



INSTALLATION PROCEDURES

COOLING TOWER MODELS

CT-75, CT-150, CT-225, CT-300



CT-75
handles up to 75,000 gallons



CT-150
handles up to 150,000 gallons



CT-225
handles up to 225,000 gallons



CT-300
handles up to 300,000 gallons



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Models CT-75 thru CT-300 Cooling Tower Series

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A.) Identifying the CT Components



Microprocessor
Control Box



Copper Test Kit
(CLA-41)



3-Year Warranty Card



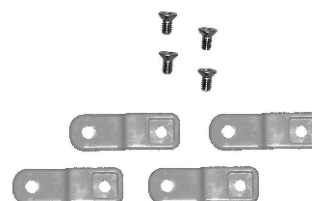
Installation Manual



7" long 90% copper, 10% silver
electrode, 3"sch 80 (CLE-20)



Flow Cell Chamber
PVC Tee 3" (CLF-57)
or Tee 4" (CLF-58)
(Customers option on
CT-150 thru CT-300 models)



Control Unit Mounting Brackets (4)
Mounting Bracket Screws (4)



30 feet coil(s) of
grey electrode wire

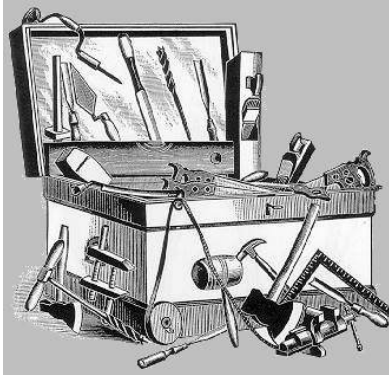
CT-75	1 electrode	1 PVC Tee	1 Coil of Grey Electrode Wire
CT-150	2 electrodes	2 PVC Tees	2 Coils of Grey Electrode Wire
CT-225	3 electrodes	3 PVC Tees	3 Coils of Grey Electrode Wire
CT-300	4 electrodes	4 PVC Tees	4 Coils of Grey Electrode Wire

OPTIONAL COMPONENTS



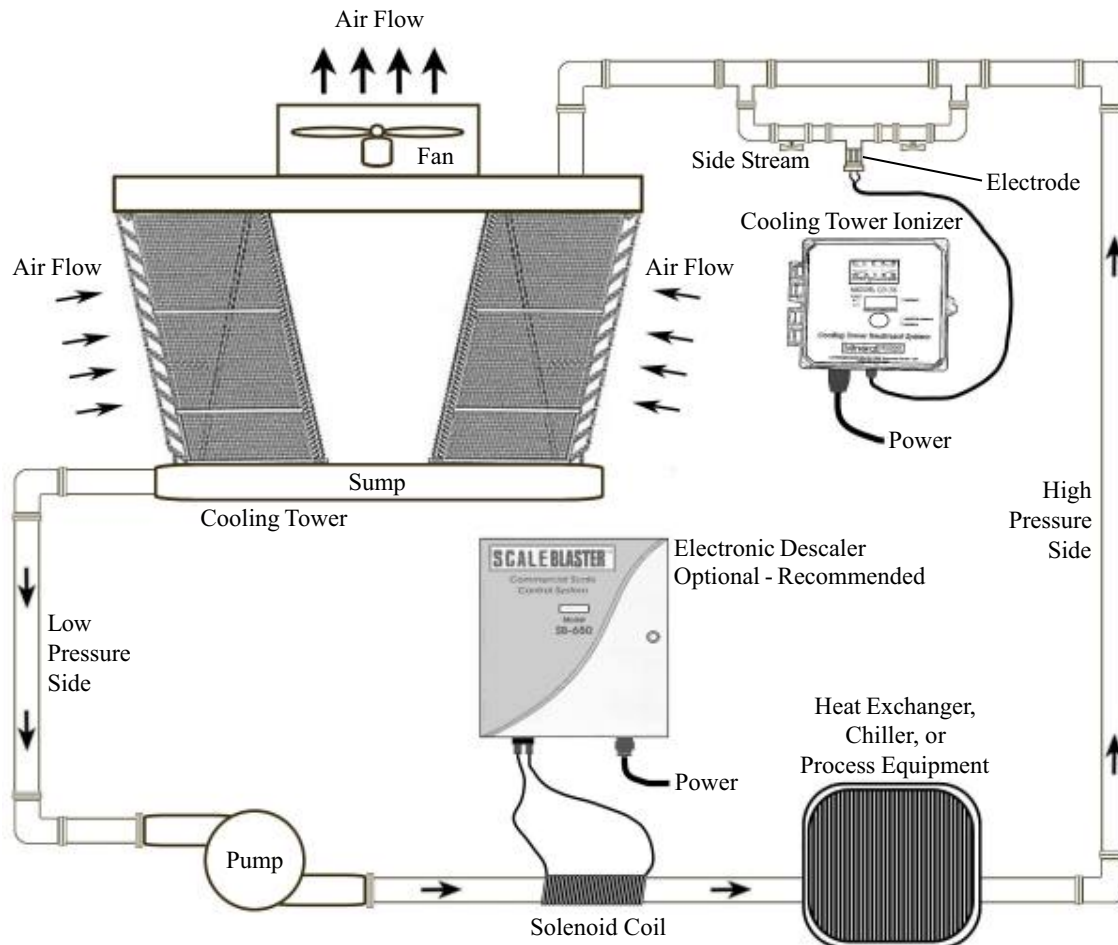
6" long 80% copper, 20% silver
electrode, 3"sch 80 (CLE-14)

B.) Tools and Materials Required



- Channel lock wrench
- Screws & anchors
- Crescent wrench
- Flexible conduit
- Screwdriver
- ½" straight conduit connector
- Drill & drill bit
- Wire stripper
- Silicone gel
- Hacksaw or backsaw
- Utility knife
- Teflon tape
- Hammer
- PVC cleaner/primer
- Voltage meter
- PVC cement
- Zip ties

C.) Site Survey



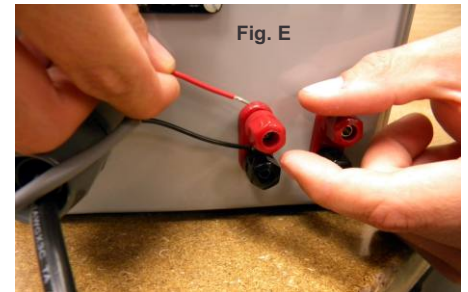
The MineralPURE CT series ionizations system involves a microprocessor control box that is mounted on a wall or on a secure stand that is within 25 feet or so of a side stream that includes a flow cell chamber and should be within 4 feet of an electrical outlet (or conforming to electrical codes). This side stream should be on the return line going into the cooling tower and after the chiller or heat exchanger.

D.) Installing the Flow Cell Tee & Side Stream

- 1). Locate a section of pipe to install the flow cell tee side stream. For best results, locate the side stream after the chiller, heat exchanger, process equipment or hot well on the return line into the cooling tower. This location of the flow cell chamber should be within 25 feet of the microprocessor control box.
- 2). The flow cell tees are 3" PVC. The side stream line may be smaller and then enlarged and reduced before and after the tees. Maintain a minimum flow rate through the side stream of 30 gallons per minute. It is recommended to install a simple flow meter at some point in the side stream to monitor flow rate.
- 3). Install the tees in the side stream with a ball valve on each end so that you can isolate the tees when the electrodes need cleaning or replacement. This way the system will not require shut-down. **ALWAYS INSTALL THE TEES HORIZONTALLY TO AVOID AIR POCKETS IN THE ELECTRODE CHAMBER.**
- 4). If there are multiple tees to be installed (for the CT-150, CT-225 or CT-300 units), you can install them side by side, with no worry about distance. They can be apart or as close together as desired
- 5). Wrap Teflon tape generously around the electrode assembly threads. Screw electrode assembly into mounted tee. **DO NOT OVER TIGHTEN.**
- 6). Attach the lead wire from the control box to the two leads on the electrode assembly. Apply silicone gel to waterproof them. This will prevent shorting.

Connecting the grey electrode wire from the electrodes to the control box

Included with every electrode and tee is a 30 foot grey cable connection. Connect the terminals to the electrodes (Fig. D) and to the terminals coming out of the control box (Fig. E). It does not matter if you are screwing into the red or black terminals, just have one on each end.



E.) Installing the Microprocessor Control Box

- 1). Before mounting the microprocessor control box, you must determine the voltage at the installation site. When locating the power source, it should be one that turns on and off with the tower pump. The power source should be within four feet of the control box.
- 2). Mount the enclosed mounting brackets on the back of the control box. Use proper anchors and screws to mount on the surface (wood, stucco, etc.).

ALL CT MICROPROCESSOR CONTROL BOXES AUTOMATICALLY SWITCH BETWEEN 110VAC and 220VAC, SO THERE IS NO NEED TO MAKE ANY INTERNAL ADJUSTMENTS.

YOU MUST FOLLOW ALL LOCAL, STATE, NATIONAL OR INTERNATIONAL CODES WHEN INSTALLING. A CERTIFIED ELECTRICIAN MAY BE REQUIRED.

- 3). You should use a flexible conduit from connection to connection on the power cable. The size of the connector already on the control box is 1/2". There is no need to cover up the electrode wire.
- 4). Once this is all complete, open up all valves and turn the power on. Check for water leaks and all electrical connections for proper and firm connections.

Black is line – White is neutral – Green is ground

F.) Balancing the Cooling Tower Water

COPPER LEVEL

Before setting the **MineralPURE Copper/Silver Ionization Unit**, you should test the copper level. Use the enclosed copper ion test kit. There may be a level of copper sulfate in the water from leached copper piping, or from a copper based algaecide. If the reading is over 10 ppm, corrections may have to be made. You want to have a proper balance of copper and silver ions in the water, so you need to find the source of the copper already in the water. Remember, this is not the same copper that is produced by the purifier. If it is from copper pipe, the copper was leached from a low pH of 7.0 or less. Make sure the pH is maintained over 7.0 to prevent further copper leaching from the pipes. If the source is from a copper-based algaecide, simply start the ionizer up at a very low level. Eventually the copper algaecide will dissipate. When this does take place, get the copper level down to .5 ppm.

PHOSPHATES

It is extremely important to remove PHOSPHATES (scale inhibitors) from the cooling tower system water. These chemicals trap the copper ions as minerals, and the proper copper-ion level cannot be obtained when scale inhibitors are present.

pH

The pH will need to be at least 7.0 (which should be no problem!). It does not matter how high the pH is in order for **MineralPURE** to work properly.

TOTAL DISSOLVED SOLIDS (TDS)

The **MineralPURE** requires some conductivity in the water for ionization to take place. For the system to perform on maximum capabilities, the TDS needs to be at least 500 PPM. Most Towers already have this level because the TDS always goes up. Only when excess bleed-off creates low cycles of concentration is this an issue.

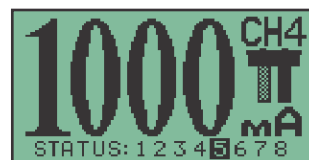
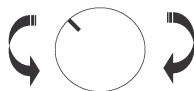
If a TDS meter is not available, turn the control knob clockwise till the digital milliamp readout on the control box reaches its highest number. If the TDS is over 450, the reading should reach at least 600. The readout goes in 5 milliamp increments starting at 'OFF'.

If the reading does not go to 1000, the "Check Electrodes" indicator will come on when you try to turn a control knob past the highest reading the unit can produce given the conductivity of the water. In other words, if the TDS level in the water is below 700 ppm, the unit may only go to 850 (for example) and when you turn the control knob to go higher, the "Check Electrode" indicator will come on. If this happens when you first start up the system, it is because of the TDS level being too low, and not the electrodes.

You can very easily raise the TDS level by decreasing the bleed-off and increasing the cycles of concentration. As water is constantly evaporating from the cooling tower, this may only take a day or two to correct.

G.) Setting the Control Box

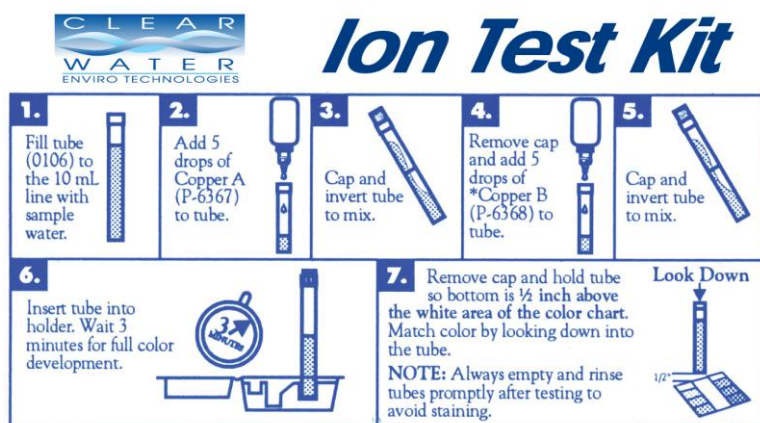
Turn the control knob counter-clockwise till the unit reads “OFF”. Then turn clockwise. The milliamp readout should go in 5 mA increments all the way to 1000. The control knob CAN be continued to turn in either direction and will not harm the equipment. If the unit does not go to 1000 when you first start up the unit, it is usually because the TDS level is not at least 500 ppm. See TDS section of this booklet.



To get the system “ionized” as quickly as possible, turn the control knob so that you obtain the highest reading (1000 or the highest possible reading). The system should be fully 'ionized” in a few days or shorter

OBTAINING THE PROPER COPPER-ION LEVEL

All units include a Copper-Ion Test Kit. Follow directions on the inside label of the test kit. When testing YOU MUST ALWAYS LOOK DOWN FROM THE TOP THROUGH THE TEST TURES – NOT FROM THE SIDE.



To reorder: Contact your dealer or Clearwater @ 1.800.756.7946 • 727.562.5186



WE RECOMMEND A COPPER-ION LEVEL 0.5 PPM.

IN VERY HOT, HUMID AREAS YOU MAY GO HIGHER AS NEEDED FOR ALGAE CONTROL.

When starting up the system, test the copper-ion level every 8 hours or so till you have obtained 0.5 PPM.

H.) Operation Procedures

MAINTAINING THE PROPER COPPER ION LEVEL

Once the desired Copper-Ion level is obtained (0.5 PPM), monitor the reading on the control box. Keep it at this setting until the Copper-Ion is either too high or too low. Generally, the computer will never need adjusting.

There is no need to test the silver-ion levels. If the copper is in the proper range, it is almost certain that the silver level will be well in the desired levels.

IF THE COPPER-ION LEVEL IS TOO HIGH (WELL OVER 0.5 PPM)

Turn the control knob down (or counter-clockwise) a notch and lower the milliamp reading by 25 mA. Test the following day. Continue this procedure till the Copper-Ion level stabilizes. You may want to wait two or three days before making the adjustments.

Once you obtain the proper setting, this usually stays the same all season long. If the water gets colder, the chance of algae and bacteria decrease, thus a lower Copper-Ion level may be required. Be sure to test the Copper-Ion level weekly in case adjustments are needed.

Test Kit Reordering Information:

Replacement Ion Test Kit - Part # CLE-41 - Includes new complete test kit as supplied with unit.

Replacement Reagents - Part # CLE-42 - Includes new reagent bottles of "A" and "B" only.

I). Cleaning and/or Replacing the Electrodes

Cleaning of the electrodes should be performed as part of a monthly preventative maintenance program. If the LCD display reads a warning to "Check Electrodes", it may be time to clean or replace them. Simply isolate the bypass line and unscrew the electrode chamber. A blue greenish coating is normal; however, if there is a heavy buildup, you may need to clean the electrode. Remove the buildup using a putty knife, a small wire brush and a solution of lemon juice or dilute muriatic acid. . If the electrodes are thin and worn out, they will need to be replaced.

Electrode Reordering Information:

Replacement Electrode - **Part # CLE-20** - 7" electrode in 3" threaded cap, 90% copper, 10% silver

Replacement Electrode - **Part # CLE-14** - 6" electrode in 3" threaded cap, 80% copper, 20% silver

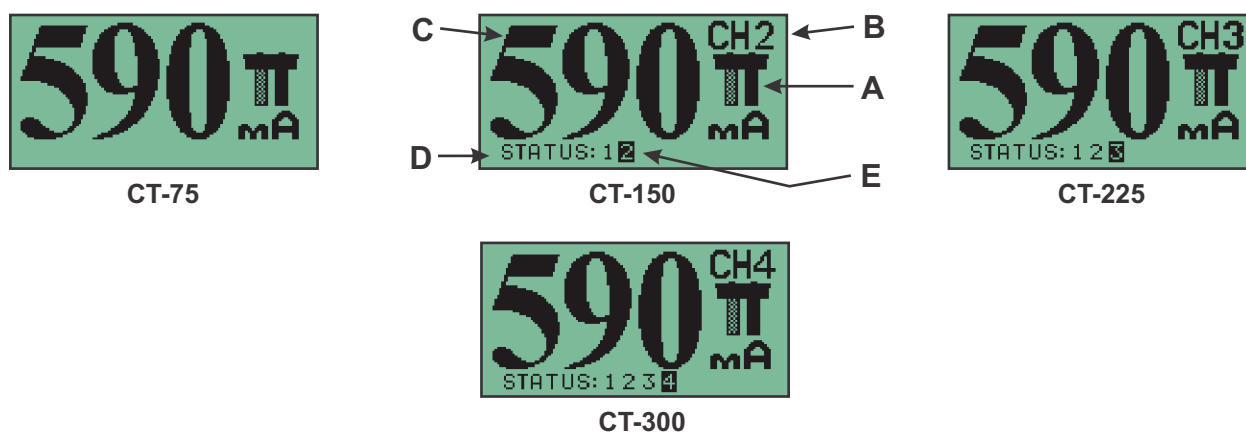
J.) CT Control Box Features

Splash Screen - All Units



During the splash screen the unit performs a self diagnostic test. If an error is found an error number 5 will be displayed (see section on error screens).

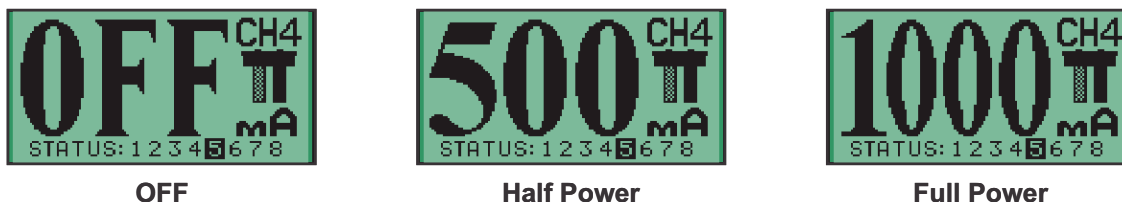
Main Screen(s)



- A - Electrode status icon
- B - Output channel being displayed
- C - Output current set to value in milliamps (mA)
- D - All channels status indicator
- E - Black box around number indicates current channel being displayed. A blinking channel indicates an error on that channel.

Output Current Indicator

This value indicates the output current flowing through the electrodes. It is adjustable from zero (OFF) to one thousand milliamps (mA), in five ma increments. The display back light will automatically turn OFF after 5 minutes. A turn of the control knob will turn ON the back light again



Electrode Status Icon & Error Screens

STEADY ON - NORMAL OPERATION

The electrode icon on the upper right side of the main screen indicates the electrical polarity as well as its operational status. The pictures to the right show the electrode icon switching from one polarity to the other. This will occur every five minutes and allow the electrodes to wear evenly to maximize the life of the electrodes.



J.) CT Control Box Features

(continued)

Electrode Status Icon & Error Screens (continued)

BLINKING with TDS - CHECK ELECTRODE or WATER TDS TOO LOW

In this mode the electrode icon will blink. The output current indicator will also change from the set to current value to the actual current value. The main cause for this to occur is the TDS level of the water is too low. In most cases the TDS level will rise and no action is required. Another reason for this warning is that the electrodes are worn out and need replacing. See the section on Inspecting and Replacing the Electrodes for more information.



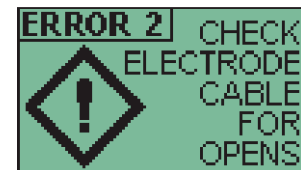
BLINKING with SHORT - SHORT CIRCUIT on ELECTRODE & ERROR SCREEN 3

This error mode is very unlikely to occur. If it should happen, most likely it will be caused by something (usually a piece of metal) bridging (shorting) the electrode terminals. To correct the error check the electrode terminals and wiring to make sure they are not touching each other. Also make sure no foreign material is shorting out the electrode from inside the electrode chamber.



BLINKING with OPEN - OPEN CIRCUIT on ELECTRODE & ERROR SCREEN 2

This will most likely happen if one of the wires gets cut or otherwise disconnected from the electrode. Check both terminals on the electrode, making sure they are connected and not excessively corroded. Also make sure there are no nicks or cuts in the electrode cable.



ERROR SCREEN 5

This error indicates an internal error has occurred. This error can occur at start up during the self diagnostic test or during the course of normal operation. The error usually means that an internal printed circuit assembly has failed. The circuit assembly will correspond with the channel number that displays the error message. It should be noted, unless the otherwise indicated, that only that channel is malfunctioning and the other channels should be operating normally. This error could be caused by a blown fuse or one of the components on the board itself. If this error happens please contact **Clearwater Enviro Technologies** for technical assistance.



Diagnostic Screen

Output Current Set -
Actual Output Current Reading -
Duty Cycle of Output
Total Hours Unit Has been On
Output Voltage
LCD Display Contrast %
Error Status Number -

```
DIAG SCREEN      CH:04
OUTPUT SET TO-600mA
ACT. CURRENT-1200mA
DUTY CYCLE-050%
HOURS ON-000860
ELE. VOLTAGE-16.5VDC
LCD CONTRST-075%
ERROR STATUS-123456
```

- Output Channel Being Displayed

This screen is used to display more technical information to the user or service technician. The following code will access the Diagnostic Screen:

1) Turn the output current knob until the output current indicator is **005**, wait about two seconds and you will notice the electrode icon will switch polarities.

2) Next dial in **030**, and wait 2 seconds



3) Next dial in **015**, and wait 2 seconds



The screen above (Diagnostic Screen) should now be displayed.

The diagnostic screen monitors seven different operational values. Each value is described in detail below.

OUTPUT CURRENT SET This is the set point for the output current (in milliampere). The unit will maintain this amperage setting thru the electrodes.

OUTPUT CURRENT READING This is a measured current value (in milliampere) of the current flowing thru the electrodes. This value is an instantaneous value and may or may not indicate a steady state current value. When in Analog Mode this reading will be the same as the current set value. When in Pulse Width Modulation Mode this value divided by the Duty Cycle Value will equal the current set value.

J.) CT Control Box Features

(continued)

DUTY CYCLE OF OUTPUT When in the pulse width modulation mode, this is the ON time of the current output to the electrodes.

TOTAL HOURS UNIT HAS BEEN ON Total time (in hours) the control unit has been in operation.

OUTPUT VOLTAGE This is the output voltage across the electrodes. This voltage can range from 2VDC to 20VDC depending on the electrode conditions, water TDS, and output current setting.

LCD DISPLAY CONTRAST The LCD display's contrast setting, in percentage.

ERROR STATUS NUMBERS This is a numerical representation of the present status. The Values and the meaning are written below.

- | | | |
|----------------------------------|---------------------------|----------------------------|
| 1) Normal Mode | 2) Electrode Open Circuit | 3) Electrode Short Circuit |
| 4) Electrode Resistance Too High | 5) Internal Error | |

Output channel being displayed is the current information on the LCD screen as it relates to this channel.

Return to Main Screen

The control box will return to the main screen when power is removed and then reapplied. Alternately the user can also dial in the following code to return to the main screen:

- 1) Turn the output current knob until the output set value is **000** wait about two seconds and you will notice the electrode icon will switch polarities.

- 2) Next dial in **025**, and wait 2 seconds

- 3) Next dial in **010**, and wait 2 seconds

```

DIAG SCREEN      CH:04
OUTPUT SET TO-000mA
ACT. CURRENT     1200mA
DUTY CYCLE       050%
HOURS ON         000860
ELE. VOLTAGE     16.5VDC
LCD CONTRST      075%
ERROR STATUS     123456
    
```

```

DIAG SCREEN      CH:04
OUTPUT SET TO-025mA
ACT. CURRENT     1200mA
DUTY CYCLE       050%
HOURS ON         000860
ELE. VOLTAGE     16.5VDC
LCD CONTRST      075%
ERROR STATUS     123456
    
```

```

DIAG SCREEN      CH:04
OUTPUT SET TO-010mA
ACT. CURRENT     1200mA
DUTY CYCLE       050%
HOURS ON         000860
ELE. VOLTAGE     16.5VDC
LCD CONTRST      075%
ERROR STATUS     123456
    
```

The control unit's LCD display should now show the main screen.



LCD Contrast Adjust Screen

The LCD contrast adjustment screen allows the user to adjust the darkness of the LCD display. To access this screen the user must dial-in the correct code on the output adjust knob. The following code will access the LCD contrast adjustment screen.

- 1) Turn the output current knob until the output current indicator is **010**, wait about two seconds and you will notice the electrode icon will switch polarities.

- 2) Next dial in **035**, and wait 2 seconds

- 3) Next dial in **020**, and wait 2 seconds

```

010 CH4
mA
STATUS: 1 2 3 4 6 7 8
    
```

```

035 CH4
mA
STATUS: 1 2 3 4 6 7 8
    
```

```

020 CH4
mA
STATUS: 1 2 3 4 6 7 8
    
```



The display will now look like the picture to the right. The LCD display's contrast can now be adjusted. The display will now show the percentage of contrast on the screen. Adjustments will make the display easier to read in different light levels. After nine seconds of inactivity on the control knob the unit will return to the main screen. After the screen switches back, the new LCD contrast level will be recorded in the control unit and will then always return to this new level when powering up. Of course, the operator can always change it again if needed.

```

40% CH4
mA
ADJUST CONTRAST 09
    
```

K.) Trouble Shooting

CAN'T OBTAIN PROPER COPPER-ION LEVEL

If you are unable to obtain the proper ion level, check all of the following factors to solve the problem:

- 1). High algae growth and cloudy water may be using up all available copper-ions the unit can produce. Check system pH.
- 2). Correct sizing of Ionizer. There should be one set of electrodes for each 600 tons of system cooling.
- 3). Correct input voltage. Is the unit set to 110VAC or 220VAC – the same as the power source?
- 4). Scaled, dirty or worn electrodes. Check electrodes for cleaning or replacing. The “Check Electrode” light may be on. (Consult the owner's manual for more details)
- 5). The TDS level too low. If the digital readout cannot at least reach the 'average' setting required, you will need to increase the TDS level. See the section of this manual under “Total Dissolved Solids” on how to increase the water's TDS level.
- 6). Improper test kit readings. Make sure you are following the proper Copper-Ion test kit procedures. Many people look at the side of the test tubes when testing instead of looking down from the top. Make sure you wait 3 minutes for the test to develop.
- 7). Steel plumbing. Never install the electrodes on steel piping. Install inside stream with PVC pipe.
- 8). Check all wires for proper connections.
- 9). No readout on the microprocessor control box. (see next section)

K.) Trouble Shooting

(continued)

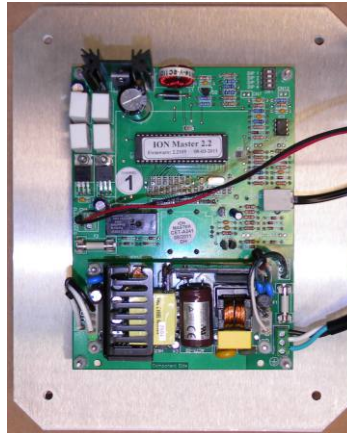
NO OUTPUT READING ON THE CONTROL BOX

If there is no reading on the LCD display when the control box is powered up, and assuming all connections are correct, you should check the fuses. Improper installation, a power surge, or lightning strikes can cause the fuses to blow. In the example below we will use a CT-150 unit, although your control box may differ the process will be essentially the same. Also if the unit just has a dim reading on the LCD display than it is a LCD contrast issue, consult Section J, LCD Contrast Adjust Screen.



To check the fuses, open up the unit and remove the four (4) screws holding the top collar in place.

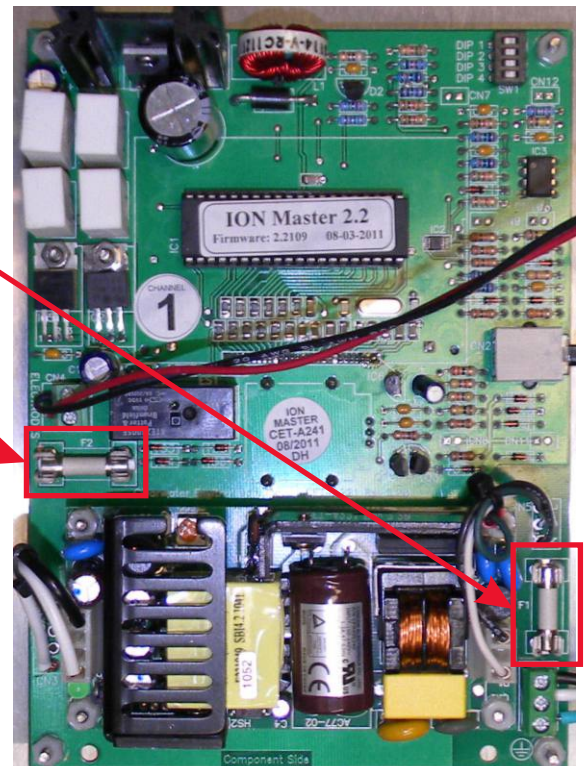
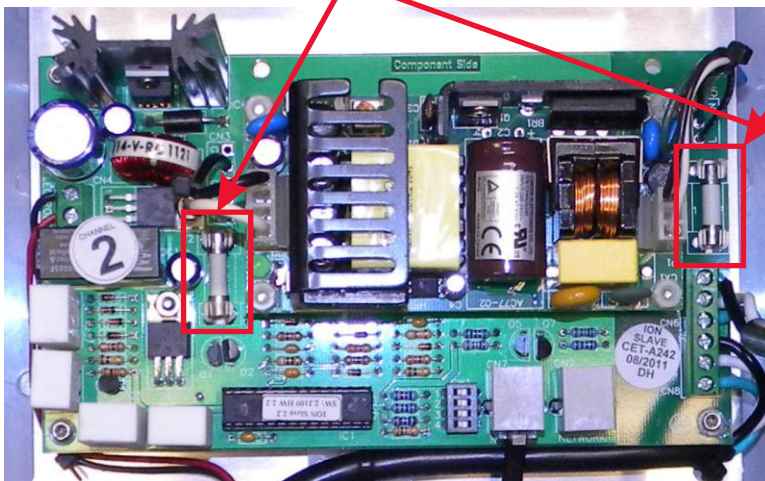
Lift face plate assembly, with printed circuit board attached, up and turn over. Do not disconnect any wires. **Very important.**



Locate fuses on back of circuit boards (indicated by the pictures) and check fuses to see if blown. Replace any blown fuses and reassemble control box in reverse of the disassembly instructions. If the fuse blows again or you still have a blank display call **Clearwater Enviro Tech** to obtain a RMA, DO NOT KEEP REPLACING FUSES!

F2 Fuse, 5X20mm
Slow Blow 4A, 250V

F1 Fuse 5X20mm
Slow Blow 2A, 250V



M.) Cooling Tower Ionizer Specifications

TOWER SIZE:

CT-75 up to 600 ton system
CT-150 up to 1200 ton system
CT-225 up to 1800 ton system
CT-300 up to 2400 ton system

INPUT VOLTAGE: 90 to 264 VAC, at 47 to 63 HZ, auto switching

INPUT CURRENT and WATTAGE: With electrode output set to 1000mA (Max.)

CT-75 - 375mA @ 110VAC (45 Watts),	350mA @ 220VAC (84 Watts)
CT-150 - 550mA @ 110VAC (66 Watts),	500mA @ 220VAC (120 Watts)
CT-225 - 1A @ 110VAC (120 Watts),	800mA @ 220VAC (192 Watts)
CT-300 - 1.3A @ 110VAC (156 Watts),	1A @ 220VAC (240 Watts)

OUTPUT VOLTAGE (all outputs): 2.5VDC to 20VDC, Auto Ranging, Dynamically Adjusted

OUTPUT CURRENT: Adjustable in 5mA increments

0 TO 1000mA DC in analog mode (each output)

0 TO 1000mA DC average in pulse width modulation mode (each output)

CIRCUIT PROTECTION: internal input fuse, both on high side and low side, input line spike/surge immunity to IEC 1000-4-5, level 3

FUSES:

F1 - 2A, 250VAC, 5x20mm, Slow Blow
F2 - 4A, 250VAC, 5x20mm, Slow Blow

IONIZATION METHOD: electrolysis of copper, copper/silver alloy electrodes by a microprocessor control circuit

ELECTRODES:

CT-75 – One set of Electrodes, comprised of 90% copper / 10% silver (CLE-20)
CT-150 – Two sets of Electrodes, comprised of 90% copper / 10% silver (CLE-20)
CT-225 – Three sets of Electrodes, comprised of 90% copper / 10% silver (CLE-20)
CT-300 – Four sets of Electrodes, comprised of 90% copper / 10% silver (CLE-20)

Copper/silver electrodes are available:

CLE-14 - 6" long 80/20 Copper/Silver Electrodes
Contact Clearwater Enviro for details

ELECTRODE CHAMBER: Customers choice between 3" or 4" inch tees.

ENCLOSURE: weather resistant NEMA 4X (IP65) rated, UL 94 Flame Rating, UL UV rated, high impact corrosion resistant thermoplastic with hinged polycarbonate cover

M.) CT Specifications

(continued)

ENCLOSURE DIMENSIONS:

CT-75 – 8" x 8" x 4"
CT-150 – 8" x 10" x 6"
CT-225 – 8" x 10" x 6"
CT-300 – 16" x 14" x 7"

OPERATING TEMPERATURE RANGE: 32 - 110 degrees F

WARRANTY: 3 years, parts and labor - excluding electrodes

HEAD LOSS:

When using:

CLF-57 – 3" Sch. 40 Tee – Flow Rate of 25 GPM Total Head Loss (psi) is < .20 PSI
CLF-58 – 4" Sch. 40 Tee – Flow Rate of 25 GPM Total Head Loss (psi) is < .20 PSI

HYDROSTATIC PRESSURE: Maximum Recommended Pressure: 50PSI

ION PRODUCTION WITH THE FOLLOWING WATER CONDITIONS:

Water Temperature: 72.7 °F
Total Chlorine: None
pH: 7.45
TDS: 347 mg/L
Hardness: 215 mg/L
Total Alkalinity: 85 mg/L



Phone: 727-562-5186 • Toll Free: 800-756-7946 • Fax: 727-562-5187
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