



Dissolved Ozone Analyzer Model W1™ User Manual

© Teledyne API (TAPI)
9970 Carroll Canyon Road
San Diego, CA 92131-1106
USA

Phone: +1 858-657-9800
Toll-free: 800-324-5190
Fax: +1 858-657-9816
Email: api-sales@teledyne.com
Website: <http://www.teledyne-api.com/>



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IMPORTANT SAFETY INFORMATION

Important safety messages are provided throughout this manual. Please read these messages carefully.

A safety message alerts you to potential hazards that could hurt you or others. Each safety message is associated with a safety alert symbol. These symbols are found in the manual and inside the instrument. The definition of these symbols is described below:



WARNING: Electrical Shock Hazard



HAZARD: Strong oxidizer



GENERAL WARNING/CAUTION: Read the accompanying message for specific information.



CAUTION: Hot Surface Warning



Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.



DO NOT TOUCH: Touching some parts of the instrument without protection or proper tools could result in damage to the part(s) and/or the instrument.



Electrical Ground: This symbol inside the instrument marks the central safety grounding point for the instrument.

Note

Technical assistance regarding the use and maintenance of this or any other Teledyne API product can be obtained by contacting Teledyne API's Technical Support Department:

Phone: 800-324-5190

Email: api-techsupport@teledyne.com

or by accessing various service options on our website at <http://www.teledyne-api.com/>.

CONSIGNES DE SÉCURITÉ

Des consignes de sécurité importantes sont fournies tout au long du présent manuel dans le but d'éviter des blessures corporelles ou d'endommager les instruments. Veuillez lire attentivement ces consignes. Chaque consigne de sécurité est représentée par un pictogramme d'alerte de sécurité; ces pictogrammes se retrouvent dans ce manuel et à l'intérieur des instruments. Les symboles correspondent aux consignes suivantes :



AVERTISSEMENT : Risque de choc électrique



DANGER : Oxydant puissant



AVERTISSEMENT GÉNÉRAL / MISE EN GARDE : Lire la consigne complémentaire pour des renseignements spécifiques



MISE EN GARDE : Surface chaude



Ne pas toucher : Toucher à certaines parties de l'instrument sans protection ou sans les outils appropriés pourrait entraîner des dommages aux pièces ou à l'instrument.



Pictogramme « technicien » : Toutes les opérations portant ce symbole doivent être effectuées uniquement par du personnel de maintenance qualifié.



Mise à la terre : Ce symbole à l'intérieur de l'instrument détermine le point central de la mise à la terre sécuritaire de l'instrument.

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GENERAL SPECIFICATIONS FOR THE W1™ DISSOLVED OZONE ANALYZERS

Measuring Principle	Transfer Method (transfer ozone from liquid to gas phase) followed by absolute determination via UV absorption
Measuring Ranges	0-2.00 mg/l or 0-5.00 mg/l or 0-1.000 mg/l. Other ranges on request.
Display Resolution	0.01 mg/l or 0.001 mg/l
Zero Drift	Better than 0.002 mg/l per month, non-cumulative..
Precision/Repeatability	0.001 mg/l
Linearity	Better than 99% throughout range
Calibration Standard	Against Indigo Method
Readout	4-character, alpha-numeric
Gas Sample Flow Rate	1 l/min
Water Sample Flow Rate	1 l/min
Analog Outputs	0-5 VDC and 4-20 mA (optional isolated)
Serial Interface	RS-232
Alarms	2 programmable alarms. 2 form C relay contacts (SPDT) rated at 5 AMP resistive load at 250 VAC
Diagnostic Features	Continuous internal diagnostics with error messaging and instrument error relay
Configurations	Wall mountable NEMA 4x / IP65 enclosure, or 19" rack 3U height.
Sample ports	1/4" compression fittings (gas) 1/4" compression fittings or 3/8" barb (water).
Supply voltage	120 or 240 VAC, 50/60 Hz
Dimensions HxWxD	with mounting board: 39" x 15" x 3.75" (991mm x 381mm x 95.25mm)
Weight	Transfer Column ~35 lbs
Environmental Operating Conditions	5-45°C; 10-90% RH non condensing Installation Category (Overvoltage Category) II Pollution Degree 2 For Indoor Use Only Maximum Operating Altitude 2000 meters

Specifications subject to change without notice.

CAUTIONS AND GENERAL NOTES

	CAUTIONS AND WARNINGS
	<ul style="list-style-type: none">• OZONE MAY BE DANGEROUS AND HARMFUL TO HUMANS. TAKE REASONABLE STEPS TO AVOID EXPOSURE. THE CURRENT GUIDELINE FOR MAXIMUM 8-HOUR EXPOSURE LIMIT TO OZONE IS 0.1 PPMV.• NEVER LOOK DIRECTLY AT THE UV LAMP WHICH IS INSIDE THE MONITOR WITHOUT PROPER EYE PROTECTION. UV RADIATION CAN CAUSE PERMANENT EYE DAMAGE.• COMPONENTS WITHIN THE MONITOR ARE POWERED BY AC VOLTAGE. TAKE ALL NECESSARY PRECAUTIONS TO ELIMINATE THE RISK OF ELECTRICAL SHOCKS.• CERTAIN COMPONENTS MAY BE HOT TO THE TOUCH. PLEASE ALLOW PROPER COOLING TIME BEFORE WORKING WITH THESE COMPONENTS.

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TAPI assumes no responsibility for the use of any measuring schemes described herein.

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GENERAL

Please review these instructions and those of the ozone monitor carefully to ensure proper installation, operation and care of the system to minimize the risk of damage due to improper handling.

Please familiarize yourself with the diagrams included in this Manual. These diagrams show the various connections and component location.

SYSTEM OVERVIEW

The Teledyne API IN USA™-brand Model W1™ is a single point dissolved ozone measuring system consisting of a **transfer column** and an **ozone monitor (see Figure 1)**. This combination continuously and selectively measures the dissolved ozone in the liquid solvent (typically water) through a physical measurement method. The resulting measurement is indicated in **mass of Ozone per unit volume of liquid** in milligrams per liter, or ppmw.

A complete description of the ozone monitor is contained in its respective manual.

Dissolved ozone can be stripped out of solution and into gaseous phase by means of the stripping column. There is a direct relationship between the ozone stripped out of the water and the dissolved ozone originally in the water. Therefore by measuring the concentration of the stripped ozone, an exact reading of the concentration of dissolved ozone can be produced.

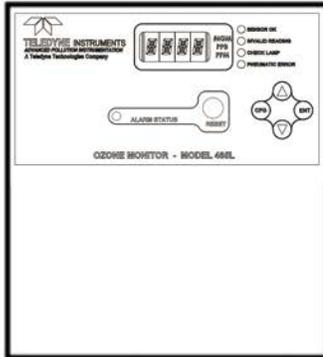
This method of measurement is known as the "Transfer Method", and its benefits include:

- Excellent repeatability
- Selective to ozone - the UV absorption monitor will not "see" Cl₂, H₂O₂, or other oxidants. Bubbles do not cause interference.
- No consumables - The column does not require membranes, chemicals, or other consumables.
- Reduced maintenance - The column is largely unaffected by fouling.

A water sample is gravity-fed continuously through the transfer column at a rate of 60 liters/hour. The pump inside the ozone monitor draws a slight vacuum on the column and forces ambient air to flow up the column as the water flows down. This counter-current flow transfers ozone out of the water stream and into the air stream. The ozone, now in gaseous form, is measured by the ozone monitor. There is a direct relationship between the amount of ozone stripped out of the water and the amount of ozone originally dissolved in the water. The monitor's microprocessor uses this relationship to exactly calculate the dissolved ozone concentration.

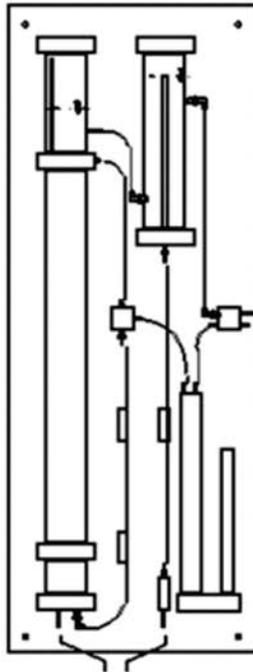
Figure 1: Overview of Model W1™ Dissolved Ozone Monitor

MEASURES DISSOLVED OZONE BY FIRST STRIPPING THE OZONE OUT OF THE WATER. THE AMOUNT STRIPPED IS PROPORTIONAL TO THE AMOUNT DISSOLVED AND IS DRIVEN BY HENRY'S LAW



OZONE MONITOR

- MEASURES THE GASEOUS OZONE STRIPPED OUT OF THE WATER BY THE STRIPPING COLUMN BELOW
- PROVIDES ABSOLUTE UV ACCURACY AND EXCELLENT SENSITIVITY



OZONE STRIPPING COLUMN

- STRIPS OZONE OUT OF SOLUTION
- SUPPLIES GASEOUS OZONE FOR MEASUREMENT BY OZONE MONITOR ABOVE
- REPEATABLE
- NO CONSUMMABLES

Figure 2: Model W1™ External Connections

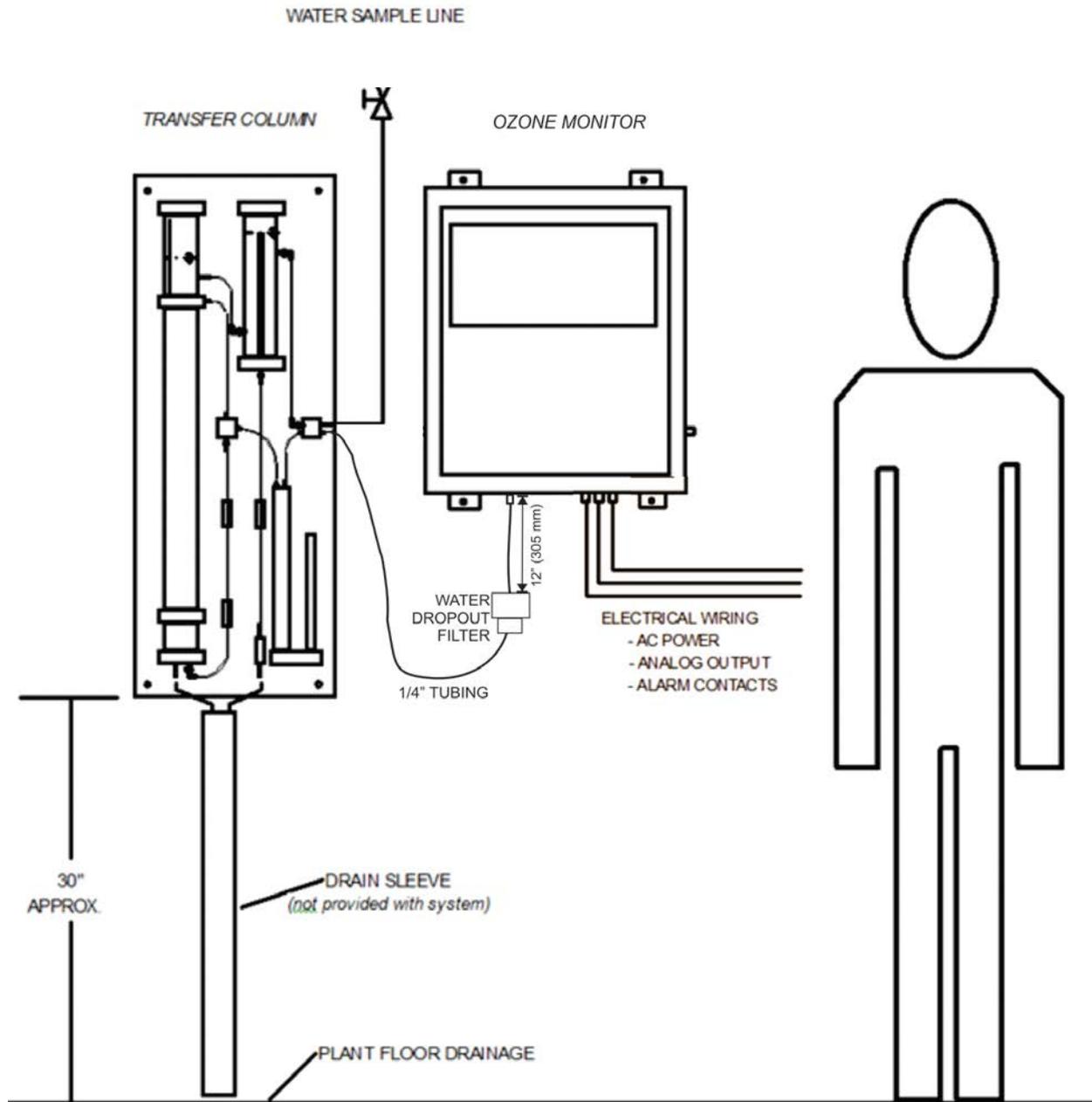


Figure 3: Model W1™ Transfer Column

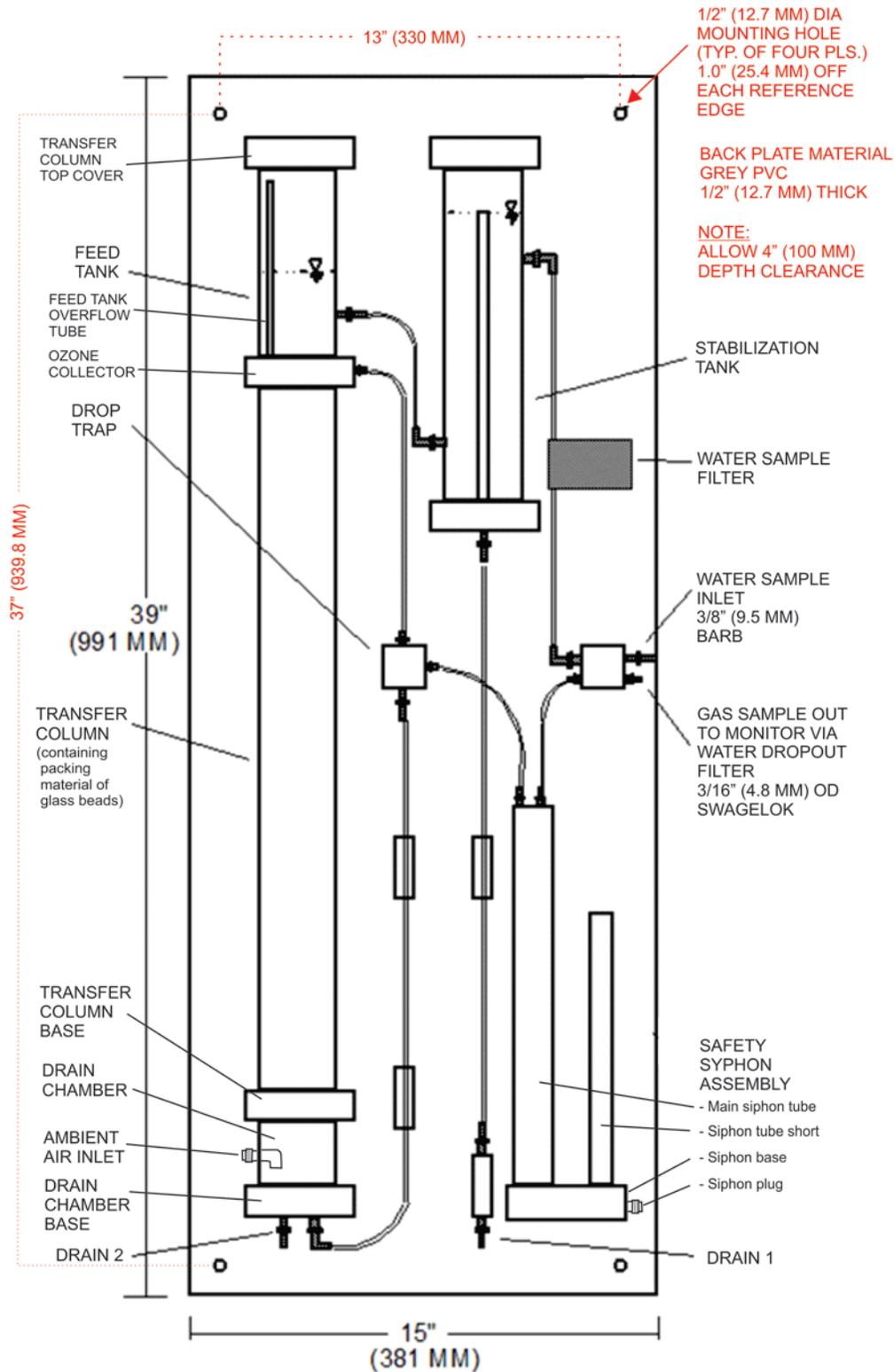
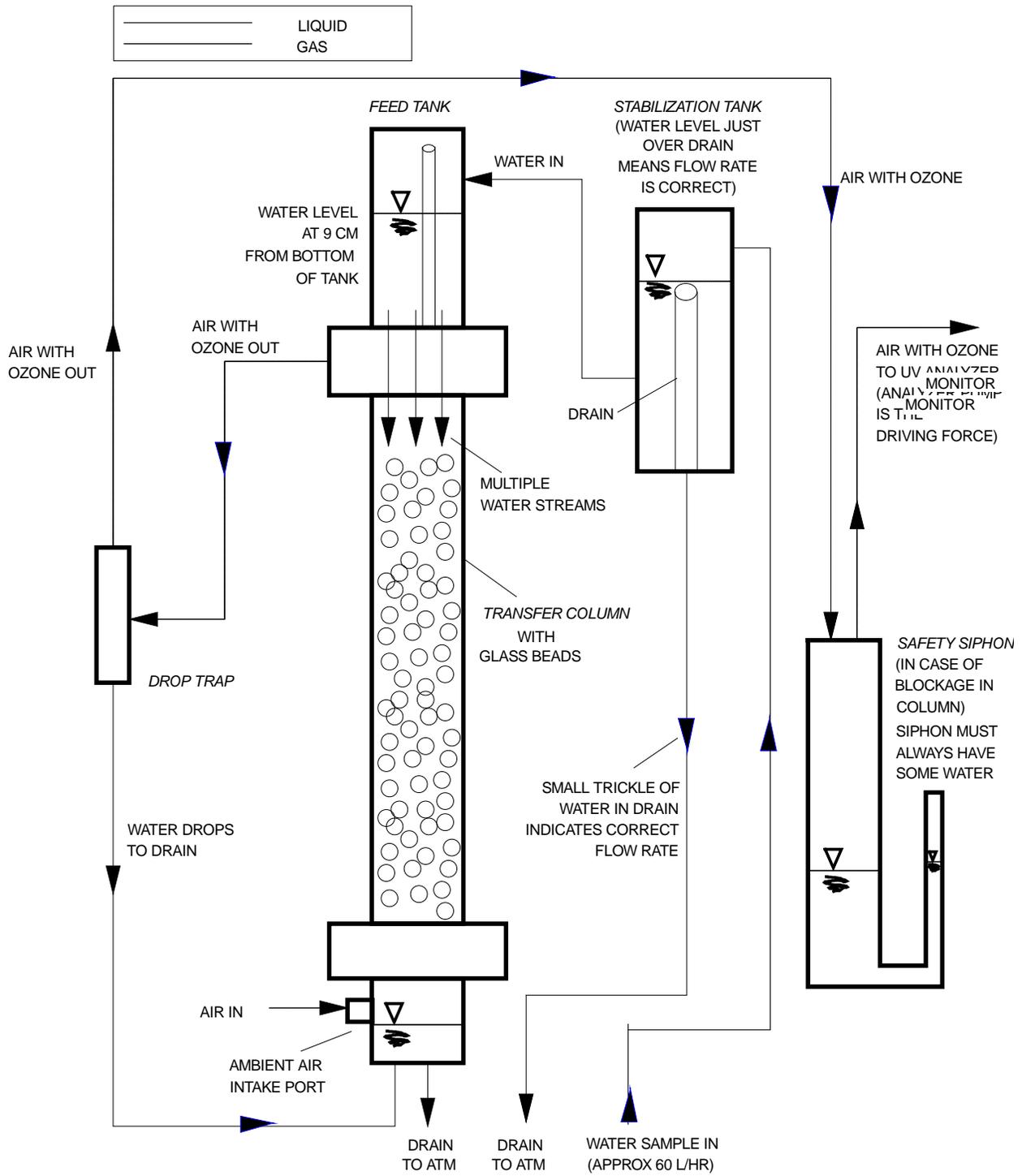


Figure 4: Transfer Column Operational Schematic



INSTALLATION OVERVIEW

Refer to Figure 2 and Figure 3. The transfer column and the monitor are wall mounted. The display of the monitor should be at eye level. The top of the column should be level with the top of the monitor. The column and the monitor should be installed vertically and within 5 feet of each other.

The transfer column requires the following external connections:

- Water sample inlet from the water source (3/8" barb)

IMPORTANT: USE ONLY MATERIALS THAT ARE RESISTANT TO DISSOLVED OZONE, SUCH AS TEFLON™.

- Gas sample outlet to the water dropout filter and ozone monitor (1/4" compression)
- Two (2) water sample drains, (3/8" barb)
- One ambient air inlet (1/4" compression)

IMPORTANT:

- **DRAIN TO ATMOSPHERE ONLY.**
 - **DO NOT DRAIN TO A PUMP.**
 - **AVOID LONG TUBING RUNS OR LOOPS.**
 - **AVOID SYPHON EFFECTS.**
-

The ozone monitor has the following external connections:

- Gas sample inlet from column (tubing supplied with the monitor)
- Gas sample outlet
- Mains AC power (see monitor's manual for power rating)
- Analog output wires
- Relay contact wires

PREPARATION AT THE PLANT SITE

Refer to Figure 2. The plant needs to make available the following in preparation for installation:

- A tap to bring the water sample to the column, with a valve to regulate the sample flow, with the ability to interface with the column's 3/8" barb fitting.
- A "drain sleeve" (recommended: PVC tube, 2" OD). This sleeve is to be secured to the wall and serves to channel the water from the column's drains down to the plant floor drain channel (Sleeve should be approx. 30" long).
- Provisions should be made to channel the drained water once it leaves the column. If desired, this water can be returned to the system.

For the Ozone Monitor:

- AC wiring, supplied by the end user, capable of carrying the power rating stipulated on the monitor's specifications label
- Analog output wiring
- Relay contacts wiring

INSTALLING AND OPERATING THE COLUMN

Installation

- a) Wall mount the column vertically. Refer to Figure 2 and Figure 3 for location and mounting specifications. The bottom edge of the column should be approximately 30" above the plant floor.
- b) Connect the water sample supply to the Water Sample Inlet 3/8" barb or 1/4" compression fitting.
- c) Use the two short pieces (~12" long) of 3/8" ID tubing on the drain fittings to channel the drain water into the "drain sleeve".
- d) Fill the Safety Siphon with water by pouring water into the open tube until the level is approximately half way up.

Operation

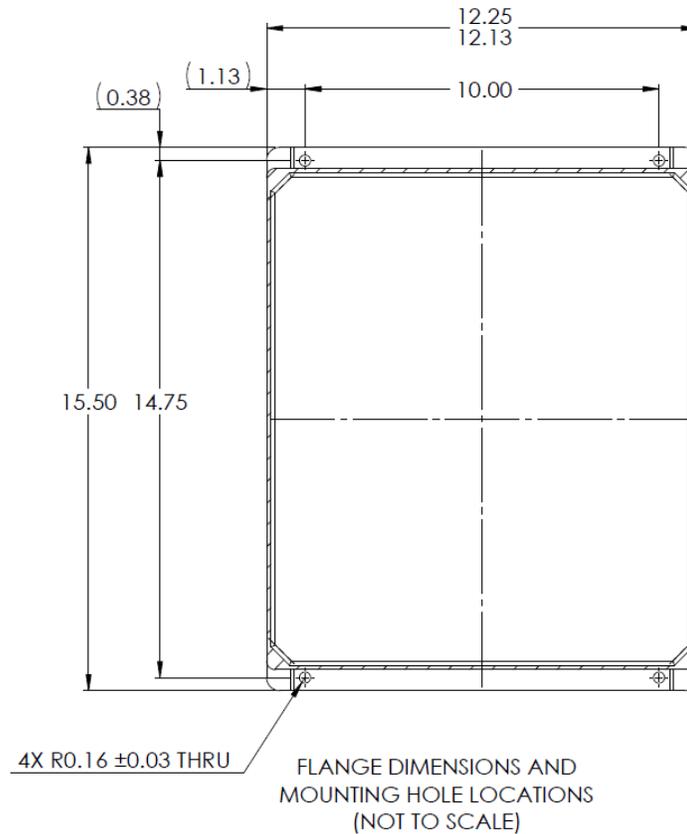
Operational flow of the column is illustrated in Figure 4.

Open the sample valve and regulate the water flow until some water flows down the Stabilization Tank drain. When this happens, the flow rate will be correct and approximately 60 l/hr will flow down the main component of the transfer column.

INSTALLING AND OPERATING THE OZONE MONITOR

For a detailed description of the ozone monitor's operation, please refer to its respective manual.

Figure 5: Model 465L Mounting Hole Locations and Dimensions



ALL TOLERANCES ±0.05 UNLESS OTHERWISE STATED

Installation

- The ozone monitor should be wall mounted, using four stainless steel bolts (hole diameter is 0.32" (8.128mm); bolt size should be 5/16" (8mm)), with 1" ventilation clearance on sides, top, and bottom. (Figure 5 shows mounting diagram for NEMA 4X enclosure. Please contact TAPI Technical Support if any questions).
- Locate the monitor so that the digital readout is at eye level. The top of the monitor should be approximately at the same height as the top of the column, or approximately 70" from the floor. The horizontal distance between the monitor and the column should ideally be 5 feet.
- Wiring connections should be performed in accordance with the instructions provided in the ozone monitor's manual.
- Connect the Gas Sample Tube (supplied with the monitor) from the column at the Gas Sample Out fitting (refer to Figure 3), through the water dropout filter to the ozone monitor's inlet port (refer to the ozone monitor's manual). Use 1/4" Teflon OD tubing. Keep the length to a minimum, and ensure that the Water Dropout Filter is 12 inches below the ozone monitor.

Operation

(Please refer to the ozone monitor's manual for operational details)

Power on the analyzer via the AC voltage supply. This causes the pump to run, and a flow restrictor sets the gas flow.

OPERATING THE COMPLETE SYSTEM

When all connections have been made, the ozone monitor has been turned on (pump on), the water sample is flowing through the column (as described above), and the column Safety Siphon is filled with water, the level of water in the right arm of the siphon will be slightly lower than the left side due to the vacuum created by the air pump inside the ozone monitor. If the monitor pump is turned off (monitor disconnected from power source), the two sides should stabilize.

IMPORTANT: If you notice that the water level in the right arm of the siphon is going down, or if air bubbles are appearing in the left side of the siphon, power off the analyzer immediately: the transfer column is blocked. See troubleshooting section below.

Once the system is operating, perform the following test:

Cover the ambient air intake at the base of the ozone transfer column (this can be done by placing a finger over the intake hole).

The water level in the Safety Siphon should change immediately.

Uncover the air intake. The water level in the siphon should "bounce back".

If this does not occur, there is an air leak and all connections should be checked.

TROUBLESHOOTING THE COLUMN

If the water level in the Short Siphon Tube (right arm of the siphon) drops rapidly, and/or there are air bubbles in the Main Siphon Tube (left arm of the siphon), this is an indication of blockage of the Transfer Column which prevents air from entering the air intake port and instead air enters through the siphon.

Disconnect power to the analyzer immediately.

Blockage of the column can be caused by foam or debris. This can typically be cleared by blowing into the transfer column drain. If there is substantial debris, the column may have to be disassembled and cleaned.

During blockage of the Transfer Column it is possible for the Feed Tank water to rise above the level of the tank's Overflow Tube, thus creating a vacuum in the tank. To release the vacuum, temporarily open the relief plug at the top of the feed tank.

MAINTENANCE

(Note: Maintenance of the ozone monitor is discussed in its respective manual).

The Transfer Column does not typically require maintenance or cleaning. If the water quality is poor, it may be advisable to clean the column once per year or as needed. Use a cleaning solution as described in the section titled **Error! Reference source not found.**

Naturally, the column will not work properly if it is clogged. There are three through-holes inside the Ozone Collector, which allow the water from the Feed Tank to trickle down into the Transfer Column. These holes should always be free. An appropriately sized filter placed at the column's Water Sample Inlet will prevent large particles from entering the column and clogging it.

Safety Siphon

Over time, the water level in the siphon will be reduced by evaporation. Refill as needed.

Filters

Filters used at the Water Sample Inlet should be cleaned periodically. Replace as needed.

Deposits in the Water Transfer Column

If there is an accumulation of organic desposits in the Water Transfer Column, refer to the section on "0".

Water inside the Ozone Monitor

The column is designed to prevent water from entering the ozone monitor. However, should water droplets infiltrate the monitor, it will be necessary to service the monitor (contact TAPI Technical Support).

Cleaning Procedures

CAUTION: DO NOT RECONNECT WATER COLUMN TO MONITOR UNTIL ALL RESIDUALS ARE REMOVED FROM WATER COLUMN. FAILURE TO DO SO WILL CONTAMINATE CATALYSTS INSIDE THE MONITOR AND GIVE ERRONEOUS READINGS.

FLUSHING THE WATER COLUMN

Refer to Figure 3 for labeled parts while following these instructions.

1. Prepare cleaning solution of 50% bleach and 50% water.
2. Isolate Water Column from the ozone monitor by powering OFF the monitor and disconnecting water column fitting labeled GAS SAMPLE OUT TO MONITOR.
3. Disconnect fitting labeled WATER SAMPLE INLET and feed cleaning solution into Water Column.
4. Allow cleaning solution to drain from the water column fitting labeled DRAIN 1.
5. Apply either positive pressure to the WATER SAMPLE INLET or negative pressure at DRAIN to allow the cleaning solution to flow through the Water Column.

6. After Water Column is clean, flush Water Column thoroughly with clean water until any residual cleaning solution is removed. (If prescribed cleaning solution is ineffective, contact TAPI Technical Support for guidance on an alternative solution).
7. Reconnect all fittings.

DISASSEMBLING AND CLEANING THE WATER TRANSFER COLUMN

In most cases the Water Transfer Column does not require cleaning; however, if cleaning becomes necessary, it is very important to comply with the following notes and cautions:

NOTE: For barbed fittings, the tubing will need to be cut and therefore replaced, as they typically have no extra length.

CAUTION: AT ALL TIMES, KEEP THE TRANSFER COLUMN UPRIGHT AND INTACT WITH THE TRANSFER COLUMN BASE; WITHOUT THE BASE OR IF TIPPED, THE BEADS WILL FALL OUT AND INCUR MICROSCOPIC OR VISIBLE ABRASIONS AND ETCHINGS THAT RENDER THEM INEFFECTIVE; THEY WILL NEED TO BE REPLACED WITH NEW BEADS.

Refer to Figure 3 for labeled parts while following these instructions.

1. Power off the Ozone Monitor.
2. Prepare cleaning solution of 50% bleach and 50% water in a clean, rubber bucket free of debris.
3. Disconnect fittings from the Feed Tank and from the Ozone Collector.
4. Take Water Column assembly down by removing the 4 Mounting Bolts and allow Water Column to drain.
5. While holding the Water Column assembly upright remove hex screws on Back Plate from the Transfer Column Top Cover and the Ozone Collector.
6. Remove Feed Tank assembly while keeping the Transfer Column in place.
7. Hold the Transfer Column upright and **KEEP IT INTACT WITH THE TRANSFER COLUMN BASE** and pour beads into bucket with cleaning solution. Let soak. Clean the beads and thoroughly rinse them to remove any residual cleaning solution. (If prescribed cleaning solution is ineffective, contact TAPI Technical Support for guidance on an alternative solution). Let the beads dry.
8. Clean Transfer Column with cleaning solution and rinse thoroughly to ensure residual solution is removed.
9. Inspect drain holes in Ozone Collector, Transfer Column Base, and Drain Chamber Base for clogs. Unclog if necessary.
10. Flush all parts with clean water.
11. Inspect o-rings on each chamber and replace if degraded.
12. Reassemble Drain Chamber between Drain Chamber Base and Transfer Column Base.
13. Reconnect Drain Chamber Base to Mounting Plate.
14. Reassemble clean, empty Transfer Column with clean Transfer Column Base and keep the two intact through the remainder of this procedure.
15. Using an appropriate funnel, pour clean beads (or new pack of beads if necessary) into Transfer Column.
16. Finish reassembling Transfer Column/Base assembly with Ozone Collector and reattach to Mounting Plate.
17. Reinsert Feed Tank with its Overflow Tube into Ozone Collector and reattach Transfer Column Top Cover to Mounting Plate.
18. Reconnect all Fittings, replacing any tubing that had been cut from its barbed fitting.