

Calibration Procedures
for the
MicroPulse Systems Monitor
in Airstream Trailers

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OVERVIEW:

The tank monitor system used in Airstream trailers is made by MicroPulse. This system uses a pressure-sensitive plug in each tank that measures water pressure (a result of the height of the water in the tank) to provide input to a panel-mounted gauge ("monitor"). The monitor has a series of LEDs (light emitting diodes) that illuminate to show the amount of water in each tank. Occasionally, tank monitors need to be reset. This document was prepared as a supplement to the MicroPulse *Systems Monitor Installation, Calibration, Operation Instructions* manual that came with your trailer.

HOW THE SYSTEM WORKS:

Each tank in your trailer (fresh water, grey water, black water) is fitted with a screw-in sensor that contains a sensitive pressure-measuring device. The plug is at the lowest point of the respective tank. As more water is added to the tank, the water pressure on the sensor becomes greater, and the difference between the *empty* measurement and the *full* measurement is used to calculate the number of LEDs that illuminate.

The monitor has a series of nine tri-color LEDs positioned vertically. These LEDs can illuminate red, yellow, or green.

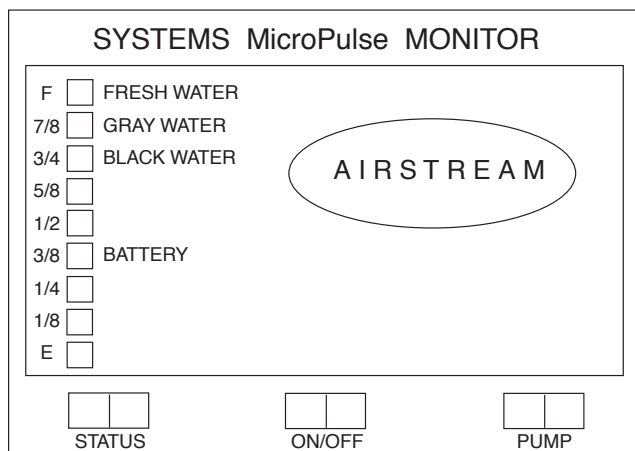


Fig. 1. Monitor has nine LEDs, a monitor ON/OFF switch, a pump ON/OFF switch, and a momentary press-to-check "status" switch.

The monitor has two basic display modes:

ALL TANKS reading. A single LED is illuminated next to each tank that is labeled on the front of the monitor. If the LED is green, the tank is either full (as in the case of fresh water) or empty (as in the case of grey and black water). If the LED is yellow, the tank is approximately half full. If the LED is red, the tank is either nearing empty (as in the case of fresh water) or nearing full (as in the case of grey and black water). An LED flashing red is a warning that the tank is basically empty (fresh water) or full (grey or black water).

INDIVIDUAL TANKS reading. The monitor can be made to display more specific information about each tank and will sequentially report how much fluid is in the tank in nine increments from empty ("E"), 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, to full ("F").

The tank sensors are connected to the monitor with cables fitted with standard telephone-type RJ-11 plugs. These plugs snap into the tank sensors as well as into the back of the monitor panel. They can be removed by gently pulling back on the small tab (just as on a telephone cord). The plug's receptacle on the back of the monitor is marked "FW" for fresh water, "GW" for grey water, and "BW" black water. In most installations, the corresponding wire is grey-covered (grey water), white-covered (fresh water), and black-covered (black water).

BATTERY METER:

The battery meter indicates the level of voltage by showing similar conditions to the water tanks from a standpoint of "full" to "empty. However, in this case, it is measuring voltage from 12 volts to 12.8 volts.

For reference purposes, here is a list of the state of charge of a 12 volt battery at different voltages:

12.6 volts	100% charged
12.5 volts	90% charged
12.4 volts	80% charged
12.3 volts	70% charged
12.2 volts	60% charged
12.1 volts	50% charged
12.0 volts	45% charged
11.9 volts	40% charged
11.8 volts	30% charged
11.6 volts	20% charged

The following figure shows the approximate voltage for each of the LED readings on the monitor:

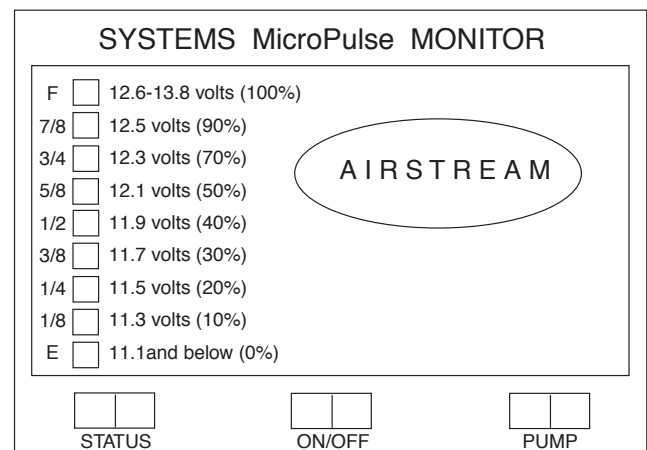


Fig. 2. Approximate voltage values for the corresponding level of the illuminated LEDs when checking battery status.

While being connected to a charging device (car or internal power converter), a battery being fully charged will measure about 13.8 volts. Once removed from the charger, the battery will drop to approximately 12.6 volts.

NOTE: Since the panel is not user-calibrate-able for battery voltage conditions, the information is provided for information only and this document will focus only on recalibrating the fresh, grey, and black water tank settings.

LEDs SERVE TWO PURPOSES:

As previously mentioned, the LEDs are used to report the full-to-empty condition of the tanks. However,

when in the “calibration” mode, the LEDs are used to report a particular function (see Fig. 3). These functions are not printed on the faceplate of the monitor, so you will need to refer to Fig. 3 below, during the calibration process.

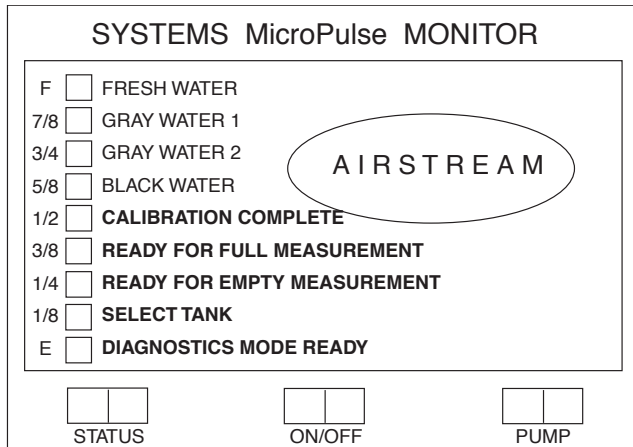


Fig. 3. When in the calibration mode, the bottom five LEDs are used to indicate the current step of the calibration process. The words in bold print indicate what is occurring in each step but since they relate to the calibration process only, they are not printed on the faceplate of the monitor.

Here is a description of the LED functions during calibration:

1. The first three or four LEDs are still used to indicate the respective tanks; fresh water, gray water (you might have two gray water LED indicators if you have two gray water tanks), and black water. (The battery LED is not user-calibratable so it is not illuminated during calibration.)

During calibration, the LEDs illuminate sequentially from the bottom up, as follows:

2. The bottom (9th LED down, next to the “E” label) lights when the system first enters the diagnostics (calibration) mode.

3. The second from the bottom (8th LED down, next to the “1/8” label) lights when the system is asking you to select a tank to be calibrated (I recommend using the CALIBRATING ONE TANK method below).

4. The third from the bottom (7th LED down, next to the “1/4” label) lights when the system is ready to calibrate the EMPTY condition of the desired tank(s).

5. The fourth from the bottom (6th LED down, next to the “3/8” label) lights when the system is ready to calibrate the FULL condition of the desired tank(s).

6. The fifth from the bottom (5th LED down, next to the “1/2” label) lights when the calibration is complete.

CALIBRATION:

If the monitor appears to be reporting false values, it is possible that a tank needs to be recalibrated. The procedure calls for calibrating the monitor with the tank empty so it knows how much pressure the sensor reads

when the tank is empty, and then calibrating it again with the tank full so it knows how much pressure the sensor reads when the tank is full. After calibration, the monitor then establishes a range of nine steps from the empty reading to the full reading and is able to report those values via the illuminated LEDs.

CALIBRATING ONE TANK:

If only one tank is suspect of being out of calibration, you can calibrate only that tank without disturbing the settings of the other tanks in the system. **If you want to calibrate all the tanks at once, switch the monitor to OFF and begin with step #4, next page.**

1. Turn the panel ON/OFF switch to OFF.

2. Remove the faceplate of the monitor by inserting your fingernail between the upper edge of the faceplate and the surrounding plastic bezel (Fig. 4). Pull the upper edge of the faceplate towards you about 1/2” and then lift the faceplate up and then out. (The faceplate is held in place with a small spring clip at the top, and two small metal fingers at the bottom. You must lift it up until the fingers clear the bezel.)



Fig. 4. To remove face panel of tank monitor, place fingernail between faceplate and bezel and pull out. (Faceplate is held by two clips along its bottom edge.)

3. Remove the RJ-11 plugs (Fig. 5) from the back of the monitor for the tanks you do NOT want to calibrate. For example, if you are calibrating only the fresh water tank, remove the BW (black water) plug and the GW (grey water) plug from the back of the panel.



Fig. 5. The leads from the tanks are plugged into the back of the monitor's faceplate with telephone-type RJ-11 connectors. Remove only the ones you do NOT want to calibrate. (The leads are colored and the lead sockets are labeled so you will know where to plug them when you reconnect the leads to the faceplate.)

4. Completely drain the tank(s) being calibrated, and then add 1 gallon of fresh water to the grey and black water tank. Add two (2) gallons of fresh water to the fresh water tank. (The sensor needs to have some pressure to measure the “empty” condition. In addition, you will have a two gallon reserve when the fresh water LED indicates empty (LED flashes red.)

5. To enter the diagnostics (calibration) mode, hold the STATUS switch in as you turn the system ON, and keep holding it in. The LEDs will flash YELLOW once. Keep holding the STATUS switch until the LEDs all flash green. Then release the STATUS switch. This places the monitor in the calibration mode.*

6. Press and release the STATUS switch one time. This begins the calibration process. The system will look for which tanks are active (plugged in) in the system and report its finding to the front panel. If a tank sensor is found (i.e. it is plugged into the back of the monitor), a green LED will appear next to the tank name. If a sensor is not found (i.e. the lead is NOT plugged into the back of the monitor), a yellow light LED will appear. (A yellow LED indicates that the tank with a yellow LED tank will not be included in the calibration.) The bottom LED (“DIAGNOSTICS MODE”) will then illuminate advising that the first step is complete.

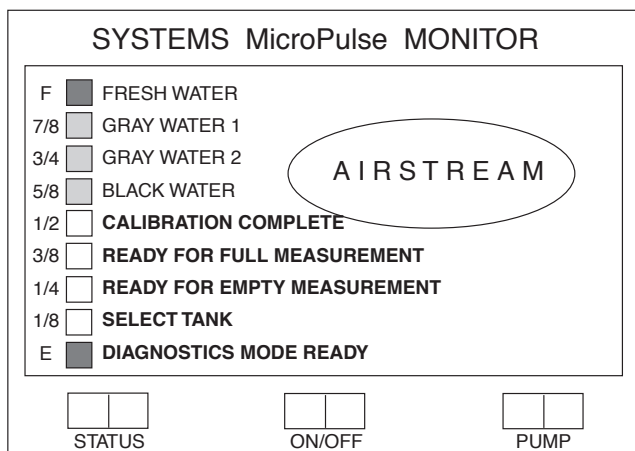


Fig. 6. The Diagnostics Mode Ready LED illuminates indicating that the system is ready to measure tank levels.

7. Press and release the STATUS switch one time. The display will illuminate a green LED next to the tank(s) it is ready to calibrate. For two seconds the next-to-last (second from the bottom) **SELECT TANK** LED will illuminate and then go out (this two-second interval is to allow you to manually select an individual tank to calibrate. However, if you want to calibrate single tanks, I recommend using the procedure of removing leads from the monitor, previous page). Wait until the second-from-bottom LED goes out. The **READY FOR EMPTY** LED (third from the bottom) will illuminate. You are now ready to calculate the amount of water in the tanks for the *empty* condition.

8. Since you have already prepared the tanks to the level you wish the monitor to report as EMPTY in step 4, above, merely press and release the STATUS switch

* If the system does not go into calibration mode, remove the 2-position shunt jumper from the back of the monitor, turn power ON for two seconds, then OFF. Replace jumper, and re-do step #5.

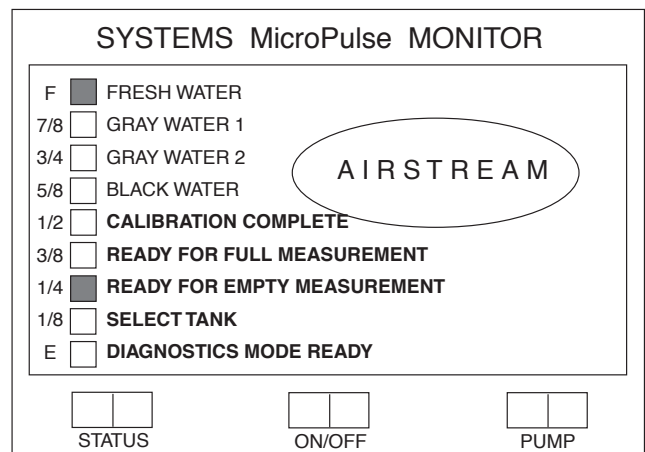


Fig. 7. The system is now ready to measure the EMPTY condition of the FRESH WATER tank (or which ever tank you have plugged in if you are calibrating only one tank).

one time. The system will calculate the EMPTY level of each tank and the **READY FOR EMPTY** LED (third from the bottom) will go out.

9. The **READY FOR FULL** LED (fourth from the bottom) should now be on. Now fill all tanks so they are almost full. The ideal height is about 1/2" below the top of the tank but there are some considerations according to the type of tank being measured:

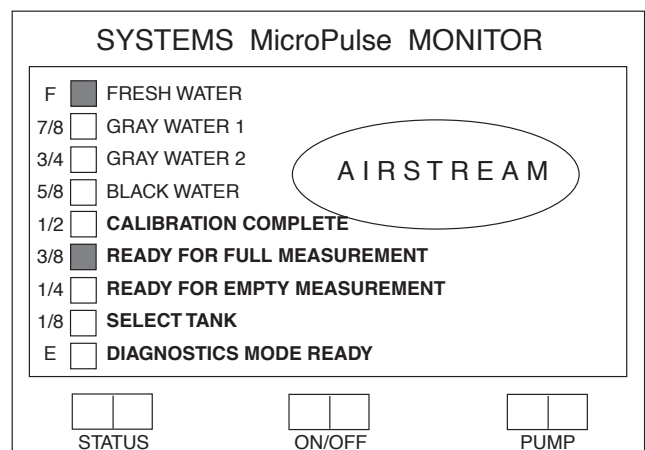


Fig. 8. The fourth LED from the bottom is now illuminated indicating that the system is ready to calibrate the FULL condition of the FRESH WATER tank (or which ever tank you have plugged in if you are calibrating only one tank).

Fresh water tank: Fill it to overflowing. Then, using a one-gallon container (water jug, milk jug, etc.) remove one gallon of fresh water by running the water from your sink or outdoor shower. This ensures that there is no water in the filler pipe or overflow pipe.

Grey water tank: Fill it until water begins to appear at the shower drain. Then, using your waste drain valve (and hose) drain off about a gallon of water. To do this, open (pull) the grey water drain valve and count slowly to five (1, 2, 3, 4, 5).

Black water tank: Fill the toilet until you can see the water level about 1" below the bottom of the pipe leading down from the toilet bowl (from inside the bathroom). (You will have to step on the discharge pedal to open the toilet's release valve. Turn the water pump OFF so you can see the water level clearly with no water flowing into the toilet.)

Now press and release the STATUS switch one time. The system will calculate the FULL level of each tank and the READY FOR FULL LED (fourth from the bottom) will go out.

10. The **CALIBRATION COMPLETE** LED should now be illuminated. Each tank that has passed the calibration process will have a green LED illuminated.

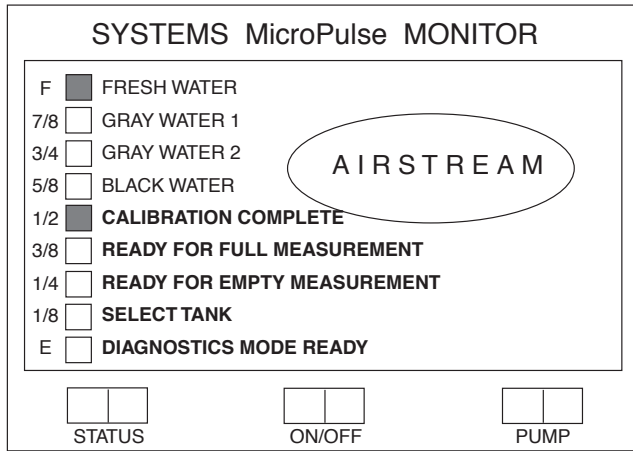


Fig. 9. The Calibration Complete LED illuminates. If all measurements were correctly taken, a green LED will illuminate next to each tank that has properly completed re-calibration.

11. To save and store the calibration, press the STATUS switch one last time. The LEDs on the monitor will turn red from “E” (empty) to “F” (full) one time, then turn green from “E” to “F” one time, and then flash green one time.

12. Turn the system off (move the ON/OFF switch to the OFF position). Re-connect the wires (if any) that were unplugged at the beginning of the calibration process. Place the lower edge of the faceplate against the plastic bezel so that the two prongs in the back of the monitor can slide down onto the bezel. Allow the faceplate to slide down and push the upper edge into place. You might have to use a fingernail or small screwdriver to carefully push the top spring down so that the faceplate snaps back into place.

Calibration steps are completed.

EXTERNAL SENSORS ARE SUSCEPTIBLE TO DAMAGE

The grey and fresh water sensors (and, in some cases, the black water sensors) are mounted within their respective compartment covers of the trailer and are generally protected from weather and moisture. However, on the 19' Bambi, 19' CCD, 20' Safari, 23' Safari, 25' CCD, 25' CCD SS, and 25' Safari SS, the black water sensor (Fig. 10) is mounted in the drain pipe just before the waste valve. This external mounting (in the splash pattern of the tires) makes the black water sensor's connector highly susceptible to water damage. Although a rubber boot is provided as a cap for the connector, the fit of the rubber boot to the cable is not sufficient to keep water from entering the connector,

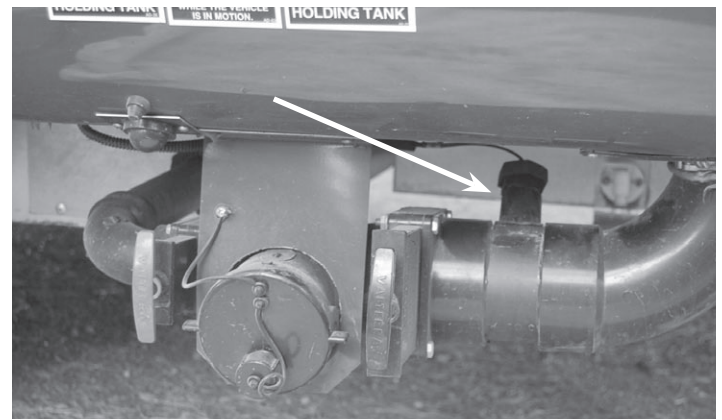


Fig. 10. The black water tank sensor is outside the trailer, in the elbow coming from the black water tank (arrow).

with the possibility of flooding the connector's cavity and shorting out the sensor. If the sensor shorts out, erratic tank volume information will be reported to the monitor indicating that the tank is full (when it really isn't) and so on. If this happens, the sensor will probably need to be replaced (see “Replacing a Sensor,” below).

PROTECTING EXTERNAL SENSORS

After installing a new sensor or sealing an existing sensor, connect the RJ-11 plug to the sensor, and pull the rubber boot down over the sensor. Wrap the boot and exposed portion of the sensor with several layers of electrical tape. Make the first few layers tighter than the outer layers (this makes the tape less prone to unravel). Place a generous bead of silicone cement on the lead wire where it enters the rubber boot. Ensure that the bead of silicone cement encircles the entire lead wire.

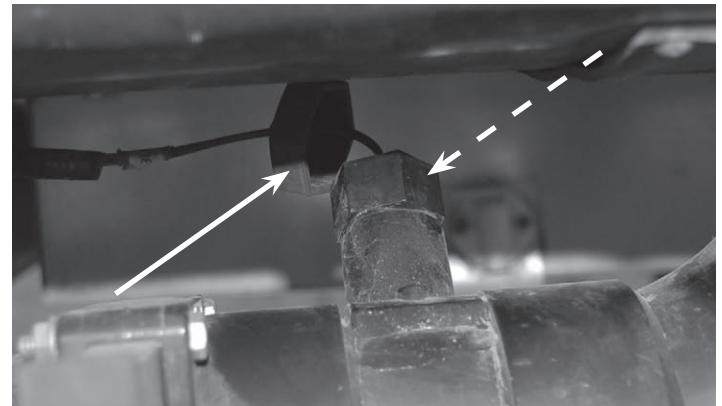


Fig. 11. The rubber boot (solid arrow) is easily removed from the sensor (dashed arrow). Assuming that the monitor is working properly (i.e., the sensor has not been flooded with water and calibration efforts appear to be functioning properly), remove the boot, unplug the RJ-11 lead from its socket by gently squeezing clip, and use a compressed air can to blow out any debris or water that might have collected in sensor. Then, replace RJ-11 connector, replace cap. Follow instructions for sealing under “Protecting External Sensors” above.

REPLACING A SENSOR

In the event the sensor does not respond properly through recalibration, it may have to be replaced. New sensors (part #500-10050-07) can be gotten from Micropulse (817.590.8718). 1) Ensure that the black water is evacuated from the tank, and the tank flushed out before removing the damaged sensor. 2) Unscrew the old sensor. 3) Apply three wraps of pipe tape to the threads, and screw in the fitting snugly, but only hand tighten. 4) Install the RJ-11 plug. 5) seal the rubber boot. 5) Follow the preceding instructions for calibration.