ELM Troubleshooting Guide for Vigilant

1.0 Overview

This guide covers troubleshooting steps for the ELM electrolyte level sensor when used with the Vigilant monitoring system. It will cover all the possible steps to troubleshoot a sensor that is in alarm, starting with the most likely to least likely causes.

2.0 How Level Alarms Work

Before troubleshooting the ELM it's important to understand how alarming works. The ELM is independent from the Vigilant system in that each sensor has functions that can operate without input from the Vigilant. The Vigilant reads the alarm state of the ELM to then register an alarm on the system.

ELM Sensor Level Detection

The ELM sensor measures the electrolyte level by using two infrared sensors.

- When the ELM sensor detects a low level, it will delay the alarm by 45 minutes to prevent false alarms.
- When the ELM sensor goes into alarm, the Level LED will turn red.
- **The ELM sensor will remain in alarm indefinitely, even if the water level is refilled.** The sensor must be recalibrated to clear the alarm (steps outlined below).

Vigilant Alarming

The Vigilant reports ELM alarms based on a series of polls taken of each sensor.

- The Vigilant polls the ELM every 90 minutes to see if there's an alarm.

- If the ELM is in alarm the Vigilant will not register the alarm, it will instead reset the ELM sensor.

- When the ELM sensor is reset, the Vigilant will poll the sensor again in 90 minutes to see if it is still in alarm.

- Assuming the electrolyte level is still low, the process of the Vigilant polling the ELM alarm and resetting it will occur 3 times.

- If the Vigilant polls and detects the ELM alarm 3 times, it will then register the alarm on the system. The alarm will appear under the alerts page, on the monitor ELM LED, on Relay 1, and on the associated Modbus points.

- When the water level is topped off and the ELM is re-calibrated, the alarm will clear immediately.

It's important to understand this process when troubleshooting. Due to the delays between resets, it can take up to 7 hours and 45 minutes for the Vigilant to register the ELM alarm. This means there could be an ELM sensor visibly in alarm on the battery, but the alarm is not registered in the software. **When troubleshooting ELM alarms in the field, rely on the ELM sensor LED rather than the Vigilant software.** If an alarm is cleared before the Vigilant has a chance to poll it 3 times, that alarm will never register in the software.

3.0 Clearing ELM Level Alarms

This section will outline how to clear an ELM alarm when the level is confirmed to be low. There are 2 ways to clear alarms, either at the ELM sensor in the field, or from the Vigilant web-interface. Clearing from the web-interface is the preferred method if possible. Always be sure to top the water level off before following the steps below.

3.1 Clear Alarms at the ELM

If the technician servicing the ELM does not have access to the web-interface, the sensors can be calibrated individually at each sensor.

1. Identify the ELM sensor that is in alarm by the red low level LED.

2. Confirm the water level is at least a half inch above the minimum line. If not, refill it.

3. Remove the cover on the bottom of the sensor and unplug the power cable. The sensor LEDs should turn off.

4. Plug the cable back into the sensor to power it on.

5. When the sensor is powered on, the green "No Fault" LED will blink for 10 seconds.

6. As soon as the blinking starts, press and hold the "RS" button until the LED stops blinking (about 2-3 seconds).

7. The LED should now be solid green which means the sensor is calibrated.

8. Press the RS button to take a manual measurement and confirm the alarm is cleared.

3.2 Clear Alarms from the Web-Interface

Calibrating the sensor(s) from the web-interface is the preferred option because multiple sensors can be calibrated at once and there is less chance of user-error. These steps will assume you understand how to login to the Vigilant.

1. Login to the web-interface and open the **Settings** section.
2. If using version 1.3.11 or later, click the **ELM Management** button.

Settings

Network	Data Management	User
Modbus	Alarm	Actions
Discharge	Diagnostics	ELM Management
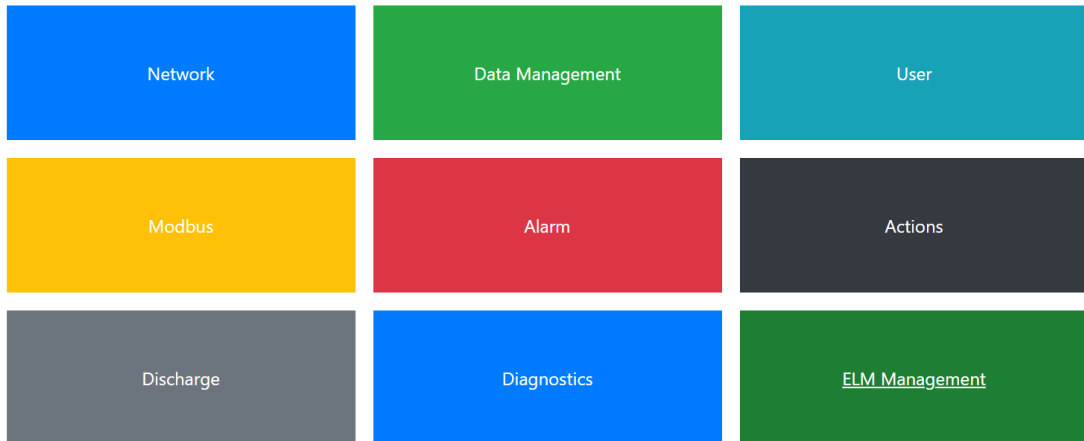
3. If using an earlier version, type "elm/" after "settings/" in the URL bar.
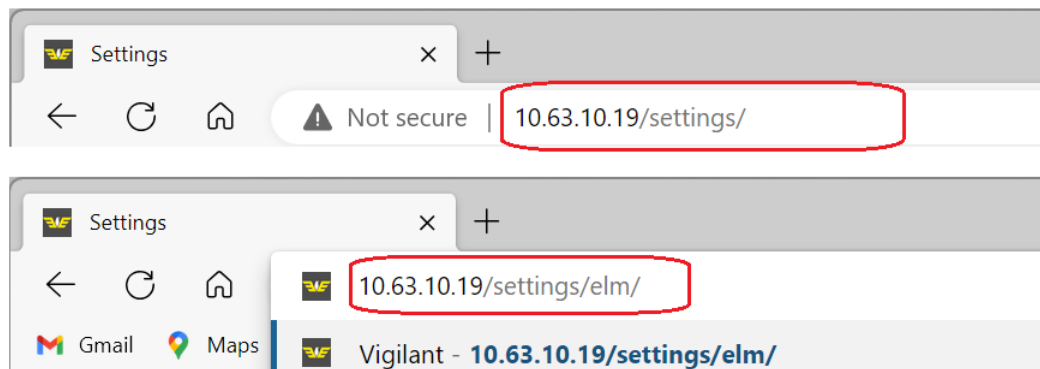
4. On the ELM management page, click the link "Click here to see what other tasks are currently scheduled."

Home / Settings / ELM management

ELM management

You can select multiple sensors from the below selection box. Holding down shift will select a range of

Click here to see what other tasks are currently scheduled.

Add

1
2
3

5. If there are tasks listed, click the **Clear/cancel all** button. If there are no tasks, proceed to the next step.

Sensor tasks

Clear/cancel all

Reference	elm_off	elm_on	connection_test	elm_calibrate	elm_spot_check	elm_read	Actions
1							Clear/cancel
2							Clear/cancel

6. When the tasks are cleared, or if there are no tasks, click the link "Click here to schedule some ELM tasks".

Sensor tasks

No tasks scheduled! Click here to schedule some ELM tasks

7. Back on the ELM management page, click the dropdown menu and select **Calibrate**.

Add

Add
Calibrate
Remove
Replace
Spot check
6

8. Under the list of sensors, select the sensor that needs calibration. Alternatively, select sensor 1, hold the shift button, and then select the last sensor. This will select all sensors.

9. With the desired sensors selected, click the submit button at the bottom of the page.

54
55
56
57
58
59
60

Submit

10. If successful, the system will say ELM tasks scheduled. Check the alerts page to confirm that any sensors in alarm have cleared.

4.0 Troubleshoot Erroneous Level Alarms

The steps in Section 3.0 should resolve the majority of ELM alarms. There are however some instances when calibrating an ELM that is at the correct water level will erroneously go into alarm again.

NOTE: For all the steps below, press the RS button once to take an immediate measurement. This will allow testing to confirm any changes have resolved the issue without needing to wait 45 minutes.

4.1 Confirm Sensor Placement

Installation of ELM sensors must be performed by qualified personnel. If a sensor is installed incorrectly, it can throw false alarms.

- When a sensor is mounted using the ELM cradle, it is aligned on the cell using the 2 pointed arrows on the sides of the cradle.

- These arrows line up with the minimum line on the cell. Depending on how the sensor was mounted, it should alarm when the water level is slightly above or below the minimum line on the cell. Confirm how the sensors are mounted and that the position is not the cause of alarm.
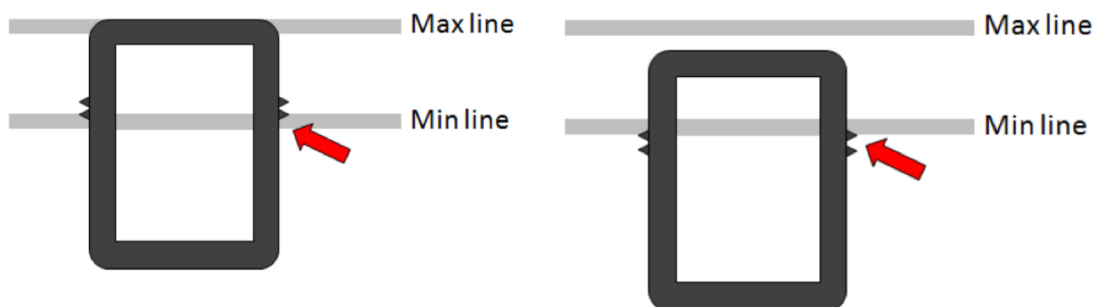
- There are some mounting positions in which the minimum line on the battery can actually cause false alarms on the sensor. If the minimum line goes in between the pointed arrows, it could be the cause of false alarms.

- If the sensor is mounted correctly, check to confirm there is nothing behind the sensor that could interfere with the infrared sensors. This could be debris, battery labels, or something else.

- If in doubt, Eagle Eye provides a template that can be used to identify if something on the jar is blocking the infrared sensors.
- If there are any issues with how the sensor is mounted, re-install the sensor using a new cradle.

4.2 Confirm Proper Measurement Mode

The ELM has two measurement modes: lead acid and nickel cadmium (NiCad). From the factory all ELM sensors ship in lead acid mode. If the ELM is in the wrong mode, it could cause false alarms. As of Vigilant version 1.3.11, verification and setting of modes must be done at the ELM sensor, not from the web-interface. These steps must be done for each sensor, not just one.

1. Press and hold the RS button for 2 seconds (until the light is solid).
2. If in NiCad mode, the LEDs will respond as follows:
   - No Fault: Flashing green
   - Level: Solid red
   - Temp: Off
3. If in lead-acid mode, the LEDs will respond as follows:

- No Fault: Solid green

- Level: Solid red

- Temp: Off

4. To change the test mode, press and hold the RS button until the No Fault LED changes state (about 10 seconds). If in NiCad mode, the LED will be solid green. If in lead-acid mode, the LED will start flashing.

4.3 Verify Sensor Voltage

While unlikely, it's possible the ELM sensor isn't receiving the required voltage for normal operation. Each sensor has a minimum working voltage of 5.5 volts DC.

1. Remove the sensor cover.

2. Using a meter, measure the voltage at the points shown below. Note that it doesn't matter which side the ribbon cable is connected to, the measurement points are the same.
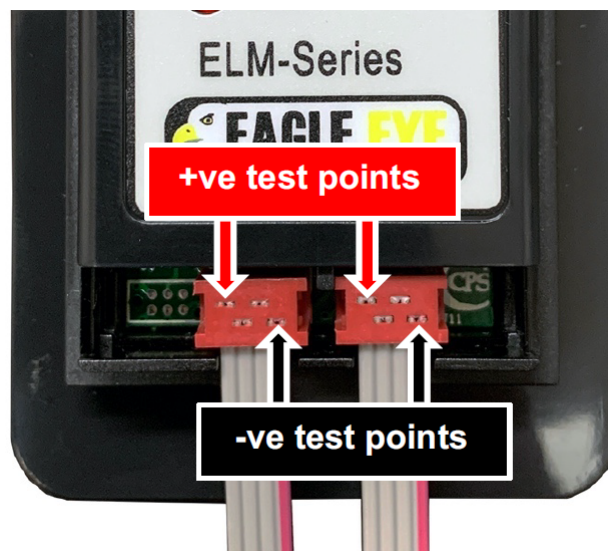

3. If the voltage is under 5.5VDC, replace the ribbon cable. If the voltage is still low, it could be the Vigilant sensor.

4.4 Move ELM Sensor

The most unlikely scenario for erroneous ELM alarms could be interference from something inside the battery jar. This can be challenging to troubleshoot because it could only affect a handful of ELM sensors on the same battery. One example of this could be an internal post that is reflecting light back at the ELM infrared sensors.

The only way to troubleshoot this issue is if something is visibly in line of the ELM sensor, try moving the sensor to a different spot on the battery. In some scenarios, this can resolve false alarms on cells that are problematic.
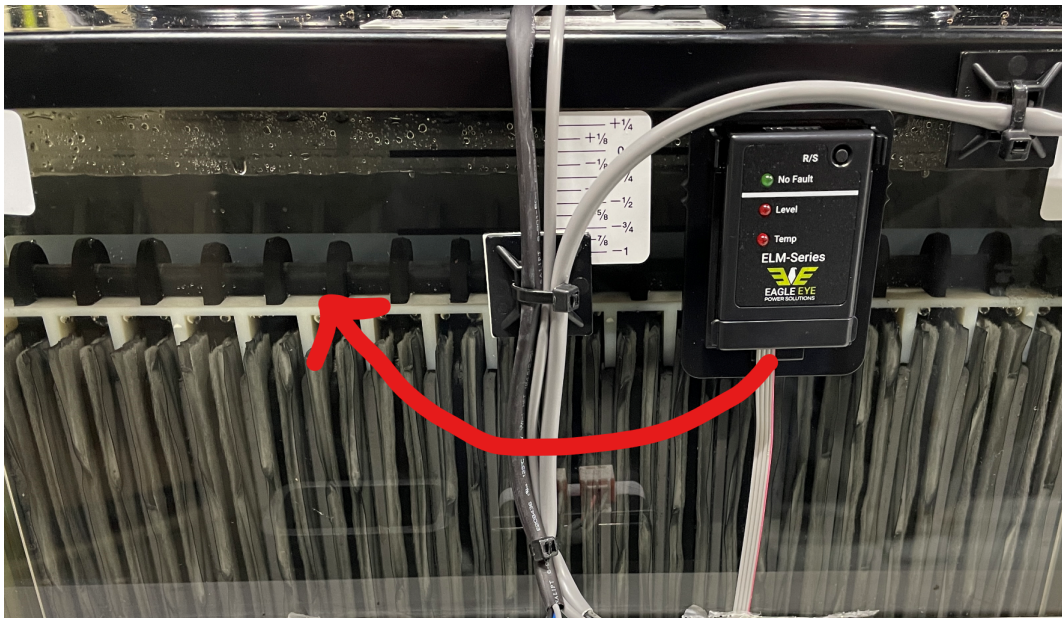
4.5 Replace ELM Sensor

If all of the above fails to fix the issue, the ELM sensor itself could be the issue. Replacement of the sensor may resolve erroneous alarms.

1. Remove the cover from the ELM.

2. Disconnect the ribbon cable.

3. Pull the sensor out of the cradle by slightly pushing out on the cradle clips.

4. Insert the new sensor and plug the cable in.

5. The sensor should power on.

6. Calibrate the sensor following the steps in section 3.0.

5.0 ELM Temperature Alarms

The ELM sensor also alarms for over temperature on each cell. On the Vigilant web-interface this is referred to as "ELM Case Temperature". It does not report an actual value, rather it alarms against a set value on the sensor. Below are the settings available:

- 95°F (35°C) - *Default setting from factory*
- 120°F (49°C)
- 145°F (63°C)
- Temperature alarm off

If ELM sensors are in temperature alarm constantly, the limit may need to be changed or disabled entirely. If the temperature alarms are not an issue, it's recommended to leave the setting at default as the Vigilant records actual temperature values per each cell.

5.1 How to Check Temperature Setting

Note: All actions to change the temperature setting, including saving the changes, must be carried out within 30 seconds, after which the sensor will revert to normal operating mode.

1. Press and hold the RS button for two seconds until all the LEDs turn on

2. While in indication & continuity test mode:

- Press and hold the RS button for four seconds

- The level indicator LED will go out and the temperature LED will remain on; the green power LED will flash regularly once, twice, three or four times in succession.

  - If the green power LED is flashing once, the temperature alarm level programmed is 95°F

  - If the green power LED is flashing twice, the temperature alarm level programmed is 120°F

  - If the green power LED is flashing three times, the temperature alarm level programmed is 145°F

  - If the green power LED is flashing four times, the temperature alarm level is switched off

5.2 How to Change Temperature Setting

1. When the green power LED begins to indicate the current temperature alarm level setting, e.g. flashing once to indicate a setting of 95°F a further brief press of the RS button will advance the alarm setting by one.

2. So, if the power LED is flashing once, pressing the RS button briefly will advance the program to setting two (120°F). Setting two can be advanced to three and so on.

3. When the flashing power LED indicates the desired setting (1, 2, 3, or 4), press and hold the RS button for a further 2 seconds.

4. The Green 'No Fault' LED will change to continuously on and the red temperature LED will go off.

5. The new setting is now the default condition and will be used even after power is removed from the sensor. The sensor returns to normal operation after storing the value.

- If the RS button is not pressed the sensor will exit the temperature setting mode after 30 seconds and the values will not be changed. The sensor will return to normal operation and continue to operate with the last saved value. In all cases if the Low Level indicator was 'on' before going into temperature setting mode the LED will remain set to the 'on' condition after exiting the temperature setting mode.