MSL- Main Steam Line Monitoring System

NOBLE GAS & N16 | BGO DETECTOR

The MSL is a dual purpose gamma radiation monitoring system designed to continuously measure the quantity of radioactive gamma isotopes in the steam line and primary and secondary leak rate in the MSL steam generator.

The system is designed to monitor gamma levels in an adjacent-to-line arrangement and includes a clamp-on style shield. The shield design with four inches of lead shielding in a 3Pi geometry can be mounted on the floor adjacent to the steam line, or mounted with the lead shield clamped to the steam line.

Internal to the shield and accessed via a maintenance port is an Apantec SD220B scintillation detector for sensitivity to gamma emitting isotopes in the steam pipe. The detector is located within a stainless steel drywell to provide a repeatable geometry for measurement. The SD220B uses a
2" x 2" BGO crystal for increased sensitivity to high energy N16 present in the steam line. The detector is designed for high temperature operation to provide reliable operation at the extended temperatures present in an adjacent to steam line environment.

The detector has an associated model SDA3E dual channel Preamp/SCA for operation of the detector, and for pulse analysis. The output of the SDA3E is wired to a locally mounted RM1W Display and Control Unit. The SDA3E provides the ability to establish separate regions of interest to allow simultaneous measurement of both noble gases and N16 in the steam line. The detector is also temperature stabilized for high temperature operation.

System Features:

- **MSL Online Sampler / N16 Steam Generator Leak Rate Monitor**
- **Gamma BGO Scintillation Detector Assembly**
- **Dual Channel SDA3E Preamplifier/SCA/HV Supply**
- **Digital Display and Control Ratemeter**
- **Isotopic Check Source**
- **MDC: MSL, 1E-1 to 1E4 mR/hr**
  N16, 5E-8 uCi/cc (18.5 x 10^3 Bq/cc)
- **Capable of detecting leak as low as 0.1 liter per hour**

The RM1W provides for complete local and remote display and control of the monitoring channel, as well as providing indication of alarm trips and system malfunctions.

The RM1W includes serial & Ethernet communications ports for centralized computer based control and display of the monitoring system. Mounted to the exterior of the sample shield is an optional model CS-9G isotopic check source for routine operability checks.

Apantec offers full qualification to the latest nuclear codes and standards including Class 1E Safety Applications. Qualifications are performed to the guidelines of IEEE-323, IEEE-344 and Regulatory Guide 1.97.

APANTEC, LLC
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System Specifications

Measurement Medium:	Pipe up to 36” Sched 40
Process Temperature:	300^{o} C (575^{o} F)
Detector:	Gamma Scintillation
Codes & Standards:	Reg. Guide 1.2.and 1.97 Safety Grade Class 1E

SD220B Gamma Scintillation Detector Specifications

Sensor:	2” x 2” BGO crystal
Detector Output:	Negative Pulse.
Detector Accuracy:	±15% of true field intensity.
Detector Linearity:	±5%.
Operating Voltage:	500 to 1500 V.
LED Background:	10–15 CPM. Auto stabilized and temp compensated
Operating Humidity:	0–100%
Temperature:	-10^{o}C to 90^{o}C

Housing: Moisture Proof Stainless Steel, NEMA 4.
Weight: 2.7 kg (5 lb).

SDA3E Specifications

Power Requirements
Power requirements: max. 250 mA, +/-15 VDC

SCA parameters

Energy Range:	100 keV to 4.00 MeV variable In steps of 10 keV from keypad
Energy Sensitivity:	100 mV to 4.00 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
Accuracy:	+/-0.5% of energy setting

LED Test Signal

Equivalent Energy:	6 MeV
Background Rate:	10 to 15 CPM

Environmental

Temperature:	0 to 50 °C,
Dimensions:	6.25” W x 7.5” H x 5.03” D
Weight:	2 lbs. nominal

Digital Display & Control Ratemeter Specifications

Processor:
32-BitHighPerformance133Mhz Integrated Real-time PC/AT-compatible for embedded applications
Robust Automotive / Telcom Grade Technology with Watchdog Timer, PC104 platform

I/O Processor: Dedicated / High Performance I/O Co-Processing via FPGA / 100 Mhz

Display: 2 x 20 character vacuum fluorescent
Analog/Digital Auto ranging and Auto zeroing
Alarm/Status Indicators:

Red indicator:	HIGH
Amber indicator:	ALERT
White indicator:	FAIL
Green indicator:	NORMAL

Outputs: Digital (3) RS485 and (1) TCP/IP Ethernet
Analog (4) 0-10VDC, or
(4) 4-20 mADC isolated
Six DPDT relays for FAIL, ALERT, HIGH alarms and controls
Relay contact rating 5A @ 115VAC resistive

Power: 90-260VAC, single phase, 47 to 63 Hz, 15 Watts

Environment: -0^{0} to +40^{0} C,
Up to 95% RH, non-condensing

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