35405200 | July 2017

resilience®

D+ Series

Installation Manual

Model: PSC5









PREFACE

Congratulations on your purchase of Resilience D Plus natural chlorine generator with full automatic control of pH and Chlorine. Your purchase will minimize the efforts needed to maintain your pool and maximize your enjoyment. The system uses a very low concentration of salt (less than the concentration in a human teardrop) and converts it into free chlorine that destroys algae and bacteria in the pool. After removing the algae and bacteria, the chlorine reverts back into salt. This process of purification continues, making the need of adding extra sanitizing chemicals to the pool virtually unnecessary.

Before installation or operation, please take the time to read this entire manual, compare package contents with the parts list, and gather tools required. Improper installation may void the warranty and create unnecessary hazards. This manual contains step-by-step instructions to help ensure that your installation meets the recommended standards. Spending the time to understand your system and its functions will assure successful, trouble-free operation. If you are unsure about any of the information in this manual, please contact your installer/dealer.

When working around your pool, please take care to avoid hazards such as electrical wires and chemicals.

CAUTION! Safety comes first!

SAFETY INSTRUCTIONS

Read and follow all instructions

All electrical work must be performed by a licensed electrician and conform to all national, state, and local codes. Improper use or installation can badly harm the unit and its surroundings. When installing and using electrical equipment, basic safety precautions should always be followed, including the following:

DO NOT OPEN THE DISPLAY COVER OF THE CONTROL BOX – NOT A SERVICABLE UNIT.

- Disconnect all AC power before installation.
- **WARNING** – to reduce the risk of injury, do not permit children to use this product.
- The Control Box must be mounted **vertically** on a flat surface and at a minimum horizontal distance of 1.5m (5ft) (or more, if local codes require so) from the pool.
- **WARNING – risk of electric shock!** Connect only to a grounding type circuit protected by a ground-fault circuit-interrupter (GFCI) outlet. The installer should provide this GFCI requirement. The GFCI should be rated for minimum 6 Amps and tested on a regular basis by pushing the test button. If the GFCI fails to operate correctly, there is ground current flowing indicating the possibility of electric shock. Do not use this unit. Disconnect unit and have a qualified professional fix the problem before using.
- The Input circuit (LN1 & N/LN1) must be connected only after OVERCURRENT DEVICES, such as fuse or circuit breaker to limit the amperage in the input wire to the maximum that is permitted by the National electrical Code.
- The Unit must be permanently connected, with copper wire, not less than 1.5 mm^2 (14 Awg).
- Do not bury the cord. Place the cord so to minimize damage by lawn mowers, hedge trimmer and other equipment.
- **WARNING!** To reduce the risk of electric shock, replace a damaged cord immediately.

● **WARNING!** To reduce the risk of electric shock, do not use an extension cord to connect the unit to electric power supply; provide a properly located outlet.

● Wiring of the unit must be performed according to the wiring instructions detailed in this manual or on the front box cover.
● Build-up of flammable fumes can result in a hazardous condition if the cell is allowed to operate without flow. This device must be operated only with the original in-line flow sensor.
● The Flow Sensor must be installed between the last piece of apparatus and the cell.
● Ensure that equipment and materials used in or around the pool and spa are compatible with salt-based sanitation systems. Certain materials may be susceptible to salt and chlorine damage.

● ALWAYS ADD ACID TO WATER, NEVER WATER TO ACID.
● Make sure the pool's machine room is properly vented to avoid damage from acid vapors.

●Under no circumstances should the machine room be used to store equipment, furniture, sports gear or any other equipment that is not related to the pool including spare acid containers. The machine room must be aired and vented prior to entering it.

● Acid container must be stored inside a spill containment vessel (a basin to hold acid in case of overflow or tipping of the acid container).
● **KEEP THESE INSTRUCTIONS FOR FUTURE USE.**

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PACKAGE CONTENTS

Please unpack your new system carefully. Do not use a knife or sharp instrument to remove contents. Enclosed in the packing you should find the following:

Control Box





Tee holder for sensors (pH & ORP)



Flow Switch Tee & Temp Sensor



6 PVC hose reducer couplings



Cell



ORP sensor



pH sensor



Dosing acid pump

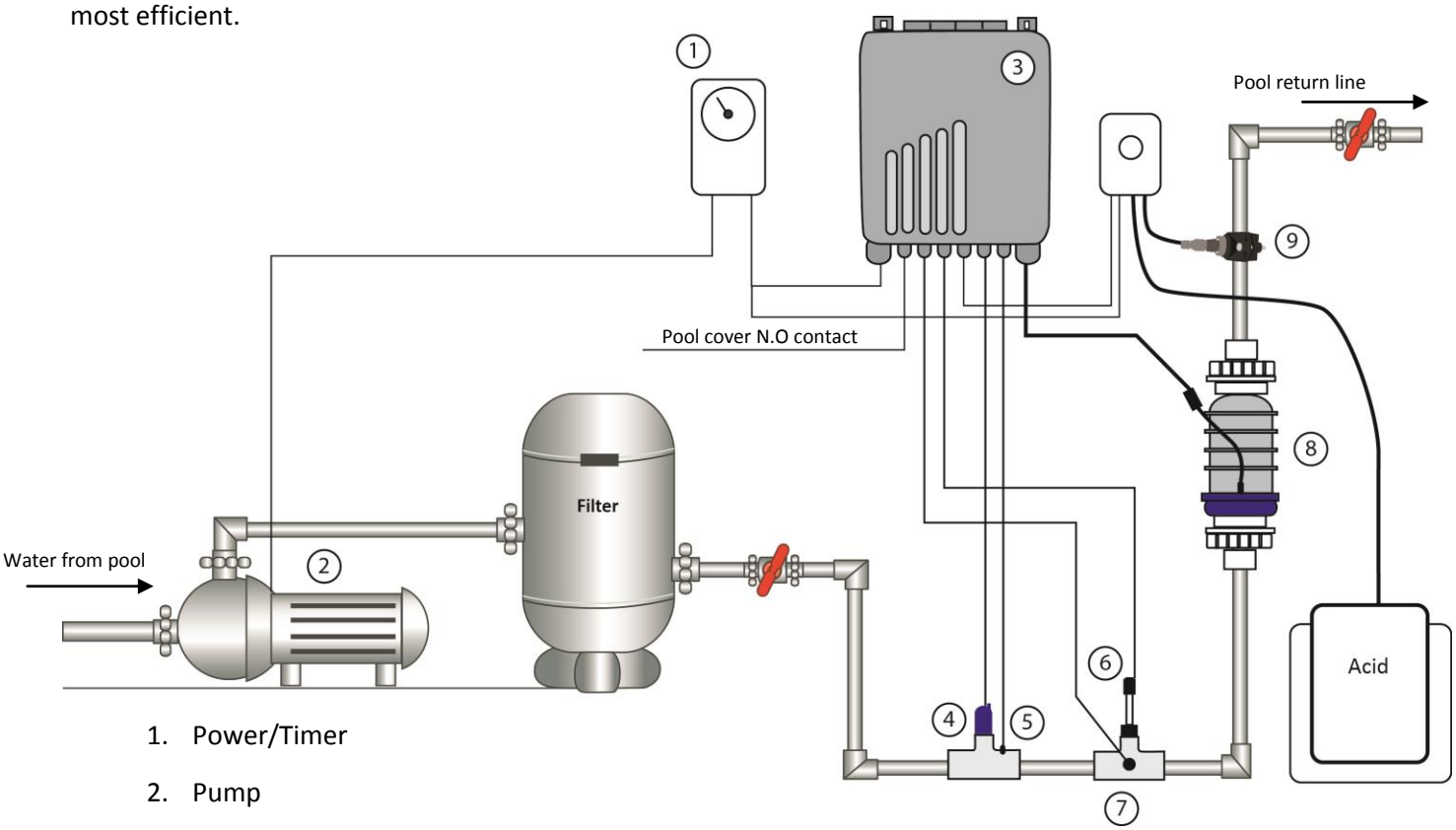
Dosing acid pump kit includes: 2 saddles (50 + 63mm), 3/8" to 1/2" adaptor, none return valve, internal replacement tube, 2 x 3m polyethylene tube, foot filter and weight.

ADDITIONAL MATERIALS REQUIRED (NOT SUPPLIED IN PACKAGE)

1. PVC solvent cement and priming fluid
2. Hacksaw or pipe cutters and petroleum jelly
3. Screwdrivers
4. Drill needed for systems with 1½ inch plumbing
5. Conduit
6. Silicone lubricant (DO NOT use silicone glue)
7. Pipe adaptors (i.e. reducer couplings)
8. High voltage wires (copper conductors only)

SYSTEM OVERVIEW

This installation manual is designed for the pool professional. It assumes the installer has a working knowledge of basic pool-service operations. It is based on actual field installations and the natural flow of progress found to be most efficient.



1. Power/Timer
2. Pump
3. Control Box
4. Flow switch
5. Water temperature sensor
6. pH sensor
7. ORP sensor
8. Cell
9. Dosing acid pump

The Natural Chlorine Generator consists of 5 main units: Control box, Cell, Flow Sensor, pH & ORP sensors attached to a Tee and dosing acid pump. These assemblies are manufactured using to most advanced corrosion resistant materials that are extremely durable. Installing them in an area that is sheltered from the sun and water will protect them from extreme weather conditions.

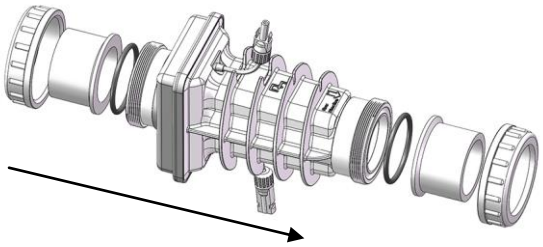
SAFETY MEASURES

1. Operate the system **ONLY** with the original flow sensor supplied with the system.
2. See important safety instructions on page 2 of this manual.

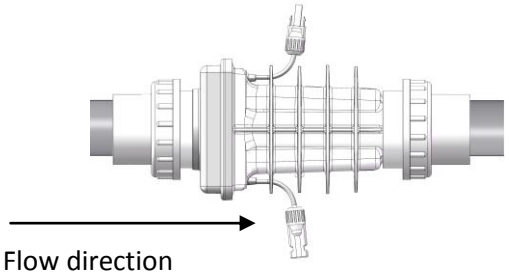
PLUMBING CONFIGURATIONS

CELL PLUMBING

1. The Cell and Flow Sensor must be installed downstream from the filter and heating devices before any Tees in the return line. The Cell may be installed horizontally or vertically as long as it is pointing in the direction of flow (i.e. blue side in and clear side out).
2. Approximately 380 mm (15 inches) of pipe length will be needed for horizontal installations for the flow Sensor and cell. Vertical installations will require less space.
3. On the pipe where the cell is installed, mark two lines 300 mm (11 3/4 inches) apart and cut out using a hacksaw or pipe cutter.
4. Unscrew and remove the barrel unions (i.e. barrel nuts and slip connections) from either end of the cell. Thread one of the barrel nuts over the pipe and glue its slip connection to the cut pipe.



5. Hold up the cell with the second union to gauge the proper distance before threading the second nut and gluing the second slip.
6. After the glue had sufficient drying time, place the cell with the O'rings into the opening between the two ends of the pipe and tighten the unions making sure that the cell is installed with the arrow pointing in the direction of the flow (i.e. water should enter from the side with the blue cap).



Flow direction

INSTALLING THE PH/ORP TEE

The Tee holding the sensors must always be installed on a horizontal pipe to be sure that the pH and ORP sensors are positioned correctly. Sensors MUST be the first element installed right after the filter. If pool is heated (heat pump, heat exchanger, electric heater or solar system), Sensors will be installed before the heating system (reading must be made on unheated water)

Always keep pH and ORP submerged in liquid. Drying will damage the sensor and void its warranty.

Sensor cables must be positioned far away from high voltage cables to prevent false readings.

Make sure the machine room is properly ventilated to avoid damage caused from acid fumes. Under no circumstances should the machine room be used to store equipment not related to the pool including spare acid containers. The machine room must be aired and vented prior to working in it.

Acid container must be stored inside a spill containment vessel (a basin to hold acid in case of overflow or tipping of the acid container.

INSTALLING THE DOSING ACID PUMP

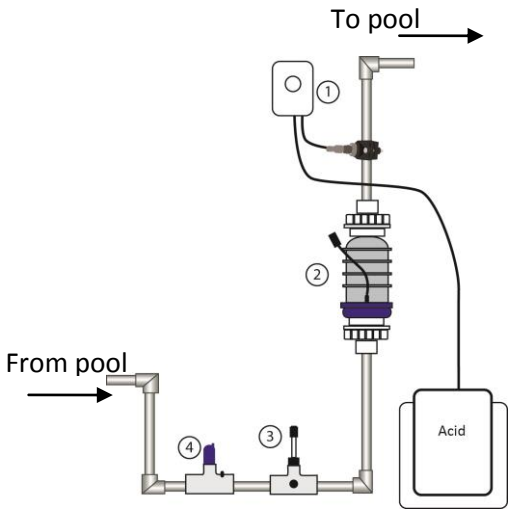
The dosing acid pump should be installed right after the chlorinator cell, in a way that ensures the cell stays full of water when the circulation pump turns off. Choose one of the plumbing configuration options below:

A. U shape installation

B. Horizontal installation

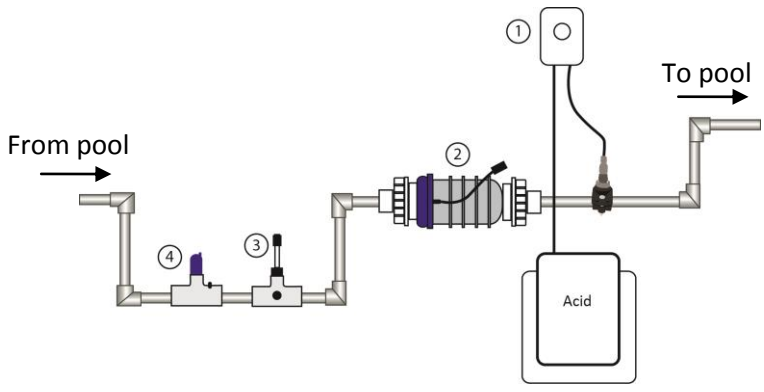
U SHAPE PLUMBING CONFIGURATION

1. Dosing acid pump
2. Chlorinator Cell
3. Tee with pH and ORP sensors
4. Flow switch Tee



HORIZONTAL PLUMBING CONFIGURATION

1. Dosing acid pump
2. Chlorinator Cell
3. Tee with pH and ORP sensors
4. Flow Switch Tee



A plumbing trap is required to keep the cell flooded with water when the dosing acid pump washes the cell during the circulation pump downtime. Create the trap so the acid injected by the dosing acid pump will be focused on the cell and not flow back to the pool or equipment set.

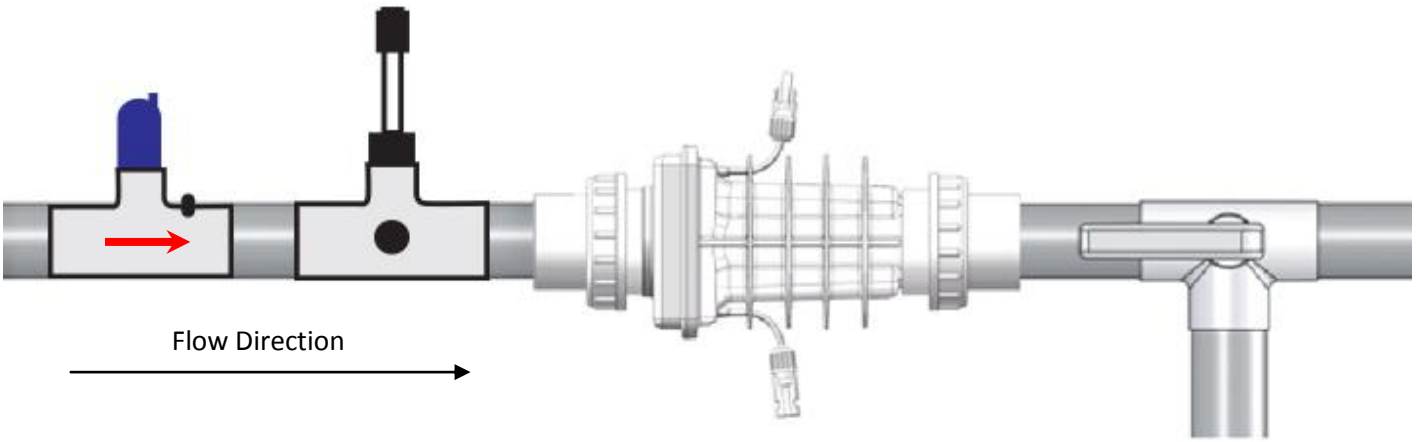
INSTALLING THE FLOW SENSOR

1. The flow sensor must be installed before the cell. Make sure that there is no valve between the cell and the flow sensor. The flow sensor may be installed vertically, in an angle, but **MUST NOT** be installed upside down. This could cause debris to settle in the flow sensor body and restrict the paddle movement.
2. Clean and glue the Tee connector (included) to the pipe, making sure that the threaded end with the sensor is on the pipes topside (as illustrated here ->).





3. **Make sure that the arrow at the top of the flow sensor points in the flow direction and that no glue or pipe cleaner touches the paddle inside the sensor as it may cause it to jam.** Double check that the flow sensor operates properly by reducing the flow for five seconds and checking if the low flow indicator on the control box lights.



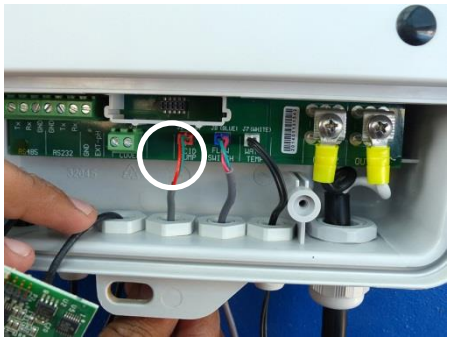
INSTALLATION OF DOSING ACID PUMP

- **Disconnect ALL power before work commences.**
- **Open the control boxes' lid to make sure the unit is turned OFF.**
- **It is recommended to wear rubber or polyethylene protective gloves and safety glasses. It is also advisable to protect your clothes or wear dispensable ones.**
- **Make sure the pool's machine room is properly vented to avoid damage from acid vapors.**
- **Under no circumstances should the machine room be used to store equipment, furniture, sports gear or any other equipment that is not related to the pool, including spare acid containers. The machine room must be aired and vented prior to entering it.**
- **Acid container must be stored inside a spill containment vessel (a basin to hold acid in case of overflow or tipping of the acid container).**

1. Determine the location where you wish to install the acid pump on the wall.
2. Check that the all components: electrical wiring, tubes etc. reach their position.
3. Drill and attach the acid pump's clip to the wall and hang the pump on it.




4. Open the control box service panel.
5. Find the acid pump connection point marked "acid pump". Insert the signal cable that originates from the pump through the hole at the bottom of the control box and connect it to the acid pump terminal. Make sure the cable is secured and reattach the service panel's cover. (See wiring the dosing acid pump, page 18).



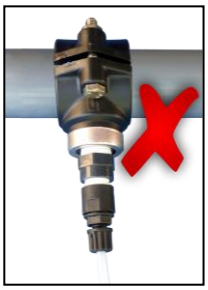


6. Wire the electrical cable of the acid pump to the main power source in the machine room (240V) parallel to the circulation pump. **This must be performed by a licensed electrician!**

Installing the pipe saddle -

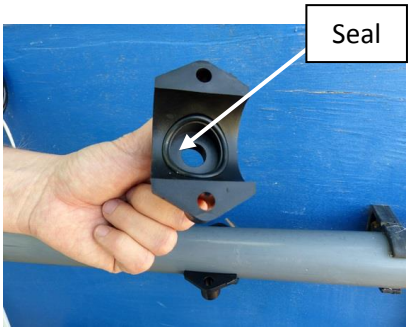
The injector non-return valve on the pipe saddle must be installed as pictured in the images with the Check mark.

The injector non-return valve MUST NOT be installed upside down!!! This could cause debris to settle inside it and restrict its functionality.





7. Establish the pipe diameter you have installed and make sure you have the correct pipe saddle (50 or 63mm).
8. Acid pump's pipe saddle must be installed right after the electrolysis cell.
9. With the proper sized saddle for your piping, locate the position where the acid will be infused through and drill a 9mm hole in the pipeline.
10. Turn the top part of the saddle and make sure the seal is properly placed. Position the two parts over the hole you just drilled.






11. Insert the two screws through the saddle's holes and tighten them (13 mm wrench is needed).



12. Wrap the threads of the saddle fitting adapter (½ to ⅜) with Teflon tape and thread it into the acid pipe saddle.
13. Wrap the injector non-return valve threads with Teflon tape and thread it into the saddle fitting adapter.




14. Cut the supplied tube to the required length - this will become the injection tube. Attach one end to the outlet of the acid pump (right side) and the other end to the injector non-return valve attached to the pipe.

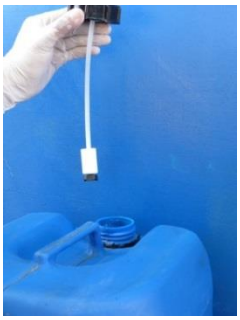
    Note the arrows impressed on the acid pump transparent cover indicating the suction and injection direction of the acid.




15. Cut another piece of tube to the required length - this will become the suction tube. Attach one end to the inlet of the acid pump (left side)**.**



16. Thread the other end other suction tube through the lid of the acid container and attach to it the weight and foot filter.
17. Close the lid of the acid container and make sure the suction tube cannot be pulled out of the container.
18. Place the acid container inside a spill container vessel (a basin to hold acid in case of overflow or tipping o the acid container).
19. **Place the acid container and spill container vessel in a safe place and in such a way that it cannot cause damage if it falls. Make sure it is positioned away from children!**




20. Turn the control box on. Manually operate the acid pump in manual mode for a number of minutes.
21. Make sure the red light on the pump is on, that it is spinning and that acid it sucked from the acid container and injected to the pipe.

After the system has been started, make sure to check the dosing acid pump and all connections for leaks.

INSTALLING THE PH SENSOR

1. Carefully remove the small protection bottle that contains a preservative liquid by unscrewing its cap.
2. Empty the preservative liquid in the bottle and set the bottle aside for storage during the winter months.
3. Insert the pH sensor into the top opening of the Tee holder. Make sure the sensor is not touching the bottom of the Tee holder and is hanging just above it. Tighten the black collar so it firmly holds the sensor in place.
4. Connect the pH sensor wire into the control box as illustrated on page 16 & 18, wiring components.

INSTALLING THE ORP SENSOR

1. Carefully remove the protective transparent cover from the sensor. Be sure not to break the thin gold electrode.
2. Place the transparent cover so it can be put back on the sensor during the winter.
3. Thread the ORP sensor into the designated side opening of the Tee holder. Make sure the thread of the sensor has Teflon tape on it to ensure no leaks will occur.
4. Connect the ORP sensor wire into the control box as illustrated on page 16 & 18, wiring components.



Warning: Never wipe sensor with a cloth or a piece of paper as it could damage it!
Always keep pH and ORP submerged in liquid. Drying will damage the sensor and void its warranty.



Tee holding sensors must not be installed so it is exposed to direct sunlight. This will cause faulty sensor readings.



The Tee holding the sensors must always be installed onto a horizontal pipe to be sure that the pH and ORP sensors are positioned vertically.



Sensors must be the first element installed right after the filter.



If pool is heated (heat pump, heat exchanger, electric heater or solar system), sensors will be installed before the heating system (reading must be made on unheated water)

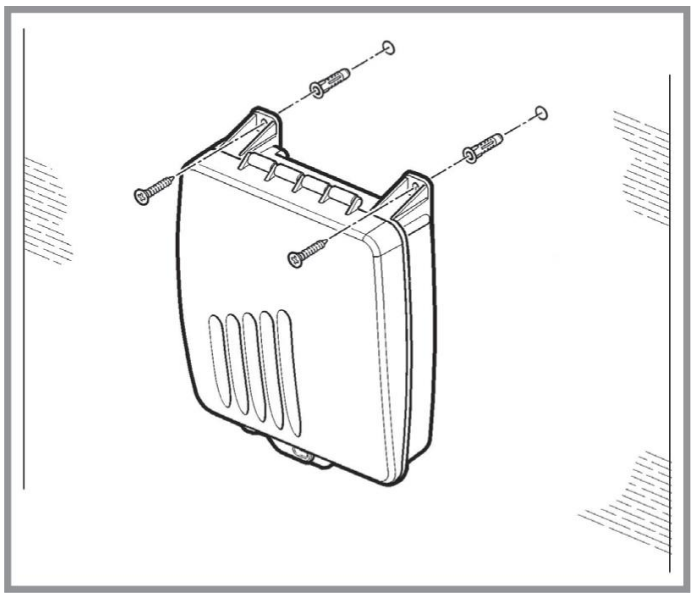


Sensor cables must be positioned far away from high voltage cables to prevent false readings.



NOTE: an incorrectly installed pH and/or ORP sensors may give incorrect measurements resulting in inappropriate operation of the system.

MOUNTING THE CONTROL BOX

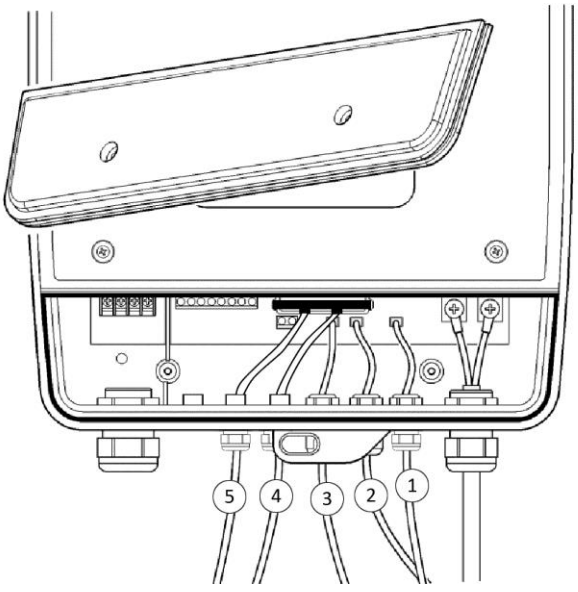


1. The control box must be mounted vertically on a flat surface, and a minimum horizontal distance of 1.5 m (5 ft) (or more, if local codes require) from the pool.
2. Select a location for your control box within 3½ meters (10 ft) from the intended cell and flow switch installation, to ensure that enough cable is available (the actual cable length is 3.7 m/ 12 ft)
3. Secure the unit on the wall using the enclosed screws and anchors. Use 8 mm (¼") drill bit for the anchor holes.
4. Remove the access cover at the lower part of the control box by opening the two screws holding it in place.
5. Hardwire the power cable to the time clock as indicated in the instructions on the next page.

CAUTION!

- Do not mount the system above a heater, inside a panel or tightly enclosed area. This can overheat and damage the system.
- Do not block the vents of the control box, located at its back.

Connect the color coded plugs with matching sockets (red, blue and white). Connect the plug sensor to the corresponding socket on the slotted card as illustrated:



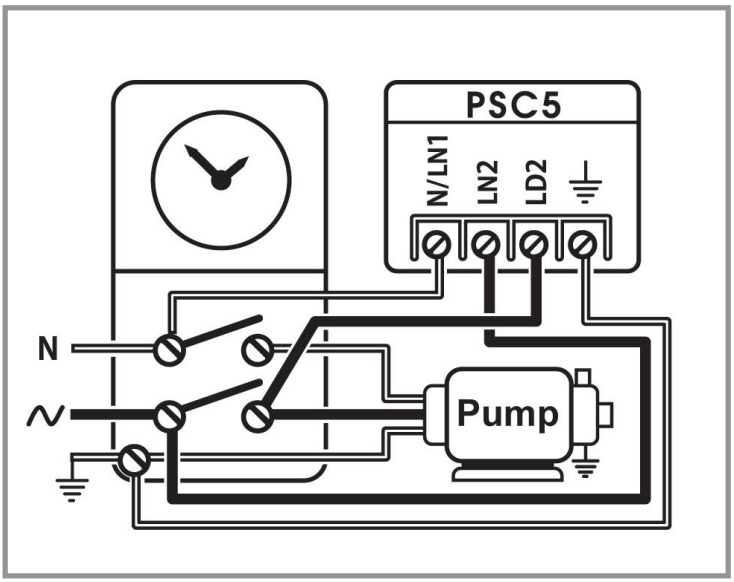
1. Temperature sensor (WHITE)
2. Flow switch (BLUE)
3. Dosing acid pump (RED)
4. pH sensor
5. ORP sensor

ELECTRICAL WIRING OF THE CONTROL BOX

CAUTION!

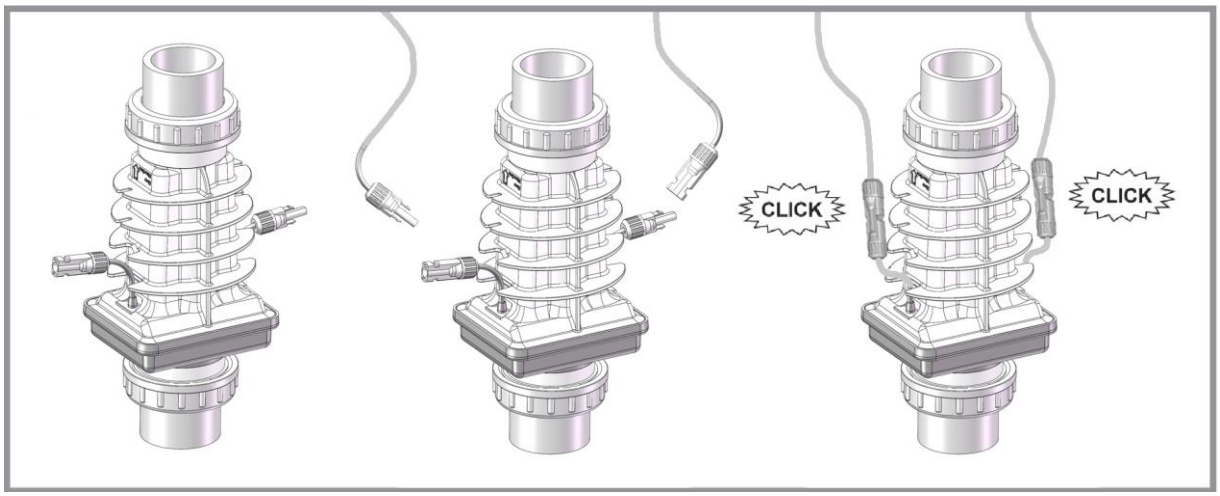
- Disconnect all power supply to the main timer/main power source before hardwiring the input voltage cables to the timer and control box.
- Hardwire all accessory equipment: dosing acid pump, Temp sensor etc. and close the access cover before resupplying main high voltage to the unit.

Electrical wiring scheme



WIRING THE CELL

Ensure that the connections are perfectly clean from any debris. Connect the two black wires from the control box to the connectors at the sides of the cell **until they "click" together**.



NOTE: do not extend the original cables leading to the cell. This decreases the system efficiency and will void warranty coverage.

WIRING THE FLOW SENSOR

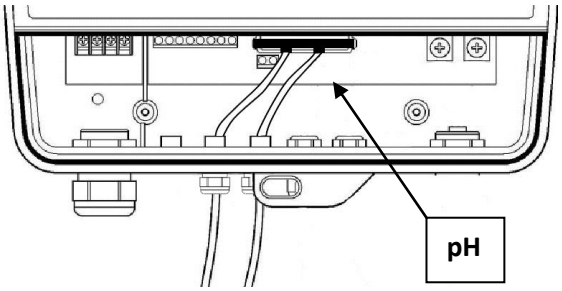
Locate the flow sensor terminals at the lower part of the control box. Insert the flow switch cable through the connector hole in the lower part of the control box, and plug it into the flow sensor socket. Tighten the threaded adaptor firmly until the cable cannot be pulled out from the box.

WIRING THE TEMPERATURE SENSOR

Locate the temperature sensor terminals in the lower part of the control box. Insert the temperature sensor cable through the connector hole in the lower part of the control box and plug it into the temperature sensor socket. Tighten the threaded adaptor firmly until the cable cannot be pulled out from the box.

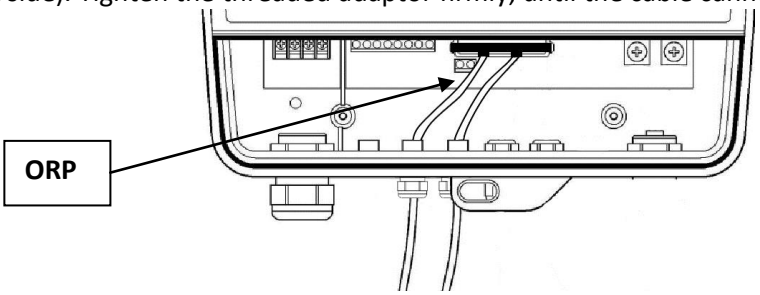
WIRING THE PH SENSOR

Locate the pH sensor terminals in the lower part of the control box, into the small green card inserted into a slot. Insert the pH sensor cable through the connector hole in the lower part of the control box and plug it into the pH sensor socket (the right side). Tighten the threaded adaptor firmly, until the cable cannot be pulled out from the box.



WIRING THE ORP SENSOR

Locate the ORP sensor terminals in the lower part of the control box, into the small green card inserted into a slot. Insert the ORP sensor cable through the connector hole in the lower part of the control box and plug it into the ORP sensor socket (the left side). Tighten the threaded adaptor firmly, until the cable cannot be pulled out from the box.



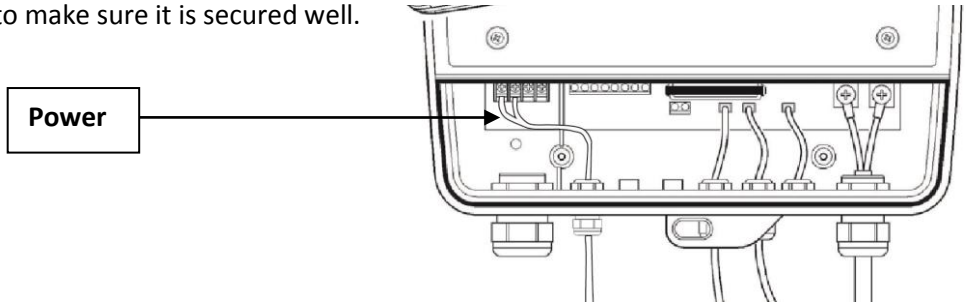
WIRING THE DOSING ACID PUMP

Locate the terminals marked "acid pump" in the lower part of the main control box. Insert the dosing acid pump "signal" cable (marked and has red connector) through the connector hole in the lower part of the control box and plug it into the acid pump socket. Tighten the threaded adaptor firmly until the cable cannot be pulled out from the box.

The second cable marked "power" can be wired in two ways:

1. Wire the electrical cable of the acid pump to the main power source in the machine room (240V) parallel to the circulation pump. **This must be performed by a licensed electrician!**
2. Insert the "power" cable through the connector in the lower part of the control box. Wire one strand to the left most socket. The remaining strand should be connected to one of the center sockets.

   Gently pull on the cable to make sure it is secured well.



WIRING THE POOL COVER INDICATION

Hardwire 2 wires that deliver dry contact signal from the pool cover control to the "pool cover" terminals in the lower part of the control box. Make sure to use a proper strain relief (PG/Heyco) that will not enable that cable from being pulled out from the control box, see page 30 for more information.

STARTING UP

BEFORE ADDING THE SALT

1. **Balance the chemicals**: See the section titled "Understanding the chemistry" on page 40 for recommended water balance. Remove metals from the water using a phosphate-free metal remover and test the water to ensure that phosphate levels are lower than 100 ppb (parts per billion). This will ensure that the transition to the natural chlorine generator system is quick and reliable.
2. **New Pools**: wait 30 days or longer if specified by your pool builder, for plaster to cure before adding salt or operating the natural chlorine generator.
3. **Biguanide Pools:** if installing the system in a pool that has Biguanide sanitizers, all Biguanide must be removed prior to system startup.

Now that your new controller has been physically installed, water chemistry should be tested and adjusted prior to initiating automated control of the pool. Check that your pool water conforms to the following ranges before powering on and setting up the Resilience D Plus.

IMPORTANT! It is compulsory to control and adjust water balance parameters **BEFORE** operating the system.

Test	Minimum	Ideal	Maximum
Salt	3000	3500	4500
pH	7.0	7.5	7.8
Free Chlorine (ppm)	1	2	3
Bromine (ppm)	2	3	4
Stabilizer - Cyanuric Acid (ppm)	20	-	70
ORP (mV)	650	720	850
Total Alkalinity	80	-	120
Calcium Hardness	200	-	400

ADDING THE SALT

1. Measure the pre-existing salinity of your pool. Previous chlorine use may cause the salinity reading to be higher due to residual salt in the chlorine.
2. Determine how much salt is needed from the Salinity Demand Table on the following page. This table is based on a salt concentration of 3500 ppm (approximately ⅓ %). More salt may be added for larger pools (e.g. 4000 ppm).
3. Keep the circulating pump on.
4. Distribute the determined amount of salt evenly around the pool. To avoid clogging the filter or damaging the control box and pump, do not add salt through the skimmer or surge tank. Brush the bottom to help dissolve the salt.
5. The readout on the chlorine generator may fluctuate until the salt is fully dissolved.
6. Turn the control box OFF. **Failure to do so will cause the fuse to blow**.
7. Keep the pump on to circulate the water.
8. Distribute the required amount of salt evenly around the pool. It will take about 8 hours for the salt to disperse evenly in the water.
9. Once the salt has fully dissolved, adjust the chlorinator to the desired setting.

Calculating the size of the pool

	Liters (dimensions in meters)	**Gallons** (dimensions in feet)
Rectangular	Length X Width X Average Depth X 1000	Length X Width X Average Depth X 7.5
Round	Diameter X Diameter X Average Depth X 785	Diameter X Diameter X Average Depth X 5.9
Oval	Length X Width X Average Depth X 893	Length X Width x Average Depth X 6.7

What type of salt should I use?

Good	**Bad – do not use!**
The best salt is an evaporated, granulated pool salt	Iodized salt
99.9% pure salt	Salts with more than 1% anti caking agents (e.g. yellow prussiate of soda or sodium ferrocyanide) – because they contain iron and will yellow the fittings. These anti caking agents are commonly found in water softener salts
	Rock salt – because of the dirt mixed with the rock salt
	Calcium chloride- is not a salt. Use only sodium chloride

Salinity demand table (in kg.)

Salt level before addition (in ppm)

How much salt to add? (In kg.)

Your pool water volume – in thousands of liters

	0	500	1000	1500	2000	2500	3000	3500	4500
10	40	35	30	25	20	15	10	5	0
20	80	70	60	50	40	30	20	10	0
30	120	105	90	75	60	45	30	15	0
40	160	140	120	100	80	60	40	20	0
50	200	175	150	125	100	75	50	25	0
60	240	210	180	150	120	90	60	30	0
70	280	245	210	175	140	105	70	35	0
80	320	280	240	200	160	120	80	40	0
90	360	315	270	225	180	135	90	45	0
100	400	350	300	250	200	150	100	50	0
110	440	385	330	275	220	165	110	55	0
120	480	420	360	300	240	180	120	60	0
130	520	455	390	325	260	195	130	65	0
140	560	490	420	350	280	210	140	70	0
150	600	525	450	375	300	225	150	75	0
160	640	560	480	400	320	240	160	80	0
170	680	595	510	425	340	255	170	85	0
180	720	630	540	450	360	270	190	95	0
190	760	665	570	475	380	285	190	95	0
200	800	700	600	500	400	300	200	100	0

Identify the current salt concentration at the top of the chart (e.g. 1000 ppm). Then find the size of your pool on the left (e.g. 100,000 liters). Run these figures down and across until they meet. That is amount of Kilograms of salt that needs to be added to your pool.

OPERATING INSTRUCTIONS

FILTRATION

Proper filtration is critical for maintaining clean and healthy water. It is typically required in the pool industry that all water of the pool pass through the filter at least one and a half (1½) times per day (at least eight hours in most pools). During very heavy use, the filter run time should be increased. If needed, the filter circulation pump and chlorine generator may run continuously.



Note: inadequate filtration reduces water clarity and causes the generator to work harder.

Related chemistry

Other chemical levels must be monitored and adjusted because they can greatly reduce the effectiveness of the chlorine produced by the system. If you use a good quality pool test kit and follow the simple instructions outlined in this manual, your natural chlorine generator will help you maintain a sparkling-clean, trouble-free pool for years with minimal effort. See the section "Understanding the chemistry", page 40 for more information.

BASIC OPERATION

The natural chlorine generator produces a pure form of chlorine to sanitize and oxidize the pool water. The chlorine residual needs to be maintained at 1 to 3 ppm. This may be tested using a standard kit or by your local pool store. To obtain the optimal residual buildup of chlorine, the best time to run your filter is in the early morning and after 4pm when there is less UV to destroy the chlorine produced, leaving chlorine in the pool to oxidize the unwanted foreign matter.

Modes:

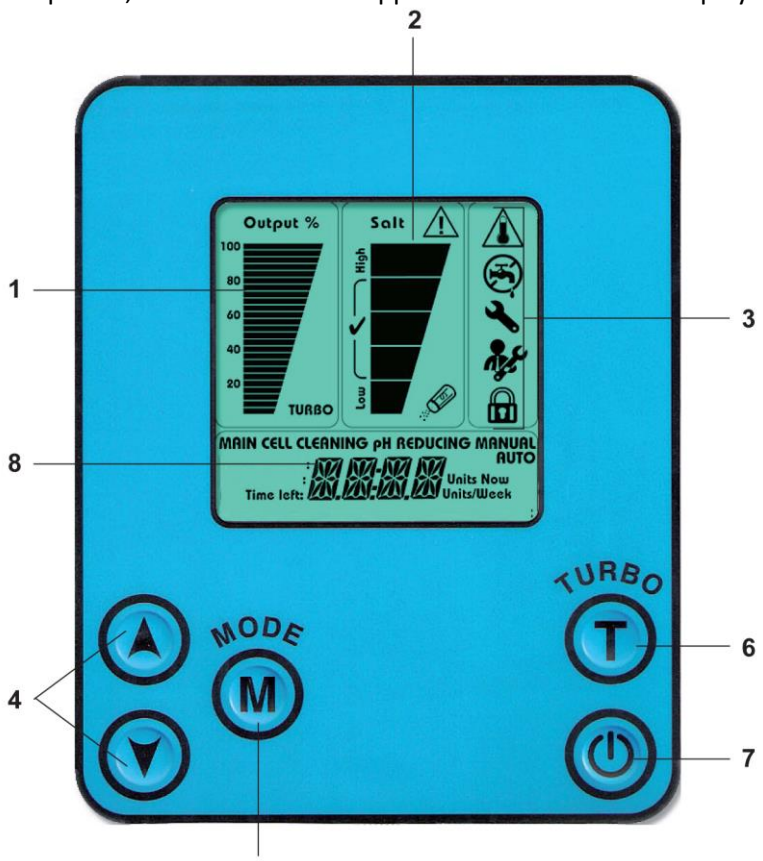
ON – the system is ON and the circulation pump is on – the system is fully operational and produces chlorine.

OFF – the unit is OFF by manual shut down of the controller using the ⏻ button. All system functions are off.

WARNING: the controller still receives power from the line.

ST:BY – The unit is in STAND-BY mode: it is waiting for the circulation pump to turn on before producing chlorine if the unit if off because the circulation pump if off, the OFF indication appears in the numerical display.

AUTO – Automatic control pH/ORP.

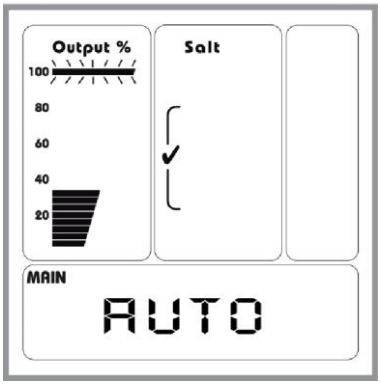


1. Chlorine output display
2. Salinity bar
3. Special icons
4. Up/Down buttons
5. Mode button (confirm)
6. Turbo button
7. ON/OFF
8. Numerical display

TURNING THE UNIT ON

1. Ensure that the main circulation pump is on.
2. Press the ⏻ button.
3. The controller turns on and automatically executes the following actions:
    - The system goes to the last setting before it was turned off
    - The main screen is active
    - Turbo time (if previously in this mode) goes back to zero (initialized).
    - The system measures the water's salinity and only after ~1 minute displays it.

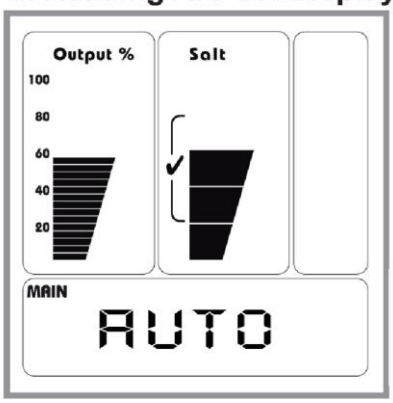
System Startup Display



Make sure all readings are ok:

- The salinity bar indicators are on at normal level (the salinity readout takes a little longer to display as the water has to be tested)
- AUTO indication appears in the numerical display

All Reading Are OK Display



To see the current readings of the pH and ORP sensors press either the ▼ or ▲ arrows.

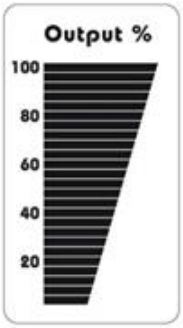
The first time one of the buttons is pressed the pH values are displayed.

The second time one of the buttons is pressed the ORP readings are visible. The readings will be displayed for a few seconds before returning to AUTO display.

pH feed output is activated when the measured pH is greater than the pH set point, indicating the need to feed acid to decrease the pH of the water. The display will show "pH REDUCING" blinking:



Chlorine output is activated when the measured ORP is below the ORP set point, indicating the need to generate more chlorine to meet the values of the set point. The "Output %"area on the LCD display will appear. System automatically begins producing chlorine to reach the set point.



The "Output %" area on the LCD display is only visible when chlorine is being generated by the system.

FROM NOW ON THE SYSTEM WILL BE OPERATING AUTOMATICALLY

OPERATING ACTIONS

In order to change the operation statuses of the system use the following operating actions:

Changing the pH set-point

Resilience D Plus is preset from the factory to maintain pH levels of 7.5.

pH set point values can only be changed within the range of 7.0 to 8.1.

To set pH set point to a different value, perform the following:

Press the M button twice and change the value by pressing the ▼ or ▲ arrows until the digital display matches your desired pH set point level.

To exit the set point mode press twice on the M button. The controller will automatically return to the normal operating mode after ten seconds, storing any changes.



Changing the ORP set-point

Resilience D Plus is preset from the factory to maintain ORP levels of 650 mV.

ORP set point values can only be changed within the range of 550 to 900.

To set ORP set point to a different value, perform the following:

Press the M button once and change the value by pressing the ▼ or ▲ arrows until the digital display matches your desired ORP set point level.

To exit the set point mode press three times on M button. The controller will automatically return to the normal operating mode after ten seconds, storing any changes.



The set point displayed on the LCD screen does not correspond to free chlorine level of the pool water. It is the selected level of 'water's disinfection potential' that is measured in millivolt units.

The set point required in order to obtain the optimal free chlorine level is set differently for each pool. A regular manual chlorine level test will be necessary to accurately adjust the ORP set point.

To increase potential chlorine generation: increase the ORP set point.

To decrease potential chlorine generation: decrease the ORP set point.

It is recommended to set the ORP set point to 750-800 during the first few days after having installed the Resilience D Plus system. This will allow for quick stabilization of the free chlorine level. If the free chlorine level is incorrect after startup it will be necessary to adjust the ORP set point accordingly.

Turbo setting

Press the (T) button (Turbo): this action increases chlorine output to 100% for a preset period of the timer. For further details about the Turbo mode see page 29.

Automatic ST:BY Mode

When the main circulation pump turns off the controller shuts down the current supply to the chlorinator cell. "ST:BY" display appears in the numerical display. This action is a safety action that prevents chlorine production without flow in the chlorinator cell.

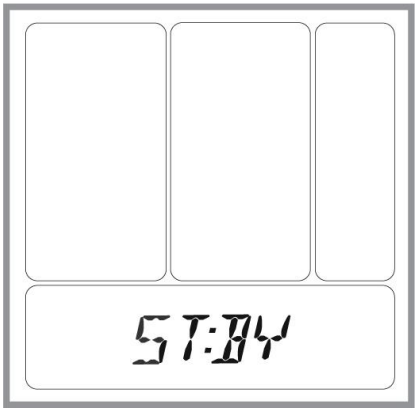
In ST:BY mode: the CELL CLEANING of the dosing acid pump is accessible as well as the option to calibrate the pH sensor when the unit if OFF (see "Calibrating pH sensor", page 30).

Unit turns ON from ST:BY Mode:

When the main circulation pump will turn on, the chlorinator will revert back to AUTO position.

- The system goes to the former setting before it was turned off.
- The main screen is active.
- The system goes back to the former setting in soft-start mode (i.e. slowly increasing the output from 0 to the former setting).
- Turbo time (if previously in this mode) continues to count back its remaining time.

ST:BY Mode Display



SALINITY READOUT

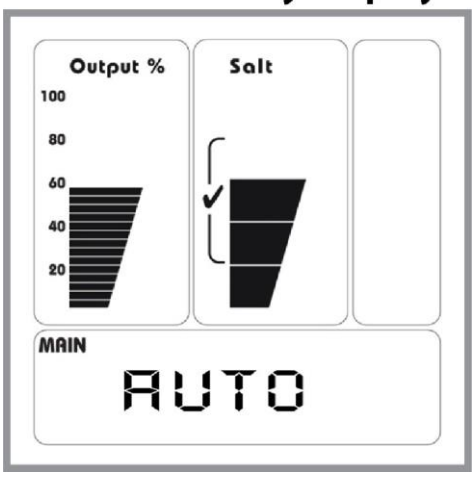
NOTE: the salt readout takes up to one minute to test and display the salt level.

NOTE: The chlorinator cell should be tested as lime-scale build up on its blades may affect the readings. Clean the blades if necessary. If the cell is clean and readings are still inaccurate please refer to the troubleshooting section of this guide, page 43.

Normal salt level

When salt level is between the recommended ranges of 2800-4700 ppm the salinity bar is in the (√ icon) area.

Normal Salinity Display



High salinity indication

Above 5500 ppm – the upper bar turns on with High salt indication.

Above 6500 ppm – the alarm salinity lamp is on.

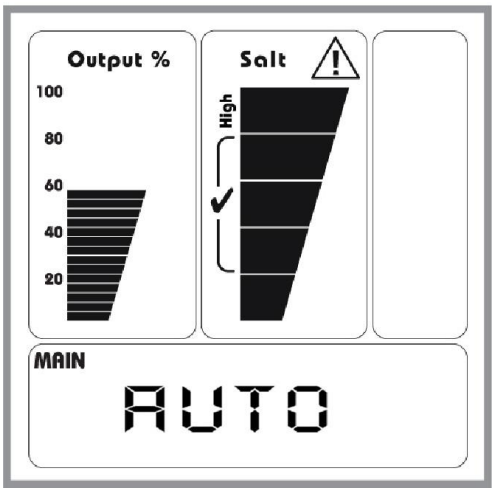
Above 8000 ppm – the upper salinity bar icons blink.

In all high salinity situations and alarms between 5,500-10,000 ppm the unit continues its normal operation.

In case of high salinity indication, the pool water should be tested by a pool professional. If levels are above 5,500 ppm, it is recommended to drain part of the pool water and refill with fresh water. Please check with your local pool professional prior to draining the pool.

At ~10,000 ppm: A monkey wrench icon lights up, output turns off but salt meter stays flashing and a HIGH SALT or SHRT CELL indication appears on the numerical display. The unit attempts to recover every few seconds.

High Salinity Display



Low salinity indication

Below 3000 ppm – the low salinity bar and the saltshaker icon are turned on.

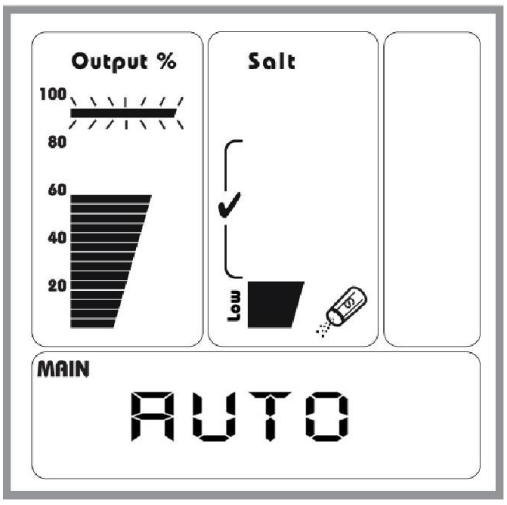
Below 2000 ppm – the low salinity bar and saltshaker icon blink.

In all low salinity situations and alarms the unit continues its operation. If the salinity is too low the requested value on the output % bar blinks and the maximum achievable output value is visible.

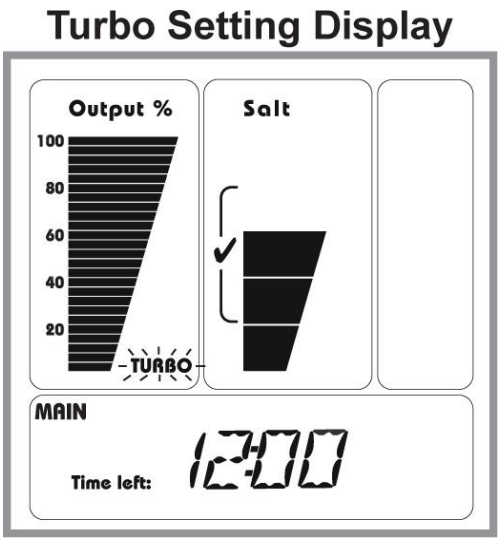
The chlorinator cell should be tested as lime-scale build up on its blades may affect the low salinity readings. Clean the blades if necessary.

In case of low salinity indication, the pool water should be tested by a pool professional and if the salinity is lower than 3000 ppm it is recommended to add salt according to the table on page 22.

Low Salinity Display



Turbo setting



Pressing the Turbo button starts turbo operation. The unit goes to 100% output for the adjusted time interval; the Turbo icon starts flashing.

The default turbo setting is 12 hours. To increase the turbo setting in 12 hour intervals, press the Turbo button one/two more times just after the first press. Then you may set the turbo time for 24, 36, 48, 60 or 72 hours.

The unit starts a Turbo time counter. The turbo counter is displayed on the numerical display.

Pressing ▲ or ▼ allows extending or shortening the Turbo time in intervals of minuets.

Minimum 0 and Maximum 72 hours values are accessible (use the same method of short and long pushes on the ▲ and ▼ buttons).

Cancelling Turbo Setting –

To cancel the adjusted Turbo setting you may do one of the following actions:

1. Wait for 5 seconds and press the Turbo button again. Verify that the Turbo icon stops blinking.
2. Turn the unit ON and OFF using the ON/OFF button.
3. During the first 5 seconds of Turbo adjusting procedure, press the Turbo button several times until the countdown display goes from 72 hours to 00:00.

Turbo mode additional information –

- Counting is performed only when the unit is AUTO.
- During the first 5 seconds in Turbo screen, additional presses on the Turbo button increases the timer in increments of 12 hours with each press: 12, 24, 48, 72 or 0 hours.
- Cancelling the Turbo option reverts back to the previous output selection.
- Pressing the Mode button while Turbo is on, allows changing between screens, while the Turbo lamp continues to blink.
- If Turbo mode is activated, the numerical display in the main screen shows the turbo timer and not the word AUTO.
- Power rises to 100%. In case of low salinity, the reading is similar to low salinity condition (i.e. the maximum output might be 60% so the blinking bar will show 100% setting and the solid output bar will show 60%).

POOL COVER FUNCTION

The unique pool cover function enables the chlorinator to reduce the chlorine output while the pool is covered.

When the pool cover is over the pool, the chlorinator will automatically reduce its chlorine output to 20% of the maximum level and an "AUX MODE" message will appear on the numerical display.

Pressing ▲ and ▼ buttons while the system is in pool cover mode enables to permanently set new output values to the unit while the pool is covered (e.g. the default setting is 20% total, but when the pools is covered you may change the default setting to be 40%. The setting will remain 40% for the next pool covering occurrences). In order to activate this function properly, make sure the control box is getting a dry contact from the pool cover control when the pool is covered.

CALIBRATING PH SENSOR

The pH sensor has been calibrated before leaving the factory, however, in order for the sensor to operate reliably and accurately it is imperative to calibrate the sensor before operating the system. The calibration will be executed by immersing the sensor in two different pH solutions: pH 7.0 and pH 4.0 solutions.

Make sure the control box is connected to the main power supply and in ST:BY mode. Turn off the pool pump.

Remove the pH sensor from its holder by unscrewing the black collar. Rinse the sensor with tap water and shake it to remove any excess water. **Do not touch or wipe the glass with a cloth as it may damage the sensor!**

1. Place the pH sensor in a buffer of pH 7.0 solution and stir the electrode in the solution several times.
2. Leave the pH sensor immersed in the solution for approximately 2 minutes in order to ensure reliable readings.
3. Turn off the control box by pressing the ⏻ button. The LCD display will show "OFF".
4. Press the M button to enter calibration mode.
5. Wait several seconds until the pH values are stable. Press on the M button to confirm the readings.
6. Remove the pH sensor from the pH 7.0 buffer solution. Rinse the sensor with tap water and shake it to remove any excess water. **Do not touch or wipe the glass with a cloth as it may damage the sensor!**
7. Place the pH sensor in a buffer of pH 4.0 solution and stir the electrode in the solution several times.
8. Wait several seconds until the pH values are stable. Press on the M button to confirm the readings.
9. The LCD display will show "DONE".

Calibration process is completed.

⚠ It is recommended to perform calibration at least once every two months during the swimming season.

⚠ Before starting the calibration process, ensure that the pH sensor is perfectly clean, and then rinse it with clear water. This will ensure that the calibration process is more accurate.

MANUAL PH CONTROL

The dosing acid pump enables the system to reduce pH levels manually by periodically infusing small amounts of acid into the pool. More acid in the water balances the pH levels, less acid units allow pH to rise.

MANUALY REDUCING THE PH

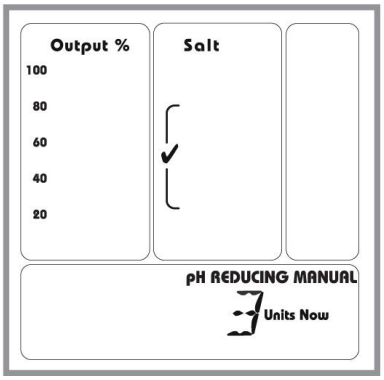
Ensure that the circulation pump is ON, then press the M "MODE" button three times to go to the "pH reducing: Manual" mode.

pH reducing: Manual

Use the ▲ and ▼ buttons to infuse the desired number of acid units immediately (e.g. "3 units now"). To eliminate this function, set the "Units Now" to 0. Turning off the circulation pump cancels this manual acid infusion.

NOTE: 1 Unit ~ 70 cc (2.5 oz).

pH Reducing Manual Display



CELL CLEANING MODE

The dosing acid pump system ensures the cell remains clean by automatically washing it with acid when the circulation pump is off. The factory preset allows a cell wash after the circulation pump logs at least 6 hours of run time (e.g. level 9).

A small amount of acid is used (approximately 70 cc / 2.5 oz), so the cleaning function has virtually no influence on the pH level in an averaged size pool. In small bodies of water or in acidic environments, the automatic cleaning should be scheduled less frequently.

Adjusting the frequency of the cleaning

1. Turn the circulation pump OFF, then press the M "MODE" button to get to the "CELL CLEANING: AUTO" mode.
2. Use the ▲ ▼ buttons to adjust the cleaning level (e.g. Level 3).

   LVL 0 = No cleaning.

   LVL 9 = most frequent cleaning.

Cell Cleaning Auto Display



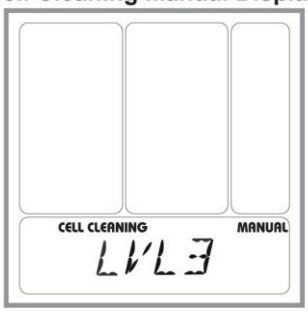
Immediately initiating a cell cleaning

1. Turn the circulation pump OFF, then press the (M) "MODE" button to get to the "CELL CLEANING: MANUAL" mode.
2. Use the (▲) (▼) buttons to adjust the cleaning level (e.g. Level 3).

   LVL 1 uses 1 unit of acid.

   LVL 4 uses 4 units of acid.

Cell Cleaning Manual Display



NOTE: the cleaning process can take more than 1 hour. If the cell remains calcified, purge it out by turning the circulation pump on for a few minutes, and then repeat the cleaning function.

Turning the circulation pump ON cancels this manual cleaning function.

NOTE: In cases that the automatic settings of the dosing acid pump does not reduce the pool's pH level or doesn't keep the cell clear, make sure that the acid container is full and that the suction tube is installed properly.

ACID PIPE REMINDER

The Check Valve and the internal tube of the dosing acid pump requires replacing every 180 days, therefore the system is set to begin counting down 180 days upon first operation. An "ACID PIPE" message appears on the numerical display every 180 days, when the Check Valve and the internal tube require replacing.

Tube need replacing, see "Replacing the internal tube of the dosing acid pump" chapter, page 38.

Once the Check Valve and the internal tube are replaced the 180 days counter needs to be reset.

To reset it do the following:

1. Press the (M) "MODE" button four times. ACID PIPE will display again.
2. Press the (▲) button once. A "NEW PIPE" and "180 DAYS" message will be displayed.
3. The systems default is to display a reminder every 180 days (recommended). Use the (▲) (▼) buttons to decrease the number of days in steps of 10 days. Once set, confirm by pressing the (M) button once.

WARNING MESSAGES

NO FLOW

The "faucet" icon is displayed and "NO FLOW" message appears on the numerical display.



If the faucet icon blinks it means that the flow switch is in "transient" position. Wait a few seconds for the icon to stop blinking and remain on the display. If the icon continues to blink, verify that you have proper flow without air bubbles in the cell pipeline.

NOTE: For installations with flow below 3 m^3/h (25 GPM) a "low flow" switch must be obtained from the manufacturer.

HIGH TEMPERATURE IN THE UNIT



High temperature icon will be turned on when unit temperature is higher than 65 °C (149°F).

If the temperature is higher than 70°C (158 °F) the control unit will reduce the chlorine output to 50%. The system will return to the full adjusted power and turn off the high temp icon when the unit temperature drops back below 65 °C (149 °F).

LOW TEMP

In case of low water temperature below 15 °C (59 °F) the unit will display "LOW TEMP" message on the numerical display and will reduce power output to maximum 50%.

If the water temperature drops below 10°C (50 °F) the unit will reduce power output to maximum 25%.

NOTE: If the water temperature sensor is not connected, the unit is preset for water temperature of 26.5 °C (79 °F). Refraining from wiring the temperature sensor may cause deviation in the salinity readings and may damage the cell in low water temperatures.

SHRT CELL

If the cell cable is shorted by some way or the salinity is much too high (above 10,000 ppm) a "SHRT CELL" indication will appear on the numerical display. The unit will reduce the power output to 0. The unit will attempt to recover from this state every few seconds and will automatically detect when the short is removed or the salinity is reduced.

NO CELL

If the cable is disconnected, the salinity is much too low (below 1000 ppm) or the cell has collected large amounts of scale deposits a "NO CELL" indication will appear on the numerical display and the unit will reduce the power output to 0. The unit will attempt to recover from this state every few seconds and will automatically detect when the cable is reconnected or the salinity and/or lime-scale is removed.

NEED PUMP

If the unit is attempting to reach the dosing acid pump when the pump is disconnected a "NEED PUMP" message appears on the numerical display. The unit will automatically detect if the dosing acid pump is connected.

ACID PIPE

The Check Valve and the internal tube of the dosing acid pump unit require replacing every 180 days. An "ACID PIPE" message appears on the numerical display when the time comes to replace them.

PH ALARM HIGH LIMIT

"PH HIGH" - When the measured pH value is higher than the limit of 8.5 pH, the LCD will show "PH HIGH". The acid pump continues to draw acid despite the alarm display.

The alarm will be cleared automatically when the measured pH value returns to within the non-alarm range (7.0-8.1 pH).

PH ALARM LOW LIMIT

"PH LOW" - When the measured pH value is less than the limit of 6.7 pH, the LCD will show "PH LOW".

The alarm will be cleared automatically when the measured pH value returns to within the normal pH range (7.0-8.1 pH).

ORP ALARM HIGH LIMIT

"ORP HIGH" - When the measured ORP value is higher than the limit of 925 mV, the LCD will show "ORP HIGH".

The alarm will automatically disappear when the measured ORP value returns to within the non-alarm range (525-925mV).

ORP ALARM LOW LIMIT

"ORP LOW" - When the measured ORP value is lower than the limit of 525 mV, the LCD will show "ORP LOW".

The alarm will automatically disappear when the measured ORP value returns to within the normal range (525-925mV).

NO CARD ALARM

"NO CARD" –pH/ORP card is not detected when AUTO mode is enabled.

PH PROBE

"PH PROBE" – pH sensor is not detected.

ORP PROBE

"ORP PROBE" – ORP sensor is not detected.

MAINTENANCE

Maintaining your natural chlorine generator maximizes the performance and life of the system and requires minimal work.



POOL WATER TESTING: Pool water should be tested weekly, but MUST be tested at least once a month.

CONTROL BOX

The Resilience D plus control box requires hardly any maintenance. Periodic cleaning of the enclosure can be conducted if needed. Use a soft cloth to wipe off any dust or debris.

WATER

Always test and record water chemistry readings in compliance with Health Department requirements using a quality manual test kit. Calibrate pH periodically as described earlier in this manual.

It is important to note that changes in pH, cyanuric acid concentration, total dissolved solids, and use of additional or alternative sanitizers will all affect the primary sanitizer residual level relative to ORP. It is important to maintain total alkalinity on a regular basis to ensure pH stability. To maintain a consistent sanitizer residual in parts-per-million (ppm), periodically adjust the ORP set point.

CELL MAINTENANCE

The clear cell allows easy, regular inspection for lime-scale and calcium build up. Visually check the cell periodically, and clean it as necessary (one to two times a year). Advanced self-cleaning technologies, including reverse polarization and IBT™ help the cell stay cleaner than other self-cleaning cells, but bi-annual cleanings are required.

Cell cleaning



CAUTION – do not use metal or other hard objects to clean the cell.



DO NOT insert anything into the cell.

<u>Both actions detailed above may scratch the precious coating on the plates and void the warranty.</u>



Always add acid to water NOT water to acid.



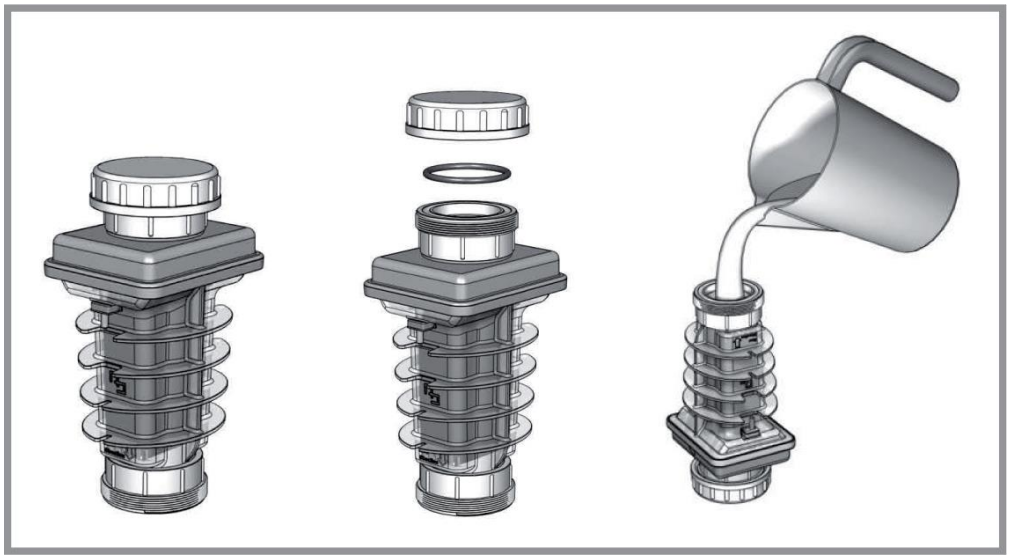
Diluted muriatic acid solution = 1 part acid to 10 parts water.



Follow the instructions of the acid manufacturer.

Cleaning using the cleaning cap

1. Disconnect the wires connecting the control box to the cell.
2. Remove the cell from the line by unthreading the barrel unions from the cell ends.
3. Remove the black O'ring on one end of the cell.
4. Attach the cell cleaning cap to the other end of the cell.
5. Pour into the cell, either undiluted white distilled vinegar, or a solution of diluted muriatic acid (one part muriatic acid to 10 parts water).
6. Wait for foaming to stop (5-10 minutes when using muriatic acid; vinegar takes longer).
7. Safely dispose of the acid solution by pouring it into your pool.
8. Rinse the cell with water hose.
9. Put the O'ring back in place and re-install the cell in the line.
10. Reconnect the wires from the control box to the connectors at the sides of the cell **until they "click" together**.



SENSOR MAINTENANCE

The sensors must be clean and free from oil, chemical deposits and contamination to function properly. After saturation in pool or spa water, the sensors may need to be cleaned on a weekly or monthly basis depending on bather load and other facility specific characteristics. Slow response, increased need to calibrate pH, and inconsistent readings are indications that the sensors are in need of cleaning.

To clean the sensors, disconnect from the Tee holder and carefully remove them. Wash the edge of the sensor with tap water to eliminate any debris caught or stuck to it.

In the ORP sensor replace teflon thread-seal tape, and reinstall sensors. Hand tighten only.

Always keep pH and ORP submerged in liquid. Drying will damage the sensor and void its warranty.

SENSOR REPLACEMENT

pH and ORP sensors are designed to provide the highest performance and longest service life. If sensors are properly cleaned but provide unstable readings or require excessive calibration, the pair of sensors should be replaced. Sensor storage

Exposure to atmospheric conditions will cause the sensor tips to dry out. Always remove and properly store sensors in their original bottles if sensors are to be removed or stored for one hour or longer. Sensors must be protected from freezing temperatures when not in use.

Store sensors in their original bottles, making sure that each one is filled with the original storage solution or clean water. If the storage containers have been misplaced, store sensors individually in small glass or plastic containers with clean water covering sensor tips.

WINTERIZING

Just like the pool plumbing, freezing may damage the system cell and flow sensor. If severe or extended periods of freezing temperatures may occur, drain all water from the pump, filter, cell, supply and return lines before temperatures drop.

The sensors should be prepared for storage as outlined above and protected from freezing temperatures.

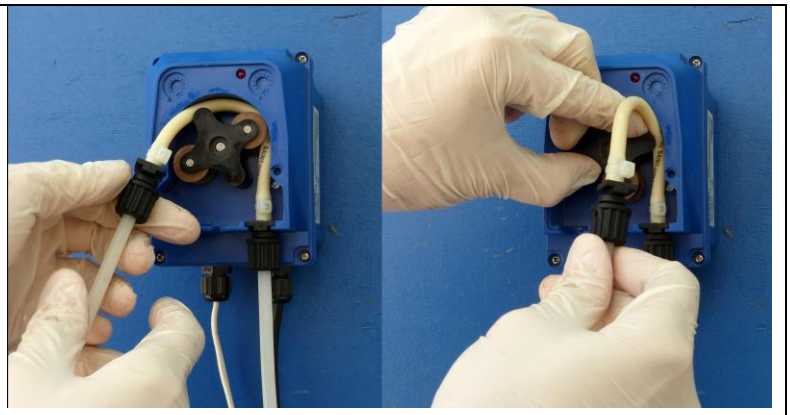
SPRING STARTUP

DO NOT turn on the system until the pools' water chemistry has been brought to the required levels. See the "Turning the Unit On" chapter on page 25 for more information.

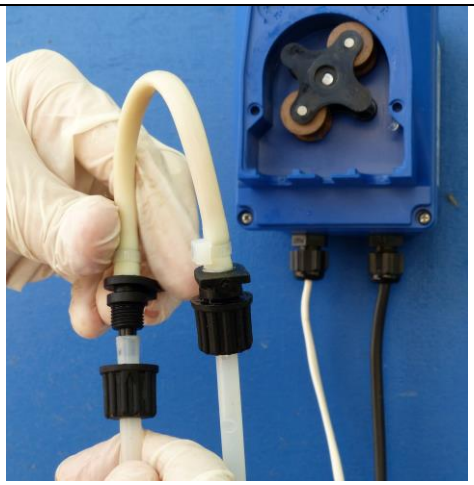
REPLACING THE INTERNAL TUBE OF THE DOSING ACID PUMP

It is recommended to replace the check valve and internal tube of the dosing acid pump before starting a new bathing season and/or every six months during the season. Please contact your local dealer to obtain a new tube. The internal tube requires replacing when ACID PIPE message is visible.

WARNING: In order to perform this operation, you MUST wear rubber or polyethylene protective gloves and safety glasses. It is also advisable to protect your clothes or wear dispensable ones.

	
Remove the transparent protective cover	Carefully slip off the rubber tube from its slot. Gently pull the tube out (clock wise) assisting with the other hand to turn the pump's engine wheel and help free the tube until it is completely out.

Note: It is advisable to flush the pump with running tap water in order to dilute any remaining acid which may have spilled from the tube.

	
Disconnect both ends of the internal tube by unscrewing the nuts from the nipples.	Screw in both ends of the NEW internal tube making sure the nuts are tightly secured.

	
Gently insert the tube back into place making sure the black bases of the tubes are tightly in their slots in the casing.	Return the transparent cover to its place.

Check for leaks and leave the pump running in manual mode for 10-20 minutes in order to release the air in the system.

UNDERSTANDING THE CHEMISTRY

The table shows the recommended balance levels followed by a more detailed explanation of the factors affecting the water chemistry. Maintaining these levels ensures maximum enjoyment of the pool. You should test your water periodically. If the water chemistry needs adjustment, your authorized dealer or most pool stores can supply you with the appropriate chemicals and procedures. We recommend either taking a copy of the Water Balance Table to the pool store, or notifying the pool store that you are using Magen eco-Energy's natural salt chlorine generator (model PSC5).

Factors	Ideal levels
Salt	**3000 – 4500 ppm**
Free Chlorine	**1 – 3 ppm**
pH	**7.0 – 7.8**
Total alkalinity	**80 – 120 ppm (depending on the saturation index)**
Stabilizer (a.k.a Cyanuric acid or conditioner)	**20-70 ppm**
Phosphates	**0-100 ppb**
Nitrates	**0 ppm**
Metals	**0 ppm**
Calcium Hardness	**Determined by the pool you own (individual for each pool)**
Total dissolved solids (TDS)	**< 1200**
Saturation index	**-0.3 to 0.3 (0 is ideal)**

Salt is the source of the Natural Chlorine. The ideal salt level to ensure maximum benefits using our system is 3500 ppm (parts per million). A lower concentration of salt may hinder the generator effectiveness. A concentration of salt above 5500 ppm may cause corrosion damage to the pool fixtures. See the "Adding salt" chapter, on page 21 for more information.

Free Chlorine vs. Combined Chlorine: The unpleasant smells and side effects often associated with chlorine are actually caused by combined chlorine (e.g. chloramines). Combined chlorine is a chlorine molecule that attacks a noxious particle in the water but is unable to destroy it. This chlorine particle remains attached to the noxious particle until one of the two is burned off; hence the term Combined Chlorine (a.k.a chloramines). To burn off the noxious particle and free up the chlorine again, pool owners have to periodically shock (with chlorine) the pool. In the natural chlorine generator the noxious particle is burned off within the generator cell and the combined chlorine is continuously converted back to free chlorine.

The free chlorine level in the pool should be maintained at 1 to 3 ppm. This level of free chlorine is comfortable to swim in with no unpleasant smells, and maintains proper sanitizing.

pH is a measure of the acidic or basic solution. A scale of 0 to 14 is used to measure pH. Pure water has a pH of seven (neutral), acid solution have a pH of less than seven, and basic (alkali) solutions have a pH of more than seven. The recommended range is 7.2 to 7.6; chlorine is much more effective within this range and the water is most comfortable for bather. **pH levels above 7.8 drastically reduce the effectiveness of the chlorine.**

To lower the pH, add muriatic acid or dry acid. Be sure to read and follow the respective manufacturer's instructions.

Total Alkalinity mitigates changes in pH. It is often referred to as the "big brother of pH". Keeping proper levels of total alkalinity helps reduce unwanted fluctuations in pH levels. Total alkalinity is also used to offset high or low levels of calcium hardness (see "saturation index" on page 42).

Add muriatic acid or dry acid to lower the total alkalinity and sodium bicarbonate to raid the total alkalinity. Be sure to read and follow the respective manufacturers' instructions.

Stabilizers (Cyanuric Acid or Conditioner) is necessary in most outdoor pools to maintain appropriate levels of chlorine. Chlorine stabilizer helps provide an appropriate residual chlorine level in the water. Without stabilizer, UV radiation from the sun will destroy most chlorine within 2 hours, but excessive amounts of stabilizer can decrease the effectiveness of chlorine. Chlorine stabilizers should be maintained at 60 ppm to offset the harmful effect of the sun while maintaining the effectiveness of the chlorine. Where pH/ORP automatic sensors are used, 40 ppm of stabilizer suffices.

Phosphates and Nitrates set very high demands on chlorine; most nitrates and phosphates often bring the chlorine level down to zero (0). You can have your water tested for nitrates and phosphates by a local professional. **Your pool should NOT contain Nitrates or Phosphates.** To reduce Phosphate levels, use a phosphate remover from your local pool professional. To reduce Nitrate levels, the pool must be partially or fully drained. Please check with your local professional prior to draining the pool.

Metals can cause loss of chlorine and can stain your pool. If a water test reveals the presence of metals, refer to your local pool professional for recommended methods of removal. Be sure to use a phosphate-free metal remover to avoid replacing a metal problem with a phosphate problem.

Calcium Hardness, like pH and alkalinity, affects the water tendency to be aggressive or scale forming. Lower levels of calcium hardness improve the chorine generators' ability to stay clean and provide softer silkier water for the swimmers. Check with your local pool professional for proper calcium levels for your pool surface.

Total Dissolved Solids (TDS) is a measure of many types of dissolved materials, including salt. High effective TDS levels (e.g. 1500 ppm and up) cause cloudy water and significantly increase chlorine demand.

To obtain the effective TDS level in a pool using a salt system, subtract the salt level from the TDS reading (e.g. 5000 TDS – 4000 salt = 1000 effective TDS).

Saturation Index determines whether the pool water is balanced, aggressive, or scale forming by comprehensively taking into account all the relevant factors, including pH level, alkalinity level, calcium hardness, and temperature. These factors should be periodically tested, then included into the worksheet on the following page to verify the proper balance of the pool and make adjustments as necessary.

SATURATION INDEX

Test the water for pH, Alkalinity, Calcium hardness and temperature, and then follow the simple steps detailed below:

1. Write your pool pH level here → pH: _____
2. Find your Alkalinity level in the chart below,

   And write the corresponding Alkalinity factor here: → Alkalinity Factor: _____

Pool Alkalinity	5	25	50	75	100	150	200	300	400
Factor	0.7	1.4	1.7	1.9	2.0	2.2	2.3	2.5	2.6

3. Find your Calcium (CaCO3) level in the chart below,

   And write the corresponding Calcium factor here: → Calcium Factor: _____

Pool Calcium	5	25	50	75	100	150	200	300	400
Factor	0.3	1.0	1.3	1.5	1.6	1.8	1.9	2.1	2.2

4. Find your pool temperature in the chart below,

   And write the corresponding temperature

   Factor here: → Temperature Factor: _____

Pool Temp	32	37	46	53	60	66	76	84	94	105
Factor	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9

5. Add the results from steps 1 through 4 above and write

   The result here: → Total of above: _____

   -12.2

6. Subtract 12.2 from step five and write the result _____

   here: → Saturation Index = ☐

- If the saturation index above is between -0.3 and +0.3, the water is well balanced.
- If the index is higher than 0.3, the water will tend to cause scaling or get cloudy. The Alkalinity and pH should be reduced accordingly, but maintained within the recommended levels.
- If the index is less than -0.3, the water will tend to be aggressive towards the pool surface, equipment, and bather. The Alkalinity and pH should be increased accordingly, but maintained within the recommended levels.

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GENERAL TROUBLESHOOTING

NOTE: Evaluating the possible causes for each problem from top to bottom (first to last) will void extra labor.

Problem	Possible Causes	What to do
Chlorine level is low	• System is turned off	• Turn the system on to the desired setting
	• ORP level is set too low in relation to chlorination demand (e.g. higher number of bather, warmer weather, increased debris in pool)	• Set the ORP to higher setting and/or increase pump operation time
	• Low salinity	• Check the salinity level (see the "salinity readout" chapter, page 27)
	• Pump operation time is too short	• Run the pump at least eight hours per day (1.5 turnovers of all the pool water) or more if necessary
	• Low stabilizer (cyanuric acid)	• Check water chemistry; stabilizer should be 60-80 ppm. If low, add stabilizer (see "Understanding the Chemistry" chapter, page 40)
	• High phosphate levels	• Check phosphate levels at your local professional and reduce to below 100 ppb
	• Chemical imbalance	• Check other chemistry and balance chemicals (see "Understanding the Chemistry" chapter, page 40)
Green Pool	• Chemical imbalance	• See "chlorine level low" above
LCD is totally OFF – No power	• System is turned off	• Turn the system on to the desired setting
	• Breaker activated	• Check the breaker leading to the pool control
	• Power wires cut, disconnected or incorrectly wired	• Check for correct wiring (see page 17)
	• Other malfunctions in control box	• Contact customer service
Flow icon turn on and off	• Normal at initial start-up or if air bubbles are in the pipes • In rare instances bad contacts in the flow sensor might cause this	• Wait a few minutes for air to release. If continuous, check plumbing to see if air enters the system in any way • Replace flow sensor with a new one

Problem	Possible Causes	What to do
Flow icon is on and NO FLOW message appears in the numerical display	• Insufficient water flow from pump to flow sensor and cell	• This is normal if there is air in the lines or for a few minutes at initial startup • Clean filters and strainers • Check for closed valves, pump cavitation, faulty pump etc'
	• Obstruction or lime-scale build up in cell	• Clean cell according to instruction manual (see "maintenance" chapter, page 35)
	• Flow sensor was not installed in the correct direction	• Turn flow sensor so arrow faces direction of water flow
	• Flow sensor is not fully threaded into the Tee connector	• Fully thread the Flow sensor into the Tee connector. Be careful not to damage the wires or sensors.
	• Cut wires or insufficient wire connections	• Check the connection to ensure proper wire contact
Output bar lights but does not reach 100%	• Output bar set too low	• Push the ▲ button to set the output level to a higher setting
	• Dirty cell	• Check the cell to ensure that the blades are in good condition and not coated with calcium buildup. Cleaning the cell is recommended if it is calcified or if the readout seems questionable. See "cell cleaning" in the "maintenance" chapter, page 35
	• Poor connection of quick connectors	• Check for debris inside the connectors. Ensure that the quick connectors are connected
	• Low pool water temperature	• In cold water (lower than 26 ^{o}C/80 ^{o}F the salt meter may indicate a lower salinity level. This is normal
	• Not enough salt due to heavy rain, initial miscalculation etc'	• Add salt to the pool. See :"Adding salt" chapter for more information, page 21 • It is recommended to periodically test the salt level by a professional and adjust according to the salinity demand table in this manual, page 22
	• Worn cell	• If none of the above resolves the problem the cell may be worn out.

Problem	Possible Causes	What to do
Salinity high	• Salinity high - Enough salt has been added causing the red light above the power meter to light	• This does not harm the natural generator, but simply indicates that the salt level is high • It is recommended to periodically test the salt levels by a professional. If above 5000 ppm, it is recommended to drain part of the pool water and refill with fresh water (please check with your local pool professional prior to draining the pool)
	• Salinity is very high - Too much salt has been added causing the high salinity icon to light up	• The salt level in the water is very high. Drain part of the water and refill the pool to bring the salinity levels down. • It is recommended to periodically test the salt levels by a professional. If above 5000 ppm, it is recommended to drain part of the pool water and refill with fresh water (please check with your local pool professional prior to draining the pool)
	• Salinity far too high – way too much salt has been added causing the unit to display a SHRT CELL message	• The salt level is exceeding high. Drain part of the water and refill the pool to bring the salinity levels down. • It is recommended to periodically test the salt levels by a professional. If above 5000 ppm, it is recommended to drain part of the pool water and refill with fresh water (please check with your local pool professional prior to draining the pool)
Salinity low	• Low salinity in the pool	• Add salt according to the table on page 22
	• Scale buildup in cell	• Check for debris in the cell; inspect blades for wear and tear or calcium buildup. Clean if necessary, instructions to be found in "maintenance" chapter
	• Faulty Temp. sensor	• Replace temperature sensor
	• During start up there is air in the system	• Air should be cleared after about one hour of run time
Low Temp	• Low water temperature, under 17^{o}C (62^{o}F)	• Wait until it warms up. So long as water temperature is lower than 17^{o}C (62^{o}F) Resilience D Plus lowers its salt production proportionally to preserve the electrolysis cells life

Problem	Possible Causes	What to do
SHRT CELL message is displayed on the numerical display	• Salinity is very high	• Drain part of the water and refill the pool to bring the salinity levels down. See troubleshooting section – salinity high (above) for more information • It is recommended to periodically test the salt levels by a professional. If above 5000 ppm, it is recommended to drain part of the pool water and refill with fresh water (please check with your local pool professional prior to draining the pool)
	• Short circuit in the cell wires	• Check that the cell wires are properly fastened and there is no reason for short circuit between them
Scale build-up inside cell	• Standard occurrence that needs cleaning approximately once a month	• Clean cell as instructed in the maintenance chapter, page 35
	• Chemical imbalance	• Balance chemicals (focus mostly on the Saturation index in the "Understanding the chemistry chapter, page 40)
White flakes in the water	• Normal occurrence when cell cleans itself	• Keeping the water well balanced reduces this occurrence focus mostly on the Saturation index in the "Understanding the chemistry chapter, page 40)
Cloudy water	• May be due to chemical imbalance or insufficient water flow	• Make sure your filtration system is working properly (e.g clean filter and/or skimmer) • Make sure the circulation time is adequate. If not, increase pump run time • Balance all chemicals referenced in the "Understanding the Chemistry" chapter, page 40 • Shock the water to eliminate build-up of any organic matter
Colored water	• Metals in the fill water may have been oxidized • Algae may be trying to form	• Have a pool professional test the pool water. If high in metals use phosphate-free metal remover • Increase circulation time if needed and clean the filter

Problem	Possible Causes	What to do
Algae	• May be due to low chlorine levels or a chemical imbalance	• Have the water tested for chemical balance including pH, phosphates and nitrates • If chlorine level is low, see "Chlorine level low" in this troubleshooting section • Use nonmetallic (polyquat) algaecide as instructed on the bottle and brush the side of the pool often • Clean the filter and shock the pool with chlorine daily until the water clarity returns

RESILIENCE D PLUS TROUBLESHOOTING

Problem	Possible causes	What to do
PH HIGH	• pH set point is too high.	• Check the set point and if required change it
	• Water chemistry is not balanced	• Manually check the pH in the water. If the reading is identical to the manual result balance waters' pH
	• Acid tank is empty	• Replace acid tank with a full one
	• Dosing acid pump is not working properly	• Check the dosing acid pump by operating it manually (see chapter "pH manual", page 31) if the acid pump is not working check its individual parts and replace if needed
	• pH sensor needs to be cleaned and calibrated	• Clean then calibrate the pH sensor as described in "calibrating pH sensor", page 30
	• pH sensor is worn out and/or faulty	• Replace pH sensor
	• Sensor cable connection may be reversed	• Ensure that sensor cable is properly connected to its respective connection on the controller unit
	• Unit is functioning on default mode	• Make sure AUTO mode is working

Symptom	Possible causes	What to do
PH LOW	• pH set point is too low	• Check the set point and if required change it
	• Water chemistry is not balanced	• Manually check the pH in the water. If the reading is identical to the manual result balance water pH
	• Dosing acid pump is not working properly	• Check the dosing acid pump by operating it manually (see chapter "pH manual" page 31) if the acid pump is not working check its individual parts and replace if needed
	• pH sensor needs to be cleaned and calibrated	• Clean then calibrate the pH sensor as described in "calibrating pH sensor", page 30
	• pH sensor is worn out and/or faulty	• Replace pH sensor
	• Sensor cable connection may be reversed	• Ensure that sensor cable is properly connected to its respective connection on the controller unit
	• Unit is functioning on default mode	• Make sure AUTO mode is working
ORP HIGH	• ORP set point is too high	• Check the set point and if required change it
	• Water chemistry is not balanced	• Manually check the Chlorine level in the water. If the reading is identical to the manual result balance water
	• Water pH too low	• Manually check the pH value to be sure that pH regulation operates correctly, then balance water if necessary
	• ORP sensor needs to be cleaned	• Clean the sensor
	• Sensor cable connection may be reversed	• Ensure that sensor cable is properly connected to its connection on the controller unit
	• Unit is functioning on default mode	• Make sure AUTO mode is working
	• Swimming pool has been covered or unused for a long time	• Decrease the ORP set point
	• ORP sensor is worn out and/or faulty	• Replace ORP sensor

Problem	Possible causes	What to do
ORP LOW	• ORP set point is too low	• Check the set point and if required change it
	• Water chemistry is not balanced	• Manually check the Chlorine level in the water. If the reading is identical to the manual result balance water
	• Water pH too high	• Manually check the pH value to be sure that pH regulation operates correctly, then balance water if necessary
	• ORP sensor needs to be cleaned	• Clean the sensor
	• Chlorinator system malfunctioning	• See "Chlorine level low", troubleshooting section
	• Sensor cable connection may be reversed	• Ensure that sensor cable is properly connected to its connection on the controller unit
	• Unit is functioning on default mode	• Make sure AUTO mode is working
	• ORP sensor is worn out and/or faulty	• Replace ORP sensor
NO CARD	• pH/ORP card is not detected when AUTO mode is enabled	• Make sure that card is properly inserted in its slot. Remove the card and visually inspect it for any damage
PH PROBE	• Sensor cable is not connected	• Connect the sensor cable to its connection on the controller unit
	• Sensor cable may be reversed	• Ensure that sensor cable is properly connected to its connection on the controller unit
	• Sensor is worn out and/or faulty	• Replace sensor
ORP PROBE	• Sensor cable is not connected	• Connect the sensor cable to its connection on the controller unit
	• Sensor cable may be reversed	• Ensure that sensor cable is properly connected to its connection on the controller unit
	• Sensor is worn out and/or faulty	• Replace sensor
Chlorine or Bromine is too high or too low	• pH, cyanuric acid concentration, total dissolved solids and use of additional or alternative sanitizers are not balanced	• Consider the effect of any chemicals recently added to the pool or spa and balance water accordingly • Check and adjust the ORP set point
pH sensor requires frequent calibration	• Sensor requires frequent calibration	• Clean the sensor, if sensor continues to provide unstable readings after cleaning, replace it

DOSING ACID PUMP TROUBLESHOOTING



WARNING! You are about to manipulate components which are in contact with concentrated Muriatic Acid. USE PROTECTIVE GLOVES, GOGGLES and CLOTHING FOR YOUR SECURITY. In case of involuntary contact with acid, flush the affected areas with running water. In case of contact with eyes, flush with water and contact a physician!

Problem	Possible Causes	What to do
Scale build-up in cell	• Automatic cell cleaning level setting is too low	• Adjust dosing LVL to a higher level (1 to 9)
	• Hydrochloric (Muriatic) Acid container is empty	• Replenish acid in container or replace with a new container • After replacing the acid container, enter manual mode and run the system for 1-2 sequences in order to release air (priming)
	• Acid inlet tube is not in contact with the acid (above acid level)	• Push the tube to the bottom of the acid container. Observe the priming procedure as described above
	• Pump does not run during self-cleaning mode (manual and automatic)	• Check the electrical connection between the dosing acid pump and the control box and the electrical wiring from the pump to the timer/main board - If red led on the pump Is illuminated but the pump is not operating the problem may be in the wiring to the main board
	• Internal tubing is worn out or ruptured	• Replace ruptured tubing • IMPORTANT: follow the instructions listed in the "Replacing the internal tube chapter", page 38
	• If there are no faults listed above, the small check valve may be obstructed	• Carefully unscrew the check valve from saddle. Disconnect the tube from the check valve. Replace with a new valve (sold separately) discard old valve
pH level in pool is too high	• Automatic pH reducing units setting is too low	• Adjust dosing level to a higher level (1 to 50 units/week)

Problem	Possible Causes	What to do
pH level in the pools is too high – no reaction to a higher setting	• Hydrochloric (Muriatic) acid container is empty	• Replenish acid in the container or replace with a new one • After replacing acid container, enter manual mode and run the system for 1-2 sequences in order to release air from the system (priming)
	• Wrong acid is used	• Verify the you are using muriatic acid (33% HCL) • Check that your acid is still active
	• Acid inlet tube is not in contact with acid (above acid level)	• Push the tube to the bottom of the acid container. Observe the priming procedure as described above
	• Pump is not running during "pH reducing mode" (manual and automatic)	• Check the electrical connection between the dosing acid pump and the control box and the electrical wiring from the pump to the timer/main board - If red led on the pump Is illuminated but the pump is not operating the problem may be in the wiring to the main board
	• Internal tubing is worn out or ruptured	• Replace ruptured tubing • IMPORTANT: follow the instructions listed in the "Replacing the internal tube chapter", page 38
	• If all of the above mentioned are all right, the small check valve may be obstructed	• Carefully unscrew the check valve from saddle. Disconnect the tube from the check valve. Replace with a new valve (sold separately) discard old valve
pH level in pool is too low (<7.1) – water becomes acidic	• Automatic pH reducing units are set too high	• Adjust/reduce the dosing level to a higher level (1 to 50 units/week) • Check that you are using the correct acid concentration (HCL 33%)