



Instruction Sheet

Low Water Cutoff with Test Button

102-020

SUPERCEDES: REVISION H DATED FEBRUARY 27, 2004

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#5401113-REV J



US Patent 6,904,800

Contact Ratings			
Voltage	Motor Switch Rating		Pilot Rating
	Full Load	Locked Rotor	
24 VAC	--	--	50 VA
120 VAC	7.5 A	43.2 A	125 VA
240 VAC	3.75 A	21.6 A	50 or 60 Hz

Listings/Approvals:

- UL GUIDE (MBPR) for Limit Controls per UL Standard 353 Limit Controls
- UL GUIDE (MCUR2) for Electrode Assemblies - Component
- CSA Class (4812 05) for Signal Appliances-Systems per CSA Standard C22.2 No. 205-M1983
- FM Approved

Probe Fitting Thread: 1/2" and 3/4" NPT

Enclosures:

Control Unit – NEMA Type 1 (For indoor use only.) Formed sheet metal with powder coat/plated finish. Five openings for 1/2" conduit fittings. (Not for use in hazardous locations.)

Remote Probe – Drawn sheet metal with powder coat/plated finish. Use appropriate conduit fitting. (Not for use in hazardous locations.)

Maximum Pressures: Steam - 15 psi (1kg/cm²)
Hot Water - 160 psi (11.2kg/cm²)

Maximum Probe Temperature: 250° F (121° C)

Maximum Ambient Temperature: 120° F (49° C)

Delay on Make (DOM): Adjustable – 0 sec. or 15 sec.

Delay on Break (DOB): Adjustable - 0, 15, 30, 45, or 60 sec.

Probe Sensitivity: Adjustable 3K - 7K Ohms

Input Supply Voltage: LTx120xx: 120VAC
LTx024xx: 24VAC to be supplied by an **EXTERNAL** Class 2 power source.

Control Power Consumption: 1.5VA at 120VAC
1.8VA at 24VAC

GENERAL

The LWCO is a microprocessor based control device to detect the presence of a conductive fluid in a vessel or tank. The electronic circuitry of the LWCO is primarily designed for use in low-pressure steam and hot water boilers to *cut off* the burner in low water level condition. (See each boiler manufacturers' specifications for recommended minimum safe levels.) The LWCO may also be used as a secondary low water cutoff on low-pressure steam boilers.

Automatic Reset Model: The "LOW WATER" LED will illuminate RED to indicate the low water condition. In normal conditions it

will illuminate GREEN. The LWCO control may be used with an alarm or automatic water feeder to keep the boiler filled to the proper level.

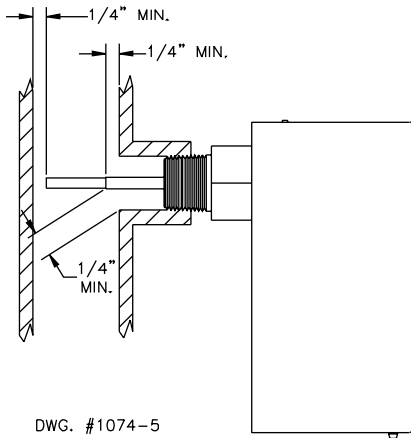
Manual Reset Model: The "LOW WATER" LED will operate the same as the Automatic Reset Model. However, if a low water condition does occur, the manual reset switch must be pressed to continue boiler operation once the proper water level has been restored. Control may be used with an alarm. DOM settings are ignored.

Both models will not lock out upon power loss provided water covers the probe.

WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Read all instructions carefully and understand them before starting installation and save for future use.
- **Do not use manual reset models with automatic water feeders or flooding and property damage can occur.**
- This LWCO device must be installed in series ahead of other limit and operating controls installed on the boiler. When installations are complete, check for correct operation of **ALL** limit and operating controls!
- To prevent damage to the device and/or electrical fire, wire insulation must be rated at 167° F (75° C) – over copper wire only.
- Instruct user how to test and operate this cutoff device as described in these instructions.

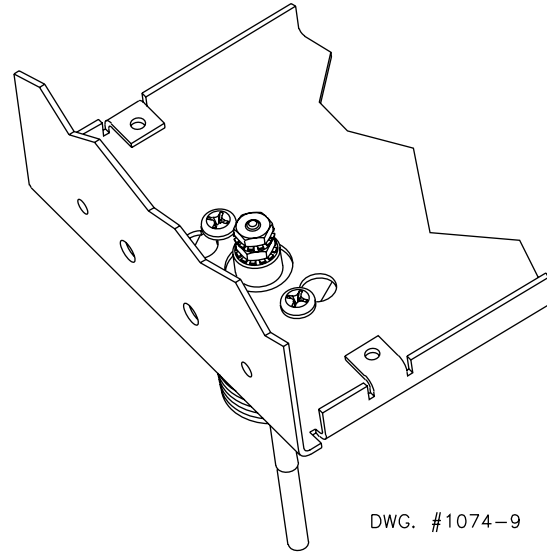
PROBE SPACING REQUIREMENTS
FIG. 1



DWG. #1074-5

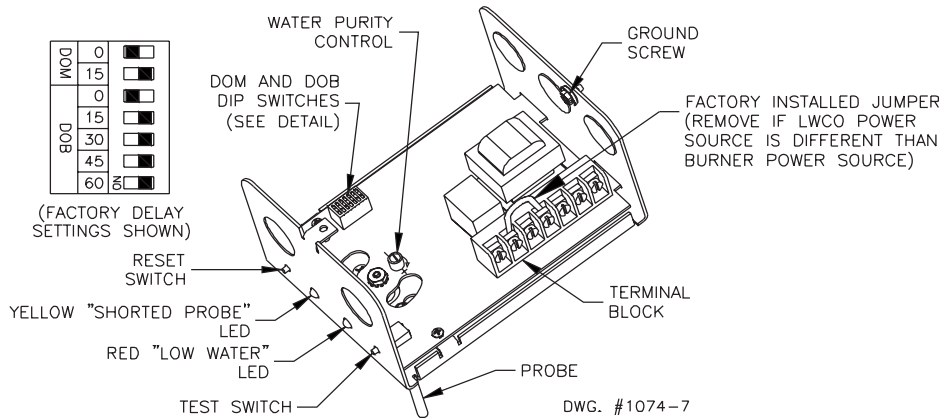
NOTE: Mount only with probe facing horizontally or vertically downward. Do not mount with probe angled upward. Maintain probe clearances as indicated. Do not mount 12" and 24" long probes horizontally.

CONTROL UNIT MOUNTED ON PROBE
FIG. 2



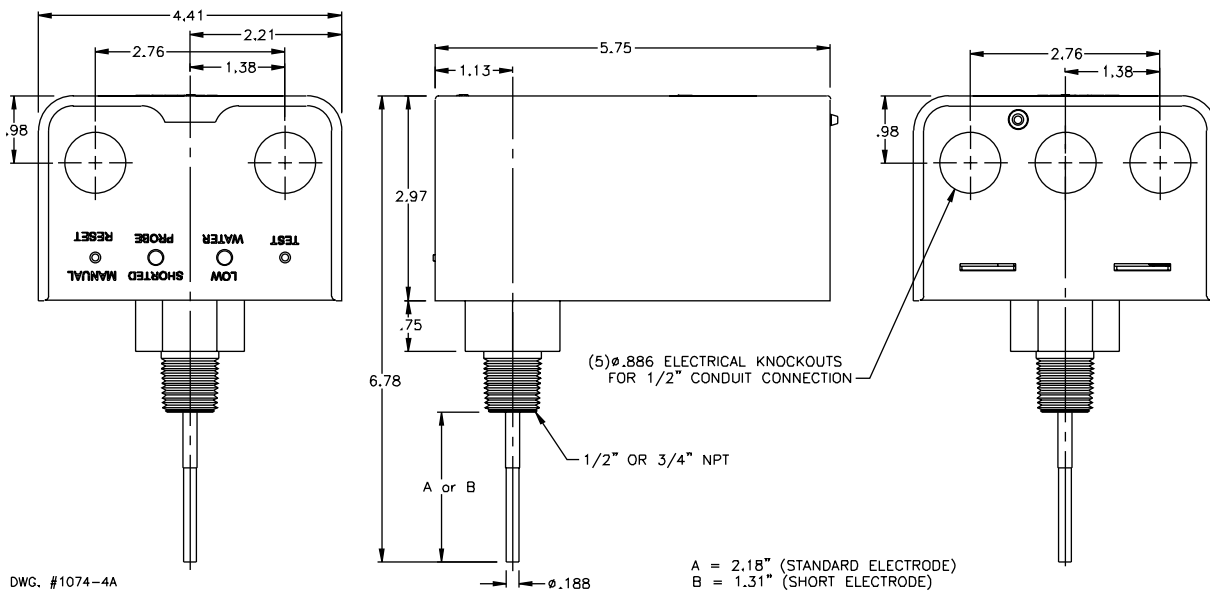
DWG. #1074-9

LWCO
FIG. 3



DWG. #1074-7

CONTROL UNIT OUTLINE DWG.
FIG. 4

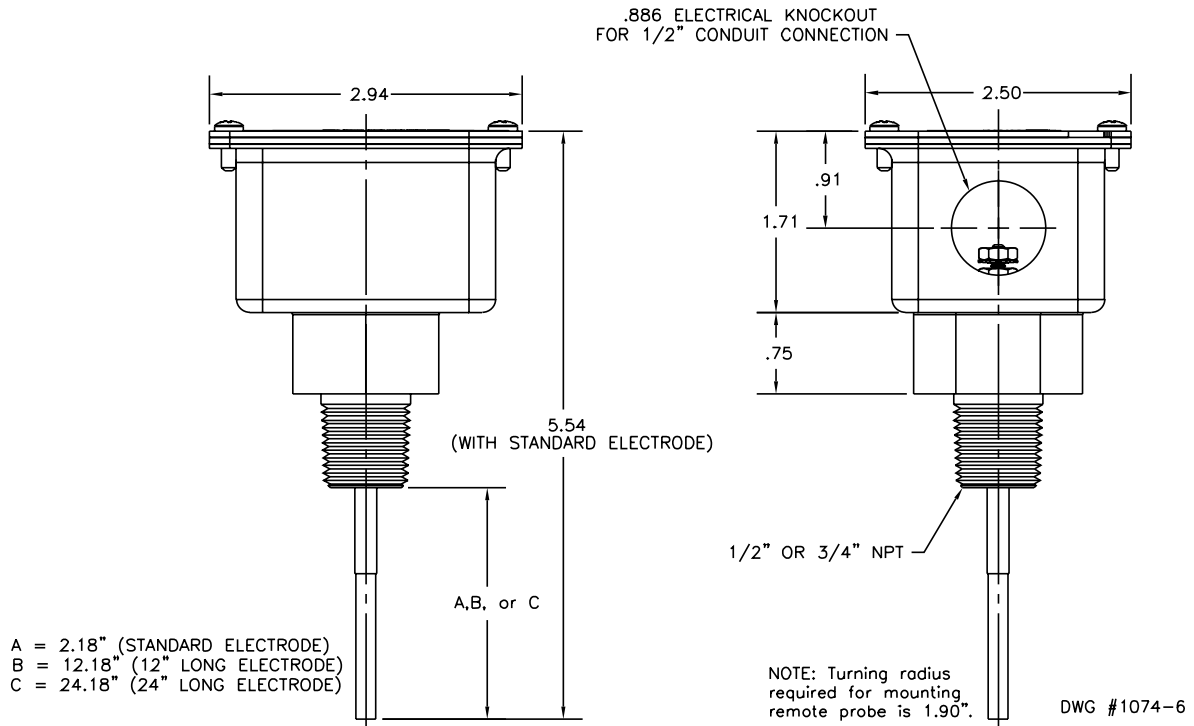


DWG. #1074-4A

A = 2.18" (STANDARD ELECTRODE)
 B = 1.31" (SHORT ELECTRODE)

REMOTE PROBE OUTLINE DWG.

FIG. 5



INSTALLATION

IMPORTANT NOTES FOR ALL PROBE INSTALLATIONS:

Apply a small amount of pipe sealant to external threads of the probe.

CAUTION: *DO NOT use teflon tape!*

1. Be sure the probe is installed above the **minimum safe** water level, as previously determined from the boiler manufacturer's literature.
2. Be sure the probe extends into the boiler cavity so that contact with the water is made.
3. Be sure the exposed portion of the stainless steel probe is a *minimum* of 1/4" from any grounding surface inside the boiler to prevent the probe from shorting (see Fig 1).

Control Unit Mounting onto Probe (See Fig. 2):

1. Tighten the probe into the tapped location of the boiler with a wrench, using bushing flats provided.
2. Make sure the heads of the two mounting screws in the probe bushing are loosened approximately 1/8" from the bushing surface.
3. Remove the first lock washer/nut from the probe threads.
4. Orient the slotted holes in the control unit over the heads of the mounting screws of the probe and turn control unit counter-clockwise so that the ends of the slots are fully under the mounting screw heads. Tighten mounting screws.
5. Replace the lock washer/nut onto probe and tighten.

Control Unit Mounting with use of Remote Probe:

Install LWCO in an appropriate location, such as boiler jacket, entry plate, or other desirable place following steps below:

1. Drill two 1/8" diameter holes 1-1/4" apart, approximately 3/4" deep.

2. Place a sheet metal screw (provided) into each hole, and tighten until screw head is 1/8" from the mounting surface.
3. Orient the slotted holes in the control unit over the heads of the mounting screws and turn control unit counter-clockwise so that the ends of the slots are fully under the mounting screw heads. Tighten mounting screws.

Remote Probe Installation and Wiring (See Fig. 6):

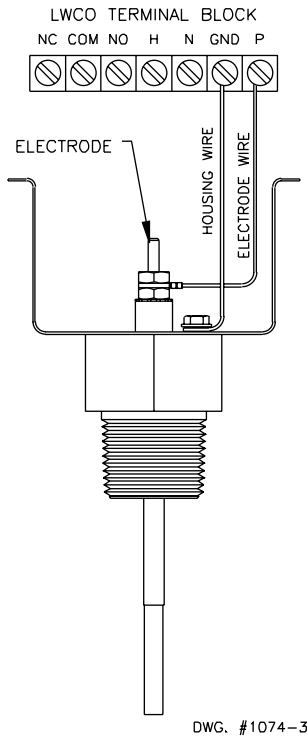
1. Be sure to follow **IMPORTANT NOTES FOR PROBE INSTALLATION**.

CAUTION: Only use a wrench on the brass bushing or damage will occur. **DO NOT** thread in probe by turning housing. **DO NOT** use teflon tape, use only a small amount of pipe sealant.

2. After the remote probe is installed and the Control Unit is mounted, use 18 AWG (min.), or as required by local code, to wire the remote probe to the Control Unit. **Remember:** Wire insulation rating must be at least 167° F (75° C).
3. Wire connection to the remote probe housing (See Fig. 6):
 - a. Crimp a #6 insulated ring terminal (provided) on stripped end of wire going to the electrode.
 - b. Remove first lock washer/hex nut from threaded probe and place ring terminal over the electrode and reinstall lock washer/hex nut onto probe and tighten.
 - c. Loop housing wire under flange head of ground screw and tighten.
4. Connecting the probe lead wires to the Control Unit terminal block (See Fig. 6):
 - a. Connect the electrode wire to terminal **P** on the Control Unit.
 - b. Connect the housing wire to terminal **GND** on the Control Unit.
5. Replace cover and securely tighten.

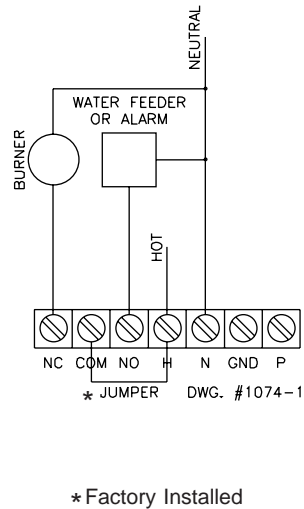
WIRING DIAGRAM FOR REMOTE PROBE

FIG. 6



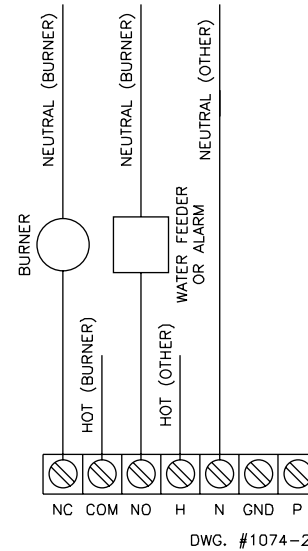
LWCO WIRING DIAGRAM USING BURNER CIRCUIT POWER SOURCE

FIG. 7



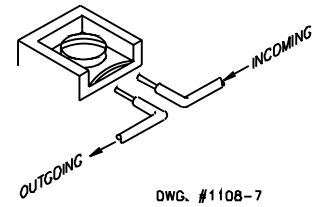
LWCO WIRING DIAGRAM USING POWER SOURCE OTHER THAN BURNER CIRCUIT

FIG. 8



TERMINAL BLOCK CONNECTIONS CLAMPING PLATE TERMINAL

FIG. 9



CAUTION:

An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire becomes dislodged from under the terminal. Use 18 AWG (min.), or as required by local code. Wire insulation rating must be at least 167°F (75°C).

NOTE: For 24 VAC models, LTx024xx, 24 VAC to be supplied by an **EXTERNAL** Class 2 power source to terminals H and N. For 120 VAC models, LTx120xx, 120 VAC is supplied by an external circuit to terminals H and N.

LWCO Wiring Using the Burner Circuit Power Source (See Fig. 7):

1. Connect the hot lead wire from the power source to terminal **H**.
2. Connect the neutral lead wire from the power source to terminal **N**.
3. Verify that factory installed jumper is present or connect an 18 AWG (min.) jumper wire from terminal **H** to terminal **COM**.

CAUTION: Be sure power source for Control Unit and burner circuit are the same voltage. Make sure you are not introducing a second voltage source into the burner circuit via the jumper. This will bypass other operating, limit, and/or safety controls, which may result in property damage, personal injury or death.

4. Connect the neutral wire of the power source to the neutral side of the burner circuit. Connect wire from the hot side of the burner circuit to terminal **NC**.
5. Connect the neutral wire of the power source to the neutral side of a water feeder or alarm. Connect wire from the hot side of the water feeder or alarm to terminal **NO**.

Control Unit Wiring Using a Power Source Other than Burner Circuit (See Fig. 8):

1. **Remove factory installed jumper.**
2. Connect the hot lead wire from the separate power source to terminal **H**.
3. Connect the neutral lead wire from the separate power source

to terminal **N**.

4. Connect the hot lead wire from the burner circuit power source to terminal **COM**.
5. Connect the neutral wire of the burner circuit power source to the neutral side of the burner circuit. Connect wire from the hot side of the burner circuit to terminal **NC**.
6. Connect the neutral wire of the burner circuit power source to the neutral side of a water feeder or alarm. Connect wire from the hot side of the water feeder or alarm to terminal **NO**.

Setting Delays (See Fig. 3)

An electronic feature is provided to prevent nuisance burner cycling. Delay on Make (DOM) is the setting for the amount of time it takes for the burner to ignite after water covers the probe, *on automatic reset models only*. Delay on Break (DOB) is the setting for the amount of time a low water condition must exist before the burner cuts off.

Delay on Make (DOM) may be set to 0 or 15 sec. Delay on Break (DOB) may be set to 0, 15, 30, 45, or 60 sec.

NOTE: Factory setting DOM to 0 - DOB to 0.

Using a small screwdriver, or similar tool, set the levers on the DIP switch to the ON position (toward printed time designations). In general, hot water boilers will have DOM and DOB set to 0 sec. while low-pressure steam boilers will have DOM and DOB set to 15 sec. Consult boiler manufacturer requirements and authorizing agency standards.

NOTE: If more than one DOM or DOB switch is on, the shortest time delay is used.

Replace cover on Control Unit and securely tighten.

Test For Proper Function:

1. DO NOT fill boiler. Turn on electric power to the boiler and set the thermostat.

Automatic and Manual Reset Models: On initial start-up the LWCO will indicate low water condition, which indicates proper function. The burner **should not** operate without water in the system. The "LOW WATER" LED on the control unit should illuminate RED.

2. Fill boiler with water.

Automatic Reset Models: Once water covers the probe the "LOW WATER" LED on the control unit should turn from RED to GREEN and the burner should ignite.

Manual Reset Models: Once water covers the probe the **reset switch** must be depressed to turn the "LOW WATER" LED from RED to GREEN and the burner should ignite.

3. Once correct operation of the LWCO has been tested, test **ALL** other safety, limit and control devices before finalizing system operation.
4. Depress the **test switch** while observing the LED's on the control unit. (NOTE: If DOB is set, be sure to depress test switch longer than DOB delay.)
 - a. If the Yellow LED illuminates faintly – this indicates that water covers the probe and is functioning properly. The "LOW WATER" LED should illuminate RED after the DOB delay, if any, expires.
 - b. If the "LOW WATER" LED does not illuminate RED after the DOB delay expires and the yellow LED illuminates, the water purity may require adjustment. See Water Purity Adjustment section.
 - c. If the yellow LED does not illuminate – the water level may be below the level of the probe or the water may be too "pure" (low conductivity). If water covers the probe, the water is too pure and must be treated.
 - d. If the yellow LED illuminates brightly – this could mean the probe is shorted (not operable). See the Troubleshooting section.
 - e. Manual reset models require pressing the reset switch to return to normal operation.
5. Testing the burner circuit wiring:
 - a. With the burner aflame, depress the **test switch** longer than DOB delay and observe the burner.
 - b. The burner should **cutoff** after DOB delay expires while the **test switch** is held. This indicates the burner circuit is wired properly. If burner remains lit see the Troubleshooting section for details.

Water Purity Control Adjustments: If testing indicates proper operation, no adjustment is required.

1. Verify that water covers the probe and that the yellow LED illuminates when the test button is pressed and held.
2. Slowly turn the water purity control, **RV1**, on the PC Board toward the "+" setting with a small screwdriver until the "LOW WATER" LED illuminates RED (see FIG. 3).
3. Once the "LOW WATER" LED illuminates RED, leave the water purity control in that position.
4. If adjustment to the maximum "+" setting does not cause the "LOW WATER" LED to illuminate RED, the water is too pure and must be treated.

Automatic Reset Models: When test switch is released the

burner will ignite after DOM delay expires and continue functioning (provided water covers the probe).

Manual Reset Models: The reset switch must be pressed to return the burner to normal operation.

Troubleshooting:

1. If testing indicates the probe is shorted, perform the following steps:
 - a. Drain the water level in the boiler below the probe.
 - b. Depress the test switch – if the yellow LED illuminates, then the probe is shorted. The shorted probe must be replaced.
2. If the LWCO fails to function normally, perform the following steps to verify the proper installation:
 - a. Make sure the water level covers the probe.
 - b. Verify **ALL** LWCO wiring.
 - c. If teflon tape was used on the threads of the brass bushing for the probe, remove the tape and install with a small amount of pipe sealant.
 - d. Adjust the water purity control as indicated in the Water Purity Control Adjustment section.
 - e. Water treatment may be required.
3. If the "LOW WATER" LED blinks RED, the safety circuits in the LWCO have detected a failure in the control and the LWCO will remain in a low water condition. To clear any temporary condition:
 - a. Remove power to the LWCO for 30 seconds.
 - b. Re-connect power to the LWCO.
 - c. If the "LOW WATER" LED continues to blink RED, the safety circuits in the LWCO have found a failure that cannot be corrected. **The control must be replaced.**

Cleaning and Replacement:

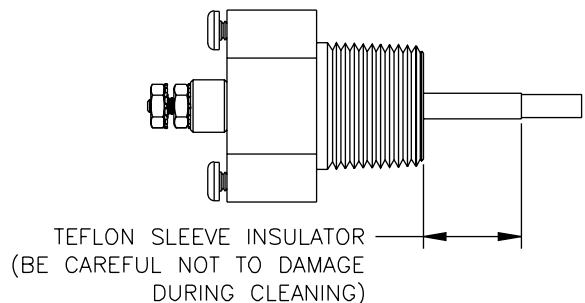
Probe must be inspected annually for scale build-up. Clean all scale from probe and teflon sleeve taking care not to damage the teflon sleeve (see FIG. 10).

Probe should be replaced every 10 years. Replace more often if used in areas where heavy water treatment is required, when cleaning is needed more frequent than annually, and/or boiler demands for make-up water are high.

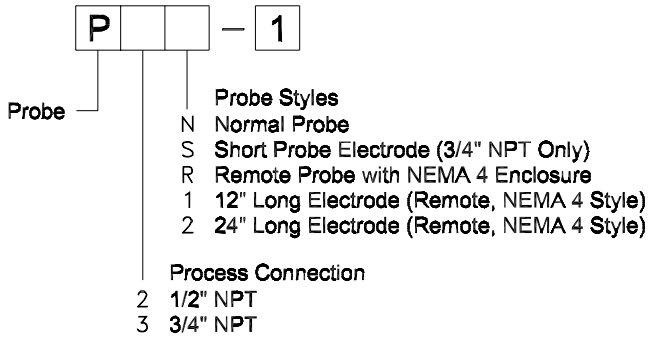
The control unit should be replaced every 15 years. In areas of high humidity and heavy dust or other airborne contaminants more frequent replacement may be required.

PROBE CLEANING

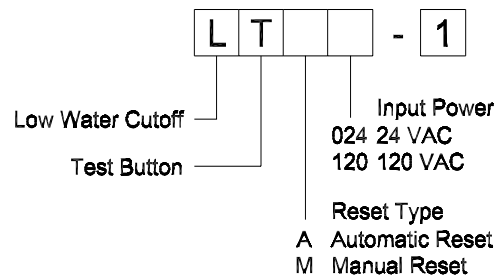
FIG. 10



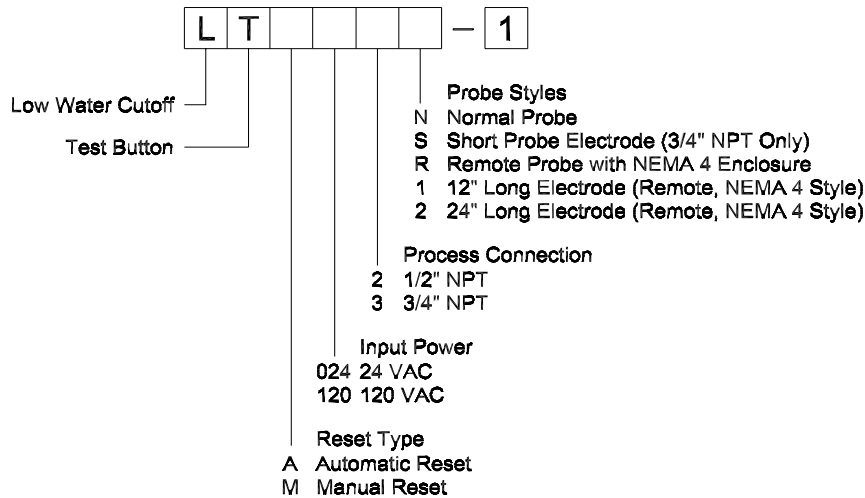
Probe Only Ordering



Control Only Ordering



LWCO Ordering



LT WIRING CROSS REFERENCE

Manufacturer	Device or Series	Power Connections		Output Contacts			Remote Probes	
		Hot	Neutral	Common	To Burner	To Water Feeder / Alarm	Probe	Probe Reference
Taco	LT Series	H	N	COM	NC	NO	P	GND
McDonnell & Miller	PS-801/851 (Older Models w/Red & Amber LEDs)	1	2	3	5	4	P or J2	Chassis GND
McDonnell & Miller	PS-801/851 (New Models w/Red & Green LEDs)	H	N	C	B	W	J2	Chassis GND
McDonnell & Miller	PS-802/852 (Older Models w/Red & Amber LEDs)	H	N	C	B	W	J7	Chassis GND
McDonnell & Miller	PS-802/852 (New Models w/Red & Green LEDs)	H	N	C	B	W	J3	Chassis GND
McDonnell & Miller	Series 750	1	2	3	4	5	P	Chassis GND
McDonnell & Miller	RB - 122	H (Black Wire)	N (White Wire)	C (Yellow Wire)	B (Yellow Wire)	-	-	-
McDonnell & Miller	RB - 120	1	2	3	4	5	-	-
McDonnell & Miller	RB - 24	Red Wire	White Wire	Yellow Wire	Yellow Wire	-	-	-
Hydrolevel	24	Black Wire	White Wire	-	Orange Wire	Brown Wire	-	-
Hydrolevel	170	H	GN	P1	P2	A	-	-
Hydrolevel	400, 500, 600, 700, 450, 550, 650, 750	1	2	P1	P2	A	H3	Chassis GND
Honeywell	RW700 Series (Except RW700A1098)	L1	L2	-	B	A	2 Red Wires, White Wire	Green Wire
Honeywell	RW700A1098	T1	T2	-	B	A	2 Red Wires, White Wire	Green Wire

Do it Once. Do it Right.

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