Honeywell

L7224 Series Oil Electronic Aquastat® Controller (2012 Compliant)

TECHNICIAN'S QUICK REFERENCE GUIDE

The following service procedure provides a quick overview for L7224 Series Controllers. For more information, refer to forms 69-1720 L7224U Installation Instructions, 66-1202 Wireless Outdoor Reset Installation Instructions, 69-2335 Outdoor Reset Installation Instructions, and 69-2343 Domestic Hot Water Module Installation Instructions. This control is compatible with both wireless and wired AquaReset Outdoor Reset Controls.

2012 DOE Compliance and Operation

Operation of this control may delay the burner operation while the residual heat is circulated out of the boiler.

NOTE: This operation may be different than earlier electronic Aquastat® revisions which did not implement thermal purge.

On the L7224U settings can be adjusted to best fit the requirements of the application.

Additional settings options are available to define an outdoor reset curve for those systems requiring Outdoor Temperature Reset and other adjustable parameters.

IMPORTANT

Outdoor Temperature Reset should be limited to those systems consisting of a cold start boiler and may include an indirect tank for domestic hot water.

Outdoor Temperature Reset should not be used with tankless coil systems as the low limit setting required in such systems may limit effectiveness

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and thereby projected increased efficiency of Outdoor Reset.

Adjusting Settings

To discourage unauthorized changing of Aquastat® settings, a procedure to enter the adjustment mode is required. To enter the adjustment mode, press the **UP**, **DOWN**, and **I** buttons simultaneously for three seconds. Press the **I** button until the feature requiring adjustment is displayed:

Display	Definition
HL_	High Limit.
Hdf	High Limit Differential.
LL_	Low Limit.
Ldf	Low Limit Differential.
duu	ZR input configured as external Domestic Hot Water (DHW) request (ON/OFF)
ASC	Anti Short-Cycle Timeout (seconds); “OFF” is disabled.
otL	Outdoor Temperature Low (minimum) parameter for the outdoor reset curve (F or C)*
otH	Outdoor Temperature High (maximum) parameter for outdoor reset curve (F or C)*
btL	Boiler Temperature Low (minimum) parameter for outdoor reset curve*
bP	Boost Period (minutes). “OFF” is displayed if Boost is inactive*
bS	Boost step (F or C) shown only if Boost is active (bP=ON)*
UUS	Warm Weather Shutdown Temperature (F or C)*
tPL**	Thermal Purging Limit Temperature (°F or °C), “OFF” if disabled
tPt**	Termal Purging Time Delay (minutes), shown only if tPL is enabled
PC	Pump Cycling (ON / OFF)
F-C	Temperature units (°F or °C)

* Settings available for adjustment on the 3-digit display only if the AquaReset Outdoor Reset Module is installed.

**Settings available for adjustment only when the W8735S1000 AquaReset Outdoor Reset Kit is NOT installed.

Then press the **UP** and/or **DOWN** buttons to move the setting to the desired value. After 60 seconds without any button inputs, the control will automatically return to the READ mode.

To use the L7224U in a cold start boiler application, disable the Low Limit function by pressing the **UP** arrow button, **DOWN** arrow button and **I** buttons simultaneously for three seconds. Then push the **I** button until **LL** is displayed. Then press the down arrow button until **OFF** is displayed.

Display

In the RUN mode, the Aquastat® will flash “bt” (boiler temp) followed by the temperature (i.e., 220), followed by °F or °C.

To read Aquastat® settings, press the **I** key to read the parameter of interest. For example, press **I** (HL) High Limit is displayed, followed by a three-digit number, i.e., 220, followed by °F or °C.

Pressing the **I** button twice more will display the **LL** (Low Limit) followed by a three-digit number and the corresponding degree designator. See the table below for an explanation of display readout.

After approximately 60 seconds without any key presses, the display will enter a dim display mode. To return to the bright display mode, simply press and release any key.

Table 1. Display readout definitions.

Text	Description	Display
Err	Error Code (if one is present)	
bT	Boiler Temperature	
HL	High Limit [1]	
HdF	High limit differential	
LL	Low Limit set-point (L7224 only)	
Ldf	Low Limit differential (L7224 only)	
tt	Local Thermostat Status	
ttE	EnviraCOM Thermostat Status	
brn	B1 (Burner) output (ON or OFF)	
Cir	C1 (Circulator) output (ON or OFF)	
ZC	ZC (Zone Control) output (ON or OFF)	
Zr	ZR (Zone Request) Call for HEAT (ON or OFF)	
duu	ZR Configured as Domestic Hot Water Request (L7224, L7248L only)	
ASC	Anti Short-Cycle Timeout	
bSP	Boiler Set-Point [2]	
dhc	DHW Module Connected [3] (YES or NO)	
ot	Outdoor Temperature [2]	
otL	Outdoor Temperature Low [2]	
otH	Outdoor Temperature High [2]	

Table 1. Display readout definitions. (Continued)

Text	Description	Display
btL	Boiler Temperature Low [2]	btL
bP	Boost Period [2]	bP
bS	Boost Step [2]	bS
UUS	Warm Weather Shutdown Temperature [2]	UUS

[1] Display shows local setting; not the setting as modified by an external enviracom control.

[2] Settings are viewable only if the outdoor reset module and outdoor temperature sensor are installed and functioning properly.

[3] Settings are viewable only if the domestic hot water module and sensor are installed and functioning properly.

Outdoor Reset

The Outdoor Temperature Compensation (OTC) feature adjusts the target boiler temperature to a point below its local high limit setting and above the boiler's condensation temperature by using the EnviraCOM communication bus to directly adjust the Aquastat set-point. Should a call for Domestic Hot Water be detected, the boiler temperature is commanded to return to the High Limit setting, ensuring a hot water supply is available. When the Domestic Hot Water demand is met, the Outdoor Reset feature is once again enabled.

NOTE: In many cases the Outdoor Reset parameters will not need to be adjusted as their default values are designed to accommodate mid-Atlantic and lower New England areas.

CAUTION

Possible Equipment Damage

When enabling the Outdoor Reset function, be sure to refer to the boiler OEM's instructions for the lowest return water setting to avoid condensation in the heat exchanger, which can result in equipment damage.

Table 2. Outdoor Reset Curve Settings and Defaults.

Parameter	Minimum Value	Maximum Value	Default
High limit	130 °F (54 °C)	240 °F (116 °C)	180 °F (82 °C)
Minimum outdoor temperature	-40 °F (-40 °C)	40 °F (4.4 °C)	0 °F (-18 °C)
Minimum boiler temperature	80 °F (27 °C)	180 °F (82 °C)	130 °F (54 °C)
Maximum outdoor temperature	30 °F (-1 °C)	70 °F (21 °C)	40 °F (4.4 °C)

Boost

If heat demand is not met within a certain time period while the boiler is in setback mode (following the Outdoor Reset curve), a Boost Period is invoked where the boiler set point is increased by a value called the Boost Step. Each time the Boost Period elapses and heat demand is not satisfied, the boiler set-point is again increased by the Boost Step, up to the maximum setting provided by the High Limit setting (see Table 3 below).

Table 3. Boost Settings and Defaults.

Parameter Name	Minimum Value	Maximum Value	Default
Boost period	5 minutes (or Off)	30 minutes	10 minutes
Boost step	5 °F (or Off)	20 °F	10 °F

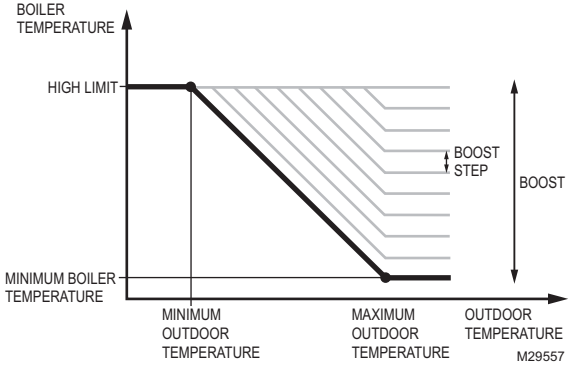

Fig. 1. Outdoor temperature setback curve with boost.

Warm Weather Shutdown: Aquastat

The Warm Weather Shutdown feature causes the boiler to shut down when the outdoor temperature exceeds a specified value. The default Warm Weather Shutdown is "OFF."

CAUTION

Zone Panel Settings

In applications with zoning panels having a priority zone for domestic hot water: Disable the warm weather shutdown feature on the Aquastat.

As Outdoor Temp reaches the Warm Weather Shutdown setpoint if enabled), the boiler is kept from cycling and will only service DHW demands.

Table 4. LED Error Codes.

Aquastat Error Code	Cause/Action	EnviraCOM Alarm
Err1	Aquastat sensor fault; check water sensor.	18
Err2	ECOM fault; check EnviraCOM™ wiring.	18
Err3	Excessive electrical noise or frequency out of range. Hardware fault; replace controller.	18, 58
Err4	B1 fault; check B1 wiring/voltage.	64
Err5	Low Line; check L1-L2, 110 Vac.	59
Err6[a]	Warning: Fuse; check ECOM wires, replace fuse.	92
Err7	Warning: EEPROM, HL, LL, Hdf, Ldf; reset to default values.	N/A
Err 8[b]	Repeated B1 fault (voltage present at B1 when output is turned off); check B1 wiring/voltage.	25
Err9[a]	Warning: Outdoor Reset System failure; communication to Outdoor Reset Module lost, Outdoor Reset Module failure, multiple outdoor temperature sensors detected on the bus, or outdoor temperature sensor failure. Check EnviraCOM wiring (1, 2, 3), check sensor wiring.	50, 53, 149
Err 10[a]	Warning: Boost Failure; Boost Mode active at least once per cycle for the last 60 consecutive cycles. Check Outdoor Reset curve settings.	150
Err 11[a]	DHW Module/Sensor failure; communication to DHW Module lost, DHW Module failure, or temperature sensor failure. Check EnviraCOM wiring (1, 2, 3), check sensor wiring.	146, 147, 148

[a] Warnings are generated to enunciate the system is not operating optimally, but the Aquastat® is still operating and maintaining boiler temperature. In the instance where an Outdoor Reset

Module is used, the warnings may indicate a reset curve setting error one or more features is not running optimally, and the Aquastat® is reverting to default settings or has stopped running the Outdoor Reset algorithms. The warnings are cleared when each issue is resolved.

[b] To clear Err 8 condition, depress and hold all three user keys simultaneously for 60 seconds. Err 8 condition clears and display returns to normal. Err 8 condition is designed to catch welded relays on the Aquastat® and will normally only occur near end of life for the control. If Err 8 condition has occurred early in the controls life, be sure to check for voltage feedback to B1 when B1 should be off and check current draw on b terminal to be sure burner is not drawing excessive current. Err 8 condition will keep repeating if B1 fault is not cleared.

Table 5. L7224 Controller Operating Sequence.

Action	System Response
Thermostat calls for heat.	Circulator starts when water temperature is above Low Limit setting (if applicable) or above the Thermal Purge Temperature Limit (tPL) if Thermal Purge is enabled. Boiler temperature is checked. Burner starts when water temperature is below High Limit setting minus the differential or at or below the Thermal Purge Temperature Limit (tPL) for cold start boilers if the Thermal Purge Temperature Limit is enabled. If tPL is enabled, the burner may also start if the boiler temperature is cooling at 10 °F or greater per minute or the Thermal Purge Time Delay (tPt) has expired. If Anti Short-Cycle Time is enabled, the burner does not start until the set Anti Short-Cycle Time between cycles expires after the previous call for heat was satisfied.
Boiler temperature exceeds the High Limit.	Burner is turned off. Burner restarts when the water temperature drops below the High Limit setting minus the Differential. If Thermal Purge is enabled, the burner is turned on when either the Thermal Purge Temperature Limit is reached, the Thermal Purge Time Delay has expired or the boiler temperature cooling rate exceeds 10 °F/ minute.
Thermostat is satisfied.	Circulator and burner turn off.
Boiler temperature drops below the Low Limit setting minus the differential (if applicable).	Burner is turned on, Circulator is turned off. Burner stops when the water temperature exceeds the Low Limit setting. Power to Zc is removed.
Error conditions 1-5.	If an error condition is detected, all outputs except ZC are shut down. Burner is off. The controller continues to function and restarts when error is corrected. During the error check sequence, the system checks for drift in the sensor and corrosion in the connections.

Action	System Response
Error condition 6.	EnviraCOM communication is not available.
Error condition 7.	The controller has reset the High Limit, Low Limit and Differential Setting to a default setting and will continue to run at those settings. Performance of the system will be degraded.
Error condition 8.	If the error condition is detected, all outputs except ZC are shut down. Burner is off.The controller continues to function and restarts when all three user keys have been pressed longer than 60 seconds.
Error condition 9*.	System continues to run with no outdoor reset functionality
Error condition 10*.	System continues to run with outdoor reset parameters enabled as programmed. Error cleared automatically.
Error condition 11*.	System continues to run with boiler temp set to High Limit.

* Error condition only available when the Outdoor Reset Module is installed.

Troubleshooting

When attempting to diagnose system performance, reference the LED display to help identify specific areas not working properly. The LED display will scroll “err,” followed by a digit (1-11). See Table 1 for a description of the error and suggested actions. See below for a troubleshooting guide.

Table 6. Troubleshooting Guide.

System Condition	Diagnostic Condition	Check	Action
Boiler is cold, house is cold.	Display is OFF.	120 Vac system power.	Turn system power on.
	Display is ON. TT-LED is OFF.	24 Vac T-T.	No 24 V; replace controller.
	Display is ON. TT-LED is OFF.	24 V present; disconnect thermostat, short T-T.	Boiler starts, check wiring and thermostat.
	Display is ON. TT-LED is ON. B1 LED is ON.	120 Vac at B1-B2.	• If no, replace controller. • If yes, check burner and wiring.
	Display is ON. TT-LED is ON.	Refer to **Err** on display.	—

System Condition	Diagnostic Condition	Check	Action
Boiler is hot, house is cold.	Display is ON. TT-LED is ON. C1 LED is ON.	120 Vac at C1-C2.	• 120 Vac at C1-C2, check wiring to pump. • Wiring ok, is pump running? If not, replace the pump. • If pump is running, check for trapped air or closed zone valves.
	Display is ON. TT-LED is ON. C1 LED is OFF. ZC LED is ON[a].	Boiler below the Low Limit temperature, wait for boiler to go above Low Limit temperature.	—
	Display is ON. TT-LED is ON. ZC LED is OFF[b].	Boiler above **LL**? If yes, check for 120 Vac between ZC and L2.	• If no 120 Vac, replace controller. • If yes, check zone relays, circulators and wiring.

System Condition	Diagnostic Condition	Check	Action
Boiler is hot, no hot potable water	Display is ON.	Boiler Demand signal from the water heater (either 120 Vac at ZR-L2, or 0 Vac on T-T; depends on installation and “duu” setting)	• 24 Vac on T-T (or 0 Vac on ZR-L2), check wiring to water heater • Wiring OK, check the water heater
		“Zr” reads “On” (or “tt” reads “On”)	• “Or” reads “OFF” but 120Vac on ZR-L2, replace the control
		“duu” setting	• Set duu to ON if 120 Vac water heater demand is connected to ZR • Set duu to OFF if open/closed water heater demand is connected to T-T
		Check DHW Module and DHW Sensor	• DHW Module not properly connected and/or DHW Sensor improperly positioned

[a] ZC LED ON indicates ZC terminal power is OFF.

[b] ZC LED OFF indicates ZC terminal power is ON.

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