Tracerco
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User Manual

Tracerco T406 X-Ray Monitor

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1 General Description

The Tracerco T406 X-Ray Monitor is a portable, battery-operated radiation monitor capable of measuring X and gamma radiation in the energy range of 17keV to 1332keV. The monitor reflects Tracerco's extensive experience in industrial and environmental radiation measurement by combining novel design features with advances in technology, to make the monitor versatile, accurate and easy to use.

The radiation detection capability is based on a special thin window Geiger Muller (GM) tube. The monitor case has been specifically designed to protect the GM detector without reducing the sensitivity to low-energy X-rays.

It is designed to be lightweight but strong, and comfortable when used over long periods. The outer protective case is made from a high-quality material that is robust, and resistant to most chemicals.

The monitor is highly tolerant to humidity and wet conditions, and its design is based on the award-winning range of TRACERCO™ radiation monitors.

2 Operational Features

2.1 Switch On

To switch the monitor on, press the red ⏻ switch. Press once for 'on' and a second time to turn the monitor off. If there are no significant local sources of radiation, the monitor will register background, which will vary with the environment, but would typically be expected to be below 0.1µSv/h.

(Please note that there may be a slight delay between switching off the monitor and the screen becoming blank).

2.2 Speaker

Pressing the grey 🔊 switch activates the internal speaker.

The speaker provides a clicking sound at a rate that is proportional to radiation intensity.

You can turn the speaker off by pressing the 🔊 switch again. When the speaker is on, the 🔊 symbol will be shown on the screen. Using the speaker reduces the life of the battery.

2.3 Backlight

The monitor has a backlight which you can use in dark conditions. Press the grey ☼ to turn the backlight on. The backlight will go off when you take your finger off the button.

2.4 Alarm Settings

The monitor is equipped with an alarm which you can set to go off when a certain level of radiation (within limits) is detected. The alarm provides a continuous high-frequency tone whenever the radiation dose level goes above the value you set. A safety feature of the monitor is that the alarm cannot be muted when it is switched on. When the alarm is on, a flashing 🔊 is displayed on the screen. You can turn the alarm off.

For information on setting the alarm, see 2.6.5 on page 6.

2.5 Status Messages

In areas where there is extremely low background radioactivity, the monitor is programmed to recognise the following situations.

2.5.1 No recorded counts over a period of 20 seconds

The monitor will display a 'lo BGnd' message on the screen.

2.5.2 No recorded counts over a period of 40 seconds

The monitor will recognise a detector problem and will display an ERR message on the screen:

Error Message	Comments	Action
ERR1	GM Tube Failure	Return to Tracerco for further diagnosis and repair
ERR2	Undefined error has occurred	Return to Tracerco for further diagnosis and repair
LO BATT	There is approximately 4 hours of batter life remaining	Replace battery. See section 3.1 of the manual for further battery information. Contact Tracerco for assistance.
0UEr	Radiation levels have exceeded the working range (1mSv/h) of the Tracerco T406 X-Ray Monitor	Remove monitor to lower dose rate

2.6 Measuring Radiation

Switching on the monitor will display all available segments for 2 seconds.

The monitor then enters normal operation. All previous information on peak radiation dose rate and accumulated radiation dose will have been re-set to zero following the power down.

2.6.1 Bar Chart Display

The monitor provides a bar chart display which you may prefer to the digital numeric display for providing an improved visual indication of dose equivalent rate trends in the region of 0 to 1000µSv/h.

If the monitor is exposed to radiation higher than 1000µSv/h, the barchart display will stay at full-scale until the radiation detected drops to below 1000µSv/h.

2.6.2 Numeric Display

The display provides a continuous numeric display of dose equivalent rates from 0 to 1000 µSv/h.

If radiation readings go above 1000µSv/h on the digital numeric scale, the display will show an OVER warning. In this situation, the monitor cannot provide a measurement of radiation dose exposure. If the level of radiation drops below 1000µSv/h, the monitor will return to normal operation.

2.6.3 Accumulated Radiation Dose

An important feature of the monitor is its ability to record an accumulated dose. Once the monitor has been switched on, the accumulated dose will be continuously updated in the monitors memory. The yellow mode (–) button allows you to view the accumulated dose in µSv on the digital display. Pressing the button allows you to switch between the digital read-out of dose rate (in µSv/h) and the accumulated dose (in µSv).

To end the accumulation, simply press the green SELECT/RESET button when in the accumulated (µSv) mode. This will reset the dose to zero and a new accumulation will start. The accumulated dose function allows you to use the monitor as an integrated dosimeter and is useful in carrying out assessments of potential dose uptake by individuals during the performance of certain operations or establishing a time integrated dose from which average dose rate values can be calculated. This is particularly useful where dose rates are extremely low and variable with time.

2.6.4 Peak Radiation Dose Rate

The monitor can record the highest dose rate (the peak rate) it has been exposed to since it was switched on. Switching off the monitor clears the memory of the previous peak rate.

Pressing the green (+) PEAK button while in the dose rate (µSv/h) mode will show the peak value. Pressing the button again will return the display to normal reading mode. Pressing the SELECT/RESET button during this peak display will reset the peak rate to zero reading, allowing you to take a new peak reading.

2.6.5 Setting Alarm Level

The Tracerco T406 X-Ray Monitor is equipped with an alarm which can be set by the operator. The alarm sound is a continuous high-pitched note.

You can set the alarm trip level in either rate values or as accumulated dose.
The available settings for the alarm are as follows.

a) Accumulated dose function

0 to 100µSv in steps of 1µSv
100 to 400µSv in steps of 10µSv
Maximum alarm trip level – 400µSv

b) Dose equivalent rate function

0 to 50µSv in steps of 1µSv
50 to 100µSv in steps of 5µSv
Maximum alarm trip level – 100µSv

To set the dose rate alarm level the speaker should be held for 3 seconds whilst in dose rate mode.

To set the dose rate alarm level the same procedure should be followed whilst in dose mode. In both cases the alarm can be turned on (A-ON) or off (A-OFF) by pressing MODE then SELECT/RESET.

If alarm on is selected the alarm level can be increased by pressing the PEAK (+) button and decreased by pressing the MODE (–) button. SELECT/RESET should be pressed to select and apply the alarm level and return to the readings display.

2.6.6 Sound Options

If the speaker symbol is not showing on the screen, both the clicking sounder and the alarm are off.
Whenever you switch on the monitor it will keep the previous alarm trip level and speaker setting.

3 Maintenance

3.1 Replacing the Battery

The condition of the battery is constantly monitored. The battery will last for approximately 100 hours of use. When the monitor shows a LO BATT warning on the screen, under normal circumstances, the battery should last for another four hours of use. When the battery is too low for reliable use, the screen will go blank.

There may be times when the LO BATT warning appears but, when the monitor has been switched off for a short period and then switched back on, the warning does not appear. This is relatively rare and usually happens after the monitor has been used in a high-radiation environment for a significant period of time.

The battery compartment is on the back of the case. The recommended batteries are alkaline manganese MN1604 / MX1604.

To remove the battery cover the single retaining screw must be unscrewed.

After changing the battery take care not to over tighten the cover screw.

3.2 General Maintenance

The case is designed to keep the build-up of contaminants to a minimum and is easy to clean with mild detergents. Solvents must not be used.

3.3 Calibration

It is best to practice that all radiation monitors are inspected and tested once a year. This includes carrying out performance checks and where appropriate, recalibrating the monitor.

We check and calibrate our radiation monitors immediately before we send them to our customers. Please refer to the Contact Us section to find your nearest Tracerco Calibration and Repair Facility.

4 Technical Specification

Radiation	X-Rays and gamma rays in range of 17 keV to 1332 keV.
Detector	Single, thin window energy compensated Geiger Muller tube.
Dose rate range	Bar graph display 0–1000 µSv/h. Digital numeric display 0-1000 µSv/h. USA version: Bar graph display 0-100 mRem/h. Digital numeric
Accumulated dose range	Digital numeric display 0–1000 µSv/h. USA version: Digital numeric display 0–100 mRem.
Peak radiation	Digital numeric display 0–1000 µSv/h. USA version: Digital numeric display 0–100 mRem.
Measurement	Can be supplied with either mRem/h or µSv/h display
Over-range response	Bar graph display will read full scale. Digital numeric display will show 0UEr (0UEr)
Case materials	Robust, chemical resistant polymers.
Variation with battery voltage	Less than 2%.
battery life	100 hours typically with background radiation.
Low battery indication	Displays at approximately 4 hours available life left (background radiation levels).
Battery	Standard 9V PP3 battery.
Ingress protection rating	Rated IP65 (dust tight and will withstand water jets).
Humidity range	0 to 95%
Weight	600 grammes (approx).
Variation with temperature	Less than ± 5% over temperature range -10°C to 40°C (14°F to 104°F).
Standard compliance	EU Directives: 2004/108/EC Electromagnetic Compatibility Directive

5 Hints for Radiation Dose Rate Monitoring

The radiation detector is in the front face of the instrument. Hold the monitor as far as comfortably possible in front of you with the head of the monitor pointing towards the potential source of radiation.

When monitoring environments where radiation levels are totally unknown, having the speaker on reduces the potential for exposure if your attention is taken away from the monitor screen. It also provides a warning to other workers in the area.

Always remember the time and distance rules to keep your personal exposure to a minimum. The accumulated dose and peak value options should reinforce safe working practices.

Before you use the monitor, check that it is working properly by placing it near a known test source or make sure that sensible background radiation values are being displayed.

6 Contact us

Contact us at one of our Global Service Centres

Billingham, UK (Global Headquarters)
Tel: +44 (0)1642 375171
Email: radiation.monitors@tracerco.com

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Email: tracerco@tracerco.com

Please visit the Tracerco website www.tracerco.com for details of other Tracerco offices and locations.

7 Tracerco Products and Services





Tracerco manufacture a wide range of intrinsically safe and standard radiation monitoring products.

Tracerco can provide a professional, rapid turnaround calibration and repair service as well as offering a hire service for a range of monitors.

Our experienced technicians can also provide an annual Hazardous Area Equipment Inspection as described by IEC 60079-17.

Tracerco

Insight through innovation

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