LM1 Liquid Monitoring System

Contamination Resistant | **Skid Mounted**

The **LM1** monitoring system consists of a **SD220N** gamma scintillation detector with **SDA3E** preamplifier/SCA unit, local **RM1W** display and control unit, **LS44** liquid sampler, liquid pumping system, and local cables to interconnect the system electronics. The detector will continuously measure the gamma energies from the liquid sample stream and provide nuclear pulses to the preamp/SCA. The preamplifier/SCA unit can be set to operate in differentiate mode measuring up to three regions of interest, or it can be operated in integrate mode measuring gross gamma activity.. The LM1 liquid monitoring system will achieve a lower limit of detection of 2.7E-8 uCi/cc of Cs137 in a 10 uR/hr Cs137 gamma background with ten minutes integration time and two standard deviations of background.

SD220N Gamma Scintillation Detector

The **SD220N** consists of a 2" x 2" NaI crystal, photomultiplier tube, mu-metal shield, dynode chain, Lucite light pipe, cylindrical enclosure and interconnecting cable. A light emitting diode (LED) is located in the Lucite light pipe for automatic gain stabilization and for use as a test pulser. A temperature sensor also located within the Lucite light pipe provides a signal for temperature compensation. **Apantec** SD series detectors include automatic compensation for gain shifts caused by aging, temperature change and power supply drift. The detector housing is 2.5" in diameter x 7 inches long. The detector will be positioned within the lead shielded sampler for attenuation of gamma background contribution. The detector nuclear output pulses are wired to the preamplifier/SCA unit for pulse height analysis. SD series detectors are available with a variety of crystal sizes and temperature ratings. Please refer to the **Apantec** data sheet describing the SD series detectors for more details.

SD220N Gamma Scintillation Detector

Crystal:	2” x 2” NaI
Dynamic Range:	1E+0 to 1E+7 CPM
Detector Accuracy:	±15% of true field intensity.
Detector Linearity:	±5%.

SDA3E Specifications

Power requirements:	max. 250 mA, +/-15 VDC
Energy Range:	100 keV to 2.55 MeV variable In steps of 10 keV from keypad
Energy Sensitivity:	100 mV to 2.55 V approx. corresponding to energy range.
Mode:	Integral or Differential
Window Width:	+/- 1% to +/- 90% around center Energy.
Output Signal:	Positive pulses, 0.5 usec wide. Capable of driving 500 ft of cable
Energy Nonlinearity:	+/-1% of full scale
Window Width	Accuracy +/-0.5% of energy setting
Temperature:	0 to 50 °C,
Dimensions:	6.25” W x 7.5” H x 5.03” D
Weight:	2 lbs. nominal

LED Test Signal

Equivalent Energy:	3 MeV
Background Rate:	10 to 15 CPM

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RM1W Display and Control Unit

The proposed display and control device is the **RM1W** Digital/Analog local display unit. The **RM1W** is packaged in a NEMA wall mounted configuration suitable for permanent mounting in the vicinity of the monitoring location and is typically provided mounted directly to the LM1 monitoring skid. Each unit includes visual and audible indication of alarm status. Each alarm also has an associated DPDT relay contact rated at 5A @120VAC. The **RM1W** is a single board embedded computer (PC/AT compatible) based instrument with advanced input/output (I/O) capabilities. Remote devices can communicate with the **RM1W** using serial RS485 or Ethernet (10/100 BaseT) protocols. Please refer to the **Apantec** data sheet describing the **RM1W** for detailed information.

RM1W Display and Control Unit Specifications

Processor:	32-Bit High Performance ARM-base Integrated Microcontroller, with three integrated timer/counter channels for data acquisition, four UARTs for serial communications, digital I/O for user interfaces, Real Time Clock, Watchdog Timer, Battery-backed RAM, Program FLASH memory, and real time clock.
Display:	2 x 20 character vacuum fluorescent display Analog/Digital Auto ranging and Auto zeroing
Alarm/Status Indicators:	
	Red indicator: HIGH
	Amber indicator: ALERT
	White indicator: FAIL
	Green indicator: NORMAL
Outputs: Digital	(1) RS232, (3) RS485, or optionally (2) Ethernet Analog (4) 0-10VDC, or (4) 4-20 mADC isolated Six DPDT and one SPDT relays for FAIL, ALERT, HIGH & other alarms contact rating 5A @ 115VAC resistive
Power:	90-260VAC, single phase, 47 to 63 Hz, 15 watts
Temp:	-10^0 to $+50^0$ C
Humidity:	0-95% RH, non-condensing

LS44 Liquid Sampler

The LS44 liquid sampler is provided for offline monitoring of liquid samples. The sampler is shielded with up to four inches of lead arranged in a 4Pi configuration.

A drywell located within the detector shield provides a repeatable geometry for the scintillation detector as well as providing a pressure boundary. The sample chamber is arranged with a self-cleaning action to reduce the build up of crud and contamination. The sample chamber liner is easily decontaminated if needed to allow the monitoring system to maintain the original sensitivity. An external riser pipe and self-venting sample chamber ensure that there are no voids in the sample volume for accurate determination of liquid concentrations. The sampler bowl is constructed of highly polished stainless steel, with wetted surfaces fabricated of corrosion resistant stainless steel. The LS44 sampler will operate in liquid pressures up to 150 PSIG. Standard process connections to the sampler are performed via 150 RF flanges with NPT connections optionally available.

Low Profile System Skid and Liquid Pumping System

The liquid monitoring system is provided on a single open frame skid suitable for mounting to a floor location. Lifting rings and forklift access are provided for movement of the system to the monitoring location. The system also includes a liquid pumping system capable of generating in excess of 20 GPM flow through the system with a head lift of in excess of sixteen feet. The liquid pump is a centrifugal type pump close coupled to a ¾ HP electric motor. A basket strainer upstream of the pump suction removes large entrained materials from the liquid sample to provide protection to the pump. Local ON/OFF pump controls are provided on the system skid. Remote pump operations are optionally available. A flow indicator and flow control valve are included for establishing the desired flow rate through the monitoring system. Fittings and valves for purging the liquid sampler are also available.

LS44 Liquid Sampler Specifications:

Sampler Volume:	5.8 liters
Lead Thickness:	4 inches
Max. Pressure:	150 psig, hydrostatic tested to 225 psig.
Weight:	1450 pounds

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