



**RP-1000  
RESIDUAL CHLORINE ANALYZER**

***INSTALLATION & OPERATION  
MANUAL***

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Eagle Microsystems, Inc.  
366 Circle of Progress  
Pottstown, PA 19464  
Phone: 610-323-2250  
Fax: 610-323-0114  
[www.eaglemicrosystems.com](http://www.eaglemicrosystems.com)

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## I. INTRODUCTION

The RP-1000 Residual Analyzer/Controller is an amperometric instrument designed to continuously analyze residual levels of free or total chlorine, utilizing an amperometric membrane type electrode assembly.

## II. SPECIFICATIONS

Power Supply	115/230 VAC Switch selectable.
Power Consumption	12W
Display	LCD, backlit, 16 characters by 2 lines, 5mm character height, 5x8 character matrix.
Pushbuttons	Four, tactile dome.
Relays	High residual, low residual, and two spares Mechanical (AC or DC), Rating (standard) 1.2A, 125VAC resistive or optional 5A @ 250VAC
Cell	Platinum cathode/silver-coated anode
Temperature	Thermister 10kohms @ 25C, Beta=4100
Analog Output	Isolated, 4 to 20mA, 500ohm drive. Represents CL <sub>2</sub> residual
Digital Output	20mA Serial (transmits to remote computer)
Instrument Range:	Free – 0.5, 2.0, 10.0, & 20.0 ppm Total – 0.5, 2.0, 5.0, & 10.0 ppm
Sample Flow:	500 cc/minute: 5 psig maximum
Sample Supply:	Continuous. Where sample interruption may be required; provisions must be made to keep the electrodes wet with fresh water.
Analyzer Location:	As close as possible to the sample point to reduce lag time.
Speed of Response:	4 Seconds from sample entry to display indication. Full scale residual change 1-1/2 to 2 minutes.
Ambient Temperature Range:	35 degrees to 120 degrees F (2 degrees to 50 degrees C)
Sample Temperature Range:	41 degrees to 139 degrees F (5 degrees to 45 degrees C)

Sample Limitations:: Samples containing high concentrations of metal ions or certain corrosion inhibitors may affect analyzer operation.

Accuracy: +/- 2% of selected range

Electronics Enclosure: NEMA 4X

Reagent Requirements:

### III. PRINCIPAL OF OPERATION

#### A. GENERAL

A sample of liquid is delivered to the cell chamber at an approximate rate of 500 cc/minute. This rate is regulated by adjustment of the sample inlet valve upstream of the sample rotameter. The excess overflows to drain.

The sample then passes over the surface of the cell membrane and a direct current is generated in direct linear proportion to the amount of chemical present in the liquid.

The membrane is kept clean by the scouring action of the sample flowing across the membrane.

This constant cleaning eliminates signal drift and recalibration providing an accurate residual measurement. A thermistor compensates for sample temperature variations.

The residual value is displayed on the LCD display.

#### B. REAGENT

A small quantity of electrolyte is contained within the electrode assembly and reacts with the chemical in the sample at the interface between the electrodes and the membrane.

Electrolyte must be replenished periodically. See probe instructions.

### IV. INSTALLATION

#### A. WALL PANEL MOUNTING

1. Position the analyzer panel on a wall at eye level and as close as possible to the sample source. Secure with bolts, leveling the analyzer before securing.

B. HYDRAULIC CONNECTIONS

1. Connect the necessary length of drain hose to the drain outlet on the analyzer. Secure with a hose clamp. Route hose to maintain a gravity fed drain (downward slope).
2. Connect one end of the 3/8" sample supply tubing to the source using a suitable connection (customer supplied). Route tubing to the inlet side of the sample flow rotameter.

C. TERMINAL CONNECTIONS

See Wiring Diagram page 10.

**NOTE:** ALL WIRING MUST COMPLY WITH APPLICABLE LOCAL AND NATIONAL ELECTRICAL CODES.

1. Remove four (4) screws securing instrument cover and lift cover.
2. Connect input power (120 Vac standard) to N,H,G terminals.
3. Connect current output and alarm contacts.

**NOTE:** DO NOT RUN LINE VOLTAGE AND SIGNAL VOLTAGE IN THE SAME CONDUIT.

V. **START-UP**

- A. Start water sample flow at approximately 500 cc/minute . To drain, water must be flowing over the overflow weir in the sample filter chamber.

The sample must be supplied continuously for reliable operation. If the system requires occasional sample cutoff, provisions must be made to keep the electrodes wet.

Sampling from a pressurized source may require a pressure regulating valve to hold the flow constant. Maximum sample line pressure: 1.0 bar

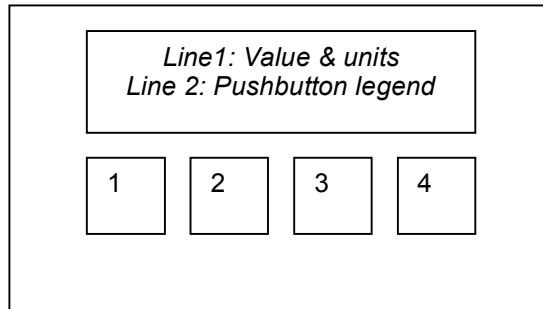
If sampling from sewage, a flushing "Y" strainer is necessary to prevent sample line from plugging. Other types of filters are not recommended.

- B. Turn the power on to the analyzer.
- C. If air bubbles are present in the reagent or flow tubing, remove by squeezing or tapping tubing or disconnecting tubing at the analyzer and flushing momentarily.
- D. The analyzer requires a minimum stabilization time of 24 hours.

- E. After stabilization, calibration may be required. Instruments are calibrated at the factory; at start-up Auto Zero adjustment is necessary to compensate for composition of the local water.

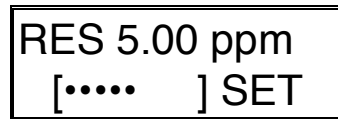
## VI. INSTRUMENT SETTINGS

The top line of the LCD display is formatted to show a selected value along with its engineering units, and the second line normally provides function labels for the four pushbuttons located below the display. The pushbuttons do not have any labels, so for the purpose of this document, the pushbuttons will be assigned numbers 1 through 4.



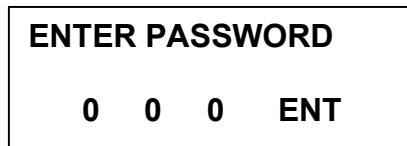
### MAIN RUN SCREEN

The value displayed is the chlorine residual in ppm or mg/l. Below the residual value is a fifty segment bar-graph representation of the residual 4mA to 20mA output (PO1).



1	<i>no label</i>	Displays the water temperature.
4	SET	The user is prompted to enter a password to enter a programming mode in which one can calibrate, set alarm set-points, and set the 4-20mA output range.

### PASSWORD ENTRY SCREEN



## RESIDUAL SETUP MENU

From the run screen, press SET and the user will be prompted to enter the password (default is 000). If the entered password is correct, the residual setup (calibration, alarm, & range) menu will be displayed.

<b>RESIDUAL SETUP</b>		
<b>CAL ALM RNG RUN</b>		

1	CAL	Enter calibration menu
2	ALM	Set the high and low residual alarm setpoints
3	RNG	Set the 4-20mA output range.
4	RUN	Go back to the main run screen

<b>CALIBRATE</b>		
<b>CELL PO1 ESC</b>		

1	CELL	Calibrate cell
2	No function	
3	OUT	Calibrate the 4-20mA output.
4	ESC	First, the operator is prompted to enter a new password and then is returned to the residual setup menu.

## CALIBRATE CELL

From the residual setup screen, press CELL to enter the cell calibration menu.

<b>CALIBRATE CELL</b>		
<b>ZRO SPAN ESC</b>		

1	ZRO	Zero cell input
2	SPAN	Set the current CL2 residual.
3	no function	
4	ESC	Go back to the calibrate menu.

## CALIBRATE ZERO SELECTION SCREEN

<b>CALIBRATE ZERO</b>		
<b>MAN</b>	<b>AUTO</b>	<b>ESC</b>

1	MAN	Manual zero
2	AUTO	Auto zero
3	no function	
4	ESC	Go back to the calibrate cell menu.

## MANUAL ZERO SCREEN

WAIT FOR...

<b>0.0 mV</b>	<b>SET</b>	<b>ESC</b>
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The top line of the display scrolls the message, "ADD ZERO WATER & WAIT FOR STABLE mV."  
The left side of the bottom line shows the current cell mV.

1	No function	
2	No function	
3	SET	Zero cell input.
4	ESC	Go back to the calibrate zero menu.

## AUTO ZERO SCREEN

<b>AUTO ZERO</b>	<b>120s</b>
<b>0.0 mV</b>	<b>ESC</b>

This screen will automatically zero the cell input if there is a stable mV input for 120 seconds. If the auto zero successful, the instrument will display an auto zero successful message. If fifteen minutes pass without an auto zero, the instrument will display an auto zero failure message.

The top, right side of the display shows a timer, and the bottom, left side shows the current cell mV.

1	No function	
2	No function	
3	No function	
4	ESC	Go back to the calibrate zero menu.



## CALIBRATE CELL SPAN SCREEN

<b>GET SAMPLE</b>
<b>0.0 mV      STR    ESC</b>

1	No function	
2	No function	
3	STR	Sample the cell input mV & water temperature and enter the screen where the CL <sub>2</sub> residual value can be set.
4	ESC	Go back to the calibrate cell menu.

If one attempts to set a ppm when the mV input is lower than the zeroed mV, the error message "ERROR! CELL mV <= ZERO" will be displayed for a few seconds.

<b>0.0 ppm</b>
<b>UP   DWN   SET    ESC</b>

1	UP	Increase CL <sub>2</sub> value
2	DWN	Decrease CL <sub>2</sub> value
3	SET	The value entered is the CL <sub>2</sub> residual at the time the STR pushbutton was pressed.
4	ESC	Go back to the get sample screen

## CALIBRATING THE ANALOG OUTPUT

For one to calibrate the analog output, an accurate DMM or equivalent current meter (20mA range) must be connected alone or in series with the 4 to 20mA (PO1) load.

<b>SET ANALOG OUT</b>
<b>4mA   20mA      EXIT</b>

1	4mA	Set 4mA point
2	20mA	Set 20mA point
3	No function	
4	EXIT	Go back to the calibrate menu.

<b>SET XX.00 mA OUT</b>
<b>UP    DWN            SET</b>

The XX.00 is either 4.00 or 20.00 and does not change when setting the selected point. Observe the current reading from the DMM and use the up and down pushbuttons to set the selected point to 4/20mA.

1	UP	Increase current
2	DWN	Decrease current
3	No function	
4	SET	Store new 4mA or 20mA point

## SETPOINTS

The RP-1000 has CL<sub>2</sub> residual high and low relay (alarm) outputs. Press ALM from the RESIDUAL SETUP screen. Select either the LOW or HIGH set point. Use the up & down pushbuttons to set the trip point and press set to store the new value. To disable a set point, enter a zero value. A low set point is activated when the CL2 residual falls to or below the set point and is deactivated when the CL2 residual rises above the trip set point plus a 0.10 (0.010) ppm(mg/l) hysteresis. A high set point is activated when the CL2 residual rises to and above the high trip point and is deactivated when the CL2 residual falls below the set point minus a 0.10 (0.010) ppm(mg/l) hysteresis.

When an alarm occurs, a message appears in the main run screen indicating the exact alarm. One now has two options:

IGNORE the alarm and de-energize the associated relay indefinitely.

CANCEL the alarm and de-energize the associated relay for 10 seconds and then reactivate the alarm if the situation has not been resolved.

<b>LOW</b>	<b>2.00 ppm</b>
<b>UP</b>	<b>DWN      SET</b>

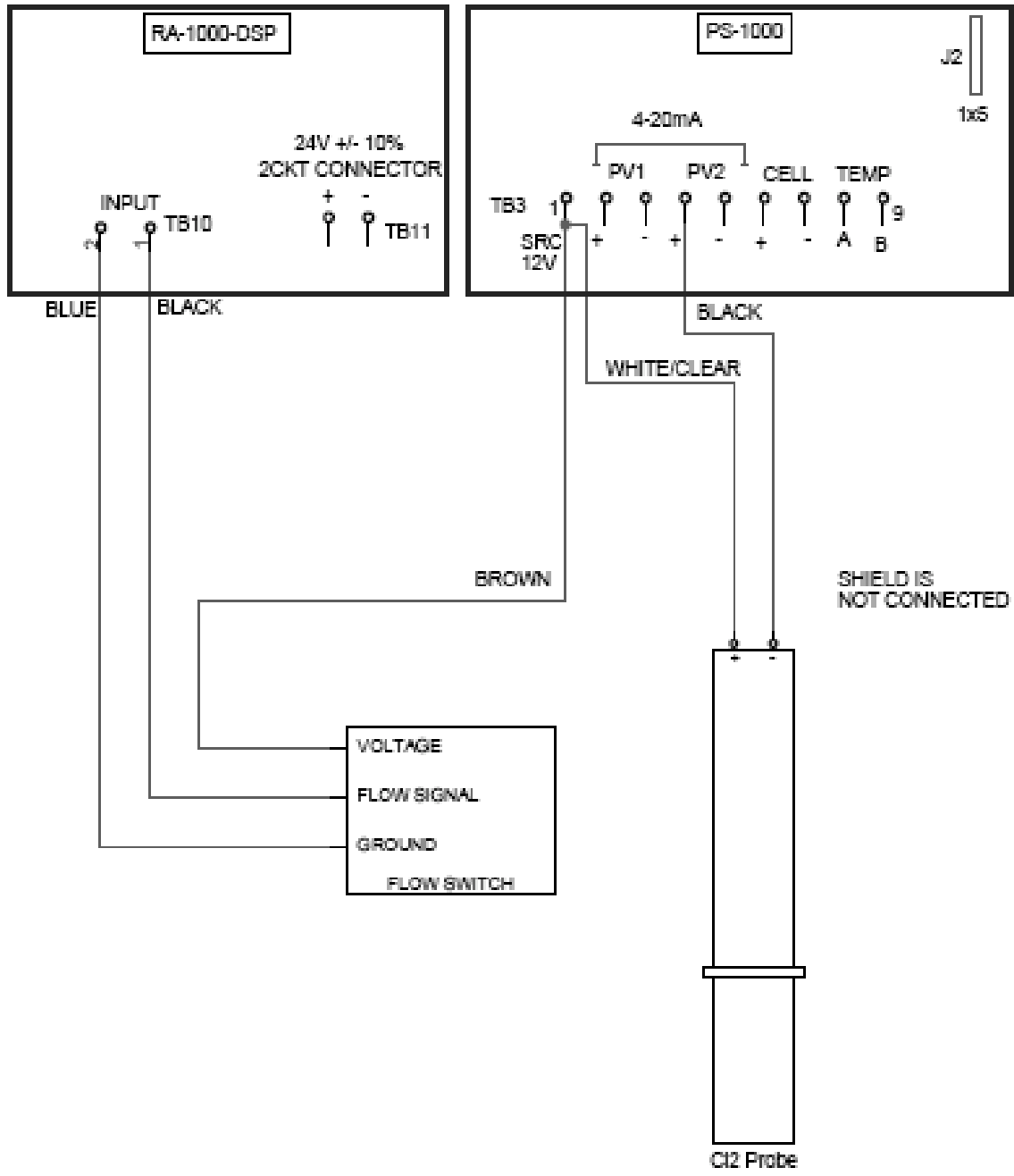
<b>HIGH</b>	<b>10.00 ppm</b>
<b>UP</b>	<b>DWN      SET</b>

## CELL RANGE

To set the range, press RNG in the residual setup screen. There are two ranges set by S2 which is located on the RA-1000 MAIN board.

<b>RNG</b>	<b>0-10.00 ppm</b>
<b>UP</b>	<b>DWN      SET</b>

<b>RNG</b>	<b>S2 POSITION</b>	Scales the 4-20mA analog output
Value X.XX	A	0 to 1,2,3,5,10, and 20 value selections (use the up and down pushbuttons to select)



EAGLE MICROSYSTEMS, INC  
PROBE & FLOW SWITCH WIRING

## VII. PROBE INSTRUCTIONS

The chlorine probe CP2.1 is a special sensor to measure free or total chlorine concentration in water.

The probe measures the following chlorine species:

Free Chlorine  
Total Chlorine

Where: Free Chlorine + Combined Chlorine = Total Chlorine

The probe has a low dependence of pH value, so it can be used in water with high pH values. The probe is recommended for potable water applications. However, it can be used for wastewater provided proper filtering be installed to condition the sample and to reduce suspended and dissolved solids to which the probe is exposed.

Warning: Do not touch the electrode finger. It must be kept clean. Do not remove the layer on the electrode finger

### 1. Set-up

The membrane cap is screwed off the electrode shaft and filled to the top with the electrolyte ECP 1.3/GEL. Holding the electrode shaft vertically, the filled membrane cap is screwed on. It may be necessary to turn the cap counter-clockwise until the thread engages. Then screw the electrode shaft clockwise (by hand) onto the membrane cap. Excess electrolyte will escape through a valve (located above the type marking) in the membrane cap. *Do not close this vent with your finger!* Make sure that the electrolyte, which has overflowed, and adhering to the outside of the probe assembly is washed off with water.

*Caution: Electrolyte may spurt from the vent opening.*

*Important: Is the membrane cap completely screwed to the electrode shaft?*

The probe should be operated for approximately one hour prior to performing the first calibration.

Important: When unscrewing the filled membrane cap make sure that the hose ring does not cover the vent above the type marking, so that air can stream through the open vent. Otherwise the membrane will be destroyed.

### 2. Insertion of the probe into the probe housing

The black O-ring is first inserted into the 1-inch opening followed by the PVC slide ring. The 1-inch PVC screw fitting is then screwed in loosely. The probe is inserted into the prepared probe housing. The probe is fixed in place with the 1-inch PVC screw fitting. Tighten the PVC screw fitting using pliers to insure that the probe cannot move once water pressure is applied to the probe housing.

### 3. Control of the Probe/Analytics

A balance or checking of the probe is performed using DPD-4 method (or DPD-1 + DPD-3) for total chlorine should be performed regularly depending on the application. A weekly check is recommended, and if necessary, more frequently. The analytically determined value is adjusted in

the analyzer as described previously. It is recommended that the electrolyte be replaced every three months.

#### 4. Maintenance

The probe shows too low a value

Caution: The brown coating of the electrode finger must not be sanded.

If a calibration is not possible because the signal from the probe is too low, remove the hose ring on the membrane cap, which closes the vent (above the type marking) so that air is allowed to stream in. Dry the electrode finger with a clean paper towel. Only the tip of the dry electrode finger (working electrode) is now cleaned with the enclosed special abrasive paper. To do this place the special abrasive paper on a paper towel, holding one corner move the tip of the vertically held probe two or three times over the abrasive. The hose ring of the membrane cap is then reinstalled to close the vent opening and the electrolyte refilled. It may be necessary to replace the membrane cap. The electrolyte should be replaced every three months.

#### 5. CP2.1Max where x = measuring range in mg/l chlorine

4-20 mA two-wire current loop (Range is written after type)

For example: CP2.1MA2: 4-20 mA = 0 – 2 mg/l chlorine

Slope calibration is done in the instrument.

Electrical Specifications:

Power supply: minimum voltage 12 Vdc, load resistor maximum 50 Ohms  
Maximum voltage 30 Vdc, load resistor 50 until 900 Ohms

#### 6. Technical Data/General Description

- Measuring system: membrane covered potentiostatic 3-electrode system
- Working electrode: Gold
- Counter electrode: Stainless steel
- The exterior housing of the probe consists of stainless steel, PVC and silicon rubber. The probe diameter is 25 mm.
- Zero-point calibration is normally not necessary
- Provided pressure remains constant, the probe can be used up to 0.5 bar. Air bubbles in from of the membrane prevent the disinfectant from passing through the membrane resulting in false readings.
- Measuring range of the probe: See order information
- Response time  $T_{90}$  is about 1 minute
- Influence of pH: there is little influence of pH on this probe. Avoid deposition of chalk.
- The recommended temperature range is 5 to 35° C.
- Membrane life is typically one year. However, this can vary considerably depending on level of maintenance and water quality. Heavy contamination of the membrane should be avoided.
- The controller and the probe connected to it must remain in operation continuously. The probe must not be allowed to become dry.
- To store the probe, first unscrew the membrane cap. Rinse the membrane cap and electrode finger with clean water and dry (dust free). Replace the membrane cap loosely onto the electrode shaft. The membrane must not rest against the measuring electrode.
- When placing probe back in service after storage, clean the electrode tip and install a new membrane cap.

7. Spare Parts

Membrane Cap: p/n M48  
 Electrolyte: p/n ECP1.3/GEL

