M-Panel
Smart Sensor (M-SS)

Newmar Service School Presentation

KIB Electronics
February 2011

Copyright Notice and Disclaimer

All rights reserved. No parts of this manual may be reproduced in any form without the express written permission of KIB Electronics.

KIB Electronics Inc. makes no representations or warranties with respect to the content hereof. In addition, information contained herein are subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, KIB assumes no responsibility for errors or omission or any damages resulting from the use of the information contained in this publication.

Smart Sensor is a trademark of KIB Electronics Inc.
V-Bus is a trademark of KIB Electronics Inc.
All other trademarks belong to their respective owners.

Revision Sheet

Release No.	Date	Revision Description
Rev.0	2/1/2011	First Release

Conditions of Sale and Product Warranty

KIB Electronics Inc. (KIB) and the buyer agree to the following terms and conditions of Sale and Purchase:

1. The M-Panel Smart Sensor series tank readers are guaranteed against defect in materials or workmanship for a period of one year from the date of registering of the original purchaser. Any unit which is found to be defective will, at the discretion of KIB, be repaired or replaced. KIB will not be responsible for any cost incurred unless an authorization number is designated by an authorized KIB representative.

2. KIB will not be responsible for the repair or replacement of any unit damaged by the user modification, negligence, abuse, improper installation, or mishandling.

3. KIB is not responsible for any loss or claim of special or consequential damages arising from the use of the product. The product must NOT be used in applications where failure of the product could lead to the physical harm or loss of human life. Buyer is responsible to conduct their own tests to meet the safety regulations of the respective industry.

4. Products distributed, but not manufactured by KIB, carry the full original manufactures warranty. Such products include, but are not limited to: power supplies, sensors, and connectors.

5. KIB reserves the right to alter any feature of specification at any time without notice to the buyer.

Safety precautions:

1.) Field Conductors - Shall be marked to indicate the temperature rating (60°C only, 60/75 or 75°C only) of the field installed conductors.
2.) Field-wiring terminals shall be marked with the "use with only copper conductor only".
3.) Wiring instructions shall be provided requiring the use of female quick-connect terminals suitable for field wiring.

NOTES:

1 M-SS System Overview Diagram

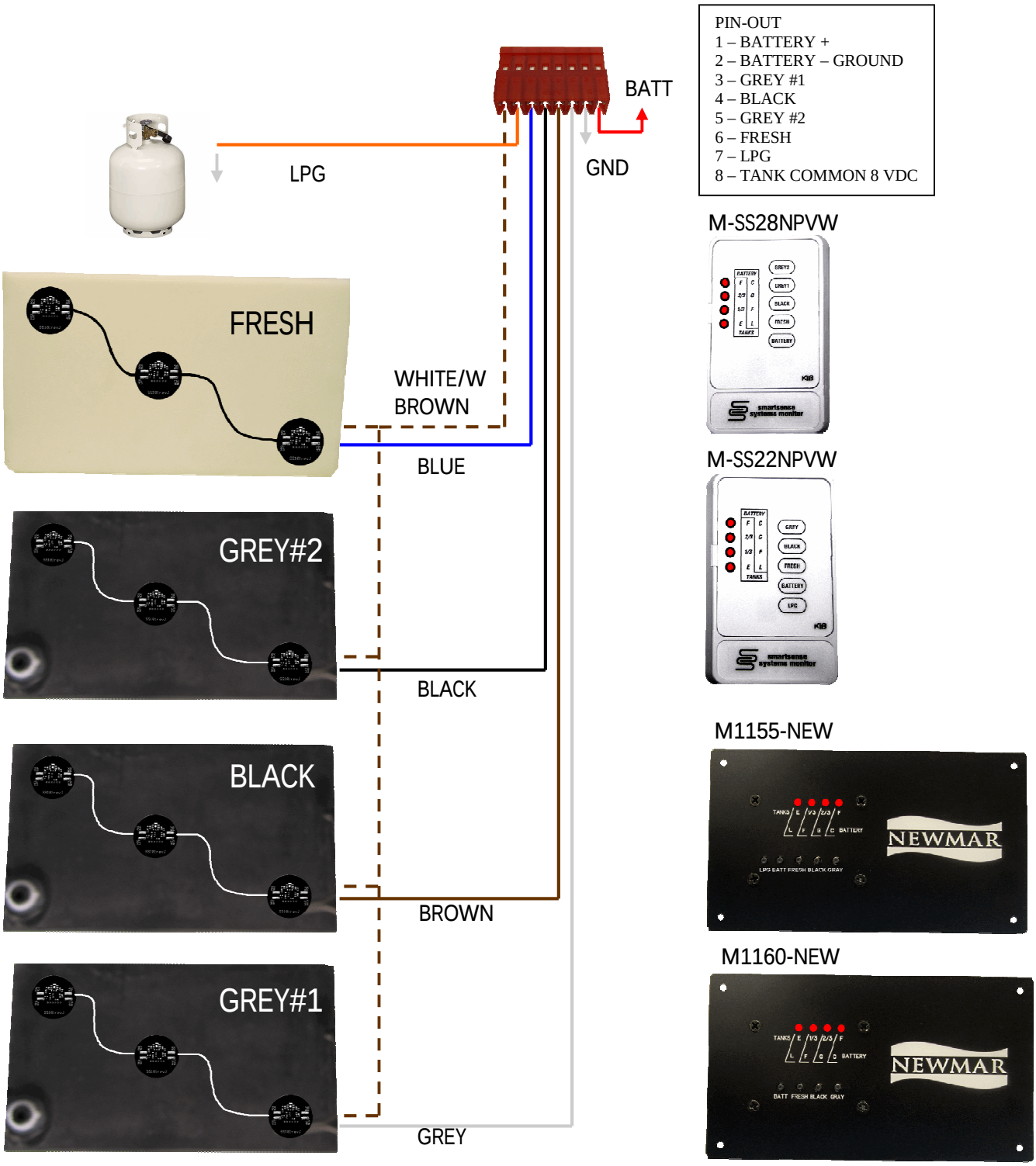

Figure 1.1

1.1 System Overview

Smart Sensor (SS) is a capacitive tank monitoring scheme designed by KIB Electronics Inc. Smart Sense offers benefits such easy installation, no hole drilling in tanks, and reduced wires.

There are four different monitor panels currently being sold

KIB #	Newmar #	GREY#1	BLACK	GREY#2	FRESH	LPG	BATT
M-SS22NPVW	108597	X	X		X	X	X
M-SS28NPVW	109787	X	X	X	X		X
M1155-NEW	114742	X	X		X	X	X
M1160-NEW	114743	X	X		X		X
SS103	109766	X	X	X	X		

Chart 1.2

1.2 Electrical Specifications

All voltages are with respect to ground unless otherwise noted.
Typical values noted reflect the assumed parameters of Ta=25°C and voltage of 12VDC.
The following is a complete system unless noted Sensor individual.
Do not exceed maximum values or damage to the components could occur.

Characteristic	Min	Typ	Max	Unit
M-SS Operating Voltage Range Fully Operational	9.5	12	28	V
M-SS Operating Current	90	-	255	mA
M-SS Standby Current	-	1	-	mA
SS103 Sensor Strand Common Voltage Note: 1	7.3	-	7.8	V
SS103 Sensor Strand Current	28	-	62	mA
SS101 Sensor Individual Current (No water)	9	10	11	mA
SS101 Sensor Individual Current (With water)	19	20	21	mA
SS103 Sensor Strand Scale 1/3	-	40	-	mA
SS103 Sensor Strand Scale 2/3	-	50	-	mA
SS103 Sensor Strand Scale 3/3	-	60	-	mA
LPG Resistance Scale 1/3	-	30	-	Ω
LPG Resistance Scale 2/3	-	50	-	Ω
LPG Resistance Scale 3/3	-	70	-	Ω
Battery Voltage Scale 1/3	-	10.5	-	V
Battery Voltage Scale 2/3	-	11.3	-	V
Battery Voltage Scale 3/3	-	12.2	-	V
M-SS Operating Temperature (Ta)	0	-	70	°C

Chart 1.3

Note: 1 This is measured across the SS103 sensors black and white power wires.

2 Monitor Panel (M-SS)

Figure 2.1

2.1 Tool Requirements

- Philips screw driver
- Blue butt splices
- Wire crimping tool
- Volt meter (Voltage, Current, and Resistance)

2.2 Overview

Monitor panels are the display interface of the M-SS system. Monitor panels display LPG, Battery voltage, FRESH, BLACK, GREY, and GREY2 tank levels. All four monitor panels currently use the M-S401 PCB board and have optional Grey2 or LPG switches. All monitor panels use an eight pin red MTA-100 connector for all connections. Battery display voltage is read through the power wire pin #1 with respect to Ground Pin#2. Tank inputs are wires 3-6, LPG is wire 7, and tank common is wire 8. LPG reads < 30Ω Empty to > 70Ω Full with respect to ground. The tank common sensor voltage is 8VDC with respect to ground, while any switch is being pressed, otherwise this output voltage is 0VDC. The tank lines are actually current sense lines and will be discussed in the Smart Sensor (SS103) section.

3 Smart Sensors (SS103)

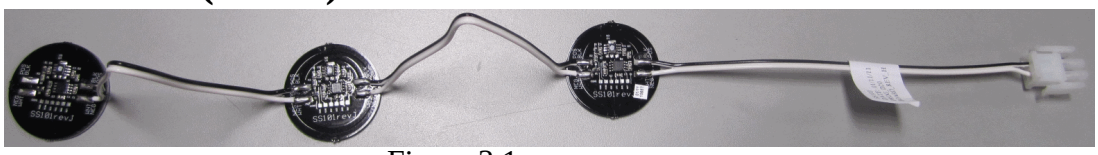

Figure 3.1

3.1 Tool Requirements

- Blue butt splices
- Wire crimping tool
- Volt meter (Voltage, Current, and Resistance)

3.2 Overview

Smart Sensors are made up of three identical boards (SS101) wired in parallel. SS103 when installed on tanks all use the same 8V for power, but then have individual returns for each tank. Smart Sensors use capacitive sensing to sense the presence of water through the tank walls.

3.3 Tank Material and Preparations

Tank walls must be non-metallic and must not be any thicker than 0.250” or the operation of the sensor will be jeopardized.

Smart Sensors are adhered to the tank using a Very High Bond (VHB) adhesive pad which is pre stuck to the sensor from KIB and then adhered to the tank by the customer. Before adhering the sensor to the tank planning of where the sensor is mounted needs to be considered. The sensor needs to be at least 1 inch from all corners of the tank. To adhere the sensor to the tanks surface first the tank MUST be cleaned with water and dried, second peel away the VHB protective layer, third press sensor firmly against tank. The adhesive has a cure time of 12 hours above 60°F, so please plan accordingly before beginning, and never adhere to a cold or wet tank.

Note1: Newmar prefers the sensor be placed with the wires horizontal.

Note2: !!Critical!! No water lines, or structure, are to be with-in 2” of the tank sensor, when the tanks are installed in coach.

3.4 Sensor Operation

Smart Sensors (SS) only detect water levels while a button is being pressed on the monitor panel. All decisions made by the sensor are based on the information the sensor had stored at the last level change. This was done to account for temperature and liquid viscosity differences over time. This also means that there are no preset values from the factory or some single calibration.

The trip point for a sensor reporting water or no water is said to be when the water line reaches the center point of the sensor. But this is conditional with the assumption that the water line was completely above or below the sensor while powered before the sensor made the decision. **Sensor Placement:** This is also why KIB requires sensor placement of at least **1" away** from any outside corner of the tank. If this was not observed the sensor would likely never see the water line completely cover or uncover the sensor, air bubbles or unlevel RV's will account for this situation.

3.5 Manual Sensor Calibration

Even though the Smart Sensor is self calibrating a Sensor can still fall into a situation where a manual calibration is required. This can be caused by debris stuck on the inside tank walls or water levels that never completely cover or uncovers the sensor.

To start, empty the tanks completely, wait at least 2 minutes to allow for any water to sheet off the interior tank walls. Next, press and hold the tank button on the monitor, it would be expected that at least the 1/3 sensor lights is on, which is why the manual calibration is being performed. While having someone else hold the tank button take you finger and touch the outer edge of the Smart sensor, be careful not to touch the center of the sensor (see figure 2.4.1), this can cause false readings. Remove your finger and if the misreading LED shuts off you have found the misreading sensor, if not move onto the next sensor in the SS103 strand. After finding the sensor that is misreading do the following in order.

Note: Sensor placement should be checked before this operation is performed.

1. Touch outer edge of the misreading sensor while powered off.
2. Press the tank read button for at least two seconds and release.
3. Remove your finger from the sensor.
4. Press the tank read button again and check for empty indication.
5. Fill the tanks and check for full indication.
6. Drain the tanks and check for empty indication again.
   (If this step does not work, sensor placement is possible cause)
7. Manual calibration is complete.

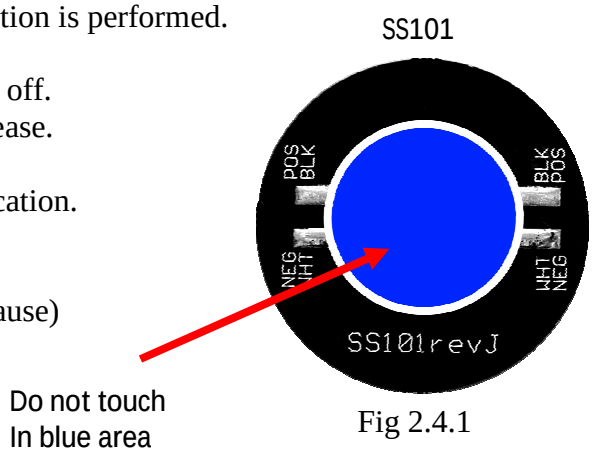

Fig 2.4.1

4.1 Trouble shooting guide

Problem	Possible Causes	Possible Solution
First time read, the sensors reads a level even though there is no water in the tank (at the factory)	Sensors need to be cycle reset	1. Fill tank full and read sensors from monitor panel 2. Empty tank completely and read sensors from monitor panel
Monitor reads 1/3 or 1/4 full on the monitor panel when tank is empty, even after a cycle reset	Any one of the sensors is reading a false trigger (It doesn't have to be the sensor on the bottom of the tank)	1. Check all sensors on misreading tank and confirm that no objects are within 2 inches from the sensor (Ex. Tank mounting track or water hoses) 2. If needed cycle reset
	Chassis or coach battery is connected to sensor power wire	Rewire sensor power from battery to sensor power from monitor panel
Monitor reads empty when the tank is 1/3 full	Battery voltage is below 10.50 Volts	Check again when battery voltage has increased
Monitor reads full on the monitor panel when tank is empty, even after a cycle reset	Possibly the Sensor sending wire was tied to a power source that burned the current sensing resistor on the monitor panel	At the monitor panel connector using an ohm meter read the resistance from the circuit ground to the tank sending wire, it should read 10 Ω±0.50Ω. If the reading is more the monitor panel will need replaced. Do not install new monitor panel, until wiring has been fix, otherwise new panel will be damaged too.
	If monitors red connector was mounted one pin off the gray tank resistor will be blown.	
Monitor reads less than full when tank is full even after a cycle reset	Sensor is not adhered to the tank	Reposition or re-adhere the sensor to tank
	Sensor is mounted to high on tank	
Monitor reads empty when liquid is present even after a cycle reset	Voltage may not be making it to the sensors	Check the voltage on the sensors connector at the tank while the sensors are plugged in and someone is holding the tank read button. The voltage should be between 6V-8V.
	Sensor sending wire has been accidently grounded	At the monitor panel using an ohm meter read the resistance from the circuit ground to the sensor sending wire, it should read 10 Ohms. If the reading is less find where wire has been grounded and fix.
	Sensors are not connected to monitor panel	Check sensor sending wire. Run new sensor sending wire to malfunctioning tank
	Sensor sending wire and sensor Power wire is reversed	Fix Wiring Sensor black wire—Battery Positive (+) Sensor white wire—battery Negative (-)
	Sensor sending wire is attached to chassis or coach battery	Rewire sensor sending wire to malfunctioning tank
LPG Reads full when empty	LPG Sensor wire is not connected	Connect LPG sensor wire to LPG sending unit
	LPG Sensor wire is connected to battery	
LPG Reads empty when full	LPG Sensor wire is connected to ground	

T F 1. M-Panel Smart Sensor (M-SS) is identical to a probe system in every way.

T F 2. KIB will be responsible for any cost incurred without any authorization numbers from KIB.

T F 3. The only differences between the four monitor panels sold to Newmar are whether or not the LPG or GREY 2 button is used.

T F 4. Smart Sensor strands (SS103) use current to report tank status to the monitor panel.

T F 5. Smart Sensor strands (SS103) are seldom defective, but instead are more often a sensor placement issue.

T F 6. Smart Sensor strands (SS103) share a common ground at the tanks.

T F 7. Smart Sensors do not retain information from a single calibration, but instead retain information from the last time the sensor was turned on.

T F 8. The monitor panel stores no information, but instead, just reports what it reads.

T F 9. The empty LED on the monitor panel only lights when a tank is empty.

T F 10. When a button on the monitor panel is pressed all sensor strands (SS103) will power.

T F 11. Plumbing within 2” of a sensor should be no problem.

T F 12. Tanks do not need any cleaning before adhering sensors to them.

T F 13. Sensor adhesive needs to cure above 60°F for 12 hours, after adhering to the tank.

T F 14. Sensors report that they see water as long as the water level is anywhere above the bottom edge of the sensor.

T F 15. Individual sensors are tied to specific LED on the monitor panel.
Ex. Bottom sensor is the 1/3 LED