MIRION
TECHNOLOGIES

Contamination and Clearance Monitors

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PROTECT WHAT'S NEXT

At Mirion Technologies, we partner with industry leaders to advance radiation safety and empower the next wave of critical innovation. From R&D labs, to critical nuclear facilities, and on the front lines, we provide proven radiation safety technologies that operate at the highest levels of precision, and deliver trusted expertise that empowers our customers to solve problems and enable breakthrough innovation.

Our Mission:

To harness our unrivaled knowledge of ionizing radiation for the greater good of humanity.

CONTAMINATION AND CLEARANCE MONITORS

- GEM™-5
- Argos™ PAB
- MiniSentry™ 2
- HandFoot-Fibre™
- Sirius™-5
- Sirius™-5 Compact
- RTM644-Smart™
- RTM662-300
- RTM662-460
- RTM662-460C
- Cronos®-4 and Cronos®-11
- RTM 750™

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PREVENTION

GEM™-5

Gamma Exit Monitor

DESCRIPTION

The Mirion highly sensitive GEM-5 gamma exit monitor provides power plants and nuclear facilities the very latest gamma detection capability to monitor pedestrians leaving areas of potential radioactive contamination. Operation of the monitor is straightforward and reliability is assured with both audible and visual aids to support monitoring activities. The easy to see color LCD screen provides visual cues and readily displays contaminated areas. Additionally, users are guided through the monitor with a voice annunciator, which provides clear voice prompts necessary for dependable unassisted operation during normal conditions. With Mirion WebRemote® software, easy-to-use touch screen graphical user interface for industrial PC-based operation results in improved health physics programs, better tracking of contamination and faster, more thorough personnel throughput at boundary points.

Access to the installed computer is through a single convenient panel on the front of the monitor. The computer includes built in USB and LAN ports, and is located inside a lockable door.

The GEM-5 is rugged, reliable and extremely easy to use.

OVERVIEW

The monitor is designed to be operated in one of three different modes depending upon the level of detection capability needed.

These are:

1. Walkthrough (monitor determines MDA based on user settable parameters).
2. Pause-and-count (enter the monitor, wait for a length of time specified by the user, then exit).
3. Two-step (stand facing the detectors for a short period (time user settable or calculated by monitor), turn 180° and repeat count, then exit).

The contamination level at which the monitor can be set to accurately alarm is different for each of these modes.

The sensitivity will differ depending upon the radionuclides, background and count times.

FEATURES

- ✓ Rugged and reliable for high traffic areas
- ✓ "Best in Industry" sensitivity
  - ✓ Eight identical large plastic scintillators
  - ✓ Three per side
  - ✓ One top/bottom
- ✓ 25 mm (1 in.) side detector lead shielding standard
  - ✓ Lead is provided as epoxy coated ingots for easy field installation and improved safety
- ✓ Optional 25 mm (1 in.) of additional lead available for side panels (can be added integral to the unit, no exterior attachments needed) for higher background conditions. Optional top and bottom detector lead kits in 25 mm (1 in.) increments are available for a total of 50 mm (2 in.) of added lead
- ✓ WebRemote enabled: provides an ergonomic and easy-to-use touch screen graphical user interface; accessible locally or via PC /tablet web browser
- ✓ Windows 7 10 IoT operating system with LAN capability and USB ports
- ✓ Same "industry-best" software and serial bus electronics as the Mirion Argos™-3/5, Sirius™-5 and Cronos®-1/4/11 monitor families no re-training needed
- ✓ Sophisticated "fast following" background trending and release-limit algorithm provides the best possible performance in any type of radiation field
- ✓ Fully compliant with IEC61098 Standard requirements
- ✓ Algorithm based on Gaussian or Bayesian statistics (compliant with the ISO 11929:2019 Standard requirements)

SETTING PARAMETERS

Parameter settings, testing, calibration and maintenance is accomplished locally or from a remote location using Mirion WebRemote. WebRemote enables tablet or PC connection to the GEM-5 via LAN or direct link.

Alternatively, the operator can use the standard monitor software, pre-installed on all GEM-5 contamination monitors, to provide local monitor access and functionality.

The following types of parameters are available for adjustment:

- Sensitivity of detection by zone
- Gamma alarm activity levels set in units of Bq, Bq/cm^2, dpm, dpm/cm^2, nCi, nCi/cm^2, pCi, pCi/cm2, µCi or µCi/cm^2
- False alarm non-detection and alarm confidence probabilities
- HV Optimization using Figure-of-Merit (FOM) calculations
- Fixed or variable count times (calculated and optimized as a function of the alarm level set, the background and the desired accuracy of measurement)

MONITORING ASSISTANCE VIA USER INTERFACE

Indicator lights at the entry show the monitor is ready to use. While the occupant is being monitored, messages and a countdown are given both on the LCD screen and audibly (multiple languages are available). Verification of proper occupant positioning is ensured with the help of infrared sensors. All positioning sensors are non-mechanical solid state types for enhanced reliability. Visible and audible alarms are given if contamination is detected. The display shows the type (gamma), the quantity and the location (alarming detector flashing on a figure). The system records data and date/time stamped logs showing the number of times the unit was used, parameters used, calibration settings, fault messages etc.

Up to four contact closure relays are available for remote signaling of the monitor's status (e.g. "In Operation", "Contaminated", "Clean", "Fault" etc. or some combinations there of).

MAINTENANCE

The GEM-5 monitors were engineered to simplify maintenance with easy access to the unit; as well as easy replacement and repair of the detectors.

For ease of diagnostics, numerous test screens are available to enable precision monitoring, and changing of parameters including high voltage and discrimination thresholds for each detector. To provide further assistance rate meters show counts seen by each detector in real-time.

Calibration of all detectors and alarm testing can each be done in less than ten minutes.

REMOTE STATUS MONITORING

A user friendly dashboard enables the status monitoring (in service, contaminated, out of service, maintenance) of multiple contamination monitors over the LAN. The dashboard is accessible from a tablet or PC web browser and requires no proprietary software installation.

SPECIFICATIONS

PARAMETER ENTRY

- Parameters may be entered with the touch of a finger using the capability of the built-in touch screen and WebRemote software. Additionally, a USB connected keyboard/mouse may be used to enter parameters.

SENSITIVITY

- The unit will detect a point source located anywhere on the monitored person, in a standard background of 80 nGy/h (8 µrad/h), using the following modes:
- Walkthrough: 830 Bq (22.5 nCi) ^{60}Co; 1850 Bq (50 nCi) ^{137}Cs
- Pause (4 s) and Count: 555 Bq (15 nCi) ^{60}Co; 830 Bq (22.5 nCi) ^{137}Cs
- Two-Step: 370 Bq (10 nCi) ^{60}Co, 8 s; 370 Bq (10 nCi) ^{137}Cs, 18 s

DETECTORS

- Configuration: Eight identical plastic scintillators; 24 sum zones
- Total scintillator volume: 86 196 cm^3; (5260 in^3)
- Total scintillator surface area: (16 968 cm^2; 2630 in^2)

ELECTRONICS

- The High Voltage (HV), preamplification, amplification, discrimination, counting, test pulse generation and other processing electronics are mounted right on the detectors. The cables between the detectors and computer are all direct current and low voltage.

EFFICIENCIES

- Typical 4π efficiency, rounded to the nearest whole number, measured with a point source placed in the center of the detector 50 mm (2 in.) from the surface and optimized using a 137Cs source and the standard Figure-of-Merit (FOM) technique for reducing signal-to-noise ratios.

Isotope	Efficiency
^{60}Co (Gamma)	24%
^{37}Cs (Gamma)	12%

PHYSICAL

- The cabinet is steel, with a rugged powder coat finish. The thin aluminum cover in front of each detector provides both protection and sensitivity.

DIMENSIONS:

- Exterior: 224.8 x 88.9 x 76.2 cm (88.4 x 35 x 30 in.) (H x W x D)
- Portal opening: 205.4 x 61.0 x 76.2 cm (80.9 x 24 x 30 in.) (H x W x D)

WEIGHT:

- Weight without lead installed: 452.5 kg (995 lb)
- Weight with one layer of side detector lead shielding installed: 975 kg (2145 lb)
- Weight with two layers of side detector lead shielding installed: 1497.5 kg (3295 lb)

COMPUTER:

- The GEM-5 computer operates on Windows 10 IoT Operating System and uses USB flash for transferring data. Data may be retrieved either via USB or a LAN
- High-quality digitized sound for prompts, with dual speakers

DISPLAY SCREEN:

- ~23.4 cm (10.4 in) touch screen LCD display, integrated onto top of unit

CERTIFICATION

- IEC 61098 compliant
- ISO 11929:2019 compliant

ENVIRONMENTAL

- Temperature range: operating (meets IEC61098): 0 to 40 °C (32 to 104 °F)
- Temperature range: storage: 0 to 50 °C (32 to 122 °F)
- Relative humidity: Operating (per IEC61098): ≤85% non-condensing at 35 °C (95 °F) maximum
- Relative humidity: storage: ≤95% non-condensing

POLLUTION DEGREE

- Mirion contamination monitors are designed for Pollution Degree 2 (IEC 664-1) and are intended for indoor use only

OVERVOLTAGE CATEGORY

- Mirion contamination monitors are designed for Overvoltage Category II (IEC 664-1)

INGRESS PROTECTION

- Mirion contamination monitors are designed to meet the IP30 rating standard

POWER

- Power requirements: 220 V ac/50 Hz/ 1.0 A or 110 V ac/60 Hz/2.0 A mains 3 m (~10 ft) IEC standard cable (supplied; specify voltage and any special cable requirements on order; contact local Mirion affiliate for further information)
- Power Consumption: standard: 110 VA and With Door /Barrier options: 200 VA (If installed)

AVAILABLE ON REQUEST

- Remote annunciators or beacons
- Custom personnel traffic barriers and/or doors (manual or electric)
- External uninterruptible power supply
- Choice of four different inner widths
- Access ramps
- Top and/or Bottom Detector Shielding available (using 25 mm (1 in) lead ingots)
- Second layer of 25 mm (1 in) lead ingots
- Shadow shielding kit with 25 mm (1 in) lead ingots
- Consult the Contamination Monitor Configuration Guide for additional options that will enhance the use of the GEM-5 system.

USER BADGE/BAR CODE IDENTIFICATION

- User identification is available using industry standard card readers to provide employee ID for the health physics database. Magnetic stripe card readers, bar code readers or proximity badges are available.

LOCAL DATABASE SUPPORT OPTION (SOFT-LDB)

- The Local Database Option facilitates quick monitoring of the effectiveness of your contamination control programs. See separate specification sheet for full details.

ORDERING INFORMATION

Part Number	Description: Monitors
816002	GEM-5, Gamma Exit Monitor, 1” Pb, Serial, 61 cm (24”) inner width.
GEM-5M	GEM-5, Gamma Exit Monitor, 1” Pb, PC-side access doors.
7063219	GEM-5W80, Gamma Exit Monitor, 80 cm inner width.
GEM-5W93	GEM-5W93, Gamma Exit Monitor, 1” Pb, 93 cm inner width.
GEM-5W100	GEM-5W100, Gamma Exit Monitor, 1” Pb, 1 m inner width.
7061572	GEM-5 SIMULATOR.

OPTIONS: Factory installation of these options represents the best value for the customer

Part Number	Description
WebRemote-Kit#Y	WebRemote Software and Rugged / Pro / Basic Hardware. FOR Rugged Y=1; FOR Pro Y=2; FOR Basic Y=3.
7062157	MAGNETIC CARD READER FOR ARGOS, GEM & CRONOS.
816100	BARCODE READER FOR ARGOS, GEM & CRONOS.
7062147	PROXIMITY READER FOR ARGOS, GEM & CRONOS.
816174	GEM-5 MANUAL SWING RETURN DOOR.
GEM5-ADX	GEM-5 AUTOSWING DOOR; EXIT ONLY.
816161	ELECTRICAL BARRIER; ENTRY/EXIT, GEM-5.
GEM5-NF	GEM-5NF, GEM5 NO FLOOR OPT., 7 DETECTORS.
GEM5-BECL	GEM5 TOP BEACON, LIGHT ONLY.
GEM5-BECS	GEM5BECS, GEM5 TOP BEACON, LIGHT/SOUNDER.
7062269	GEM5-IPCAM212, IP CAMERA KIT FOR GEM-5.
SOFT-LDB	Loc.Database Support;Factory Installed.

OPTIONS: Can be ordered any time

Part Number	Description
201240	USB KEYBOARD/TOUCHPAD FOR ARGOS, SIRIUS & GEM-5.
816032	GEM5RP61-80, SET OF EXIT/ENTRANCE RAMPS.
816087	TOP PAN/EXTRA LEAD KIT FOR GEM-5.
GEM5-RP100	GEM5RP100, SET OF ENTRY/EXIT RAMPS 100 cm.
GEM5-PbTOP100	Top PAN/EXTRA LEAD KIT, GEM-5W100.
GEM5-PbTOP93	Top PAN/EXTRA LEAD KIT, GEM-5W93.
GEM5-PbTOP80	Top PAN/EXTRA LEAD KIT, GEM-5W80.
7062330	BOTTOM EXTRA LEAD KIT, GEM-5.
GEM5-2Pb	2nd Layer of 1” Lead Shielding for GEM-5.
816153	SHADOW SHIELD KIT FOR GEM-5.
81614	GEM5CJIG, GEM-5 CALIBRATION JIG.
7063341	GEM-5 WOOD SHIPPING CRATE.
GEM5-CRATE	GEM-5 WOOD SHIPPING CRATE, REUSABLE.
SOFT-CREMOTE	CRemote, Remote Control Data Access LAN SW.
7062263	CRemote, Remote Data Access LAN SW – Additional License.
SOFT-LDB-KIT	Loc.Database Support;Field Install. Kit
SOFT-LDB-KITPC-G	Loc.Datab.Supp.;Field Inst.Kit w/PC;-GEM5.PC;GEM5.

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MONITORING

Argos™ PAB

Whole Body Contamination Monitors

Argos TPS Family: Argos “PAB” Monitors for α/β Detection

The Mirion Argos-PAB family of Whole Body Surface Contamination Monitors provides the ultimate user-friendly operation with thorough and reliable detection of external contamination on personnel working in nuclear environments. The Argos-5 PAB and Argos-3 PAB monitors feature our most advanced gasless, Thin Plastic Scintillator (TPS) detectors optimized for the best possible alpha /beta response (along with minimizing the gamma response).

Until recently, the elimination of counting gas has been the only advantage of using plastic scintillation detectors over traditional gas flow detectors in whole body monitors. The sacrifice for this advantage was in detector performance (low efficiency, bad uniformity) leading to longer count times. Mirion has successfully addressed the challenges of this gasless detector technology, minimizing the trade-off between operating costs and performance.

FEATURES

- The first gasless alpha/beta Whole Body Contamination Monitor
- Fast personnel throughput with exceptional coverage due to optimized counting geometry and shielding
- The Argos-5PAB unit provides the ultimate in (two-step) contoured body coverage
- The Argos-3PAB unit provides contoured body coverage with strategic positioning of detectors in an economical configuration
- Alpha and Beta discrimination capability for unequivocal contamination status
- Space-saving design minimizes overall clearance requirements and enables easy maintenance access from front and side of the unit
- WebRemote® software enabled: ergonomic and easy-to-use touch screen graphical user interface; accessible locally or via PC/tablet web browser
- Windows 10 IoT operating system with LAN capability and USB ports
- Same “industry-best” software and serial bus electronics across the Mirion Argos-TPS/AB, Cronos®-1/4 /11, Sirius™-5 and GEM™-5 family; no re-training needed
- Compliant with IEC61098 Standard requirements
- Algorithm based on Gaussian or Bayesian statistics (compliant with the ISO 11929:2010 Standard requirements)

The Argos-3 /-5PAB gasless monitors offer the same industry-best contour geometry as the Argos-3 /-5AB gas flow monitors. The need for counting gas is eliminated by using scintillation detectors with an embedded PMT to minimize dead space between detectors. This arrangement provides optimal contour geometry and coverage for the occupant.

All Argos monitors use a sophisticated "fast following" background trending and release-limit algorithm to provide the best performance in a stable or varying radiation field.

Mirion WebRemote software, an easy-to-use touch screen graphical user interface for industrial PC-based operation, supports improved health physics programs, with better tracking of contamination and faster, more thorough personnel throughput at boundary points.

Excellent detector protection, modularity of components, and extensive diagnostics result in direct reductions in maintenance, repair, and operation costs.

OVERVIEW

The design of the TPS-AB-579 detectors, used in the Argos-PAB monitors, has been optimized to provide excellent signal-to-noise ratios and furthermore, the detection capability both across and along the detectors is extremely uniform. There is virtually zero edge effect degradation (typical non-uniformity of response is <1.20).

The Thin Plastic Scintillation detectors, TPS-AB-579, are identical in form factor to the gas flow detectors from the Argos-3 /-5AB family. Therefore, the current generation of Argos-3 /-5AB family can be field upgraded to the TPS-AB-579 detector technology*.

The TPS-AB-579 detectors are designed to operate without gas and their windows can be easily field repaired.

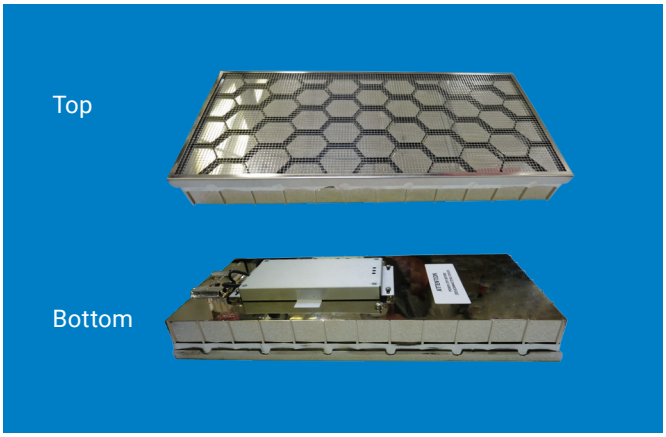
The overall benefit of Mirion detector geometry and detector design is that count times will be significantly reduced compared to other competitive systems.

Additionally, the radon progeny rejection feature of the software in Mirion Alpha/Beta contamination monitors is a useful tool to help reduce radon interference and minimize false alarms.

When gamma detection capability is needed, the Zeus™ option (consisting of a shadow shield and three large plastic scintillators) can be added to the Argos-PAB unit. There is no difference between the Zeus option for Argos-3 /-5 AB and Argos-3 /-5 PAB units.

BODY COVERAGE

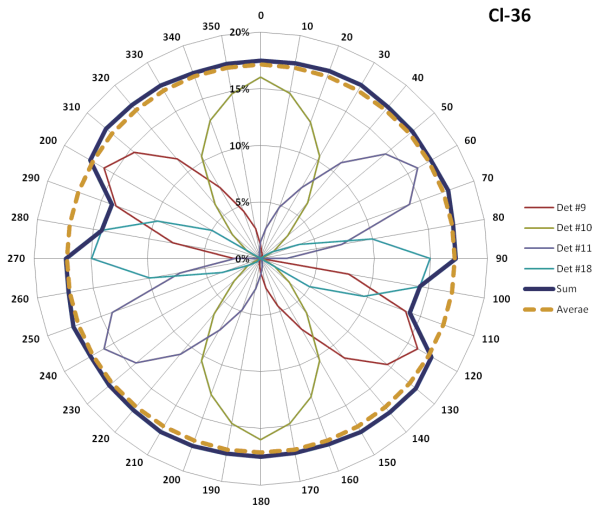
The Argos-5 detector design has been configured to contour the human body as closely as possible while paying particular attention to those parts of the body most likely to be contaminated. Gaps between detectors have been minimized. The benefit of this design is clearly shown by the horizontal scan on the next page.



The Argos-3PAB monitor provides the very best option for cost effective whole body coverage in the industry by encompassing all of the features of the Argos-5PAB unit but with fewer detectors (18 versus 25, respectively). The removed detectors are replaced by blank plates and have been strategically chosen to cover areas of the body least likely to be contaminated. This version provides the best value in a surface contamination monitor when budget is limited. The Argos-3PAB unit is upgradeable to the Argos-5PAB unit by simply installing additional detectors.

*Applies to Argos-3/-5AB units manufactured since February 2008 (contact factory to confirm)

The following scan was done in accordance with the IEC 61098 Standard, which specifies a ^{36}Cl source moved around a phantom positioned 5 cm uniform from the front detector. It shows how uniform the body coverage is when compared to the scans published in the literature of competitive monitors.



Argos-3/-5PAB Horizontal Scan Efficiency for ^{36}Cl,
IEC 61098 Phantom test 5 cm from center detector.

ELECTRONICS

The Argos-PAB computer operates on Windows 10 IoT Operating System and uses USB flash for transferring data. Data may be retrieved either via USB or a LAN.

The High Voltage (HV), preamplification, amplification, discrimination, counting, test pulse generation and other processing electronics are mounted right on the detectors. The cables between the detectors and computer are all direct current and low voltage.

SETTING PARAMETERS

Parameter settings, testing, calibration and maintenance functions are accomplished locally or from a remote location using Mirion WebRemote software. The WebRemote software enables Tablet or PC connection to the Argos-PAB monitor via LAN or direct link.

Alternatively, the operator can use the standard Monitor Software, pre-installed on all Argos-PAB Contamination Monitors, to provide local Monitor access and functionality.

The following types of parameters are available for adjustment:

- Sensitivity of detection by detector and/or detection zone.
- Alpha, Beta, and Gamma alarm activity levels can be set in units of Bq, Bq/cm^2, dpm, dpm/cm^2, µCi, µCi/cm^2, nCi, nCi/cm^2, pCi, pCi/cm^2.
- False alarm and alarm confidence probability.
- HV Optimization using Figure-of-Merit calculations.
- Fixed or variable count times (calculated and optimized as a function of the alarm level setpoint, local background levels and desired accuracy of measurement).

GAMMA DETECTION (ZEUS) OPTION

- The Zeus option adds full gamma detection capability
- Three large plastic scintillators monitor body contamination
- Smaller scintillator monitors the head
- Scintillators are shielded with 10 mm (~0.4 in.) of lead
- A 25 mm (~1.0 in.) lead curtain minimizes selfshielding effects

Zeus gamma detectors

Argos monitor with Zeus option

OTHER OPTIONS

Consult the Mirion Contamination Monitor Configuration Guide for details of options that will enhance the use of this monitor.

MONITORING ASSISTANCE VIA USER INTERFACE

Indicator lights at the entry show when the monitor is ready to use. While the occupant is being monitored, messages and a countdown are delivered audibly (multiple languages are available) and visually on the LCD screen.

Occupant positioning is verified and corrected with the aid of photoelectric sensors, visual messages and voice prompts.

Visible and audible alarms are given if contamination is detected. A “CONTAMINATED” result is shown on a large color LCD display with voice reinforcement and an LED lights up beside each contaminated detector.

The display shows the type (alpha, beta or gamma if applicable), the quantity and the location of the contamination based on which detector(s) is alarming. The system records data and date/time stamped logs showing the number of times the unit was used, parameters used, calibration settings, fault messages, etc.

Up to four contact closure relays are available for remote signaling of the monitor’s status (e.g. “In Operation”, “Contaminated”, “Clean”, “Fault”, etc.).

REMOTE STATUS MONITORING

A user friendly dashboard enables status monitoring (in service, contaminated, out of service, maintenance) of multiple contamination monitors over the LAN. The dashboard is accessible from a tablet or PC web browser and requires no proprietary software installation.

MAINTENANCE

The Argos family of Whole Body Surface Contamination Monitors simplify maintenance with easy access from front and center of the unit; as well as easy replacement and repair of detectors.

A separate LED on each detector shows which detector is alarming and/or being addressed on the LCD screen.

For ease of diagnostics, numerous test screens are available to enable precision monitoring and changing of parameters including high voltage and discrimination thresholds for each detector. To provide further assistance, rate meters show counts seen by each detector in real-time.

Calibration and alarm testing of all detectors can be done in less than 30 minutes. It can be easily executed by just one person and is highly automated.

EFFICIENCY

Typical 4π efficiency, rounded to the nearest whole number, measured with a 10 cm x 10 cm plate source placed in the center of the detector and optimized using a ^{60}Co source and the standard Figure of Merit (FOM) technique for reducing signal-to-noise ratios. For comparison with instruments specifying 2π efficiency or % of emission surface rate, multiply the efficiencies shown below by 2.

Typical efficiencies	TPS-AB-579 detectors, on contact, with 0.25 mm fine mesh	TPS-AB-579 detectors, on contact, with 0.5 mm fine mesh	TPS-AB-579 detectors, on contact, with foot grill on 0.25 mm fine mesh
^{14}C (β)	2%	2%	1%
^{99}Tc (β)	10%	9%	6%
^{60}Co (β)	11%	10%	8%
^{137}Cs (β)	20%	18%	13%
^{36}Cl (β)	22%	20%	16%
^{90}Sr / ^{90}Y (β)	27%	25%	18%
^{241}Am (α)	14%	13%	7%
^{235}U (α)	11%	10%	4%
^{239}Pu (α)	12%	11%	6%

Typical 4π efficiency, rounded to the nearest whole number, measured with a point source placed in the center of the detector and optimized using a ^{137}Cs source and the standard Figure of Merit (FOM) technique for reducing signal-to-noise ratios (for Zeus option).

Isotope	Body Detector Efficiency at ~5 cm (2”) from fine mesh
^{60}Co (γ)	15%
^{137}Cs (γ)	7%

Plastic Scintillator Detectors	TPS
Quantity	Argos-5PAB unit: 25
Quantity	Argos-3PAB unit: 18
Type	Plastic Scintillation
Window (Note that the window assembly is field replaceable)	Multilayer Aluminized Mylar at 1.2 mg/cm^2
Radiation Monitored	Alpha/Beta

SPECIFICATIONS

Physical	Model	
	Argos-5PAB unit	Argos-5PAB Zeus
SIZE (w x h§ x d)*:	91.5 x 225.7 x 99.1 cm (36.0 x 88.9 x 39.0 in.)	91.5 x 225.7 x 104.3 cm (36.0 x 88.9 x 41.1 in.)
WEIGHT**:	333.3 kg (733.3 lb)	895.8 kg (1970.8 lb); add 528 kg (1161.6 lb) for removable lead brick ingots

§ ...feet fully extended add 6.8 cm (2.7 in.)
* ...Argos-3PAB and Argos-3PAB Zeus are the same size as their Argos-5 counterparts
** ...or less for Argos-3 configurations

ELECTRICAL
Power Requirements:

- 220 V ac/50 Hz/1.0 A or 110 V ac/60 Hz/2.0 A mains 3 m (~10 ft) IEC standard cable (supplied; specify voltage and any special cable requirements on order; contact local Mirion affiliate for further information)

CERTIFICATION

- IEC 61098 compliant
- ISO 11929:2012 compliant

ENVIRONMENTAL
Temperature Range:

- Operating (meets IEC61098): 0 – 40 °C (32–104 °F)
- Storage: 0 – 50 °C (32–122 °F)

Relative Humidity:

- Operating (per IEC61098): ≤85% non-condensing at 35 °C (95 °F) maximum
- Storage: 95% non-condensing

Power Consumption:

Model	Power Consumption
Argos-3PAB unit:	160 VA
Argos-5PAB unit:	170 VA
Argos-3/5 unit with Door/Barrier options*:	+90 VA

*If installed and applicable; add this value to the above numbers.

ORDERING INFORMATION

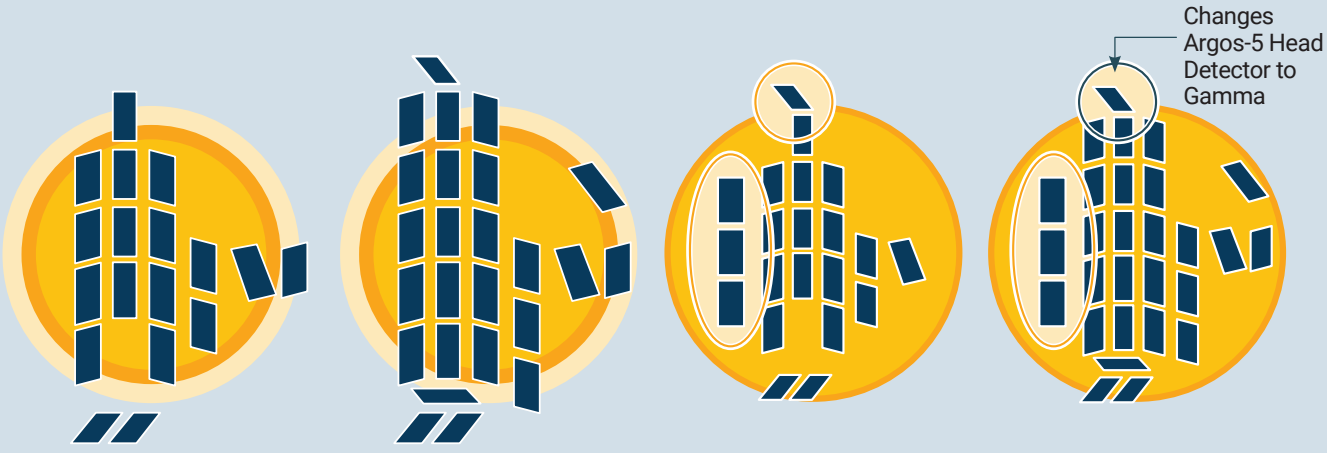
- Argos-3PAB unit: 2-Step Whole Body Mon. TPS-Alpha/Beta (18 detectors)
- Argos-5PAB unit: 2-Step Whole Body Mon. TPS-Alpha/Beta (25 detectors)
- 7062229: Zeus3G, Gamma Capability for Argos-3 unit
- 818002: Zeus5G, Gamma Capability for Argos-5 unit

OPTIONS

WebRemote-Kit Options (For Rugged, Y=1; For PRO Y=2; For Basic, Y=3)

- WebRemote-Kit#Y – WebRemote Software and Rugged/Pro/Basic Hardware
- The Mirion contamination monitors can be integrated with Horizon® Supervisory Software to provide an integrated solution with Mirion instruments. Horizon complements the functionality of the WebRemote Contamination Monitor Interface
- Consult the Mirion Contamination Monitor Configuration Guide for additional options that will enhance the use of this monitor

TYPICAL DETECTOR CONFIGURATION ARRANGEMENTS FOR ARGOS-3/-5PAB MONITORS



- Argos-3PAB Configuration
  18 Detectors
- Argos-5PAB Configuration
  25 Detectors
- Argos-3PAB Configuration with Zeus-3G Gamma capability added
- Argos-5PAB Configuration with Zeus-5G Gamma capability added

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ISO 9001 SYSTEM CERTIFIED
MERIDEN CT
ATLANTA GA
OAK RIDGE TN
CONCORD ON

SPC-124-EN-A – 10/2023

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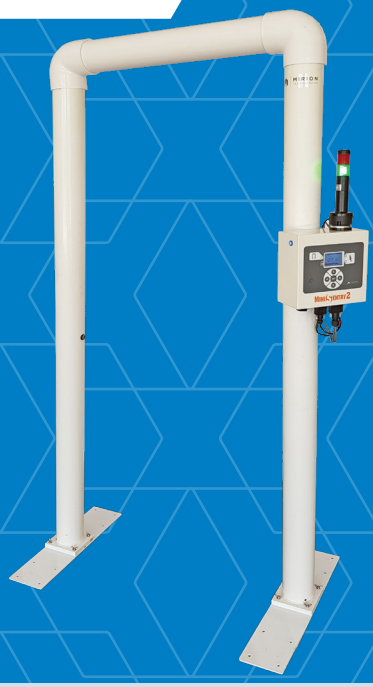
MiniSentry™2

Transportable Gamma Portal Monitor



DESCRIPTION

The MiniSentry 2 is a portal monitor for screening of pedestrians or vehicles for gamma radiation. It is designed to be quickly set up and operated with very little training or expertise in radiation detection technology. This portable system is well-suitable for emergency scenarios and security applications.

The monitor provides intuitive clean/contaminated status indication via the integrated LCD screen, LEDs, loud-speaker and an optional LED light tower. The modern firmware is simple to use and provides at the same time a comprehensive password protected expert settings menu. Three different measurement modes (walk-through, enter-wait, count-rate) are available to support various applications. All measurement data can be easily exported to a Microsoft Excel-readible *.csv files for further analysis.

The background is automatically subtracted and constantly monitored if the light barrier does not sense a person or vehicle occupying the portal. Emphasis has been placed on self-diagnostics both on start-up and during operation to guarantee correct operation.

The MiniSentry 2 is designed to meet the requirements of the US Federal Emergency Management Agency (FEMA-REP-21) as well as the IEC 62244:2021 standard.

FEATURES

QUICK AND EASY SETUP AND OPERATION

- Gamma portal monitor for rapid deployment and emergency response
- Quick and easy setup with automatic start-up and operation
- Simple clean/contaminated status indicator
- Very little training or expertise in radiation detection needed
- Weight less than 43 kg (95 lb)

FLEXIBLE SOLUTION

- Suitable for in- and outdoor operation in adverse weather conditions (IP54, -30°C to +55°C)
- Three different measurement modes available (walk-through, enter-wait, count-rate)
- Powered by battery (>65 hours autonomy1), USB or 100 - 240V
- Ready for connection of additional CSP probe (for example α/β frisker probe SAB100 or neutron probe SN-S)
- Many options and accessories available

STATE-OF-THE-ART RADIOLOGICAL PERFORMANCE

- Detection of 1 µCi 137Cs (according to FEMA-REP-21)
- Based on high sensitivity plastic scintillation detectors with 2x 5.3 litres active volume
- Wide energy range: 30 keV – 2 MeV

MINISENTRY™2 TRANSPORTABLE GAMMA PORTAL MONITOR

SPECIFICATIONS

RADIOLOGICAL

- Two 182.9 x 7.6 x 3.8 cm (72 x 3 x 1.5 in.) gamma plastic scintillation detectors.
  Total detector volume: 10.6 litres (648.1 $in.^3$)
- Detection performance exceeds FEMA-REP-21 and IEC 62244:2021
- **Minimum detectable activity:** <1 µCi Cs-137 at walking speed (in regular background of 100 nSv/h)
- **Energy range:** 30 keV to 2 MeV

MECHANICAL

- **Dimensions (H x W x D):** 216 x 112 x 45 cm (85 x 44 x 17.8 in.) assembled
- **Pedestrian internal opening:** 203 x 76 cm (80 x 30 in.)
- **Weight:** 43 kg (95 lb), heaviest component: 16 kg (35 lb)
- **Transport case:** hard transport case with wheels for easy storage and transportation.

FUNCTIONAL

- **Alarm indication:** green/red LED, LCD display and audible alarm (> 85 dB(A) at 30 cm, volume adjustable)
- **Measurement units:** cps, Bq, µCi, cpm, dpm
- **Measurement modes:** Walk-through, Enter-wait, Count-rate
- **Data export and import to USB stick:** export of measurement log files to Microsoft Excel-readible *.csv. Export and import of parameter settings.

ELECTRICAL

- **Battery:** Integrated rechargeable Li-ion battery 5300 mAh, 3.7V for approx. 13 h autonomous operation (depending on configuration). Built-in charger
- **Power Requirements:** 100 – 240 V or via USB (Type A) for continuous operation and charging of integrated battery
- **Occupancy sensor:** adjustable infrared light barrier

ENVIRONMENTAL

- **Water and dust:** IP54
- **Operating temperature:** –30°C to +55°C (–13 °F to 122 °F)
- Weather resistant for outdoor operation in adverse weather conditions

CONFIGURATION OPTIONS

- **Battery Extension Module**: Additional battery module to extend the time of autonomous operation to >65 hours.
- **Kit for Extended Passage Width:** Extends the passage width to 91.5 cm to allow for example the monitoring of persons in wheelchairs.
- **Vehicle Monitoring Kit:** This kit allows to extend the internal opening width of the MiniSentry 2 to 2.4 m. In this configuration the MiniSentry 2 is set-up without the top part of the monitor, and the two detector posts are free standing. A cable connection between the two detector posts is established for data transfer. The kit includes the required cable sets, cable protection and additional baseplates for the two detector posts.
- **Light tower:** Additional visual indication of contamination result in all directions by red/green lights.
- Connector for CSP probe: Adds a connector to the MiniSentry™ 2 to allow the connection of a CSP probe. Including mechanical holder for CSP probe.
- Any CSP probe, for example α/β frisker probe SAB-100 or neutron probe SN-S

CERTIFICATION AND COMPLIANCE CE

- Alignment: Line seems to start with a blank space
- Meets the requirements of the 1995 FEMA standard for portal monitors (FEMA-REP-21), “Contamination Monitoring Standard for a Portal Monitor Used for Radiological Emergency Response”
- Exceeds the requirements of IEC 62244:2021 “Radiation protection instrumentation – Installed radiation monitors for the detection of radioactive and special nuclear materials at national borders for monitoring of pedestrians.

1- in configuration with battery extension module.

Readout unit with Light tower

MIRION TECHNOLOGIES

MIRION
TECHNOLOGIES

HAND FOOT MONITORING

HandFoot-Fibre™

Hand Foot Clothing Monitor

DESCRIPTION

The HandFoot-Fibre monitors are used for contamination screening of hands, feet and clothes for alpha, beta and gamma radiation. Due to their weight and agility these monitors are used in circumstances which do not require a full body monitor or for mobile monitoring purposes.

The monitor's eight detectors are based on the state-of-the-art Mirion fibre detector technology, enabling a fast and reliable measurement process, even in high or fluctuating background conditions. There are three versions available:

HandFoot-Fibre™ XL with alpha and beta sensitive RFD485 fibre detectors for the use in all nuclear environments.

HandFoot-Fibre™ A+ with RFD485 A+ detectors, featuring a discrimination of alpha and beta radiation.

HandFoot-Fibre™ MED featuring HybridFibre™ detectors, which are sensitive to alpha, beta and gamma radiation and particularly well suited for medical applications.

FEATURES

- Outstanding detector sensitivity and homogeneity
- Economic and robust operation and maintenance
- 100% gas-free
- Very short measurement time
- Easy and intuitive usage
- Touch screen and audio interface
- Detachable probe for monitoring of clothing
- Wheels for easy transport
- Available in different versions for alpha/beta, alpha+beta and beta+gamma measurement

HANDFOOT-FIBRE™ HAND FOOT CLOTHING MONITOR

MIRION FIBRE DETECTORS

For the highest performance requirements, the state-of-the-art Mirion fibre detector technology utilizes scintillating fibre detectors that feature some of the industry's lowest area of dead zones. This results in an outstanding sensitivity with an exceptionally high measurement homogeneity.

The clever detector design allows quick and easy repairs, for an economic and robust operation with minimal downtime.

MEDICAL APPLICATION

HandFoot-Fibre MED has been developed for medical applications. The HybridFibre™ detectors are detecting alpha, beta, and gamma radiation with a particularly high sensitivity for low energy radiation (up to 30 keV).

In handling medical isotopes like Co-57, Tc-99m, or I-125 the HandFoot-Fibre MED is an expert. A nuclide database is provided, and can be extended with user's own entries. The monitor applies to the EMC requirements of laboratory medicine.

USER BENEFITS

EASY AND ECONOMIC OPERATION AND MAINTENANCE

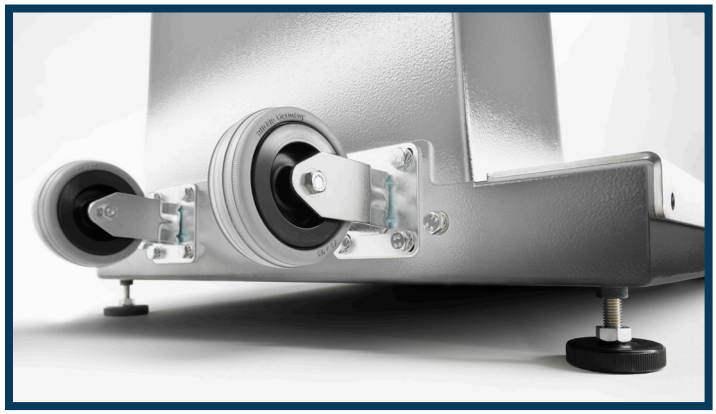
- Short measurement time thanks to outstanding detector sensitivity and simultaneous measurement of hands and feet
- P2-accelerator reduces measurement time by up to 30%
- Automatic background subtraction
- Rigorous standardization for reduced pool of spare parts
- Comprehensive user interface based on Mirion's innovative Lighthouse software platform and Windows 10 IoT operating system
- Detachable frisker probe for measuring of cloths/body

MOBILE MONITORING

- Lightweight
- Easy to move thanks to wheels and handle. Larger wheels for transport on rough ground available (optional)

ABILITY TO NETWORK

- Connect to CeMoSys™ software for centralized monitoring (optional)



TECHNICAL SPECIFICATIONS

Dimensions

- Height: 1660 mm
- Width: 478 mm
- Depth: 750 mm

Weight

- 57 to 63 kg, depending on version

Detectors

- Eight scintillating fibre detectors

Detection limit

- 30 Bq/hand, 45 Bq/foot (Co-60) for XL version
- 33 Bq/hand, 45 Bq/foot (Co-60) for MED version

MIRION
TECHNOLOGIES

MIRION TECHNOLOGIES

HAND FOOT MONITORING

Sirius™-5

Hand, Cuff and Foot Surface Contamination Monitors

Sirius-5AB monitor with four hand /cuff detectors, two foot detectors and optional frisker.

The Mirion Sirius-5 provides thorough and reliable detection of external contamination on the hands and feet of personnel working in nuclear environments. Depending on your monitoring needs, Sirius monitors are designed to use either plastic scintillator (TPS) gasless detectors or patented* gas flow proportional detectors (LFP-579).

With Mirion WebRemote® software, an easy-to-use touch screen graphical user interface for industrial PC-based operation results in improved health physics programs, better tracking of contamination and faster, more thorough personnel throughput at boundary points.

Excellent detector protection, modularity of components, and extensive diagnostics result in direct reductions in maintenance, repair, and operation costs.

Sirius monitors use a sophisticated “fast following” background trending and release-limit algorithm to provide the best performance in a stable or varying radiation field.

*Patent US 7,470,913 B1 High Efficiency and High Homogeneity Large-Area Gas-Filled Detectors

FEATURES

- Rugged and reliable for high traffic areas
- Optimized counting geometry to measure both sides of the hands /cuffs and bottom of feet in one step operation
- Easy access for maintenance from the top, front and sides. No access to the rear of the unit is required
- All positioning sensors are solid state devices for increased reliability
- Superior detector protection, modularity, and diagnostics result in direct reductions in maintenance, repair and operation costs
- WebRemote enabled: ergonomic and easy-to-use touch screen graphical user interface; accessible locally or via PC / tablet web browser
- Windows 10 IoT operating system with LAN capability and USB ports
- Same “industry-best” software and serial bus electronics across Mirion Argos™-3/-5, GEM™-5 and Cronos® -1/- 4 /-11 monitor families; no re-training needed
- Compliant with IEC61098 Standard requirements
- Algorithm based on Gaussian or Bayesian statistics (compliant with the ISO 11929:2010 Standard requirements)

Sirius-5 monitors provide the optimum balance between cost and coverage, monitoring the palms, backs of the hands, cuffs and feet in a single step, with a very close counting geometry for the best sensitivity. The detectors are vertically oriented to minimize the possibility of detector contamination.

The Sirius-5 is available with either six gas flow proportional detectors optimized for alpha and beta detection or six gasless thin plastic scintillator detectors optimized for beta, alpha/beta or beta/gamma capability. Gasless and gas flow proportional detectors are identical in form factor. As a result, changing between gasless and gas flow proportional operations on the monitor is as simple as changing between TPS and LFP-579 style detectors and pre-amplifiers. Additionally, both detector styles are interchangeable between Sirius-5 hand , cuff and foot monitors and the Mirion Argos-3 /-5 whole body monitors, minimizing management of spares and reducing maintenance costs for facilities where both hand, cuff and foot and whole body monitors are required.

ELECTRONICS

The High Voltage (HV), preamplification, amplification, discrimination, counting, test pulse generation and other processing electronics are mounted right on the detectors. The cables between the detectors and computer are all direct current and low voltage.

SETTING PARAMETERS

Parameter settings, testing, calibration and maintenance is accomplished locally or from a remote location using Mirion WebRemote software. The WebRemote platform enables Tablet or PC connection to the Siirius-5 unit wvia LAN or direct link.

Alternatively, the operator can use the standard Monitor Software, pre-installed on all Sirius-5 Contamination Monitors, to provide local monitor access and functionality.

The following types of parameters are available for adjustment:

- Sensitivity of detector by zone
- Alpha, beta, and/or gamma alarm activity levels set in units of Bq, Bq/cm^2, dpm, dpm/cm^2, nCi, nCi/cm^2, pCi, pCi/cm^2, µCi or µCi/cm^2
- False alarm and alarm confidence probability
- HV Optimization using Figure-of-Merit (FOM) calculations
- Fixed or variable count times (calculated and optimized as a function of the alarm level setpoint, local background levels and desired accuracy of measurement)

Table 1. Model-specific information

RADIOLOGICAL (TYPICAL)

Model	Sirius-5AB	Sirius-5PB/PAB/PBG
Detector Type and Quantity	LFP-579 x6	TPS x6
Two Moveable Hand Detectors	Yes	
Frisker Option Available	Mirion Gas Flow Proportional Detector (LFP-100DHP)	Mirion CSP™ SMART probes (SB/SAB/SABG-100)*
Detector Type (Hands, Cuff & Foot)	Gas Flow Proportional	Plastic Scintillator
Radiation Monitored	Alpha/Beta	Beta (PB), Alpha/Beta (PAB) or Beta/Gamma (PBG)
Window Area Per Detector	~579 cm^2	
Window	0.8 (±12%) mg/cm2 (Mylar); window assembly is field replaceable	1.2 mg/cm^2 (Multilayer Aluminum coated Mylar); window assembly is field replaceable
Typical Gas Flow Rate	10 cm^3/min	Not applicable as external gas is not required
Possible Gas Mixtures	P5, P7.5, P-10 (Argon-Methane), or Argon/CO_2 (90/10)%	

Table 2. Typical 4π efficiencies, measured with 10 cm x 10 cm plate source placed in the center of the detector. For comparison with instruments specifying 2π efficiency or % of emission surface rate, multiply these figures by 2. § No Alpha/Beta discrimination for TPS-B-579 and no Alpha/Beta separation for TPS-BG-579.

Typical efficiencies:	LFP-579 detectors, on contact, with 0.5 mm fine mesh	LFP-579 detectors, on contact, with foot grill on 0.25 mm fine mesh	TPS-B-579 detectors, on contact, with 0.5 mm fine mesh	TPS-B-579 detectors, on contact, with foot grill on 0.25 mm fine mesh	TPS-AB-579 detectors, on contact, with 0.5 mm fine mesh	TPS-AB-579 detectors, on contact, with foot grill on 0.25 mm fine mesh	TPS-BG-579 detectors, on contact, with 0.5 mm fine mesh	TPS-BG-579 detectors, on contact, with foot grill on 0.25 mm fine mesh
^{14}C (beta)	8%	6%	4%	3%	2%	1%	2%	2%
^{99}Tc (beta)	16%	14%	13%	10%	9%	6%	9%	7%
^{60}Co (beta)	14%	14%	15%	11%	10%	8%	7%	6%
^{137}Cs (beta)	25%	22%	21%	18%	18%	13%	15%	12%
^{60}Co (gamma)	–	–	–	–	–	–	16%	17%
^{137}Cs (gamma)	–	–	–	–	–	–	7%	7%
^{36}Cl (beta)	25%	23%	23%	20%	20%	16%	14%	13%
$^{90}Sr/^{90}Y$ (beta)	32%	26%	29%	23%	25%	18%	17%	14%
^{241}Am (alpha)§	17%	13%	15%	9%	13%	7%	12%	7%
^{235}U (alpha)§	16%	11%	11%	4%	10%	4%	7%	2%
^{239}Pu (alpha)§	16%	12%	12%	7%	11%	6%	10%	5%

*See separate specification sheets for the CSP Family smart probes.

MONITORING ASSISTANCE VIA USER INTERFACE

Indicator lights at the entry show the monitor is ready to use. While the occupant is being monitored, messages and a countdown are given both on the LCD screen and audibly (multiple languages are available). Verification of proper occupant positioning is ensured with the help of infrared sensors. All hand and foot positioning sensors are non-mechanical solid state types for enhanced reliability. Visible and audible alarms are given if contamination is detected. The display shows the type (alpha or beta), the quantity and the location (alarming detector flashing on a figure). The system records data and date /time stamped logs showing the number of times the unit was used, parameters used, calibration settings, fault messages etc.

A relay closure is available for remote signaling of the monitor's status (e.g. "In Operation", "Contaminated", "Clean", "Fault", etc.

MAINTENANCE

The Sirius-5 monitors simplify maintenance with easy access from the front and center of the unit; as well as easy replacement and repair of the detectors. A separate LED on each detector shows which detector is alarming and/or being addressed on the LCD screen.

For ease of diagnostics, numerous test screens are available to enable precision monitoring, and changing of parameters including high voltage and discrimination thresholds for each detector. To provide further assistance rate meters show counts seen by each detector in real-time.

Calibration of all detectors and alarm testing can each be done in less than ten minutes.

REMOTE STATUS MONITORING

A user-friendly dashboard enables the status monitoring (in service, contaminated, out of service, maintenance) of multiple Contamination Monitors over the LAN. The dashboard is accessible from a Tablet or PC web browser and requires no proprietary software installation.

SPECIFICATIONS

PARAMETER ENTRY

- Parameters may be entered with the touch of a finger using the capability of the built-in touch screen and WebRemote software. Additionally, a USB connected keyboard/mouse may be used to enter parameters

MECHANICAL

Cabinet:

- Steel with rugged powder coat finish for column and top, stainless steel base and foot pan cover provide for ease of decontamination and minimum maintenance
- Dimensions for any of the Sirius-5 models is approximately (W x H x D): 78.0 x 179.3 x 91.9 cm (33.5 x 70.6 x 36.2 in.)
- Approximate weights are (with no options installed):

Model	Weight
Sirius-5AB	125.0 kg (275.0 lb)
Sirius-5PB /PAB/PBG	135.8 kg (298.8 lb)

ELECTRONICS

Computer:

- The Sirius-5 computer operates on Windows 10 IoT operating system with LAN capability and USB ports for transferring data. Data may be retrieved either via USB or a LAN
- High-quality digitized sound for prompts, with dual speakers

Display Screen:

- ~23.4 cm (10.4 in.) touch screen LCD display, integrated onto top of unit

Easy access Input/Output and Power Entry Ports panel at foot of pedestal in rear:

- Six USB ports and one Ethernet port (RJ-45)
- IEC standard AC receptacle
- Sirius-5AB also includes a gas connector

Environmental:

- Temperature Range:
  - Operating (meets IEC 61098) – 0-40 °C (32-104 °F)
  - Storage – 0-50 °C (32-122 °F)
- Relative Humidity:
  - Operating (per IEC 61098) – ≤ 85% non-condensing at 35 °C (95 °F) maximum
  - Storage – ≤ 95% non-condensing

Power Requirements:

- 220 V ac/50 Hz /1.0 A or 110 V ac /60 Hz/2.0 A mains 3 m (~10 ft). IEC standard cable (supplied; other cables are available; specify special cable requirements; contact local Mirion affiliate) for further information

Power Consumption:

- 110 VA

Certifications:

- IEC 61098 compliant
- ISO 11929:2010 compliant

OPTIONS

Gas Flow Hand-Held Tool/Body Frisker (Sirius5-FSKAB)

The Sirius-5AB unit can be fitted with the optional Model LFP-100DHP frisker (100 cm^2, 0.8 (±12%)mg/cm^2) that has excellent response to alpha/beta radiation. It comes with a retractable cable (incorporating the gas flow in the same cable) which provide up to 3 m (10 ft) of frisking range. An integral flow proportional frisker is available to enhance the monitoring capabilities. The frisker body incorporates an amber LED to indicate count rate, a beeper for audible indication and a red LED for alarm. The LCD displays the digital/analog rate meter results plus the current background level, alarm point and highest count rate achieved during current frisk. When not in use, the frisker continuously monitors background.

Gasless Hand-Held Tool/Body Friskers (Sirius5-FSKPAB, Sirius5-FSKPB and Sirius5-FSKPBG)

The Sirius-5 gasless units can be fitted with the Mirion SB/SAB/SABG-100 CSP 100 cm^2 plastic scintillation probe to provide beta/ alpha-beta/or alpha, beta-gamma capabilities.

Horizon 2.0 Compatibility

The Mirion contamination monitors can be integrated with Horizon® Supervisory Software to provide an integrated solution with Mirion instruments. Horizon software complements the functionality of the WebRemote Contamination Monitor Interface.

Local Database Support Option (SOFT-LDB)

The Local Database Option facilitates quick monitoring of the effectiveness of your contamination control programs. See separate specification sheet for full details.

SIRIUS™-5 HAND, CUFF AND FOOT SURFACE CONTAMINATION MONITORS

Model	Description	Number if Detector Positions
Sirius-5AB	1-STEP HAND/CUFF/FOOT MON.; ALPHA/BETA	6
Sirius-5PB	1-STEP HAND/CUFF/FOOT MON.; PLAS. BETA	6
Sirius-5PAB	1-STEP HAND/CUFF/FOOT MON.; PLAS. ALPHA/BETA	6
Sirius-5PBG	1 STEP HAND/CUFF/FOOT MONITOR PLAS. BETA/GAMMA	6
Sirius-5 SIM	1-STEP HAND/CUFF/FOOT MON.; SIMULATOR	6 (no actual detectors; blank-off plates)

Option	Description
WebRemote-Kit#Y	WebRemote Software and Rugged / Pro / Basic Hardware. FOR Rugged Y=1; FOR Pro Y=2; FOR Basic Y=3.
Sirius5-FSKAB	FRISKER OPT.; SIRIUS-5AB
Sirius5-FSKPB	FRISKER OPTION; SIRIUS-5PB
Sirius5-FSKPAB	FRISKER OPTION; SIRIUS-5PAB
Sirius5-FSKPBG	FRISKER OPTION; SIRIUS-5PBG
Sirius5-MAG	MAGNETIC CARD READER FOR SIRIUS
Sirius5-BAR	BARCODE CARD READER FOR SIRIUS
Sirius5-PROX	PROXIMITY CARD RDR FOR SIRIUS
SOFT-LDB	Loc.Database Support;Factory Installed. Provides local database support for a new Mirion Contamination monitor: • Factory Installed. • Includes latest Mirion SOFT-MON-SERIAL application software (Version 8.01 or above).
Sirius-5 Casters Kit	Casters with Integrated Leveling Feet to facilitate installation at final location. Includes: • Four 50 mm swivel casters. • Associated hardware to mount to Sirius-5.
Sirius-5 Wood Shipping Crate, Reusable	• For use with Sirius-5 only. • Field installable (contact local Mirion Service affiliate for assistance). • Includes custom foil vacuum bag to reduce moisture effects during shipping.

MIRION TECHNOLOGIES

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MIRION TECHNOLOGIES

HAND & FOOT MONITORING

Sirius™-5 Compact

Compact Hand, Cuff and Foot Contamination Monitors

Efficient hand, cuff and foot monitoring in areas with size constraints.

The Sirius-5 Compact is an evolution of the well-proven Sirius-5 and delivers the same exceptional performance in a compact form.

The Sirius-5 Compact provides thorough and reliable detection of external contamination on the hands and feet of personnel working in nuclear environments. The Sirius-5 Compact monitor is rugged and reliable for high traffic areas, compact for areas with size constraints and maneuverable with integrated casters and handle. Depending on your monitoring needs, Sirius monitors are designed to use either plastic scintillator (TPS) gasless detectors or patented* gas flow proportional detectors (LFP-579).

*Patent US 7,470,913 B1 High Efficiency and High Homogeneity Large-Area Gas-Filled Detectors

FEATURES

- ✓ Compact footprint: suitable for confined locations, and maximizing available space
- ✓ Rugged and reliable: for high traffic areas – minimal downtime and service required
- ✓ Integrated casters and handle: easily movable. Can set up temporary stations, responding to situations quickly
- ✓ Excellent radiological performance: various detector combinations possible
- ✓ Optimized counting geometry: Measure both sides of the hands/cuffs and bottom of feet in one step operation – time saving and increased throughput
- ✓ Comprehensive and well-proven Monitor Program software platform, including WebRemote® software and Dashboard: Ergonomic and easy to use, touch screen software, intuitive – users with limited experience can easily locate parameter settings
- ✓ Designed for 365/24/7 operation: high uptime and minimum maintenance
- ✓ Same components and spare parts as for Argos™-3/-5, Sirius-5, GEM™-5 and Cronos®-1/-4/-11 contamination monitors
- ✓ Windows 10 IoT operating system with LAN capability and USB ports
- ✓ Compliant with IEC 61098 and ISO 11929:2019

Sirius-5 Compact

WebRemote software offers an intuitive touch screen graphical user interface for industrial PC-based operation, as well as comprehensive remote monitoring and remote management capabilities. Users can easily locate parameter settings for improved health physics programs, better tracking of contamination, and faster, more thorough personnel throughput at boundary points.

As a common software platform for many Mirion contamination products, including Argos, Cronos, GEM-5 and Sirius monitors, no re-training is needed to learn the software.

Sirius monitors use a sophisticated “fast following” background trending and release-limit algorithm to provide the best performance in a stable or varying radiation field.

Excellent detector protection, modularity of components, and extensive diagnostics result in direct reductions in maintenance, repair, and operation costs. Furthermore, the Sirius-5 Compact features the same components and spare parts from all contamination monitors of the same family (Argos-3/-5, Sirius-5, GEM-5 and Cronos-1/-4/-11 contamination monitors). The Sirius-5 Compact will therefore not require a separate inventory of spare parts or service management, resulting in reduced cost of ownership.

DETECTOR CONFIGURATIONS

The Sirius-5 Compact is equipped with six detectors. It is available in four different configurations, which feature different detector technologies:

LFP-579 Gas Flow Detectors

LFP-579 gas flow detectors provide highly sensitive alpha and beta measurement capability with separate alpha and beta measurement channels for each detector. The patented detector design makes use of three independent counting sections which reduce background for an optimal detection capability. This design further enhances uniform detector response. The Sirius-5AB Compact is designed to inherently minimize gas usage. Therefore, no “gas management system” is required.

The overall benefit of the detector geometry and patented detector design is the reduction of count times by as much as 25% compared to similar systems.

TPS-B-579 Thin Plastic Scintillation Detectors

TPS-B-579 thin plastic scintillation detectors are gas-free detectors, specifically designed for best possible beta response and minimal sensitivity to gamma background radiation.

The need for counting gas is eliminated by using plastic scintillation detectors. The design of the TPS-B-579 detectors provides excellent signal-to-noise ratios and furthermore, the detection capability both across and along the detectors is extremely uniform. There is virtually zero edge effect degradation.

TPS-AB-579 Thin Plastic Scintillation Detectors

TPS-AB-579 thin plastic scintillation detectors are state-of-the-art gas-free detectors with alpha and beta measurement capability with separate alpha and beta measurement channels for each detector.

The detectors do not require any counting gas and feature an extremely uniform detector response.

TPS-BG-579 Plastic Scintillation Detectors

TPS-BG-579 plastic scintillation detectors are unique gas-free detectors with beta and gamma measurement capability with separate beta and gamma measurement channels for each detector. Additionally, the beta channels work in anticoincidence mode with the gamma channels, which significantly reduces the sensitivity of the beta channel to elevated background. This allows for excellent measurement performance for beta radiation, also in elevated gamma background.

MODULARITY

All detector types are identical in form factor. They are interchangeable between Sirius-5 hand, cuff and foot monitors and the Mirion Argos-3/-5 whole body monitors, minimizing management of spares and reducing maintenance costs for facilities where both hand, cuff and foot and whole body monitors are required.

READ-OUT ELECTRONICS

The High Voltage (HV) preamplification, amplification, discrimination, counting, test pulse generation and other processing electronics are mounted right on the detectors. The cables between the detectors and computer are all direct current and low voltage.

The digital signal processing and alarm evolution is performed by a computer, which operates on Windows 10 IoT and uses SSD for data storage. Data may be retrieved either via USB or a LAN.

MAINTENANCE

The Sirius-5 Compact monitors simplify maintenance with easy access from the front and center of the unit and improved accessibility to the top part of the unit. Detectors can easily be replaced and repaired.

For ease of diagnostics, numerous test screens are available to enable precision monitoring, and changing of parameters including high voltage and discrimination thresholds for each detector. To provide further assistance, rate meters show counts seen by each detector in real time.

Calibration of all detectors and alarm testing can each be done in less than ten minutes.

SETTING PARAMETERS

Parameter settings, testing, calibration and maintenance is accomplished locally or from a remote location using Mirion WebRemote software. The WebRemote platform enables tablet or PC connection to the Sirius-5 Compact via LAN or direct link.

Alternatively, the operator can use the standard Monitor Software, pre-installed on all Sirius-5 Compact Contamination Monitors, to provide local monitor access and functionality.

The following types of parameters are available for adjustment:

- Sensitivity of detector by zone
- Alpha, beta, and/or gamma alarm activity levels set in units of Bq, Bq/cm^2, dpm, dpm/cm^2, nCi, nCi/cm^2, pCi, pCi/cm^2, µCi or µCi/cm^2
- False alarm and alarm confidence probability
- HV Optimization using Figure-of-Merit (FOM) calculations
- Fixed or variable count times (calculated and optimized as a function of the alarm level setpoint, local background levels and desired accuracy of measurement)

MONITORING ASSISTANCE VIA USER INTERFACE

The LCD touch screen display indicates when the monitor is ready to use. While the occupant is being monitored, messages and a countdown are delivered both audibly (multiple languages available) and visually on the LCD touch screen. Occupant positioning is verified and corrected with the aid of photoelectric sensors, visual messages and voice prompts. Visible and audible alarms are given if contamination is detected.

A “Contaminated” result is shown on the color touch screen display with voice reinforcement. The display shows the type (alpha or beta), the quantity and the location of the contamination based on which detector(s) is alarming. The system records data and date/time stamped logs showing the number of times the unit was used, parameters used, calibration settings, fault messages, etc. A relay closure is available for remote signaling of the monitor’s status (e.g. “Contaminated”, “Out of Service”, “Fault”, “Clean”, etc.).

REMOTE STATUS MONITORING

A user-friendly dashboard enables the status monitoring (in service, contaminated, out of service, maintenance) of multiple contamination monitors over the LAN. The dashboard is accessible from a tablet or PC web browser and requires no proprietary software installation.

Table 1. Model-specific information

RADIOLOGICAL (TYPICAL)

Model	Sirius-5AB	Sirius-5PB/PAB/PBG
Detector Type and Quantity	LFP-579 x6	TPS x6
Two Moveable Hand Detectors	Yes	
Frisker Option Available	Mirion 100 cm² alpha/beta CSP™ SMART probe*	
Detector Type (Hands, Cuff & Foot)	Gas Flow Proportional	Plastic Scintillator
Radiation Monitored	Alpha/Beta	Beta (PB), Alpha/Beta (PAB) or Beta/Gamma (PBG)
Window Area Per Detector	~579 cm^2	
Window	0.8 (±12%) mg/cm^2 (Mylar); window assembly is field replaceable	1.2 mg/cm^2 (Multilayer Aluminum coated Mylar); window assembly is field replaceable
Typical Gas Flow Rate	10 cm^3/min	Not applicable as external gas is not required
Possible Gas Mixtures	P5, P7.5, P-10 (Argon-Methane), or Argon/CO_2 (90/10)%	

Table 2. Typical 4π efficiencies, measured with 10 cm x 10 cm plate source placed in the center of the detector and in contact with the detector mesh. For comparison with instruments specifying 2π efficiency or % of emission surface rate, multiply these figures by 2.

Typical efficiencies:	LFP-579 detectors, on contact, with 0.5 mm fine mesh	LFP-579 detectors, on contact, with foot grill on 0.25 mm fine mesh	TPS-B-579 detectors, on contact, with 0.5 mm fine mesh	TPS-B-579 detectors, on contact, with foot grill on 0.25 mm fine mesh	TPS-AB-579 detectors, on contact, with 0.5 mm fine mesh	TPS-AB-579 detectors, on contact, with foot grill on 0.25 mm fine mesh	TPS-BG-579 detectors, on contact, with 0.5 mm fine mesh	TPS-BG-579 detectors, on contact, with foot grill on 0.25 mm fine mesh
^{14}C (beta)	8%	6%	4%	3%	2%	1%	2%	2%
^{99}Tc (beta)	16%	14%	13%	10%	9%	6%	9%	7%
^{60}Co (beta)	14%	14%	15%	11%	10%	8%	7%	6%
^{137}Cs (beta)	25%	22%	21%	18%	18%	13%	15%	12%
^{60}Co (gamma)	–	–	–	–	–	–	16%	17%
^{137}Cs (gamma)	–	–	–	–	–	–	7%	7%
^{36}Cl (beta)	25%	23%	23%	20%	20%	16%	14%	13%
$^{90}Sr/^{90}Y$ (beta)	32%	26%	29%	23%	25%	18%	17%	14%
^{241}Am (alpha)§	17%	13%	15%	9%	13%	7%	12%	7%
^{235}U (alpha)§	16%	11%	11%	4%	10%	4%	7%	2%
^{239}Pu (alpha)§	16%	12%	12%	7%	11%	6%	10%	5%

*See separate data sheets for CSP smart probes.

§ No Alpha/Beta discrimination for TPS-B-579 and no Alpha/Beta separation for TPS-BG-579.

SPECIFICATIONS

PARAMETER ENTRY

- Parameters may be entered with the touch of a finger using the capability of the built-in touch screen and WebRemote software. Additionally, a USB connected keyboard/mouse may be used to enter parameters

MECHANICAL

Cabinet:

- Steel with rugged powder coat finish for column and top, stainless steel base and foot pan cover provide for ease of decontamination and minimum maintenance
- Approximate dimensions:
  (H x W x D)1465 mm x 640 mm x 844 mm (57.7" x 25.2" x 33.2")
- Approximate weight is 110 kg (242.5 lb) without options

ELECTRONICS

Computer:

- The computer of the Sirius-5 Compact operates on Windows 10 IoT operating system with LAN capability and USB ports for transferring data. Data may be retrieved either via USB or a LAN
- High-quality digitized sound for prompts

Display Screen:

- ~23.4 cm (10.4 in.) touch screen LCD display, integrated onto top of unit

Easy access Input/Output and Power Entry Ports panel at foot of pedestal:

- Two USB ports and one Ethernet port (RJ-45)
- Standard three-prong IEC 60320 power inlet socket (C14)
- Sirius-5AB Compact also includes a gas connector

Environmental:

- Temperature Range:
  - Operating (exceeds IEC 61098): 0 to +45 °C (+32 to +113 °F)
  - Storage – 0-50 °C (32-122 °F)
- Relative Humidity:
  - Operating (per IEC 61098): ≤ 85% non-condensing at 35 °C (95 °F) maximum
  - Storage: ≤ 95% non-condensing

Power Requirements:

- 115/230 (±10%) VAC, 50/60 Hz, 2/1 A nominal mains
- 3 m (~10 ft) standard cable with IEC 60320 C13 plug supplied (other mains cables are available; specify any special cable requirements - contact local Mirion Service/Sales affiliate for more information).

Power Consumption:

- Average: 35 W
- Maximum: 60 VA (Typical)

Certifications:

- IEC 61098 compliant
- ISO 11929:2019 compliant

CE

OPTIONS

Alpha/Beta Tool/Body Frisker Probe

The Sirius-5 Compact can be fitted with the optional 100 cm² external alpha/beta CSP frisker probe. The plastic scintillation probe provides gas-free monitoring in two separate measurement channels with discrimination between alpha and beta radiation.

Uninterruptible Power Supply (UPS)

The UPS allows autonomous operation for up to 30 minutes without external power. The UPS is mounted on a mounting bracket on the back of the Sirius-5 Compact. Please note: Default options are intended for the North American region only; contact local Mirion affiliate for other regions.

Dosimetry Reader Integration for DMC 3000™ Dosimeter

- Integration of LDM 320D dosimeter reader for use with DMC 3000 dosimeters
- Direct data-exchange between contamination monitor and DosiServ™ Dose Management Software (Requires DosiServ dose management system)

Card/Barcode Readers

This monitor includes integration of a barcode, magnetic card or proximity card reader. Information on card is stored together with measurement results from each measurement to allow identification of the person being monitored. Mirion recommends sending a sample of card to the factory to ensure compatibility.

CeMoSys™ Software Compatibility

Mirion contamination monitors can be integrated with the CeMoSys central monitoring system (version 2.0 or above) to provide comprehensive supervisory functionalities for all connected contamination monitors.

SIRIUS™-5 COMPACT HAND, CUFF AND FOOT CONTAMINATION MONITORS

Part Number	Description
SIRIUS-5ABCOMP	Sirius-5AB Compact: One step compact hand/cuff/foot monitor, with Alpha/Beta Discrimination, Gas Flow Proportional Detectors
SIRIUS-5PBCOMP	Sirius-5PB Compact: One step compact hand/cuff/foot monitor, for Beta, Thin Plastic Scintillator Detectors
SIRIUS-5PABCOMP	Sirius-5PAB Compact: One step compact hand/cuff/foot monitor, with Alpha/Beta Discrimination, Thin Plastic Scintillator Detectors
SIRIUS-5PBGCOMP	Sirius-5PBG Compact: One step compact hand/cuff/foot monitor, with Beta/Gamma Discrimination, Plastic Scintillator Detectors
SIRIUS-COMP-FSKPAB	Frisker with 100cm² alpha/beta CSP frisker probe
SIRIUS5-COMP-UPS	Uninterruptible Power Supply (UPS) with a mounting bracket (shelf) for Sirius-5 Compact (for North America only)
7098537	Integrated LDM 320D dosimeter reader with direct data-exchange between contamination monitor and DosiServ. Requires DosiServ Dose Management System
0009CVMS0002	CeMoSys™ Client License for interfacing with CeMoSys™ Central Monitoring System (version 2.0 or above)
SIRIUS-COMP-BECS	Beacon/Light tower with sounder
SIRIUS5-PURGE-DET	Factory installed LFP-579 Purge Detector for Sirius-5AB Compact
SIRIUS5-COMP-BAR	Barcode card reader
Sirius5-MAG	Magnetic card reader
Sirius5-PROX	Proximity card reader
SIRIUS5-GASMON	Gas pressure monitor for low gas pressure check
7098218	Wood shipping crate

Many additional upgrade options are available for in-field upgrades to existing Sirius-5 Compact Monitors.
Contact your Mirion sales and service affiliate for more information.

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ISO 9001 SYSTEM CERTIFIED MERIDEN CT ATLANTA GA OAK RIDGE TN CONCORD ON

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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: 24Bq or 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,
- Unprecedent 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_{α}=1.65, detection safety quantile k_{β}=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 lenght :
  - Conveyor : default lenght 300 cm
  - External chain conveyor, standard length 1.9 m
- 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

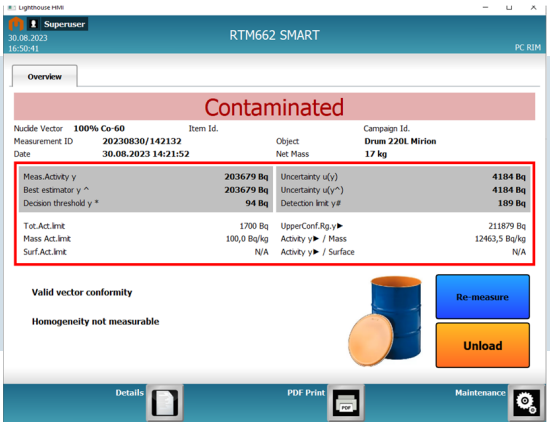
- Single/double doors, single/double chain conveyors, motorized operation with PLC,
- Automatic object loading, integrated in measurement software, object detection by the weight scale,
- Up to 2 still cameras, triggered by position sensors,
- Remote user interface with colour screen, keyboard and pointing 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



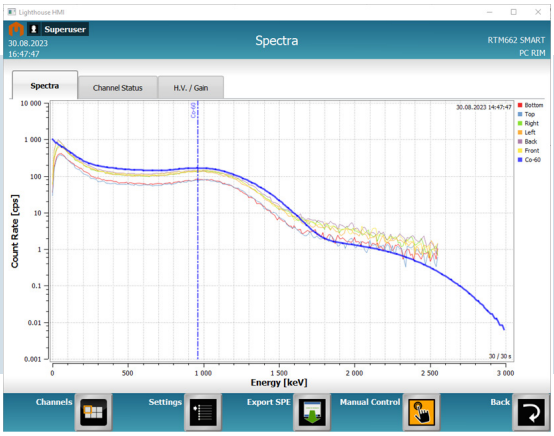
RESULTS SCREEN

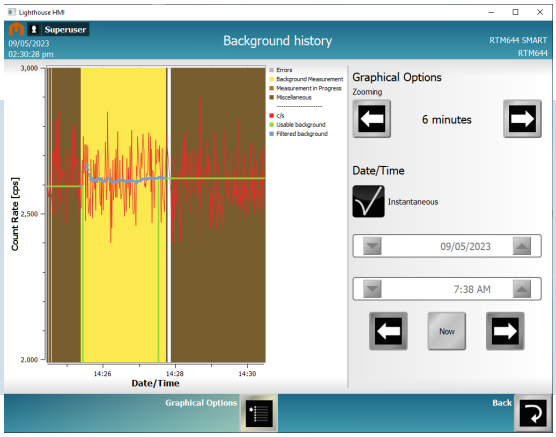
Detailed display of measurement conditions and results for a case where the alarm level is exceeded.

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.

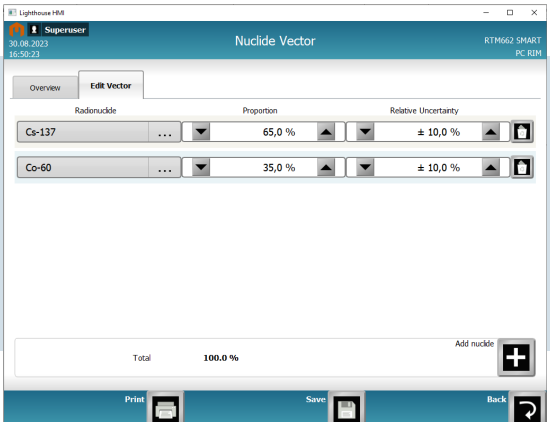




BACKGROUND DIAGNOSTICS

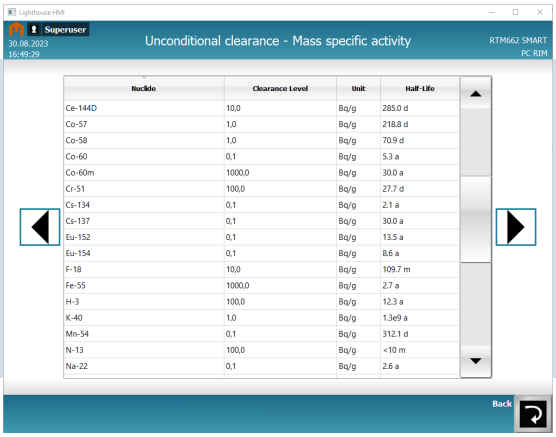
Graphical display of the background history including the count-rate, the filtering process and the refence background. The background history is stored for 3 months with a resolution of 1 s for 3 days and 60 s for the remaining time.

RTM644-SMART™ LARGE CLEARANCE MONITOR



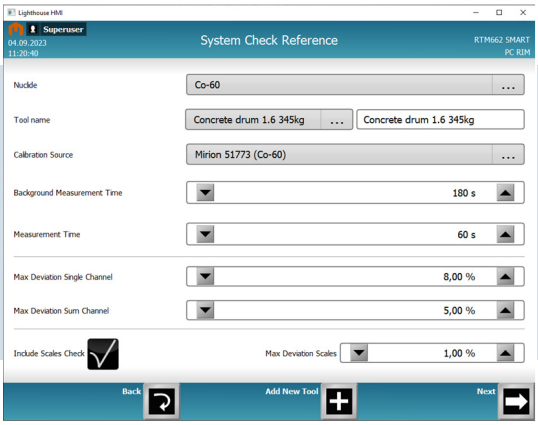
NUCLIDE VECTORS

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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RTM662-300

(CGO-Smart™ LNC)

Clearance Monitor

The Mirion RTM662-300 Gamma Clearance Monitor is designed for Clearance measurements of average sized items like waste bags, toolboxes or 100 liters drums.

DESCRIPTION

The RTM662-300 is an advanced clearance monitor for large objects. It consists of a measurement chamber with a manually operated swing door. The objects are detected and weighed by integrated scales and checked for gamma radiation by 6 state-of-the-art plastic scintillation detectors with spectroscopic read-out.

The RTM662-300 is based on an advanced software platform with Windows 10 IoT operating system. This analysis software reports nuclide specific activity, brings lower measurement uncertainties, handles complex nuclide vectors and simplifies maintenance.

It is based on the well-proven algorithm principles and improved leading nuclide correlation method (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
- **Average Waste bags and 100 drums:** counting chamber dimensions 60.8 x 60.1 x 84 cm³, volume 307 liters,
- **Low MDA:** 18 Bq Co-60 achieved by 6 plastic scintillator detectors in a 4π configuration, modular lead lingot shielding of up to 50 mm on six sides,
- **Unprecedented precision and low uncertainty:** Spectrometric detector readout and signal processing, simulation-based object models, automatic efficiency and background correction,
- **Highly customizable:** Configurable fingerprints, release limits and object models,
- **Simple use:** user-friendly and intuitive graphical user interface, optional 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, fork pockets,
- **Safe transportation** by crane or forklift with full shielding installed.

RTM662-300 CLEARANCE MONITOR

The RTM662-300 comes with advanced administrator and maintenance features: the real-time energy spectrum display provides with a radiological health check of detector array on a single glance. All calibration and routine efficiency checks are user-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 personalized report generation, decision tracing, recalculation and interfacing to waste management systems.

RADIOLOGICAL CHARACTERISTICS

DETECTION

- 6 large-volume plastic scintillation detectors – total active volume: 113,4 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 automatic 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 900 cps (approx.100 nSv/h, 50 mm lead),
- False alarm safety quantile k_α=1.65, detection safety quantile k_β=1.65, T_{BKG}= 300 s

Measurement time (s)	10	30	60	180
Co-60	**63 Bq**	**37 Bq**	**28 Bq**	**18 Bq**
Cs-137	**127 Bq**	**75 Bq**	**56 Bq**	**36 Bq**
Ba-133	**123 Bq**	**72 Bq**	**54 Bq**	**35 Bq**

MECHANICAL CHARACTERISTICS

- Chamber: 60.8 x 60.1 x 84 cm³ (LxWxH), 307 liters,
- Ext. chassis dimensions (LxWxH): 109.9 x 91.2 x 154.1 cm³, Without cladding and handles : 95.0 x 89.9 x 154.1 cm³
- Built-in weight scale, maximum 150kg, 0.1 kg resolution,
- 25 or 50 mm lead shielding, transportable by crane or forklift with the shielding installed,
- Total weight with shielding:

Shielding	Without (only bottom)	25	50
Weight	**1250 kg**	**2221 kg**	**3414 kg**

FUNCTIONAL CHARACTERISTICS

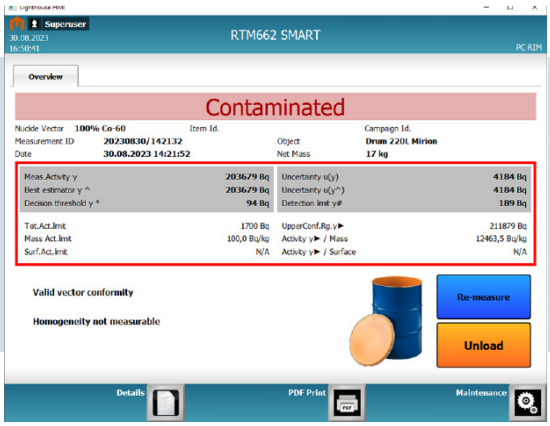
- Double / single sided, manual doors operation,
- Automatic item detection by weigh scale, still-camera in the measuring chamber,
- User interface by two 10”, colour touchscreens, remote control station possible,
- Visual and audible contamination alarm,
- Report and label printing, optional barcode 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,
- 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: 110-230 V, 50-60 Hz
- Nominal current : 5 / 3 A
- UPS backup autonomy (computer only): 60 min
- 2 external USB connectors, 1 LAN connection
- 2 floating-contact outputs



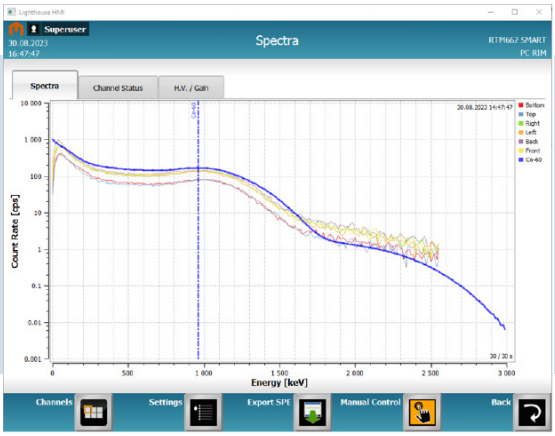
RESULTS SCREEN

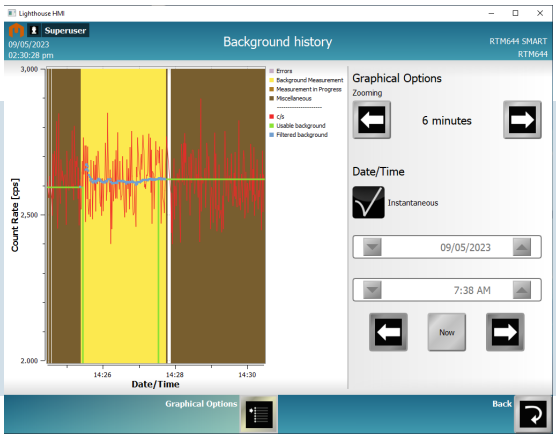
Detailed display of measurement conditions and results for a case where the alarm level is exceeded.

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*

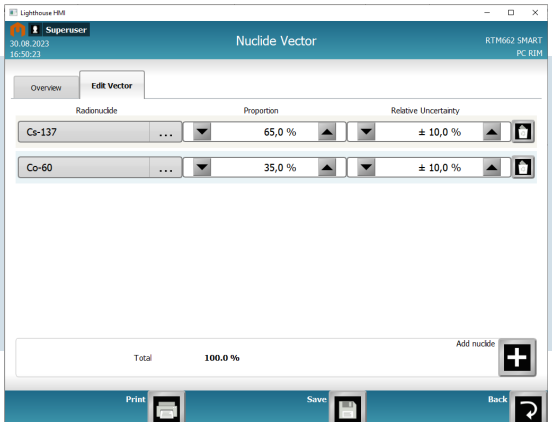




BACKGROUND DIAGNOSTICS

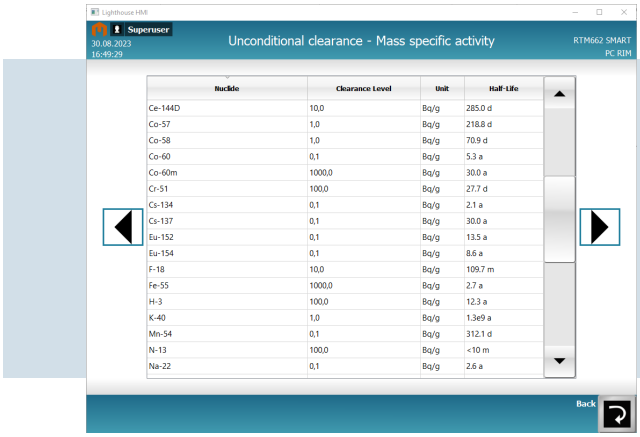
Graphical display of the background history including the count-rate, the filtering process and the refence background.
The background history is stored for 3 months with a resolution of 1 s for 3 days and 60 s for the remaining time*

RTM662-300 CLEARANCE MONITOR



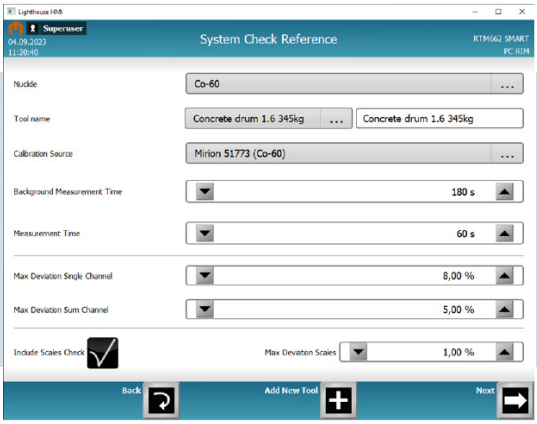
NUCLIDE VECTORS

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*

**All Mirion products are subject to continuous improvement and replacement of outdated components. This may lead to occasional design changes. Screenshots are for illustration purposes only, details depend on the ordered configuration.*

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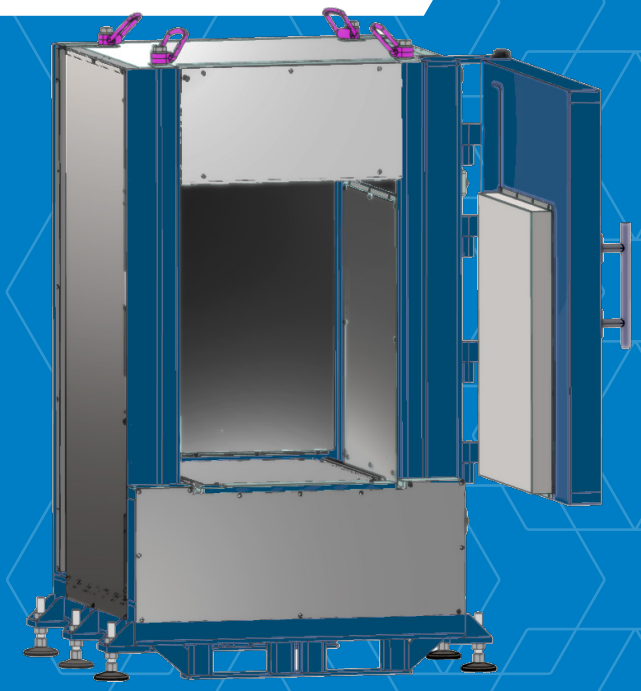
RTM622-460

Clearance Monitor



The Mirion RTM662-460 is designed for clearance measurements of large items like large waste bags, crates or drums.

DESCRIPTION

The RTM662-460 is an advanced clearance monitor for large objects. It consists of a measurement chamber with a manually operated swing door. The objects are detected and weighed by integrated scales and checked for gamma radiation by 6 state-of-the-art plastic scintillation detectors with spectroscopic read-out.

The RTM662-460 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 and simplifies maintenance.

It is based on the well-proven algorithm principles and improved leading nuclide correlation method (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
- **Large Waste bags and drums:** counting chamber dimensions 70 x 70 x 95 cm³, volume 460 liters,
- **Low MDA:** 22 Bq Co-60 achieved by 6 plastic scintillator detectors in a 4π 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,
- **Highly customizable:** Configurable fingerprints, release limits and object models,
- **Modern software platform:** Windows 10 IoT LTSC operating system and Lighthouse analysis software,
- **Simple use:** user-friendly and intuitive graphical user interface, optional 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, fork pockets,
- **Safe transportation** by crane or forklift with full shielding installed.

RTM662-460 CLEARANCE MONITOR

The RTM662-460 comes with advanced administrator and maintenance features: the real-time energy spectrum display provides with a radiological health check of detector array on a single glance. All calibration and routine efficiency checks are user-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 personalized report generation, decision tracing, recalculation and interfacing to waste management systems.

RADIOLOGICAL CHARACTERISTICS

DETECTION

- 6 large-volume plastic scintillation detectors – total active volume: 113,4 litres,
- Spectrometric read-out, 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 automatic 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 900 cps (approx.100 nSv/h, 75 mm lead),
- False alarm safety quantile k_{α}=1.65, detection safety quantile k_{β}=1.65, T_{BKG}=300 s

Measurement time (s)	10	30	60	180
Co-60	**75 Bq**	**44 Bq**	**33 Bq**	**22 Bq**
Cs-137	**151 Bq**	**89 Bq**	**67 Bq**	**44 Bq**
Ba-133	**146 Bq**	**96 Bq**	**64 Bq**	**43 Bq**

MECHANICAL CHARACTERISTICS

- Chamber: 70 x 70 x 95 cm³ (LxWxH), 460 litres,
- Ext. chassis dimensions: 115 x 158 x 235 cm³ (LxWxH),
- Built-in weight scale, maximum 500kg, 0.1 kg resolution,
- 25mm, 50mm or 75mm lead shielding, transportable by crane or forklift with the shielding installed,
- Total weight with shielding:

Shielding	Without (only bottom)	25 mm	50 mm	75 mm
Weight	**2150 kg**	**3692 kg**	**5534 kg**	**7376 kg**

FUNCTIONAL CHARACTERISTICS

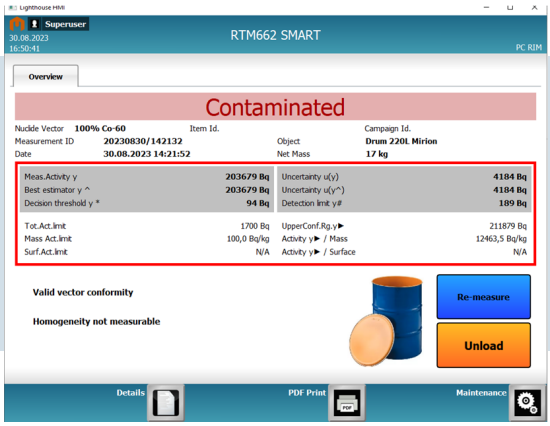
- Single door, manual operation,
- Automatic object detection by the weight scale,
- Optional software controlled cameras,
- Remote user interface with colour screen, keyboard and pointing device, single RJ45 cable connection,
- Visual and audible contamination alarm,
- Report and label printing, optional 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,
- 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: 110-230 V, 50-60 Hz
- Nominal current 5 / 3 A
- UPS backup autonomy: 60 min
- 2 external USB connectors, 1 LAN connection
- 2 floating-contact outputs



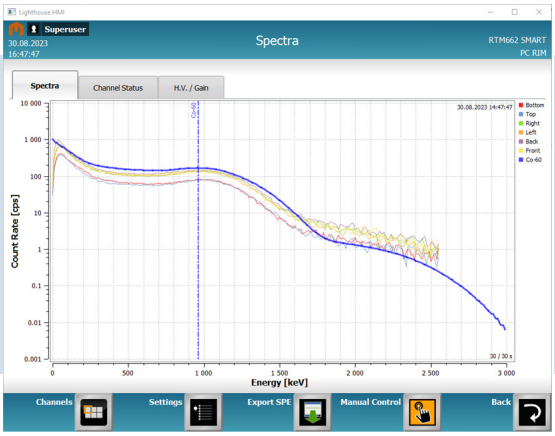
RESULTS SCREEN

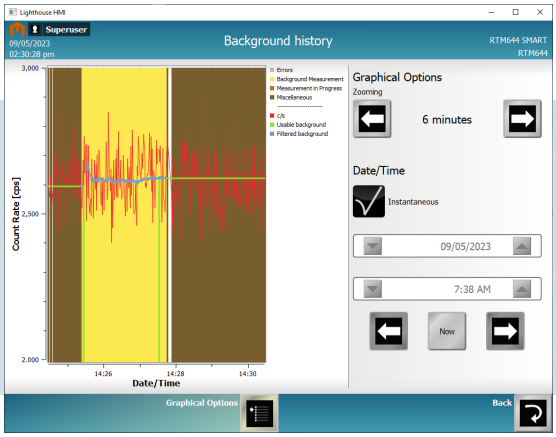
Detailed display of measurement conditions and results for a case where the alarm level is exceeded.

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.

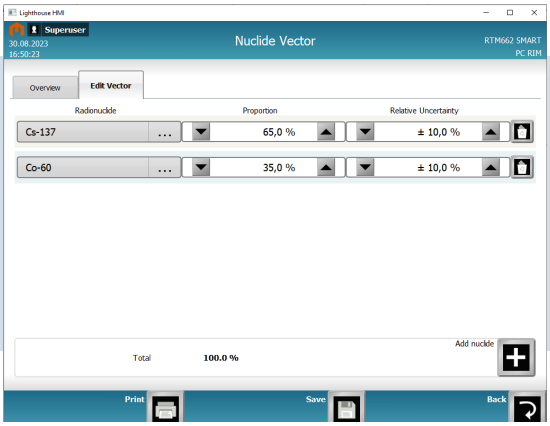




BACKGROUND DIAGNOSTICS

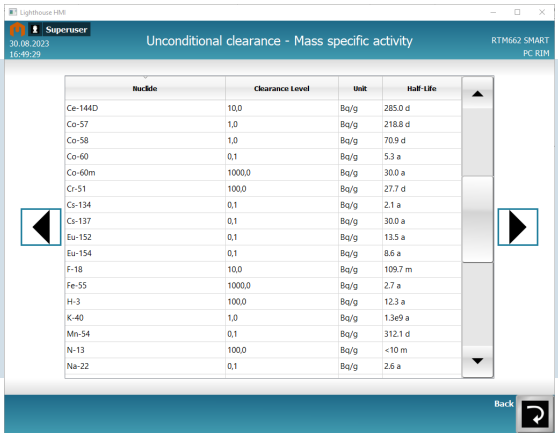
Graphical display of the background history including the count-rate, the filtering process and the refence background. The background history is stored for 3 months with a resolution of 1 s for 3 days and 60 s for the remaining time.

RTM662-460 CLEARANCE MONITOR



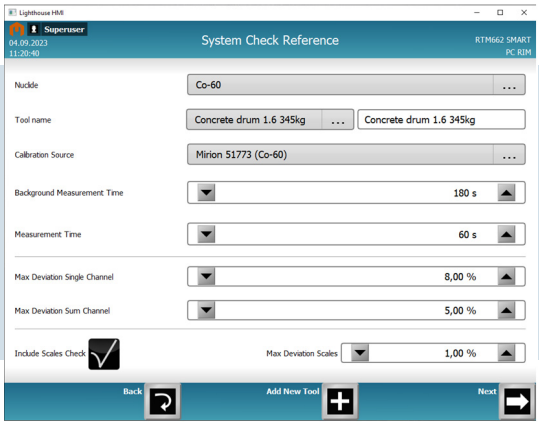
NUCLIDE VECTORS

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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RTM662-460C

Clearance Monitor

The Mirion RTM662-460C is designed for clearance measurements of 200 liters drums or other large items like waste bags.

DESCRIPTION

The RTM662-460C is an advanced clearance monitor for large objects. 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 6 state-of-the-art plastic scintillation detectors with spectroscopic read-out.

The RTM662-460C shared teh 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 the 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 reliable efficiency correction for all nuclides in the fingerprint. The automatic verification and optimization of the declared nuclide vector can reduce the measurement uncertainties further.

FEATURES

- **Gamma clearance monitor** compliant with Euratom 2013/59, IAEA RS-G-1.7, ISO11929:2019
- **Large Waste bags and 200 liters drums:** counting chamber dimensions 70 x 70 x 95 cm³, volume 460 L,
- **Low MDA:** 22 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,
- **Unprecedent precision and low uncertainty:** Spectrometric detector readout and signal processing, simulation-based object models, automatic efficiency and background correction,
- **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 weigh scale,
- **Straightforward calibration and maintenance:** single source calibration, real-time spectrum display, software guided efficiency check and hardware diagnostics,
- **Robustness and ergonomics:** Stainless steel chamber lining and external cladding,
- **Safe transportation** by crane lifting eyelets or forklift pockets

RTM662-460C CLEARANCE MONITOR

The RTM662-460C comes with advanced administrator and maintenance features: the real-time 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.

Validated Monte-Carlo simulations are available as a complementary service to extend the functionality to application-specific objects, the assessment of specific environmental conditions or nuclide vectors.

RADIOLOGICAL CHARACTERISTICS

DETECTION

- 6 large-volume plastic scintillation detectors – total active volume: 113,4 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 automatic 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 900 cps (approx.100 nSv/h, 75 mm lead),
- False alarm safety quantile k_α=1.65, detection safety quantile k_β=1.65, T_{BKG}= 300 s

Measurement time (s)	10	30	60	180
Co-60	**75 Bq**	**44 Bq**	**33 Bq**	**22 Bq**
Cs-137	**151 Bq**	**89 Bq**	**67 Bq**	**44 Bq**
Ba-133	**146 Bq**	**86 Bq**	**64 Bq**	**43 Bq**

MECHANICAL CHARACTERISTICS

- Chamber: 70 x 70 x 95 cm³ (LxWxH), 460 liters,
- External dimensions: 115 x 158 x 235 cm³ (LxWxH),
- Conveyor: length 250 cm, max. object diameter 63 cm,
- Built-in weight scale, maximum 500 kg, 0.1 kg resolution,
- 50 to 75 mm lead shielding, in-field installation possible from the outside, transportable by crane or forklift with shielding installed,
- Total weight with shielding:

Shielding	Without (only bottom)	50 mm	75 mm
Weight	**2150 kg**	**5534 kg**	**7376 kg**

FUNCTIONAL CHARACTERISTICS

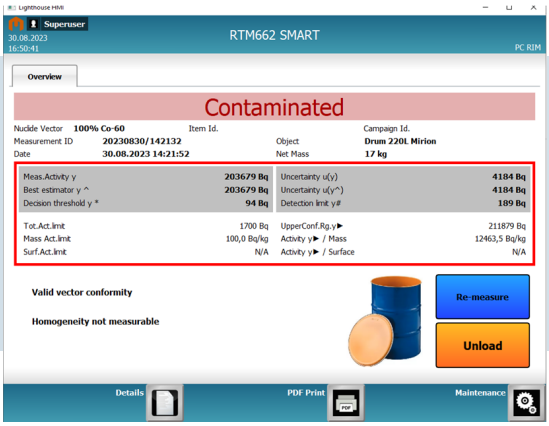
- Single door with chain conveyor, motorized operation with PLC,
- Up to 2 still cameras, triggered by position sensors,
- Automatic object loading, integrated in measurement software, object detection by the weight scale,
- Remote user interface with colour screen, keyboard and pointing device, single 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 module for configurable quality assurance system check procedures
- Software assisted monitor diagnosis and calibration,
- 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
- Detailed, configurable PDF report generator,
- 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 10 / 5 A
- UPS backup autonomy (computer only): 60 min
- 2 external USB connectors, 1 LAN connection
- 2 floating-contact outputs



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

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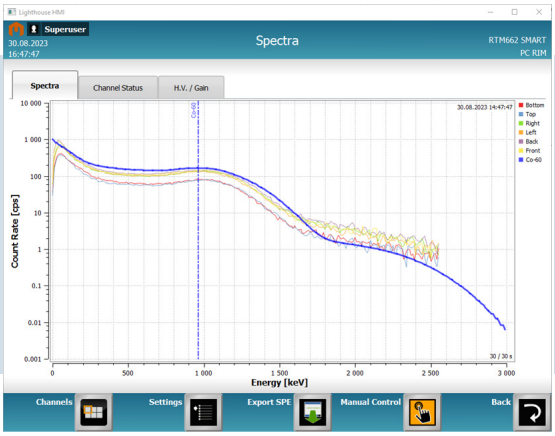
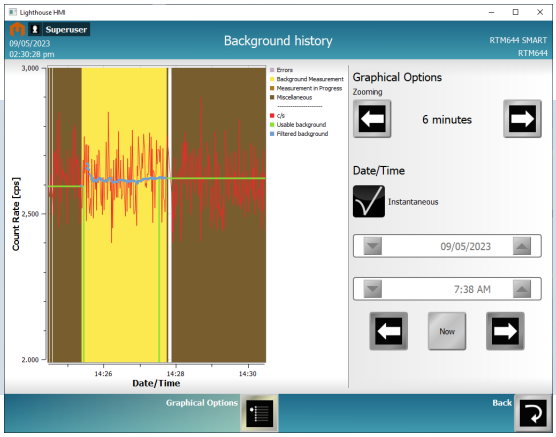
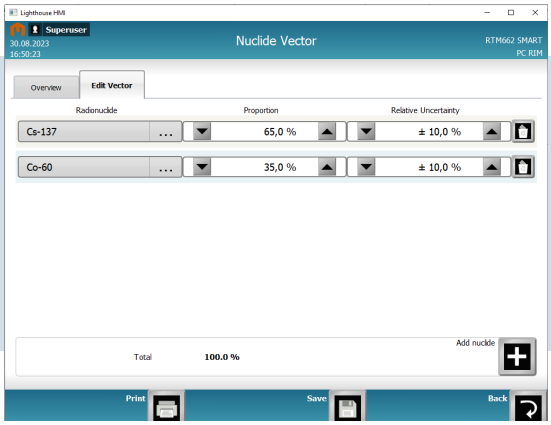




BACKGROUND DIAGNOSTICS

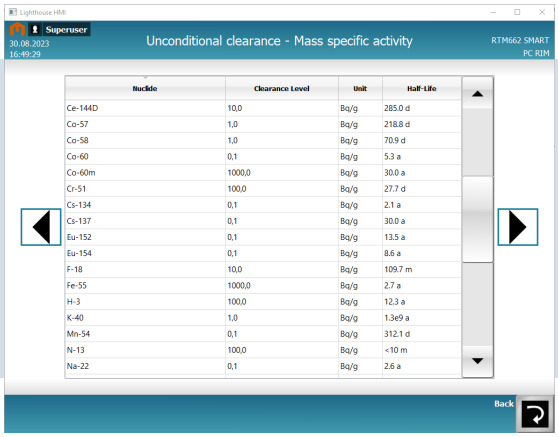
Graphical display of the background history including the count-rate, the filtering process and the refence background. The background history is stored for 3 months with a resolution of 1 s for 3 days and 60 s for the remaining time.

RTM662-460C CLEARANCE MONITOR



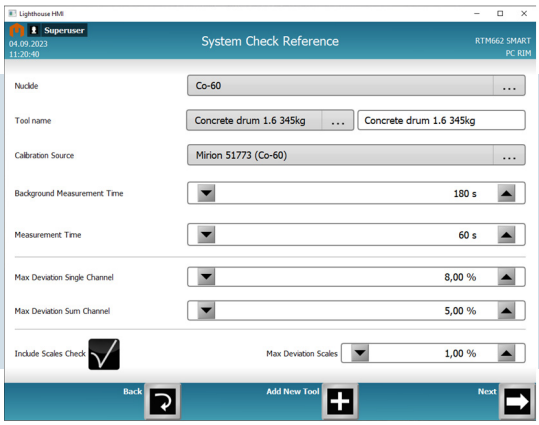
NUCLIDE VECTORS

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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GAMMA WASTE ASSAY SYSTEMS

Cronos®-4 and Cronos®-11

Gamma Object/Tool Monitors

DESCRIPTION

The Cronos-4 and Cronos-11 Gamma Object/Tool Monitors are extremely sensitive instruments used to detect gamma radiation in/on articles such as waste bags, tools, briefcases, hard hats, and other miscellaneous objects. Measurements which ensure that objects have no detectable radioactivity can result in significant cost savings in waste processing and/or storage.

By taking all the best features of Mirion contamination monitors together with new technology and input from health physicists and radiation protection workers worldwide, Mirion has produced a monitor that significantly outperforms any previous monitors in its class.

All Cronos monitors use a sophisticated “fast following” background trending and release-limit algorithm to provide the best performance in a stable or varying radiation field.
The very low detection threshold is optimized by the quantity and sensitivity of the detectors, the thickness of the lead shielding and the measuring time, so that stringent user requirements can be met.

With Mirion WebRemote® software, an easy-to-use touch screen graphical user interface for industrial PC-based operation results in improved health physics programs, better tracking of contamination and faster, more thorough personnel throughput at boundary points.
The devices are rugged and reliable; and they are extremely easy to use.

FEATURES

- ✓ Cronos-4 counting chamber volume: 128.7 L (4.5 cu. ft)
- ✓ Cronos-11 counting chamber volume: 345.5 L (12.2 cu. ft)
- ✓ Amongst the lowest MDA/largest counting chamber volume combinations
- ✓ Robust, ergonomic and easy-to-use and to decontaminate
- ✓ Counts gamma photons with energy >50 keV
- ✓ Six 50 mm (~2 in.) thick large surface area plastic scintillator detectors
- ✓ Six sides of removable 25 mm (~1 in.) thick lead ingot shielding standard
- ✓ Built-in 100 kg (~220 lb) range, 0.1 kg (0.22 lb) resolution, weigh scale
- ✓ Single or dual door operation
- ✓ Automatic or manual selection of transmission correction factors
- ✓ Alarms/messages provided audibly and visually
- ✓ Same “industry-best” software and serial bus electronics consistent with Mirion Argos™-3/5, GEM™-5 and Sirius™ family; no re-training needed
- ✓ WebRemote enabled: provides an ergonomic and easy-to-use touch screen graphical user interface; accessible locally or via PC/tablet web browser
- ✓ Windows 7 Embedded operating system with LAN capability and USB ports
- ✓ Algorithm based on Gaussian or Bayesian statistics (compliant with the ISO 11929:2010 Standard requirements)

DETECTOR GEOMETRY AND BACKGROUND COMPENSATION

The Cronos' large cubic shaped measurement cavities are accessed through one or two doors. Six large area plastic scintillator detectors surround all sides of the cavities providing highly sensitive measuring volumes. Ambient background in the cavities is minimized by one (standard) or two (optional) 25 mm (~1 in.) thick layers of lead shielding. Adding the second layer of lead ingots does not change any internal dimensions or volume.

ELECTRONICS

The Cronos' computer operates on Windows 7 Embedded Operating System and uses USB flash for transferring data. Data may be retrieved either via USB or a LAN.
The flat color display screen(s), the computer and the controls and optional indicator lights are located on top of the instrument. The High Voltage (HV), preamplification, amplification, discrimination, counting, test pulse generation and other processing electronics are mounted right on the detectors – therefore, no HV cabling exists.

SETTING PARAMETERS

Parameter settings, testing, calibration and maintenance is accomplished locally or from a remote location using Mirion WebRemote. WebRemote enables Tablet or PC connection to the Cronos-4/11 via LAN or direct link. Alternatively, the operator can use the standard Monitor Software, pre-installed on all Cronos Contamination Monitors, to provide local Monitor access and functionality. The following types of parameters are available for adjustment:

- Sensitivity of detection.
- Alarm activity levels can be set in units of Bq, dpm, or nCi.
- Weights (when applicable) in units of kg, g, lb.
- Specific Activities (when applicable) in units of Bq/kg, dpm/kg, nCi/kg, pCi/kg, Bq/g, dpm/g, nCi/g, pCi/g, Bq/lb, dpm/lb, nCi/lb and pCi/lb.
- False alarm non-detection and alarm confidence probabilities.
- HV Optimization using Figure-of-Merit (FOM) calculations.
- Fixed or variable count times (calculated and optimized as a function of the alarm level setpoint, the background and the desired accuracy of measurement).

MONITORING ASSISTANCE VIA USER INTERFACE

GENERAL

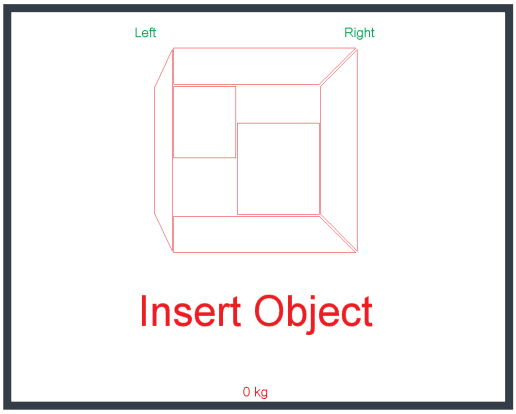
The various stages of the automatic measuring cycle are displayed on the screen(s) and a voice prompt will warn the user when a particular threshold has been exceeded (multiple languages are available). A trace can be kept of all checks made via the hard copy printout (if a printer is attached) and/or via software logging. In addition, performance monitoring data (such as detector efficiency check and calibration efficiency data can be saved to comma separated value (CSV) files for easy trending analysis with spreadsheet programs.

EASE OF USE

From cold startup to operation in as little as two minutes depending upon background conditions.

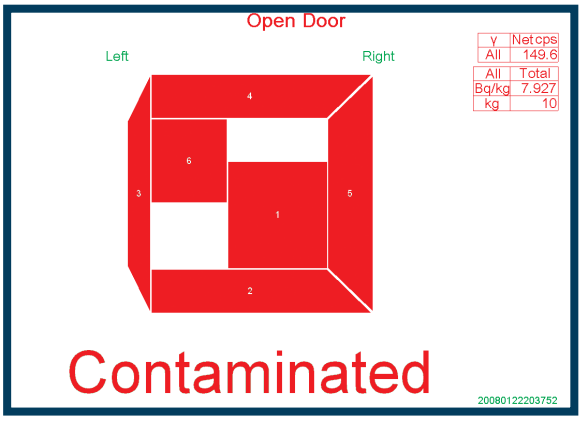
To use the unit, one simply follows the messages displayed on the screen:

1. Open the door, place the object(s) to be monitored inside, close the door and press the Start button.



2. After the measuring period (and if the alarm threshold has not been reached), the message “Clean” is displayed and the operator can then remove the object by opening the door (or secondary door if in two-door operating mode).

3. If a pre set alarm threshold is exceeded, an audible alarm warns the operator and the red indicator “Contaminated” appears on the screen.



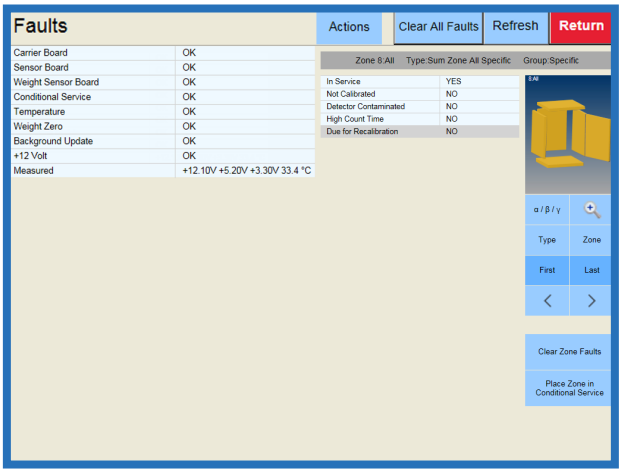
This display will show the quantity and location of the contamination based on which of the detectors is alarming, unless alarm is set on sum zone only. The operator opens the door, removes the object(s) and closes the door. The Cronos-1 will then perform a detector contamination check automatically to ensure there is no detectable amount of radioactivity remaining in the unit.
The measurement results can be printed out. This includes: time/date stamps, “BKG” background value, “Net” count and result of check (“CLEAN” or “CONTAMINATED” etc.).
Once the object(s) has been removed from the unit and the doors closed, the device automatically switches to continuous background acquisition.

MAINTENANCE

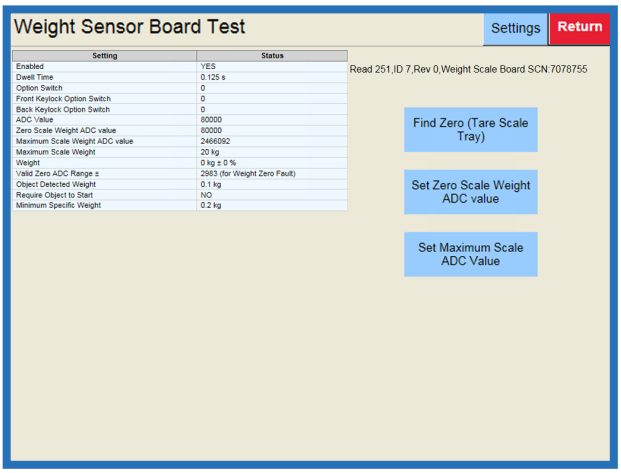
The system records data and time /date stamped logs showing the number of times the unit was used, parameters used, calibration settings, fault messages, etc. The system will also take itself out of service if the calibration interval is exceeded or other operational conditions exist which prevent the unit from achieving its desired sensitivity. These conditions can be configured by the user. Calibration can be easily executed by just one person and is highly automated.

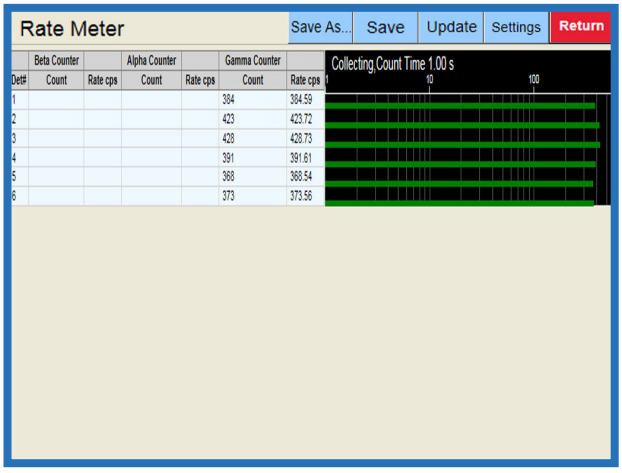
REMOTE STATUS MONITORING

A user friendly dashboard enables the status monitoring (in service, contaminated, out of service, maintenance) of multiple contamination monitors over the LAN. The dashboard is accessible from a tablet or PC web browser and requires no proprietary software installation.



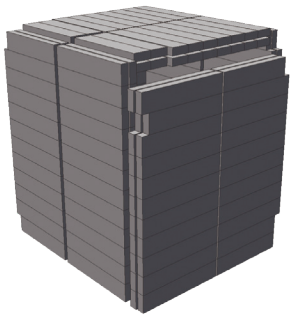
For ease of diagnostics numerous test screens are available to enable precision monitoring, and changing of parameters including high voltage and discrimination thresholds for each detector.

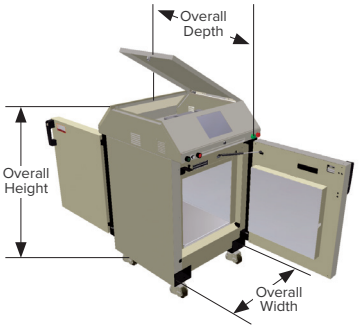
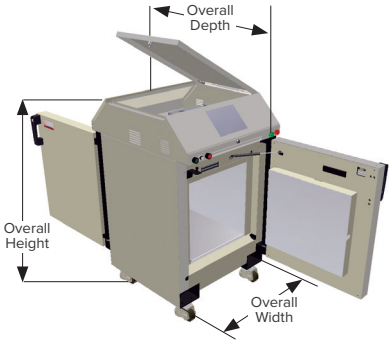
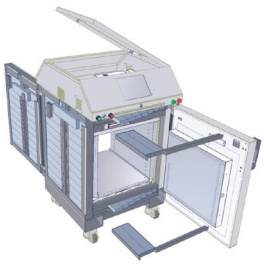




SPECIFICATIONS

MODEL-SPECIFIC

TYPE	DESCRIPTION/ NOTES	Cronos-4	Cronos-11
RADIOLOGICAL			
Time to reach MDA:	Calculated count times for MDA = 83 Bq (5000 dpm) 80 nSv/h background, 1" lead shielding, α = 0.15% and 1-β = 97.5% confidence intervals.	• For ^{137}Cs: 48 seconds • For ^{60}Co: 10 seconds	• For ^{137}Cs: 130 seconds • For ^{60}Co: 22 seconds
Detectors:		• For doors and main unit: six 45.7 x 45.7 x 5.1 cm (18 x 18 x 2 in.) plastic scintillators with built-in photomultiplier tubes. • 65.1 L (2.3 cu. ft) total detector volume.	• For doors: two 61 x 61 x 5.1 cm (24 x 24 x 2 in.) plastic scintillators with built-in photomultiplier tubes. • For main unit: four 61 x 74.9 x 5.1 cm (24 x 29.5 x 2 in.), plastic scintillators with built-in photomultiplier tubes. • 130.5 L (4.6 cu. ft) total detector volume.
Shielding:	Top and bottom 25 mm (~1 in.) lead shielding (or optional 50 mm (~2 in.) shielding) around the six sides of the measurement cavity for nearly 4π counting geometry.		
MECHANICAL			
Internal Dimensions:	Width	46.5 cm (18.3 in.)	63.5 cm (25.0 in.)
	Depth	57.9 cm (22.8 in.)	87.2 cm (34.3 in.)
	Height	47.8 cm (18.8 in.)	62.4 cm (24.6 in.)
	Internal Volume	~128.7 L (`4.5 cu. ft)	~345.5 L (~12.2 cu. ft.)

TYPE	DESCRIPTION/ NOTES	Cronos-4	Cronos-11
External Dimensions:			
	Overall Width	73.2 cm (28.8 in.)	88.4 cm (34.8 in.)
	Overall Depth	85.5 cm (33.7 in.) for body 95.2 cm (37.5 in.) for body and door handles	114.7 cm (45.2 in.) for body 124.4 cm (49.0 in.) for body and door handles
	Overall Height (including leveling feet flush with bottom of Casters)	129.1 cm (50.8 in.)	145.7 cm (57.4 in.)
	Door Thickness	7.0 cm (2.7 in.)	7.0 cm (2.7 in.)
Weight:	Unit with No Lead	445 kg (981 lb)	563 kg (1241 lb)
	Lead (1 layer)	751 kg (1656 lb)	1264 kg (2787 lb)
	Lead (2 layers)	1503 kg (3314 lb)	2529 kg (5575 lb)
	Total (with 1 layer of lead)	1207 kg (2661 lb)	1841 kg (4059 lb)
	Total (with 2 layers of lead)	1958 kg (4317 lb)	3105 kg (6845 lb)
Accessibilty:			

COMMON RADIOLOGICAL

RADIATION DETECTED

Gamma photons with energy over 50 keV: ^{241}Am, ^{133}Ba, ^{137}Cs, ^{60}Co, etc.

GENERAL

OPERATING MODES

The unit can be used with a two door operating mode (entrance and exit doors) or with one door operation only (the exit door is locked and only the entrance/front door is used for control). In either mode, doors are interlocked such that they must be closed to initiate a count.

Automatic weighing of packages 100 g to 100 kg (~0.2 lb. to ~220.5 lb.) and calculation of the specific activity for a given radioisotope or mixture with transmission correction factor(s) is also available via software and/or rotary dial switch.

PARAMETER ENTRY

Parameters may be entered with the touch of a finger using the capability of the built-in touch screen and WebRemote software. Additionally, a keyboard/trackball combo placed in a drawer in the top of the device is provided for entering parameters.

SPECIFICATIONS

UTILITY DEVICES

Lockable Keyboard Drawer:

- Houses special keyboard/trackball combo human interface device, integrated in top of unit for easy access

Rotary Switch:

- Used to manually select special preset user-defined parameter options (such as transmission correction factors) during normal operation without need to access keyboard

Display Screen:

- ~ 233.9 mm (10.4 in.) touch screen LCD display, integrated in top of unit (second display kit optionally available for exit side)

Bottom-mounted Input/Output and Power Entry Ports Box:

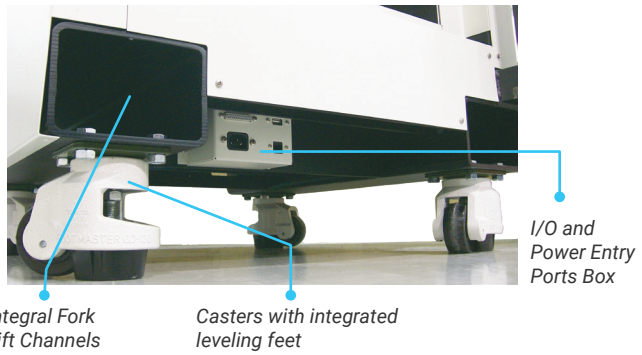
- Parallel (Centronics) printer port, printer not supplied
- One USB port and one Ethernet port (RJ45)
- IEC standard AC receptacle

Handling:

- Four casters: swiveling with integrated leveling feet (optional)
- Two integral fork lift channels to ease transportation

Internal Lining:

- Removable aluminum plate on top of load sensors for easy decontamination



ELECTRICAL

Power Requirements:

- 220 V ac/50 Hz/1 Amp or 110 V ac/60 Hz /2 Amp mains 3 m (~10 ft) IEC standard cable (supplied; specify and special cable requirements on order)

CERTIFICATION

- IEC 61098 compliant
- ISO 11929:2010 compliant

ENVIRONMENTAL

Temperature:

- Operating temperature range 0 to +45 °C (+32 to +113 °F)

Humidity:

- 85% non-condensing

ORDERING INFORMATION

- Cronos-4 (SCN 817800) – 128.7 L (4.5 cu. ft) internal volume. Internal Dimensions (W x D x H): 46.5 cm x 57.9 cm x 47.8 cm (18.3 in. x 22.8 in. x 18.8 in.)
- Cronos-11 (SCN 817900) – 345.5 L (12.2 cu. ft) internal volume. Internal Dimensions (W x D x H): 63.5 cm x 87.2 cm x 62.4 cm (25.0 in. x 34.3 in. x 24.6 in.)

OPTIONS (FOR CRONOS-4, X=4; FOR CRONOS-11, X=11)

- CrnsxPB: Secondary layer of 25 mm (~1 in.) lead ingot shielding for Cronos-x; (to bring total thickness to ~50 mm (2 in.))
- CrnxJIG: Source Calibration jig for Cronos-x (source not supplied)
- CrnsxLR: Removable, non-metal Cronos-x liners kit with preprinted center points for decon./calibration
- Crnsx2D: Secondary color LCD display kit for exit side of unit for Cronos-x
- CrnsMAG: Magnetic Strip Reader
- CrnsBAR: Bar Code Reader
- CrnsPROX: Proximity Card Reader
- Crns4TAB: Stand/Plinth table to elevate Cronos-4 only
- CrnxLFT: Lifting Sling Arrangement for Cronos-x
- CRemote: Centralized Remote Control & Data Access Software for use with Mirion Argos, Sirius, GEM and Cronos contamination monitors
- 817885 (Cronos-4), 817985 (Cronos-11) – Secondary color touch screen LCD kit for exit of unit

WebRemote-Kit Options (For Rugged, Y=1; FOR PRO Y=2; FOR basic, Y=3):

- WebRemote-Kit#Y – WebRemote Software and Rugged/Pro/Basic Hardware. Includes Dashboard, WebRemote, and Monitor 9.0 Software. Includes Rugged, Pro, or Basic hardware, and applicable accessories.
- The Mirion contamination monitors can be integrated with Horizon® Supervisory Software to provide an integrated solution with Mirion instruments. Horizon complements the functionality of the WebRemote Contamination Monitor Interface.

MIRION TECHNOLOGIES

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RTM750™

Laundry and Small-Items Conveyor Monitor

Detection of radioactive contamination on clothing and other small and/or long items such as tubes, poles and valves.

DESCRIPTION

The laundry and small items RTM750 monitor is used for detection of radioactive contamination on clothing and other small and/or long items such as tubes, poles and valves.

Detector arrays above and below the stainless-steel mesh belt guarantee high sensitivity. The detector arrangement ensures measurements without any dead zones. The gap between the belt and upper detector array is adjustable to achieve as low detection limits as possible, monitored by light barriers.

The RTM750 monitor can be equipped with various detector combinations to meet specific requirements.

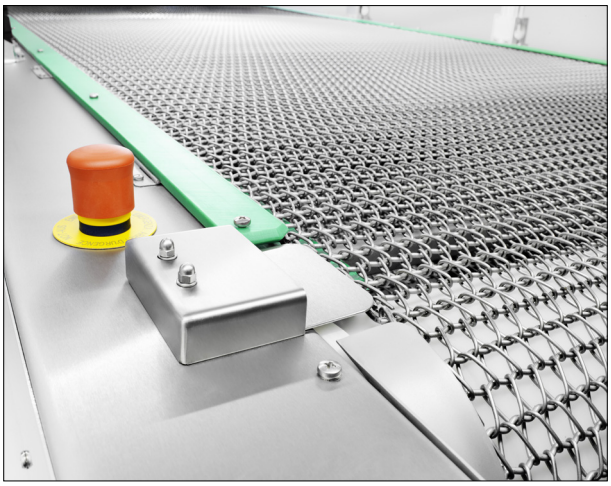
FEATURES

- High sensitivity, no dead zones
- Beta plastic, gamma plastic, gas detectors, or combinations
- Belt available in various dimensions
- Automatic speed control
- Height adjustment (2 - 18 cm; optionally more)
- Automatic background subtraction
- Selectable alarm levels in cps, cpm, Bq, Bq/cm^2
- Audible and visible alarm indication
- Alpha/beta discrimination (optional)
- Second conveyor for automated sorting of items (optional)
- Uninterruptible power supply (optional)

RTM750™ LAUNDRY AND SMALL-ITEMS CONVEYOR MONITOR

FUNCTIONALITY

The belt speed is calculated and set automatically in a range between 0.6 and 12 m/min dependent on measurement mode, current background, alarm threshold, detection safety and false alarm rate (acc. to ISO 11929). In case of alarm the belt reverses its movement to the start and stops. An alarm message is displayed on the screen. A high contamination alarm, e.g., in case of hot spots, triggers an additional acoustic alarm. All contaminations are clearly indicated by visual and audible alarm. The results are stored in a measurement database. To avoid puncturing detectors by the measured goods a plastic belt can be utilized (optional). An additional conveyor allows for automatic sorting of the measured goods according to the measurement result (optional).



USERS BENEFITS

- High throughput: up to 375 overall/h
- Contamination measurement from below and above
- Adjustable height of upper detectors (2 - 18 cm; optional up to 40 cm)
- Large TFT 19” color display (touch screen optional)
- Automatic system check
- Uninterruptible power supply (optional)

TECHNICAL SPECIFICATIONS

- Standard dimensions:
  - Length: 2000 - 3400 mm
  - Width: 900 - 1400 mm
  - Height: 1730 - 1980 mm
- Detectors: beta plastic scintillation or gas-flow detectors or gamma plastic scintillation or combinations
- Detection limit: 45 Bq (Co-60, 1.2 m/min)
- Belt speed: 0.6 m/min - 12 m/min
- Energy range: 50 keV - 3 MeV

OPTIONS

- Impermeable plastic conveyor belt
- Additional conveyor for sorting clothes according to measurement result
- Mechanical height adjustment for whole RTM750 monitor
- Tray and trackball, plus finger protection
- Alpha/beta discrimination
- ISO 11929 implementation

MIRION TECHNOLOGIES

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Notes

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MKTG-2819-EN-1 - 10/2024

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