

# DATA Sheet

## Parts Per Million Dissolved Oxygen Systems



Model 900  
Portable Analyzers



Model 9100  
Analyzer



Model 9200  
Analyzer



Model 9300  
Analyzer

The Royce line of PPM level dissolved oxygen (DO) analyzers is the largest, most varied line in the world. Features like microprocessor-based intelligent electronics, with a choice of rugged, patented self-cleaning sensors, or maintenance free disposable cartridge sensors, make the totally waterproof Royce line of portable PPM DO analyzers the best available - anywhere.

The **MODEL 900** Portable Analyzer offers features like single button calibration, self diagnostics, analog and digital communications outputs and many more features never before considered in a portable analyzer. Built for the rugged, wet environment of the conservationist, aquaculturist, and industrial operator - the Model 900 is setting a new standard for portable electronic analysis.

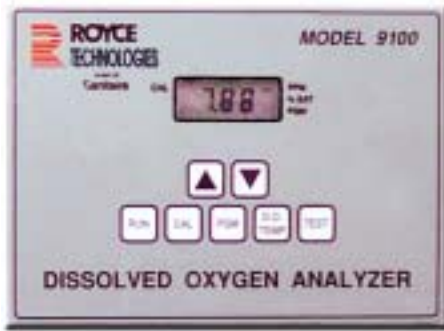
Ideal for continuous DO monitoring where economy is a primary criteria, The **Model 9100** is priced to offer a user friendly, reliable analyzer that fits any budget. Although the price is low, and its operation is simple, the Model 9100 is of the quality that DO monitoring customers have come to expect from Royce Technologies. This economic system, which uses the field proven **Model 95A** or **Model 99** DO sensors, offers standard features such as sensor / analyzer self diagnostics, a readout in PPM or % saturation, and programmable setpoint relays - all included in the lowest priced rugged DO analyzer available.

The **Model 9200** Continuous DO analyzer provides the ultimate level of monitoring accuracy and aeration control available anywhere in the world. The analyzer is provided standard with everything available on the Model 9100. It also offers menu directing setup and trend graphing on the display, simultaneous DO and temperature readout on the display, standard automatic sensor membrane self-cleaning, digital AND analog outputs, a sensor output voltage mode, and four programmable setpoint relays. Used with the **Model 96A** DO sensor, the Model 9200 has become the benchmark analyzer for the DO monitoring & blower control market in the 21st century.

The **Model 9300 Sensor Buoy System** is designed for large pond or lagoon aeration systems where dissolved oxygen monitoring and control is required but the sensor cannot be readily reached for maintenance. With features like programmable totally hands free automatic recalibration and long-term sensor self-cleaning, normal maintenance time for this system is around one year. There are almost 3000 of these systems in use around the world.

Both the Model 9100/95A & Model 9200/96A systems, completed the 2002 Instrument Testing Association's (ITA) comparative DO test with outstanding results. Test results are available. Contact Royce Technologies for more information.

Model 9100  
Single-Channel  
Analyzer



**Features**

- Microprocessor based electronics
- Range 0 - 99.9 PPM and % Saturation 0 - 99.9%
- Readings to 1/100 PPM up to 10 PPM
- One step, push button calibration
- Two methods of calibration are standard
- Automatic temperature, Altitude, salinity compensation
- Electronic self-diagnostics
- Isolated 4 - 20 mA or 0 - 20 mA
- Digital serial output available
- 2 programmable relays

**Specifications**

**Dissolved Oxygen:**

Ranges, 0 - 99.9 mg/l (PPM)  
0 - 100% Saturation  
Resolution, 0.01 mg/l  
1% Saturation  
Accuracy,  $\pm$  0.1 mg/l or 1% Saturation

**Temperature - Selectable:**

0 - 50°C x .1°C or  
23 - 122°F x 1°F  
Accuracy,  $\pm$  0.2°C  
Compensation, +/- 1% of reading

**Stability:**

.1mg/l

**Input Power:**

Switch selectable 115/230 VAC, 50/60 Hz  
Or 24 VDC

**Readout Device:**

Harsh environment, one-half inch LCD digital display

**Outputs:**

One Isolated Analog Output for Temperature  
One Isolated Analog Output for DO  
Either: Isolated 4 - 20 mA or 0 - 20 mA driving 600 ohms Max.

or one RS-485 digital, isolated  
2 Standard setpoint relays with programmable hysteresis  
Form C rated 250 VAC at 6 Amps resistive

**Calibration:**

Automatic, one step push button calibrates for DO, altitude, salinity

**Enclosure:**

NEMA 4X (IP65)

**Weight:**

6 lbs., 2.75 kgm

[Mounting Information on Page 8](#)

Model 9200  
Single-Channel  
Analyzer



**Features**

- Microprocessor based electronics
- Range 0 - 99.9 PPM and % Saturation 0 - 99.9%
- Simple calibration with "help screen" prompts
- Automatic temperature, Altitude, salinity compensation
- Individual DO and temperature outputs
- 4 programmable relays
- One step, push button calibration
- Electronic self diagnostics for sensor and analyzer
- Electrochemical self cleaning sensor - Standard
- Standard 24 hour trend graph
- Backlight display

**Specifications**

**Dissolved Oxygen:**

Ranges, 0 - 99.9 mg/l (PPM)  
0 - 100% Saturation  
Resolution, 0.01 mg/l  
1% Saturation  
Accuracy,  $\pm$  0.1 mg/l or 1% Saturation

**Temperature - Selectable:**

0 - 50°C x .1°C or  
23 - 122°F x 1°F  
Accuracy, +/- 0.2°C  
Compensation,  $\pm$  1% of reading

**Stability:**

.1mg/l

**Input Power:**

Switch selectable 115/230 VAC, 50/60 Hz

**Readout Device:**

Harsh environment, 2.5" x 4.5" graphical LCD digital display

**Outputs:**

One Isolated 4 - 20 mA Output for DO  
One Isolated 4 - 20 mA Output for Temperature  
One RS-485 digital, isolated  
4 Standard setpoint relays with programmable hysteresis  
All relays are Form C rated 250 VAC at 6 Amps resistive

**Display:**

DO, temperature, relay status, trend graph and programming menus

**Calibration:**

Automatic, one step push button calibrates for DO, altitude, salinity

**Enclosure:**

NEMA 4X (IP65)

**Weight:**

[Mounting Information on Page 8](#)

# Model 9300 Sensor Buoy System Maintenance Free Dissolved Oxygen Control System



## Features

- Sensor cleaned automatically for up to 12 months
- Sensor automatically calibrated daily
- Automatic control of aerators, alarms and other devices - Up to four outputs
- A backlit display provides both DO and temperature readings

- Self-diagnosing electronics with automatic built in buoy test protocols
- 16 - day data logging
- Sensing buoy utilizes only 2 moving parts which are completely sealed
- Buoy utilizes a unique guard system against the intake of solids

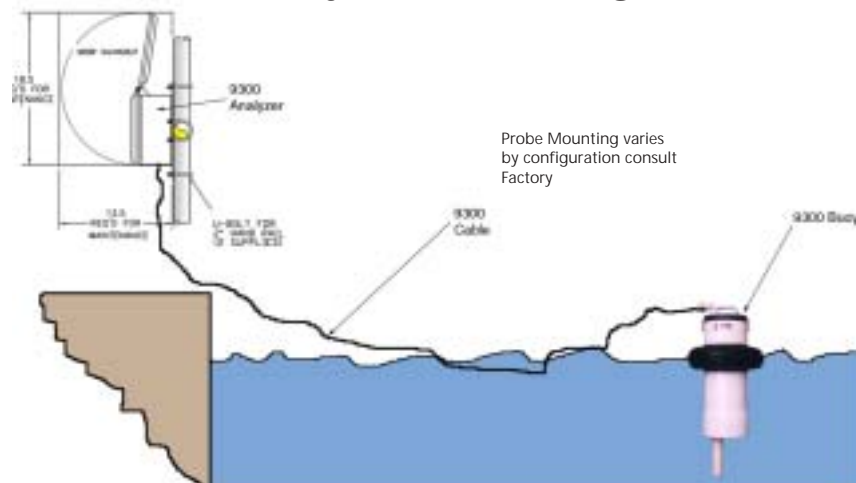
Over 8 years of research in the field led to the development of the Royce Sensor Buoy System. Originally designed for large wastewater and fish growing lagoons where DO sensing devices could not be easily reached for maintenance. In use since 1992, there are now over 2500 of these systems operating throughout the world.

Controller, which is mounted on the lagoon or aeration basin handrail. Automatic sensor recalibration occurs once per day, at a time that is programmed into the controller by the user.

The system is made up of the **Model 9300** Buoy Control Monitor and the Sensing Buoy that incorporates the proven Royce **Model 95A** galvanic DO sensor. Automatic sensor cleaning is a chemical process that occurs once every 12 minutes, all controlled from the Model 9300

The System's Sensing Buoy is made from rugged schedule 80 PVC and can be either floated away from a lagoon bank or hard mounted from the handrails of an aeration basin. The only moving parts inside the buoy are two small DC powered pumps that move water through a unique polymer manifold during the sampling and calibration processes. Service of the buoy system is minimal, usually required only once per year.

## Buoy Rail Mounting



# Model 900 Portable PPM Dissolved Oxygen System



## Model 900 Specific Features

- Reads in PPM DO, temperature, % saturation
- Rugged enclosure and sensor
- Two choices of sensors
- Accessories for various field and lab applications

The Royce Model 900 Portable Dissolved Oxygen (DO) Measuring System is a rugged waterproof instrument designed for the rigors of remote sampling. The system includes a choice of two rugged sensors - the **Model 95A** rechargeable sensor or the **Model 99** disposable cartridge sensor

Utilizing full microprocessor controlled electronics, the **Model 900** is quickly programmed by the user for conditions (salinity, partial pressure, etc.) specific to his application. From that time on - all functions are single button action.

Recalibration of the sensor is a single keystroke of the instrument and should not be required more than once per week. A complete recharge of the **Model 95A** sensor is no more than a 5 minute operation and should not be required sooner than every 3 to 6 months - if the system is used properly. The **Model 99** disposable sensor cartridge should last at least 1 year before replacement is necessary.

## Model 900 System Specifications

### Dissolved Oxygen Autoranging:

Ranges, 0.00 - 99.9 mg/l (PPM) x 0.01 PPM to  
10.0 to 99.9 mg/l (PPM) x 0.1 PPM or  
1 - 100% Saturation x 1% Sat.

### Temperature - Selectable:

0 - 50°C x .1°C or  
23 - 122°F x 1°F  
Accuracy, ± 0.2°C  
Compensation, ± 1% of reading

### Display:

Harsh environment, 1/2" LCD digital display

### Stability:

.1mg/l

### Repeatability:

± 1% (at constant temperature)

### Sensor Response Time:

99% of actual in less than 30 seconds

### Sample Flow Requirements:

Less than .4 ft/sec with 1 mil membrane

### Outputs:

0 - 1 VDC, adjustable  
RS-232 Serial digital interface

### Weight:

3.4 lbs., 1.55 kgm

## Supplied Standard with Model 900 Systems,

with Model 95 Sensor, **Part #59748**

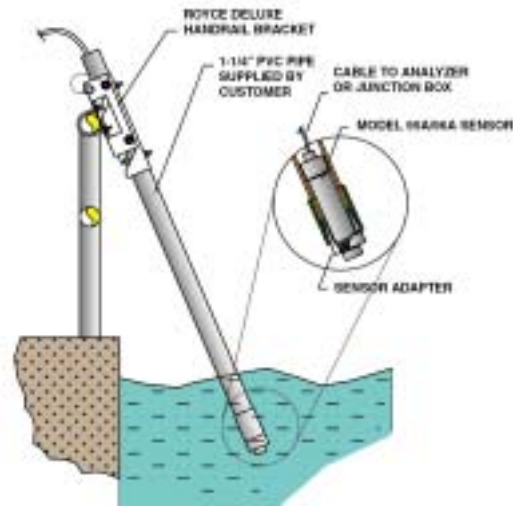
with Model 99 Sensor, **Part #58132**

- Model 900 rugged DO/Temperature analyzer
- Sensor of choice will have a 15' cable and waterproof military connector
- Membrane Protection Cap
- Flexible sensor storage cap
- Waterproof cap for output connector
- Nylon "grip strap" which converts to a handy belt holder
- One dozen 1 mil Teflon\* membranes in a hard storage case (95A sensor only)
- 16 ounces of potassium chloride electrolyte (95A sensor only)
- 9V battery
- Detailed Instruction manual

## Optional Accessories and Equipment

- Flexible zippered waterproof nylon carry bag with webbed nylon handle, separate protective pocket for manual, **Part #59381**
- Model 95 Sensor adaptor for 2" T flow cell mounting, **Part #59377**
- Model 95 Sensor collar adaptor kit for ground water monitoring insertion assemblies, **Part #59378**
- Model 95 Epoxy flow cell with 1/4" stainless steel connections, **Part #54532**
- Output cable assembly with waterproof connector, **Part #59396**
- 24 - 2 mil Teflon\* membranes for Model 95A sensor, **Part #59252**
- 24 - 1 mil Teflon\* membranes for Model 95A sensor **Part #59251**
- Model 99 replaceable cartridge, 1 mil membrane, **Part #59842**
- Model 99 replaceable cartridge, 2 mil membrane, **Part #59843**

## Series 90 DO Sensors



### Features

- Rugged noncorrosive construction
- Platinum cathode, lead anode
- Automatic temperature compensating
- Can be easily rebuilt in the field
- No special tools required
- Simple positive membrane replacement
- Patented electrochemical self-cleaning available (Model 96A only)
- Jet-cleaning available

### Specifications

**Cathode Type and Material:** Galvanic - Platinum

**Anode Material:** Coiled lead wire

**Electrolyte:** Potassium Chloride gel

**Repeatability:**  $\pm 1\%$  (at constant temperature)

**Response Time:** Using 1 mil membrane - PPM  
99% of actual, from air calibration  
< 30 seconds

**Temperature Accuracy:**  $\pm .2^{\circ}\text{C}$

**Sample Flow Requirements:** 0.4 feet per second  
with 1 mil membrane

**Repeatability:**  $\pm 1\%$  (at constant temperature)

The Royce **Models 95A** and **96A** Sensors are the latest sensor developments in the field of continuous DO monitoring and control. The small silhouette, but rugged construction of the Models 95A/96A create a unique sensor for the rough applications found in the wastewater treatment, ground water, aquaculture, and oceanographic industries. Both sensors contain precision internal circuitry and use the proven galvanic method of measurement.

The **Model 96A** Sensor is unique in that it incorporates a dual cathode, dual anode system which gives it the ability to perform the Royce patented, electrochemical self cleaning function when used in conjunction with the **Model 9200** Analyzer. The response time and stability of this sensor are so good that it is the very same DO sensor used with the Royce Parts Per Billion DO Measuring Systems (Bulletin #PPB). This rapid response time capability makes the **Model 96A** the DO Sensor of choice for oceanographic profiling applications.

The **Model 95A** is a rugged rechargeable sensor that comes supplied with membranes and KCL gel

solution with a system purchase that should last for five years with normal use. The **Model 99** offers the convenience of a maintenance-free disposable sensor cartridge.

The **Model 95A** and **99A** Sensors were specifically developed for the **Model 9100** continuous monitoring analyzer and the **Model 900** portable Analyzer. The sensors incorporate all of the features of the **Model 96A** except they do not have the dual cathode, dual anode configuration to accommodate electrochemical self-cleaning.

The trim, reliable mounting bracket assembly employed with the Royce line of Series 90 DO Sensors is simple to install and allows for easy access to the sensor for quick maintenance. A narrow profile sensor/collar arrangement allows for a standard PVC pipe installation from any standard rail. This configuration dramatically reduces the potential of rag fouling. For those users that feel that the "floating ball" sensors provide an adequate monitoring platform, the Royce **Model 95A** and **99A** Sensors will easily adapt to that configuration.

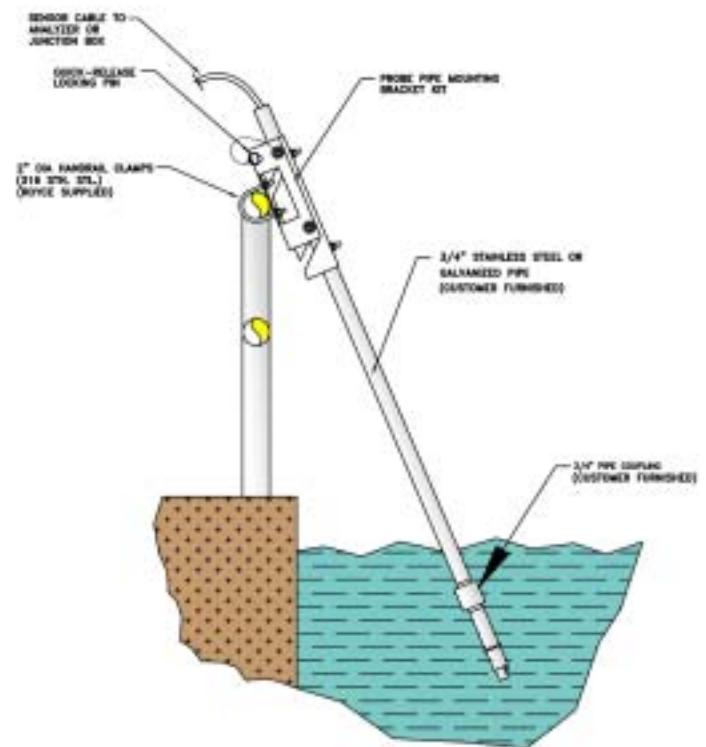
## Model 99 Replaceable Cartridge DO Sensor



Model 99 Cartridge Dissolved Oxygen Sensor

### Sensor Mounting

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### Features

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- Economical initial price
- Rugged Noncorrosive construction
- Long lived cartridge
- Galvanic in operation
- Temperature compensated
- 1 or 2 mil membranes available
- Jet-cleaning available

The **Model 99** replaceable Dissolved Oxygen Cartridge was specifically designed to answer the needs of plants which did not want to recharge sensors. It utilizes the same proven technology and basic design criteria found in all the Royce sensors. Rugged, easy to use, quick changing and with all the accuracy and reliability users have come to trust in Royce Technologies.

### Sensor Specifications

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**Cathode Type and Material:** Galvanic -  
Platinum

**Anode Material:** Coiled lead wire

**Electrolyte:** Potassium Chloride gel

**Repeatability:**  $\pm 1\%$  (at constant temperature)

**Response Time:** Using 1 mil membrane - PPM  
99% of actual, from air calibration in 60 seconds

**Temperature Accuracy:**  $\pm .2^{\circ} \text{C}$

**Sample Flow Requirements:** 0.4 feet per second with 1 mil membrane

**Dimensions:** 1.2" Dia. x 5.8" long

**Weight:** (w/25 cable) .5 lbs., 22 kgm

### Spares

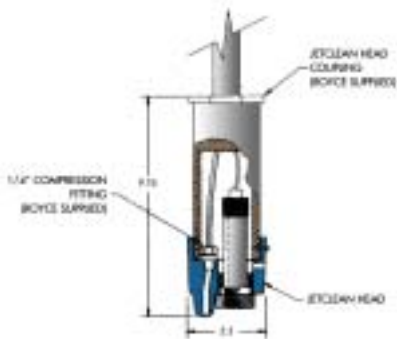
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- 1 Mil Sensor Cartridge - #59842
- 2 Mil Sensor Cartridge - #59843
- Backshell with 25' Cable - #54730

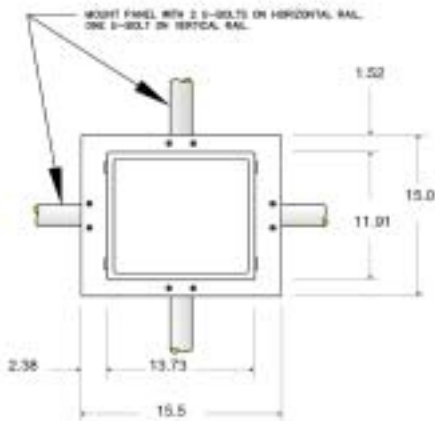
## "Jet Clean" Sensor Membrane Cleaning System

The Royce **Jet-Clean** sensor **Cleaning System** is designed for the purpose of cleaning the DO membrane which may be soiled by organic, inorganic, or biological debris. The system can be configured in two ways, (1) for plants with house air or water (minimum pressure must be 30 psi), a simple solenoid can be used to supply a periodic high pressure wash stream across the electrode measuring surface; or (2) a miniature industrial, rail mounted, compressor system can be supplied that will periodically supply 65 psi of air across the membrane surface. No matter which method of cleaning is used all Royce DO analyzers are programmed to allow the user to adjust their preferred cleaning cycle time. The DO sensor is mounted in a molded epoxy "jet head" which is contoured in order not to collect rags or other debris.

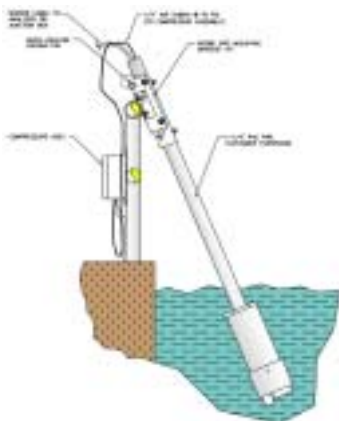
### Jet Head Sensor Assembly



### Compressor Outline & Mounting



### Sensor Mounting



### Compressor Specifications

**Type:** Air Compressor, Light, Noncontinuous duty  
**Pressure supplied:** 40 to 60 PSIG  
**Temperature Limits:** 0 to 50°C  
**Enclosure:** NEMA 4X, 14"W x 12"H x 6"D  
**Input Power:** 115/230 VAC, 60/50 Hz  
**Weight:** 23 pounds (10,4 kgms)  
 26 pounds (11.8 kgms) with rail kit  
**Options:** Heater (Recommended for -10°C)  
 Rail Mounting Kit

### Additional Features and Options

#### ROYCE Electrochemical Sensor Cleaning

A unique Royce patent used for the automatic self cleaning of the DO sensor membrane. On a timed basis, programmed into the Model 9200 analyzer by the operator, the sensor membrane, discouraging growth on the membrane. This process will allow for up to six months, depending upon the sensors environment, of maintenance free operation. This is a standard feature of the Model 9200 analyzer. The Model 96A sensor is required.

#### Model RDC-92 Remote Display Junction Box

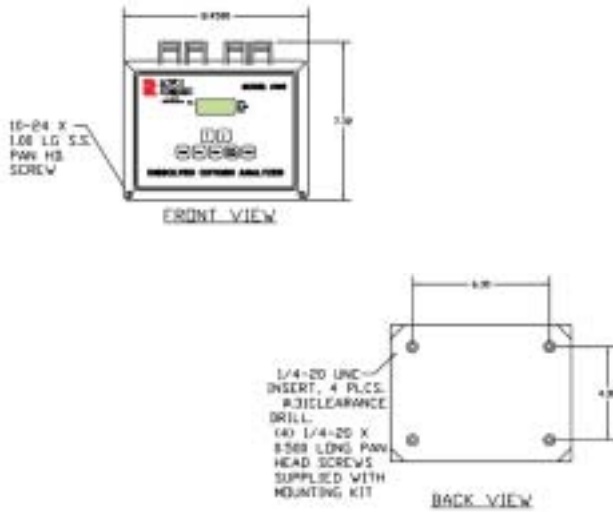
The Model RDC-92 is a NEMA 4X fiberglass junction box that is mounted on the rail at the same location as the DO sensor when the Model 9200 Analyzer is to be mounted away from the sensor. The RDC-92 incorporates a 1/2 inch harsh environment LCD digital display for visual monitoring and an air calibration button so calibration can be performed away from the parent analyzer. Power for the junction box is supplied by the parent instrument. Temperature limitation for the junction box is -40 to 85°C.

#### Time Delay Control

In applications where the simple "set point relay" method of aeration control is inappropriate, the Model 9200 analyzer relays may be programmed to "pulse" at predetermined intervals when setpoints are exceeded. This is often used with positional control systems for weirs, gates, etc. It is a standard feature on the Model 9200 analyzer.

## Model 9100 Mounting Information

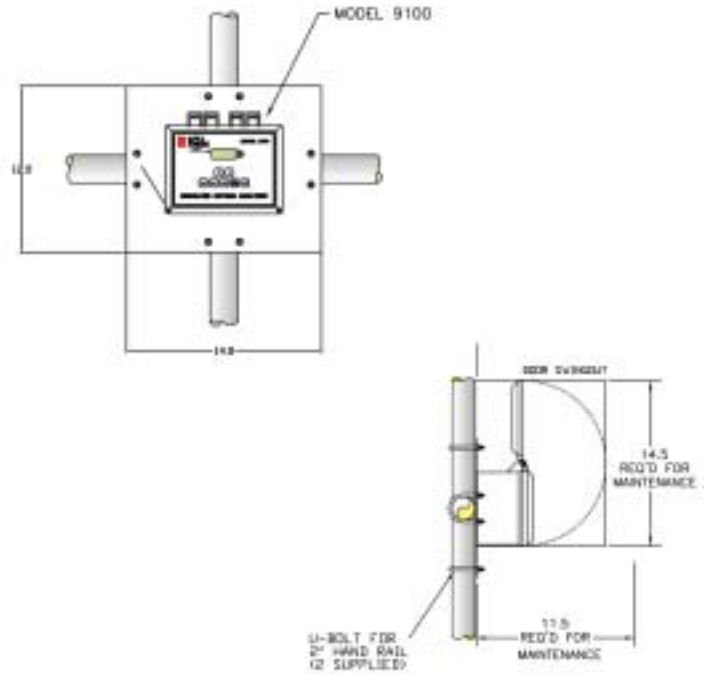
### Analyzer Dimensions



**NOTES:**

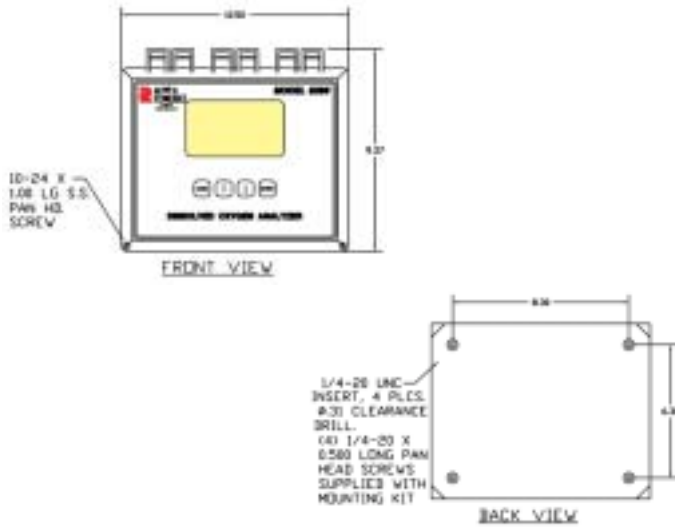
1. CONSTRUCTION: POLYCARBONATE NEMA 4X ENCLASURE MOUNTED ON 125° ALUMINUM PANEL
2. APPROXIMATE WEIGHT: 12 LBS.

### Rail Mounting



## Model 9200 Mounting Information

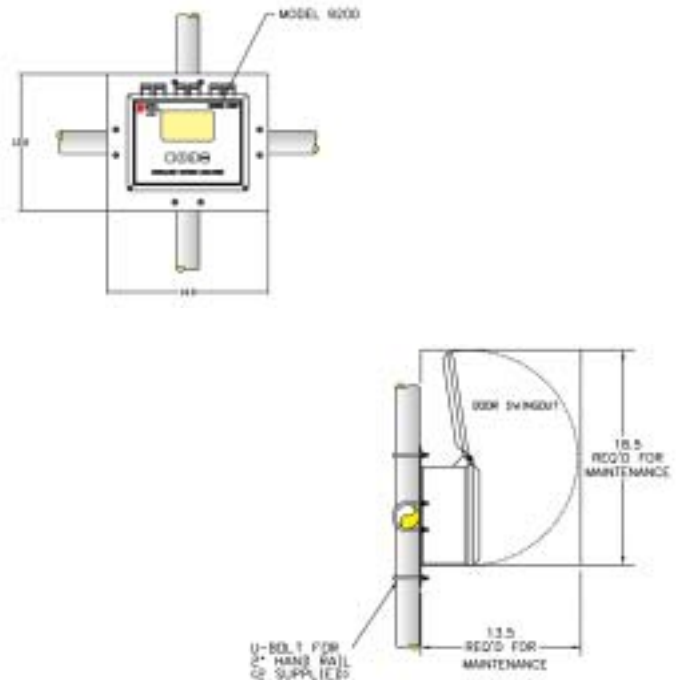
### Analyzer Dimensions



**NOTES:**

1. CONSTRUCTION: POLYCARBONATE NEMA 4X ENCLASURE MOUNTED ON 125° ALUMINUM PANEL
2. APPROXIMATE WEIGHT: 12 LBS.

### Rail Mounting



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