

**224GB/DU ION CHAMBER**  
**SPECIFICATIONS**

Power	100 to 125 VAC, 50 to 60 Hz (built-in filter)
Fusing	2 Amp line fuse in power entry module of control unit
Range (Auto ranging)	Range 1: 0 to 20 mCi/m <sup>3</sup> (0 to 740,000 Bq/l) Range 2: 0 to 20 Ci/m <sup>3</sup> (0 to 740,000,000 Bq/l)
Resolution	Range 1: 1 μCi/m <sup>3</sup> (37 Bq/l) Range 2: 1 mCi/m <sup>3</sup> (37,000 Bq/l)
Accuracy	Within ±10% of reading (calibrated for tritium in nitrogen at 760 torr at 20°C)
Zero Drift	Range 1: Less than ±1 μCi/m <sup>3</sup> per week Range 2: Less than ±1 mCi/m <sup>3</sup> per week
Temperature (relative to electronics)	Electronics stable to ±1 LSD over range of 0°C to 50°C Note: Concentration measurement is a function of temperature through the PVT gas law
Noise	Less than ±1 μCi/m <sup>3</sup> (long term)
Display	Custom 12-character red LED matrix display readable at 50 ft. (15.4 m)
Zero Check	Electronic zero test - push button with display on front
Zero Adjust	Digital zero adjust - push button switch plus zero adjust and digital panel meter display. To be performed with Zero Check.
Instrument Test	Functional check of entire electrometer, signal conditioning and readout electronics. Push button switch activated and display of 13000 ±390.
Alarms	Two audio/visual alarms with acknowledge and automatic reset. Set points are independent and adjustable throughout both ranges.
Alarm Lockout	Automatic 90 second alarm lockout on power up and zero.
Analog Outputs	Linear output proportional to tritium concentration, range indicator, high and low alarm indicators, and fault indicator, optional logarithmic output
Data Storage	All instrument settings (alarm settings, offset, etc.) retained in EEPROM.

**OPERATING PARAMETERS**

Temperature Range	Electronics: 0°C to 50°C Note: Concentration measurement is a function of temperature through "PVT" gas law
Humidity	0% to 95% R.H.
Flow Rate of Sample Gas	The system contains no pump. Flow rate is determined by characteristics of user supplied pump. Response time is proportional to flow rate. 224DU - No pump due to perforated chamber/passive sampling.
Pressure	700 to 800 torr to maintain rated accuracy. Although the measurement is affected, the ion chamber can operate between vacuum and 30 psia without damage to chamber or electrometer. 224DU – Perforated chamber/passive sampling.
Sample Gas Composition	The system is calibrated to measure tritium in nitrogen at 760 torr at 20°C.
Installation	The ion chamber and control unit can be located up to 1000 feet (307 m) apart without degradation of signal.

**PHYSICAL DESCRIPTION**

Volume	Total (VCR inlet to VCR outlet): 2406 cc (±1%) Active (volume used for measurement): 1800 cc (±2%)
Fittings (Inlet/Outlet)	Two 1/4" VCR (Swagelok) female fittings for gas sample inlet and outlet.
Materials	All components fabricated from stainless steel with a #8 polish except for O-ring seals (Viton), electrode feed-through (Torlon), and ion chamber insulator (Torlon or Ultem 1000). The electrometer is housed in a circular aluminum housing which is O-ring sealed to the stainless-steel base plate of the ion chamber. An aluminum cover is O-ring sealed to the electrometer housing. All aluminum components are anodized.
Mounting	Ion chamber base plate contains three 1/4-20 tapped holes in a semicircle configuration for mounting to optional chamber mounting bracket.
Dimensions	9.25" (23.5cm) high 7.5" (19.05cm) flange diameter
Weight	13.5 lbs. (6.2 kg) Shipping: 20 lbs. (9.1 kg)



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**224RM ION CHAMBER**  
**SPECIFICATIONS**

Power	100 to 125 VAC, 50 to 60 Hz (built-in filter)
Fusing	2 Amp line fuse in power entry module of control unit
Range (Auto ranging)	Range 1: 0 to 2 mCi/m <sup>3</sup> (0 to 74,000 Bq/l) Range 2: 0 to 2 Ci/m <sup>3</sup> (0 to 74,000,000 Bq/l)
Resolution	Range 1: 0.1 μCi/m <sup>3</sup> (3.7 Bq/l) Range 2: 0.1 mCi/m <sup>3</sup> (3,700 Bq/l)
Accuracy	Within ±10% of reading (calibrated for tritium in nitrogen at 760 torr at 20°C)
Zero Drift	Range 1: Less than ±0.1 μCi/m <sup>3</sup> per week Range 2: Less than ±0.1 mCi/m <sup>3</sup> per week
Temperature (relative to electronics)	Electronics stable to ±1 LSD over range of 0°C to 50°C Note: Concentration measurement is a function of temperature through the PVT gas law
Noise	Less than ±0.1 μCi/m <sup>3</sup> (long term)
Display	Custom 12-character red LED matrix display readable at 50 ft. (15.4 m)
Zero Check	Electronic zero test - push button with display on front
Zero Adjust	Digital zero adjust - push button switch plus zero adjust and digital panel meter display. To be performed with Zero Check.
Instrument Test	Functional check of entire electrometer, signal conditioning and readout electronics. Push button switch activated and display of 1300.0 ±39.0
Alarms	Two audio/visual alarms with acknowledge and automatic reset. Set points are independent and adjustable throughout both ranges.
Alarm Lockout	Automatic 90 second alarm lockout on power up and zero.
Analog Outputs	Linear output proportional to tritium concentration, range indicator, high and low alarm indicators, and fault indicator, optional logarithmic output
Data Storage	All instrument settings (alarm settings, offset, etc.) retained in EEPROM.

**OPERATING PARAMETERS**

Temperature Range	Electronics: 0°C to 50°C Note: Concentration measurement is a function of temperature through "PVT" gas law
Humidity	0% to 95% R.H.
Flow Rate of Sample Gas	The system contains no pump. Flow rate is determined by characteristics of user supplied pump. Response time is proportional to flow rate.
Pressure	700 to 800 torr to maintain rated accuracy. Although the measurement is affected, the ion chamber can operate between vacuum and 30 psia without damage to chamber or electrometer.
Sample Gas Composition	The system is calibrated to measure tritium in nitrogen at 760 torr at 20°C.
Installation	The ion chamber and control unit can be located up to 1000 feet (307 m) apart without degradation of signal.

**PHYSICAL DESCRIPTION**

Volume	Total (VCR inlet to VCR outlet): 2406 cc (±1%) Active (volume used for measurement): 1800 cc (±2%)
Fittings (Inlet/Outlet)	Two 1/4" VCR (Swagelok) female fittings for gas sample inlet and outlet.
Materials	All components fabricated from stainless steel with a #8 polish except for O-ring seals (Viton), electrode feed-through (Torlon), and ion chamber insulator (Torlon or Teflon). The electrometer is housed in a circular aluminum housing which is O-ring sealed to the stainless-steel base plate of the ion chamber. An aluminum cover is O-ring sealed to the electrometer housing. All aluminum components are anodized.
Mounting	Ion chamber base plate contains three 1/4-20 tapped holes in a semicircle configuration for mounting to optional chamber mounting bracket.
Dimensions	9.25" (23.5cm) high 7.5" (19.05cm) flange diameter
Weight	13.5 lbs. (6.2 kg) Shipping: 20 lbs. (9.1 kg)



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**224PP ION CHAMBER**  
**SPECIFICATIONS**

Power	100 to 125 VAC, 50 to 60 Hz (built-in filter)
Fusing	2 Amp line fuse in power entry module of control unit
Range (Auto ranging)	Range 1: 0 to 20 Ci/ m <sup>3</sup> (0 to 740,000 Bq/ m <sup>3</sup> ) Range 2: 0 to 20,000 Ci/ m <sup>3</sup> (0 to 740,000,000 Bq/ m <sup>3</sup> )
Resolution	Range 1: 0.1 $\mu$ Ci/m <sup>3</sup> (3.7 Bq/l) Range 2: 0.1 mCi/m <sup>3</sup> (3,700 Bq/l)
Accuracy	Range 1: within $\pm$ 10% of reading Range 2: within $\pm$ 10% of reading
Zero Drift	Range 1: Less than $\pm$ 1 mCi/m <sup>3</sup> per week Range 2: Less than $\pm$ 1 Ci/m <sup>3</sup> per week
Temperature	Range 1: Stable to $\pm$ 1 mCi/m <sup>3</sup> over range of 0°C to 50°C Range 2: Stable to $\pm$ 1 Ci/m <sup>3</sup> over range of 0°C to 50°C
Noise	Less than $\pm$ 1 mCi/m <sup>3</sup> (long term)
Display	Custom 12-character red LED matrix display readable at 50 ft. (15.4 m)
Zero Check	Electronic zero test - push button with display on front
Zero Adjust	Digital zero adjust - push button switch plus zero adjust and digital panel meter display. To be performed with Zero Check.
Instrument Test	Functional check of entire electrometer, signal conditioning and readout electronics. Push button switch activated and display of 1300.0 $\pm$ 39.0
Alarms	Two audio/visual alarms with acknowledge and automatic reset. Set points are independent and adjustable throughout both ranges.
Alarm Lockout	Automatic 90 second alarm lockout on power up and zero.
Analog Outputs	Linear output proportional to tritium concentration, range indicator, high and low alarm indicators, and fault indicator, optional logarithmic output
Data Storage	All instrument settings (alarm settings, offset, etc.) retained in EEPROM.

**OPERATING PARAMETERS**

Temperature Range	Electronics: 0°C to 50°C Note: Concentration measurement is a function of temperature through "PVT" gas law
Humidity	0% to 95% R.H.
Flow Rate of Sample Gas	The system contains no pump. Flow rate is determined by characteristics of user supplied pump. Response time is proportional to flow rate.
Pressure	700 to 800 torr to maintain rated accuracy. Although the measurement is affected, the ion chamber can operate between vacuum and 200 psia without damage to chamber or electrometer.
Sample Gas Composition	The system is calibrated to measure tritium in hydrogen.
Installation	The ion chamber and control unit can be located up to 1000 feet (307 m) apart without degradation of signal.

**PHYSICAL DESCRIPTION**

Volume	178 cc ± 2 cc total volume 25 cc nominal counting volume
Fittings (Inlet/Outlet)	Two 1/4" VCR (Swagelok) female fittings for gas sample inlet and outlet.
Materials	All components fabricated from stainless steel with a #8 polish except for O-ring seals (Viton), electrode feed-through (Torlon), and ion chamber insulator (Torlon or Ultem1000). The electrometer is housed in a circular aluminum housing which is O-ring sealed to the stainless-steel base plate of the ion chamber. An aluminum cover is O-ring sealed to the electrometer housing. All aluminum components are anodized.
Mounting	Ion chamber base plate contains three 1/4-20 tapped holes in a semicircle configuration for mounting to optional chamber mounting bracket.
Dimensions	3.625" (9.21cm) high 7.5" (19.05cm) flange diameter
Weight	16 lbs. (7.3 kg) Shipping: 23 lbs. (10.5 kg)