

Troubleshooting & Servicing

All electric systems can be broken down into 3 subsystems - console, sensors and wiring. If each subsystem is tested in sequence separately, seemingly intractable problems can usually be easily solved.

Most problems are a result of wiring to the wrong points or of water getting into the wiring or sensors. Another cause of many problems is improper or no system grounding. Careful reference to the installation instructions and wiring diagrams and waterproofing all wiring splices will eliminate most of the field problems encountered.

Equipment required:

Voltmeter/Ohmmeter
Potentiometer (1K to 10K, value not critical)
Jumper wire
Small screwdriver

LC 1000 Series Alarms

These alarm consoles respond to an closed connection between Input+ and Input- by actuating the light and horn. A closed connection between Input+ and Input-will turn on the light and horn. The closed connection can be made with a jumper wire.

Jumper positions JP3, 4, 5 and 6 should be set for Normally Closed.

All jumper settings must be the same.

<u>Jumper</u>	<u>Jumper Plug</u>
JP3	A-B
JP4	D-E
JP5	U-V
JP6	X-Y

Output relays will be normally energized, and will shut off on alarm.

Relay Contact states with no alarm

C to N.C.	No Continuity
C to N.O.	Continuity

With no input wiring connected, Input+ to Input- = **+12 VDC**

LS 600ab, LS 600, LS 602 O/W, LS610 Sensors

These sensors are Open/Closed switch sensors. With the float(s) in **Normal** position, the wire pair(s) should have no continuity (**open circuit**). With the float(s) in **Alarm** position, the wire pair(s) should have continuity (**short circuit**).

9-901, 9-902 & 9-903 Sensors

These sensors are active electronic sensors. They cannot be tested by a continuity check. When connected to the appropriate console, and power is applied, the following D.C. voltage readings can serve as a rough guide :

Red to Black = 3.5 VDC 0.3

White to Black = 1.5 VDC 0.5 (in Air)

White to Black = 2.25 VDC to 2.75 VDC (in Hydrocarbon)

White to Black = > 3 VDC (in Water)

LDE & E 700 Series Gauges

1. Shut off power to the gauge.
2. Disconnect the 2-412 probe wiring from the terminal block-.
3. Connect a **potentiometer** (1K to 10K, the value is not critical) to the terminal block in place of the 2-412 sensor. one end of the potentiometer is connected to the terminal marked **R**, and the other end of the potentiometer is connected to the terminal marked **B**. The wiper of the potentiometer is connected to the terminal marked **W**.
4. Turn on power to the gauge.
5. The gauge readings will vary as the position of the potentiometer wiper is changed. The potentiometer can be used to move the gauge readings over the full span of possible volumes.

NOTE: **The readings from the potentiometer should not be used to judge the accuracy of the gauge, as the potentiometer is only an approximation of the tank unit, which is custom made and calibrated for the particular tank.**

Testing the 2-412 In-Tank Gauging Sensor

To test the 2-412 sensor, it must be disconnected from the gauge unit. **Always shut off power to the gauge when connecting or disconnecting the 2-412 sensors, the power cable, and wiring to any other sensor or to the relay outputs.**

All wires of the 2-412 sensor are isolated from the body and housing of the sensor. They **should all measure open circuit** to these points and to the conduits. If any resistance is measured from any of these wires to any of these points, then water has created a leakage path from the sensor or wiring splices. Make sure that all splices are contained in waterproof junction boxes and are potted or sealed to be waterproof.

If the product float has been removed from the tube of the 2-412, make sure that it is replaced facing in the same orientation. The magnet in the float will only work if it is facing in the correct orientation. The interior of the 2-412 is hermetically sealed and no field repairs can be made on it.

Testing the Product Float

Use an ohmmeter to measure the resistance between the Red and the Black wires of the 2-412 sensor. The resistance of the 2-412 is 72.5 per inch of sensing length. If the readings are incorrect, they should be repeated where the 2-412 is joined to the conduit wires. These readings should be made with the conduit wires disconnected from the 2-412 unit.

If the readings are now correct, then there is a problem with the conduit wires. Always make sure that the wires running through the conduit follow the proper color coding. Incorrect readings will result if the color coding is not followed.

With the float at the bottom of travel, the reading between White and Black is 0. With the float at the top of travel, the reading between White and Red is 0. The reading between the Black and White wires will increase as the float moves up, and will be a ratio of the percentage of float travel to overall sensing length.

<u>Model</u>	<u>Approx. Tank Dia,</u>	<u>Sensing Length</u>	<u>Resistance</u>	<u>Ungaugable</u>
2-412	41	41.125"	2980	6.875"
2-412	61	65.125"	4720	6.875"
2-412	81	85.125"	6170	6.875"
2-412	10	113.125"	8200	6.875"
2-412	121	131.125"	9500	6.875"

Example :

Sensing length = 85.125".

overall resistance = $(72.5 * 85.125) = 6170$ (Red to Black).

Float travel from bottom of sensor 20".

Black to White resistance = $(72.5 - 20) = 1450$.

Red to White resistance = $(72.5 * 65.125) = 4720$.

Testing the Water Float

The Orange and Green wires are for the water detection float. They are connected to the ends of a reed switch that will measure open circuit or short circuit depending on the water float position.

Water Float **Up** (activated)

Orange to Green = **closed circuit**.

Water Float **Down** :(not activated)

Orange to Green = **open circuit**.

Common Symptoms and Solutions

Symptom : Display blank and no lights are on.

General Make sure that 120 VAC power is connected to the power connection terminal block and that the power is turned on. With power off, check the fuse to make sure that it is not blown. If the fuse is blown, replace only with the proper size fuse.

LDE 700, LDE 9000 series : There should be +5 VDC open circuit (with no wires attached) between TB2 position 1 and position 3.

LDE 740 : There should be +5 VDC open circuit (with no wires attached) between TB4 position 1 and position 3.

LC 1000 : There should be +12 VDC open circuit (with no wires attached) between TB1 position 1 and position 2.

Symptom : Display flashes - LDE 700, 740 series

LDE& E 700 series : Move the switch labelled S2 on the circuit board to the **NORMAL** position (left).

LDE 740 : Move the theft switch labelled S1 on the display circuit board to the **NORMAL** position.

Symptom; system always displays the minimum or maximum gaugeable setting no matter how much product is in the tank.

Symptom System displays Error Code 9 (volume measurement underrange).

Symptom : System displays Error Code 7 (volume measurement overrange) or a reading greater than full capacity.

Make sure that all wires are connected properly from the 2-412 sensor to the tank input (TB2). Make sure that there are no shorted or open wires. Make sure that there is no water in a wire splice or in a sensor housing. Make sure that the gauge calibrations are set properly.

Symptom : Switch (Aux.) light is always on, or goes on when it shouldn't.

Make sure that Switch (Aux.) input is working properly and that the switch input is programmed and(jumper settings)are selected for the proper state (LC 1000 only). Make sure that the switch is open in its none alarm state.

Symptom : Leak detection channel gives false water alarm.

Check to make sure that the sensor is in contact only with Air. Make sure that the ground wire (**B**) and the sensor input wire (**W**) have continuity from the sensor to the alarm console. Make sure that the sensor input wire (**W**) is not shorted to power. Place system in **Calibrate** mode with the sensor clean and in Air.

Symptom : Leak detection channel gives false alarms.

Check to make sure that the sensor is in contact only with Air. Pull sensor from installation and make sure that it is not fouled or clogged. If sensor is fouled or clogged, clean with soap and water solution or a mild solvent and dry and unclog with compressed air. Place system in Calibrate mode with the sensor in air. Check all wiring for continuity, proper connections and make sure that there are no shorts.

When the sensor has been immersed in water it takes a period of time for the sensor to drain completely and dry. During this time the sensor will oscillate between water/ hydrocarbon and hydrocarbon/air readings. This may cause the hydrocarbon or water alarm to latch into the system memory. This may be cleared when the sensor is dry and in air by calibrating the leak detection sensor.

SYMPTOM : Leak detection channel shows no lights.

This condition indicates that when the leak sensors were calibrated either no sensor was connected to that input or a defective or miswired sensor was connected to that input. If a new sensor is connected to the input, use the keypad or RS-232 command for gauges or the dip switch for 9000 series panels to calibrate the leak detection channels. If a leak input still shows no lights, the connected sensor is probably wired incorrectly or is defective.

Symptom : Leak detection channel shows all 3 lights on (LDE 740).

This condition indicates that when the leak sensor was calibrated it was working correctly and either has now failed, or the wiring has become defective. Use the keypad or RS-232 command to calibrate the leak detection channels. If that leak input now shows no lights, the connected sensor is probably wired incorrectly or is defective.

LDE 9001, 9002, 9004 Series Panels

Test Light Indications

Air	Water	Hydrocarbon	Meaning
ON	ON	ON	Calibrations Running
ON	ON	OFF	Memory Failure
OFF	OFF	OFF	Sensor Failure
OFF	ON	OFF	Water Alarm

SYMPTOM : No lights are on for any sensor and system does not respond to pressing TEST button.

Make sure that 120 VAC power is connected to the power connection terminal block and that the power is turned on. With power off, check the fuse labeled F5 to make sure that it is not blown. If the fuse is blown, replace only with a 1/4 Amp., 3AG Slo-Blo fuse.

SYMPTOM : No lights are on for a sensor, system responds to pressing TEST button.

Check to make sure that all sensor wires are connected to the proper terminal block contacts. Make sure that the conduit wires in the run from the sensor to the alarm console have continuity and are not shorted to each other. A sensor that has the power wire **(R)** or input wire **(W)**

disconnected or shorted to ground will show the sensor failure indication. Make sure that the metal conduits and the sensor housing do not have water in them.

Symptom : More than 1 light is on for a sensor, system responds to pressing TEST button.

Make sure that dip switch position 7 is in the "OFF" position to shut off calibration mode.

Symptom : More than 1 light is on for a sensor, system responds to pressing TEST button.

Clear the alarm memory condition by placing the system in calibration mode, or by pressing TEST and RESET buttons at the same time.

Symptom : More than 1 light is on for a sensor, system does not respond to pressing TEST button.

Call factory for servicing.

- Verify that the power supply terminals are correctly wired.
- Verify that system power is properly wired to a separate, dedicated circuit breaker.
- Verify that all sensors have been properly wired with color-coded or marked 18 AWG wires and that the proper color-coding or marking has been maintained throughout the wiring runs.
- Verify that all wiring splices are waterproof. An epoxy splice kit or silicon waterproofing should be used for all wiring splices.
- Securely clamp down the intrinsic safety enclosure door.

System Defaults

The LDE 700

Series gauges have default settings that apply when the system is shipped from the factory, and when a cold reset command has been performed. If these settings are suitable for the application, no field programming of these functions has to be done.

System Settings:

Automatic Inventory Printouts 1,2,3 Disabled

Tank Settings:

High (overflow) Level Alarm 90% of tank capacity

Low Level Alarm 20% of tank capacity

Theft Threshold 1% volume change

Offset Adjustment 0.00 Inches

Product Code 00

Tank Name Product

Switch Input Settings:

Switch State Normally Open (selectable)

Relays:

Relay State Normally Non Energized

Automatic Shutoff Disabled (1 to 15 minutes)

Relay Activation Delay Disabled (5 minutes)

Relay Actuations See Chart Below

Horn:

Horn State Enabled

Horn Repeat Delay 10 Minutes (fixed)

Automatic Shutoff Disabled (1 to 7 minutes)

Horn Actuations See Chart Below

RS-232 Port:

Baud Rate 300

Word Length 7 Bit

Parity Even

Stop Bits 1 Bit

Autoanswer Ring Count 0 Rings (Disabled)

Code	Relay	Horn
1	High Alarm	1
2	Low Alarm	2
3	S1(E-700)or S1&S2 Alarm(LDE700)	3
4	S2(E-700)or(LDE 700)Hydrocarbon Leak Alarm	4
9	Theft Alarm	4

LDE 740 Series Panels

System Settings:

Header Lines 1,2,3	Blank
Automatic Inventory Printouts 1,2,3	Disabled

Tank Settings:

High (overflow) Level Alarm	90% of tank capacity
Critical Level Alarm High-High	95% of tank capacity
Low Level Alarm	20% of tank capacity
Delivery Threshold	50 Gallons
Theft Threshold	50 Gallons
Offset Adjustment	0.00 Inches
Product Code	00
Tank Name	Product

Switch Input Settings:

Switch State	Normally Open (selectable)
Standby Generator Operation	Disabled

Relays:

Relay State	Normally Non Energized
Automatic Shutoff	Disabled (1 to 15 minutes)
Relay Activation Delay	Disabled (1 to 5 minutes)
Remote Reset	Disabled
Latching Relay Operation	Disabled
Relay Actuations	See Chart Below

Horn:

Horn State	Enabled
Horn Repeat Delay	10 Minutes (1 to 10 minutes)
Automatic Shutoff	Disabled (1 to 7 minutes)
Horn Actuations	See Chart Below

RS-232 Port:

Baud Rate	2400
Word Length	7 Bit
Parity	Even
Stop Bits	1 Bit
Port Mode	Local Port, no echo

RS-232 Port when in modem mode:

Autoanswer Ring Count	2 Rings (Enabled)
Dialing Mode	Tone
Alarm Autodial	Disabled
Automatic Inventory Autodial 1,2,3	Disabled
Phone Number	Blank

Code	Condition	Relay	Horn
01	Low Alarm Tank 1	5	+
02	Low Alarm Tank 2	5	+
03	Low Alarm Tank 3	5	+
04	Low Alarm Tank 4	5	+
05	High Alarm Tank 1	1	+
06	High Alarm Tank 2	2	+
07	High Alarm Tank 3	3	+
08	High Alarm Tank 4	4	+
09	Critical Alarm Tank 1	8	+
10	Critical Alarm Tank 2	8	+
11	Critical Alarm Tank 3	8	+
12	Critical Alarm Tank 4	8	+
13	High Water Tank 1	8	+
14	High Water Tank 2	8	+
15	High Water Tank 3	8	+
16	High Water Tank 4	8	+
17	Aux/Switch 1 Actuation	6	+
18	Aux/Switch 2 Actuation	6	+
19	Aux/Switch 3 Actuation	6	+
20	Aux/Switch 4 Actuation	6	+
21	Aux/Switch 5 Actuation	6	+
22	Aux/Switch 6 Actuation	6	+
23	Aux/Switch 7 Actuation	6	+
24	Aux/Switch 8 Actuation	6	+
25	Oil Leak Channel 1	7	+
26	Oil Leak Channel 2	7	+
27	Oil Leak Channel 3	7	+
28	Oil Leak Channel 4	7	+
29	Oil Leak Channel 5	7	+
30	Oil Leak Channel 6	7	+
31	Oil Leak Channel 7	7	+
32	Oil Leak Channel 8	7	+
33	Water Leak Channel 1	8	
34	Water Leak Channel 2	8	
35	Water Leak Channel 3	8	
36	Water Leak Channel 4	8	
37	Water Leak Channel 5	8	
38	Water Leak Channel 6	8	
39	Water Leak Channel 7	8	
40	Water Leak Channel 8	8	
41	Theft Tank 1	8	
42	Theft Tank 2	8	
43	Theft Tank 3	8	
44	Theft Tank 4	8	
45	Diagnostic Failure	8	

LDE 9001, 9002,9004 Series Panels

Configuration Dip Switch (SI on alarm board)

Switch	Function	Meaning
1	Horn on water for sensor 1	OFF, ON
2	Horn on water for sensor 2	OFF, ON
3	Relay on water for sensor 1	OFF, ON
4	Relay on water for sensor 2	OFF, ON
5	Automatic horn reset select 1	See Chart Below For Times.
6	Automatic horn reset select 2	
7	Calibrate mode select	OFF=Run, ON=Calibrate
8	Number of sensors	OFF=L Sensor, ON=2 Sensors

Switch 6	Switch 5	Setting
OFF	OFF	time delay disabled
OFF	ON	1 minute delay
ON	OFF	3 minute delay
ON	ON	5 minute delay

LDE & E 700, LDE 740 Series Panels

Keypad Error Codes

0	Print Buffer Overflow
1	Unimplemented Command
2	Clock has Lost Time (battery failure)
3	Range Error
4	RAM (memory) Error
5	Keypad Buffer Overflow
6	Syntax Error
7	Probe (Volume) Measurement Overage
8	Cold Reset
9	Probe (Volume) Measurement Underrange
10	Clock Timeout (box in lower part of display)

RS-232 Connector Pinouts

DB-25 Connector pin	Signal	Direction
1	Protective Ground	-----
2	TxD	to modem
3	RxD	to gauge
4	RTS	to modem
5	CTS	to gauge
6	DSR	to gauge
7	Signal Ground	-----
8	DCD	to gauge
20	DTR	to modem
22	RING	to gauge

Note DTR is actively pulled to a true state. If DTR is not used, it may be left unconnected. DSR, DCD and RING are ignored by the LDE 740.

RTS/CTS are used as hardware handshaking signals.

TxD	Transmitted data
RxD	Received data
RTS	Request to Send
CTS	Clear to Send
DTR	Data Terminal Ready
DSR	Data Set Ready
DCD	Data Carrier Detected
RING	Ring Indicator

Null modem cables at a minimum will cross wires for TxD/RxD and RTS/CTS. Some communications software will require also crossing the DTR wire to the DSR and/or the DCD wire(s). RING may also have to be terminated. See your communications software for exact requirements. Communications using a null modem cable should be set as Direct Connect in the communications software.

In modem port mode, the LDE 740 can match its baud rate to the negotiated modem connection baud rate. This is known as adaptive baud rate equalization. When the modem is disconnected, the baud rate will return to its previously programmed speed. RS-232 Port setups that are printed or displayed will show the programmed baud rate, not the negotiated baud rate.

When automatic dialouts are enabled in modem port mode, the LDE 740 will attempt to call the stored phone number every 10 minutes for 1 hour until a connection is made. If a connection to the stored phone number cannot be completed in 1 hour, the dialout attempt will be aborted.

When a connection to the stored phone number is established, the LDE 740 will stay on-line so that further interrogation of the gauge may be performed. If no communication with the remote system is received for 2 minutes, the modem is disconnected, and the phone is hung up. The LDE 740 will then return to its previously programmed baud rate.

If a remote system calls the LDE 740, the gauge will stay on-line until no communication with the remote system is received for 5 minutes. The modem is then disconnected, and the phone is hung up. The LDE 740 will then return to its previously programmed baud rate.

Maintenance

The time between maintenance periods is a variable that will depend upon the environment in which the sensors and system console are operating. The console should be tested at least every six months by using the keypad self-diagnostic commands, and the accuracy of product level measurement verified by comparison to a dipstick measurement.

Leak detection sensors should be visually inspected for fouling or clogging at least once a year. A fouled or clogged leak sensor can give false alarms. If a leak sensor is fouled or clogged, it should be cleaned with soap and water or a mild solvent, and unclogged with compressed air. It may be air-dried or dried with a hair dryer. It is important that the sensor be completely dry before reinstallation. After visual inspection, the leak sensors should be reinstalled, and recalibrated.

If an actual leak occurs, after corrective action is taken, the leak sensors should be cleaned and inspected and recalibrated before reinstallation.

General Installation Checklist

Do not apply power to the unit until its installation has been checked and found to be in accordance with the instructions in this manual; the National Electrical Code; federal, state and local codes; and other applicable safety codes.

1. Check to be sure that the sensor wires are contained in a dedicated, separate wiring conduit. No other wiring may be in this conduit including other manufacturer's intrinsically safe wiring.
2. verify that all conduits enter the alarm console through the proper conduit openings on the bottom of the console. No conduit entries may be

from the top or sides of the console.

3. Verify that (2) 12 AWG copper wires have been connected between TBI (labeled Earth Ground) and a good earth ground. These ground wires should make a direct run to the ground point. They should not be jumped or spliced to other grounds or the A.C. ground, as that can cause ground loops. It is important that no relay, motor, pump or other wiring that controls inductive equipment run with the ground wires. Voltage spikes caused by inductive equipment turning on or off can couple into the ground, which can act as an antenna carrying these spikes into the computer system.