



## GAMMA WASTE ASSAY SYSTEMS

# Cronos<sup>®</sup>-1

Gamma Object/Tool Monitors



## FEATURES

- Counting chamber volume: 42.9 L (1.5 cu. ft.)
- Robust, ergonomic, easy-to-use and decontaminate
- Photon energy range from 50 keV to 2 MeV
- Four or optional six large surface area plastic scintillator detectors
- Six sides of removable 25 mm (~1 in.), with optional 50 mm (~2 in.), thick lead ingot shielding
- Single or dual door operation
- Automatic or manual selection of transmission correction factors (with weight scale option)
- Adjustable upper level discriminator to reduce count time
- Same “industry-best” software and serial bus electronics across Mirion Cronos-4/11, Argos™-3/5, Sirius™-5 and GEM™-5 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 ISO 11929:2010 Standard Requirements)

## DESCRIPTION

The Cronos-1 Gamma Object/Tool Monitor is an extremely sensitive instrument used to detect radioactivity on small articles such as notebooks, keys, tools, hard hats, and other miscellaneous objects. Short count times and high efficiency make the Cronos-1 Gamma Object/Tool Monitor the ideal tool for the implementation of an Empty Pocket policy at your facility.

Measurements which ensure that objects have no detectable radioactivity can result in significant cost savings in waste processing and/or storage.

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, assuring that stringent user requirements can be met.

With Mirion WebRemote<sup>®</sup> 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.

### BENEFITS

- Implement your empty pocket policy at minimum cost
- Low count times and high performance for faster throughput at RCA/boundaries
- Designed for safe installation and transportation
- Reduced spares inventory and interchangeability of parts
- Notification for objects left behind by personnel reduces potential for lost objects (weight scale option only)

### Detector Geometry and Background Compensation

The Cronos' large cubic shaped measurement cavity is accessed through one or two doors. Four to six large area plastic scintillator detectors surround all sides of the cavity providing a highly sensitive measuring volume. Scintillators overlap to optimize detection uniformity and reduced dead zones. Ambient background in the cavity 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-1 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 touch screen, color display; computer, controls, and 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. 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. WebRemote enables tablet or PC connection to the Cronos-1 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 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

#### 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 data log can be kept of all checks made via the hard copy printout (if a printer is attached or available on the local network) 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.

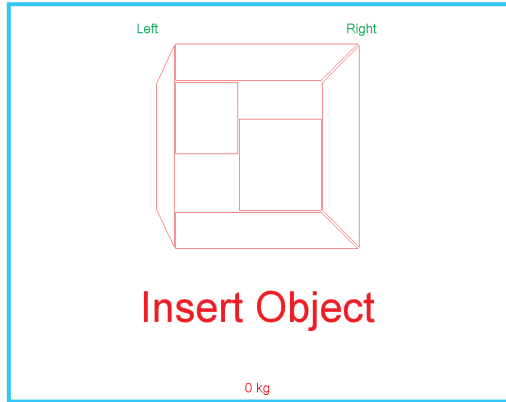
#### Ease of use:

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

## Cronos-1 | GAMMA OBJECT/TOOL MONITORS

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

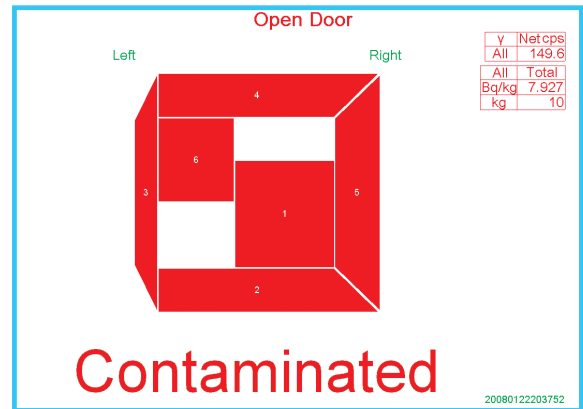
1. Open the door, place the object(s) to be monitored inside, close the door and press the Start button.



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.

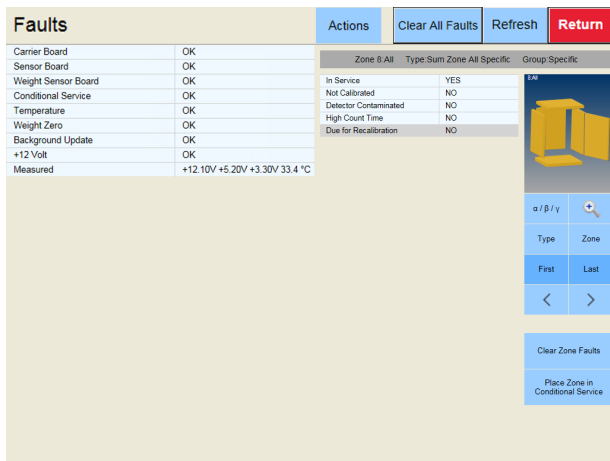
The measurement results can be printed out. This includes: time/date stamps, “BKG” background value, “Net” count and result of check (“CLEAN” or “CONTAMINATED” etc.).

Once the object(s) has been removed from the unit and the doors closed, the device automatically switches to continuous background acquisition.

### MAINTENANCE

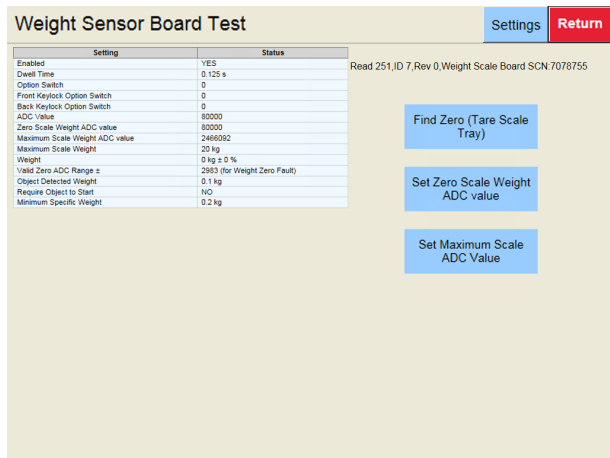
The system records data and time/date stamped logs showing the number of times the unit was used, parameters used, calibration settings, fault messages, etc.

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.



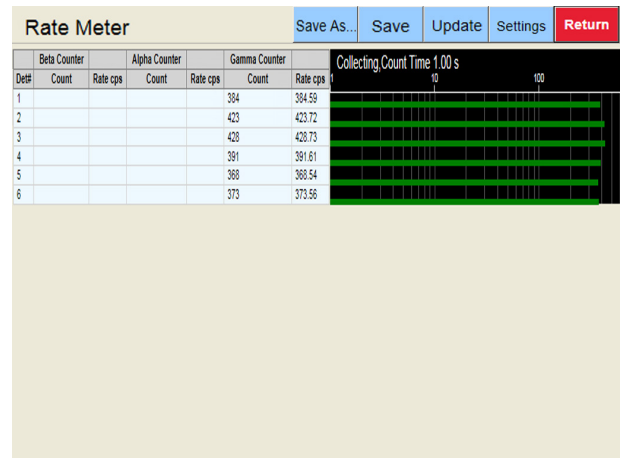
For ease of diagnostics numerous test screens are available to enable precision monitoring, and changing of parameters including high voltage and discrimination thresholds for each detector.

Convenient access to the computer and electronics via the lockable drawer makes maintenance easy.



### REMOTE STATUS MONITORING

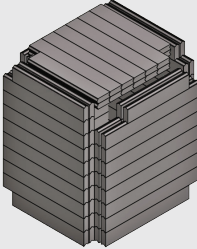
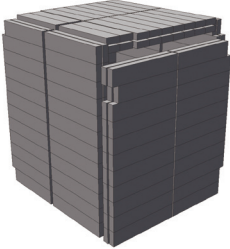
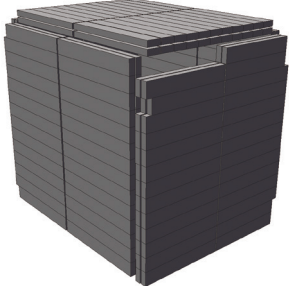
A user friendly dashboard enables the status monitoring (in service, contaminated, out of service, maintenance) of multiple contamination monitors over the LAN. The dashboard is accessible from a tablet or PC web browser and requires no proprietary software installation.




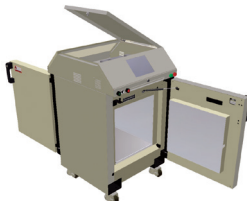
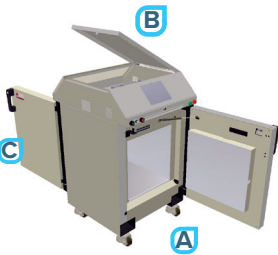
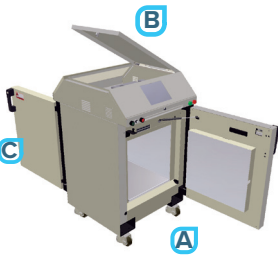
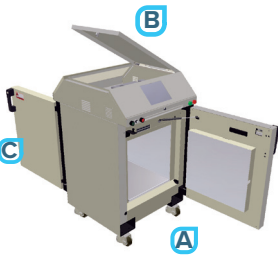
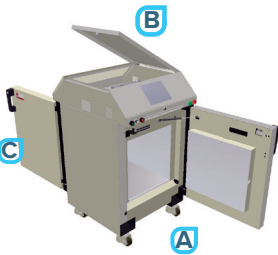
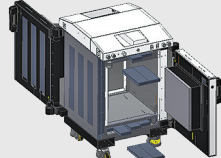
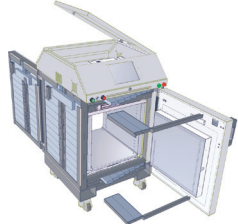
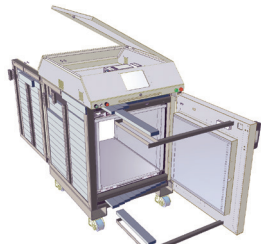
**SPECIFICATIONS**

Model-Specific

**CRONOS FAMILY COMPARISON**

		Cronos-1	Cronos-4	Cronos-11
<b>Radiological</b>				
<b>Time to reach MDA</b>	Calculated count times for MDA = 83 Bq (5000 dpm) 80 nSv/h background, 1" lead shielding, $\alpha = 0.15\%$ and $1-\beta = 97.5\%$ confidence intervals.	<u>6 Detector Configuration</u> <ul style="list-style-type: none"> <li>For <sup>137</sup>Cs: 24 seconds</li> <li>For <sup>60</sup>Co: 6 seconds</li> </ul> <u>4 Detector Configuration</u> <ul style="list-style-type: none"> <li>For <sup>137</sup>Cs: 35 seconds</li> <li>For <sup>60</sup>Co: 9 seconds</li> </ul>	<u>6 Detector Configuration</u> <ul style="list-style-type: none"> <li>For <sup>137</sup>Cs: 48 seconds</li> <li>For <sup>60</sup>Co: 10 seconds</li> </ul>	<u>6 Detector Configuration</u> <ul style="list-style-type: none"> <li>For <sup>137</sup>Cs: 130 seconds</li> <li>For <sup>60</sup>Co: 22 seconds</li> </ul>
<b>Detectors</b>		<ul style="list-style-type: none"> <li>For doors and main unit: six 38.7 x 33.2 x 5.1 cm (15 x 13 x 2 in.) plastic scintillators with built-in photomultiplier tubes.</li> <li>Detector volume for main unit detectors (four total) 25.5 L (0.90 cu. ft.).</li> <li>Detector volume for main unit and Optional door detectors (six total) 38.2 L (1.4 cu. ft.).</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> <li>65.1 L (2.3 cu. ft) total detector volume</li> </ul>	<ul style="list-style-type: none"> <li>For doors: two 61 x 61 x 5.1 cm (24 x 24 x 2 in.) plastic scintillators with built-in photomultiplier tubes.</li> <li>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.</li> <li>130.5 L (4.6 cu. ft) total detector volume.</li> </ul>
<b>Shielding</b>	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 4 $\pi$ counting geometry			
<b>Mechanical</b>				
<b>Internal Dimension</b>	Width	34.1 cm (13.4 in.)	46.5 cm (18.3 in.)	63.5 cm (25.0 in.)
	Depth	36.5 cm (14.4 in.)	57.9 cm (22.8 in.)	87.2 cm (34.3 in.)
	Height	34.5 cm (13.6 in.)	47.8 cm (18.8 in.)	62.4 cm (24.6 in.)
	Internal Volume	~42.9 L (1.5 cu. ft)	~128.7 L (4.5 cu. ft)	~345.5L (12.2 cu. ft.)

**CRONOS FAMILY COMPARISON**

		Cronos-1	Cronos-4	Cronos-11
<b>External Dimensions</b>	<b>A</b> Overall Width			
	<b>B</b> Overall Depth			
	<b>C</b> Overall Height			
				
	Overall Width	60.0 cm (23.6 in.)	73.2 cm (28.8 in.)	88.4 cm (34.8 in.)
	Overall Depth	63.4 cm (25.0 in.) for body 73.1 cm (28.8 in.) for body and door handles	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 (Flush with bottom of casters or flush with bottom of the leveling feet)	<u>With Standard Leveling Feet</u> 96.3 cm (37.9 in.) <u>With Optional Casters</u> 100.4 cm (39.5 in.)	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.)	7.0 cm (2.7 in.)
<b>Weight</b>	Unit with No Lead	260 kg (573 lb)	445 kg (981 lb)	563 kg (1241 lb)
	Lead (1 layer)	416 kg (917 lb)	751 kg (1656 lb)	1264 kg (2787 lb)
	Lead (2 layers)	832 kg (1834 lb)	1503 kg (3314 lb)	2529 kg (5575 lb)
	Total (with 1 layer of lead)	683 kg (1506 lb)	1207 kg (2661 lb)	1841 kg (4059 lb)
	Total (with 2 layers of lead)	1099 kg (2423 lb)	1958 kg (4317 lb)	3105 kg (6845 lb)
<b>Accessibility</b>				

**COMMON RADIOLOGICAL**

**Radiation Detected:**

Photons with energy over 50 keV: <sup>241</sup>Am, <sup>133</sup>Ba, <sup>137</sup>Cs, <sup>60</sup>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 10 g to 20 kg (~0.02 lb to ~44.1 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 USB connected keyboard/mouse may be used to enter parameters.

## SPECIFICATIONS

### UTILITY DEVICES

**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

**USB Ports**

- Three USB Ports: two conveniently available on the outside, and one under the unit

**Display Screen:**

- ~264 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:**

- USB Port
- 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:**

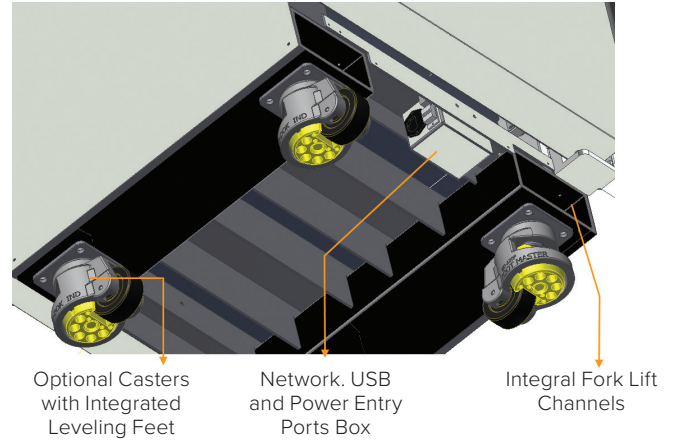
- Operating temperature range 0 to +45 °C (+32 to +113 °F)

**Humidity:**

- 85% non-condensing

## ORDERING INFORMATION

- Cronos-1 (SCN CRONOS-1) – 42.9 L (1.5 cu. ft) internal volume. Internal Dimensions (W x D x H): 34.1 cm x 36.5 cm x 34.5 cm (13.4 in. x 14.4 in. x 13.6 in.)
- 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

- Crn1CAST: Four optional casters with integrated leveling feet
- Crn1PB: Secondary layer of 25 mm (~1 in.) lead ingot shielding for Cronos-1; (to bring total thickness to ~50 mm (2 in.))
- Crn1LFT: Cronos -1 lifting sling
- Crn1JIG: Source Calibration jig for Cronos-1 (source not supplied)
- Crn1Scale: Weight scale option for Cronos-1
- Crn1D2: Secondary color LCD touch screen kit for exit side of unit
- Crn1TAB: Stand/Plinth table to elevate Cronos-1 only
- Crn1TAB-VAR: Non-standard height stand/plinth to elevate Cronos-1 only
- SOFT-CRemote: Centralized Remote Control and Data Access Software for Cronos/Argos/GEM-5/Sirius Contamination Monitors
- SOFT-LDB: Database option for Cronos-1

**ID Card Reader Options:**

- 7062157: Optional Magnetic Strip Card Reader
- 816100: Optional Bar Code Card Reader
- 7062147: HID Compatible Proximity Card Reader

**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.

