

Version

5

LDARtools

phx21™ Level 1 Repair Manual

Rev. Date: February 24, 2022

To confirm that this is the most current version, please go to <http://www.ldartools.com/documentation/>
OR
Go to the Customer Portal and Open the “Docs” section.



Table of Contents

Requirements of Level 1 Certification	1
Add to Firewall Whitelist	1
External Parts.....	2
Storage and Use Conditions.....	2
Connecting the Probe.....	3
Disconnecting the Probe	3
Powering the phx21 On or Off	4
Filling the phx21 with H ₂	5
Charging the phx21	6
Rebooting the Charger.....	6
Changing the Inlet Filter.....	7
Replacing the Probe Tip Filter.....	7
Repair Procedures.....	8
phx21 Vitals Chart	8
Standard Pressures, Flow, & Voltages	8
Required Spare Parts.....	9
Tool Kit Inventory	9
Identify phx21 Internal Parts.....	9
Removing the phx21 Case	10
Reinstalling the phx21 Case	10
Opening & Closing the Flame Arrestor Assembly.....	11
Adjusting the Low Pressure H ₂ (LPH ₂).....	11
Adjusting the Probe Flow	12
Checking the Probe Integrity.....	13
Replacing the Battery	14
Replacing the Pump	15
Replacing the Glow Plugs.....	16

Requirements of Level 1 Certification

- Internet access
- Company email access
- Phone Access
- 1 Flow Meter Assembly (phx21) - LDAR# 1735
- On-site spare inventory
 - 1 QTY – Pump
 - 2 QTY - Glow Plugs
 - 10 QTY - Probe O-ring
 - 1 QTY - Can of O-ring Grease
 - 1 QTY - Inlet Filter

Add to Firewall Whitelist

The following sites must be whitelisted by your site IT Department for effective on-site troubleshooting and support.

- ldartools.litmos.com
- storeldar.com
- ldartools.agiloft.com
- ldartools.com
- time.windows.com
- time.nist.gov
- ldartoolsissuereport@gmail.com
- splashtop.com
- inteset.com
- 216.239.35.4

External Parts

- The connection end (**north overmold/north end plate**) contains the following:

- A. Bluetooth® antenna
- B. Power button
- C. Charger plug
- D. Probe port
- E. Hydrogen fill port



- The **phx21** case
 - Case is a solid aluminum piece with serial number and manufacturer information.

- The **FID end plate (south overmold)** contains the following:

- A. FID exhaust (flame arrestor assembly)



Storage and Use Conditions

Overnight equipment storage and calibration must be done indoors at or near room ambient conditions (15-25 °C) with a maximum humidity of 85%.

Connecting the Probe

1. Check that **O-ring** looks brand new.
2. Align the **quick disconnect**, which is attached to **probe hose**, with the **probe port**.
3. Snap the **quick disconnect cable** into the **probe port**.

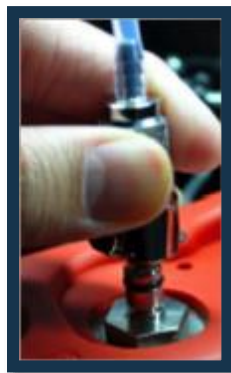
TECH TIP: Lubricate **O-rings** with **O-ring Grease (LDAR#881)** if dull provided by LDARtools. Also lubricate the **H₂ fill port** at this time.

Note: The **probe** and a **probe tip filter** must be connected to the **phx21** before igniting the device.



Disconnecting the Probe

1. Press the tab on the **quick disconnect** to release the **probe**.
2. Pull **probe** off gently.



Powering the phx21 On or Off

1. To turn the **phx21** on or off, perform one of the following:
 - a. ON: Press and hold the **power button** for 2 seconds.
 - b. OFF: Press and hold the **power button** for 5-8 seconds.
2. The **power button** has several indicators that indicate the current status.
 - a. No light = Off.
 - b. Solid Green Light = On and the **phx21** is connected via Bluetooth®.
 - c. Blinking Green Light = On but the **phx21** is not connected via Bluetooth®.



Device is turned on.



Device is turned off.

Filling the phx21 with H₂

Gases are typically stored under pressure in metal cylinders. Cylinders are designed to withstand high pressures. Improper handling and use of compressed gases can result in devastating consequences. Be sure to follow all safety guidelines outlined by your facility.

1. Remove the **H₂ quick-fill cover (LDAR #747)**.
2. Make sure of the following:
 - The H₂ cylinder being used to fill the **phx21** has a regulator in place.
 - Bleed any air out if the gauges do not read pressure. A quick turn of the handle will accomplish this.
 - Use the *phx21 Vitals Chart* (pg. 8) to set/check cylinder pressure.
 - Verify no dust/debris is in the **H₂ fill port** or the **H₂ fill adapter (LDAR# 1260)**.
 - Arrow on red handle is pointing to the breather side of the fill valve.
3. Connect the **probe** to the **probe port**. **DO NOT SKIP THIS STEP.**



4. Connect the **H₂ fill adapter** to the **H₂ fill port**.



IMPORTANT: Do *NOT* attach the **H₂ fill adapter** to the **probe port**. This will lead to a costly repair.

5. Turn the handle 180° to open valve. Arrow should point to the fill hose.
6. Wait for 5-10 seconds while your H₂ supply is replenished.
7. Turn the handle back 180° to close valve. There will be a slight hiss from the release of pressure. Arrow should be pointing at the breather again.
8. Pull on the collar of the **H₂ fill adapter** to release it.

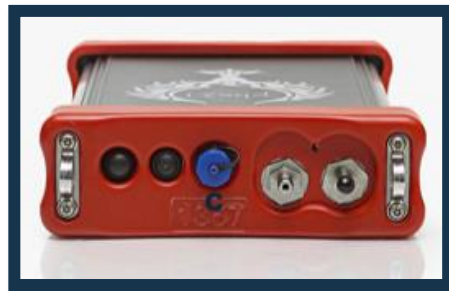
9. Twist the **H₂ quick-fill cover** onto the **H₂ fill port**. The **phx21** *MUST* be operated with the **H₂ quick-fill cover** in place at all times. It is recommended to keep replacements on site.

Charging the phx21

1. Obtain a **phx21 charger (LDAR# 762)**.
2. Turn off the **phx21** by pressing and holding the **power button** for 5-8 seconds.
3. Twist the blue **charger jack cap (LDAR# 646)** counterclockwise to access the **charging port**.

IMPORTANT: The *charger jack cap* *MUST* be in place while using the **phx21** in a hazardous area.

4. Align the grooves of the **phx21 charger** and the **charger jack**.



5. Twist the turning collar on the **charger** connector clockwise. A light on the **charger** will flash when the connection is successful. The light should blink until the **battery** is charged. Once charged, the light will remain solid.

TECH TIP: Don't over-tighten as it will cause damage. Only tighten until resistance is felt.

Rebooting the Charger

1. Connect the **charger**.

Note: The **battery** will not charge while the **pump** is on and the **phx21** will run as long as H₂ is available.

2. Turn off the **phx21** by pressing and holding the **power button** for 5-8 seconds.
3. Unplug the **charger** and wait for 5 seconds.
4. Plug the **charger** back in. The **phx21** will now charge properly.

TECH TIP: An option for this is to have the charger(s) on an outlet timer to cycle the power after all techs go home for the day.

Changing the Inlet Filter

1. Turn the **probe port** counterclockwise by hand using the **socket 3/8" drive 5/8"** (LDAR# 969).
2. Remove **probe port**. If dirty, do not clean. Replace the **inlet filter** (LDAR# 825).

IMPORTANT: Cleaning will damage pump. Replace and notify management that technicians are not using **probe tip filters**. Do not use **TVA cup filters**.

3. Screw the **probe port** into the **phx21** clockwise.
4. Tighten the **probe port** with the provided **socket 3/8" drive 5/8"**, no wrench, using hand only. This can be tightened very snugly.

Replacing the Probe Tip Filter

1. Locate the **probe filter** between the **probe tip** (LDAR# 1091) and the **probe**.
2. Make sure **pump** is off before removing old/contaminated filter.
3. Remove the dirty filter, and then attach the **probe tip** to a clean filter. LDARtools offers two types of filters: **Probe Filter-Double Thread** (LDAR# 025) and the **Probe Filter** (LDAR# 1264).

IMPORTANT: A **probe tip filter** must be in place at ALL times while the **phx21** is running.

Repair Procedures

Before any repairs are performed on-site, you must fill out the Report an Issue form at LDARtools.com. You will receive instructions and procedures via email.

Remember, to protect the intrinsic safety and reliability of the **phx21** analyzer, *ONLY* certified personnel may perform the repairs. Any repairs that cannot be performed based on the procedures provided by LDARtools must be authorized in writing by LDARtools management.

Make sure to complete any required hazard analysis as appropriate or required by your facility.

phx21 Vitals Chart

Standard Pressures, Flow, & Voltages

Low Pressure H₂ (LPH₂)	5.5 – 5.7psi Report an issue if adjustments are needed 2x in a week.
Probe Flow	1 LPM +/- .1 LPM or LDARtools Approved Site-Specific
High Pressure H₂ (HPH₂)	400-1800 psi
Pump Power Level (PPL)	650-850 (this is % without the decimal). If PPL is 850 “MAX PPL” warning will flash. Do not start a day of monitoring with PPL >800, report an issue. If PPL is <650, then probe flow is not set correctly and might cause calibration issues intermittently. Confirm that the probe flow is correct. If the PPL is still <650, report an issue.
Battery	8-9 volts charged. If voltage > 9V with charger plugged in, do not start a day of monitoring, report an issue.

Required Spare Parts

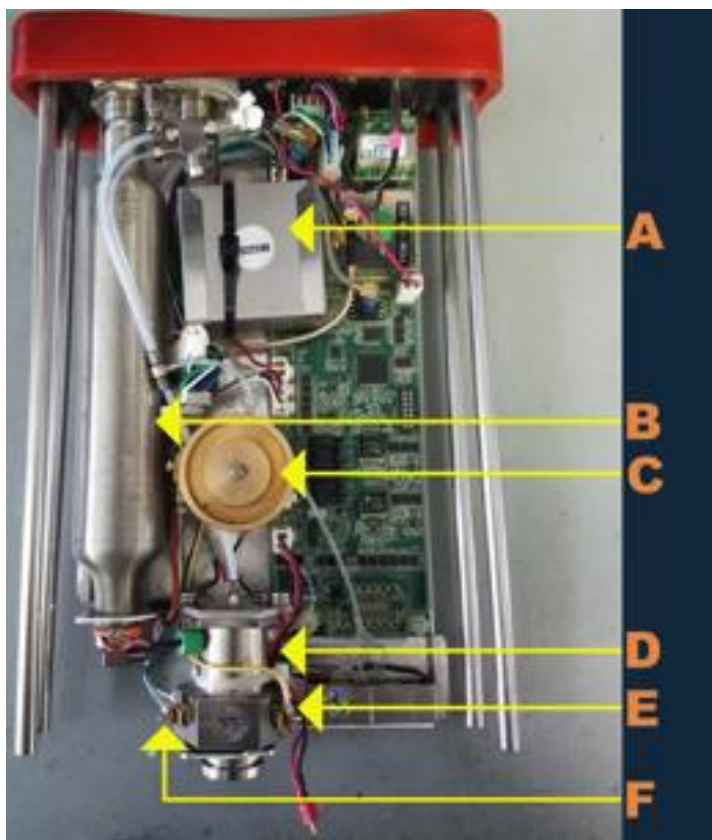
1. Pump LDAR# 1163 – 1 QTY
2. Glow Plug LDAR# 766 - 2 QTY
3. Probe O-Ring LDAR# 358 - 10 QTY
4. Inlet Filter LDAR# 825 - 1 QTY
5. O-Ring Grease LDAR# 881 - 1 QTY

Tool Kit Inventory

1. Stubby Wiha Screwdriver LDAR# 965
2. T25 Security Bit/Gear wrench LDAR# 964
3. Socket 3/8" Drive 5/8" LDAR# 969
4. Glow Plug Fitting Wrench 5/16" LDAR# 967
5. Locknut Fitting Wrench 3/16" LDAR# 968
6. Flame Arrestor Key LDAR# 798
7. 1/4" Wrench LDAR# 1478
8. Screw Driver Kit (5 pcs.) LDAR# 1546
9. Angled Wire Cutters LDAR# 1741

Identify phx21 Internal Parts

- A. Pump
- B. H₂ cylinder
- C. H₂ regulator
- D. FID
- E. Glow Plug (primary)
- F. Glow Plug (secondary)



Removing the phx21 Case

1. Unscrew the eight screws [4 **case screws (LDAR #758)** and 4 **FID endplate screws (LDAR #732)**] on the **phx21's FID endplate** with the provided screwdriver .
2. Lift the **FID endplate** once the screws are removed and remove the **battery**.
3. Lay the **phx21** on its back and hold the **connection end plate (north overmold)** with one hand, and then firmly pull on the black case with the other hand.

Reinstalling the phx21 Case

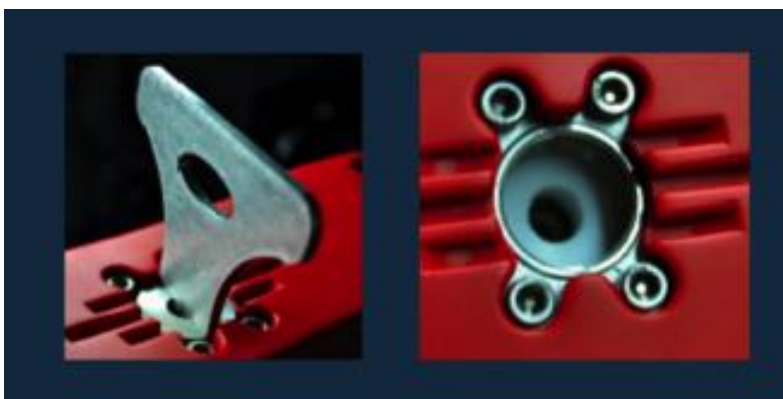
1. Slide the black case on. Make sure all four metal rods are outside the black case.
2. Attach the **FID end plate (south overmold)** once the black case is back into place.
3. Make sure the screws, plates, and bushings are in place. The four outer screws are Torx screws with a rounded head. The four screws around the **FID assembly** are Allen cap screws.

TECH TIP: Don't over-tighten as it will cause damage. Only tighten until resistance is felt plus ½ a turn.

Opening & Closing the Flame Arrestor Assembly

1. Insert the **flame arrestor key (LDAR#798)** into the large groove across the center of the assembly.
2. Turn the **flame arrestor key** counterclockwise. You should see a **white Teflon gasket** inside the **FID port** once the assembly has been removed.
3. To close, place **flame arrestor assembly** back in **FID**. Turn the **flame arrestor key** clockwise. Check for any debris in the threads and remove as needed.

TECH TIP: If resistance is met before completely installed, stop immediately and report an issue. Final tightening force should be similar to a water hose spigot.



Adjusting the Low Pressure H₂ (LPH₂)

1. Launch the **phx21 software** on the PDA.
2. Select *phx21*.
3. Connect to the device, and then run the program.
4. Tap *Menu*, tap *Details*, tap *Menu*.
5. Tap *Solenoid 1 On*.
6. Make sure *Solenoid 1 On* has a checkmark.
7. Locate the LPH₂ reading on the PDA.

8. Located on the **HP Regulator w/2" Dia. (LDAR# 1147)** rotate the locknut counterclockwise using the **locknut fitting wrench ¼" - 3/16"** to loosen it.
9. Use the **Screw Driver Kit (LDAR# 1546)** with the flat head option to turn the stem and adjust the pressure. Do either:
 - a. To increase pressure: Turn clockwise.
 - b. To decrease pressure: Turn counterclockwise.

TECH TIP: Use the *phx21 Vitals Chart* to set / check ranges.

10. To begin the adjustment, decrease the pressure to 4.0 psi.

TECH TIP: You can *increase* the pressure at any time during the adjustment. If you need to *decrease* the pressure, you must lower it to 4.0 psi and *then increase* until you've reached the acceptable pressure range listed on the *phx21 Vitals Chart*.

Do NOT decrease the pressure as your final adjustment.

11. Tighten the locknut on the **HP Regulator w/2" Dia.** while holding the stem.

TECH TIP: Don't over-tighten as it will cause damage. Only tighten until resistance is felt.

12. Toggle **Solenoid 1** on and off five times.
13. Turn on **Solenoid 1**, leave it on, toggle **Solenoid 2** on and off five times.
14. Turn **Solenoid 1** and **Solenoid 2** off. Turn on **Solenoid 1**.
15. Check the LPH₂ on the PDA. Use the *phx21 Vitals Chart* to check ranges. If the LPH₂ is not within range after warm-up is complete, go back to step 8 and repeat. If after many attempts it does not settle in range, report an issue to LDARtools.

TECH TIP: When you ignite the **phx21**, the LPH₂ may increase. This is normal.

Adjusting the Probe Flow

1. Launch the **phx21** basic monitoring software on the PDA. Use the **flow meter assembly (LDAR# 1735)** connected directly to the **probe port** with the **silicone tubing** pushed over the **port**. Make sure the **filter** is on the inlet side of the flow meter.
2. Turn on the **pump** using the power button on the **Display** tab.
3. Use the **locknut fitting wrench ¼" - 3/16"** to rotate the locknut on the *vent needle valve* counterclockwise to loosen it.
4. Turn the valve stem of the **vent needle valve** and adjust the probe flow. Do either:

- a. To decrease the flow: Turn clockwise.
- b. To increase the flow: Turn counterclockwise.

TECH TIP: Turn the stem very slowly when adjusting the flow.

5. Adjust the flow is in accordance with the *phx21 Vitals Chart*.
6. Tighten the locknut while holding the stem in place.

TECH TIP: Don't over-tighten as it will cause damage. Only tighten until resistance is felt.

7. Check the flow by watching the meter.

Note: This procedure should never need to be performed unless it was adjusted incorrectly before.

Checking the Probe Integrity

Method 1: Block the Probe Tip – Check – Daily

1. With the **phx21** running, place your thumb over the *probe tip*. The *pump* should quickly stop. Remove your thumb. Restart the *pump*, test complete.
2. If the unit does not stop, the *pump* is still drawing a “sample” through a leak in your *probe*.
3. Go to Method 3 to quickly locate the leak.

Method 2: Probe vs. Inlet Flow Rates – Check Weekly or Max PPL

1. Use *flow meter assembly (LDAR# 1735)* to measure the flow at your *probe tip*.
2. Use your *flow meter assembly* to measure the flow at your *probe port*.
3. If the *probe port* flow is greater than the *probe tip* flow, you have a leak.
4. Go to Method 3 to quickly locate the leak.

Method 3: Pinpoint Leak – Check – When Probe Port Flow > Probe Tip Flow

ATTENTION: Before beginning test, make sure this is within site safety parameters.

1. Add a 5-foot piece of tubing to your **probe tip**. This is to avoid drawing a contaminated sample.

2. Without causing a spark, depress the button on a BIC lighter to release a flow of butane.
 - **Caution:** *DO NOT* strike a flame with the lighter.
3. Direct the Butane along the length of the **probe hose** and at the joints of your **probe** while watching the PDA connected to the **phx21**.
4. Move the lighter slowly. If there is a leak, it will be drawn through the breach, into the **phx21** and will register a PPM reading in a matter of seconds.
5. If you detect a PPM reading, isolate the leak. If the **probe hose** is leaking replace it. If the **probe** is leaking, report an issue.

Replacing the Battery

1. Remove the **FID endplate**. (See *Removing the phx21 case*, pg. 10)
2. Remove the **battery foam (LDAR# 741)**.
3. Hold the connectors, and then carefully disconnect the **battery (LDAR# 911)**.
4. Slide the **battery** out of the case. Discard or return the **battery**.
5. Reverse steps to install new **battery**.

IMPORTANT: Do not use any **battery** other than the one sold by LDARtools; **battery (LDAR #911)**. The **battery** is made and certified specifically for the **phx21**.

Replacing the Pump

1. Cut the zip tie holding the **pump (LDAR#1163)** in place, which runs across the body of the **pump**.
2. Cut the zip tie securing the **pump inlet tubing** (larger of the 2 tubes on the **pump**) to the **inlet filter housing**.
3. Lift the **pump** with one hand, then disconnect the white electrical connector.

TECH TIP: Do *NOT* pull on the wire. They can be pulled out of the connector with minimal force. Grasp the white plastic connector.

4. Pull the **pump outlet tubing** off of the **pump outlet fitting**; **pump outlet tubing** should slide off as well.
5. Attach the adhesive squares on the new **pump**.
6. Thread the zip tie over the **pump inlet tubing** (larger of the 2 tubes on the **pump**).
7. Thread the black zip tie through the holes under the pump base and over the **pump**.
8. Slide the **pump inlet tubing** back onto the **inlet filter housing**.
9. Attach the **pump outlet tubing** onto the **pump outlet fitting**.
10. Attach the new **pump's** white electrical connector.
11. Tighten and trim the zip tie ends.
12. Use *phx21 Vitals Chart* to set/check ranges.
13. Fill out the sticker on the **pump** and the chart on the **pump procedure**. Email a photo of the completed chart to pump@ldartools.com. This will activate the warranty on the **pump**. Failure to do this will void the warranty.

Replacing the Glow Plugs

ATTENTION: If using a secondary **Glow Plug**, report an issue. The unit will only operate for a day or more on the **secondary Glow Plug**.

1. Locate the **Glow Plugs (LDAR# 766)** on either side of the **FID assembly**:
 - a. The yellow **Glow Plug** wire is primary (E).
 - b. The blue **Glow Plug** wire is the secondary (F).

TECH TIP: Below steps work for replacing either **Glow Plug**.

2. Grasp the wire clip on **Glow Plug** wire, and then pull off of **Glow Plug**.
3. To loosen the **Glow Plug** turn counterclockwise using the **Glow Plug fitting wrench 5/16” – 1/4.”**
4. Unscrew and remove the **Glow Plug** using your fingers.
5. Make sure the washer is in place.
6. Insert the new **Glow Plug**, and then turn it clockwise to tighten the fit.

TECH TIP: Don't over-tighten as it will cause damage. Only tighten until resistance is felt plus 1/16 of a turn. Check that there is no gap between the **Glow Plug**, the washer and the **FID**. If a gap is found, report an issue.

7. Reconnect the wire clip to the lower ring after installing the **Glow Plug O-ring (LDAR# 1113)**.

