Introduction

Evaporative cooling equipment such as cooling towers, closed circuit coolers and evaporative condensers require a means to control the make-up water supply. The standard EVAPCO make-up offering consists of a mechanical valve and float assembly. This mechanical assembly is limited to 50 psig inlet water pressure. Many customers desire an electronic offering which allows for precise control of factory-recommended basin levels without the need for field adjustment. In addition, the Electronic Water Level Controller (EWLC) utilizes a slow closing electric solenoid valve and wye strainer with positive closure to prevent water hammer, allows for 5-125 psig inlet water pressure, and virtually eliminates freeze-up that may occur with the mechanical float valves. EVAPCO has two EWLC offerings for upgrading from the standard mechanical level control.

1. **3-Probe Electronic Water Level Control (EWLC)**
   The EVAPCO 3-probe EWLC package contains a stilling chamber, a Y-strainer, an ASCO slow closing solenoid valve and a 3-probe assembly consisting of a ground probe, a make-up water cut-in probe and a make-up water cut-out probe. The stilling chamber helps balance the water level, removing such factors as splashing water. All components are shipped loose for field mounting in pre-punched holes. Wiring of the controller and solenoid valve is “by others”.

2. **5-Probe Electronic Water Level Control (EWLC)**
   The EVAPCO 5-probe EWLC contains the same features as the 3-Probe with an additional high level alarm probe and a low level alarm probe. This feature allows the user to trigger alarms and offers the ability for integration into a Building Automation System, providing an extra level of monitoring. All components are shipped loose for field mounting in pre-punched holes. Wiring of the controller and solenoid valve is “by others”.

Figure 1: EWLC Assembly  
Figure 2: Mechanical Float Valve Assembly
**Electronic Water Level Control Troubleshooting**

In the event that a problem is encountered with the electronic water level control, the following part of this bulletin will address specific troubleshooting methods that should be utilized to resolve the issue. Please refer to the appendices of this document for a quick troubleshooting table and wiring diagrams.

**Testing**

It should not be necessary to test every EWLC. However, if a problem occurs the testing procedure below will help to pinpoint the cause of the issue and identify a solution.

NOTE: Common electrical wiring practices dictate the convenience of a pig-tail loop in the wiring and flex conduit leading to the EWLC junction box to allow removal of the probe assembly without completely disconnecting wiring and conduit.

Before testing a 3-probe or 5-probe EWLC, **confirm power is disconnected** and remove the enclosure cover. Check that all connections are tight, that there are no signs of water infiltration and no apparent damage to the circuit boards. Verify the seal embedded in the enclosure lid is intact and not torn. Make sure there is no scale build-up on the ends of the probes by removing the controller from the standpipe. If scale is present, remove this buildup by gently rubbing with an emery cloth or scotch-brite pad.

To test the 3-probe and 5-probe EWLC, disconnect all existing wiring and use a 120 Volt AC power cord that can be wired to the two power terminals. On a 3-probe EWLC there is one terminal on each side of the transformer labeled L1 and L2 (Figure 3). The 3-probe EWLC contains one circuit board which controls the make-up valve. There are jumper wires between the transformers on the three boards of the 5-probe EWLC, so only one set of power connections are needed (Figure 4). The circuit board closest to probes is for make-up control and the other two are for the low and high alarms.

![Power Terminals](image-url)
The probes of the EWLC can be either submerged in and out of a reservoir of water or the water level can be simulated using a short length of wire. To simulate a high water condition, the ground probe (longest) and the make-up cut-out probe need to be wired together (Figure 5). The cut-out probe will be the shortest probe on a 3-probe and the second shortest probe on a 5-probe. NOTE: There is not a shock hazard using this method as there is minimal current flowing through the probes.

After a short time delay, the red LED light will turn on (Figure 6). This indicates that the relay has changed from the normal state. Since the valve is wired to the normally closed contact for the make-up control, the **light on** indicates the solenoid valve should be **closed**. Alternately, the red **light off** would indicate an **open** solenoid valve.
To test the function of the relay contacts on the make-up circuit board, hook up an electrical multi-meter to the normally closed (NC) and common (C) terminals (Figure 7). These terminals are labeled on the circuit board. The meter should be switched to read circuit resistance indicated by the ohm (Ω) symbol on the meter (Figure 8).

When a low water level is simulated, the meter will read a closed circuit or minimal resistance (Figure 9). In a high water simulation, the meter will read an open circuit or infinite resistance (Figure 10). If the red light turns on, but the relay contacts do not change state, then the relay is most likely defective. If the light does not turn on when a high water level is simulated, unplug the power cord and check to make sure there are no loose wiring connections inside the enclosure at the ends of the probes.
Once the red light is on, quickly move the wire from the make-up cut-out probe to the make-up cut-in probe. The cut-in probe is the middle length probe on both the 3- and 5-probe controllers (Figure 5). The light should stay on while there is connection between the ground and cut-in probes. The light will not turn off until the wire is removed because the relay is latched between the make-up cut-out and cut-in probes.

The other two boards in the 5-probe enclosure are for the low and high level alarms (Figure 4). The relay contacts should be labeled with stickers near the circuit board. The high alarm will be the set of contacts furthest away from the probes. The procedure to test the make-up relay is also used to test the high and low alarms. Connecting a wire from the ground probe to the low or high alarm probe will cause the corresponding red light to turn on and the relay to change state. There is a short delay between the removal/connection of the wire and the relay changing state. The alarm relays are not latched and should go back to a normal state after the wire is removed.
## Appendix A: Electronic Water Level Control Troubleshooting Table

<table>
<thead>
<tr>
<th>Problem</th>
<th>Test</th>
<th>Possible Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solenoid Valve Stuck Open</strong></td>
<td>If make-up light is on in the controller</td>
<td>Foreign body stuck in valve</td>
<td>Inspect valve, make sure y-strainer is working with no holes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wiring issue</td>
<td>Voltage is supplied to valve independent of the make-up relay. Compare wiring to wiring diagram (Appendix B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relay not switching</td>
<td>See below</td>
</tr>
<tr>
<td></td>
<td>If make-up light is off in the controller</td>
<td>Normal</td>
<td>Valve should be open if make-up light is off</td>
</tr>
<tr>
<td><strong>Solenoid Valve Stuck Closed</strong></td>
<td>If make-up light is off in the controller</td>
<td>Wiring issue</td>
<td>Voltage is not being supplied to the valve. Compare wiring to wiring diagram and take a voltage measurement (Appendix B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relay not switching</td>
<td>See below</td>
</tr>
<tr>
<td></td>
<td>If make-up light is on in the controller</td>
<td>Normal</td>
<td>Valve should be closed if make-up light is off</td>
</tr>
<tr>
<td></td>
<td>Apply voltage directly to solenoid</td>
<td>Solenoid defective</td>
<td>If valve will not open, replace valve</td>
</tr>
<tr>
<td><strong>Water Level Too High</strong></td>
<td>If make-up light is off in the controller</td>
<td>Probes dirty</td>
<td>Clean probes with emery cloth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basin knockout in wrong location</td>
<td>Verify with location drawing in submittal</td>
</tr>
<tr>
<td></td>
<td>If the make-up light is on in the controller</td>
<td>Valve stuck open</td>
<td>See above</td>
</tr>
<tr>
<td><strong>Water Level Too Low</strong></td>
<td>If the make-up light is off in the controller</td>
<td>Water usage is greater than make-up rate</td>
<td>Reduce bleed rate and/or increase make-up rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valve stuck closed</td>
<td>See above</td>
</tr>
<tr>
<td></td>
<td>If the make-up light is on in the controller</td>
<td>Basin knockout in wrong location</td>
<td>Verify with location drawing in submittal</td>
</tr>
<tr>
<td><strong>Alarms Not Working</strong></td>
<td>Site specific</td>
<td>Wiring Issue</td>
<td>Consult wiring diagram (Appendix B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relay not Switching</td>
<td>See below</td>
</tr>
<tr>
<td><strong>Relay Not Switching</strong></td>
<td>Relay not energizing (see test procedure)</td>
<td>Defective relay</td>
<td>Replace controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Defective board</td>
<td>Replace controller</td>
</tr>
</tbody>
</table>
Appendix B: Wiring Diagrams

EVAPCO, INC.

Title: Electric Water Level Control Wiring
Description: Induced Draft / 3 Probe, 1 Valve
Drawing # C1A0000-A

Diagram 1:
- 120 VAC/60 Hz
- Integral Level Probe/Relay in a NEMA 4 Polycarbonate Enclosure 017-00103P
- Electric Make-Up Valve (Normally Closed)
- 120V Power Required to Open

Notes:
1. Dashed lines indicate wiring by others.
2. Typical wiring per probe.

Diagram 2:
- 120 VAC/60 Hz
- Integral Level Probe/Relay in a NEMA 4 Polycarbonate Enclosure 017-00204P
- Alarm Circuit Voltage (As Desired)
- Low Alarm
- High Alarm
- Electric Make-Up Valve (Normally Closed)
- 120V Power Required to Open

Notes:
1. Dashed lines indicate wiring by others.
2. Typical wiring per probe.