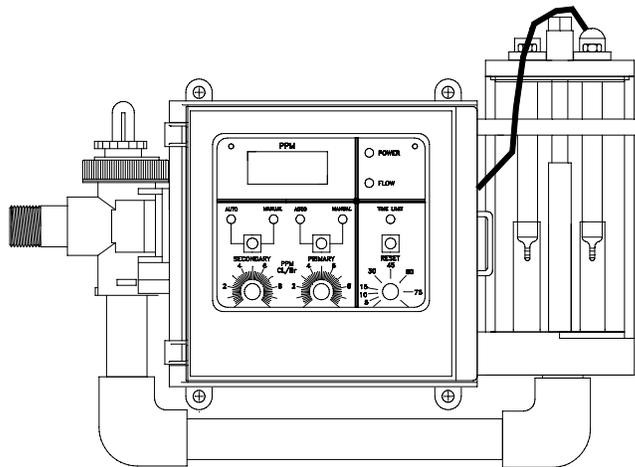


LAKWOOD INSTRUMENTS MODEL 398

CHLORINE COOLING TOWER CONTROLLER

INSTRUCTION MANUAL

SERIAL #: _____



Lakewood Instruments

7838 North Faulkner Road, Milwaukee, WI 53224 USA

Phone (800) 228-0839 • Fax (414) 355-3508

<http://www.lakewoodinstruments.com>

Lakewood Instruments

Congratulations on your purchase of a Lakewood Instruments product. We would like to take this opportunity to welcome you to the Lakewood Instruments product family.

With proper care and maintenance, your product should give you trouble-free service. Please take the time to read and understand the operation manual, paying special attention to the sections on **INSTALLATION** and **MAINTENANCE**.

If, in the future, any parts or repairs are required, we strongly recommend that only original replacement parts be used. Our Customer Service Department would be happy to assist you with your parts or service requests.

We thank you for your selection and purchase of an Lakewood Instruments product.

MODEL 398

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INTRODUCTION

The Model 398 Chlorine Controller measures the free residual chlorine in water utilizing the double-band potential technique. The measurement closely follows the standard dpd test for these residuals. Two **ON/OFF** control outputs are provided to permit operation of a high and low chlorine feed rate. This can help to trim difficult to control systems to the desired residual.

Keeping the actual residual close to the desired residual gives the most effective disinfecting results without wasting chlorine.

Applications

This controller can be used effectively in most applications with free chlorine residuals from 1 to 10 ppm.

Unlike many other chlorine controllers, pH does not affect the Model 398 free chlorine residual reading. This is because other controllers are responsive only to the acid form of chlorine or do not work above 8 pH. Most wet analyzers are costly to maintain and have the associated safety concern of requiring the handling of reagent chemicals. These also have limited pH and temperature capability. Standard ORP does overcome some of the problems of wet analyzers, but the actual measurement reading is in millivolts which does not correlate linearly with ppm of free chlorine. Often ORP is a hit-or-miss proposition because the natural composition of the source water without chlorine affects the millivolt reading.

The Model 398 overcomes these problems. It is low-maintenance, like an ORP electrode, but the output is linear with ppm of free chlorine. Some of the special areas of application include:

- Cooling tower disinfection
- Decorative fountain disinfection
- Swimming pool chlorine residual
- Sterilization of prepared food containers
- Vegetable washing
- Waste stream odor and color

Features

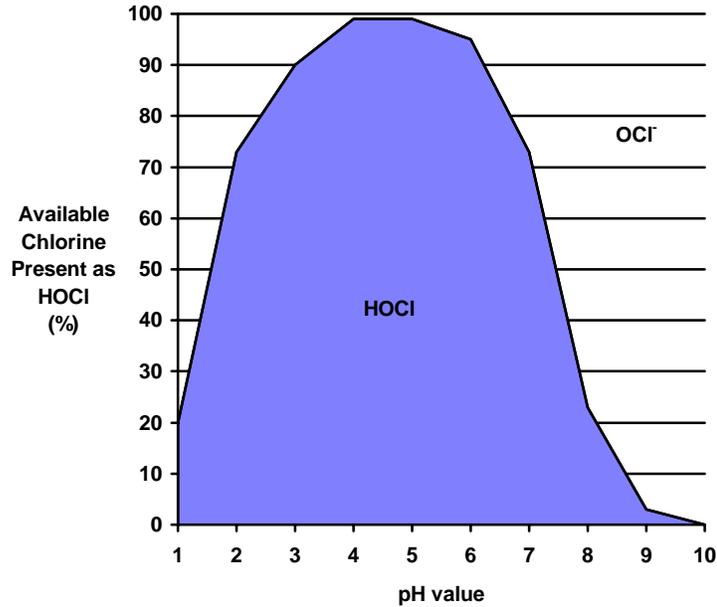
Designed with the needs of the application in mind, the Lakewood Instruments Model 398 has many special features:

- Two chemical feed setpoints for chemical pumps or chlorinator valves
- Excessive chlorination time alarm to alert the operator of system upset or loss of chlorine
- Parts per million (ppm) linear display of free chlorine residual
- Flow switch and flow sight to protect against loss of sample flow
- Large flowcell and piping for non-fouling maintenance-free operation
- Isolated 4-20 mA output option for process control or datalog
- Weatherproof enclosure
- UL-listed materials
- Digital display

Chlorine Facts

Chlorine exists in two forms dependent on pH: hypochlorous acid and hypochlorite. The sum of these two is by definition called "free chlorine." The acid form, however, has 80 times more disinfecting ability than the hypochlorite. That is why it is so important to keep the pH below 7.8.

The chart below shows the variation of the two forms with pH.

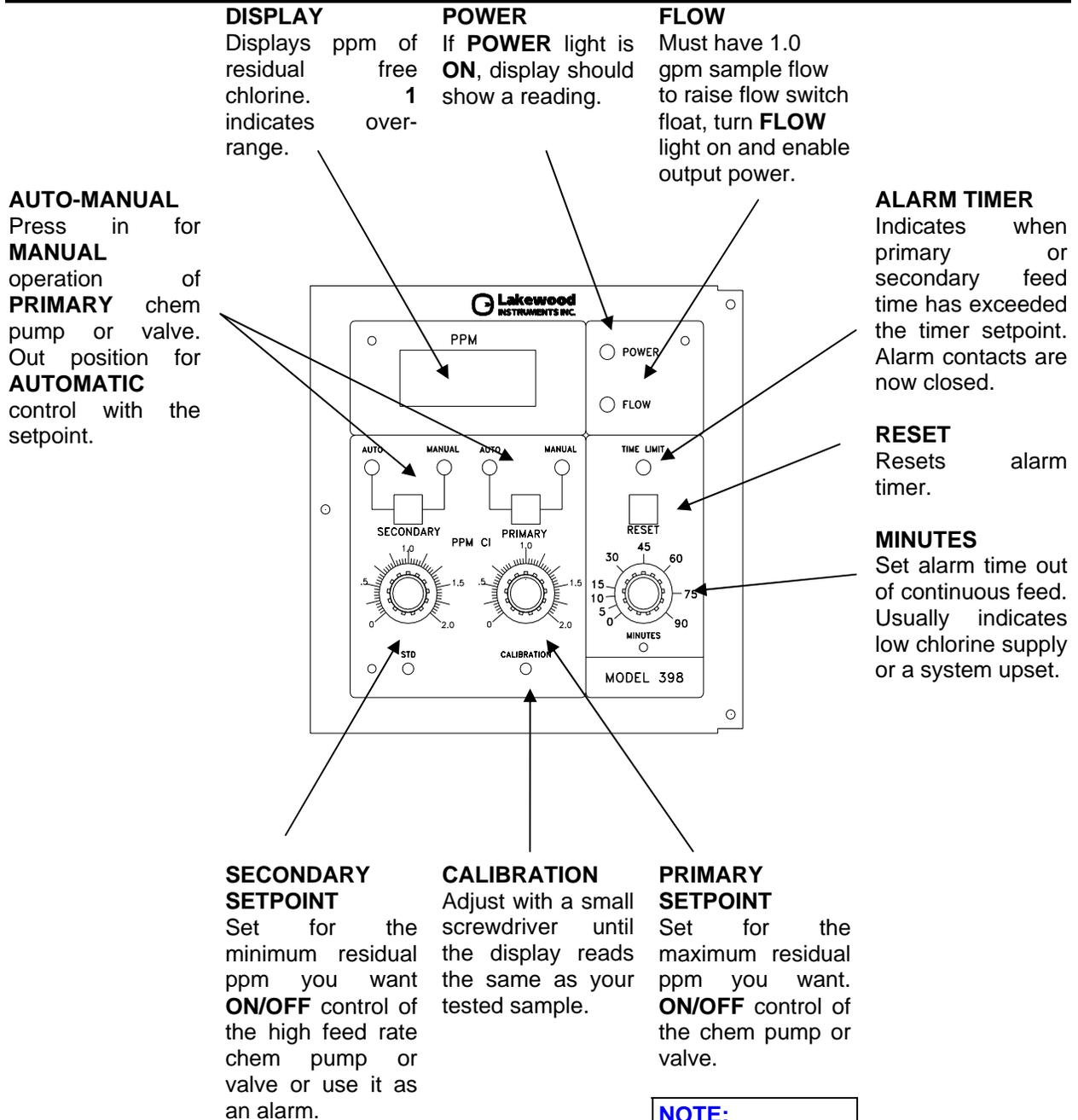


The double-banded potential electrode measures the free form of chlorine and therefore is not affected by changing pH. Also, since the DPD test contains a pH buffer, this colorimetric test will closely follow the double-banded potential readings.

Either one or two **ON/OFF** control outputs can be used to introduce chlorine into the system. Two pumps or valves permit a high and a low feed rate to "trim" the residual to its final value. Use the **PRIMARY** output for the main control pump or valve.

See the prints at the back of the manual for control ideas.

Face Place Components



NOTE:
STANDARD SETPOINT IS 0-2 ppm, CUSTOM AVAILABLE AT 0-10 ppm.

INSTALLATION

Checking

Inspect the shipping carton for obvious external damage. Note on the carrier's Bill of Lading the extent of the damage and/or notify the carrier.

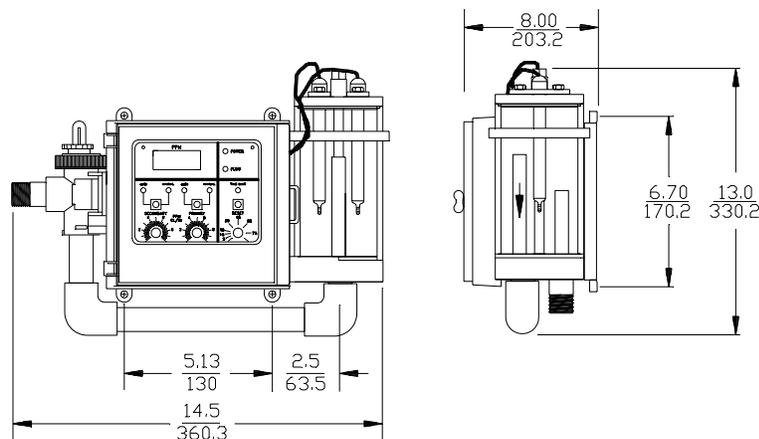
Save the shipping carton until your controller is started up. If there was shipping damage, call the Lakewood Instruments Customer Service Department (800) 228-0839 and return the controller to the factory in the original carton.

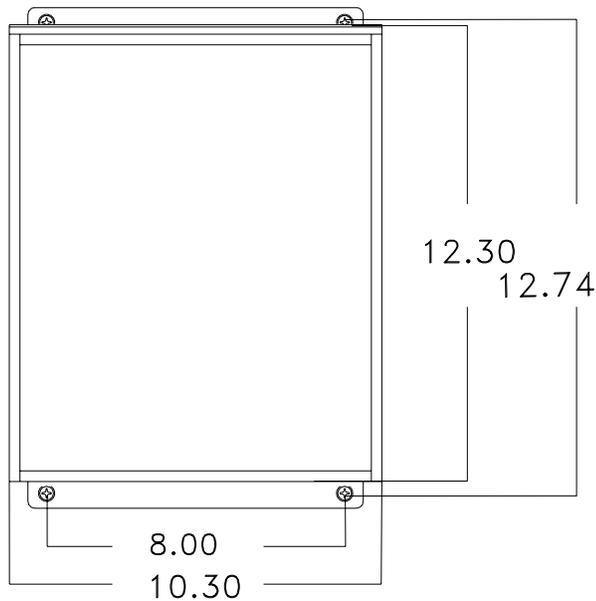
Mounting

Mount the controller or prefabricated system on a **FLAT, NON-VIBRATING** wall.

Avoid drilling or punching additional holes in the controller enclosure. Damage incurred as a result of any alterations to the enclosure is not covered under the Lakewood Instruments product warranty.

NOTE: EXCESSIVE HEAT AND DIRECT SUNLIGHT EXPOSURE WILL DARKEN THE LCD, MAKING IT DIFFICULT TO READ AND MAY SHORTEN THE LIFE OF OTHER ELECTRONIC COMPONENTS.





The **SE Option** combines a Model 398 controller and a Model 66 in this larger single enclosure.

Plumbing

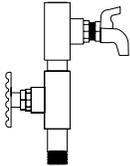
STANDARD MODEL 398 CONTROLLER PLUMBING

Plumbing Materials

- Inlet plumbing can be $\frac{3}{4}$ " PVC, iron or copper pipe.
- Provide at least 1 gpm to the controller. A 4 psi differential from take-off to injection is sufficient. If flow is marginal, consult your Lakewood Instruments Factory Representative.
- Outlet plumbing can be $\frac{3}{4}$ " PVC or CPVC. Schedule 80 is recommended for strength and sunlight protection.
- If copper or iron pipe is used, install a PVC union to relieve the stress on the controller plumbing.

Cooling Tower Applications

- First, plumb the inlet flow. This line brings the sample water in past the chlorine sensor for evaluation, and then pushes the flow switch float up to activate the unit.



RECOMMENDATION: FOR YOUR CONVENIENCE, INCLUDE A SAMPLE LINE SHUT-OFF VALVE AND A SAMPLE VALVE SPOUT IN THE INLET FLOW PLUMBING.

- Then plumb the outlet flow (solution/sample line) to the tower return line where you will insert your chemical feed system.
- The outlet flow should be connected to the tower return or condenser water return line. If you choose to plumb the controller across the circulating water pump, the chemical must be injected into the circulating pump discharge after the controller take-off.
- If your piping layout does not allow you to plumb the controller properly (i.e., to the tower return line or to the tower basin), contact the Lakewood Instruments Customer Service Department (800) 228-0839. A phone call can save a lot of construction time.

WARNING! NEVER INJECT CHEMICALS UPSTREAM FROM THE CONTROLLER FLOWCELLS.

PREFABRICATED CHEMICAL PUMP AND CONTROLLER ASSEMBLIES

The units follow the same instructions given for the standard chlorine controller listed above.

RECOMMENDATION: IF THE SOLUTION/SAMPLE LINE IS RETURNED TO THE COOLING TOWER RETURN LINE, USE A CORPORATION STOP (MODEL 9160), A SOLUTION LINE INJECTOR (MODEL 9006) OR A DISPERSING PIPE SUCH AS THE MODEL 9175. THIS AIDS CHEMICAL-WATER MIXING AND ENHANCES WATER TREATMENT CONTROL CAPABILITIES.

Wiring

STANDARD MODEL 398 CONTROLLER WITH POWER CORD AND OUTLETS

There are a number of options available. The standard unit comes with a power cord and outlets for the primary and secondary chemical feed pumps or valves. If only one feed device is used, plug it into the **PRIMARY** outlet. Follow the wiring procedure in the order it is stated below:

- Make sure the power cord is unplugged while you are working with the wiring.
- If you are to use conduit wiring only for the feed device, do the following:
 - On the left side of the face plate, turn and pull on the lock screw and swing open the panel to expose the terminal blocks on the back panel for wiring connections.
 - Refer to the wiring diagrams for the correct terminal block connections.
 - After you are done, make sure there are no loose connections and that all tools and debris are removed.
 - Close the panel.
 - Tighten the face plate screw and continue the wiring process.

Plug in the power cord to a convenient 115 VAC outlet.

WEATHERPROOF ENCLOSURE (-WP OPTION) WITHOUT OUTLETS

Instead of having outlets to plug pumps into, the -WP Option provides conduit knockouts so you can bring all the wiring into the unit through the conduit. You then wire the pumps directly to the terminal blocks as shown in the wiring diagram.

WARNING! DO NOT PLUG IN CHEMICAL PUMPS THAT ARE LARGER THAN 1/6 HP. THE CONTROL RELAYS ARE INTENDED FOR ELECTRONIC OR SMALL MOTOR-DRIVEN CHEMICAL PUMPS. LARGE PUMPS REQUIRE THE -HR OPTION WITH 25 AMP RATED INTERPOSING RELAYS. CONTACT LAKEWOOD INSTRUMENTS FOR SPECIAL INSTRUCTIONS.

PREFABRICATED CHEMICAL PUMP AND CONTROLLER ASSEMBLIES

The chemical pumps, biocide timers and other options are already prewired with prefabricated systems. You only need to wire the power source and the solenoid blowdown valve. **DO NOT** use less than 16 gauge wire because the system is fused for 10 Amps.

21-398 PREFAB

All external power connections are made to a junction box with terminal blocks located on the right-hand side of the controller.

WARNING! PUNCHING OR DRILLING MORE KNOCKOUTS MAY ALLOW STRAY CHIPS TO RUIN CIRCUIT BOARD COMPONENTS.

25-398 POLYETHYLENE SHELF PREFAB

All external power connections are made to the controller terminal blocks located in the rear of the controller.

OPTIONS SETUP

-35C Isolated 4-20 mA Output Option

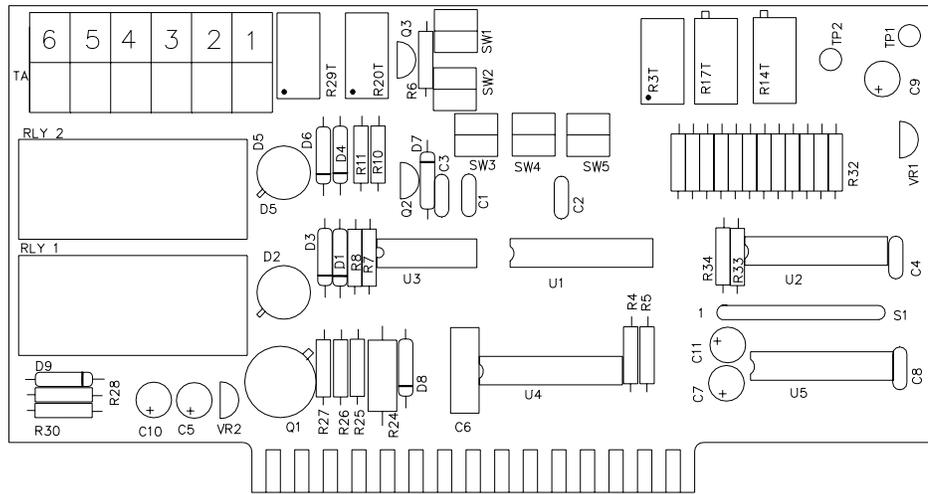
The Model 398 can be equipped with isolated 4-20 mA outputs for a recorder or computer. This option allows you to monitor your system from a remote location. This interface card plugs into the back panel. The output is factory-preset for 0 ppm = 4 mA and the full-scale = 20 mA. The **ZERO** and **SPAN** adjustments allow you to scale the output over the 0-10 ppm chlorine range. The charts below are examples of these calibrations. Before you calibrate, wire the recorder or computer to terminal block **TF**.

NOTE: IF YOU WANT BOTH THE -35C AND -42C OPTIONS, YOU NEED THE -44C OPTION.

- Unplug your chemical pump or feed valve.
- Connect a DC voltmeter (DVM) to the -35C card — [(+) to **TP-2** and (-) to **TP-1**].
- Remove the chlorine sensor orange terminal block with a pair of long-nose pliers. The LCD on the front panel will read **0** — the 4 mA value.
- Then turn the **R-14 (ZERO)** adjustment screw on the -35C card until your DVM reads **0** Volts — the 4 mA value. Then replace the sensor terminal block.
- Adjust the **CALIBRATE** until the display reads **5.0** — the 12 mA ½ full-scale value, or **1.0-5.0** for 0-10 ppm models.
- Finally turn the **R-17 (SPAN)** adjustment screw on the -35C card until your DVM reads **2** Volts — the 12 mA value.
- Plug your feed pump or valve back into the proper outlets and wire them to their proper terminal points if you have the -WP Option.

Range: 0-10 ppm

ppm	mA	TP ₂ Volts
0	4	0
5	12	2
10	20	4



Model -35 Card

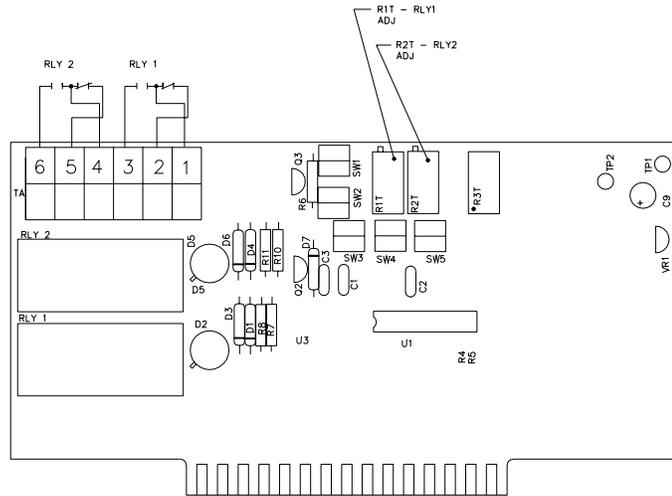
-42C High/Low Alarms Option

Extra High and Low Alarms for remote alarm status or computer alarm log are available with this option. The -42C card plugs into the back panel.

NOTE: IF YOU WANT BOTH THE -35C AND -42C OPTIONS, YOU NEED THE -44C OPTION.

- Unplug your chemical pump or feed valve.
- Make a note of the current ppm reading. Then adjust the **CALIBRATE** to set the desired low alarm value on the display.
- Then open the front panel again. On the -42C card, turn the Low Alarm Screw (**R-1T**) counterclockwise until the alarm is activated. Your Low ppm Alarm is now set.
- Now turn the **CALIBRATE** until the LCD reads the value you desire for your High Alarm trip point.
- On the -42C card, turn the High Alarm Screw (**R-2T**) clockwise until the alarm is activated. Your High ppm Alarm is now set.

- Turn the **CALIBRATE** to make the display read the actual water ppm.
- Plug your feed pump or valve back into the proper outlets and wire them to their proper terminal points if you have the -WP Option.



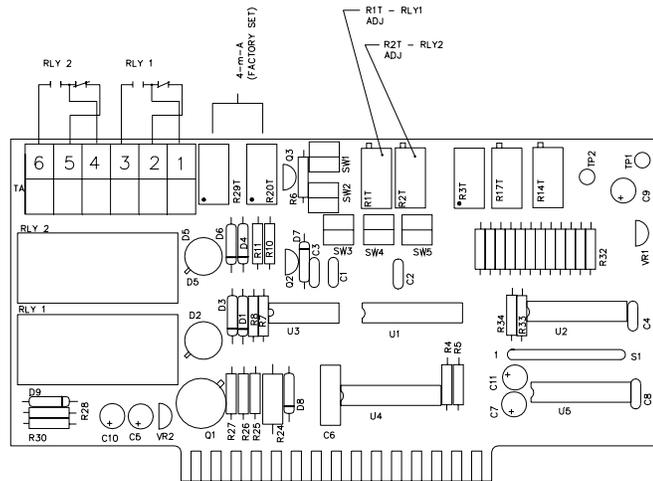
NOTES:

- SW 1 _____ HIGH RELAY 1
- SW 2 _____ LOW RELAY 1
- SW 3 _____ HIGH RELAY 2
- SW 4 _____ LOW RELAY 2

Model -42 Card

-44C Option

The -35 and -42 Options are combined in one card so you can operate a 4-20 mA output and the High/Low Alarms at the same time. Refer to the setup procedures for both cards described above.



- NOTES:
- SW 1 ---- HIGH RELAY 1
 - SW 2 ---- LOW RELAY 1
 - SW 3 ---- HIGH RELAY 2
 - SW 4 ---- LOW RELAY 2

Model -44 Card

Biocide Timer Options

If the Model 398 Chlorine Controller is required to bring the residual up to the setpoint only at a certain time of the day or night. It can be wired into a Lakewood Model 63 or 66 Biocide Clock Timer.

MODEL 63 ELECTROMECHANICAL 7-DAY TIMER CONDUCTIVITY HIGH/LOW ALARM

- Actuation for 15-minute increments, with a day-skip feature.
- Wiring information is provided in the **Wiring** section of this manual.

MODEL 66 MICROPROCESSOR CLOCK TIMER

- Up to 3 biocide feeds and delay timer for biocide retention.
- This timer is used to feed other biocides and/or chlorine on a programmed schedule.
- Output 1 of the Model 66 is for the chlorine feed. The other outputs are for other biocides.

- Refer to the *Model 66 Instruction Manual*. Wiring information is provided in this manual as well in the **Wiring** section.

-SE OPTION

- Both the Model 398 controller and a Model 66 clock timer are assembled into a single 10W x 12H x 8D enclosure.
- Refer to the wiring diagrams and the *Model 66 Instruction Manual* for instructions.
- Output 1 of the Model 66 is for the chlorine feed. The other outputs are for other biocides.

YOUR CONTROLLER IS NOW READY FOR USE

START-UP AND CALIBRATION

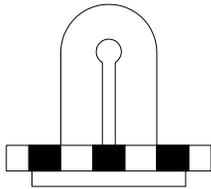
Programming and calibrating the Model 398 Controller is easy. Just start at the beginning and work all the way through this section.

Inspection

All the plumbing and wiring needs to be properly attached before turning on the flow or power (see the **Plumbing** and **Wiring** sections of this manual). Check for loose wire connections if you have the weatherproof enclosure, and make sure the sensor and flow switch lock rings are secure. Then, plug the unit in.

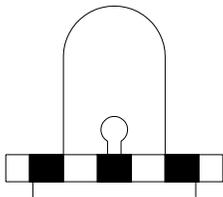
Flow Switch

The flow switch is located on the left side of the controller. The float has a magnet that rises due to flow. When water flow is present, the float rises in the flow sight and a magnetically operated reed switch activates the **SYSTEM** light and all power outlets are operative. Without flow, the float is not visible in the flow sight, the **SYSTEM** light is **OFF** and all of the outlets are inoperative. A built-in back check valve helps prevent reverse flow. When the flow stops, this valve helps keep chemicals that were injected downstream away from the flow switch assembly and the electrodes.



Turn the water flow **ON** to check the flow switch. Use the sample line inlet valve if you installed one.

The float should rise in the flow sight and the **SYSTEM** light should come on to indicate flow is **ON**. Flow should be at least 1 gpm. If the flow does not raise the flow switch float, increase the pipe size.



Now turn the water flow **OFF**. The float should drop to indicate there is no flow and the **SYSTEM** light should go **OFF**.

Turn the flow back **ON** for the rest of the start-up.

Setup Procedure

If one chemical pump is used, plug in this chemical pump in the **PRIMARY** outlet. If you have the weatherproof version, wire the chemical pump to the terminal block.

Set the **PRIMARY** steeping knob to the desired maximum ppm. If the **SECONDARY** feed is used, turn the steeping knob to the minimum allowable ppm. For example: **PRIMARY** set to 1.5 ppm and the **SECONDARY** set to 0.5 ppm.

SET THE ALARM TIMER

Turn the alarm timer knob to the maximum amount of time you are willing to let the chemical pump run with **NO** increase in chlorine to the **PRIMARY** steeping. If this time is exceeded, an alarm contact will close and the **ALARM** light will turn **ON**.

Set the timer to 90 minutes, unless you wish to have a shorter time.

Calibration

In order to calibrate your unit, you must first measure the sample water. You can use any DPD test available from Lakewood Instruments, your water treatment engineer or any swimming pool supply store. A small, straight screwdriver is needed to adjust the **CALIBRATE** shaft.

You may need to manually charge the water system with chlorine to get a reading. If you do, try to bring it up to at least 1 ppm. If the system has previously had no chlorine feed, you may have to feed for quite a while to kill off the system organic growth so that you can have a residual.

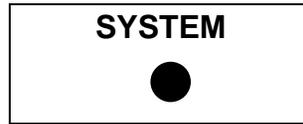
MEASURE THE SAMPLE WATER

Use the sample valve spout, if you installed one.

- Measure the water free chlorine residual, following the directions in your test kit. It is also a good idea to measure the sample water pH and to log it in with your records.
- Make careful note of the free chlorine residual, since you will use it to calibrate your unit.

NOW YOU CAN CALIBRATE THE CONTROLLER.

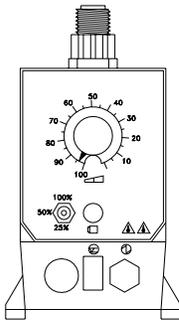
- Make sure the **SYSTEM** light is **ON**, indicating flow.



You should adjust the **CALIBRATE** shaft until the LCD reads the same as the sample determined by the color test. For example, if the test indicated 1.2 ppm, then the LCD should read:



SET THE CHLORINE CHEMICAL PUMP OUTPUT



- Set the chemical pump to the output capacity your water treatment engineer recommends (i.e., 50% output capacity). If a valve is being used to control the feed, just adjust the feed rate to the best guess. Use 25% if you are not sure.
- Allow the system to run. Watch to see how fast the residual ppm rises to the setpoint. If there is too much overshoot, cut back the feed rate. If it takes too long for the residual to raise to the setpoint and the alarm timer actuates, increase the feed rate.

Maintenance and Technical Service

Maintenance

In every case below, make sure you have shut off the sample flow and the power to the controller before you do anything.

DOUBLE-BAND POTENTIAL ELECTRODE

- Remove the sensor lock plate screws.
- Very carefully pull the glass sensor out of the flow chamber. Keep the O-ring in place.
- Clean the tip of the sensor in murtatic or swimming pool acid (5-10% HCl). **DO NOT** scour or wipe off the sensor tip. Only wash it off with tap water after cleaning.
- Carefully replace the glass sensor in the flow chamber. Locate the sensor in the center of the clear riser tube inside the flow chamber as shown.
- Replace the electrode lock plate screws.
- Calibrate the controller, then allow the controller to operate for a half-hour in order to stabilize the electrodes. Then you can recalibrate the controller for best accuracy.

FLOW CHAMBER CLEANOUT

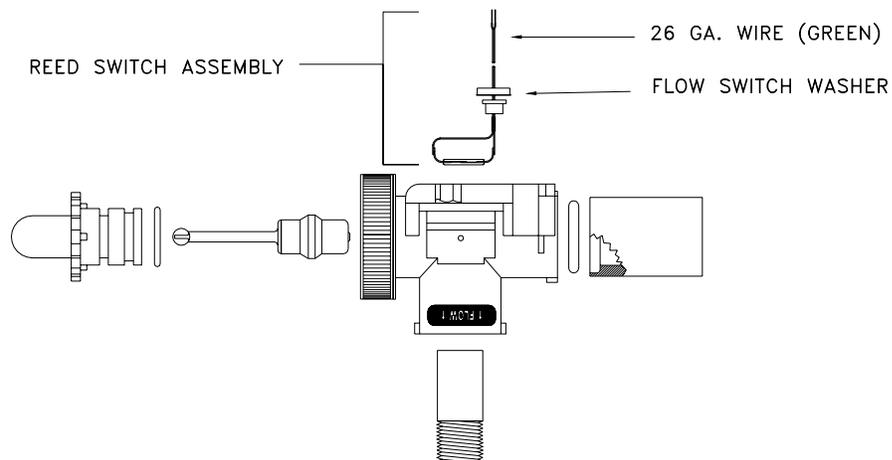
- Unscrew the top flow chamber retaining screw.
- Pull off the top cover plate and rest it on a clean surface with the electrode pointing up. Or remove the electrode before pulling off the top plate. There is less chance of breaking the electrode.
- Disassemble the clear outer chamber.
- Clean all the parts in warm, soapy water. Rinse off in tap water.
- Lubricate the O-rings with silicone lubricant. **DO NOT** use petroleum-based grease.

- Reassemble, taking care not to twist the top assembly, which will break the electrode on the riser tube.

FLOW SWITCH CLEANOUT

- Unlock the red lock ring and remove the flow sight.
- Remove the float with your fingers.
- Bottle brush the float, flow sight and the flow switch assembly to remove any residue.
- Clean off the O-ring and then apply silicone-based lubricant to keep the O-ring moist.
- Make sure you lock down the red lock ring after you replace the components.
- After you turn the inlet flow back on, check for leaks.

REED SWITCH REPLACEMENT



- Remove 3 screws holding flow switch.
- Remove screws holding other plumbing components.

- Pull hard on the green wires to remove the reed switch.
- Install and wire new reed switch.
- Reinstall plumbing.

Technical Service

 **Technical Support for Lakewood Instruments can be reached by calling (800) 228-0839 or faxing (414) 355-3508, Monday through Friday, 7:00 a.m. - 5:00 p.m. CST.**

 **Mail and returns should be sent to:**

**Lakewood Instruments
7838 North Faulkner Road
Milwaukee, WI 53224 USA**

When any merchandise is returned to the factory, please call and obtain a return material order (RMO) number and have the following information available:

- Customer's name, address, phone and fax numbers.
- A purchase order number (no exceptions) for cases where parts are required that are not under warranty.
- A contact person's name and phone number to call if the equipment is beyond repair or to discuss any other warranty matter.
- Equipment model and serial numbers.
- Reason for return (i.e., repair, warranty, incorrect part, etc.).

We will then fax to your attention an RMO form that must accompany the returned item.

NOTE: THE RMO NUMBER MUST BE CLEARLY WRITTEN ON THE OUTSIDE OF THE PACKAGE(S) BEING RETURNED.

Parts List and Service Guide

When calling Lakewood Instruments, please have the controller's complete model number and serial number available, together with the software version and the software revision so that the technician can better assist you.

When any parts are returned to the factory, please indicate:

- Customer's name and address
- Individual at customer location to send the repaired controller or new part to
- The person (and phone number) to call if the equipment is beyond repair or for any warranty matter

PART NUMBER	DESCRIPTION
67283	Model 398 front panel.
67224	Model 398 rear circuit board.
67342	Double-band potential sensor

NOTE: PLEASE SPECIFY MODEL NUMBER WHEN ORDERING.

67234	Flow switch magnet.
67215	Molded flow switch and flow housing.
67235	Replacement reed switch block.
67266	Flow sight.

Write your controller's complete model number and serial number here so that you will have them available if you wish to contact an Lakewood Instruments technician.

Model Number:

Serial Number:

Troubleshooting

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
NO POWER TO THE SOLENOID VALVE OR CHEMICAL PUMP. SYSTEM light is OFF .	1. If the flow switch float is down in the sight glass...	1. Increase sample flow. 1 gpm minimum is needed. Clean the flow switch.
	2. If the flow switch float is up in the sight glass...	2. Replace the flow relay, reed switch block and/or float.
	3. The fuse may be blown.	3. Check for 24V solenoid. Check outlets for 115 VAC. Check chemical pump in another outlet.
SYSTEM light is ON .		Turn the setpoint above current chlorine level. Check outputs for 115 VAC. Check valve solenoid and chemical pump.
If all of the above checks out OK, but you still don't have power to the outputs, call to make arrangements to return the rear circuit board for repair.		
Chlorine display is not working or reading is too low.	1. Clean the sensor.	1. See the Maintenance section of this manual.
	2. Remove the sensor orange terminal block.	2. If the controller calibrates and the setpoints work, replace the sensor. If the controller does NOT work with the setpoints or you cannot calibrate the controller display, replace the controller front panel.
	3. Replace the sensor terminal block and recalibrate the controller.	
Controller reads properly, but is not feeding chemicals. <div style="border: 1px solid black; padding: 2px; color: blue; font-weight: bold;"> NOTE: IF A CLOCK TIMER IS USED AND THE TIME IS <u>NOT</u> READY TO CHLORINATE, THERE WILL NOT BE OUTPUT POWER.) </div>	1. If the flow sight shows proper flow...	1. Proceed to 3.
	2. If the flow sight does not show proper flow...	2. Initiate proper flow or replace the flow switch, then proceed to 3.
	3. If the SYSTEM light is NOT ON ...	3. Short terminal TB , lugs 1 & 2. If the light comes on, the flow switch is faulty and needs to be replaced or the flow is simply insufficient.
	4. If the SYSTEM light is ON ...	4. Check and see if biocide is feeding. Check and see if the lockout time has expired. Check jumper for biocide plug.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
<p>The TIMER light is ON, indicating allowed feed time to reach the setpoint has been exceeded.</p>	<p>1. You may be out of chlorine.</p>	<p>1. Add chlorine.</p>
	<p>2. If the chemical pump is still working...</p>	<p>2. Increase the chemical pump feed rate. Then press RESET.</p>
	<p>3. If the alarm light is still ON...</p>	<p>3. There may be a problem with the panel. The alarm light should go OFF when RESET is pressed or when there is no flow.</p>

For more information call toll free in the USA (800) 228-0839

Manufactured in the USA

Lakewood Instruments

7838 North Faulkner Road, Milwaukee, WI 53224 USA

Phone (800) 228-0839 • Fax (414) 355-3508

<http://www.lakewoodinstruments.com>