

AM1F Continuous Air Monitor Fixed Filter

INTERNET READY

GAIN STABILIZED



The **AM1F** is a low profile fixed filter monitor designed to continuously collect and measure the quantity of radioactive beta particulates or gamma iodines in the sample stream. The system will monitor radioactive airborne levels in either working spaces, or via a process tubing connection to a remote stack, duct or other air space. The **AM1F** can be set for representative sampling if desired.

System Features

- System Skid Assembly, fully wired & plumbed
- AS43F Lead Shielded Sampler
- SD201P Beta Scintillation Detector or SD220N Gamma Scintillation Detector
- Isotopic Check Source (optional)
- Fixed Filter Holder
- Preamplifiers/SCA/HV Supply
- RM1W Display and Control Units
- Pump and Sample Control (purge) Modules
- Power Distribution Box

System Design Information

The sampler uses a fixed filter geometry with three inches of lead shielding. Internal to the sampler is an Apantec SD201P beta scintillation detector for sensitivity to beta particles or SD220N gamma scintillation detector for measurement of iodines. The sampler accepts both a particulate filter paper and an optional activated charcoal cartridge using a common filter holder mechanism. The detector is positioned in a lead shield, Model AS43F in close proximity to the sample deposition point.

The detector has an associated Preamp/SCA model SDA3E 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 Preamplifier includes three separate single channel analyzer circuits which are set to window the beta, activities. A vacuum pumping system capable of 1 SCFM (30 LPM) is included on the **AM1F** monitoring skid. The pumping system will include local mass flow control of the process fluid to maintain sampling rates during filter loading. Pump controls will be provided on the local skid. The local RM1W units interface with an optional remote RM1R unit or DORIS software via serial communications for full remote control of each channel. When used for isokinetic sampling, the flow rate on the sample skid is controlled using a velocity signal from the sample point to minimize sample loss during transmission of the sample to the filter deposition point.



SD201P/SDA3E Scintillation Detector/Preamp

Apantec has developed the SD Series of detectors for use in process monitoring systems. For the AM1FP channel, Apantec has selected the **SD201P** plastic scintillation detector for continuous measurement of the beta activity accumulated on the fixed filter media. The **SD201P** consists of a NE102 plastic scintillation, photomultiplier tube, mu-metal shield, dynode chain, Lucite light pipe, cylindrical enclosure and four foot long integral cable pigtail. A light emitting diode (LED) is located in the Lucite light pipe for automatic gain control. A thermistor located within the Lucite light pipe provides a temperature signal for temperature compensation. 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.

SD Series Detector Specifications:

Detector: SD201PB NE102 beta plastic
SD220N 2" x 2" NaI crystal
Dynamic Range: 1E+0 to 1E+7 CPM
Detector Output: Negative Pulse.
Accuracy: ±15% of true field intensity.
Linearity: ±5%.
Operating Voltage: 500 to 1500 V.
Nominal LED Bgrnd: 10–15 CPM.
Humidity: up to 95% non-condensing.
Housing: Moisture Proof Stainless Steel.
Weight: 2.7 kg (5 lb).

SDA3E Preamplifier/analyzer

The scintillation detector detects the accumulated activity and provides the nuclear pulses to an external SDA3E preamplifier/analyzer unit for pulse analysis. The preamplifier/analyzer unit analyzes the nuclear pulses, provides the detector biasing voltage, and performs gain stabilization. The preamplifier unit communicates with the skid mounted RM1W 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 analyzer is controlled via the host ratemeter using software controls to adjust the single channel analyzer (SCA) window settings such as window width, and energy threshold. 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 2.55 MeV variable
In steps of 10 keV

Energy Sensitivity: 100 mV to 2.55 V approx.
corresponding to energy

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
+/-1% of full scale

Energy Nonlinearity:

Window Width

Accuracy: +/-0.5% of energy setting

LED Test Signal

Equivalent Energy: 3 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

RM1W Display and Control Unit

The display and control device is the Apantec model RM1W. The unit is packaged in a NEMA wall mounted configuration suitable for permanent mounting on the system skid. The RM1W 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:

<u>CONDITION</u>	<u>VISUAL</u>	<u>AUDIBLE</u>	<u>RELAY</u>
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

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. 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 interconnect 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.

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 RAM 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 res

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

Temp: 10⁰ to +50⁰ C

Humidity: up to 95% RH, non-condensing

AS43F Sampler

The AS43F sampler is provided for monitoring of particulate and/or iodine activity. The sampler is shielded with up to three inches of lead arranged in a 4Pi configuration. A detector mount located within the shield provides a repeatable geometry for the scintillation detector as well as providing a pressure boundary. The AS43F sampler is an easy to use design that uses a fixed filter holder for collection of airborne radioactive particles and/or iodines.

The filter holder accepts industry standard 47 mm diameter filter paper as well as provisions for use of a TEDA or silver zeolite cartridge for capture of iodines. When used for particulate monitoring only, the cartridge is replaced by a backing screen to provide support for the filter paper. The scintillation detector, when installed within the sampler, is in close proximity to the deposited material for maximum sensitivity. The sampler is constructed of painted cold rolled steel with corrosion resistant stainless steel used on wetted surfaces.

Low Profile/Vacuum Pumping System

The 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 includes a vacuum pumping system capable of generating in excess of 1 SCFM flow. The pump is a carbon vane progressive cavity or metal bellows pump with integral fractional horsepower motor. Local ON/OFF pump controls are provided on the system skid. Remote pump operations are optionally available. A flow indicator and flow control valve provide desired flow rate through the monitoring system.

Vacuum/Sampling Specifications:

Filter Paper: Particulate: 47mm to 57mm Iodine: TEDA impregnated Type 72 2.25 in. dia (57.1 mm dia) 99% retention of 0.3 micron or larger particles and iodine at 1 SCFM (30 LPM)

Vacuum Pump: Progressive cavity carbon vane, diaphragm, or Metal Bellows 5 in/hg at 1 SCFM flow

Flow Rate: 0-1 SCFM (0-30 LPM) rotameter standard, optional thermal mass flow measurement Accuracy $\pm 15\%$

Flow Totalizer: Continuous totalization until reset

Power: 220 VAC, 50/60 Hz, single phase, or 120 VAC, 50/60 Hz, single phase

Outputs: LOW FLOW Alarms, DPDT Relay, 5A, 120 VAC rated Visual Display on RM1W digital display

Automatic Gain Stabilization

Apantec scintillation detectors operate with a unique gain stabilization circuitry for accurate and automatically compensated detection of activity. Imbedded within the detector enclosure, and optically coupled to the light pipe assembly, is an LED and thermistor for gain compensation. The LED is pulsed at a known low pulse repetition rate with a known pulse width and amplitude to provide a reference signal to the SDA3E preamplifier/SCA. The SDA3E contains circuitry that compares the LED pulses with a reference reading to provide a feedback for automatic gain compensations due to drift and aging. The thermistor within the detector automatically corrects the detector output for variations in gain due to temperature shifts. This unique feature extends the calibration cycle of the radiation monitoring channel and improves system accuracy.