ITT

McDonnell & Miller

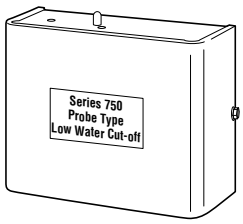
Installation & Maintenance Instructions
MM-213(F)

GUARDDOG®

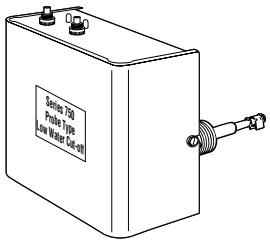
U.S. Pat. No. 6,571,625

Series 750

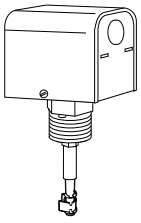
Probe Type Low Water Cut-Offs with Remote Sensors



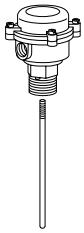
Series 750 Control Unit



Series 750P-MT Control Unit



Remote Sensor Model RS-1-LP

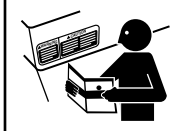


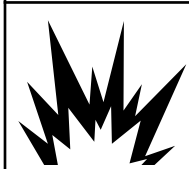
Remote Sensor Model RS-1-BR-1

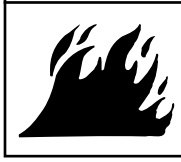
Applications:

- **Primary conductance type control for commercial or industrial hot water boilers with remote or integral sensing provisions.**
- **Secondary control for commercial or industrial steam boilers.**

⚠ WARNING





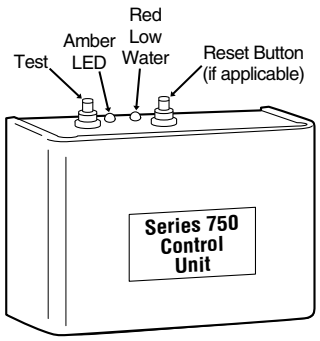


- **Before using product, read and understand instructions.**
- **Save these instructions for future reference.**
- **All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of plumbing and electrical equipment and/or systems in accordance with all applicable codes and ordinances.**
- **Boiler manufacturer schematics should always be followed. In the event that the boiler manufacturer's schematic does not exist, or is not available from the boiler manufacturer, refer to the schematics provided in this document.**
- **To prevent serious burns, allow the control and surrounding equipment to cool to 80˚F (27˚C) and allow pressure to release to 0 psi (0 bar) before servicing.**
- **To prevent an electrical fire or equipment damage, electrical wiring insulation must have a rating of 167˚F (75˚C) if the liquid's temperature exceeds 180˚F (82˚C).**
- **This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all the limit and operating controls, before leaving the site.**
- **We recommend that secondary (redundant) Low Water Cut-Off controls be installed on all steam boilers with heat input greater than 400,000 BTU/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low water condition. Moreover, at each annual outage, the low water cut-offs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.**
- **When using mixed voltages, do not jumper from terminal 1 to terminal 3.**
- **To prevent electrocution, when the electrical power is connected to the control, do not touch the terminals, or electrical wires.**
- **To prevent electrical shock, turn off the electrical power before making electrical connections.**

Failure to follow this warning could cause property damage, personal injury or death.

SPECIFICATIONS

The Series 750 controls provide continuous protection against low water conditions for commercial and industrial applications. Newer models feature user-friendly diagnostic LEDs and increased probe sensitivity to prevent nuisance shut-downs.



Previous Models

Control Unit

Temperature Ratings:
Storage: -40˚F to 135˚F (-40˚C to 57˚C)
Ambient: 32˚F to 135˚F (0˚C to 57˚C)

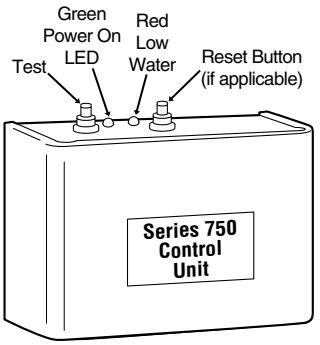
Humidity: 85% (non-condensing)

Electrical Enclosure Rating: NEMA 1 General Purpose

RS-1-BR1 Remote Sensor
Maximum Steam Pressure: 250 psi (17.6 kg/cm^2)
Maximum Water Pressure: 250 psi (17.6 kg/cm^2)
Maximum Water Temperature: 406˚F (208˚C)
Electrical Enclosure Rating: NEMA 1 General Purpose
Connection Size: 1" NPT

RS-1-LP
Maximum Steam Pressure: 15 psi (1.0 kg/cm^2)
Maximum Water Pressure: 160 psi (11.2 kg/cm^2)
Maximum Water Temperature: 250˚F (121˚C)
Electrical Enclosure Rating: NEMA 1 General Purpose
Connection Size: 3/4" NPT

PA-800 Probe (included with 750P-MT-120)
PA-800-U Probe (included with 750P-MT-U-120)
Maximum Steam Pressure: 15 psi (1.0 kg/cm^2)
Maximum Water Pressure: 160 psi (11.2 kg/cm^2)
Maximum Water Temperature: 250˚F (121˚C)
Connection Size: 3/4" NPT



Newer Models

Electrical Specifications

Model	Voltage	Motor Switch Rating (Amperes)		Pilot Duty
		Full Load	Locked Rotor	
120 VAC	120 VAC	7.2	43.2	125 VA at 120 or 240 VAC 50 or 60 Hz
	240 VAC	3.6	21.6	

Control Voltage: 120 VAC
Hz: 50/60
Control Power Consumption: 3 VA (max.)
Probe Sensitivity: 20,000 ohm

Automatic Reset Models
Whenever water is below the level of the probe, the control will go into a low water condition. When the water level has been restored, the control will automatically return to a run condition.

Manual Reset Models
If a low water condition occurs (water off probe), the manual reset button must be pressed once the water level is restored to a level above the probe.

CSD-1 Code Compliance
On Manual Reset units, if the control is in a low water condition (water off probe) when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe.

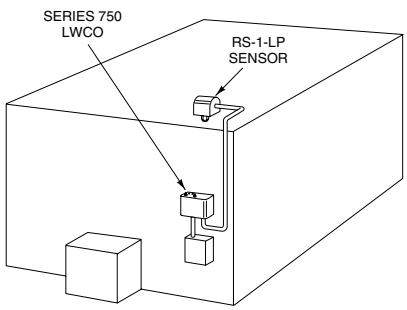
STEP 1 - Where to Install the Remote Sensors

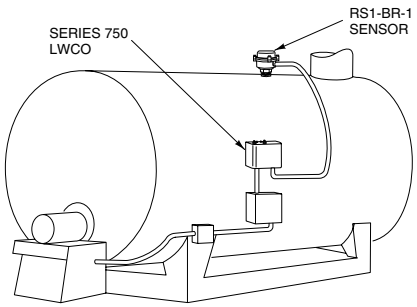
Determine where to install the remote sensor based on the following requirements:

a. The tip of the probe or extension **must be installed above the minimum safe water level,** as determined by the boiler manufacturer.

b. Probes must be installed vertically if they are more than 5" (127mm) long.

c. There must be a minimum 1/4" (6.4mm) clearance between the probe and any grounding surface inside the boiler.

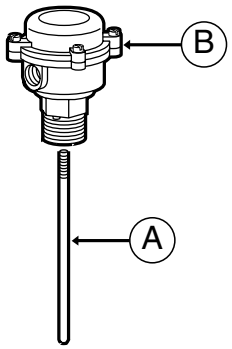




STEP 2 - Installing the Remote Sensor

For the Model RS-1-BR-1 sensors, only:

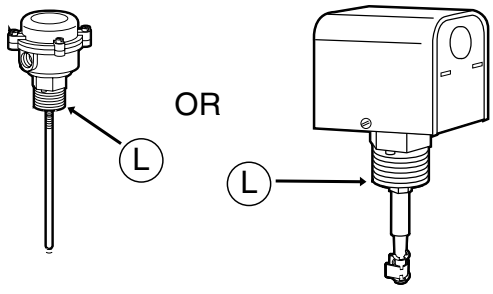
a. Cut the probe to desired length. Screw, clockwise, the threaded stainless steel probe extension (A) into the remote sensor (B). Carefully tighten the locking nut to approximately 1 ft•lb (1.7 N•m). Do not cut the clear plastic protective tube.



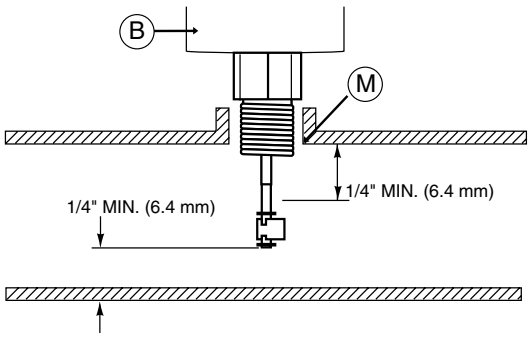
For All Remote Sensors

b. Apply a small amount of pipe dope to the first threads (L) of the remote sensor.

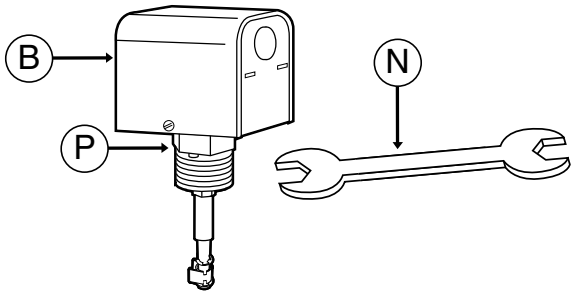
IMPORTANT: Do not use Teflon® tape or thread sealant.



c. Insert the remote sensor (B) into the boiler tapping (M) as determined in Step 1.

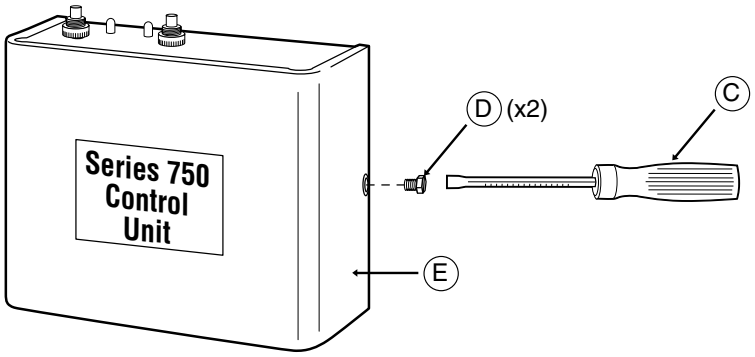


d. Using a wrench (N), tighten the brass hex adapter (P) on the remote sensor (B) to approximately 63 ft•lb (85 N•m). DO NOT TIGHTEN BY TURNING THE SENSOR HOUSING.



STEP 3 - Installing the Control Box

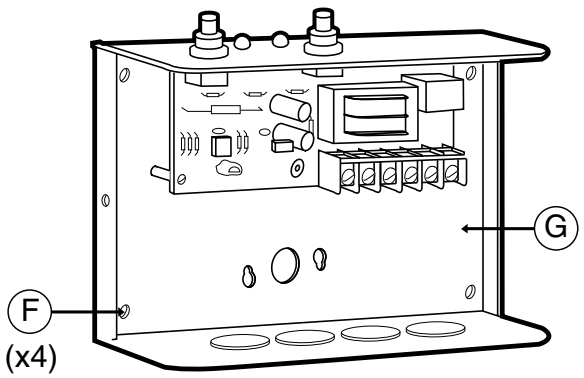
a. Using the flatblade screwdriver or nut driver (C), loosen the two (2) screws (D) and remove cover (E).



IMPORTANT: To protect control from damage caused by liquid or debris, mount as shown with buttons on top.

b. Using the four (4) 3/16" (4.8mm) mounting holes (F), attach the control (G) to the boiler jacket, entry plate, or other suitable location.

NOTE: Mounting hardware is not included.



STEP 4 - Locating and Installing the 750P-MT (Unimount)

a. Based on the following criteria locate a suitable position for the probe (A):

For all Applications:

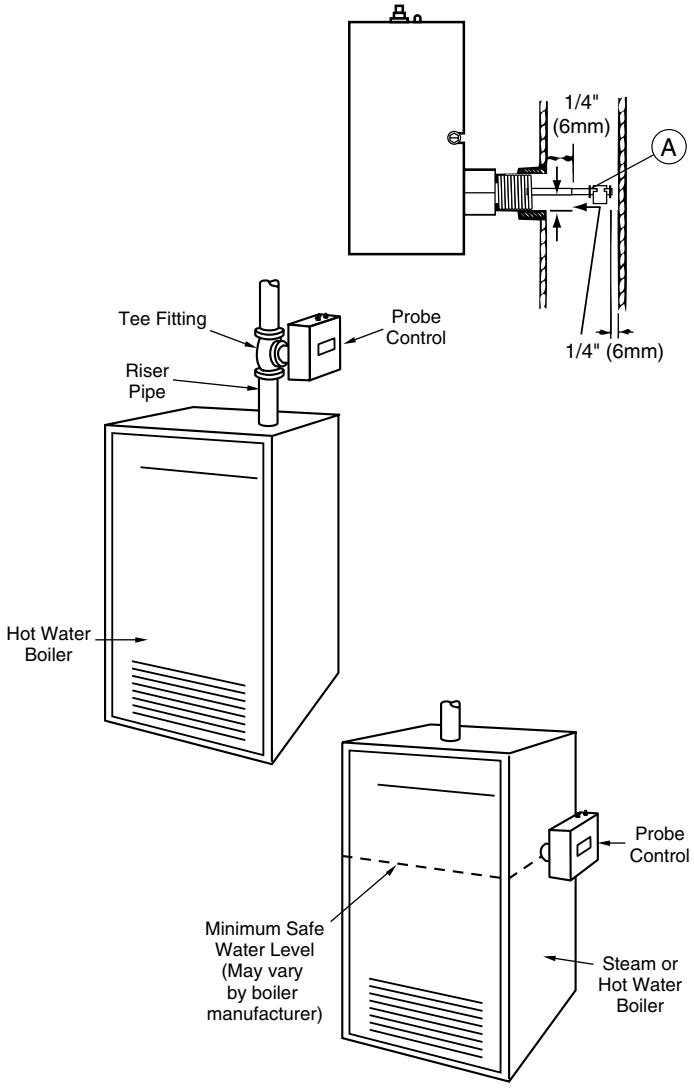
1. Make sure probe is installed above minimum safe water line as determined by the boiler manufacturer.
2. Make sure that ends and sides of the probe are at least 1/4” (6.4mm) from all internal metal surfaces.
3. Make sure the probe is positioned to shut off the boiler before the water level falls below the lowest visible part of the gauge glass.

For Steam Boilers:

1. Refer to boiler manufacturers instructions to determine suitable tapping for the probe.

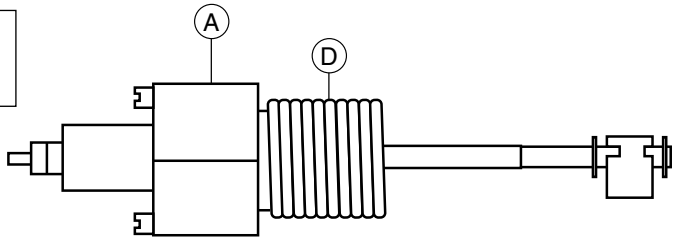
For Hot Water Boilers:

1. Refer to boiler manufacturers instructions to determine suitable tapping for the probe.
2. Locate probe in supply piping using a tee fitting.

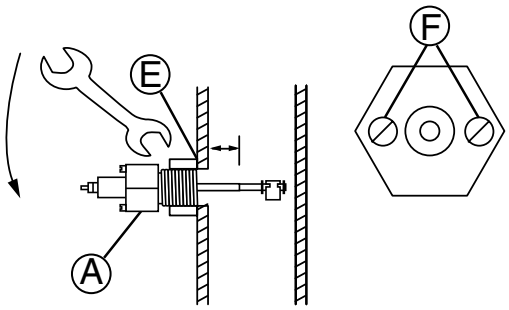


b. Apply a small amount of pipe dope to the first external threads (D) of the probe (A).

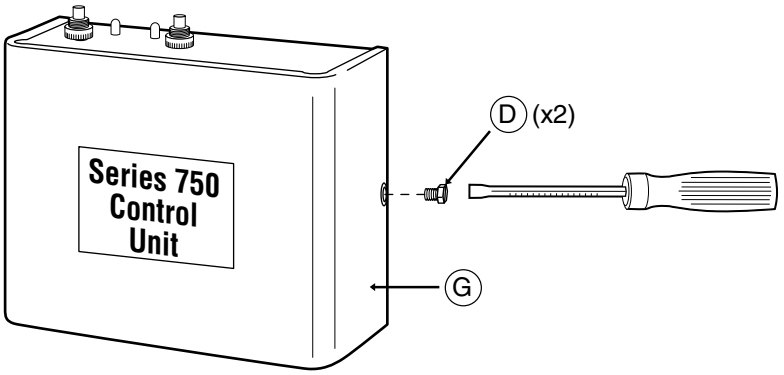
IMPORTANT: Do not use Teflon® tape or thread sealant.



c. Using a wrench, tighten the probe (A) into the tapped connection (E) that was determined in Step 1 of these instructions. Tighten to 47 ft•lb (64 N•m).
NOTE: Be sure to align the probe so that the mounting screws (F) are in a horizontal position.



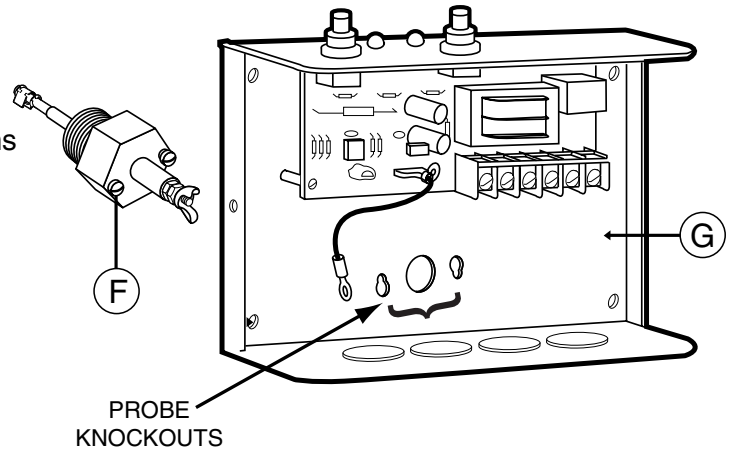
d. Using the flatblade screwdriver, loosen the two (2) screws that secure the cover (G) to the control about 1-1/2 turns and remove cover.



Direct Mounting - Unimount Models

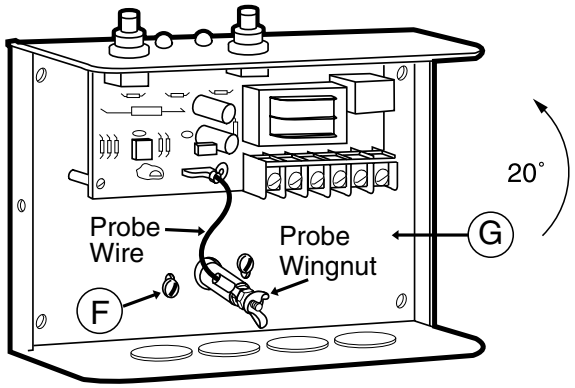
a. Push out the probe knockouts and remove completely from the control housing.

b. Using a flatblade screwdriver, loosen the probe mounting screws (F) 1/8" (3mm) about 1-1/2 turns and slip the control housing (G) over these two screws at a 20˚ angle.



c. Rotate the control housing (G) 20˚ counterclockwise so that the slots in the control base are firmly under the screw heads. Tighten the mounting screws (F) to approximately 2 ft•lb (2.6 N•m).

d. Remove wingnut from probe and position ring terminal of probe wire on threaded probe rod. Secure with wingnut.



STEP 5 - Electrical Wiring

IMPORTANT

Boiler manufacturer schematics should always be followed. In the event that the boiler manufacturer's schematic does not exist, or is not available from the boiler manufacturer, refer to the schematics provided in this document.

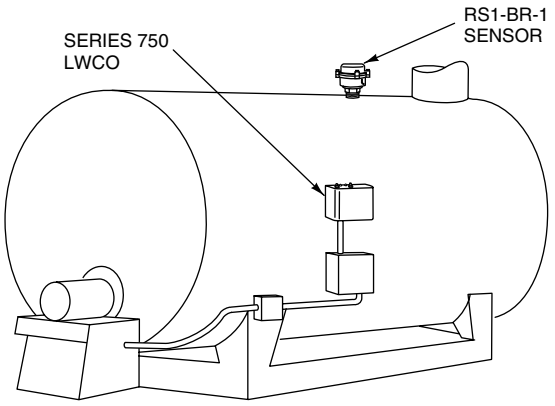
WARNING

To prevent an electrical fire or equipment damage, electrical wiring must have a rating of 167˚F (75˚C) if the liquid's temperature exceeds 180˚F (82˚C).
Failure to follow this warning could cause property damage, personal injury or death.

- Mount **Control Box** in a suitable location near the boiler's main electrical panel.

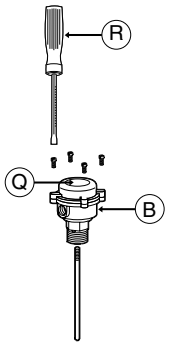
NOTE

Boiler sight glass must be visible from location of Control Box and must be within 25 feet of Control Body.

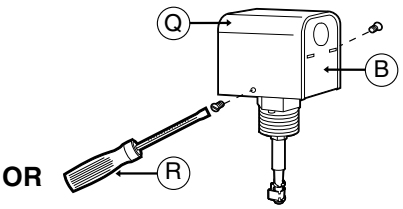


a. Remove the sensor housing cover (Q).

1. ***For Model RS-1-BR-1,*** using a flathead screwdriver (R), remove the four (4) screws and separate the housing cover (Q) from the sensor (B).
2. ***For Model RS-1-LP,*** using a flathead screwdriver or nut driver (R), loosen the two (2) screws and separate the housing cover (Q) from the sensor (B).



Model RS-1-BR-1



Model RS-1-LP

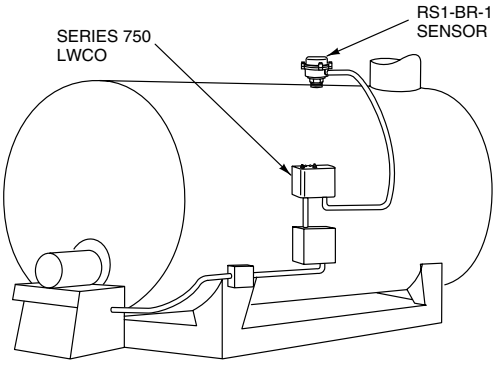
- Install electrical conduit between **Probe Housing** and **Control Box.**

NOTE

Wire must be 18 AWG stranded with glass braided silicone jacket (UL 3071) suitable for high temperature (200˚C) service.

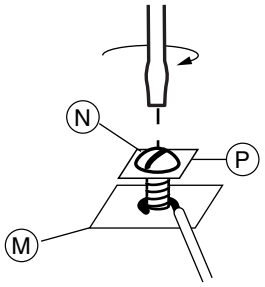
NOTE

Refer to and follow local codes and standards when selecting conduit and electrical fittings. Wires from Probe Housing and Control Box must be in their own conduit. If they are run in conduit with other wires, there may be interference that can affect the performance of the control.



b. For all wire connections to the terminal block (M).

1. Strip about 1/3" (8.5 mm) of insulation from the wire.
2. Loosen the terminal screw (N), DO NOT REMOVE, and move the wire clamping plate (P) back until the plate touches the back side of the screw head.
3. Insert the stripped end of the wire under the wire clamping plate (P) and securely tighten the terminal screw (N).



Wiring Diagram Legends

1. Bold lines indicate action to be taken in Step shown.
2. Dotted black lines indicate internal wiring.

Remote Sensor Wiring:

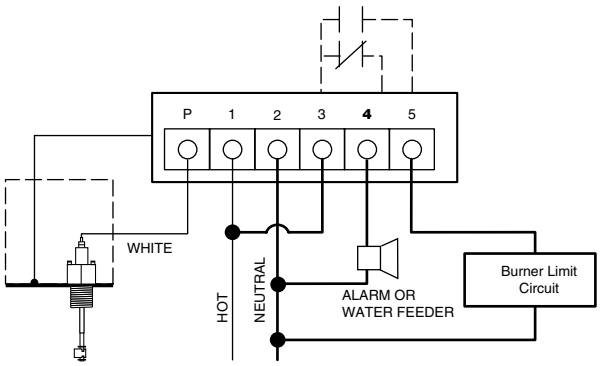
- Connect wire from probe end to Terminal 'P'
- Connect wire from remote sensor green ground screw to chassis green ground screw

Unimount Sensor Wiring:

- Connect ring terminal of wire to probe end
- Slide female spade connection of wire onto male spade connection on terminal board

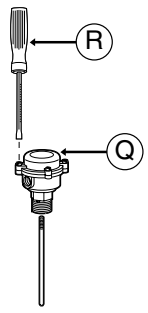
Control Wiring:

- Connect 120V hot wire to terminal 1
- Connect 120V neutral wire to terminal 2
- Connect jumper wire from Terminal 1 to Terminal 3
- Connect wire from beginning of Burner circuit (thermostat, gas valve, limits, etc.) to terminal 5
- Connect wire from end of Burner circuit to terminal 2

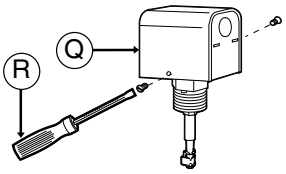


c. Secure the sensor housing cover (Q).

1. ***For model RS-1-BR-1,*** using the flatblade screwdriver (R), tighten the four (4) screws into the housing (Q) to approximately 3 ft•lb (4 N•m).
2. ***For model RS-1-LP,*** using the flatblade screwdriver or nut driver (R), tighten the two (2) screws into the housing (Q) to approximately 2 ft•lb (2.6 N•m).

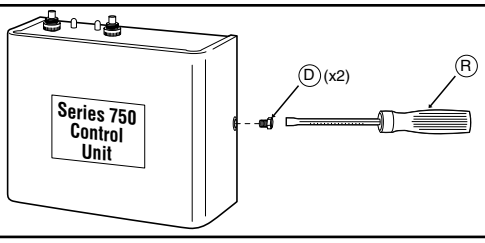


OR



Model RS-1-BR-1 **Model RS-1-LP**

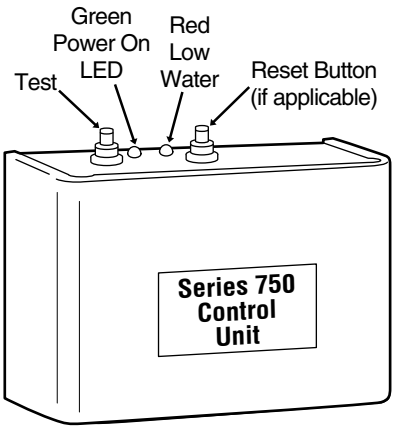
d. Secure the control housing cover by using the flatblade screwdriver or nut driver (R) to tighten the two (2) screws (D) to approximately 2 ft•lb (2.6 N•m).



STEP 6 -Testing and Diagnostic Procedures

Series 750 LWCO with Green Power On LED and Red Low Water LED

Start-Up



Newer Models

a. Before filling the system, turn on the electric power to the boiler.
- **1.** Upon initial power up, the Green and Red lights will flash simultaneously 4 times.
- **2.** The Green and Red lights will turn "ON".
- **3.** The burner will never turn "ON" during power up, if water is off the probe.

b. Now fill the boiler with water.
(auto reset units only)
- **1.** When water touches the probe, the Green light will remain "ON".
- **2.** The Red light will turn "OFF" and the burner will turn “ON” as long as there is water on the probe.

(manual reset units only)
(When water returns to the probe, nothing will happen until the manual reset button is depressed.)
- **1.** After depressing manual reset button, the Green and Red lights will flash simultaneously 4 times.
- **2.** Then the Green light will turn "ON" and the Red light will turn “OFF”.
- **4.** The burner will turn "ON" as long as there is water on the probe.

Manually Testing Control

c. Slowly drain the boiler of water.
(both auto and manual reset units)
- **1.** When water drops off the probe, the Green light will remain "ON".
- **2.** The Red light will turn “ON” and the burner will turn “OFF”, if water is off the probe.

Testing Control Using "Test Button"

d. Depressing test button with "water on probe" (auto reset units only):
(Must depress and hold the test button to activate test cycle.)
- **1.** When test cycle is activated the Red and Green lights will flash simultaneously 3 times.
- **2.** The Red light will turn “ON”.
- **3.** Burner will turn "OFF".
- **4.** The Green light will continue flashing as long as test button is depressed.

(Release test button, if water is still on probe)
- **5.** The Green light will stop flashing and turn "ON".
- **6.** The Red light will turn "OFF".
- **7.** Burner will turn "ON" as long as there is water on the probe.

e. Depressing test button with "water on probe" (manual reset units only):
(Must depress and hold test button to activate test cycle.)
- **1.** When test cycle is activated the Red and Green lights will flash simultaneously 3 times.
- **2.** The Red light will turn "ON".
- **3.** Burner will turn "OFF".
- **4.** The Green light will continue flashing as long as test button is depressed.

(Release test button. You must depress the manual reset button to unlock the low water cut-off.)
- **5.** After depressing manual reset button, the Green and Red lights will flash simultaneously 4 times.
- **6.** Then the Green light will turn "ON" and the Red light will turn "OFF".
- **7.** The burner will turn "ON" as long as there is water on the probe.

f. Depressing test button with "water off probe" (both auto and manual reset units):
Since control is in "low water" the Green light will flash and the Red light will remain “ON”. The burner will remain “OFF”.

CSD-1 Compliance
On Manual Reset units, if the control is in a low water condition (water off probe) when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe.

Series 750 LWCO with Amber LED and Red Low Water LED

For Control Unit Models with a Test Switch

a. Hold the test switch down while noting the amber LED on top of the control housing.

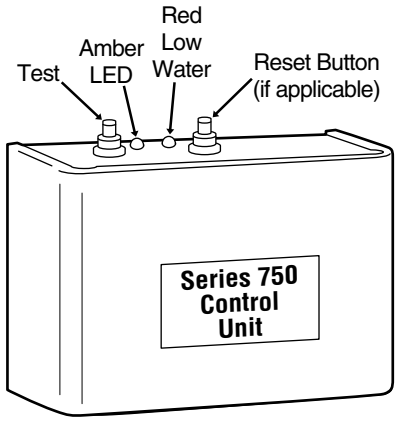
1. **If the amber LED glows dimly,** the water level is above the probe.
2. **If the amber LED is off,** the water level may be below the probe or the water is too pure and may require the addition of boiler water treatment.
3. **If the amber LED glows brightly,** it could indicate a grounded (non-operable) probe. If this is the case, proceed to "Troubleshooting" on page 12.

b. Test for correct burner circuit wiring.

1. Hold down the test switch while the burner is running.
2. If the burner shuts off while the test switch is depressed, the burner circuit is wired correctly.
3. ***For automatic reset models -*** release the test switch and the burner should resume firing provided that the boiler water is in contact with the probes.
4. ***For manual reset models -*** the burner will not return to normal operation until the reset switch is depressed.

If you believe the probe to be grounded, perform the following steps for control with test switch.

1. Make sure that the liquid level is below the probe.
2. Depress the test switch. If the amber LED turns “ON” the probe may indeed be grounded. If so, check the probe to make sure that it is the proper length, or replace the grounded probe.



Older Models

If control fails to operate as required, perform the following diagnostic checks:

1. Check to be sure that the water level in the boiler is at or above the level of the probe.
2. Re-check all wiring to ensure proper connections as specified in boiler manufacturer's wiring diagrams or these instructions.
3. Check to ensure that Teflon® tape has not been used on the threaded connection of the electrode to the boiler.
4. Re-check the electrical ground connection for the remote sensor and control unit.
5. Check the quality of the boiler water to ensure adequate conductance.

MAINTENANCE

SCHEDULE:

- **Test the low water cut-off annually or more frequently.**
- **Remove and inspect the self-cleaning probe every 5 years.**

⚠ CAUTION

Replace Probe if:
- **Teflon® insulator is cracked or worn.**
- **Probe is loose.**

Failure to follow this caution could cause property damage, personal injury or death.

- **Replace probe every 10 years.**
- **Replace the low water cut-off every 15 years.**

NOTE

Clean probe by wiping with non-abrasive cloth and rinsing with clean water. DO NOT use sharp instruments to remove any accumulations of rust or scale.

McDonnell & Miller
8200 N. Austin Ave.
Morton Grove, IL 60053
tel: 847-966-3700
fax: 847-966-9052
www.mcdonnellmiller.com

Printed in U.S.A. 11-06 210210