Integrated Control Systems

LA1 Level Alarm Rev B

2 Channel or 4 Channel Installation Instructions

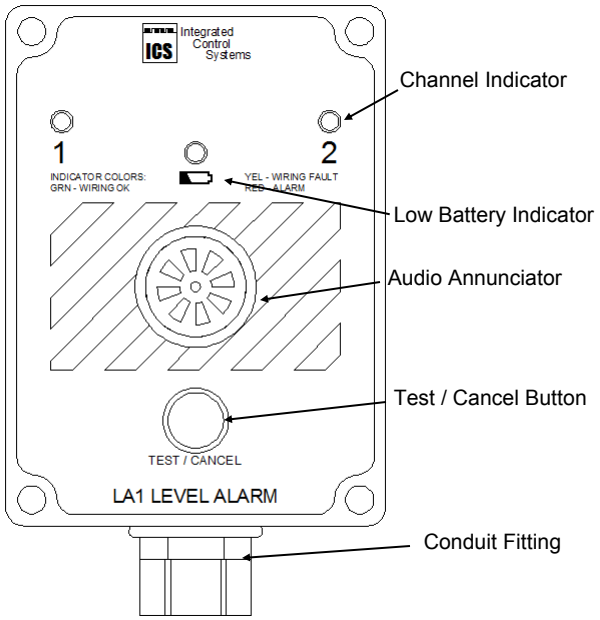
WARNING: *This product MUST be installed by qualified personnel only. It must be installed in compliance with local and national electrical codes and intrinsic safety standards. ICS is not responsible for damages or losses resulting from misuse or incorrect installation of this product.*

The LA1 Level alarm is used on liquid storage tanks to alarm when the fuel level reaches any high level or low level set point. The alarm controller is available in either a 2 or 4 channel configuration. Each probe level switch requires one channel of the alarm controller and may operate as either high or low level in normally open or closed configuration. The probes are available in several lengths to suit just about any application. As the probe parts are all stainless steel, they can also be used in many other liquid level applications. Read through the instructions completely before beginning installation.

I. PARTS IDENTIFICATION:

1. Open the packaging and verify that the required parts are present. Use the diagrams at right to identify the LA1 components.

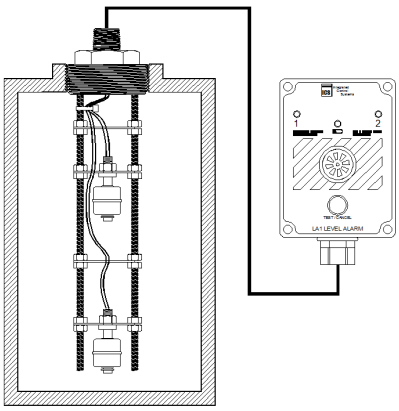
LA1 Alarm Controller (2 Channel Shown)



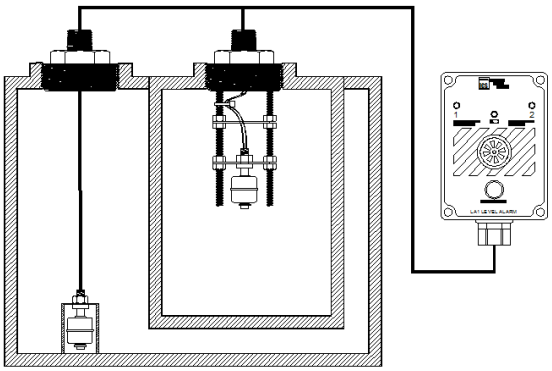
II. PROBE CONFIGURATION:

The LA1 can be installed with many different configurations. Several common configurations are shown below. Choose the number of channels and the number and type of probes which best fit your application.

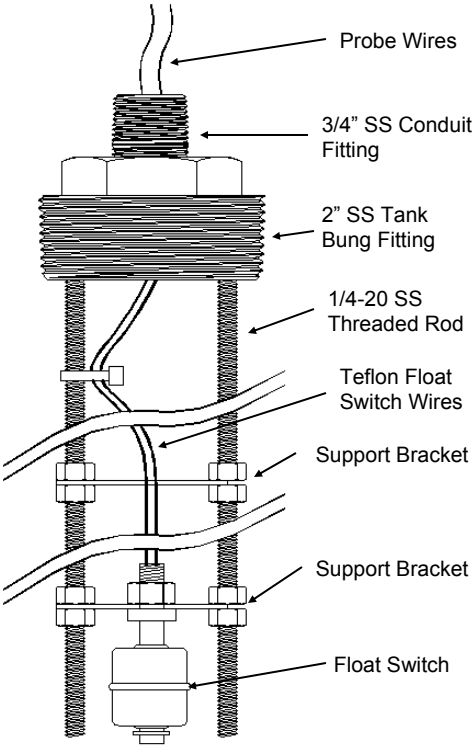
2 Channel Alarm with High and Low level Probe



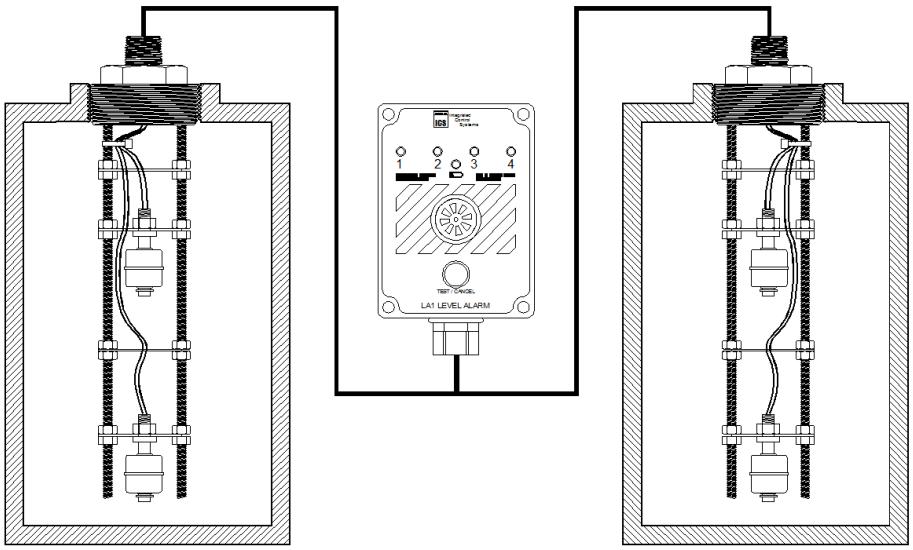
2 Channel Alarm with High Level Probe and Interstitial Probe



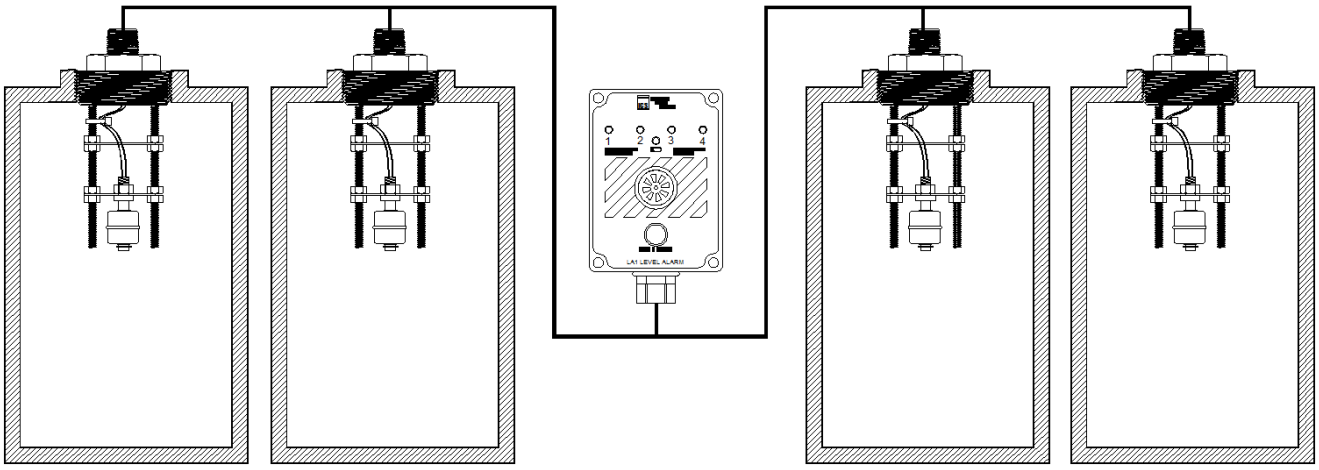
LA1 Probe Assembly (Single Switch Shown)



4 Channel Alarm with High and Low level Probes



4 Channel Alarm with 4 High level Probes



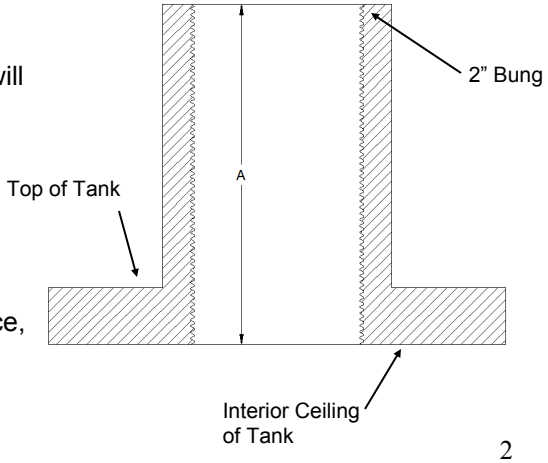
PROBE SETUP:

1. Before configuring the probe(s) we will need to calculate the exact position of the float switch(es) for high and/or low level monitoring.

2. Determine the location on top of the tank where the LA1 probe will be installed. Most tanks have a 2” threaded bung, but some tanks may require an adapter. The LA1 probe cannot be installed on an opening smaller than 2 inch. If an adapter is required, install the adapter and make the measurements with it in place.

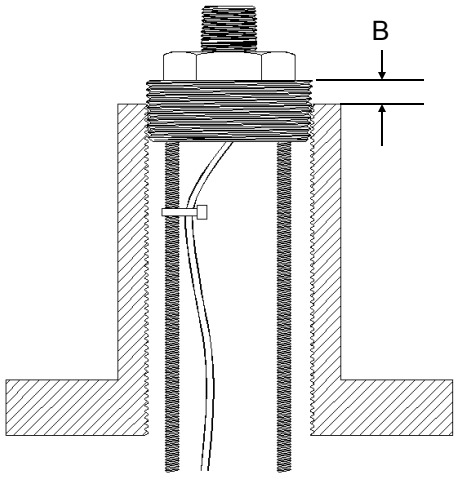
3. Use a measuring tape to determine the distance “A” in the diagram at right. This is the distance from the top of the bung to the interior ceiling of the tank. If there is an adapter or riser pipe in place, measure to the top of the adapter and/or riser pipe.

A (inches) = _____



4. Install the LA1 probe temporarily, and record the distance “B” in inches above the 2” bung that the probe fitting protrudes. Refer to the diagram at right. B (inches) = _____

LA1 Probe Height Measurement



PROBE SETUP - HIGH LEVEL (OVERFILL):

1. Determine the interior height of the tank from the manufacturer’s specs. or measurement and multiply it by the appropriate value in the table below to get the correct float switch depth. Round the result to the next higher 1/8”.

Liquid Level Trigger Point	Horizontal Cylinder	Vertical Tank
95%	0.097	0.05
90%	0.1565	0.10

Record this value as “C”. C (inches) = _____

Example: If the interior tank height is 48 inches, it is a horizontal cylinder tank, and we want the alarm to trigger at 90%, then:

C = 48 x 0.1565 = 7.512

Using the chart below, 0.512 is greater than 1/2” but less than 5/8”, so the result is rounded up to 7-5/8 inches.:

Decimal Equivalents for 1/8” Increments							
1/8”	1/4”	3/8”	1/2”	5/8”	3/4”	7/8”	1”
0.125	0.25	0.375	0.5	0.625	0.75	0.875	1.0

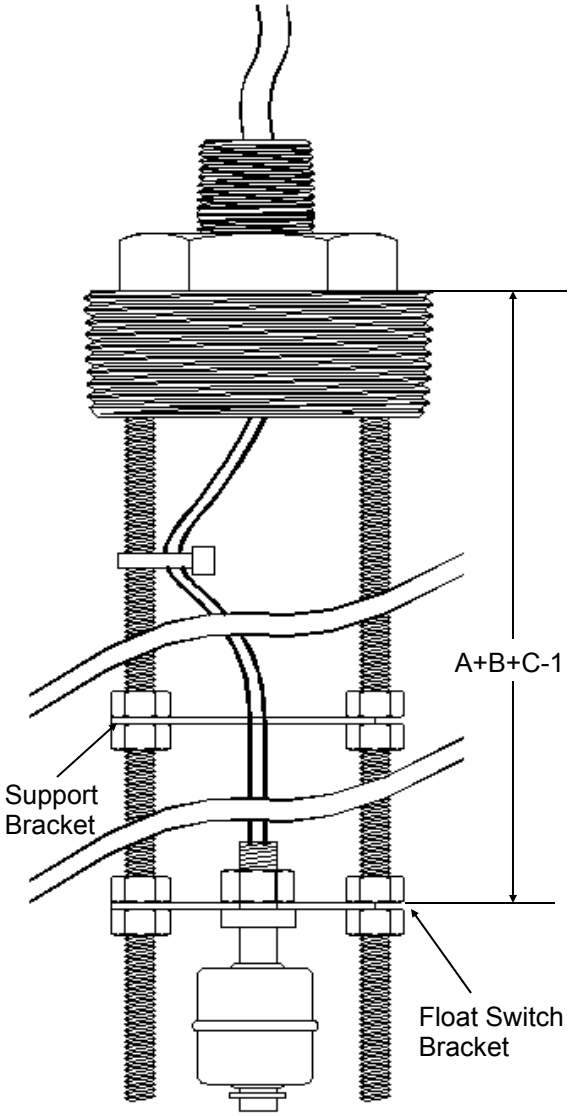
C = 7-5/8 inches

2. Now add the three measurements together and subtract 1 inch, to get the correct set point for the float switch.

A + B + C –1 (inches) = _____

3. Lay the probe horizontally and adjust the position of the float switch so that the length from the top of the 2” fitting threads to the float switch bracket matches the length above. Add additional threaded rods as required using the stainless steel coupling nuts and lock nuts. When set, tighten the nuts together to secure the bracket in place.

LA1 Probe Float Switch Setting (HIGH LEVEL)



PROBE SETUP - LOW LEVEL (UNDERFILL):

1. Determine the interior height of the tank from the manufacturer’s specs. or measurement and multiply it by the appropriate value in the table below to get the correct float switch depth. Round the result to the next lower 1/8”.

Liquid Level Trigger Point	Horizontal Cylinder	Vertical Tank
5%	0.903	0.95
10%	0.8435	0.90

Record this value as “C”. C (inches) = _____

Example: If the interior tank height is 48 inches, it is a horizontal cylinder tank, and we want the alarm to trigger at 10%, then:

C = 48 x 0.8435 = 40.488

Using the chart below, 0.488 is greater than 3/8” but less than 1/2”, so

Decimal Equivalents for 1/8” Increments							
1/8”	1/4”	3/8”	1/2”	5/8”	3/4”	7/8”	1”
0.125	0.25	0.375	0.5	0.625	0.75	0.875	1.0

the result is rounded down to 40-3/8 inches.:

C = 40-3/8 inches

2. Now add the three measurements together and subtract 1 inch, to get the correct set point for the float switch.

A + B + C –1 (inches) = _____

3. Lay the probe horizontally and adjust the position of the float switch so that the length from the top of the 2” fitting threads to the float switch bracket matches the length above. Add additional threaded rods as required using the stainless steel coupling nuts and lock nuts. When set, tighten the nuts together to secure the bracket in place.

4. Level switches used for low level must be reconfigured, as the switches are set by default to be normally open when the float is in the down position. To set the switches for low level sensing, remove the E-Clip at the bottom of the float switch. Remove the stainless steel float from the shaft, turn the float around and replace it onto the shaft so that the dimple on the end of the float is at the top. Now reinstall the E-Clip to secure it. This will configure the float switch to be normally open in the UP position. See diagram at bottom right.

PROBE SETUP (ALL TYPES):

1. Set the support bracket(s) so that all brackets are evenly spaced along the length of the probe. Tighten the nuts together to secure the bracket(s) in place.

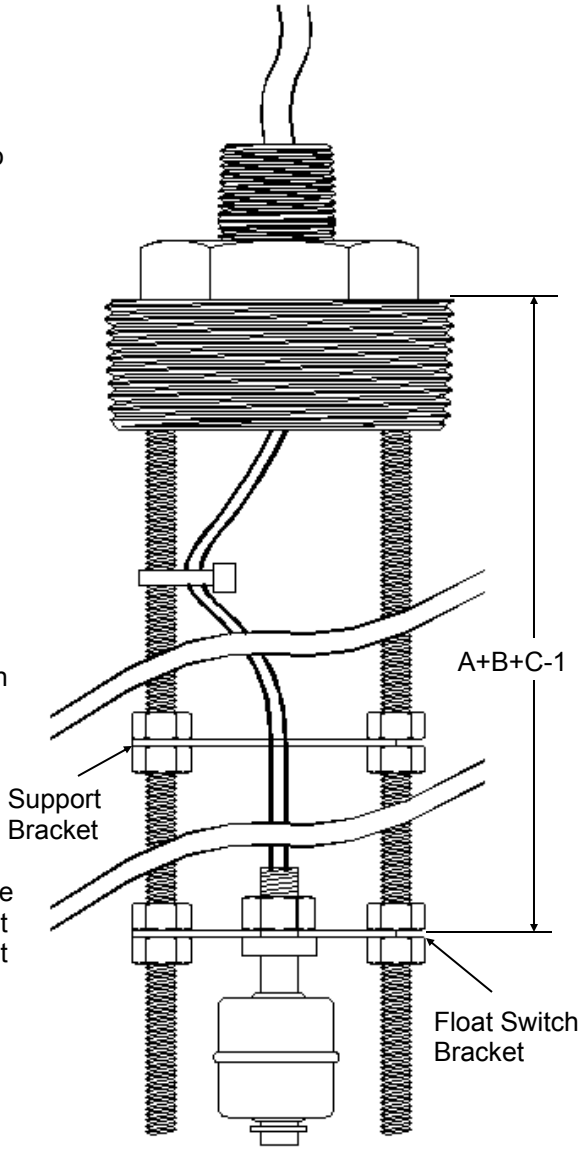
2. If the probe assembly is longer than the height of the tank, trim the bottom ends of the threaded rods to the appropriate length.

3. Test fit the probe into the tank, making sure that the bottom of the probe does not contact the bottom of the tank. Do not tighten yet, as the float switches will need to be tested with the alarm controller before being installed permanently.

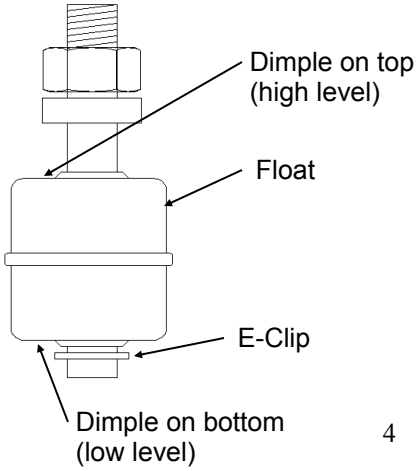
4. If more than one probe is being installed, repeat the probe installation procedure for the remaining probes. When this is done, continue with the alarm controller installation.

Note: For maximum safety, float switches should always be used in the normally closed position. Set according to the diagram at right.

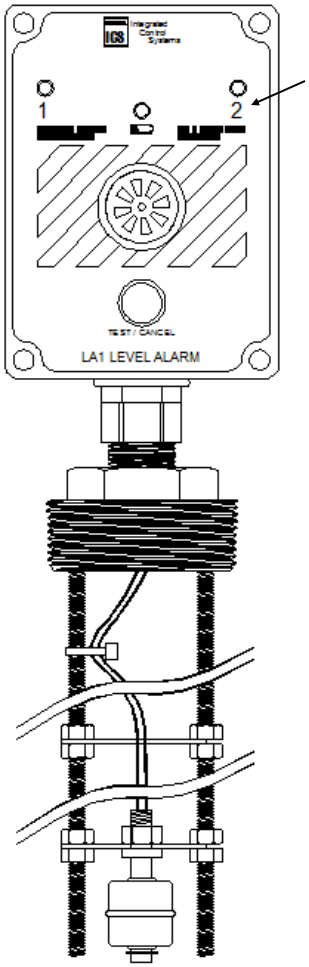
LA1 Probe Float Switch Setting (LOW LEVEL)



LA1 Float Switch Configuration



III. ALARM CONTROLLER INSTALLATION:



Alarm Box mounted to probe

1. The alarm controller may be mounted either directly on top of a probe, or remotely from the probe(s) up to 1000 feet away. The alarm unit is intrinsically safe, so it can be mounted directly onto or close to a fuel tank. The alarm controller should be mounted in a convenient location for the driver filling the tank to operate it and hear the alarm.

2. Determine the best mounting location for your application and install any hardware required prior to mounting the alarm controller.

PROBE TOP MOUNTING:

1. The diagram for probe top mounting is shown at right. Guide the probe wires through the alarm box conduit fitting and screw the box fitting onto the probe. Do not tighten until the probe is mounted onto the tank.

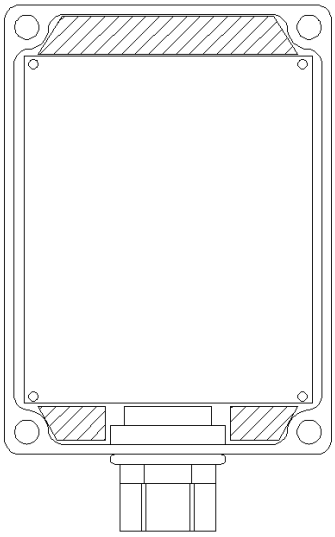
REMOTE MOUNTING:

1. Remove the 4 cover screws from the alarm box. Unplug the ribbon cable connector from the main circuit board and set the cover aside. Remove the main circuit board from the cabinet by removing the 4 screws at the circuit board corners. Removing the board will prevent accidental damage during mounting.

2. Note the areas inside the cabinet above and below the circuit board. These are indicated by the shaded areas in the diagram at lower right. Drill mounting screw holes in these areas only and mount the cabinet in the desired location. Use silicone sealant or sealing washers to prevent water from entering the cabinet. Do not drill any holes or mount any fasteners behind the circuit board. The alarm controller may be up to 1000 ft. from each probe.

3. When the cabinet is securely mounted, reinstall the circuit board with the wire terminals toward the bottom.

4. Use conduit and wire as needed to run the wires from each probe fitting to the fitting at the bottom of the alarm controller. Note that each probe switch has a two wires. These connections are not polarity sensitive. The probes should be wired at this point, but not mounted into the tank yet. If using ICS probes, make sure they are set to the normally closed position. (down = closed for high level, and down = open for low level)



> **WARNING:** *The wiring between the probes and the alarm controller is intrinsically safe. It must contain probe wires only and must not be shared with wires of any other circuits.*

PROBE CONNECTIONS:

1. Make sure that the alarm controller circuit board is mounted and that the ribbon cable from the front panel is connected. The batteries should not be installed yet.

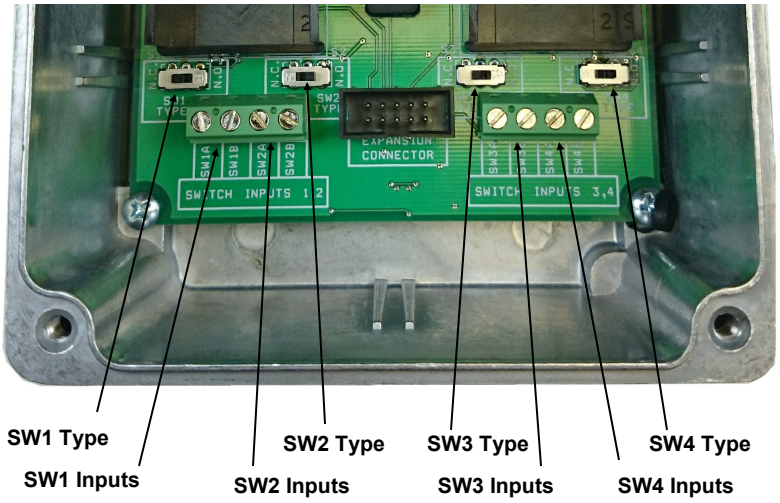
2. Trim and strip the probe wires so that they will fit neatly into the screw terminals at the bottom of the alarm controller board.

3. Connect the probe wires for each channel to the SWxA and SWxB terminals. The input terminals are not polarity sensitive.

4. If you are using Normally closed float switches, set the slide switch for that probe to the N.C. or normally closed position. If using a normally open float switch, set the slide switch for that switch position to N.O. or normally open. Normally closed float switches are preferred as a circuit failure will cause an alarm. All of ICS probes are normally closed.

4. Repeat this process for the remaining channels.

LA1 PROBE WIRING CONNECTIONS (4 Channel unit shown)



IV. POWER UP AND TESTING:

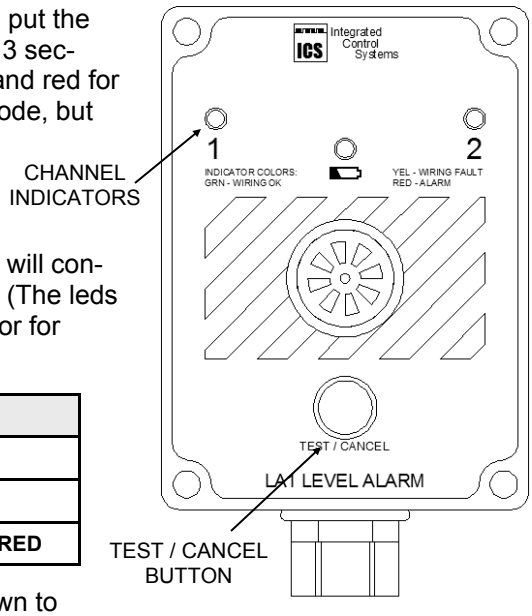
1. Make sure that the float switches of all probes are in their normal positions. (High level switches should be down and Low level switches should be up) Make sure that the low level switch floats have been reversed using the directions on page 4.

2. Install the batteries into the battery holders.
When first installed, the audio alarm may make a fading alarm sound. This is normal.

3. If none of the front panel LEDs are lit, proceed to step 5.

4. If the alarm triggers immediately and remains on, press the TEST / CANCEL button to silence it. Check the LED indicators on the front panel of the LA1. Find any channel LED(s) that are flashing red and check the corresponding float switch(es). The float switch may be in the wrong position or the NC/NO switch may be in the wrong position.

5. Press the TEST / CANCEL button on the alarm controller. This will put the alarm controller into TEST mode. The audio alarm and will sound for 3 seconds. The indicator LEDs on the front panel will flash yellow, green, and red for one second each. The red low battery led will also light during test mode, but this does not mean that the battery is low. Test mode allows the operator to check that all indicators and alarms are working properly, and that the battery charge is OK.



6. When test mode has completed after 3 seconds, the indicator leds will continue to flash once per second to indicate the status of each channel. (The leds flash instead of remaining on to conserve battery power.) The led color for each channel has the following meaning:

LED COLOR	MEANING
GREEN	CIRCUIT READY, NO ALARM
RED	ALARM, CHANNEL TRIGGERED
YELLOW	FLOAT SWITCH WAS TRIGGERED, THEN CLEARED

After several minutes of operation, the alarm controller will power-down to conserve battery power. It will continue to monitor all probe switches however, and will alarm immediately if any switch is triggered.

7. If any channels of the alarm controller will not be used, set the NC/NO switch for that channel to NO. The channel indicator will always display green to indicate channel ready. To disable the LED indicator for channels 2, 3, or 4, locate the 2 pin jumper behind each led on the inside of the alarm controller front panel. Move the corresponding shorting block from 2 pins to 1 pin. The channel can be re-enabled at a later time by reinstalling the shorting block.

8. Test the function of each probe switch by manually moving it to the alarm position (UP for high level switches and DOWN for low level.) After a few seconds, verify that the alarm sounds and that the corresponding channel indicator turns red. Press the TEST / CANCEL button to cancel the alarm. Note that the indicator for that channel will remain red to indicate which channel caused the alarm. Now move the switch back to the non-alarm position. After a few seconds, verify that the LED for that channel changes to yellow. This indicates which channel caused the alarm, but that the switch is back in the non-alarm position.

9. Repeat steps 7 and 8 for every switch of each probe.

10. When all channels of the LA1 have been tested and are functioning properly, install the probes into the tank(s) and tighten. Use Teflon tape or other thread sealer to seal the threads.

11. Press the TEST / CANCEL button on the alarm controller again and make sure that after test mode, each channel shows a green light. The system is now ready for operation.

V. OPERATION:

HIGH LEVEL:

1. Before beginning a fill operation on the tank, the operator should press the TEST / CANCEL button on the LA1 level alarm. Pressing this button will test the alarm, visual annunciator and all indicators for 3 seconds to verify that the batteries are in working condition, and that all indicators of the system are working. If the LA1 does not perform these functions, filling the tank(s) should not be performed until the system is working properly. Replace the batteries if necessary. See the last page of this document for battery information.

2. After the 3 second test mode is complete, the LA1 will flash all channel indicators once per second. The channel indicator for the tank being filled should be green. This indicates that the probe is properly connected and will alarm at the correct level. If any channel is red, then the probe circuit for that channel is in the alarm state and filling of the tank(s) should not continue.

3. The operator will begin filling the tank(s). When the level reaches the height of the high level float switch, the alarm will sound and the visual annunciator will flash. The channel indicator will change to red to indicate which channel is causing the alarm.

4. The operator stops the fill operation and acknowledges the alarm by pressing the TEST / CANCEL button. The channel LED will remain red as long as the probe switch is in the alarm position. If a probe switch triggers, and then releases (i.e. up and back down), the LED will change to yellow to indicate which channel caused the alarm. The yellow indicator will reset back to green after several minutes, when the alarm box goes into sleep mode.

***Note**: If the operator does not press the TEST / CANCEL button prior to filling, the LA1 will still sound the alarm if the level of the tank rises above the high level set point. Pressing the button is recommended however, to test the batteries and the probe circuits before each fill operation.*

LOW LEVEL:

1. Once the LA1 is installed, no action is necessary. At any time during fueling operations, if the level falls below the low level switch, the alarm will sound, the visual annunciator will flash, and the channel indicator for the low level flow switch will display red. Press the TEST / CANCEL button to cancel the alarm.

***Note**: At regular intervals, the TEST / CANCEL button should be pressed on the LA1 to insure that the unit still has battery power and that the probe circuits are intact.*

INTERSTITIAL SPACE:

1. Once the LA1 is installed, no action is necessary. At any time, if the level in the interstitial space rises above the float switch, the alarm will sound, and the channel indicator for the interstitial space float switch will display red. Press the TEST / CANCEL button to cancel the alarm.

***Note**: At regular intervals, the TEST / CANCEL button should be pressed on the LA1 to insure that the unit still has battery power and that the probe circuits are intact.*

LA1 SYSTEM SPECIFICATIONS

Alarm Controller Materials	
Cabinet	Cast Aluminum
Pushbutton	Stainlesss Steel
Overlay	Polycarbonate
Conduit Hub	Zinc
Visual Annunciator	Stainless Steel / Acrylic
Audio Annunciator	ABS Plastic

Probe Materials	
3/4” Conduit Nipple	304 Stainless Steel
3/4” to 2” Pipe Adapter	304 Stainless Steel
1/4-20 Threaded Rod	303 or 18-8 Stainless Steel
1/4-20 Nuts	18-8 Stainless Steel
Float Switch Assembly	304 Stainless Steel
Wire	Teflon

Alarm Controller Specifications	
Channel Indicator Brightness	9300 mcd
Visual Annunciator Brightness	55,800 mcd
Audio Alarm Sound Level	95 dB
Operating Temperature	-20 to 60 C

Probe Specifications	
Float Density	0.536 g/cm³
Maximum Float Pressure	290 psi @ 70F
Probe Operating Temperature	-20 to 100 C
Max. Probe Wire Length	1000 ft.

Alarm Controller Electrical Specification	
Battery Type	9 Volt Lithium
Operating Current Draw	5 to 80 mA typical
Standby Current Draw	< 5µA
Max. Internal Capacitance	19mA
Max. Internal Inductance	10mH
Max. Probe Current	5mA
Max. Probe Voltage	9V

Probe Electrical Specifications	
Max. Probe Voltage	50V
Max. Switching Current	1A
Probe Capacitance	0.15 µF
Probe Inductance	1 nH
Max. Allowable Capacitance per channel (with 1000 ft. wire)	0.06 µF
Max. Allowable Inductance per channel (with 1000 ft. wire)	0.2 mH

As defined in article 501 – Class 1, Division 1, Groups C and D Locations of the National Electric Code, this apparatus and its interconnected components are intrinsically safe. Under normal or defined fault conditions this apparatus and its wiring cannot release sufficient energy to ignite a specific ignitable atmospheric mixture by opening, shorting, or grounding.

LA1 MODEL NUMBERS	
Model Number:	Description:
LA1-AU-2C	LA1, Battery powered, 2 channel
LA1-AU-4C	LA1, Battery powered, 4 channel
LA1-PR-1S-3F	LA1 Probe, single switch, 3 foot length
LA1-PR1-1S-6F	LA1 Probe, single switch, 6 foot length
LA1-PR1-1S-9F	LA1 Probe, single switch, 9 foot length
LA1-PR1-1S-12F	LA1 Probe, single switch, 12 foot length
LA1-PR1-2S-3F	LA1 Probe, double switch, 3 foot length
LA1-PR1-2S-6F	LA1 Probe, double switch, 6 foot length
LA1-PR1-2S-9F	LA1 Probe, double switch, 9 foot length
LA1-PR1-2S-12F	LA1 Probe, double switch, 12 foot length
LA1-PR2	Probe, single switch, Shielded, 12 foot wire
LA1-VCB	AC Power Barrier with 4 external outputs

Integrated Control Systems

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