

300/400 SERIES - FIXED CONFIGURATION

FAMILY TREE

The 300 and 400 series instruments can be supplied with special ionization chambers so that measurements as low as 10^{-7} Ci/m³, or as high as pure tritium can be reached.

This section covers specific models with a fixed configuration. These models have established designs made for specific applications. Options are available to suit different requirements for range of measurement, alarms and outputs.

See Section 3 for 300 and 400 series modular construction instruments. These monitors have more choices for options, such as ionization chambers, displays, alarms and outputs.

The 300 and 400 series monitors are classified into four basic groups:

311 series - single range ionization chamber, with single chamber

321 series - single range ionization chamber, with dual chambers

411 series - multirange ionization chamber, with single chamber

421 series - multirange ionization chamber, with dual chambers

300 SERIES MONITORS

(Single range ionization chambers)

The 300 series monitors use "single" range ionization chambers.

The standard versions use a 4/4 digit panel meter, the tritium monitor can measure over a 4 plus decade range of measurement 1 - 19,999.

Special versions use higher digit count displays, and the tritium monitor can measure as high as 5 decades of measurement 1 - 99,999.

400 SERIES MONITORS

(Automatically switched, multi-ranging ionization chambers)

The 400 series monitors use multiranging ionization chambers for a wider range of measurement. Seven decades of measurement are feasible for some ionization chamber configurations.



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SPECIFIC MODELS

Each of the following models can include a variety of individual features and options described in the following pages.

SINGLE IONIZATION CHAMBER DESIGNS

MODEL 311

All Model 311 instruments use single ionization chambers and single "range" electrometers.

MODEL 411

Similar to the 311 series, the 411 instruments have a single ionization chamber. However, a wider range of measurement is afforded through the use of automatic, range-switching electrometer amplifiers (i.e. multirange ionization chambers).

DUAL IONIZATION CHAMBER DESIGNS

MODELS 321/421 (STANDARD)

These models feature dual ionization chambers for tritium specific or oxide of tritium specific measurements, and simultaneously, for the suppression of response to environmental gamma fields.

MODELS 321/421 NPPM (NUCLEAR POWER PLANT MONITOR)

An industrial version of the standard 321/421 tritium monitor configured for the special environmental conditions in heavy water CANDU nuclear power plants. Designed to measure HTO (or total T) in the presence of other radioactive gases. Available with contamination (plate-out) proof ionization chambers.

MODEL 357RM GENERAL PURPOSE ROOM AIR MONITOR

A low cost, table top monitor with single range ionization chambers, alpha (radon) pulse rejection, analog panel meter and dual 2L chambers with resolution to 1 $\mu\text{Ci}/\text{m}^3$.

MODEL 347 ROOM AIR MONITOR WITH BETTER SENSITIVITY

Using quadruple ionization chambers for optimum gamma compensation. Model 347 features highest sensitivity to tritium. Noise level and stability are $\pm 0.5 \mu\text{Ci}/\text{m}^3$.



COMMON FEATURES

The ionization chambers are normally furnished as separately or remote mounted, CODE ICR. Upon special request, chambers can be mounted inside the main electronics cabinet, use CODE ICR.

MEASUREMENT, RANGES AND SENSITIVITY

Using linear ionization chambers, OTC tritium monitors have been designed and built for measurement sensitivities from 0.1 $\mu\text{Ci}/\text{m}^3$ (1 s.d.) to pure tritium. As can be expected, chamber size and configuration is related to sensitivity.



FEATURES

ALARMS, MEASUREMENT

Single or two independent alarms with visual and acoustic signals. Front panel mounted potentiometers or thumb switches are used to adjust the level set point. 400 series multiranging instruments are further equipped with range selector switches so that alarm setting can be made over the entire range of measurement.

DISPLAYS

A variety of digital displays are available. Use CODE DDxx depending on the number of digits required.

300 series single range instruments are often equipped with 4 1/2 digit (0-19,999) digital panel meters, or with a 5 decade analog logarithmic output signals.

The 400 series employ moving decimal points on the panel meter and may include additional range indicating lights to identify the measurement decade in operation. Logarithmic analog outputs for 400 series instruments have scales of up to seven decades. Range switching is automatic and is not visible to the instrument operator.



OPTIONS

All electronic, pneumatic or mechanical options and features, as listed are available as far as applicable, for all 300 and 400 series. However, the 357 and 347 models are only available with a reduced set of special options.



All 300 and 400 series instruments are equipped with a number of basic common features.

REAR PANEL INTERFACE

All 300 and 400 series instruments have rear panel connections suitable for remote display, control or computer interface.

These include, as a minimum,

- Analog signal (0 - 10 V)
- Alarm functions, including remote acknowledge
- Supply voltages
- Range information (400 series)

Additional rear panel signals which are associated with special features.



MODEL 347**LOW COST MONITOR FOR ULTRA SENSITIVE
DETECTION OF AIRBORNE RADIOACTIVE GASES
QUADRUPLE IONIZATION CHAMBERS FOR BEST
GAMMA COMPENSATION**

A low cost very high sensitivity general purpose monitor for reliable measurements to as low as 0.5 $\mu\text{Ci}/\text{m}^3$ in the presence of significant external gamma fields.

OTC Model 347 tritium monitor will not respond to ambient radon, this instrument is fast, accurate and has long term zero stability.

This monitor is a simplified, lower cost, version of the 300 series instruments, but with a restricted number of available optional features.

The quadruple chambers are Kanne type arranged in a cruciform pattern.

A separately mounted pump system with HEPA and ULPA filters assures a sample free of particulates.

OPTIONAL EQUIPMENT AVAILABLE

Remote Alarm Units
Remote Meter Displays
Tritium Gas Calibrator
Calibration Resistor 4-
20 mA Output
Logarithmic Output
RS232 Output



TECHNICAL SPECIFICATIONS

MEASUREMENT RANGES DISPLAY ACCURACY

STABILITY AND DRIFT LONG TERM

NOISE

GAMMA COMPENSATION

RESPONSE RATE ELECTRONIC

WARM-UP TIME

ALARM	SYSTEM Tritium in Air Concentration single, 0.1 to 1999.9 $\mu\text{Ci}/\text{m}^3$ Digital Meter, 4 ¹ // digit LED $\pm 10\%$ of reading, $\pm 1 \text{ uCi}/\text{m}^3$, whichever is greater $\pm 1 \text{ uCi}/\text{m}^3$, ambient temperature <1 uCi/m^3 , 2 sigma, with 30 second time constant second ionization chamber pair of equal volumes, mounted in cruciform pattern, serves to cancel effects of external gamma fields two linear time constants, 30 seconds for <80 $\mu\text{Ci}/\text{m}^3$ 3 seconds for >80 $\mu\text{Ci}/\text{m}^3$ less than 5 minutes required for high voltage power supplies to stabilize single alarm, with set point adjustable from 1 to 1000 $\mu\text{Ci}/\text{m}^3$
IONIZATION CHAMBER	measuring: 2900 cm^3
VOLUME	total wetted: 4000 cm
ENVIRONMENTAL	Storage Temperature: -40°C to +60°C Operating Temperature: 0°C to +50°C Humidity: 0 to 95 % RH non-condensing
PHYSICAL CABINET	Bench top, frame constructed of aluminum extrusions, front and rear panel
POWER	115 VAC or 240 VAC 50/60 Hz
DIMENSIONS	8.8" [223mm] H x 19.0" [483mm] W x 16.0" [406mm] D
WEIGHT	45 lbs [20.4 kg]
FLOWMETER	0 -10 LPM adjustable rotameter

DUST FILTER and PUMP separately mounted

POWER 115 VAC or 240 VAC 50/60 Hz

DIMENSIONS 7.0" [178mm] H x 17.0" [432mm] W x 16.0" [406mm] D

WEIGHT 20 lbs [9.1 kg]

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PARTS LIST FOR MODEL 347 TRITIUM MONITOR

<u>Qty Req'd</u>	<u>Part No.</u>	<u>Description</u>
1	VCO-201-E1 or VCO301- P2	120VAC Pump or 240VAC Pump
1	803562	HEPA Filter Cartridge (pack of three)
1	CWFG01PLV	Ultra Pure Filter Element
1	2-231-S604-70	O-Ring for Filter Cover (pack of ten)
1	2-036-S613-60	O-Ring for Filter Housing (pack of ten)
1	RMA-21-SSV	Flow Meter
1	AP-141-12-1 or AP-141-12- 2	Digital Panel Meter, 120VAC or Digital Panel Meter, 240VAC
1	A41-43-36	Mains Transformer
1	100251-ASSY	Main PCB Assembly for Model 347
1	100511-347	4-20mA Output & Logarithmic Converter Board
1	100512-347	RS232 Output Board
1	KL-701	Knob Lock for Compensation Control
1	MS91528-1N2B	Knob for Compensation Control
1	MDL-1/4	Fuse, 1/4 Amp (pack of 5) AC
1	17501	Power Cord (USA and Canada)



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OPTIONAL EQUIPMENT AVAILABLE

- Remote Alarm Units
- Remote Meter Displays
- Tritium Gas Calibrator
- Calibration Resistor
- RS232 Output
- Logarithmic Output
- 4-20mA Output
- Plate-Out proof wire grid chamber

MODEL 357RM

LOW COST MONITOR FOR DETECTION AND MEASUREMENT OF AIR BORNE TRITIUM

The model 357 tritium monitor is stable to 1 $\mu\text{Ci}/\text{m}^3$. (1 S.D.)

Only OTC tritium monitors are designed and built to distinguish tritium against natural radon background. Instruments that do not have this feature will exhibit a noisy zero response even if the electronics is claimed to be stable.

With radon rejection, the Model 357 ignores radon and is, therefore, fast, sensitive and accurate. Once adjusted, it is long-term zero stable and, due to special electrometer design, its span calibration is permanently stable.

These monitors are simplified versions of OTC 300 series monitors which have been in continuous service for twenty years. They come in rack mount configuration and are also suited for table top use.

The only maintenance required for Model 357 is periodic service of the pump and replacement of the dust filter.

The sensitivity and noise level of Model 357 is superior to current competitive instrumentation by an order of magnitude.



TECHNICAL SPECIFICATIONS

MEASUREMENT	Tritium in Air Concentration 1 - 19,999 uCi/m ³ Digital
RANGE DISPLAY	Meter, 4 ¹ / ₄ " digit LED ±10 % of reading, ±1 uCi/m ³ ,
ACCURACY	whichever is greater ±1 uCi/m ³ , ambient temperature
STABILITY AND DRIFT LONG TERM	±1 uCi/m ³ , 2 sigma, with 20 second time constant
NOISE	second ionization chamber of equal volume, coaxially mounted, serves to cancel effects of external gamma fields
GAMMA COMPENSATION	two linear time constants 20 seconds for measurements below approximately 80 uCi/m ³
RESPONSE RATE ELECTRONICS	3 seconds for measurements above 80 uCi/m ³
ALARM SYSTEM	single alarm, with set point adjustable from 1 to 1,000 uCi/m ³
INDICATORS	acoustic signaler, red LED
IONIZATION CHAMBER VOLUME	measuring: 1,600 cm ³ total wetted: 2,000 cm ³
ION TRAP	Kanne Type, coaxial integral hose barb
PORTS	fittings for 3/16" I.D. vinyl tubing
FLOWMETER	0-10 LPM adjustable rotameter
DUST FILTER AND PUMP	High efficiency respirator type cartridge. Long life continuous duty oscillating piston positive displacement pump
ENVIRONMENTAL	Storage Temperature: -40° C to +60° C Operating Temperature: 0° C to +50° C Humidity: 0 to 95 % RH non-condensing
POWER	115 VAC or 240VAC, 50/60 Hz
PHYSICAL CABINET	19" rack mount, frame constructed of aluminum extrusions, front and rear panel are 1/8" thick aluminum. Covers are aluminum sheet.
DIMENSIONS	8.8" [223mm] H x 19.0" [483mm] W x 16.0" [406mm] D 40
WEIGHT	lbs. [18.2Kg]
OPTIONS	Plate-out proof chamber design Choice of one additional output; RS232 Serial Data, 4-20mA or logarithmic Output



PARTS LIST FOR MODEL 357 TRITIUM MONITOR

<u>Qty Req'd</u>	<u>Part No.</u>	<u>Description</u>
1	VCO-201-E1 or VCO301- P2	120VAC Pump or 240VAC Pump
1	803562	HEPA Filter Cartridge (pack of three)
1	2-231-S604-70	O-Ring for Filter Cover (pack of ten)
1	2-036-S613-60	O-Ring for Filter Housing (pack of ten)
1	VFA-24-SSV	Flow Meter
1	AP-141-12-1 or AP-141-12- 2	Digital Panel Meter, 120VAC or Digital Panel Meter, 240VAC
1	A41-43-36	Mains Transformer Transformer
1	A14-2.5-36	for High Voltage Power Supply
1	100251-ASSY	Main PCB Assembly for Model 357 4-
1	100511-Model 357	20mA Output & Logarithmic Converter Board
1	100512-357	RS-232 Output Board
1	KL-701	Knob Lock for Compensation Control
1	MS91528-1N2B	Knob for Compensation Control
1	MDL-1	Fuse, 1 Amp (pack of 5)
1	17501	AC Power Cord
1	1020934 or	Ionization Chamber Assembly for Model 357 Dual Solid Wall Electrodes or
1	1020974 or	Ionization Chamber Assembly for Model 357 Wire Grid Measure Side and Solid Wall Compensation Side or
1	1021101	Ionization Chamber Assembly for Model 357 Dual Wire Grid Electrodes



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**MODEL 357BW
TRITIUM MONITOR**

The model 357BW is a single range, ionization chamber monitor for the measurement of tritium. It is contained in a NEMA 12 enclosure and is suitable for permanent installation and for continuous duty.

It is suited for the monitoring of rooms, glove boxes, fume hoods, exhaust stacks and systems, as well as process piping when supplied with external dedicated ionization chambers.

The enclosure has a hinged door with a tempered glass window. The enclosure is double-hinged so that it can be opened for servicing the various components inside. The audible alarm and a pushbutton for muting the audible alarm are located on the top of the enclosure. The sample inlet and exhaust fittings are located on top of the enclosure. Connector receptacles are mounted on the top of the enclosure for AC power entry and remote output.



Major distinguishing features include the following:

Display/Control Unit installed in a Wall Mount
NEMA 12 enclosure.

Available with Dual or Quadruple ionization chambers

Single measurement range over four plus decades.

Plate out proof ionization chambers eliminate "background" zero drift

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PERFORMANCE SPECIFICATIONS

MEASUREMENT

Range Display Accuracy	single, 1 - 10,000 $\mu\text{Ci}/\text{m}^3$
Reproducibility	4 digit panel meter, LED
	$\pm 5\%$ of reading, $\pm 1 \mu\text{Ci}/\text{m}^3$ whichever is greater
	$\pm 5\%$ over the entire measurement range
Zero Drift	1 $\mu\text{Ci}/\text{m}^3$ long term, over the entire temperature range
Temperature Coefficient	Less than $\pm 0.3\%/^{\circ}\text{C}$, total accumulated error $< \pm 10\%$ relative to 20°C reading
Response Time	two linear electronic time constants, 20 seconds for measurements below approximately $80 \mu\text{Ci}/\text{m}^3$, 3 seconds for measurements above $80 \mu\text{Ci}/\text{m}^3$
Background Subtraction	second pair of ionization chambers of equal volume, mounted in a cruciform arrangement, serves to cancel effects of external gamma fields
	less than five minutes
Warm Up Time Over	All segments on digital panel meter display will flash when the measurement has exceeded $10,000 \mu\text{Ci}/\text{m}^3$
Range Indication	

ALARM SYSTEMS

High Level Alarm	a single set point alarm system is adjustable with digital thumb switches over the entire measurement range
	Audible and Visual flashing red LED.
Indicator Mode	A toggle switch is used to select the operating mode, Latching or Non Latching with a momentary Reset position
Switch	Audible and Visual steady amber LED indicates when either one of two conditions occur, A failure of any one of the internal D.C. power supplies or malfunction of the electrometer
Malfunction Alarm	Audible and Visual steady amber LED indicates when the sample flow rate has dropped to below 2 LPM
Low Flow Alarm	silences the audible indicator for all of the above alarms
Acknowledge push button	measuring 1800 cm^3
	total wetted 4000 cm^3

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MODEL 357BW :
TRITIUM MONITOR, continued :

IONIZATION CHAMBER
INTERNALLY MOUNTED

	Wire grid, contamination resistant
Ionization Chamber	Silicone rubber
	0.1 to 2 atmospheres
Electrode	1/4" stainless steel Swagelok
Gaskets	chamber: stainless steel
Pressure Ports	electrometer housing: aluminum
Material of Construction	

SAMPLE FLOW SYSTEM
INTERNALLY MOUNTED

Flow Meter	0-10 LPM adjustable rotameter
Dust Filter and Electrostatic Filter	high efficiency 99.99% at 0.1 microns, respirator type
Pump	long life continuous duty oscillating piston positive displacement pump. Medo VCO201 E1

ENVIRONMENTAL

Temperature	-40° C to +65° C storage 0° C to +55° C operating
Humidity	0 - 95 % RH
Air Conditioning	Ventilation or air conditioning is not required.

PHYSICAL, MAIN CABINET NEMA 12 rated

Size	24.0" [610mm] wide x 24.0" [620mm] high x 19.0" [483mm] deep
Power	120 VAC ±10%, 60 Hz, 1A , 1 PH 1
Fuse	A slow blow fuse .
Weight	160 pounds [73 kg]

**MODEL 357BWC
CART MOUNTED
TRITIUM
MONITOR**

**MODEL 357BWC
CART MOUNTED SEMI-PORTABLE TRITIUM MONITOR**

The Model 357BWC is a single range, ionization chamber monitor for the measurement of tritium. It is contained on a mobile stainless steel cart and is suitable for moving to multiple sampling points and for continuous duty. The display /control unit is enclosed in a NEMA 12 enclosure on top the cart. It is suited for the monitoring of rooms, glove boxes, fume hoods, exhaust stacks and systems, as well as process piping. The NEMA enclosure has a hinged door with a tempered glass window and is double hinged so that it can be opened for servicing the various components inside.



Major distinguishing features include the following:

- 1-10,000 $\mu\text{Ci}/\text{m}^3$
- Quad 2L Ionization Chambers (gamma compensation)
- Contamination/Plate-out Proof Design (wire grids)
- Alpha Pulse Suppression (radon compensation)
- Dual Desiccant Dryer Cartridges (noble gas compensation)
- Heavy duty pump, HEPA filter and Flow Meter

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**MODEL 357BWC
CART MOUNTED TRITIUM MONITOR**

PERFORMANCE SPECIFICATIONS

MEASUREMENT

Range	single, 1 - 19,999 $\mu\text{Ci}/\text{m}^3$
Display	4/4 digit panel meter
Accuracy Stability and Drift	$\pm 5\%$ of reading, $\pm 1 \mu\text{Ci}/\text{m}^3$ whichever is greater $\pm 1 \mu\text{Ci}/\text{m}^3$ long term (thirty days), ambient temperature conditions
Noise Response	$\pm 1 \mu\text{Ci}/\text{m}^3$, 1 sigma, with alpha suppression in use
Rate	two linear electronic time constants approximately 20 seconds for signals up to about $80 \mu\text{Ci}/\text{m}^3$ approximately 3 seconds for signals above $80 \mu\text{Ci}/\text{m}^3$
Offset Compensation	Manual compensation control provided to offset the effects of gamma radiation and/or tritium build-up
Warm Up Time	less than five minutes

ALARM SYSTEMS

High Level Alarm	A single set point alarm system is adjustable with digital thumb switches over a 1 to 10,000 $\mu\text{Ci}/\text{m}^3$ range
Indicator Mode	Audible and Visual flashing red LED
Switch	A toggle switch is used to select the operating mode, Latching or Non Latching with a momentary Reset position
Malfunction Alarm	Audible and Visual steady amber LED indicates when either one of two conditions occur, A failure of any one of the internal D.C. power supplies or malfunction of the electrometer
Low Flow Alarm	Audible and Visual steady amber LED indicates when the sample flow rate has dropped to below 1 LPM
Acknowledge Push Button	Silences the audible indicator for all of the above alarms



**MODEL 357BWC
CART MOUNTED
TRITIUM
MONITOR**

**MODEL 357BWC
CART MOUNTED TRITIUM MONITOR, continued**

IONIZATION CHAMBER

Measuring volume	1800 cm ³
Total wetted volume	4,000 cm ³
Electrodes	Wire Grid, contamination resistant
Gaskets	Silicone rubber
Pressure	0.1 to 2 atmospheres
Ports	1/4" Stainless Steel Gyrolok
Material of Construction	Stainless Steel
Electrometer Housing	Aluminum

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SAMPLE FLOW SYSTEM

Pump	115Vac, 50/60 Hz, diaphragm type Thomas 107CAB11
Flow Rate	6 LPM Maximum, 5 LPM recommended 1-
Flow Meter	10 LPM, Dwyer RMA-21-SSV HEPA
Dust Filter	respirator type Scott 803562-01 103kPa (1
Maximum Pressure	atmosphere) 1/4" stainless steel gyrolok
Connections	tube fittings 316L Stainless Steel, 1/4" OD
Tubing	Differential pressure switch, Dwyer Model 1823-2 adjusted to trip <1 LPM.
Low Flow Sensor	ON/OFF circuit breaker power to pump
Pump Control	Sample Mode; the sample stream passes through the both the upstream and downstream ionization
Sampling Modes	chambers and exits through the sample outlet hose.
By-Pass Mode	Manually operated valves change the flow path to exclude the ionization chambers and the desiccant column.
Inlet Temperature	Thermometer -20 °C to +120 °C Range
Moisture Trap	Parker Type S1P with visible coalescing element



**MODEL 357BWC
CART MOUNTED TRITIUM MONITOR, continued**

ENVIRONMENTAL

Temperature	5° C to +50° C Operating
Humidity	0 - 95 % RH
Air Conditioning	Ventilation or air conditioning is not required.

PHYSICAL, MAIN CABINET

Mounting	The system is mounted on a heavy-duty cart of stainless steel construction with low friction casters (two swivel types at one end and two straight types at the other). The swivel casters have locking mechanisms.
Size	24" [610mm] Wide x 41.02' [1042mm] Long x 36' [914mm] Height to top shelf of cart with a 53" [1346mm] Overall Height
Enclosure Weight	NEMA 12 Rating
Inlet/Outlet Hoses	288 lbs [131kg] Sample inlet and outlet hoses are braided stainless steel construction with quick connect couplers at each end. Length is 42' [1.07 meters]



**MODEL ASU-4
AIR SAMPLING UNIT**

The Air Sampling Unit (ASU) is intended for simultaneous air sampling from 4 different locations. A portion of the sampled air is routed to a Tritium Monitor. Air can be sampled from a location up to 60m away. The ASU is a wall mount NEMA 12 enclosure. The enclosure has a hinged door that is furnished with a tempered glass window providing a view to the inside of the enclosure in order to visually check the air flow rate setting and signal lights. The enclosure is a double-hinged design, so that it can be opened for service.



Features include the following:

Components Installed in a Rugged, Wall Mount Industrial NEMA 12 Enclosure

Auto and Local Control Modes Programmable Logic Controllers

Programmable Display with a Color LCD Screen Flow Meters and Filters

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**MODEL ASU-4
AIR SAMPLING UNIT**

TECHNICAL SPECIFICATIONS

Air Flow Rate	3-25 LPM, Nominal Setting 10 LPM
Operational Temperature Range	10° to 40°C
Operating Principle	Air sample is pulled by a pump from 4 different locations into a manifold and then sent out through the exhaust line, which is sampled by a tritium monitor. Each flow rate from 4 inlet lines is adjusted by air flow meter. There is a separate purge air inlet.
Air Mixing Manifold	Built from aluminum bar stock with 5 inlets and one outlet. Inlets are for 4 sample lines and one purge line. The outlet is connected to the pump inlet.
Flow Meter	Polycarbonate body flow meter, with stainless steel valve, adjustable range from 1 to 25 LPM.
Filters	Respirator cartridge type HEPA filter for all four sample inlets and one purge inlet. Connection fittings are 1/4" SS Swagelok fittings.
Enclosure	NEMA 12 rated, 24" [600mm] wide x 18.8" [478mm] high x 22.56" [573mm] deep
Differential Pressure Switch	Diaphragm pressure switch used to detect low flow. Set point is ~ 5 LPM
Programmable Logic Controller (PLC)	Panasonic PLC with relay outputs, powered by a 24VDC power supply for. PLC also has RS232 serial data output for future expansion to include remote Capability.
Pump	Thomas reciprocating piston pump, model 2688CE44, 470W, 115VAC, 60Hz
Solenoid Valves	Brass body, nitrile rubber seals 130
Weight	lb [59 Kg]



**MODEL 321/421
NUCLEAR
POWER
PLANT
TRITIUM
MONITOR**

NUCLEAR POWER PLANT TRITIUM MONITOR MODEL 321/421 NPPM

This tritium monitor is a version of the OTC standard 321/421 series, configured for the special environmental conditions associated with nuclear power plants, especially those of the CANDU type. This monitor can be used for other applications where tritium specific measurements in the presence of other radionuclides are required.

Major distinguishing features include the following:

Measures tritium or tritium oxide specifically

Immune to other radioisotopes, including reactor gases as well as radon

Gamma compensated dual chamber design

Plate out proof ionization chambers eliminate "background" zero drift

Drift free "zero"

Rugged industrial enclosure

Unaffected by variations in temperature or humidity

A variety of alarms and controls are available. Optional Remote Displays and Sampling Units can be built to suit different applications.



SENSITIVITY - NOISE LEVELS

The Model 421 NPPM has been designed to exhibit sensitivities commensurate with safety requirements associated with worker exposure in power plants. Sensitivity limits induced by background noise levels with instruments incorporating 2 liter ionization chambers approach $0.3 \mu\text{Ci}/\text{m}^3$.

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RANGE

The Model 421 NPPM is dual range, extending measurement to up to 6 plus decades.

MAINTENANCE

Except for routine attention the sample line dust filters and preventive maintenance to the sampling pump, the instrument will provide decades of trouble free service.

SUPERVISORY SIGNALS

Computer compatible outputs are provided to signal operational failure including loss of sample flow, pump failure, electrical failure including that of the electronics, and failure of the ionization chambers.



MEASUREMENT

Range, typical	two, automatically switch 0.1 - 10,000 $\mu\text{Ci}/\text{m}^3$ low range 1.00 - 200.00 mCi/m^3 high range other ranges available
Display	4 1/2 digital panel meter
Accuracy	$\pm 2\%$ of reading, \pm L.S.D., whichever is greater
Stability and Drift	$\pm 1.0 \mu\text{Ci}/\text{m}^3$ long term (thirty days), ambient temperature conditions
Noise Response	$\pm 1.5 \mu\text{Ci}/\text{m}^3$, 1 sigma, with alpha suppression in use
Rate	three linear electronic time constants approximately 40 seconds for signals up to about $80 \mu\text{Ci}/\text{m}^3$ approximately 10 seconds for signals from 80 to $10,000 \mu\text{Ci}/\text{m}^3$ approximately 3 seconds for signals above $1.00 \text{mCi}/\text{m}^3$
Warm Up Time	less than ten minutes

ALARM SYSTEMS

High Level	Low Range Level alarm with 4-digit thumb wheel potentiometer preset from 1 - 9,999 $\mu\text{Ci}/\text{m}^3$. High Range Level alarm with 3-digit thumb wheel potentiometer preset from 2 - 200 mCi/m^3 . Toggle switch selector for High or Low Range Level Set Points. An Alarm condition activates a visual (red LED) an acoustic indicator and fail-safe relay closure. Toggle switch selector for latching or non-latching modes and reset. Acknowledge push button to silence acoustic indicator after alarm is tripped.
Malfunction	Failure of any one three conditions will activate a non-latching visual indicator and fail-safe relay closure. One, a dc power supply monitor verifies all internal dc supplies are within specification. Two, verifies that the electrometer cable is connected. Three, sample flow monitored by a delta pressure switch.



1160 US ROUTE 50
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**IONIZATION CHAMBER
INTERNALLY MOUNTED**

Measuring volume:	1,200 cm each
Total wetted volume:	2,000 cm ³ each
Electrodes	Wire Grid, contamination resistant
Pressure	0.1 to 2 atmospheres
Ports	1/4" stainless steel Swagelok

**SAMPLE FLOW SYSTEM
INTERNALLY MOUNTED**

Pump Flow Rate	diaphragm type 115/230 VAC 50/60 Hz
Flow meter Dust	14 LPM maximum @ 0 psia
Filter Connection	0 - 10 LPM adjustable
Low Flow Sensor	HEPA respirator type
	1/4" stainless steel Swagelok tube fittings
	Differential pressure switch

ENVIRONMENTAL

Temperature	-40° C to +65° C storage 0° C to +55° C operating
Humidity	0 - 95 % RH Ventilation or air conditioning is
Air Conditioning	not required.

PHYSICAL, MAIN CABINET

Size	29.37' [747mm] High x 23.63'[600mm] Wide x 18.62' [473mm] Deep wall mounted NEMA 12 painted steel enclosure with key lockable door
Power up	115/230 VAC, 50/60 Hz, 50 W including pump and to 4 remote indicators
Weight	186 lbs [84kg]



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**MODEL 321/421
NUCLEAR
POWER
PLANT TRITIUM
MONITOR
SPECIFICATIONS**

RECYCLING DRYER UNIT

Desiccant dual copper tube coaxial columns containing desiccant agent. Columns are equipped with internal heaters for the regeneration of the desiccant

Cycling System

Motor driven cam timer controls solenoid valves and the heaters for sequential operation of each column

Column A	Column B
In use	1. heat column
In use	2. purge vapor
In use	3. cool column

The sequence of events takes six hours for completion, whereupon the sequence recommences for the opposite column.

VISUAL INDICATORS

Status Indicator Rotary pointer knob indicates different states of the sample/regenerate process for both desiccant columns

Low Flow indicates when purge pump flow is <2 LPM

Power 115/230 V, 50/60 Hz, 1500 Watts

Circuit Protection Crcuit breaker/power ON/OFF switch

Physical Size 30" [762mm] W x 46.75" [1187.5mm] H x 13.5" [343mm]D wall mounted painted steel enclosure

Weight 245 lbs [111 kg]



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TRITIUM SAMPLING UNIT (OPTIONAL)

Pump Flow Rate Flow Meter

Dust Filter Pressure 115/230 VAC, 50/60 Hz

Connections Low Flow Sensor 89 LPM Maximum at 0 psia

Vacuum Sensor 10-100 LPM

HEPA respirator type

CONTROLS

0.1 - 2 atmospheres

Power Control Pump Control

1/4" stainless steel Swagelok tube fittings

Sample Control Valve Selection differential pressure switch

vacuum switch

VISUAL INDICATORS

Manifold Low Flow

Pushbutton switch for power

Connections

Maintained pushbutton switch for power to pump

ENVIRONMENTAL

Temperature

maintained pushbutton switch for MAIN/REMOTE control

controlled by a rotary switch

Humidity

Air Conditioning

red LED, "on" when purge pump flow fails or falls below 2 LPM.

PHYSICAL

Physical Size

1/4" stainless steel Swagelok tube fittings

Power Weight

-40° C to +65° C Storage
0° C to +50° C Operating

0 - 95 % RH

Ventilation or air conditioning is not required.

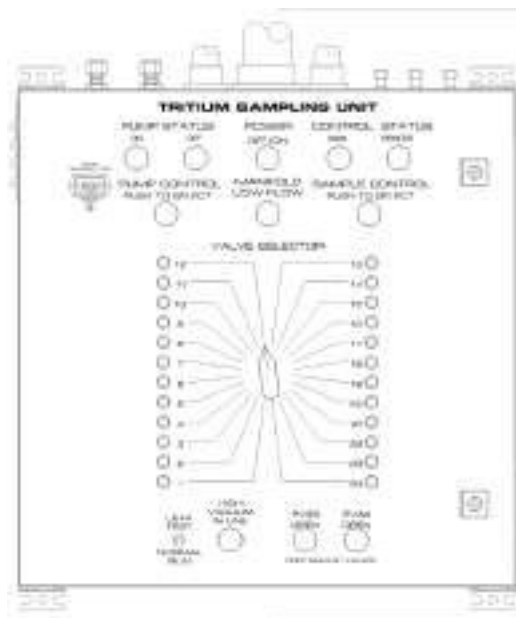
23.62' [600mm] Wide x 25.75' [654mm] High x
15.16' [385mm] Deep NEMA 12 Enclosure

120VAC, 60Hz, 1Ph, 15A

101 lbs [46 kg]

MODEL 321/421 NUCLEAR POWER PLANT TRITIUM MONITOR SPECIFICATIONS

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*MODEL 321/421
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PLANT TRITIUM
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SPECIFICATIONS*

REMOTE DISPLAY / CONTROL UNIT (OPTIONAL)

Power Control	ON/OFF toggle switch for power to unit
Pump Control	ON/OFF maintained pushbutton switch for power to pump
Sample Control	MAIN/REMOTE maintained pushbutton switch for control unit selection
Valve Selection	Valve selection controlled by PLC touch screen

VISUAL INDICATORS

PLC Touch Screen	Displays Tritium Concentration 120VAC, 60Hz, 1Ph, 2A
Power	

ENVIRONMENTAL

Temperature	-40° C to +65° C Storage 0° C to +50° C Operating
Humidity Air	0 - 95 % RH not required.
Conditioning	

PHYSICAL

Physical Size	23.62' [600mm] Wide x 25.75' [654mm] High x 15.16' [385mm] Deep Excluding Hardware
NEMA Rating	NEMA 12
Power	120VAC, 60Hz, 1Ph, 2A
Weight	66 lbs [30 kg]



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