



300/400 SERIES - MODULAR CONFIGURATION TRITIUM MONITORS (Model 311, 321, 411, 421)

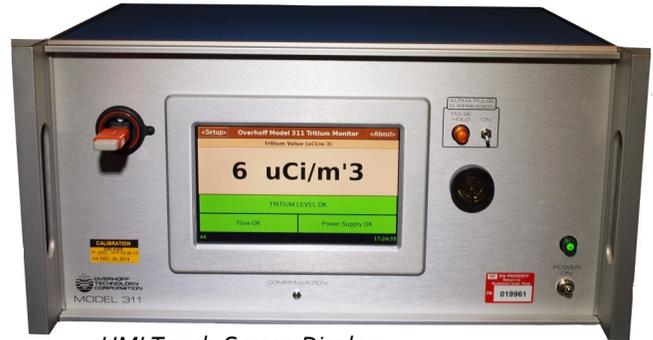
INTRODUCTION

The **300/400** series units are a family of stationary tritium in air monitors that are highly customizable through a large selection of options. These units are AC powered and are intended for continuous, unattended operation.

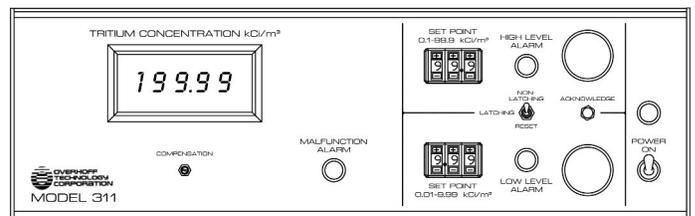
They can be configured to serve a variety of purposes, including environmental surveillance in rooms, stacks or power plants, as well as glove boxes and process piping in tritium handling facilities.

The 300/400 series units are grouped into four main categories as shown on the right, according to whether they use single or dual ionization chambers, or if they measure a single range or incorporate automatic range switching for wide range of measurement.

Customers can further choose the size of the ionization chamber, which is correlated to measurement range and sensitivity, and additional options, such as display type (LCD color touch-screen or digital panel meter), alarm configuration, mounting configuration, etc.



HMI Touch-Screen Display



Standard Digital Display

300 SERIES

Single range monitors, the 300 series instruments, can be configured to measure over 3 to 5 decades selected anywhere between $10^{-7} \mu\text{Ci/cc}$ ($1 \mu\text{Ci/m}^3$) to pure tritium.

Enhanced sensitivity ($0.1 \mu\text{Ci/m}^3$) can be achieved through use of larger ionization chambers.

400 SERIES

Multi-range monitors, the 400 series instruments, will measure over much wider ranges, covering up to as much as 6.5 decades of displayed measurement with a single chamber.

A wide range of measurement places extreme demands on ionization chamber design with regard to contamination effects of tritium oxide. Proper design ensures linearity over the full range and minimum offset at the low end of the measurement range. Wider measurement ranges such as 7 decades may use switched ionization chambers, using one ionization chamber only for low signal levels, and a second chamber only for high values. Overhoff has developed a special "wire-grid" ionization chamber which creates a phantom wall and reduces tritium plate-out contamination by up to 1,000 times or more.

MODEL SELECTION PROCESS:

1. **Select Instrument Type:** 311, 321, 411, or 421
2. **Select Interface-Display Type:** Standard Digital Display or HMI Touch-Screen Display
3. **Select Chamber Size:** 50mL, 200mL, or 2L
4. Choose **Internally or Remotely Mounted** Ionization Chamber
5. **Select Options.** Note: Pump, Filter, and Flowmeter assembly are not included as part of the standard system, and if desired, should be ordered as an option.

MODELS AVAILABLE: (but not limited to)	
311 series	Single range, with single ionization chamber
321 series	Single range, with dual ionization chamber
411 series	Multi-range, with single ionization chamber
421 series	Multi-range, with dual ionization chamber

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NOTE: GAMMA RESPONSE

The 311 and 411 series of tritium monitors employ single ionization chambers, which respond not only to tritium but will also respond to external gamma and X ray fields. Typically, a flux of 1 mR/hr will produce instrument response equivalent to about 90 $\mu\text{Ci}/\text{m}^3$. Lead shielding can be supplied to mitigate gamma sensitivity.

In contrast, the 321 and 421 series of tritium monitors feature dual ionization chambers, the two chambers being of identical geometry and are used to cancel gamma response. Instruments with four ionization chambers are specified for optimum gamma suppression under challenging field gradient and energy conditions.

2. Select MEASUREMENT DISPLAY AND INDICATORS

All 300 and 400 series instruments offer the choice of interface-display type:

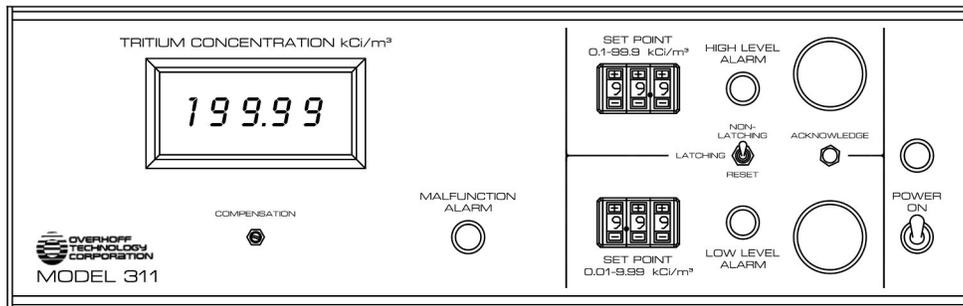
1. Standard Digital Display:

4.5 Digit or 5 Digit Programmable Display Panel Meter

SDD Standard Digital Display (1-20,000 range)

PDD: Programmable Digital Display (1-99,999 range)

Separate controls for adjusting alarm set-points and indicators.

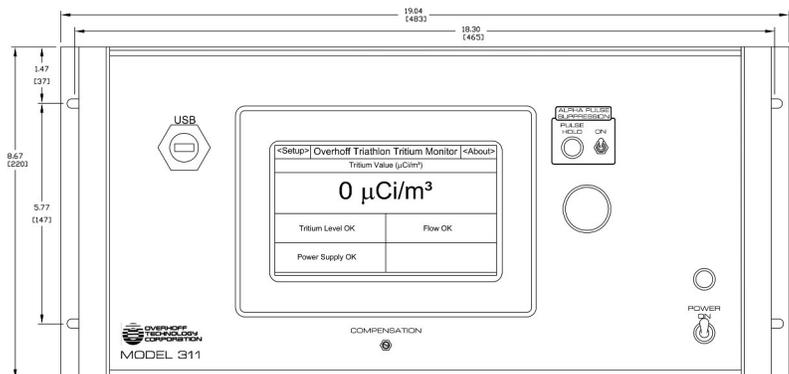


2. HMI Configuration:

LCD Color-touch screen display.

Touch-screen display handles all control (alarm set-points), indicator, and display functions.

Automatically includes Ethernet output and additional alarm indicators: Low Flow Alarm and System Failure Alarm (High Voltage Failure, Low Voltage Failure, and Electrometer Failure). These alarm indicators can be added to the standard digital display configuration at additional cost.





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3. Select CHAMBER SIZE	Ordering Code:	Typical Measurement Range:	
		Ci	Bq
50mL Single ionization chamber	50mL	0.01 to 199.99 Ci/m ³	0.001 to 19.999 TBq/m ³
50mL Single ionization chamber	50mL	0.001 to 19.999 Ci/m ³	1 to 19,999 GBq/m ³
200mL Single ionization chamber	200mL	1 to 19,999 mCi/m ³	1 to 19,999 GBq/m ³
200mL Single ionization chamber	200mL	0.1 to 1,999.9 mCi/m ³	0.1 to 1,999.9 GBq/m ³
2 Liter Single ionization chamber	2 LS	1 to 19,999 μCi/m ³	0.1 to 1,999.9 MBq/m ³
2 Liter Dual ionization chamber	2 LD	*1 to 19,999 μCi/m ³	*0.1 to 1,999.9 MBq/m ³
2 Liter Quad ionization chamber	2 LQ	0.1 to 1,999.9 μCi/m ³	0.01 to 199.99 MBq/m ³

*Can also be configured for extra sensitivity down to 0.1 to 1,999.9 μCi/m³ or 0.01 to 199.99 MBq/m³

300/400 series chambers are typically remotely mounted, but can be mounted inside the instrument enclosure upon request. 50mL and 200mL chambers are used for higher tritium concentrations and are only available in stainless steel. 2 liter chambers are made of aluminum, unless otherwise requested (brass or stainless steel).

Ionization chambers are available in versions with wire-grids (reduce plate-out contamination by up to 1000x when working with higher tritium concentrations), perforated walls (passive sampling, no pump), or as otherwise requested.

Dual 2L chambers are the most popular choice for room/stack monitoring applications. Single 2L is useful for applications where gamma compensation is not required. 50mL & 200mL chambers are designed for high range (process, glovebox, etc).



SPAN ACCURACY AND LINEARITY

All OTC tritium monitors are calibrated to high levels of accuracy, and can be factory adjusted to a precision as high as 5% in terms of equivalent electrical signal, or better than 15% when using certified tritium gas.

RESPONSE RATE

The measurement signal level and the rate (time constant) are inherently interrelated. High measurement levels demand fast response, whereas low measurement levels demand long time constants, in order to smooth out noise and to provide a stable display. To accommodate this contradictory requirement, three distinct time constants have been incorporated into the instruments.

- 3 second for measurement above 1000 mCi/m³
- 5 to 10 second time constant for measurement of 80 - 1000 mCi/m³
- 20 seconds or more for measurement below 80 mCi/m³

ALARMS

The 300/400 series has a superior alarm system including audible and visual alarm indicators, two adjustable tritium level alarms, latching and non-latching modes, and acknowledge (mute). The HMI touch-screen automatically includes a low flow alarm and a malfunction alarm for low voltage power supply failure, high voltage power supply failure, and electrometer failure. The low flow alarm and malfunction alarm can be added to the standard digital display interface for additional cost. Three alarm relays are included as standard.



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STABILITY AND NOISE LEVEL

The measurement sensitivity is specified in terms of stability and noise level under fully operational conditions, and not just to the electronic system performance alone.

For example, an instrument designed to measure to one micro Curie per cubic meter will exhibit a noise level and stability of better than $1 \mu\text{Ci}/\text{m}^3$ for one standard deviation. Normally, the stability of the electronic circuitry itself is better by an order of magnitude.

OTC tritium monitors feature long term zero stability under all environmental conditions.

OTC pioneered proprietary methods to eliminate tritium monitor sensitivity to environmental effects including the disintegration of ambient radon, and of natural terrestrial and cosmic radiation.

ELECTRICAL INTERFACES

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

These include, as a minimum,

- I. Analog signal (0 - 10 V)
- II. Alarm functions, including remote acknowledge
- III. Supply voltage
- IV. Range information (400 series)

Additional data outputs available, such as RS-232, RS-485, Ethernet, and USB.

APS Alpha Pulse Suppression

Noise free measurements of airborne tritium is only possible by suppressing response to alpha decay due to environmental radon. With circuitry which inhibits instrument response to radon and large cosmic ray pulses, measurement sensitivities as low as $0.1 \mu\text{Ci}/\text{m}^3$ can be attained.



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ADDITIONAL OPTIONS:

Logarithmic Converters (ordering code: LOG)

Circuits to convert instrument output signals to a logarithmic form for the purpose of logarithmic meter displays or for chart recorders with logarithmic scales. Useful for signal compression when used with 4-20 ma or digital interfaces.

Totalizer (ordering code: TZ)

An 8 digit LCD display for time integrated activity rate of tritium (total flow * tritium concentration). Very useful for the determination of inventory passage through stacks or hoods. A battery ensures retention of data during periods of line power loss.

Pump and Flowmeter Assembly (ordering code: PFA)

A complete assembly consisting of HEPA filter, pump and adjustable flowmeter.

System Failure Monitor (ordering code: SFM)

This supervisory circuit detects and signals failure of all d.c. power supplies, and verifies the integrity of the ionization chamber/electrometer. Includes low voltage failure, high voltage failure, and electrometer failure.

Low Flow Failure Alarm (ordering code: LFA)

Alarm that indicates loss of flow rate.

Chart Recorder (ordering code: CR)

An electronic chart recorder can be linked with the instrument to store data. The recorder has color LCD touch screen, removable memory card and RS-232 output.

Customer selected Alarm Output Configuration (ordering code: ALX)

Special alarm configurations are available to fit into all 300/400 series instruments. Consult the factory for available options.

Gold Plated Measurement Chamber (ordering code: GP)

Gold Plating of measurement chamber to help reduce tritium plate-out contamination.

Mirror Polished Measurement Chamber (ordering code: MP)

Mirror Polishing of measurement chamber to help reduce tritium plate-out contamination.

Wire-Grid Ionization Chamber (ordering code: WG)

Wire-grid style ionization chamber to reduce tritium plate-out contamination by up to 1,000x.

Remote Display Unit (ordering code: RDU)

Such options are designed to suit particular customer requirements and can include a variety of annunciators, visual and acoustic. Consult the factory for details.

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RS-232/RS-485/Ethernet Computer Interfaces

All conventional computer interfaces are available on plug in cards.

Helium Leak Test Certificate (ordering code: HLT)

Certification that the ionization chambers have passed leak tests performed with a helium mass spectrometer.

Calibration Resistors (ordering code: CALR)

Ultra high meg ohm resistors, certified to about 2% precision for use for electrical calibration (or verification) of the tritium monitors response.

Calibration Gas (ordering code: CALG)

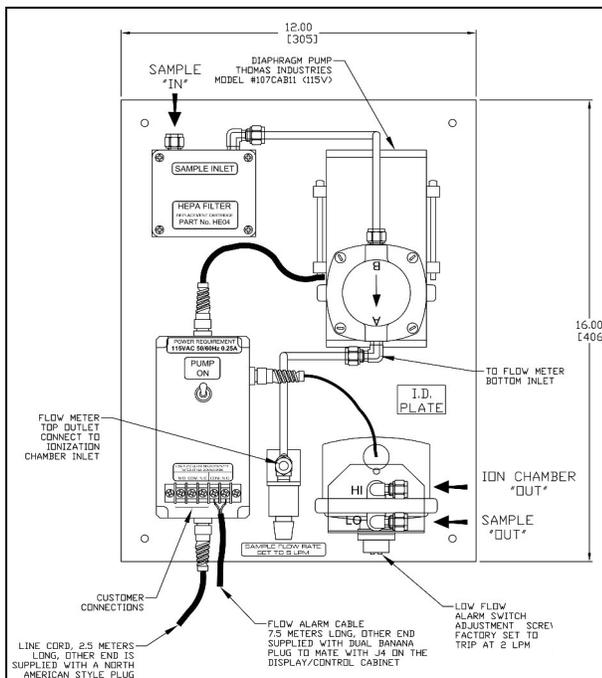
NIST traceable tritium gas calibrators. Gas is contained in a "lecture" bottle, the calibrator is supplied with all necessary components, including the regulator, gages, and valves.

Voltage To Current Converter (ordering code: E-I)

The 0 to 10 volt measurement signal can be converted to a standard 4 to 20 ma current signal.

400 series (multiranging) instruments can be equipped with a 4 to 20 ma signal which covers the entire range of operations.

Although not absolutely required, for better measurement resolution it is suggested that the 4 to 20 ma converter be preceded by a logarithmic conversion.



External Pump, Filter, and Flowmeter Assembly



Tritium Gas Calibrator

Released 10/29/20