



### System calibration

Each DrumScan® SGS Plus system is supplied pre-calibrated to meet the specific measurement needs of each customer. The specifics of each calibration are agreed with the customer prior to the commencement of factory based commissioning.

The day-to-day check of correct system operation is achieved via a standardisation routine. At pre-determined intervals, the operator is required to perform a standardisation measurement. This is used to check the system's energy calibration and compare the measured photopeak count rates, dead times and full-width-half-maximums (FWHMs) of the detector against acceptable limits using the gamma emissions

from the transmission source. Background and assay measurements are inhibited unless the standardisation measurement is valid. The standardisation routine is quick and is achieved via a single button on the operator interface.

System calibration is checked by the periodic measurement of a dummy waste drum, supplied with the instrument, in to which a source(s) of known activity is placed at a pre-determined location.

### Helical scan

Unique to DrumScan® SGS Plus is a continuous, vertical scan of the detector and transmission source which move up and down the drum as it rotates, to produce a helical scan.

This results in superior accuracy over conventional segmented gamma scanners due to the uniform gamma detection efficiency over the whole of the drum and the gamma transmission source scanning all of the drum.

### Correction for waste matrix attenuation

Measured activities are corrected for the effects of gamma attenuation by the waste matrix using world-leading matrix attenuation correction techniques. These include Mean Waste Density and Differential Photopeak Absorption (DPA) together with TransWeight<sup>1</sup> and Gamma Transmission<sup>2</sup> which are patented by BIL Solutions Ltd.

TransWeight offers improved assay accuracy for partially filled drums and stratified or layered drums with very dense segments. Gamma

Transmission offers improved assay accuracy over the traditional gamma transmission technique for unknown, heterogeneous matrix compositions because it does not assume a default matrix composition.

An 'Intelligent Combination' algorithm selects the optimum matrix attenuation correction technique for each drum segment.

### DrumScan® HRGS One Shot Assay System

The DrumScan® HRGS One Shot Assay System is a lower cost alternative to DrumScan® SGS Plus in which the radioactive emissions from the entire drum are measured without vertical scanning. This variant is cost-effective for the rapid assay of solid, homogeneous wastes such as soil, incinerator ash and sludges in full drums or in drums with known fill heights. It is particularly suited to in-cell applications.

### Specification

#### Measurement system size/mass:

Detector lift module 1200 mm long, 1000 mm wide, 2210 mm high / 650 kg  
Turntable module 900 mm long, 900 mm wide, 550 mm high / 230 kg  
Transmission source lift module 900 mm long, 900 mm wide, 2150 mm high / 555 kg

Drum size: 100 to 500 litres (25 to 130 US gallons); 575 to 1200 mm high, 490 to 800 mm diameter

Drum mass: 10 to 1000 kg (22 to 2200 lb)

Drum loading/unloading: Fork-lift truck or manually-operated pallet truck. Roller conveyor optional

Turntable rotation speed: 10 rpm

Detector: 15% efficiency, liquid nitrogen cooled, coaxial, high purity germanium (HPGe) with 30 litre dewar as standard. Other options available

Pulse processing electronics: ORTEC® DSPEC Pro™ Advanced Digital Gamma-Ray Spectrometer

Gamma transmission source: 370 MBq (10 mCi) <sup>152</sup>Eu. Other activities available

Computer: Compact industrial PC with CD-RW. Other options available

Operating system: Windows® XP

Monitor/printer: 17" colour TFT / colour inkjet as standard. Other options available

Operating voltage/current: 110 or 230 V AC, 50/60 Hz, configured at shipment / 16 A at 110 V

### Performance

#### Minimum detectable activity (MDA):

Assuming a uniform distribution of activity within a scanning segment in a 0.3 µSv/hr (30 µrem/hr) radiation background (95% confidence)

<sup>60</sup>Co, 0.08 Bq/g (10 kBq); <sup>137</sup>Cs, 0.1 Bq/g (12 kBq) for a 200 litre drum

weighing 120 kg in 30 minutes

<sup>235</sup>U, 0.35 - 0.45 g for a 200 litre drum weighing 100 kg in 10 - 15 minutes

<sup>60</sup>Co, 12 kBq/g (6 GBq) in a 200 litre drum containing 500 kg waste

<sup>137</sup>Cs, 35 kBq/g (17 GBq) in a 200 litre drum containing 500 kg waste

Use of attenuating filters can increase range to >12 GBq <sup>60</sup>Co and >30 GBq <sup>137</sup>Cs

10 to 120 minutes, optimised for application

Better than ± 15% geometrical uncertainty for a 200 litre drum

1.8 keV at 1332 keV

Energy range: 50 keV to 2.5 MeV

Dose rate envelope: Waste items up to 5 mSv/hr (500 mrem/hr) contact gamma dose rate

Up to 10 µSv/hr (1 mrem/hr) without further external shielding

Operating temperature range: 0°C to 40°C

Operating humidity range: 5% to 80% relative humidity (non-condensing) at 40°C

Remote operation: In excess of 100 m (330 feet) from drum measurement location

#### Maximum detectable activity:

Count time:

Accuracy:

Energy resolution (FWHM):

Energy range:

Dose rate envelope:

Gamma radiation background:

Operating temperature range:

Operating humidity range:

Remote operation:

### Options

Different detector efficiencies for other ranges of sensitivity.

Electrically cooled HPGe detector where liquid nitrogen is unavailable.

Drum dose rate measurement at selected positions close to drums during assay.

Integration with roller conveyor for automated drum handling.

Attenuating filters to meet needs of both LLW and ILW measurements.

Customised results reporting for single drum measurements and/or waste consignments.

Bar code reader for automatic input of waste drum's unique identification code.

DrumScan® HRGS One Shot Assay System for homogeneous waste monitoring.

Product and residues monitoring through derivatives of DrumScan® SGS Plus.

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## DrumScan® SGS Plus Helical Scanning Assay System

- Accurate, reliable and cost-effective assay of drums from 100 to 500 litres (25 to 130 US gallons) weighing up to 1000 kg (2200 lb)

- Ideally suited to measurement of solid, homogeneous and heterogeneous wastes contaminated with fission products, activation products, plutonium and uranium (including <sup>235</sup>U enrichment) for categorisation and sentencing. Waste drum fill height can be unknown and variable

- Simple to use, Microsoft® Windows® driven operator interface requiring no specialist radiometric or computing knowledge

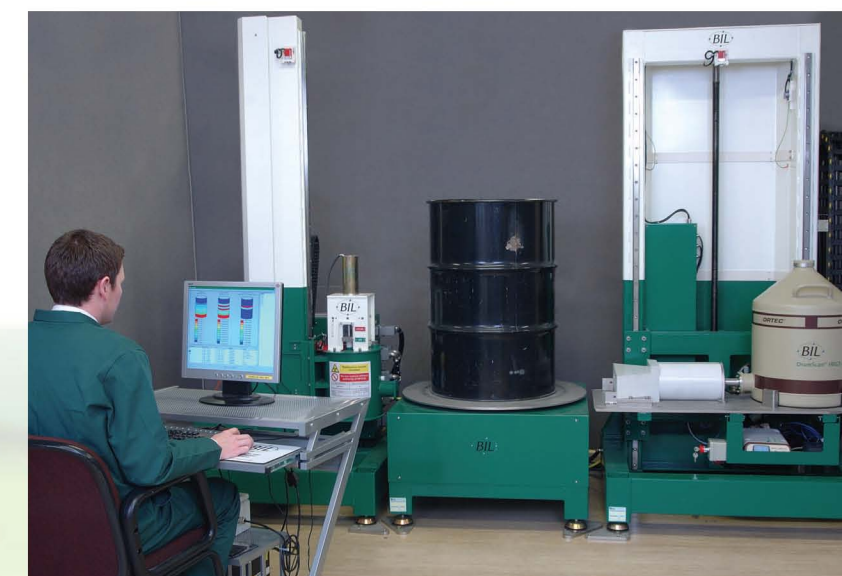
- Customised results reporting for single waste item measurements and/or waste consignments (e.g. automatic generation of Drigg D4 form for UK LLW consignment)

- Highly flexible detector, turntable and transmission source geometry, and inclusion of optional attenuating filters to meet needs of both low level and intermediate level waste measurements

- Stand-alone use requiring manual handling of drums or automated drum handling via roller conveyor for high throughput, high drum dose rate or hot-cell applications

- Remote PC control in excess of 100 m (330 feet) to minimise operator dose uptake

- Patented, world-leading matrix attenuation correction techniques including 'Intelligent Combination' algorithm to minimise assay error for both low and high density wastes



- Unique continuous, helical scan resulting in superior accuracy over conventional segmented gamma scanners

- Inference of activity of all 'difficult-to-measure' radionuclides (e.g. pure beta emitters or low activity gamma emitters) from multiple, directly measured, reference radionuclides via customer-defined wastestream fingerprints (scaling factors or nuclide vectors)

- Automatic decay-correction of previously measured total radionuclide content for reassessment of waste drums where a significant time has elapsed

- Unique full colour, graphical display of waste density, radionuclide activity and total activity within a drum

- Results stored automatically in a Microsoft® SQL Server database, with provision for easy back-up

- Optional electrically cooled high purity germanium (HPGe) detector where liquid nitrogen is unavailable

- Optional drum dose rate measurement at selected positions close to drum during assay

- Optional bar code reader for automatic input of each waste drum's unique identification code

BIL Solutions Ltd's DrumScan® SGS Plus Helical Scanning Assay System builds on the success of the original high resolution gamma spectrometry (HRGS) model and extends the capabilities for the measurement of solid radioactive wastes. The result is a highly configurable and easy to use system that enables the accurate, reliable and cost-effective assay of both homogeneous and heterogeneous wastes for categorisation and subsequent sentencing for storage or disposal.