



EXPERTS IN WATER CHEMISTRY SINCE 1903



## **9165S Luminescent Dissolved Oxygen Smart Sensor User Manual**



## WALTRON CUSTOMER COMMITMENT

This instruction manual is a technical guide to aid the customer in the set-up, operation, and maintenance of their new Waltron measuring system. Waltron provides continuous product improvement and reserves the right to make any modifications to the information contained herein without notice.

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Technical questions concerning this product should be addressed to:

**Waltron Technical Service Department**  
Flemington, New Jersey  
**Phone:** (908)-534-5100  
**Fax:** (908)-534-5546  
[www.waltron.net](http://www.waltron.net)

Please be ready to provide the following information:

- Date Sensor was purchased
- Sensor model and serial number
- Recent maintenance history

Waltron's technical expertise and extensive experience provides personalized solutions to the water quality industry. It is Waltron's commitment to provide the customer with timely and accurate technical service and support.

Waltron fully expects the customer to be satisfied with the quality, performance, and cost of this product.

If there are any questions or concerns regarding this product, please feel free to contact Waltron at (908)-534-5100.

**Thank you for choosing Waltron!**

Please note the Waltron mailing and shipping address:

Waltron Bull & Roberts, LLC  
25 Minneakoning Road, Suite 101  
Flemington, NJ 08822



## SAFETY

Please observe proper safety and handling precautions when installing, operating, maintaining, and servicing this product. The following should be noted and adhered to:

- Read and understand manual before working with sensor.
- Pay special attention to warning labels on enclosures, containers, and packages.
- Only qualified personnel should be involved in the installation, operation, and servicing of the sensor.
- Follow safety precautions when operating sensor in conditions of high pressure and/or temperature.

To obtain analyzer safety information or Safety Data Sheets (SDS), please contact Waltron or visit the website at [www.waltron.net](http://www.waltron.net).



## WARRANTY AGREEMENT

If, within one year from the date of shipment, the customer experiences any equipment defects or is not satisfied with the manufacturing, Waltron will repair, or at its option, replace any defective part(s) free of charge. This warranty requires that the defective part(s) be returned to Waltron with shipping charges prepaid.

At Waltron discretion, a Technical Service Specialist may be sent out to repair or replace the defective part(s) on location. Traveling time and expenses of the Technical Service Specialist is at the customer's expense.

Equipment sent to Waltron must be appropriately packaged and the following information must be provided prior to returning to Waltron:

- The Return Authorization (RA) number assigned to the customer by the Waltron Technical Service Department
- Customer name, address and department
- Name and telephone number of the individual responsible for returning items for repair
- Brief problem description

### **Ship to Waltron service center:**

Waltron Bull & Roberts, LLC  
25 Minneakoning Road, Suite 101  
Flemington, NJ 08822

### **The Waltron Warranty Agreement:**

- Covers expendable sensors for one month after shipment and reusable electrodes for six months after shipment.
- Does not apply to damages occurred during shipping.
- Warranty will be nullified if goods have been used for purposes other than those for which they are intended or if any seal has been removed, broken or tampered with or if the Waltron trademark or serial number has been removed, defaced, or altered.
- Does not cover expendable supply items such as reagents, tubing and electrolytes.
- Does not cover misuse or mistreatment by the user.
- Does not cover previous repair or alteration by unauthorized individuals.

Waltron does not assume responsibility for contingent liability through alleged failure or failures of products or product accessories.

## CHECKLIST OF MATERIALS

- In order to ensure customer satisfaction, Waltron does its best to provide adequate and timely packaging and shipping services. Please perform the following after receiving a shipment:
- Inspect all shipping containers upon receipt and record any visible damage. If there are any outward signs of damage, please retain all containers and packages for inspection by carrier. Please retain all packing material so that it can be used for future moving and shipping needs.
- Check all items received against those on the packing list. Chemicals are usually shipped in a separate package and will be itemized accordingly.
- Verify that the number of packages received agrees with the packing list and shipping papers.
- Notify both Waltron and the carrier if any problems occur.

### **Important Notice:**

- All analyzers and sensors are inspected and tested prior to shipment.
- In normal use, the unit should require only minor maintenance and should operate correctly and without fault over a long period of time.
- Please note that if electronic components need to be replaced, it may be necessary to adjust and/or calibrate the analyzer.
- Failure to carry out correct maintenance procedures may result in inaccurate analyzer readings.



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## 1 OVERVIEW

### 1.1 TECHNICAL SPECIFICATIONS

#### 1.1.1 PERFORMANCE SPECIFICATIONS

|                           |                                               |
|---------------------------|-----------------------------------------------|
| <b>Range(s) Available</b> | 0-200ppb, 0-2000ppb, 0-45ppm                  |
| <b>Technology</b>         | Luminescent                                   |
| <b>Accuracy</b>           | +/- 0.6ppb at 1ppb / 2% of the measured value |
| <b>Sample Frequency</b>   | 30 seconds                                    |

#### 1.1.2 INPUT / OUPUT SPECIFICATIONS

|                       |                                            |
|-----------------------|--------------------------------------------|
| <b>Power</b>          | 12-24V DC, 1.5W, Optional AC Power Adapter |
| <b>Analog Outputs</b> | (1) 4-20mA current output (sink)           |

#### 1.1.3 SAMPLE DELIVERY & OPERATING CONDITIONS SPECIFICATIONS

|                             |                              |
|-----------------------------|------------------------------|
| <b>Sample Medium</b>        | Liquid                       |
| <b>Sample Flowrate</b>      | 10-500 ml/min                |
| <b>Sample Temperature</b>   | 23 – 131°F (-5 – 55°C)       |
| <b>Sample Pressure</b>      | Maximum of 145 psig (10 bar) |
| <b>Sample Interferences</b> | None                         |
| <b>Sample Connections</b>   | 1/4" OD Tubing (Swagelok)    |
| <b>Outlet Sample</b>        | Ambient pressure             |
| <b>Ambient Temperature</b>  | 32 – 131°F (0 – 55°C)        |

#### 1.1.4 MECHANICAL SPECIFICATIONS

|                                         |                                                                |
|-----------------------------------------|----------------------------------------------------------------|
| <b>Construction / Finish</b>            | Stainless Steel / Corrosion Resistant                          |
| <b>Materials in Contact with Sample</b> | Stainless Steel                                                |
| <b>Mounting</b>                         | Wall Mount                                                     |
| <b>Dimensions</b>                       | Height = 11" (280mm); Width = 5" (127mm); Depth = 5.3" (135mm) |
| <b>Weight</b>                           | 4.9lbs (2.2kg)                                                 |
| <b>Degree of Protection</b>             | IP67 connections                                               |
| <b>Distance</b>                         | 3m (9.8ft), 5m (16.4ft), 10m (32.8ft)                          |

#### 1.1.5 ADDITIONAL SPECIFICATIONS

|                       |                                  |
|-----------------------|----------------------------------|
| <b>Calibration</b>    | Yearly (sensor exchange program) |
| <b>User Interface</b> | Optional Panel Monitor           |

## 1.2 INTENDED USE

The Waltron 9165S Dissolved Oxygen Smart Sensor utilizes luminescent technology for measuring dissolved oxygen in water at ppb levels. Luminescent technology has unique features and benefits compared to traditional dissolved oxygen sensing technologies. The 9165S provides high accuracy with excellent long-term stability. The 9165S Dissolved Oxygen Smart Sensor can be used in a variety of online analysis applications throughout many different industries.

The 9165S must be connected to a sample line. The connections to the flowcell are ¼" (6mm) Swagelok fittings. The dissolved oxygen must be measured in a full, flowing sample line. Using the sensor in a pipe that is not full or taking the measurement while the product is not flowing will cause errors or will it cause damage to the device.

### Features:

- Luminescent DO Sensor Spot Technology
  - Benefit: Maintenance Free (no membranes or electrolyte)
- Extremely Fast Response
  - Benefit: Reliable readings after a unit start-up within minutes
- No Sample Interference
  - Benefit: Reliable readings in changing conditions (load, temperature, flow, pressure)
- Factory Sensor Exchange Program
  - Benefit: Zero Downtime & Zero Maintenance
- Compact Design
  - Benefit: Simple Installation
- Simple Operation
  - Benefit: Connect to any external device via 4-20mA

## 1.3 SAFETY

### 1.3.1 SYMBOLS

The symbols 'Note:', 'Warning!' and 'Danger' used in this instruction manual have the following meanings.

---

**NOTE:**

Instructions for the correct and effective use of the instrument.

---

---

**WARNING!**

Incorrect or careless use may cause serious damage to the instrument.

---



Incorrect or careless use may place the user or the surroundings in **DANGER**.

---

### 1.3.2 PRECAUTIONARY MEASURES AND SAFETY INSTRUCTIONS

---

**WARNING!**

To avoid a short circuit, never insert metal objects into the connector.

The use of chlorite-based or fluorine-based cleaning products is not permitted. These may cause damage to the instrument.

---



Ensure that the pipe is not pressurized and that the instrument is disconnected from the power supply during assembly and disassembly. This will prevent electric shocks.

---



During CIP/cleaning, the outside of the instrument may become hot. The sensor will turn itself off automatically when the inside of the sensor reaches a temperature of 65°C. Do not touch the outside of the instrument.

---

## 2 INTRODUCTION

### 2.1 ANALYZER OVERVIEW

The 9165S has two main sections:

1. Sensor Housing
2. Flow Cell

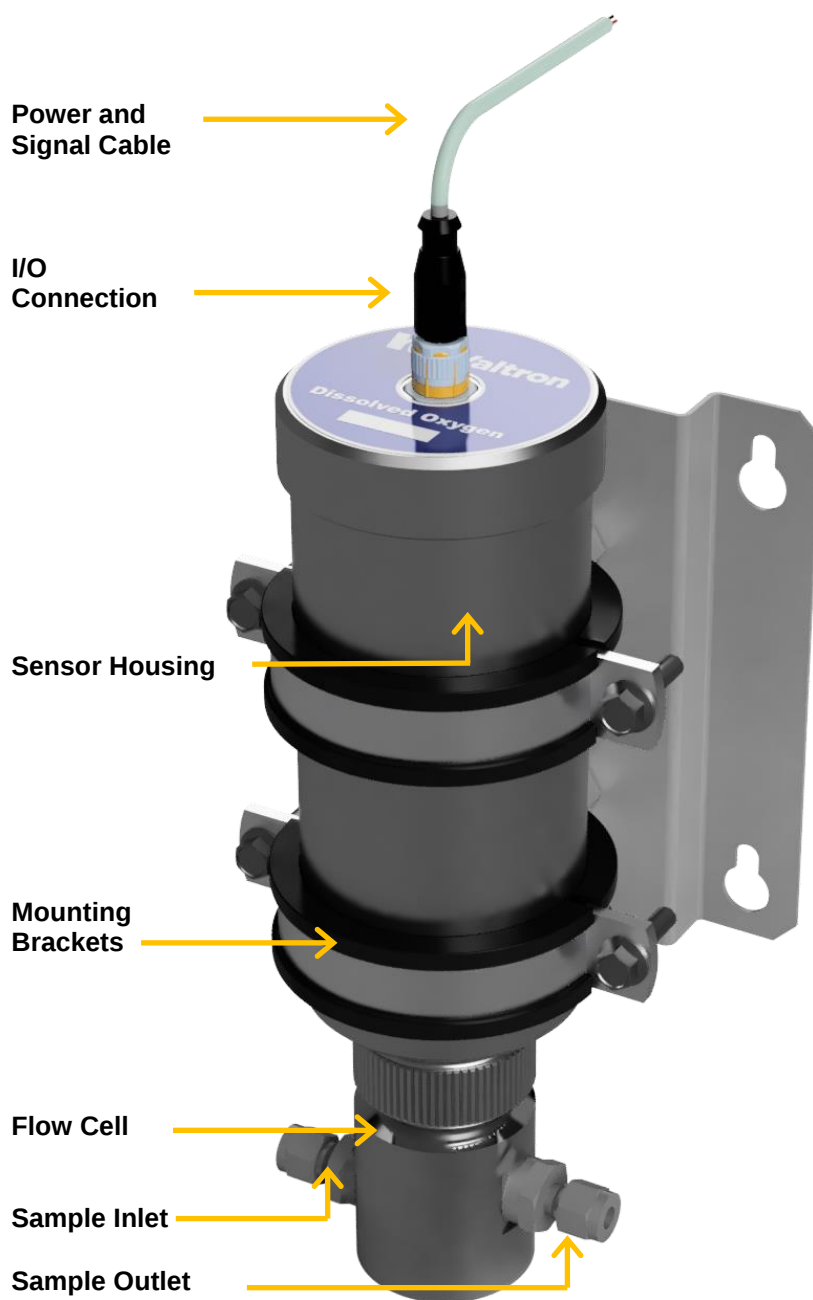
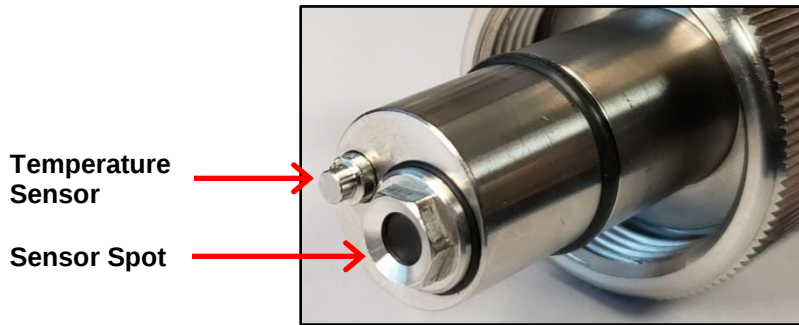


Figure 2.1: Sensor overview.

## 2.2 SENSOR

The bottom of the sensor housing provides the location of the sensor spot, shown in the figure below.



**Figure 2.2: Sensor head.**

## 2.3 SENSOR SPOT

The 9165S Sensor Spot is recognizable by its hexagonal shape.



**Figure 2.3: 9165S Sensor Spot.**

## 2.4 O<sub>2</sub> MEASUREMENT PRINCIPLE

The O<sub>2</sub> measurement is based on measuring the luminescence of a layer that is sensitive to oxygen. The luminescence changes according to the partial pressure of oxygen. The quantity of dissolved oxygen gas in the liquid is calculated with the aid of the measured partial pressure of oxygen and the temperature.

The oxygen sensor optically measures the liquid's O<sub>2</sub> content based on the luminescence measurement principle, where an oxygen-sensitive layer is exposed to blue light. As a result, molecules in the oxygen-sensitive layer are excited.

In the absence of oxygen, the molecules light up red. In the presence of oxygen, the oxygen molecules collide with the molecules in the oxygen-sensitive layer. The molecules that collide with oxygen no longer light up. Through this process, a link is created between the oxygen concentration and both the light intensity and the speed at which the light intensity is reduced. The light intensity reduces when the oxygen concentration is higher, whilst the light intensity reduces at a faster speed.

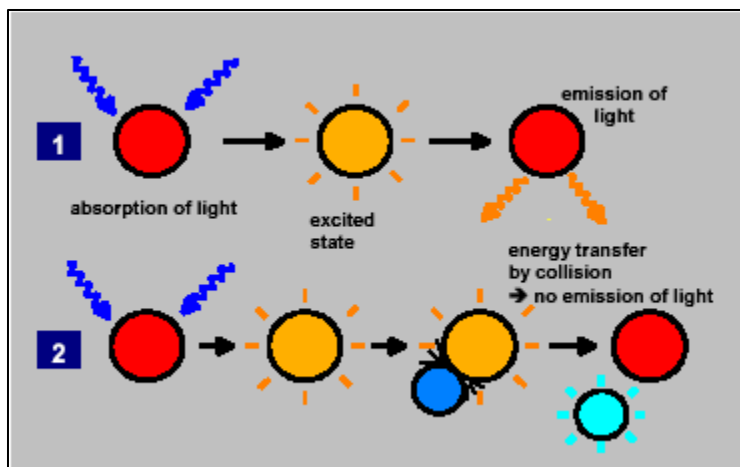


Figure 2.4: Luminescence in the absence of oxygen (1) and in the presence of oxygen (2).

The oxygen content is calculated using the time difference between the exposure to the blue light and the molecules lighting up (phase shift) and the product temperature.

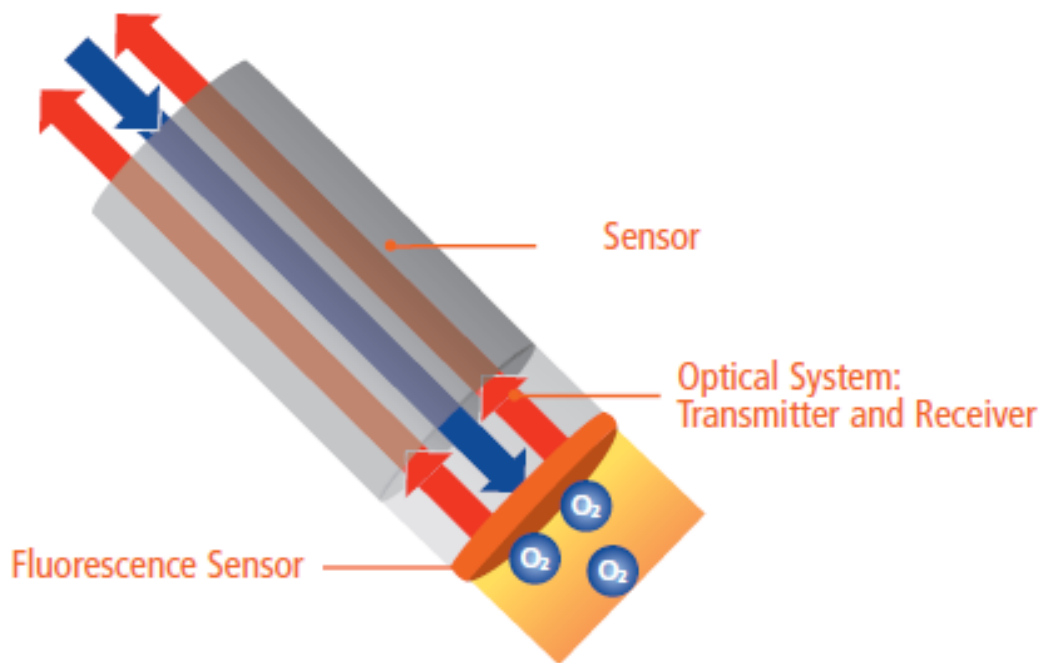


Figure 2.5: Optical sensor depiction.

## 3 INSTALLATION

### 3.1 DELIVERED CONTENT

The 9165S is calibrated, configured and tested by Waltron before shipment and the instrument is, therefore, ready for immediate use. It is not necessary to calibrate the instrument again before it is used for the first time.

Check whether the delivery is complete and undamaged. If the delivery is incomplete or damaged, contact Waltron or the Waltron representative in your region immediately (see [www.waltron.net](http://www.waltron.net)). Always state the serial number, the order number or the invoice number (as given by Waltron) of the 9165S in all correspondence.

---

**NOTE:**

Before using the instrument, you must make sure the instrument is complete and no parts are missing.

---

The delivery includes:

- Sensor with flow cell
- Mounting plate
- DC Power and Data cable
- Instruction manual

Optional extras that can be ordered:

- AC Power and Data Cable
- Panel Monitor Display
- Additional cable lengths

See section 10 for a complete list of spare parts and components.

### 3.2 PRE-INSTALLATION

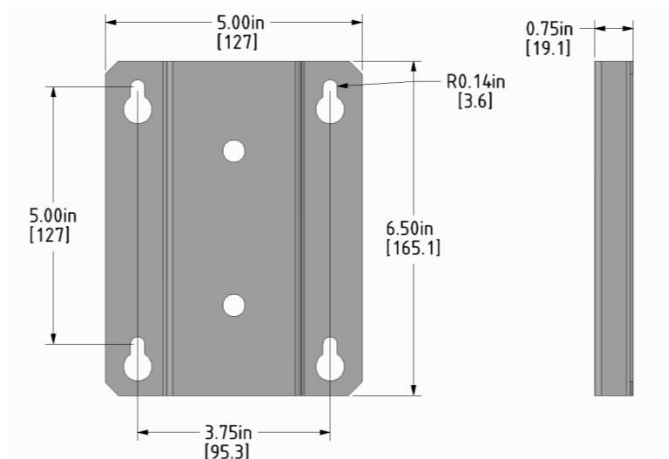


Make sure the 9165S is not connected to a sampling point that produces pressures or pressure peaks greater than 10 bar.

---

### 3.3 MOUNTING THE 9165S

The 9165S can be mounted on a wall or a flat surface using the dimensions shown in the figure below.



**Figure 3.1: Dimensions of the 9165S mounting plate for wall mounting.**

### 3.4 ASSEMBLING THE SENSOR

The sensor housing and flow cell come fully assembled to the mounting plate. The figure below shows how the sensor properly fits into the flowcell. It is important that the sensor spot is always the first to be in contact with the flowing product.



**Figure 3.2: Fitting the sensor into the flowcell.**



Figure 3.3: Sensor orientation relative to flow direction.

### 3.5 SAMPLE CONNECTIONS

The inlet and outlet sample connections to the flowcell are ¼" Swagelok fittings. It is highly recommended to use stainless steel tubing for the sample lines to prevent outside oxygen from entering the sample stream.

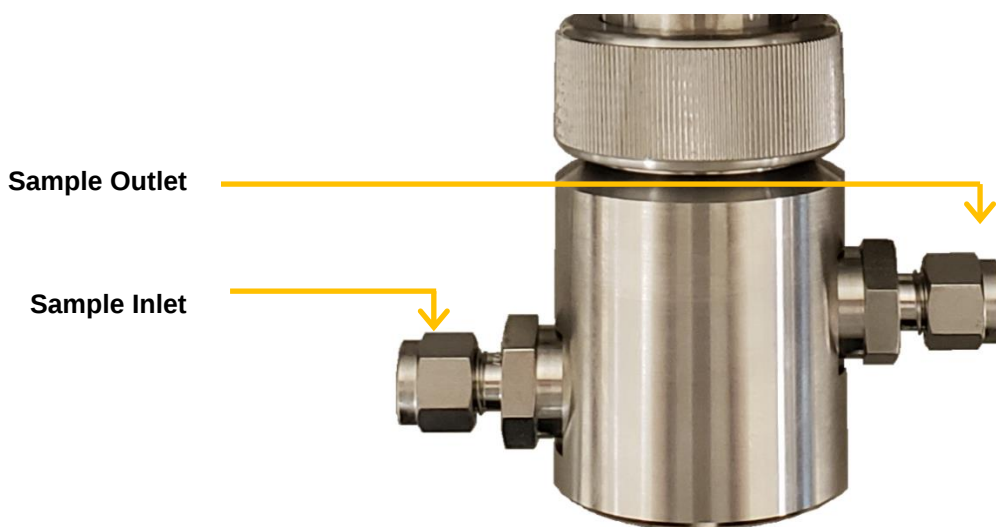


Figure 3.4: Sample Connections.

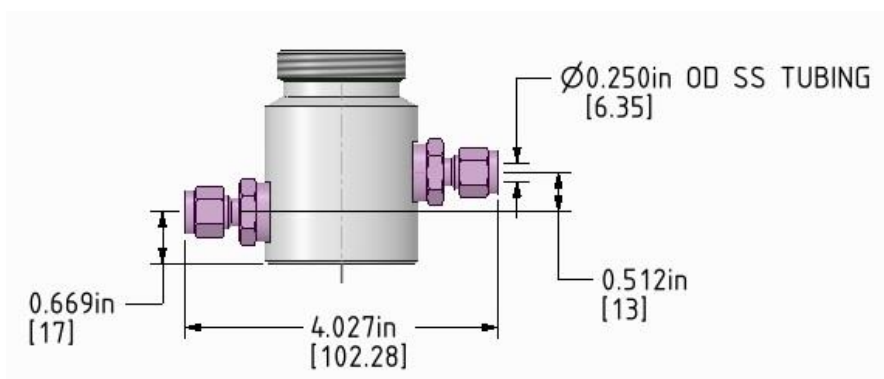


Figure 3.5: Sample Connection Dimensions.

## 3.6 ELECTRICAL CONNECTIONS

### 3.6.1 POWER AND COMMUNICATION CABLE

**Table 3.1: Connector 1: Power connection to 12 - 24V DC.**

| Type     | Wire color | Pin |
|----------|------------|-----|
| Live     | Gray       | 5   |
| Neutral  | White      | 2   |
| Analog + | Blue       | 3   |
| Analog - | Violet     | 7   |

**Table 3.2: Connector 2: (Optional) Power supply cable: 100V – 240V AC.**

| Type     | Wire color |
|----------|------------|
| + 12 VDC | Wall Plug  |
| Analog + | Blue       |
| Analog - | Violet     |

---

**WARNING!**

Incorrect wiring of voltage source will cause damage to the sensor and require repair not covered by warranty. It is highly recommended that colors and pins on the power and signal cable be double checked prior to plugging in.

---

---

**NOTE:**

The 9165S provides a powered analog signal through the Analog + (Blue) Wire. Analog - (Violet) acts as a current sink to achieve the output signal. Signal reading and capture devices connected to this current loop must not share common connections with other loops.

---

## 3.7 PREPARATION AND START-UP

Power can be supplied to the sensor after all the cables have been connected. The 9165S will initialize automatically once the power is turned on.

---



Hard materials, such as woodchips and/or grindings, may damage the 9165S measuring head.

---

## 4 SENSOR INTERFACE

### 4.1 CONFIGURATION

The 9165S can be configured into three ranges:

- 0 - 200 PPB
- 0 - 2,000 PPB
- 0-45 PPM

### 4.2 SIGNAL

The sensor will come preconfigured, at point of order, to the desired output range. This range will be represented by a signal ranging from 4 mA to 20 mA to be read by an external device.

**Table 4.1: Ranges and Signal.**

| 5% Scale | 0-200 ppb | 0-2000 ppb | 0-45 ppm | Signal |
|----------|-----------|------------|----------|--------|
|          |           |            |          |        |
| 0%       | 0         | 0          | 0        | 4 mA   |
| 25%      | 50        | 500        | 11.25    | 8 mA   |
| 50%      | 100       | 1000       | 22.5     | 12 mA  |
| 75%      | 150       | 1500       | 33.75    | 16 mA  |
| 100%     | 200       | 2000       | 45       | 20 mA  |

---

## 5 OPERATION

### 5.1 GENERAL INFORMATION

Prior to using the 9165S for online measurement, be sure that all installation and start-up procedures have been properly followed.

### 5.2 MEASUREMENT

Once connected to power, the 9165S will begin online measurement. The measurement frequency is fixed to 30 seconds. Every 30 seconds the light source will pulse, taking a new dissolved oxygen measurement. Simultaneously, the 4-20mA current output will be updated to the corresponding value. The current output will hold its value for 30 seconds at which time the next dissolved oxygen reading will be taken and the 4-20mA current output will be updated.



## 6 CALIBRATION

### 6.1 CALIBRATION OF THE SENSOR

The 9165S is calibrated at the factory and no additional calibration is required prior to use.

### 6.2 CALIBRATION FREQUENCY

It is recommended that the sensor be recalibrated after 1 million exposures. With the default sample time (1 measurement/30 seconds), the sensor must be recalibrated once a year, assuming that the sensor is in operation 24 hours a day, seven days a week. The sensor must be returned to Waltron for calibration.

### 6.3 SENSOR EXCHANGE PROGRAM

Participation in the sensor exchange program is the recommended procedure for calibrating the 9165S sensor. Once enrolled, Waltron will ship a fully refurbished sensor (new sensor spot, calibrated, calibration certificate). Once the new sensor is installed in place of the existing sensor, the old sensor is returned to Waltron in the provided packaging.

For sensor calibration services or exchange, please contact Waltron or visit the website at [www.waltron.net](http://www.waltron.net).

## 7 MAINTENANCE

### 7.1 CLEANING

Only use water (or water with a detergent) to clean the sensor.

---

**Warning!**

Never use tools to clean the sensor coating. Touching the coating may cause serious damage to the instrument.

---

Recommended cleaning products:

- Alkaline cleaner with an NaOH or KOH base.
  - ( $\leq 95^{\circ}\text{C}$ ,  $\leq 5\%$  NaOH or KOH)
- Acid cleaner with an  $\text{HNO}_3$  or  $\text{H}_3\text{PO}_4$  base.
  - ( $\leq 60^{\circ}\text{C}$ ,  $\leq 3\%$   $\text{HNO}_3$  or  $\text{H}_3\text{PO}_4$ )

---

**NOTE:**

Maintenance must be carried out by personnel who are familiar with the applicable maintenance regulations.

---



Wear suitable protection against chemicals and pay special attention to hot cleaning agents.

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## 8 DEACTIVATING AND STORAGE

### 8.1 DEACTIVATING

If the 9165S is no longer used, the components must be sent to an appropriate waste disposal organization or the entire unit can be returned to Waltron. The materials from which the main components are made are stainless steel, electrical components, and POM.

### 8.2 STORAGE

The instrument must be stored in a dry location and be protected against mechanical and/or chemical damage. If the 9165S is not going to be used for a long time, the instrument must be thoroughly rinsed with water to clean it. The instrument must then be emptied, flushed with air and dried.

The 9165S must be completely empty (dry) when it is stored away.

## 9 TROUBLESHOOTING

| Problem                        | Cause                                    | Solution                                                                     |
|--------------------------------|------------------------------------------|------------------------------------------------------------------------------|
| 4-20mA current output is zero  | The power supply has not been connected. | Connect the power supply.                                                    |
| 4-20mA current output is 20mA  | The sensor is reading over-range.        | Check flowcell for air bubbles and allow more time for sensor to rinse-down. |
| 4-20mA current output is 0.5mA | Sensor is in error mode.                 | Return sensor to Waltron for evaluation.                                     |

## 10 SPARE PARTS AND SERVICES

If you order spare parts or require exchange services after one year, we kindly request you to include all the information given below.

- Serial number of the 9165S
- Description
- Part number

**Table 8.1: Spare Parts and Service Listing.**

| Description                                     | Part No.   |
|-------------------------------------------------|------------|
| 9165S DC Power and Signal Cable, 3m             | K5002-019  |
| 9165S DC Power and Signal Cable, 5m             | K5002-020  |
| 9165S DC Power and Signal Cable, 10m            | K5002-021  |
| 9165S Signal Cable with AC Adapter, 3m          | K5002-022  |
| 9165S Signal Cable with AC Adapter, 5m          | K5002-023  |
| 9165S Signal Cable with AC Adapter, 10m         | K5002-024  |
| Sensor Exchange Services for Annual Calibration | K5000-001R |
| Flowcell with Sample Fittings                   | K5000-103  |
| LDO Sensor Bracket                              | K5000-008A |
| LDO Sensor Mounting Plate                       | K5000-034  |

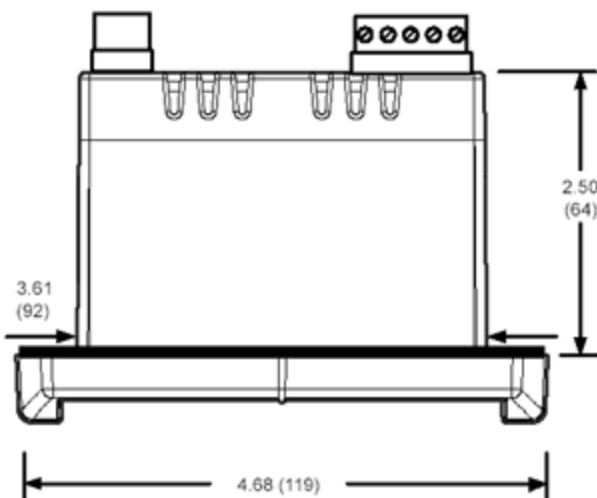
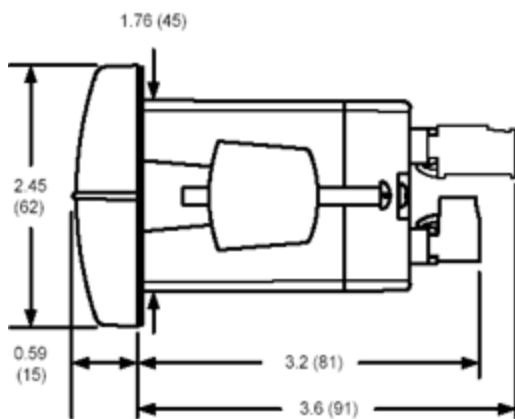
## 11 APPENDIX A: PANEL MONITOR CONNECTIONS

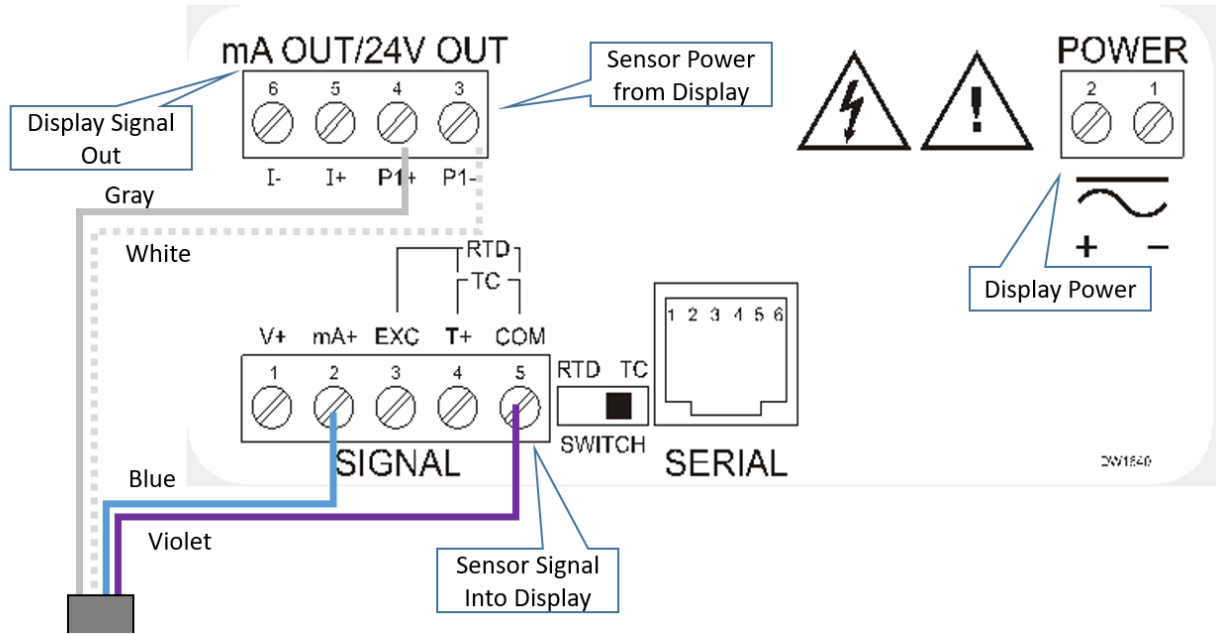
The 9165S Smart Sensor can be connected to an external panel monitor that can function as a power supply and readout of the 4-20mA current output.

Precision Digital PD765-6X3-10



Units: Inch (mm)





| Type     | Wire color | PD765         |
|----------|------------|---------------|
| Live     | Gray       | P1+           |
| Neutral  | White      | P1-           |
| Analog + | Blue       | Signal 2 mA + |
| Analog - | Violet     | Signal 5 COM  |