



TELEDYNE API
Everywhereyoulook™



User Manual
Model W1
Dissolved Ozone Analyzer

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TRADEMARKS

All trademarks, registered trademarks, brand names or product names appearing in this document are the property of their respective owners and are used herein for identification purposes only.

SAFETY MESSAGES

Important safety messages are provided throughout this manual for the purpose of avoiding personal injury or instrument damage. Please read these messages carefully. Each safety message is associated with a safety alert symbol and is placed throughout this manual; the safety symbols are also located inside the instrument. It is imperative that you pay close attention to these messages, the descriptions of which are as follows:



WARNING: Electrical Shock Hazard



HAZARD: Strong oxidizer



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



CAUTION: Hot Surface Warning



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.



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



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

CAUTION



This product should only be used for the purpose and in the manner described in this manual. If you use this product in a manner other than that for which it was intended, unpredictable behavior could ensue with possible hazardous consequences.

NEVER use any combustible/explosive gas with this product!

For Technical Assistance regarding the use and maintenance of this instrument or any other Teledyne API product, contact Teledyne API's Technical Support Department:

Telephone: +1 800-324-5190
Email: api-techsupport@teledyne.com

or access any of the 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.

MISE EN GARDE



Cet produit doit être utilisé aux fins décrites et de la manière décrite dans ce manuel. Si vous utilisez cet produit d'une autre manière que celle pour laquelle il a été prévu, l'instrument pourrait se comporter de façon imprévisible et entraîner des conséquences dangereuses.

NE JAMAIS utiliser de gaz explosive ou combustible avec cet produit!

WARRANTY

WARRANTY POLICY (02024J)

Teledyne API (TAPI), a business unit of Teledyne Instruments, Inc., provides that:

Prior to shipment, TAPI equipment is thoroughly inspected and tested. Should equipment failure occur, TAPI assures its customers that prompt service and support will be available. (For the instrument-specific warranty period, please refer to the “Limited Warranty” section in the Terms and Conditions of Sale on our website at the following link: http://www.teledyne-api.com/terms_and_conditions.asp).

COVERAGE

After the warranty period and throughout the equipment lifetime, TAPI stands ready to provide on-site or in-plant service at reasonable rates similar to those of other manufacturers in the industry. All maintenance and the first level of field troubleshooting are to be performed by the customer.

NON-TAPI MANUFACTURED EQUIPMENT

Equipment provided but not manufactured by TAPI is warranted and will be repaired to the extent and according to the current terms and conditions of the respective equipment manufacturer’s warranty.

PRODUCT RETURN

All units or components returned to Teledyne API should be properly packed for handling and returned freight prepaid to the nearest designated Service Center. After the repair, the equipment will be returned, freight prepaid.

The complete Terms and Conditions of Sale can be reviewed at http://www.teledyne-api.com/terms_and_conditions.asp

CAUTION – Avoid Warranty Invalidation



Failure to comply with proper anti-Electro-Static Discharge (ESD) handling and packing instructions and Return Merchandise Authorization (RMA) procedures when returning parts for repair or calibration may void your warranty. For anti-ESD handling and packing instructions please refer to the manual, Fundamentals of ESD, PN 04786, in its “Packing Components for Return to Teledyne API’s Customer Service” section. The manual can be downloaded from our website at <http://www.teledyne-api.com>. RMA procedures can also be found on our website.

ABOUT THIS MANUAL

Note

We recommend that all users read this manual in its entirety before operating the instrument.

CONVENTIONS USED

In addition to the safety symbols as presented in the *Safety Messages* page, this manual provides *special notices* related to the careful and effective use of the instrument and related, pertinent information.

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY
This special notice provides information to avoid damage to your instrument and possibly invalidate the warranty.

Important

IMPACT ON READINGS OR DATA
Provides information about that which could either affect accuracy of instrument readings or cause loss of data.

Note

Provides information pertinent to the proper care, operation or maintenance of the instrument or its parts.

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1. INTRODUCTION, CAUTIONS, AND SPECIFICATIONS

The Teledyne API Model W1 is a single-point dissolved ozone measuring system consisting of a transfer column and an ozone monitor (see Figure 1). This system continuously and selectively measures the dissolved ozone in the liquid solvent (typically water) through a physical measurement method indicated in mass of ozone per unit volume of liquid in milligrams per liter. This method of measurement is known as the "Transfer Method" about which more information is offered in the Principles of Operation section of this manual.

Information and operation of the ozone monitor is contained in its respective manual.

Features of the W1 include:

- Excellent repeatability, reliability, and accuracy
- Highly stable optical system
- Selective to ozone - the UV absorption monitor will not "see" Cl₂, H₂O₂, or other oxidants. Bubbles do not cause interference.
- No consumables
- Low maintenance

1.1. CAUTIONS

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 personal injury or product damage due to improper handling.

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



HAZARD: Strong oxidizer. Ozone may be dangerous and harmful to humans. Take reasonable steps to avoid exposure. Look up and adhere to current guidelines for maximum exposure limit to ozone.



CAUTION: UV radiation can cause permanent eye damage. Never look directly at the UV lamp inside the monitor, without the correct eye protection.



WARNING: Electrical Shock Hazard. Components within the monitor are powered by AC voltage. Take all necessary precautions to eliminate the risk of electrical shocks.



CAUTION: Hot Surface Warning. Certain components may be hot to the touch. Please allow proper cooling time before working with these components.

1.2. SPECIFICATIONS

Table 1-1. Specifications

Parameter	Description
Measuring Principle	Transfer Method (transfer ozone from liquid to gas) followed by absolute determination by UV absorption
Measuring Ranges	0-1, 0-2 mg/L
Resolution	0.001 mg/L
Linearity	Better than 99% throughout range
Zero Drift	Better than 0.005 ppm per month, non cumulative
Alarms	
Standard Option	Two field programmable alarms accessible via MODBUS Serial or TCP Form C relay contacts (SPDT, 5A 250 VAC resistive)
Diagnostic Features	Continuous internal diagnostics with error messages and instrument error signal output
Analog Outputs	4-20 mA or 0-5 VDC standard
Communication Interface	RS-232 interface, MODBUS
Supply Voltage	100-240 VAC 50/60 Hz, Typical Power Consumption 74W
Water Flow Rate	1.0 LPM (Gravity fed)
Gas Flow Rate	1.0 LPM
Sample Port Connections	1/4" compression fittings (gas) 1/4" compression or 3/8" barb (water)
Environmental Operating Conditions	0-40 °C, 0-95% RH, non-condensing Installation Category (Over voltage Category) II Pollution Degree 2 Intended for Indoor Use Only at Altitudes ≤ 2000m
Dimensions HxWxD	39.0" x 15.0" x 4.0" (991 mm x 381 mm x 102 mm)
Weight	Transfer Column ~35 lbs (~16 kg)
(Additional specifications for the Model 480 monitor are in its manual).	

2. SYSTEM INSTALLATION

The transfer column and the monitor are wall mounted, as diagram shows in Figure 2-1. 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.

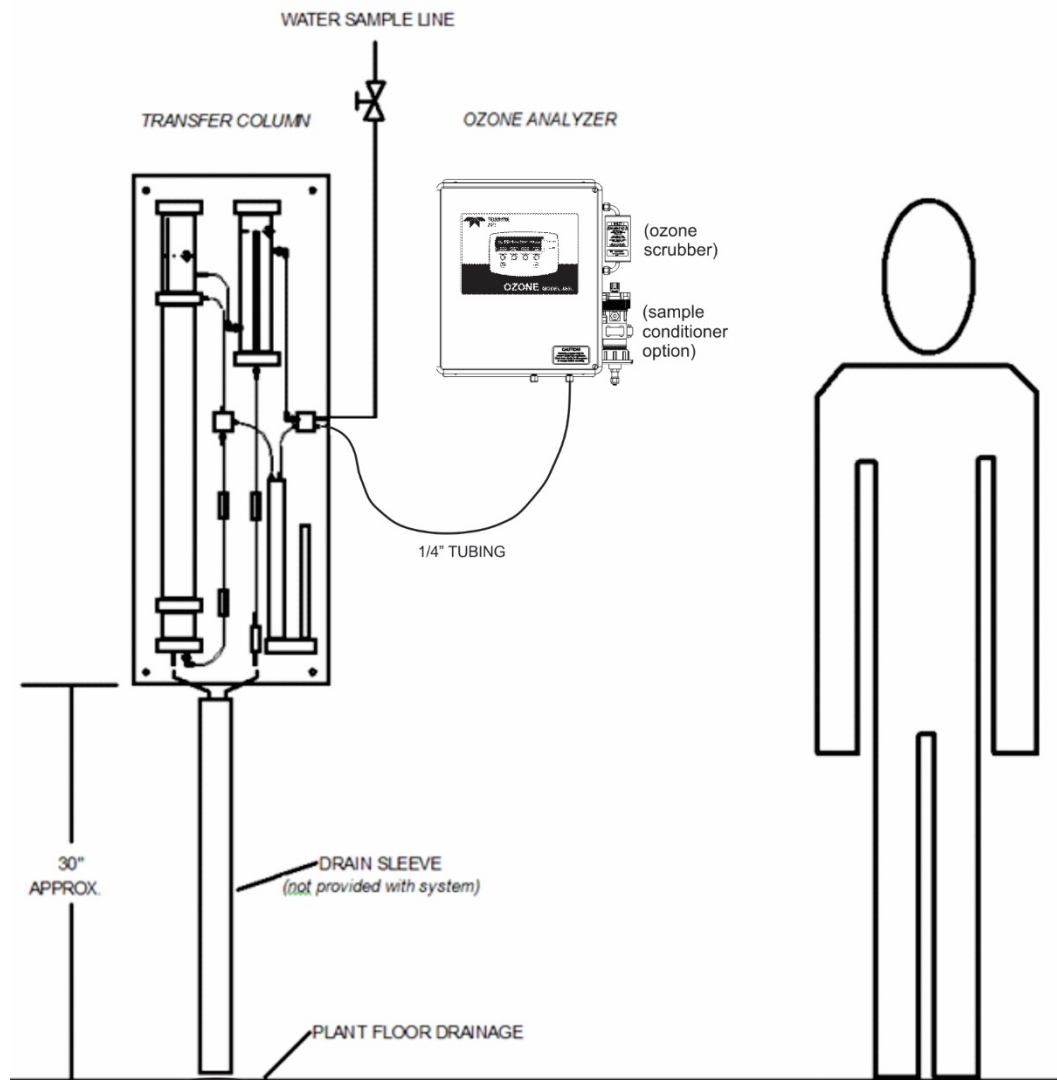


Figure 2-1. Water Transfer Column and Ozone Monitor Setup

2.1. EXTERNAL CONNECTION REQUIREMENTS

Please comply with the following notes:

Note

- **Use only materials that are resistant to dissolved ozone, such as Teflon™.**
- **Drain to atmosphere only.**
- **Do not drain to a pump.**
- **Avoid long tubing runs or loops.**
- **Avoid syphon effects.**

2.1.1. TRANSFER COLUMN EXTERNAL CONNECTIONS

The water transfer column requires the following:

- Water sample inlet from the water source (3/8" barb)
- Gas sample outlet to the ozone monitor (1/4" compression)
- Two (2) water sample drains, (3/8" barb)
- Drain sleeve for the sample drains to plant floor drain (not provided with product)
- One ambient air inlet (1/4" compression)

2.1.2. OZONE MONITOR EXTERNAL CONNECTIONS

The ozone monitor requires the following:

- 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

2.2. SITE PREPARATION

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

2.3. COLUMN INSTALLATION AND OPERATION

Column installation is illustrated in Figure 2-1, and mounting hole locations and dimensions are shown in Figure 2-2.

2.3.1. COLUMN INSTALLATION

The bottom edge of the column should be approximately 30" above the plant floor.

1. Wall mount the column vertically.
2. Connect the water sample supply to the Water Sample Inlet 3/8" barb or 1/4" compression fitting.
3. 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".
4. Fill the Safety Siphon with water by pouring water into the open tube until the level is approximately halfway up.

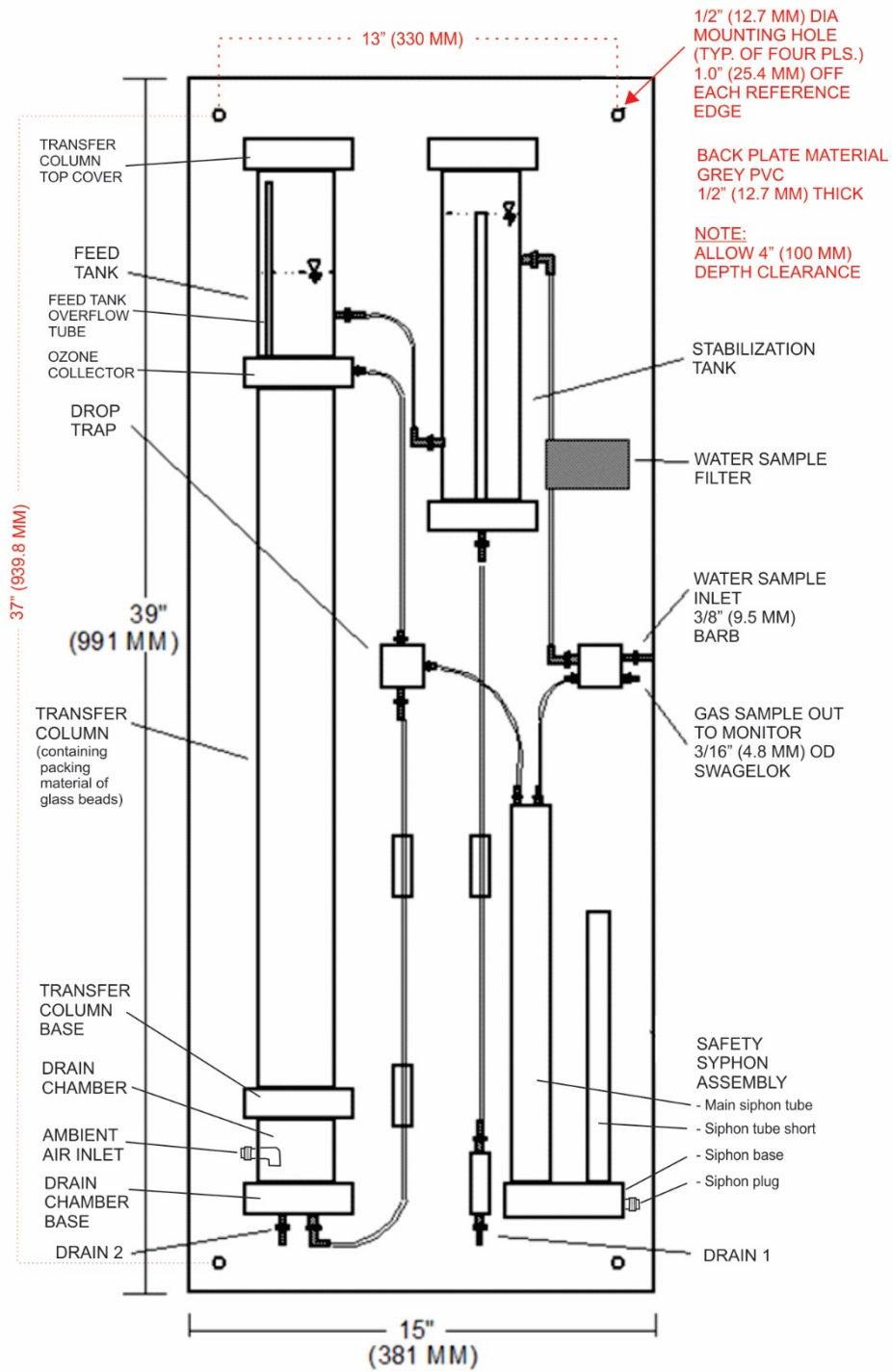


Figure 2-2. Water Transfer Column Mounting Hole Locations and Dimensions

2.3.2. COLUMN OPERATION

Operational flow of the column is illustrated in Figure 2-3.

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.

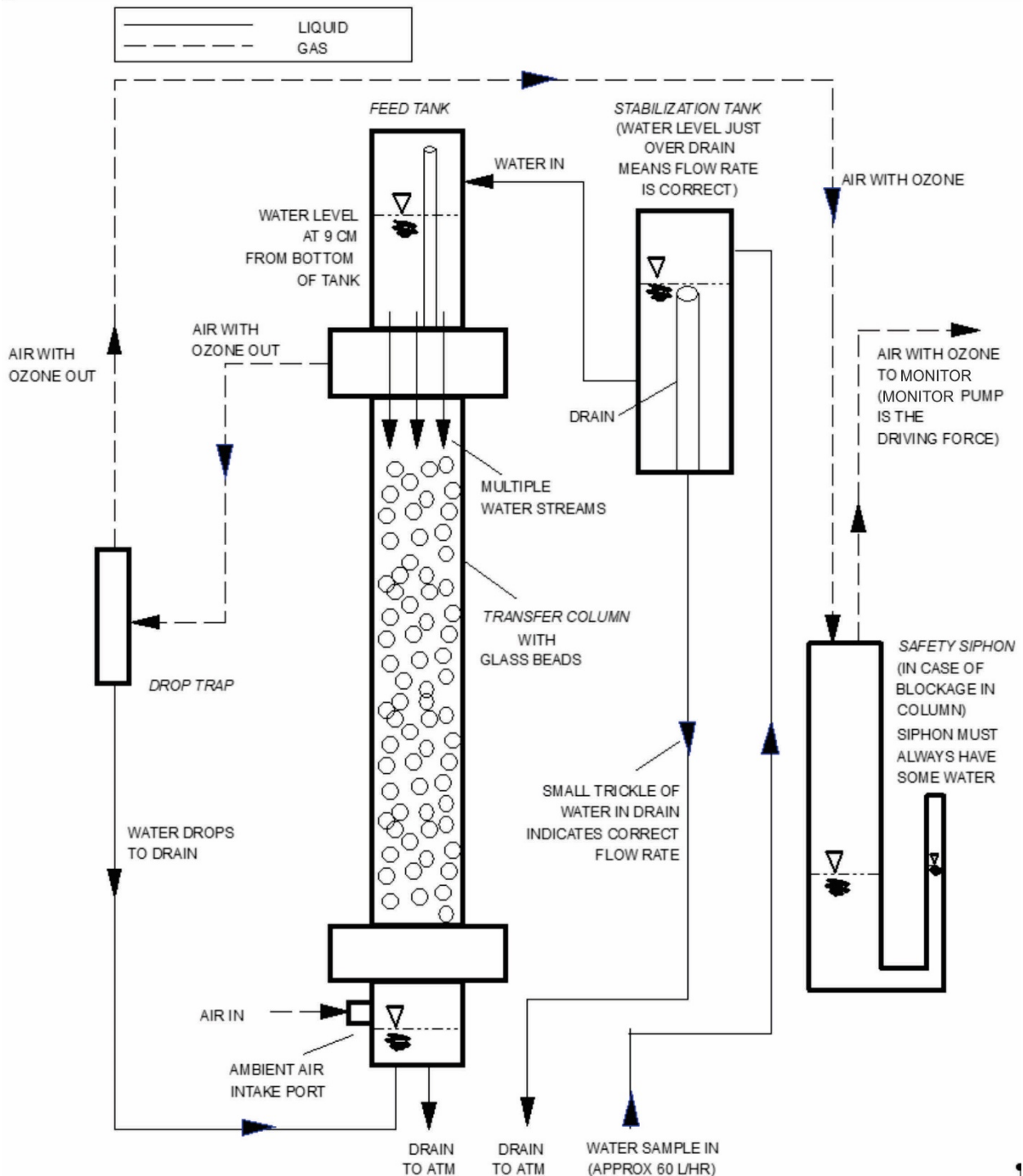


Figure 2-3. Water Transfer Column Gas and Liquid Flow Diagram

2.4. OZONE MONITOR INSTALLATION AND OPERATION

Ozone monitor installation is illustrated in Figure 2-1, and mounting hole locations and dimensions for NEMA 4X enclosure are shown in Figure 2-4.

2.4.1. OZONE MONITOR INSTALLATION

The ozone monitor should be wall mounted, with 1" ventilation clearance on sides, top, and bottom, ideally within 5 horizontal feet of the Column.

1. Use four stainless steel bolts size 5/16" (8mm). Hole diameter is 0.32" (8.128mm).
2. Place 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.
3. Make the wiring connections according to the ozone monitor's manual instructions.
4. Connect the Gas Sample Tube (supplied with the monitor) from the column at the Gas Sample Out fitting (refer to Figure 2-2) to the ozone monitor's inlet port (see Figure 2-1, and refer to the ozone monitor's manual).
 - Use 1/4" Teflon OD tubing.
 - Keep the length to a minimum.

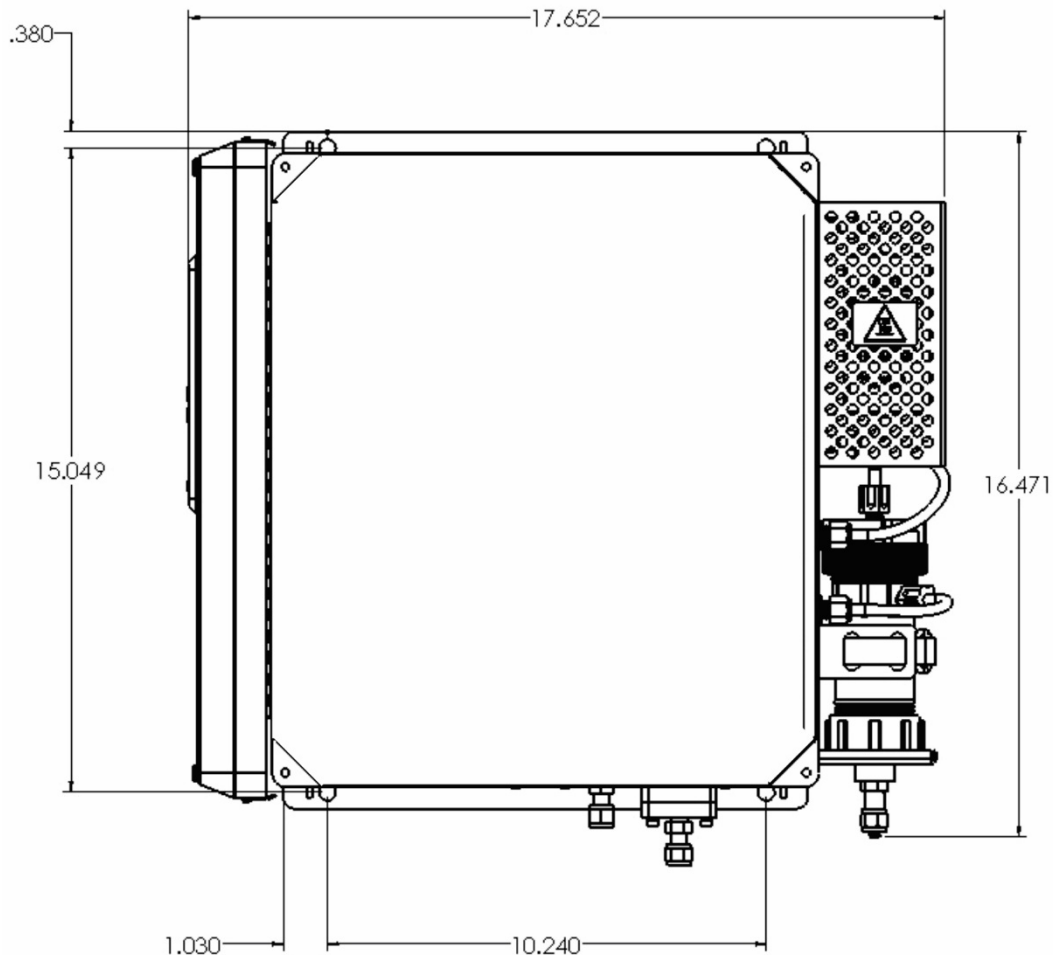


Figure 2-4. Ozone Monitor Mounting Hole Locations and Dimensions

2.4.2. OZONE MONITOR OPERATION

Refer to the ozone monitor's manual for operational details.

1. Power on the analyzer via the AC voltage supply.
2. Check that the pump is running.

A flow restrictor sets the gas flow.

3. SYSTEM OPERATION

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY
Immediately power off the analyzer if 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, which means that the transfer column is blocked. See Section 4.2.1 to troubleshoot.

When all connections have been made, and the ozone monitor has been powered on (pump on), the water sample is flowing through the column, 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.

Once the system is operating, perform the following test:

1. 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).
2. The water level in the Safety Siphon should change immediately.
3. 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.

4. COLUMN MAINTENANCE AND SERVICE

Maintenance of the ozone monitor is provided in its respective manual.

The Transfer Column does not typically require maintenance or cleaning. However, if the water quality is poor, it may be advisable to flush or clean the column once per year or as needed, using a cleaning solution as described in Section 4.4.

Other maintenance items include the safety siphon and filter (Table 4-1),

Table 4-1. Maintenance Schedule

ITEM	ACTION	FREQUENCY
Safety Siphon	refill	as needed per evaporation
Filters at water sample inlet	clean or replace	as needed per clogging or slow drainage (Section 4.2.2)
Water Column	flush or clean	as needed per cloudiness or organic deposits (Section 4.1)

4.1. CLEANING PROCEDURES

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY

Do not reconnect Water Column to monitor until all residuals are removed from the Water Column after flushing or cleaning. Failure to do so will contaminate catalysts inside the monitor and give erroneous readings.

4.1.1. FLUSHING THE WATER COLUMN

Refer to Figure 2-2 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.

4.1.2. DISASSEMBLING AND CLEANING THE WATER TRANSFER COLUMN

ATTENTION

COULD DAMAGE INSTRUMENT AND VOID WARRANTY

Keep the Water Column upright and intact with its base at all times! Without the base or if tipped, the beads will fall out and incur microscopic or visible abrasions and etchings that render them ineffective; they must be replaced with new beads.

Note

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

Refer to Figure 2-2 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.

4.2. TROUBLESHOOTING

Troubleshooting is rarely required, but this section covers possible occurrences.

4.2.1. RAPID DROP IN WATER LEVEL OR OCCURRENCE OF BUBBLES

Disconnect power to the analyzer immediately.

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.

- 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 (Section 4.1.2).
- Check for vacuum: 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.

4.2.2. CLOGGED COLUMN

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.

4.2.3. 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).

4.3. TECHNICAL ASSISTANCE

For spare parts, or if this manual and its troubleshooting & service section do not solve your problems, technical assistance may be obtained from:

Teledyne API Technical Support
9970 Carroll Canyon Road
San Diego, California 92131-1106 USA

Toll-free Phone: +1 800-324-5190

Phone: +1 858-657-9800

Fax: +1 858-657-9816

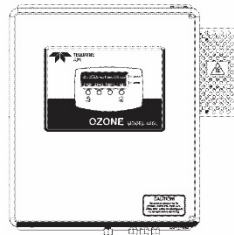
Email: api-techsupport@teledyne.com

Website: <http://www.teledyne-api.com/>

5. PRINCIPLES OF OPERATION

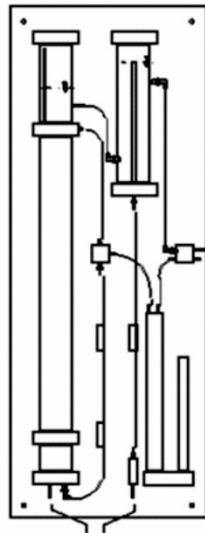
The Model W1 strips dissolved ozone out of solution and into gaseous phase by means of the stripping column, and the Model 480[X] measures the amount of ozone. This system is based on Henry's Law which states that there is a direct relationship between the ozone stripped out of the water and the dissolved ozone originally in the water: The amount of dissolved gas in a liquid is proportional to its pressure over the liquid. The monitor's microprocessor uses this relationship to exactly calculate the dissolved ozone concentration. 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.

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 5-1. Dissolved Ozone System