MARLEY

user manual

LLC water level control

INSTALLATION - OPERATION - MAINTENANCE

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READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.



contents

This manual contains vital information for the proper installation

Note	and operation of the LLC controls. Carefully read the manual before installation or operation and follow all instructions. Save this manual for future reference.		
	Quick Start Guide	4	
	Description	5	
	Operation	6	
	Water Makeup Function	7	
	HAND-OFF-AUTO Switch	7	
	Internal Components	8	
	Electrode Probe Assembly	9	
	Operation Sequence Illustrations	9	
	Water Makeup Control Sequence	10	
	High-Level Alarm Sequence	11	
	High-Level Cutoff Sequence	11	
	Low-Level Alarm Sequence	12	
	Low-Level Cutoff Sequence	12	
	Troupleshooting	13	
	Electrode Probe Part Numbers	14	
	Relay Circuit Card Part Numbers	15	
	Part Numbers	15	
	Wiring Diagrams	16	
	The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.		
▲ Warning	Indicates presence of a hazard which can cause severe personal injury, death or substantial property damage if ignored.		
△ Caution	Indicates presence of a hazard which will or can cause personal injury or property damage if ignored.		
Note	Indicates special instructions on installation, operation or mainte- nance which are important but not related to personal injury hazards.		

Note

introduction

These instructions are intended to assure that field connections are completed properly and the control system operates for the maximum time possible. Since product warranty may depend on your actions, please read these instructions thoroughly prior to operation.

If you have questions about the operation and/or maintenance of this control system and you do not find the answers in this manual, please contact your Marley sales representative.

Hazard of electrical shock or burn. Be sure to turn off power to the panel before servicing. If working on equipment out of site of panel disconnect, lockout using standard lockout procedure.

Safety First

The Marley control system uses UL listed components installed in accordance with the National Electric Code. The location of the cooling tower and field installation of the control system can affect the safety of those responsible for installing, operating or maintaining the tower and controls. However, since SPX Cooling Technologies does not control the tower location, or field installation, we cannot be responsible for addressing safety issues that are affected by these items.

The following safety issues should be addressed by those responsible for installation, maintenance or repair of the tower and controls:

- Access to and from the control panel (including the customer supplied main disconnect/branch circuit protection.)
- Proper grounding of electrical control circuits.
- Sizing and protection of branch circuits feeding the control panel.
- Qualification of persons who will install, maintain and service the electrical equipment.

These are only some of the safety issues that may arise in the design and installation process. Marley strongly recommends that you consult a safety engineer to be sure that all safety considerations have been addressed.

Other safety issues are addressed in literature supplied with your tower. You should closely review the literature prior to installing, maintaining or repairing your tower.

△ Warning

△ Warning

quick start guide



Note: If the control panel is furnished with a water makeup selector switch located on the right-hand side of the enclosure:

HAND: position: Solenoid will energize. **OFF:** position: Solenoid is de-energized **AUTO:** Solenoid will operate depending on water level in relation to water probe height.

description

SYSTEM DIAGRAM



The Liquid Level Control systems are used to accomplish five different functions:

- Water Makeup
- Low Water Alarm
- Low Water Cutoff
- High Water Alarm
- High Water Cutoff

The most common application of a water level control system is water makeup. The system regulates the amount of water in the tower basin and keeps it within normal operating levels. This makeup system is used to control a remotely installed water solenoid valve. When the water level drops below a prescribed, preset level, the solenoid valve is energized by the control system to fill the basin to its proper level. High and low water alarms can be utilized to give warnings associated with abnormal operating water levels. To provide indication of these types of alerts, the control system provides dry contacts to interface with various digital control systems or can be connected to user supplied alarm indicators to signal when corrective action is required.

Low-water cutoffs are commonly used to protect pumps from operating without sufficient water. When used in unattended operating environments, the low-water cutoff is configured to shut the pump off, thus preventing costly repairs. Dry contacts can be wired directly in series with pilot duty controls or to digital control systems to initiate the shutdown of protected equipment during low-water situations.

Operation

The LLC water level control system consists of special purpose liquid sensing relays on one or more individual circuit cards connected to a probe assembly located in the cold-water basin. Each circuit card contains one relay and external signaling is provided by each of these special purpose cards. The individual relay provides a "Form C" normally open and normally closed dry contact. The circuit card activates the relay using "through the water" continuity by way of the senor probes located in the cold-water basin of the cooling tower.

Utilizing water's ability to conduct electricity, a circuit path can be established between one probe tip and the other. Current conducts through the water across probes of dissimilar length. One common or reference probe is present in all systems and is shared by all functions of the system. This probe can be identified by its length. It is the longest probe in the system and extends the deepest into the basin. The current path is routed between all other probe tips and this one "common". When the water level reaches the shorter probe, the circuit is completed and the relay responds, opening or closing relay contacts corresponding to a fixed level. For low-level control, the ground reference probe and a slightly shorter probe provide the circuit. When the water level drops below this tip, the continuity between this probe and the reference probe is interrupted and the relay contacts transfer. The distance from the tip of the low probe to the floor of the basin determines the minimum water level that is allowed before an alarm is produced or pump operation is interrupted.

The number of additional probes is determined by the individual application. As an example, in a "water makeup" system there are three probes. One reference and two standard or short-tipped probes. The tip of the reference probe is normally positioned slightly above the basin floor with the additional probe tips positioned at different heights dictated by their specific function. The Makeup system would have one probe at a height to begin or start filling the basin and another positioned higher to complete or stop filling. A probe for a High Alarm or High Cutoff would be positioned at a level to activate when the basin water exceeds its normal operating level and logically a Low Alarm or Low Cutoff would be positioned to detect a low water level nearer the bottom of the basin. Again, signaling is achieved in two ways. High Level and Makeup cards react when the water provides a completed circuit or continuity between its sensor and the reference probe. The second type of signal is for Low Level detection. The Low Level cards react when the water is not present and opens the circuit or disrupts the current flow between its probe and the reference.

A water level control system can be configured to meet various combination requirements. Since one individual circuit card is responsible for each function, the size and circuitry varies in proportion to the number of operations desired. For example, a water level makeup control will require a control panel with one circuit relay card and three probes. A system configured for water makeup that includes a high alarm and a low alarm, will require three circuit cards and five probes—one circuit card for the water makeup option, one for high operation and one for low.

Water Makeup Function

A system is designed for alarms and/or cutoff indication only would not be equipped with the water makeup function.

The circuitry for water makeup in the LLC control panel provides an independent circuit breaker for direct connection to a 110-120VAC water solenoid valve. This added feature allows customer installation without having to provide an additional power circuit to energize the solenoid. The solenoid is connected to terminals 2A and 4A as represented on the control's specific wiring diagram.

Purpose and Function of the HAND-OFF-AUTO Switch

Located on the right side of the control's enclosure is a HAND-OFF-AUTO switch. This switch is used primarily at cooling tower startup and in maintenance procedures where the tower basin is empty or has been drained. When the tower's basin needs to be manually filled, the switch is placed in the HAND position. This selection bypasses the probe assembly's feedback and directly energizes the solenoid valve connected to the water supply. Once the cooling tower basin



is filled, the switch is placed in the AUTO position to allow the adjusted probe assembly to monitor and sustain the proper operating level. Placing the switch in the OFF position completely interrupts any monitoring or fill action normally provided by the LLC control panel. Normal tower operation depends upon the HAND-OFF-AUTO switch being positioned in the AUTO mode at all times.



Internal Components of the LLC Control Panel

LLC control panels are built to UL and CUL standards and are designed to provide the numerous configurations needed for cooling tower applications. All LLC control panels include a main circuit breaker with an additional circuit breaker and a HAND-OFF-AUTO switch provided when the system includes a water makeup circuit. The additional circuit breaker provides an exclusive control circuit for a 120VAC water solenoid valve. High and low circuit relay cards and the appropriate terminal connections comprise the rest of the components necessary for the specific configuration. The raised terminal strip provides easier access to make the necessary connections of the water probe assembly and customer interface.



Stainless Steel Electrode Probe Assembly

The electrode probe tips are stainless steel suspended from a noncorrosive PVC enclosure box with 30 feet of wire for each probe. A galvanized or stainless steel stilling chamber is installed over the probes to calm the water for accurate readings.

Illustrations Describing Operation Sequence

The next three pages are simplified illustrations representing the sequence of operation for each type of circuit card:

Page 10 - Makeup

Page 11 - High Alarm - High Cutoff

Page 12 – Low Alarm – Low Cutoff

Each relay circuit card has two green indicator lights. The ON light indicates the card is powered and ready to function. The ENERGIZED light indicates when the probe system is functioning and should be used when troubleshooting.



Water Makeup Control - Sequence of Operation - B Card

Selector Switch in AUTO Position





High Level Alarm - Sequence of Operation - B Card

High Level Cutoff - Sequence of Operation - B Card





Low Level Alarm - Sequence of Operation - A Card

Low Level Cutoff - Sequence of Operation - A Card



troubleshooting

The control panel has been tested before shipment and most issues lie outside of the control panel e.g. proper probe connections to the control panel and probe tip level heights in the basin of the cooling tower.

In an effort to troubleshoot the system please check the following:

- Check probe heights in the stilling chamber. The levels may be factory set but if in question contact your Marley sales representative for level height information. Probe wire height is secured using an adjustable cord grip located inside the conduit box located on top of the stilling chamber.
- Check if probe wires are connected correctly at the user terminal strip located inside the control panel. Each probe wire is printed with an identifying number on the black insulation of the wire every few inches. For example the reference probe is always #13 and needs to be connected to terminal point #13 in the control panel.
- If probe wires are extended in the field, check to make sure the extension wire is numbered correctly and connections are secure.
- After time, contaminates may build up on the probe tips. Clean tips with an abrasive cleaning pad and make sure the tips are screwed in making a good connection.
- If provided, the make-up selector switch on side of the control panel must be in AUTO position

Checking the power circuit for the makeup solenoid

 Rotate the selector switch to the HAND position. The solenoid should energize allowing makeup water to flow into the cooling loop. Inside the control panel is a single-pole circuit breaker which must be in the ON position to power the circuit.

Checking control panel functionality

- To determine the control panel works as designed check the green LED lights on each circuit card and watch the relays change state in the clear cased relays located on each level card. Refer to the charts on pages 10 through 12 for LED light sequence of operation.
- Another method is to remove probe wiring from the terminal strip and simulate water level by using jumper wires at the probe terminal points. For example a jumper wire from #13 to #16 would indicate high-water alarm.

parts list



Electrode Probe Assembly

Additional part numbers can be found on the next page

parts list



Relay Circuit Card

Part Number **D55194** – Used for Makeup, High Alarm and High Cutoff (LLC24B2F50N) Part Number **D55195** – Used for Low Alarm and Low Cutoff (LLC24A2F50N)

Description
H-O-A Switch
Makeup Relay Card
High Alarm Relay Card
High Cutoff Relay Card
Low Alarm Relay Card
Low Cutoff Relay Card
Standard Probe Sensor (Complete with tip and 30 ft wire)
Standard Probe Sensor (Complete with tip and 30 ft wire)
Reference / GND Probe Sensor (Complete with tip and 20 ft wire)
Reference / GND Probe Sensor (Complete with tip and 50 ft wire)
Standard Probe Sensor 3.5" Stainless Steel Tip
Reference / GND Probe Sensor 6" Stainless Steel Tip
Terminal Blocks Kit (2 Gray, 2 Blue and 1 End)
EMI Filter
Reference Marked #13
Makeup On Marked #14
Makeup Off Marked #15
High Alarm Marked #16
High Cutoff Marked #17
Low Alarm Marked #18
Low Cutoff Marked #19
Generic Level No Wire #

wiring diagrams – contents

Drawing Number	Description	Page
08-24248	Makeup High Alarm High Cutoff Low Alarm Low Cutoff	17
08-24233	Makeup High Alarm Low Alarm	18
08-24218	Makeup	19
08-24219	High Alarm	20
08-24220	Low Alarm	21
08-24221	High Cutoff	22
08-24222	Low Cutoff	23
08-24230	High Cutoff Low Alarm	24
08-24231	Low Cutoff Low Alarm	25
08-24232	High Cutoff Low Cutoff	26
08-24228	High Cutoff High Alarm	27
08-24229	Low Cutoff High Alarm	28
08-24225	Makeup High Cutoff	29
08-24224	Makeup Low Alarm	30
08-24223	Makeup High Alarm	31
08-24234	Makeup High Alarm High Cutoff	32
08-24235	Makeup High Alarm Low Cutoff	33
08-24236	Makeup High Cutoff Low Alarm	34
08-24237	Makeup Low Alarm Low Cutoff	35
08-24238	Makeup High Cutoff Low Cutoff	36
08-24239	High Alarm High Cutoff Low Alarm	37
08-24240	High Alarm Low Alarm Low Cutoff	38
08-24241	High Alarm High Cutoff Low Cutoff	39
08-24242	High Cutoff Low Alarm Low Cutoff	40
08-24243	Makeup High Alarm High Cutoff Low Alarm	41
08-24244	Makeup High Alarm Low Alarm Low Cutoff	42
08-24245	Makeup High Alarm High Cutoff Low Cutoff	43
08-24246	Makeup High Cutoff Low Alarm Low Cutoff	44
08-24247	High Alarm High Cutoff Low Alarm Low Cutoff	45



























































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