Model 6553 Series
of Intrinsically Safe Gas
Analyser Systems for
Hydrogen & Purge Gas Purity
Measurement

Instruction Manual

Digital Displays 4689 500/501

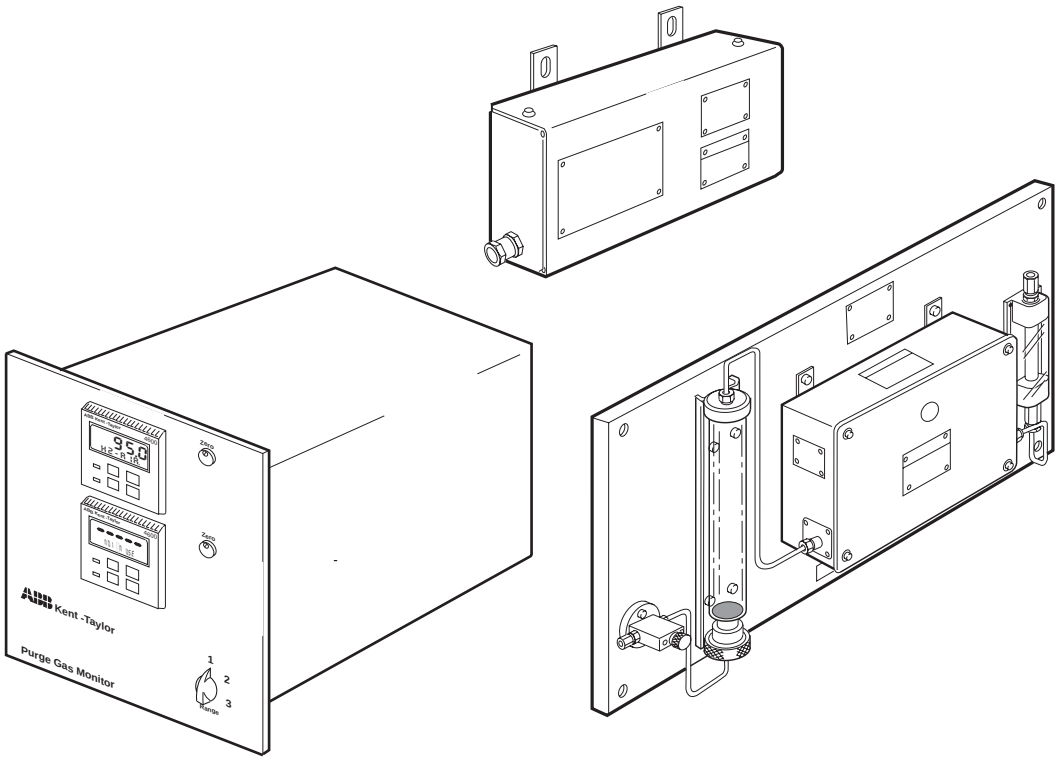


ABB Instrumentation

ABB KENT-TAYLOR

The Company

ABB Kent-Taylor is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Kent-Taylor's dedication to quality and accuracy.

BS EN ISO 9001

St Neots, U.K. – Cert. No. Q5907
Stonehouse, U.K. – Cert. No. FM 21106

EN 29001 (ISO 9001)

Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K. – Cert. No. 0255

Use of Instructions

Warning.
An instruction that draws attention to the risk of injury or death.

Caution.
An instruction that draws attention to the risk of damage to the product, process or surroundings.

Note.
Clarification of an instruction or additional information.

Information.
Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Kent-Taylor.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

1 INTRODUCTION

Warning. This operating manual applies only to those systems which have been designed and constructed to the standards specified in the schedules of the BASEEFA certificates listed. The separate units to which these certificates apply are clearly identifiable by model numbers and the data on the identification and BASEEFA certification labels fixed to them. Other combinations of similar equipment built to any earlier specifications are not covered by certificate number EX 77138. This is particularly important where new replacement units are to be incorporated into existing installations covered by any earlier certification standards. If in any doubt about the installation of particular combinations of certified equipment, please contact Kent-Taylor for advice before proceeding.
It is essential that units are installed strictly in accordance with the appropriate standards for electrical equipment for use in flammable atmospheres. Any deviation from the specified installation conditions, or any unauthorized repairs or adjustments can invalidate the safety assurances given by the certification of the unit.

The ultimate responsibility for any particular installation lies with the installing user/contractor.

This manual gives the installation, operating and maintenance information for the range of Kent-Taylor Model 6553 Intrinsically Safe Gas Analyzer Systems, normally used with hydrogen cooled electrical power generators.

The complete 6553 analyzer system uses a combination of three different units. Each unit is independently certified by BASEEFA (EECS) for use as part of an intrinsically safe system to the standards of SFA.3012:1972 for use in association with Group IIC (hydrogen) hazardous atmospheres. The different units of the system are:-

a) The Model 6553 Gas Monitor Unit which is available in several options. The inputs to these units are certified to code Ex(ia)IIC under BASEEFA certificate Ex 77124/B/S with the unit installed in the **safe** area only.

b) Models 6539 960 and 6548 001 Katharometer Units which form part of an intrinsically safe Model 6540 203 or 6548 000 Katharometer Analyzer Panel. The 6539 960 unit is certified to code Ex (ia) IIC T5 under BASEEFA certificate Ex 76179/B for installation in the **hazardous** area.

Warning. The 10 bar unit, 6548 001, has been certified EX (ia) T5 by BASEEFA. However, it must be pointed out that the standard to which it has been certified only considers flammable gas mixtures at nominally 1 bar pressure, as neither BASEEFA nor any other certifying house have a standard covering such gas mixtures at elevated pressures. It is recommended that to fully conform with the certification, gas sample mixtures at elevated pressures (i.e. above 1 bar) are reduced to nominally atmospheric pressure before presentation to the katharometer, and that gases leaving the katharometer system are vented to atmosphere.

The 6539 960 katharometer may or may not be fitted with ignition arrestors in the sample connection lines, depending on user requirements.

c) The Model 4234 constant current Power Supply Unit, which provides a suitable supply for one katharometer unit. These units have their output certified to code Ex (ia) IIC under BASEEFA certificate Ex 76180/B/S for installation in the **safe** area only.

The complete gas monitoring system, if installed in accordance with the certificate schedules and the requirements given in this manual, is itself certified intrinsically safe to an overall code Ex (ia) IIC under the system certificate number Ex 77138. The system diagram is shown in Fig. 2.1.

If further information or assistance is required, ABB Kent-Taylor specialist staff, service centres or worldwide organization may be contacted through the most convenient address given on the back cover of this manual. Specialist training courses can also be arranged by our Training Centre.

All the various system options consist of one or more of the following units with the further option of fitting the monitor and power supply units in a cubicle. Specific information relating to a cubicle option will be supplied separately.

2.1 Model 6553 Gas Monitor

The Gas Monitor is a unit suitable for panel mounting or in a control cubicle in the safe area. The various monitor options use one or two digital displays with protected access for zero adjustments and may also have a range selector switch – see Fig. 2.1.

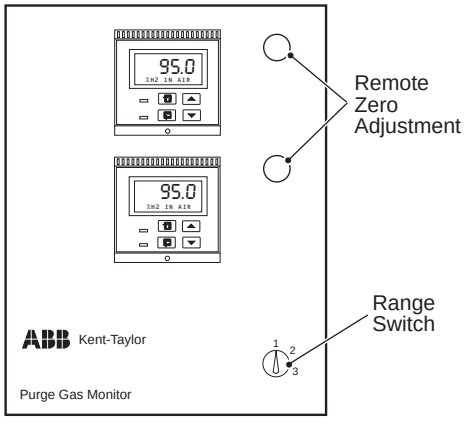


Fig. 2.1 Model 6553 Gas Monitor

2.1.1 Dual Range Display

A selector switch for each display provides independent parameter selection as follows:

Position (1) Percentage of Hydrogen in Air by volume.
This is the hydrogen purity measurement of the coolant gas under normal operation of the system. The display covers a range of 85 to 100% or 80 to 100% hydrogen in air depending on the range selected. Two alarm outputs and a value retransmission signal are provided for this switch position.

Position (2) Percentage of Hydrogen in Carbon Dioxide by volume.
This range is for use in hydrogen purging operation. One alarm programmable for hydrogen in carbon dioxide or air in carbon dioxide and a retransmission signal are provided for this switch position.

Position (3) Percentage of Air in Carbon Dioxide by volume.
This range is for use in carbon dioxide purging operation. One alarm programmable for hydrogen in carbon dioxide or air in carbon dioxide and a retransmission signal are provided for this switch position.

The Model 4689 displays are dedicated variants of the Company's Model 4600 Series Indicator/Controllers. With this special variant (4689), the displays and alarm indicators on the front panel remain the same but software control is specific to the Katharometer systems. All user programmable data can be protected from unauthorized alteration by a programmable 5-digit security number.

The zero adjustments on the front panel of the monitor allow remote zeroing of the katharometers in the **hazardous** area. The adjustment access for a particular display is adjacent to the display and at the same level.

The monitor unit has a protective case which can be removed for access to the interior without removing the whole monitor unit from the katharometer panel.

The monitor also contains encapsulated zener barrier units to limit the electrical energy level that can be applied from the instrument circuits into the **hazardous** area. These zener barrier units are located below the display units, on a bus-bar which **MUST** be earthed (grounded). A metal screening arrangement segregates the connections made to equipment in the **hazardous** area. A main fuse is fitted inside the monitor case for the electricity supply line.

2.2 Katharometer Analyzer Panels

2.2.1 Panel 6540 203

This panel incorporates the 6539 960 Katharometer Unit. When the gas monitoring system is certified for hydrogen purity and purge gas monitoring applications there are two katharometer analyzer panels in the **hazardous** area. Single display systems only require one katharometer panel.

Each panel has a katharometer assembly which comprises a thermally lagged katharometer type 6539 960, a metering valve, a flowmeter and a drying chamber. These items are mounted on a flat panel suitable for fixing to a vertical surface close to the sample point. One of the katharometers is calibrated for the hydrogen purity measurement, while any other may be similar or dual ranged for hydrogen and air in carbon dioxide measurements - see Fig. 2.2.

The inlet and outlet gas unions to these katharometer units may, in some instances, be fitted with ignition arrestors, but these are not a necessary part of the certification. The katharometer analyzer panel has a model number of 6540 203/J if the katharometer is fitted with ignition arrestors and 6540 203/K if no arrestors are fitted.

2.2.2 Panel 6548 000 (High Pressure Version)

A 6548 001 Katharometer Unit is fitted on this analyzer panel, for arrangements similar to those above, incorporating high pressure fixtures and fittings. Ignition arrestors are not available for this version.

2.2.3 Katharometer Unit

Each sealed katharometer assembly incorporates a Wheatstone Bridge made up of fine glass coated platinum filaments. One pair of parallel arms is sealed in the reference gas (hydrogen or carbon dioxide) and the other pair exposed to the sample gas.

When the intrinsically safe stabilized current from the power supply unit (Model 4234) is passed through this bridge, the temperature of the platinum filaments rises to a point of thermal equilibrium. Under conditions which are arranged to give minimum radiation and convection heat transfer, the equilibrium temperature depends on the thermal conductivity of the gas surrounding the filament. Thus any difference between the thermal conductivity of reference and sample gases will cause an imbalance in the bridge; this imbalance (as a millivolt signal) is indicated by the monitor unit.

Zener diodes are connected across the input connections from the power supply unit to the katharometer in order to limit the maximum voltage which could be developed across the filament bridge under external fault conditions. The current is limited to a safe value under fault conditions by the power supply unit.

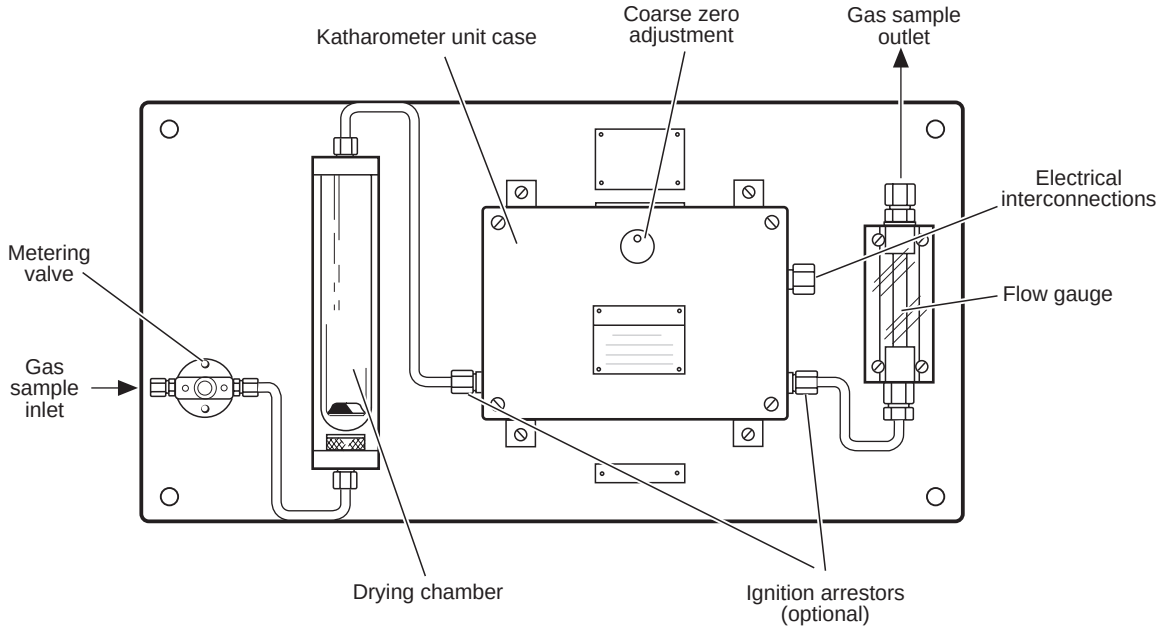


Fig. 2.2 Location of Items – Model 6540 203 Katharometer Analyzer Panel

2.3 Model 4234 Power Supply Unit

Warning. Do **NOT** connect mains supply to the power supply unit with the output terminals on open circuit. This causes premature component failure.

Caution. Ensure that the power supply unit is correct for the mains supply voltage available. A nominal 110 V unit cannot be adapted for use with a nominal 240 V supply, or the other way around.

In order to operate a katharometer unit in the hazardous area, one Model 4234 Power Supply Unit is required for each katharometer. The Power Supply Unit supplies a stabilized 350 mA d.c. signal, and must be mounted in the **safe** area. There are two separate versions available for either a nominal 110-120 V a.c. or 200-220/240 V a.c. supply voltage. The stabilized current output is current and voltage limited to restrict the energy supply into the hazardous area.

The model 4234 is housed in a metal case fitted with lugs for wall/panel mounting. Cable gland entries are provided at opposite ends of the case for supply voltage input and stabilized output cables to the hazardous area. The printed circuit board assembly and diode heat sink are mounted on a metal chassis and separate labelled terminal blocks are used for making electrical interconnections – see Fig. 3.3 and 5.4.

The circuit is protected by a cartridge fuse. This fuse must have a high breaking capacity (h.b.c.) rating of 4000 A to comply with the terms of the certification.

2.4 Remote Indicator/Controllers

The 6553 monitor unit has provision for retransmission values and ancillary indicator/controllers may be connected to these outputs, providing that they are installed in the **safe** area and the installation conforms to the requirements given in Section **5.1**.

3 PREPARATION

3.1 Identification

It is essential that installers and users clearly identify the various units of the monitoring system as follows:

3.1.1 Model 6553 Monitor Unit – Fig. 3.1

The 6553 monitor is available in several options, these being defined by the code number as given in Section **3.1.4.**

The identification and certification labels are fixed to the outside of the monitor case as shown in Fig. 3.1. The precise interpretation of the identification code gives information on the 6553 system as shown in Section **3.1.5.**

Note. Although the display units may be marked as ABB Kent-Taylor 4600 on their front panels, they are special units for this monitor and a standard Model 4600 cannot be used. The precise identity of the display unit is given on the identification label shown in Fig. 3.1.

3.1.2 Models 6540 203 and 6548 000 Katharometer Analyzer Panels

The identification of a panel is given by the panel reference number label as shown in Fig. 3.2. The Identification and certification labels of the individual katharometer units are fixed to the katharometer case, as shown in Fig. 3.2. The different katharometer units for hydrogen or purge gas are distinguished by reference to the 'zero gas' specified on their identification label.

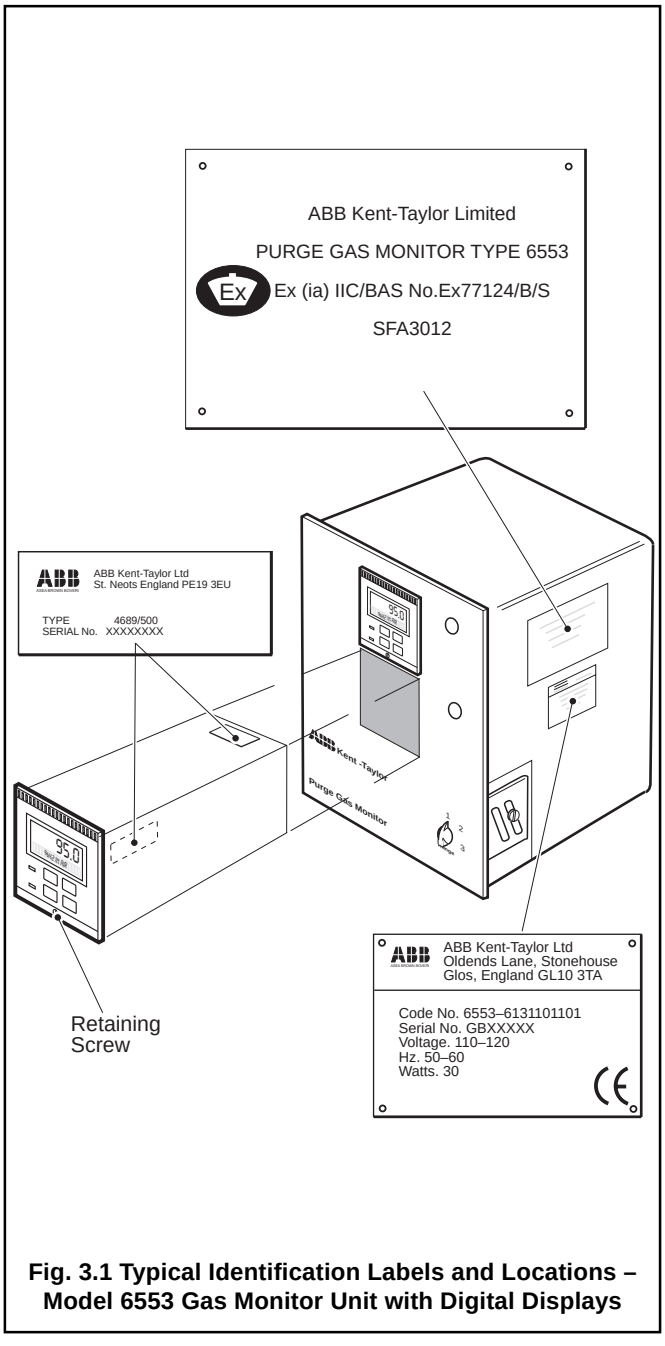


Fig. 3.1 Typical Identification Labels and Locations – Model 6553 Gas Monitor Unit with Digital Displays

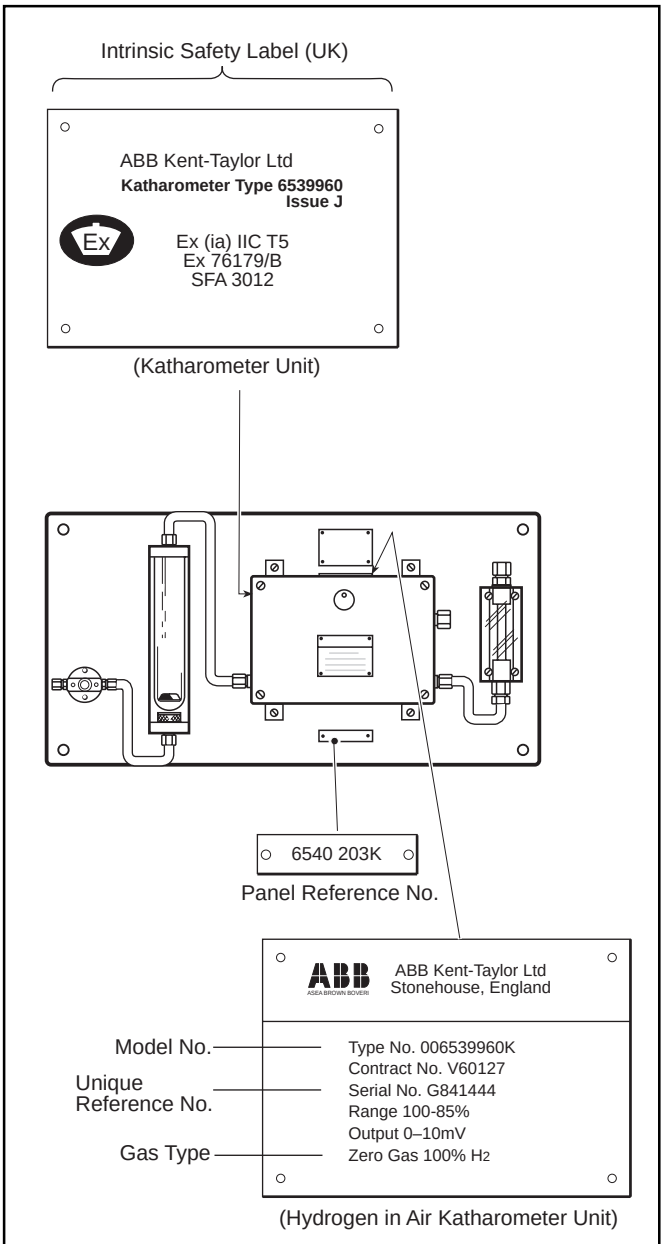


Fig. 3.2 Typical Identification Labels and Locations – Model 6540 203 Katharometer Analyzer Panel

3.1.3 Model 4234 Power Supply Unit

The identification and certification labels are fixed to the outside of the unit case, as shown in Fig. 3.3.

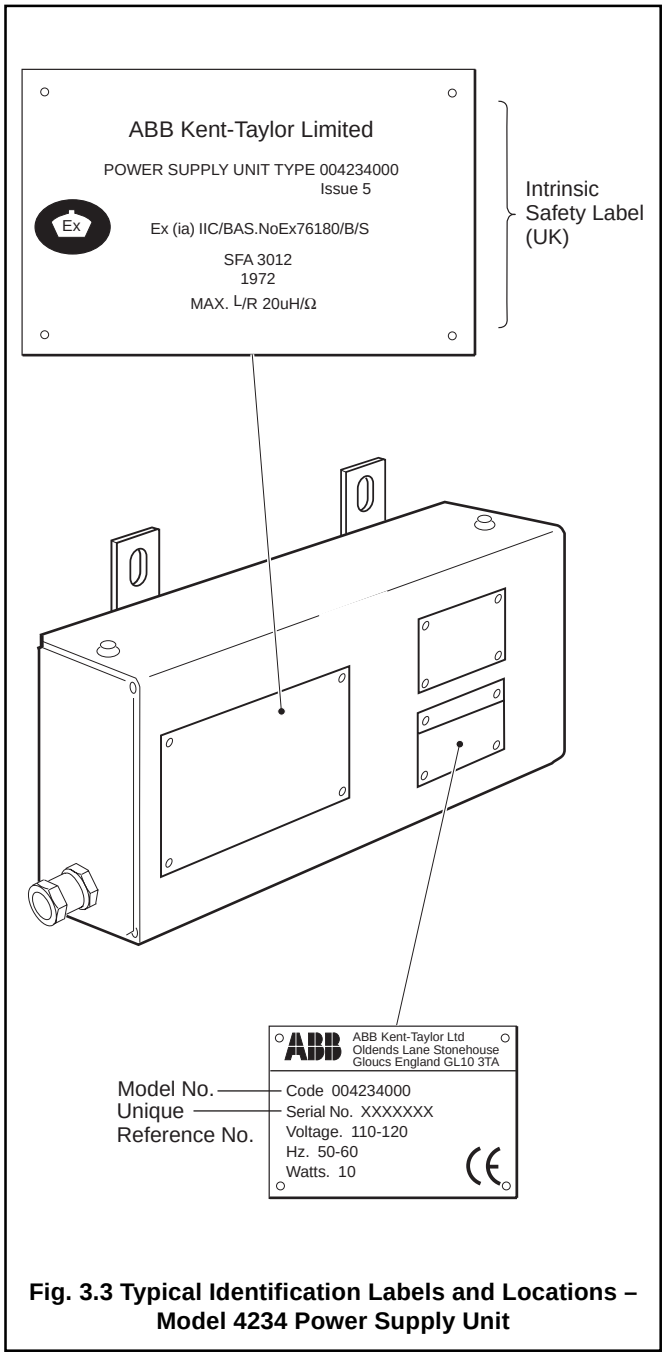
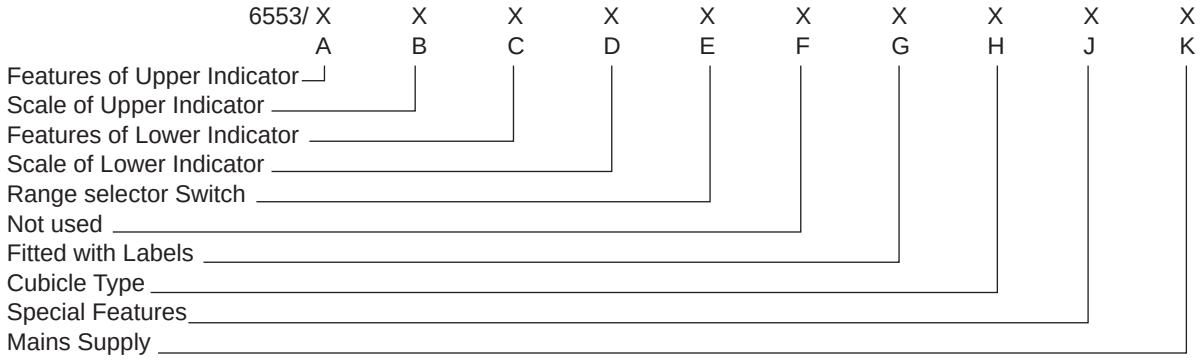


Fig. 3.3 Typical Identification Labels and Locations – Model 4234 Power Supply Unit

3.1.4 Coding System



The equipment conforms with the requirements of SFA 3012 for class IIC gases to Code Ex (ia) IIC provided that the equipment is installed in accordance with instructions provided. The display unit and power supply units must be installed in a **safe** (nonhazardous) area, and gas analysis panels may be mounted close to the sample point in the **hazardous** area.

3.1.5 Ordering Code – 6553 Hydrogen Purity and Purge Gas.

A Features of Upper Indicator
- 6 Two alarms + retrans. 4 to 20 mA

B Scale of Upper Indicator
- 1 100 to 85% H_2 in Air
- 2 100 to 80% H_2 in Air
- 3 0 to 100% Air in CO_2, 0 to 100% H_2 in CO_2, 85 to 100% H_2 in Air
- 4 0 to 100% Air in CO_2, 0 to 100% H_2 in CO_2, 80 to 100% H_2 in Air
- 5 85 to 100% H_2 in Air
- 6 80 to 100% H_2 in Air

C Features of Lower Indicator
- 0 Indicator Not Fitted
- 3 Alarm (EA) + retrans. 4 to 20 mA

D Scale of Lower Indicator
- 0 Indicator Not Fitted
- 1 0 to 100% Air in CO_2, 0 to 100% H_2 in CO_2
- 2 100 to 85% H_2 in Air
- 3 100 to 80% H_2 in Air
- 4 0 to 100% Air in CO_2, 0 to 100% H_2 in CO_2, 85 to 100% H_2 in Air
- 5 0 to 100% Air in CO_2, 0 to 100% H_2 in CO_2, 80 to 100% H_2 in Air
- 6 85 to 100% H_2 in Air
- 7 80 to 100% H_2 in Air

E Range Selector Switch
- 0 Not fitted
- 2 Fitted, with facilities for Remote Indication of Switch Position.
- 3 Fitted with two range switches, upper and lower indicator + remote indication of switch position.

F Additional Output Signal – Not Used
- 0 Not used

G Fitted with Labels
- 1 English
- 2 French
- 3 German

H Type of Cubicle
- 1 Without Cubicle.
- 4 Purge Cubicle (D1) (with purity)
- 5 Purity Cubicle (D2, D3, D6 or D7) (purity only)

J Special Features
- 0 None
- 9 Fitted

K Mains Supply
- 1 110 V, 50/60 Hz
- 2 220 V, 50/60 Hz
- 3 240 V, 50/60 Hz

3.1.6 Option Combinations (6553/[X])

The digit decode is shown in Section **3.1.4.**

[X]	Purity only: top ind.	3-Range: top ind. only	Std. purge system	2 x purity display	2 x 3 ranges	Purity top : 3 ranges lower
A	6	6	6	6	6	6
B	1,2,5,6	3,4	1,2,5,6	1,2,5,6	3,4	1,2,5,6
C	0	0	3	3	3	3
D	0	0	1	2,3,6,7	4,5	4,5
E	0	2	2	0	3	2
F	0	0	0	0	0	0
G	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
H	1,5	1,5	1,4	1,5	1,4	1,4
J	0,9	0,9	0,9	0,9	0,9	0,9
K	1,3	1,3	1,3	1,3	1,3	1,3

4.1 Locating and Mounting System Items

4.1.1 Model 6553 Gas Monitor

The monitor must be located in the **safe** area of the application plant in a sheltered interior environment.

The monitor is intended to be panel mounted in a position to suit reading of the displays and with access to the rear to enable wiring interconnections to be made. The panel preparation requirements and installation dimensions are shown in Fig. 4.1. The monitor is secured to the panel by two clamping brackets at opposite corners of the monitor chassis.

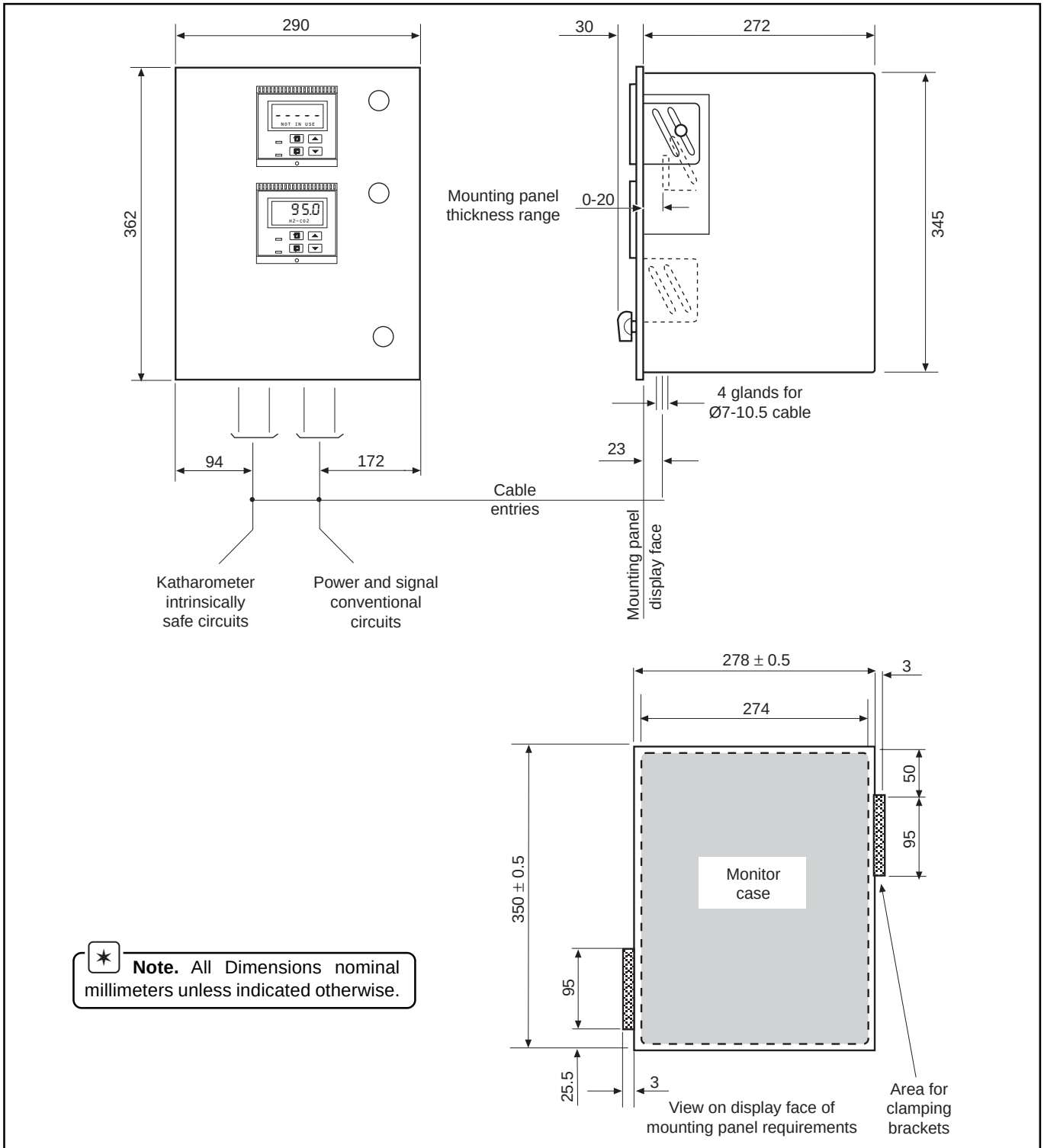


Fig. 4.1 Installation Dimensions and Interconnection Positions – Model 6553 Gas Monitor Unit with Digital Displays

4.1.2 Katharometer Analyzer Panels Fig. 4.2

Caution. Ensure that the correct panel, specifying zero gas 'Hydrogen' or 'CO_2', is located at the required position and ensure that the panel is of the correct pressure rating.

The panel is located in the **hazardous** area (zone 0,1 or 2) of the application plant in a sheltered interior environment. Avoid a location which subjects the katharometer unit to direct sunlight. When two katharometer panels are used they should be positioned so as to be at the same ambient temperature.

The katharometer unit is fixed to the panel, which has fixing holes at each corner, and should be mounted on a suitable vertical surface close to the sample tapping point. The installation dimensions for the panels are shown in Fig. 4.2 and 4.3.

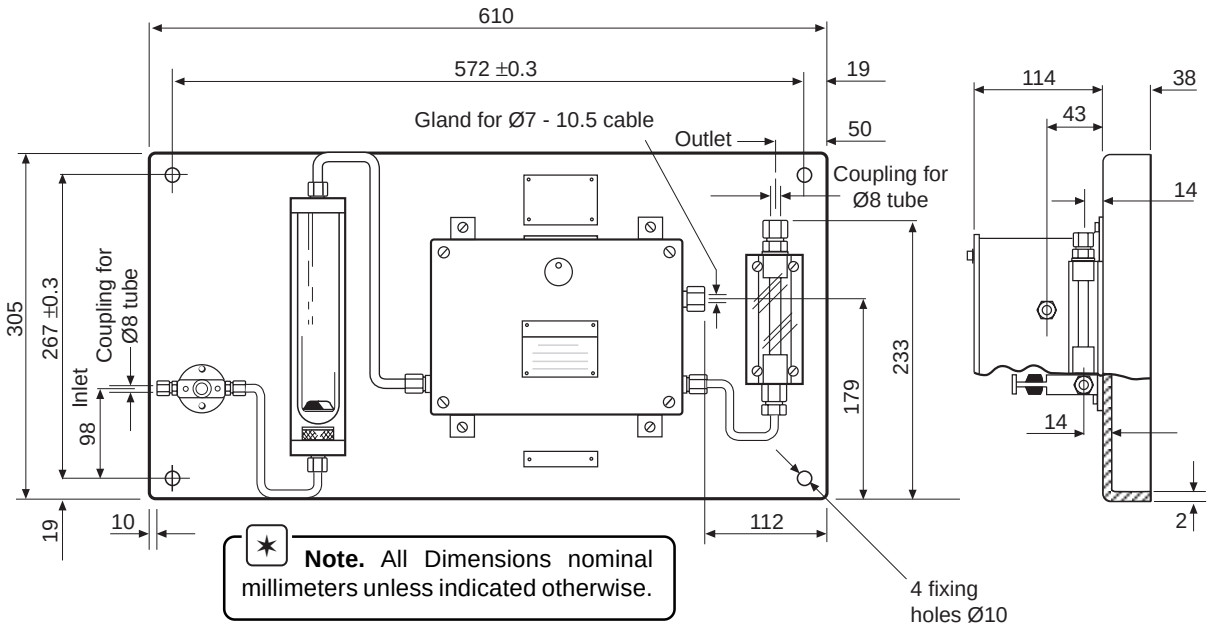


Fig. 4.2 Installation Dimension and Interconnection Positions – Model 6540 203 Katharometer Analyzer Panel

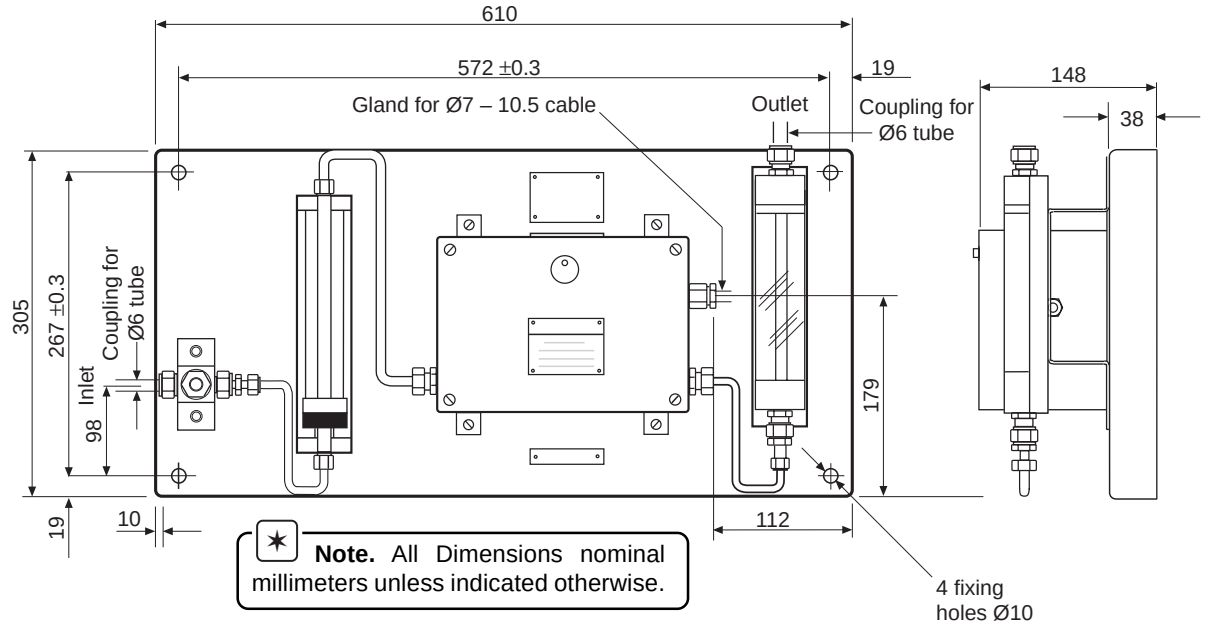


Fig. 4.3 Installation Dimension and Interconnection Positions – Model 6548 000 Katharometer Analyzer Panel

4.1.3 Model 4234 Power Supply Unit

The unit must be located in the **safe** area of the application plant in a sheltered interior environment.

The power supply unit has 4 fixing lugs and should be mounted on a suitable vertical surface. The installation dimensions are shown in Fig. 4.4.

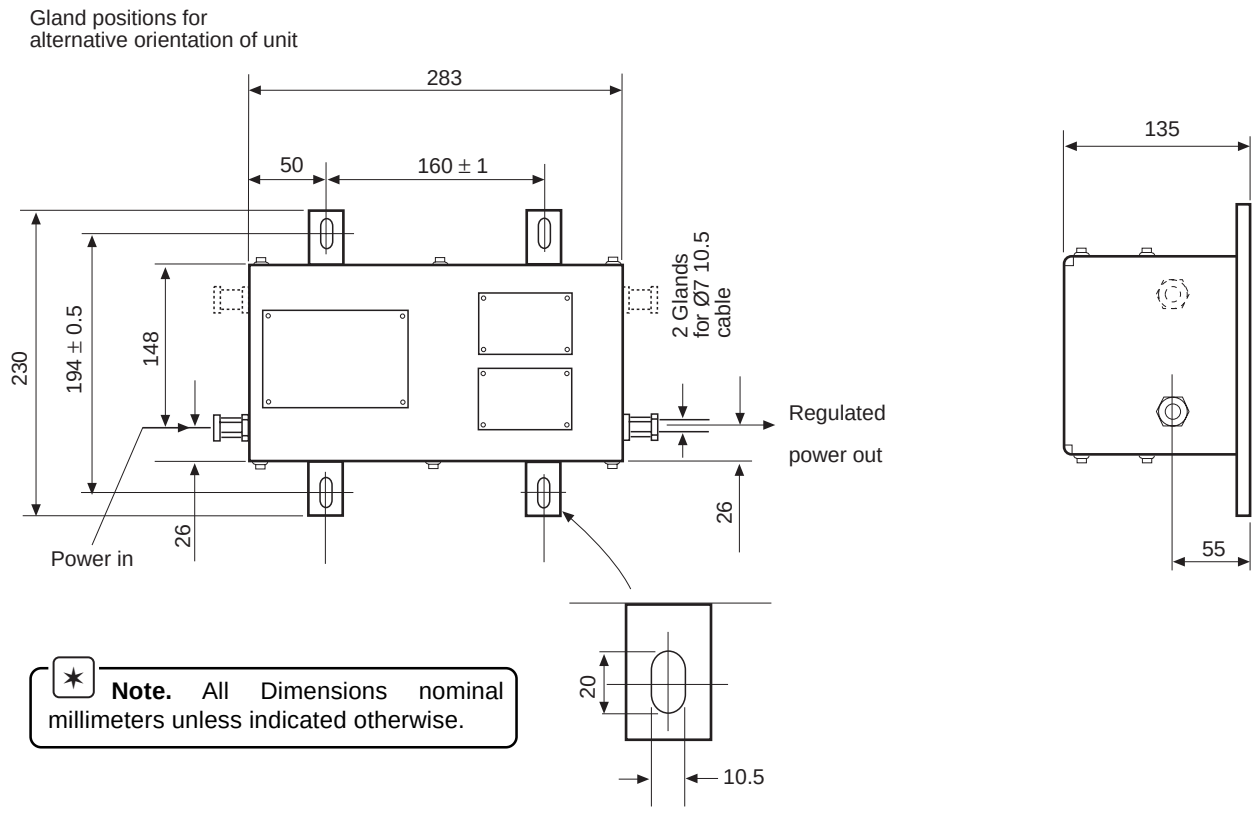


Fig. 4.4 Installation Dimension and Interconnection Positions – Model 4234 Power Supply Unit

4.2 Sample Gas Interconnections

Warning. A hazardous mixture of hydrogen in air could develop in the event of leakage from the sample gas system. Katharometer analyzer panels should be located in a ventilated area.

The sample pressure must not exceed the value given in Section **13.**

The incoming sample gas temperature must not exceed the temperature given in Section **13.**

If there is a risk of significant particle contamination , a suitable 1 µm filter unit should be incorporated in the system before the sample gas enters the analyzer system.

Compression couplings are supplied at the sample inlet and outlet to the katharometer panel. These couplings are suitable for connecting 8 mm (Model 6540 203) or 6 mm (6548 000) outside diameter metal tube. It is recommended that stainless steel tube is used.

The complete tubing system should be tested for leaks in accordance with the requirements of the responsible authority.

5 ELECTRICAL INSTALLATION

5.1 Electrical Interconnections

Warning.

- Equipment in this system operates on a.c. mains supply voltage electricity. Suitable safety precautions must be taken to avoid the possibility of electric shock.
- Although certain instruments are fitted with internal fuse protection, a suitably rated external protection device, e.g. a 3 A fuse or miniature circuit breaker (m.c.b.), must also be fitted by the installer.
- The proper electrical connections and wiring standards must be achieved to establish the intrinsic safety of the system, as certified.
- The a.c. input and intrinsically safe d.c. output wiring must be routed separately from non-intrinsically safe wiring.

Fig. 5.4 shows the interconnecting wiring requirements for the gas analyzer system, which must be strictly observed. Details of cable requirements, which must be strictly adhered to, are also given – see Section **5.2.1.**

After completing the wiring, check that the continuity earthing (grounding) and isolation of all circuits is to the required local electrical standards for intrinsically safe circuits.

The separate units of the analyzer system must be interconnected as follows:

5.1.1 Model 6553 Gas Monitor (Fig 5.1)

Warning. No connections must be made to the hazardous area terminals (Terminal Block 2) other than as specified in wiring diagram Fig. 5.3. The appropriate cable requirements must be also satisfied.

Remove the outer case from the back of the unit to gain access to the cable glands and terminal blocks.

The electrical connections are made through the appropriate cable gland at the bottom of the unit into the terminal block immediately above them. **Hazardous** and **safe** area sections are separated.

The alarm and signal outputs on terminal block 1 (TB 1), between TB1 - 1 and TB1 - 16, may be connected as required. The availability of signal outputs will vary with the particular 6553 system. Refer to Fig. 5.3 for details.

Make the wiring connections in accordance with the information given in the wiring diagram Fig. 5.3 and Section **5.1**.

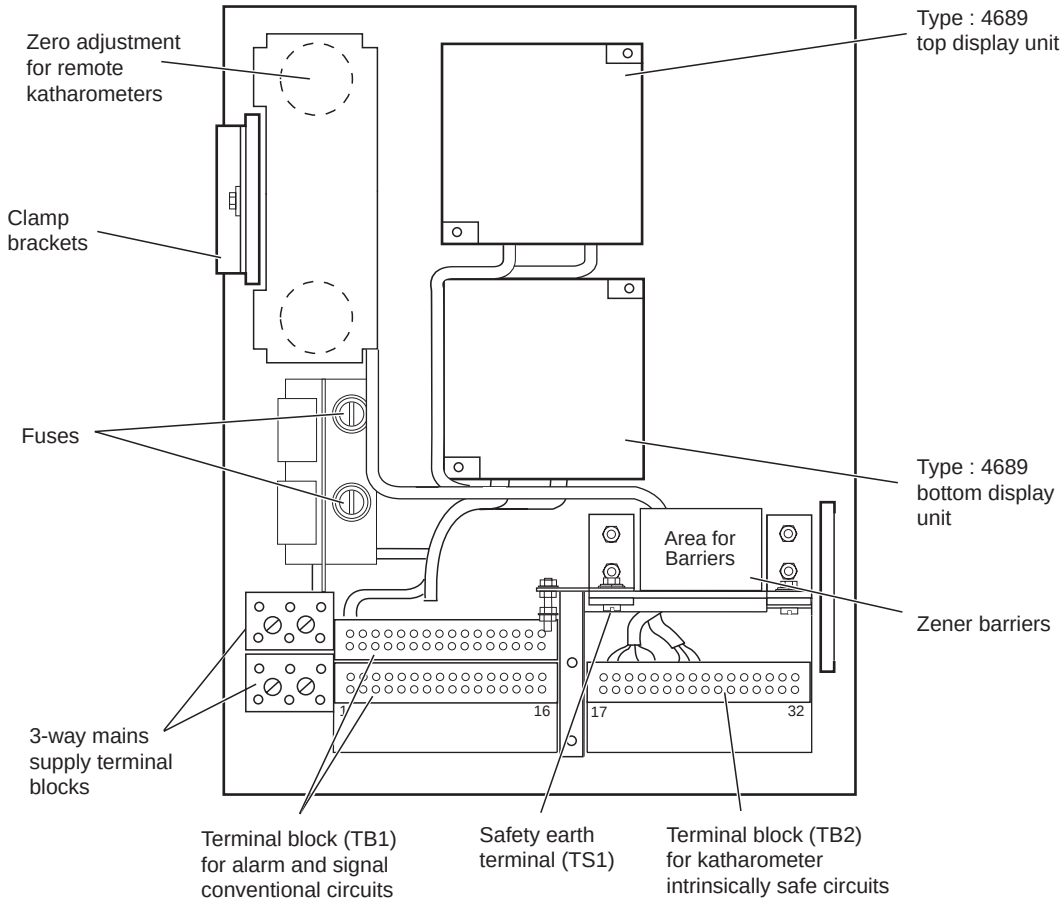


Fig. 5.1 Location of Components Inside case (Rear View) Model 6553 Gas Monitor Unit with Digital Displays

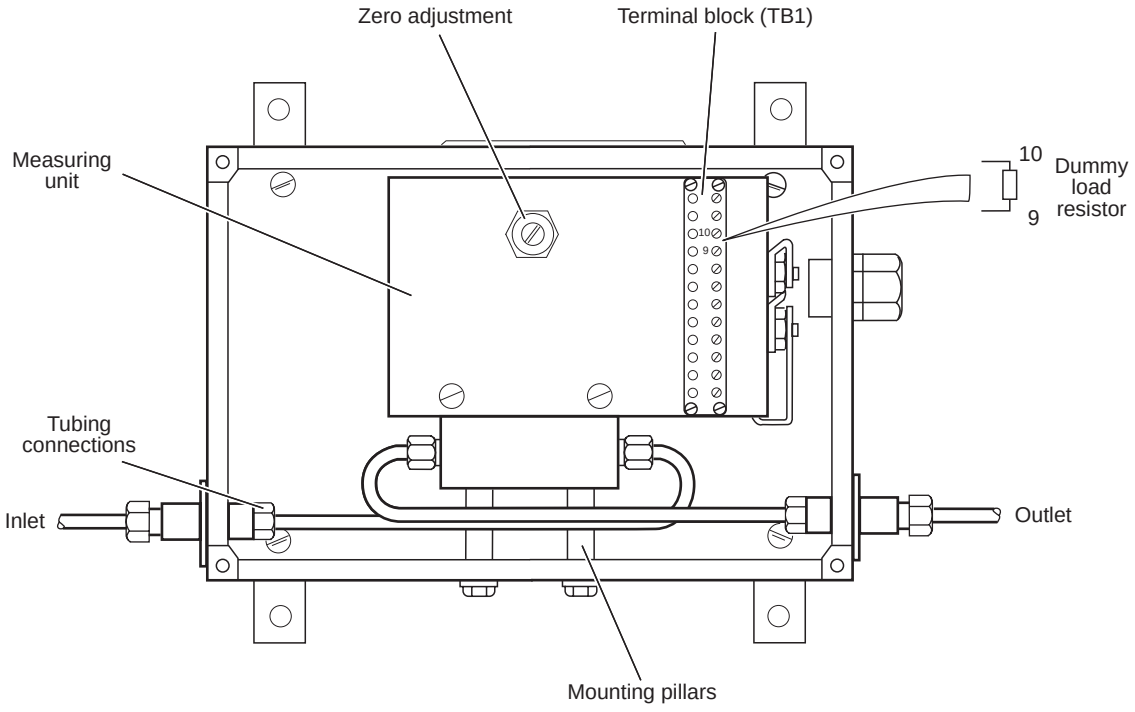


Fig. 5.2 Location of Components Inside Case – Model 6539 960 Katharometer Unit

Caution. The integrity of the fail-safe operation of the zener barrier units depends on a **Safety Earth** connection which must not have a resistance greater than 1R0 to the application plant earth (ground).

Make the Earth (Ground) and **Safety Earth** connection at the stud (TS1) – see Fig. 5.1.

On completion of wiring and checks, replace the outer case and secure the clamping brackets to the mounting panel.

5.1.2 Models 6540 203 and 6548 000 Katharometer Analyzer Panels

Electrical connections are made inside the katharometer unit (6539 960) on the analyzer panel – see Fig. 5.2.

Remove the cover of the katharometer unit to gain access to the terminal block (TB1) inside.

Make the electrical connections in accordance with the information given in wiring diagram Fig. 5.3 and Section **5.2.**

The electrical connections are made at the terminal block (TB1) via the cable gland, or any replacement gland to suit the intrinsically safe wiring requirements. When the appropriate interconnections have been made, if remote zero is to be used, remove the 510R dummy load resistor from across terminals 9 and 10 and set the zero adjustment on the katharometer to the approximate midpoint.

Replace the cover of the katharometer unit on completion of wiring up.

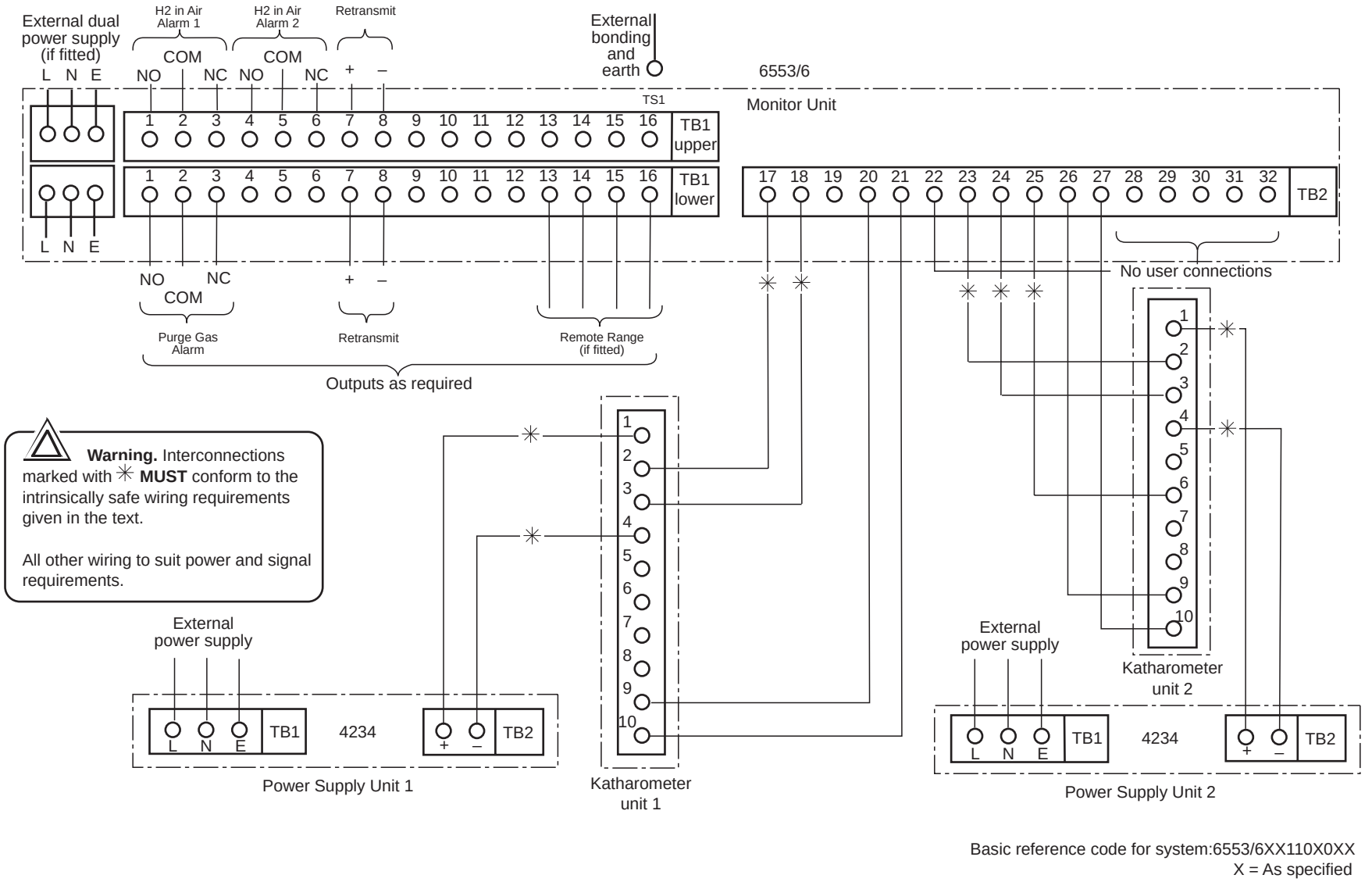
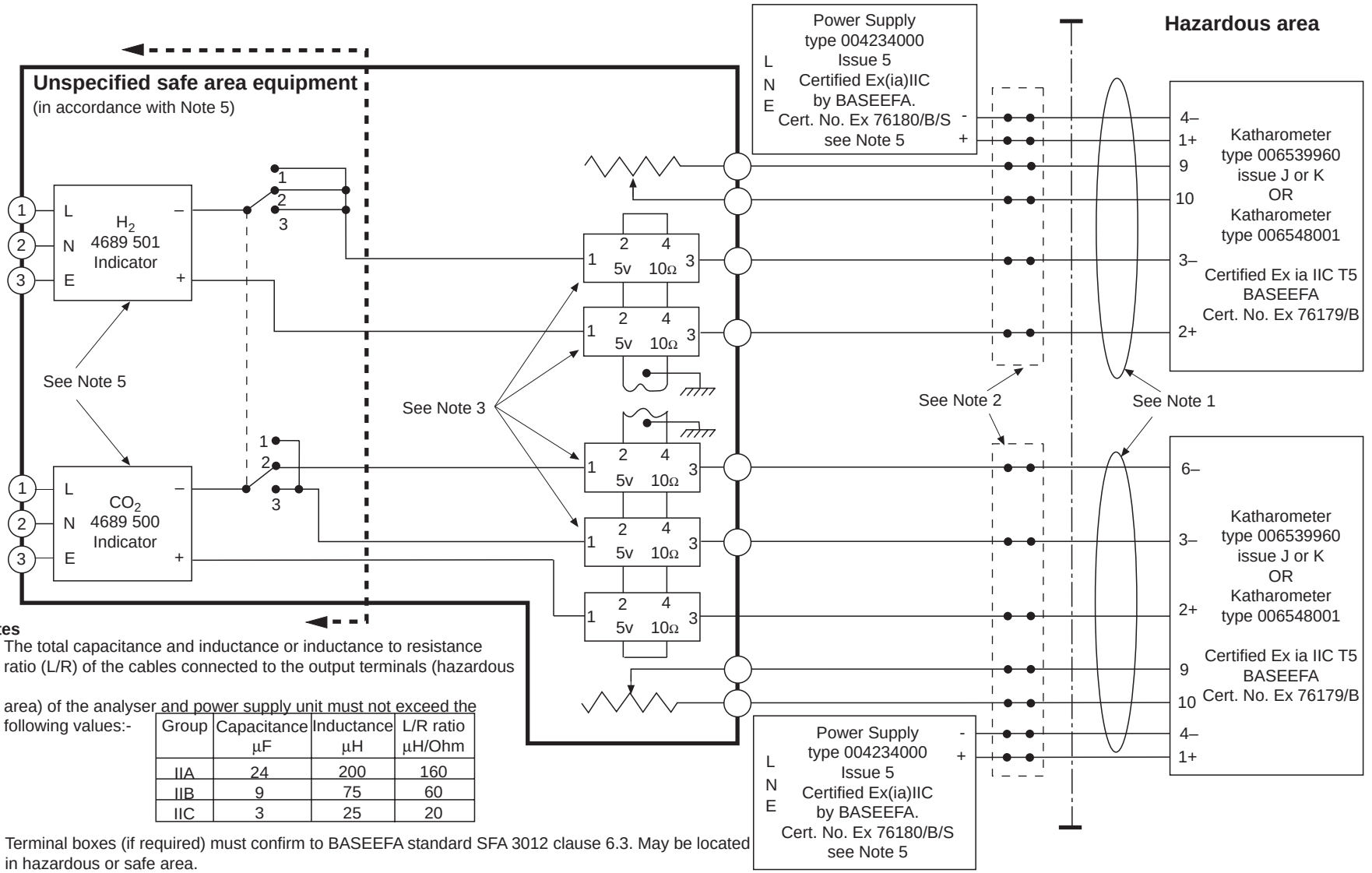


Fig. 5.3 Interconnection Wiring Diagram – Model 6553 Intrinsically Safe Analyzer System using two displays



Notes

1 The total capacitance and inductance or inductance to resistance ratio (L/R) of the cables connected to the output terminals (hazardous area) of the analyser and power supply unit must not exceed the following values:-

Group	Capacitance µF	Inductance µH	L/R ratio µH/Ohm
IIA	24	200	160
IIB	9	75	60
IIC	3	25	20

2 Terminal boxes (if required) must confirm to BASEEFA standard SFA 3012 clause 6.3. May be located in hazardous or safe area.

3 BASEEFA certified 5v 10Ω shunt zener diode barriers of like polarity, certified Ex(ia)IIC. MTL 105+ve

4 The installation must conform to the BASEEFA Installation Conditions, issue 6 dated 1 September 1976.

5 Safe area equipment must not contain a source of potential relative to earth in excess of 250V rms or 250v d.c.

Fig. 5.4 System Diagram. System Cert. Ex76181/1 dated Dec 1988

5.1.3 Model 4234 Power Supply Unit – Fig. 5.5

Warning. Do **NOT** connect mains supply to the power supply unit with the output terminals on open circuit. This causes premature component failure.

Caution. Ensure that the power supply unit is correct for the mains supply voltage available. A nominal 110V unit cannot be adapted for use with a nominal 240 V supply, or the other way round.

Remove the cover of the unit to gain access to the terminal blocks inside.

Locate the terminal block (TB3) adjacent to the transformer T1. To ensure the correct transformer tapping is used for the incoming mains supply, adjust the brown wire, if necessary, to the appropriately marked TB3 terminal to either 110 or 120 V (200, 220 or 240 V, for alternative power supply unit).

Make electrical connections in accordance with the information given in the wiring diagram Fig. 5.3 and Section **5.2.1.**

The electrical connections are made at terminal blocks TB1 and TB2, through the appropriate cable gland, or any replacement gland to suit intrinsically safe wiring requirements. Secure the incoming cable by the cable clips adjacent to the terminal blocks.

Fit the cover on completion of wiring up.

5.2 Intrinsically Safe Requirements

These requirements relate to the interconnecting wiring made to and from Models 6540 203 or 6548 000 Katharometer Analyzer Panels in the hazardous area, and those for remote ancillary items connected to the system.

5.2.1 Cable Requirements

The interconnecting cables between the various units of the gas analysis system are subject to stringent limitations because of the requirements of the intrinsic safety certification. These are listed below and detailed in Fig. 5.4.

All cables entering the **hazardous** area must be kept separate from cables in the **safe** area. Cables entering the **hazardous** area must not be run with other cables, and terminations must have an earthed screen to separate them from connections for other circuits. The detailed requirements are as follows:

a) Connections between Models 6540 203 or 6548 000 Katharometer Analyzer Panels and Model 4234 Power Supply Unit.

   All cables from the Katharometer into the **hazardous** area must have an inductance/resistance ratio not exceeding 18 μH/Ω, (for Group IIC gases). There is a further requirement that the maximum resistance of this interconnecting cable is limited to 2 Ω. This may place a limitation on the length of the total cable run.

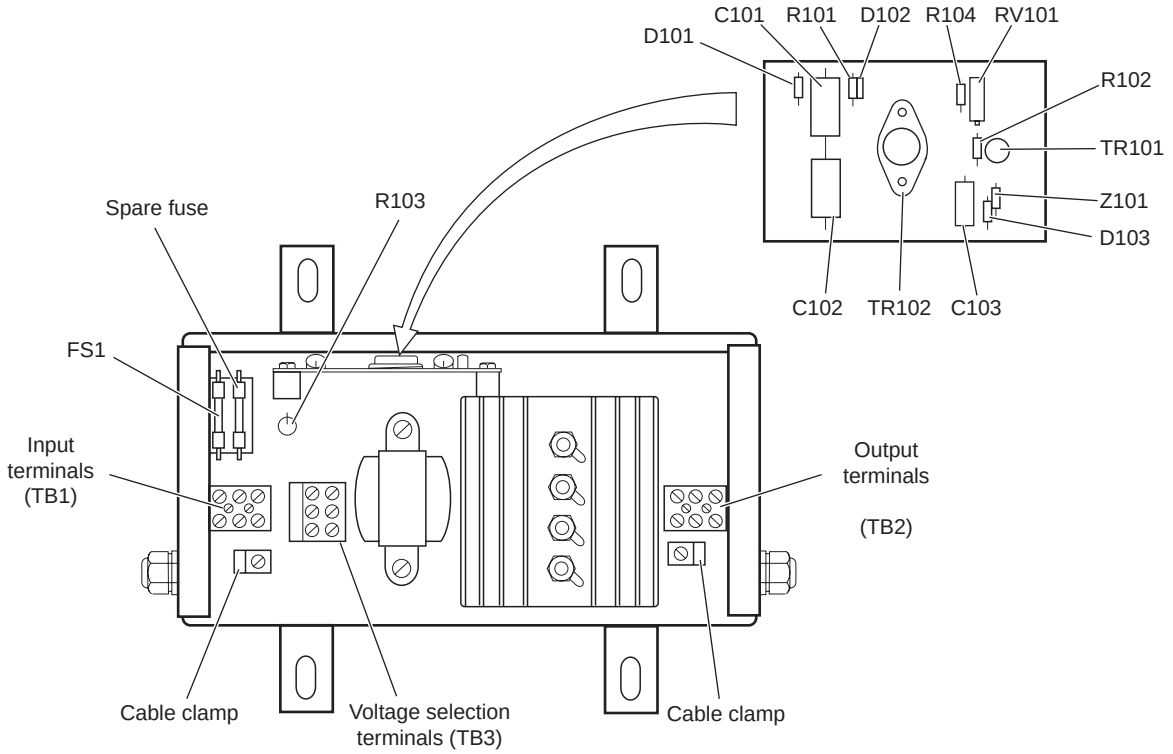


Fig. 5.5 Location of Components Inside Case – Model 4234 Power Supply Unit

Single sheathed conductor cables should be twisted together to reduce their mutual inductance, and routed separately from cabling for non-intrinsically safe circuits in the **safe** area.

b) Connections between Models 6540 203 or 6548 000 Katharometer Analyzer Panels and Model 6553 Gas Monitor Unit.

Katharometer to display unit cables, carrying the output signals through zener barrier units inside the monitor unit, are subject to of a maximum inductance/resistance ratio of 18 μH/Ω (for group IIC gases). These wires are indicated by a ✳ in Fig. 5.3.

No special requirements are necessary to limit the choice of cable for the interconnection between the katharometer zero adjustment controls and the monitor unit.

5.2.2 Recommended Cables

The limitations imposed restrict the choice of wiring cable to a few types. 'Pyrotenax' meet the requirements of less than 18 μH/Ω with their mineral insulated cable type PCC 2L1.

The Company should be consulted with information on any other cables proposed for use in the installation of this system.

Detailed cable specifications of the above mentioned type is available from:

Pyrotenax Limited
Hedgeley Road
Hebburn-on-Tyne
County Durham
Telephone: 0191 483 4123

5.2.3 Installing Remote Ancillary Items

Any indicator/controllers, or other electrical equipment, connected to TB1 of the Model 6553 Gas Monitor Unit must not be supplied from, nor contain, a potential source greater than 250 V d.c. or 250 V r.m.s. with respect to earth (ground).

5.2.4 Full Intrinsically Safe Requirements

For systems to be modified or used with other gases the full BASEEFA requirements must be complied with as follows:

a) The total Capacitance and Inductance or Inductance to Resistance ratio (L/R) of the cables connecting the katharometer unit to the hazardous area terminals of the monitor unit (TB2) and power supply unit terminals (TB1) must not exceed the values given in Table 5.1.

b) Any terminal boxes used in the hazardous or safe areas must conform to BASEEFA Standard SFA.3012, Clause 6.3.

c) The overall installation must conform to the BASEEFA installation conditions, Issue 6 (September 1976). See Fig. 5.4.

Gas Group	Capacitance μF	Inductance mH	Inductance/ Resistance μH/Ω
IIA	4.8	0.152	144
IIB	1.8	0.057	54
IIC	0.6	0.019	18

Table 5.1 6553 – Intrinsically Safe Wiring Requirements

6 SETTING UP

When the gas analyzer system has been correctly installed in accordance with the requirements for intrinsic safety given in Section **5.2**, carry out the following setting-up procedures:

6.1 Katharometer Analyzer Panel – Filling the Drying Chamber – Fig. 6.1

a) Remove the drying chamber on the katharometer analyzer panel by unscrewing the large knurled nut at the base of the chamber. Pull the chamber down and out of the sealing groove to remove it from the panel.

b) Open a container of fresh granular calcium chloride or calcium sulphate. Immediately fill, and prepare to replace, the drying chamber.

✶ **Note.** The capacity of the drying chamber is about 140 ml. To fill the chamber, approximately 100 g of calcium chloride or calcium sulphate is required.

c) Replace the drying chamber in its sealing groove and reposition the chamber to enable it to be secured and sealed by hand tightening the knurled nut.

d) Carry out an approved leak testing procedure before passing sample gas through the system.

6.2 Setting Sample Flow

When all tubing interconnections have been made and external parts of the sample system checked for leaks, the suggested procedure is as follows:

a) Arrange to supply calibration quality carbon dioxide gas through the gas analyzer system at the normal working pressure of the application plant and within the limits given in Section **13.**

b) Gradually open the metering valve on the katharometer panel to pressurize the complete system to the maximum pressure given in Section **13**.

⚠ **Caution.** Testing for leaks with carbon dioxide may not be considered an adequate check of gas tight integrity in respect of the more penetrating hydrogen gas. Consideration may be given to the use of a gas , such as helium, which has penetrating properties nearer to that of hydrogen.

c) Slowly open the metering valve to give a nominal flowrate of gas of 100 to 150 ml min^{-1}. Do not exceed the maximum flowrate given in Section **13**.

d) Set the flowrate and shut off the calibration gas external to the analyzer system.

e) Repeat this procedure for each katharometer analyzer panel, as required.

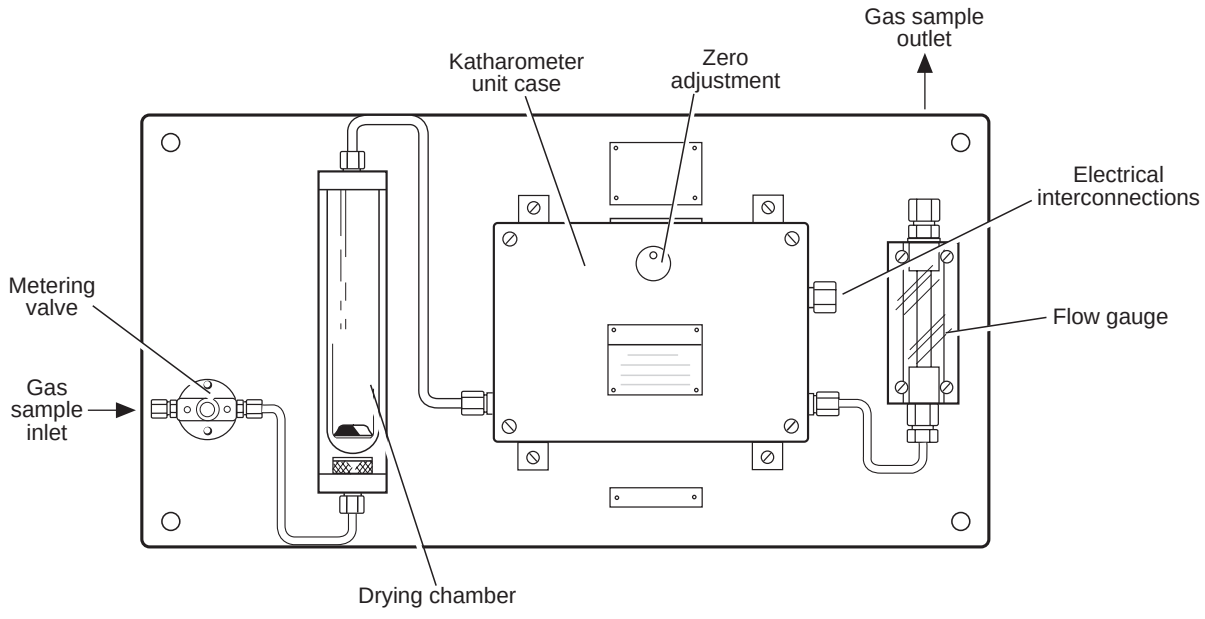


Fig. 6.1 Katharometer Analyzer Panel

6.3 Electrical Checks

Carry out the following electrical checks:

6.3.1 Model 4234 Power Supply Unit Output

The procedure is as follows:

Warning. This unit is part of the certified intrinsically safe system. Appropriate safety precautions must be taken to prevent any incendive electrical discharges in the hazardous area when carrying out this task

Testing the output may only be carried out with the hazardous area cable disconnected and a dummy load resistor fitted across the output. **Never operate the unit to supply an open circuit**.

a) Electrically isolate the power supply unit.

b) Remove the cover from the power supply unit.

c) Disconnect the output wires to the hazardous area at terminals TB2+ and TB2–.

d) Connect a 10 Ω (2 W ±5%) dummy load resistor across terminals TB2+ and TB2–.

Warning. Ensure that proper electrical safety precautions are taken at all times when undertaking this procedure.

e) Switch on the power supply unit and check that it is stable at 350 mA.

f) On completion of tests, isolate the unit, remove the dummy load resistor and reconnect the output wires to the hazardous area.

g) Replace the cover on the unit.

6.3.2 Zener Barrier Units

The zener barriers in the 6553 Monitor Unit are checked at the time of manufacture. To ensure absolute safety when fitting a new instrument, check that the barriers in the monitor are properly earthed by carrying out a routine test before using the analyzer system.

Warning.

- This unit is part of the certified intrinsically safe system. Appropriate safety precautions must be taken to prevent any incendive electrical discharges in the hazardous area when carrying out this task.
- If these tests reveal a faulty zener barrier, the barrier must be replaced by a new unit. The barrier is a sealed unit and no repair is permitted. The correct zener barriers are certified intrinsically safe to EX (IA) IIC and no other type may be substituted.

a) Electrically isolate the 6553 monitor unit.

b) Remove the outer case from the monitor.

c) Disconnect the cable connected to terminal 3 of the barrier unit.

d) Using a low voltage ohmmeter, measure the resistance between terminals 1 and 3. This must be less than 18.15 Ω. If in excess of this value - **change the barrier**.

e) Using a low voltage ohmmeter, ensure that the resistance between terminals 2 and 4 of the barrier unit and the application plant safety earth is less than 1 Ω.

f) Connect the wire to terminal 3 on the barrier unit.

g) Fit the outer case to the 6553 Monitor Unit.

6.3.3 Checking System Earth

Check the resistance between earth terminals on the analyzer system and the application plant system safety earth does not exceed one ohm.

7 CONTROLS & DISPLAYS

7.1 Displays – Fig. 7.1

The displays comprise a 5-digit, 7-segment digital upper display line and a 16-character dot-matrix lower display line. The upper display line shows actual values of hydrogen purity, hydrogen in air, air in CO_2, alarm set points or programmable parameters. The lower display line shows the associated units or programming information.

7.2 Switch Familiarization Fig. 7.1 and 7.2

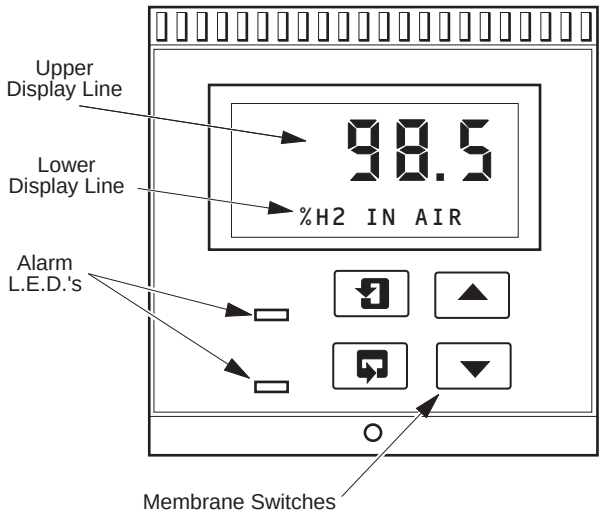
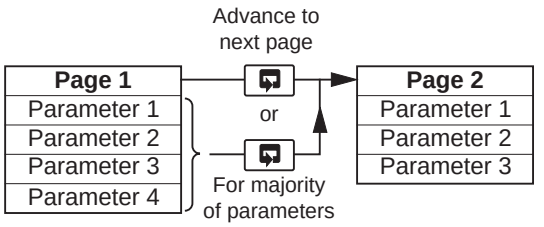
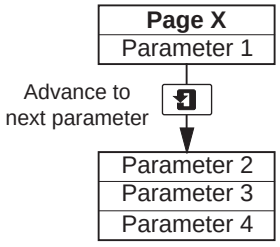


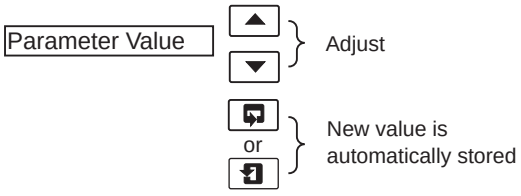
Fig. 7.1 Location of Controls and Displays



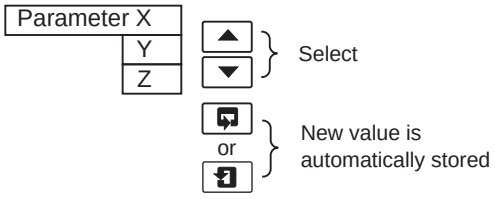
A – Advancing to Next Page



B – Moving Between Parameters



C – Adjusting and Storing a Parameter Value



D – Selecting and Storing a Parameter Choice

Fig. 7.2 Function of the Membrane Switches

Warning. When the apparatus is connected to its supply, terminals may be live, and the opening of covers or removal of parts (except those to which access may be gained by hand) is likely to expose live parts.

8.1 Instrument Start-up

In normal operation the instrument displays the **Operating Page** which is a general use page in which parameters are viewed only and cannot be altered. Any changes to the operating parameters are implemented using the switches as described in **7.2 Switch Familiarization.** To alter or program a parameter refer to Section **10**. A 5-digit Security Code is used to prevent unauthorized access to programmable parameters. The value is preset at 00000 to allow access during commissioning but should be altered to a unique value, known only to authorized operators, as described in the **Setup Outputs Page**.

When all the required wiring connections and electrical checks have been correctly made, the power supplies to the various units may be switched on as follows:

a) Switch on the supply voltage to the 4234 Power Supply Unit.

b) Switch on the supply voltage to the 6553 Monitor unit.

8.2 Alarm Set-points

8.2.1 Type of Alarm Action

The alarm action can be configured to operate in a variety of ways to suit the operator. It is, however, strongly recommended that the hydrogen alarm is configured for 'fail-safe' operation.

For 'fail-safe' operation the alarm relay coil is energized during normal operation and is de-energized upon recognition of an alarm condition, thereby providing 'fail-safe' alarms. i.e. with Alarm 1 set point = 95.0, when the display is indicating greater than 95.0 (plus hysteresis), then Alarm Relay 1 is energized and Alarm 1 LED is OFF. When the display indicates less than 95.0 (minus hysteresis), then Alarm Relay 1 is de-energized and Alarm 1 LED is ON. This operating mode ensures that, in the event of a mains power failure, an alarm condition is signalled.

8.2.2 Hydrogen Alarm Set Point

It is suggested that the hydrogen alarm set-points should be based on a reducing percentage of hydrogen as it is displaced by air entering the application plant. This can be achieved by setting Alarm 1 and Alarm 2 (if fitted) to give ample warning of the development of a potentially explosive mixture. Factory settings are Alarm 1 = 95.0 and Alarm 2 = 90.0 (if fitted).

The procedure is as follows:

Access the programming pages (Section **10**) and input the alarm set-points in accordance with the information given in **Set Up Outputs Page.** The hydrogen alarm set point can only be set with the selector switch in position 1.

The hydrogen alarm relay action can be configured for 'fail safe', high alarm action or low alarm action – see Section 10.1.3.

8.2.3 Purge Gas Alarm Set Point

One alarm is available from the lower indicator and can be programmed to act on either percentage of hydrogen in carbon dioxide or percentage of air in carbon dioxide. The relay will only activate if the range switch position corresponds to the gas mixture selected for the purge gas alarm operation. The purge gas alarm set point can only be set with the range switch in positions 2 or 3.

The purge gas relay action can be configured for 'fail-safe', high alarm action or low alarm action – see the Programming Pages in Sections **10.2.3** and **10.3.3**.

The purge gas alarm relay will de-energize when the switch is in position 1.

8.3 Electrical Calibration

The instrument is factory calibrated for electrical voltage signal input. No adjustment is normally necessary for proper functioning of the purge gas monitor. If electrical calibration is required, a voltage source capable of supplying 10.00 mV and 250.00 mV is needed. The katharometer input to the monitor unit should be disconnected and the voltage source signal applied according to the instructions in the **Electrical Cal** programming page – see **Section 10**.

Note. The 4600 Series instruments incorporate a two point electrical calibration sequence requiring both zero and span inputs for a calibration. It is not possible to adjust either the range zero or the range span scale points independently.

8.4 Gas Calibration

Before putting the system on-line, it is recommended that a calibration check for the 'zero' reading is made using calibration standard sample gas.

The 'zero gas' is permanently marked on the data plate on the 6539 960 or 6548 001 katharometer unit. This gas when passed through the ka tharometer gives a zero millivolt output. To provide a fail-safe condition it is recommended that the hydrogen purity zero gas is a 80% or 85% hydrogen in nitrogen mixture so that if power is lost to the katharometer, an alarm condition will occur at the monitor unit.

The local 'zero' adjusters on the katharometer units in the hazardous area are redundant when this adjustment is transferred to the gas monitor unit. The potentiometers in the katharometer units should be set to the midpoint on installation, and sealed off.

Full scale output from the katharometer is obtained by a 100% hydrogen gas sample and no adjustment of the katharometer output is normally required. The maximum signal for the full scale reading is sealed during manufacture and should not be altered by users.

8.4.1 Hydrogen Gas Calibration

Warning. Test for leaks in accordance with the requirements of the responsible authority after making any hydrogen connections.

a) Arrange to pass calibration quality Hydrogen gas through the Katharometer Unit on the appropriate katharometer analyzer panel, at the normal working pressure of the sample gas system. This should give the correct flowrate of gas, as set previously.

b) Power up the monitor unit, and the hydrogen katharometer unit by switching on the appropriate power supply unit.

c) Set the range selector switch on the monitor unit to position (1).

d) The display unit indicates the measurement parameter - percentage by volume of hydrogen in air (%H2 IN AIR) - on the lower line. The upper line indicates a value for the parameter.

e) With hydrogen calibration gas passing through the sample system at the normal flowrate, the displayed value should stabilize within 2 hours to read the correct value (80, 85 or 100%) as appropriate.

Note. A zero adjustment facility is available from the potentiometer adjacent to the display unit. Adjustment is made by inserting a screwdriver through the hole behind the small escutcheon plate.

8.4.2 Purge Gas

When a purge gas katharometer forms part of the 6553 system, the startup procedure is as follows:

a. Arrange to pass calibration quality carbon dioxide through the purge gas katharometer, on the appropriate katharometer analyzer panel. The gas should be at the normal working pressure of the sample gas. This should give the correct flowrate of purge/sample gas as set previously.

b. Power up the monitor unit, and the purge gas katharometer unit by switching on the appropriate power supply unit.

c. Set the range selector switch on the gas monitor unit to position 3.

d. The top display unit will indicate NOT IN USE.

e. The bottom display unit will indicate the selected measurement parameter - percentage by volume of air in carbon dioxide (%AIR IN CO2) - on its lower display line. The upper display line will indicate a value for the parameter.

f. With carbon dioxide calibration gas passing through the sample system at the normal flowrate, the upper line of the bottom display unit should stabilize within 2 hours to read 0.0

Note. A remote zero adjustment facility is available at the bottom 'zero' potentiometer adjacent to the display unit. Adjustment is made by inserting a screwdriver through the hole behind the small escutcheon plate.

g. Reset the range selector switch on the gas monitor to position 2. The top display will continue to indicate NOT IN USE.

h. The bottom display will indicate the selected measurement parameter - percentage by volume of hydrogen in carbon dioxide (%H2 IN CO2) - on the lower line. The upper line will indicate a value for the parameter.

i. With carbon dioxide continuing to pass through the sample system, the upper line of the bottom display unit should stabilize within a few minutes to read 0.0 .

Note. No adjustment of the bottom zero potentiometer is necessary. As any adjustment required will already have been made while calibrating the 'air in carbon dioxide' range.

9.1 Normal

During normal operation the Model 6553 Gas Analyzer System is used to indicate the purity of hydrogen used as a coolant. The top display will show the percentage of hydrogen in air, which should be safely in excess of the explosive limit at the hydrogen rich end.

There are no routine adjustments required to the gas analyzer system after completion of start-up procedures and putting on-line in monitoring mode. The system only requires minor adjustments to the metering valve to maintain the required flowrate and the carrying out of safety routines.

A summary of the functions and status of the system for the different range selector switch positions is shown in Table 9.1.

9.1.1 Purging of Hydrogen Coolant Gas

When the hydrogen coolant has to be removed from the application plant, it would be wasteful and dangerous to release the coolant gas directly into the atmosphere. So it is necessary to ensure that the system is outside of the explosive limits for air in hydrogen before allowing air into the system.

Initially, inert purge gas (carbon dioxide) is introduced into the system. When the hydrogen concentration is safely below the explosive limit, air is introduced into the system to completely displace the other two gases.

The Model 6553 Gas Analyzer System provides all the necessary indications and output signals to enable this operation to be carried out safely.

With respect to the operation of the gas analyzer system, the procedure is as follows:

Warning. Suitable safety procedures will apply to the operation of the gas cooling and sample system.

a) Power up the purge gas katharometer and carry out a calibration check on the katharometer in accordance with the information given in Section **8.3**.

b) Select position (2) of the range selector switch on the monitor unit. This will cause the display units to indicate and have the functions given in Table 9.1.

c) Commence the purging operation.

d) When the changeover to introduce air into the application plant is made, select position (3) of the range selector switch on the monitor unit. This will cause the display units to indicate and have the functions given in Table 9.1.

9.1.2 Filling with Hydrogen Coolant Gas

This procedure is a reversal of the purging procedure.
Initially, inert purge gas (carbon dioxide) is introduced into the application plant until the air content is safely below the explosive limit for air in hydrogen. When this limit is reached, hydrogen is gradually introduced into the system to displace the other two gases.

With respect to the operation of the gas analyzer system, the procedure is as follows:

Warning. Suitable safety precautions will apply to the operation of the gas cooling and sample systems.

	Range Selector Switch Position	Upper Display Line		Lower Display Line		Alarm 1 Set Point	Alarm 2 Set Point
		Actual Display	Function	Actual Display	Function		
Top Display Unit	(1)	××××.×	Variable Value	%H2 IN AIR	Hydrogen Purity	A/R	A/R
	(2)	- - - - -	Inhibit	NOT IN USE	Inhibit	Inhibit	Inhibit
	(3)	- - - - -	Inhibit	NOT IN USE	Inhibit	Inhibit	Inhibit
Bottom Display Unit	(1)	- - - - -	Inhibit	NOT IN USE	Inhibit	Inhibit	Inhibit
	(2)	××××.×	Variable Value	%H2 IN CO2	Purge Gas Purity	A/R %H2 IN CO2	N/A
	(3)	××××.×	Variable Value	%AIR IN CO2	Purge Gas Purity	A/R %AIR IN CO2	N/A

A/R – As required N/A – Not available

Table 9.1 Functions and Status of Display Units for Different Range Selector Switch Positions

a) Power up the monitor unit and hydrogen and purge gas katharometers.

b) Carry out separate calibration check procedures on the katharometers in accordance with the information given in Section **8.3**.

✶ **Note.** Commence the filling operation within 24 hours of carrying out the calibration procedure.

c) Select position (3) of the range selector switch of the monitor unit. This will cause the display units to indicate and have the functions given in Table 9.1.

d) When the changeover to introduce hydrogen into the application plant is made, select range (2) of the range selector switch on the monitor unit. This will cause the display units to indicate and disable functions as given in Table 9.1.

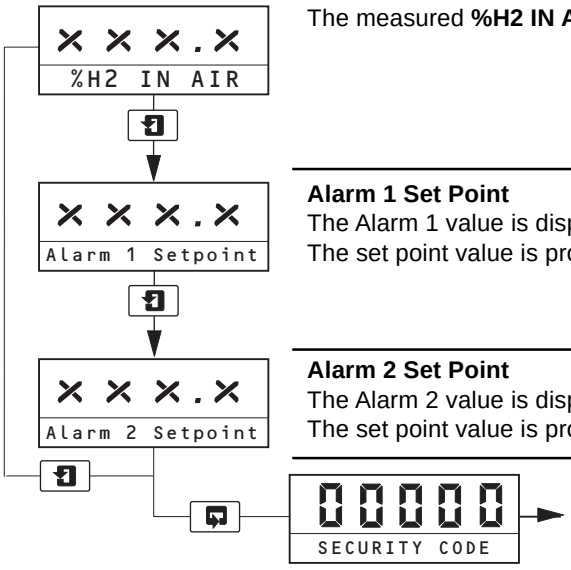
e) When the bottom display indicates that hydrogen filling is complete, arrange to pass the sample gas alternately through the hydrogen and purge gas katharometers.

f) Make alternate selections of the reading from each katharometer by operating the range selector switch on the monitor unit between positions (1) and (2).

g) When both readings stabilize at the required value, shut down the purge gas katharometer and position the range selector switch at (1). The hydrogen measurement analyzer system is on-line in monitoring mode.

9.2 Operating Page – Range 1 (Read Only)

UPPER DISPLAY RANGE 1



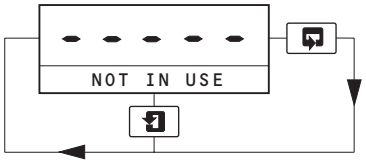
The measured **%H2 IN AIR** is displayed.

Alarm 1 Set Point
The Alarm 1 value is displayed.
The set point value is programmable – see **Set Up Outputs Page** Section **10.1.3**.

Alarm 2 Set Point
The Alarm 2 value is displayed.
The set point value is programmable – see **Set Up Outputs Page** Section **10.1.3**.

Advance to **Security Code Page**

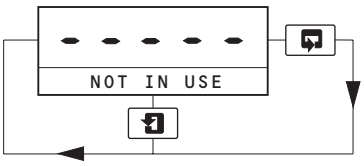
LOWER DISPLAY RANGE 1



When Range 1 is selected, **%H2 IN AIR** measurement will be indicated on the upper display, and the lower display will indicate **'NOT IN USE'**.

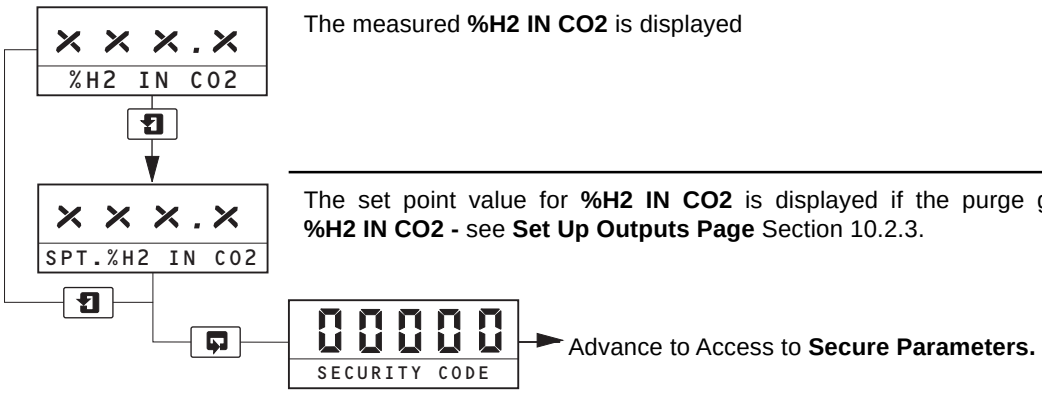
9.3 Operating Page – Range 2 (Read only)

UPPER DISPLAY RANGE 2



With Range 2 selected, **%H2 IN CO2** measurement will be indicated on the lower display, the upper display will indicate **'NOT IN USE'.**

LOWER DISPLAY RANGE 2



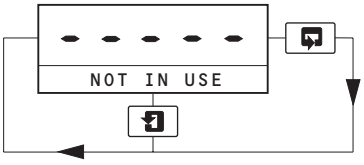
The measured **%H2 IN CO2** is displayed

The set point value for **%H2 IN CO2** is displayed if the purge gas alarm is selected for **%H2 IN CO2 -** see **Set Up Outputs Page** Section 10.2.3.

Advance to Access to **Secure Parameters.**

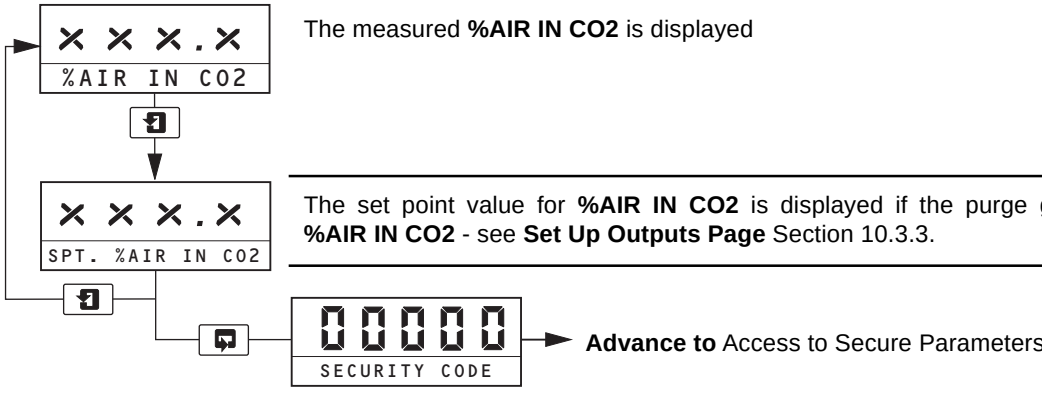
9.4 Operating Page – Range 3 (Read only)

UPPER DISPLAY RANGE 3



With Range 3 selected, the upper display will indicate **'NOT IN USE'**, and the lower display will indicate **%AIR IN CO2** measurement.

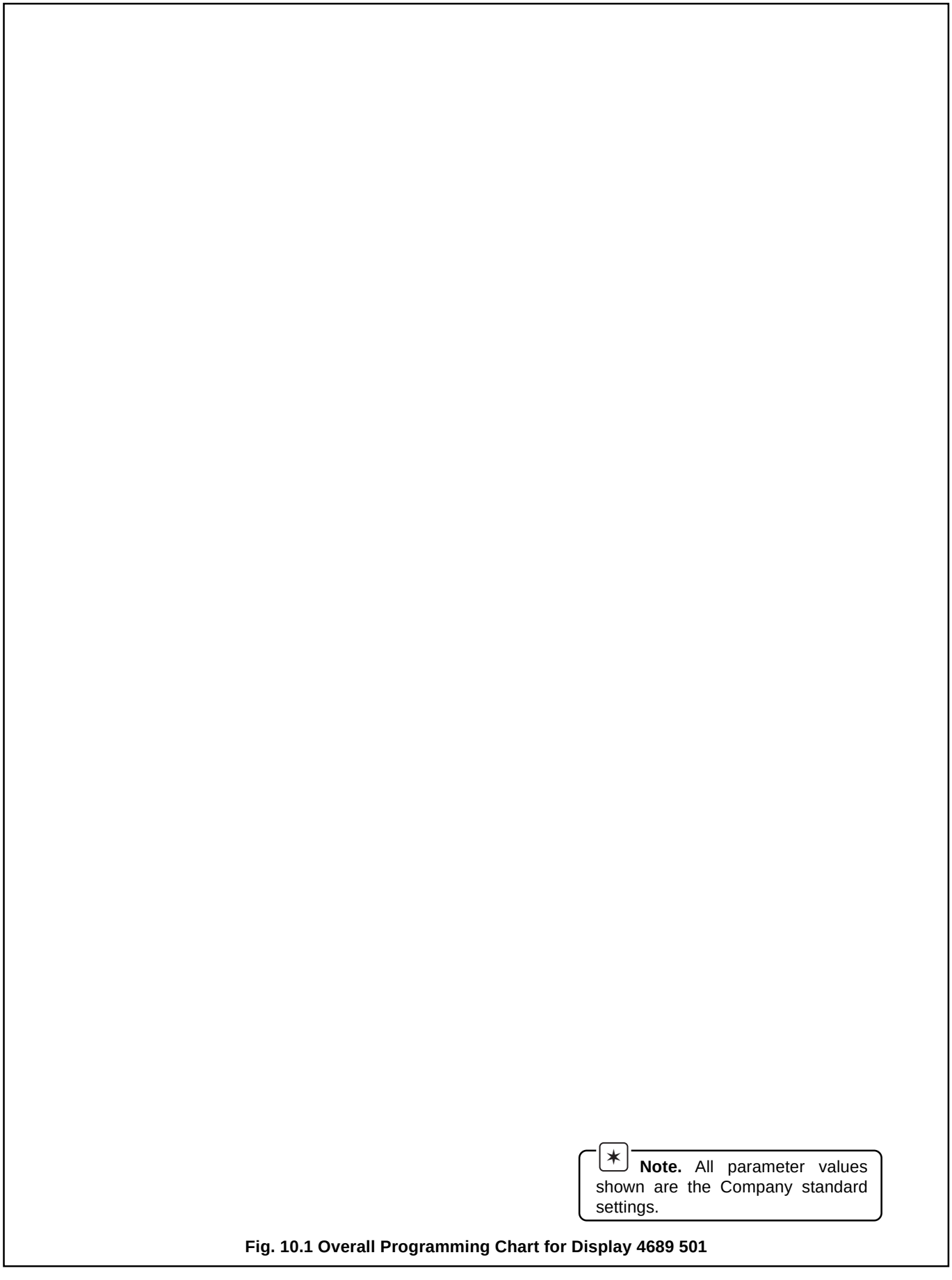
LOWER DISPLAY RANGE 3



The measured **%AIR IN CO2** is displayed

The set point value for **%AIR IN CO2** is displayed if the purge gas alarm is selected for **%AIR IN CO2** - see **Set Up Outputs Page** Section 10.3.3.

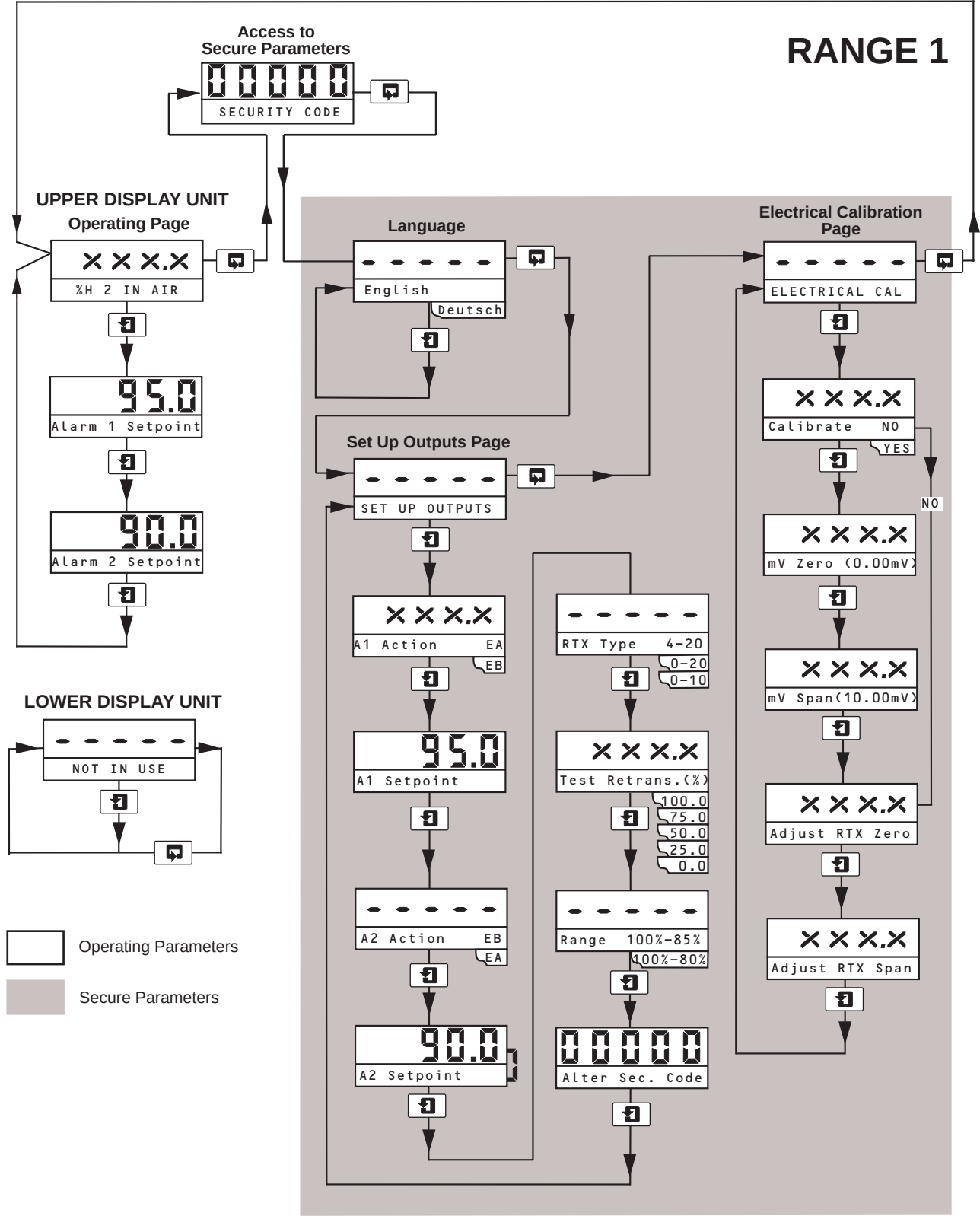
Advance to Access to Secure Parameters**.**

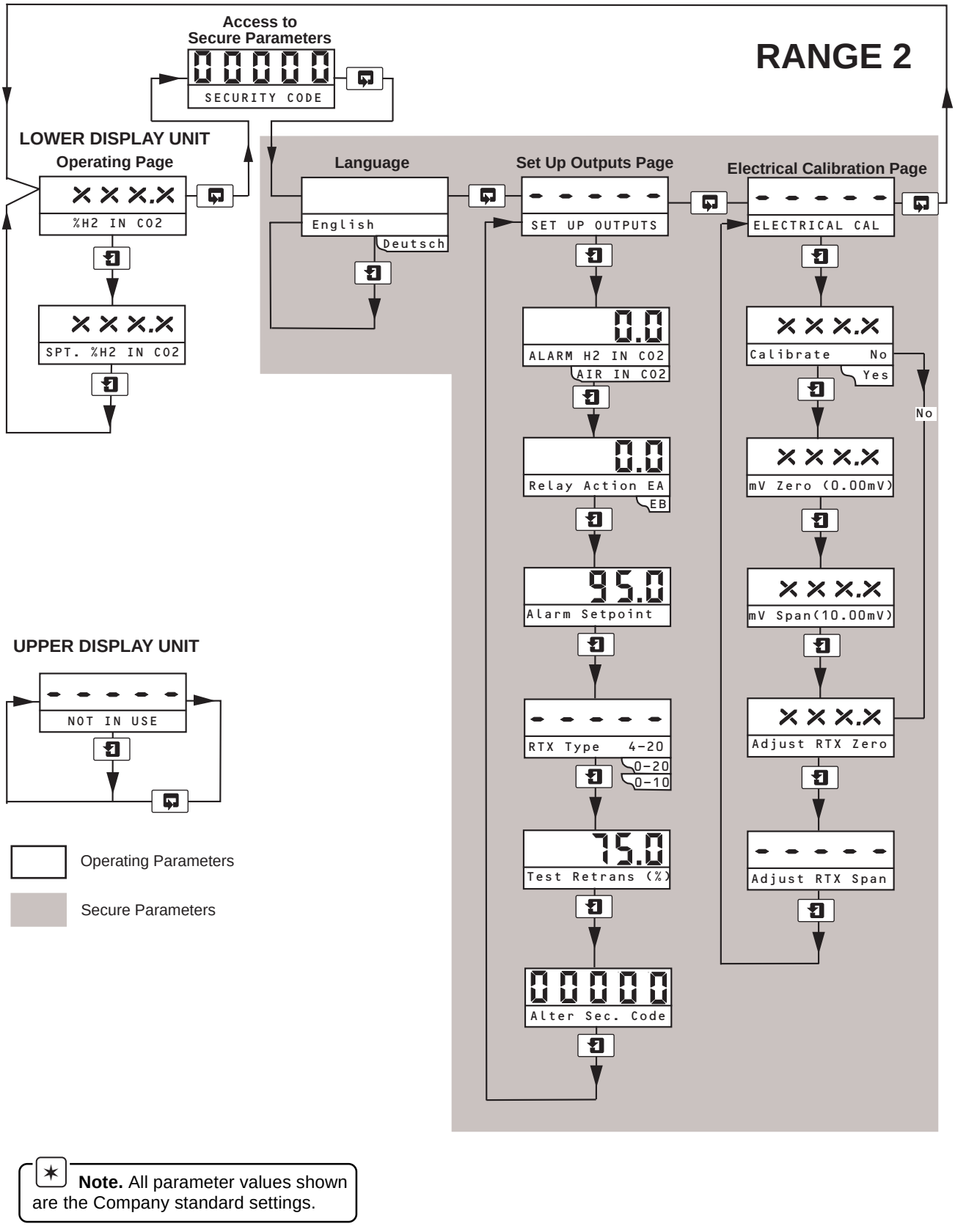


✶ **Note.** All parameter values shown are the Company standard settings.

Fig. 10.1 Overall Programming Chart for Display 4689 501

RANGE 1


Access to Secure Parameters
00000
SECURITY CODE
UPPER DISPLAY UNIT
Operating Page
XXX.X
%H 2 IN AIR
95.0
Alarm 1 Setpoint
90.0
Alarm 2 Setpoint
LOWER DISPLAY UNIT
NOT IN USE
Language
English
Deutsch
Set Up Outputs Page
SET UP OUTPUTS
XXX.X
A1 Action EA
EB
95.0
A1 Setpoint
A2 Action EB
EA
90.0
A2 Setpoint
RTX Type 4-20
0-20
0-10
XXX.X
Test Retrans.(%)
100.0
75.0
50.0
25.0
0.0
Range 100%-85%
100%-80%
00000
Alter Sec. Code
Electrical Calibration Page
ELECTRICAL CAL
XXX.X
Calibrate NO
YES
NO
XXX.X
mV Zero (0.00mV)
XXX.X
mV Span(10.00mV)
XXX.X
Adjust RTX Zero
XXX.X
Adjust RTX Span
Operating Parameters
Secure Parameters



Note. All parameter values shown are the Company standard settings.

Fig. 10.2 Overall Programming Chart for Display 4689 500

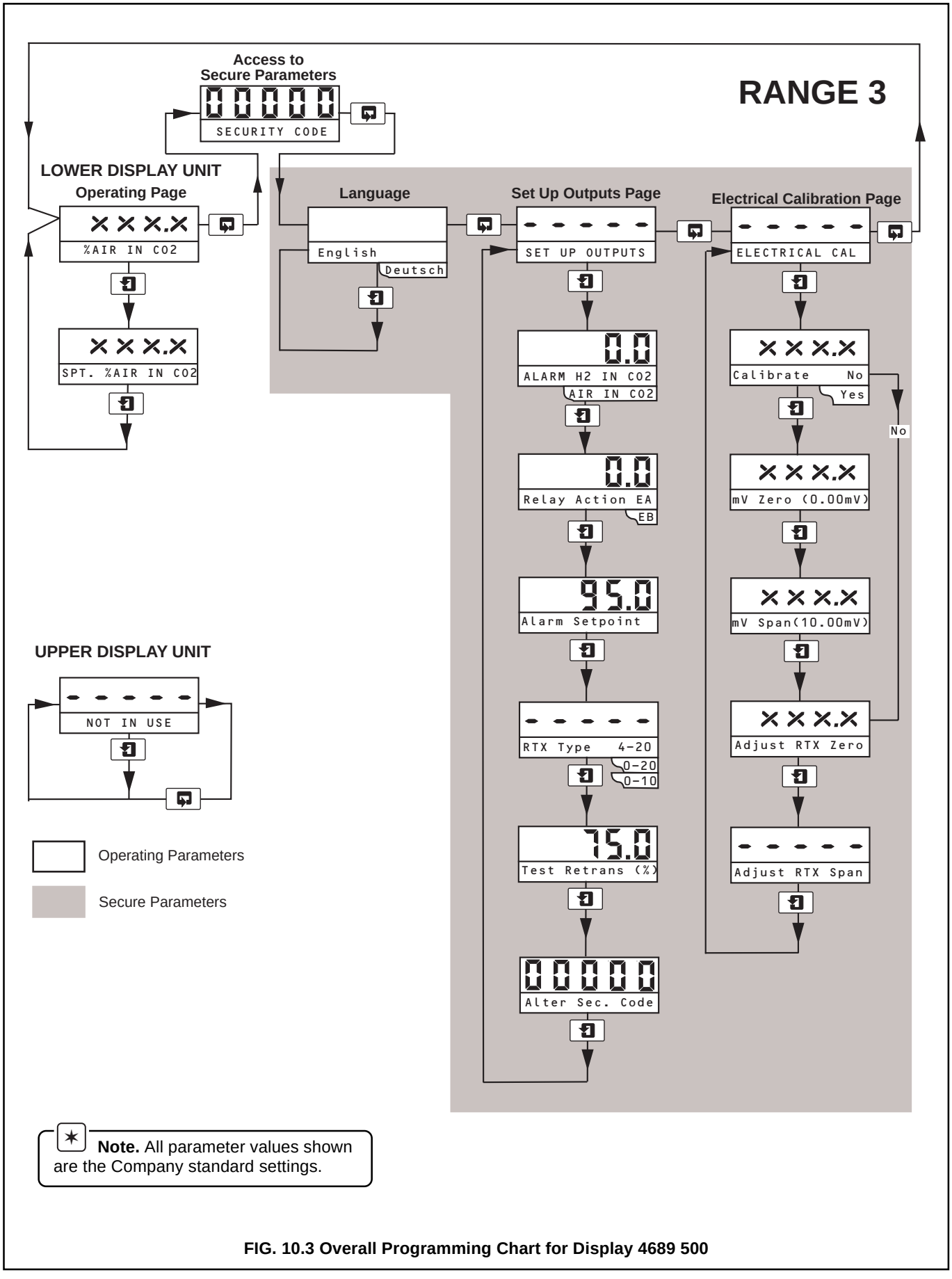


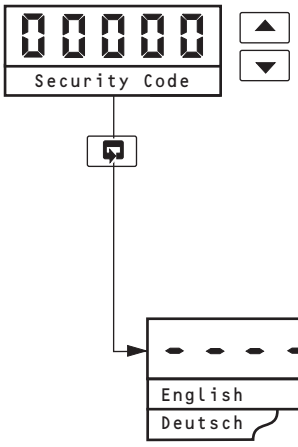
FIG. 10.3 Overall Programming Chart for Display 4689 500

10.1 Range 1

10.1.1 Access to Secure Parameters (Range 1)

A 5-digit code is used to control access to secure parameters.

UPPER DISPLAY RANGE 1

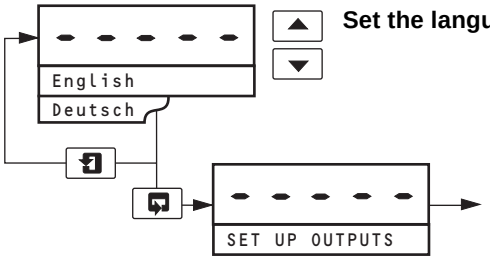


Security Code
Enter the required code number, between 00000 and 19999, to gain access to the secure parameters. If an incorrect value is entered, access to subsequent programming pages is prevented and the display reverts to the **Operating page.**

Note. The security code is preset at '00000' to allow access during commissioning but should be altered to a unique value, known only to authorized operators – see **Access Page**

Advance to **Language Selection.**

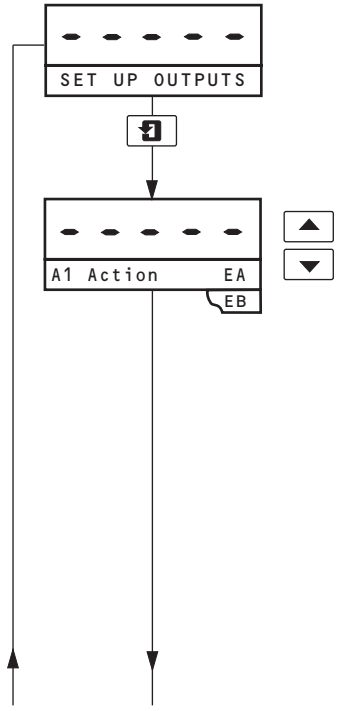
10.1.2 Language Selection



Set the language required. Subsequent displays change to the language selected.

Advance to Set Up Outputs Page

10.1.3 Set Up Outputs Page



Page Header – **SET UP OUTPUTS**

Advance to next parameter.

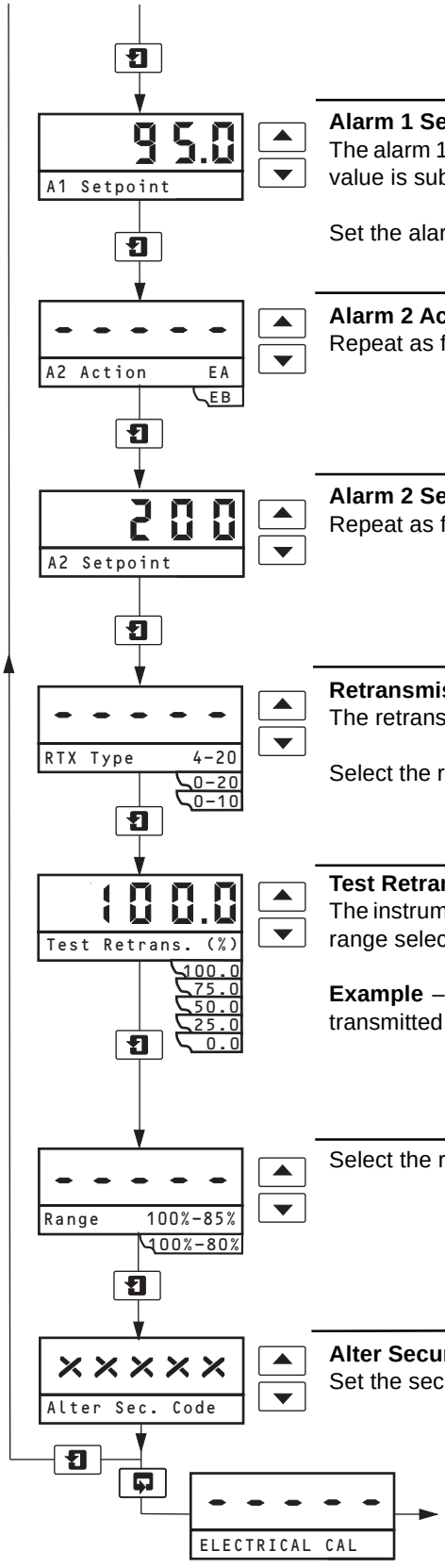
Alarm 1 Action
For **'Fail-safe'** alarm operation the relay's alarm state must be the same as the power-down state, i.e. the relay is de-energized.
For **high alarm** operation the relay must be **Energized B**elow the alarm set point (EB).
For **low alarm** operation the relay must be **Energized A**bove the alarm set point (EA).
The alarm l.e.d.s are illuminated in the alarm condition.
Select the required alarm 1 action from the following table:

Alarm Action	L.E.D. Action for Input Above Set Point	L.E.D. Action for Input Below Set Point	Relay Action for Input Above Set Point	Relay Action for Input Below Set Point
EB	ON	OFF	De-energised	Energised
EA	OFF	ON	Energised	De-energised

The set point band is defined as the actual value of the set point plus or minus 1% of the set point value. Alarm action occurs if the input value is above or below the set point band. If the input moves within the set point band the last alarm action is maintained.

…continued

continued…



Alarm 1 Set Point
The alarm 1 set point can be set to any value within the input range being displayed. The set point value is subject to hysteresis within the set point band as detailed above.

Set the alarm set point to the required value.

Alarm 2 Action
Repeat as for **Alarm 1 Action** above.

Alarm 2 Set Point
Repeat as for **Alarm 1 Set Point** above

Retransmission Output Type
The retransmission output is assigned to the hydrogen purity range.

Select the retransmission output current range required (4 to 20 mA, 0 to 20 mA or 0 to 10 mA).

Test Retransmission Output
The instrument automatically transmits a test signal of 0, 25, 50, 75 or 100% of the retransmission range selected above. The % test signal selected is shown on the upper display.

Example – for a selected range of 0 to 20 mA and 50% retransmission test signal, 10 mA is transmitted.

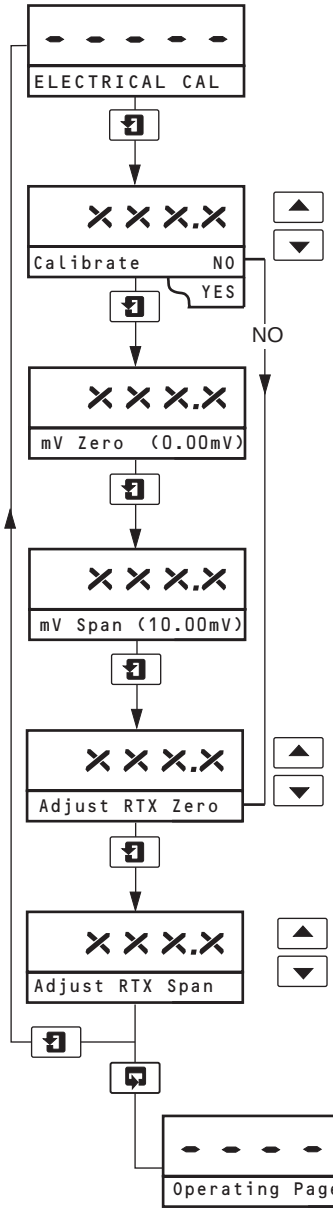
Select the required retransmission test signal.

Alter Security Code
Set the security code to a value between 00000 and 19999.

Advance to **Electrical Calibration Page**.

10.1.4 Electrical Calibration Page

UPPER DISPLAY
RANGE 1



Page header – **ELECTRICAL CAL.**

Note. The 4600 Series instruments incorporate a two point electrical calibration sequence requiring both zero and span inputs for a calibration. It is not possible to adjust either the zero or the span scale points independently.

Calibration
Proceed as described in Section **8.3 Electrical Calibration,** but apply a signal input equivalent to range zero (0.0 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Calibration Range Zero %H2 IN AIR
Proceed as described in Section **8.3**, but apply a signal input equivalent to **%H2 IN AIR** range zero (0.00 mV). Allow the instrument display to stabilize.

Advance to next parameter

Calibration Range Span %H2 IN AIR
Apply a signal input equivalent to **%H2 IN AIR** range span (10.0 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Adjust Retransmission Zero
Set the milliammeter reading to 4 mA

Note. 4 mA is retransmitted as 'zero' and is not affected by the retransmission type selected in Section **10.1.3**.

Adjust Retransmission Span
Set the milliammeter reading to 20 mA

Note. 20 mA is retransmitted as 'span' and is not affected by the retransmission type selected in Section **10.1.3**.

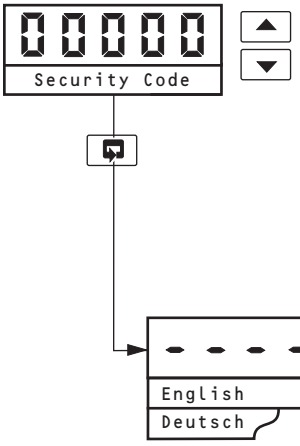
Return to **Operating Page**

10.2 Range 2

LOWER DISPLAY RANGE 2

10.2.1 Access to Secure Parameters

A 5-digit code is used to control access to the secure parameters.

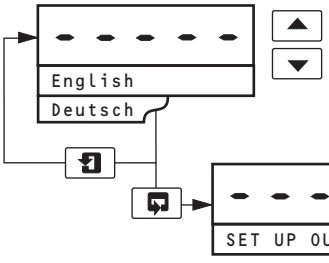


Security Code
Enter the required code number, between 00000 and 19999, to gain access to the secure parameters. If an incorrect value is entered, access to subsequent programming pages is prevented and the display reverts to the **Operating page.**

Note. The security code is preset at '00000' to allow access during commissioning but should be altered to a unique value, known only to authorized operators – see Section **10.2.3 Set Up Outputs Page.**

Advance to **Language Page**.

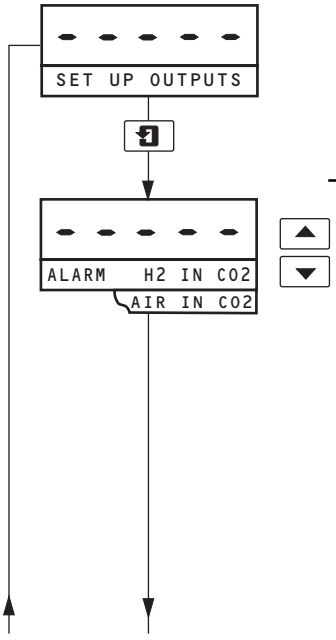
10.2.2 Language Page



Set the language required. Subsequent displays change to the language selected.

Advance to Set Up Outputs Page

10.2.3 Set Up Outputs Page



Page Header – **SET UP OUTPUTS**

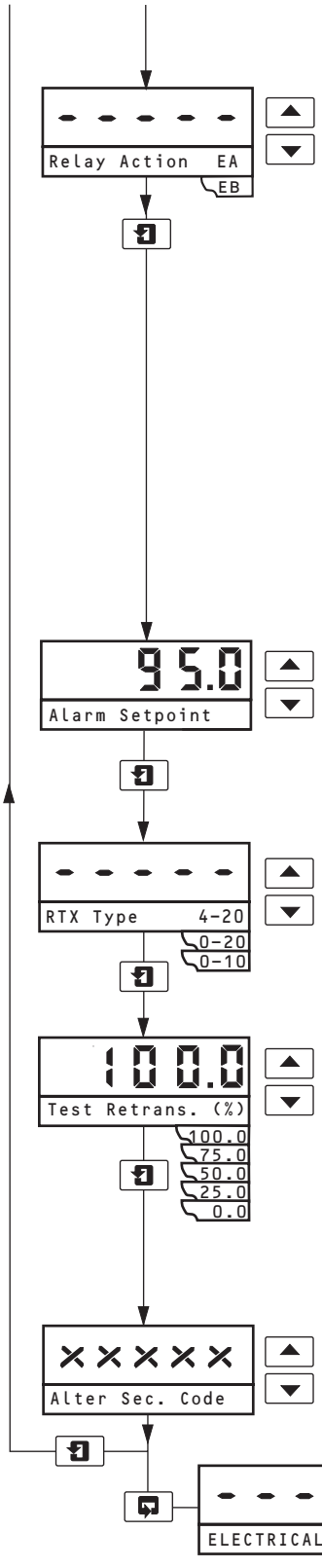
Advance to next parameter.

Purge Gas Alarm Select
Select the parameter on which the purge gas alarm is to operate.

Reprogram as required to agree with selected range:
i.e. for Range 2 select **H2 IN CO2**
Range 3 select **AIR IN CO2**.

continued…

…continued



Purge Gas Relay Action

For **'Fail-safe'** alarm operation the relay's alarm state must be the same as the power-down state, i.e. the relay is de-energized.
For **high alarm** operation the relay must be **Energized B**elow the alarm set point (EB).
For **low alarm** operation the relay must be **Energized A**bove the alarm set point (EA).
The alarm l.e.d.s are illuminated in the alarm condition.
Select the required alarm action from the following table:

Alarm Action	L.E.D. Action for Input Above Set Point	L.E.D. Action for Input Below Set Point	Relay Action for Input Above Set Point	Relay Action for Input Below Set Point
EB	ON	OFF	De-energised	Energised
EA	OFF	ON	Energised	De-energised

The set point band is defined as the actual value of the set point plus or minus 1% of the set point value. Alarm action occurs if the input value is above or below the set point band. If the input moves within the set point band the last alarm action is maintained.

Purge Gas Alarm Set Point

The alarm set point can be set to any value within the input range being displayed. The set point value is subject to hysteresis within the set point band as detailed above.

Set the alarm set point to the required value.

Retransmission Output Type

The retransmission output is assigned to the purge gas concentration.

Select the retransmission output current range required (4 to 20 mA, 0 to 20 mA or 0 to 10 mA).

Test Retransmission Output

The instrument automatically transmits a test signal of 0, 25, 50, 75 or 100% of the retransmission range selected above. The % test signal selected is shown on the upper display.

Example – for a selected range of 0 to 20 mA and 50% retransmission test signal, 10 mA is transmitted.

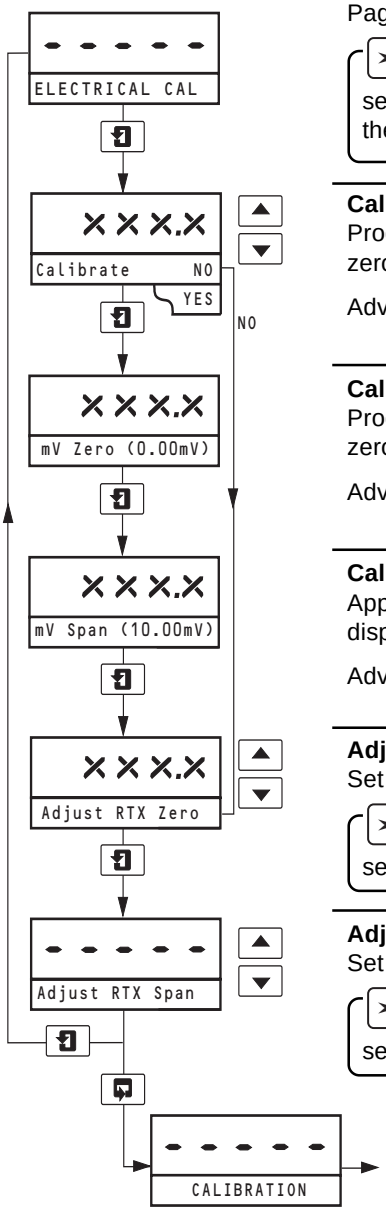
Select the required retransmission test signal.

Alter Security Code

Set the security code to a value between 00000 and 19999.

Advance to **Electrical Calibration Page**.

10.2.4 Electrical calibration page



Page Header – ELECTRICAL CAL

Note. The 4600 Series instruments incorporate a two point electrical calibration sequence requiring both zero and span inputs for a calibration. It is not possible to adjust either the zero or the span scale points independently.

Calibration
Proceed as described in Section **8.3 Calibration,** but apply a signal input equivalent to range zero (0.0 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Calibration Range Zero %H2 IN CO2
Proceed as described in Section **8.3**, but apply a signal input equivalent to %H2 IN AIR range zero (0.00 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Calibration Range Span %H2 IN CO2
Apply a signal input equivalent to %H2 IN CO2 range span (10.0 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Adjust Retransmission Zero
Set the milliammeter reading to 4 mA

Note. 4 mA is retransmitted as 'zero' and is not affected by the retransmission type selected in Section **10.1.3**.

Adjust Retransmission Span
Set the milliammeter reading to 20 mA

Note. 20 mA is retransmitted as 'span' and is not affected by the retransmission type selected in Section **10.1.3**.

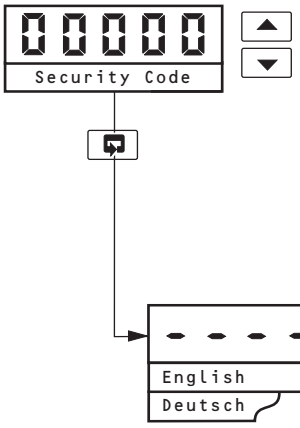
Return to **Operating Page**

10.3 Range 3

LOWER DISPLAY RANGE 3

10.3.1 Access to Secure Parameters

A 5-digit code is used to control access to the secure parameters.



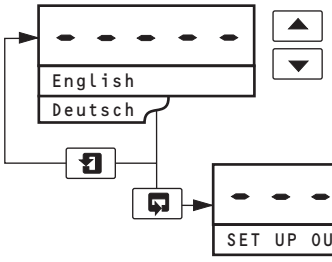
Security Code

Enter the required code number, between 00000 and 19999, to gain access to the secure parameters. If an incorrect value is entered, access to subsequent programming pages is prevented and the display reverts to the **Operating page.**

Note. The security code is preset at '00000' to allow access during commissioning but should be altered to a unique value, known only to authorized operators – see Section **10.3.3 Set Up Outputs Page**.

Advance to **Language Page.**

10.3.2 Language Page

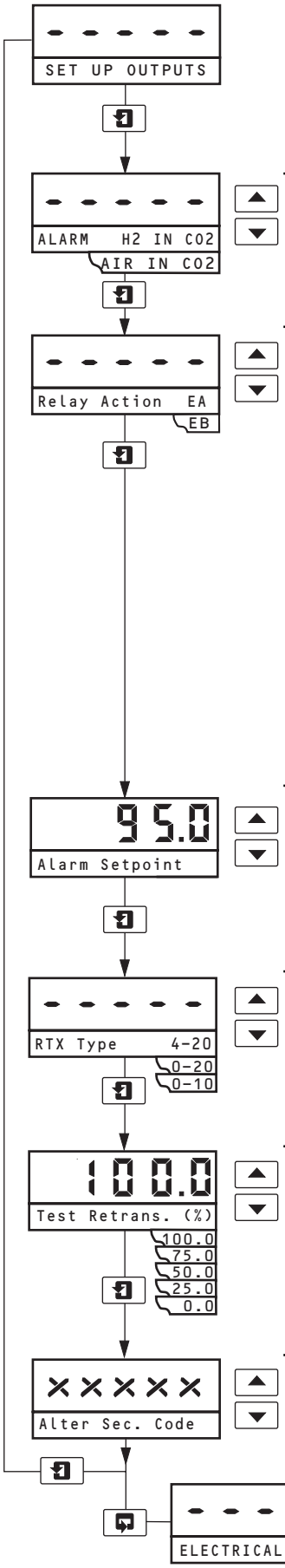


Set the language required. Subsequent displays change to the language selected.

Advance to **Set Up Outputs Page**

10.3.3 Set Up Outputs Page

LOWER DISPLAY
RANGE 3



Page Header – **SET UP OUTPUTS**

Advance to next parameter.

Purge Gas Alarm Select
Select the parameter on which the purge gas alarm is to operate.
Reprogram as required to agree with selected range:
i.e. for Range 2 select **H2 IN CO2**
Range 3 select **AIR IN CO2**.

Purge Gas Relay Action
For **'Fail-safe'** alarm operation the relay's alarm state must be the same as the power-down state, i.e. the relay is de-energized.
For **high alarm** operation the relay must be **Energized B**elow the alarm set point (EB).
For **low alarm** operation the relay must be **Energized A**bove the alarm set point (EA).
The alarm l.e.d.s are illuminated in the alarm condition.
Select the required alarm action from the following table:

Alarm Action	L.E.D. Action for Input Above Set Point	L.E.D. Action for Input Below Set Point	Relay Action for Input Above Set Point	Relay Action for Input Below Set Point
EB	ON	OFF	De-energised	Energised
EA	OFF	ON	Energised	De-energised

The set point band is defined as the actual value of the set point plus or minus 1% of the set point value. Alarm action occurs if the input value is above or below the set point band. If the input moves within the set point band the last alarm action is maintained.

Purge Gas Alarm Set Point
The alarm set point can be set to any value within the input range being displayed. The set point value is subject to hysteresis within the set point band as detailed above.

Set the alarm set point to the required value.

Retransmission Output Type
The retransmission output is assigned to the purge gas concentration.

Select the retransmission output current range required (4 to 20 mA, 0 to 20 mA or 0 to 10 mA).

Test Retransmission Output
The instrument automatically transmits a test signal of 0, 25, 50, 75 or 100% of the retransmission range selected above. The % test signal selected is shown on the upper display.
Example – for a selected range of 0 to 20 mA and 50% retransmission test signal, 10 mA is transmitted.

Select the required retransmission test signal.

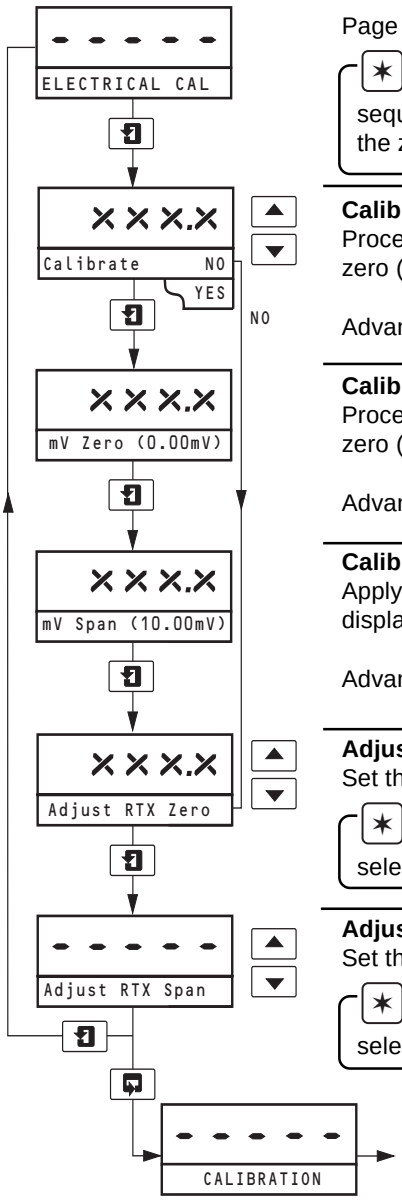
Alter Security Code

Set the security code to a value between 00000 and 19999.

Advance to **Electrical Calibration Page**.

10.3.4 Electrical Calibration Page

LOWER DISPLAY RANGE 3



Page Header ELECTRICAL CAL

Note. The 4600 Series instruments incorporate a two point electrical calibration sequence requiring both zero and span inputs for a calibration. It is not possible to adjust either the zero or the span scale points independently.

Calibration
Proceed as described in Section **8.3 Calibration,** but apply a signal input equivalent to range zero (0.0 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Calibration Range Zero %AIR IN CO2
Proceed as described in Section **8.3**, but apply a signal input equivalent to **%AIR IN CO2** range zero (0.00 mV). Allow the instrument display to stabilize.

Advance to next parameter

Calibration Range Span %AIR IN CO2
Apply a signal input equivalent to **%AIR IN CO2** range span (10.0 mV). Allow the instrument display to stabilize.

Advance to next parameter.

Adjust Retransmission Zero
Set the milliammeter reading to 4 mA

Note. 4 mA is retransmitted as 'zero' and is not affected by the retransmission type selected in Section **10.1.3**.

Adjust Retransmission Span
Set the milliammeter reading to 20 mA

Note. 20 mA is retransmitted as 'span' and is not affected by the retransmission type selected in Section **10.1.3**.

Return to **Operating Page**

Calibration Message	Explanation	Action
Calibrating...	Calibration of new calibration coefficients	None
Calibration Pass	The new calibration coefficients are used	None
H2-AIR Cal Fail	The new calibration coefficients are ignored and the last known good calibration coefficients are used.	Repeat procedure with a calibrated mV source. If the problem persists, contact the Company

Table 10.1 Katharometer Calibration Messages for Section 10.1.3 Upper Display Unit

Calibration Message	Explanation	Action
Calibrating...	Calibration of new calibration coefficients	None
Calibration Pass	The new calibration coefficients are used	None
H2-CO2 Cal Fail AIRCO2 Cal Fail	The new calibration coefficients are ignored and the last known good calibration coefficients are used.	Repeat procedure with a calibrated mV source. If the problem persists, contact the Company

Table 10.2 Katharometer Calibration Messages for Sections 10.2.3 and 10.3.3 Lower Display Unit

11 MAINTENANCE

Warning.
- Each unit of this system forms an integral part of a certified intrinsically safe system. Appropriate safety precautions must be taken to prevent any incendive electrical discharges in the hazardous area when carrying out any of the following tasks.
- Equipment in this system operates on a.c. mains supply voltage electricity. Suitable precautions must be taken to avoid the possibility of electric shock.
- The maximum pressure and temperature specified for particular parts of the system must not be exceeded.

The katharometer unit and its associated equipment are designed for stable and accurate operation over long periods.

This section covers the requirements for fault finding, diagnostic tests and maintenance tasks.

11.1 General Maintenance

11.1.1 Pressure
The operation of the katharometer units is not affected significantly by changes in pressure providing that they are within the pressure limits given in Section **13**.

11.1.2 Flow
The katharometer zero balance and sensitivity are independent of the sample flowrate, as the sample gas sensing system depends on molecular diffusion. But the speed of response is affected by the flowrate. This means that the flow resistance of the drying chamber is a compromise between obtaining speed of response, and avoiding a rapid degradation of the desiccant.

11.1.3 Leaks
There is an inherent safety requirement that there are no leaks into or out of the sample system. Any leaks could also affect the correct operation of the katharometer unit.

11.1.4 Vibration
The katharometer unit will tolerate reasonable levels of mechanically induced vibration. Pulsations due to unsteady sample flow can affect the katharometer filaments and cause errors due to excessive cooling.

11.1.5 Contamination
Contamination in the sample system can arise from oil or suspended particles, or from erosion of material from the sample system upstream of the katharometer unit.

11.1.6 Ambient Temperature
The calibration of the katharometer is not significantly affected by variations of the ambient temperature. Temperature changes can affect the sensitivity and reduce accuracy on sensitive ranges.

11.1.7 Bridge Current
The working current of the katharometer bridge is 350 mA supplied from the power supply unit. This value must remain stable during normal operation as the katharometer output signal is approximately proportional to the cube of the bridge current.

11.2 Diagnostic Tests

11.2.1 Checking Output of 4234 Power Supply Unit
Carry out the test procedure given in Section **6.3.1**.

11.2.2 Checking Integrity of Zener Barrier Units
Carry out the test procedure given in Section **6.3.2**.

11.2.3 Checking the Katharometer Output

Warning.
- This unit is part of the certified intrinsically safe system. Appropriate safety precautions must be taken to prevent any incendive discharges in the hazardous area when carrying out this task.
- Ensure that the proper electrical safety precautions are taken at all times when undertaking this procedure.

a) Electrically isolate the monitor unit

b) Remove the outer cover from the 6539 960 katharometer unit.

c) With the katharometer operating, check if the voltage across terminals TB1 - 1 and TB1 - 4 is not above 4 V with 350 mA passing. If the voltage is above this value it is likely that one or more filaments of the bridge is broken.

d) With the katharometer operating, check that the voltage across terminals TB1 - 1 and TB1 - 4 is below 2.8 V with 350 mA passing. If the voltage is below this value and there is no zero adjustment available, it is likely that there is an accumulation of liquid within the katharometer block.

e) If the reading from the test made at step 3 is unstable when the katharometer block is tapped gently, this could indicate that a filament is damaged but not open circuit.

If any of these tests indicate that the katharometer is faulty the complete katharometer unit must be returned for repair or replacement.

The sensitivity adjusters of katharometer units are sealed and must not be tampered with.

11.3 Routine Maintenance

11.3.1 Hydrogen Katharometer Calibration
Carry out a calibration check in accordance with Section **8.3**.

This task should be carried out at intervals of 3 months of on-line use and prior to system filling.

11.3.2 Purge Gas Katharometer Calibration

Carry out a calibration check in accordance with Section **8.3**.

This task should be carried out before using the katharometer for monitoring a purging procedure and thereafter at 3 monthly intervals.

11.3.3 Changing Desiccant in Drying Chamber

The need to change the desiccant in the drying chamber on the katharometer analyzer panel depends on the condition of the sample gas.

It is recommended that the analyzer system is monitored regularly during the initial phase of operation for indications that the desiccant is exhausted. Then a suitable maintenance interval for this task can be established.

As the desiccant degrades, the white grains can be seen to have a yellowish tinge and the granular form becomes more consolidated. If liquid contamination occurs the desiccant becomes brown and consolidated.

Warning. Suitable safety precautions will apply to the operation of the gas cooling and sample systems.

a) Isolate the sample gas system from the main system. Carry out a limited hydrogen purging operation on the sample system in accordance with the instructions of the responsible authority.

b) Carry out the procedure given in Section **6.1**.

c) After purging any residual air from the sample system in accordance with the requirements of the responsible authority, allow hydrogen to pass through the katharometer again.

This task should be undertaken on the basis of instrument response or at intervals of one year.

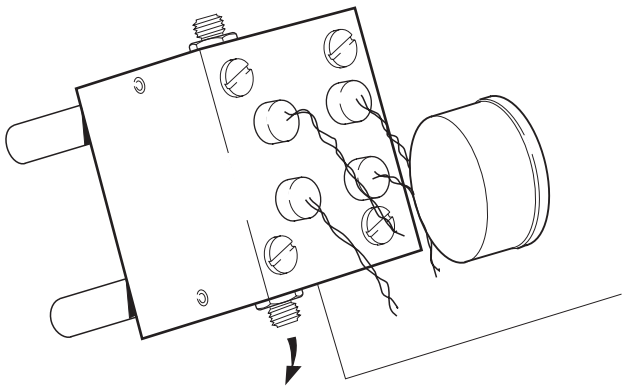


Fig. 11.1 Removing Liquid from the Katharometer Block

11.4 Repair Maintenance

11.4.1 Removing Liquid from Katharometer Measurement Block

If tests indicate that there is likely to be an accumulation of liquid in the measurement block, it may be removed using the following procedure:

a) Electrically isolate the defective katharometer at its power supply unit.

b) Isolate the gas sample system to the particular katharometer from the main gas cooling system. Purge the sample system of hydrogen in accordance with the requirements of the responsible authority.

Warning. The thermal insulation inside the case must not be damaged or removed.

c) Remove the cover of the katharometer unit and dismantle the internal sample system tubing.

d) Remove the fixing screws which secure the mounting pillars to the case. See Fig. 5.3.

e) Disconnect the interconnecting wiring at terminal block TB1.

Caution. Do not insert any type of probe into the gas system of the measurement block or use compressed air to blow through the system.

f) Remove the measuring unit from the case and tilt at 45° to the horizontal. This will allow any liquid to drain from the measurement block. See Fig. 11.1.

g) Pour a small quantity of rectified spirit (ethanol) through the measurement block. Allow as much liquid as possible to drain out. Assist this by gentle shaking. Repeat this procedure several times until all evidence of contamination is removed.

h) Fit the measuring unit into its case. Replace the fixing screws and remake the electrical interconnections at terminals TB1 - 1 and TB1 - 4.

i) Fit the internal sample gas tubing.

j) Make the sample gas tube interconnection couplings.

k) Replace the desiccant in the drying chamber in accordance with the procedure given in Section **11.3.3**.

l) Carry out a leak test in accordance with the requirements of the responsible authority.

m) Power up the katharometer unit by switching on the appropriate power supply unit.

n) Arrange to pass dry air or another suitable dry gas through the katharometer at the normal sample flowrate for 24 hours.

o) Isolate the katharometer unit at its power supply unit.

p) Make the remaining electrical connections at TB1 of the katharometer unit – see Fig. 5.3.

q) Replace the cover of the katharometer unit.

r) Power up the katharometer unit from its power supply unit.

s) Carry out a calibration procedure in accordance with Section **8.3**.

Note. It is possible that the zero reading may drift for several days after the removal of liquid.

This task should be undertaken as required.

11.4.2 Removal of a Display Unit Chassis

a) Electrically isolate the gas monitor unit.

b) Release the retaining screw through the display facia and carefully withdraw the chassis from its edge connectors and out through the front panel. See Fig. 3.1.

c) Fit the chassis by carefully inserting and pressing firmly into position before tightening the retaining screw.

d) Power up the monitor unit and carry out a calibration in accordance with Section **8.3**.

This task should be undertaken as required.

Error Message	Explanation
NV Memory Error	The contents of the non-volatile memory has not been read correctly during power up. *

* To rectify fault, switch OFF, wait 10 seconds and switch ON again. If fault persists, contact the Company.

Table 11.1 Error Messages

12 SPARE PARTS LIST

Warning. Interference with any unit or its components implies acceptance of responsibility by that person for ensuring the continuing maintenance of intrinsic safety requirements. Unauthorized repair, spare parts or incorrect assembly may render any unit unfit for use within a hazardous area.

Note. Although the digital display units may be marked 4600 on their display facia, they are dedicated variants which are not interchangeable with the Company's standard 4600 Controller/Display. These dedicated display units are identified (4689 500 or 4689 501) as shown in Fig. 3.1.

When ordering a 6539 960 katharometer unit, it is necessary to specify the zero gas in association with the Company part number. See the typical identification label shown in Fig. 3.2.

12.1 Consumables

Description **Part No.**

Model 6540 203 Katharometer Analyzer Panel
Granular anhydrous Ca Cl_2 ..... Locally sourced

12.2 Routine Maintenance Parts

Description **Part No.**

Model 4234 Power Supply Unit
Fuse, 500 mA/≥4000 A hbc cartridge 002417 005

Model 6553 Gas Monitor Unit
Fuse, 500 mA a/s 1.25x 0.25 in glass cart. 0231 596
Function selector switch, 3 position., 2 wafer 0234 710
Function selector switch, 3 position., 3 wafer 0234 711
Potentiometer (1 kΩ), zero adjustment 002569 036

Model 6540 203 Katharometer Analyzer Panel
Seal, top of drying chamber 002310 012
Seal, bottom of drying chamber 006519 160
Gauze, drying chamber 006525 700
Katharometer Unit, coupling seal sleeve 006525 130

12.3 Repair Maintenance Parts

Description **Part No.**

Model 4234 Power Supply Unit
Nominal 110 V unit..... 004234 001
Nominal 240 V unit 004234 002

Model 6540 203 Katharometer Analyzer Panel
Flowmeter, 50 to 250 ml/min 006540 460
Valve, metering 006540 361
Katharometer unit (H_2) ..... 006539 960(H2)
Katharometer unit (CO_2) ..... 006539 960(CO_2)

Model 6553 Gas Monitor Unit
Display unit (H_2) 4689 501
Display unit (CO_2) 4689 500
Zener barrier unit 0248 299

(a) Model 6553 Gas Monitor Unit BASEEFA Certificate No. Ex 77124/B/S

Available Ranges: ..... (a) 100 to 85% hydrogen in air
(b) 0 to 100% hydrogen in carbon dioxide
(c) 0 to 100% air in carbon dioxide

Digital Display Units:
H_2 in Air: 4689 501
Air in CO_2 / H_2 in CO_2: 4689 500

Range Selector Switch Positions (when fitted): ..... (1) Percentage by volume, hydrogen in air
(2) Percentage by volume, hydrogen in carbon dioxide
(3) Percentage by volume, air in carbon dioxide

Accuracy (display units): ..... ±0.25% of scale span

Ambient Temperature Range: ..... 0 to 45°C

Power Supply : ..... 110/120 or 200/220/240 V ac, 50/60 Hz (2 separate versions)

Power Consumption : ..... 30 VA approximately.

Outline Dimensions: ..... 290 x 362 x 272 mm

Weight : ..... 12 kg approximately

Environment : ..... Sheltered interior, 0 to 90% RH

(b) Model 6540 203 Katharometer Analyzer Panel BASEEFA Certificate No. Ex 76179/B
Incorporating Model 6539 960 (H_2) or 6539 960 (CO_2) Katharometer Unit

Power Supply: ..... 350 mA d.c., from 4234 PSU

Signal Output: ..... 0 to 10 mV for each range

Accuracy: ..... ±2% of scale span, each range

Dead Time: ..... Typically 5 seconds

Response Time: ..... Typically 40 s for 90% step change at katharometer. Tubing and drying chamber introduce extra delays.

Ambient Temperature: ..... Maximum of 50°C

Sample Connections: ..... Compression couplings, 8 mm outside diameter tube.

Sample Pressure: ..... Minimum, 125 mm H_2O
Maximum, 0.35b (G)

Normal Sample Flowrate: ..... 100 to 150 ml min^{-1}

Maximum Gas Flowrate: ..... 250 ml min^{-1}

Minimum Gas Flowrate: ..... 50 ml min^{-1}

Outline Dimensions: ..... 610 x 305 x 152 mm

Weight: ..... 8.6 kg approximately.

Environment: ..... Sheltered interior

(c) Model 6548 000 Katharometer Analyzer Panel **BASEEFA Certificate No. Ex 76179/B**
Incorporating Model 6548 001 (H_2 and CO_2) Katharometer Unit

Power Supply: ..... 350 mA d.c., from 4234 PSU

Signal Output: ..... 0 to 10 mV for each range

Accuracy: ..... ±2% of scale span, each range

Dead Time: ..... Typically 5 seconds

Response Time: ..... Typically 40 s for 90% step change at katharometer. Tubing and drying chamber introduce extra delays.

Ambient Temperature: ..... Maximum of 50°C

Sample Connections: ..... Compression couplings, 6 mm tube

Sample Pressure: ..... Minimum, 125 mm H_2O
Maximum, 10 bar (G)

Normal Sample Flowrate: ..... 100 to 150 ml min^{-1}

Maximum Gas Flowrate: ..... 250 ml min^{-1}

Minimum Gas Flowrate: ..... 50 ml min^{-1}

Outline Dimensions: ..... 610 x 305 x 152 mm

Weight: ..... 8.7 kg approximately.

Environment: ..... Sheltered interior

(d) Model 4234 Power Supply Unit BASEEFA Certificate No. Ex. 76180/B/S

Input Voltage: ..... 110/120 V or 200/220/240 V a.c., 50/60 Hz (2 separate versions)

Fuse Rating: ..... 500 mA hbc (high breaking capacity ≥4000 A)

dc Output: ..... 350 mA stabilized

Load Conditions: ..... 1 katharometer – 13 Ω max.
Interconnecting cable – 2 Ω max.

Ambient Temperature Range: ..... – 5 to +50°C

Supply Variations: ..... ±6% (V)
±4% (Hz)

Regulation: ..... Within ±0.8% for:
(i) Load var. of ±15%
(ii) Supply var. of ±6%
(iii) Ambient temp. var. of ±10°C

Ripple: ..... Less than 1 mA r.m.s.

Stability: ..... Within ±0.7% of initial setting, over period of 1 month with load resistance, supply voltage and ambient temperature at nominal stated values

Outline Dimensions: ..... 148 x 283 x 135 mm

Weight: ..... 3.8 kg approximately.

Environment: ..... Sheltered interior

A1.1 Model 4234 Power Supply Unit

Two different power supply units are available to suit different supply voltages. See **Spare Parts List**.

A1.1.1 Functional Description

A circuit diagram for each type is shown in Fig. A1 (240 V), Fig. A2 (110 V).

A stable supply voltage is produced across zener diodes Z3 and Z4 by utilizing the forward slope resistance of zener diodes Z1 and Z2 in the full-wave rectifier bridge connected to the secondary winding of transformer T1. A reference voltage is produced across C103 by zener diode Z101 in conjunction with R101, with diode D103 providing temperature compensation. This reference voltage is applied to the base of TR101, which is used to drive the power transistor TR102 to produce a constant current output of 350 mA. The small preset potentiometer RV101 is used to provide a fine adjustment for the current output.

The output current is restricted by inviolate resistors which ensure that the requirements of the intrinsic safety certification are met, even under a '2-fault' condition.

Warning. This unit is part of the certified intrinsically safe system, Appropriate safety precautions must be taken to prevent any incendive electrical discharges in the hazardous area when carrying out maintenance tasks.

A1.1.2 Fault Finding

Caution. Do not operate this unit without an electrical load on the output.

If testing indicates that this unit is defective, further fault finding may be carried out based on the typical test point values given in Table A1. There are several test point available on the unit. Reference should be made to Figs. A1, A2 and the markings on the circuit boards for the location of test points and components.

Test Point	Voltage V	Form	Conditions
TP1	9.1	d.c.	With respect to 0V
TP2	3.5	d.c.	With respect to 0V
TP3	3.0	d.c.	With respect to 0V
TP4	2.4	d.c.	With respect to 0V
TP5	5.0	d.c.	With respect to 0V using 10Ω dummy load
TP6	1.7	d.c.	With respect to 0V
T1	9.1	a.c.	At secondary

Table A1 Test Point Values - Model 4234 Power Supply Unit

Note. The primary winding of the transformer T1 incorporates a thermal cutout device to prevent overloading under fault conditions. Sufficient time must be allowed for this to cool and reset after a fault has occurred, and before continuing further testing.

A1.1.3 Parts List

Repair Maintenance Parts

Description	Part No.
Resistor	
R101, 910R, ±2%, 0.5 W, metal oxide	-
R102, 3k3, ±2%. 0.5 W, metal oxide	-
R103, 4R7, ±1%, 9 W, wirewound	-
R104, 100R, ±2%, 0.5 W, metal oxide	-
Variable resistor	
RV 101, 1k0, Spectrol Reliance, CW51	-
Capacitor	
C101, 1000 µF, 16 V, elect., Mullard 0175 15102	-
C102, 1000 µF, 16 V, elect., Mullard 0175 15102	
C103, 100 µF, 16 V, elect, Mullard 0165 14101	-
Transistor	
TR101, BC 108, Mullard	-
TR 102, 2N 3766, Motorola	-
Diode	
D101, BYX 36 - 600, Mullard	-
D102, BYX 36 - 600, Mullard	-
D103, AAZ - 15, Mullard	-
Zener diode	
Z1, BZY93C9V1, Mullard	-
Z2, BZY93C9V1. Mullard	-
Z3, BZY93C9V1, Mullard	-
Z4, BZY93C9V1, Mullard	-
Z101, BZY88C3V3, Mullard	-
Fuse	
FS1, 500 mA, hbc cartridge, Belling Lee L693	-
Transformer	
T1, 110 - 120 V primary	4234 130
T1, 200 - 220 - 240 V primary	4234 140

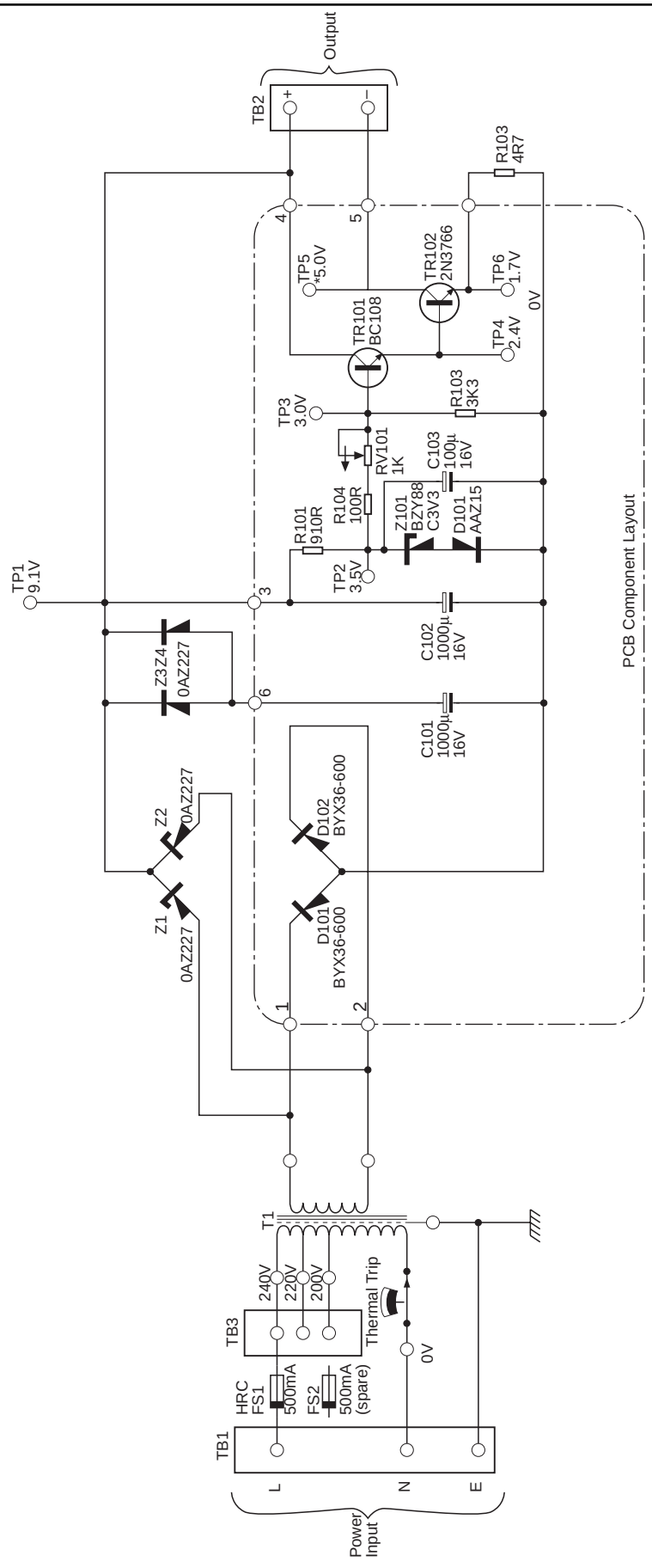
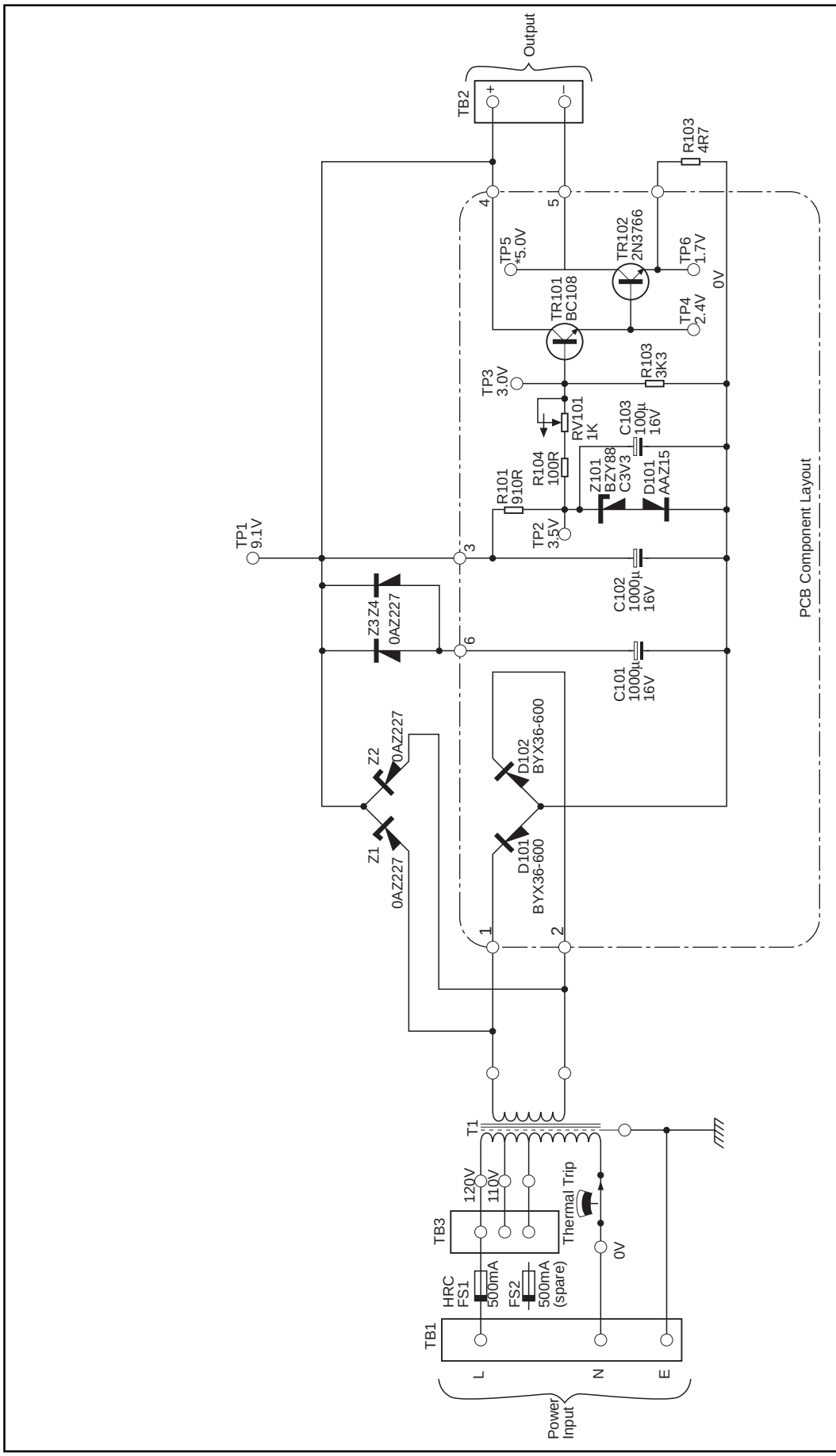


Fig. A1 Power Supply Unit Model 4234 – Overall Circuit (200/220/240V Version)

*Measured with a 10R load.



*Measured with a 10R load.

Fig. A2 Power Supply Unit Model 4234 – Overall Circuit (110/120 Version)

PRODUCTS & CUSTOMER SUPPORT

A Comprehensive Instrumentation Range

Analytical Instrumentation

- ***Transmitters***
  On-line pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.
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- ***Laboratory Instrumentation***
  pH and dissolved oxygen meters and associated sensors.
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  For water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.
- ***Gas Analyzers***
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- ***Controllers***
  Digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.
- ***Recorders***
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Electronic Transmitters

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- ***I to P Converters and Field Indicators***

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  Electromagnetic, insertion type probes and watermeters.
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- ***Mass Flow Meters***
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Customer Support

ABB Kent-Taylor provides a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

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Italy

ABB Kent-Taylor SpA
Tel: +39 (0) 344 58111
Fax: +39 (0) 344 56278

Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.

In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of operating and maintenance records relating to the alleged faulty unit.

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