Model 4234

Operating Instructions

Intrinsically Safe Power Supply Unit

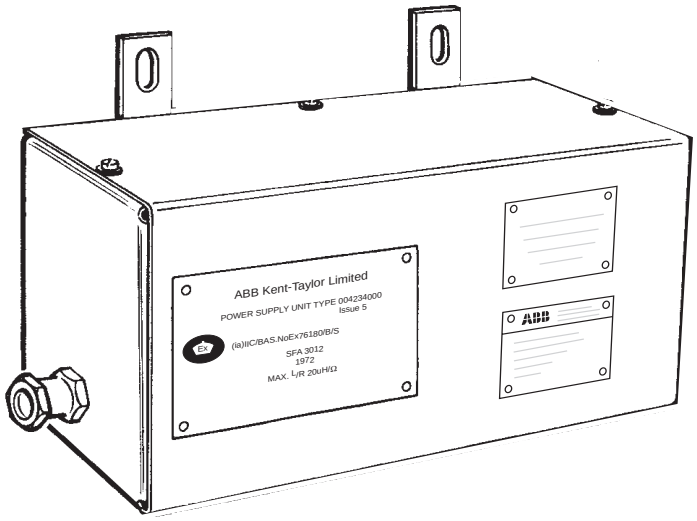

ABB Instrumentation

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The Company

ABB Instrumentation 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.

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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.

0255

Use of Instructions

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

Note.
Clarification of an instruction or additional information.

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

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 Instrumentation.

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

1.1 General

This instruction manual describes the installation and operation of the Model 4234 Power Supply Unit, designed to provide a stabilised 350mA d.c. supply for operation of a single katharometer unit installed in a hazardous area. This Power Supply Unit is certified as intrinsically safe to the requirements of SFA.3012:1972 (code Ex (ia) IIC) and carries the BASEEFA Certificate No. Ex 76180/B/S, and must be installed in the safe area.

An appendix to these instructions is included which provides information regarding associated equipment for use with installations in hazardous areas.

1.2 Description

The Model 4234 is available in two separate versions, one for 110-120V and the other for 200-220-240V a.c. supply mains.

The unit is housed in a metal case fitted with mounting lugs. Cable gland entries are provided at opposite ends of the case for supply voltage input and intrinsically safe output cables respectively. Connections are made via two separate labelled terminal blocks which are mounted on a metal chassis together with the transformer, diode heat sink and fuse holder. A printed circuit board assembly (see Fig. 1.1) contains the circuit components, and is mounted at right angles to the chassis to provide sufficient ventilation for cooling the series regulator transistor.

Two fuses are mounted within the unit. One is connected in the primary circuit of the transformer and the other is a spare. Both are of the high breaking capacity type rated at 500mA and must only be replaced with identical types.

2 SPECIFICATION

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

Fuse Rating: 500mA ($1^1/_2$ in.) h.b.c. cartridge type

D.C. Output: 350mA stabilised

Load: One katharometer (13Ω max) plus interconnecting cable (2Ω max)

Ambient Temperature Range: –5 to +50°C

Permissible Supply Variation: Voltage ±15%
Frequency ±4Hz

Output Regulation: Within ±0.8% for
a) Load variation ±15%
b) Supply variation ±6%
c) Ambient temperature ±10°C

Ripple: Less than 1% peak to peak

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

Dimensions: 148mm x 280mm x 132mm

Fixing: Four slots 20mm x 10mm on centres 194mm horizontally and 160mm vertically

Weight: 3.8kg approximately

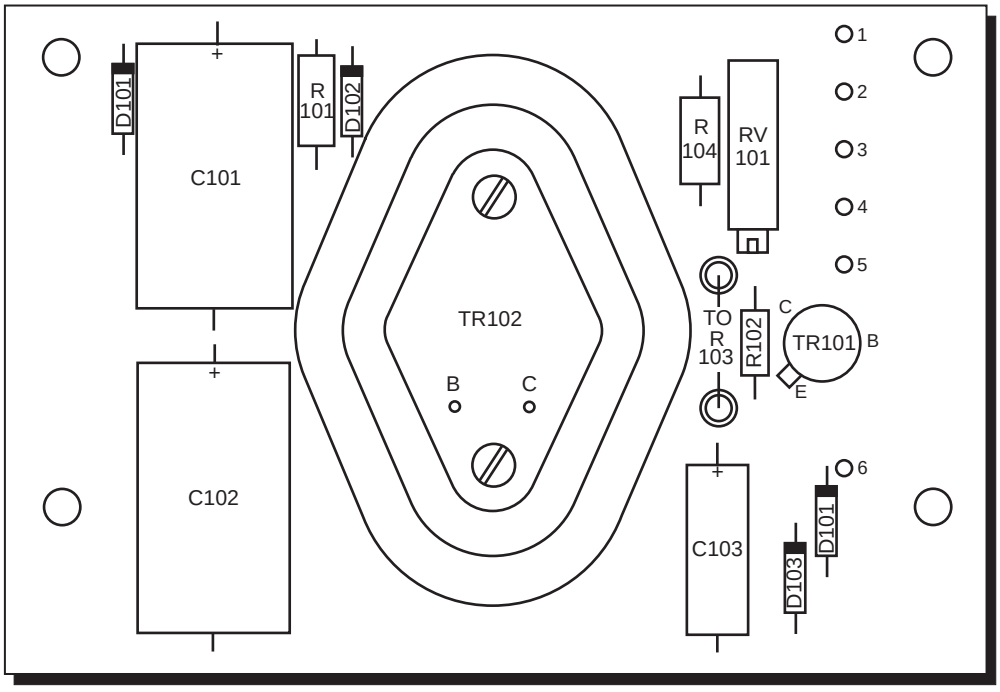


Fig. 1.1 Model 4234 (Issue 5) Printed Circuit Board

3.1 Mounting

The Model 4234 Power Supply Unit must be mounted on a wall or panel in the safe area by means of the four fixing lugs. These have slotted holes 20mm x 10mm on horizontal centres of 194mm and vertical centres of 160mm. Fig. 3.1 shows the overall dimensions of the unit.

The unit must be mounted in a clean, dry and well ventilated position. Before commencing installation, check that the unit supplied is suitable for the supply voltage available, i.e. either 110-120V or 200-220-240V. (See Data Plate on the unit cover, Fig. 3.2).

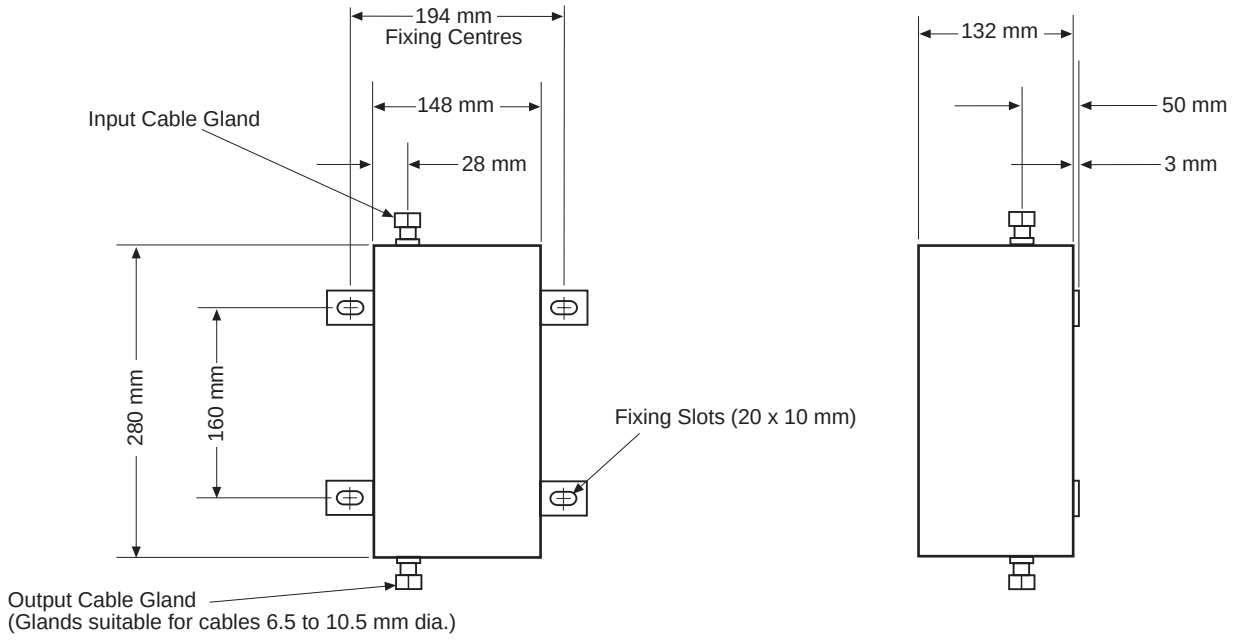


Fig. 3.1 Unit Dimensions

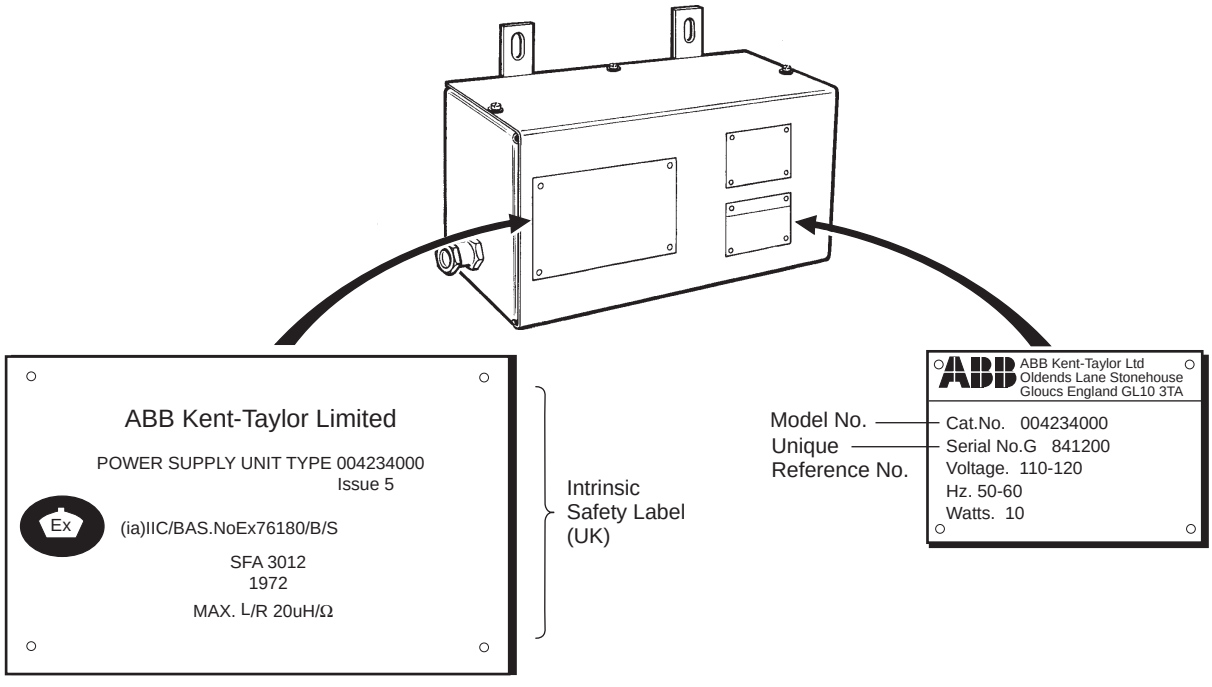


Fig. 3.2 Typical Identification Labels and Locations

3.2 Electrical Connections

Warning. If the unit is cubicle mounted or has its cover removed for test purposes, a.c. mains supply voltage may be accessible at certain locations within the assembly when supplies are connected.

All normal precautions must be taken to avoid the risk of accidental electrical shock during installation and maintenance of the equipment. Ensure that the supply cable is disconnected at its source before touching any electrical connections.

Caution. Ensure that the correct version of the unit has been supplied for the supply voltage available. A 110V unit cannot be used with a 240V supply or vice versa.

The power supply unit must not be operated with the load (i.e. katharometer) disconnected, as this can lead to premature component failure.

3.2.1 Changing Supply Tapping

Remove the power supply unit case to obtain access to the three separate labelled terminal blocks (see Fig. 3.3). Terminal block TB3 situated adjacent to transformer T1 is used as a voltage selector for the transformer primary tapping (see Figs. 3.4 and 3.6). Tapping is available for 110 and 120 volts or for 200, 220 and 240 volts depending on version. In both cases, and should it be necessary, the correct tapping for the supply available must be selected by connection of the brown wire to the appropriate labelled terminal.

Connect the d.c. output and the a.c. mains input cables as follows (see Section 3.4).

Terminal Block TB1
a.c. Supply Input
(110V or 240V nominal depending on version)

Term.	Connect To
E	Earth (ground)
N	Neutral
L	Line

Terminal Block TB2
350mA d.c. output to katharometer

Term.	Connect To
+	Katharometer terminal 1
–	Katharometer terminal 4

3.3 Cable Requirements

The interconnecting cable between the Model 4234 and the katharometer is subject to a stringent limitation imposed by the intrinsic safety requirements. Fig. 3.5 outlines the requirements for the overall system. Cable connection requirements relating to the zener barrier devices are dealt with in APPENDIX A.

The inductance/resistance ratio of the cable used to carry the stabilised 350mA d.c. supply into the hazardous area must not exceed the maximum for the relevant atmosphere classification as specified in the certification schedules.

Maximum ratios are:

20 μH/ohm for Group IIC atmospheres
60 μH/ohm for Group IIB atmospheres
160 μH/ohm for Group IIA atmospheres

It should be further noted that, as stated in Section 2, the resistance of this interconnecting cable must not exceed 2Ω. This limits the maximum cable length between a katharometer and its associated power supply unit.

Single sheathed conducting cables must be tightly twisted together to reduce their mutual inductance and laid separately from cables carrying ‘safe area’ connections.

The only requirement in respect of intrinsic safety for the cable used to connect the a.c. supply voltage to the Model 4234 is that it should NOT be routed with the intrinsically safe 350mA stabilised supply output cable. It should be noted that the cable glands will accept a cable up to 10.5mm in diameter.

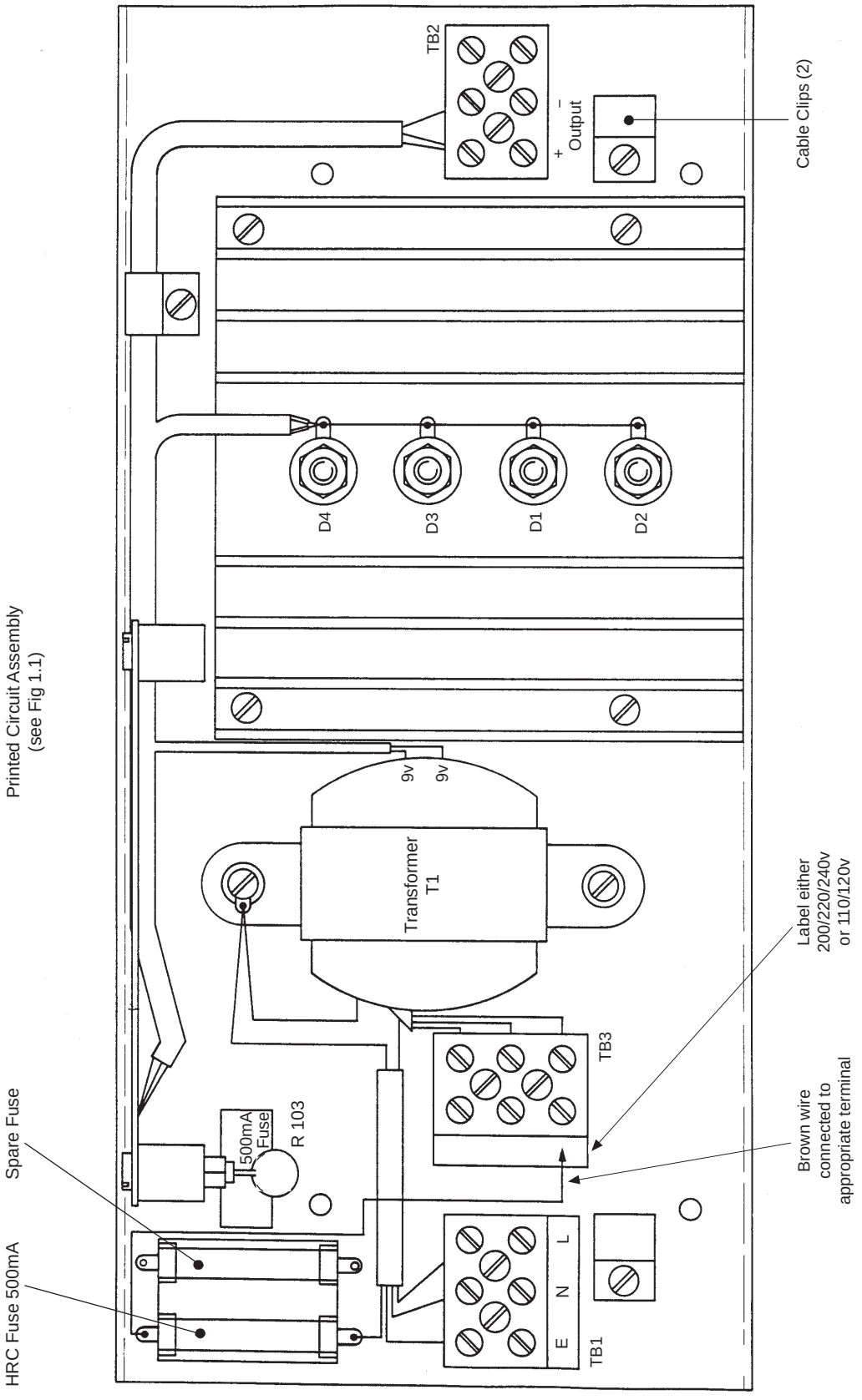
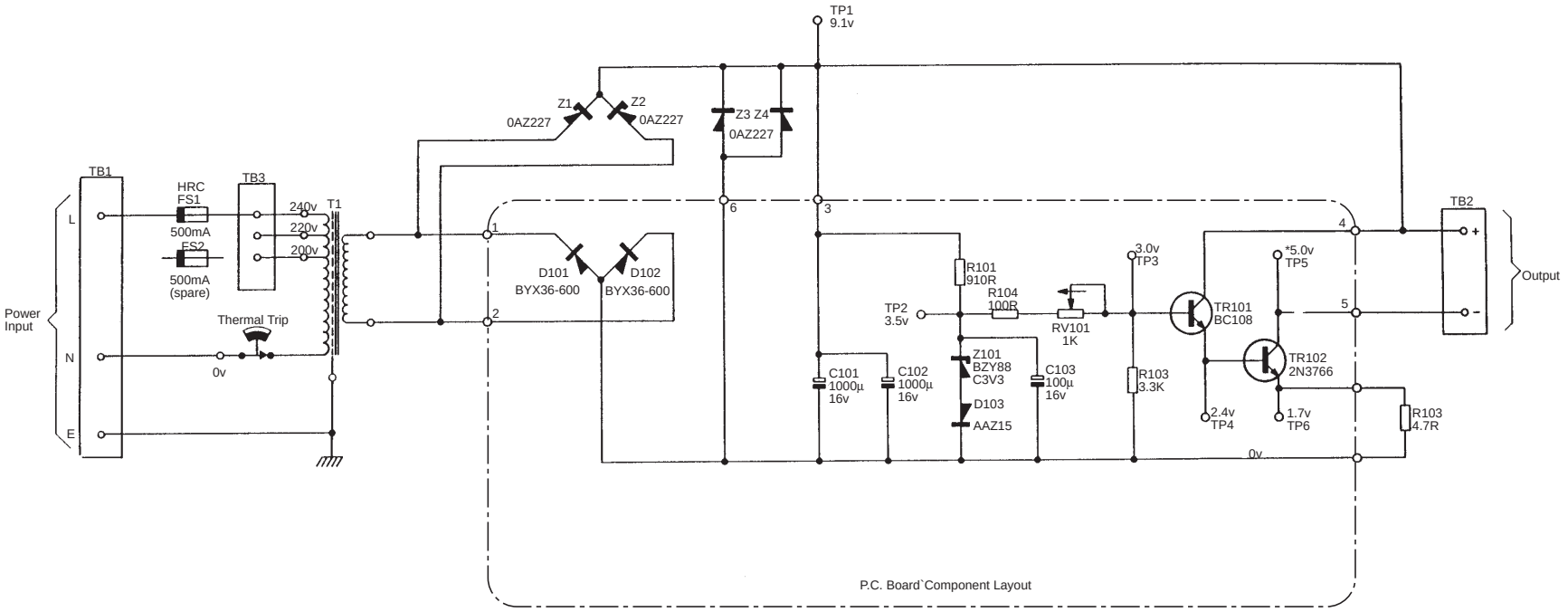


Fig. 3.3 Component Layout



*Measured with a 10R load

Note. All d.c. voltages to be measured in respect to 0V line. All voltages measured at 350mA load current.

Fig. 3.4 Circuit Diagram (200/220/240V Version)

Note 1 The total capacitance and inductance or inductance to resistance ratio L/R of the cables which connect the output from the power supply together with the barrier outputs (hazardous area terminals) to the katharometer input/output terminals must not exceed the values indicated in the table.

Note 2 The installation must conform to the BASEEFA installation conditions issue 6 (1 Sept. 1976)

Group	Capacitance in μF	Inductance or L/R ratio in mH	in μH/ohm
IIA	24.0	0.200	160
IIB	9.0	0.075	60
IIC	3.0	0.025	20

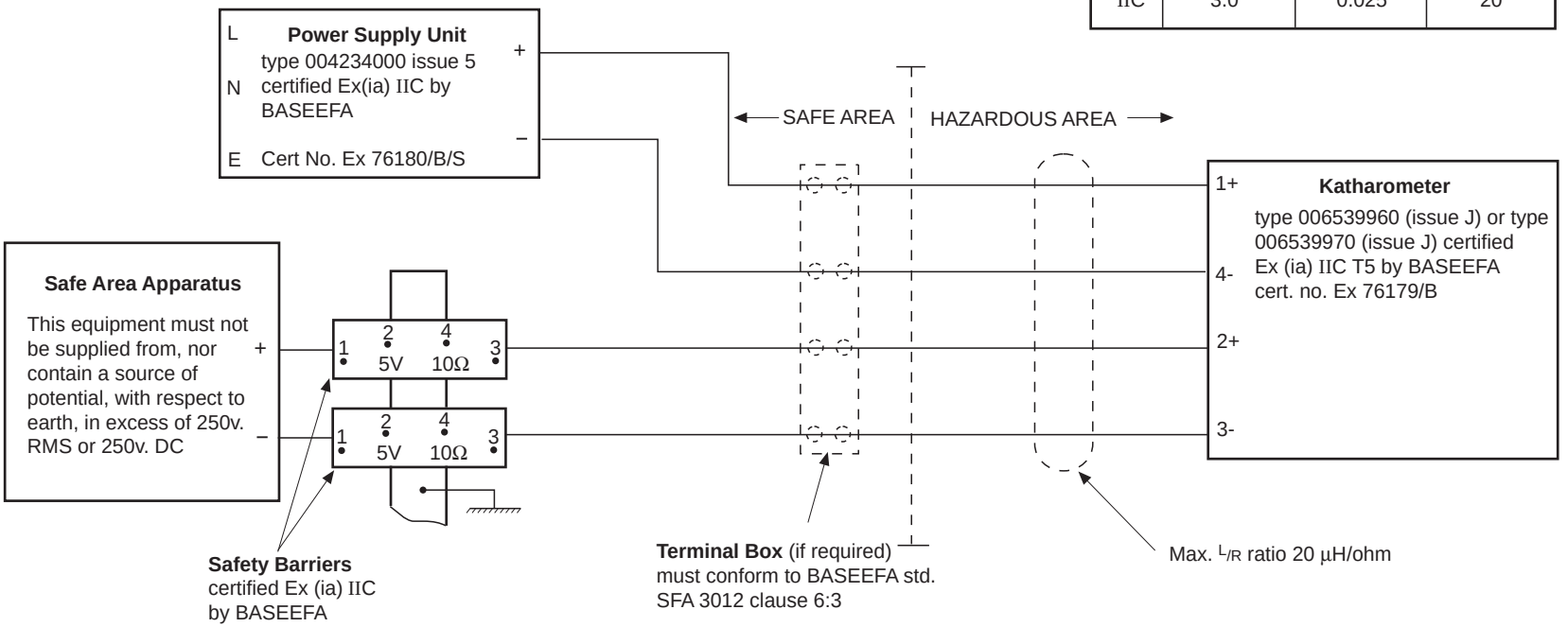


Fig. 3.5 The Intrinsically Safe Gas Analysis System

4 SERVICING

4.1 Safety and Certification

The Model 4234 Power Supply Unit has been certified intrinsically safe to the requirements of SFA.3012.1972 (Code Ex ia IIC) and carries the BASEEFA Certification No. EX 76180/B/S.

To ensure that this standard of safety is maintained in operation it is essential that any servicing or similar work on the unit shall be performed only by suitably trained personnel in possession of all necessary information and a knowledge of the relevant standards applicable.

Warning. Interference with any unit or its components implies acceptance by that person of responsibility for ensuring that intrinsic safety continues to be maintained.

Unorthorised repair or incorrect assembly may render any unit unfit for use within a hazardous area.

4.2 Circuit Description

A stable supply voltage is produced across zener diodes Z3 and Z4 by utilising the forward slope resistance of zener diodes Z1 and Z2 in the full wave rectifier bridge connected across 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 350mA.

The preset potentiometer RV101 enables fine adjustment of the current output.

The maximum output current is restricted by inviolate resistors and a series regulator to ensure that the requirements of the intrinsic safety certification are met even under a '2-fault' condition.

4.3 Test Voltages

Warning. Before starting any test switch off the power supply unit and remove the katharometer connections from the power supply terminal block.

Connect a 10Ω (5W minimum rating) resistor across the output terminals before again switching on for test purposes.

Table 4.1 gives short list of test voltages measured on a typical unit when using a digital voltmeter. Reference should be made to the circuit diagram (Fig. 3.4) for location of test points and components.

Note. It must be noted that the primary winding of the transformer T1 incorporates a thermal cutout device to prevent overheating under fault conditions. Sufficient time must be allowed for this to cool and reset after a fault has occurred before commencing further diagnoses.

Table 4.1 Test Points/Voltages

Test Point	Typical Voltage (Vd.c.) (With respect to the zero volts line)
TP1	9.1
TP2	3.5
TP3	3.0
TP4	2.4
TP5	5.0*
TP6	1.7

Transformer secondary 9.1V a.c.
*Measured with a 10Ω dummy load.

The following list specifies all the circuit components in the Model 4234 Power Supply Unit.

Warning. No unauthorised modifications may be made and any replacement components or assemblies must be exactly as specified.

Table 5.1 Components

Circuit Ref.	Value	Tol. (±%)	Rating	Type	ABB Kent–Taylor Part No.
Resistors					
R101	910Ω	2	1/2W	Metal Oxide	00 2541 076
R102	3K3Ω	2	1/2W	Metal Oxide	00 2541 087
R103	4.7Ω	5	9W	Wire Wound	00 2541 166
R104	100Ω	2	1/2W	Metal Oxide	00 2541 066
Variable Resistors					
RV101	1K0Ω	2			00 2569 013
Capacitors					
C101	1000µF		16V		00 2512 007
C102	1000µF		16V		00 2512 007
C103	100µF		6.4V		00 2512 001
Transistors					
TR101				BC108	00 2654 005
TR102				2N3766	00 2654 009
Diodes					
D101				BYX36–600	00 2625 003
D102				BYX36–600	00 2625 003
D103				AAZ15	00 2625 001
Zener Diodes					
Z1				0AZ227	00 2614 006
Z2				0AZ227	00 2614 006
Z3				0AZ227	00 2614 006
Z4				0AZ227	00 2614 006
Z101				BZY88C3V3	00 2614 003

Table 5.2 Miscellaneous Components

Circuit Ref.	Description	ABB Kent–Taylor Part No.
FS1	500mA h.b.c. type cartridge fuse (Belling–Lee Type L693)	00 2417 005
T1	Transformer, tapped 110–120V primary, OR	00 4234 130
	Transformer, tapped 200–220–240V primary	00 4234 140
	Complete p.c.b. assembly	00 4234 113

APPENDIX A – ASSOCIATED APPARATUS

A.1 The Use of Zener Barrier Devices

When a katharometer installed in a hazardous area is connected to an indicator, recorder or other apparatus situated in the safe area (see Fig. 3.5) encapsulated zener barrier units must be installed in order to prevent excess voltages from appearing in the hazardous area via the interconnecting cables.

The certified intrinsically safe gas analysis system shown in Fig. 3.5 covers the use of 5V 10Ω positive barriers for this application (see Fig. A.1).

The type of barrier currently supplied by ABB Kent-Taylor for this purpose is the Type MTL 105 5V 10Ω positive manufactured by Measurement Technology Ltd. and covered by BASEEFA Certification No. 72100/B/S. The terminal numbers and operational checks given below refer to this type.

It is a requirement of the certificate that:

- the barrier must be mounted in the safe area and protected by an adequate enclosure whose temperature must not exceed 45°C, and
- terminals 2 and 4 (the earth connections) must be connected so that the total earth loop impedance does not exceed 1Ω (BS 5345 Part 4, clause 16.1).

Apparatus connected to terminals 1 and 2 (safe area connections) must not be supplied from, nor contain, a potential source greater than 350V peak (250V r.m.s.) with respect to earth. Mains powered apparatus connected to terminals 1 and 2 must be isolated from the mains supply by a double wound transformer, and the primary winding of this transformer must be protected by appropriate h.b.c. or rewirable fuses.

Fig. 3.5 provides details of the certified equipment (katharometer) which may be connected to terminals 3 and 4 (hazardous area connections). It must be noted especially that the intrinsic safety certificate limits the choice of cables which may be connected to terminals 3 and 4. Single sheathed conducting cables should be tightly twisted together to reduce mutual inductance, and laid separately from cabling carrying ‘safe area’ connections.

Zener barrier units are carefully checked at the time of manufacture and functional checks should be confined to measuring the end to end resistance only as follows:

a) Disconnect any cable connected to terminal 3 (the hazardous area connection).

b) With a low voltage ohmmeter, measure the resistance between terminals 1 and 3.

   This should be 18.15Ω maximum. IF NOT - CHANGE THE BARRIER.

c) Check that the impedance between terminals 2 and 4 and earth is less than 1Ω.

d) Reconnect cable to terminal 3.

Warning. If these measurements reveal a faulty zener barrier, it must be replaced by a new one. Do not attempt to repair or tamper with a suspect zener barrier unit. The zener barrier units are certified intrinsically safe to Ex (ia) IIC and no other type is permitted. The type fitted is Measurement Technology Ltd, Type MTL 105 Positive, covered by a BASEEFA Certificate No. 72100/B/S.

e) To replace a zener barrier refer to Figs. A.1 and A.2.

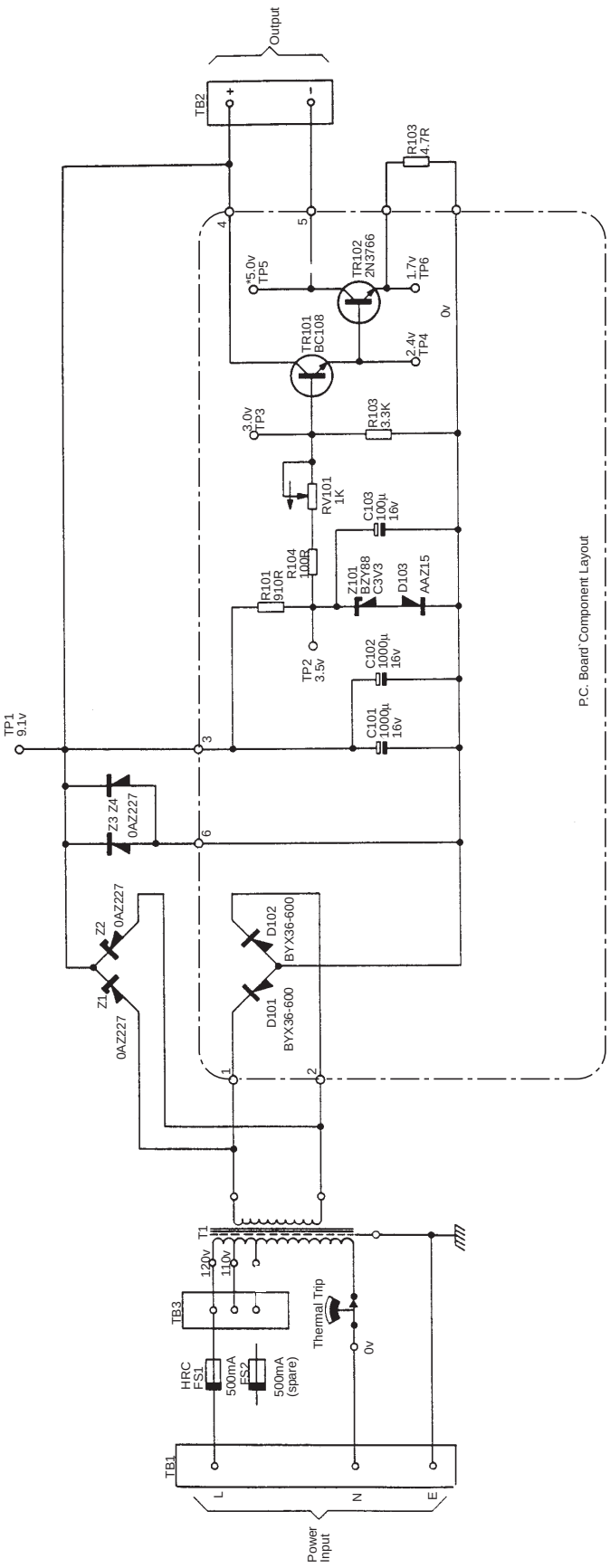
Caution. It is possible the the zener barrier devices referred to in this appendix may be of a different manufacture, specification and fixing. In which case, the following data must be submitted in the text or on figures:

The type fitted is Safety Technology Ltd, Type 2A, 4V and 10Ω. The units are certificated intrinsically safe to code Ex (ia) IIC and are covered by BASEEFA Certificate No. Ex 77149.

A.2 Katharometers for use in Hazardous Areas

The Intrinsically Safe System Certificate Ex. 76181 permits use of two types of certified katharometer unit in the hazardous area. These are the direct measurement type 6539 960 (Issues J or K), using a filament sealed in a reference gas, and the differential type 6539 970 (Issues J or K), in which a comparison gas sample is required.

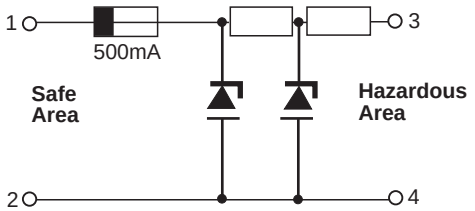
The katharometers are themselves separately certified to the standards of SFA 3012:1972 (code Ex (ia) IIC T5) under BASEEFA certificate No. Ex 76179/B. No other type of katharometer may be used under the terms of the certification schedules. Full details of the operation of the katharometers are given in a separate manual.



*Measured with a 10R load

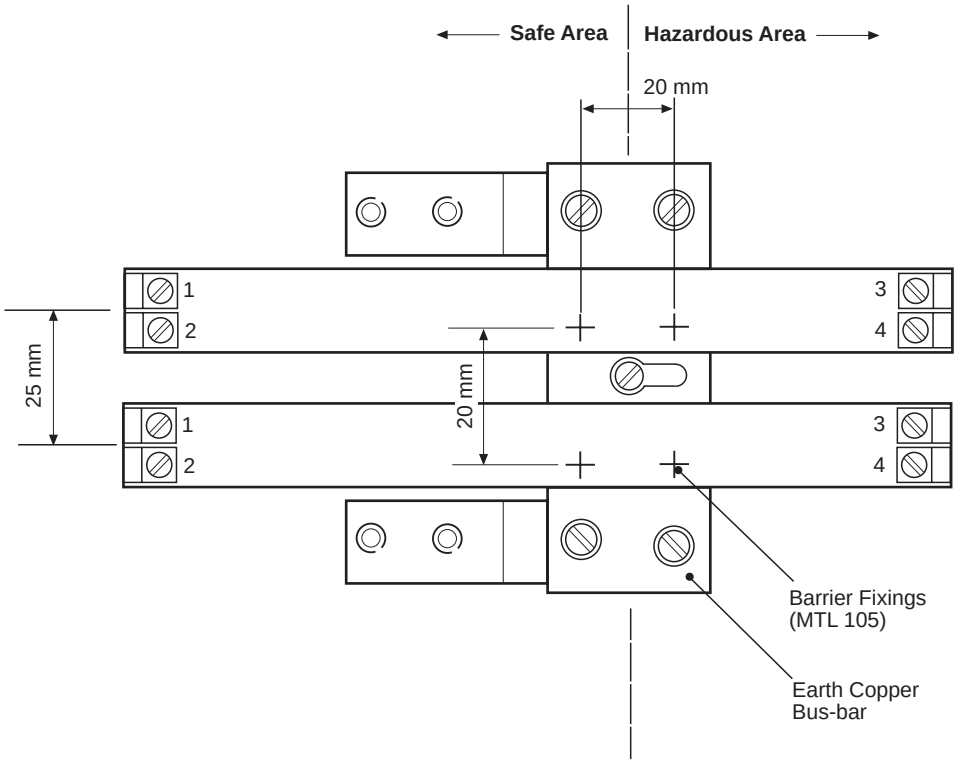
Note. All d.c. voltages to be measured in respect to 0V line. All voltages measured at 350mA load current.

Fig. A.1 Overall Circuit (110v/120v Version)



Note. Barriers must be certified by BASEEFA to code Ex (ia) IIC

Zener Barrier – Internal Arrangement



Installation of Zener Barrier Units

Fig. A.2 Installation and Connection of Barrier Devices

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Tel: +44 (0)1453 826661
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United States of America

ABB Automation Inc.
Instrumentation Division
Tel: +1 215-674-6000
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Italy

ABB Kent-Taylor SpA
Tel: +39 (0) 344 58111
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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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ABB Instrumentation Ltd
St. Neots
Cambs.
England, PE19 3EU
Tel: +44 (0) 1480 475321
Fax: +44 (0) 1480 217948

ABB Instrumentation Ltd
Analytical & Flow Group
Stonehouse, Glos.
England, GL10 3TA
Tel: +44 (0) 1453 826661
Fax: +44 (0) 1453 827856

ABB Automation Inc
Instrumentation Division
125 E. County Line Road
Warminster, PA 18974 USA
Tel: +1 215-674-6000
Fax: +1 215-674-7183

ABB Kent-Taylor SpA
22016 Lenno
Como
Italy
Tel: +39 (0) 0344 58111
Fax: +39 (0) 0344 58278