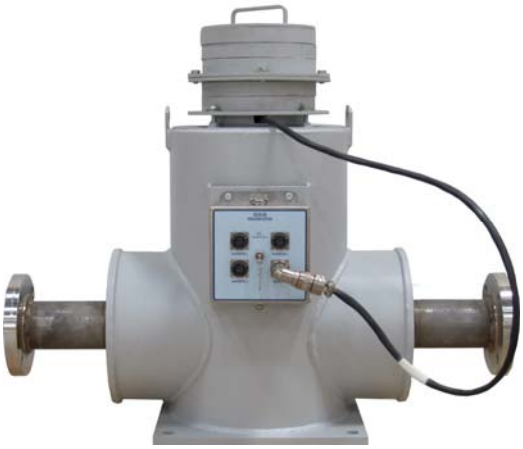
Pipe On-Line Monitor
POM403

INTERNET READY



The POM403 is a process or effluent monitor designed to continuously measure the quantity of radioactive gamma isotopes in the sample stream. The system is designed to monitor gamma levels in an adjacent-to-line arrangement and includes a clamp-on style sampler for process connection The POM-403 monitor uses a split shield design with four inches of lead shielding in a 3Pi geometry. Internal to the sampler and accessed via a maintenance port is an Apantec SD220N scintillation detector for sensitivity to gamma emitting isotopes in the process pipe. The detector is located within a stainless steel drywell to provide a repeatable geometry for measurement. The detector has an associated model SDA3E Preamp/SCA for operation of the detector, and for pulse analysis. The output of the SDA3E is wired to a locally mounted RM1 display and control unit.

The RM1 provides for complete local display and control of the monitoring channel, as well as providing local indication of alarm trips and system malfunctions. The RM1 includes serial communications ports for operation and display of the monitoring system from a remote location. Mounted to the exterior of the sample shield is an optional model CS-9G isotopic check source for routine operability checks. The maintenance cycle for the POM403 Monitor is 24 months. The extended maintenance cycle is achievable because there are no moving parts, uses all low current consuming electronics, and takes advantage of the Apantec exclusive gain stabilization circuit that

GAIN STABILIZATION

automatically compensates gain shifts caused by changes in temperature and aging. 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.

System Features

- **System skid, fully wired, plumbed and assembled**
- **OS4A Sampler**
- **SD220N Gamma NaI Scintillation Detector Assembly**
- **SDA3E Preamplifiers/SCA/HV Supply**
- **RM1 Display and Control Unit**
- **Isotopic Check Source (Optional)**
- **1E+0 to 1E+7 CPM range**

SD220N NaI Scintillation Detector/Preamp

The Apantec SD series detectors are scintillation based radiological detectors primarily used for process and environmental radiation monitoring systems in nuclear power plants. A separate single-channel analyzer (SCA) model SDA3E is used for pulse height analysis and biasing voltages. The detectors include a gain stabilization circuit for drift free operation. The SD series detectors include a scintillator, photomultiplier tube, mu-metal shield, and dynode chain in a cylindrical enclosure. A light emitting diode (LED) is located in the detector enclosure for automatic gain control. A temperature sensor also located within the detector provides a temperature signal for temperature compensation. The scintillation material is selected based on the process conditions and required sensitivity.
The detector will be positioned within the lead shielded sampler for attenuation of gamma background contribution.

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SD220N Specifications

Detector Type: 2" x 2" NaI(TI) crystal
MDC: ^{137}Cs:1.0 E^{-7} uCi/cc (3.7 E^{+3} Bq/m^3)
Range: Normal: 6 decades
Accuracy: ±15% over entire normal range,
Environment: 0° to +122°F (0° to +50°C)
Up to 90% RH Non-condensing
Operating Voltage: provided by SDA3E
Dimensions: 7 in. L x 2.25 in.Dia

SDA3E Preamplifier/analyzer

The SD220N gamma scintillation detector detects the gamma events and provides analyzed nuclear count rate data for each region of interest (ROI) to an external SDA3E analyzer unit. The SDA3E unit integrates the count rate data for each ROI, provides the detector low DC operating voltage, and performs gain stabilization. The preamplifier unit communicates with the skid mounted RM1 display and control unit using Ethernet communications for display of the measured activity and for alarm. The SDA3E is a NEMA-4 enclosed assembly mounted within five feet of the detector. The SDA3E is controlled via the host ratemeter using software controls to adjust the multi channel analyzer (SCA) settings such as regions of interest.
The SDA3E settings are maintained in non-volatile memory to automatically reset the system after power disruptions.

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

OS4A Sampler

The OS4A Online Sampler is an adjacent-to-line shielded unit providing four inches of lead shielding around the pipe to be monitored and the detector. A drywell inside the sampler provides the detector with a repeatable geometry for measurement. The OS4A series sampler is a split shield design that bolts to the exterior of the pipe that is being monitored. The OS4A sampler is designed for pipe sizes from four inches and higher in diameter.

Sampler Specifications

Sampler: 150 lb rated pressure
Shielding: 4" lead in a 3Pi geometry
Flow Rate: Determined by existing flow rate
Sampler Weight: 600 lb nominal
Process Fluid Temperature: 30°F to 130°F (-1.11°C to 54.4°C) high temperature systems available

RM1 Display and Control Unit

RM1 Display and Control Unit

The proposed display and control device is the Apantec model RM1. The unit is packaged in a NEMA wall mounted configuration suitable for permanent mounting on the system skid. The RM1 includes visual and audible indication of alarm status. Each alarm also has an associated DPDT relay contact rated at 2A @120VAC.

The following indications will be provided at the front panel of the unit:

CONDITION	VISUAL	AUDIBLE	RELAY
HIGH	Red	Tone	DPDT
ALERT	Amber	Tone	DPDT
FAIL	White	Tone	DPDT
NORMAL	Green	None	None
CHK SOURCE	Digital	None	DPDT
LOW FLOW	Digital	Tone	DPDT
AUX	None	None	DPDT

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Each unit includes a bit mapped digital/analog display, which is used to indicate both the radiation activity and operator messages. Radiation activity is displayed digitally in scientific notation and as an analog bargraph for trending. The display is autoranging and can be configured via operator input to display process information as either Counts Per Minute (CPM) or engineering units (uCi/cc, Bq/m3). Operator messages are presented in the digital display to provide information such as alarm setpoints, error messages, alarm conditions and instrument status. Operators interface with the unit via a security keyed membrane switch.

By using the MODE, SET and INCREMENT keys, the HIGH and ALERT alarm setpoints can be established at any point in the instrument range.

The security keylock switch prevents unauthorized access to the keypad switch and alarm setpoints. Check source activation, lamp test and other diagnostic functions can be performed without the security keylock.

In addition to the visual, audible and relay transition outputs previously described, each unit also includes analog and digital input/output signals. Analog 4-20mADC and 0-10VDC inputs/outputs are provided for interfacing with analog devices such as recorders.

Redundant RS485 serial communications ports are provided for networking the local units with remote display and control units. Ethernet communications ports are also provided for interconnecting the various radiological sensors to the display unit and for networking channels for remote display and control.

The power supply is filtered and conditioned for input line noise rejection and protection from transients and voltage drop out. A lithium battery backup is maintained for retention of historical information for a period of up to 200 hours after loss of primary battery power. Critical system operating parameters are stored in non-volatile memory for unattended start-up of the system after power outages.

The PIM403 system can be operated using the DORIS software instead of the RM1 series display and control units if desired.

Display and Control Unit Specifications

Processor: 32-Bit High Performance 133Mhz Integrated Microcontroller. Designed for Real-time and PC/AT-compatible embedded applications
Robust Automotive / Telcom Grade Technology with Watchdog Timer

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

Display: *240 x 128 pixel bit mapped LCD with backlight*
Simulates 2 x 20 character display used on ADM series units
Analog/Digital Autoranging and Autozeroing
Alarm/Status Indicators:
Red indicator: HIGH
Amber indicator: ALERT
White indicator: FAIL
Green indicator: NORMAL

Outputs: *Digital (3) RS485 and (1) TCP/IP Ethernet and (1) USB*
Analog (4) 0-10VDC, or (4) 4-20 mADC isolated
DPDT relay contact for FAIL, ALERT and HIGH alarms
Relay contact rating 2A @ 115VAC

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

Temp: *10^0 to $+50^0$ C*

Humidity: *up to 95% RH, non-condensing*

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