



MODEL TRIMARAN—H₂O Ultra Low-Level Automated Tritium in Water Monitor

This monitor has been designed for real time ultra low-level detection of tritium in water in the industrial environment of nuclear power plants. Low MDA, reliability, ruggedness, and simplicity of automatic operation is what sets this monitor apart from laboratory type of the equipment. The Model Trimaran-H₂O has been designed to feature sample enrichment, measuring the lowest levels of tritium in water as possible. In addition to industrial use, this monitor is also used for other purposes, such as monitoring changes in tritium content of ground water, drinking water, and waste water.

LOW MINIMUM DETECTABLE ACTIVITY (MDA)

The unit detects tritium decay by extracting T₂ and H₂ from the water, enriching/concentrating the sample, then making sensitive measurement with matched gas flow proportional counters. To minimize cosmic and gamma radiation effects, optional ½" lead shielding provides low background noise. See below for MDA.

RESPONSE TIME SENSITIVITIES

MDA	MDA	MDA	MDA
8 HOURS	24 HOURS	7 DAYS	ONE MONTH
500 Bq/L	250 Bq/L	40 Bq/L	TBD
13,500 pCi/L	6,750 pCi/L	1000 pCi/L	TBD

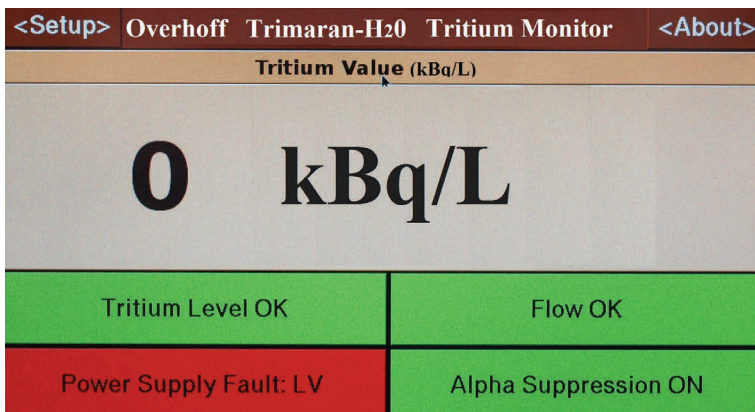
INTEGRATED COMPUTER, DISPLAY, AND SOFTWARE

Equipped with a fully-integrated computer, this smart instrument logs all data points on an insertable USB flash drive. Data communication to external programs is available via TCP/IP. Standard data output is USB and RJ-45 with an optional 4-20 mA. Alarm relay connections are included on the back panel.

Custom software allows the user to adjust several of the measurement parameters, such as: units of measurement, alarm limits, flow rate for totalizing, among others.



- Highly Sensitive** to 40 Bq/L for Tritium in water
 - Smart Electronics** Onboard computer, Custom software, Internal data-logging
 - Gamma Compensated** Automatic Gamma Background subtract
 - Ease of Operation** No LSC fluid needed
No liquid mixed waste
 - No Zero Drift** long term zero stability
 - Sample Enrichment** Provides ultra-low MDA and high accuracy
- The Overhoff Model **Trimaran-H₂O Tritium in Water Monitor** utilizes cutting-edge proportional counting technology to provide a smart instrument with unequalled performance in sensitivity, stability, ease of operation, and data acquisition/analysis.



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PRESSURE REGULATING EQUIPMENT

Pressure of input sample streams can be up to 103 kPa. This pressure is immediately reduced to 2-3psi via Pressure Regulating Valves (PRV). Each PRV is associated with Pressure Relieve Valve set to open at 100 kPa, therefore, the pressure in the system can never be more than 100 kPa, which makes it safe to handle. This also makes the instrument Class 6 Nuclear Device.

FULLY INTEGRATED PACKAGE

Model Trimaran-H₂O is a completely self-contained instrument for real time observation of tritium concentration in water. The instrument is mounted inside of the 200cm tall steel enclosure with reinforced anchoring feet and locked access.

P-10 gas (90% Argon, 10% Methane, non-combustible) cylinder is connected to the unit externally. This quantity is sufficient for 60 days of continuous operation.

The main subassemblies are:

1. Sample water input lines
2. External cooling loop in case of hot samples
3. PRV and RV system with manifolds
4. Water purification system (oil-in-water and micron filter)
5. Sample water pump
6. Detection module
7. Data acquisition electronics module
8. System control module
9. Waste water output line, RV output line and sample bypass output lines
10. Pre-filter
11. Sample Enrichment assembly

PLC CONTROL

Sampling of input lines and control of alarms and pumps is done by PLC unit placed inside of the System Control Module. There is an alarm provided in case of PLC failure as well as manual override so that the operation can be continued manually until PLC is replaced. Manual operation is a backup system; the unit normally operates in automatic mode.

ROUTINE MAINTENANCE

Scheduled maintenance of consumables is required. P-10 gas cylinder needs to be replenished every 2 months and sample water filters need to be replaced. Also, periodic check of the efficiency and background is recommended if there is a possibility of increased background contamination and due to standard life cycle of electronics components.

ANNUAL INSPECTION AND SERVICE

It is recommended that the instrument be inspected and serviced on an annual basis to ensure continuing trouble free operation. All components of the instrument should be inspected and instrument re-calibrated.

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REPAIR

Equipment failures of a minor nature can be repaired under local supervision by the operator of the equipment. When necessary, the manufacturer (Overhoff Technology Corporation (OTC)), or its agents can dispatch service personnel for quick remediate action.

DOCUMENTATION

All OTC equipment is accompanied by complete documentation, which includes the following:

1. User and Maintenance Manual that contains:
 - a. Theory of operation
 - b. Installation instructions
 - c. Operation instructions
 - d. Calibration procedure
 - e. Suggested maintenance
 - f. Repair instructions
 - g. Drawings, diagrams and schematics

Training will be provided by the manufacturer, at this factory, free of charge. Assistance with commissioning is also available by the manufacturer (OTC).

ADVANTAGES OF PROPORTIONAL COUNTING SYSTEM VERSUS LIQUID SCINTILLATION

Until recently, the only detectors capable of measuring very low levels of tritium in water were Liquid Scintillation Counting (LSC) based. However, the LSC approach has some obvious disadvantages, such as: the LSC fluid must be constantly refilled at a significant cost in labor, money, and space; LSC fluid is also hazardous material and mixing with tritium results in 'liquid mixed waste,' which must be carefully stored, transported and disposed of.

By utilizing proportional counting technology, the user only has to acquire a compact standard steel tank of proportional gas, which will last for more than a month and is available from a variety of suppliers. The P-10 counting gas is 90% Argon and 10% Methane, and is not toxic or combustible. Measurement via this method achieves same or better low-end sensitivity, without having to deal with LSC fluid and waste.

SAMPLE ENRICHMENT

With LSC and proportional counting detectors, Overhoff has pushed tritium detection to the most sensitive limit. However, samples can be so dilute, even with large multi-liter detectors, there are not enough disintegrations per second for good measurements. This issue is overcome by concentrating or enriching the sample. This may be accomplished using iterative processes to concentrate the tritium in water using phase change or other physical differences (not chemical processes since 1H, 2H, and 3H are chemically identical.) Overhoff scientists have developed their own iterative sample enrichment cycle, creating system sensitivities far beyond other automated flow-through systems.

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MODEL TRIMARAN-H₂O TECHNICAL SPECIFICATION

MEASUREMENT RANGE:	0 kBq/L – 130kBq/L
RESOLUTION (SENSITIVITY):	1.0kBq/L
MINIMUM DETECTABLE LIMIT:	40 Bq/L (in 1 Week) at confidence level of 95%
DISPLAY:	LCD Color Touch Screen; units of display user- settable (i.e., pCi/cc, MBq/m ³ , MPCa, μCi/m ³)
RESPONSE RATE:	See Sensitivity Response Chart on Page 1
MEASUREMENT METHOD:	Gas flow proportional counters
PROPORTIONAL COUNTERS:	Dual copper clad acrylic counter tubes, 2 liter active volume, 2.5 liter wetted volume, 0.001 inch tungsten collector anode
COUNTER GAS:	P-10 or "MAGIC" gas for high performance Flow rate 250 cc/min, typical
MEASUREMENT ALARM SET POINT:	Can be manually adjusted
DATA RECORDING/OUTPUT:	Insertable USB flash drive; Data communication via TCP/IP. Standard data output is USB & RJ-45
SAMPLING/MIXING SYSTEM:	See diagram 1 on page 5.
WASTE MANAGEMENT:	Unused water output lines with Swagelok® fittings are provided, user to provide recycling system or waste collection system.
TEMPERATURE:	0°C to 50°C
HUMIDITY:	0 to 95 % R. H.
SEISMIC:	Withstands modest shock
ELECTRICAL:	Power 110/230VAC, 5A
MECHANICAL:	Self contained, mounted on a steel frame with lifting eyes for easy transport.
DIMENSIONS:	31.5in x 23.6in x 84.0in (800mm x 600mm x 2133mm)
WEIGHT:	1100 lb (500 kg)

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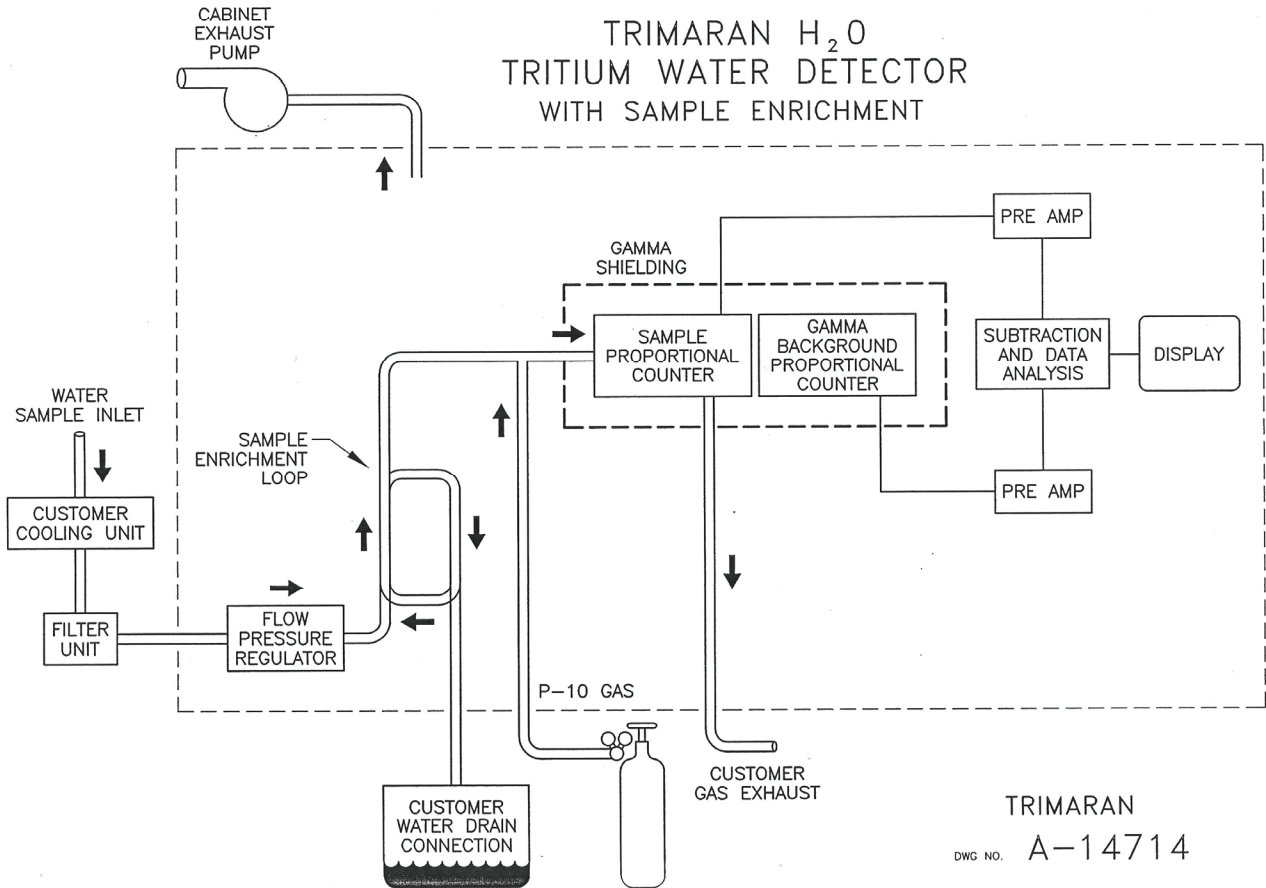


Diagram 1: Model Trimaran-H₂O Flow Path