MAN0079 ISSUE 1.1

MANUAL

CMS DUAL

OPERATION And MAINTENANCE MANUAL

Lab Impex Systems

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LIS DOCUMENT CONTROL RECORD

TITLE: CMS Dual - Operation and Maintenance Manual

ISSUE: 1

Amendment No.	AMENDMENT RECORD AND DETAILS
0	Initial issue
1	New Feature – Alert relay can be used as a Channel B alarm relay.
2	
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6	
7	
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9	

Amendment		0	1	2	3	4
PREPARED	BY	MPW	MPW			
	DATE	08 Sept 2008	11 Feb 2011			
APPROVED	BY	IEB	RWalker.			
	DATE	09 Sept 2008	16/02/2011			
Amendment		5	6	7	8	9
PREPARED	BY					
	DATE					
APPROVED	BY					
	DATE					

CONTENTS

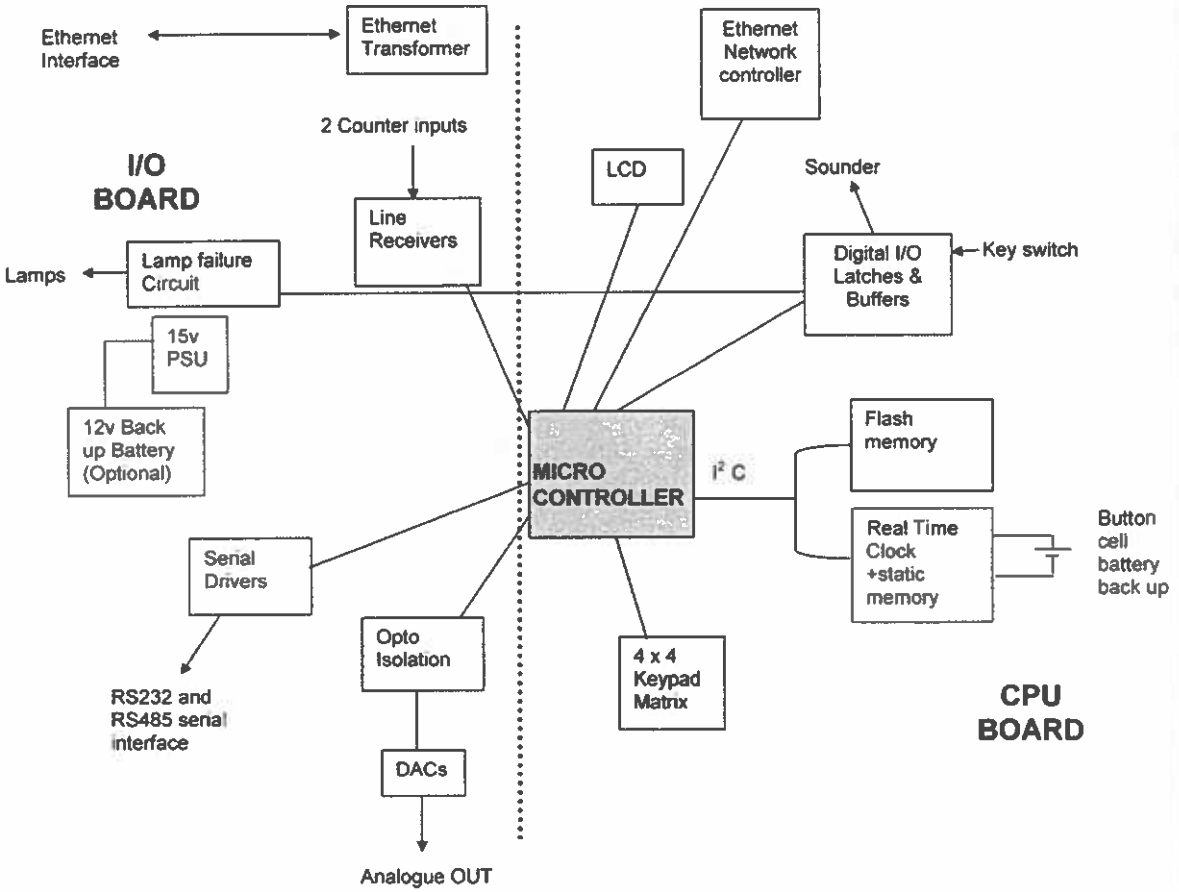
1. Introduction

The CMS Dual is a dual channel gamma monitor. It features a graphic LCD display, sealed keypad and has built-in serial and Ethernet interfaces. As an option, a backup battery can be fitted and will keep the unit fully operational in the event of mains failure.

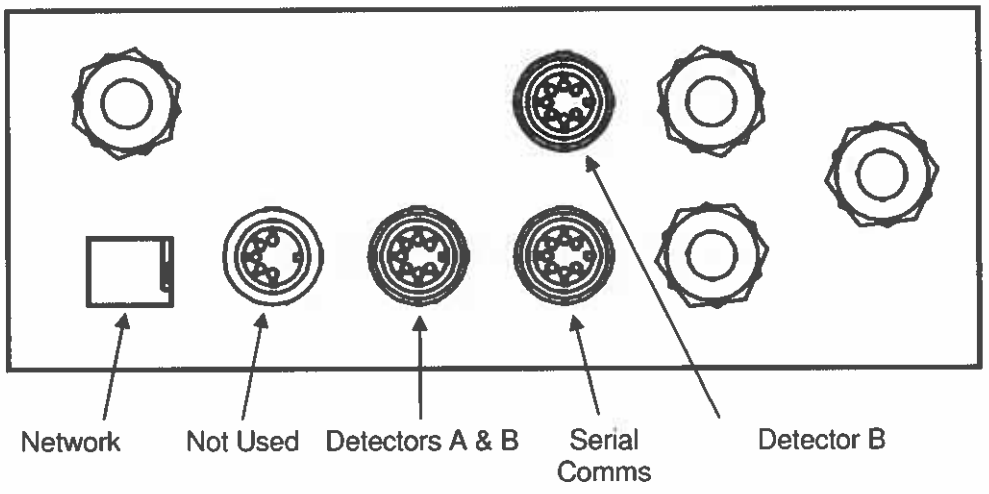
1.1. Illustration

CMS Dual

1.2. CMS Block Diagram



1.3. Connector Panel



1.4. Features of the CMS Dual

- Dual channel rate-meter
- Dead -time correction
- Two configurable alarm thresholds for each channel
- Relay outputs for fault and alarm conditions
- Programmable Lamp and sounder modes for each alarm
- Alpha Numeric display of alarm state and activity level
- Display units for activity levels are configurable
- Graphic display of '% Alarm Level' can be referenced to any alarm threshold
- Options to latch faults and alarms
- Detector failure monitoring
- Mains failure and battery voltage monitors
- Lamp failure monitors
- Configurable key switch to protect parameters and actions
- 8 different user login accounts with programmable access to parameters & actions
- Data log stores up to 2000 records (including detector cps), with a programmable logging interval
- Event log stores up to 128 events
- Clock and calendar
- Built in RS 232, RS 485 and Ethernet (UDP) interfaces
- HTTP server enables the display of current status, parameter values, historic data and event data over a network via a standard internet browser
- Battery backup: fully operational for up to 30 minutes in the event of mains failure (incorporates low battery alarm)
- 2 x 4 to 20 mA electrically isolated analogue outputs for chart recorder etc
- Detector shut-down input for use near Cyclotrons

2. Getting Started

2.1. Goods Inwards Check

On receiving the CMS, check that its packaging is not damaged. If the package is damaged or its contents are not correct, please contact Laboratory Impex Systems immediately.

2.2. Preparing for Installation

The CMS is designed to be attached to a wall or other vertical surface. Once mounted, the mains and other external connections must be made - refer to section 7 for further installation instructions.

Internal parameters should be reviewed and configured to suit the operational requirements (alarm levels etc).

Section 4 gives configuration details for the CMS; detector information can be found in section 9.

3. Operation

When operating normally (no faults, no alarms) the green multi-element LED on the front panel will show a continuous rotating pattern, the green beacon (if fitted) will be on and the sounder, red LED and beacon will be off. The default display screen will indicate the current radiation level as well as the time and date. This section gives full details of the user interface and behaviour under alarm and fault conditions.

3.1. Display Screens

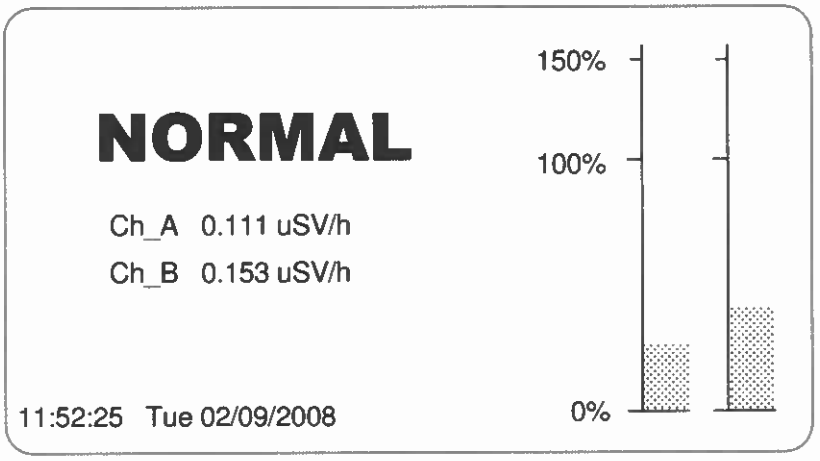
The CMS uses a number of different screens to communicate with a user:

- Default screen - normally displayed unless one of the alternate screens is selected:
- Main Menu – allows you to choose one of the optional screens:
- Historic Data screen
- Event log screen
- Parameter menu

Selecting a specific action from one of these will normally result in an edit/dialogue screen, for example to change a parameter value.

3.1.1. Default Screen

This is displayed when the instrument is first turned on and will remain until another screen is requested. It displays a graphical and numeric representation of the current activity reading, and a banner indicating the current (or latched) alarm or fault status.



The vertical bar graphs represent the current activity as a percentage of the alarm level settings.

The numeric result shows the current activity level in the chosen units, e.g. µSv/h (see Calibration – section 8.2) to 3 significant figures and a maximum of 7 digits (i.e.9,990,000 is the highest value)

If the dose rate causes the detector count rate to exceed the preset Overrange value the display will show an overrange message.

To display the detector count rate in rcps (raw counts per second) press the '2' key. The detector count rate (after dead time correction) will be displayed for 3 minutes and the screen will then revert to showing the normal result. Pressing the '1' key during this time will restore the normal result.

To speed up testing etc, pressing the '.' key (decimal point) resets the time constant buffers so that the result of changing the dose rate at the detector can be seen more quickly. The effective averaging time will then start to increase until the normal value is reached (refer to the parameters section for more information on time constants and averaging).

For more options, press OK or an arrow key to bring up the main Menu.

3.1.2. Main Menu

The main menu offers a choice of four screens:

- Display Count Rate (This is the Default screen as described above).
- View Historic Data
- View Event Log
- View & Edit Parameters

Use the arrow keys to Select the required option then press OK. Alternatively, to return to the default screen, press the ESC key.

3.1.3. Historic Data Screen

The historic data screen displays a list of stored results and will appear blank if there are no results in the log. It is possible for there to be several hundred pages of historic data.

To select the data that you wish to view and to navigate through it, use the keypad as follows:

Key 1 Display Channel L data in SI Units
Key 2 Display Channel L data in Counts / Second
Key 3 Display Channel H data in Counts / Second (not used on this variant)

Key 8 Move 10 pages back in time (Page no. increasing)
Key 0 Move 10 pages forward in time (Page no. decreasing)
Key ▲ Move 1 page back in time (Page no. increasing)
Key ▼ Move 1 page forward in time (Page no. decreasing)

To return to the main menu, press the ESC key.

3.1.4. Event Log Screen

The event log screen displays a list of events that have occurred. Examples of events include Login / Logout, alarms, faults, battery status etc).

To navigate through the event log, use the keypad as follows:

Key 8 Move 10 pages back in time (Page no. increasing)
Key 0 Move 10 pages forward in time (Page no. decreasing)
Key ▲ Move 1 page back in time (Page no. increasing)
Key ▼ Move 1 page forward in time (Page no. decreasing)

To return to the main menu, press the ESC key.

3.1.5. Parameter Menu

The parameter screen is used to view and edit parameter values. It consists of multiple pages, with the page number being displayed in the top right corner. The currently logged in user is also displayed.

To navigate through the parameters, use the keypad as follows:

Key 8 Move 1 page down the list (Page no. increasing)
Key 0 Move 1 page up the list (Page no. decreasing)
Key ▲ Move 1 entry up the list
Key ▼ Move 1 entry down the list

To edit the selected parameter, press OK.

To return to the main menu, press the ESC key.

3.1.5.1 Dialogue Screens

Pressing OK whilst in the parameter list will produce a dialogue screen. These screens are context specific, and will guide a user through the editing process using prompts. Refer to Configuration (section 4) for more details of parameter editing.

To return to the previous screen from a dialog screen, press 'ESC'.

3.2. Alarm Reporting

There are two activity alarms **Alarm** and **Alert** that can have their threshold values set, and can be enabled or disabled, individually. An alarm will be indicated when the displayed result exceeds the threshold. Note that alarm thresholds have a fixed hysteresis of 10% so that, once triggered, the alarm condition will be considered as active until the result is 10% lower than the alarm level.

Alarm is always the highest threshold and must be set above Alert. If the Alert level is not required it can be disabled by setting the parameter value to zero.

Alarms can be reported in various ways:

- By a message banner on the LCD screen
- By a sounder
- By a red beacon
- By a red led on the front panel
- By relay outputs
- By messages on a web page
- By status values sent to a data management system such as a 9205 EMS
- By an entry in the event log

The behaviour of the red lamp and sounder in response to alarms is configurable. For each alarm level the red lamp can be flashing, continuous or off, and the sounder can be pulsed, continuous or off - see the Advanced Configuration section (4.3.3) for details.

3.2.1. Alarm Latching

CMS alarms can be made to latch by setting the Latch Alarms parameter to 'Yes'. In this case the indications will continue when the alarm condition has passed until it is manually acknowledged.

A message on the default screen will indicate any latched CMS alarms present. To acknowledge a latched alarm, press the DEL key on the keypad (from the default screen). If the audible alarm has not been muted the first press of DEL will do this. Pressing DEL again will bring up a request to enter a user passcode and once a suitable password has been entered - see Configuration (section 4) - any latched CMS alarms will be cleared. The Configuration section also gives details of passcodes.

3.3. Fault Reporting

The CMS will report and log the following fault conditions:

- Mains failure
- Low battery voltage (when fitted)
- Detector failure/s
- Detector over range
- Lamp failure/s (when beacons fitted)
- Analogue input/s out of range (when analogue I/O options fitted)

Faults are reported using the same indications as Alarms - see above - but the green LED and beacon (if fitted) will flash and the Fault relay will change state. On request, units may be factory-configured to activate the alarm relays in addition to the Fault relay under fault conditions. The type of fault/s detected will be indicated at the top of the display screen.

The behaviour of the red lamp and sounder in response to a fault condition is configurable, with the same range of options as for alarms - see the Advanced Configuration section (4.3.3.1) for details.

To mute the sounder when it is operating, press the DEL key on the keypad when the default display is shown (a prompt message will indicate this). No passcode is required to mute the sounder.

3.3.1. Fault Latching

CMS faults can be latched by setting the Latch Faults parameter to 'Yes'. In this case the indications will continue when the fault condition has passed until it is manually acknowledged.

A message on the default screen will indicate any latched CMS faults present. To acknowledge a latched fault, press the DEL key on the keypad (from the default screen). If the audible alarm has not been muted the first press of DEL will do this. Pressing DEL again will bring up a request to enter a user passcode and once a suitable password has been entered - see Configuration (section 4) - any latched CMS faults will be cleared. The Configuration section also gives details of passcodes.

3.4. Muting the Sounder

To mute the sounder when it is operating, press the DEL key on the keypad when the default display is shown (a prompt message will indicate this). No passcode is required to mute the sounder.

3.5. Event Logging

Any occurrence of the following events will be logged by the CMS:

- Restart Processor has reset

- Alarm — Highest Activity Alarm
- Alert — Lower Activity Alarm
- Level Ok — No activity alarm
- Login U1 — User 1 logged in
- Login U2
- Login U3
- Login U4
- Login U5
- Login U6
- Login U7
- Login U8
- Login U9
- Login Fail — Login attempt failed (bad password)
- Logout — User logged out
- Muted — Sounder was muted
- DetA Fail — Channel A detector failed
- DetB Fail — Channel B detector failed
- DetA Ok — Channel A detector OK
- DetB Ok — Channel B detector OK
- Over Rnge — Overrange condition occurred
- Range Ok? — Exited from an overrange condition
- Ack Alarm — Alarm was acknowledged
- PowerFail — Mains power failure
- Power Ok
- Bat Low — Battery voltage low
- Bat Ok
- Params dl — New parameter set downloaded
- Lamp Fail — One or more lamps has failed
- Lamps Ok

The event data can be read on the LCD, or via a web page, or it can be downloaded to a computer file using ftp.

To display the event data on the LCD, select 'View Event Log' from the main menu.

To navigate through the event log, use the keypad as follows:

Key 8 Move 10 pages back in time (Page no. increasing)
Key 0 Move 10 pages forward in time (Page no. decreasing)
Key ▲ Move 1 page back in time (Page no. increasing)
Key ▼ Move 1 page forward in time (Page no. decreasing)

To return to the main menu, press the ESC key.

3.6. Count Logging

When count logging is enabled (see 'Logging Interval' parameter), each Historic Data record stores the following information:

- Calculated reading in SI Units, channel A
- Calculated reading in SI Units, channel B
- Counts per second, channel A detector[1]

- Counts per second, channel B detector[1]
- Date and Time
- 8 bits of status information (ADC inputs status, detector failure status, over-range status, detector in use)[2]

[1]Detector count rates are dead time corrected and use the same averaging as the displayed activity result.

[2]The status information associated with each record can only be read using a 9205 EMS system, or by offline interpretation of the downloaded computer files.

Historic data can be read on the LCD, or via a web page, or on a connected 9205 EMS, or it can be downloaded to a computer by using File Transfer Protocol (ftp).

To display the data on the LCD, select 'Historic Data' from the main menu. To view and to navigate through it, use the keypad as follows:

Key 1	Display Channel A data in SI Units
Key 2	Display Channel B data in SI Units
Key 4	Display Channel A data in Counts / Second
Key 5	Display Channel B data in Counts / Second
Key 8	Move 10 pages back in time (Page no. increasing)
Key 0	Move 10 pages forward in time (Page no. decreasing)
Key ▲	Move 1 page back in time (Page no. increasing)
Key ▼	Move 1 page forward in time (Page no. decreasing)

To return to the main menu, press the ESC key.

3.7. Start Up Modes

3.7.1. Normal Start Up

Operation commences automatically, as soon as the mains is applied. If the power is interrupted, the CMS will indicate a mains power failure and will continue to run from battery. It will run from battery until the mains is restored or the battery voltage becomes too low for satisfactory operation. Restoring the mains while running from battery will clear the power fail indication.

3.7.2. Reset-hold Mode

If a new CMS battery is fitted or the CMS battery fuse is replaced with no mains connected, the CMS will become dormant. By pressing the (internal) reset switch (SW1), the CMS will turn on and run from battery.

To prevent the battery from running flat, the CMS may be returned to its dormant state as follows:

- Remove the mains supply
- Set the CMS to display its default screen
- Turn the key-switch to its horizontal position
- Press the 0 key.

3.7.3. Logged Off Mode

If data logging is enabled, a CMS will normally start up in the 'logged on to network' state. If it becomes necessary to move a CMS from one location to another, it must be set to 'logged off Mode'. This ensures that it will not send data to a connected data logging system such as a 9205 EMS, until a new CMS_id has been assigned.

To start up in Logged Off mode:

- Remove mains power
- Set the CMS to display its default screen
- Turn the key-switch to its horizontal position
- Press the 0 key. (CMS will now turn off)
- Hold down the '0' key and at the same time reconnect the mains

Alternatively, use the 'Comms' option under 'View & Edit Parameters' then press 2.

Note: *Before the CMS is connected in the new position on the network, it will be necessary to change its CMS_Id parameter and clear the count log buffer.*

4. Configuration

4.1. Access Control

The CMS uses passcodes and a key switch to protect its operational settings from unauthorised interference. It is possible to disable the key switch if desired, see Config Word in the Advanced Configuration section (4.3.1).

There are 9 standard user levels: 'User0' to 'User8' where User0 is the default level that requires no password.

Every User level including User0 has READ access to all parameter values and logs and can mute the audible alarm but if any other action is attempted the system will request entry of a passcode which identifies the level of the user. Once a passcode is correctly entered that user is 'logged in' and will stay logged in until they return to the default screen (or the system automatically returns to it after a period of user inactivity).

4.1.1. User Levels

User 0
This is the default user level and does not require a passcode. User0 can not change any Parameters or perform any Actions.

User 1 to User 8
Standard users have configurable passcodes, and configurable access rights to change any Parameter or perform any Action. When the CMS is initialised during production, default passcodes and access rights are assigned as follows:

4.1.2. Access Rights

Default parameter access rights and details of how to modify them are given in section 4.3.2 below.

4.1.3. Default Passcodes

User	Default Passcode
1	11
2	22
3	33
4	44
5	55
6	66
7	77
8	88

4.1.4. Changing Passcodes

Users can change their own passcode using the 'Set Own Passcode' action in the Parameter menu. Passcodes can have a maximum of 6 digits.

Care should be taken to ensure that no two passcodes are the same. If this happens, it will be impossible to access one of the affected user accounts until one of the passcodes is reset. To avoid this situation it is suggested that each passcode starts with its own user number, as in the table above.

4.1.5. Resetting Passcodes

Any user with the required access rights (Users 7 and 8 by default) is able to reset any passcode to its default value, by using the 'Reset Passcode' action from the Parameter menu.

4.2. Parameters and Actions

Parameters and actions are accessed via the parameter menu. Parameters have associated values that can be changed, actions, which generally cause a change immediately (e.g. testing a lamp), are accessed in exactly the same way as parameters.

There are to 5 pages of parameters. To navigate through the parameters, use the keypad as follows:

Key 8	Move 1 page down the list (Page no. increasing)
Key 0	Move 1 page up the list (Page no. decreasing)
Key ▲	Move 1 entry up the list
Key ▼	Move 1 entry down the list

To edit the selected parameter, press OK. Dialogue screens will be displayed, taking you through the process of logging in and editing values. While entering a new value the DEL key will undo the last key press and pressing ESC will abort the entry and restore the previous value.

Once logged in, you can edit multiple parameters without having to re-enter the passcode. The parameters you are allowed to change are marked with a dot in the menu. If you attempt to edit a parameter for which you do not have permission, you will be prompted to log in as a different user.

The level of the currently logged-in user is displayed on each page of the parameter menu. You can log out by pressing the ESC key until the default screen is displayed; automatic logging out will occur after 2 minutes of inactivity.

Below is a list of parameters and actions available from the parameter menu, with a short description for each. When parameter values are changed, their new values (including the Parameter Checksum) should be recorded. A copy of the table in section 4.3.2 may be used for this.

1. Date

Enter the date in the following format: dd.mm.yy
E.g. 1 March 2008 would be: 01.03.08

2. Time
Enter the time (24 hour clock) in the following format: hh.mm

3. Disp Units
This determines the units displayed after the main activity result. It does not change the actual result value whose units are determined by the Calibration Factor/s, set during calibration (see section 8.2).

Setting	Displayed Units
0	mSv/h
1	mGy/h
2	µSv/h
3	µGy/h
4	mRad/h
5	mRem/h
6	cps
7	Sv/h
8 +	Reserved for future additions

4. Alarm A, Alarm B, Alert A and Alert B
For each of the two channels (A & B), enter the required alarm and alert thresholds in the units selected in Displayed Units (above). Other alarm behaviour options can be set via this entry, refer to section 4.3.3.2.

Alarm is used for the highest threshold and must be set to be equal to or above Alert; otherwise an error message will be displayed.

If the Alert level is not required it can be disabled by setting the parameter value to zero.

5. Time ConsA S, Time ConsA L, Time ConsB S and Time ConsB L
For each of the two channels (A & B), Short and long time constants, in seconds, are used by the count averaging algorithms. When the detected count rate is steady the long value is normally used but when a rate change is detected the averaging time is reduced. On start-up or when the averaging buffers are manually reset (see 3.1.1) the effective averaging time is at a minimum and proceeds to grow to the value determined by these parameter values. See also the Step Sensitivity parameter (26 below).

6. Dead Time A and Dead Time B
Enter the dead time compensation values (in micro seconds) for each of the two channels (A & B). By selecting a value close to the actual dead time of the detector assembly the automatic compensation algorithm will reduce errors at high count rates. To disable dead time compensation enter a value of zero.

7. Cal Factor A and Cal Factor B

These are calibration factors for the A and B channel detectors respectively. If either detector is not fitted, set its calibration factor to zero. The Calibration Factor is a multiplier that converts the detector cps to displayed units (e.g. µSv/h).

The number displayed is limited to values between 0.00001 and 9999900.

8. DetA Fail and DetB Fail

These are minimum count rates (counts / second) for the A and B channel detectors respectively.

If no pulses are seen from a detector within a time period given by 3/Det Fail, the detector will be considered to have failed.

The number displayed is limited to values between 0.00001 and 9999900.

To disable this feature, set its value to zero.

9. OverrangeA and OverrangeB

These are maximum count rates (counts / second) for the A and B channel detectors respectively.

If a higher count rate is seen from a detector, a fault will be reported. (Refer to section 3.3).

To disable this feature, set its value to zero.

10. Clr Counts

This action clears the count log.

11. Clr Events

This action clears the event log.

12. Set Passcode

This action is used to change the current user's passcode.

13. Reset Pascde

This action is used to reset the passcode, for any chosen user, to its default value.

14. IP Address

Set this to define the instrument's address on an IP network.

15. Subnet Mask

Set this when connecting the instrument to an IP network

16. CMS_Id
This is a one to three digit number used as an instrument identifier on web page displays. It is also used to identify the monitor to a data management system.

17. Netwk Addr
This is the monitor's network address. It is used by a data management systems (such as the LIS 9205) using serial or Ethernet connections.

18. Latch Faults
Set this option to 'Yes' if fault latching is required. Other fault behaviour options can be set via this entry, refer to section 4.3.3.1.

19. Latch Alarms
Set this option to 'Yes' if alarm latching is required (see section 3.2).

20. Logging Int
This sets the interval (in seconds) between entries in the historic count log. The minimum logging interval is 5 seconds. Note: the logging interval automatically reduces by a factor of five when any alarm level is exceeded.

To turn off count logging, set this parameter to zero.

21. DAC0 Max, DAC1 Max
These parameters define the maximum value that can be represented on each analogue output, i.e. the value corresponding to 20mA.

22. DAC Decades
This parameter has two values that can be individually set to define the number of decades (LOG10) spanned for each analogue output. Setting either of these values to zero causes a linear output on the appropriate channel.

23. Test DACs
A utility to test the outputs of the digital to analogue converters. Refer to section5.3.1.

24. Tests

A utility to test relays, lamps, sounder, monitor digital inputs and reset the CMS. Having selected this option, a test menu appears as follows:

0 - Reset All Relays	De-selects tests. (Alarm, Alert and Fail relays are energised.)
1 - Alarm Relay	Alarm relay is de-energised.
2 - Alert Relay	Alert relay is de-energised.
3 - Fault Relay	Fail relay is de-energised.
4 - Sounder	Operates sounder
5 - Green Lamp	Operates green 'Normal' LED and green beacon segment.
6 - Red Lamp	Operates red 'Alarm' LED and red beacon segment.
7 - Watchdog Reset	Reset the CMS and re-starts it at the default screen
Digital Input States:	10001111
Press key (0 to 7)	

Press keys 0 to 7 to select the required test. Press key 0 or the DEL key to de-select a test. Note: The watchdog reset will reset the CMS and re-start it at the default screen.

The digital input states are monitored continuously, with channel 0 displayed as the LSB.

25. Comms

This gives options to reset the communication software and to log on/off a connected 9205 data management system. It also displays the current network status: Normal (Logged ON), Logging Off or Logged Off. When logged off the CMS will not respond to a connected 9205 EMS system; in addition, no data will be written to the count buffer in the Logged Off state.

There is also an option to set Maintenance Mode. When set, this disables the sounder and alarm relays and sets a bit in the comms messages so that a 9205 system can also disable alarms. During calibration or testing, setting the CMS into Maintenance Mode will prevent unwanted alarms.

26. Step Sense

Step Sensitivity is a feature that can be used to optimise the response time when a sudden rise in activity occurs. The default value of 2 should not normally need changing but the range is from 1 (most sensitive) to 5 (least sensitive). Setting the value too low could make the CMS more likely to give false alarms when the alarm level is low and/or the background level is high.

27. Config Word (display only, not user-settable)

A bit pattern used to enable/disable and configure certain features of the instrument - see Advanced Configuration section (4.3.1) for details.

28. Serial No
The serial number of the CMS unit. A serial no. of B0123/456 would be entered as: 012300456

29. F/w Version
Displays the version of the currently running firmware.

30. Build Date
Shows the date the current firmware was produced.

31. Param Check
The number displayed here represents a 16-bit checksum of the parameter values (excluding passcodes). It can be viewed and checked against the previously recorded value to give reassurance that no-one has altered parameter settings.

4.3. Advanced Configuration

4.3.1. Config Word

The Config Word (Parameter 27) is a factory configuration bitmap. It can be set to:

- Disable Ethernet.
- Disable the use of the key switch, where it is not required.
- Disable lamp monitoring, where red and green lamps are not fitted.
- Configure which alarm threshold the activity bar graph is scaled on.
- Configure Alarm and Alert relay operation.
- Set the date format.
- Configure the CMS to re-send all historic records (e.g. to a 9205 EMS) after restart.

4.3.1.1 Config Word Bit Values

The displayed Config Word is a decimal representation of a 16-bit binary number. Its value is determined by adding together the numbers indicated below:

Bit 0
0 Enable Ethernet
1 Disable Ethernet **(add 1)**

Bit 1
0 Enable lamp monitoring
1 Disable lamp monitoring **(add 2)**

Bit 2
0 Enable key switch
1 Disable key switch **(add 4)**

Bit 3
0 Enable Noise Filter
1 Disable Noise Filter **(add 8)**

Bit 4 Reserved for future expansion

Bit 5
0 U.K. date format
1 U.S. date format **(add 32)**

Bit 6
0 Enable Sounder
1 Disable Sounder **(add 64)**

Bit 7
0 Alarm Relay = Ch A & Ch B Alarm, Alert Relay = Ch A & Ch B Alert
1 Alarm Relay = Ch A Alarm, Alert Relay = Ch B Alarm **(add 128)**

Bits 8-12 Reserved for future expansion

Bit 13
0 Fault drives fault relay
1 Fault drives alarm and fault relay (Also drives alert relay if Bit 7 is 1) **(add 8,192)**

Bits 14
0 Standard Noise Filter
1 Alternate Noise Filter **(add 16,384)**

Bit 15
0 Send historic data to 9205 once only
1 Resend all historic data after a restart **(add 32,768)**

Example: *If the key-switch was disabled and the U.S. date format enabled, the Config word would be 4 + 32 = 36*

4.3.2. Modifying Access Rights for Parameters

Each parameter has a security bitmap stored with it, which determines which users (1 thru 8) have access to change that parameter. When the CMS is initialised during production test, default values are written to these security bitmaps, giving access rights as described in the table below.

	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	VALUE
Date + Time			√	√	√	√	√	√	
Displayed Units					√	√	√	√	
Alarm Level			√	√	√	√	√	√	
Alert Level			√	√	√	√	√	√	
Attn Level			√	√	√	√	√	√	
Change Over			√	√	√	√	√	√	
Over Range			√	√	√	√	√	√	
Step Sensitivity			√	√	√	√	√	√	
Calibration Factor Low					√	√	√	√	
Calibration Factor High					√	√	√	√	
Dead Time Low			√	√	√	√	√	√	

	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	VALUE
Dead Time High			√	√	√	√	√	√	
Time Const Short			√	√	√	√	√	√	
Time Const Long			√	√	√	√	√	√	
Low Detector Fail Time			√	√	√	√	√	√	
High Detector Fail Time			√	√	√	√	√	√	
Latch Faults			√	√	√	√	√	√	
Latch Alarms			√	√	√	√	√	√	
Clear Count Log			√	√	√	√	√	√	
Clear Event Log			√	√	√	√	√	√	
Set Own Passcode	√	√	√	√	√	√	√	√	
Reset any Passcode							√	√	
IP Address							√	√	
Subnet Mask							√	√	
CMS Id		√	√	√	√	√	√	√	
Network address							√	√	
Tests/ Test DACs			√	√			√	√	
Maintenance		√	√	√			√	√	
Logging interval			√	√	√	√	√	√	
DAC 0 Max			√	√			√	√	
DAC 1 Max			√	√			√	√	
DAC Decades			√	√			√	√	
Ack Alarm	√	√	√	√	√	√	√	√	
Change Parameter Security							√	√	

The access rights can be subsequently modified by any user with the necessary 'Reset Passcode' access (by default only users 7 & 8).

From the parameter menu, select the parameter for which you wish to change the access rights.

Log in as user 7 or 8.

Do NOT enter a new parameter value as requested, but key in 3 dots followed by the new security bitmap (a value of 0 to 255), followed by OK.

Use the table below to calculate a new bitmap value, by adding up the number under each user who requires access.

User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8
1	2	4	8	16	32	64	128

Example 1 Security bitmap for all users except user 1

2 + 4 + 8 + 16 + 32 + 64 + 128 = 254

...254 <OK> will enable access.

Example 2 Security bitmap for users 1 and 2

1 + 2 = 3

...3 <OK> will enable access.

Example 3 Security bitmap for users 3, 4, 7 and 8

4 + 8 + 64 + 128 = 204

...204 <OK> will enable access.

On completion of this operation, a confirmation message will flash up, indicating success or failure, and the display will revert to the parameter menu.

4.3.3. Modifying Red Lamp and Sounder Behaviour

4.3.3.1 Fault Behaviour

The green LED and green beacon segment will always flash to indicate a fault, but the behaviour of the red lamps (Alarm LED and red beacon segment) and sounder in response to a fault can be changed as follows:

- Select the 'Latch faults' operation from the parameter menu.
- Press OK and login if requested.
- Do NOT enter a choice as requested, but instead, enter two dots followed by a 2 digit code. The first digit sets the red lamps mode. The second digit sets the sounder mode. Digits have the following meaning:

  0 – None (i.e. always Off)
  1 – Continuous
  2 – Pulsed/Flashing

- Press OK.

Example1.
To set the red lamps pulsed and the sounder continuous when a fault occurs, enter:

..21

Example2.
To leave the red lamps off and the sounder off when a fault occurs, enter:

..00

The selected settings will be displayed next to the latch faults status as follows:

CLCS (constant lamp, constant sounder)

PLCS (pulsed lamp, constant sounder)

CLNS (constant lamp, no sounder)

etc.

4.3.3.2 Alarm Behaviour

The process for configuring the red lamps and sounder in response to an alarm or alert condition is the same as that for faults (above) except that 'Alarm' or 'Alert' should be selected from the parameter menu:

- Select the alarm or alert threshold from the parameter menu.
- Press OK and login if requested.
- Do NOT enter a choice as requested, but instead, enter two dots followed by a 2 digit code. The first digit sets the red lamps mode. The second digit sets the sounder mode. Digits have the following meaning:

  0 – None (i.e. always Off)
  1 – Continuous
  2 – Pulsed/Flashing

- Press OK.

The selected settings will be displayed next to the alarm or alert threshold value as follows:

CLCS (constant lamp, constant sounder)

CLPS (constant lamp, pulsed sounder)

PLNS (pulsed lamp, no sounder)

etc. (see 4.3.3.1 above for explanatory examples of this)

5. Input / Output Facilities

5.1. Relay Outputs

There are 3 relay outputs each with dual pole changeover volt-free contacts. They are marked on the instrument as 'Fault', 'Alarm' and 'Alert'.

Fault Relay

The fault relay is de-energised when a fault is present. Therefore, under a fault condition the 'NC' (Normally Closed) contacts will be closed:

Fault Normal

Alarm Relay

The alarm relay is de-energised when an alarm condition is present. Therefore, under an alarm condition the 'NC' (Normally Closed) contacts will be closed:

Alarm Normal

Note: *On request, units may be factory-configured to de-energise the alarm relay in addition to the Fault relay under fault conditions. In this case the alarm relay will also de-energise in a fault condition. The alarm relay may also be configured to de-energise on channel A and channel B alarm conditions or only on a channel A alarm condition. Refer to section 4.3*

Alert Relay

The alert relay is de-energised when an alert condition is present. Therefore, under an alert condition the 'NC' (Normally Closed) contacts will be closed:

Alert Normal

Note: *On request the alert relay may also be configured to de-energise on channel B alarm conditions (and not de-energise on any alert condition). If the unit has also been configured to de-energise the alarm relay in addition to the Fault relay under fault conditions, then the alert relay will also be de-energised under fault conditions. Refer to section 4.3*

There are facilities for testing the CMS relay outputs. These are found in the 'Tests' screen accessed from the parameter menu (section 4.2 item 24).

5.1.1. Maximum Contact Ratings

Current	3A
Voltage	250V AC
Switching Power	60W
Switching VA	125VA

5.2. Digital I/O

The CMS can be factory-configured to use up to 6 digital outputs and 4 digital inputs. Apart from digital input 2, these are not normally required for gamma monitoring but if the unit has been configured for a specific application the details will appear in the System-specific Information section (11).

By connecting digital input 2 to 0V, power is removed from the detectors. This feature is used to protect the detectors if a nearby Cyclotron if fired.

5.3. Analogue Outputs

The two 4 to 20 mA analogue outputs are designed to connect to external equipment using 4 to 20 mA current loops. They are typically used to drive chart recorders or data logging systems.

Analogue outputs have an internal isolated PSU to provide power for the current loops. Each output can be set to give a linear or log10 representation of the current A and B channel radiation levels. The following parameters are used to configure the characteristics of each output:

- 'DAC Decades' has two values to define the number of decades spanned for each output individually (in log10 output mode). Setting either of these values to zero causes a linear output on the appropriate channel.
- 'DAC0 Max' and 'DAC1 Max' are used to define the maximum value that can be represented on each output (i.e. the value corresponding to 20mA).

The analogue outputs do not require calibration but they can be tested using the Test DACs feature described in section 5.3.1.

5.3.1. Test DACs

The 'Test DACs' feature in the 'Parameters' menu causes the selected DAC to output a test current:

- From the 'Parameters' menu, select 'Test DACs'.
- Log in if requested.
- When prompted by the 'Which DAC? (0 or 1)' prompt, type 0 then OK or 1 then OK.
- When prompted by the 'Output mA (0 to 20)' prompt, type the required current then OK. I.e. To set 4 mA, type 4 then OK.
- The cursor will then disappear leaving the value 4 on the display. This indicates that the value (4 mA) has been set.
- Pressing OK again enables a new value to be set whereas pressing ESC will step back through the menus.
- Press ESC four times to exit completely.

6. Communications

The CMS has two connectors for external data communications: a 7-pin 'Serial Comms' socket for RS 485 or RS 232, and an RJ45 network connector for Ethernet (TCP/IP). The network connector has a yellow LED that is always on but flashes during data transmission. There is also a green LED that comes on when a connector is correctly inserted.

6.1. Web Server

The CMS contains an HTTP server which can send web pages over a TCP/IP network to a remote computer. To do this, the CMS must first be configured with an appropriate IP address and subnet mask for the network it will be attached to (see 'IP Address' and 'Subnet Mask' parameters in section 4.2).

1. Connect the CMS to the network using the RJ45 connector.
2. Using a web browser (such as Internet Explorer, or Netscape) on the remote computer, type the IP address of the CMS into the address bar and press OK.

   E.g. 192.168.1.219< OK >

3. After a few seconds, the CMS navigation page should appear on the PC screen.

There are 4 pages which show status information similar to that available from the 4 options on the main CMS menu. Use the underlined links on the left of the screen to navigate between them.

Note that only the 30 most recent entries are available from the event log and the count log via HTTP.

6.2. File Transfer

It is possible to transfer files to and from the CMS over a TCP/IP network, using ftp.

Files that can be downloaded to the CMS are:

- 'params' binary parameters file.
- 'webpages' the web pages used by the HTTP server.

Files that can be uploaded from the CMS are:

- 'params' binary parameter file.
- 'countlog' the historic count data.
- 'eventlog' the event log data.

Configure the CMS with an appropriate IP address and Subnet Mask and connect it to the network.

On the remote computer, bring up a command prompt window, move to the required directory and type 'ftp 'followed by the IP address of the CMS.

Press return and you should be prompted for a username and password.

The username is 'ftp'

The password is the same as the passcode for user 8.

To download a file to the CMS, type 'put' <CR> and follow the prompts.

To upload a file from the CMS, type 'get' <CR> and follow the prompts.

6.3. 9205 EMS System

The CMS can communicate with a 9205 EMS system using RS485, RS232, or UDP over Ethernet.

Because the 9205 communication protocol was originally designed for the CMS-1 not all features are currently supported: parameter reading and editing is not available, and not all of the status variables are passed on. The situation may change with future versions of 9205 and CMS software.

7. Installation

7.1. Mounting Considerations

The CMS is designed to be mounted on a vertical wall or other surface. It can be fixed without needing to open the unit.

The mounting diagram (section 11) shows the positions of the three mounting lugs. The CMS should be secured by 3 screws or other secure wall fixings.

Space must be allowed for opening the door which hinges on the right hand side and needs to open at least 90° for connection and service access.

For outdoor use the CMS is designed to be mounted inside a weatherproof cabinet.

All electrical connections are on the underside of the unit. Refer to the drawings section (11).

Detector mounting drawings can be found in section 1.

7.2. System Connections

External connections to the card are made via connectors or screw terminals at the bottom of the enclosure. Connections for standard applications are shown in the interconnection diagram (section 11).

7.2.1. Mains supply

Normally supplied with mains cable internally connected to screw terminals (L and N) and chassis stud for ground. See section 10.2 for mains power requirement. Internal termination details are shown in the mains cable diagram (section 11).

7.2.2. Detector Probes

8-pin female screw-lock DIN connectors. Refer to interconnection diagram (section 11) for pin assignment.

Further detector information can be found in section 13.

7.2.3. Relays

Three relays with dual pole changeover contacts are fitted as standard:

Alarm Relay - Highest level alarm or Channel A alarm.

Alert Relay - Lower level alarm or Channel B alarm.

Fail Relay - Fault

Refer to section 5.1 for more information on relay operation.

Relay contacts are available on screw terminals, and cable glands are provided. Termination details are shown in the interconnection diagram (section 11).

7.2.4. Digital I/O

The Cyclotron Input is detailed in section 5.2

If any other digital input or output signals have been configured for your application they will be detailed in the System-specific Information (section 12).

7.2.5. Analogue Outputs DAC0 and DAC1

Two independent 4 to 20 mA outputs. Connections are available on screw terminals and an analogue I/O cable gland is provided. Termination details are shown in the interconnection diagram (section 11).

7.2.6. RS232/RS485Serial Data

7-pin screw-lock DIN connector with pins for RS 232 or RS 485 serial data.

7.3. Battery Considerations

If a CMS back up battery is fitted it will be pre-charged and the CMS will be dormant (see Reset Hold Mode - section 3.7.2). This is because leaving a battery in a discharged state can significantly shorten its life.

Connecting the CMS to the mains supply will wake it up.

If the mains is ever disconnected for long periods it is recommended that the battery fuse (FS2) is removed to prevent discharge and the battery fully recharged every 6 months.

8. Maintenance and Calibration

8.1. Maintenance

The CMS requires very little routine maintenance. Before commencing any maintenance work the operator should ensure all necessary local rules are followed e.g. obtaining permit to work, informing control rooms of work to be carried out, etc. Also, note the following warning notice:

SAFETY WARNING

Mains voltage is accessible when the internal cover is open.

8.1.1. Routine Maintenance

The following list covers the recommended actions to be carried out annually:

- Clean the external surfaces of the enclosure
- Ensure that all connections are secure
- Carry out a visual inspection looking for signs of damage to the CMS, connecting cables, probes and any other associated components.
- If the CMS is fitted with a back-up battery (lead-acid gel type) then consideration should be given to testing and/or replacing it depending on how critical the application is. These batteries should normally last for a number of years (see section 7.3). For maximum reliability they should be changed every year. Alternatively mains power should be removed and the CMS monitored to confirm that the battery is still functioning correctly. Typically a fully charged battery will keep the CMS running for at least 30 minutes.

The battery replacement procedure is:

1. Switch off an isolate the mains power (CMS will report mains failure)
2. Turn the key-switch to the right and press 0 (CMS will power off)
3. Note the safety warning above
4. Open the enclosure (key required)
5. Unlock and open the black internal cover plate
6. Remove the metal cover plate to which the black internal cover is attached (undo 4 screws and lift it away)
7. Locate the battery (top left)
8. Unfasten the Velcro retaining strap
9. Disconnect the push-on connections from the battery terminals
10. Grip the battery module and remove it, noting the connector orientation

11. Fit the new battery in the same orientation
12. Replace the connections taking care that the polarity is correct
13. Tighten the retaining strap
14. Replace the metal cover plate
15. Close and lock the black cover
16. Close and lock the CMS door
17. Leave the CMS running from the mains for 24 hours to fully charge the new battery (unless it was pre-charged before fitting)
18. Clear any latched faults caused by the changeover process
19. Remove the mains supply and confirm that the CMS continues to operate satisfactorily
20. Re apply mains supply.

After changing a battery or any other maintenance work carry out a routine test on the CMS.

8.1.2. Alarm Checking

CMS alarms can be checked by exposing the detectors to a doserate above the preset alarm thresholds. Alarm indications (sounder, lamps and relays) can also be tested from the tests page, accessed via the parameter menu.

8.2. Calibration

8.2.1. Introduction

The purpose of calibration is to ensure that the system correctly processes and displays results in the required units (e.g. µSv/h). Each detector needs to be calibrated to allow for variations in detector efficiency. Calibration is achieved by setting the Calibration Factor parameter/s.

The displayed units can be changed by altering the Disp Units parameter. Note that changing Disp Units only changes the displayed text. It does not change the actual result value whose units are determined by the Calibration Factor. For example, to change a unit calibrated in µSv/h to read in mSv/h the Disp Units parameter must be changed and the calibration factor divided by 1000.

8.2.2. Detector Calibration Checking

Checking for correct calibration involves exposing the detector to a known dose rate i.e. a large source of the chosen isotope (e.g. Cs-137 or Co-60). Wait for the displayed result to settle and check that it is within the required limits e.g. ±20%. Note that the ring marked on the GDI detector probe indicates the centre of the active area. To confirm calibration over the full operating range a number of different dose rates should be used.

8.2.3. Calibration Adjustment

If the result of calibration checking shows that the parameter/s need to be changed refer to the Configuration section (4) for details of how to access the parameter menu. The calibration factor is the ratio of displayed result (e.g. µSv/h) to displayed detector cps (see section 3.1.1). It is a linear multiplier so increasing the parameter value will increase the displayed result proportionally.

Dead time correction improves the reading accuracy at high dose rates. Initially, a standard value can be used (see section 1) and optimised if required to give maximum accuracy across the range of dose rates.

Whenever parameters are altered the new values should be recorded.

8.2.4. Analogue Output Calibration

The analogue outputs do not require calibration but can be checked using the Test DACs feature from the parameter menu.

9. Detectors

The CMS Dual is primarily designed to monitor count signals from two GDI GM tube detectors. The detectors function automatically and need no attention other than routine calibration (see section 8.2). The GDI range of detectors have self-contained electronics to generate the high voltage and amplify the pulses. An output buffer gives the GDI a capability of driving long cables allowing the detector to be remotely mounted. For cable lengths up to 100 metres (300 feet) from the CMS the GDI can be powered from the CMS via the signal cable. For greater distances a local power supply would be needed.

Note: *The ring marked on the GDI detector probe indicates the centre of the active area.*

For further details of the GDI detectors, refer to manual MAN0038 contained in section 13 of this manual.

10. Safety Information

10.1. Safety Notices

Your attention is drawn to the following:

1. Actions that could compromise the characteristics of the product:

- Incorrect electrical supply.
- Incorrect or improper use, or not in accordance with warnings given in the User Manual supplied with the product.
- Installation by personnel not competent/trained to carry out the work.
- Replacement of original components or accessories with another of a type not approved by the manufacturer, carried out by unauthorised personnel.
- Exposure of the unit to water or other conductive or corrosive substances.
- Exposure of the unit to temperatures or voltages beyond its rated range.
- Bypassing safety functions by modifying the equipment or its external wiring.
- Incorrect external connections or wiring - any system may be safety-related. Suitable consideration must be given to the overall system design including interconnections between the instrument and other components. No unauthorised modifications should be made to external wiring without obtaining the necessary approval.

2. Ionising Radiations Regulations

- This equipment is tested at the factory before shipment, however, it is the responsibility of the user to ensure that it is calibrated to applicable local requirements and that working parameters are set to provide the required operating characteristics.

3. Contamination Risks

- Any equipment which can become contaminated in use should be reviewed by the user to identify possible exposure and/or contamination hazards. Where these can occur, suitable local rules/systems of work should be put in place to minimize the risk.

10.2. Mains Supply

Supply Voltage	90-264V	
Frequency	47-63 Hz	
Max. Current	100mA	
Mains supply/plug:	3A fuse	
Internal CMS Fuses:		
Mains live	(FS3)	1AT 20mm anti-surge fuse
Mains neutral	(FS4)	6.3AT 20mm anti-surge fuse – 1AT must be fitted if the instrument is to be powered from a European site safety transformer.
DC power	(FS1)	2AT 20mm anti-surge fuse
CMS battery	(FS2)	2AT 20mm anti-surge fuse
Internal SSM fuses:		
SSM DC power	(FS5)	2AT 20mm anti-surge fuse

Note: *SSM not part of this product, fuse holder is present due to common PCB.*

10.3. Operating Environment

Temperature: 0 to +50 ºC
Max. Relative humidity 95% (up to 30 ºC)

10.4. CE Marking

The CMS bears the CE mark, indicating the manufacturer's declaration of conformity with:

- EMC Directive 89/336/EEC, as amended by 92/31/EEC and 93/68/EEC
- Low Voltage Directive 93/23/EEC, as amended by 93/68/EEC

Unauthorised modification of the unit is expressly forbidden. Such action could nullify conformance with the above directives and is therefore unlawful.

11. Drawings (MAN9553)

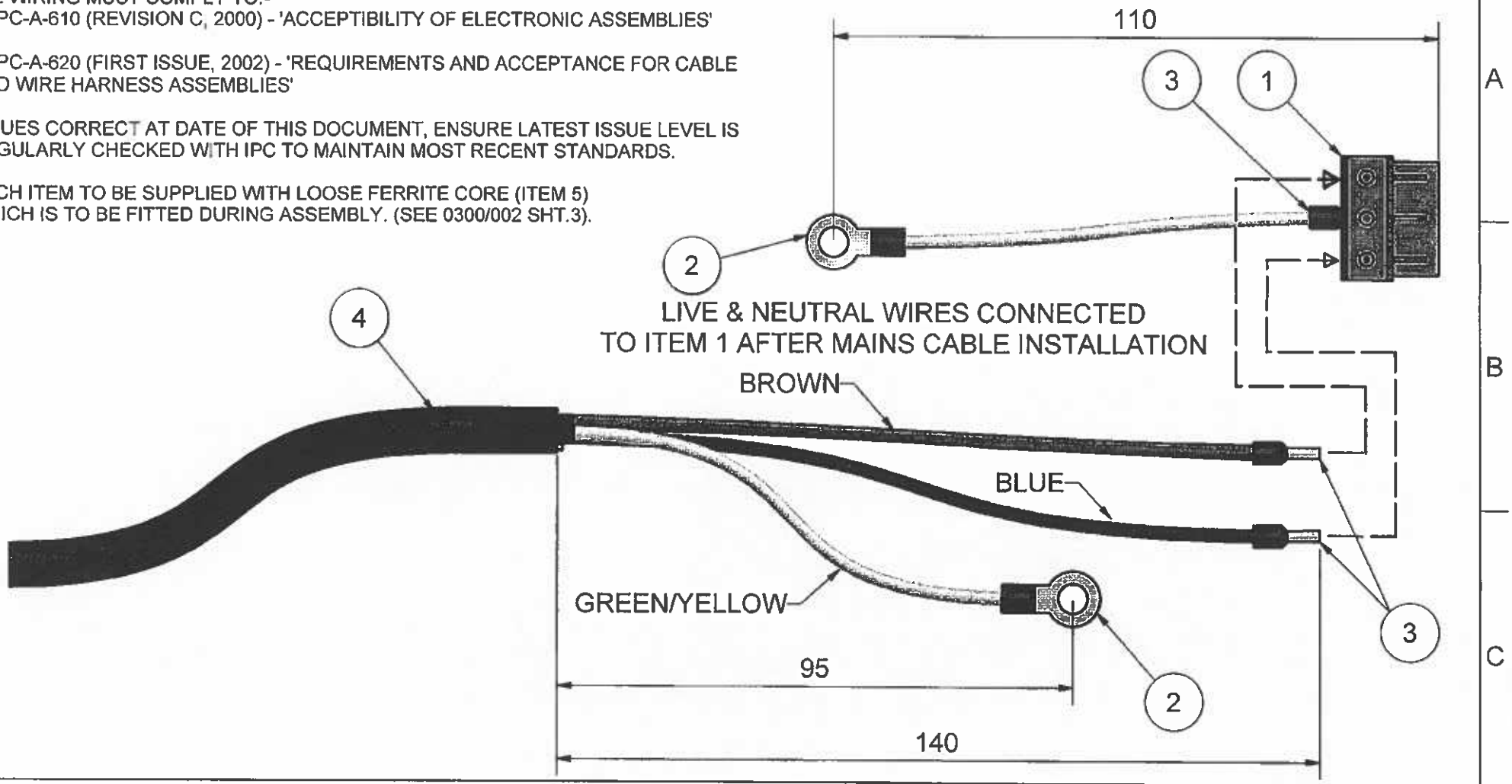
Drawing Number	Drawing Title
0300/902	CMS-Pet, CMS-Gas & CMS-Dual Space Envelope and Installation Detail
0300/351	CMS-2 Mains cable assembly
0300/002	CMS-2 Mark II General Assembly
0300/200	CMS-2 Mark II Wiring Schematic

ALL WIRING MUST COMPLY TO:-
a. IPC-A-610 (REVISION C, 2000) - 'ACCEPTIBILITY OF ELECTRONIC ASSEMBLIES'

b. IPC-A-620 (FIRST ISSUE, 2002) - 'REQUIREMENTS AND ACCEPTANCE FOR CABLE AND WIRE HARNESS ASSEMBLIES'

ISSUES CORRECT AT DATE OF THIS DOCUMENT, ENSURE LATEST ISSUE LEVEL IS REGULARLY CHECKED WITH IPC TO MAINTAIN MOST RECENT STANDARDS.

EACH ITEM TO BE SUPPLIED WITH LOOSE FERRITE CORE (ITEM 5) WHICH IS TO BE FITTED DURING ASSEMBLY. (SEE 0300/002 SHT.3).



MATERIAL	FINISH	TOLERANCES
SEE 0300/352	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED.	GENERAL TOLERANCES UNLESS OTHERWISE STATED. LINEAR: 2 DEC PLC - ±0.1mm; 1 DEC PLC - ±0.25mm; NONE - ±0.4mm; ANGULAR - ±1/2° HOLES: Ø0-8 +0.08 -0.0; Ø8-14 +0.1 -0.0
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING		

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
B	FERRITE CORE NOTE ADDED	RB	ML	ML	26.02.07

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Laboratory Impex Systems Ltd
Impex House, 21 Harwell Road
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Tel: +44 (0)1202 684848
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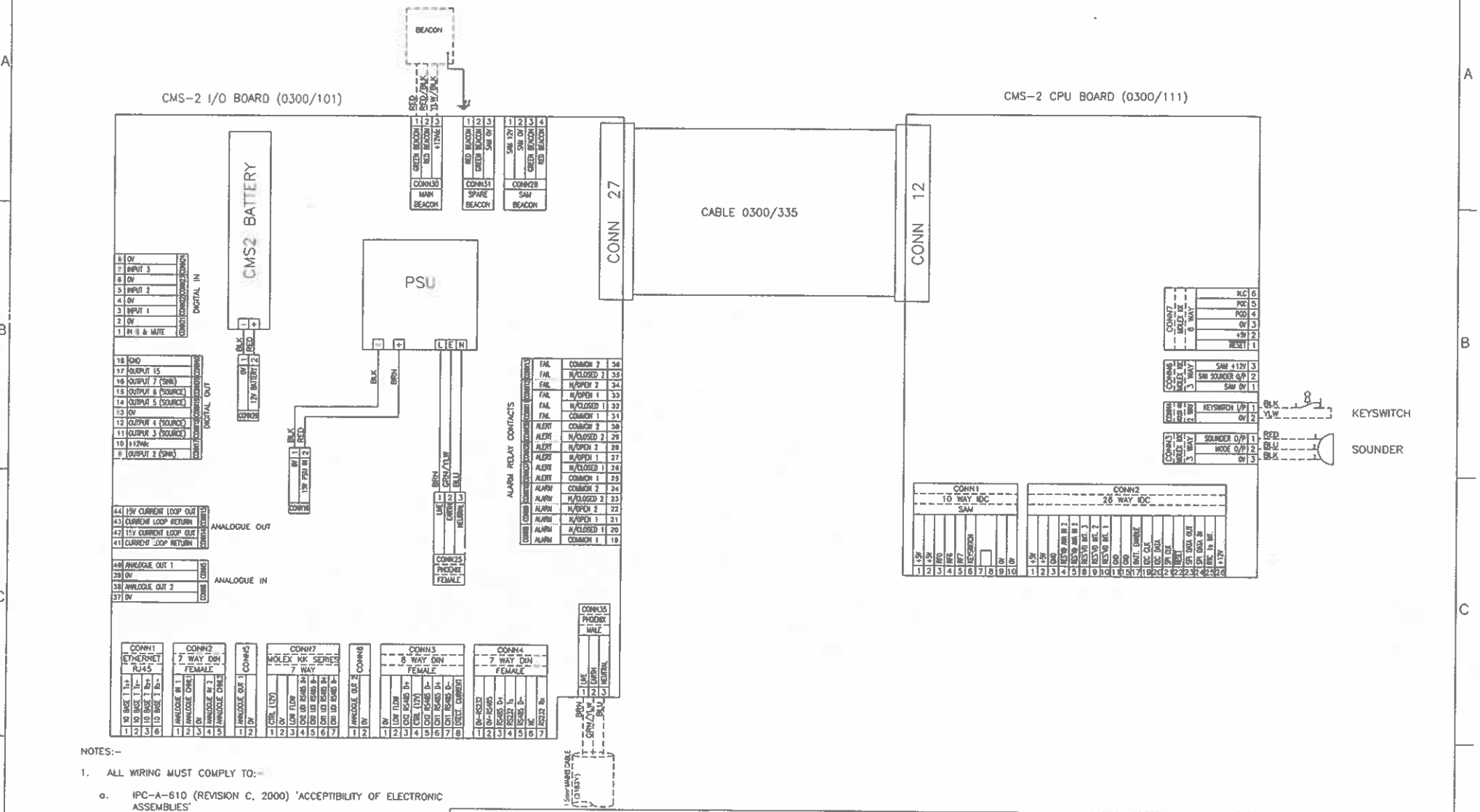
SCALE	ISSUE	DRAWN
NTS	B	N.P
DIMS. IN	DATE	CHECKED
mm	06.05.05	MSJ

TITLE CMS-2
MAINS CABLE ASSEMBLY

DRG. NO.	SHEET	APPROVED
0300/351	1 OF 1	CP

LIS244 Iss3 | 07.02.2005



NOTES:-

1. ALL WIRING MUST COMPLY TO:-
   a. IPC-A-610 (REVISION C, 2000) 'ACCEPTIBILITY OF ELECTRONIC ASSEMBLIES'
   b. IPC-A-620 (FIRST ISSUE, 2002) 'REQUIREMENTS AND ACCEPTANCE FOR CABLE AND WIRE HARNESS ASSEMBLIES'.

   ISSUES CORRECT AT DATE OF THIS DOCUMENT. ENSURE LATEST ISSUE LEVEL IS REGULARLY CHECKED WITH IPC TO MAINTAIN MOST RECENT STANDARDS.
2. ALL WIRES TO BE IDENTED AS SHOWN.
3. ALL WIRES, UNLESS OTHERWISE STATED TO BE 0.5mm² (16/0.2).
4. UNLESS OTHERWISE STATED, 0.5mm WIRES TO BE TERMINATED USING EITHER PHOENIX AI 0,5-8WH or AI-TWIN 2x0,5-8WH BOOTLACE FERRULES.
5. CABLES SHOWN AS ------ ARE INTEGRAL TO CMS-2 AND NOT SPECIFIC TO SAM INSTALLATION.

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED EDGES MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND OILS HAVE BEEN REMOVED	GENERAL TOLERANCES UNLESS OTHERWISE STATED: LINEAR 2 DEC PLC ±0.1mm, 1 DEC PLC ±0.25mm, NONE ±0.5mm; HOLES Ø0.8 +0.08 -0.0, Ø6.14 +0.1 -0.0; ANGULAR ±1°

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
C	RELAY MODS FOR MK II	MR			8.5.06
B	RELAY NAMES CHANGED	MR	NP	MSJ	12/05/06

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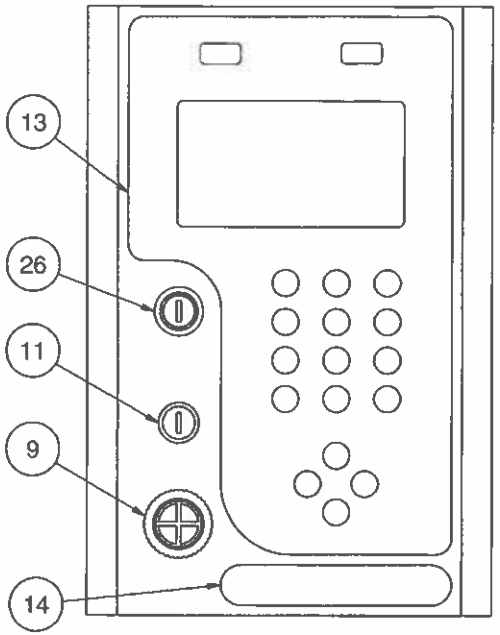
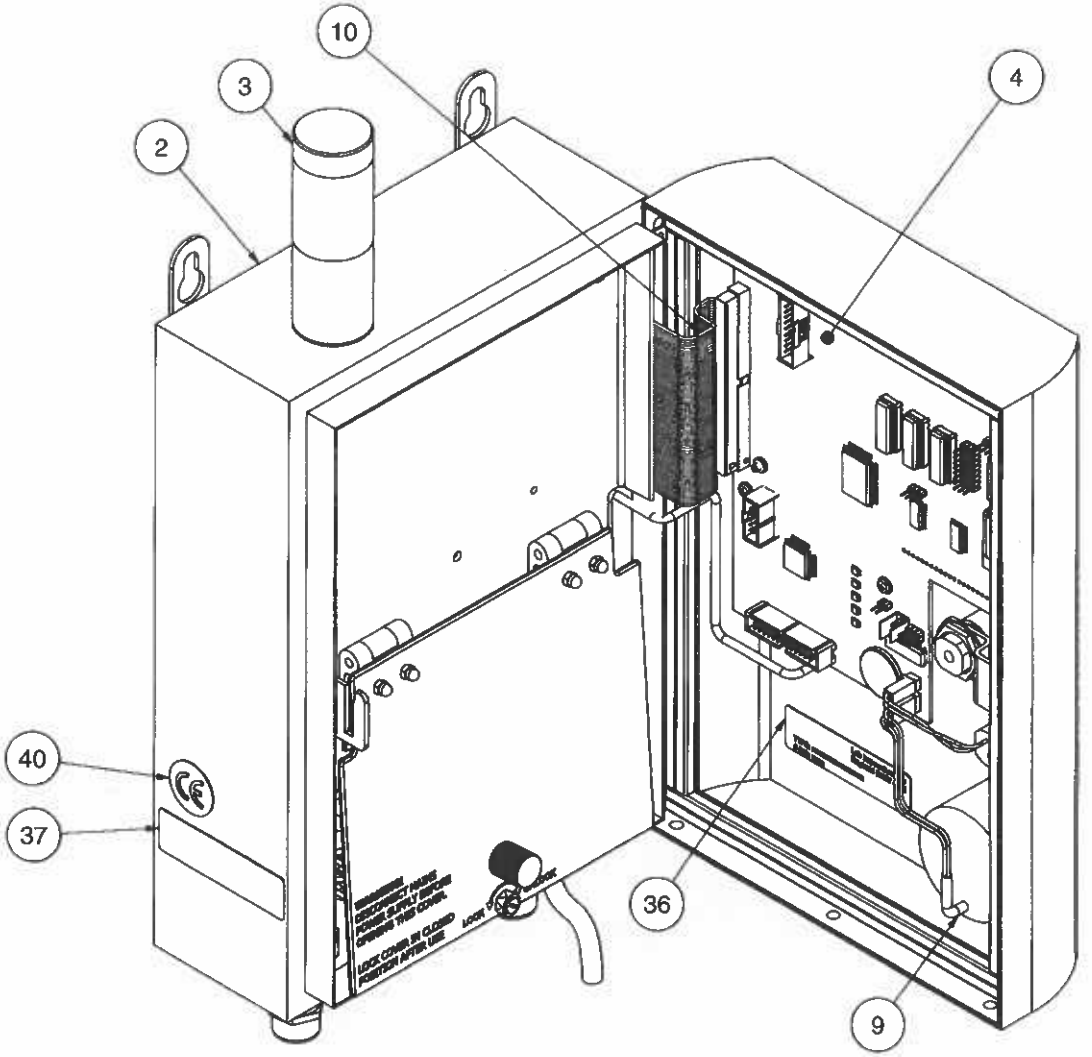
Fax: +44 (0)1202 683571

TITLE: CMS-2 MK II WIRING SCHEMATIC

SCALE	ISSUE	DRAWN
NTS	C	N.P
DIMS. IN	DATE	CHECKED
mm	31.05.05	MSJ
DRG. NO.	SHEET	APPROVED
0300/200	1 OF 1	CP



SUPPLY LOOSE, TO BE FITTED BY L.I.S. TEST DEPARTMENT



ASSEMBLY SEQUENCE:-

1. ASSEMBLE LOCK, KEYSWITCH & SOUNDER ASSEMBLIES INTO LID. (SHT 2)
2. INSERT CABLE GLANDS INTO BASE. (SHT 3)
3. ADHERE KEYPAD LABEL TO LID. (SHT 4)
4. CONNECT EARTH BONDING STRAPS & MAINS CABLE. (SHT 3)
5. ATTACH BRACKET & BATTERY TO I/O BOARD USING VELCRO STRAP. (SHT 5)
6. INSERT I/O BOARD INTO BASE AND SECURE USING HEX PILLARS. (SHT 6)
7. INSERT DISPLAY & CPU ASSEMBLY INTO LID AND SECURE. (SHT 7)
8. ATTACH CONDUCTIVE GASKET TO LID FLANGE. (SHT 8)
9. CONNECT WIRING/CABLES TO SOCKETS ON I/O & CPU BOARDS USING THREAD SEALANT ON PSU TERMINALS (SHTS 1 & 2)
10. FIX INTERNAL COVER PLATE ASSY TO PILLARS. (SHT 6)

ALL SCREW THREADS (EXCLUDING EARTH BONDING POINTS AND WIRING TERMINATION SCREWS) MUST BE SECURED USING LOCTITE THREADLOCK (ITEM 43)

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED.	GENERAL TOLERANCES UNLESS OTHERWISE STATED. LINEAR: 2 DEC PLC - ±0.1mm; 1 DEC PLC - ±0.25mm; NONE - ±0.4mm. HOLES: Ø0-6 +0.08 -0.0; Ø6-14 +0.1 -0.0. ANGULAR - ±1/2°

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD	PG	PG	27.08.08
E	22.02.07	MR	NP	CP	04.09.07
D	LABEL RESPOSITONED	RB	MR	NP	22.02.07

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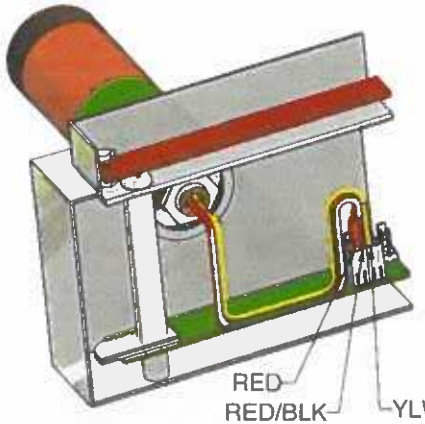
SCALE	ISSUE	DRAWN
NTS	F	NP
DIMS. IN	DATE	CHECKED
MM	27.05.05	MSJ

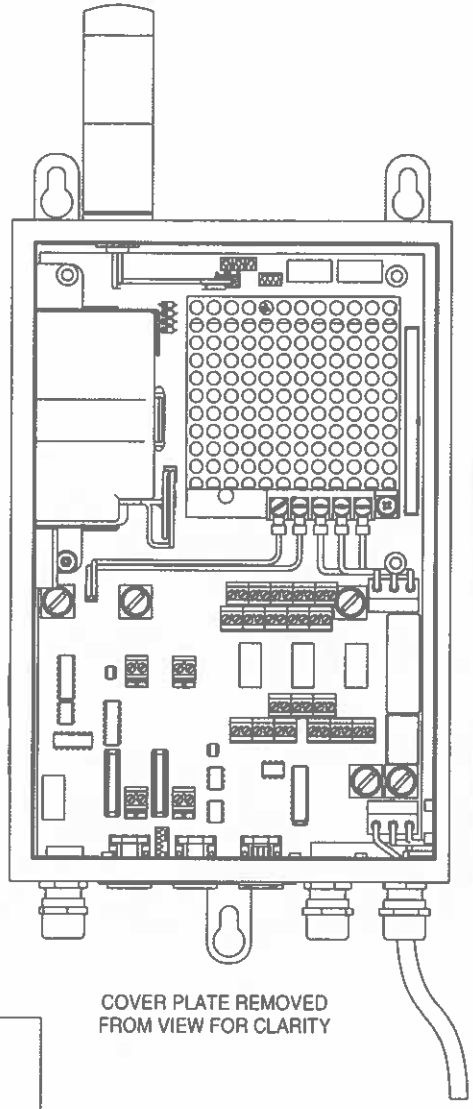
TITLE: CMS-2 MARK II GENERAL ASSY

DRG. NO.	SHEET	APPROVED
0300/002	1 OF 8	CP



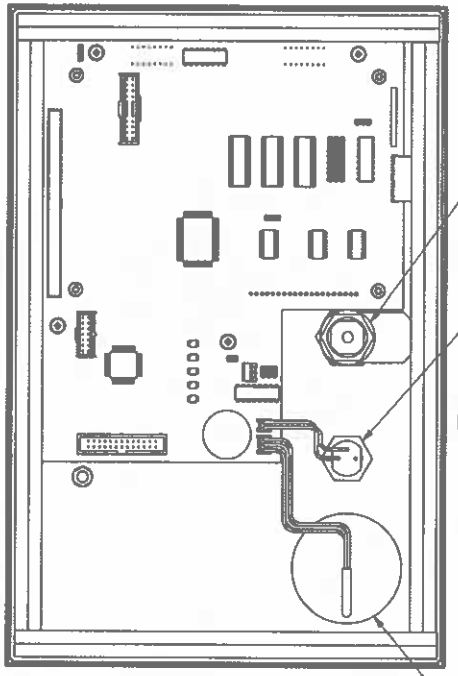
BEACON ASSEMBLY
CONNECTION

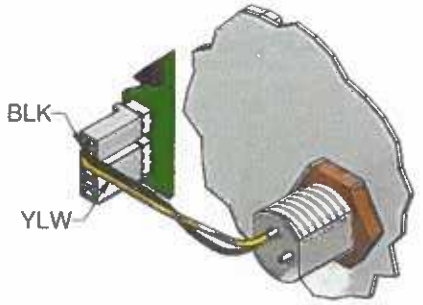
INSERT BEACON ASSEMBLY THROUGH HOLE IN TOP FACE OF ENCLOSURE AND SECURELY TIGHTEN LOCK NUT.
THEN CONNECT MOLEX CONNECTOR ONTO LEFT HAND HEADER ON PCB AS SHOWN



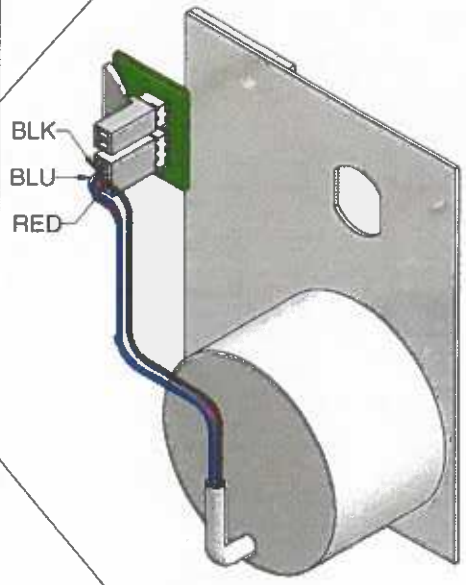
COVER PLATE REMOVED FROM VIEW FOR CLARITY

ENSURE 16mm SHAKEPROOF WASHER IS LOCATED BETWEEN CAM AND CAM LOCK NUT





KEYSWITCH ASSEMBLY
CONNECTION

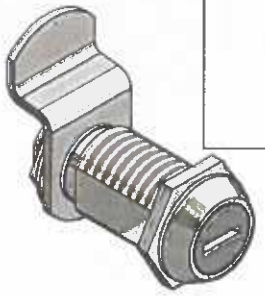


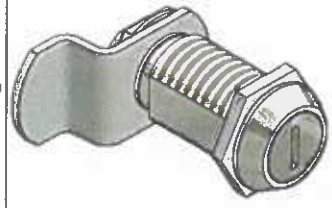
SOUNDER ASSEMBLY
CONNECTION

KEYLOCK ASSEMBLY

UNLOCKED POSITION
KEY CANNOT BE REMOVED

90°CLOCKWISE ROTATION
BETWEEN LOCKED AND
UNLOCKED POSITION





IMPORTANT!
ENSURE THAT IN THE LOCKED POSITION, THE KEY CAN BE REMOVED

MATERIAL	FINISH	TOLERANCES (GENERAL TOLERANCES UNLESS OTHERWISE STATED)
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED	LINEAR: 2 DEC PLC - ±0.1mm; 1 DEC PLC - ±0.25mm; NONE - ±0.4mm. ANGULAR: ±1° HOLES: 00 0 +0.08 -0.0; 08-14 +0.1 -0.0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD	PG		27.08.08
E	SHTS 1 & 5 UP-ISSUED	MR	NP	CP	04.09.07
D	CONNECTIONS MODIFIED	RB	MR	NP	22.02.07

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SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ

TITLE: CMS-2 MK II
GENERAL ASSEMBLY
SOUNDER,BEACON & KEYSWITCH

DRG. NO	SHEET	APPROVED
0300/002	2 OF 8	CP

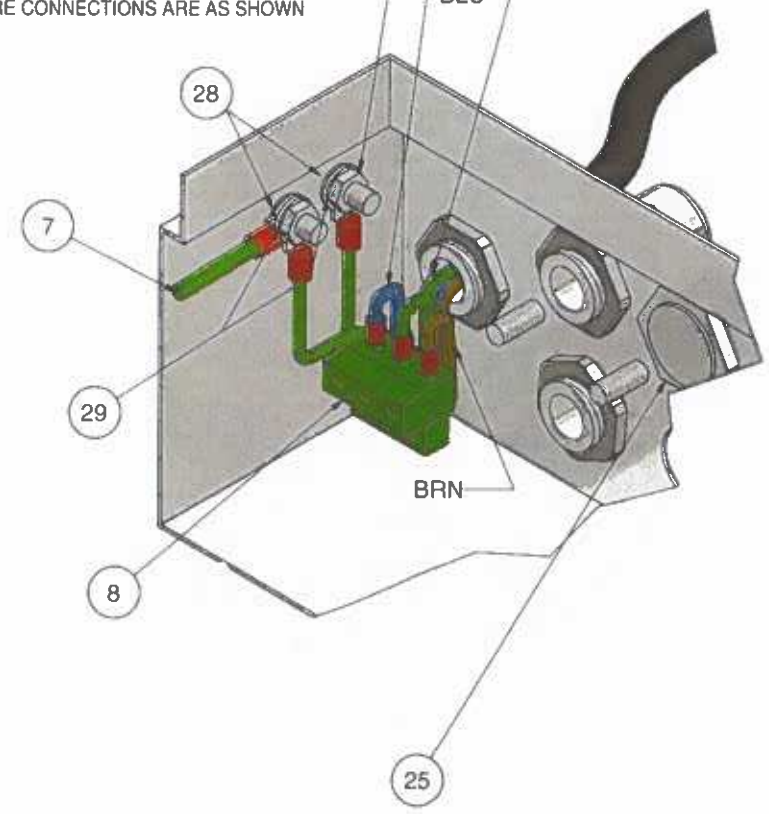
LIS244 Iss3 | 07.02.2005

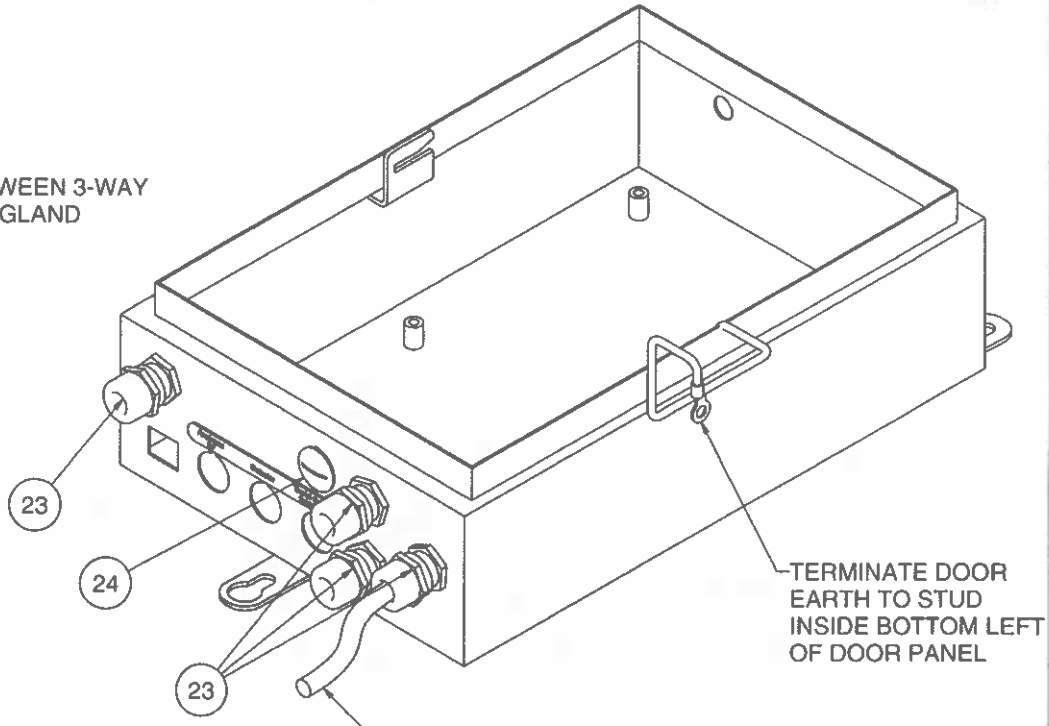
MAINS POWER CONNECTION DETAIL

INCOMING EARTH LEAD TERMINATES ONTO FIRST EARTH TERMINAL WITHIN ENCLOSURE

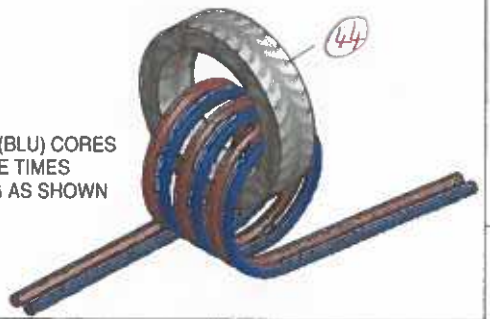
FIT FERRITE RING BETWEEN 3-WAY CONNECTOR & CABLE GLAND

MAINS POWER CONNECTIONS ENSURE CONNECTIONS ARE AS SHOWN





LIVE (BRN) & NEUTRAL (BLU) CORES TO BE WRAPPED THREE TIMES AROUND FERRITE RING AS SHOWN



MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL SWARF, FILINGS, DUST AND FOREIGN MATTER REMOVED	GENERAL TOLERANCES UNLESS OTHERWISE STATED LINEAR: 2 DEC PLC ±0.1mm; 1 DEC PLC ±0.25mm; NONE ±0.4mm; ANGULAR ±1° HOLES: 00-8 +0.08 -0.0; 08-14 +0.1 -0.0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD	PG	CP	27.08.08
E	SHEETS 1 & 5 UP-ISSUED	MR	NP	CP	04.09.07
D	FERRITE RING ADDED	RB	MR	NP	22.02.07

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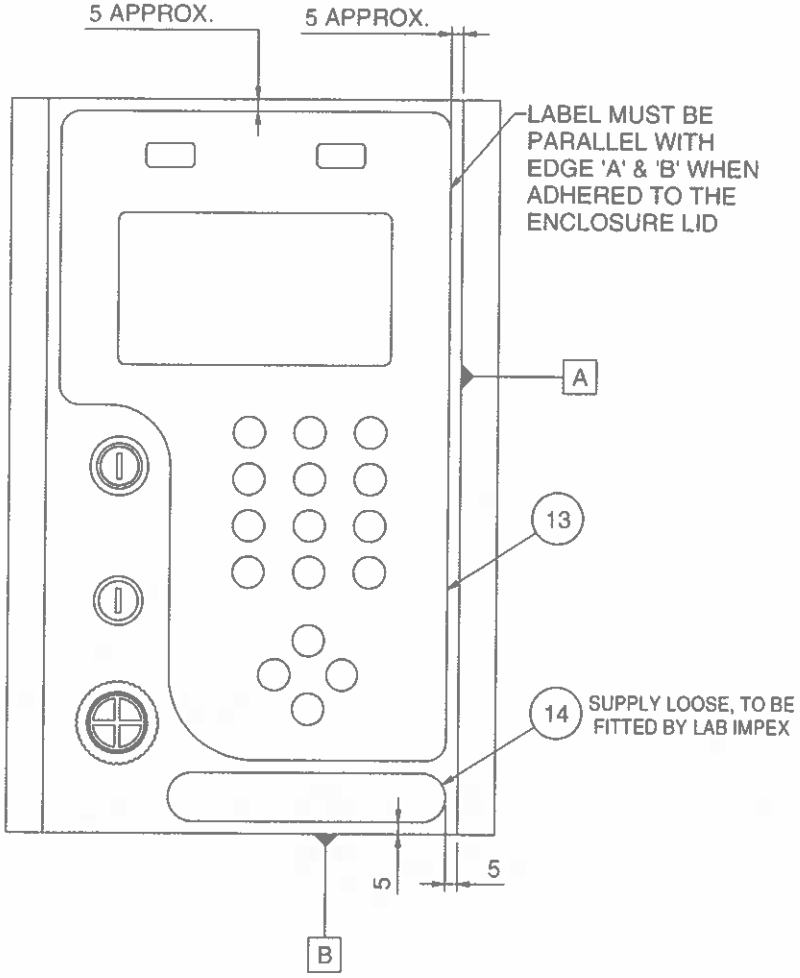
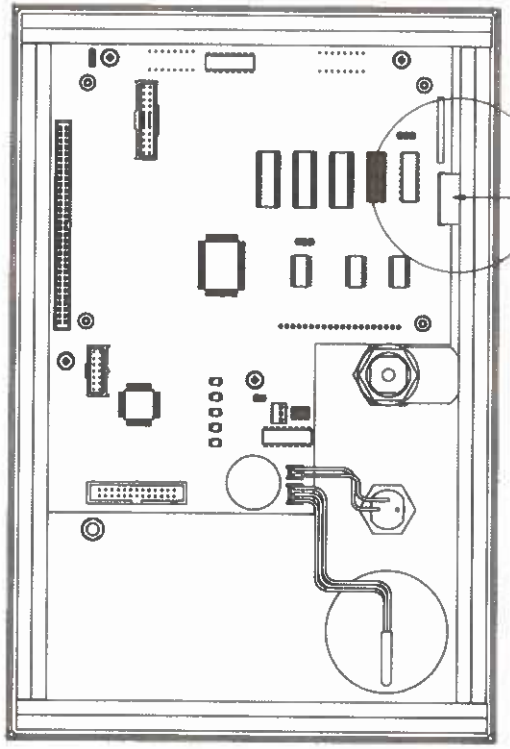
SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ

TITLE CMS-2
GENERAL ASSEMBLY
CABLE GLAND & I/O CONNECTIONS

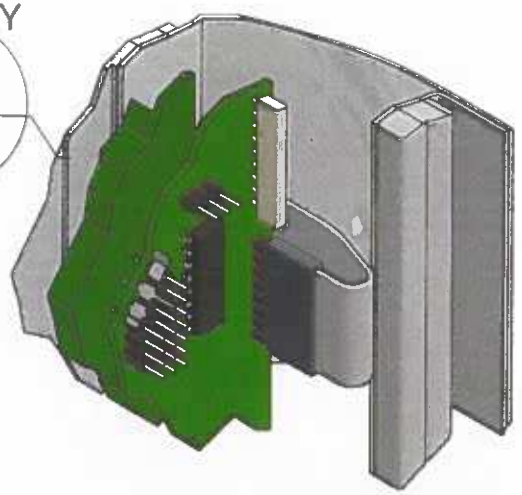
DRG. NO.	SHEET	APPROVED
0300/002	3 OF 8	CP

LIS244 Iss3 07.02.2005





VIEW 'Y'
KEYPAD CONNECTION DETAIL



GENTLY INSERT FLEXIBLE CIRCUIT CONNECTOR INTO 8 WAY PCB HEADER, ENSURING FLEXIBLE CIRCUIT IS NOT CREASED OR DAMAGED.

NOTES:-
1. ENSURE ADHESIVE BACKING IS EXPOSED ON EARTH TAB ON REAR OF KEYPAD BEFORE FIXING INTO POSITION.
2. LABEL MUST BE ALIGNED TO ASSURE OPTIMUM VISIBILITY OF LED ARRAYS AND LCD.
3. LABELS MUST BE FREE FROM SCRATCHES, CREASES & AIR BUBBLES AFTER ADHERING TO LID.

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE DEBURRED FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED	GENERAL TOLERANCES UNLESS OTHERWISE STATED LINEAR: 2 DEC PLS ±0.1mm; 1 DEC PLC ±0.25mm; NONE ±0.4mm; ANGULAR ±1.0° HOLES: 00-8 +0.08 -0.0; 08-14 +0.1 -0.0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD	PG	CP	27.08.08
E	SHEETS 1 & 5 UPISSUED	MR	NP	CP	04.09.07
D	SEE OTHER SHEETS	RB	MR	NP	22.02.07

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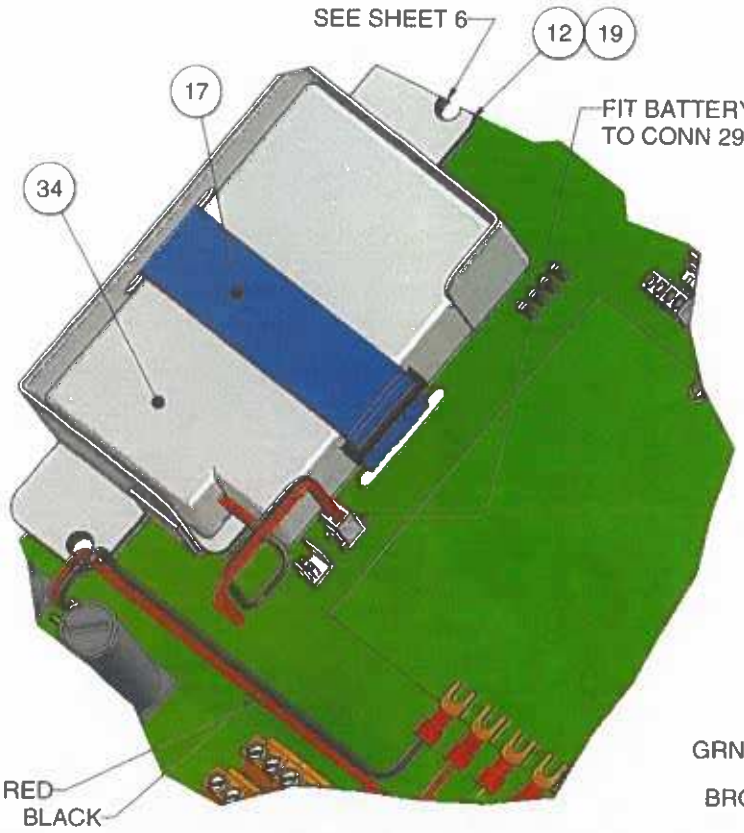
SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ

TITLE CMS-2
GENERAL ASSEMBLY
ADHERING KEYPAD & LABEL TO LID

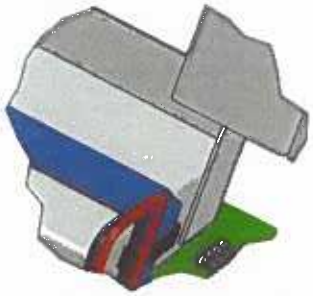
DRG. NO.	SHEET	APPROVED
0300/002	4 OF 8	CP

LIS244 Iss3 | 07.02.2005

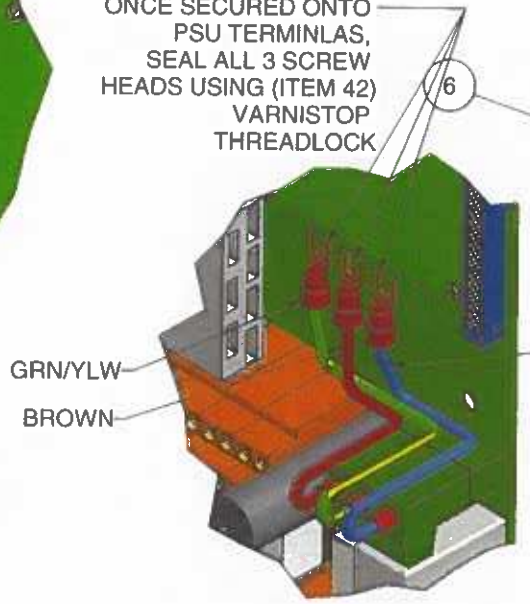


CONNECTION OF POWER DISTRIBUTION LOOM
POSITION WIRES AS SHOWN
PSU OMITTED FOR CLARITY

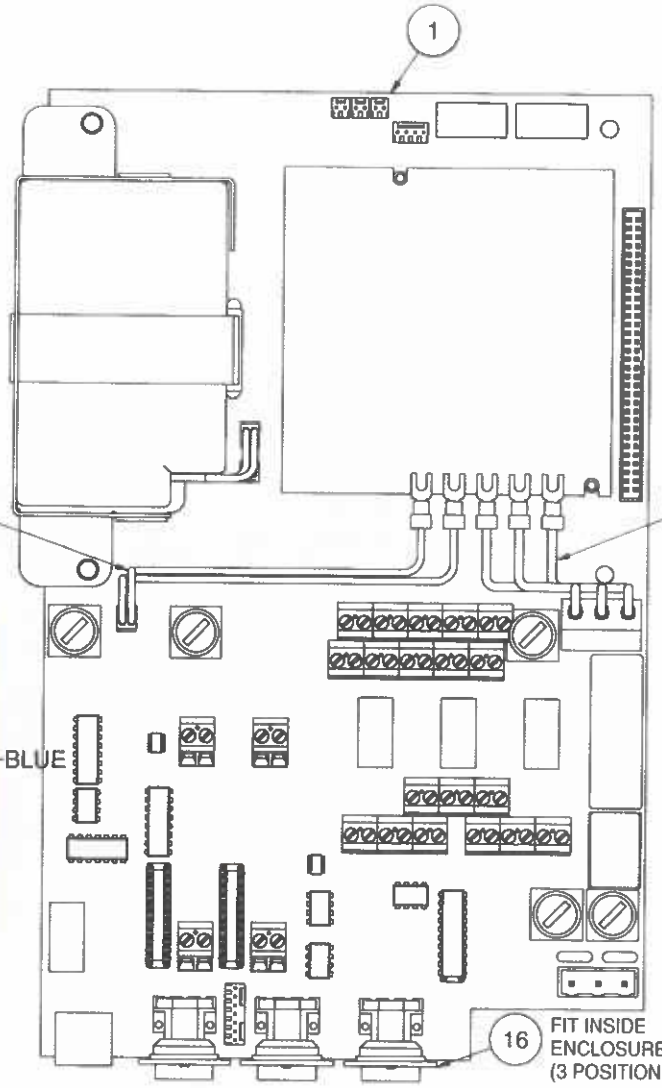
HOOK & LOOP STRAP ATTACHMENT
(SEE NOTES)



ONCE SECURED ONTO
PSU TERMINLAS,
SEAL ALL 3 SCREW
HEADS USING (ITEM 42)
VARNISTOP
THREADLOCK



CONNECTION OF PSU CABLE ASSEMBLY
POSITION WIRES AS SHOWN
PSU OMITTED FOR CLARITY



NOTES:-

1. BATTERY BRACKET ISOLATOR TO BE PLACED BETWEEN BATTERY BRACKET AND PCB.

2. INSERT HOOK & LOOP STRAP THROUGH SLOT IN PCB, ENSURE HOOKS/LOOPS ARE FACING AWAY FROM THE BATTERY. WRAP HOOK & LOOP STRAP AROUND THE PCB, BATTERY & BRACKET THEN FEED THROUGH SECURING RING. PULL TIGHT THEN FIRMLY PRESS HOOKS & LOOPS TOGETHER ENSURING THAT THE VELCRO CAN BE UNDONE AND BATTERY CAN BE REMOVED WITHOUT THE NEED FOR THE REMOVAL OF THE PCB OR THE CUTTING OF THE STRAP.

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED	GENERAL TOLERANCES UNLESS OTHERWISE STATED LINEAR 2 DEC PLC - ±0.1mm 1 DEC PLC - ±0.25mm NONE - ±0.4mm ANGULAR - ±0° HOLES Ø0-8 +0.08 -0 Ø8-14 +0.1 -0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADEED (P8)	WD	PG		27.08.08
E	PSU LOCTITE ADDED-ECR 159	MR	NP	CP	04.09.07
D	BATTERY ASSY MODIFIED	RB	MR	NP	23.02.07

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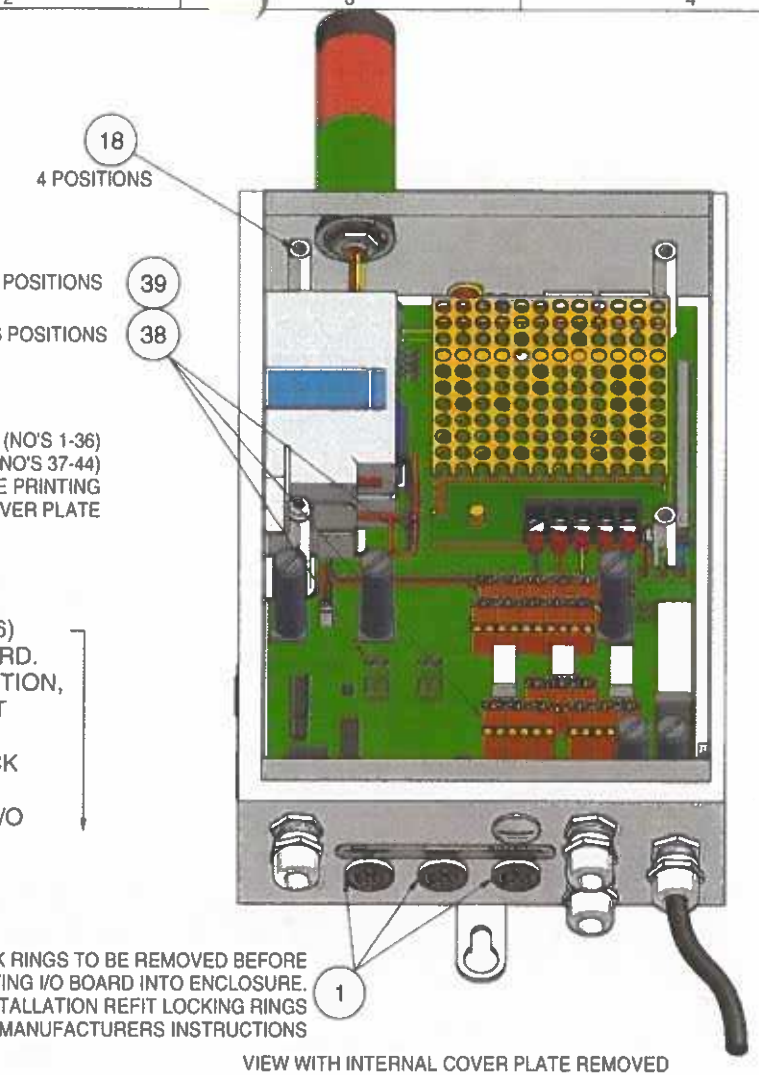
SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ

TITLE CMS-2 MK II
GENERAL ASSEMBLY
I/O BOARD ASSEMBLY

DRG. NO.	SHEET	APPROVED
0300/002	5 OF 8	CP

LIS244 Iss3 | 07.02.2005

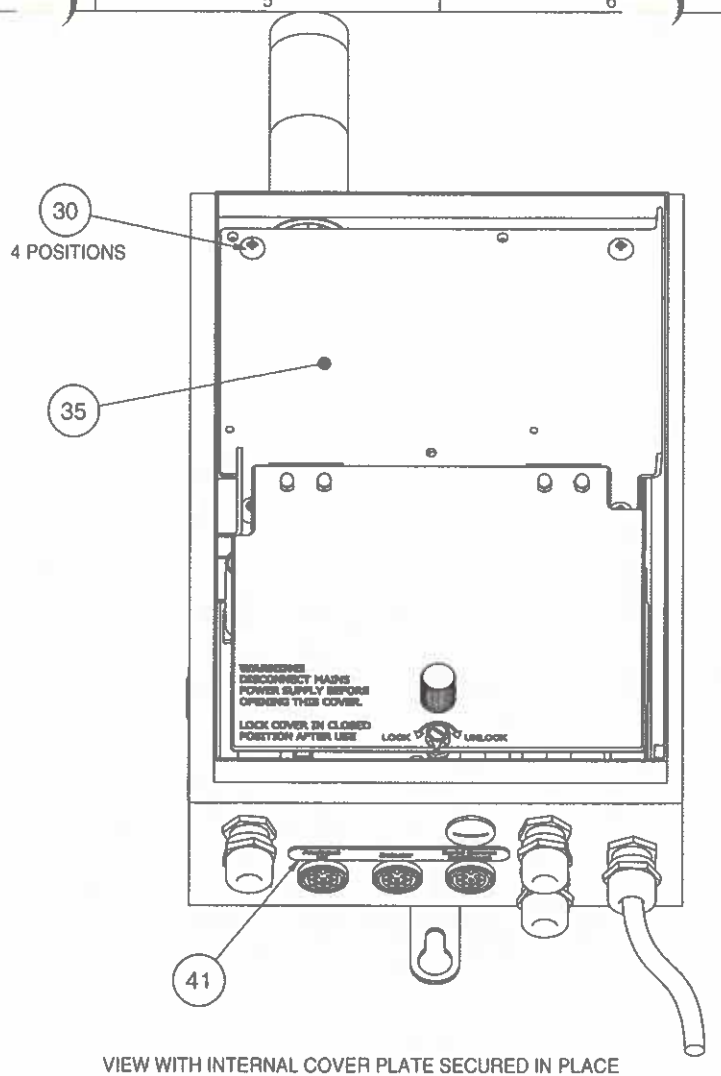


IDENT ORANGE TERMINALS USING ITEM 38 (NO'S 1-36)
IDENT GREEN TERMINALS USING ITEM 39 (NO'S 37-44)
THE NUMBER LOCATION SHOULD MATCH THE PRINTING ON THE INSIDE OF THE FOLDING COVER PLATE

FIT DIN SPACER GASKET (ITEM 16) PRIOR TO INSERTION OF I/O BOARD. INSERT I/O BOARD IN THIS DIRECTION, BY INSERTING THE BOTTOM LEFT CORNER OF THE PCB INTO THE ENCLOSURE FIRST. ENSURE LOCK NUTS ON DIN CONNECTORS ARE TIGHTENED BEFORE SECURING I/O BOARD TO BASE OF ENCLOSURE USING NYLON PILLARS.

LOCK RINGS TO BE REMOVED BEFORE INSERTING I/O BOARD INTO ENCLOSURE. AFTER INSTALLATION REFIT LOCKING RINGS AS PER MANUFACTURERS INSTRUCTIONS

VIEW WITH INTERNAL COVER PLATE REMOVED



VIEW WITH INTERNAL COVER PLATE SECURED IN PLACE (TO BE FITTED AS FINAL ASSEMBLY OPERATION)

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, FESSIOUS DUST AND BLEMISHES REMOVED	GENERAL TOLERANCES UNLESS OTHERWISE STATED LINEAR: 2 DEC PLC - ±0.1mm; 1 DEC PLC - ±0.25mm; NONE - ±0.4mm ANGULAR - ±1° HOLES: 00-8 +0.08 -0.0; 08-14 +0.1 -0.0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD			27.08.08
E	SHEETS 1 & 5 UPISSUED	MR	NP	CP	04.09.07
D	NOTES MODIFIED	RB	MR	NP	22.02.07

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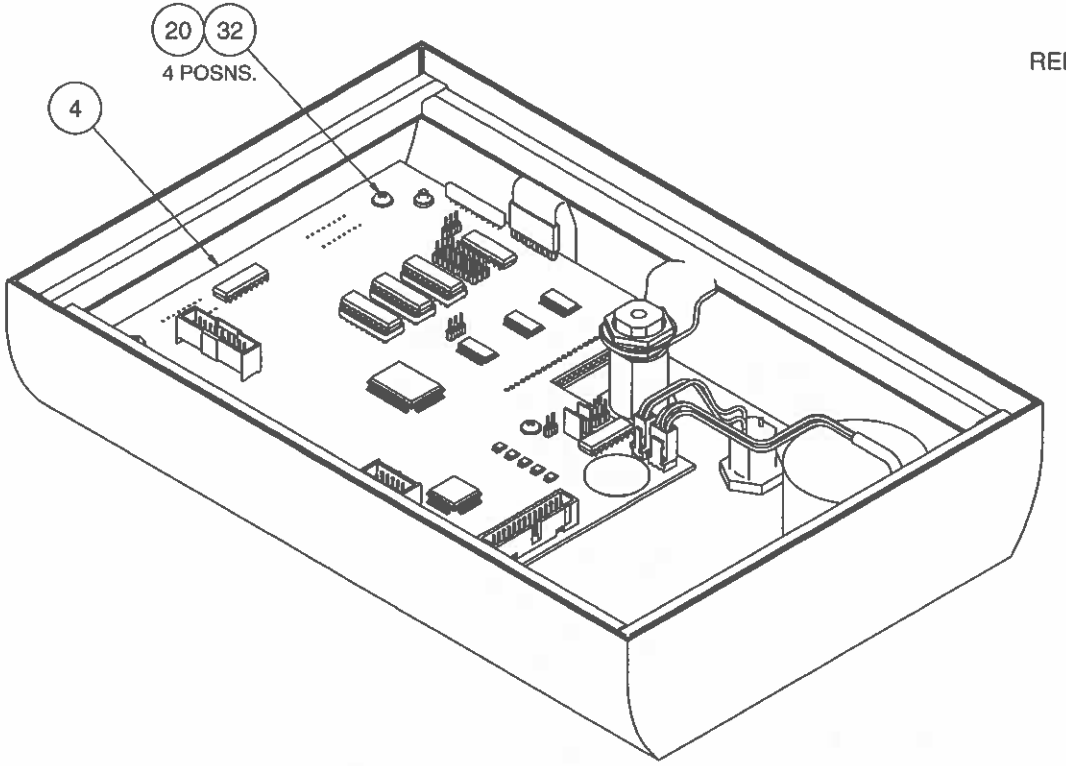
Fax: +44 (0)1202 683571

SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ

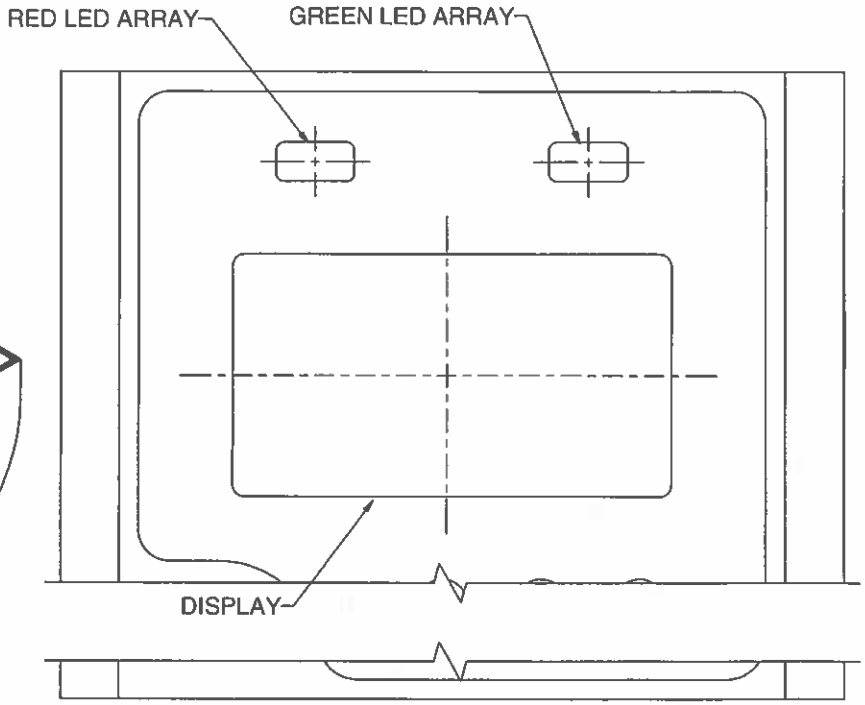
TITLE: CMS-2 MK II
GENERAL ASSEMBLY
I/O BOARD ASSEMBLY

DRG. NO.	SHEET	APPROVED
0300/002	6 OF 8	CP

US244 iss3 | 07.02.2005



SECURE DISPLAY & CPU BOARD ASSEMBLY
INTO LID USING SCREWS AND WASHERS
(AS SHOWN)



ENSURE LED ARRAYS ON DISPLAY & CPU BOARD
ASSEMBLY ARE CENTRALLY ALIGNED TO THEIR
RESPECTIVE APPERTURES IN THE LID IN BOTH PLANES.

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE. DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED.	GENERAL TOLERANCES UNLESS OTHERWISE STATED. LINEAR: 2 DEC PLC ±0.1mm, 1 DEC PLC ±0.25mm, NONE ±0.4mm, ANGULAR ±1/2° HOLES: 00-8 +0.08 -0.0, 09-14 +0.1 -0.0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD		MC	27.08.08
E	SHEETS 1 & 5 UP ISSUED	MR	NP	CP	04.09.07
D	SEE OTHER SHEETS	RB	MR	NP	23.02.07

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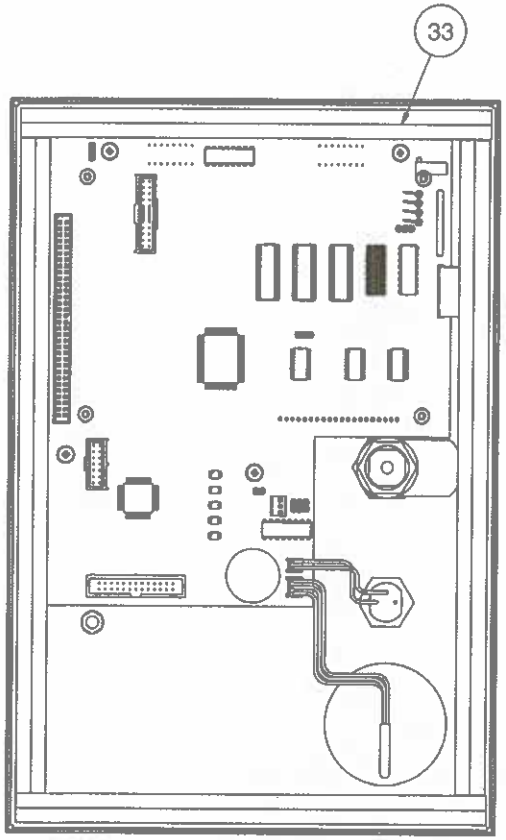
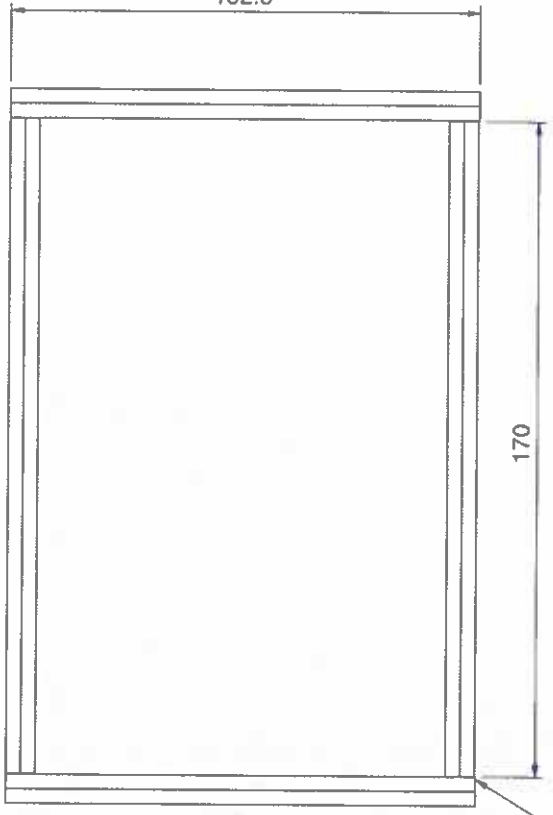
TITLE: CMS-2 MK II
GENERAL ASSEMBLY
DISPLAY/CPU INSTALLATION

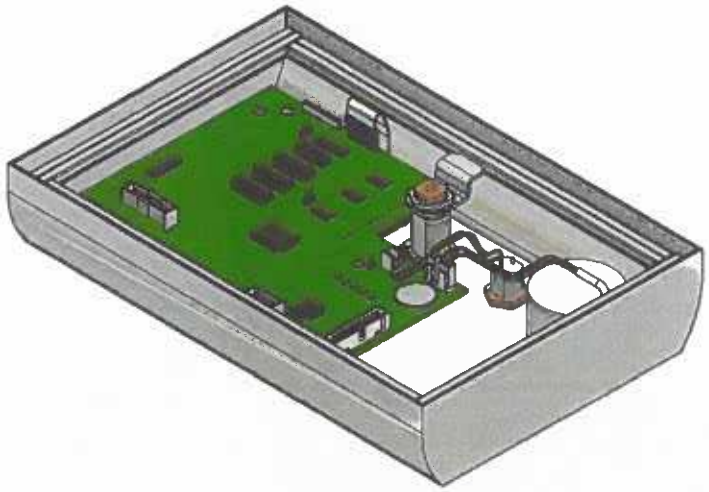
SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ

DRG. NO.	SHEET	APPROVED
0300/002	7 OF 8	CP





SEE NOTE ON FITTING



ISOMETRIC VIEW FOR
REFERENCE ONLY

FITTING NOTE

ASSEMBLE CONDUCTIVE GASKET
INTO ENCLOSURE LID AS SHOWN, ENSURING
STRIPS AT TOP AND BOTTOM COVER
THE ENTIRE WIDTH OF LID

A GAP OF 1MM MUST BE LEFT AT THE TOP
AND BOTTOM OF EACH OF THE VERTIAL
GASKET SPRIPS TO ALLOW VENTERLATION

CUT CONDUCTIVE GASKET TO DIMENSIONS SHOWN.

MATERIAL	FINISH	TOLERANCES
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED	GENERAL TOLERANCES UNLESS OTHERWISE STATED. LINEAR: 2 DEC PLC ±0.1mm, 1 DEC PLC ±0.25mm, NONE ±0.4mm, ANGULAR ±1/2°. HOLES: 00-8 +0.08 -0.0, 08-14 +0.1 -0.0

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
F	NOTE ON GASKET ADDED (P8)	WD	PC		27.06.08
E	SHEETS 1 & 5 UPISSUED	MR	NP	CP	04.09.07
D	SEE OTHER SHEETS	RB	MR	NP	23.02.07

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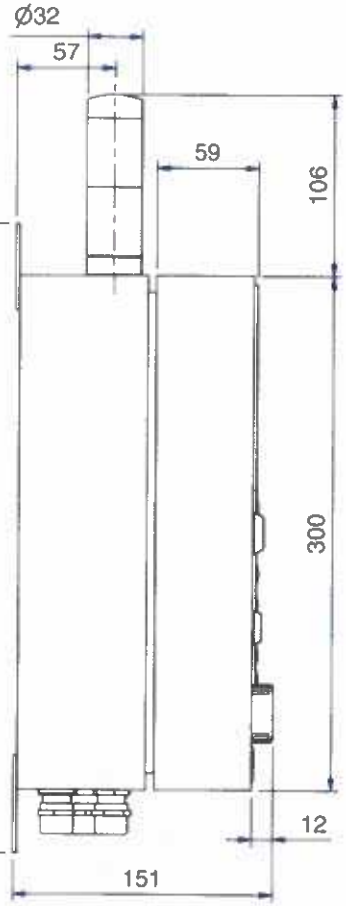
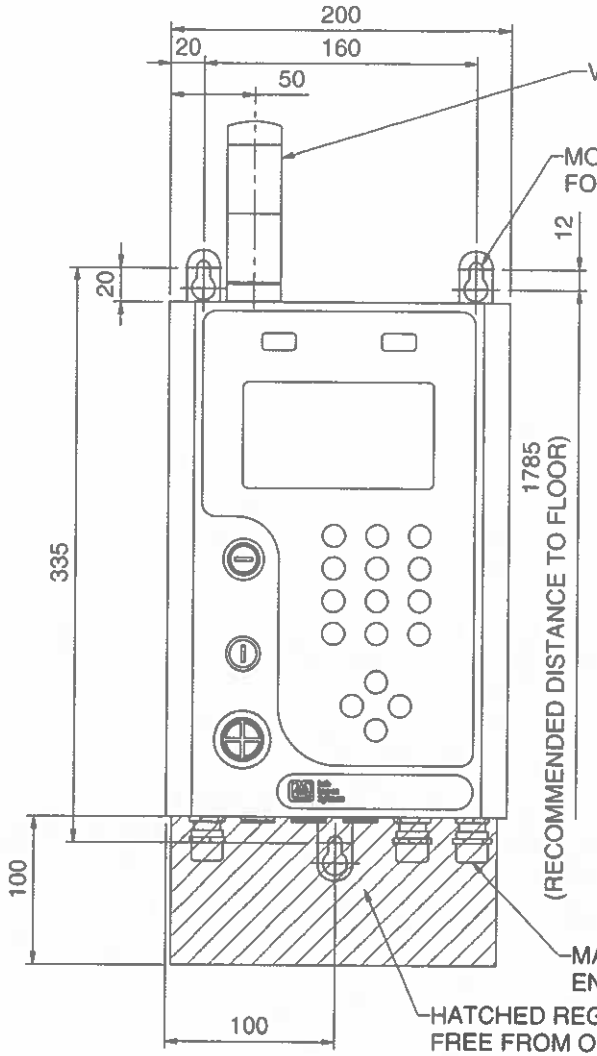
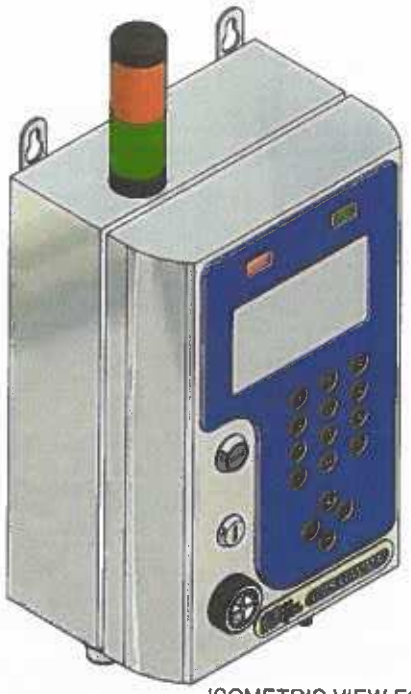
TITLE: CMS-2 MK II
GENERAL ASSEMBLY
CONDUCTIVE GASKET ASSEMBLY

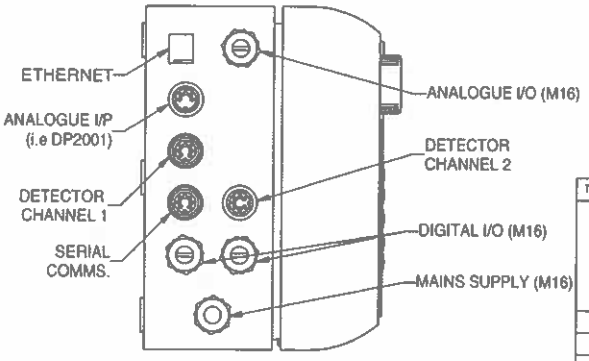
SCALE	ISSUE	DRAWN
NTS	F	N.P
DIMS. IN	DATE	CHECKED
mm	27.05.05	MSJ
DRG. NO.	SHEET	APPROVED
0300/002	8 OF 8	CP







ISOMETRIC VIEW FOR
REFERENCE ONLY



PACKAGING:
PACKAGE SIZE 480x250x210
100% RECYLABLE MATERIALS
GROSS WEIGHT = 5.4KG
NET WEIGHT = 4.9KG

STORAGE DETAILS:
UNITS ARE SHIPPED IN PACKAGING THAT IS SUITABLE FOR STORAGE PURPOSES.

PRESERVATION:
UNITS SHOULD BE STORED BETWEEN -20°C AND +50°C, IN A DRY ENVIRONMENT.
RELATIVE HUMIDITY MUST NOT EXCEED 95%

MATERIAL — ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING
FINISH — ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE, DEBURRED, FREE FROM SCRATCHES, AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED.
TOLERANCES GENERAL TOLERANCES UNLESS OTHERWISE STATED
LINEAR: 2 DEC PLC ±0.1mm; 1 DEC PLC ±0.25mm; NONE ±0.5mm
HOLES: Ø0-8 +0.05 -0.0; Ø8-14 +0.1 -0.0
ANGULAR: ±1°

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE
D	"DUAL" ADDED TO TITLE	N.P			11.09.07
C	PACKAGING & 'GAS' ADDED	AB	M.R	N.P	27.04.07
B	TITLE CHANGE TO 'CMS PET'	MR	NP	CP	2-9-02

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SCALE	ISSUE	DRAWN
NTS	D	N.P
DIMS. IN	DATE	CHECKED
mm	13.05.05	M.R

TITLE CMS-PET, CMS-GAS & CMS-DUAL SPACE EVELOPE & INSTALLATION DETAIL

DRG. NO.	SHEET	APPROVED
0300/902	1 OF 1	C.P

LIS244 Iss3 | 07.02.2005

12. System-specific Information

This section can be used to record system-specific information

13. Detector Details (MAN0038 Issue 2.0)

Lab Impex Systems

Detectors

Operation and Maintenance Manual

MAN0038

Issue 2.0

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Nuffield Industrial Estate
Poole, Dorset BH17 0GE

Detectors

Operation and Maintenance Manual

MAN0038

Issue 2.0

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LIS DOCUMENT CONTROL RECORD

TITLE: Detectors – Operation & Maintenance Manual

ISSUE: 2

Amendment No.	AMENDMENT RECORD AND DETAILS
0	Based on issue 1.9 with 1202 tube data amendment
1	
2	.
3	
4	
5	
6	
7	
8	
9	

Amendment		0	1	2	3	4
PREPARED	BY	MPW				
	DATE	19-12-07				
APPROVED	BY					
	DATE	19/12/07				
Amendment		**5**	**6**	**7**	**8**	**9**
PREPARED	BY					
	DATE					
APPROVED	BY					
	DATE					

CONTENTS

1. Scintillation Detectors

1.1. General

Lab Impex can supply a wide range of scintillation detectors to suit most requirements including:

- Thallium doped sodium iodide - NaI(Tl)
- Caesium iodide - CsI
- Silver-doped zinc sulphide - ZnS(Ag)
- Plastic scintillators

NaI(Tl)
Thallium doped Sodium Iodide is the most popular scintillator for radiometrics. It provides the highest efficiency in terms of light output and it has a relatively high radiation stopping power. Light emission wavelength is suited to most PM tubes.

CsI
Caesium Iodide based scintillators find limited application, as they are not as efficient as NaI (Tl). However, they are more robust and are not hygroscopic. Possessing a higher density and hence better stopping power than NaI, CsI scintillators suffer from a lower efficiency and are slightly more temperature sensitive.

ZnS(Ag)
Silver activated Zinc Sulphide is one of the older inorganic scintillators. It has high scintillation efficiency compared to NaI, but it is only available as a polycrystalline powder. As a result, its use is limited to thin screens (<25µg/cm^2) used primarily for detection of alpha particles or other heavy ions.

Plastic Scintillators
These comprise a solid solution of organic scintillating molecules in a polymerised solvent. These are easily shaped and fabricated into rods, cylinders, or flat sheets. Plastic scintillators are characterised by a relatively large light output, and a short decay time in the order of nano seconds. Because the density and atomic number are rather low, such scintillators are best suited for the detection of beta emissions.

NOTE:

Due to the wide variations possible with scintillation detectors specific detector information is supplied, as applicable to the application.

2. GM Tubes

2.1. General

The Lab Impex energy-compensated halogen-quenched detectors cover a wide range of dose rates making them suitable for many applications.

There are two different families of detector:
GM-1: Compact design with PET 100 connector for use with UDI-1 interface unit.
GDI: Self-contained unit including high voltage supply, pulse amplifier and driver.

2.2. Detector Ranges

GDI No.	GM-1 No.	Absorbed Dose/ Dose Equivalent	Dose Rate Range
GDI/1301	GM-1/301	Grays	0.1 mGy/h – 10 Gy/h
GDI/1304	GM-1/304	Sieverts	0.1 mSv/h – 10 Sv/h
GDI/1313	GM-1/313	Grays	10 µGy/h – 3 Gy/h
GDI/1314	GM-1/314	Sieverts	10 µSv/h – 3 Sv/h
GDI/1321	GM-1/321	Grays	0.1 µGy/h – 0.1 Gy/h
GDI/1324	GM-1/324	Sieverts	0.1 µSv/h – 0.1 Sv/h
GDI/1201	GM-1/201	Grays	0.1 µGy/h – 40 mGy/h
GDI/1202	GM-1/202	Sieverts	0.1 µSv/h – 40 mSv/h
GDI/1221/01	GM-1/221/01	Grays	<0.1 µGy/h – 1 mGy/h

2.3. GM-1 Detectors with UDI-1 Interface

2.3.1. UDI Links

For all GM detectors, the links are set as follows:

Link 1 = Normal (1-2)
Link 3 = Discriminator (2-3)
Link 4 = Unimportant

2.3.2. Recommended UDI settings

The following settings have been found to provide the optimum results.

GM-1 Type	HV (VR1)	L Level (VR3)*	U Level (VR2)*	Gain
GM-1/301	550	100 mV	Max	2
GM-1/304	550	100 mV	Max	2
GM-1/313	575	100 mV	Max	2
GM-1/314	575	100 mV	Max	2
GM-1/321	575	100 mV	Max	2
GM-1/324	575	100 mV	Max	2
GM-1/201	500	100 mV	Max	2
GM-1/202	500	100 mV	Max	2
GM-1/221/01	450	100 mV	Max	3

* Threshold adjustment. To accurately set the threshold measure with a DVM across the comparator inputs – i.e. between TP5 and the wiper of the pot. This should be done with the detector disconnected and link 1 (test signal) in the normal (1-2) position – otherwise the pulses may affect the reading. Refer to the UDI-1 manual for more details.

2.4. GDI Detectors with Integrated Electronics

No customer adjustments are required - all settings are made at the factory.

2.5. Typical CMS Set up Parameters – GDI and GM-1/UDI

Detector Type		Approximate Calibration (Conversion) Factor	Over-range CPS	Approximate Dead Time		Detector Fail
GDI	GM-1			Seconds (CMS-1)	µseconds (CMS 2)	CPS
GDI/1301	GM-1/301	29.0	312,500	0.000017	17	0.0001
GDI/1304	GM-1/304	32.0	312,500	0.000017	17	0.0001
GDI/1313	GM-1/313	6.7	500,000	0.000019	19	0.0001
GDI/1314	GM-1/314	7.5	500,000	0.000019	19	0.0001
GDI/1321	GM-1/321	1.2	100,000	0.00002	20	0.001
GDI/1324	GM-1/324	1.3	100,000	0.00002	20	0.001
GDI/1201	GM-1/201	0.56	63,000	0.000029	29	0.01
GDI/1202	GM-1/202	0.56	63,000	0.000029	29	0.01
GDI/1221/01	**GM-1/221/01**	0.08	20,000	0.000066	66	0.01

Notes:

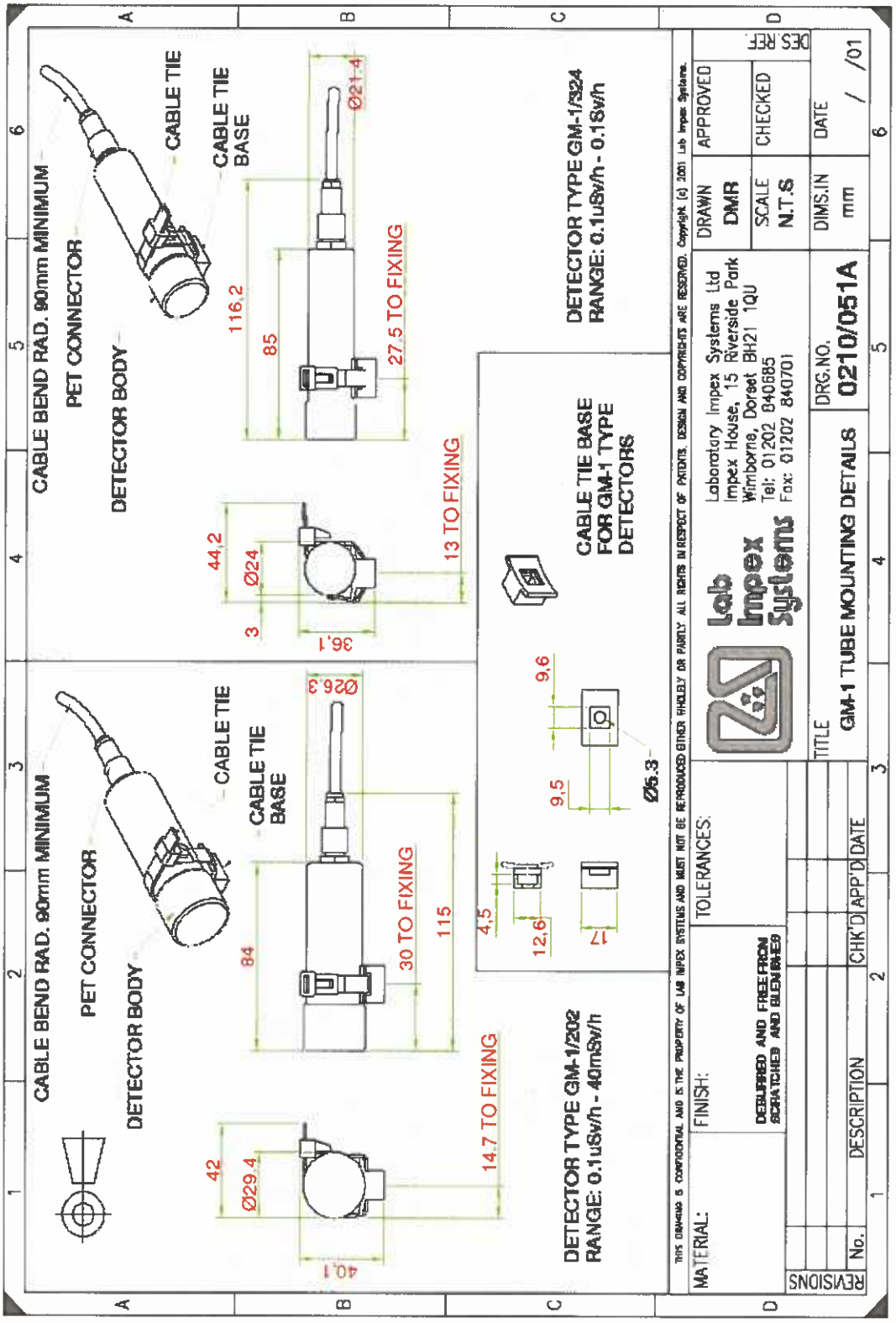
Calibration / conversion Factor and Dead Time values may be modified to optimise the accuracy of a particular detector at low and high count rates respectively.

Calibration / conversion Factors are in µSv/h per CPS or µG/h per CPS as appropriate (see 2.2). If other units are selected the factor must be changed accordingly, e.g.

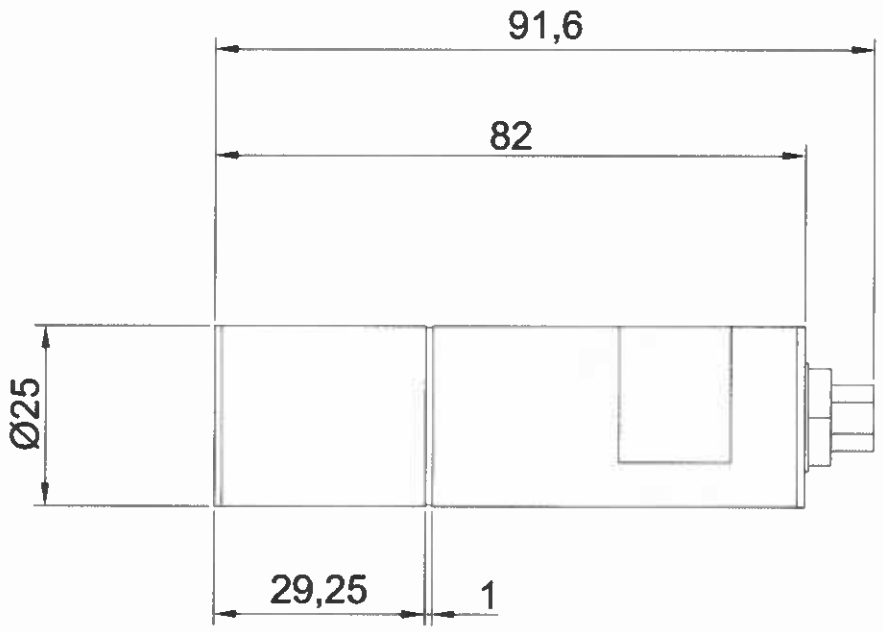
Lower detector fail times are possible especially at high background levels but if set too low occasional false Fails may occur.

CMS 2 is the generic name for the current CMS with graphical display. CMS-1 is the model with 2-row alpha-numeric display.

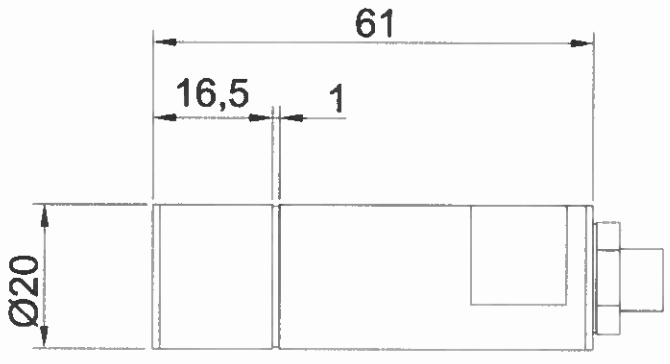
3. GM Detector Mounting Details



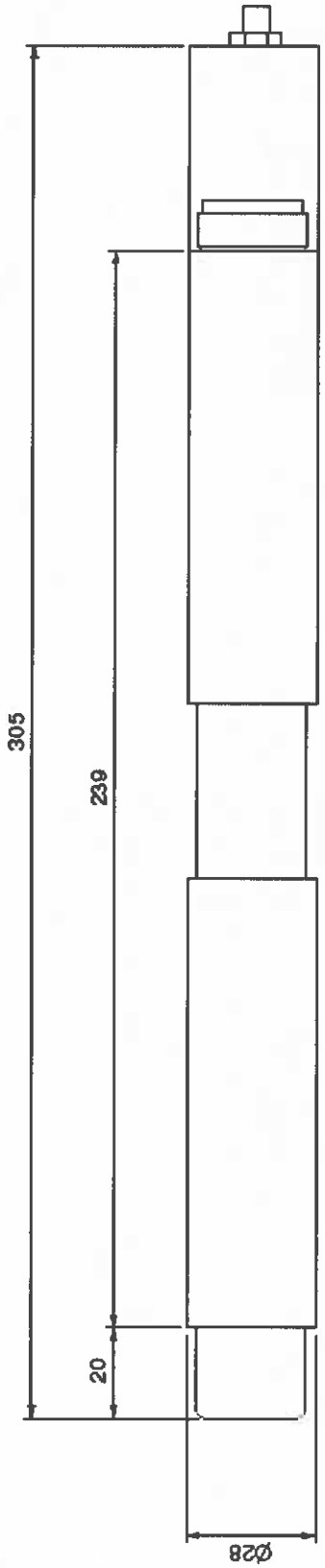
3.1. GM-1/301, 304, 321, 324, 201 & 202



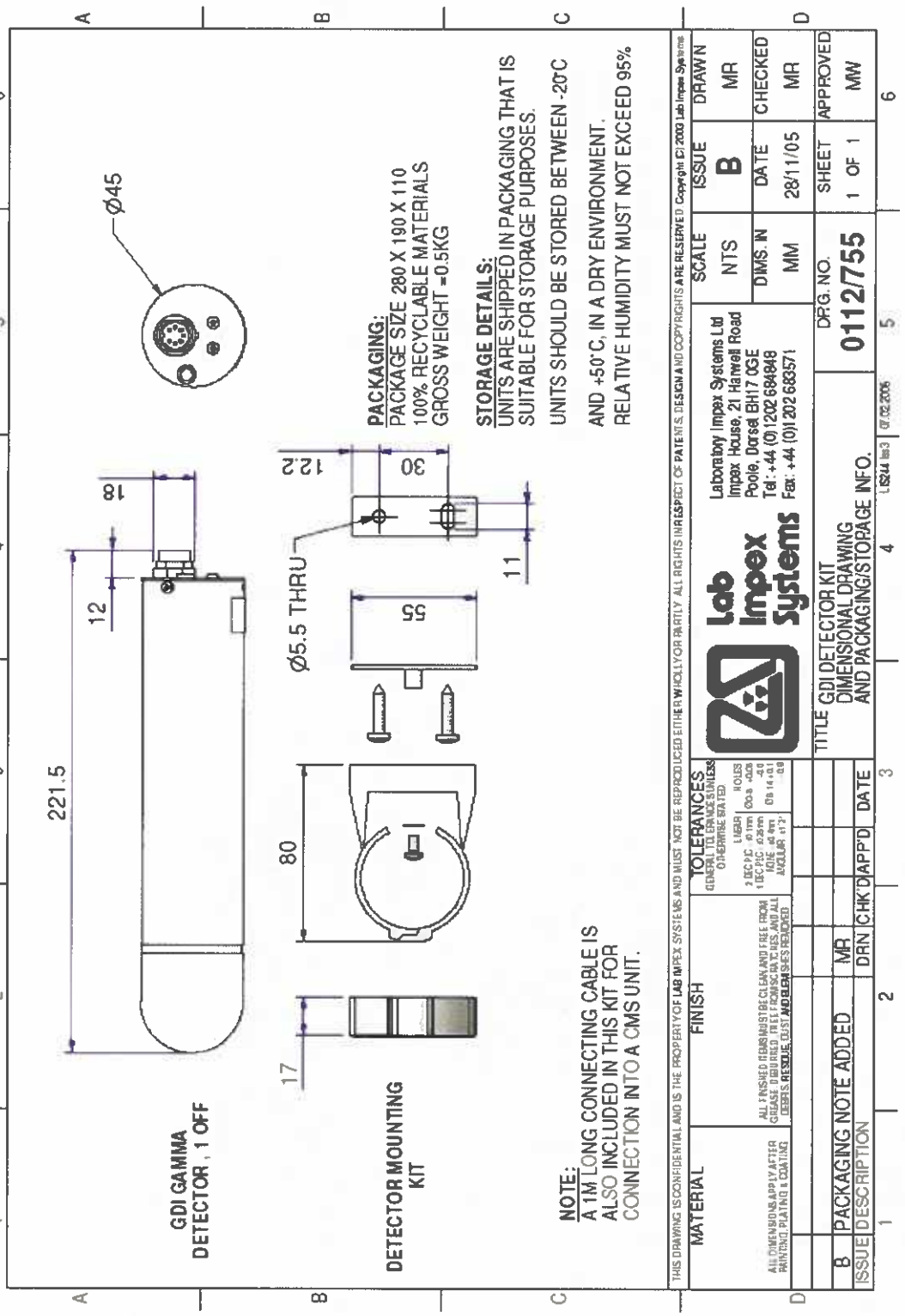
3.2. GM-1/313 & 314



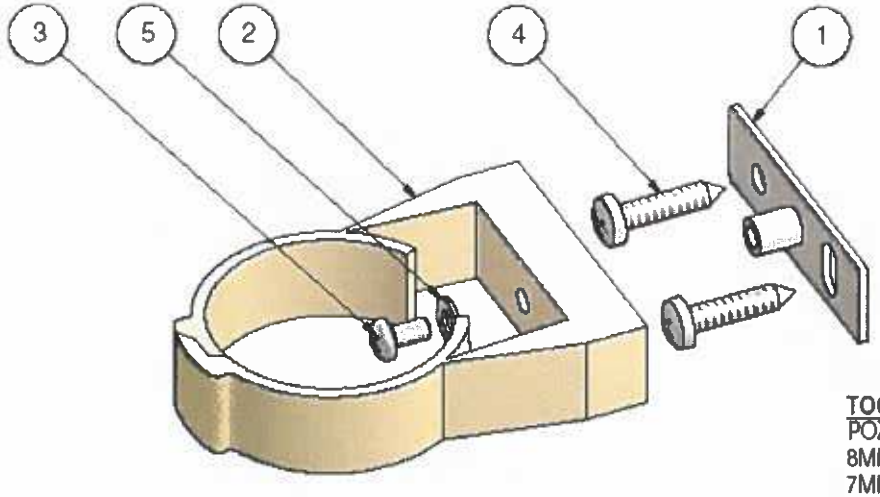
3.3. GM-1/2201



4. GDI Mounting Details



ALL ITEMS ARE SUPPLIED LOOSE IN BAG , FOR ON-SITE ASSEMBLY



TOOLS REQUIRED:
POZI-DRIVE SCREWDRIVER
8MM CARBIDE TIPPED MASONARY DRILL
7MM DRILL BIT (SUITABLE FOR PLASTERBOARD)
DRILL
SAFETY GOGGLES

INSTALLATION PROCEDURE.
1. FIX THE BRACKET TO THE WALL, USING THE SLOTTED HOLE TO ENSURE IT LIES STRAIGHT.
2. RAWLPLUGS FOR EITHER PLASTERBOARD OR MASONARY ARE SUPPLIED, ENSURE TO USE THE CORRECT TYPE.
3. WITH THE BRACKET SECURELY FIXED, THE TUBE CLAMP SCREWS INTO PLACE USING ITEM 3

MATERIAL	FINISH	TOLERANCES
N/A	N/A	GENERAL TOLERANCES UNLESS OTHERWISE STATED. LINEAR: 2 DEC PLC - ±0.1mm, 1 DEC PLC - ±0.25mm, NONE - ±0.4mm, ANGULAR - ±1/2°. HOLES: Ø0-6 +0.05 -0.0, Ø6-14 +0.1 -0.0
ALL DIMENSIONS APPLY AFTER PAINTING, PLATING & COATING	ALL FINISHED ITEMS MUST BE CLEAN AND FREE FROM GREASE. DEBURRED, FREE FROM SCRATCHES AND ALL DEBRIS, RESIDUE, DUST AND BLEMISHES REMOVED.	

ISSUE	DESCRIPTION	DRN	CHK'D	APP'D	DATE

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SCALE	ISSUE	DRAWN
NTS	A	MR
DIMS. IN	DATE	CHECKED
mm	03/11/05	

TITLE: GDI FIXING KIT ASSY

DRG. NO. 0112/761

SHEET 1 OF 1

APPROVED

LIS244 Iss3 07.02.2005

4.1. GM Tube Technical Data

4.1.1. GDI/1301 & GM-1/301

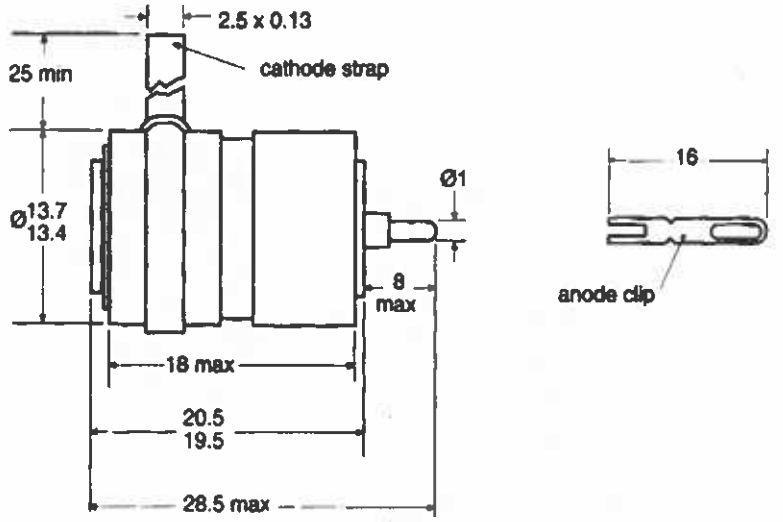
Halogen-quenched γ radiation counter tube fitted in a filter. The energy response is flat to within ±15% over the range 80 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1301 is an energy compensated version of the ZP1300. The ZP1302 incorporates a long life artificial background source.

QUICK REFERENCE DATA		
Dose rate range	10^{1} to 1 x 10^{4} 10^{-6} to 1 x 10^{3}	mGy/h R/h
Plateau threshold voltage	500	V
Plateau length	100	V
Recommended supply voltage	550	V
Chrome iron cathode	80 to 100	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



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Note: cathode strap should be connected to the tube as shown

CATHODE (ZP1300)		
Thickness	80 to 100	mg/cm²
Sensitive length	7	mm
Material	chrome iron	
ENVIRONMENTAL (Manufacturer's test conditions)		
Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²
FILLING	helium, neon, halogen	
CAPACITANCE		
Anode to cathode	1.0	pF
TUBE WEIGHT	20	g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)
Measured in circuit of Figure 2.

Starting voltage		max	400	V
Plateau threshold voltage		max	500	V
Plateau length			100	V
Recommended supply voltage			550	V
Plateau slope		max	0.3	%/V
Background (shielded with 50mm Pb with	ZP1301:	max	1	count/min
an inner liner of 3 mm Al) at 550 V	ZP1302:	max	12 to 120	count/min
Dead time at 550 V		max	13	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.2	MΩ
Anode voltage	max	600	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at = 25 °C	5×10^{10}	count

MEASURING CIRCUIT
R_1 = 2.2 MΩ
R_2 = 47 kΩ
C_1 = 1 pF*

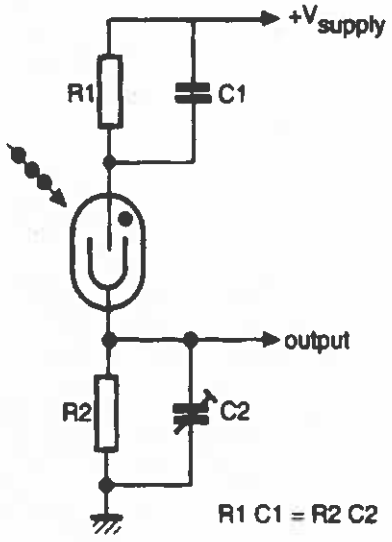
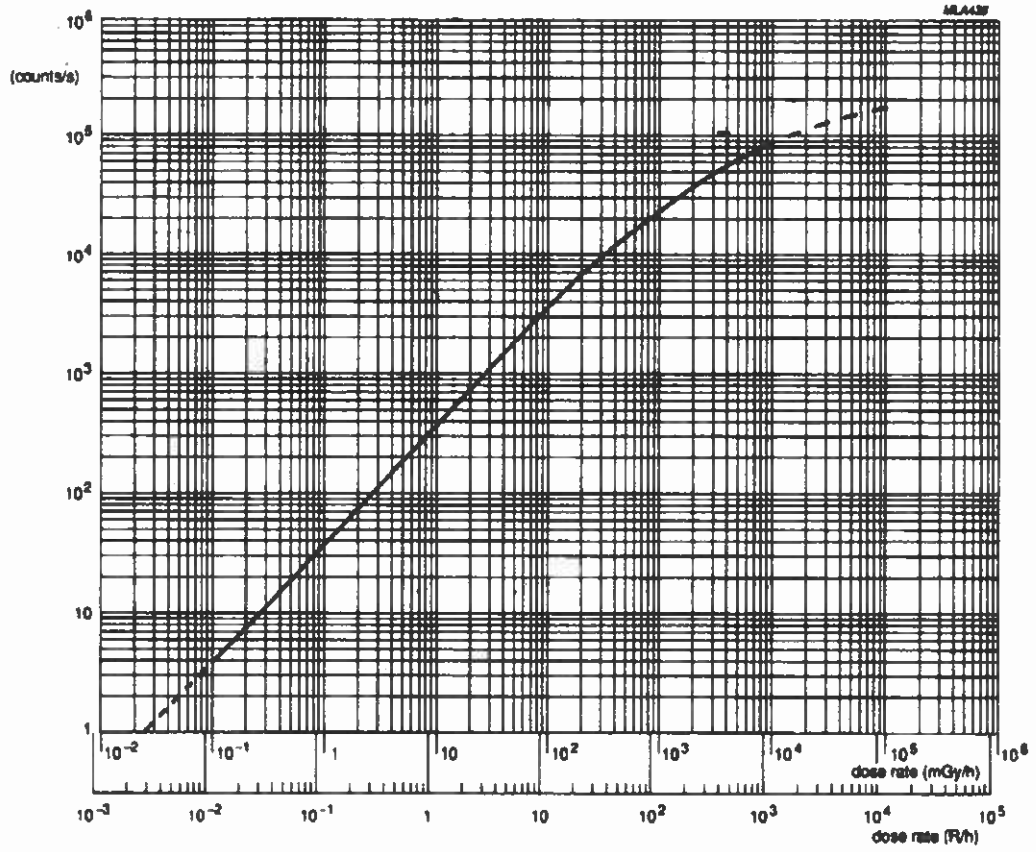
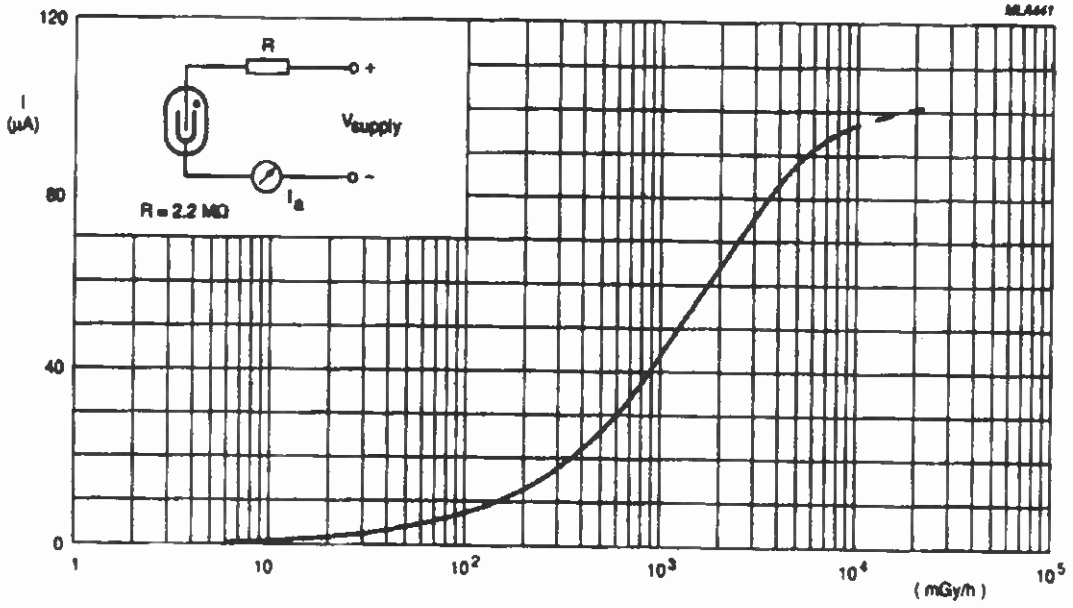


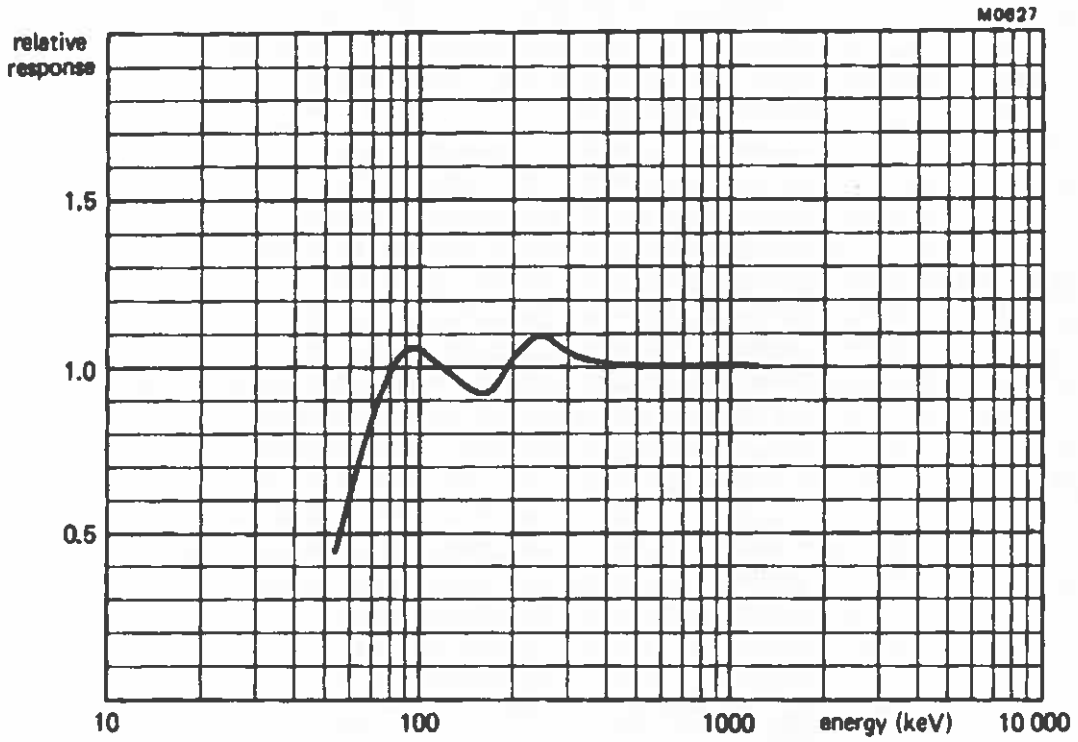
Figure 2



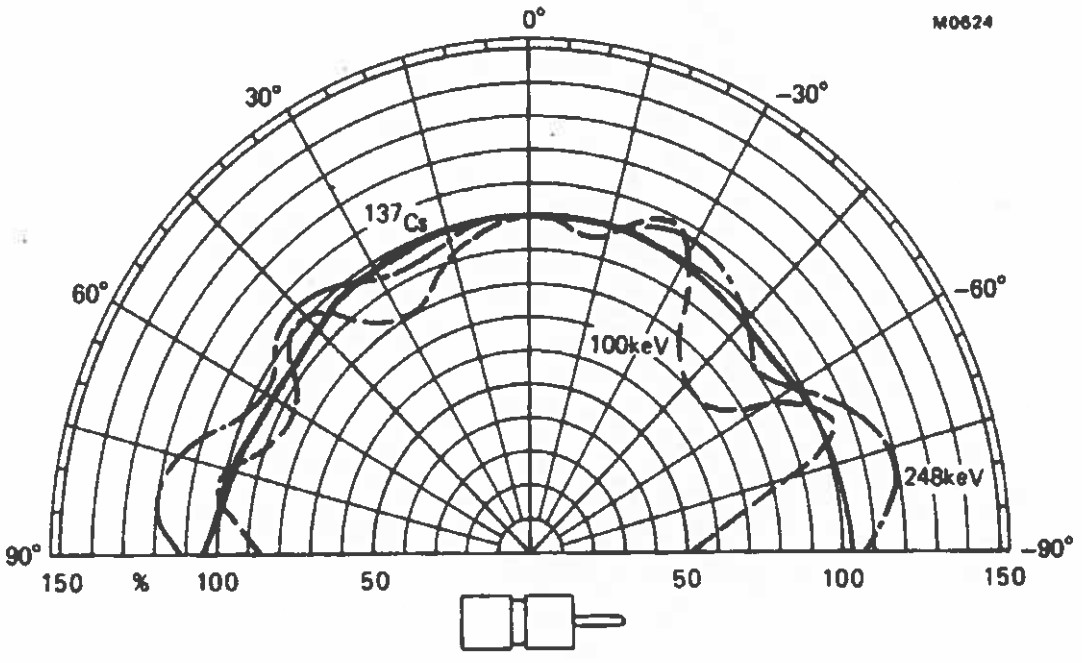
Typical counting rate as a function of dose rate (^{137}Cs)



Typical current as a function of dose rate (^{137}Cs)



Typical energy response relative to ^{137}Cs



Typical polar responses (normalised to 100% at 0°)

4.1.2. GDI/1304 & GM-1/304

GEIGER MÜLLER TUBE

Halogen-quenched γ radiation counter tube fitted in a filter. The ambient dose equivalent energy response is flat to within ±15% over the range 80 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1304 is an energy compensated version of the ZP1300.

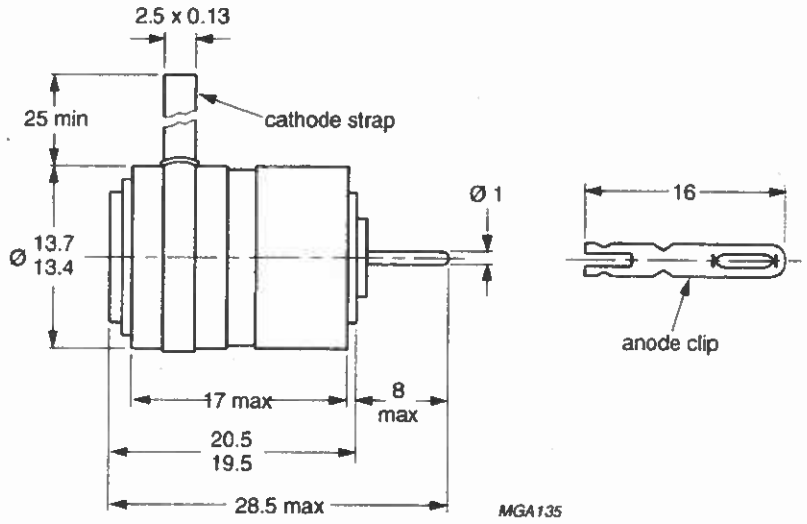
QUICK REFERENCE DATA

Dose rate range	10^2 to 1 x 10^7	µSv/h
Plateau threshold voltage	500	V
Plateau length	100	V
Recommended supply voltage	550	V
Chrome iron cathode	80 to 100	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



Note: cathode strap should be connected to the tube as shown

CATHODE (ZP1300)

Thickness	80 to 100	mg/cm²
Sensitive length	7	mm
Material	chrome iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²

FILLING helium, neon, halogen

CAPACITANCE

Anode to cathode	1.0	pF

TUBE WEIGHT 20 g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)
Measured in circuit of Figure 2.

Starting voltage	max	400	V
Plateau threshold voltage	max	500	V
Plateau length		100	V
Recommended supply voltage		550	V
Plateau slope	max	0.3	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al) at 550 V	max	1	count/mi
Dead time at 550 V	max	13	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.2	MΩ
Anode voltage	max	600	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at ≈25 °C	5×10^{10}	count

MEASURING CIRCUIT

R_1 = 2.2 MΩ
R_2 = 47 kΩ
C_1 = 1 pF*

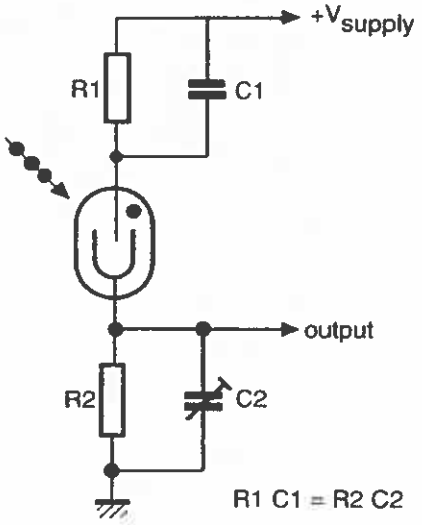
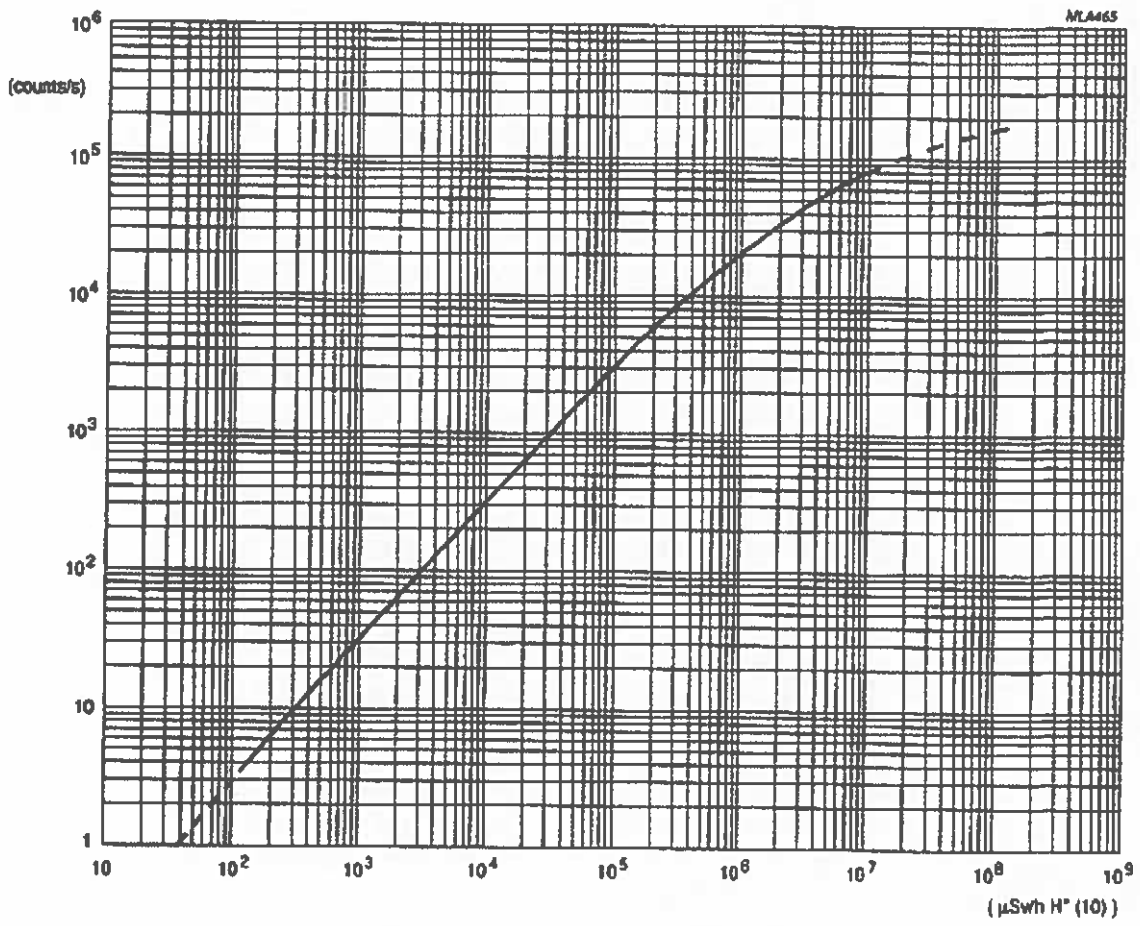
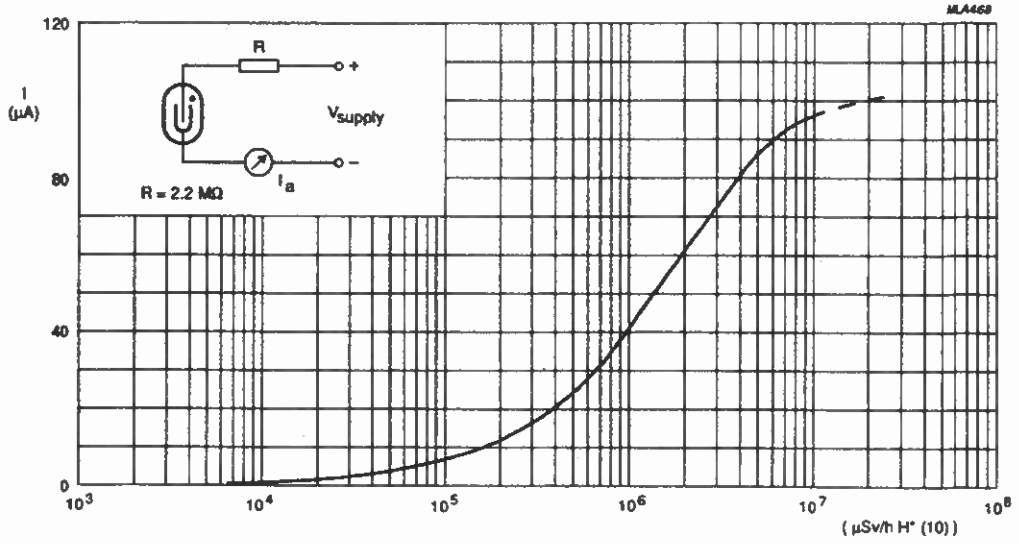


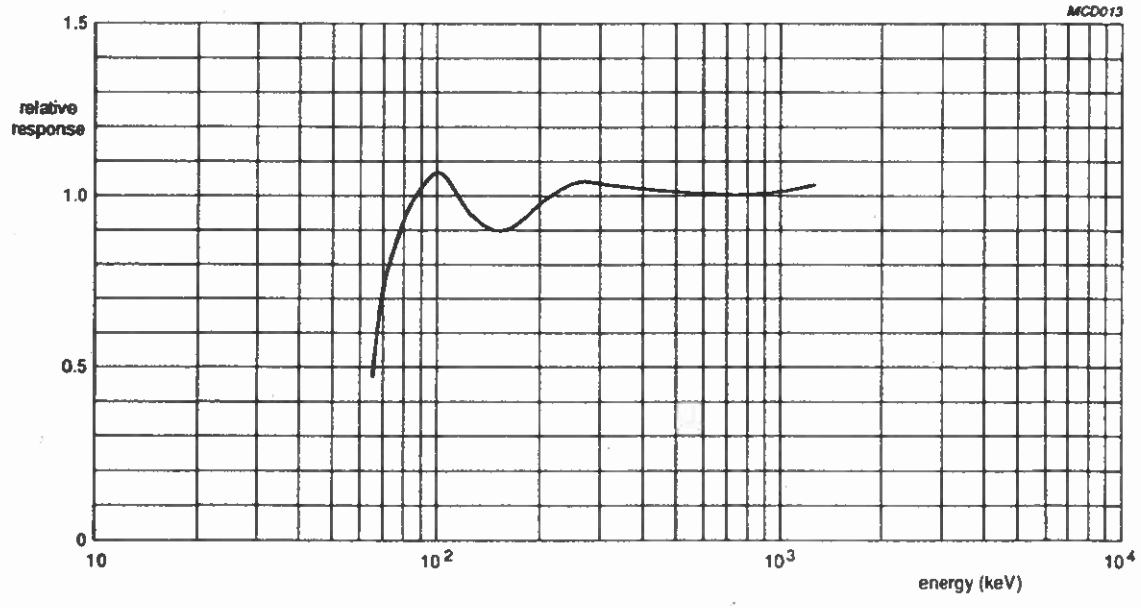
Figure 2



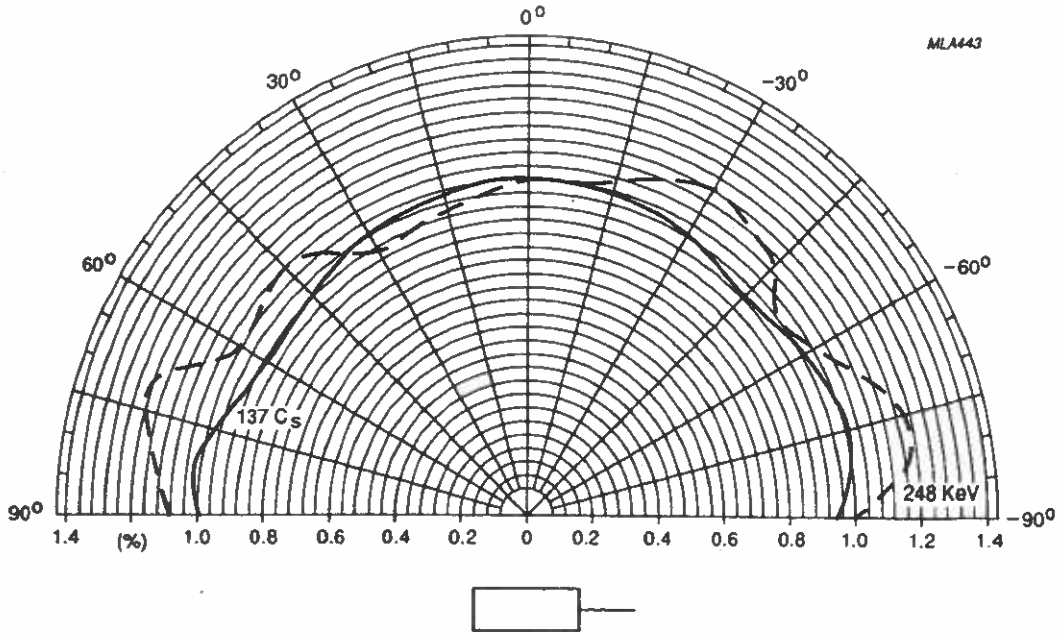
Typical counting rate as a function of dose rate (^{137}Cs)

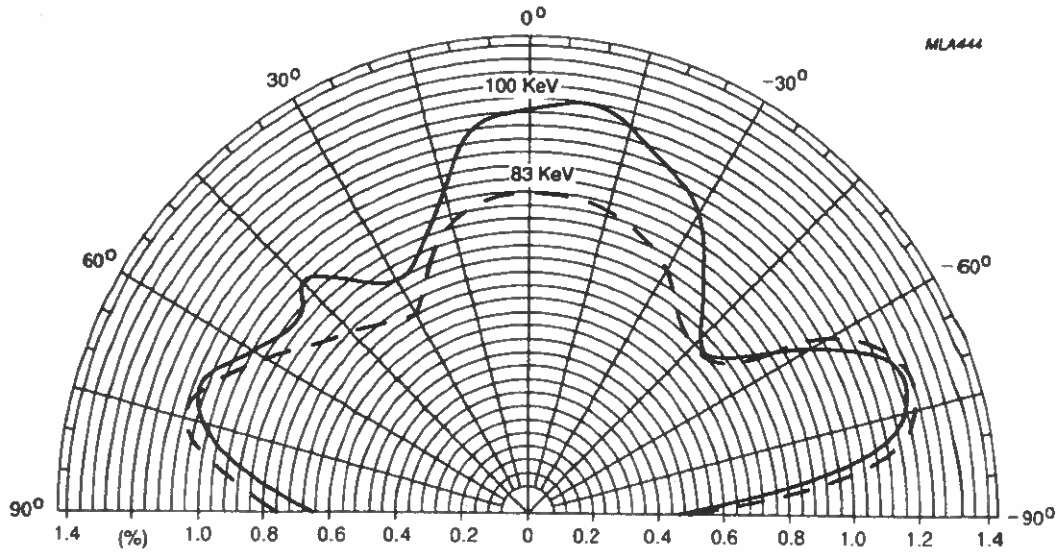


Typical current as a function of dose rate (^{137}Cs).



Typical ambient dose equivalent energy response relative to ^{137}Cs.





Typical polar responses (normalised to 100% of 0°)

4.1.3. GDI/1313 & GM-1/313

Halogen quenched γ radiation counter tube fitted in a filter. The energy response is flat to within ± 15% over the range 50 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1313 is an energy compensated version of the ZP1310.

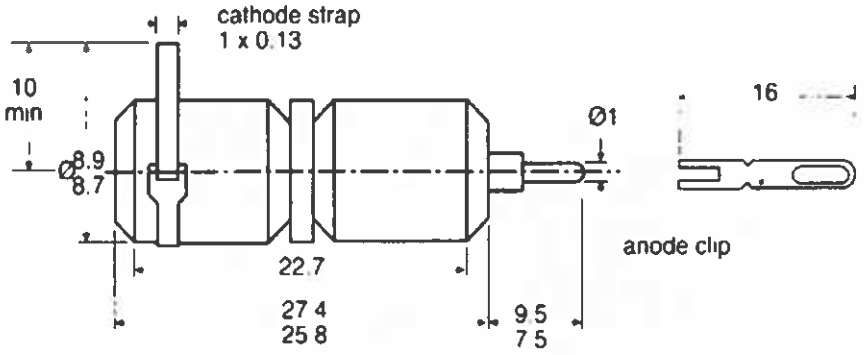
QUICK REFERENCE DATA

Dose rate range	10^{-2} to 3 x 10^{1}	mGy/h
	10^{3} to 4x 10^{2}	R/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome iron cathode	80 to 100	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



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Note: cathode strap should be connected to the tube as shown

CATHODE (ZP1310)

Thickness	80 to 100	mg/cm²
Sensitive length	16	mm
Material	chrome iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²

FILLING helium, neon, halogen

CAPACITANCE

Anode to cathode	2.0	pF

TUBE WEIGHT 7.0 g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)
Measured in circuit of Figure 2

Starting voltage	max	380	V
Plateau threshold voltage	max	500	V
Plateau length		150	V
Recommended supply voltage		575	V
Plateau slope	max	0.15	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max	2	count/min
Dead time, at recommended supply voltage	max	15	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.2	MΩ
Anode voltage	max	650	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at = 25 °C	5×10^{10}	count

MEASURING CIRCUIT

R_1 = 2.2 MΩ
R_2 = 47 kΩ
C_1 = 1 pF*

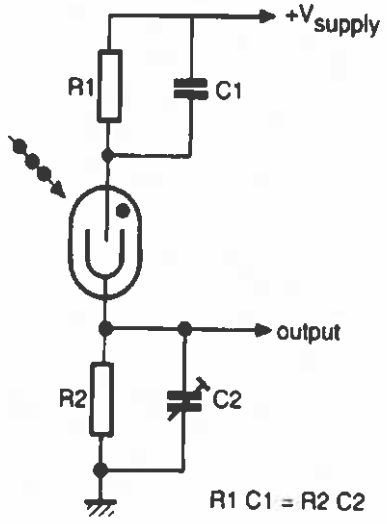

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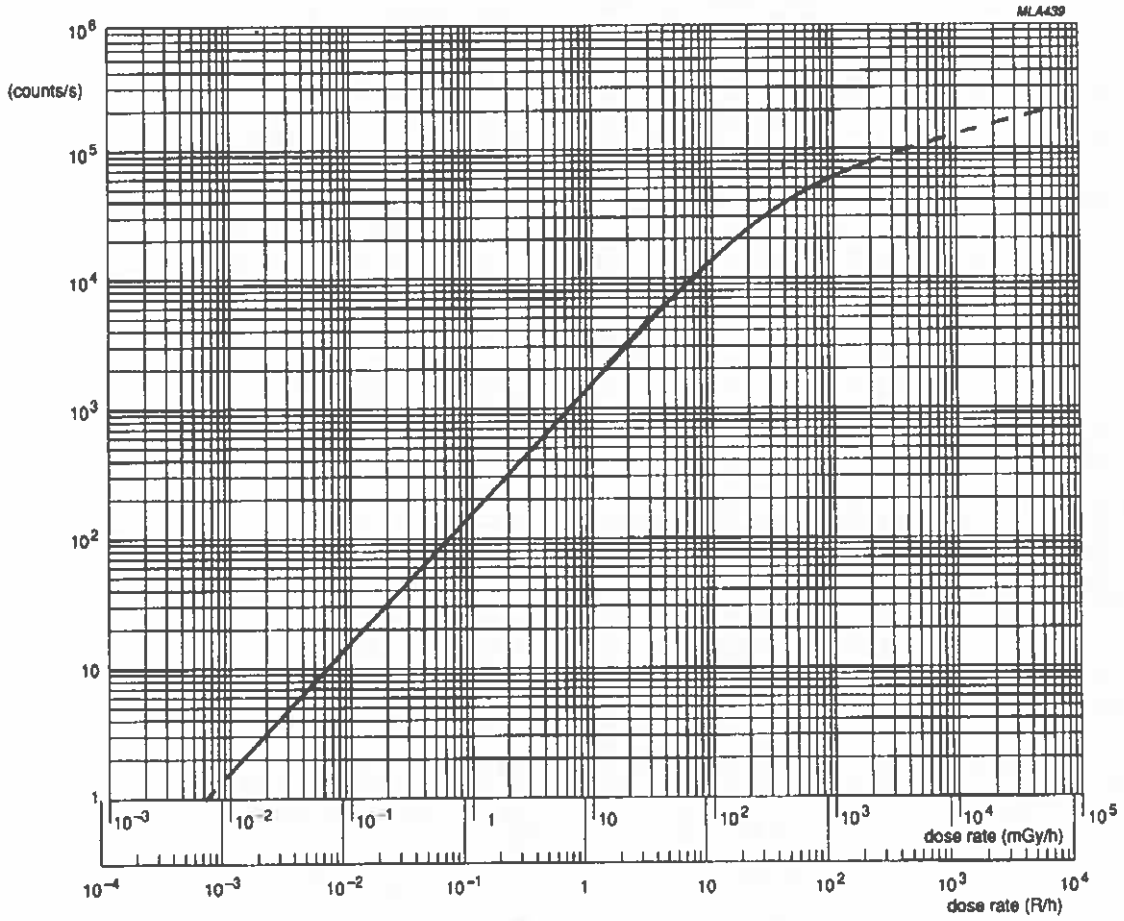
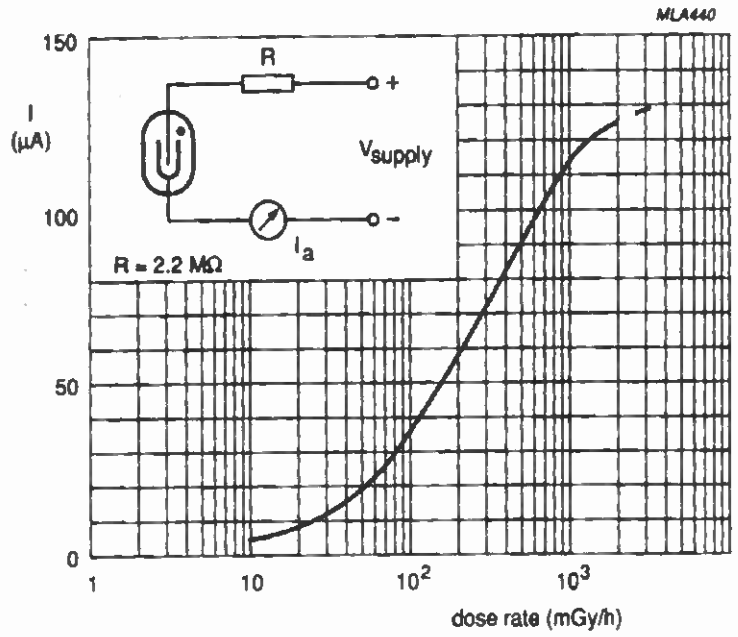
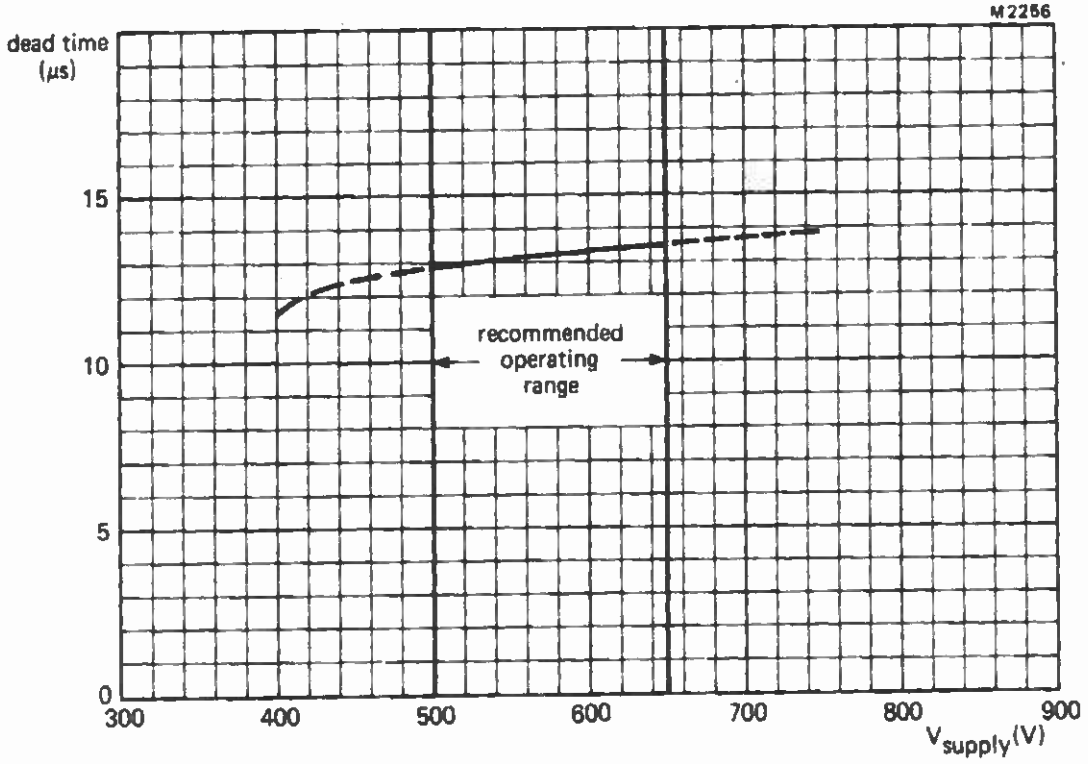
Figure 2



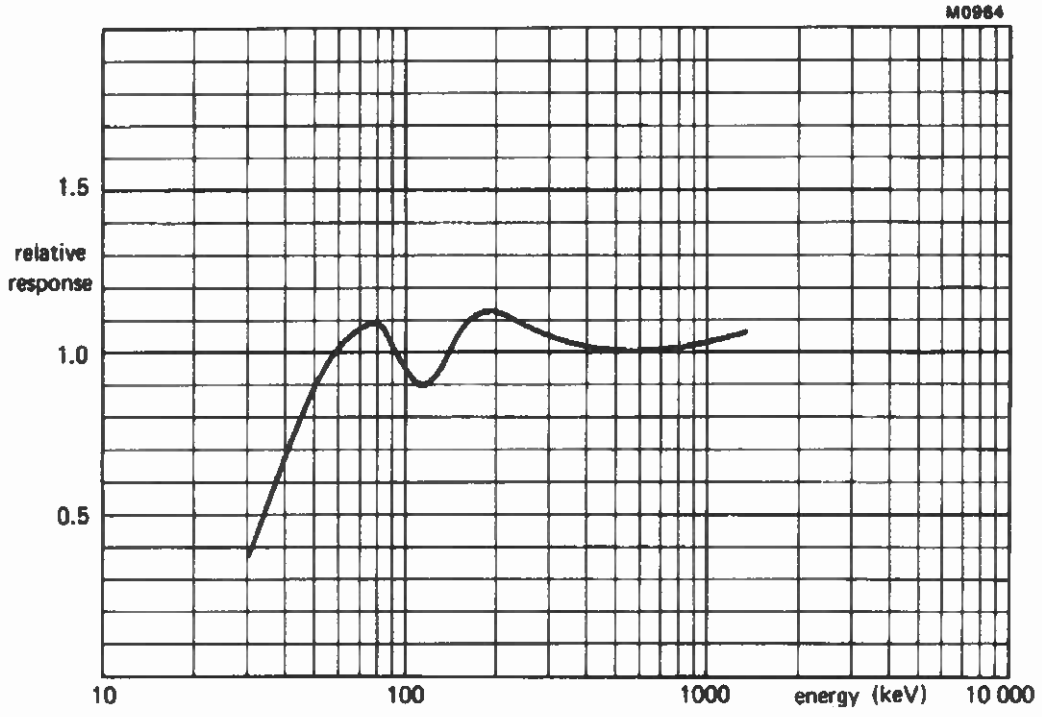
Typical counting rate as a function of dose rate (^{137}Cs)



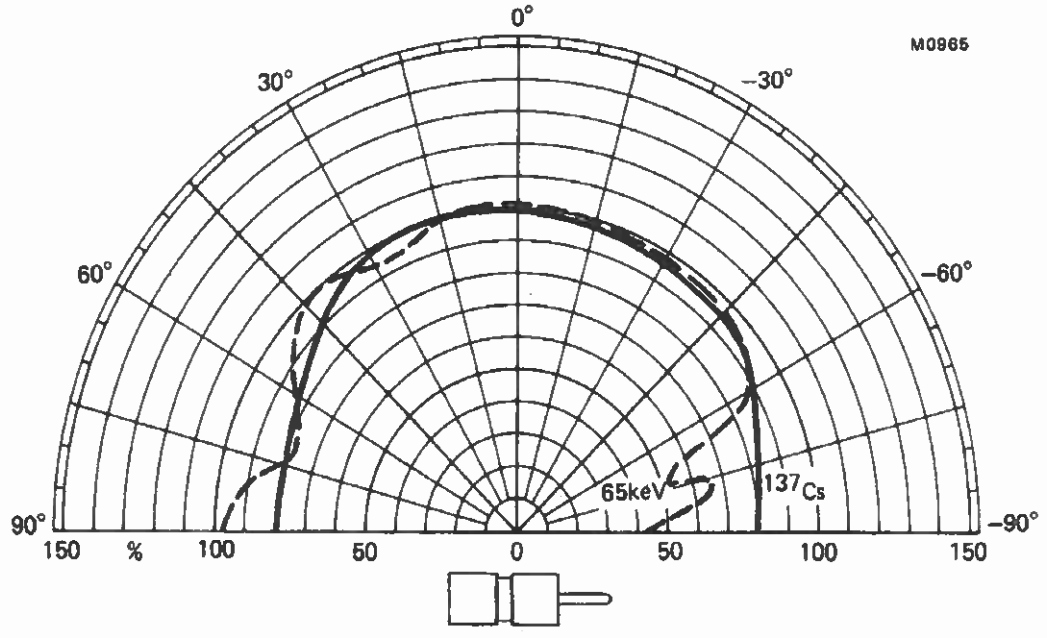
Typical current as a function of dose rate (^{137}Cs)



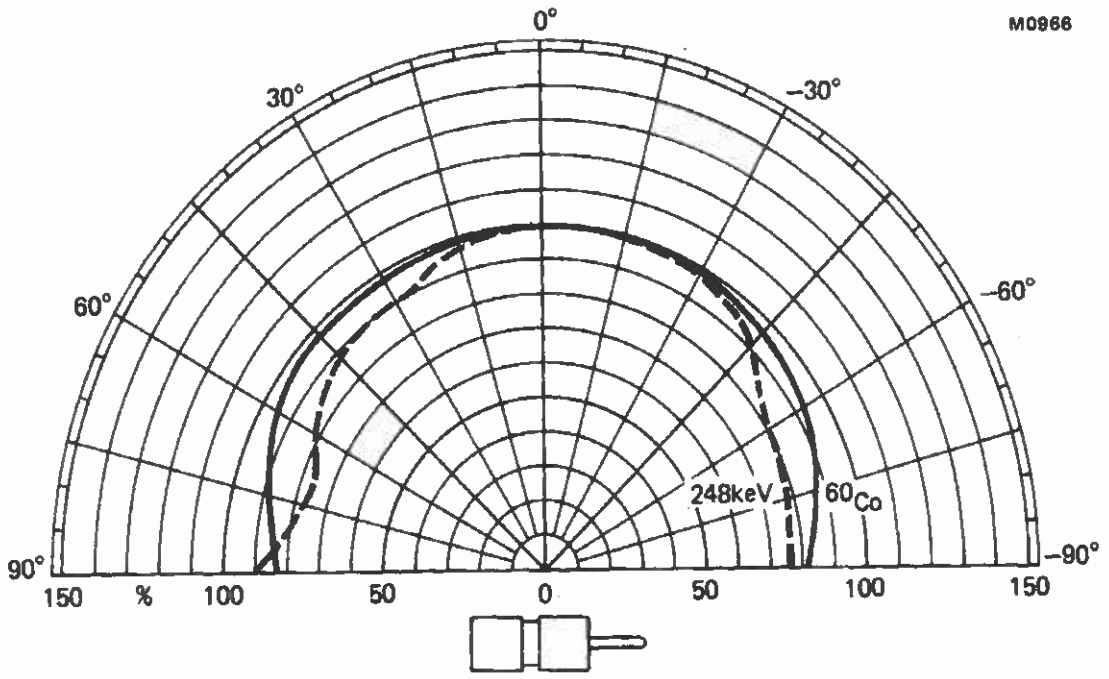
Typical dead time as a function of supply voltage



Typical energy response (side response) relative to ^{137}Cs



Typical polar responses (normalised to 100% at 0°)



Typical polar responses (normalised to 100% at 0°)

4.1.4. GDI/1314 & GM-1/314

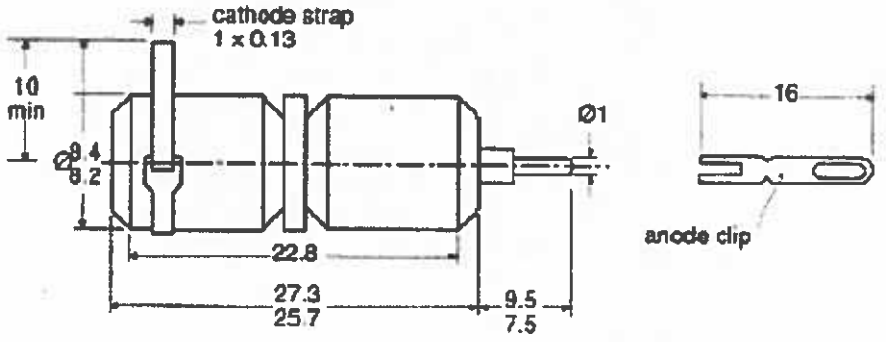
Halogen-quenched γ radiation counter tube fitted in a filter. The ambient dose equivalent energy response is flat to within ±15% over the range 50 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1314 is an energy compensated version of the ZP1310.

QUICK REFERENCE DATA		
Dose rate range	10 to 3 x 10^6	µSv/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome iron cathode	80 to 100	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



Note: cathode strap should be connected to the tube as shown

CATHODE (ZP1310)		
Thickness	80 to 100	mg/cm²
Sensitive length	16	mm
Material	chrome iron	
ENVIRONMENTAL (Manufacturer's test conditions)		
Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²
FILLING	helium, neon, halogen	
CAPACITANCE		
Anode to cathode	2.0	pF
TUBE WEIGHT	6.0	g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)

Measured in circuit of Figure 2.

Starting voltage	max	380	V
Plateau threshold voltage	max	500	V
Plateau length		150	V
Recommended supply voltage		575	V
Plateau slope	max	0.15	%/V
Background shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max	2	count/min
Dead time, at recommended supply voltage	max	15	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.2	MΩ
Anode voltage	max	650	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at = 25 °C	5×10^{10}	count

MEASURING CIRCUIT

R_1 = 2.2 MΩ

R_2 = 47 kΩ

C_1 = 1 pF*

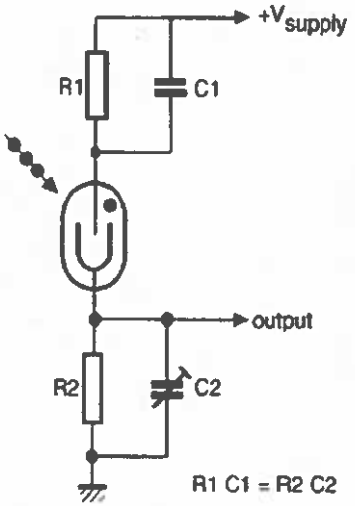
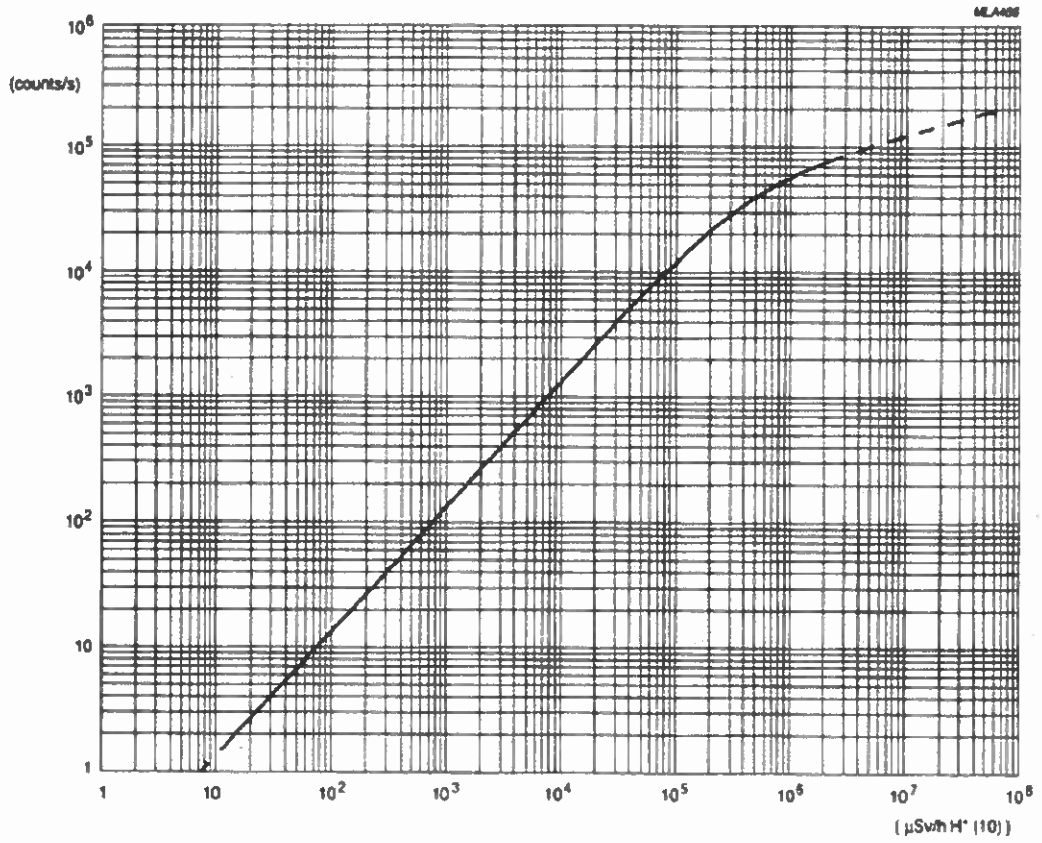
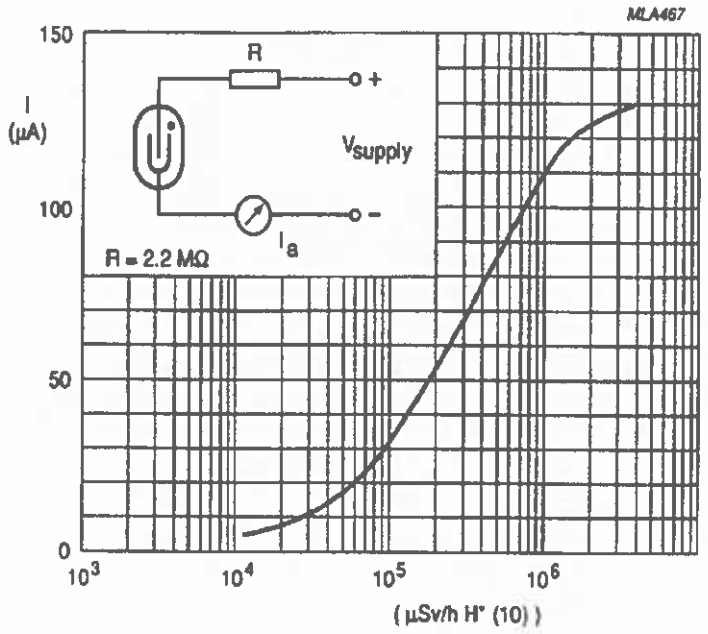


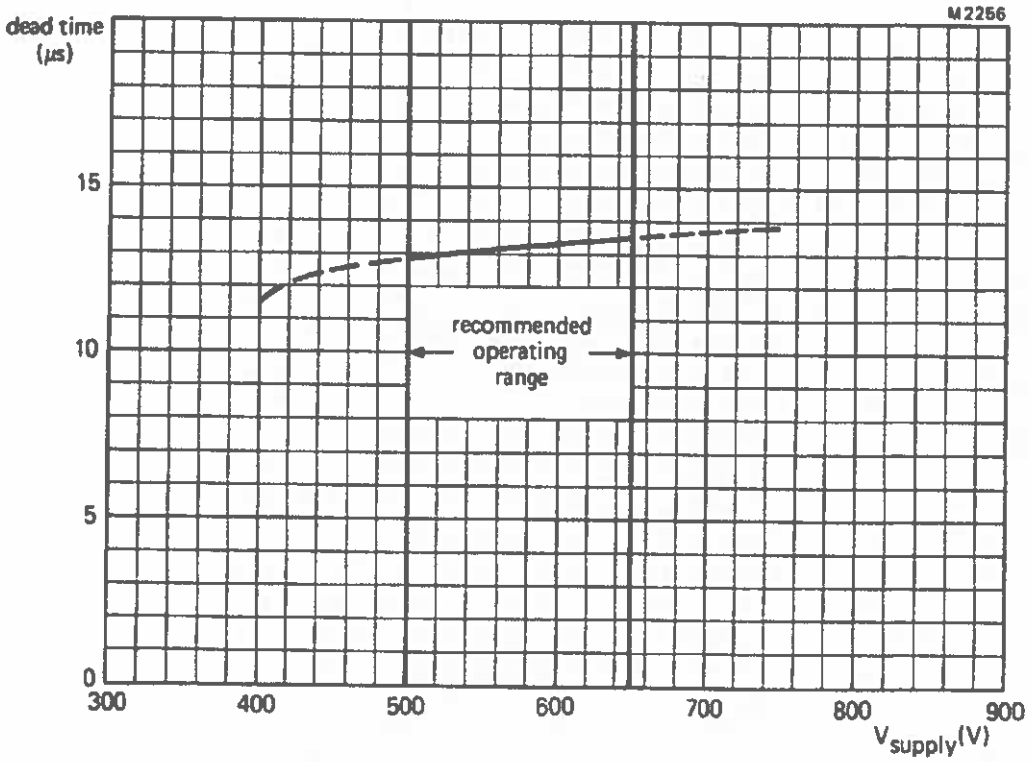
Figure 2



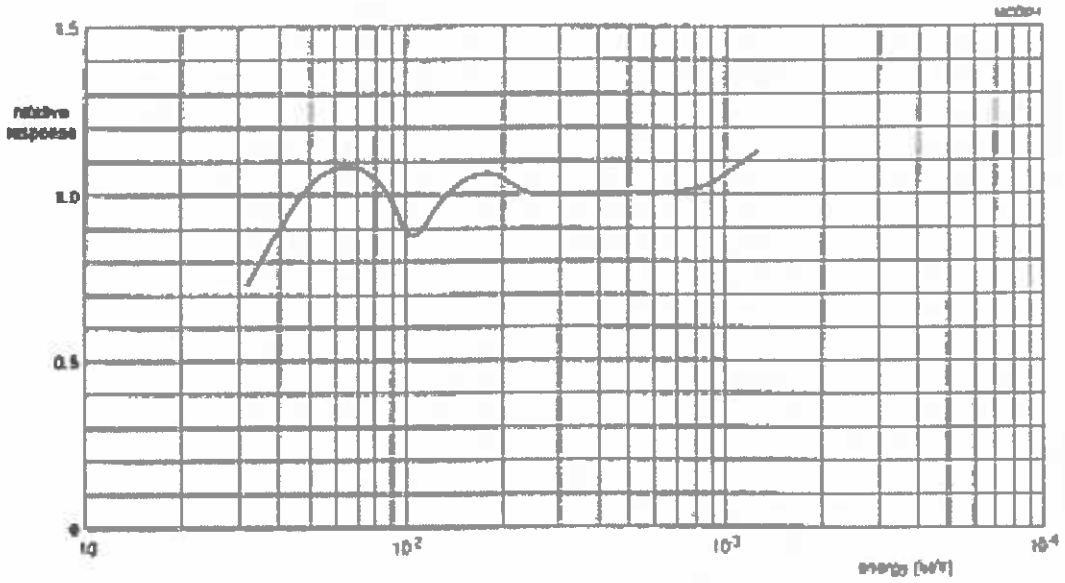
Typical counting rate as a function of dose rate (^{137}Cs).



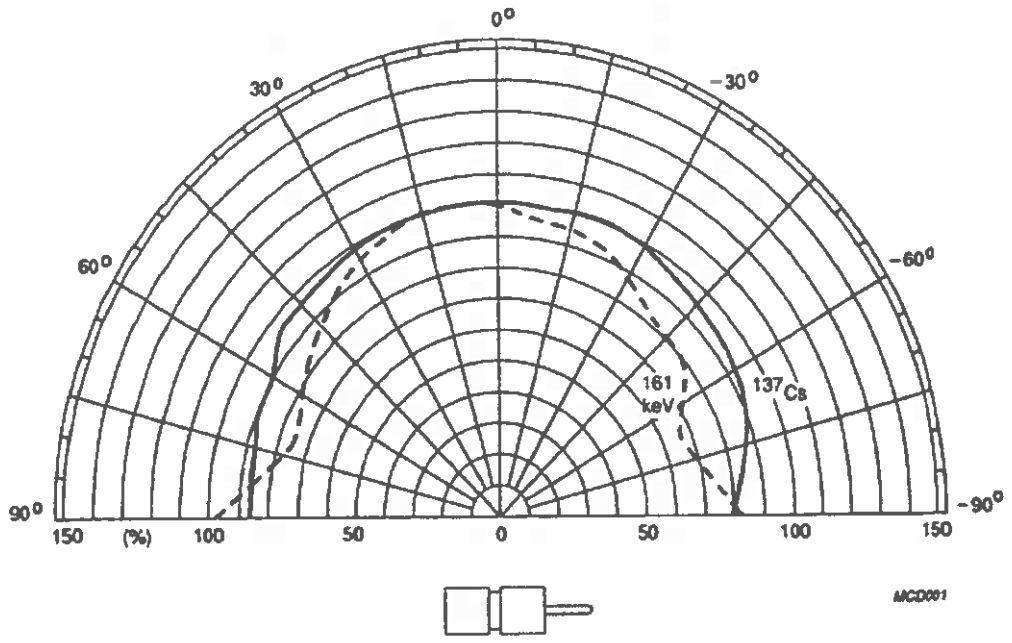
Typical current as a function of dose rate (^{137}Cs)



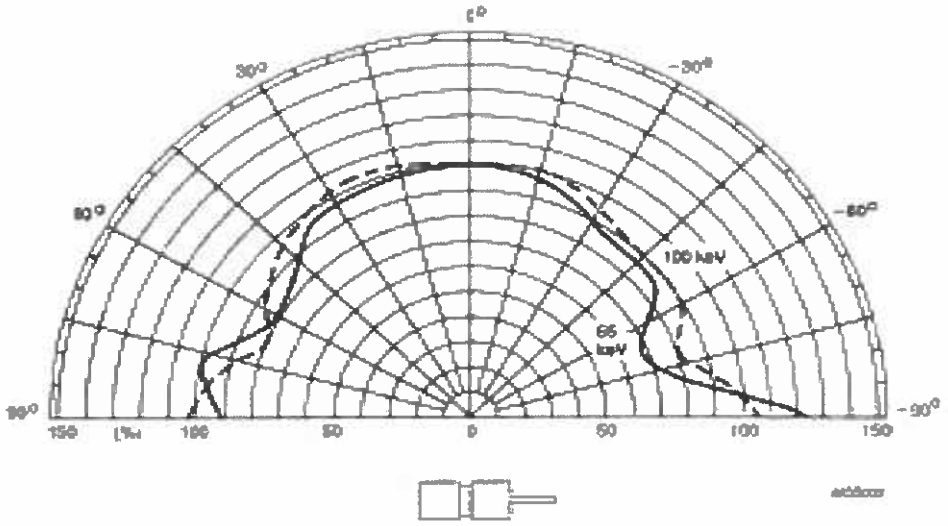
Typical dead time as a function of supply voltage



Typical energy response (side response) relative to ^{137}Cs.



Typical polar responses (normalised to 100% at 0°).



Typical polar responses (normalised to 100% at 0°)

4.1.5. GDI/1321 & GM-1/321

Halogen-quenched γ radiation counter tube fitted in a filter. The energy response is flat to within ±20 % over the range 40 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1321 is an energy compensated version of the ZP1320.

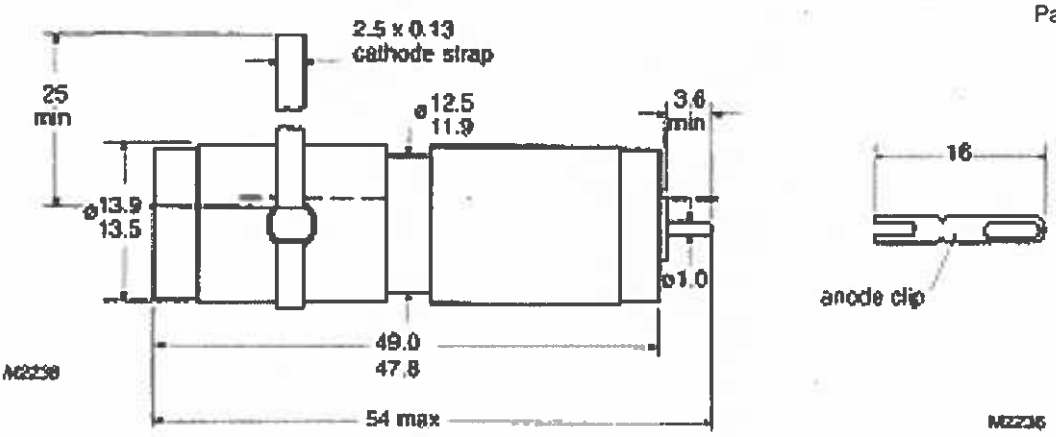
QUICK REFERENCE DATA

Dose rate range	3×10^{-3} to 10^{2}	mGy/h
	4×10^{-4} to 10	R/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome iron cathode	32 to 40	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



CATHODE (ZP1320)

Thickness	32 to 40	mg/cm²
Sensitive length	27	mm
Material	chrome iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²

FILLING neon, argon, halogen

CAPACITANCE

Anode to cathode	1.3	pF

TUBE WEIGHT 23 g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)

Measured in circuit of Figure 2.

Starting voltage	max	380	V
Plateau threshold voltage	max	500	V
Plateau length		150	V
Recommended supply voltage		575	V
Plateau slope	max	0.08	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max	12	count/min
Dead time, at recommended supply voltage	max	55	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.2	MΩ
Anode voltage	max	650	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at ≈ 25 °C	5×10^{10}	count

MEASURING CIRCUIT

R_1 = 4.7 MΩ

R_2 = 100 kΩ

C_1 = 1 pF*

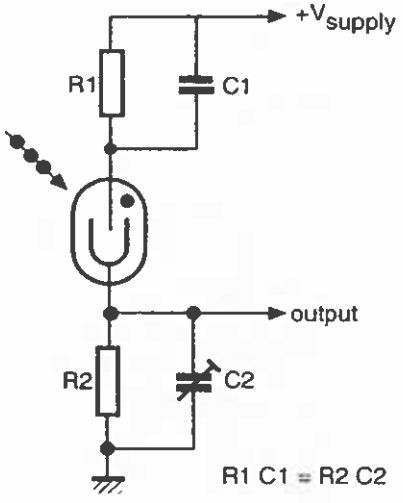
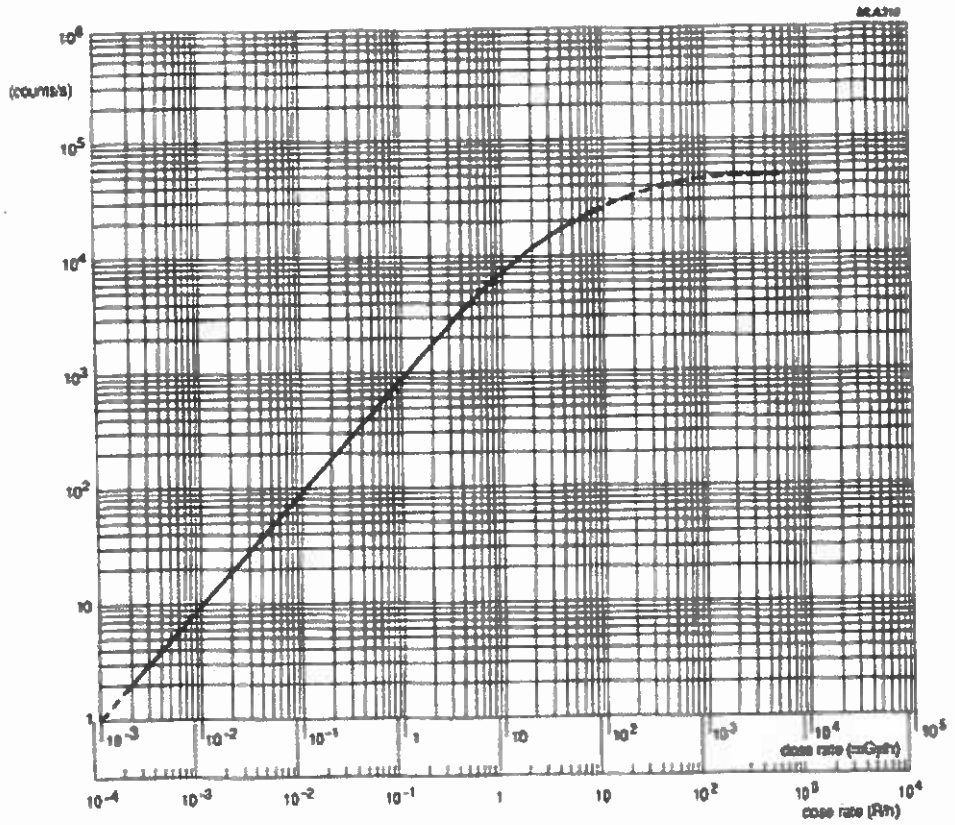
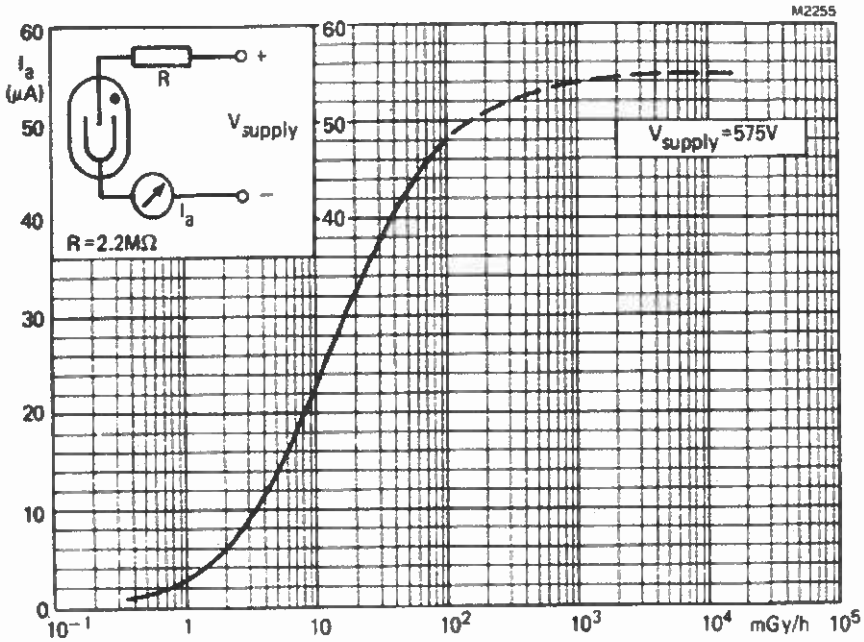


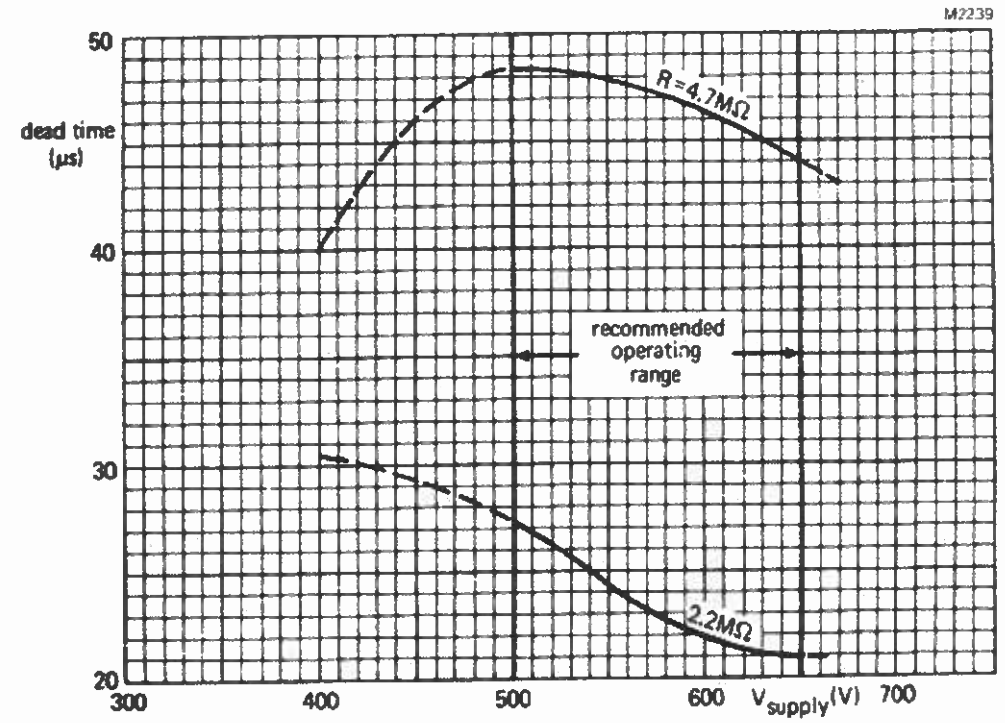
Figure 2



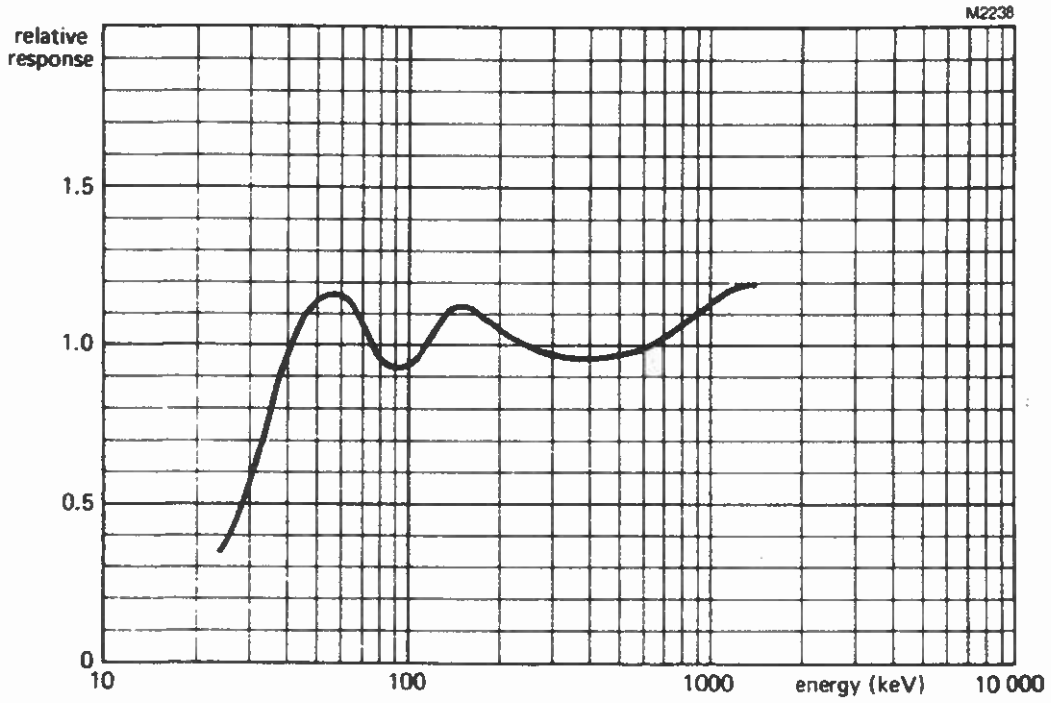
Typical counting rate as a function of dose rate (^{137}Cs)



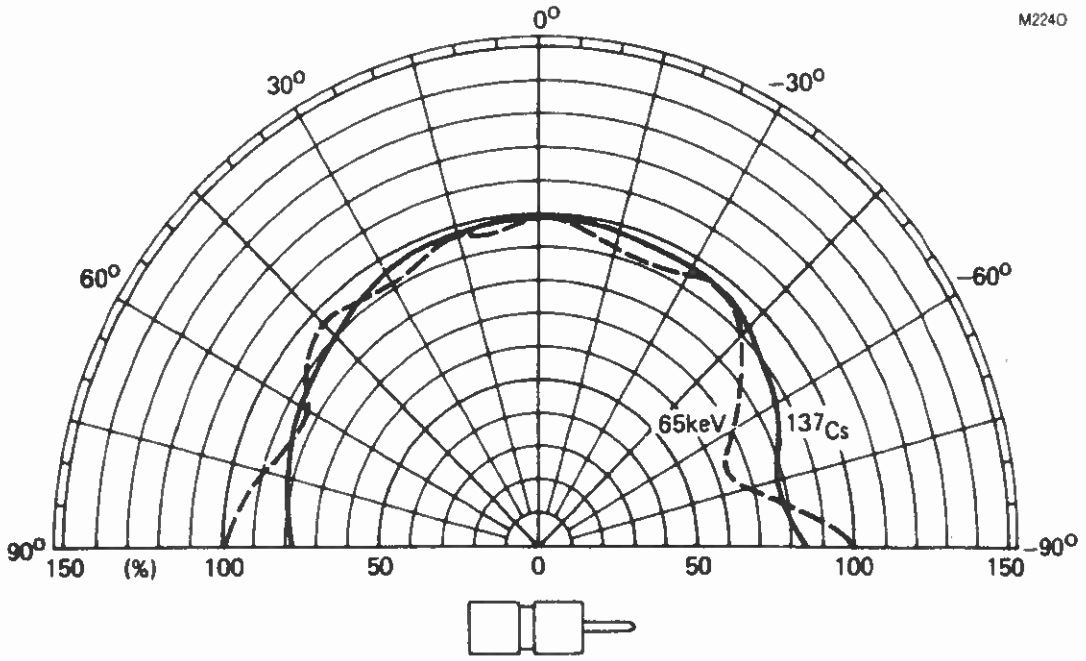
Typical current as a function of dose rate (^{137}Cs)

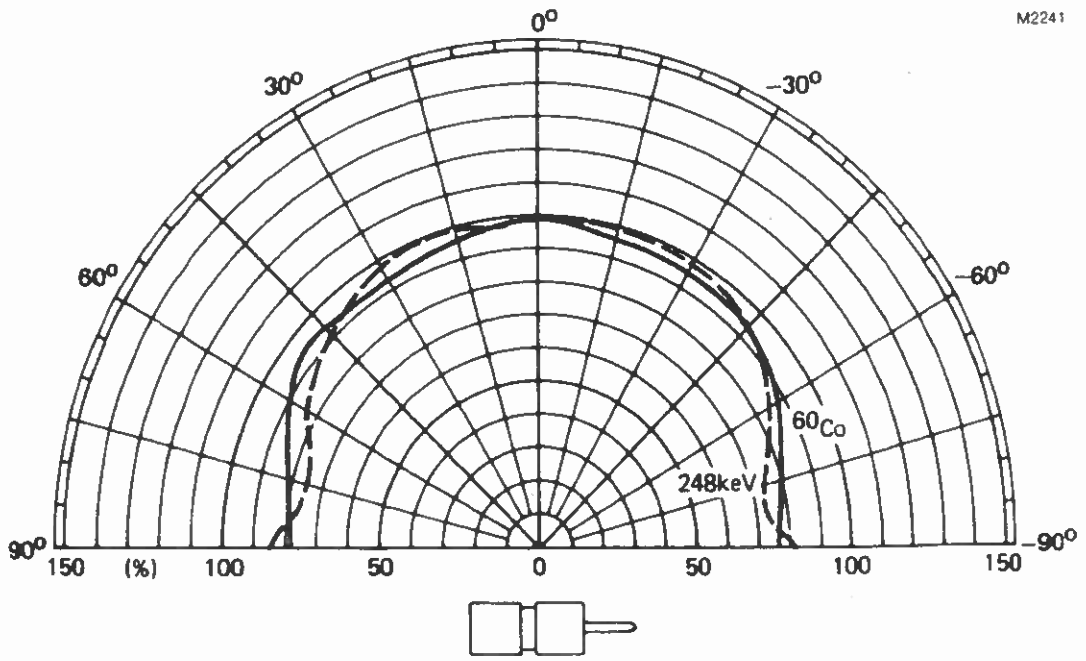


Typical dead time as a function of supply voltage



Typical energy response relative to ^{137}Cs





Typical polar responses
(normalised to 100% at 0°)

4.1.6. GDI/1324 & GM-1/324

Halogen-quenched γ radiation counter tube fitted in a filter. The ambient dose equivalent energy response is flat to within $^{+20\%}_{-10}$ over the range 40 keV to 1.25 MeV referred to ^{137}Cs (661 keV).

The ZP1324 is an energy compensated version of the ZP1320.

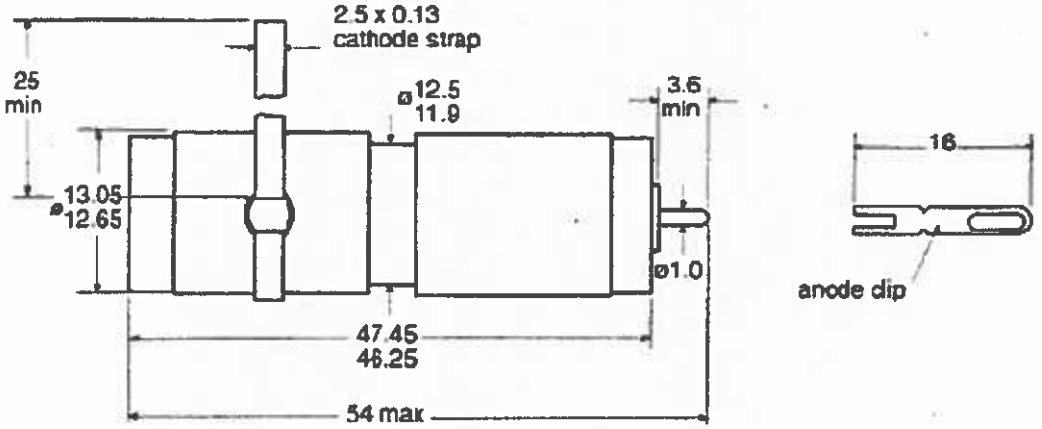
QUICK REFERENCE DATA

Dose rate range	3 to 10^5	µSv/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome iron cathode	32 to 40	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



CATHODE (ZP1320)

Thickness	32 to 40	mg/cm²
Sensitive length	27	mm
Material	chrome iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²

FILLING neon, argon, halogen

CAPACITANCE

Anode to cathode	1.3	pF

TUBE WEIGHT 18 g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)
Measured in circuit of Figure 2.

Starting voltage	max	380	V
Plateau threshold voltage	max.	500	V
Plateau length		150	V
Recommended supply voltage		575	V
Plateau slope	max	0.08	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max	12	count/min
Dead time, at recommended supply voltage	max	55	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.2	MΩ
Anode voltage	max	650	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at = 25 °C		$5 \times 10^{[illegible]}$	count

MEASURING CIRCUIT

R_1 = 4.7 MΩ
R_2 = 100 kΩ
C_1 = 1 pF*

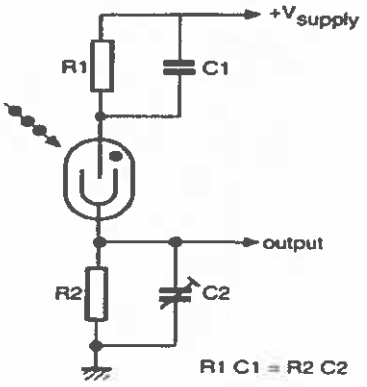


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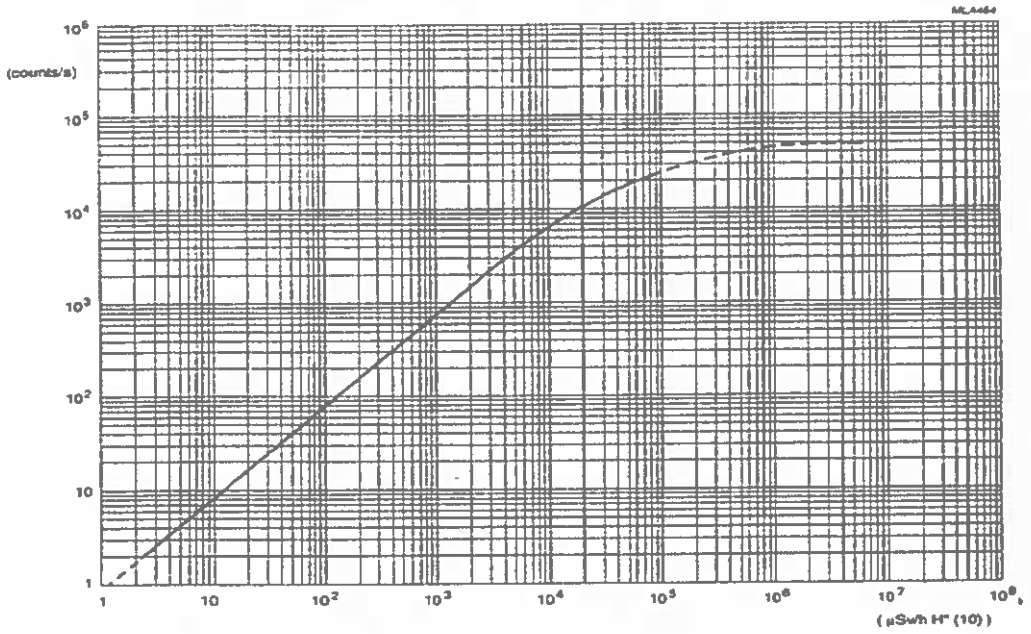
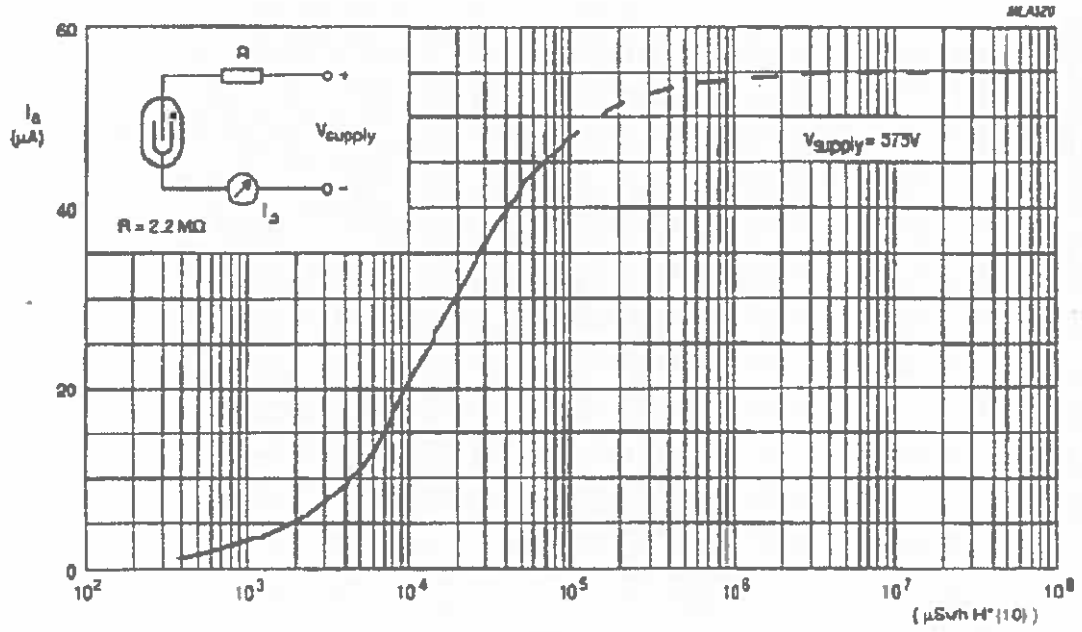
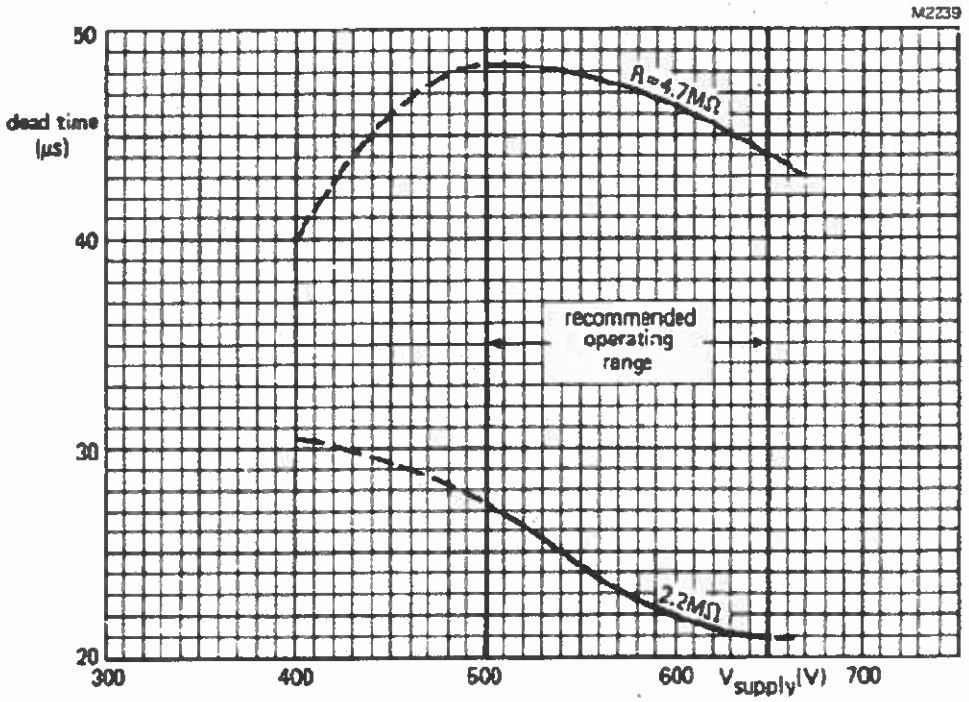
Figure 2



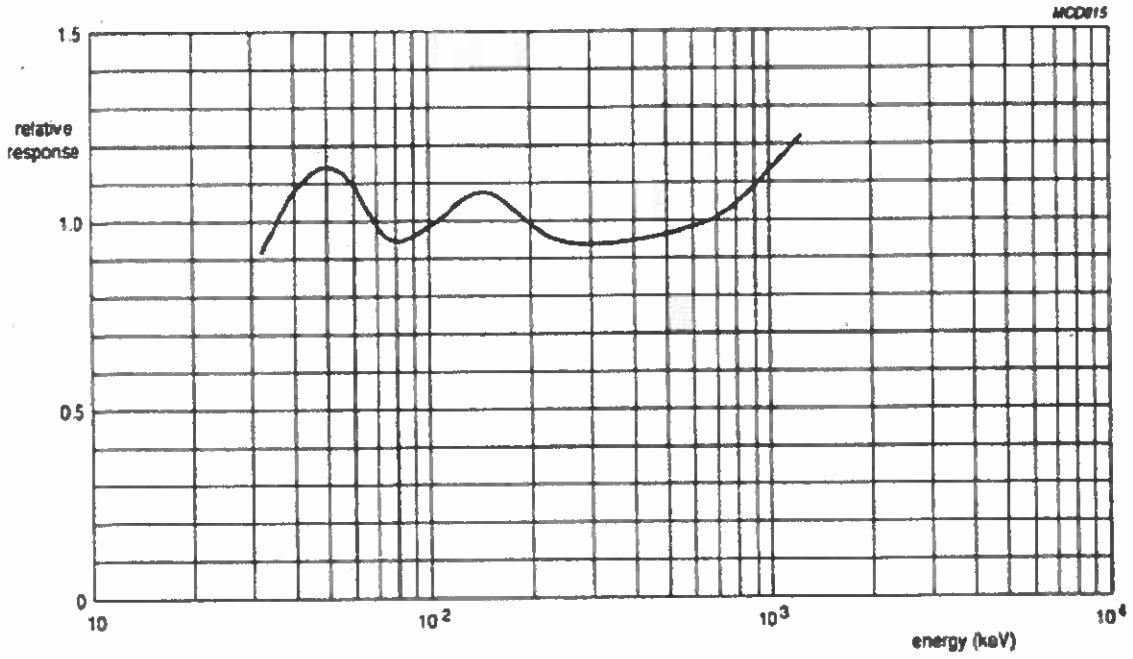
Typical counting rate as a function of dose rate (^{137}Cs)



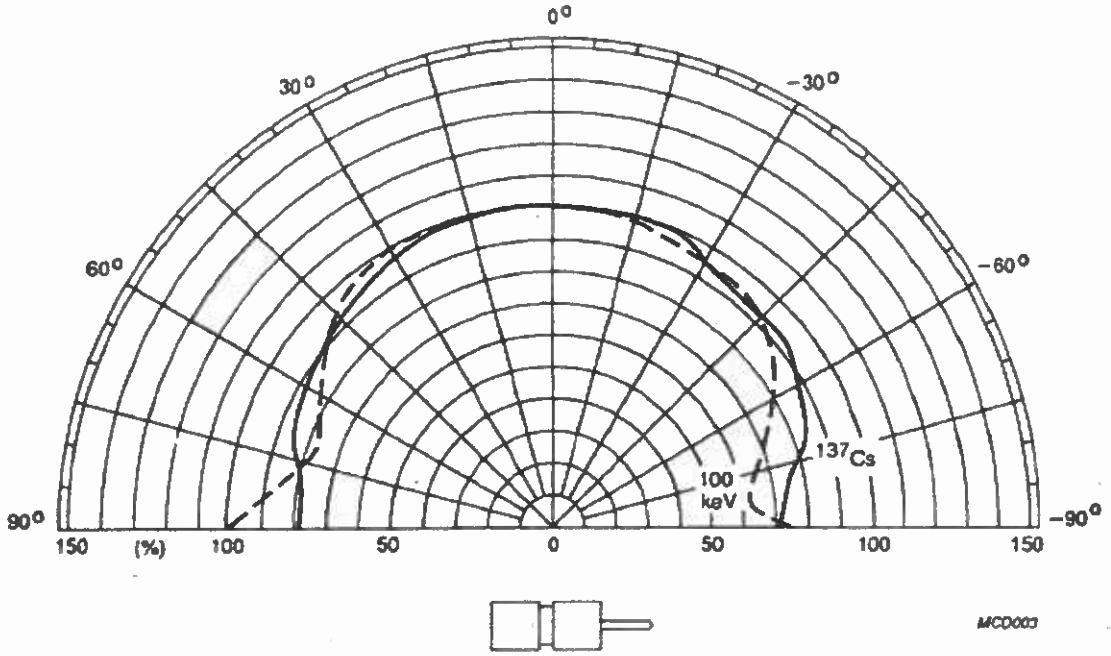
Typical current as a function of dose rate (^{137}Cs)

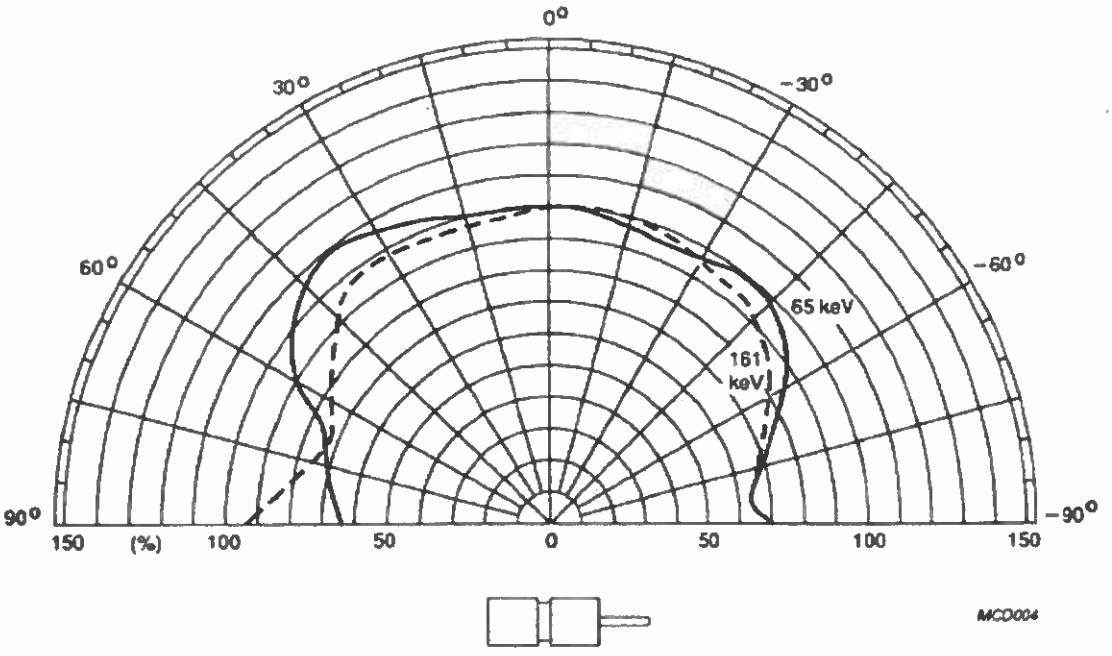


Typical dead time as a function of supply voltage



Typical energy response relative to ^{137}Cs





Typical polar responses
(normalised to 100% at 0°)

4.1.7. GDI/1201 & GM-1/201

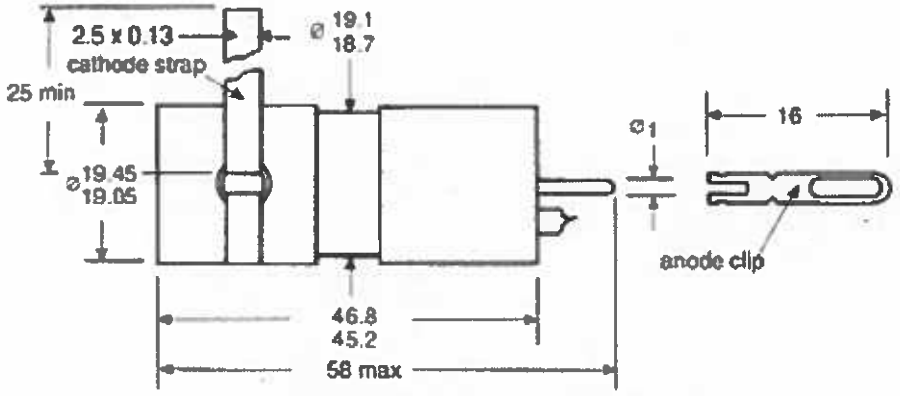
Halogen-quenched γ radiation counter tube fitted in a filter. The energy response is flat to within $^{+25}_{-15}$% over the range 50 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1201 is an energy compensated version of the ZP1200.

QUICK REFERENCE DATA		
Dose rate range	10^{-3} to 40	mGy/h
	10^{-4} to 5	R/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome iron cathode	250	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



Note: cathode strap should be connected to the tube as shown.

CATHODE (ZP1200)		
Thickness	250	mg/cm²
Sensitive length	40	mm
Material	chrome iron	
ENVIRONMENTAL (Manufacturer's test conditions)		
Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²
FILLING	neon, argon, halogen	
CAPACITANCE		
Anode to cathode	1.2	pF
TUBE WEIGHT	38	g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)
Measured in circuit of Figure 2

Starting voltage	max	325	V
Plateau threshold voltage	max	400	V
Plateau length		200	V
Recommended supply voltage		500	V
Plateau slope	max	0.04	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max	10	count/min
Dead time, at recommended supply voltage	max	110	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	4.7	MΩ
Anode voltage	max	600	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at = 25 °C		5×10^{10}	count

MEASURING CIRCUIT

R_1 = 10 MΩ
R_2 = 220 kΩ
C_1 = 1 pF*

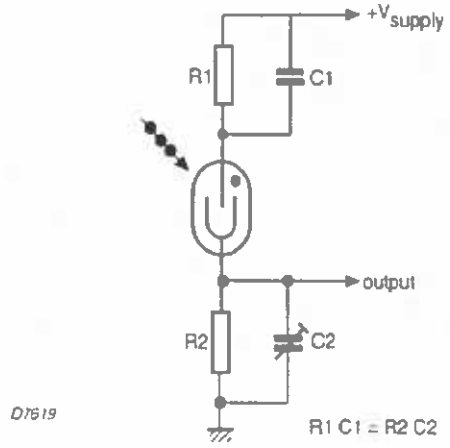
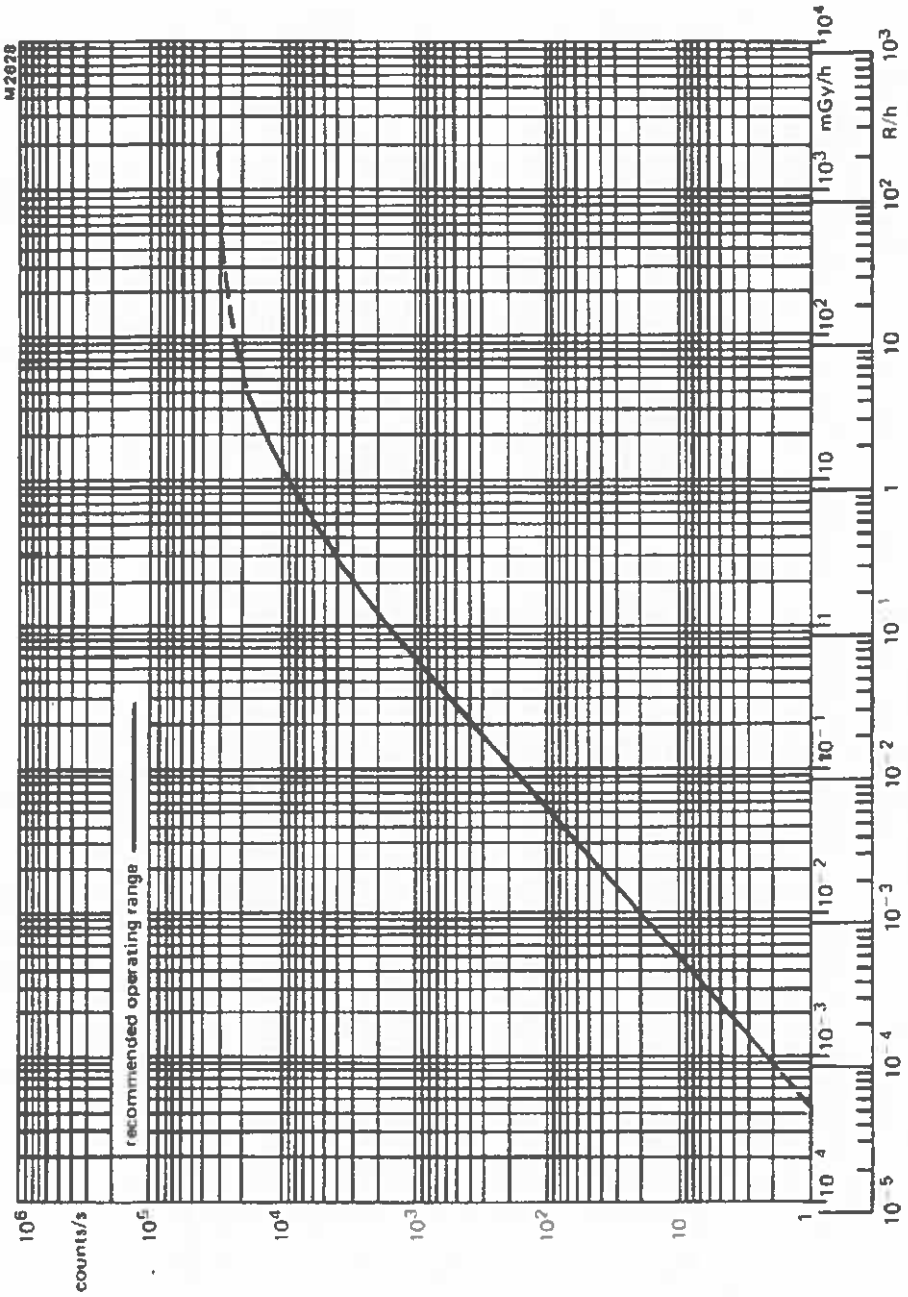
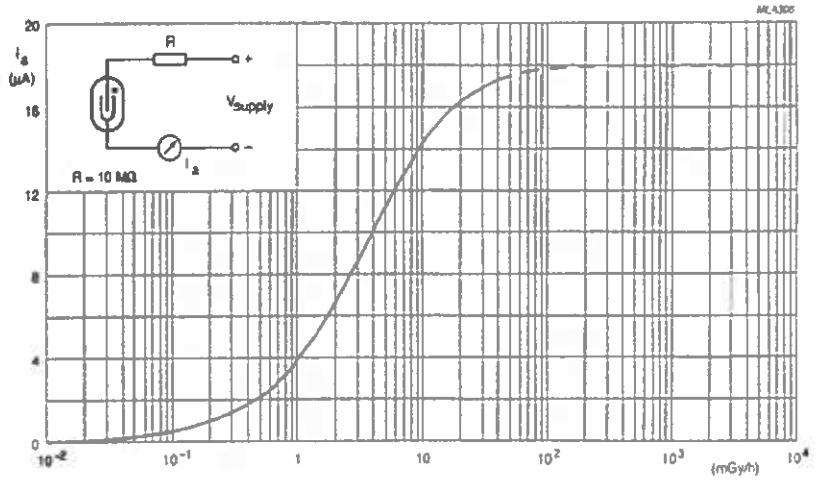


Figure 2

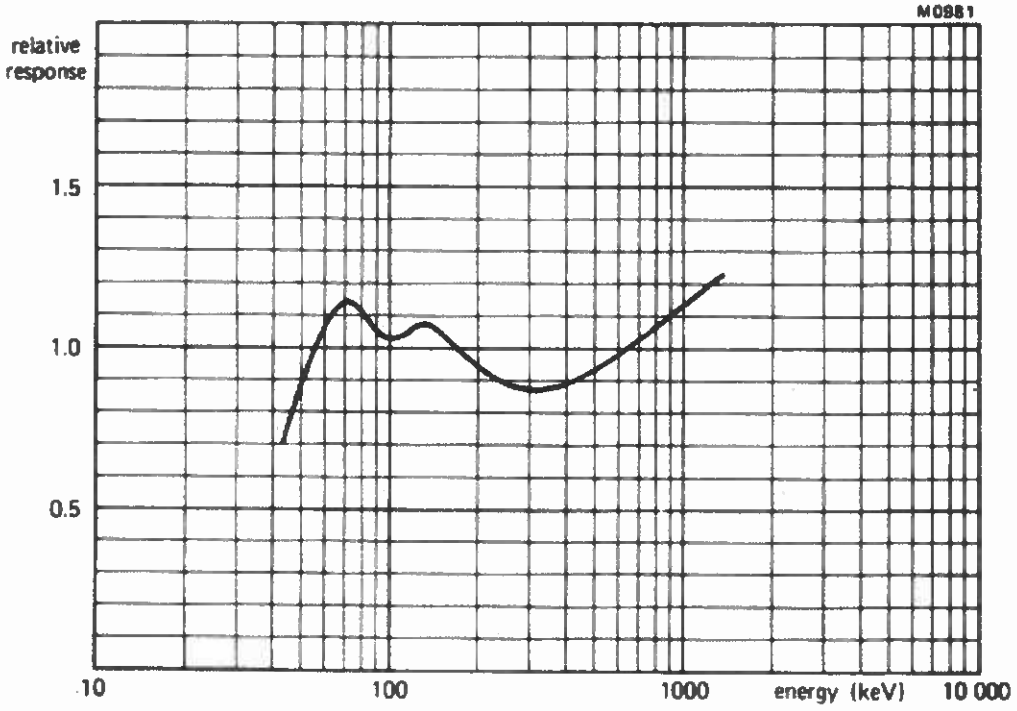
*See General Information (paragraph 5.5)



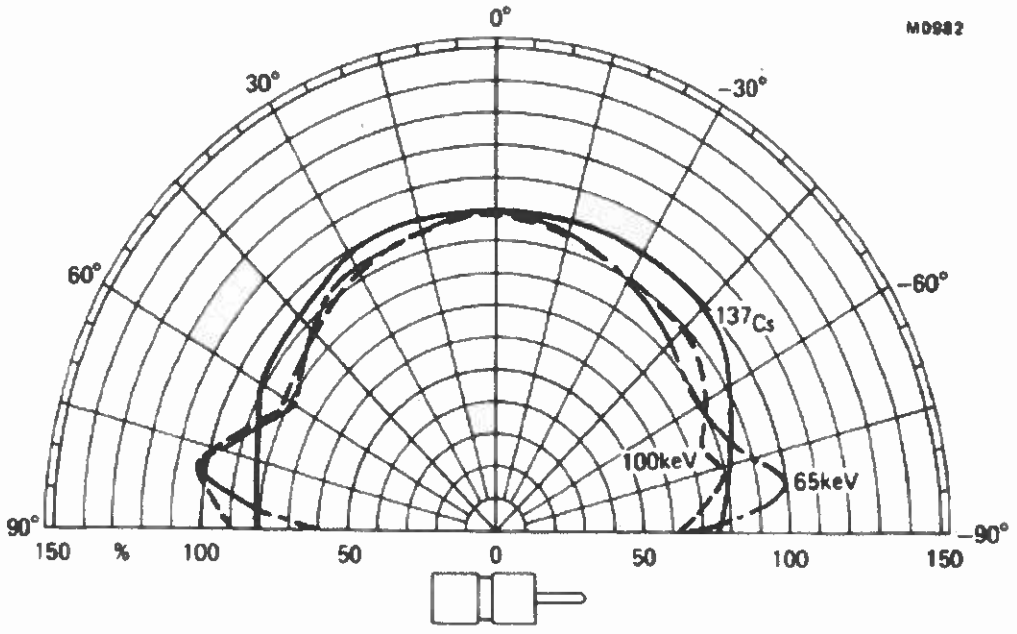
Typical counting rate as a function of dose rate (^{137}Cs)



Typical current as a function of dose rate (^{137}Cs)



Typical energy response relative to ^{137}Cs



Typical polar responses (normalised to 100% at 0^{o})

4.1.8. GDI/1202 & GM-1/202

GEIGER MÜLLER TUBE

Halogen-quenched γ radiation counter tube fitted in a filter. The ambient dose equivalent energy response is flat to within $^{+30}_{-20}$% over the range 50 keV to 1.25 MeV referred to ^{137}Cs (661 keV).

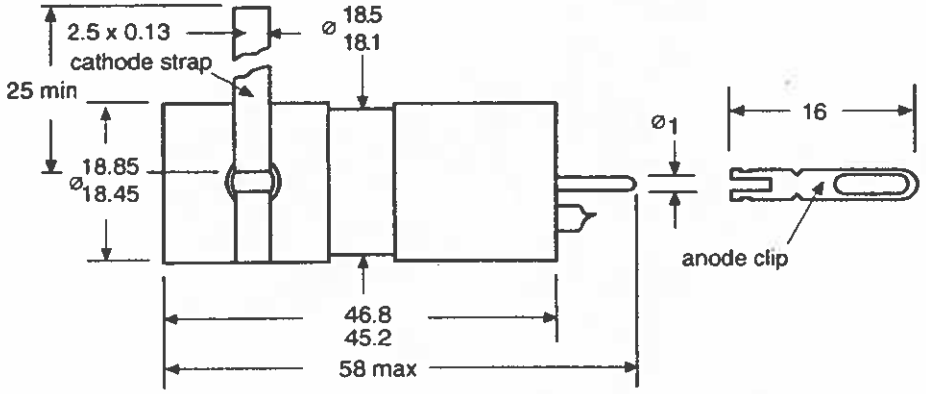
The ZP1202 is an energy compensated version of the ZP1200.

QUICK REFERENCE DATA		
Dose rate range	1 to 4 x 10^4	µSv/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome iron cathode	250	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



Note: cathode strap should be connected to the tube as shown.

CATHODE (ZP1200)		
Thickness	250	mg/cm²
Sensitive length	40	mm
Material	chrome iron	
ENVIRONMENTAL (Manufacturer's test conditions)		
Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²
FILLING	neon, argon, halogen	
CAPACITANCE		
Anode to cathode	1.2	pF
TUBE WEIGHT	32	g

OPERATING CHARACTERISTICS (Ambient temperature ≈ 25 °C)
Measured in circuit of Figure 2.

Starting voltage	max	325	V
Plateau threshold voltage	max	400	V
Plateau length		200	V
Recommended supply voltage		500	V
Plateau slope	max	0.04	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max	10	count/min
Dead time, at recommended supply voltage	max	110	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	4.7	MΩ
Anode voltage	max	600	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at ≈ 25 °C	5×10^{10}	count

MEASURING CIRCUIT
$R_1 = 10\ M\Omega$
$R_2 = 220\ k\Omega$
$C_1 = 1\ pF$ *

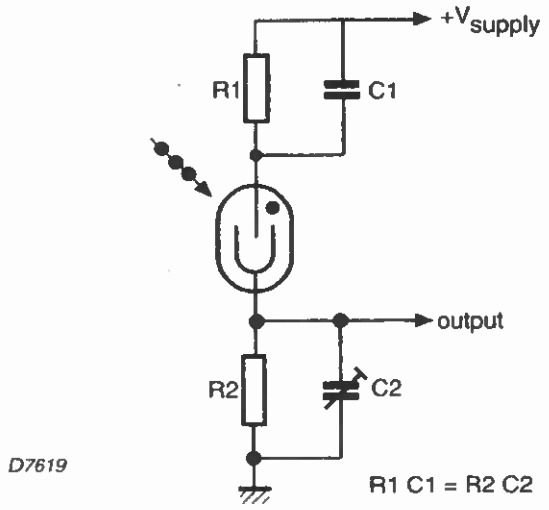
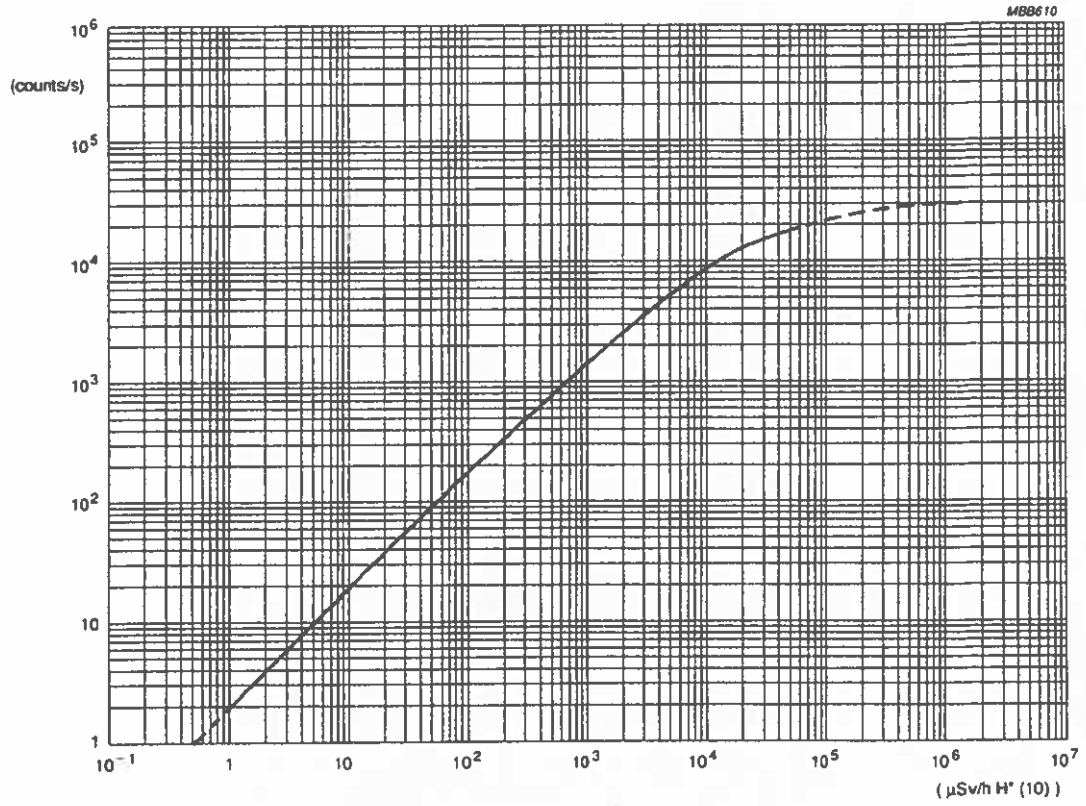
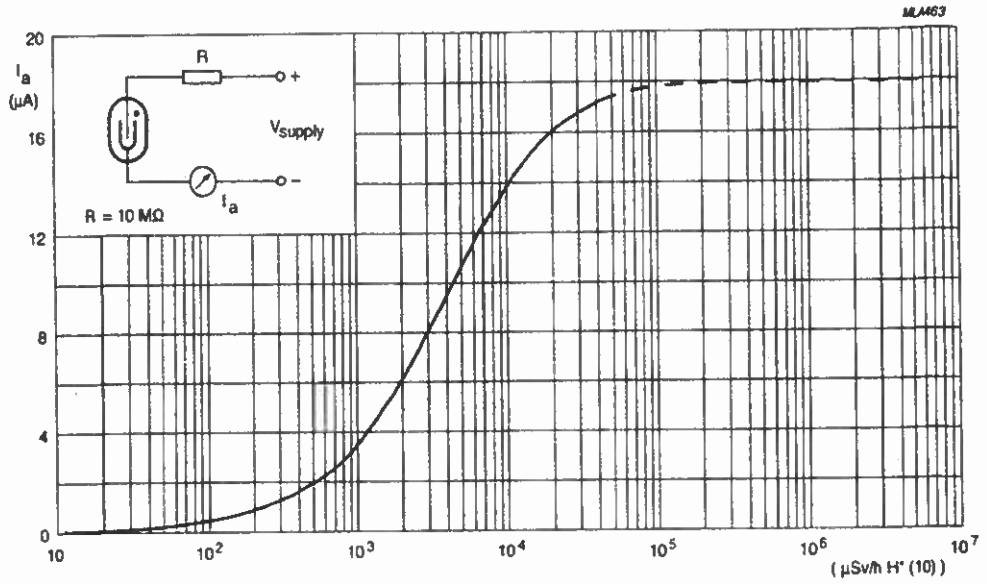


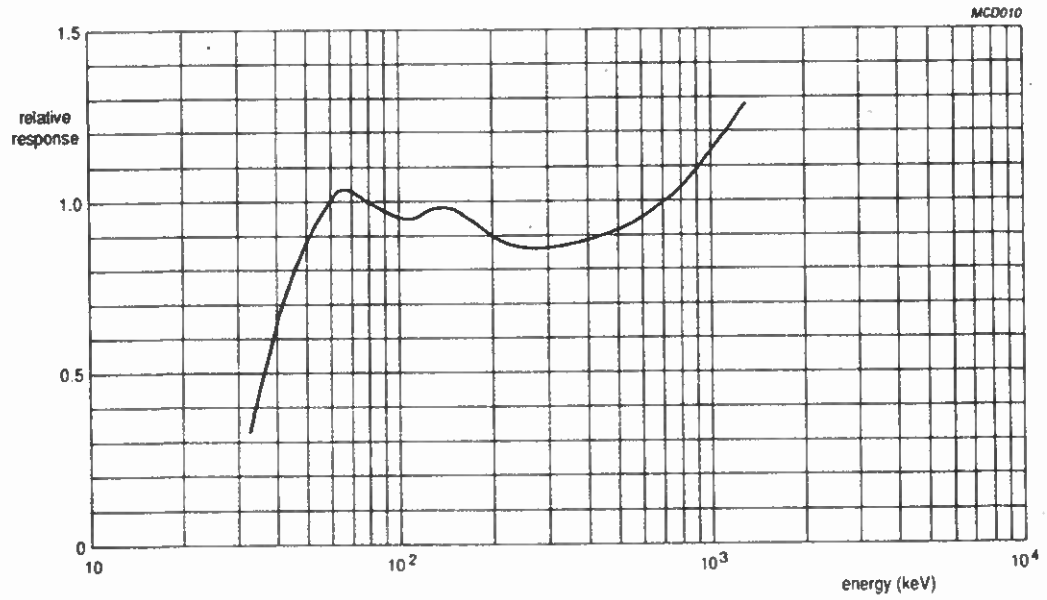
Figure 2



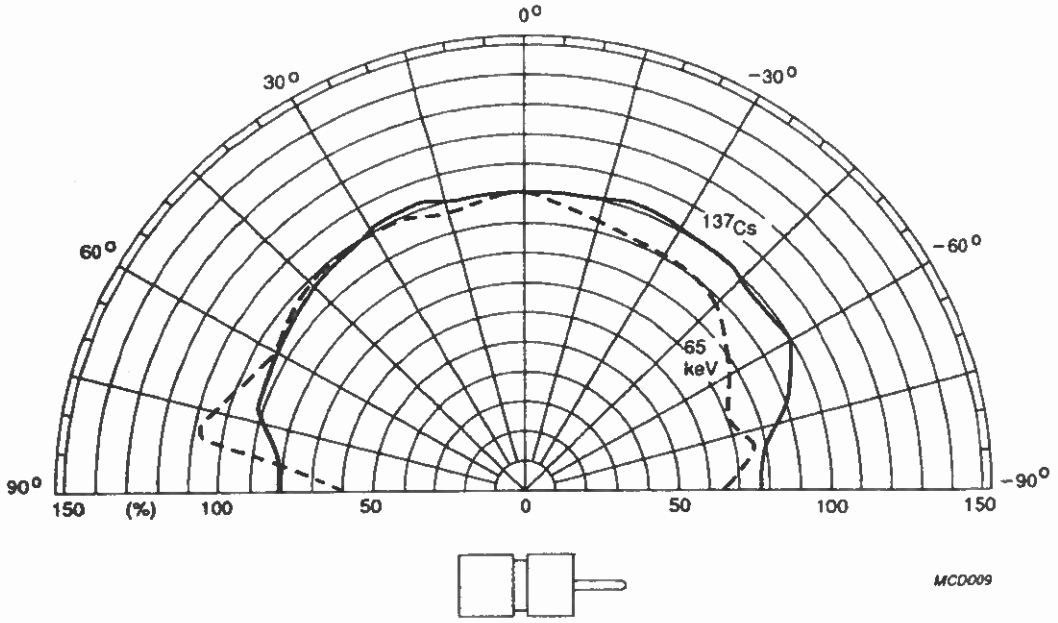
Typical counting rate as a function of dose rate (^{137}Cs)

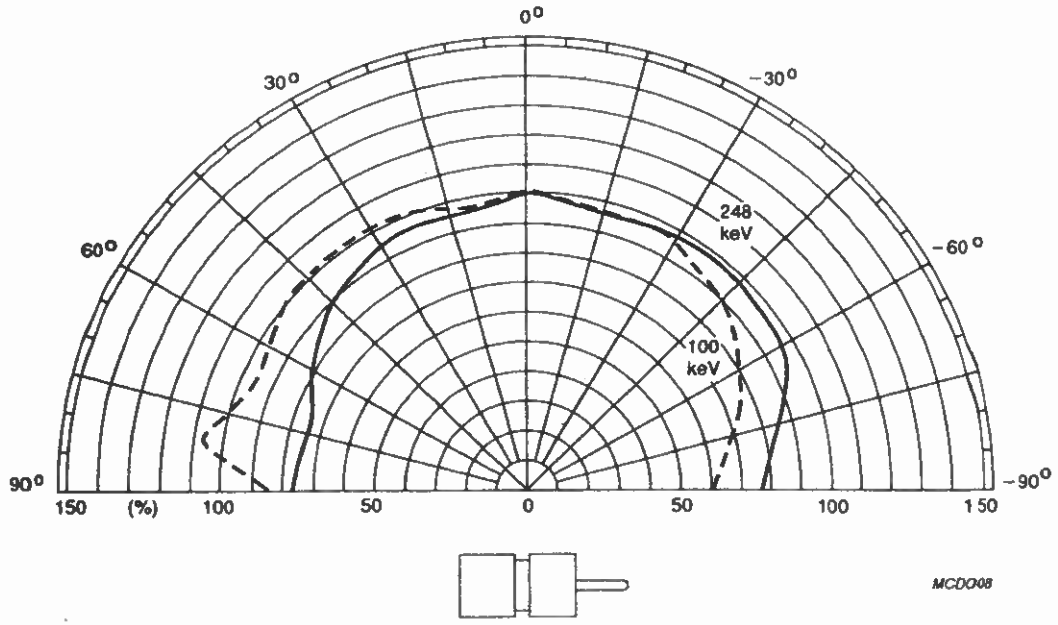


Typical current as a function of dose rate (^{137}Cs).



Typical ambient dose equivalent energy response relative to ^{137}Cs.





Typical polar response (normalised to 100% at 0°)

4.1.9. GDI/1221/01 & GM-1/221/01

Halogen-quenched γ radiation counter tube. The ZP1221/01 is the low background version of the ZP1221.

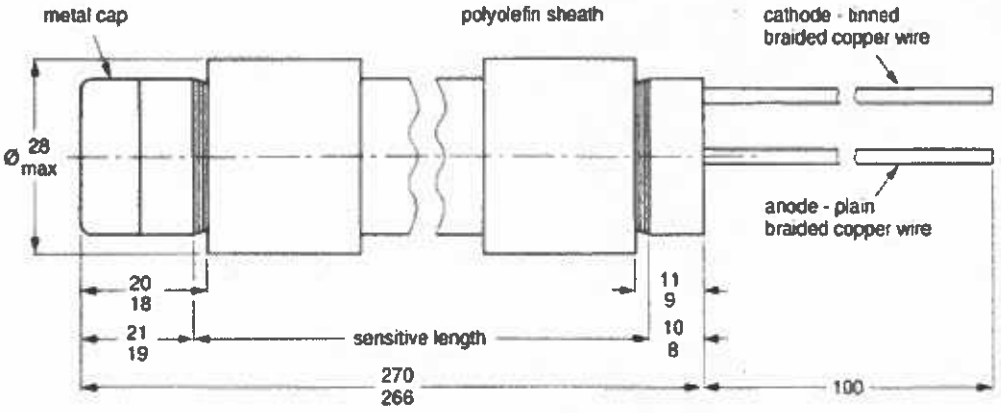
QUICK REFERENCE DATA

Dose rate range	2×10^{-4} to 3 2×10^{-3} to 3×10^{1}	mGy/h R/h
Plateau threshold voltage	400	V
Plateau length	100	V
Recommended supply voltage	450	V
Chrome iron cathode	525	mg/cm²

This data must be read in conjunction with General Information Geiger Müller tubes.

MECHANICAL DATA Dimensions in mm

Figure 1



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Note: tube must not be clamped within 30 mm of either end.

CATHODE (ZP1220)

Thickness	525	mg/cm²
Sensitive length	240	mm
Material	chrome iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s²

FILLING neon, argon, halogen

CAPACITANCE

Anode to cathode	10	pF

TUBE WEIGHT 350 g

OPERATING CHARACTERISTICS (Ambient temperature = 25 °C)
Measured in circuit of Figure 2.

Starting voltage		max	350	V
Plateau threshold voltage		max	400	V
Plateau length			100	V
Recommended supply voltage			450	V
Plateau slope		max	0.15	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at	ZP1221:	max	90	count/min
recommended supply voltage	ZP1221/01:	max	60	count/min
Dead time, at recommended supply voltage		max	210	µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min	2.7	MΩ
Anode voltage	max	500	V
Ambient temperature			
- continuous operating	max	+70	°C
	min	- 40	°C
- storage	max	+75	°C

LIFE EXPECTANCY

Life expectancy at = 25 °C	5×10^{10}	count

MEASURING CIRCUIT

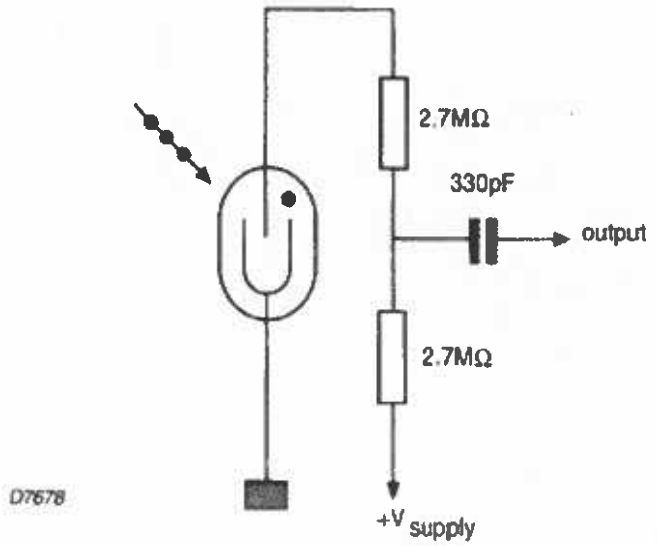
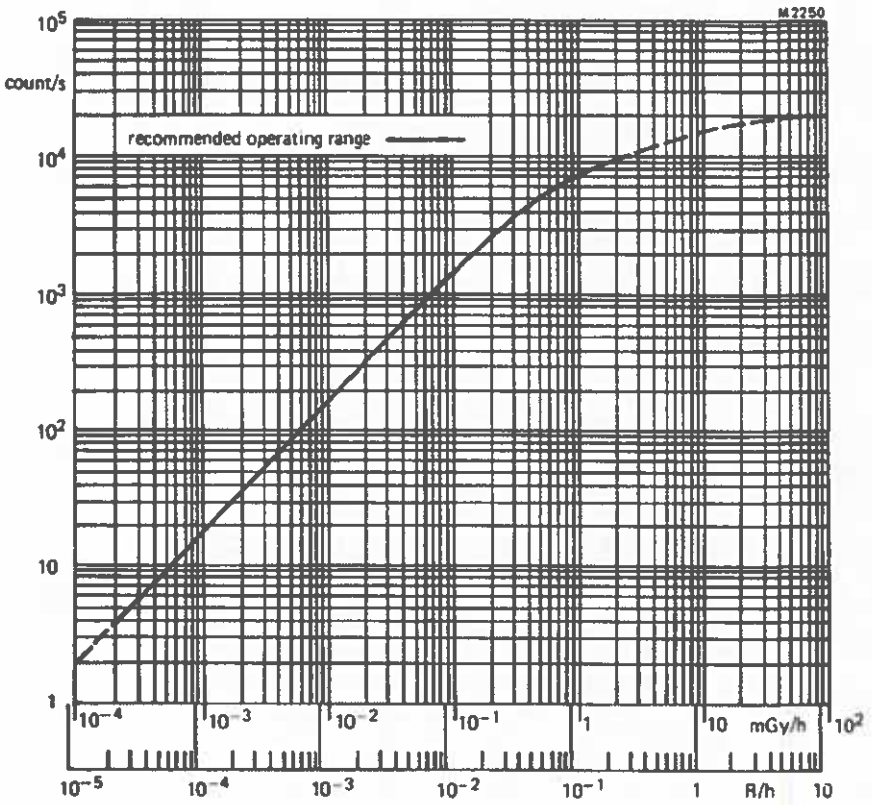
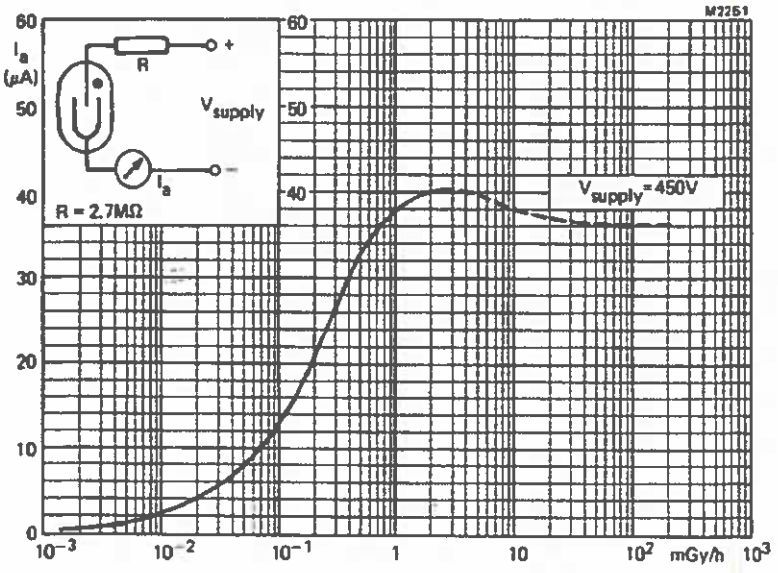


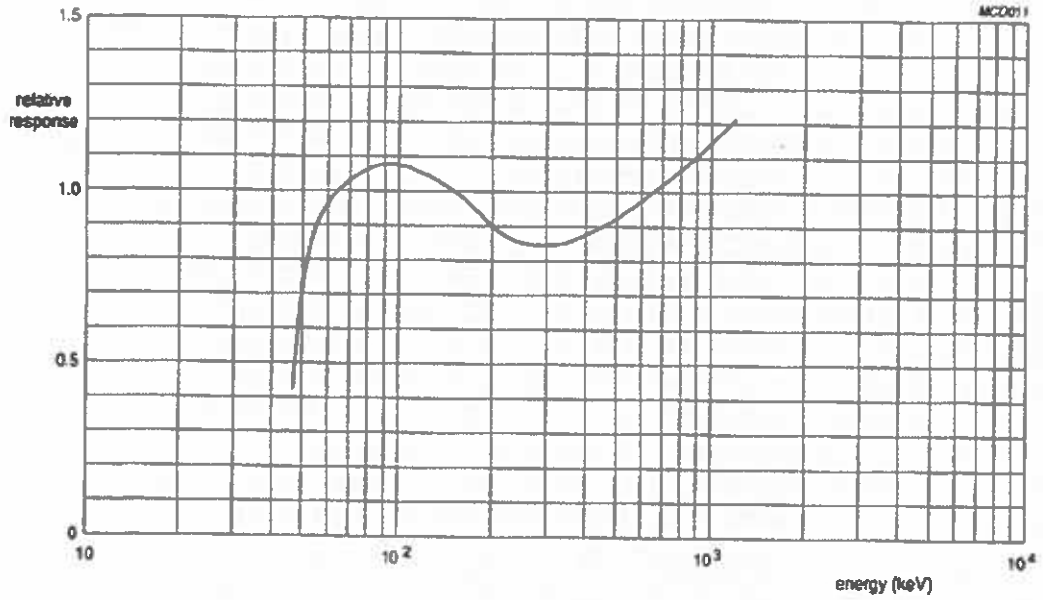
Figure 2



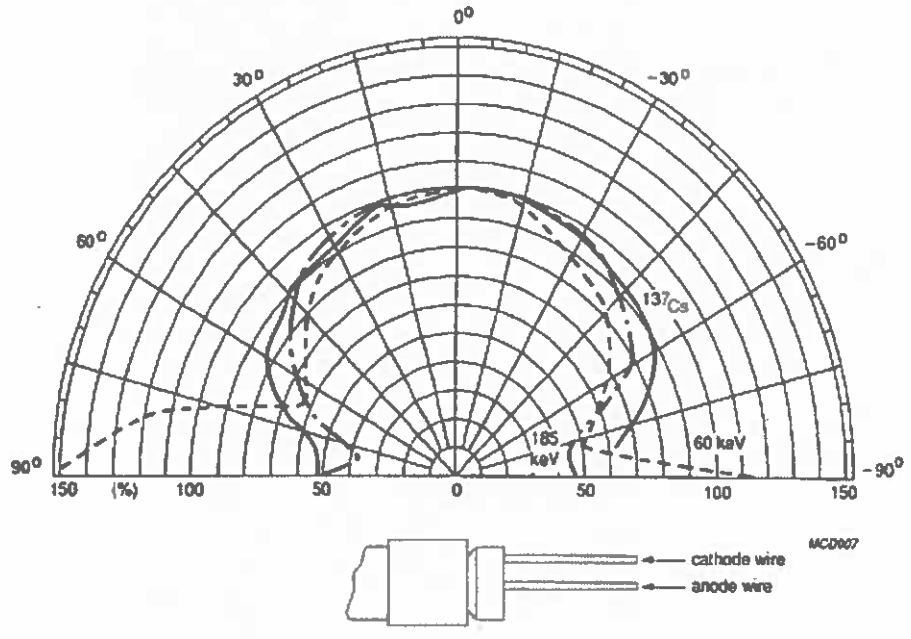
Typical counting rate as a function of dose rate (^{137}Cs)



Typical current as a function of dose rate (^{137}Cs)



Typical energy response relative to ^{137}Cs.



Typical polar responses (normalised to 100% at 0°).

5. System-specific Information

This section may be used to store information specific to the installation