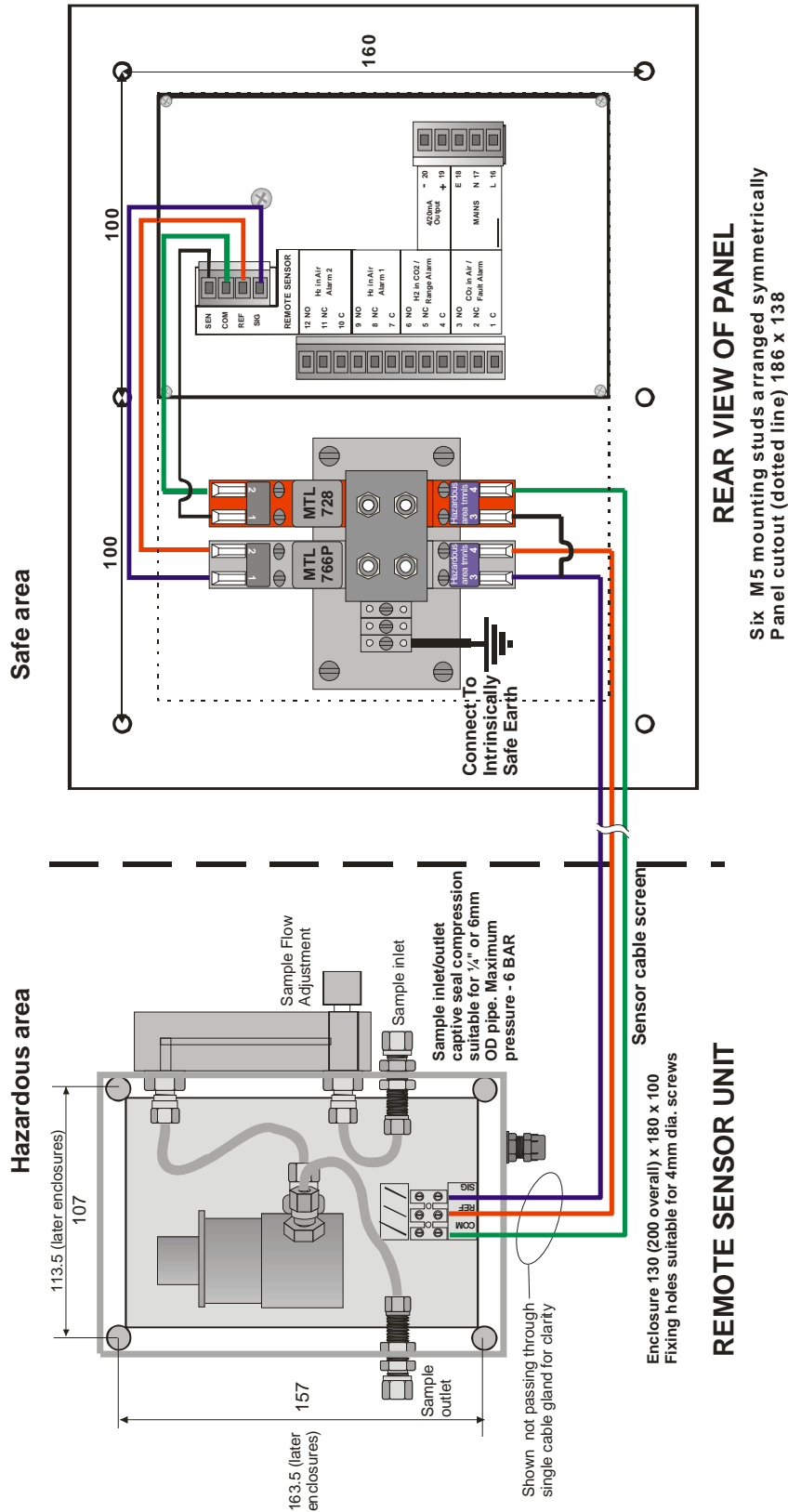


Fig. 4a

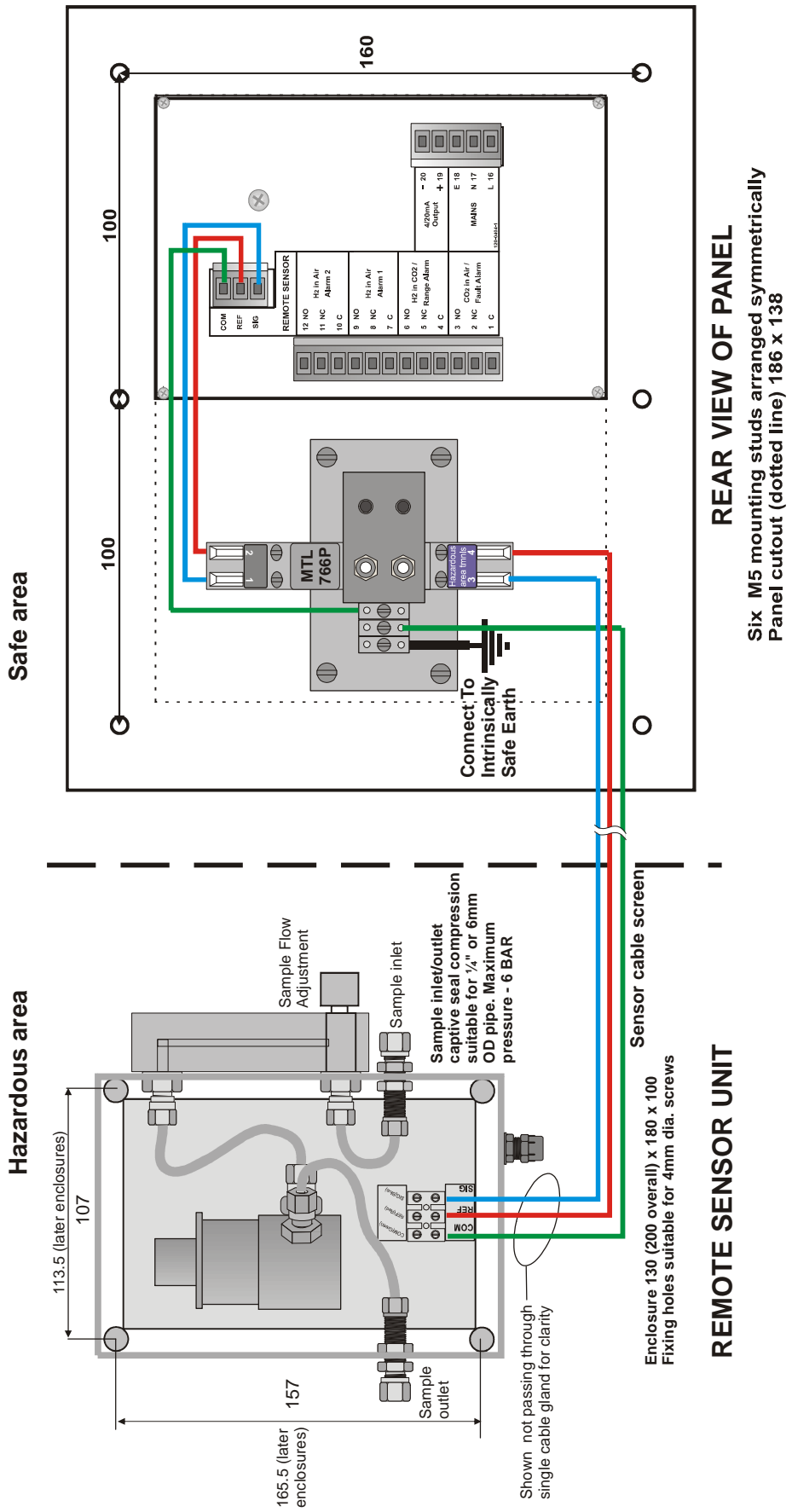
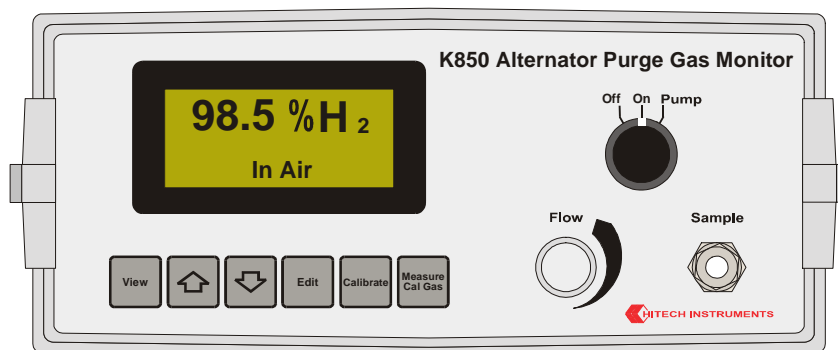


Fig. 4b

SWITCHING ON

K850 and K6050



K850 Controls

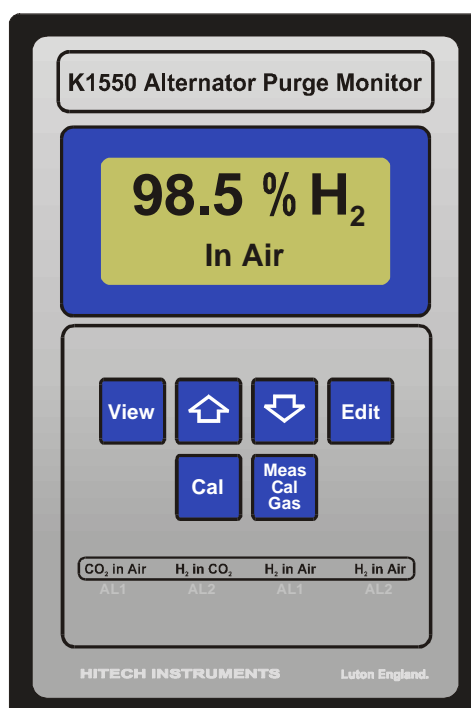
Fig. 5

These instruments are switched on by turning the front panel rotary switch to “On”.

The instrument is normally powered by its internal rechargeable batteries and these are fully charged when dispatched from the factory. A mains (A.C.) powered switch-mode power supply is supplied along with an adapter for a 12v vehicle outlet socket. When the power supply is attached and powered up, the internal batteries are charged automatically, irrespective of whether the instrument is on or off.

K1550 and K1650

These instruments power up immediately power is applied to the supply terminals.



K1550 and K1650 Front Panel Fig. 6

INITIALISATION

On power-up the screen will display details of the instrument's name and software number. This display will remain for a few moments, then the instrument will automatically enter Measurement Mode and set itself to Range 3 (hydrogen in air). The concentration of gas in the measurement chamber is displayed. If the sample is something other than air, hydrogen or a mixture of the two, then the value shown will not be accurate or a fault code message will be displayed – see table.

In the measurement mode the display and the analogue outputs are continually updated with the latest measured values.

K1550 and K1650 only: During initialisation the 4 to 20mA output goes to 2mA to indicate an invalid measurement. If the instrument is outside of its operating range (fault code displayed) then the 4 to 20mA output goes to 20.3mA or 3.7mA to indicate this. **The K850 and K6050**, which have 0 to 1V analogue output, give 0v during initialisation and 0V or 1V for fault conditions.

MAKING MEASUREMENTS

Flow sample at between 100 and 300ml/min, using the pump in the K850/K6050 if necessary (sample at less than 25mm water gauge).


It is essential that the range setting is appropriate to the measurement being made. The ranges are as follows


Range 1: 0 to 100% Carbon Dioxide in Air

Range 2: 0 to 100% Hydrogen in Carbon Dioxide

Range 3: 90 to 100% Hydrogen in Air (or Hydrogen purity range)
(Automatically selected when the instrument is powered up)

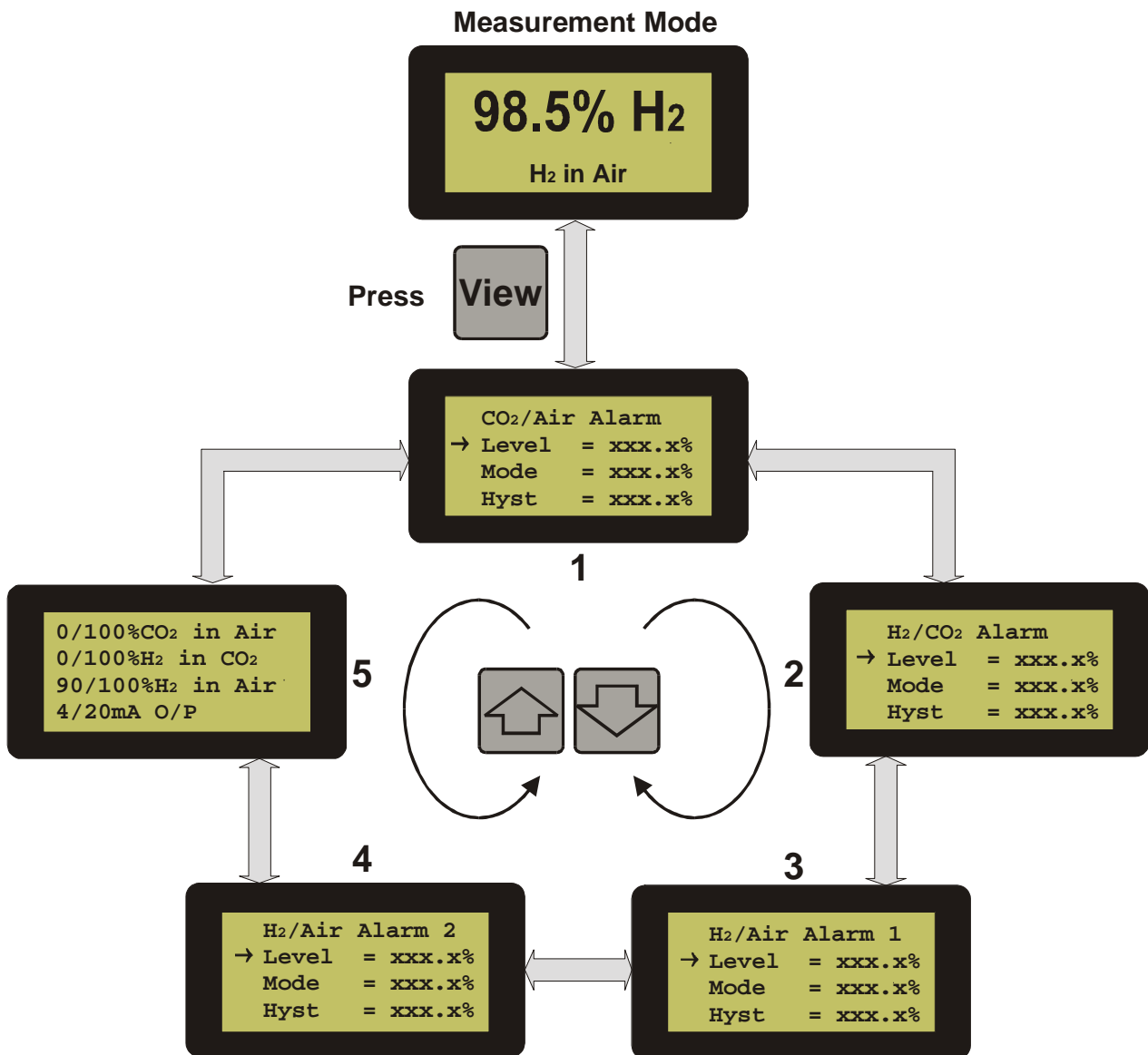
CHANGING RANGE

From Range 1 press the  key once for Range 2 and once again for Range 3.

The  key scrolls back through the ranges and the selected range is shown at the bottom of the display.

VIEWING AND CHANGING THE ALARM SETTINGS

K1550 & K1650 ONLY

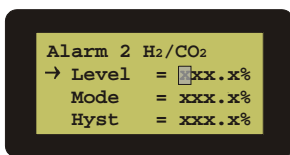







Any of the values with an arrow can be changed by entering **Edit Mode**. To enter **Edit Mode** press the **Edit** button. The following screen will then be displayed.



Press **Edit** again to enter Edit Mode. **The operator should now ensure that continuing will not cause any plant malfunction or safety problems, due to locking of the outputs.**

A flashing block cursor, as illustrated below, will appear on the first character of the parameter to be edited.



Use the   buttons to change the digit or word to that required and then use the  button move the cursor to the  next digit. Characters can be skipped by pressing the button again. When the  button is

pressed on the final digit the new value is stored and the instrument returns to View Mode.

Note: 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.*

- Alarms only operate when the range they apply to is selected. E.g. If Range 3 (90 to 100% hydrogen in air) was selected only alarms 3 and 4 would be active; alarms 1 and 2 would be automatically set to the 'OFF' mode until the appropriate range was selected. This is not the case for alarms 1 and 2 if they are programmed as 'Fault' and 'Range Selected' indicators.
- The analogue output is set to 2mA when the instrument is - a) Initialising
b) In calibration c) Fault code is being displayed

FAULT CODES

Fault code	Meaning
1	Indicates fault while instrument is in the CO2 in air range
2	Indicates fault while instrument is in the H2 in CO2 range
4	Indicates fault while instrument is in the H2 in air range
8	Temperature channel A/D reading out of range low
16	Temperature channel A/D reading out of range high
32	CO2 offset too low (< 4% H2 based on H2 in CO2 range)
64	CO2 offset too high (> 4% H2 based on H2 in CO2 range)
128	Air offset too low (< 10% H2 based on H2 in air range)
256	Air offset too high (> 10% H2 based on H2 in CO2 range)
512	CO2 scale too low (CO2 reading < 60% based on CO2 in air range)
1024	CO2 scale too high (CO2 reading > 140% CO2 based on CO2 in air range)
2048	H2 in air scale too low (H2 reading < 60% H2 based on H2 in air range)
4096	H2 in air scale too high (H2 reading > 140% H2 based on H2 in air range)
8192	H2 in CO2 scale too low (H2 reading < 60% H2 based on H2 in air range)
16384	H2 in CO2 scale too high (H2 reading > 140% H2 based on H2 in air range)
32768	Measure channel A/D reading < (-)4090 counts
65536	Measure channel A/D reading > 4090 counts

Most of the above fault codes will only occur in **Calibration Mode**.

Measurement Mode can only produce faults below 31 and 32768 and above.

When they occur the codes are reported on the screen. Multiple faults are shown as their sum. E.g. A high air offset combined with a fault in the

hydrogen in air range would be reported as fault code 260 (256+4). In all cases alarm relay 1, if configured as a fault alarm, will switch.

CALIBRATION

General

Hitech katharometer based analysers are extremely stable instruments and require only very occasional calibration. The exact calibration period depends on the type of sample and environment the instrument is placed in. In practice it is unlikely that check periods of less than one month would be necessary and three to six months would normally be in order. We recommend that any quality assurance procedures written for the instrument are written to allow verification as opposed to calibration. Verification involves checking that the instrument provides the correct analysis of a standard gas within the limits of the instrument and only calibrating when a result outside of limits is produced. The frequency of the verification would need to be in line with the quality regime being operated by the user.

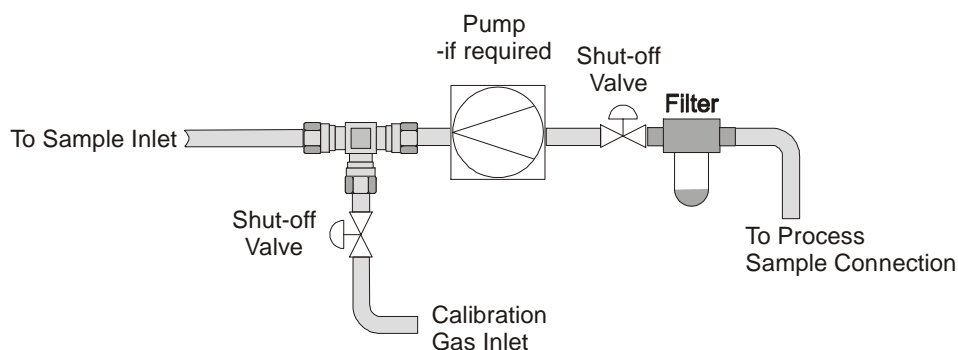
SAFETY NOTE

*The analogue output is set to 2mA(K1550 and K1650) or 0v(K850 and K6050) while the instrument is being calibrated. Ensure that any control loops that are connected to the instrument are disabled prior to verifying or calibrating the instrument. Also ensure that the process is in a safe state and the exhaust of the standard gas is vented to a safe area. Calibration mode can only be entered by pressing the **Calibrate** button for approximately 8 seconds whilst in Measurement Mode.*

Piping

Ensure that the piping and connectors are of good quality with no possibility of leaks. Metal piping is preferred as it is less prone to damage and sealing problems. Bear in mind that pressure regulators and gauges that may be in the calibration gas lines all have a certain amount of dead space within them and so may require purging for several minutes before the delivered gas matches that of the cylinder contents. The regulator etc. may be connected to the instrument and the purge monitored by using the instrument in measurement mode. Only when the reading is steady has the dead space been purged.

For permanent installations (K1550 and K1650) it may be convenient to include a 'T' piece and appropriate valves in the sample inlet line so that the calibration gas is easily connected.



Calibration Gases

Three are required – 100% Hydrogen, 100% Carbon Dioxide, Dry Air
The diagram that follows illustrates the calibration process.

Analysers Working at Alternator Casing Pressure

When this is the case the analyser must be calibrated at the appropriate pressure(s) for best accuracy.

A typical filling regime for an alternator is described below.

1. From the alternator casing filled with air at atmospheric pressure, CO₂ is introduced to purge out the air. At the end of this operation, when CO₂ level is high (approaching 100%), the system is pressurised to some pressure - **we will refer to it as x barg.**
2. H₂ is then introduced at x barg to purge out the CO₂. When the H₂ level is high (approaching 100%), system is pressurised to a higher pressure – **we will refer to it as y barg.**

The following assumptions are made in advising this alternative calibration process.

- The 0 to 100% CO₂ in air range is only used as an approximate indicator until the CO₂ level gets near to 100%. Only at high CO₂ level is the reading required to be reasonably accurate.
- The 0 to 100% H₂ in CO₂ range is again only used as an approximate indicator until the hydrogen level gets near to 100%.
- The 90 to 100% H₂ in air is the most important range and requires best accuracy throughout.

To accommodate this situation the following techniques and processes are used.

The instrument's three calibration points must be performed at the pressures indicated below.

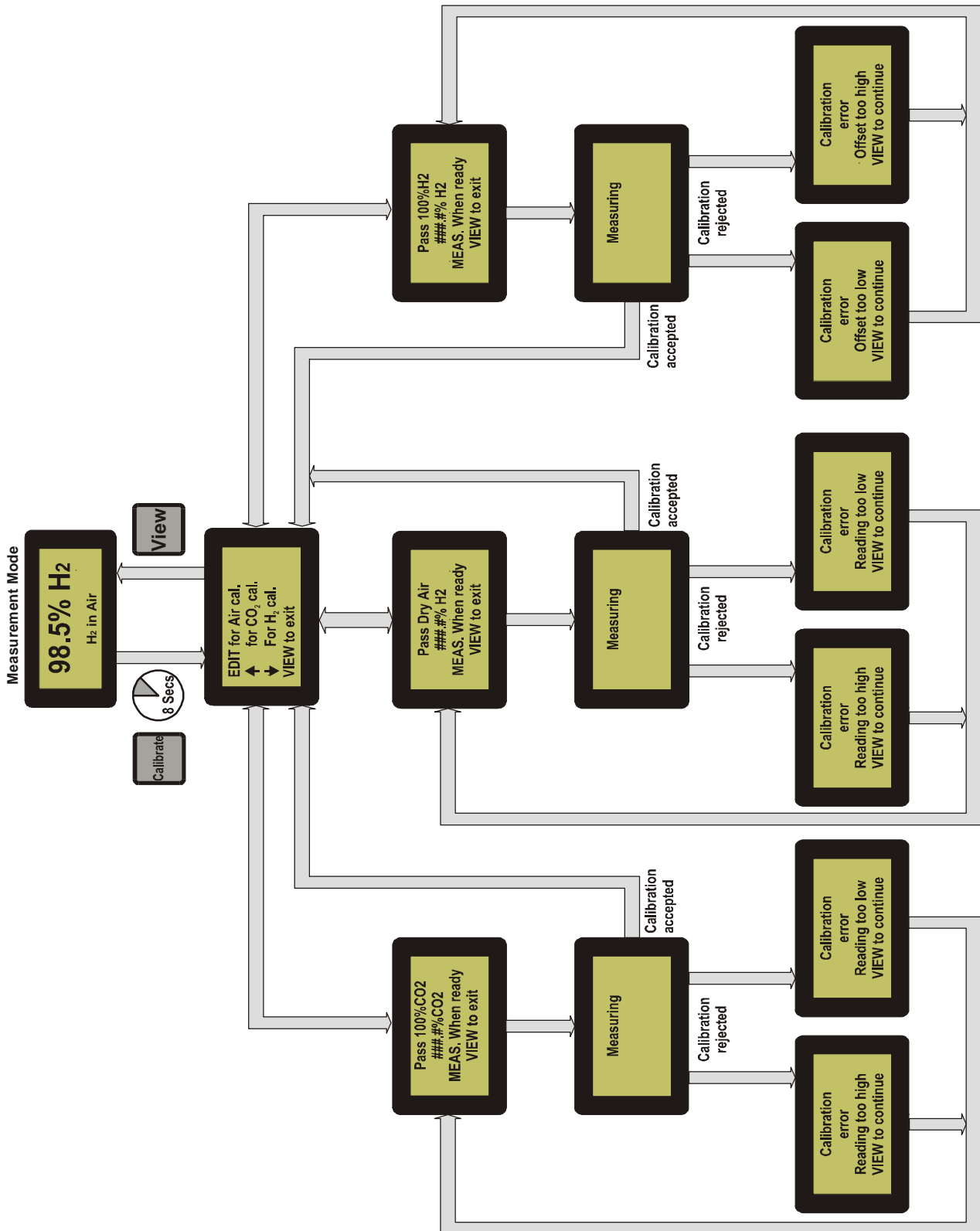
100% Air calibration – at atmospheric pressure

100% Hydrogen calibration – at y barg

100% Carbon dioxide – at x barg

This approach will produce the 'best fit'.

K1550, K1650, K850 and K6050 Alternator Purge Calibration



SERVICING

The katharometer sensor is non depleting and will last indefinitely if not subjected to misuse. The sensor can only be replaced by the use of specialist equipment and would have to be returned to Hitech or their agent should a replacement be required.

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