



**LAKOS**  
FILTRATION SOLUTIONS<sup>®</sup>

## **Installation and Operators Manual**

**Model: SmartPurge<sup>™</sup> Solids Level Control System**



**FRESNO, CALIFORNIA, USA**

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## ***Introduction***

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The LAKOS SmartPurge System is an intelligent purging option for efficiently evacuating solids from LAKOS Separators. This system utilizes a solids-level sensing probe as well as user-adjustable timing logic to determine when to open the separator purge valve. This helps alleviate the guesswork of determining when and how often to purge the separator, thus minimizing fluid loss when purging too often as well as minimizing wear and tear on the purge equipment. The SmartPurge system can additionally act as a failsafe feature to help ensure that the separator never overfills with solids.

### **Special Controller Features:**

The LAKOS SmartPurge system combines a specially engineered solids-in-liquids sensing probe and a proprietary smart relay controller to sense when the solids accumulation in the separator justifies opening a valve to evacuate the solids from the separator. The controller also monitors elapsed time since the previous purge and, based on user input, will open the purge valve on a regular timed basis if the probe does not detect a high solids level during that interval. Fault monitoring is also incorporated into the controller to alert the user in the event of blocked purge piping or purging system upset. If the probe initiates a purge cycle three consecutive times without clearing, the controller automatically halts further purges for a “time-out” period and illuminates a red fault light. Once this “time-out” period elapses, the controller will attempt three more purge cycles. If the fault condition has cleared, the controller resumes normal operations. If the fault condition persists, the controller will continue in fault mode, for another “time-out” period.

### **Vibration-Driven Probe:**

The solids sensing probe is a point level vibratory design used to detect the presence of solid material that has settled in water or aqueous solutions. The vibrating blade has a mechanical resonance frequency of about 290 Hz. When solids accumulation covers the blade of the probe, the vibration stops. This is sensed by the built-in electronic circuitry causing the controller to initiate a purge cycle. When the blade becomes uncovered, the vibration will restart and continue monitoring for solids level. Since only the end of the vibrating blade is sensitive and not the base, buildup on the separator wall has no influence on the sensor. The shape of the blade and its vibration also have a self-cleaning effect.

## **Warranty**

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All LAKOS SmartPurge systems are warranted to be free of defects in material and workmanship for a period of at least 1 year from the date of delivery. Extended warranty or no coverage applies as follows:

All components: 12 months from the date of installation; if installed 6 months or more after ship date, warranty shall be a maximum of 18 months from ship date. If a fault develops, notify us or your local representative, giving a complete description of the alleged malfunction. Include the model number(s), date of delivery and operating conditions of subject product(s). We will subsequently review this information and at our option, supply you with either servicing data or shipping instructions with returned materials authorization number. Upon prepaid receipt of subject product(s) at the instructed destination, we will perform such necessary product repairs or replace such products(s) at our expense.

This limited warranty does not cover any products, damages or injuries resulting from misuse, misapplication, neglect, normal expected wear, chemically-caused corrosion, improper installation or operation contrary to factory recommendation. Nor does it cover equipment that has been modified, tampered with or altered without authorization.

No other extended liabilities are stated or implied and this warranty in no event covers incidental or consequential damages, injuries or cost resulting from any such defective product(s).

This warranty supersedes any and all previous warranties provided by LAKOS Corporation.

## General Specifications

|  |  |
|--|--|
| <b>Controller Input, Valve Output Power:</b>   | 100 to 240 V AC 50/60 Hz   |
| <b>Controller Internal Power Supply:</b>       | 24 VDC   |
| <b>Controller and Probe Power Consumption:</b> | 9 VA   |
| <b>Allowable Ambient Temperature:</b>          | <p>Probe: -4° F to +140° F (-20° C to +60° C)</p> <p>Controller: -4° F to +104° F (-20° C to +40° C)<br/>(+131° F/ +55° C in user-supplied ventilated enclosure)</p> |
| <b>Process Temperature: (Probe)</b>            | -4° F to +176° F (-20° C to +80° C)  |
| <b>Maximum Process Pressure: (Probe)</b>       | 145 psi (10 bar)   |
| <b>Probe Material:</b>                         | 304 Stainless Steel  |
| <b>Controller Enclosure:</b>                   | Non-Metallic NEMA 4X/IP66  |
| <b>Probe Electrical Enclosure:</b>             | Powder Coated Aluminum:<br>NEMA 4X/IP66  |
| <b>Probe Relay Output:</b>                     | DPDT contacts, 5 Amps 250 VAC  |
| <b>Max Rating</b>                              | 6A   |
| <b>Probe Mounting:</b>                         | 1 1/2" NPT   |
| <b>Probe Housing Conduit Entries:</b>          | 3/4" NPT   |

# Pre-Assembly/Pre-Startup Checklist

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## SAFETY SUMMARY

Review the following safety precautions to avoid injury and prevent damage to the equipment.

The product should be installed, commissioned, and maintained by qualified and authorized personnel only. A millwright or pipefitter should install the plumbing fittings.

Install according to installation instructions and comply with all National and Local codes.

Use electrical wire that is sized and rated for the maximum voltage and current of the application. Properly ground the enclosure to an adequate earth ground.

Observe all terminal and relay contact ratings as called out on the probe nameplate and in this installation manual.

Ensure that the probe enclosure cover is in place and secured tightly during normal operation.

If this product is used in a manner not specified by the manufacturer the safety protection could be compromised.

## Safety Terms and Symbols



**WARNING:** Warning statements identify conditions or practices that could result in injury or loss of life, including risk of electrical shock.



**CAUTION:** Caution statements identify conditions or practices that could result in damage to this product or other property.

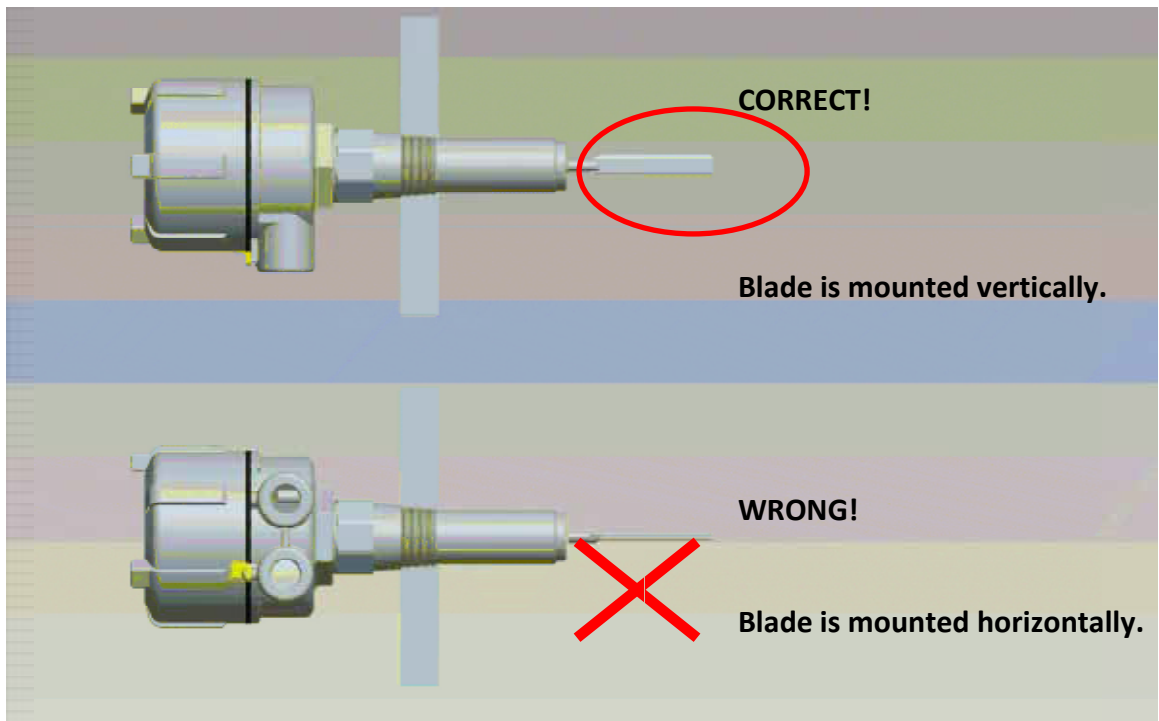
## **Probe Installation Instructions:**

**CAUTION: Do not handle probe by its blade or drop it. The blade must not be bent or its dimensions altered in any way. Maximum load on the end of the blade is 22 lbs (100 N/10kp). Returned units with bent or damaged probes are not covered under warranty.**

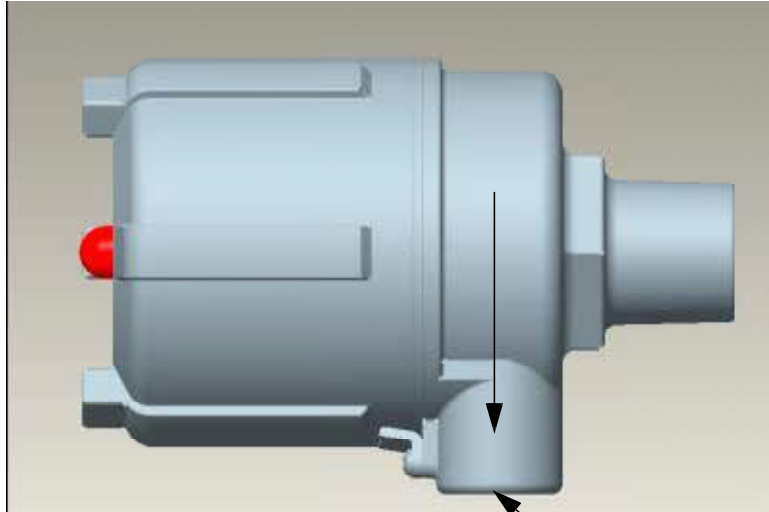
1. The sensor probe is installed by screwing the male mounting threads into a 1-1/2" FNPT coupling located near the purge outlet of the separator. Use PTFE tape or equivalent to ease assembly. Use a 2 inch (50mm) wrench to tighten the unit into the mounting socket. The probe must be turned until the blade is vertically oriented, so that solids material can flow freely over the blade and do not rest on it, potentially causing false triggers. Use the round indentation on the 2 inch hex collar to identify the blade orientation. When the indentation is facing up, the blade is oriented correctly. Refer to Figure 1 for a view of blade orientation
2. Check for leaks before installing conduit(s).

**CAUTION: Do not screw in by turning the enclosure housing!**

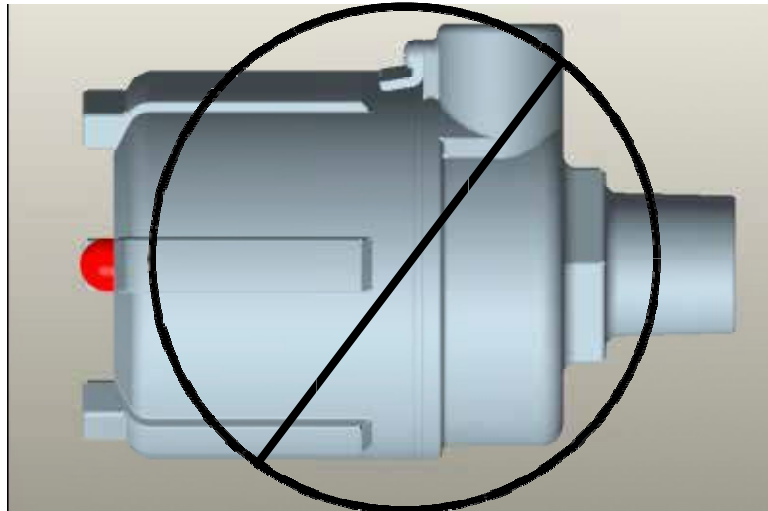
**Figure 1**



### 3. Housing Mounting Instructions



Always mount unit with  
conduit opening  
facing down



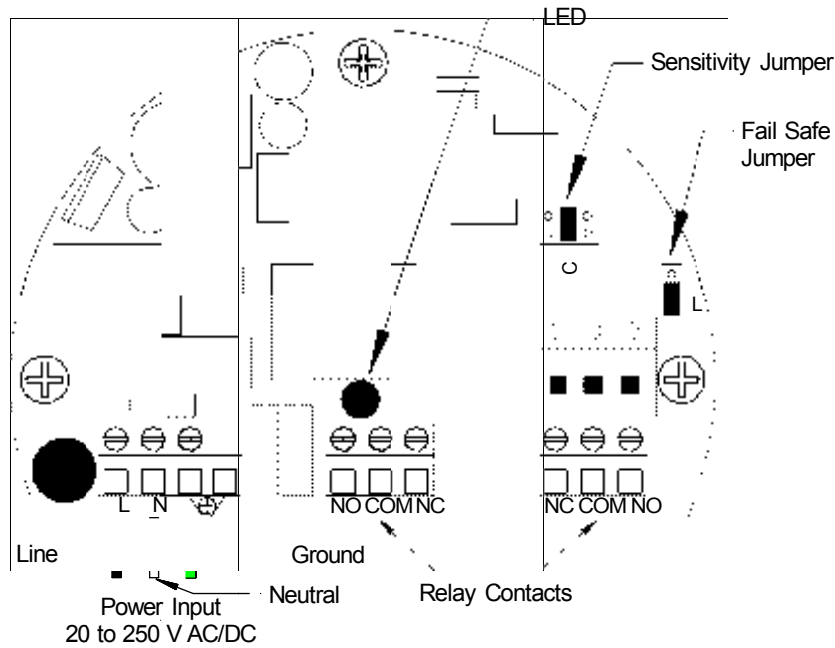
#### Conduit Seal

When installing this level indicator in environments where it is possible for moisture or moist air to enter the enclosure through the electrical conduit, the conduit opening should be sealed with a duct seal compound or putty appropriate for the purpose.



4. The conduit entries must always point downwards to prevent moisture from seeping inside the housing. If the housing is not in the correct position after the probe has been firmly screwed into the separator port, proceed as follows:
  - i. Remove the cover of the housing.
  - ii. Unscrew and remove the 3 mounting screws for the upper circuit board.
  - iii. Remove the upper circuit board. Be careful not to bend the interconnect pins on the bottom of the circuit board.
  - iv. Unscrew and remove the 3 hex standoffs that secure the lower circuit board.
  - v. Remove the lower circuit board. The wires from the probe do not need to be removed from the circuit board, but care should be taken not to damage the circuit board or wires.
  - vi. Use a 10mm wrench or socket to loosen and remove the nut that secures the housing to the vibrating rod assembly.
  - vii. Lift off the housing from the vibrating rod assembly. Take care not to damage the wires or the circuit board.
  - viii. The housing can be rotated in 90° increments to achieve an orientation that has the conduit entries pointing downward.
  - ix. Place the housing back on the vibrating rod assembly so that the tube for the wires is in one of the 4 notches in the housing.
  - x. Replace the flat retaining washer and flat washer and screw the nut back on the stud from the vibrating rod assembly. Firmly tighten the nut.
  - xi. Replace the lower circuit board and secure it with the 3 standoffs.
  - xii. Replace the upper circuit board. Be sure to align all of the interconnecting pins on the bottom of the upper circuit board and plug the 2 boards together.
  - xiii. Secure the upper circuit board with the 3 mounting screws.
  
5. The solids sensor is powered from the controller by 24 volt DC. The terminals on the circuit board for the power supply and the relay contacts allows for a maximum conductor size of 12 AWG. An equipment grounding connection (earth ground) should be supplied to the unit from the controller for safety. See the diagram below for terminal and component identification. Field wiring should conform to all national and local electrical codes and any other agency or authority having jurisdiction over the installation.





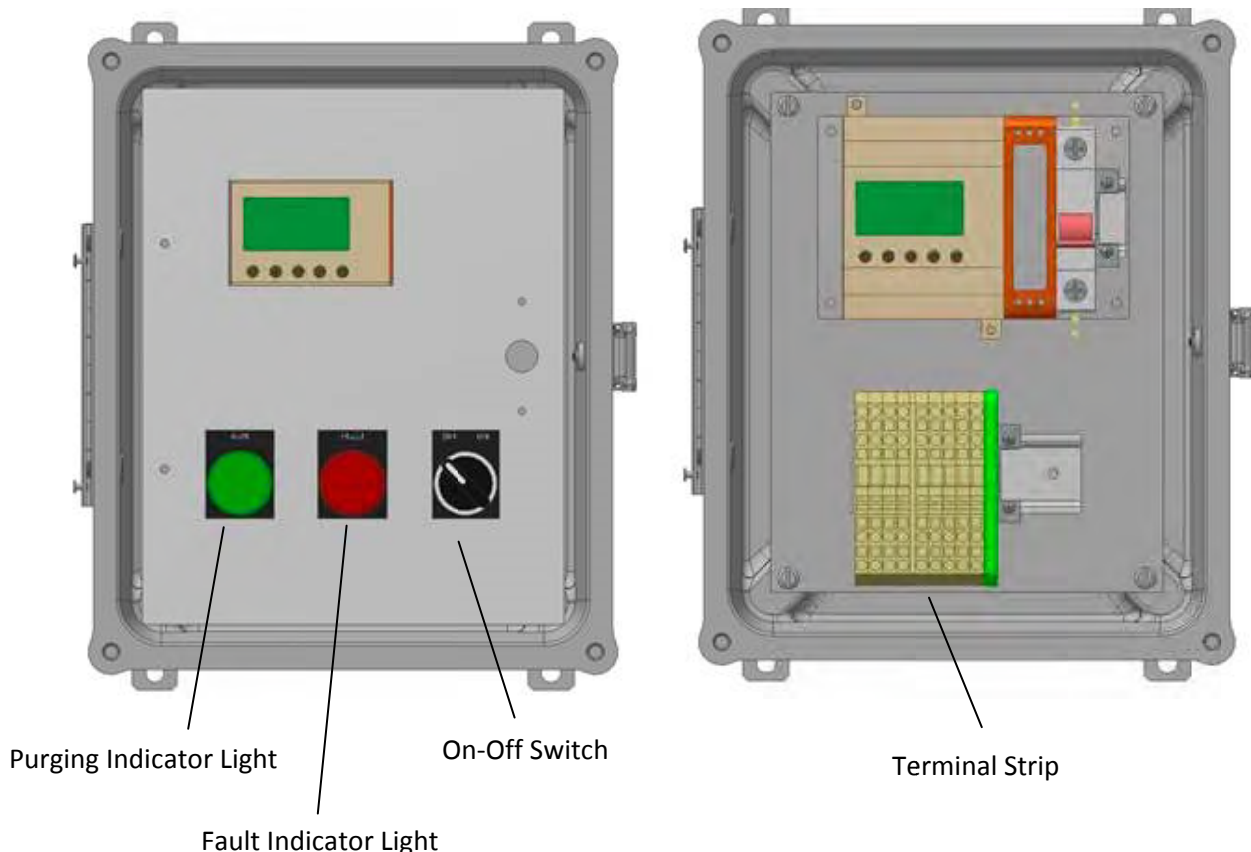
**Figure 2**  
Wiring Terminal &  
Component Identification

6. Ensure the Fail Safe jumper is positioned on the “Low” setting. Fail-Safe “Low” means that the relay will be de-energized when the probe is uncovered and will energize when the probe is covered. In this mode, a power failure will cause the relay contacts to indicate that the probe is uncovered whether it is or not.
7. Ensure the Sensitivity jumper is positioned on “C”.
8. The LED on the circuit board and visible through the back of the housing is a visual indication of the status of the vibrating rod relay. The LED will be flashing when the relay is de-energized and will be ON solid when the relay is energized.

| Probe Status | LED Status | Relay Status                       |
|--------------|------------|------------------------------------|
| UNCOVERED    | FLASHING   | DE-ENERGIZED (COM CONNECTED TO NC) |
| COVERED      | ON SOLID   | ENERGIZED (COM CONNECTED TO NO)    |
|              |            |                                    |

## Controller:

1. 100-240V 50/60 Hz AC power supply is required for operation of the SmartPurge system. Note that the controller and probe are powered by 24 VDC internally, but the input voltage applied to the system is what is passed through to the valve actuator(s). Ensure the purge valve system used is rated for the electrical input power applied to the SmartPurge controller. The controller is not a voltage transformer.
2. Wire the controller, the probe and the valve system per the wiring diagram shown on page 23.
3. Ensure the 6A circuit breaker is in the closed/engaged position (indicator window is red )
4. Once installed, test by turning water supply on slowly, allowing water to pressurize the separator. Check for leaks in purge equipment.
5. Apply power to the controller enclosure and turn panel switch to "On". Verify that the display on the controller is on.
6. Program the controller for the times desired following the instructions in the next section.
7. Initiate a manual purge by pressing the left arrow button on the controller. The panel-mounted green light will illuminate and valve actuation should occur. The controller's display screen will shift to show the time left on the purge cycle. After initial purge cycle, the green light extinguishes and the valve closes. The controller's display reverts to the home screen and the Purge Events counter will index by one to show a purge cycle has occurred.
8. During operation, the red light on the solids-level probe will flash when the solids level is below the probe. When the solids level reaches the probe, the light will be illuminate continuously until the solids level drops below the probe. Depending on the delay timer setting (see programming instructions below) the purge valve may not open immediately after the light



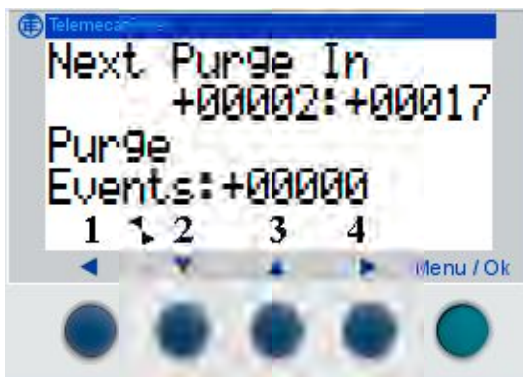
# Startup and Operation

## 1. PROGRAMMING

There are three user-adjustable parameters:

- Purge interval time/frequency (minutes)
- Purge duration (seconds)
- Dwell time before system reacts to a sensor probe trigger, also called Hysteresis (seconds)

These settings can be easily adjusted using the Electronic Purge Controller. Before adjusting timer settings, make sure you STOP the program. Power is still required to make any changes.

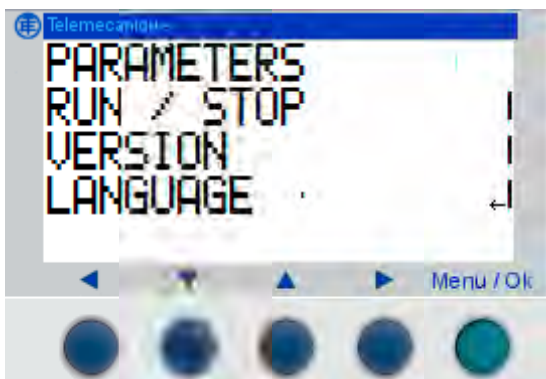


**Home Screen:**

Next Purge In – Displays interval time remaining before the next timed purge cycle start in Hours: Minutes

Purge Events –Displays the total number of purge cycles that have occurred since the last reset

To make changes to the various timers, the program needs to be stopped. Press the green “Menu / Ok” button once, which will bring you to the **Edit Screen** shown below:



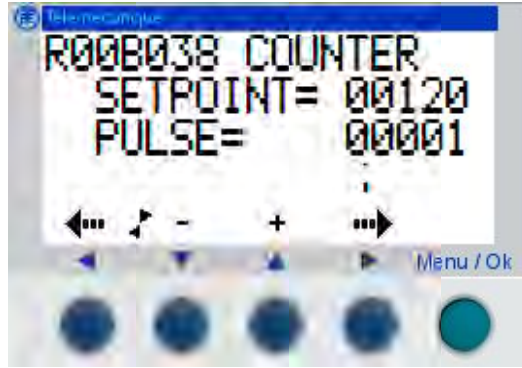
**Edit Screen:**

Press the down arrow once to see “RUN / STOP” flashing.

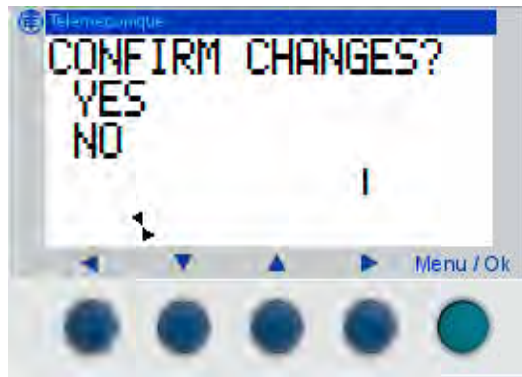
Press the green button once to see “STOP PROGRAM” menu with “YES” flashing.

Press the green button once more to confirm.

With the program stopped, changes to the timers can now be made. Return to the **Edit Screen** by pressing the green “Menu / Ok” button. With “PARAMETERS” flashing in the **Edit Screen**, press the green button to continue to the parameter screens.

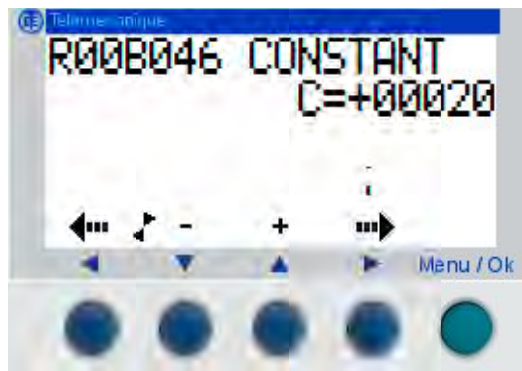


“R00B038” is the purge interval time (minutes) to set the time between timed purge cycles. The picture to the left shows it to be set at 120 minutes (2 hours), and is the factory default setting. To leave this value alone, push the up arrow button once to move to the next parameter screen and go to the “R00B046” section below. To change, press the right arrow to highlight the “SETPOINT=00xxx” set point. Then, using the up or down arrows, change the time as desired.

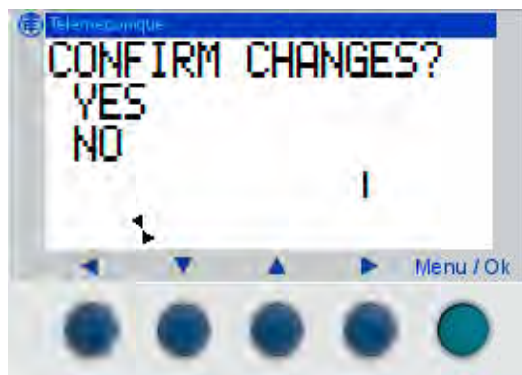


Press the green button to show “CONFIRM CHANGES”. With “YES” flashing, press the green button again to confirm. This returns you to the “R00B038” screen. Press the right arrow twice to highlight the “R00B038” line. Do not change the “PULSE=00001” setting.

Press the up arrow button to move to the “R00B046” parameter screen.



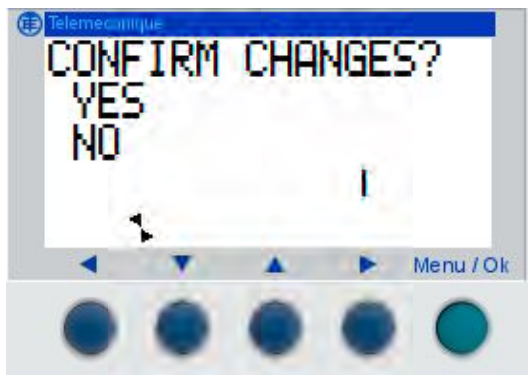
“R00B046” is the purge duration time (seconds) to set how long the valve is to be opened. The picture to the left shows it to be set at 20 seconds, which is the factory default setting. To leave this value alone, push the up arrow button once to move to the next parameter screen and go to the “R00B108” section below. To change, press the right arrow button once to highlight “C=+000xx”. Then use the up or down arrow buttons to change this value. **6 seconds is the minimum allowable value to allow the valve time to open fully.**



Press the green button to show “CONFIRM CHANGES”. With “YES” flashing, press the green button again to confirm. This returns you to the “R00B046” screen. Press the right arrow once to highlight the “R00B046” line. Press the up arrow button to move to the “R00B108” parameter screen.

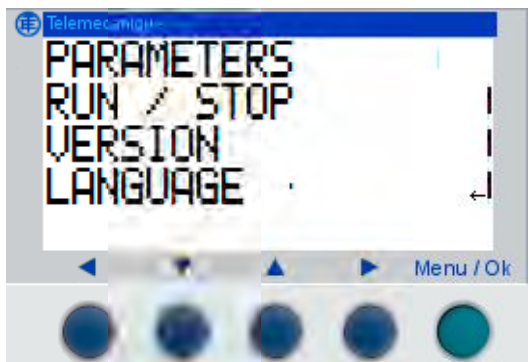


“R00B108” is the dwell time (seconds) that the system will wait before initiating a purge after a probe trigger, sometimes called Hysteresis. The picture to the left shows it set to 5 seconds and is the factory default setting. To leave this value alone, press the green “Menu/OK” button and go to the **Restarting** section below. To change, press the right arrow to highlight the “ACTIVE=0000x” set point. Using the up or down arrows, change the time as desired.



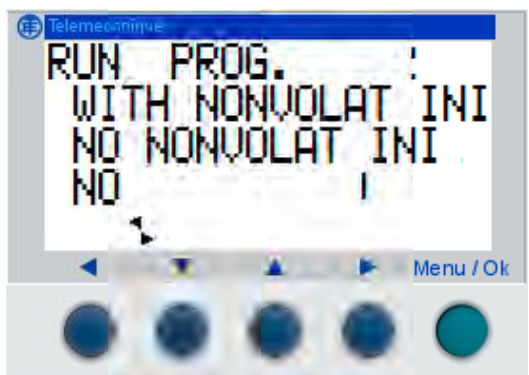
Press the green button to show “CONFIRM CHANGES”. With “YES” flashing, press the green button again to confirm. This returns you to the “R00B108” screen. Press the right arrow twice to highlight the “R00B108” line. Do not change the “INACTIVE=00000” setting.

This completes the user adjustable settings. Press the green “Menu / Ok” button once to return to the Edit Screen.

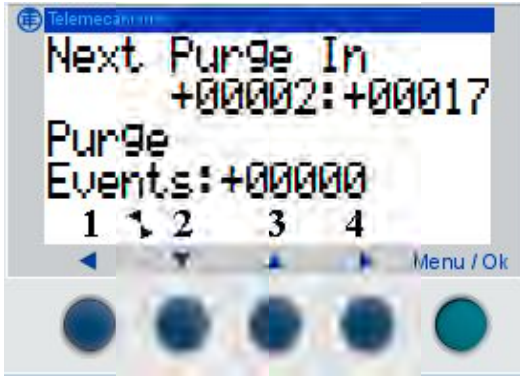


## Restarting

With “PARAMETERS” flashing in the Edit Screen, press the down arrow once to highlight “RUN/STOP” and then press the green button once.



With the “WITH NONVOLAT INI” line flashing, press the green button once more. The system startup screen will show for a few seconds and then change to the “Home Screen”

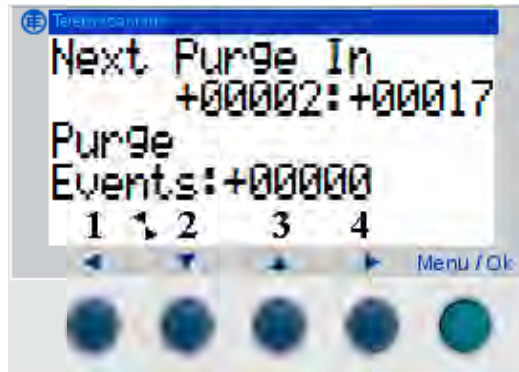


The system is now running again with the updated timer settings.

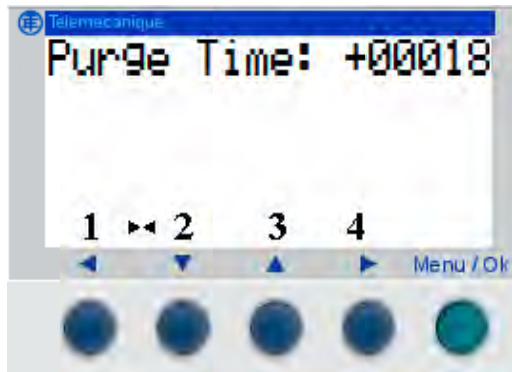
## 2. NORMAL OPERATIONS

The four grey buttons below the controller screen have the following functions in run mode:

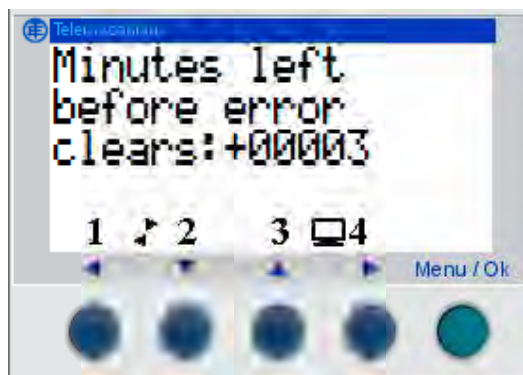
- |   |   |   |  |
|---|---|---|--|
| ◀ | Left Arrow - Initiates a manual purge cycle without resetting timer | ▲ | Up Arrow - Resets purge interval timer and purge cycle counter |
| ▼ | Down Arrow - Clears fault condition                                 | ▶ | Right Arrow - Resets purge cycle counter                       |



Pushing the Left Arrow button (#1) starts a manual purge cycle and the purge duration countdown screen will appear as shown below. Note: The Purge Interval timer is not reset and continues to count down.



If the Fault Duration Time-Out timer is engaged (three consecutive probe triggers within the pre-programmed Failsafe Trigger timer), the controller screen will appear as shown below:



Pushing the Down Arrow Button (#2) will clear the fault and resume operation. The Purge Event counter remains un-cleared.

Pushing the Up Arrow button (#3) resets the Purge Interval timer to the programmed value and clears the Purge Events counter to zero. The system startup screen will display for a few seconds before returning to the home screen.

Pushing the Right Arrow button (#4) clears the Purge Event counter to zero.

### 3. TIMER SETTING TIPS

Timer **R00B038**, purge interval timer, is the maximum allowable time in minutes between purges. In some applications, fluid must be dumped on a periodic basis (such as cooling system blown down, fluid refresh, etc.) and this timer can accomplish this while purging the accumulated solids at the same time. Ideally, the probe will trigger prior to this timer elapsing, but in the event it does not, the separator will still purge as required on a timed basis. If the probe triggers the purge first, this purge interval timer is reset to the programmed value. It is highly recommended to make an estimate of how long it would take to fill the separator to its stated collection capacity based on estimated solids loads and use this as your initial minimum purge interval time. Use this time as the minimum interval if it is less than a periodic blown down or drain interval.

Timer **R00B046**, purge duration, is the time in seconds the valve is opened during each purge. Specifically, it is the time between the valve starting to open and it starting to close. There is an additional 7 seconds preset in the system during which the valve is closed. So, the total system purge cycle from start to fully closed is **R00B046** PLUS 7 seconds. This timer should be set for the minimum length of time it takes to fully clear out the separator purge collection chamber, PLUS all of the purge piping. It is important to ensure that the majority of the separated solids have travelled all



the way out of the purge piping before closing the purge valve to avoid settling in the pipeline. Typically, this can be determined by observing how long it takes for the color of the purged liquid to change as it leaves the end of the purge pipe. When it goes from dark to suddenly light(er), the majority of the solids have likely cleared the line. If it is not possible to observe the purge flow out the end of the purge piping, or the color of the fluid is characteristically dark, use the Purging and Solids Handling Guidelines (document #LS-608 available from LAKOS at [www.lakos.com](http://www.lakos.com)) and using a calculation of the estimated volume of the purge piping plus the purge collection chamber volume to determine the minimum time to flush the separator and purge piping. Since it takes time for solids to begin moving once the valve is opened, add 10-20% to the calculated time to ensure full evacuation.

Timer **R00B108**, probe trigger dwell time/hysteresis, is the time delay in seconds before the system responds to a solids probe signal. Generally, this can be set to 0-30 seconds to ensure there is a continuous signal from the sensor vs. a false trigger due to swirling solids in the collection chamber. However, if it is determined with actual practice that the system is able to accumulate more solids before purging without risk of plugging the purge line, this timer can be set higher to allow more accumulation between purges. Use caution when allowing the separator to fill higher than the probe level. Some solids, like coarser sand, can build up a bit more without danger of bridging the purge outlet. However, flaky and jagged solids (like mill scale, crushed gravel and machining swarf) or softer materials containing clay can easily bind together and form a cemented mass that will blind off the purge and require mechanical removal.

An internal, non-user adjustable timer called a “failsafe trigger time”, is the time in seconds during which three consecutive probe triggered purges must take place before sending the system into fault mode. If three triggers occur during this time, the system enters a “time-out” fault delay during which NO purges are attempted, and the fault light illuminates. The primary purposes of this feature are to: 1) guard against an unlikely internal failure of the probe itself, 2) an inadvertent blinding of the probe blade with solids material such that the probe believes it is buried, when it is not, or 3) react to a plugged purge line or overfilled separator due to insufficient purging or a purge valve failure. In the case of conditions 1) and 2), the fault timer prevents excessive purging and subsequent liquid loss, and gives the user time to acknowledge the fault and resolve the issue. In the event of condition 3), the fault condition alerts the user that the separator is not emptying itself. Its minimum factory setting is a function of the purge duration and the probe trigger dwell time. It is internally set for a calculated time by adding the purge duration selected (R00B046) and the purge trigger dwell time selected (R00B108) plus 7 seconds and multiplying this by 2. As an example, if the purge time is set for 15 seconds, and the probe trigger dwell time is set for 5 seconds, the calculation looks like:

$$(\text{Purge time} + \text{dwell time} + 7) * 2 = (15 + 5 + 7) * 2 = 54 \text{ seconds}$$

Another internal, non-user adjustable timer called the fault duration time, is the “time out” period in minutes before the system will attempt to resume normal purging after a fault condition. Its minimum factory setting of 3 minutes is a function of the duty cycle on an ABV-equipped system and is to allow the valve actuator to cool enough to stay within its rated 20% duty cycle.

**If possible, regularly monitor the red fault indicator light or wire the system to a horn or remote monitoring location so that faults can be quickly ascertained and addressed promptly. The unused DTDP contacts in the probe housing may be used to connect a remote alarm.**

#### 4. WINTERIZING

Heat tracing or pipe insulation may be used if operating below -4F (-20 C). Please contact your local supplier of these products to ensure proper usage.

# Maintenance

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1. Record and compare timer/counter readings during the first several days or weeks of operation, and whenever periodic check-up and maintenance is required. These records are helpful in troubleshooting when a problem occurs during the operational life of the system. In addition, knowing the average time durations between probe triggers will help the user determine an appropriate Purge Interval timer setting to use. In many cases, the probe should be the primary triggering mechanism and the purge interval timer used as a backup. This ensures minimum purge cycles. In other cases, however, the separator needs to be purged on a regular timed basis due to plant requirements, and the probe can be used as a failsafe to purge before the timer elapses.
2. Over time, the probe surfaces may become coated with scale and/or residue. If this is a known consideration in the proposed application, periodically remove the probe from the separator and clean using a mild acid wash. Reinstall using PTFE tape or equivalent on the probe's threads.
3. Periodically actuate the system by initiating a manual purge to ensure that the connectivity to the valve actuator remains intact.

# Trouble-Shooting Procedures

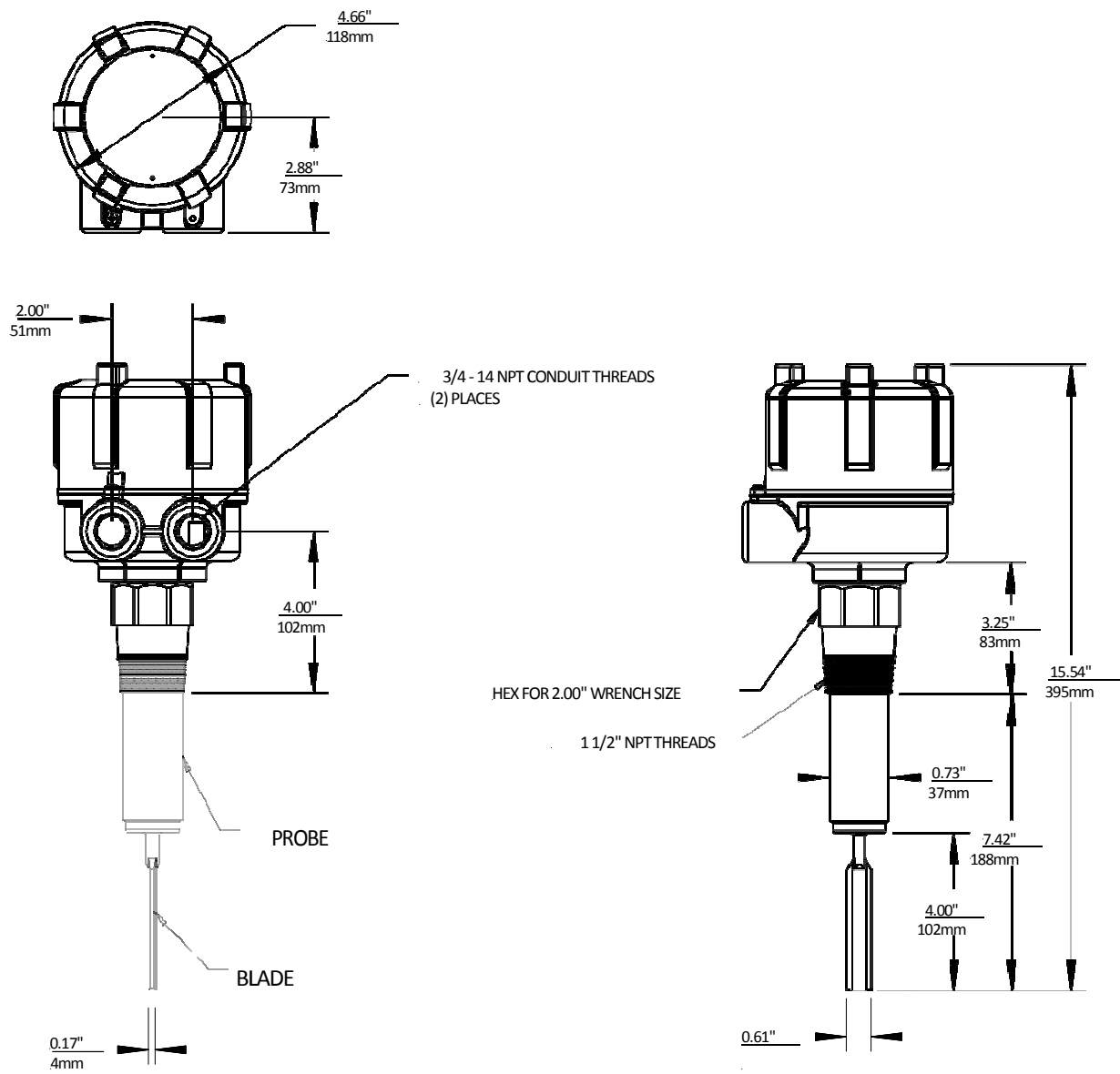
| SYMPTOM  | PROBLEM   | SOLUTION  |
|--|---|---|
| Red "Fault Indicator" light illuminates                      | System is in "Fault Mode" due to initiating 3 purge cycles within pre-programmed time period            | Push the down arrow button (#2) on controller to clear fault. Then press the left arrow button (#1) to initiate a manual purge. If separator is purging normally, change the value of <b>R00B46</b> (purge duration) to a longer period of time.<br>If purge valve will not mechanically actuate, proceed to the next symptom remedy below. |
|  |   | If valve does actuate, but no flow occurs, separator or purge piping plugged with solids or the purge line is obstructed. Clean out separator collection chamber and purge line and ensure nothing downstream is blocking the flow of purge liquid.   |
|  |   | Probe has failed or been buried in unpurged solids. Isolate separator, drain it, and remove probe for inspection. Clean, verify operation, and return to duty. Ensure separator is clean of accumulated solids. If probe has failed, contact factory for replacement.   |
| Actuator does not respond to control signal                  | Actuator wired incorrectly  | Check wiring diagram and rewire.  |
|  | Wrong voltage   | Check power supply and make appropriate changes.  |
|  | Thermal overload activated  | Allow motor to cool, actuator will automatically reset.   |
|  | Actuator failed   | Contact factory for replacement.  |
| Too much water is purged per cycle compared to solids volume | Purge duration too long   | Readjust <b>R00B046</b> purge duration time parameter to shorter duration   |
|  | Purging too soon once probe triggers  | Readjust <b>R00B108</b> dwell/hysteresis time parameter to wait longer before initiating purge  |
| Purge line plugging over time                                | Insufficient purge duration to clear solids out of purge piping   | Readjust <b>R00B046</b> time parameter to longer duration   |
|  | Incorrect purge line piping   | Contact LAKOS factory for recommendation.   |
| Fault Indicator coming on even when purging is normal        | Insufficient failsafe trigger time due to high volume of solids and/or insufficient purge duration time | Readjust <b>R00B038</b> downward to purge more frequently   |
|  |   | Purge for longer periods by adjusting <b>R00B046</b> purge duration time parameter for longer duration  |

# Reference Materials

## Diagrams

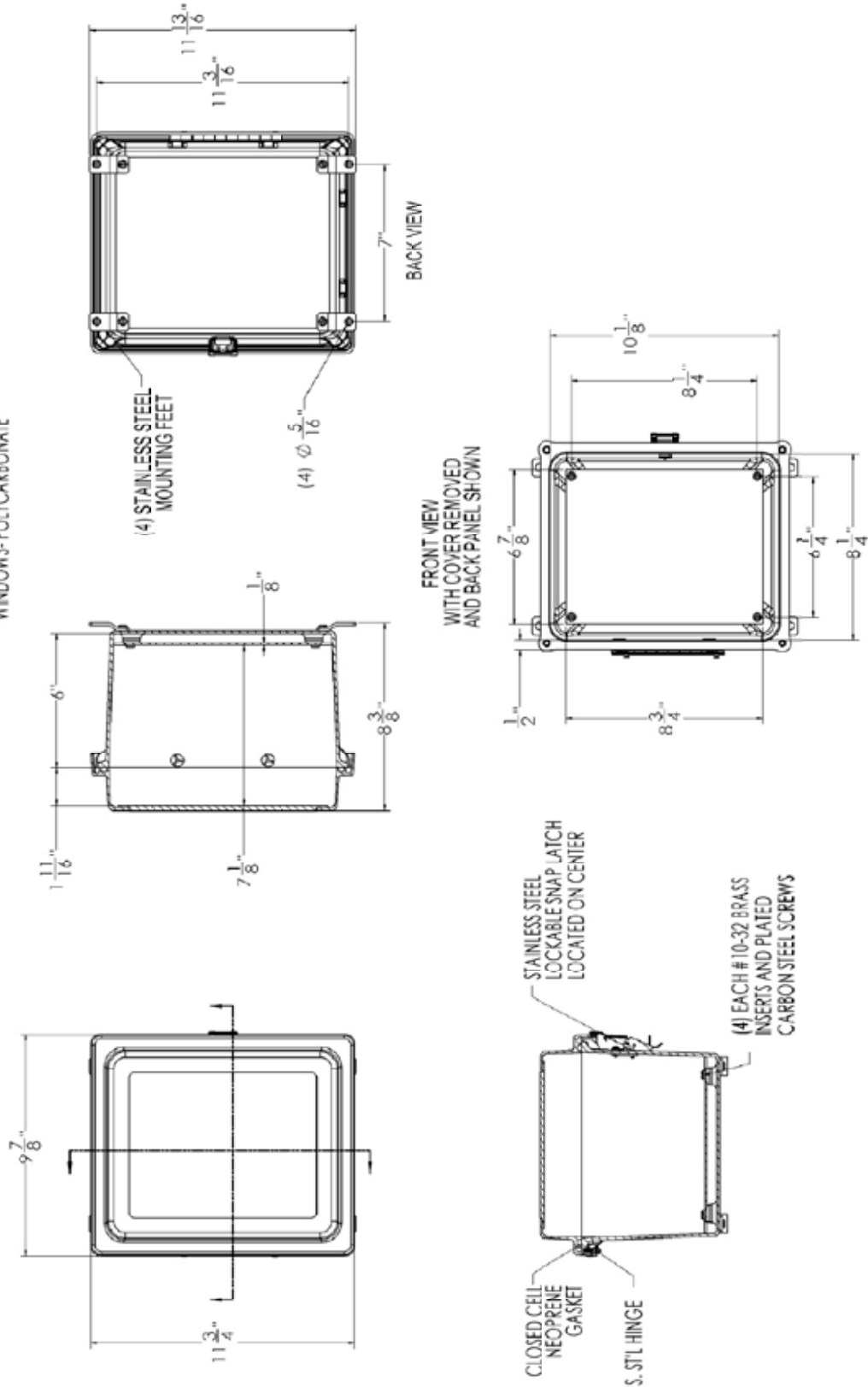
- A. Probe Dimensions
- B. Enclosure Dimensions
- C. Wiring Schematic

### A. Probe Dimensional details

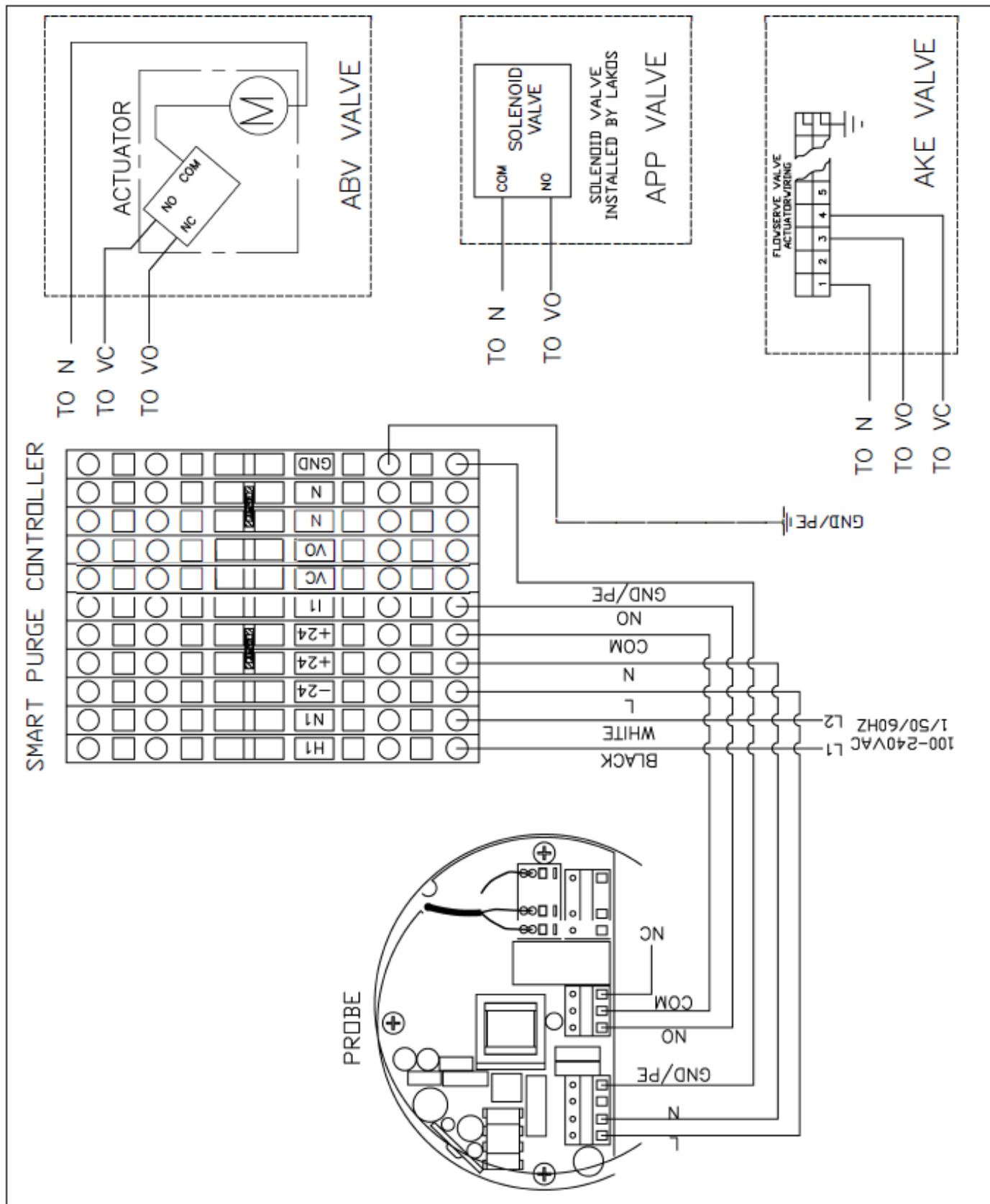


B. Enclosure Dimension

MATERIAL:  
 BOX- COMPRESSION MOLDED FIBERGLASS REINFORCED POLYESTER  
 COVER- COMPRESSION MOLDED FIBERGLASS REINFORCED POLYESTER  
 WINDOWS- POLYCARBONATE



C. Wiring Schematic



## ***Reference Materials***

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### **Spare Parts for SmartPurge Systems**

- Complete Probe Assembly                      LAKOS P/N: 137699
- Complete CUL/UL Controller                LAKOS P/N: 137817

**Parts:**

- Lakos Probe Relay – Not Programmed      LAKOS P/N: 137896



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