RDS-200 UNIVERSAL SURVEY METER

USER'S GUIDE

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CONTENTS

1. INTRODUCTION

This manual is a description of the functions of the RDS-200 Universal Survey Meter with program version V1.0X. The program version can be checked at start-up when the program version number is displayed at the bottom of the display.

1.1. Range of Use

The RADOS RDS-200 is a portable radiation meter for general use. Because of its versatile functions and durability it is suited for a wide range of applications in military, civil defense, industrial and laboratory use etc.

An external gamma probe can be attached to the RDS-200. An external pulse measurement beta probe can be used for activity measurements. A printer can be used to print out the measurement results.

The RDS-200 can also be used as a measurement unit with the RADOS AAM-90 Area Monitoring System.

1.2. Taking the Meter in Use

The RDS-200 uses three size IEC LR6 (AA) alkaline batteries. It is also possible to use normal dry cells or rechargeable batteries, but this shortens the operation time, especially in cold conditions. Also, the dry-cell batteries may leak as they run out of power. The battery case cover is located at the bottom end of the meter. The cap is slotted, easing the opening e.g. with a coin. (The cap includes also a thread for connection on a camera tripod.) Fresh batteries are inserted positive (+) pole first. It is also possible to use external +12V DC power supply with a special adapter.

2. USER INTERFACE

2.1. Front Panel Controls

The front panel controls consist of the following:

⊙	On/Off
💡	Display Illumination
Σ ▼NO	Dose Rate, slow time constant
DOSE ▲YES	Dose
🔊 ADJ	Alarm

2.2. Display

The analog bargraph display is logarithmic and covers four decades (0.1…1000 µSv/h) and a unit display. If dose rate is higher than 999 µSv/h, the unit segment (µSv/h, mSv/h or Sv/h) after the digital dose rate starts blinking. One bar equals to a change of 30%. The display is used to display the dose rate, its alarm threshold, and pulse rate, the latter with the range of 1 – 10000 cps. The time constant of the bargraph is fast (0.5 sec), enabling the observation of rapid dose rate changes.

The larger numeric display is used for displaying the dose rate, the dose, setting the alarm thresholds and displaying the number of pulses. In addition the larger numeric display shows the status of the meter (OFL, DEF). The dose rate and dose display places the decimal point automatically and displays the unit of measurement (µSv/h, mSv/h and Sv/h; or µSv, mSv and Sv). Units mSv/h, Sv/h, mSv and Sv are blinking when in use. Two different time constants can be selected for the dose rate display (see 3.5 Dose Rate Display Time Constants). In pulse rate mode the display has automatic decimal point and unit (cps, kcps) selection.

The smaller numeric display is used for displaying the error codes.

Note that the unit "rem" is indicated as "R" on the display.

The display also contains the following symbols:

ALARM (Used in dose and dose rate alarms.)

PULSE INDICATION

BATTERY (Indicates a battery alarm.)

SETTINGS (Used in setting the alarm thresholds.)

SNAIL (Indicates the dose rate display's slow time constant. See Chapter 3.5.)

METER, ARROW and BETA (Beta probe attached.)

METER AND ARROW (Gamma probe attached.)
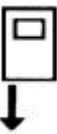
METER AND ARROW (Printing.)

2.3. External Device Interface

The meter has an interface for external gamma probes or for a beta probe. There is also a connector for the attachment of the meter to a PC with software like RADOS AAM-95 Area Monitoring System. The connectors are located at the bottom part of the meter. The connectors are equipped with protective covers. When the connectors are not in use, the covers should be kept in place.

3. FUNCTIONS

The meter is turned on by pressing the POWER switch. Note that the switch must be pressed for about one second for the meter to switch on. The meter is also turned off by pressing the POWER switch again for about one second. When the meter is turned on, all segments of the display are turned on and off so that the proper functioning of the display may be verified.

Following functions can be done with the keyboard:

1. Clearing the accumulated dose
2. Illuminating the display
3. Setting the pulse indication on and off
4. Muting a dose or dose rate alarm signal
5. Selecting the integration time of the dose rate display, (1.5 s/ 1...99 min)
6. Selecting the dose display
7. Changing alarm threshold

3.1. Clearing the Accumulated Dose

The total accumulated dose is the dose that has accumulated since the dose was last reset. The dose does not clear even when the power is switched off or the batteries are removed. The dose can however be cleared when the power is switched on. This can be done by pressing the DOSE button when the text 'Clr DoS' with blinking Clr appears on the display.

The text 'Clr DoS' is shown on the display for five seconds after the meter is turned on. If you do not want to clear the dose you can press the DOSE

RATE button. If none of the keys is pressed, the dose is restored after a waiting time of 5 seconds.

3.2. Display Illumination

The display illumination is turned on by pressing the DISPLAY ILLUMINATION switch. The display illumination will be on for as long as the button is pressed.

3.3. Pulse Indication

Pulse indication emits short beeps, whose frequency is proportional to the dose rate. With the help of the pulse frequency it is easy to note any changes in the dose rate, without having to keep an eye on the display all the time. The useful range of the pulse indication is approximately 1…100 µSv/h corresponding to 0.5…50 pulses/s.

The pulse indication is turned on by pressing the ALARM button; the PULSE INDICATION symbol appears on the top left hand corner of the display. To turn off the pulse indication, press the ALARM button again; the PULSE INDICATION symbol disappears.

3.4. Muting an Alarm

If the set dose or dose rate alarm thresholds are exceeded (see 3.8 Alarm Thresholds), the ALARM symbol starts to blink on the display, simultaneously the meter emits an audible alarm. If external devices are connected to the meter, the meter will emit also an external audible alarm.

The alarm may be muted with the ALARM button. Muting the alarm switches the alarm sound off. The ALARM symbol remains on the display until the alarm thresholds are no longer exceeded.

3.5. Dose Rate Display Time Constants

Because of the random nature of radiation, large variations may occur in the dose rate readings of the meter, especially at low dose rates. These variations are smoothened in the dose rate numeric display by integrating the readings. Thus the displayed reading is a mean value of the readings over a longer period and the variation is lessened. The time constant of integration represents the degree of the integration, i.e. its smoothening effect. A higher time constant means that the reading is a mean value for

a longer period and thus the variations on the display are smaller. Two time constants, slow and fast, may be chosen for the dose rate display. In normal use the fast time constant is used.

After the meter is turned on the time constant is set at fast. To change to the slow time constant, press the DOSE RATE button. As a sign of the long time constant the SNAIL symbol appears on the display and there will be a text '1...99 m' on the smaller numeric display. The slow time constant is active as long as the button is pressed. To change back to the fast time constant, release the DOSE RATE button. The SNAIL symbol and the text '1...99 m' disappear from the display.

The integration time can be set between 1…99 minutes. The long time average of the dose rate is displayed and updated every 30 seconds. Before the first average of the dose rate the symbol ' - - - ' is shown on the display.

Note that although the display is updated every 30 seconds, the sampling rate is the set 1…99 min. Thus the slow time averages of the dose rate are stored in the internal memory of the meter within the set integration time of 1…99 min. Maximum of 864 averages are stored.

Time Constants of Display Sections

Display Section	Time Constant	Algorithm	Other terms
Analog bargraph	0.5 s	Integration of pulses of the last 0.5 seconds	
Numeric display, fast time constant	1.5 - s	7/8 x old dose rate + 1/8 x new dose rate	
Numeric bargraph, slow time constant	1...99 min	Integration of pulses of the last 1...99 minutes	if new dr $\leq$ 0.3 uSv/h, dr = the average of previous and present dose rates

Slow Time Constant

The measurement interval can be set by serial communication.

Note! If the RDS-200 meter's ID is set to 0 (zero), the slow time constant will change back to the default value of 5 minutes, after the power has been switched off and on.

3.6. Dose Display

To change to the dose display, press the DOSE button. The accumulated dose can be seen on the larger numeric display. On the smaller numeric display there will be a text 'DoS' indicating dose display. To change back to the dose rate display, release the DOSE button.

3.7. Cov-Display

The coefficient of variation display ('CoV') can be activated by serial communication. The value of 'Cov' is shown on the display below the dose rate value. The 'Cov' is displayed as %. The range is 0 - 99%. The value of 'Cov' is calculated as

$$\frac{\sqrt{n-1}}{n} \times 100\%$$

where 'n' represents the number of pulses from the GM tube.

3.8. Alarm Thresholds

Two dose rate alarm thresholds and one dose alarm threshold may be set in the meter. The default value of the first alarm thresholds is 100 µSv/h. The other two thresholds (0 µSv/h and 0 mSv) are not active. The default values can be changed freely between 0 - 999 mSv/h and 0 - 999 mSv with a PC.

If the dose or the dose rate values reach the thresholds, the meter will sound an alarm. The alarm thresholds can be changed from preset menus. Both thresholds can be set and removed independently.

The alarm thresholds are set in a special threshold setting mode, where the threshold is selected from a menu by stepping up or down with the DOSE RATE and DOSE buttons. To enter the threshold setting mode press the ALARM and DOSE RATE buttons (for dose rate alarm threshold setting) or the ALARM and DOSE buttons (for dose alarm setting) together for two seconds. The meter returns to the operating mode, if no button has been pressed within the last 10 seconds.

3.8.1. Setting the Dose Rate Alarm Threshold

Enter the threshold setting mode by pressing the ALARM button and DOSE RATE button for two seconds. The SETTINGS symbol appears on the display, and dose rate display digits start to blink. Now you can choose the alarm threshold from the preset menu. The DOSE RATE button steps down the menu and the DOSE button steps up the menu. To step faster, hold the DOSE RATE or DOSE buttons down longer. The possible alarm threshold values are: 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90, 1.00, 2.00, 2.50, 3.00, 4.00, 5.00, 6.00, 7.00, 8.00, 9.00, 10.0, 20.0, 25.0, 30.0, 40.0, 50.0, 60.0, 70.0, 80.0, 90.0, 100, 200, 250, 300, 400, 500, 600, 700, 800 and 900 µSv/h, and 1.00, 2.00, 2.50, 3.00, 4.00, 5.00, 6.00, 7.00, 8.00, 9.00, 10.0, 20.0, 25.0, 30.0, 40.0, 50.0, 60.0, 70.0, 80.0, 90.0, 100, 200, 250, 300, 400, 500, 600, 700, 800 and 900 mSv/h.

To clear the alarm threshold set the value at 0.00. The menu does not scroll around, i.e. you cannot step directly from the smallest value to the highest by pressing the DOSE RATE button or vice versa.

When the dose rate alarm threshold has been selected, it is activated by exiting the threshold setting mode. The threshold setting mode may be exited either by waiting for the 10 seconds or by pressing the ALARM button.

Note that the selected alarm thresholds are active, but depending on the configuration they either are or are not stored on EEPROM. If the alarm thresholds are not stored on EEPROM, they are valid as long as the meter is on. After the meter has been turned off, the default values are restored.

The set threshold is displayed on the analog display as a bar, if the threshold is set within the range of the scale displayed.

The active alarm threshold level can always be checked by pressing the ALARM and DOSE RATE buttons simultaneously and then exiting the mode after 10 seconds.

3.8.2. Dose Rate Alarm

If the dose rate alarm threshold is met, the ALARM symbol starts to flash on the display and the meter emits an audible alarm signal.

The alarm signal is a FAST SERIES OF BEEPS. The signal stops when either the alarm condition is no longer met or the alarm is muted by pressing the ALARM button. The alarm begins again, if the meter is restarted with the POWER switch and the alarm condition is still met.

The flashing ALARM symbol on the display is not cleared from the display, before either the dose rate falls below the threshold or the threshold is changed to a higher one above the current dose rate value.

3.8.3. Setting the Dose Alarm Threshold

Enter the threshold setting mode by pressing the ALARM and DOSE buttons for two seconds. When the SETTINGS symbol appears on the display the dose display digits start to blink. Now you can choose the alarm threshold from the preset menu. The DOSE RATE button steps down the menu and the DOSE button steps up the menu. To step faster, hold the DOSE RATE or DOSE button down longer. The possible numeric values are the same as in the dose rate threshold setting (the corresponding units being µSv and mSv). To clear the alarm threshold set the value at 0.00. The menu does not scroll around. When the dose alarm threshold has been selected, it is activated when the user exits the threshold setting mode. The threshold setting mode may be exited either by waiting for 10 seconds or by pressing the ALARM button once.

Note that the selected alarm thresholds are active, but depending on the configuration they either are or are not stored on EEPROM of the meter, when exiting the alarm threshold mode. If they are not stored on the EEPROM, they are valid only as long as the meter is on. After the meter has been turned off, the default values are restored.

The active alarm threshold level can always be checked by pressing the ALARM and DOSE buttons simultaneously and then exiting the mode after 10 seconds.

3.8.4. Dose Alarm

If the dose alarm threshold is met, the ALARM symbol starts to flash on the display and the meter emits an audible alarm signal. The dose alarm signal is a SLOW SERIES OF BEEPS. The signal stops when either the dose limit is changed or the alarm is muted by pressing the ALARM button. The alarm begins again, if the meter is restarted with the POWER switch and the alarm condition is still met. (Dose is not cleared.)

The flashing ALARM symbol on the display is not cleared from the display until the alarm condition is no longer met, i.e. when the accumulated dose is cleared or when the alarm threshold is changed to a higher one above the current dose reading.

3.8.5. Simultaneous Dose Rate & Dose Alarm

If both the dose rate and the dose alarm thresholds are met at the same occasion, the ALARM symbol starts to flash on the display and the meter emits an audible alarm signal.

The alarm signal is a CONTINUOUS, NOT INTERMITTENT BEEP. If one of the two alarm conditions is no longer met, the alarm signal changes accordingly.

4. OTHER FUNCTIONS

4.1. Sample Memory

The dose rate averages of 1...99 minutes are collected in the so called sample memory. The sample memory capacity is 864 dose rate readings. The dose rate readings are cleared, when the meter is switched off.

4.2. Printing the Dose Rate Readings

At any time the readings already stored may be printed on a printer or be downloaded to a computer (see Chapter 8. Attaching a PC). In addition to the readings, also the highest, the lowest and the mean dose rate values are printed.

To start printing the dose rate readings press the DOSE RATE and the DOSE buttons simultaneously. During the printing the METER symbol is displayed, along with an ARROW pointing away from the METER symbol. Note that during printing the dose and dose rate are not calculated. However, the pulse indication is operating, if it was switched on before starting the printing.

4.3. Print Format

In the printout the sample memory locations are divided into groups of five, starting from the first location. Each group is printed on a separate line. One line consists of the number of the first memory location and five dose rate samples. If one of the memory locations of the group does not contain a value, a dash is printed in its place.

In addition to the dose rate readings, the printout contains a header text, the time interval of the automatic sampling, the reading unit (microSv/h or millirem/h), the number of readings, the mean and the greatest and smallest values.

Following is an example of a printout:

```
RDS-200    V 1.00    PRINTOUT
TIME INTERVAL:   5 MIN
DOSE RATE UNIT: microSv/h

NUMBER:  SAMPLES
   1       0.10       0. 10      0. 10      11. 2      50592
   6       19190      10363      0. 21      0.16       1.57
   11      6.72       106        172        112        945
   16      287        137        1.20       0.22       0.16
   21      151        325        343        0.27       1344
   26      768        255        293        312        311
   31      195        195        1.54       1.17       0.39
   36      0.14       -          -          -          -

AVERAGE OF 36 SAMPLES:
           2400
MIN:
   3       0.10
MAX:
   5       50592
```

5. EXTERNAL GAMMA PROBE

External gamma probes, type GMP-12 (RADOS cat. no. 1233-183), GMP-12XL (RADOS cat. no. 1233-197), GMP-12L (RADOS cat. no. 1233-190) and GMP-12H (RADOS cat. no. 1233-191) can be used with the meter. The probes are attached to the interface connector at the bottom part of the meter. The meter automatically recognizes the probe when it is attached to the meter.

During the recognition all display segments are switched on. When the probe has been recognized the meter indicates it by sending short audible beep signals and a METER symbol with an ARROW pointing towards the meter appears down in the bottom left-hand corner of the display.

Audible signals:
three short beeps   GMP-12 or GMP-12XL recognized
two short beeps   GMP-12L recognized
one short beep   GMP-12H recognized

The functions of the meter with the external gamma probe are congruent with its functions with the internal gamma detectors (see chapters 3 and 4) except for cases mentioned later on.

The useful range of pulse indication is about 0.05 uSv/h...5 uSv/h (0.5 urem/h...500 urem/h), when using the GMP-12XL sensor. With the GMP-12 and GMP-12L sensors the useful range of pulse indication is about 0.25 uSv/h...25 uSv/h (25 urem/h...2.5 mrem/h). With the GMP-12H sensor the useful range of pulse indication is about   10 uSv/h...1 mSv/h (1 mrem/h...100 mrem/h).

If the external gamma probe is in use and error codes Er5, Er6 or Er7 appear on the display, the error codes are due to the GM tubes of the external gamma probe. (See chapter 9.)

6. EXTERNAL BETA PROBE

An external beta probe, type GMP-11 (RADOS cat. no. 1233-122) or GMP-15 (RADOS cat. no. 1233-176) can be used with the meter. The probe is attached to the interface connector at the bottom part of the meter.

The meter automatically recognizes the probe. When the probe is in use the METER symbol is shown on the display, with an ARROW pointing toward the symbol, and a BETA symbol next to the ARROW, both below the METER.

In the beta measurement mode the meter displays the results as pulses per time unit. The displayed unit is either pulses per second, "CPS", or one thousand pulses per second, "kCPS". The unit is chosen automatically.

Note that with an external probe the results cannot be printed out.

6.1. Pulse Indication

Pulse indication can also be used with the beta probe. Each pulse is indicated by a short beep. The pulse frequency corresponds to the level of radiation. Any changes in the level of radiation can be quickly noted from the frequency of the pulses, without having to keep an eye on the display all the time.

The useful range of the pulse indication is about 0.5-50 pulses/s.

To turn the pulse indication on, press the ALARM button. The PULSE INDICATION symbol appears in the top left-hand corner of the display.

To turn the pulse indication off, press the ALARM button again. This also clears the PULSE INDICATION symbol from the display.

7. ACTIVITY MEASUREMENT WITH AN EXTERNAL BETA PROBE

With an external beta probe it is possible to measure the activity levels of e.g. foodstuff or equivalent samples. The meter calculates the total number of counts from the probe over a determined period of time.

The beta probe is connected to the interface at the bottom part of the meter.

In the foodstuff activity measurement the probe is placed in a container. The measurements are done with an empty container, and with a known sample of foodstuff. The sample's activity level can be estimated from the results. When more accurate results are needed, the probe has to be calibrated in standard geometry for each separate isotope.

The meter displays the result as total counts. If the number of counts exceeds the value of 999 the display changes to display thousands of counts, indicated by a "k" after the number. If the display exceeds 999 thousand counts, the display will indicate an overflow by showing "OFL". In such a case the pulse counting is interrupted.

7.1. Starting Up the Measurement

To start the measurement, switch the meter into the measurement mode by pressing the DOSE and DOSE RATE buttons simultaneously. The smaller numeric display starts to flash "060 m".

If pulse indication is needed, it has to be turned on before switching to the measurement mode (see 6.1 Pulse Indication).

7.2. Setting the Measurement Time

When the meter is in the measurement mode the measurement time can be chosen. The measurement time flashes on the smaller numeric display. The default value is 60 minutes, which can be seen on the display as "060 m". The measurement time is chosen from a preset menu. The DOSE RATE button steps down the menu and the DOSE button steps upwards. Possible values for the time are: 15, 30, 60, 90 seconds, 6, 10, 15, 30, 45, 60, 90, 120, 180, 240, 300, 360, 420, 480,

720 and 960 minutes. The periods indicated in minutes correspond to 0.1, 0.167, 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 12 and 16 hours. 'Minute' is abbreviated "m" in the display. Seconds are displayed without a unit mark.

After the measurement time has been chosen, the measurement may be started.

7.3. Starting and Stopping the Measurement

To start the measurement, press the ALARM button.

During the measurement the larger numeric display shows the number of pulses stored and the smaller numeric display shows the remaining measurement time. The measurement stops automatically after the measurement time has elapsed, and the meter emits a long audible signal. After the measurement the larger numeric display shows the total number of counts and the smaller numeric display flashes the time that was used for the measurement.

If you want to repeat the measurement press the ALARM button. The meter switches again over to the measurement time selection. The default value is the same that was used in the previous measurement.

To exit from the measurement mode switch the power off.

8. ATTACHING A PC

The RDS-200 meter is attached to a PC with a Data Transfer/ Alarm cable (RADOS cat. no. 1233-202). The cable can be attached also to a printer equipped with a serial RS 232C interface. Connector adapters may be needed when connected to the printer.

The interface parameters of the meter are as follows:

- Data transfer rate 300 Bd or 1200 Bd, set by PC
- Data length 8 bits
- Parity no
- Handshake no

9. ALARMS AND ERROR CODES

The alarms are indicated with the display symbols and audible beep signals. The possible alarms are:

– Dose rate alarm (a flashing ALARM symbol and a fast intermittent sound signal).
– Dose alarm (a flashing ALARM symbol and a slow intermittent sound signal).
– Battery alarm when at least 5 hours of operating time in background radiation level left (long sound alarm when the alarm first appears, and after it the BATTERY symbol is shown on the display).
– Battery alarm when no more power to operate (a continuous sound alarm and the display is turned off.

The error codes are displayed on the smaller numeric display. The error codes are blinking. The possible error codes and the corresponding errors are as follows:

– Er0; dose rate of 10 Sv/h has been exceeded.
  Dose may be under estimated.
– Er1; an incorrect calibration coefficient (the meter has not been calibrated)
– Er2; the dose and parameter memory's checksum incorrect (faulty memory)
– Er3; the total dose over 10 Sv (the meter must be serviced)
– Er4; not in use
– Er5; the more sensitive GM tube is not sending pulses (the tube is faulty)
– Er6; the less sensitive GM tube is not sending pulses (the tube is faulty)
– Er7; neither one of the GM tubes is sending pulses (both of the tubes are faulty or the voltage of the tubes is missing)
– Er8; incorrect program memory checksum (the memory is faulty)
– Er9; operation error in the sample memory (the memory is faulty)

If the meter has several errors, the corresponding error messages alternate on the display. An audible alarm is sounded along the error messages. With the codes Er7, Er8 and Er9 the sound is continuous (measurements cannot be performed). With the other codes the sound is a short, infrequent beep.

The other status messages are displayed on the larger numeric display (dose rate display). The possible messages are as follows:

- Dose rate overflow:
  OFL (overflow, alternates with the dose rate display when in the range of 10…40 Sv/h, continuously on the display in the range of 40…100 Sv/h)
- Dose rate overflow at low energies:
  OFL (when the radiation energy is in the range of 50 keV...70 keV and the dose rate is over 10 mSv/h)
- Dose overflow:
  OFL on the larger numeric display and Er3 on the smaller numeric display indicating that the total dose is over 10 Sv
- Faulty meter:
  DEF (the meter is faulty, situations in which the measurements cannot be performed: error codes Er7, Er8 and Er9)

10. AUXILIARY ALARM DEVICES

Auxiliary alarm devices can be connected to the RDS-200 meter with a Data Transfer / Alarm cable (RADOS cat. no. 1233-202). The cable is equipped with a connector to the RDS-200 meter and with a D-connector.

To connect an auxiliary alarm device open the shell of the D-connector. Solder extra wires to the brown wire and to the black wire. If the D-connector is going to be used with a PC, do not disconnect the black wire from the D-connector pin. Put insulating tape around the solder points to prevent short circuit. Close the D-connector shell.
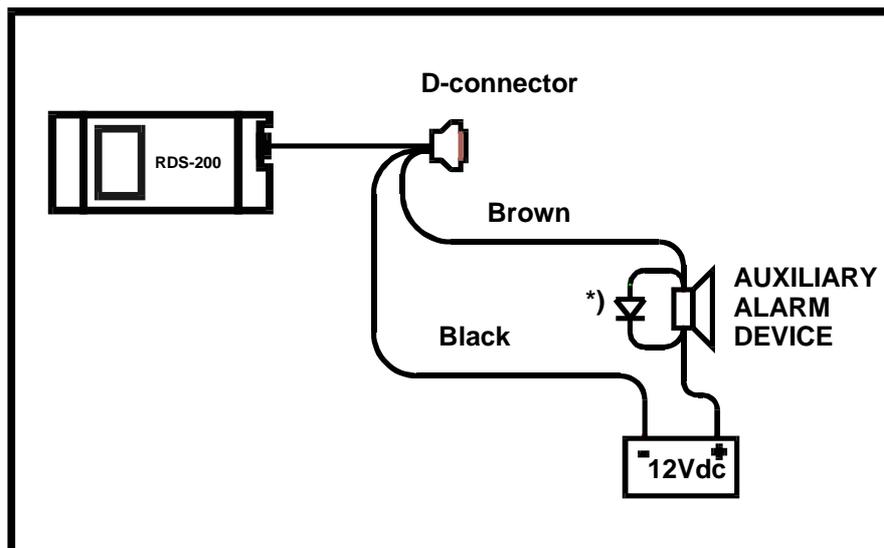
The wires are connected as follows:

Brown: Open collector output.

When alarm is activated, output will sink current max. 100 mA, voltage typ. 0.2 V above ground.

When alarm is not activated, current sink is 0 (or OFF). Maximum allowed voltage at this output is +24 V DC above ground.

Black: Ground, negative battery voltage.

*) Use protective diode (e.g. 1N4935 or equivalent) right across the alarm device, if the alarm device is an inductive load (e.g. relay or magnetic buzzer).

Notice that the RDS-200 meter itself does not supply power to the auxiliary alarm device, thus an external DC voltage supply (typically 12 V) is needed. The auxiliary alarm is activated in case of lower dose rate alarm or error codes Er0...Er9.

11. CONNECTORS

The RDS-200 has the following connectors:

PC/ Alarm Connector:
1. Hirschmann   type: ELST 4408 RV FM8 05
2. Binder Series 718   type: 09-3391-00-04

External Probe Connector:
1. Souriau   type: 851 02E 10-6S50
2. Amphenol   type: 62GB-12E10-6S

12. CONFIGURATION

The configuration of meter can be set by the U command. The communication parameter, one HEX-ASCII-character, consists of four bits. Parameter value ranges from '00' to 'FF' corresponding to bit values 0000 0000b ... 1111 1111b. (Hex characters 0 ...9, A...F are in use, note that A...F are all capital letters.)

Meaning of the bits; $b_7 \, b_6 \, b_5 \, b_4 \, b_3 \, b_2 b_1 b_0$:

Bit	Function	Configuration	Default
0	Communication speed	0 = 300 Bd 1 = 1200 Bd	1
1	Chirp on/off	0 = off 1 = on	1
2	Analog display	0 = Only unit uSv/h in use (max display 1000 uSv/h) 1 = Units uSv/h, mSv/h and Sv/h in use (automatic scale)	1
3	Push buttons (on/off and display illumination always enabled)	0 = disabled 1 = enabled	1
4	Dose rate alarm	0 = Alarm according to the short time dose rate 1 = Alarm according to the average dose rate	0
5	Auxiliary alarm connection	0 = with Data Transfer / Alarm Cable 1 = with CB-200 Connection Box	0
6	Restore original alarm thresholds	0 = disabled 1 = enabled	0
7	Low power mode (RS-232 driver powered only during communication)	0 = off 1 = on	1

Command line for default configuration is #10*0*U*8F*01AB

The unit can be changed by command Z. This message has two parameters (characters). The parameters are as follows:

'R' = Rem
'S' = Sievert

'C' = Cov (coefficient of variation) display enabled
'N' = Cov display disables

Possible combinations are as follows:

#10*0*Z*SN*01D3   (Sievert-unit and measurement without Cov-display)
#10*0*Z*SC*01C8   (Sievert-unit and measurement with Cov-display)
#10*0*Z*RN*01D2   (Rem-unit and measurement without Cov-display)
#10*0*Z*RC*01C7   (Rem-unit and measurement with Cov-display)

13. SPECIFICATIONS

Radiation detected:	Gamma and x-rays, 50 keV…3 MeV. Beta radiation with an external probe.
Detectors:	Two energy-compensated GM tubes. Energy response according to the ambient dose equivalent.
Dose rate measurement range:	0.01 µSv/h…10 Sv/h or 1 µrem/h...1000 rem/h
Dose measurement range:	0.01 µSv …10 Sv or 1 µrem...1000 rem
Resolution:	Three significant digits or 0.01 Sv/h on dose rate and 0.01 µSv on dose. Alternatively three significant digits or 1 µrem/h on dose rate and 1 µrem on dose.
Calibration accuracy:	<± 5%, Cs 137 reading along the calibration direction and in the calibration field, temperature +20 °C.
Dose rate linearity:	< ± 15% ± least significant number, in the range of 0.05 µSv/h…10 Sv/h or 5 µrem/h...1000rem/h
Response dependence on radiation direction:	± 25%, within ±45 degrees from the calibration direction, test energy 65 keV, within the range of 0.05 µSv/h...10 mSv/h or 5 µrem/h...1 rem/h ± 35%, within ±45 degrees from the calibration direction, test energy 83 keV, within the range of 10 mSv/h…10 Sv/h or 1 rem/h...1000rem/h

Energy range:	50 keV…3 MeV, within the range of 0.05 µSv/h …10 mSv/h or 5 µrem/h...1 rem/h 80 keV…3 MeV, within the range of 10 mSv/h…10 Sv/h or 1 rem/h...1000 rem/h
	Note that at energy levels between 50…80 keV overflow messages are given, if measurement range limit 10 mSv/h or 1 rem/h are exceeded.
Response dependence on radiation energy:	-20%… +30 %, within the range of 0.05 µSv/h…10 mSv/h or 5 µrem/h...1 rem/h ± 15%, within the range of 10 mSv/h…10 Sv/h or 1 rem/h...1000 rem/h
Temperature range:	-30°C…+55°C, operating -40°C…+55°C, operating (restricted display operation) -40°C… +70°C, storage
Power supply:	3 alkaline batteries (IEC LR6), +12 V DC external battery adapter (optional) or AC adapter (optional)
Battery life:	200 h in background field (+ 25 °C)
Battery alarm:	15 h before battery power-out
Overflow indication:	OFL displayed
Error diagnostics:	Continuous checking of electronics and GM tubes operation (10 error codes).
Casing:	Impact resistant, aluminium profile body with ABS plastic end caps, enclosure class IP67 (IEC 529), shielded against RF interference and NEMP.
Dimensions:	92 x 199 x 44 mm
Weight:	610 g without batteries 700 g with batteries