

Specification DataFile

■ **BASEEFA Certification**

- intrinsically safe to SFA 3012:1972 for Group IIc

■ **Continuous monitoring**

- fail-safe alarms indicate immediate danger conditions

■ **Direct reading Katharometer in single, dual and triple range panels**

- low installation and maintenance costs

■ **Option of independent redundant systems**

- enhanced security of measurement

■ **Customized LCD indication**

- full flexibility of membrane touch-pad switches



*Superior technology and quality
from the world leader in
hydrogen measurement.*

Application

Modern high capacity turbogenerators need to be efficiently cooled. Hydrogen, with a thermal conductivity of about seven times that of air, is in general use as the coolant. Great care and accurate measurement is necessary to ensure that the hydrogen remains pure during operation of the machine: air, entering the system, could produce a potentially explosive mixture.

Similarly, when it is necessary to remove the hydrogen for maintenance, it is not desirable to purge directly with air. The purging sequence therefore comprises two distinct operations: hydrogen is purged from the system using carbon dioxide, nitrogen or argon, followed by the removal of the purge gas with air. This sequence is reversed for refilling.

The Katharometer provides a reliable means of measuring any two component (binary) gas mixtures and is the ideal monitoring system for turbogenerator applications.

Katharometer

Principle of Operation

The katharometer comprises a Wheatstone bridge, each arm of which contains a fine, glass-coated, platinum wire. One pair of parallel arms is sealed in a reference gas of known thermal conductivity and the other pair is exposed to the sample gas. A constant current is passed through the bridge network.

When a constant current is passed through an electrical conductor surrounded by gas in a chamber, the temperature rises to a point of thermal equilibrium. Provided radiation, convection and end-conduction losses are minimized, the temperature of the conductor depends upon the heat loss by conduction through the gas. The temperature attained is therefore related to the thermal conductivity of the surrounding gas and hence, the resistance of the wire is a function of the thermal conductivity.

Any difference between the thermal conductivities of the reference and sample gases causes an imbalance of the bridge. The out-of-balance current is therefore a function of the difference in thermal conductivities of the two gases and a display unit can be calibrated directly in terms of the percentage of one gas with another.

Description

A complete system for the turbogenerator application comprises:

- Display and control monitor
- Two gas analysis assemblies
- Two power supply units

The power supply units Model 4234 (Issue 5) provide the analyzer assemblies with a stable 350mA d.c. supply. These power units must be installed in a 'safe' area, but the current output from them may be transmitted to the Katharometers in the danger area.

Two gas analysis assemblies, Models 6540–203 or 6548–000, are necessary to provide the three required ranges. Each assembly is fitted with a thermally lagged Katharometer, a needle flow-control valve, a flow gauge and a drying chamber.

The Katharometer system is available in three formats:

- 1) One Katharometer system indicates only Hydrogen purity by measuring 100 to 85%, or 85 to 100%, H₂ in air. This is accompanied by a dual range Katharometer measuring the purge sequence 0 to 100% H₂ in purge gas and 0 to 100 % air in purge gas.
- 2) For applications where duplication of reading is important, two Katharometer systems, can be used, each incorporating three-range Katharometers, each measuring : 85% to 100% H₂ in air; 0 to 100% H₂ in purge gas; and 0 to 100% air in purge gas.
- 3) Where only the Hydrogen purity measurement is required a single instrument is used measuring 85 to 100% H₂ in air or 100 to 85% H₂ in air.

The Display and Control Monitor Model 6553 is designed to be incorporated into the turbogenerator purge control cubicle. Two ABB 4689 indicators are provided. The upper indicator is calibrated to the desired hydrogen-in-air range and is fitted with two-step alarms for failing hydrogen purity and a device which drives the instrument downscale – the low purity end – when the input is open circuited. The lower indicator is dual ranged for the purge sequence and also has a device to drive downscale – to zero – when the input is open circuited. This indicator can also display the hydrogen purity indicated in the upper display in addition to the purge ranges

Where duplication of all three ranges is required they are displayed on both indicators.

Two potentiometers enable the Katharometer zeros to be adjusted from the control cubicle. The overall system is certified intrinsically safe to SFA 3012:1972 for Group IIc when wired in accordance with the certified system drawing.

H₂ purity alarms are only active on the hydrogen purity range switch position 1.

Digital Indicators

The 4600 Series universal transmitter provides the operator interface and communication to other devices. The signal from the sensing system is converted by the transmitter and the information is presented on a large, custom designed, easy-to-read, backlit liquid crystal display. This display is used, in conjunction with the four tactile membrane key pads, to prompt the user through the programming procedures.

Zener Barrier Devices

Zener barrier devices are included in the Model 6553 cabinet to prevent any dangerous electrical feedback from the indicators to the danger area. The action of the barriers is to pass the signal, with negligible distortion, up to the avalanche voltage of the zener diodes. Above this voltage the zener diodes become conducting and hold the voltage between terminals 3 and 4 to a safe level. The units are fully encapsulated in epoxy resin.

Analyzer Panels

In addition to the Katharometer range options, the Analyzer Panels are also available with options for use on low pressure or high pressure gas sample systems (see system diagrams below and overleaf).

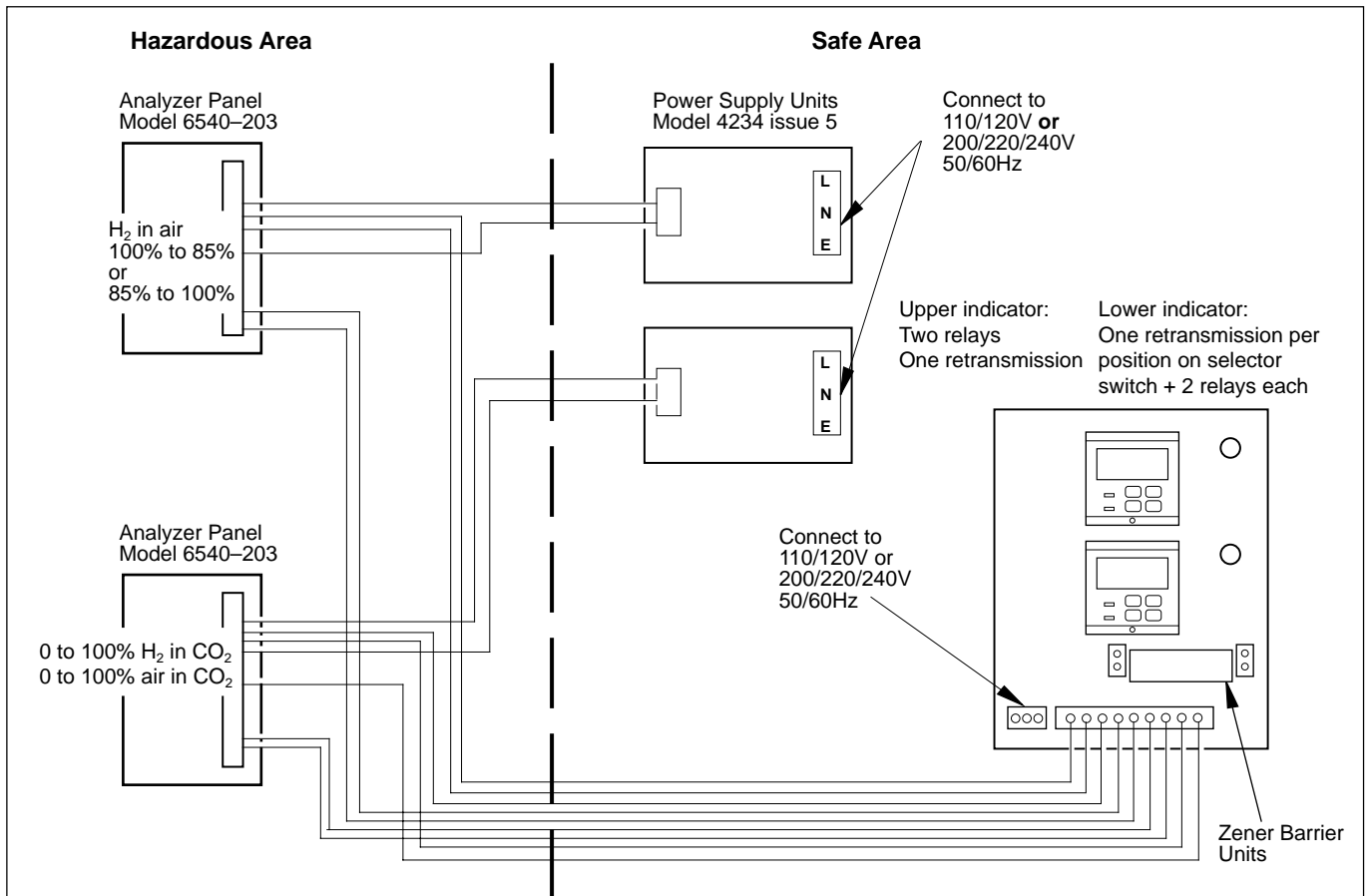
The Model 6540-203 Panels are only suitable for use on systems where the gas sample is vented to atmosphere and the pressure in the analyzer panel is therefore only marginally above atmospheric pressure (1bar absolute).

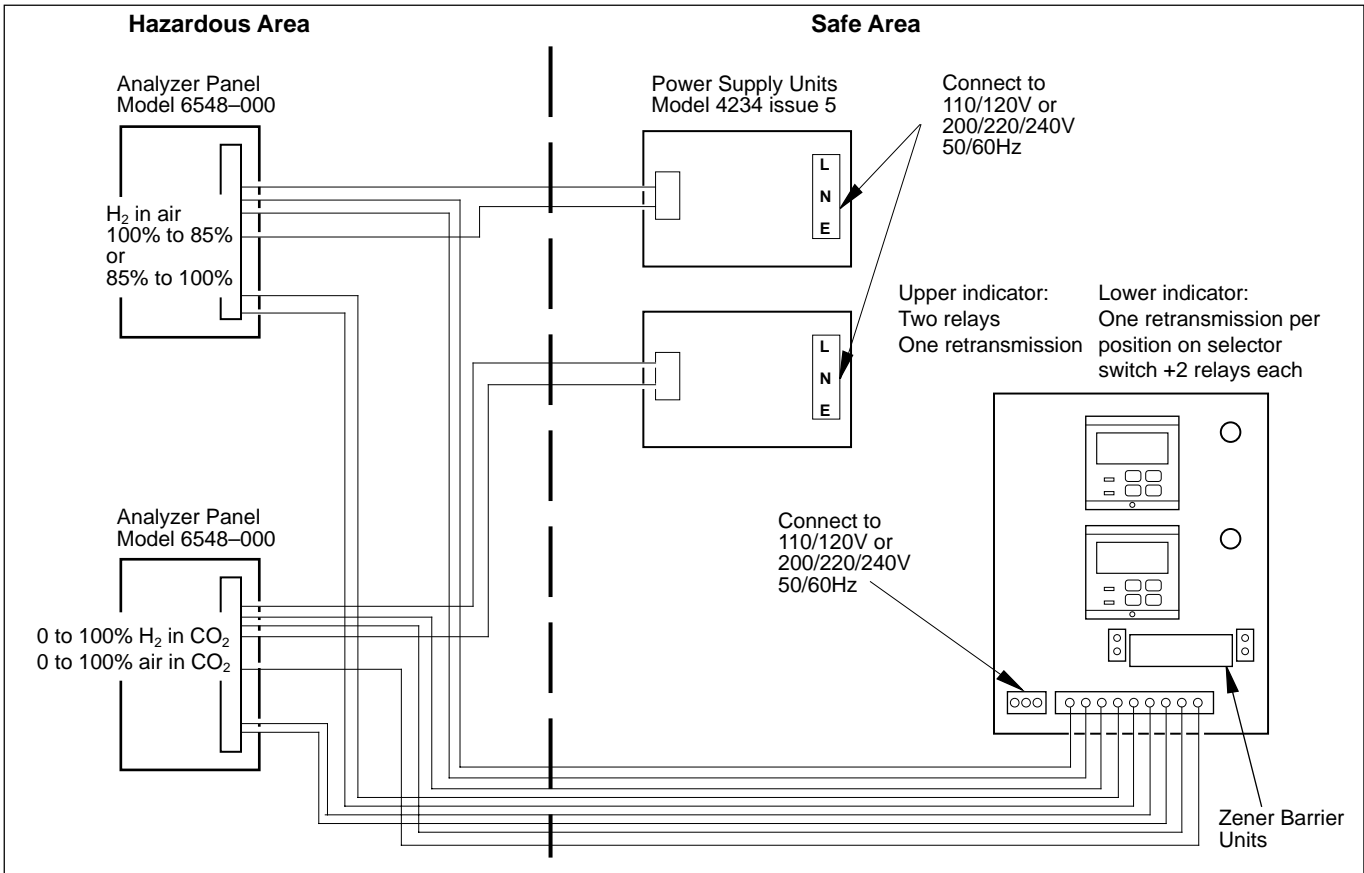
For applications where the gas sample may be returned to the generator cooling system at an elevated pressure, the Model 6548-000 Analyzer Panel must be used. This analyzer panel is equipped with items and fittings suitable for such duties and is pressure tested to 10bar (gauge). As no certification exists

for measurements at pressures above 1bar absolute (nominal), it must be understood that the stated I.S. certification does not cover use at higher pressures.

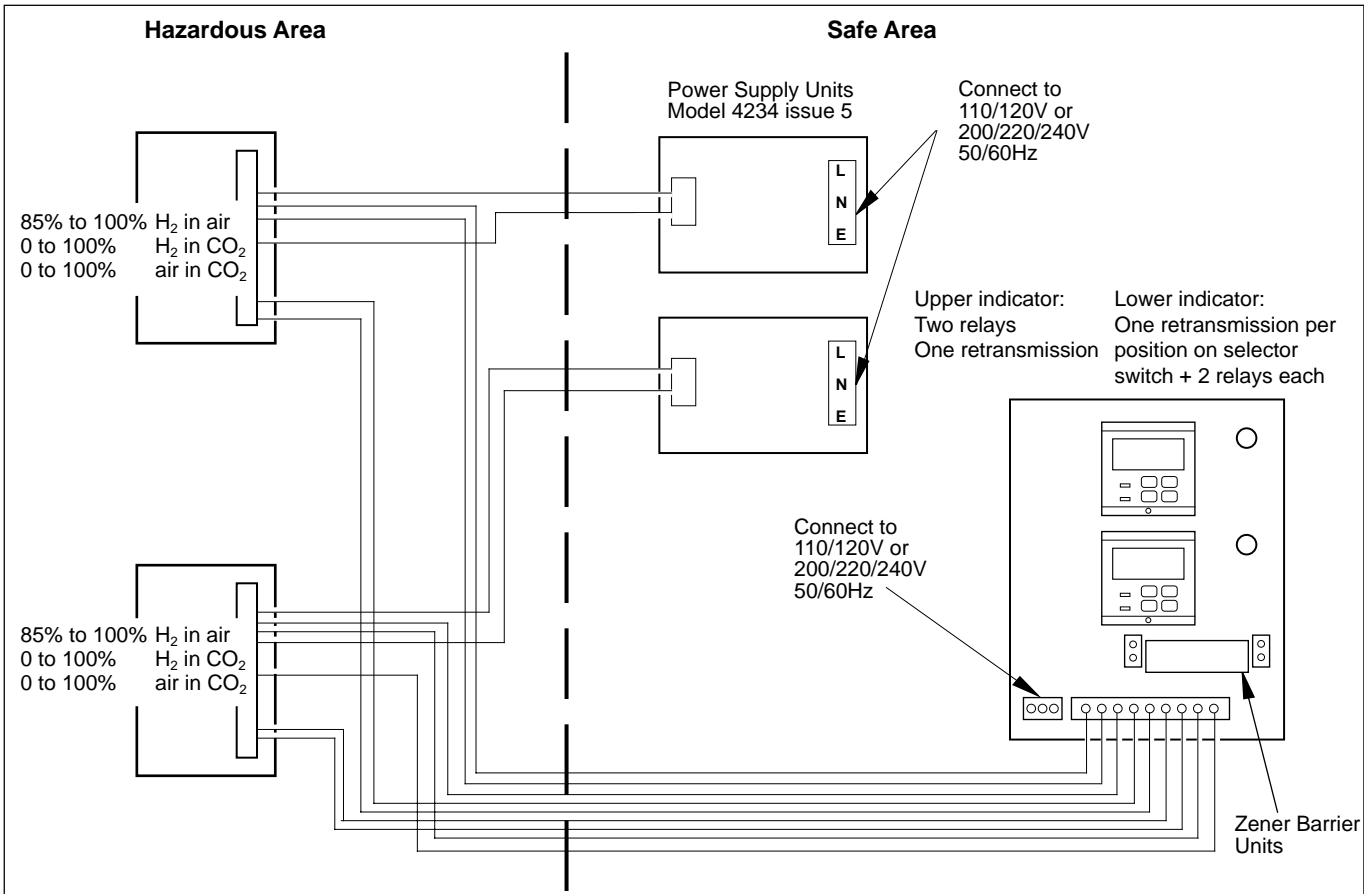
The system diagrams showing these options show the purge gas as being CO₂, the ranges being 0 to 100% H₂ in CO₂ and 0 to 100% air in CO₂. These Katharometers are calibrated specifically for these ranges and cannot be used or modified for use, with alternative purge gases, such as Nitrogen or Argon. Similarly the 4689 Digital Display Unit software is dedicated to the specified purge gas to be used.

Where an alternative purge gas is to be used this must be identified at the time of ordering and the appropriate order codes used.



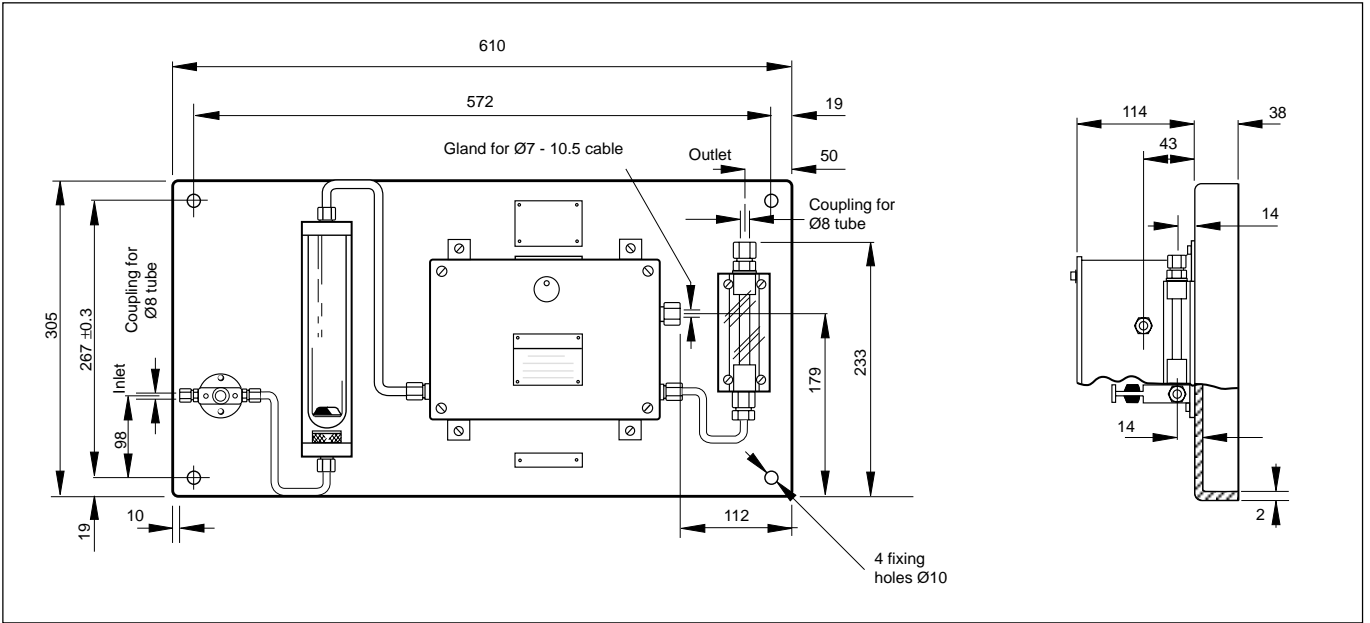


High Sample Pressure System – Standard System Interconnection Diagram Model 6553, Analyzer Panels Model 6548-000 and Model 4234 (Issue 5) Power Supply U nits

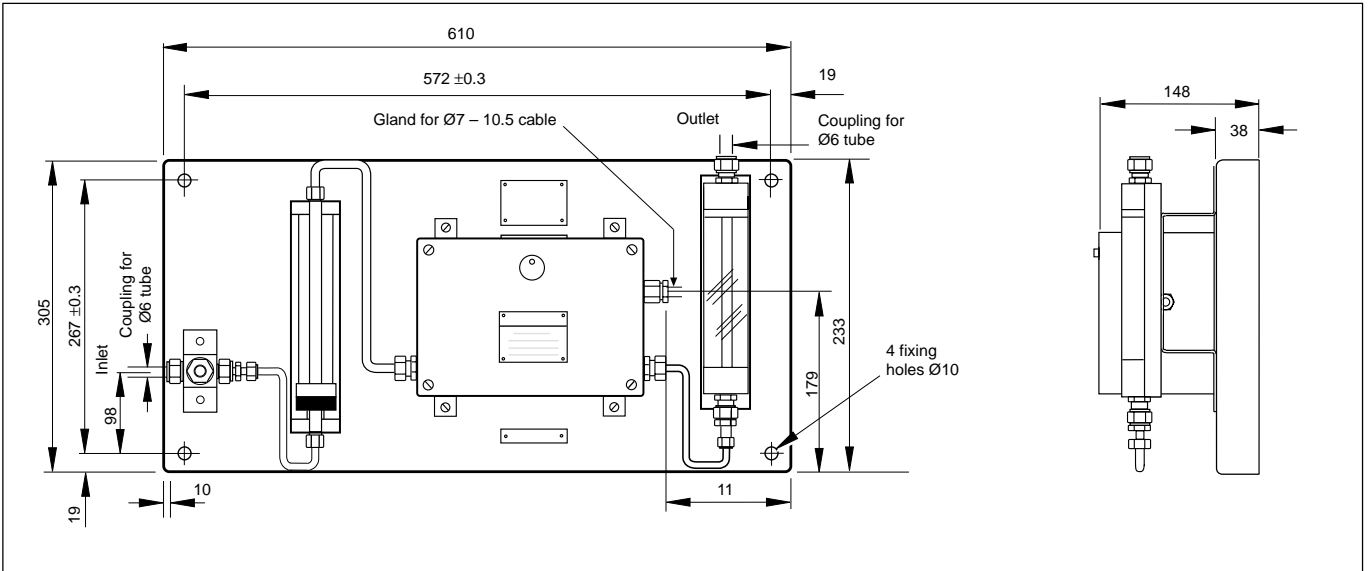


2 x 3-Range Interconnection Diagram Model 6553, Analyzer Panels 6540-203 or 6548-000 and Model 4234 (Issue 5) Power Supply U nits

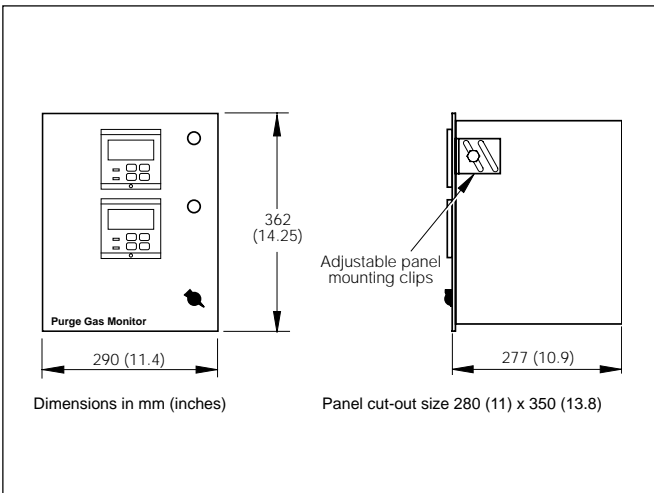
Overall Dimensions



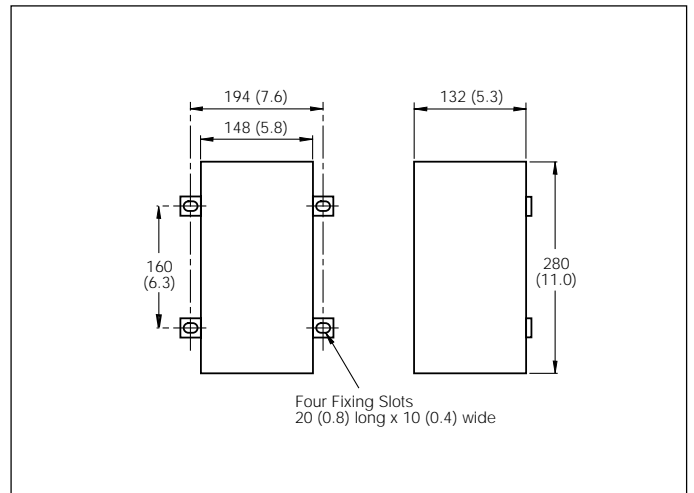
Katharometer Analyzer Panel Assembly 6540-203



Katharometer Analyzer Panel Assembly 6548-000

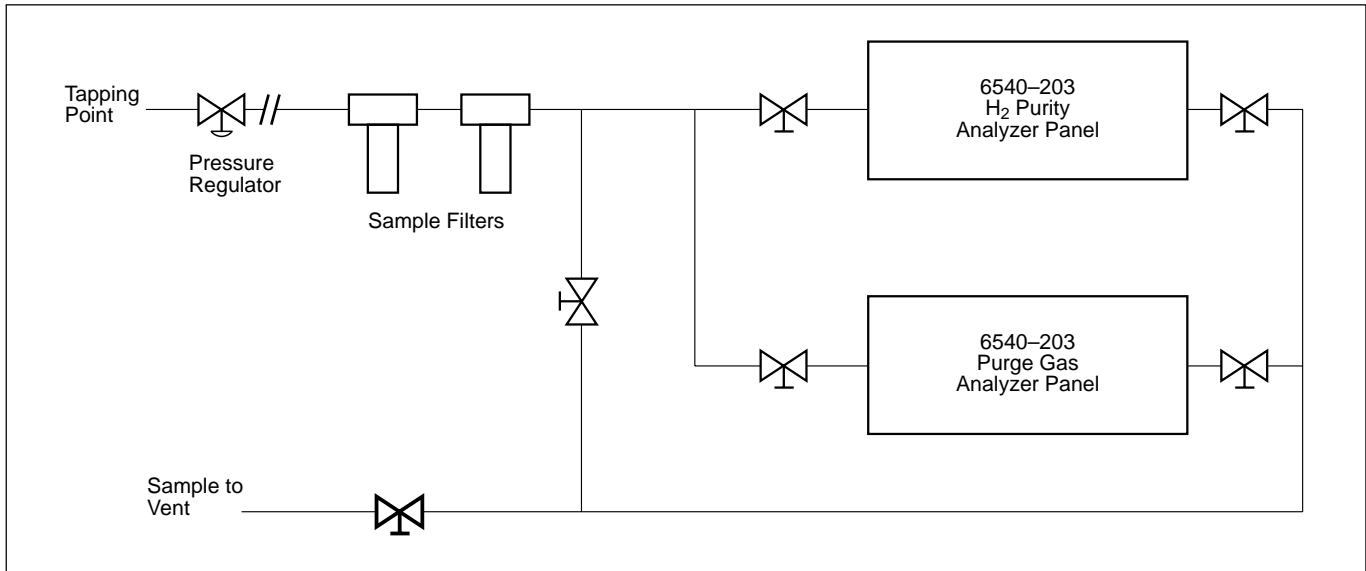


Model 6553 Monitor

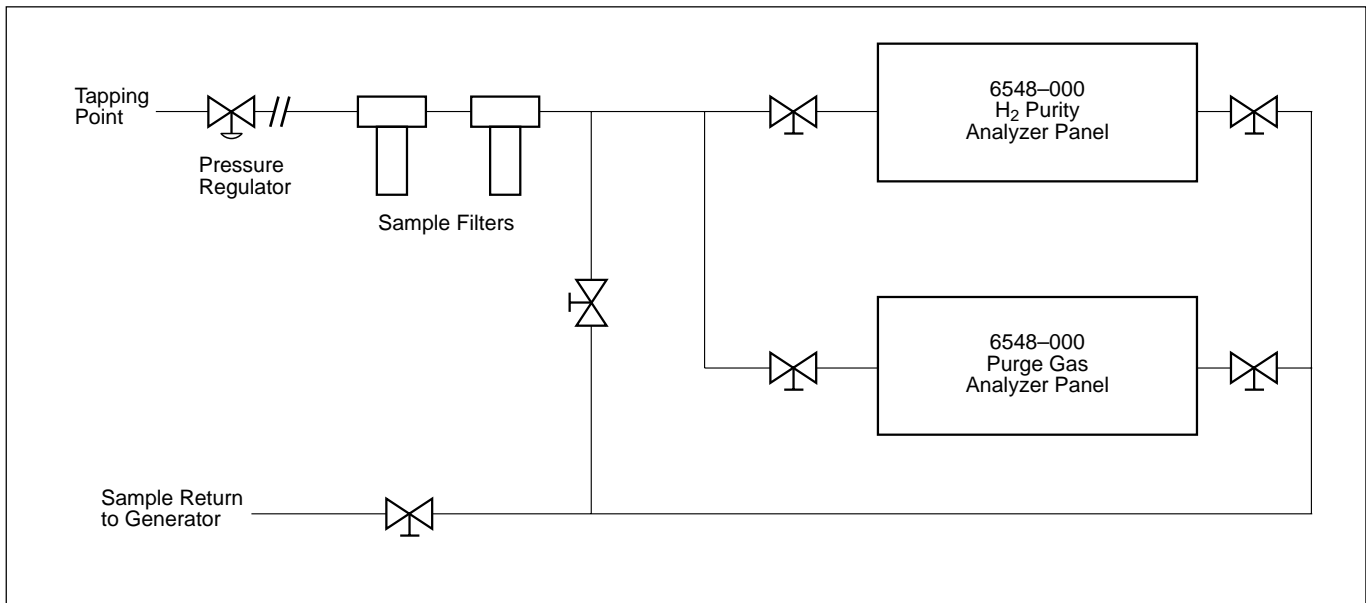


Intrinsicly Safe Power Supply Unit Model 4234 (Issue 5)

Purge Gas Systems



Low Pressure System – Sample Vented



High Pressure System – Sample Non-vented

Hi/Lo Sample Pressure Systems

The above illustrations show typical sample system arrangements, identifying the choice of gas analyzer panel required to suit either low or high pressure sample conditions.

Cubicles

When simplified installation is required the Model 6553 display unit and 4234 power supply units can be supplied ready-mounted in a wall-mounting enclosure.

Access to the display unit is via the front door which is fitted with a window for visibility of the selected range. The two power supplies and the rear of the 6553 unit are accessed by a hinged rear compartment.

The cubicle is pre-wired such that the only electrical connections are between the customer connections within the cubicle and the analyzer panels, which are separately installed in the hazardous area, and the electrical supply.

SPECIFICATION

Model 6553 Gas Monitor

BASEEFA Certificate No. Ex77124/B/S

Available ranges:

- (a) 100 – 85% H₂ in air + others (80% or 85% to 100%)
- (b) 0 – 100% H₂ in CO₂
- (c) 0 – 100% air in CO₂

Digital Display Units

H₂ in air – 4689-501
Air in CO₂/H₂ in CO₂ – 4689-500
All three ranges – 4689-502

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 (32 to 113°F)

Power Supply

110/120V ac or 200/220/240V a.c., 50/60Hz
(two separate versions)

Power Consumption

30VA approximately

Outline Dimensions

290 x 362 x 272mm (11.4 x 14.25 x 10.9 in.)

Weight

12kg (26.4lb)

Environment

Sheltered interior, 0 to 90% RH

Model 4234 Power Supply Unit

BASEEFA Certificate No. Ex 76180/B/S

Input Voltage

110/120V or 200/220/240V ac, 50/60Hz
(two separate versions)

Fuse Rating

500mA hbc (high breaking capacity ≥ 4000A)

dc Output

350mA stabilized

Load Conditions

1 Katharometer – 13Ω max.
Interconnecting cable – 2Ω max.

Ambient Temperature Range

–5 to 50°C (23 to 122°F)

Supply Variations

± 6% (V)
± 4% (Hz)

Regulation

Within ± 0.8% for:

- (i) Load variation of ± 15%
- (ii) Supply variation of ± 6%
- (iii) Ambient temperature variation of ± 10°C (21°F)

Ripple

Less than 1mA rms

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 287 x 135mm (5.8 x 11 x 5.3 in.)

Weight

3.8kg (8.4lb) approx.

Environment

Sheltered interior

Models 6540–203 and 6548–000 Katharometer Analyzer Panel

BASEEFA Certificate No. Ex 76179/B

Model 6540–203 incorporating Model 6539–960 (H₂) or 653–960 (CO₂) Katharometer Unit

Model 6548–000 incorporating Model 6548–000 (H₂ and CO₂) Katharometer Unit

Power Supply

350mA d.c., from 4234 Power Supply Unit (Issue 5)

Signal Output

0 to 10mV for each range

Accuracy

± 2% of scale span, each range

Dead Time

Typically 5s

Response Time

Typically 40s for 90% step change at Katharometer
Tubing and drying chamber introduce extra delays

Ambient Temperature

Maximum of 50°C (122°F)

Sample Connections

Compression couplings, 6mm o. d. tube

Sample Pressure

Minimum 125mm H₂O
Maximum 0.35 bar (Gauge) – Model 6540–203
Maximum 10 bar (Gauge) – Model 6548–000

Normal Sample Flowrate

100 to 150ml/min.

Maximum Gas Flowrate

250ml/min

Minimum Gas Flowrate

50ml/min

Outline Dimensions

610 x 305 x 152mm (24 x 12 x 6 in.)

Weight

8.6kg (18.9lb)

Environment

Sheltered interior

Note. Systems can be supplied for use with Nitrogen or Argon purge gases as an alternative to the CO₂ ranges. Details on application to the Sales Office, Stonehouse.



Front View of Cubicle



Rear View of Cubicle



The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

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