HELIUM CONCENTRATION TESTER

OPERATIONS AND MAINTENANCE MANUAL

LACO TECHNOLOGIES

Manual Name: LHCT03D & LHCT03D-R Operations and Maintenance Manual
Product Group: Helium Concentration Tester
Manual Rev. Number: SMT-07-1021 D1

LACO TECHNOLOGIES

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1. About This Manual

The purpose of this manual is to provide instructions for the installation, operation, and troubleshooting of the **LHCT03D/LHCT03D-R Helium Concentration Tester.** The manual contents will be provided in hardcopy format and available to download at www.lacotech.com. This manual applies to software releases 2.00 or greater.

1.1. Contact Information

For technical assistance or to order replacement parts call, fax or email from the information listed below.

LACO Technologies, Inc.	Phone: (800) 465-1004
3085 West Directors Row	Phone: (801) 486-1004
Salt Lake City, Utah 84104	FAX: (801) 486-1007
www.lacotech.com	info@lacotech.com

Returned equipment will not be accepted without prior authorization. Prior to shipping, please call for a returned material authorization (RMA) number. LACO Technologies reserves the right to cancel the warranty if the controller is disassembled without authorization.

1.2. Warning Messages

See below for the range of warning messages used in this manual. The text in these messages indicates the severity range of each warning message.

1.2.1. Safety & Warning Messages

DANGER: Imminent threat of danger resulting in death or severe injuries. Dangerous situation potentially resulting in death or severe injuries.

WARNING: Dangerous situation resulting in major injuries. Dangerous situation resulting in damage to property or the environment.

CAUTION: Dangerous situation resulting in minor injuries.

NOTICE: Dangerous situation resulting in damage to property or the environment.

2. Safety

2.1. Intended Use

The Helium Concentration Tester leak test system is designed to measure helium concentration in conjunction with a Helium Leak Detector (HLD).

- Helium Concentration Tester may only be used with Helium gas.
- You must install, operate, and service this device only in compliance with these operating instructions.
- Adhere to the storage and usage recommendations.

2.2. Owners Requirements

2.2.1. Safe Operations

- Operate the device only when it is in technically perfect working order.
- Operate the device only as specified in a safety-conscious and hazard-conscious manner and in compliance with these operating instructions.
- Comply with the following regulations and monitor their compliance.
    - Intended use.
    - Safety and accident prevention regulations.
    - International, national, and local standards and guidelines.
    - Additional provisions and regulations that are specific to the unit.

Safety Conscious

- Use only original parts or parts approved by the manufacturer.
- Keep these operating instructions available at the equipment location.

2.2.2. Personal Qualifications

- Allow only qualified service technicians to work with and on the device. The qualified service technicians must have received training on the device.
- Allow personnel in training to work with and on the device only under the supervision of trained qualified service technicians.
- Make sure that the authorized personnel have read and understood the operating instructions and all other applicable documents, especially the information regarding safety, maintenance, and repairs before starting work.
- Never perform maintenance on the system with the power on.

2.3. Operator Requirements

- Read, observe, and follow the information in these operating instructions and the working instructions created by the owner, especially the safety instructions and warnings.
- Carry out any work based on the complete operating instructions.
- If you have any questions regarding operation or maintenance that you cannot find answers to in these instructions, then please contact LACO customer service.
- When using the equipment, be sure to follow the safety procedures outlined by your facility. These safety procedures should cover the two primary types of hazard training:
    1. Equipment hazards.
    2. Facility-related hazards.
- Never override or bypass any hardware or software interlocks.
- All safeguard devices must be in place when equipment is in operation. Operators, set-up operators, helpers or installation personnel should not alter, remove, or disable safety equipment.
- The Helium Concentration Tester must be operated according to the specification in this manual, otherwise the protective measures may be impaired.

2.4. Dangers

The device was built according to recognized safety regulations. Nevertheless, improper use or maintenance can result in danger to life and limb of the operator or other persons and damage the device and other property. In order to prevent safety issues, follow the items listed below.

- Use the equipment only as intended (Section 2.1)
- Only authorized and trained personnel should use the equipment. (Section 2.2, 2.3, 2.4)
- Follow all safety labels (Section 2.6)
- Follow all safety procedures when servicing equipment as outlined in section 2.7.

Below are summarized potential risks or hazards to service or operator personnel.

2.4.1. Dangers from Electrical Power

- Considerable voltages arise inside the device. Touching parts where electrical voltage is applied can result in death.
- Disconnect the device from the electrical power supply prior to any installation and maintenance work. Make sure that the electrical power supply is reconnected with authorization. Testing live parts results in danger to life.
- The device contains electrical components that can be damaged from high electrical voltage.
- Before connecting the device to the power supply, make sure that the supply voltage specified on the device is the same as the local power supply.
- Keep all liquids away from electrical panels and connections.

2.5. Safety Labeling

2.5.1. Hazardous Voltages

Identify enclosures with voltages over 24VDC that should be serviced only with the power disconnected.

2.6. Equipment Safety Practices

2.6.1. Process or System Faults

Process or System faults are monitored and controlled by the logic controller (PLC). For more information on Fault troubleshooting see section 7. When a fault occurs, the system stops, and the screen indicates the specific fault reason. Once the fault is fixed the system will auto recover to the system status state “ready to test”.

⚠CAUTION

Process or system faults do not remove hazardous voltage from the system. Only authorized, qualified, trained personnel should service this equipment.

3. Scope of Delivery, Transport, and Storage

3.1. Shipping items

- Helium Concentration Tester
- Helium Concentration Tester hardcopy manual
- Concentration Tester Sniffer probe, Sample syringe and spare puncture gasket.
- DB9 serial (RS-232) cable
- DB9 MxF cable
- DSUB Gender changer, FxF
- 3M RJ-45 ethernet cable
- (2) 5 AMP fuse
- 2 AMP fuse
- KF25 center ring
- KF25 wing nut clamp
- USB drive with PDF copy of manual
- Power cord

3.2. Transport & Location

The Helium Concentration Tester controller will be transported in a shipping box with packaging. Remove the Helium Concentration Tester from the box and inspect system for any signs of damage (dented panels, paint scratches, etc.). Any damage to the system should be reported to the carrier immediately. Located the unit with easy access to the required utilities (see section 5).

3.3. Storage and Usage conditions

Store and operate the Helium Concentration Tester per the table located in section 4.3.1

3.4. Decommissioning

The system can be disposed of by the user or sent to LACO Technologies. Please comply with environmental and safety regulations of your country when disposing of the device. The device is made of recyclable materials. This option may be used to avoid waste and protect the environment.

If a Helium Concentration Tester system needs to be sent back to LACO, contact LACO to arrange shipment. Ensure the systems if free from all harmful substances or contaminants, such as radiation, toxins, caustic materials, or contamination.

4. Equipment Description

4.1. Function of Equipment

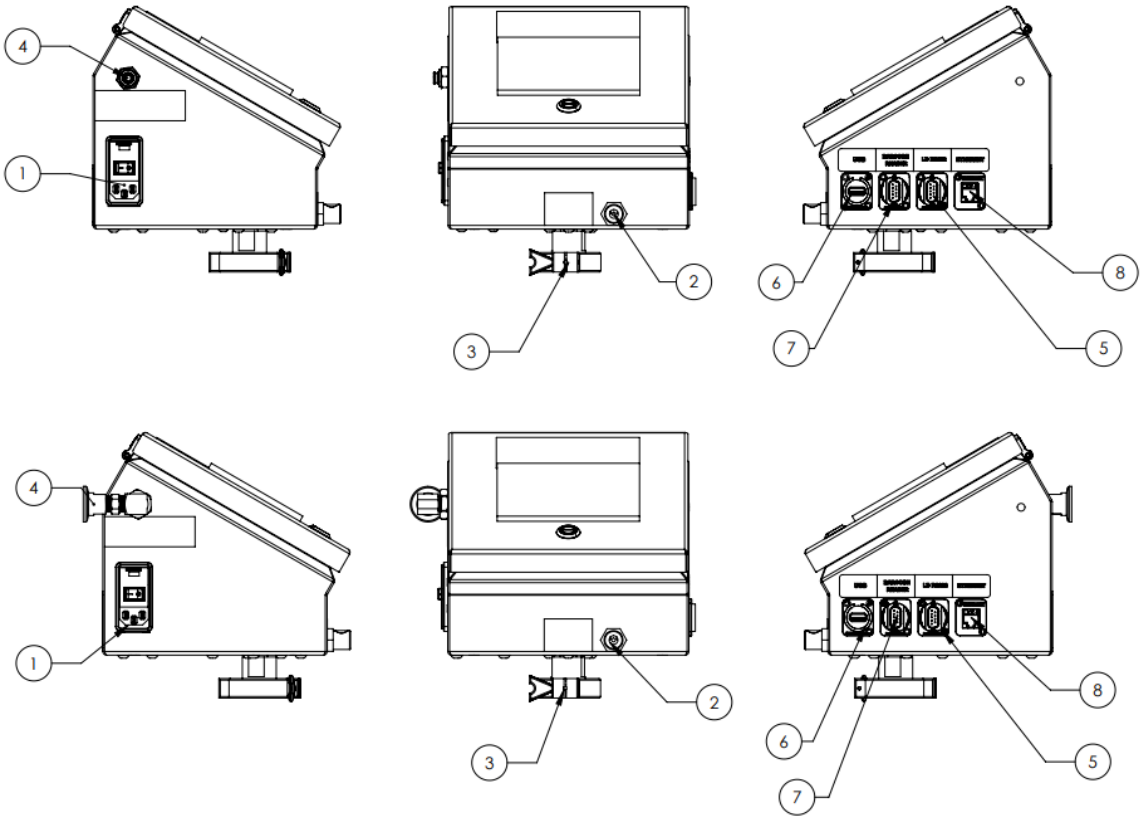
The Helium Concentration Tester is designed to measure Helium gas concentration in conjunction with a Helium leak detector (HLD). See section 4.3.5 for a list of supported leak detectors. There are two versions of LACO's Helium Concentration Tester.

1. LHCT03D – Comes with internal Diaphragm pump.
2. LHCT03D-R – Comes with external KF-16 vacuum connection for user to connect to their own vacuum pump. User to supply their own vacuum hose. Two-stage rotary vane pumps are recommended.

For applications requiring frequent testing and/or fast response times, the "-R" version is recommended.

4.2. Equipment Connections & Diagram

ID	Equipment Feature	Std Version	-R Version
1	Main electrical power entry module w/ fuse drawer	IEC C-13	IEC C-13
2	Gas Sniffer port	Staubli QD	Staubli QD
3	Leak Detector connection port	KF 25	KF 25
4	Gas exhaust/ Pump port	¼" tube OD	KF 16
5	System RS-232 port	DB9 Male	DB9 Male
6	USB port	USB 2.0	USB 2.0
7	Barcode RS-232 port	DB9 Male	DB9 Male
8	Ethernet	RJ45	RJ45



Leave the gas exhaust port open and do not connect any additional tubing or devices.

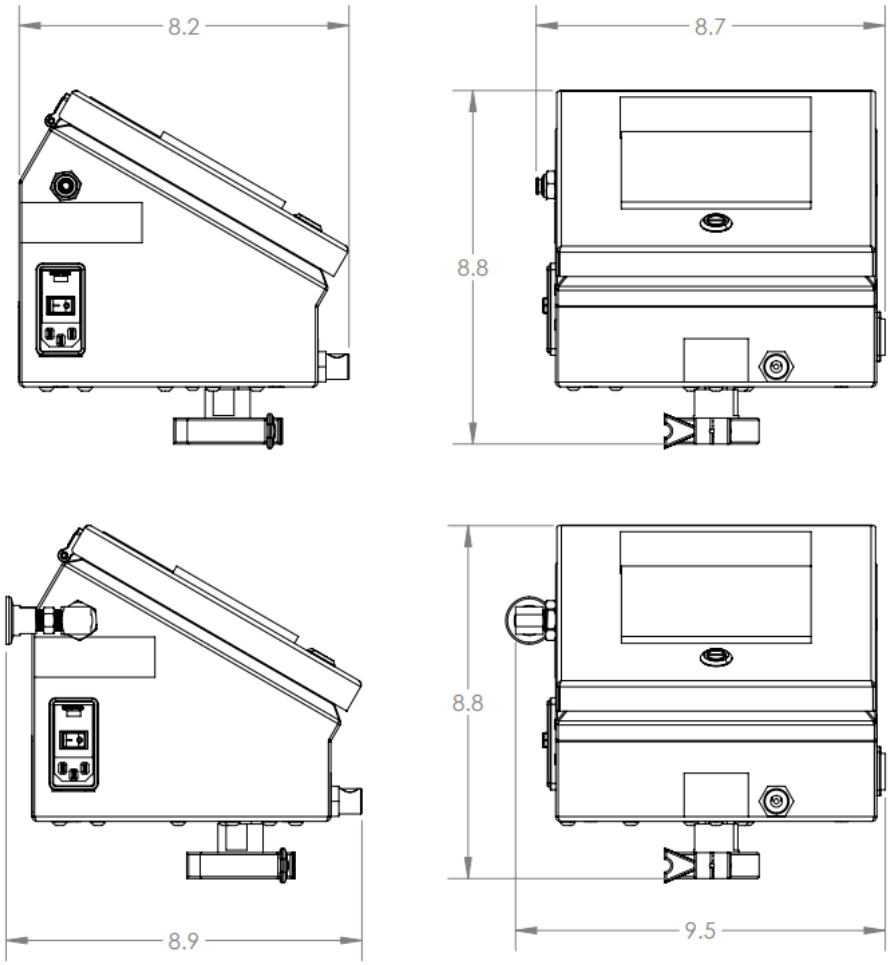
4.3. Technical Data Tables

4.3.1. Storage and Usage Table

Storage and Usage Specifications Table	
Storage Temperature	10 °C to 55 °C (14 °F to 131 °F)
Operation Temperature	10 °C to 35 °C (14 °F to 95 °F)
Max. relative humidity up to 31 °C (88 °F)	80%
Max. relative humidity from 31 °C to 55 °C (88 °F to 95 °F)	Linearly decreasing from 80% to 50%
Use	Indoors only
Max. altitude above sea level	2000 m a.s.l
Noise level	< 70 dB (A) (acc. to IEC standard)
Pollution	II (According to IEC 61010 / Part 1: "Usually, only non-conducting contamination may occur. However, temporary conductivity caused by condensation is permissible at times.")

4.3.2. Mechanical Data Table

Feature	Standard Version Mechanical Specs	-R Version Mechanical Specs
System size	8.8” H x 8.7” W x 8.2” D	8.8” H x 9.5” W x 8.9” D
Weight	13 lbs.	13 lbs.
Max acceleration during operation	1G (horizontal)	1G (horizontal)



4.3.3. Electrical Requirements

Depending on the Helium Concentration Tester configuration the electrical requirements will fall into one of the two groups listed below.

Electrical Service Requirement	Main Power Cable Requirements
120 V~, 50/60 Hz, 1~, 5 Amp Max	IEC C13, 16 AWG, 3 cond.
208-240 V~, 50/60 Hz, 1~, 5 Amp Max	IEC C13, 16 AWG, 3 cond.

Feature	Specifications
Overall IP rating	1
Enclosure Nema rating	1

4.3.4. Gas Connection Requirements

Helium that is sampled in the gas sniffer must be only a maximum of 5 PSIG.

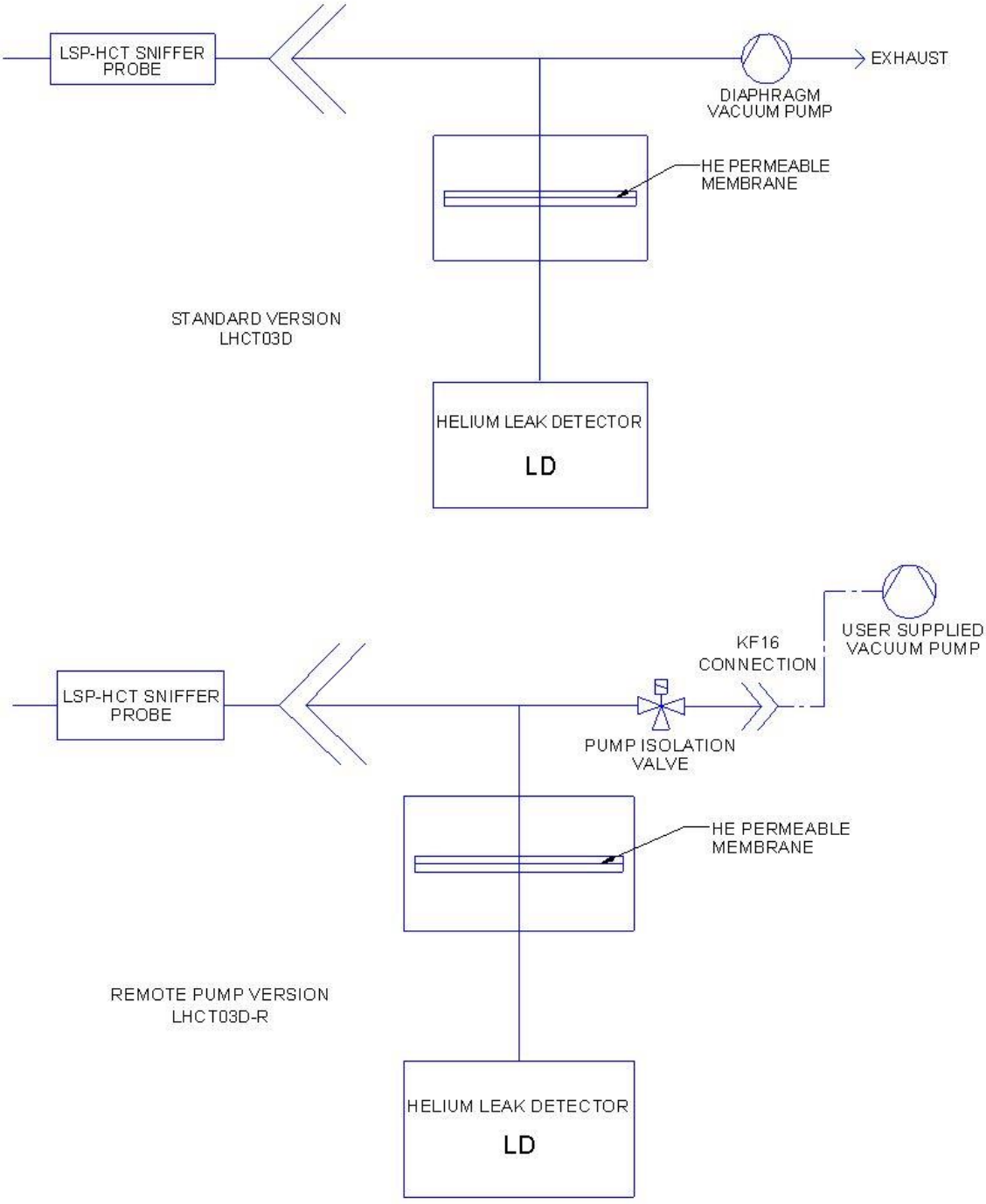
4.3.5. Test Performance Specifications

Feature	Performance Specifications
Supported Leak Detectors	LACO TITANTEST, Inficon LDS-3000 or LDS-2010, Alcatel 180T or 182T
Detectable Gases	Helium (He)
Startup Time	Depends on Leak Detector startup time
Accuracy	5% of full scale
Response Time	Less than 5 seconds (typical)
Measurement Range	1% to 100% Helium
Flow	120 sccm

4.3.6. Software and Communication Features

Feature	Specifications
Control System	PLC controller with 4.3” color touchscreen
Communication	Ethernet, RS-232 to HLD and USB (for data logging)

4.4. Equipment Schematics



4.5. Equipment Testing Process

Before shipping a Helium Concentration Tester, the following test and checks are performed.

- System overall functionality (software and mechanical) is tested.
- System calibrated to full scale.
- System is calibrated to customers desired % Helium concentration. If no concentration is specified, LACO will calibrate to 10%.

4.6. Accessories

PART NUMBER	DESCRIPTION
TV118566	Barcode Reader assembly
LVFRCN40XN25S	REDUCER, CONICAL, NW40XNW25SS
LVFNN25X3.15S	NIPPLE, NW25, 3.15” LONG SS
TVC-###-#	TITAN VERSA Compact leak detector
TVT-###-#	TITAN VERSA Tower leak detector
TVTD-###-#	TITAN VERSA Tower Dry leak detector
TVL-###-#	TITAN VERSA Horizontal leak detector
TVLD-###-#	TITAN VERSA Horizontal Dry leak detector

5. Installation Procedures

⚠CAUTION

This product can only be used with a helium leak detector. The following brands of leak detectors are supported with this product.

- TitanTest – Laco
- Alcatel Leak Detectors (182T, 380, etc.)
- Inficon and Leybold HLD's (LDS-3000,)

5.1. Machine Connections

5.1.1. Main System Power

The main electrical cord provided uses the specifications outlined in section 4.3. the cable has a North American rated male Nema 5-15 connector. For voltages over 130 VAC or for installations outside North America the male Nema 5-15 connector must be removed and either the power cord be hardwired or wired with an appropriate pule into the desired 240 VAC max power source.

⚠CAUTION

Depending on installation and routing of supply lines, a trip hazard may be created. It is the responsibility of the facility installation personnel to eliminate or minimize all trip hazards or identify such hazards with visual warning signs.

5.1.2. USB port

A USB thumb drive can be connected to the USB port. This can be used for downloading csv files or for updating the software.

5.1.3. Barcode Serial port

A Honeywell Xenon 1900 barcode reader can be connected to the DB9 port to assist in entering test ID data. The reader can be purchased from LACO by ordering part number LT-BC. This reader can read both 1D and 2D bar codes. The barcode reader must be configured to default settings of 115200 baud.

5.1.4. Ethernet port

The user can remote control and/or monitor the LHCT by connecting a PC or PLC to the ethernet port. See section 9 for more details.

5.1.5. Leak Detector RS-232

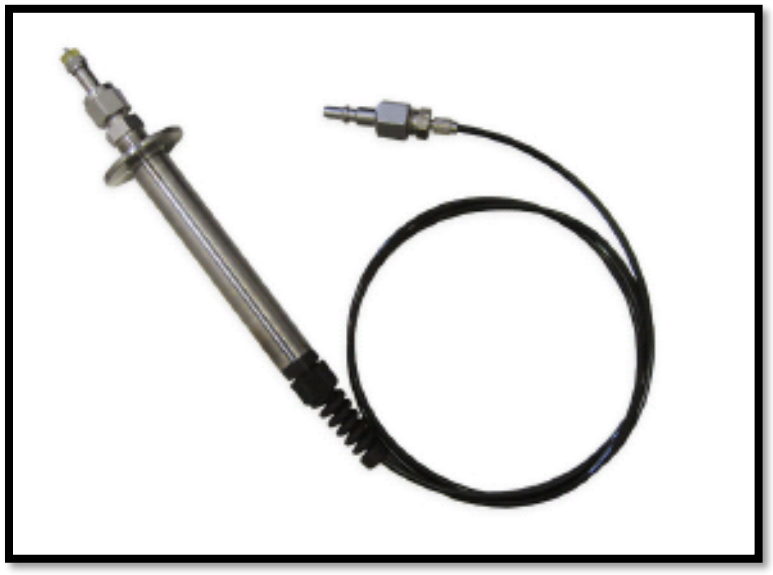
Connect provided DB9 serial cable from the HCT “LD RS-232” port to your Leak Detector per the table below. Inficon/ Leybold Leak Detectors will require a M/F null modem DB9 cable (TV5946). Alcatel/ Pfeiffer Leak Detectors will require a M/F DB9 straight cable (LMSA0338). These items are provided in the documentation and spares bag.

Using your Leak Detector manual, verify your Leak Detector serial settings are set per the table below.

Leak Detector brand	Serial Settings
TITANTEST, Inficon, Leybold	Settings: 19200 baud, 8, N, 1 Method: Ascii
Alcatel, Pfeiffer	Settings: 9600, 8, N, 1* *these are typically default

5.1.6. Helium Sniffer Probe

The sniffer probe (P/N LSP-HCT-5) must be fully inserted into the quick disconnect connector on the front of the LHCT03D/ LHCT03D-R.



5.2. Machine Start-Up

NOTICE

Before starting or stopping the system, it is important to become familiar with operation procedures. Only trained, qualified, authorized, personnel should operate this system.

Perform the following sequence of events in the order listed for electrical re-energization of the tool:

1. Ensure that all hand tools are removed from the equipment and that is ready for start-up.
2. Notify personnel in the area that you are going to start-up the equipment.
3. Turn the power entry module to the “ON” position and turn on the HLD.
4. After the HLD has gone through its power up sequence the concentration tester will communicate serially with the LHCT03D/ LHCT03D-R. ensure that the leak detector in on for at least 15 minutes before running test with the Helium Concentration Tester.

5.3. Machine Shutdown

Perform the following sequence of events in the order listed for electrical energy isolation of the tool:

1. Notify personnel in the area that you are going to shut down the equipment.
2. Take the leak detector out of cycle and turn it off.
3. Turn the power entry module switch to the “OFF” position.

6. Operating Procedures

6.1. Switching on and off the device

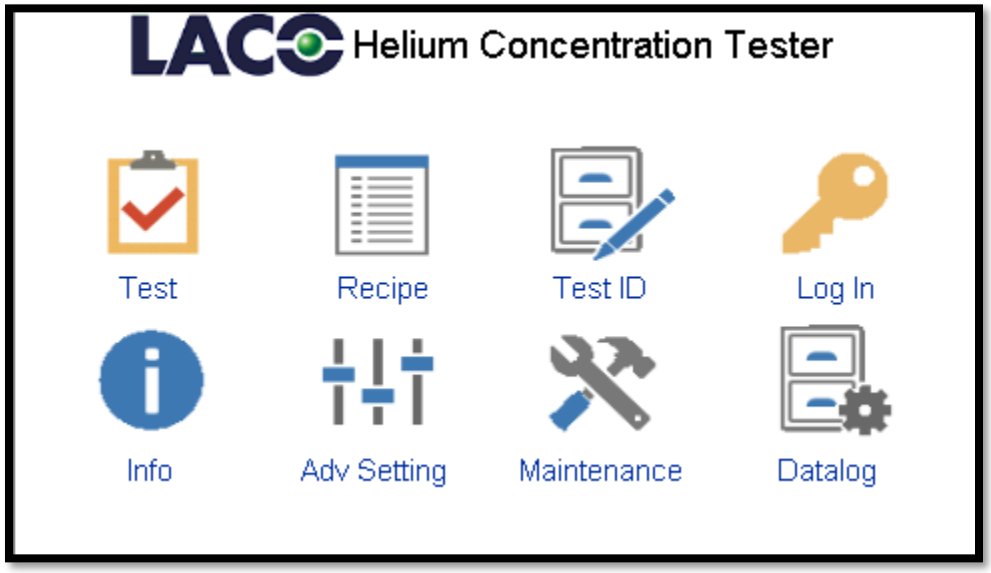
Refer to section 5.2 to start the device and section 5.3 to turn off the device.

6.2. Software screens and Parameter Settings

6.2.1. Info Screen

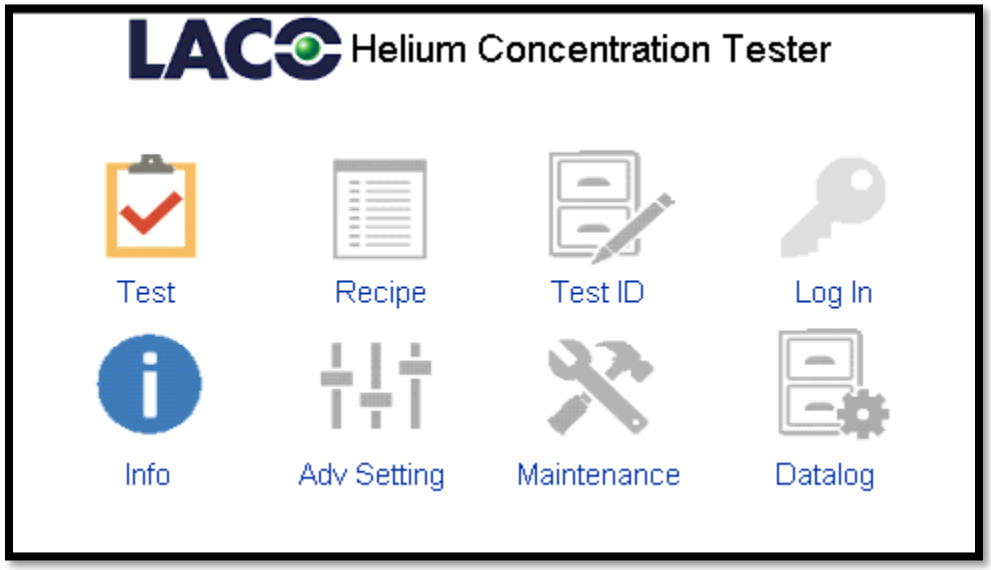
This screen lists the current software revision and is shown during startup and can be accessed from the home menu.

6.2.2. Home Screen



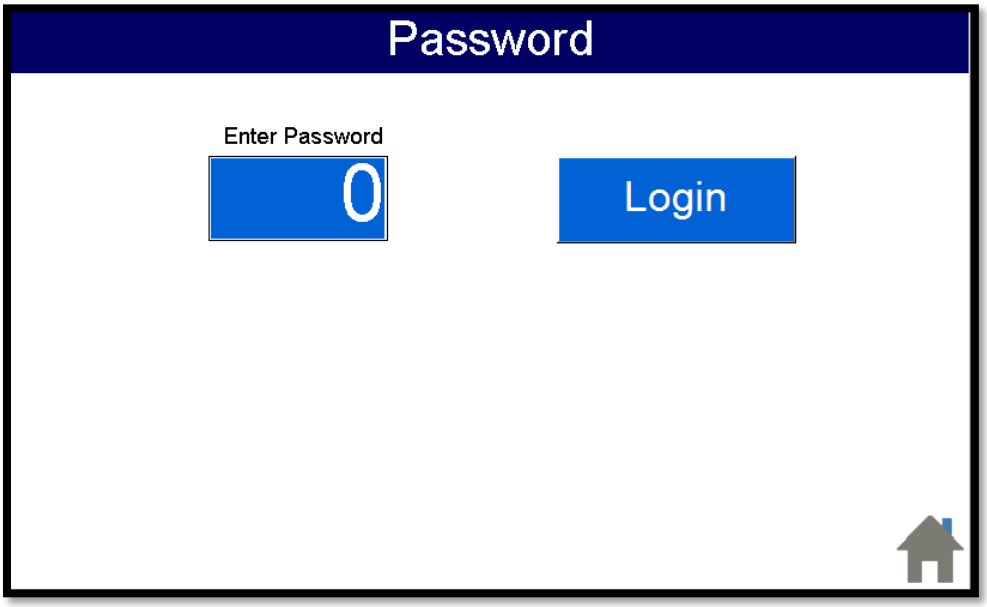
The home screen allows access to all LHCT controller software features. Press the desired icon to access the needed menu. The Home screen is accessible from any screen by pressing the home icon in the lower right-hand corner of the screen.

Depending on the current access level (see section 6.3.3) some screen icons may be “grayed” out, or inaccessible due to the current access level. For example, while logged in as an Operator (the default and lowest login level) the home screen will look like this:



From the home screen one can access the Test, Parameters, Info and Advanced Settings screens. The home screen is accessible from any screen by pressing the home icon in the lower right corner. The Advanced Settings Menu screen is password protected by the password 1234.

6.2.3. Log In Screen



The above screen appears by pressing the Log In key icon. Enter the password for desired level of access. There are three access levels on the LHCT controller.

1. Operator Level.

   The Operator Level requires no password. This is the default level when the LHCT controller is powered on. In this mode the user can do the following.

   - Run tests
   - View system information
   - Log in

2. Technician Level

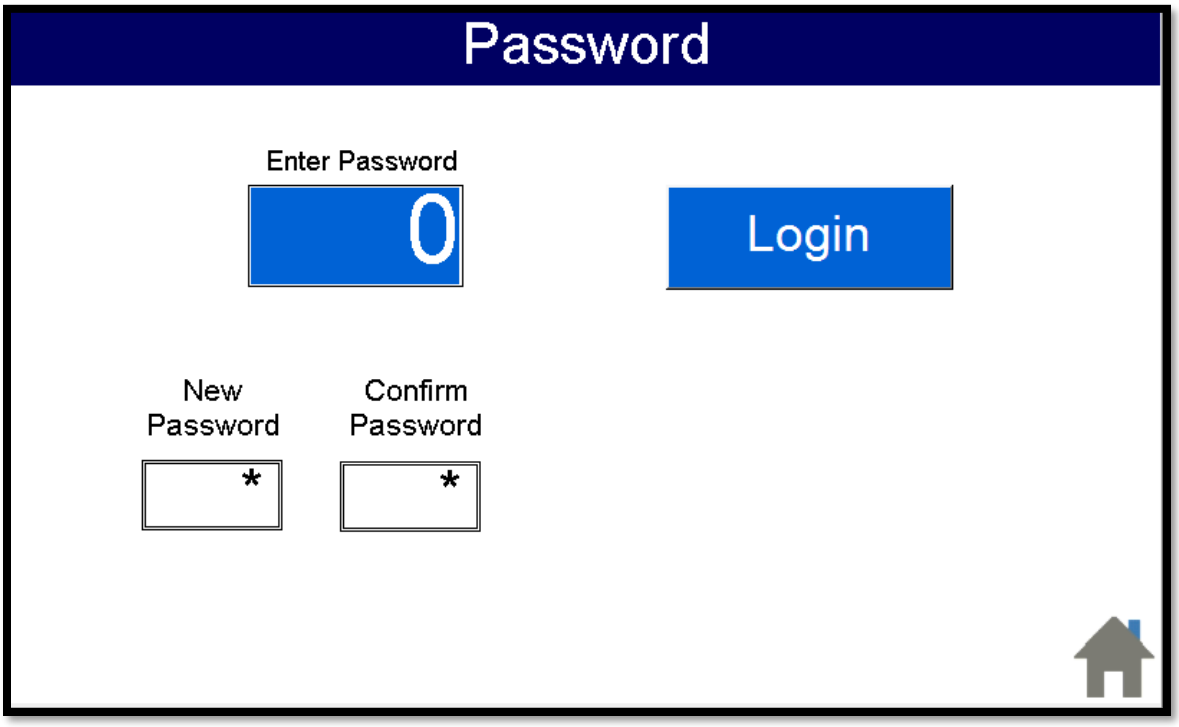
   To access the Technician Level, press the gray number area above the OK button and enter the password and press the OK button. The as-shipped password is 1234. If a correct password is entered the screen will go back to the home menu. If a used is logged in as Technician, they may change the password by entering a 4-digit password twice and pressing the CHANGE button (see screenshot below). The technician login will log out automatically after 5 minutes unless the machine is operating in manual mode. Press the log in button with an incorrect password while in Technician Level to manually return to Operator Level. The Technician Level gives access to:

   - Edit data logging settings
   - View maintenance settings
   - Change password
   - Operate the system in manual mode

3. Advanced Level

To access the Advanced Level, enter the advanced password and press OK. The hard-coded password is 5226. If a correct password is entered the screen will go back to the home menu, if a user is logged in as Advanced, they may change the password by entering a 4-digit password twice and pressing the CHANGE button (see screenshot below). The advanced login will log out automatically after 15 minutes unless the machine is operating in manual mode. Press the CANCEL button while in Advanced Level to manually return to Operator Level. The Advanced Level gives access to:

- All the features of the Technician Level
- Advanced Settings



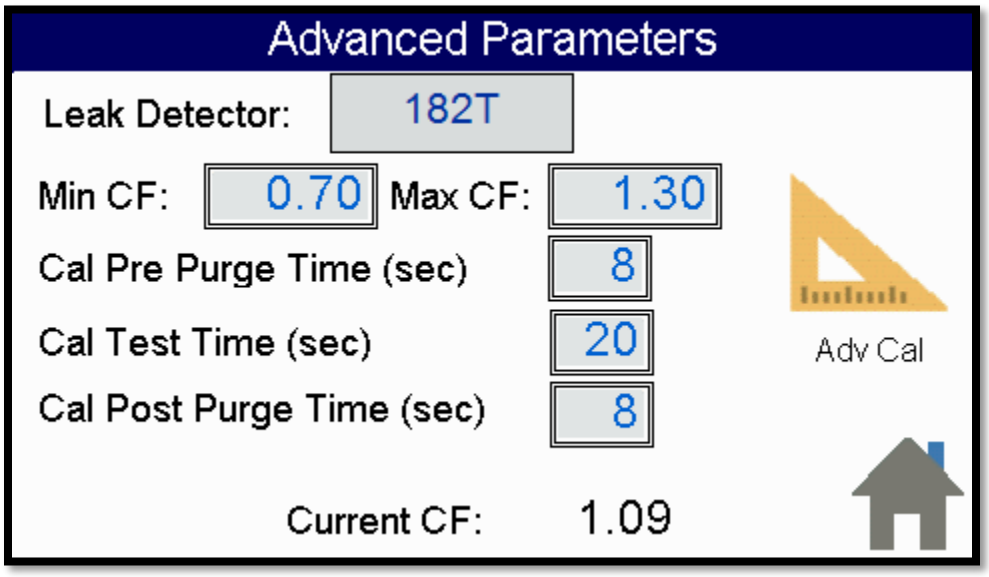
6.2.4. Advanced Parameters Screen

⚠CAUTION

The LHCT controller is shipped with the correct advanced settings. Advanced settings should not be changed, unless consulting with LACO. Use extreme caution when changing advanced settings, because most settings reflect the physical system configuration. Inadvertent changing of advanced settings can make the LHCT system inoperable or a cause unsafe conditions.

NOTICE

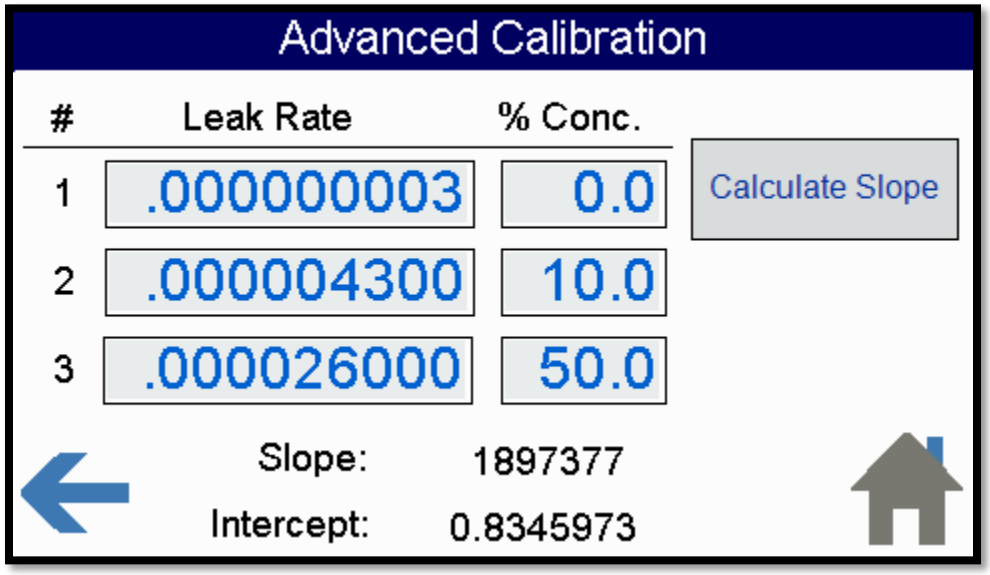
All current advanced settings will be identified in the appendix of the manual with a separate signed sheet of paper.



Enter the following advanced parameters:

- Select the Leak Detector to be used with the Helium Concentration Tester by pressing the LD icon to toggle through the available options.
    - TITANTEST
    - ASM 182 or ASI-35
    - TITANVERSA
    - LDS-3000
    - LDS-2010
- Min and Max CF – Typical Cal factors are around 1.0 so choose min and max cal factors that would reject out of limit calibrations.
- Cal Pre-Purge Time (sec) – Before a calibration the pump runs for this time to ensure test line helium free and ready for calibration.
- Cal Test Time (sec) – During this time the user insets their probe into the know gas sample min and the software monitors the signal to find the max helium reading.
- Cal Post-Test Purge Time (sec) – After the cal test time is complete the user removes the probe from the gas sample mix and pump purges the test line from test gas.

6.2.5. Advanced Calibration Screen



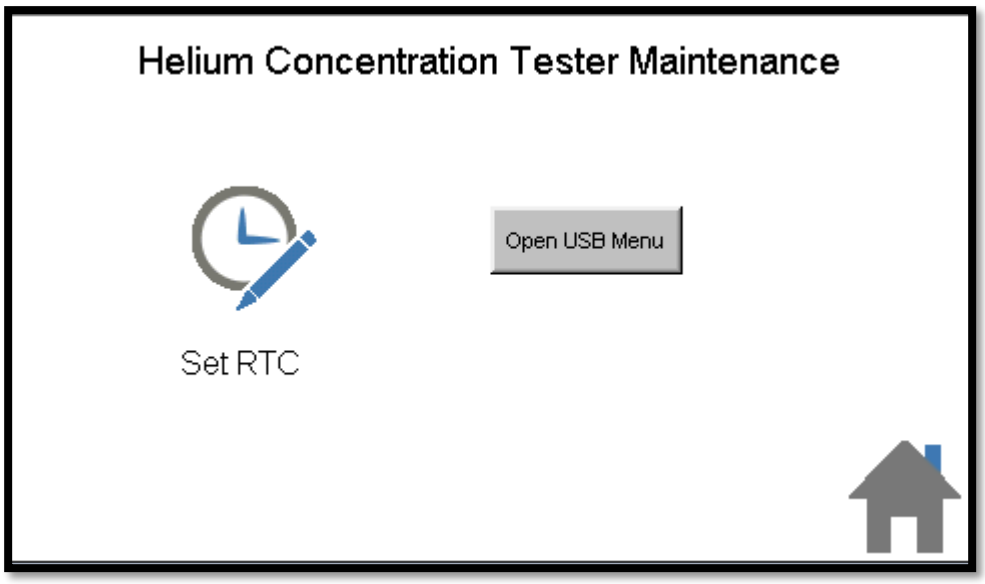
LACO performs a multi-point calibration on the tester based on the customer's typical helium concentration range. However, the user may likely need to perform an advanced calibration in certain cases such as leak detector, test condition or test environment changes.

This screen allows for a three-point calibration. Calibration point 2 should be at the customer's default % concentration (or 10% if unspecified) and the other two values should be at the extreme ends of the customer's measuring range. Run the three tests from the test screen and then enter the data into this screen and press the calculate slope button and a new slop and intercept values will be calculated. See the as-shipped parameters printout in the end of this manual for a listing of all as-shipped parameters.

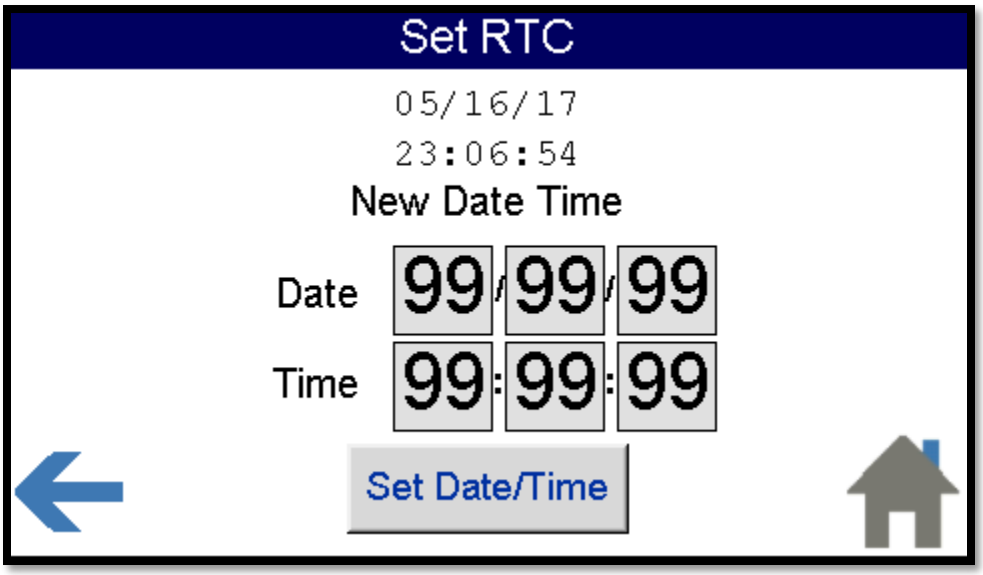
Before calibrating first prepare a helium concentration sample by using a certified helium mix or using the clear syringe assembly provide in the LSP-HCT-5 sniffer box. For a 10% sample, set the syringe to 10mL and spray 100% helium into the syringe. As the spray probe is removed cover the syringe opening with your finger and move to a new (uncontaminated) area. Blow over tip area with retract syringe to 100mL (with finger slightly removed) to obtain a 10% sample. Keep finger on syringe until testing. For other concentrations adjust syringe volume settings accordingly.

6.2.6. Maintenance Screen

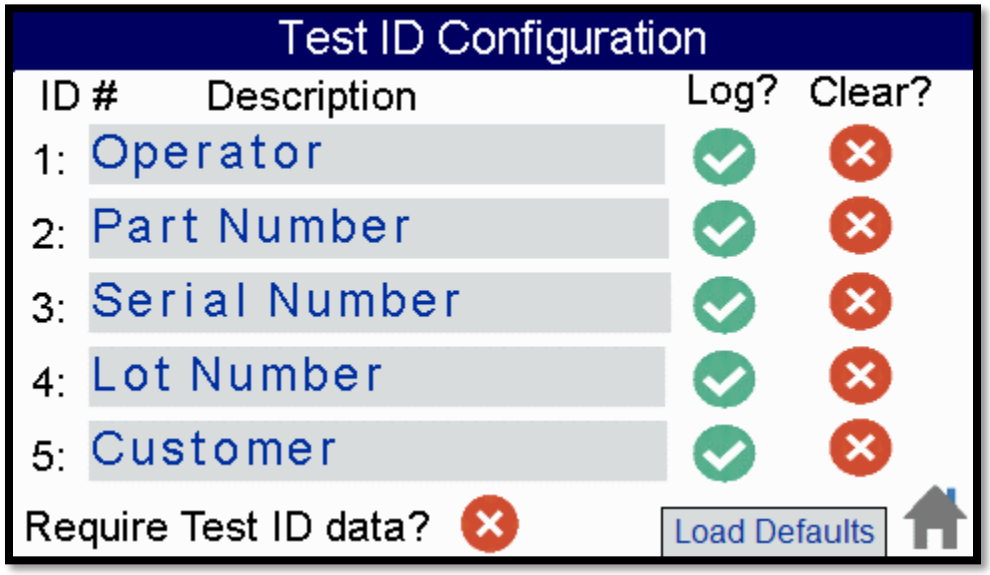
This screen allows user to enter date and time info and the USB upload utility if the updated software needs to be downloaded.



6.2.6.1. RTC Screen



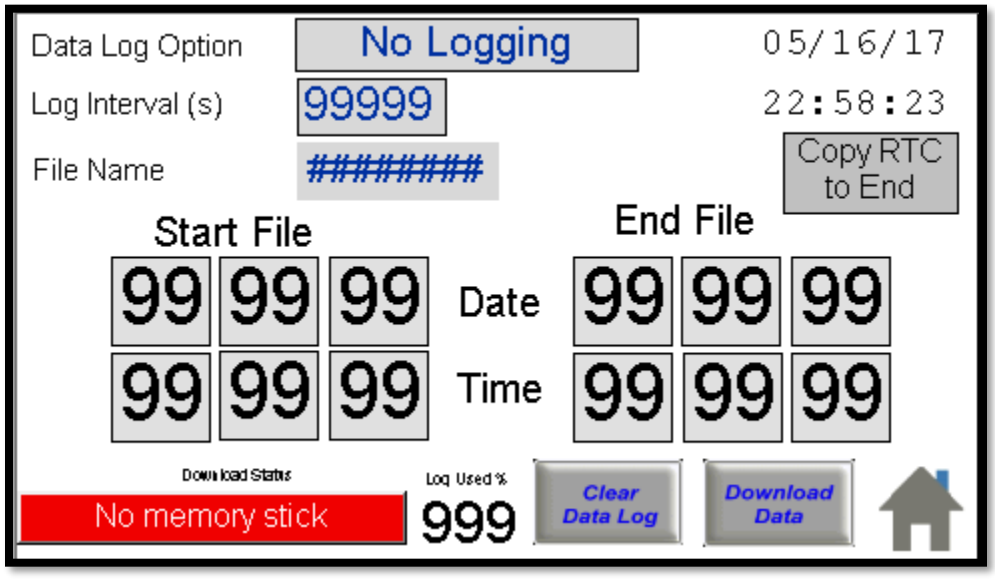
6.2.7. Test ID Data Settings



Up to 5 user defined Test ID data points can be configured on the Test ID Configuration screen. Descriptions can be entered on the touchscreen, or the user can load Default Test ID's by pressing the "Load Defaults" button. Select the "Log" icon if you want to log the data. Select "Clear" if you want the controller to delete the Test ID at the end of a completed test.

The require Test ID data option requires a user to enter all blank data fields after they press the start button on the test screen.

6.2.8. Data Log Settings Screen



LHCT controllers can log process data to the controller and this data can then be uploaded with a connected USB disk drive (DOK). Users can log data by one of the following 3 data log methods:

- None
- Manual Logging – When this option is selected, the user will see a disk icon on the test screen. When the disk icon has a red check mark no data is being logged. The user must select the icon and data will start to log and the icon will have a green check mark. Press the button again to stop logging data.
- Auto Logging – For this option data will automatically be collected at the end of a test cycle (just one row of data).

The percentage of the data logging memory used is displayed on the run, manual and data log screens. All the data logging is collected into one csv file. To retrieve the data, perform the following steps:

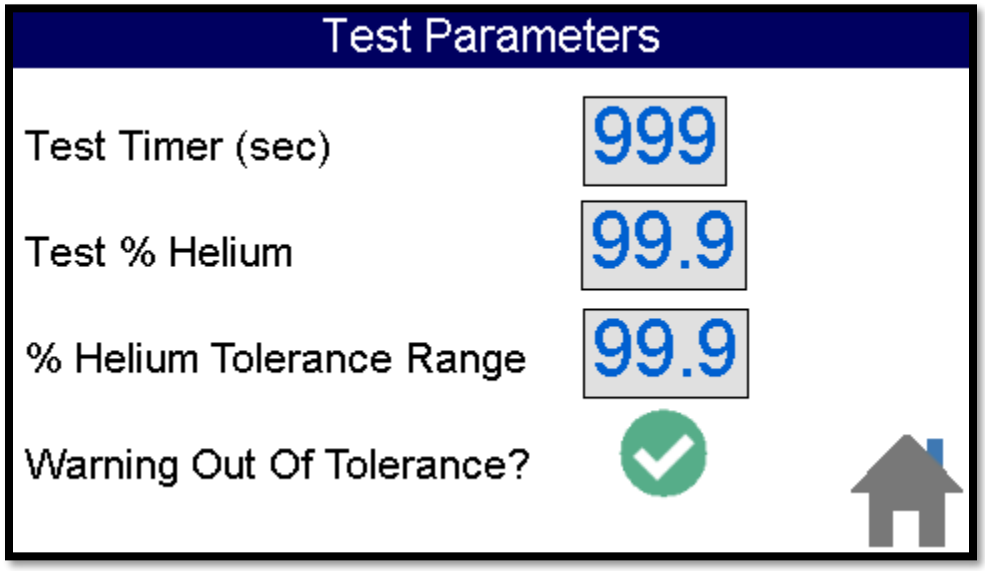
- Inset a USB disk drive into the side of the controller.
- Go to the data log screen and enter the start and end data and time of the data range that needs to be uploaded.
- Enter an up to 8-character download file name.
- Press the download data tab.
- The download status bar should read “in process”.
- Once the download status reads “download complete” the user can retrieve the USB drive from the USB port.

Once the uploaded data has been verified on a PC, it is recommended to delete old data log data by pressing the “Clear Data Log” button.

Below is a small sample of how the csv data log file will look.

DATE	TIME	HeConcAdj	MaxHeConc	RawLeakRate
16/5/17	18:09:44	46.9863205	47.00364685	0.000026502

6.2.9. Parameters Screens

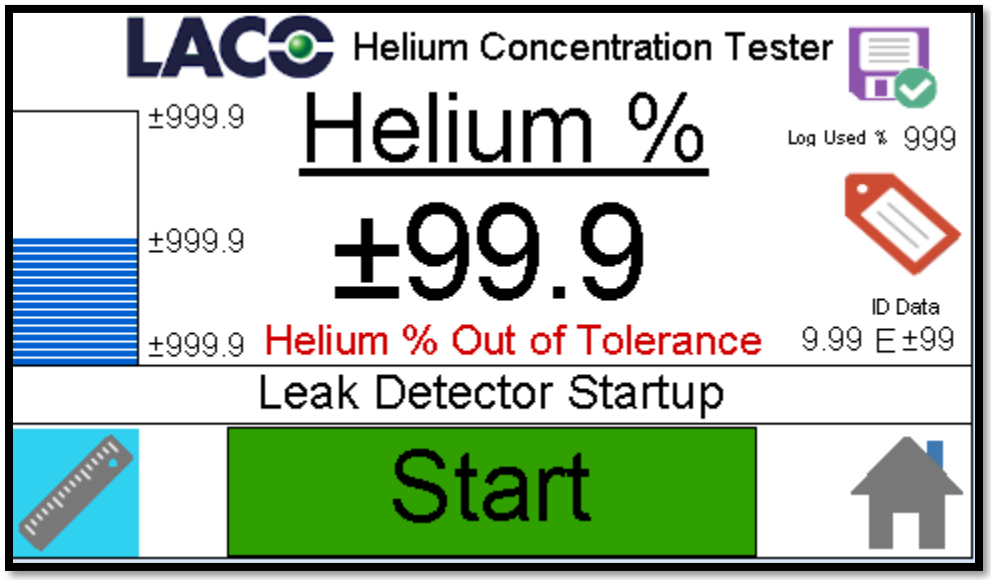


- Test Timer (sec) – Entered desired gas sampling time. Minimum time is 10 seconds and maximum is 300 seconds.
- Test % Helium – This is the default or typical helium concentration % that is measured.
- % Helium Tolerance Range – This range helps the customer determine if their gas sampling is in or out of their desired range. For example, if a customer is measuring 50% helium concentration with a tolerance of 2% the system can warn if the measured gas mixture is not between 48-52%.
- Warning Out of Tolerance – When selected this option allows a screen warning text to appear on the test screen during testing if the measured mixture is out of tolerance.

6.3. Leak Detector Preparation

- Perform internal calibrations on all non-Alcatel leak detectors at least monthly and preferably weekly.
- Ensure the leak rate on the test screen matches that of the leak detector output.
- Ensure leak detector is on for at least 15 minutes before testing.
- Change backing pump oil regularly.
- Ensure leak detector is serviced regularly, whether by LACO or in-house.
- Ensure leak detector is not in zero mode when in test.
- If the leak detector is a TITANTEST there are three modes in the TITANTEST: Vacuum, Auto Test, and Sniff. Ensure the leak detector is always set to Vacuum test mode.

6.4. Running Helium Concentration Tests



The test screen above loads upon system startup or can be accessed from the home screen by pressing the test screen icon. The following system states listed below are possible. When the system is powered on and the leak detector is not yet in the measure state then the Leak Detector Startup state will be displayed.

For Alcatel and TITANTEST leak detectors the message below will appear after the leak detector turbo has fully come up to speed. The user must manually put the leak detector in cycle by pressing the Cycle or Start/ Stop button before the Helium Concentration Tester is in ready mode and can start testing. Alcatel leak detectors will automatically go through an internal calibration during each start up cycle. After the auto calibration is complete the leak detector should be put into cycle.

System states:

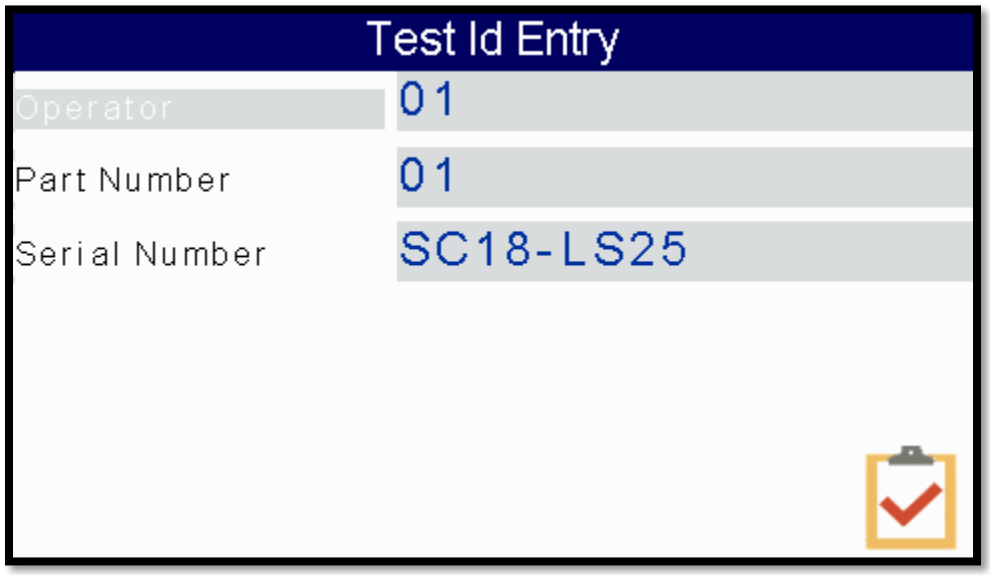
- Leak Detector Startup
- Put LD in Cycle After Calibration
- Ready for Test
- Helium % Test
- Calibration Pre-Cal Purge
- Cal – Insert probe into sample and press Cal
- Calibration Test
- Calibration Post-Test Purge – Remove probe
- Calibration Pass
- Calibration Fail

When the system is ready to test the Start/ Stop button on the test screen will read “Start”. To start a test, press ‘START’. The unit will run for 5 seconds to purge existing gas out of the line then the gas analyzer test will run per the test time. It is recommended that the user ensures the probe is placed into the gas sample and the % concentration will be displayed on the screen. Note that it may be good to remove the probe 5-10 seconds before the test time is finished (or run not sample test) so any residual helium is pumped through the test line. If this is not done residual helium may be trapped in the test line and the system cam read high helium concentrations during non-test times.

During a test cycle the Start/ Stop screen button will read “Stop” and the user can press the stop button to abort the test or calibration at any time.

If blank Test ID fields exist the red ID data tag will flash, as a reminder. If all Test ID fields and populated screen will show a green tag icon.

If the “Require Test ID Data Option” has been selected the system shows the screen below, if required data fields are blank. The user can use a barcode reader or the touch screen to enter the needed data. Once all fields are correct press the test screen icon and the test will continue.



6.5. Calibration

It is recommended that the user calibrates the Helium Concentration Tester each day the tester in used. Before calibration the user needs to ensure the leak detector has been on for at least 15 minutes and they have a known gas sample concentration. The user must ensure that this sample matches the “Test % Helium” in the parameters screen.

Before calibrating, first prepare a helium concentration sample by using a certified helium mix or using the clear syringe assembly provided in the LSP-HCT-5 sniffer box. For a 10% sample, set the syringe, to 10mL and spray 100% helium into the syringe. As the spray probe is removed cover the syringe opening with your finger and move to a new (uncontaminated) area. Blow over tip area and retract syringe to 100mL

(with finger slightly removed) to obtain a 10% sample. Keep finger on syringe until testing. For other concentrations adjust syringe volume settings accordingly.

Users can calibrate the system by pressing the Cal icon in the lower left corner of the test screen. The four steps of calibration are outlined below.

1. Calibration Pre-Cal Purge
2. Cal – Insert probe into sample and press Cal
3. Calibration Test
4. Calibration Post-Test Purge – Remove Probe

In step 1 the pump runs per the Cal Pre-Purge Time to ensure the test line is helium free and ready for calibration. Next the following text is displayed, “Cal – Insert probe into sample and press Cal”. During the Cal Test Time the user insets their probe into the known gas sample mix and software monitors the signal to find the max helium reading.

After the Cal Test timer is complete the user removes the probe from the gas sample mix and the pump purges any residual gas from the test line, if the new Cal factor was within the minimum and maximum CF limit then the calibration was successful otherwise calibration fail will be displayed.

7. Software Faults

The three possible faults for the LACO Helium Concentration Tester are listed in the table below. Whenever a fault occurs refer to the table below for help in identifying fault causes with likely remedies to fix the fault.

When a fault occurs the fault description will be displayed on the test screen status. Refer to the Fault Troubleshooting steps and once the fault is fixed, the system will auto recover to the system status state “Ready to Test”.

Fault Description	Fault Causes	Fault Troubleshooting
Leak Detector Communication Fault	The system is unable to get proper analog readings from the Leak Detector	• Check that the mass spectrometer is powered on and in measure mode. • Check that the mass spectrometer communications settings have not been changed. • Check that the serial cable connection from LHCT to LD is correct. • Check that the correct LD is chosen in Advanced Settings.
Leak Detector Fault	Internal fault in Leak Detector	• Refer to manufacturers user manual for assistance in troubleshooting. • Ensure all LD settings are correct.
Leak Detector Not Ready	This fault occurs when the Leak Detector is not in measure or test mode after 6 minutes of power on.	• Incorrect Leak Detector settings on non-functioning Leak Detector causing the Leak Detector to not get to measure mode.

8. Maintenance, Spare Parts, and Troubleshooting

Ensure the associated Helium Leak Detector used with the Concentration tester is maintained regularly by doing the following.

- Perform internal calibration on all non-Alcatel Leak Detectors at least monthly and preferably weekly.
- Change backing pump oil regularly.
- Ensure Leak Detector is serviced regularly, whether by LACO or in-house.
- Ensure all connections are leak tight.

NOTICE

Take note of all parts noted as critical spares and all recommended replacement intervals

Items identified as critical spares typically have a high likelihood of needing replacement so the Helium Concentration Tester can stay in proper operating condition. Parts listed that are not critical spares may fail but are more unlikely to than critical spares. Take special not of the replacement intervals in the table below as it is always best to replace a component before it fails and leads to equipment downtime.

ID	Item part number	Description	Replacement Interval	Critical Spare
1	LSP-HCT-5	PROBE, SNIFFER FOR HE, 5 FT LONG, STAUBLI CONNECTION	AS NEEDED	
2	LMSA108839	HOSE BARB W/ FILTER ASSEMBLY, LHCT PROBE	AS NEEDED	X
3	LMSA0249	PUMP, DIAPHRAM, 7.2 LPM, 24 VDC	2000 HOURS	
4	LMSA5300	EPDM, DIAPHRAGM, LHCT03D PUMP	2000 HOURS	X
5	LVFCN25A	CLAMP, NW25, ALUM	AS NEEDED	
6	LVFGN25SV	RING, CENTER, NW25, SS/VITON	AS NEEDED	
7	LMSA3853	FUSE, 5X20MM, 5 AMP, SLOW BLOW, GLASS	AS NEEDED	X
8	LVFNN25X3.15S	NIPPLE, NW25, 3.15” LONG SS	AS NEEDED	
9	LVFRCN40XN25S	REDUCER, CONICAL, NW40XNW25SS	AS NEEDED	
10	LMSA106966	LHCT, FILM, 0.002” X 1.0” DIA	AS NEEDED	
11	LMSA0250	WASHER, URETHANE, 50 D, 8MM OD X 2MM ID X 3MM THICK	AS NEEDED	
12	LST-120	SNIFFER TIP ASSEMBLY, 120 SCCM FLOW	AS NEEDED	
13	LMSA0196	SYRINGE, CLEAR, 140 CC	AS NEEDED	

If helium concentration readings are consistently low, then the gas sample probe may be plugged. First replace barb tip, LMSA108839 (item 2). If readings are still low, send the probe assembly into LACO and a new internal tip assembly can be replaced (item 12). If additional seal washers are needed order part number LMSA0250 (item 11).

If leak rate readings are too high during testing the following items may need replacement.

- Diaphragm Pump (item 3)
- Pump Diaphragm Seal (item 4)
- Film disk (item 10)

The membrane pump is rated to around 2000 hours of typical usage.

Items 5, 6, 8, 9 can be used to configure with different vacuum connections depending on the Leak Detector used.

9. Ethernet Remote Communication Interface

The ethernet settings for the remote communication interface require the following settings:

- The IP address of the HCT for communication is 192.168.1.100 on port 100.
- Set controlling hardware to IP address 192.168.1.3 and listen on port 100.

Note: if a different IP address is needed, contact LACO and we will set a software modification for install (see section 10.3)

All send and reply commands end with a [CR] character. All read commands start with a "?" and requests or set commands start with a "!" character. Refer to the table below for all commands and syntax.

ID	Command Description	RS-232 Command	Response Example	Validity
0	Start cycle	!CS	CS	Ready only
1	Start calibration cycle	!CC	CC	Ready only
2	Abort cycle/ acknowledge fault	!CA	CA	In-cycle only
3	System status	?SS	SS: Recovery or SS: Ready or SS: In Cycle or SS: Fault	All
4	Test Data ready for upload	?DR	DR: YES or DR: NO	All
5	Read last test result array	?TD	TD: (Date)- (Time)-(TestID#1)-(TestID#2)-(TestID#3)-(TestID#4)-(TestID#5)-(Max % Helium Concentration)	Test Data Ready = Yes.
6	Read current leak rate	?LR	LR: 1.23E-9	All
7	Read current % helium concentration	?HC	HC: 12.3	In-cycle only
8	Read max % helium concentration after test	?MH	MH: 10.8	Test Data Ready = Yes.

*Test ID data will only be displayed if configured to be logged.

10. Appendix

10.1. Short Instruction List

Installation

- Connect Helium Concentration Tester to HLD test port and connect the provided DB9 serial cable between the devices.
- Connect Concentration Tester power plug to electrical power source.
- Turn on both HLD and Tester.
    - After HLD is fully powered and warmed up ensure the tester status message reads “Ready to Test”.

Calibration

- Preform daily when using the LHCT.
- Press the “Cal” button to calibrate the system. The first step goes through background cleanup step.
- Insert the gas sniffer probe into a known gas sample when prompted by the Tester.
- Remove the probe and the Tester will ensure background is clean, then as the LD detects the helium the Tester will automatically adjust its internal calibration accordingly.
- Verify that the calibration was successful by reading Calibration Passed.

Testing

- Press the “Start” button to test gas samples. The Tester will record the Max reading during the test time.

Shut Down

- Turn off both the Helium Concentration Tester and the HLD.

10.2. As-Shipped Parameters

See the As-Shipped Parameters printout in the end of this manual for a listing of all As-Shipped Parameters.

10.3. Software upgrade via USB drive

If a software upgrade is needed, follow the steps outlined below.

1. LACO will email a zipped file. On a computer, unzip the emailed file and place the FP3070TN folder onto the USB drive.
2. Place the USB drive into the 2500 USB port.
3. Go to the Maintenance Screen and press the “Open USB” button.
4. Confirm “Yes” that you want to preform USB sick operation.

5. Select the “Download” option.
6. Select the “Firmware”, “Font”, “Application” and “Logic” boxes and the press download.
7. Confirm that you want to proceed with download by pressing “OK”.
8. The unit will proceed through all downloads.
9. Select “Ok” to the download completed successfully.
10. On the downloads screen select the “Exit” button and the unit will restart.