INSTALLATION, OPERATION AND INSTRUCTION MANUAL

Level-Trac Model LT-302 Control Unit

Note: This document should be reviewed in its entirety prior to installation of equipment.

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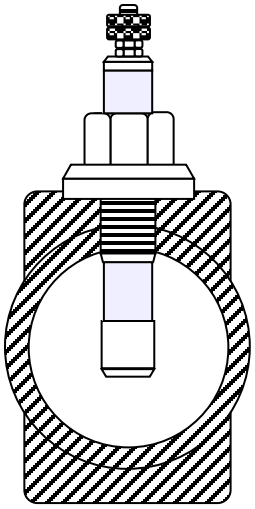
1.0 Operating Principle

The Level-Trac LT-302 is a remote level indication system. The system may also be used as an alarm or trip device.

Discrimination between water and steam is based on the significant difference in resistivity between the two states over the saturation range. The sensing element is a probe with an insulated tip inserted in a probe manifold (Figure 1.1.) If a voltage is applied to the probe tip, conduction occurs between the tip and the inside wall of the column, resulting in an indication of water. Probe and manifold dimensions are selected to provide a resistance typically less than 100 KΩ when the probe is immersed in water, as compared to a resistance greater than 5 MΩ when in contact with steam. An electronic discrimination circuit is arranged to sense whether the Probe resistance is less than 100 KΩ representing water or greater than 5 MΩ representing steam.

With probes spaced vertically in a manifold attached to the boiler (Figure 1.1) and with each probe connected to its own sensing and water/steam indication circuit.



Typical Probe Manifold
Cross Section

Figure 1.1

2.0 System Configuration

Probes are installed in the probe manifold. A length of high temperature wire connects the probes and the manifold to the control unit. The probe manifold itself serves as a common conductor. The presence of water will complete a circuit between the manifold and the probe tip. The LT-302 is designed to control one or two probes, independently or co-dependent.

A printed circuit board contained in a NEMA 4X (IP65) wall mounted enclosure provide up to 2 discrete water/steam discrimination circuits, LED display, relay alarm/trip outputs, fault detection and terminals for the connection of a remote display Unit.

To avoid galvanic interaction with the probe and variations in sensing voltage due to changing electrolytic potentials, a square wave alternating voltage source is applied to the probe, and the sensing circuit responds only to an alternating waveform. The voltage applied to the probe is less than 6 volts, current limited

2.1 Channel Assignment

Alarm/Trip State: Each channel is individually assigned an alarm/trip state, “wet” or “dry” by solder pad J7 (Probe 1) and J15 (Probe 2). If there is no jump, the corresponding channel will interpret “dry” condition as normal, and “wet” as alarm state. To designate a probe channel’s normal state as “Wet,” make the solder jump at J7 (Probe 1), and/or J15 (Probe 2.)

Relay State

Each relay may be set as normally energized or normally de-energized. In the normally energized state the contact is closed in the channel’s normal (non-alarm) state, as defined in the previous paragraph. This is considered “failsafe” with the contact opening in the defined alarm condition, or with a loss of power. A red LED indicates that the relay is closed.

Channel Co-Dependency

The channels may be tied together so that a relay will only respond to an agreement of both channels. This feature is often referred to as “voting logic”. To make each probe respond to a single probe input, make the jump at J6 (Probe 1) and/or J14 (Probe 2). To make them co-dependent, or use voting logic, jump J10 (RL1) and/or J18 (RL2.) Where each relay is to respond to a single probe channel, jump J6 (RL1) and/or J14 (RL14.)

Out of Sequence Logic

This option will invoke a Process Fault alarm if a Water over Steam condition exists in the probe assignment. Example: Probe 1 is positioned lower than Probe 2 on a water column. If Probe 2 indicates “wet” and Probe 1 remains “dry”, the Process Fault alarm will activate. To activate this feature jump JS1 solder pad.

2.2 Cable Monitoring: This feature employs two probe wires from the control unit for each probe, and is applicable to normally dry channels. There is a conductivity circuit for these two wires which are to be joined at the probe. Failure of either probe wire causes that channel to indicate “Wet” or “Alarm” state.

The logic is that a dry probe single wire configuration would result in that channel indicating a dry (non-alarm) state. This would not be detected by the system or operator.

The A1 and A2 solder pad jumps next to the probe wire plug control this feature. If the probe channel is to be normally wet, or this feature is not wanted, jumping A1 and/or A2 will tie the two terminals together, and provide the continuity at that point, instead of at the probe, and a single wire may be used.

2.3 Local Indication

There are two LEDs on the PCB that will indicate the state of the relays. A door mounted indicator option is available.

2.4 Alarm/Trip and Fault Detection Relays

Two 8A DPDT relays are supplied to provide contacts for alarms, trips or system fault annunciation.

RL1 and RL2 are independently selected to operate in energized (failsafe) or de-energized normal state. When operated in the energized state, trip will occur in the event of power loss to the system.

RL1and RL2 are independently set to delay 1 second, 5 seconds, 10 seconds or 15 seconds.

2.5 Sensitivity

Each probe channel of the LT-302 can be set to one of three sensitivity ranges:

>4 mS/cm²
>2 mS/cm²
>1 mS/cm²

These values are effectively halved by using a shrouded probe. This increases the surface area of the system common and places the common much closer to the probe sensing element. Sensitivity is rarely an issue, and it is suggested that the mid-range setting be used initially to evaluate system performance in the actual application.

2.6 System Fault

System Fault is indicated by a flashing yellow LED labeled “SF” on the PCB. There are two triggers for System Fault:

1. The On/Off slide switch that enables the Red/Green test switches is in the “On” position.
2. When the invoked via solder jumps on the discriminator PCB: out of sequence logic (i.e. Water over Steam). This is only valid where the probes are installed in a vertical progression respective of water level.

A failed probe insulator will typically cause the probe to be grounded, regardless of whether it is normally Wet or Dry. Hence, a dry probe with a failed insulator will indicate as Wet. If this occurs with a probe that has a functioning Dry probe below it, the out of sequence logic will declare a System Fault.

2.7 Process Fault

Process Fault is indicated by a flashing yellow LED labeled “PF” on the indicator, and is invoked by any channel that is not in its normal state, wet or dry.

Probe cable monitoring is achieved by verifying continuity between two wires to probes that are expected to be normally Dry. A break in continuity between these two wires will simulate a Wet probe, and cause a System Fault. For the single wire connection to the normally Wet probes, an open-circuit connection will indicate Dry, activating the out of sequence Fault Detection circuit.

2.8 Test Switches

The LT-302 is supplied with two test switches, that simulate an all Wet or all Dry state. There is an On/Of slide switch that activates the Red/Green test switches and prevents the corresponding relays from going into alarm state during a simulation. When the slide switch is in the “On” position, System Fault will be indicated as a reminder that the LT-302 is in the simulation mode.

3.0 Installation and Cabling

3.1 Enclosure

The LT-302 Electronic Unit enclosure is usually located near the probe manifold(s). The LT-302 enclosure should be located to provide clear routing of cables, minimum risk of damage from surrounding plant or activities and adequate visibility of the display. The standard enclosure is a Stahlin Diamond Shield, Model DS080804HPL, supplied with mounting foot kit. The instructions for mounting this enclosure are provided as Appendix A of this manual.

3.2 Main Power Supply

Line, Neutral and Earth Ground are connected directly to the switching power supplies located in the base of the enclosure. The power requirements are: 100 to 240 VAC ± 10% @ 15VA, 48 - 63 Hz. If two power sources are not available, install a wire jump to connect the switching power supplies.

3.3 Wiring Control Unit-to-Probes

It is recommended that a continuous length of high temperature cable be used to cover the span from the probes to the LT-302 control unit. Quest-Tec Solutions has a custom fabricated cable, available as an option, in 4, 8, 12, 16 and 25 conductor versions. (The specification for 16 conductor cable is attached as Appendix B to this manual.) 20 AWG, nickel plated copper conductors should be used where elevated temperatures are expected. A maximum run of no more than 100 feet is recommended. Two conductors are required for each normally Dry probe, one conductor for each normally Wet probe, and two conductors for system Common.

Figure 3.3.1 shows the terminals provided for wiring the probes. Three terminals are supplied for each probe. One for Ground and 2 for each probe To the right of each terminal block are two sets of solder pad jumps. The “A” jumps tie the two probe wires together, and should be jumped for all probes that are expected to be wet in the normal state. When “A” is jumped, a single wire can be used for the probe, either terminal 1 or 2.

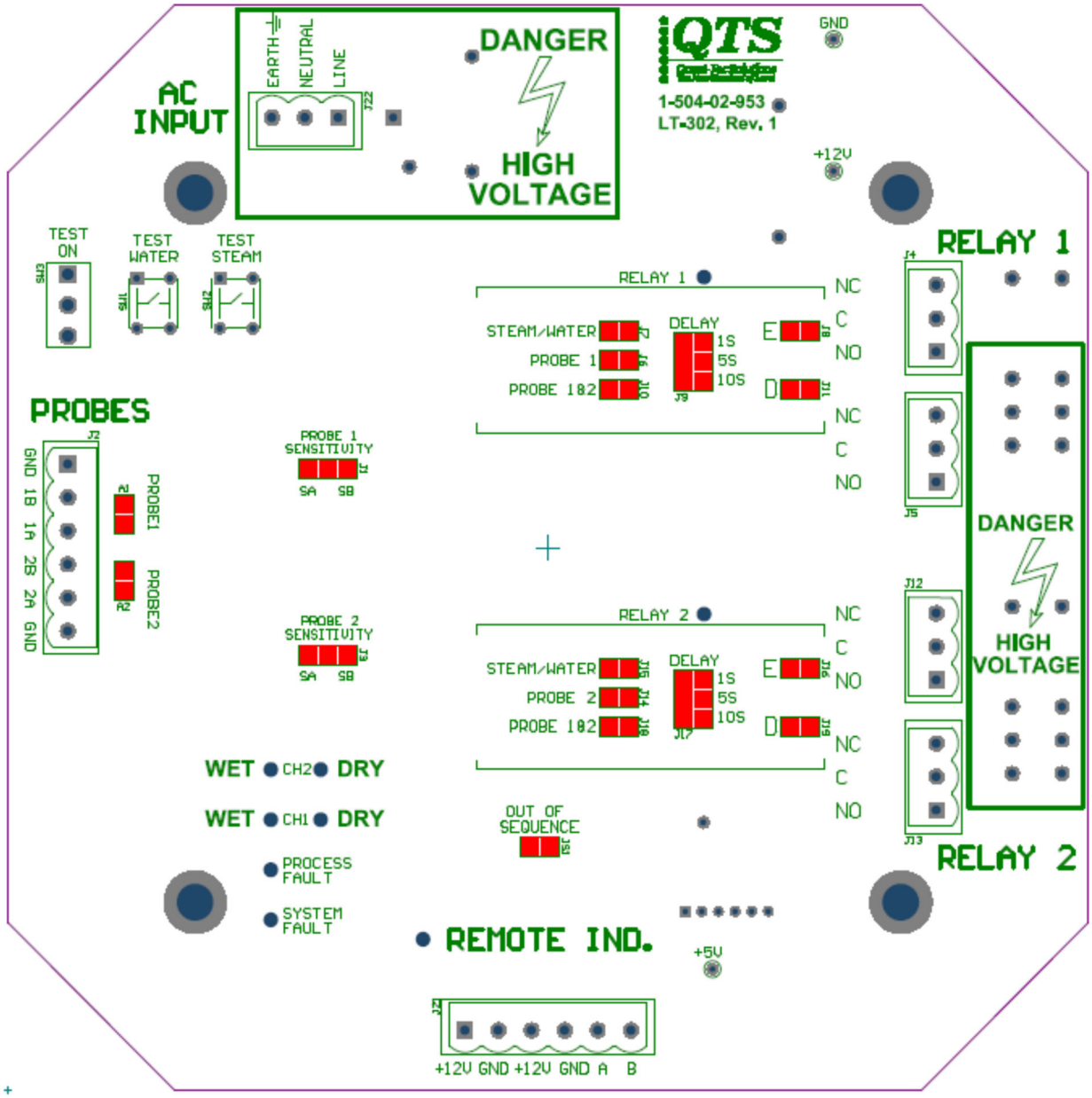


Figure 3.3.1

The Common Ground terminals (3 and 4) are common across the entire system, meaning that the common connection for any probe will work for any probe. Each probe holding device should have at least one common ground connection at minimum. The “B” jump invokes a continuity check of the probe wire, if required. (Units from the factory will normally have this jump made.)

For unused channels, making the “A” solder jump will cause the display to indicate a Dry state.

3.4 Wiring Alarm/Trip Relays

Figure 3.3.1 shows the connection point for relays. Each terminal block is supplied with a Phoenix Series MSTB plug.

The “High Voltage” notice printed on the PCB in the Relay proximity relevant only to the service wired in by the user to the relay contacts.

There is an LED located at each relay to indicate the current status of the relay. When illuminated, the corresponding relay is energized. The relays are rated 8A at 250 VAC. *Note: If the continuous load is anticipated to be greater than 5A at 250 VAC, the board traces must be replaced with wire. This is a factory modification.*

3.5 Panel Mount Remote Level Indicator

The Model LT-302 Control Unit can power up to two remotely mounted displays. The Model LTI-302 is designed to be mounted on a panel, with a cut-out size of 4.2” H X 2-5/8” W (107 mm H x 67 mm W). The quantity of conductors required is calculated by taking the number of channels used and adding 6. See Figure 3.4 for the location of terminal blocks TB8 and TB9. Terminal functions of the LT-302 Control Unit are as follows:

RS458B
RS485A
Ground
+12 VDC
Ground
+12 VDC

These correspond directly with the numbered terminals on the LTI-302. The remote display will operate with a single Ground and +12 VDC, the second pair is redundant.

4.0 Commissioning

4.1 Before installing the wired plugs for the probes, remote indicators and relays, power up the unit, slide the test enabler switch to the “ON” position, depress and hold the green test switch and check that all green LEDs are illuminated. Release the green test switch, then depress and hold the red test switch and check that all red LEDs are illuminated. Slide the test enabler switch to the “OFF” position

4.2 Turn off the power, and install the wired probe plugs. Power up the unit, and observe. If the column is empty all probe channels should have the red LEDs illuminated. Short each probe in turn by touching a wire between the knurled nuts and probe body, checking that the corresponding green LED becomes illuminated.

4.3 Turn off the power and install the wired remote display plugs, if used. Power up the unit and check correct illumination of LED's by operation of the green and red test buttons.

4.4 Verify that the RL1 and RL2 relays are receiving power as intended by observing the LED associated with each relay. When an LED is illuminated the associated relay has power and should be energized. If the “E” solder jump is made the relay LED will be illuminated when in normal state and will turn off when in the alarm or trip state. This is reversed when the “D” solder jump is made. (The relay LED Is powered by the current that activated the relay. It will verify that the relay has power, but does not verify that the relay has actually closed. Continuity must be checked at the terminals to verify that the relay is performing properly.)

When configuring the wiring for relays, note that the PCB labels “NC” and “NO” are based on the relays being in a de-energized (solder jump “D” mode).

4.5 Routine Maintenance: The LT-302 control unit requires no routine maintenance. However, it is recommended to periodically clean the external probe insulators with a small brush to keep free of accumulated dust, and to remove, clean and inspect the probes after one year’s service.

5.0 LT-302 Control Unit Specifications

Enclosure:
Wall mounted glass-fiber reinforced polyester, IP65/NEMA4X protection for location in harsh environments.

Dimensions: 9.39” H X 9.76” W X 4.31” D (239 mm H X 248 mm W X 110 mm D)
Mounting Legs: (4) 0.50” X 0.31” (13 mm X 8 mm) Slots on 10.21” H X 6” W Centers (250 mm H X 152 mm W)

Inputs:
Discrimination between water and steam for up to 2 channels numbered in ascending order.

Sensitivity: Discrimination threshold may be selected for a minimum conductivity of 1 mS/cm², 2 mS/cm² or 4 mS/cm². (Use of a shrouded probe insert effectively reduces these values by half.)

Probe Normal State: This is set by solder jumps, making a jump for all probes anticipated to be in the wet state as normal. Probes that are normally wet require a single wire, probes that are normally dry require two wires.

Local Indication:

Remote Display (optional):
Two vertical columns having 0.394” (10 mm) square LED’s on the front of the enclosure. One row of Green LED's represents water and another row of Red LED’s represents steam. A Yellow flashing LEDs signal a System or Process Fault Condition.

Supply Requirements:
100 to 240 VAC ± 10%, 48 - 63 Hz

Utility Consumption:
20 Watts

Temperature Rating:
Operating: -13º F (-25º C) to 158º F (70º C), Storage: -58º F (-50º C) to 212º F (100º C)

Relay Outputs:

Alarms/Trips: RL1 through RL2 can be set to activate on the input of one probe channel, or any of three parings. Enabling all three parings results in a voting logic circuit that polls three probes, activating in a 2 of 3 scenario.

Alarm and Trip Relays may be set to a direct (de-energized) or inverse (energized) normal state The Fault relay is set to an inverse (energized) normal state.

Relay Ratings:
DPDT, Max. Current: 8 Amps @ 250VAC

Remote Display (optional):
Six terminals are provided for direct connection to a Remote Display Unit. The Remote Display Unit option for the LTI-302 is intended for control room location.

Installing and Removing Covers
To remove cover:
1) Open the enclosure completely and provide adequate support to keep the cover from being damaged during disassembly.

2) Using a hammer and screwdriver, gently tap on the end of the hinge pin nearest the middle of the enclosure (closed end) so that the pin becomes unseated at the other end (approx. 1/4")

3) Using pliers, grasp the opposite end (flattened) of the hinge pin and pull completely out. Repeat steps 1 and 2 to remove the second hinge pin.

To install new cover
4) Assemble hinge pins to the cover by inserting the round end of the pin into the hinge core in the cover. You may need to use a hammer to gently tap the pin into place. Repeat this for the second pin.

5) Align the cover with the base in the open position.

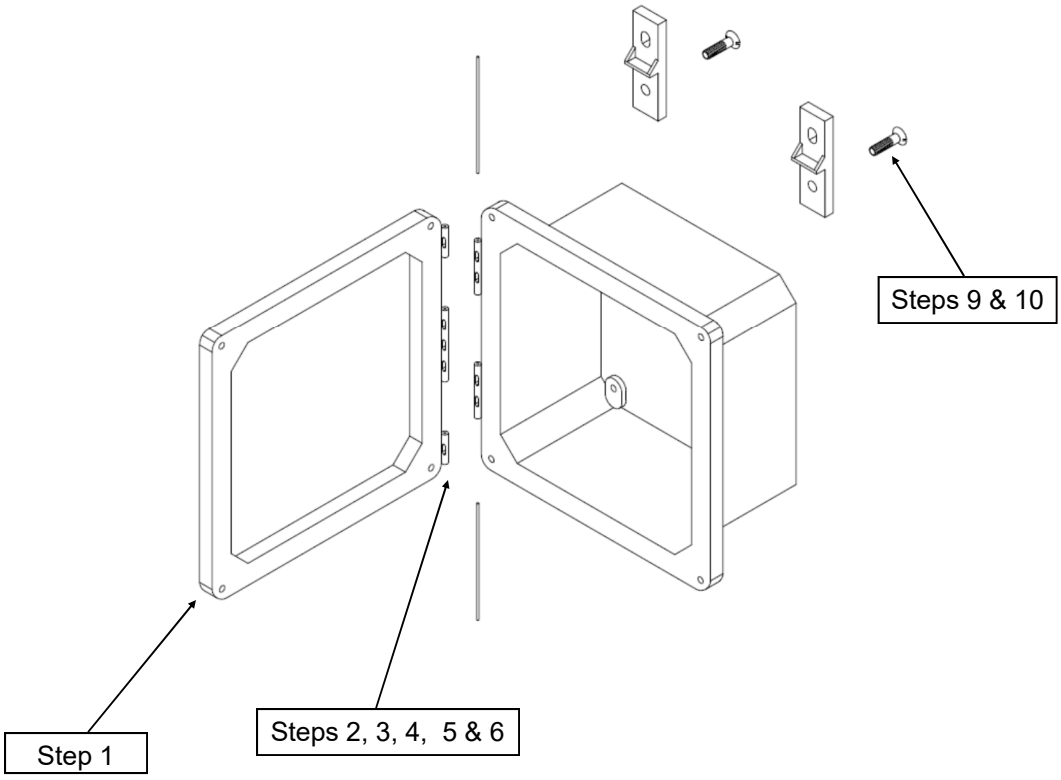
6) Using a small hammer, gently tap the hinge pin into the corresponding hole in the base until the end of the pin is fully seated and flush with the cover surface. Repeat this step for the second hinge pin.

Changing out the latches
7) Remove existing latch by gently tapping the latch off the dovetail on the side of the enclosure.

8) Assemble the new latch by sliding the latch base onto the corresponding dovetail on the enclosure base **UNTIL COMPLETELY SEATED**. Repeat steps 7 & 8 for the other latches.

Adding Mounting Feet
9) Place mounting foot on the back side of enclosure so that the countersink hole is directly over the brass insert.

10) Using a screw driver and the #10-32 x 7/16" flat head screw, tighten the mounting foot to the enclosure. Torque to approximately 25 in-lbs. Repeat steps 9 and 10 for the remaining mounting feet.



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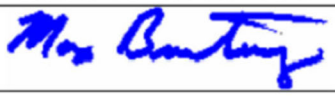
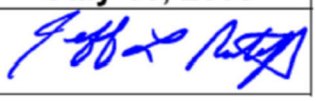
Spec:	M22759-12-20-16C	Date:	July 16, 2009
By:		Approved:	

M22759/12-20 16 CONDUCTOR CABLE UNSHIELDED
EXTRUDED WHITE PFA JACKET

PRIMARY WIRE TYPE	M22759/12-20-9
CONDUCTOR SIZE	20 19/32
CONDUCTOR MATERIAL	NICKEL PLATED COPPER
CONDUCTOR DIAMETER	.037" - .041"
PRIMARY INSULATION MATERIAL	PTFE
PRIMARY WIRE DIAMETER	.056" - .060"

CABLE CONSTRUCTION

NUMBER OF CONDUCTORS	16
COLOR CODE	9-96-93-954-92-90-94-97-98-91 901,902,903,904,905,906
JACKET MATERIAL	PFA
JACKET COLOR	WHITE
JACKET THICKNESS	.015" NOMINAL
CABLE FINISHED DIAMETER	.305" NOMINAL

PERFORMANCE CHARACTERISTICS

TEMPERATURE RATING	500° F / 260° C
VOLTAGE RATING	600 VOLTS