# BECSys2

## Operation and Maintenance Manual


Certified to NSF/ANSI Standard 50

BECS TECHNOLOGY

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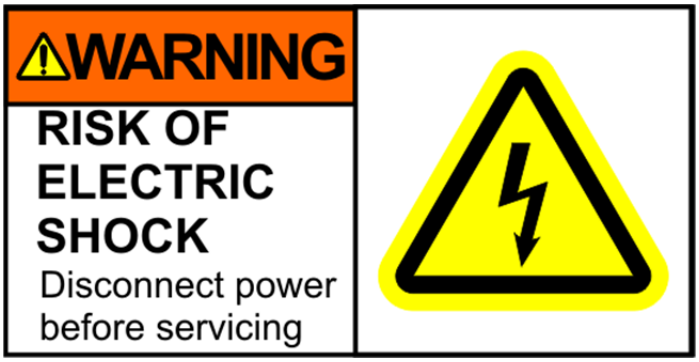
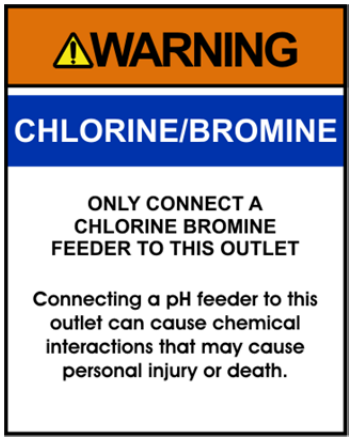
## Warnings

**Pay particular attention to the following warnings encountered while utilizing your BECSys2 Water Chemistry Controller:**








**Warning: Various other warning boxes may be found throughout the manual text.**

**Caution: Various other caution boxes may be found throughout the manual text.**

## General Guidelines

Proper installation and use of the BECSys controller depends on the specific needs of the application. Read the manual completely before starting the installation and ensure all guidelines and recommendations are followed. All components should be mounted and the flow cell plumbing installed and pressure tested before wiring the controller. Ensure compliance with all applicable plumbing and electrical codes during the installation as well.

**⚠ Caution: The BECSys controller should not be installed where it is accessible to the public.**

**⚠ Caution: The BECSys controller should be sealed while under operation. All IO, power cables, and unused ports must be sealed using hardware rated NEMA4 or better. Damage to the controller caused by improper sealing of the enclosure is not covered under warranty.**

## Firmware Version

This manual was written for firmware v1.40. If you received newer firmware but did not receive a copy of the manual covering that version of firmware, please contact your distributor.

## Environmental Conditions

The BECSys2 is housed in a NEMA 4X (IP65) enclosure. It should not be used in explosive environments. The BECSys2 should be mounted so that adequate ventilation is provided around the enclosure, preventing general environmental specifications from being exceeded (see table below).

| Environmental Specifications | |
|---|---|
| **Specification** | **Rating** |
| Storage Temperature | -30 to 60 Deg C |
| Ambient Operating Temperature | -18 to 40 Deg C |
| Ambient Humidity | 95% non condensing maximum humidity |

## Electrical Specifications

The BECSys2 may be ordered in either a 115VAC model or a 230VAC model. Following are the electrical specifications for each model:

| Controller Ratings | | |
|---|---|---|
| | **115VAC Model** | **230VAC Model** |
| Voltage: | 115VAC 60Hz | 230VAC 50Hz |
| Phase: | Single | Single |
| Current: | 9.25 Amps Full Load | 4.625 Amps Full Load |
| | (¼ Amp – Controller) | (⅛ Amp – Controller) |
| | (9 Amps – Relay Outputs, 3A X 3) | (4.5 Amps – Relay Outputs, 1.5A X 3) |

| Relay Output Ratings | | |
|---|---|---|
| | **115VAC Model** | **230VAC Model** |
| Relay 1 (K1) | 115VAC (max) – 3 Amps | 250VAC (max) – 1.5 Amps |
| Relay 2 (K2) | 115VAC (max) – 3 Amps | 250VAC (max) – 1.5 Amps |
| Relay 3 (K3) | 115VAC (max) – 3 Amps | 250VAC (max) – 1.5 Amps |

## NSF Suggested Operation Ranges

| | |
|---|---|
| ORP | 650mV to 850mV |
| pH | 6.8 to 8.2 |
| Free Available chlorine or bromine | 0 to 10 ppm as $Cl_2$<br>0 to 20 ppm as $Br_2$ |

## Applicable Sensor Operating Ranges

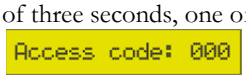
| Standard Sensors | |
|---|---|
| pH | 0.0 to 14.0 pH |
| ORP | -1500mV to 1500mV |
| Reed Flow Switch | Switch Point (On): 2.0 gpm |
| Rotary Flow Switch | Switch Point (On): 1.5 gpm |
| **Optional Sensors** | |
| Temperature | 32°F to 212°F (0°C to 100°C) |

## Section A: Programming the Controller

# A – 1: The Program Menu

### A – 1.1: Entering the Program Menu

To enter the program menu, press and hold both the Cal and Up key for three seconds. At the end of three seconds, one of two things will happen.




If the access codes have been set, the unit will prompt you for your access code. Use the up and down arrow to change the current digit, and press the Cal button to go to the next digit. Once all three digits are set, the controller will either display the first menu item or display "Access Denied" if the code you entered didn't match one of the access codes.


When the LCD screen clears, release the keys and "Program" should appear on the display. Press the Up key to enter the menu and press the Down key to exit.

Once in the program menu, use the Up or down arrows to scroll to the setting you wish to change. Press the Cal key to select the setting, then use the Up or down arrows to modify the value. Press the Cal key again to enter the new value and return to the menu. To exit the program menu, scroll to the "Exit menu" option and depress the Cal key.

**NOTE: After two minutes of no programming activity, the Time-Out feature will automatically exit the programming menu.**


### A – 1.2: Selecting Language

The BECSys2 can be programmed to display in three different languages. Once you have entered the program menu the screen will display Language ENG, signifying that the display is currently set to English. Pressing the Cal key will display a question mark (?) before the language. Use the up and down buttons to select between ENG (English), ESP (Spanish), and FRA (French), and press the Cal key to select the language you would like to use for the display.


### A – 1.3: pH High Alarm Point

Pressing the down arrow displays pH High followed by the current pH high alarm point. To change this setting, press the Cal key, use the up or down arrows to input the value you would like, then press the Cal key again to save the new value.


### A – 1.4: pH Low Alarm Point

Pressing the down arrow displays pH Low followed by the current pH low alarm point. To change this setting, press the Cal key, use the up or down arrows to input the value you would like, then press the Cal key again to save the new value.


### A – 1.5: ORP High Alarm Point

Pressing the down arrow displays ORP High followed by the current ORP high alarm point. To change this setting, press the Cal key, use the up or down arrows to input the value you would like, then press the Cal key again to save the new value.


### A – 1.6: ORP Low Alarm Point

Pressing the down arrow displays ORP Low followed by the current ORP low alarm point. To change this setting, press the Cal key, use the up or down arrows to input the value you would like, then press the Cal key again to save the new value.


### A – 1.7: Temperature High Alarm Point

Pressing the down arrow displays Temp High followed by the current temperature high alarm point. To change this setting, press the Cal key, use the up or down arrows to input the value you would like, then press the Cal key again to save the new value.

### A – 1.8: Temperature Low Alarm Point

Pressing the down arrow displays Temp Low followed by the current temperature low alarm point. To change this setting, press the Cal key, use the up or down arrows to input the value you would like, then press the Cal key again to save the new value.


### A – 1.9: ORP/ppm

Pressing the down arrow displays ORP/ppm selection. This option selects whether to use an ORP set point or a ppm set point for the main Cl/Br feed control. It is set to ORP by default. To change this setting, press the Cal key, use the up and down arrows to change between ORP and ppm, then press the Cal key again to save the new value. This option is only available if configured to allow ppm control.


### A – 1.10: Exiting the Menu

Pressing the down arrow displays Exit menu. Pressing the Cal key exits the programming menu.

## Section B: Normal Operation

### B – 1: Displaying the Set points

To display the Set Points, press the Set point key briefly. The set points will be displayed for three seconds.


### B – 2: Modifying the Set Points

To modify the set points press the Set point key for three seconds. If the access codes have been set, the unit will prompt you for your access code, otherwise the display will change to pH SetPt followed by the current pH Set point. For help entering your access code, see ***A - 1.1: Entering the Program Menu***.


#### B – 2.1: Modifying the pH Set Point

To change this setting, use the Up or Down Arrows to input the new value, then press the Set point key again to save it. To skip entering a new value, press the Set Point key.


#### B – 2.2: Modifying the ORP Set Point

If the system is configured to control using an ORP set point, the screen will display ORP SetPt followed by the current ORP Set point. To change this setting, use the Up or Down Arrows to input the new value, then press the Set point key again to save it. To skip entering a new value, press the Set Point key.


#### B – 2.3: Modifying the ppm Set Point

If the system is configured to control using a ppm set point, the screen will display ppm SetPt and the current ppm set point on the LED bar graph will be flashing. To change this setting, use the UP or Down Arrows to adjust this value shown on the LED bar graph and press the Set point key again to save the new value. To skip entering a new value, press the Set Point key.


#### B – 2.4: Modifying the Booster Trigger Point

If Relay 3 is configured for Cl/Br Booster control, the screen will display boostr trig followed by the current trigger point. To change this setting, use the Up or Down Arrows to input the new value, then press the Set point key again to save it. To skip entering a new value, press the Set Point key.


#### B – 2.5: Modifying the Booster End Point

If Relay 3 is configured for Cl/Br Booster control, the screen will display booster end followed by the current end set point. To change this setting, use the Up or Down Arrows to input the new value, then press the Set point key again to save it. To skip entering a new value, press the Set Point key.


### B – 3: Single Point Calibration

To enter the calibration menu, press and hold the Cal key for three seconds. If the access codes have been set, the unit will prompt you for your access code, otherwise the display clears followed by Cal pH and the current pH reading. For help entering your access code, see ***A - 1.1: Entering the Program Menu***.


#### B – 3.1: Single Point Calibration - pH

The display should now read Cal pH followed by the current pH reading. Use the arrow keys to adjust the displayed value to match your test kit reading, and then press the Cal key to save it. To skip entering a new value, press the Cal key.


#### B – 3.2: Single Point Calibration - Temp

The display should now show Cal Temp followed by the current Temp calibration value. Once again, use the arrow keys to adjust this value to the real value then press the Cal key to enter it. To skip entering a new value, press the Cal key.

### B – 3.3: Single Point Calibration - ppm

If ppm is available on your unit, the display should read Cal ppm and the ppm LED's will be flashing. Use the arrow keys to adjust the LED bar graph to match your test kit reading, and then press the Cal key to save it. To skip entering a new value, press the Cal key.


### B – 3.4: Probe Error

If during a single point calibration you receive the error message "Probe Error!" contact your distributor.

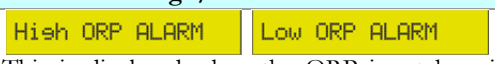

## B – 4: Alarms

During normal operation, the following alarms may be displayed. Some alarms will not be available depending on the system's configuration.

### B – 4.1: pH High/Low alarms

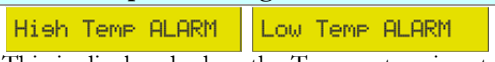

This is displayed when the pH input has risen above/fallen below the pH high/low alarm point. These alarms will also trigger the Cl/Br Lockout alarm.

### B – 4.2: ORP High/Low alarms




This is displayed when the ORP input has risen above/fallen below the ORP high/low alarm point.

### B – 4.3: Temperature High/Low alarms




This is displayed when the Temperature input has risen above/fallen below the Temperature high/low alarm point.

### B – 4.4: No Flow alarm


This is displayed when the flow input indicates the flow has stopped. This alarm disables all chemical feeds.

### B – 4.5: (x) min Feed Delay


When flow is disrupted and then restored, the controller will delay restarting feeds for a programmed duration in order to prevent operating feeds based on readings from stagnant water. (x) = the number of minutes remaining before feeds are allowed to start (e.g. 5 min Feed Delay).

### B – 4.6: Cl/Br Lockout


This is triggered whenever there is a pH high or low alarm. This message indicates that the Cl/Br feed (relay 2) and the optional Cl/Br Booster (relay 3) are disabled in order to prevent the Cl/Br feeds from driving the pH even further out of range.

### B – 4.7: pH FAILSAFE ALM


This is displayed when the active pH feed (feed up or feed down) attempted to feed continuously for the selected failsafe duration. The active pH feed is disabled until one of the following conditions occurs:

1) The pH input reaches the programmed set point.
2) Disruption of flow
3) User manually resets the failsafe.

### B – 4.8: Cl/Br FAILSAFE


This is displayed when the Cl/Br feed attempted to feed continuously for the selected failsafe duration. The Cl/Br feed is disabled until one of the following conditions occurs:

1) The ORP/ppm input reaches the programmed set point.
2) Disruption of flow
3) User manually resets the failsafe.

### B – 4.9: Booster FAILSAFE


This is displayed when the optional Cl/Br Booster feed attempted to feed continuously for the selected failsafe duration. The Cl/Br Booster feed is disabled until one of the following conditions occurs:

1) The ORP input reaches the Cl/Br Booster set point.
2) Disruption of flow
3) User manually resets the failsafe.

## B – 5: Resetting a Failsafe Alarm

To reset a failsafe alarm, press and hold the Up and down arrow keys momentarily.

The BECSys2 requires no maintenance other than a periodic calibration check and sensor cleaning.

## C – 1: Potentiometric Sensors (pH and ORP)

### C – 1.1: Electrode Cleaning:

Slow response time and large offsets may indicate the electrode has become coated. The nature of the coating will dictate the type of cleaning technique that should be used.

**⚠ Warning: You may lightly blot the water On a pH sensor tip on a paper towel, but never vigorously rub or wipe the pH bulb because this may scratch the delicate outer layer on the pH glass impairing its response.**

- Soft coatings, like bacterial films, are best removed using a squirt bottle or the water jet from a faucet. If this is not successful, then gently wipe with a soft wet cloth.
- For a more severe coating, first try a strong detergent (something similar to Dawn liquid detergent) and warm water, using a soft brush (like a toothbrush). Isopropyl alcohol on a Q-tip is another good choice. Rinse the measuring end in distilled water before reinstallation.
- Greasy and oily coatings are best removed with a detergent solution or a solvent that will not attack the sensor body. Methanol and isopropyl alcohol are good choices for solvents. Acetone, MEK, THF, or trichloroethane will irreparably harm the electrode.
- Hard coatings, like calcium or lime scale, are best removed with a solvent appropriate for the particular coating. A 5% solution of hydrochloric acid (HCl) would be a good choice for calcium scale. If unsure of the proper solvent to remove a hard mineral coating, then alternate between a 5% hydrochloric acid and a 4% sodium hydroxide (NaOH) for 10 minutes each. After treating the electrode with these strong acids or bases, rinse the electrode with water and soak it in a pH 4 buffer for at least 1/2 hour.
- The platinum tip of an ORP sensor can be cleaned with an abrasive as a last resort. Gently scour the platinum with a 600 grit wet emery cloth, or preferably, a 1-3 micron alumina polishing powder.

### C – 1.2: Long-Term Storage:

Save the wetting cap that came with the sensor for long-term storage. After removing the sensor from the flow-cell, clean it as in routine maintenance, and then store it in the wetting cap using a pH 4 buffer saturated with potassium chloride (KCl). The potassium chloride will prevent electrolyte from leaching out of the sensors reference cell. The wetting cap only needs to be half full. If a number of sites are going to be serviced, for example, at the end of a season, then it might be a good idea to carry a pint of 4.0/KCl storage solution.

## Section D: Feed Charts

Use the charts on the following pages to determine the correct amount of chemical to add to spa or pool water to achieve desired conditions. Choose which chart to use by the chemical indicated and the number of gallons to be treated.

### D – 1: Spa Feed Charts

**Quantity of Muriatic Acid Needed to Lower Total Alkalinity**

| Desired Decrease In ppm | Gallons in Spa | | | | | |
|---|---|---|---|---|---|---|
| | 100 | 150 | 250 | 500 | 750 | 1000 |
| 10 | 1.25 ts | 2.00 ts | 1.00 tb | 2.00 tb | 3.00 tp | 0.25 cp |
| 20 | 2.50 ts | 4.00 ts | 2.00 tb | 0.25 cp | 0.33 cp | 0.50 cp |
| 30 | 1.25 tb | 2.00 tb | 3.00 tb | 0.33 cp | 0.67 cp | 0.75 cp |
| 40 | 5.00 ts | 2.50 tb | 0.25 cp | 0.50 cp | 0.75 cp | 1.00 cp |
| 50 | 2.00 tb | 3.00 tb | 5.00 tb | 0.67 cp | 1.00 cp | 1.33 cp |
| 60 | 2.50 tb | 0.25 cp | 0.33 cp | 0.75 cp | 1.00 cp | 1.50 cp |
| 70 | 3.00 tb | 0.25 cp | 0.50 cp | 1.00 cp | 1.33 cp | 1.75 cp |
| 80 | 3.50 tb | 0.33 cp | 0.50 cp | 1.00 cp | 1.50 cp | 2.00 cp |
| 90 | 0.25 cp | 0.33 cp | 0.67 cp | 1.00 cp | 1.67 cp | 2.33 cp |
| 100 | 0.25 cp | 0.50 cp | 0.67 cp | 1.33 cp | 2.00 cp | 2.50 cp |

ts = teaspoon tb = tablespoon cp = one cup (8 fl oz)

**Quantity of Sodium Bisulfate Needed to Lower Total Alkalinity**

| Desired Decrease In ppm | Gallons in Spa | | | | | |
|---|---|---|---|---|---|---|
| | 100 | 150 | 250 | 500 | 750 | 1000 |
| 10 | 1.50 ts | 2.50 ts | 1.00 tb | 2.50 tb | 0.25 cp | 0.33 cp |
| 20 | 1.00 tb | 1.50 tb | 2.50 tb | 0.33 cp | 0.50 cp | 0.67 cp |
| 30 | 1.50 tb | 2.50 tb | 0.25 cp | 0.50 cp | 0.75 cp | 1.00 cp |
| 40 | 2.00 tb | 3.00 tb | 0.33 cp | 0.67 cp | 1.00 cp | 1.25 cp |
| 50 | 2.50 tb | 0.25 cp | 0.50 cp | 0.75 cp | 1.25 cp | 1.50 cp |
| 60 | 3.00 tb | 4.50 tb | 0.50 cp | 1.00 cp | 1.50 cp | 2.00 cp |
| 70 | 0.25 cp | 0.33 cp | 0.50 cp | 1.00 cp | 1.67 cp | 2.25 cp |
| 80 | 0.25 cp | 0.33 cp | 0.67 cp | 1.25 cp | 2.00 cp | 2.50 cp |
| 90 | 0.33 cp | 0.50 cp | 0.75 cp | 1.50 cp | 2.25 cp | 3.00 cp |
| 100 | 0.33 cp | 0.50 cp | 0.75 cp | 1.67 cp | 2.50 cp | 3.25 cp |

ts = teaspoon tb = tablespoon cp = one cup (8 fl oz)

**Quantity of Bicarbonate of Soda Needed to Raise Total Alkalinity**

| Desired Increase In ppm | Gallons in Spa | | | | | |
|---|---|---|---|---|---|---|
| | 100 | 150 | 250 | 500 | 750 | 1000 |
| 10 | 1.25 ts | 2.00 ts | 4.00 ts | 2.50 tb | 0.25 cp | 0.33 cp |
| 20 | 1.00 tb | 1.50 tb | 2.50 tb | 5.00 tb | 0.50 cp | 0.50 cp |
| 30 | 1.50 tb | 2.00 tb | 3.50 tb | 0.50 cp | 0.67 cp | 1.00 cp |
| 40 | 2.00 tb | 3.00 tb | 0.33 cp | 0.50 cp | 1.00 cp | 1.00 cp |
| 50 | 2.50 tb | 3.50 tb | 6.00 tb | 0.75 cp | 1.00 cp | 1.50 cp |
| 60 | 3.00 tb | 0.25 tb | 0.50 cp | 1.00 cp | 1.33 cp | 1.75 cp |
| 70 | 3.50 tp | 0.35 cp | 0.50 cp | 1.00 cp | 1.50 cp | 2.00 cp |
| 80 | 0.25 cp | 0.33 cp | 0.50 cp | 1.25 cp | 1.75 cp | 2.50 cp |
| 90 | 0.33 cp | 0.50 cp | 0.67 cp | 1.33 cp | 2.05 cp | 2.75 cp |
| 100 | 0.33 cp | 0.50 cp | 0.75 cp | 1.50 cp | 2.25 cp | 3.00 cp |

ts = teaspoon tb = tablespoon cp = one cup (8 fl oz)

**Quantity of Calcium Chloride Needed to Increase Calcium Hardness**

| Desired Increase In ppm | Gallons in Spa | | | | | |
|---|---|---|---|---|---|---|
| | 100 | 150 | 250 | 500 | 750 | 1000 |
| 10 | 1.25 ts | 2.00 ts | 1.00 tb | 2.00 tb | 3.00 tb | 0.25 cp |
| 20 | 2.50 ts | 4.00 ts | 2.00 tb | 0.25 cp | 0.33 cp | 0.50 cp |
| 30 | 1.25 tb | 2.00 tb | 3.00 tb | 0.33 cp | 0.67 cp | 0.75 cp |
| 40 | 4.00 ts | 2.50 tb | 0.25 cp | 0.50 cp | 0.75 cp | 1.00 cp |
| 50 | 2.00 tb | 3.00 tb | 5.00 tb | 0.67 cp | 1.00 cp | 1.33 cp |
| 60 | 2.50 tb | 0.25 cp | 0.33 cp | 0.75 cp | 1.00 cp | 1.50 cp |
| 70 | 3.00 tp | 0.25 cp | 0.50 cp | 1.00 cp | 1.33 cp | 1.75 cp |
| 80 | 3.50 tp | 0.25 cp | 0.50 cp | 1.00 cp | 1.50 cp | 2.00 cp |
| 90 | 0.25 cp | 0.33 cp | 0.33 cp | 1.00 cp | 1.67 cp | 2.33 cp |
| 100 | 0.25 cp | 0.50 cp | 0.67 cp | 1.33 cp | 2.00 cp | 2.50 cp |

ts = teaspoon tb = tablespoon cp = one cup (8 fl oz)

**Quantity of Chlorine Compound Needed to Increase 1 ppm**

| Percent Chlorine In Product | Gallons in Spa | | | | | |
|---|---|---|---|---|---|---|
| | 100 | 150 | 250 | 500 | 750 | 1000 |
| 5 | 0.50 tb | 2.00 ts | 1.25 tb | 2.50 tb | 0.25 cp | 0.33 cp |
| 10 | 0.25 tb | 1.00 ts | 2.00 ts | 1.25 tb | 2.00 tb | 2.50 tb |
| 12 | 0.25 tb | 1.00 ts | 0.50 tb | 1.00 tb | 1.50 tb | 2.00 tb |
| 30 | 0.25 tb | 0.33 ts | 0.75 ts | 1.25 ts | 2.00 ts | 2.50 ts |
| 40 | 0.167 ts | 0.25 ts | 0.500 ts | 1.00 ts | 1.50 ts | 2.00 ts |
| 50 | 0.167 ts | 0.25 ts | 0.375 ts | 0.75 ts | 1.25 ts | 1.50 ts |
| 60 | 0.167 tb | 0.200 ts | 0.375 ts | 0.50 ts | 1.00 ts | 1.25 ts |
| 65 | 0.100 ts | 0.167 ts | 0.250 ts | 0.50 ts | 0.75 ts | 1.00 ts |

ts = teaspoon tb = tablespoon cp = one cup (8 fl oz)

## D – 2: Pool Feed Charts

| Quantity of Muriatic Acid Needed to Lower Total Alkalinity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Desired Decrease In ppm | Gallons in Pool | | | | | | | | |
| | 10,000 | 25,000 | 50,000 | 75,000 | 100,000 | 200,000 | 500,000 | 750,000 | 1,000,000 |
| 10 | 1.30 pt | 1.62 qt | 3.25 qt | 1.22 gl | 1.62 gl | 3.25 gl | 8.13 gl | 12.20 gl | 16.25 gl |
| 20 | 1.30 pt | 3.25 qt | 1.62 gl | 2.43 gl | 3.25 gl | 7.50 gl | 16.20 gl | 24.30 gl | 32.50 gl |
| 30 | 1.95 qt | 1.22 gl | 2.44 gl | 3.86 gl | 4.98 gl | 9.76 gl | 24.40 gl | 36.60 gl | 48.80 gl |
| 40 | 2.80 qt | 1.63 gl | 3.25 gl | 4.87 gl | 6.50 gl | 13.00 gl | 32.50 gl | 48.80 gl | 65.00 gl |
| 50 | 3.25 qt | 2.03 gl | 4.07 gl | 6.10 gl | 8.14 gl | 16.28 gl | 40.70 gl | 61.00 gl | 81.40 gl |
| 60 | 3.90 qt | 2.44 gl | 4.88 gl | 7.32 gl | 9.76 gl | 19.52 gl | 48.80 gl | 73.20 gl | 97.80 gl |
| 70 | 1.14 gl | 2.84 gl | 5.69 gl | 8.54 gl | 11.38 gl | 22.76 gl | 56.90 gl | 85.45 gl | 113.80 gl |
| 80 | 1.30 gl | 3.25 gl | 6.50 gl | 9.75 gl | 13.00 gl | 26.00 gl | 65.00 gl | 97.50 gl | 138.00 gl |
| 90 | 1.48 gl | 3.66 gl | 7.31 gl | 10.96 gl | 14.82 gl | 29.24 gl | 73.10 gl | 109.60 gl | 146.20 gl |
| 100 | 1.63 gl | 4.06 gl | 8.12 gl | 12.18 gl | 16.24 gl | 32.48 gl | 81.20 gl | 121.80 gl | 162.40 gl |
| 120 | 1.96 gl | 4.88 gl | 9.76 gl | 14.64 gl | 19.52 gl | 39.00 gl | 97.80 gl | 148.40 gl | 196.20 gl |
| 150 | 2.44 gl | 6.09 gl | 12.18 gl | 18.27 gl | 24.40 gl | 48.80 gl | 121.80 gl | 182.70 gl | 244.00 gl |
| 200 | 3.25 gl | 8.12 gl | 18.24 gl | 24.36 gl | 32.50 gl | 65.00 gl | 162.40 gl | 243.80 gl | 325.00 gl |

pt = one pt (16 fl oz) qt = one quart (32 fl oz) gl = one gallon (128 fl oz)

| Quantity of Bicarbonate of Soda Needed to Raise Total Alkalinity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Desired Increase In ppm | Gallons in Pool | | | | | | | | |
| | 10,000 | 25,000 | 50,000 | 75,000 | 100,000 | 200,000 | 500,000 | 750,000 | 1,000,000 |
| 10 | 1.50 lb | 3.75 lb | 7.50 lb | 11.25 lb | 15.00 lb | 30.00 lb | 75.00 lb | 112.50 lb | 150.00 lb |
| 20 | 3.00 lb | 7.50 lb | 15.00 lb | 22.50 lb | 30.00 lb | 60.00 lb | 150.00 lb | 225.00 lb | 300.00 lb |
| 30 | 4.50 lb | 11.25 lb | 22.50 lb | 33.75 lb | 45.00 lb | 90.00 lb | 225.00 lb | 337.50 lb | 450.00 lb |
| 40 | 6.00 lb | 15.00 lb | 30.00 lb | 45.00 lb | 60.00 lb | 120.00 lb | 300.00 lb | 450.00 lb | 600.00 lb |
| 50 | 7.50 lb | 18.75 lb | 37.50 lb | 56.25 lb | 75.00 lb | 150.00 lb | 375.00 lb | 562.50 lb | 750.00 lb |
| 60 | 9.00 lb | 22.50 lb | 45.00 lb | 67.50 lb | 90.00 lb | 180.00 lb | 450.00 lb | 675.00 lb | 900.00 lb |
| 70 | 10.50 lb | 26.25 lb | 52.50 lb | 78.75 lb | 105.00 lb | 210.00 lb | 525.00 lb | 787.50 lb | 1050.00 lb |
| 80 | 12.00 lb | 30.00 lb | 60.00 lb | 90.00 lb | 120.00 lb | 240.00 lb | 600.00 lb | 900.00 lb | 1200.00 lb |
| 90 | 13.50 lb | 33.75 lb | 67.50 lb | 101.25 lb | 135.00 lb | 270.00 lb | 675.00 lb | 1012.50 lb | 1350.00 lb |
| 100 | 15.00 lb | 37.50 lb | 75.00 lb | 112.50 lb | 150.00 lb | 300.00 lb | 750.00 lb | 1125.00 lb | 1500.00 lb |

lb =pounds of dry chemical

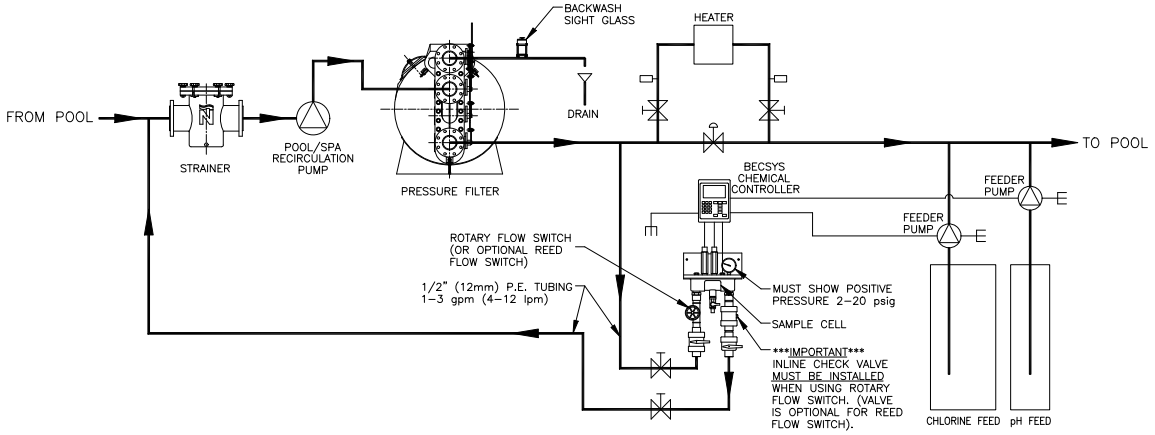
| Quantity of Calcium Chloride Needed to Increase Calcium Hardness | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Desired Increase In ppm | Gallons in Pool | | | | | | | | |
| | 10,000 | 25,000 | 50,000 | 75,000 | 100,000 | 200,000 | 500,000 | 750,000 | 1,000,000 |
| | lb oz | lb oz | lb oz | lb oz | lb oz | lb | lb oz | lb oz | lb |
| 10 | 1 4 | 3 2 | 6 4 | 9 6 | 12 8 | 25 | 62 8 | 93 12 | 125 |
| 20 | 2 8 | 6 4 | 12 8 | 18 12 | 25 0 | 50 | 125 0 | 197 8 | 250 |
| 30 | 3 12 | 9 6 | 18 12 | 28 2 | 37 8 | 75 | 187 8 | 281 4 | 375 |
| 40 | 5 0 | 12 8 | 25 0 | 37 8 | 50 0 | 100 | 250 0 | 375 0 | 500 |
| 50 | 6 4 | 15 10 | 31 4 | 46 14 | 62 8 | 125 | 312 8 | 468 12 | 625 |
| 60 | 7 8 | 18 12 | 37 8 | 56 4 | 75 0 | 150 | 375 0 | 562 8 | 750 |
| 70 | 8 12 | 21 14 | 43 12 | 65 10 | 87 8 | 175 | 437 8 | 658 4 | 875 |
| 80 | 10 0 | 25 0 | 50 0 | 75 0 | 100 0 | 200 | 500 0 | 750 0 | 1,000 |
| 90 | 11 4 | 28 2 | 56 4 | 84 6 | 112 8 | 225 | 562 8 | 843 12 | 1,125 |
| 100 | 12 8 | 31 4 | 62 8 | 93 12 | 125 0 | 250 | 625 0 | 937 8 | 1,250 |
| 150 | 18 12 | 46 14 | 93 12 | 104 10 | 187 8 | 375 | 937 8 | 1,406 4 | 1,875 |
| 200 | 25 0 | 62 8 | 125 0 | 187 8 | 250 0 | 500 | 1,250 0 | 1,875 0 | 2,500 |

| Quantity of Chlorine Compound Needed to Increase 1 ppm | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Percent Chlorine In Product | Gallons in Pool | | | | | | | | |
| | 10,000 | 25,000 | 50,000 | 75,000 | 100,000 | 200,000 | 500,000 | 750,000 | 1,000,000 |
| 5 | 3.2 cp | 2 qt | 1 gl | 1.5 gl | 2 gl | 4 gl | 10 gl | 15 gl | 20 gl |
| 10 | 1.6 cp | 1 qt | 2 qt | 3 qt | 1 gl | 2 gl | 5 gl | 7.5 gl | 10 gl |
| 12 | 1.33 cp | 1.67 pt | 1.517 qt | 2.276 pt | 3.33 qt | 1.665 gl | 4.163 gl | 6.245 gl | 8.326 gl |
| 30 | 0.278 lb | 0.665 lb | 1.390 lb | 2.085 lb | 2.780 lb | 5.580 lb | 13.900 lb | 20.850 lb | 27.800 lb |
| 40 | 0.209 lb | 0.521 lb | 1.043 lb | 1.565 lb | 2.086 lb | 4.172lb | 10.430 lb | 15.645 lb | 20.860 lb |
| 50 | 0.167 lb | 0.417 lb | 0.834 lb | 1.251 lb | 1.668 lb | 3.336lb | 8.340lb | 12.511 lb | 16.680 lb |
| 60 | 0.139 lb | 0.348 lb | 0.695 lb | 1.043 lb | 1.390 lb | 2.780lb | 6.950 lb | 10.425 lb | 13.900 lb |
| 65 | 0.128 lb | 0.321 lb | 0.642 lb | 0.963 lb | 1.284 lb | 2.568lb | 6.420 lb | 9.630lb | 12.840 lb |
| 70 | 0.119 lb | 0.298 lb | 0.596 lb | 0.894 lb | 1.192 lb | 2.384lb | 5.960lb | 8.940 lb | 11.920 lb |
| 75 | 0.111 lb | 0.278 lb | 0.556 lb | 0.834 lb | 1.112 lb | 2.224 lb | 5.560 lb | 8.340 lb | 11.120 lb |
| 80 | 0.104 lb | 0.261 lb | 0.521 lb | 0.782 lb | 1.042 lb | 2.064 lb | 5.210 lb | 7.815 lb | 10.420 lb |
| 85 | 0.096 lb | 0.417 lb | 0.491 lb | 0.737 lb | 0.982 lb | 1.964 lb | 4.910 lb | 7.365 lb | 9.829 lb |
| 90 | 0.093 lb | 0.232 lb | 0.463 lb | 0.695 lb | 0.926 lb | 1.852 lb | 4.630 lb | 6.945 lb | 9.260 lb |
| 100 | 0.083 lb | 0.209 lb | 0.417 lb | 0.626 lb | 0.634 lb | 1..668 lb | 4.170 lb | 6.225lb | 8.340 lb |

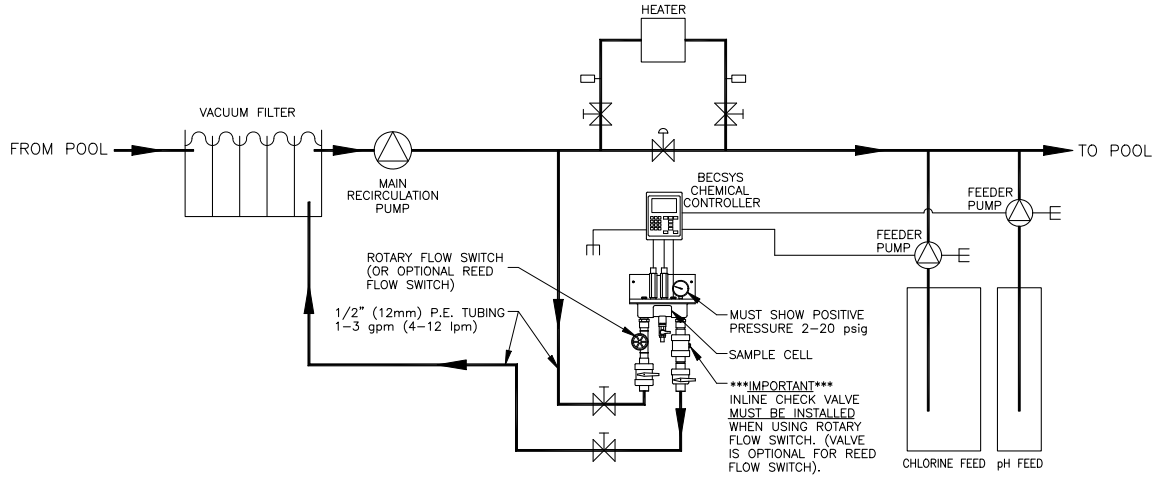
cp = one cup (8 fl oz) pt = one pt (16 fl oz) qt = one quart (32 fl oz)
gl = one gallon (128 fl oz) lb =pounds of dry chemical

## Section E: Installation Diagrams

### E – 1: Pressure Filter Installation




### E – 2: Vacuum Filter Installation



## Section F: Replacement Parts

| Fuses | | |
|---|---|---|
| 8140086 | **115V Unit** Main Fuse | Time Lag 250mA 250V |
| 8140093 | **230V Unit** Main Fuse | Time Lag 125mA 250V |
| 9140088 | Relays 1-3 | Time Lag 3A 250V |
| 8140059 | RS485 Fuse | Time Lag 250mA 250V |
| 8320053 | Fuse Cap | |

| Sensors | |
|---|---|
| **pH Sensors** | |
| 9660013 | BECSys pH Sensor (30" cable) [range: 0 to 14.0 pH] |
| 9660010 | BECSys pH Sensor (10' cable) [range: 0 to 14.0 pH] |
| **ORP Sensors** | |
| 9660022 | BECSys ORP Sensor Platinum Band (30" cable) [range: 0 to 1000mV] |
| 9660023 | BECSys ORP Sensor Platinum Band (10' cable) [range: 0 to 1000mV] |
| 9660038 | BECSys ORP Sensor Solid Gold Band (30" cable) [range: 0 to 1000mV] |
| 9660040 | BECSys ORP Sensor Solid Gold Band (10' cable) [range: 0 to 1000mV] |
| **pH/ORP Sensor Accessories** | |
| 8500061 | 4/KCl solution (pint); for long-term storage of sensors |
| 8680015 | ½" Wetting Cap for pH and ORP sensors |
| **Temperature Sensors** | |
| 9660016 | Temperature Sensor (30" cable) [range: 32°F to 212°F (0°C to 100°C)] |
| 9660003 | Temperature Sensor (10' cable) [range: 32°F to 212°F (0°C to 100°C)] |
| **Flow Switches** | |
| 9660006 | Reed flow switch [Switch Point (On): 2.0 gpm] |
| 9660007 | Rotary flow switch [Switch Point (On): 1.5 gpm] |
| 9060547 | Spring Check Valve |
| 8680019 | Rotary Flow Switch Replacement Kit includes: 1 Pin, 1 Cover, 1 Wheel, 1 O-ring |
| 8060663 | Rotary Flow Switch Replacement Pin |
| 8060664 | Rotary Flow Switch Replacement Cover |
| 8060665 | Rotary Flow Switch Replacement Wheel |
| 8060666 | Rotary Flow Switch Replacement O-Ring |

| Boards | |
|---|---|
| 1200406 | BECSys2 CPU PCB |
| 1200407 | BECSys2 Relay PCB |

| Software | |
|---|---|
| 1230084 | BECSys2 Firmware |

| Documentation | |
|---|---|
| 8620006 | BECSys2 Operation and Maintenance Manual |
| 8620009 | BECSys2 Installation and Technical Manual |

| Misc | |
|---|---|
| **Enclosure Parts** | |
| M000063 | BECSys2 Lid Assembly (No PCB) no ppm scale |
| M000064 | BECSys2 Lid Assembly (No PCB) 0.2-3.0 ppm scale |
| M000065 | BECSys2 Lid Assembly (No PCB) 0.6-6.0 ppm scale |
| 9440141 | BECSys2 Overlay, no ppm scale |
| 9440144 | BECSys2 Overlay, 0.2-3.0 ppm scale |
| 9440145 | BECSys2 Overlay, 0.6-6.0 ppm scale |
| 8060736 | Small watertight cord grip PG-7 |
| 8060735 | Large watertight cord grip NPT ½" |
| **Internal Components** | |
| 8041102 | 2 Position Pluggable Terminal Block (Temperature) |
| 8041103 | 3 Position Pluggable Terminal Block (Flow Switch, RS485) |
| 8380650 | RS485 IC |
| 9060533 | Shield Screws |
| 9520034 | Ribbon Cable |

| Flow Cell Replacement Parts | |
|---|---|
| **Round Flow Cell** | |
| 1220210 | Round Flow Cell Body |
| 1220205 | Acrylic Cover for Round Flow Cell |
| 8060626 | O-Ring for Round Flow Cell |
| 1220207 | PVC Mounting Plate for Round Flow Cell |
| 8080625 | Screws – Mounting Plate |
| **Rectangular Flow Cell** | |
| 1220201 | 2-Sensor Rectangular Flow Cell Body |
| 1220200 | Acrylic Cover for 2-Sensor Rectangular Flow Cell |
| 8060669 | O-Ring for 2-Sensor Rectangular Flow Cell |
| **Common Flow Cell Components** | |
| 9060189 | Screws – Acrylic Cover |
| 8060623 | Elbow, 90° PVC |
| 8060624 | Elbow, 45° PVC |
| 9060538 | Plug, ¼" PVC |
| 9060541 | Nipple, ½" Close |
| 8060621 | Sample Valve, ¼" Ball Cock |
| 9060546 | Ball Valve ½" PVC |
| 9060549 | S80 Bushing, PVC ¾ x ½ |
| 9060544 | Pressure Gauge |
| 8060673 | Pressure Regulator |

## LIMITED WARRANTY

BECS warrants the controller electronics and flow cell against any defect in workmanship or materials for a period of two years from the date of shipment. BECS warrants the BECSys pH and ORP sensors (9660010, 9660013, 9660022, 9660023, 9660038, and 9660040) against any defect in workmanship or materials for a period of two years from the date of shipment. In the event of a component failure due to any defect in workmanship or materials, BECS will repair, or if repair is not possible, replace the defective part or parts of the BECSys controller.

BECS will have the sole right to determine whether to repair or replace a product. BECS will not be responsible for any expense associated with installation of repaired or replacement parts.

## LIMITATIONS AND EXCLUSIONS

This is a LIMITED WARRANTY. BECS makes NO WARRANTIES other than those contained herein. The LIMITED WARRANTY replaces and is in lieu of any WARRANTIES of MERCHANTABILITY or of FITNESS FOR A PARTICULAR PURPOSE which are expressly DISCLAIMED. All GENERAL, SPECIAL, INDIRECT, INCIDENTAL AND/OR CONSEQUENTIAL DAMAGES ARE EXCLUDED AND DISCLAIMED.

This Limited Warranty is governed by Missouri Law and all disputes related to or arising from this transaction or Limited Warranty shall be resolved in Circuit Court of St. Louis County, Missouri.

Any claims under this Limited Warranty must be brought within ONE YEAR after the cause of action accrued.

BECS TECHNOLOGY has been designing and manufacturing the industry's most reliable water chemistry controller for over 20 years. Our 24,000 $ft^2$ facility in Saint Louis, Missouri is home to an exceptional design team, and all manufacturing is performed onsite at this facility where we can personally assure the quality of our products. The BECS commitment to excellence drives the most innovative new products and unparalleled customer service.

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9487 Dielman Rock Island Industrial Dr. St. Louis, MO 63132 Tel:(314) 567-0088