CRA-7 Chlorine Residual Analyzer
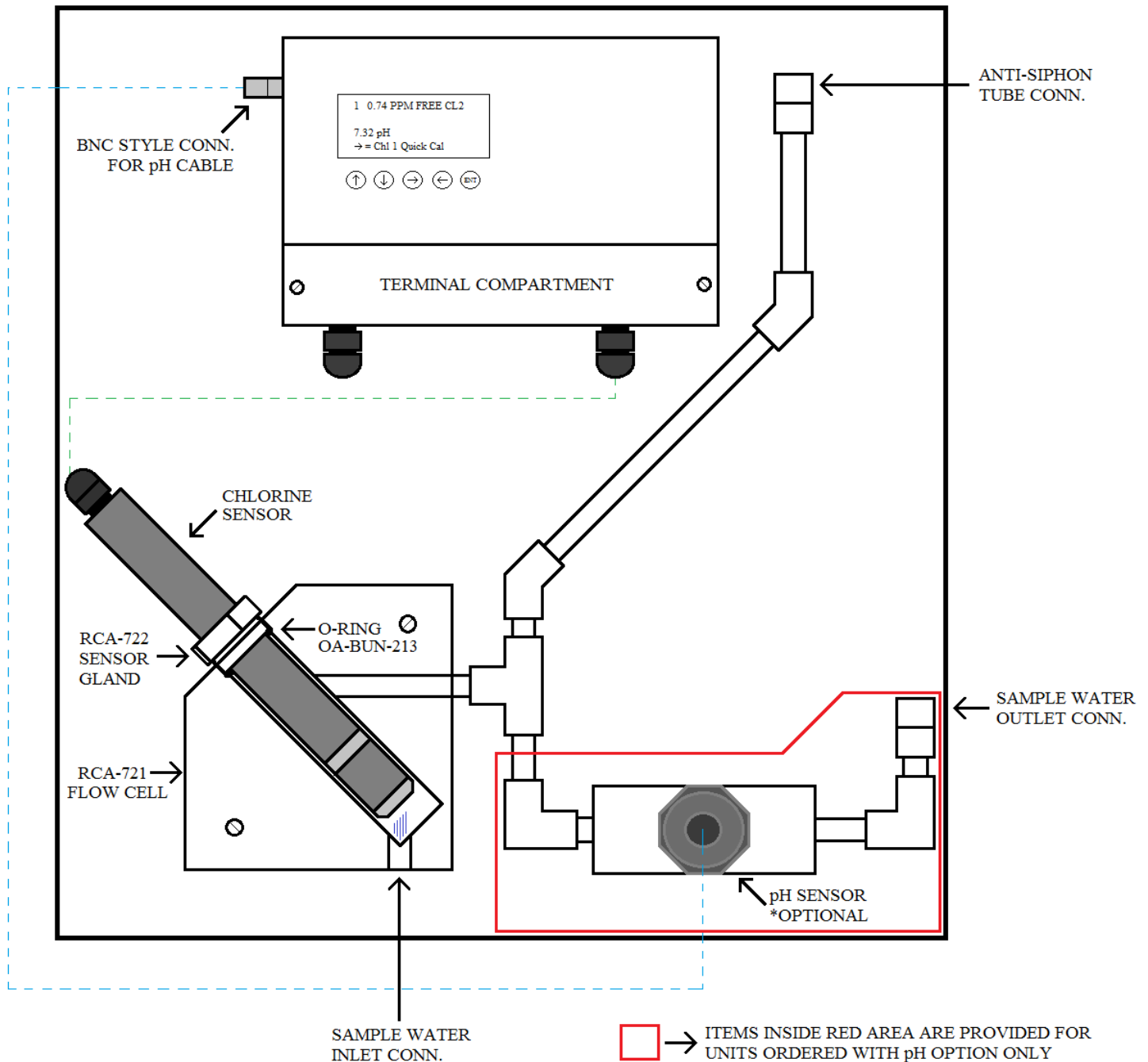
Installation, Operation & Maintenance

General: The Archer Instruments CRA-7 is continuous analysis instrument, designed to monitor levels of residual chlorine or residual Chlorine Dioxide in the stream of sample water. The CRA-7 is also offered with an optional pH measurement configuration, which can be used to monitor the pH of the sample water and (if desired) mathematically compensate a free chlorine measurement for the effects of changing pH levels.
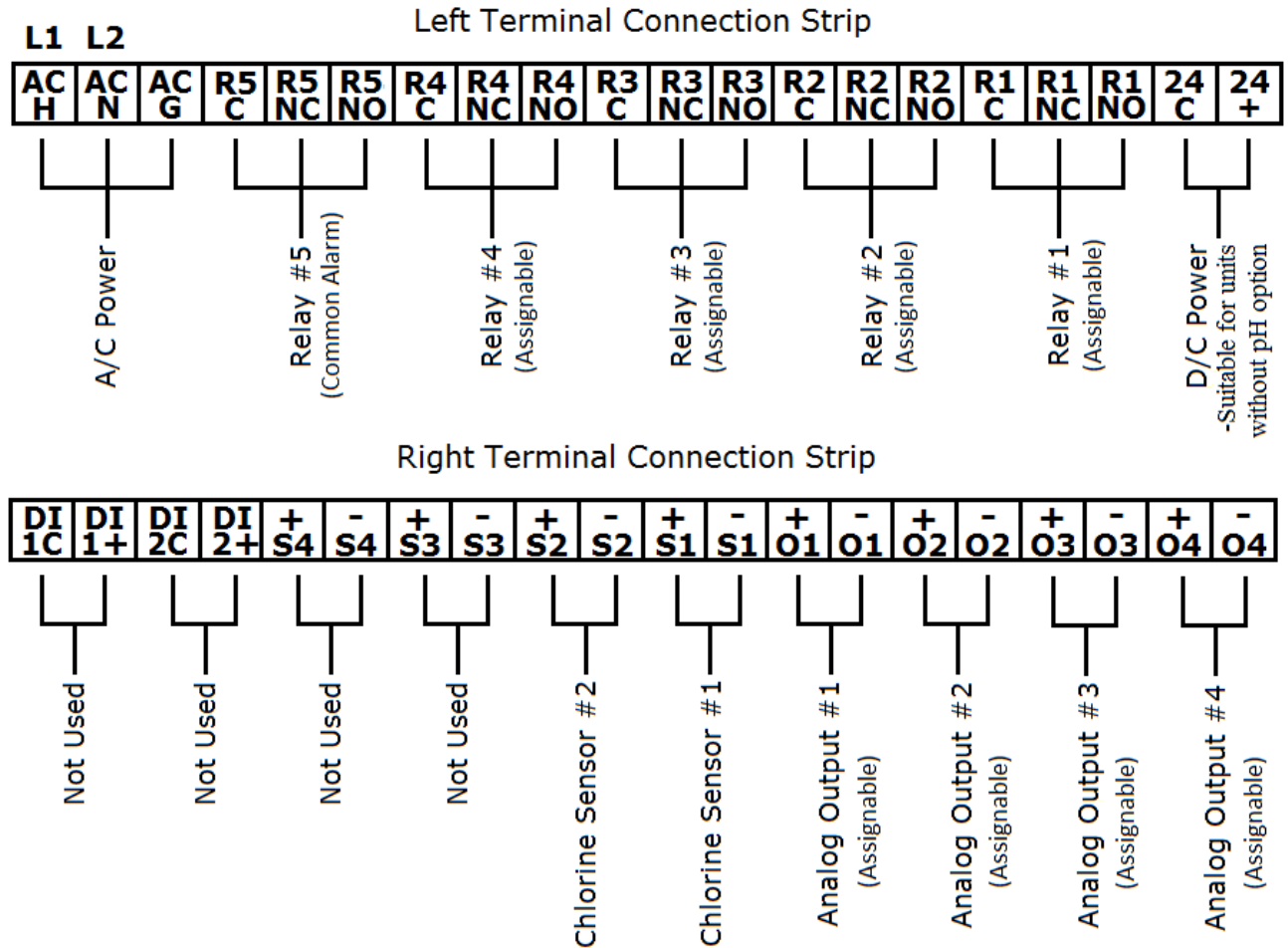
Installing the CRA-7:

1. Installation:

a. The CRA-7 is shipped from the factory on a ½" thick 20" x 16" polypropylene panel and is designed for wall-mounting. To protect the sensor(s) during installation or future maintenance-related removal, be sure to allow adequate space around the CRA-7 panel.

    i. * To avoid interference, it is strongly advised that the CRA-7 not be installed in close proximity to any large motors or rotating machinery.

BNC STYLE CONN. FOR pH CABLE

1 0.74 PPM FREE CL2

7.32 pH
→ = Ch1 1 Quick Cal

TERMINAL COMPARTMENT

ANTI-SIPHON TUBE CONN.

CHLORINE SENSOR

RCA-722 SENSOR GLAND

O-RING OA-BUN-213

RCA-721 FLOW CELL

SAMPLE WATER OUTLET CONN.

pH SENSOR *OPTIONAL

SAMPLE WATER INLET CONN.

ITEMS INSIDE RED AREA ARE PROVIDED FOR UNITS ORDERED WITH pH OPTION ONLY

b. A separate compartment is provided for access to internal wire terminals. The two (2) terminal blocks can be removed in order to ease wiring connections.

   i. * To ease the process of cutting enclosure penetrations, it may be helpful to remove the CRA-7 controller from the panel. Two #12-24 screws are located on each side of the terminal compartment. Once these are removed, the controller can be lifted up and off of the remaining screw.

c. Wiring Connections - The bottom compartment on the CRA-7 enclosure houses the wiring terminal strips. Refer to the below wiring terminal diagrams:

Left Terminal Connection Strip

L1	L2																	
AC H	AC N	AC G	R5 C	R5 NC	R5 NO	R4 C	R4 NC	R4 NO	R3 C	R3 NC	R3 NO	R2 C	R2 NC	R2 NO	R1 C	R1 NC	R1 NO	24 C	24 +

A/C Power — Relay #5 (Common Alarm) — Relay #4 (Assignable) — Relay #3 (Assignable) — Relay #2 (Assignable) — Relay #1 (Assignable) — D/C Power -Suitable for units without pH option

Right Terminal Connection Strip

DI 1C	DI 1+	DI 2C	DI 2+	+ S4	- S4	+ S3	- S3	+ S2	- S2	+ S1	- S1	+ O1	- O1	+ O2	- O2	+ O3	- O3	+ O4	- O4

Not Used — Not Used — Not Used — Not Used — Chlorine Sensor #2 — Chlorine Sensor #1 — Analog Output #1 (Assignable) — Analog Output #2 (Assignable) — Analog Output #3 (Assignable) — Analog Output #4 (Assignable)

d. If the CRA-7 is provided with the optional pH configuration, a BNC style connector is provided on the left side of the enclosure for connection of the pH sensor cable.

e. Chlorine sensors are shipped pre-wired to the controller. Additional connections offered allow for the use of up to five (5) relays and up to four (4) analog outputs.

2. **Sample Water Connections:**

    a. The CRA-7 is provided with 25 feet of 3/8" LLDPE tubing as well as connectors for the sample water inlet, sample water outlet and the siphon break.

        i. Sample Water Supply: It is important that the sample water flow provided to the CRA-7 enter the flow cell at a consistent pressure and flow. Ideally, the sample water pressure should be roughly 10 – 15 PSI and the flow rate roughly 10 - 15 GPH.

            1. A pressure regulating valve (inlet pressure rating 150 PSI and adjustable outlet pressure range 0 – 25 PSI) is provided with each CRA-7, to allow for a consistent sample water pressure to the analyzer, even if the sample water source pressure fluctuates.

            2. Install the pressure regulator in the sample water supply line. A fixed flow orifice located inside the flow cell ensures steady flow to the sensor, provided the supply pressure remains constant.

        ii. Siphon Break: As the sample water flows out of the analyzer flow cell, it is common for a slight siphon-effect (vacuum) to occur. Over time this can slowly draw the electrolyte out of the chlorine sensor membrane cap, causing failure of the sensor. To avoid this, the CRA-7 is provided with a siphon break connection.

            1. Connect a short section (roughly 3 or 4 feet is sufficient) of tubing to the connection provided. This tubing must extend upward toward the ceiling and should be capped with the bug cap provided.

        iii. Sample Water Outlet: Connect the tubing provided to the outlet connection and run tubing to desired drain location. Be sure that the outlet tubing is directed only downward.

3. **Sensor(s):**

    a. Chlorine Sensors are shipped "dry". This means the membrane cap has no electrolyte inside. Once sample water is connected and the analyzer is ready for start-up:

        i. Remove the sensor by loosening the sensor gland.

        ii. Slide the sensor out of the flow cell.

        iii. Unscrew the membrane cap and carefully fill the cap with the electrolyte gel provided, being sure to not allow air bubbles in the gel.

        iv. Screw the cap fully onto the sensor. When screwing the cap onto the sensor, some electrolyte should be excreted from under the rubber ring.

> **NOTE:** The first resistance felt is the sensor's sealing o-ring. Screw the cap on further until it has fully mated with the sensor body.

     v. Making sure the RCA-722 sensor gland and OA-BUN-213 o-ring are in place on the sensor, insert the sensor into the flow cell, so that the tip / end of the membrane cap is directly above the sample water inlet. Then tighten the sensor gland.

   b. <u>pH Sensors</u> are shipped with a container of pH 4 buffer solution sealed around the measurement electrode. **The pH measurement electrode must not be allowed to dry out**. Install the pH sensor only after sample water has been provided to the CRA-7 flow assembly.

     i. When ordered with the pH configuration, the CRA-7 is provided with a pre-plumbed installation gland for the pH sensor. This configuration is deliberately designed to ensure the pH sensor remains wet, even if sample water flow is interrupted.

     ii. While the pH installation fitting can be rotated to slightly adjust the angle of the sensor, it is recommended that the pH sensor be installed in a horizontal position. This ensures the measurement electrode will remain wet, even if some air accumulates inside the fitting. If preferred, turning the fitting to a 45 degree angle is also acceptable.

Operating the CRA-7:

<u>User Interface:</u>

1) The user-interface consists of a four line, eighty character display and five pushbuttons.

   a. <u>Up Arrow</u> – Allows for navigation "up" on certain screens and also allows for increasing displayed editable values on certain screens.

   b. <u>Down Arrow</u> – Allows for navigation "down" on certain screens and also allows for decreasing displayed editable values on certain screens.

   c. <u>Right Arrow</u> – Allows access to the "quick calibration" for Sensor 1.

   d. <u>Left Arrow</u> – Allows user to "back up" to the previous screen or menu.

   e. <u>Enter</u> – The enter button is used to move forward to the next screen and also to select options on screens with multiple options.

<u>Main Operating Screens:</u>

1) During normal operation, the main screen will display the status of each sensor in use (either 1 or 2 chlorine sensors and pH if in use), with one sensor's status detailed on each displayed line.

2) The displayed status includes the channel number, the actual reading displayed in labeled engineering units and the status (either "OK" or the alarm condition).

3) While on the main operating screen, pressing the right arrow accesses the quick calibration screen for chlorine sensor #1. Pressing ENTER accesses the password-protected configuration and diagnostic menus.

4) Quick Calibration: The CRA-7 offers direct access to calibrate the span for chlorine sensor #1 only, which can be accessed from the main operating screen by pressing the right arrow button.

   NOTE: Before performing a calibration, the actual residual chlorine level must be measured by an independent instrument.

   a. After pressing the right arrow button, a screen will display either "EXIT without making any changes" or "Measurement needed to calibrate on next screen". These two options can be switched using the up and down arrow buttons.

   b. Once the screen displays "Measurement needed to calibrate on next screen", press the ENTER button to access the calibration screen. Once on the calibration screen, use the up and down arrow buttons to match the "Desired" value to the actual measured chlorine residual value. Then press the ENTER button to save.

Password Protected Menus:

1) The CRA-7 password (needed to edit the channel configuration, perform other calibrations, change relays & output functions or view the diagnostics menus) is 7.

2) The Menus: Once the password is entered, a menu appears with 11 possible selections. Use the up and down arrows to scroll through these selections:

   c. Relay X Function: Four selections allow the user to set up relays 1 through 4 for the desired alarm condition and desired function:

      i. Assignment: This menu allows the user to select which alarm condition the indicated relay will be assigned for. All configured alarms for any channel in use, power failure and sensor failures are selectable. Otherwise, any relay can be assigned "Off".

      ii. Relay Bias: Each relay is provided for use as normally open or normally closed. Select "Normally Open" or "Normally Closed" as desired.

d. <u>CHX SETUP / ALARMS:</u> Two chlorine channel selections allow the user to set-up each channel individually.

    i. The initial screen under this section allows the user to enable or disable the channel. Change the selection using the up and down arrows. If the channel is disabled, pressing enter will return to the previous menu. If the channel is enabled:

    ii. <u>Alarm Low Trip Level</u>: Each channel incorporates two configurable alarm points. The first "Alarm Low" is a falling alarm and the desired alarm level is entered on this screen using the up and down arrows.

    iii. <u>Alarm Low Delay:</u> During a low alarm condition, the controller will wait a certain number of seconds before activating the horn and alarm relay. This can be useful to reduce the possibility of false alarms. An actual alarm condition must exist continuously for the amount of time (seconds) entered. This is pre-set to 10 seconds and in most applications this need not be changed.

    iv. <u>Alarm Low Latching / Non-Latching:</u> Select desired relay behavior. If set to latching, the alarm relay(s) in use will not reset without an operator physically resetting the unit by pressing the up and down arrows. If this is set to "non-latching" the alarm relay(s) in use will reset on its own if the actual alarm condition clears.

    v. <u>Alarm High Trip Level</u>: Each channel incorporates two configurable alarm points. The second "Alarm High" is a rising alarm and the desired alarm level is entered on this screen using the up and down arrows.

    vi. <u>Alarm High Delay:</u> During a high alarm condition, the controller will wait a certain number of seconds before activating the horn and alarm relay. This can be useful to reduce the possibility of false alarms. An actual alarm condition must exist continuously for the amount of time (seconds) entered. This is pre-set to 10 seconds and in most applications this need not be changed.

    vii. <u>Alarm High Latching / Non-Latching:</u> Select desired relay behavior. If set to latching, the alarm relay(s) in use will not reset without an operator physically resetting the unit by pressing the up and down arrows. If this is set to "non-latching" the alarm relay(s) in use will reset on its own if the actual alarm condition clears.

    viii. <u>Engineering Units:</u> Select the target chlorine measurement type, to match the sensor in use. This is pre-set by the factory to match the sensor.

    ix. <u>Sensor Range:</u> Enter the full scale of the sensor in use. This is pre-set by the factory to match the sensor.

    x. <u>Averaging Filter:</u> During operation, the CRA-7 will display and output the measured chlorine residual value, based on a mathematical average of

the previous <u>X</u> number of seconds. This is helpful to limit the effects of various factors that may cause brief fluctuations with the measured value. This filter is preset to 10 seconds and generally need not be changed.

xi. <u>Calibration:</u> The CRA-7 offers a simple span calibration for the measured chlorine value.

NOTE: Before performing a calibration, the actual residual chlorine level must be measured by an independent instrument.

a. After pressing the right arrow button, a screen will display either "EXIT without making any changes" or "Measurement needed to calibrate on next screen". These two options can be switched using the up and down arrow buttons.

b. Once the screen displays "Measurement needed to calibrate on next screen", press the ENTER button to access the calibration screen. Once on the calibration screen, use the up and down arrow buttons to match the "Desired" value to the actual measured chlorine residual value. Then press the ENTER button to save.

e. <u>pH SETUP / ALARMS:</u> The CRA-7 offers an optional pH measurement channel, which can be used to continuously monitor the sample water pH or (if desired) mathematically compensate the chlorine measurement (free chlorine only) on channel one for the effects of changing pH.

i. The initial screen under this section allows the user to enable or disable the pH channel. Change the selection using the up and down arrows. If the channel is disabled, pressing enter will return to the previous menu. If the channel is enabled:

ii. <u>Alarm Low Trip Level</u>: Each channel incorporates two configurable alarm points. The first "Alarm Low" is a falling alarm and the desired alarm level is entered on this screen using the up and down arrows.

iii. <u>Alarm Low Delay:</u> During a low alarm condition, the controller will wait a certain number of seconds before activating the horn and alarm relay. This can be useful to reduce the possibility of false alarms. An actual alarm condition must exist continuously for the amount of time (seconds) entered. This is pre-set to 10 seconds and in most applications this need not be changed.

iv. <u>Alarm Low Latching / Non-Latching:</u> Select desired relay behavior. If set to latching, the alarm relay(s) in use will not reset without an operator physically resetting the unit by pressing the up and down arrows. If this is set to "non-latching" the alarm relay(s) in use will reset on its own if the actual alarm condition clears.

v. <u>Alarm High Trip Level</u>: Each channel incorporates two configurable alarm points. The second "Alarm High" is a rising alarm and the desired alarm level is entered on this screen using the up and down arrows.

vi. <u>Alarm High Delay:</u> During a high alarm condition, the controller will wait a certain number of seconds before activating the horn and alarm relay. This can be useful to reduce the possibility of false alarms. An actual alarm condition must exist continuously for the amount of time (seconds) entered. This is pre-set to 10 seconds and in most applications this need not be changed.

vii. <u>Alarm High Latching / Non-Latching:</u> Select desired relay behavior. If set to latching, the alarm relay(s) in use will not reset without an operator physically resetting the unit by pressing the up and down arrows. If this is set to "non-latching" the alarm relay(s) in use will reset on its own if the actual alarm condition clears.

viii. <u>Configure Channel:</u> Select whether the pH measurement is to "Monitor" only, or used to "Compensate" a free chlorine measurement on channel 1 for changes in sample water pH.

NOTE: Unless the sample water is known or expected to change significantly (more than 0.5 pH), compensation of the Archer Instruments free chlorine sensor is generally not necessary, as pH fluctuations less than 0.5 pH will have only a minor influence on the measurement.
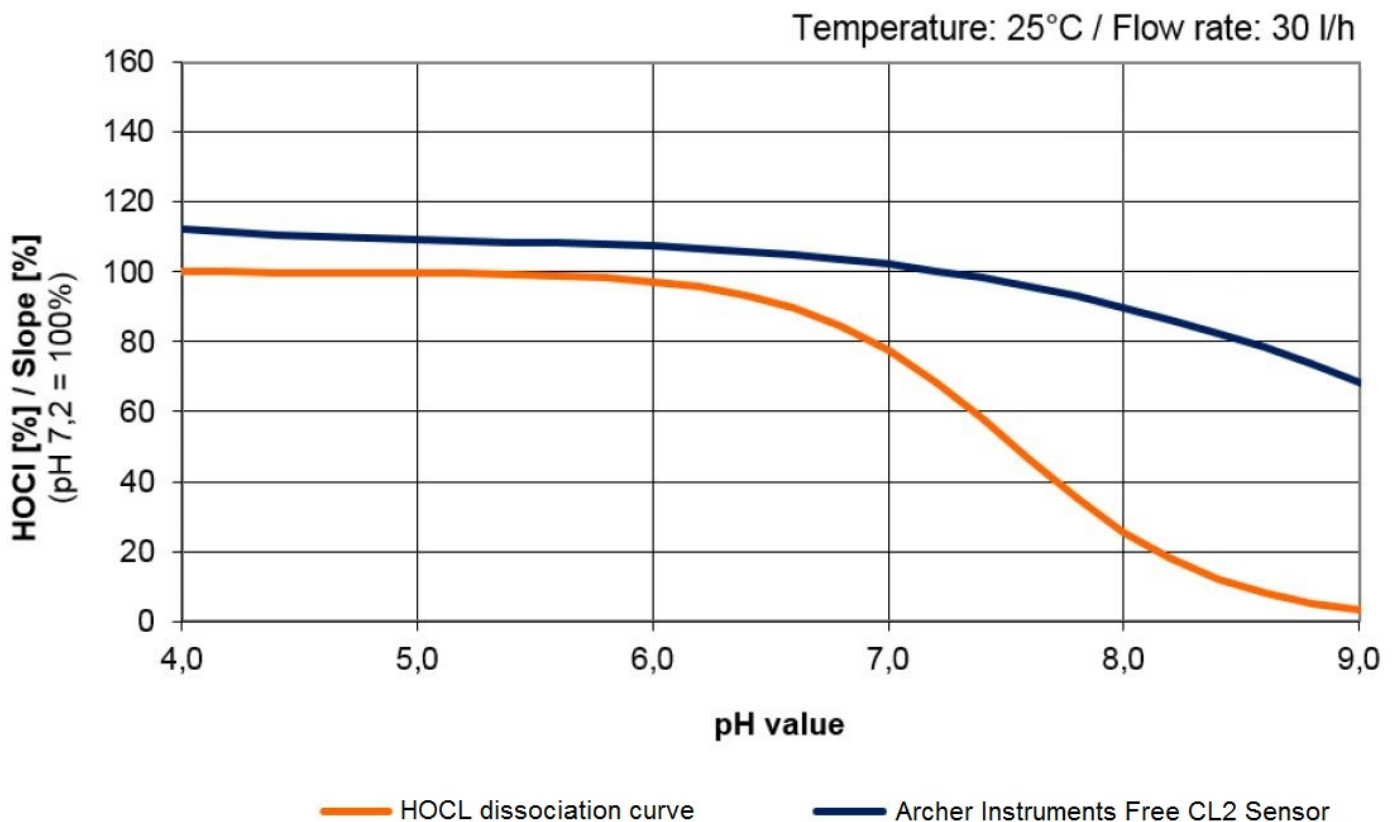
*The chart above illustrates the typical dissociation curve of free chlorine, relative to pH

values (in orange) as well as the reduced effect of dissociation on the Archer Instruments free chlorine sensor (in blue). Refer to this chart to determine whether or not the application requires pH compensation.

ix. <u>Sensor Range:</u> The next two screens allow the low and high range of the pH sensor to be set. These are pre-set to match the sensor provided.

x. <u>Averaging Filter:</u> During operation, the CRA-7 will display and output the measured pH value, based on a mathematical average of the previous $\underline{X}$ number of seconds. This is helpful to limit the effects of various factors that may cause brief fluctuations with the measured value. This filter is preset to 10 seconds and generally need not be changed.

xi. <u>Calibration:</u> The CRA-7 pH Channel offers two calibration options. The first is a single point "offset" calibration. The second is a two point calibration process, requiring pH calibration standards (two standards are needed of either 4, 7 or 10 pH). Use the up and down arrows to select which calibration method is desired.

1. <u>1 Point Scaling:</u> The CRA-7 offers a simple offset pH calibration for the measured pH value.

    NOTE: Before performing an offset calibration, the actual pH level must be measured by an independent instrument.

    c. After pressing the right arrow button, a screen will display either "EXIT without making any changes" or "Cal Fluid needed to calibrate on next screen". These two options can be switched using the up and down arrow buttons.

    d. Once the screen displays "Cal Fluid needed to calibrate on next screen", press the ENTER button to access the calibration screen. Once on the calibration screen, use the up and down arrow buttons to match the "Desired" value to the actual measured chlorine residual value. Then press the ENTER button to save.

2. <u>2 Point Scaling:</u> The CRA-7 offers a two point pH calibration for the measured pH value.

    NOTE: Before performing an offset calibration, pH calibration standards (two standards are needed of either 4, 7 or 10 pH).

    a. After pressing the right arrow button, a screen will display either "EXIT without making any changes" or "Cal Fluid needed to calibrate on next screen". Once "Cal Fluid needed to calibrate on next screen" is displayed, press enter.

        b. Remove the pH sensor and immerse in pH calibration standard of either 4 or 7 pH. Using the up and down arrow, select either 4 or 7 pH to match the calibration standard being used. After allowing time for full stabilization of the measured value, press ENTER.

        c. Remove the pH sensor from the first standard and immerse in pH calibration standard of either 7 or 10 pH. If a 7 standard was used for the first point, the second standard must be 10 pH. Using the up and down arrow, select either 7 or 10 pH to match the calibration standard being used. After allowing time for full stabilization of the measured value, press ENTER.

   f. <u>Controller Setup:</u> This section allows the user to select whether or not a battery backup is in use and also allows the user to select the relay bias (normally open or normally closed) for the common relay (relay #5). Relay #5 will trip on any alarm condition. The general intent is for this relay to be used as a normally closed contact, to open upon power failure or electronic failure of the CRA-7 controller. However, the bias can be selected as normally open if desired.

   g. <u>Analog Outputs:</u> The CRA-7 comes standard with four (4) separate 4-20mA analog outputs. In this section, each output can be selected to represent any one of the three measurement channels.

       xii. The analog output number is displayed at the top of the screen. For each analog output, use the up and down arrow to scroll through the three channels until the desired channel is indicated. Then press ENTER. This will record your selection and present the next analog output.

   h. <u>Diagnostics:</u> This section allows the user to see the actual signal condition of each channel, the status of Relay 5, the status of the digital input (for remote alarm acknowledgement) and the power supply status.

       xiii. <u>Test Relays:</u> In addition, the diagnostics section allows the user to test-operate the relays. When on the test screens, pressing the up arrow initiates the test. Releasing the up arrow ends the test.

   i. <u>Main Menu:</u> Selecting "Main Menu" returns the unit to the main operating screen (exits the password-protected menus).

Maintenance:

1) The CRA-7 requires little maintenance.
   a. Sensor calibrations should be performed as needed.
   b. Chlorine sensor membrane caps require replacement once every 4 – 6 months. This depends on the sample water quality and the level of measured chlorine.
   c. pH sensors will require replacement typically every 1 – 2 years.

2) Servicing the chlorine sensor:

a. Shut off sample water flow to the CRA-7.
b. Unscrew the CRA-722 Sensor Gland and remove the sensor from the flow cell.
c. Lift the rubber ring off of the membrane cap as shown below. This exposes the bleed hole, allowing air to pass in as the cap is unscrewed.
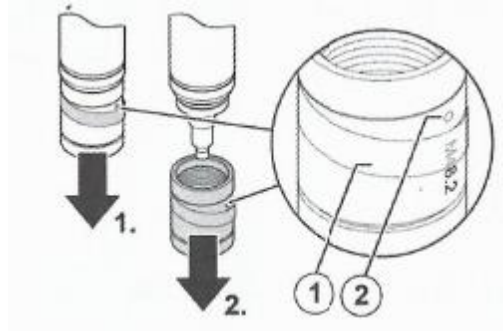
1) Rubber Ring
2) Bleed Hole

d. If the electrolyte is being replaced but not the membrane cap, empty the electrolyte from the cap and thoroughly rinse out the cap with potable water.
e. Remove any remaining water from the inside of the membrane cap using air or carefully using a **clean** paper towel or cloth.
f. Hold the blue emery scour pad in place, hold the sensor upright as shown below and move the tip of the electrode over the scour pad at least twice. Use a fresh area of the scour pad for each pass.
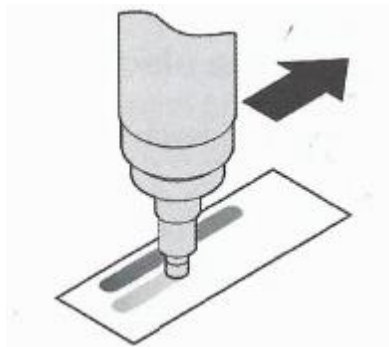
g. Replace the rubber ring onto the membrane cap (its original position).
h. Fill the membrane cap with electrolyte, taking care there are no air bubbles.
i. Holding the sensor and membrane cap upright, screw the membrane cap fully onto the sensor. Some electrolyte should be excreted under the rubber ring.
   NOTE: The first resistance felt is the sensor's sealing o-ring. Screw the cap on further until it has fully mated with the sensor body.
3) Replacement membrane caps, electrolyte, pH sensors and replacement parts are maintained in stock by Archer Instruments for fast shipment.

-Should you have any questions during maintenance of your CRA-7 Chlorine Residual Analyzer, please contact your local service provider or Archer Instruments for support.