

smartRV[™] BlackMagic[™] Tank Sensor System



Thank you for purchasing the smartRV BlackMagic Tank Sensor System from RV Intelligence®.

Follow this quick step-by-step guide to upgrade your tank sensor system today!

How it works

The BlackMagic Tank Sensor System works with **CAPACITIVE SENSING TECHNOLOGY**, the same way your smart device touch screen senses your finger, the BlackMagic Tank Sensor senses that there is liquid on the other side of the tank wall, **ANY LIQUID**. The BlackMagic Tank Sensor is different from other similar products on the market because our patent pending sensor allows the for **FULL LENGTH CAPACITIVE SENSING ON ANY TANK**, and our sensor is very robust and easy to install. Other products cannot be installed on every tank, require a new display panel, or provide only "spot" sensing where the three LEDS that work just like they do today.

The BlackMagic Tank Sensor utilizes the current display in your RV, the current wiring and the three LEDs, but our patent pending technology shows you **YOUR TANK LEVEL IN 10 STEPS!** Even more important, we show you when you are **REALLY ON EMPTY, AND REALLY AT FULL** on those same three LEDs.

The unit comes as one board and is then broken apart into a control board and four sensor boards. The sensor boards can be adjusted in size, can be uneven sizes and can sized by breaking off tabs on each end of the sensor. The idea is to create a **VIRTUAL LINE ALONG THE SIDE OF THE TANK WITH THE SENSORS**, with the overfull sensor being near the top of the tank. The sensors are placed in a line along the side of the tank, but can be separated physically, as an example if the full and overfull sensors were on one face of the tank, and the 1/3 and 2/3 sensors were around the corner it would still work, as long as the "virtual" line is made from bottom to overfull sensor. The control board should be placed as close as possible to the sensor boards. The control board is connected to a sensor with a pair of wires, one wire is the measurement wire, the second wire does not connect to the sensor, but it terminated right at the sensor connection, this wire provides compensation so that stray signals are removed.

Now to the display, the BlackMagic Tank Sensor **COMMANDS THE LEDS TO DISPLAY ENHANCED INFORMATION**, the LEDs are flashed to show you where the level of the tank is and goes solid when that sensor is completely covered in liquid. As the example, if the LEDs are showing nothing but the EMPTY LED, your tank is really empty. As the tank fills with liquid, the first led (1/3) will be flashing once per second, when the level exceeds ~10% the LED will begin flashing twice per second, then three time per second, then goes solid at over 30% and then the next LED (2/3) will begin flashing once per second and so on until the final LED (3/3: FULL) goes solid and you are now full. Now for the really important feature, overfull, really overfull. The BlackMagic Tank Sensor will flash all three LEDs three times a second continuously to show that the overfull sensor is activated, now when you want to add that little bit of extra fresh water or allow a few more uses of the other tanks, you will know exactly when you have reached the real limits.

See our FAQ at the end of this manual or online or contact us directly, we want your questions answered and your experience with our product to be a great one!

Thank you from RV Intelligence.

smartRV™ BlackMagic™ Tank Sensor System

INSTALLATION

The following instructions should make this installation process a smooth one. Please read the instructions to ensure correct usage and thorough understanding. If you have any questions, please contact us via email at support@rviqproducts.com or web chat at www.rv-intelligence.com. Also, please check out the website for helpful information videos.

The information in this manual is subject to change without notice. • The manufacturer assumes no responsibility for any errors that may appear in this manual. • Installing any third party hardware in your RV may void your manufacturer warranty. Please consult your manufacturer's warranty for more information before installing. • The reproduction, transmission or use of this document or contents is not permitted without express written authority.

PREPARATION INFORMATION

EQUIPMENT

- smartRV BlackMagic Tank Sensor System
- □ wire nuts
- □ twisted red/white wire
- double-sided VHB tape
- □ ability to drain & fill the tank

TOOLS NEEDED

- □ wire cutters
- □ wire strippers
- □ pliers (optional)



- Identify the location of the tank you wish to monitor. Empty the chosen tank prior to installation. Ensure there is sufficient clearance for a safe installation of the new system.
- Choose a location on the tank where the main board and sensor boards will be mounted. The main board and sensor boards should be mounted away from metal objects such as bolts or a metal frame. Also, the sensors and control board must not be mounted very near the inlet or outlet water flow. For optimal performance, sensors should be mounted flush to a relatively smooth surface; not on a crease or curve.
- The main board is mounted <u>horizontally</u> on the left and the sensor boards on the right. The sensor boards (1/3, 2/3 and FULL) can be mounted diagonally, vertical, horizontal, or a combination. The OVER FULL sensor is mounted <u>horizontally</u> within a 1/2 inch of the top of the tank. The goal is to have the sensor boards span the range of the tank height and create a virtual line (example layouts are shown at step 8).

NOTE: See our website video section for more information.

- Keep the distance between the main board and sensor boards under 1-1/2 feet to maximize sensor accuracy.
- Detach the main board and sensor boards by gently snapping the crease at each joint. Avoid applying force on the connectors. It's easiest to start with the main board. If the sensor boards are too long, they can be shortened by snapping segments along the perforations with pliers. The minimum sensor size is 1-3/8 inches.

INSTALLATION INSTRUCTIONS

- 1. Thoroughly clean the chosen area on the tank removing any debris. Wipe the clean area with a clean towel and rubbing alcohol.
- Apply one strip of VHB tape and apply it to the back of a sensor. DO NOT remove the tape backing or mount at this time. Repeat applying tape to each sensor then apply (2) tape strips to the main board. (Figure 1).

NOTE: An extra strip of tape is provided, cut into small sections and use to secure any loose wiring at the end of the installation.



Figure 1

smartRV[™] BlackMagic[™] Tank Sensor System

- 3. Orient the main board horizontally with the one white/black connector on the left and the (4) white/black connectors on the right. Remove the tape backing and mount the main board to the tank. Remove the tape backing and mount each sensor board as described in the preparation above. (Figure 2 shows an example of a possible layout, all it has to do is create a virtual line that covers the tank from top to bottom.)
- 4. Identify the (red) signal and (white) ground wires going to the tank from the red knot wire harness which will be on your vehicle already. (Figure 3)



NOTE: You will use the extra tape strip provided to secure loose hanging wire later. 6. Sever and strip the red signal and white ground wires going to the tank. The red signal wire should no longer be connected to the red knot wire harness. Next,

- connect the (red) signal wire to the new red signal wire by inserting them into the one of the provided wire nuts and twisting them together, and then do the same for the white ground wires, should be three connections in the ground. Strip and insert the other end to the main board's signal [RED-SIGNAL] and ground [WHT-GROUND] connectors on the left side of the main board. (Figure 4)
- 7. Powering the be can done it either of two ways:
 - a. 3.3-volt battery holder (optional) connected to the small red and black connectors with the "3.3V Battery Input" label between them

NOTE: Batteries are not included for the 3.3V system, you CAN NOT use more than 3.6V through as it will destroy the unit. The battery life of this system is expected to be in upwards of 10 years.

b. connect the board to the vehicles 12-volt system through the black connector Labeled "12Vdc Only" label, this will power the unit fine as long as the vehicle battery is working properly, and the ground is connected to RV DC ground.

NOTE: Only use ONE of these methods to power the unit.

- 8. Begin by wiring the bottom sensor (1/3 sensor) first. Measure, cut and strip a length of twisted red and white wires so that it will connect from the main board to its designated sensor with as little slack in the wire as possible. The wires should not cross over other twisted wires. (Figure 5) Strip the red wire and insert it into the bottom sensor's black connector, again it should click into place (1/3 sensor). The white wire is not connected to the sensor on this side. (Figure 6) On the other side of the twisted wire, strip the red and white wires. Insert the red wire into bottom black connector that monitors the 1/3 level. Insert the white wire above it into the corresponding white connector.
- 9. Repeat steps 7 for each sensor level. (2/3, FULL, OVER FULL). Additional layouts shown below.







10. Secure any loose hanging wires with any extra included VHB tape. Once the main board and all sensors are connected, the system will be ready for calibration.



Figure 2



Figure 3



Figure 4



Figure 5



NOTE: The white wire is NOT connected

RVI07BM01-BETA.R1

INSTALLATION

CALIBRATION

CALIBRATION INSTRUCTIONS

Congratulations on installing the smartRV BlackMagic Tank Sensor System. The sensors are now ready for calibration. The following instructions should make this calibration process a smooth one. Please read the instructions to ensure correct usage and thorough understanding. If you have any questions, please contact us via email at support@rviqproducts.com or web chat at www.rv-intelligence.com. Check out the website for helpful information videos.

Let's begin with the low-level calibration; remember that the tank with the new system must be <u>completely empty</u>. If it is not; please do so before proceeding. The system will act like a standard sensor and roughly report when you are at 1/3, 2/3, and FULL until the tank has had a chance to fully calibrate itself. It is best to complete the low and high level calibrations for accurate reporting levels.

There are two methods to calibrate the low or empty calibration, but only one for the high of full level.

Low or empty calibration can be done manually at the tank sensor or via the panel control button, both result in a sensor that is reset to zero and is ready to have the full calibration completed.

1. Pushing the button on your OEM tank panel will display 2 flashes of all the LEDs once each time you hit the button on the panel indicating that the low and high level sensors are <u>not</u> calibrated.



- 2. Perform a low-level calibration
 - a. The first method is to connect the two gold pads on the control board with anything metal such as a coin, screwdriver tip or bit of wire, for ten (10) seconds, and the unit will record the current values as an empty tank. Once completed the display will only flash once indicating that the low-level calibration is set, but not the high or full level calibration.



CALIBRATION

b. The second method is to hold the display button for the tank down for 20 seconds



c. Push the button at a one second on, one second off, cadence. The LEDs flash once when it registers a correctly timed button push.



d. Repeat step (b) 10 more times without pausing.
NOTE: If you do not push the button at the correct cadence, it will reset the calibration sequence, preventing accidental calibration during normal use. Return to step 2a at any time to restart the calibration sequence.

e. After the 10 registered hits, hold the button for 10 seconds and you will see the LEDs descend from FULL down to EMPTY 10 times then it will stop.



f. Release the button and the low calibration is complete.



g. Now that the initial low calibration routine is complete, the panel will display one flash of all the LEDs to indicate that it has a <u>low</u> calibration, but not a high calibration. If the LEDs do not flash as indicated, return to step 2a to restart the calibration sequence.



3. Perform a high level calibration.

NOTE: Until the tank has a chance to fully calibrate itself it will act like a standard sensor and roughly report when you are at 1/3, 2/3, and FULL.

a. Begin filling the tank and checking the panel often until the panel displays 3 flashes instead of solid lights.



b. **STOP** filling the tank. The liquid in the tank has reached the OVER FULL sensor and the tank auto-calibrates to its full level.

OPERATION

OPERATION EXAMPLES

Once calibrated; pushing the button on your OEM tank panel, corresponding to the tank with the new system installed, will display the level of the tank system or an error pattern.

When not overfilled, the tank panel will now display solid lights along with flashes indicating how full the tank truly is. Each flash indicates the level is 11% above the solid LED level. For example, if you see 2 flashes of the FULL LED and the 2/3 LED is solid; your tank is roughly 88% of the calibrated capacity. Once FULL LED is solid, stop filling the tank.



If you have any questions, please contact us via email at <u>support@rviqproducts.com</u> or web chat at <u>www.rv-intelligence.com</u>. Check out the website for helpful information videos.

Frequently asked Questions:

- Are the places on the tank that I should not install the BlackMagic Tank Sensor?
 - You should not install the sensors or allow the wires to be very close to or contact any metal, as metal will impact the performance of the sensor.
 - You should not place the sensors or allow the wires to be very close to or contact the inlet or outlet pipes, the sensors can interpret the flowing water as level data.
- How does the unit get its power, from the display panel?
 - No, the unit must be provided with power, the unit can accept 12 Volts DC from the vehicle wiring, or 3.3Vdc can be provided with the included battery pack.
 - The unit also must be provided a ground, there is a ground in the existing wiring harness, usually the WHITE wire.
- If I use the battery option, how long will it be before I will have to replace the battery?
 - Our testing shows that you could look at your tank for one full minute, every day for more than 10 years on one battery, and our battery pack as two batteries, so ~20 years. Think about how long you really hold that button, and how many times you camp.
- Does the BlackMagic tank sensor require calibration?
 - Yes, it does, and there are two different ways to calibrate the unit.
 - On the BlackMagic control board there are two metal tabs, connecting these tabs together with anything metal will reset both empty and full calibrations and set the current state as empty, any US coin will fit! This can also be accomplished from the display panel with a specific series of button presses.
 - Full calibration is accomplished by filling the tank until the over full sensor is activated.
- How will I know if my unit is calibrated?
 - If the unit is activated and not calibrated, it will flash all the LEDs twice on start, if there is no empty calibration then no value will be displayed.
 - If the unit is calibrated for empty only, it will flash once on start, and will show levels as solid LEDs, not enhanced resolution, IE: will work as the original sensor did.
 - If the unit is fully calibrated, it will not flash on start, and you will get full display capabilities.
- What happens if I do not complete my full calibration by filling my tank?
 - The unit will act as a "spot" sensor, turning on the Display LEDs without the flashing them for enhanced resolution. They will work, but you will not enjoy the advanced features till you fill the tank fully.