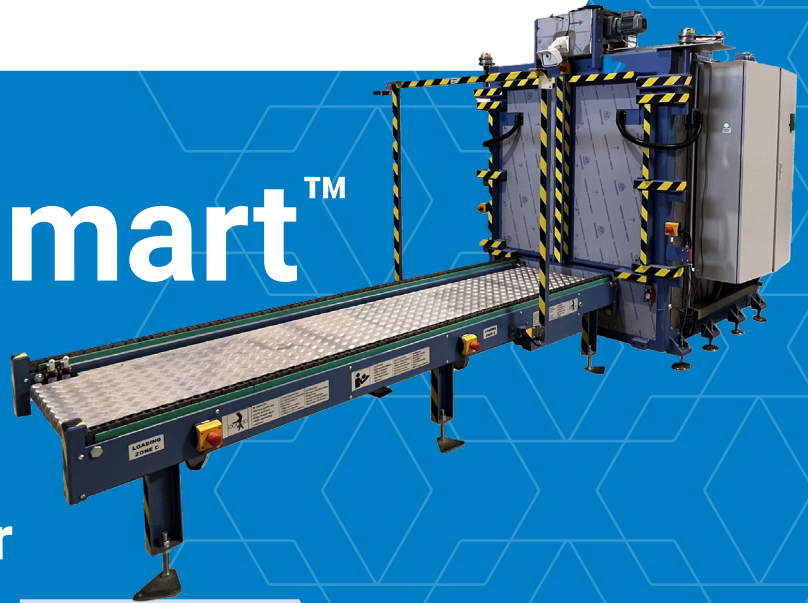




RTM644-Smart™



Large Clearance Monitor

The Mirion RTM644-Smart Gamma Clearance Monitor is designed for measurements of large items like EPAL crates, 400 or 200 liters drums, palettes or big-bags with a measurement chamber size of 1870 liters.

DESCRIPTION

The RTM644-Smart is the most advanced clearance monitor and key monitoring equipment for every major clearance campaign. It consists of a measurement chamber with motor-operated swing doors and automatic chain conveyor system. The measurement objects are weighed by integrated scales and checked for gamma radiation by 24 state-of-the-art plastic scintillation detectors with spectroscopic read-out.

The RTM644-Smart shares the common, modern Lighthouse™ monitor software platform, with Windows 10 IoT operating system. This analysis software reports nuclide specific activity, brings lower measurement uncertainties, handles complex nuclide vectors, automatizes loading and simplifies maintenance.

It is based on the well-proven algorithm principles and improved leading nuclide correlation (LNC) technology as used in many Mirion RTM monitors. The state-of-the-art spectrometric detector read-out and the simulation-based object models, allow an unprecedented measurement accuracy. It provides with reliable efficiency correction for all nuclides in the fingerprint. The automatic verification and optimization of the declared nuclide vector can further reduce the measurement uncertainties.

FEATURES

- **Gamma clearance monitor** compliant with Euratom 2013/59, IAEA RS-G-1.7, ISO11929:2019
- **Palettes, EPAL crates, 200 L, 400 L drums, big-bags:** maximum weight 1000 kg; counting chamber 138 x 112 x 121 cm³ (LxWxH), volume 1870 liters.
- **High throughput:** up to 16 tons per hour
- **Low MDA:** 34 Bq Co-60, achieved by 24 plastic scintillator detectors with spectroscopic read-out in a 4 π configuration, modular lead lingot shielding of up to 75 mm on six sides,
- **Unprecedented precision and low uncertainty:** Spectrometric detector readout and signal processing, simulation-based object models, automatic efficiency and background correction,
- **Improved handling of inhomogeneities:** optional analysis software module,
- **Highly customizable:** 1 or 2 doors configuration, selectable conveyor length, container installation; Configurable fingerprints, release limits and objects,
- **Modern software platform:** Windows 10 IoT LTSC operating system and state-of-the-art Lighthouse analysis software
- **Simple use:** user-friendly and intuitive graphical user interface, software-controlled door and conveyor operation, remote control station, built-in weight scale,
- **Straightforward calibration and maintenance:** single source calibration, real-time spectrum display, software guided efficiency check and hardware diagnostics,
- **Robustness and safety:** Stainless steel chamber lining and external cladding, robust chassis, door hinges and position switches, protection fences and oversize sensors,
- **Safe transportation** by crane with full shielding installed.

RTM644-SMART™ LARGE CLEARANCE MONITOR

The RTM644-Smart comes with advanced administrator and maintenance features: the realtime energy spectrum display provides with a radiological health check of detector array on a single glance. All calibration and routine efficiency checks are configurable and software guided. The comprehensive and intuitive monitor software comes with user configurable libraries for release limits, radiological fingerprints or editable standard objects like crates or waste drums.

To extend the functionality to application-specific objects or assess specific environmental conditions or nuclide vectors, validated Monte-Carlo-simulations are available as a complementary service. The self-contained results database facilitates customized report generation, decision tracing and recalculation.

RADIOLOGICAL CHARACTERISTICS

DETECTION

- 24 large-volume plastic scintillation detectors – total active volume: 303 litres,
- Spectrometric read-out with 256 channels,
- Lower energy threshold: 80 keV,
- Measurable activity range: 10 Bq to 1 000 000 Bq.

BACKGROUND PROCESSING

- Advanced background filter permitting the detection and suppression of transitory background variations and an accelerated adaptation to lasting changes.
- The background stability is monitored also during the measurement,
- Automatic calculation of the background reduction by the object.

ALGORITHM

- Calculation of the mass or surface specific activity per nuclide,
- Bayesian statistics based, compliant with the ISO11929:2019 for calculation and clearance decision,
- Simulation based object models, valid for all nuclides in the library,
- Single nuclide efficiency calibration, no dummy objects needed for geometry correction,
- Automatic correction of the detection efficiency and background attenuation for mass, density and geometry of the objects,
- Compensation of NORM contributions by nuclide including density correction,
- Configurable nuclide vectors (fingerprints) and release limits.

SPECIAL

- Verification and optimization of the declared nuclide vector during clearance measurements,
- Residual chamber contamination checks,

DETECTION LIMITS

- Point source in chamber centre,
- Background (BKG) count-rate 2400 cps (approx. 100 nSv/h, 75 mm lead),
- False alarm safety quantile $k_a=1.65$, detection safety quantile $k_b=1.65$, $T_{BKG}=300$ s

Measurement time (s)	10	30	60	180
Co-60	116 Bq	69 Bq	51 Bq	34 Bq
Cs-137	234 Bq	139 Bq	103 Bq	69 Bq
Ba-133	226 Bq	134 Bq	99 Bq	66 Bq

MECHANICAL CHARACTERISTICS

- Chamber: 138 x 112 x 121 cm³ (LxWxH), 1870 liters,
- Ext. chassis dimensions: 191 x 186 x 229 cm³ (LxWxH),
- Conveyor: default length 300 cm
- Built-in weight scale, maximum 1000kg, 0.1 kg resolution,
- 50 or 75 mm lead shielding, transportable by crane with the shielding installed,
- Total weight with shielding:

Shielding	50 mm	75 mm
Weight	13 500 kg	17 600 kg

FUNCTIONAL CHARACTERISTICS

- Single/double doors, single/double chain conveyors, motorized operation with PLC,
- Automatic object loading, integrated in measurement software, object detection by the weight scale,
- Up to 2 still cameras, triggered by position sensors,
- Remote user interface with colour screen, keyboard and pointing device, single RJ45 cable connection,
- Visual and audible contamination alarm,
- Report and label printing, optional barcode-reader user-configurable PDF report generator,
- Hierarchical password protected administrator access,
- Software assisted monitor diagnosis and calibration,
- Software module for configurable quality assurance system check procedures
- Preconfigurable software libraries of
 - Objects (drums, bags, clothes, toolboxes etc.),
 - Nuclide vectors / Fingerprints,
 - Nuclides,
 - Release limits etc.
- Self-contained results database with raw spectra and object data for reporting, tracing and recalculation,
- Network capability with interface to waste-management system.

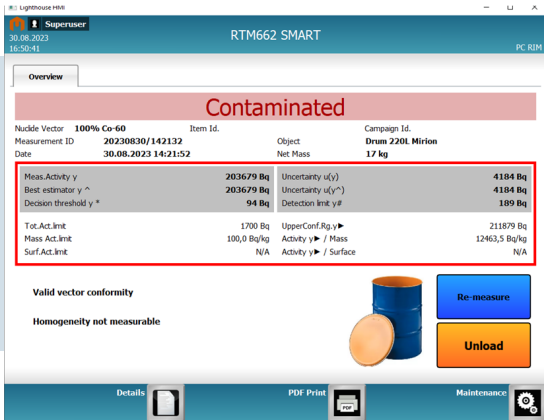
ENVIRONMENTAL CHARACTERISTICS

- Operating temperature range +5°C to +45°C
- Storage temperature range -25°C to +60°C
- Relative humidity (non-condensing) 40% to 100%

ELECTRICAL CHARACTERISTICS

- Operating voltage: 220 / 380 V, 3 phases, 50-60 Hz
- Nominal current: 5 A
- UPS backup autonomy (computer only): 60 min
- 2 external USB connectors, 1 LAN connection
- Configurable logical outputs available on request

RTM644-SMART™ LARGE CLEARANCE MONITOR



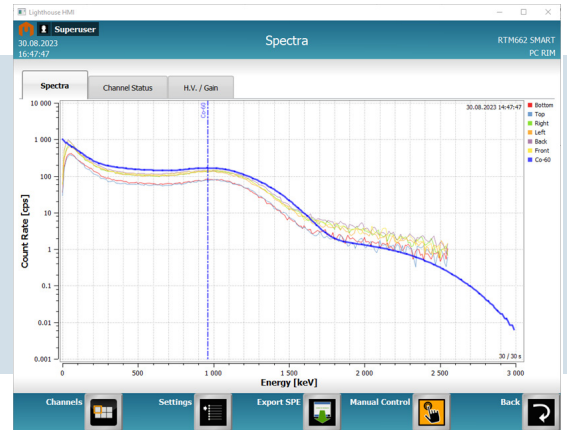
RESULTS SCREEN

Detailed display of measurement conditions and results for a case where the alarm level is exceeded.

The screen contains all information about the measured activity, its uncertainty as well as the decision and detection limit, as required by ISO11929.

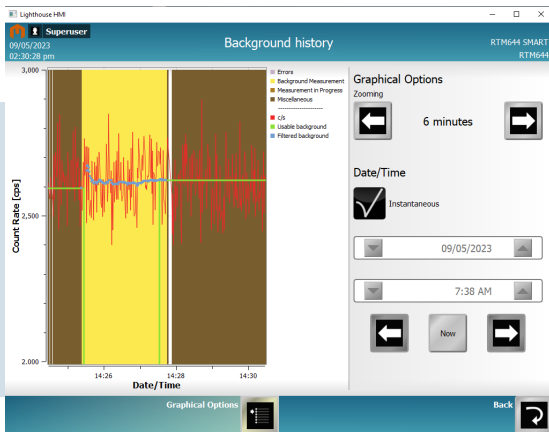
REAL-TIME SPECTRA DISPLAY

The radiological health check is simplified by comparing visually an actual Co-60 spectrum with a reference. With the spectrum in the accurate position, the detection efficiency will also have the expected value. Any deviations can be analysed and corrected in dedicated menus.

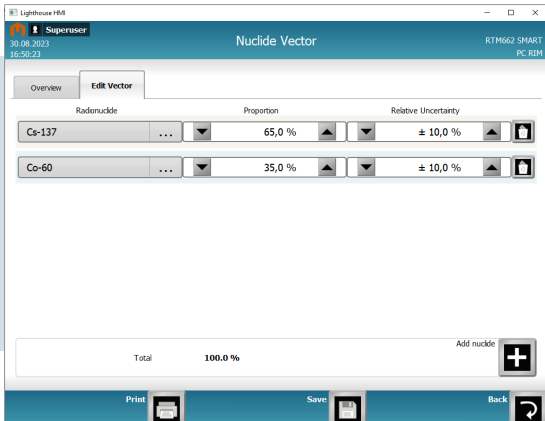


BACKGROUND DIAGNOSTICS

Graphical display of the background history including the count-rate, the filtering process and the reference background. The background history is stored for 3 months with a resolution of 1 s for 3 days and 60 s for the remaining time.



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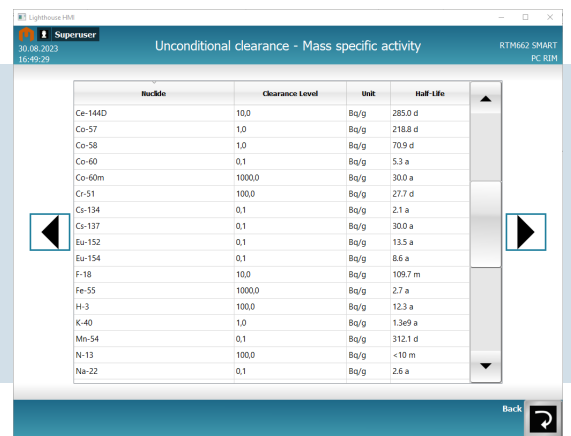
NUCLIDE VECTORS

Configuration screen for the nuclide vectors. The declared abundance of the nuclides is used to calculate the release limits and the expected detection efficiency.

The uncertainty is included in the calculation of the total coverage range according to ISO11929.

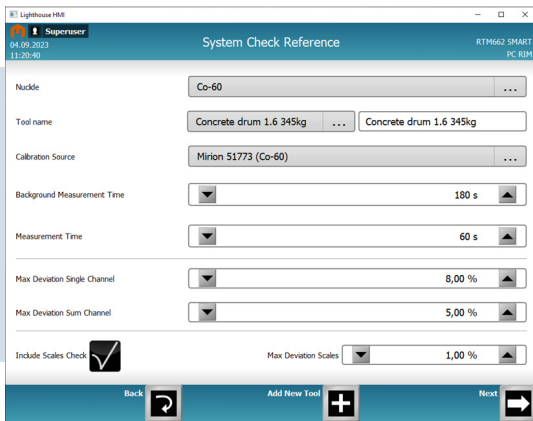
RELEASE LIMITS

Library of the nuclide specific release limits. Different, user-configurable datasets can be selected.



SYSTEM CHECK

Quality assurance procedures require periodic verification of the detection efficiency and correct operation of the system. The System Check module provides comprehensive functionalities to simplify periodic quality assurance.



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