



# TS1

## Ultra Sonic Tank Sender Training

27 November 2007

# Topics

- TS1 Tank Sender
- TS1-PK Programming Kit
- TS1 Programming Software
- Programming TS1
- Troubleshooting





# TS1

- TS1 is an advanced tank sender based on the ultra sonic measurement technology.
- Same tank sender can be configured via software to support:
  - 240-33ohm gauge, 10-180ohm gauge and 0-5volt DC meter
  - All size tanks with depth up to 2 meters
  - Accurate measurement for non-linear size tank
  - Standard SAE 5 mounting hole and easy fit



TS1 Tank Sender



# TS1-PK Programming Kit





# TS1-PK

- TS1-PK is the programming kit for the TS1 tank sender, which enables TS1 to be pre-programmed for target tank via a computer USB port.
- Consists of one interface box and one USB-to-Serial converter cable.
- One 9V battery must be installed into the interface box before use.



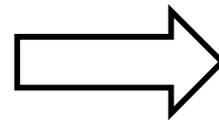
TS1-PK (battery not included)

# Battery Installation

- Install the 9V battery into the TS1-PK interface box as shown below.
- Put the back cover on with four screws provided with the TS1-PK kit.



TS1-PK without 9V Battery

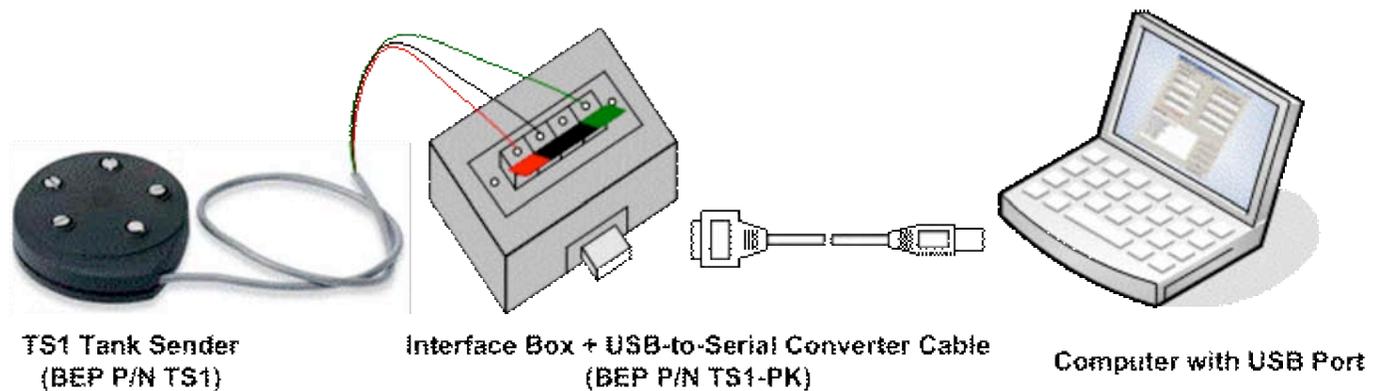


TS1-PK with 9V Battery installed



# Connection

- The following diagram illustrates the connection between TS1 and TS1-PK, computer and TS1-PK.
- The computer will be running the TS1 Programming software, called “TS Programmer”.



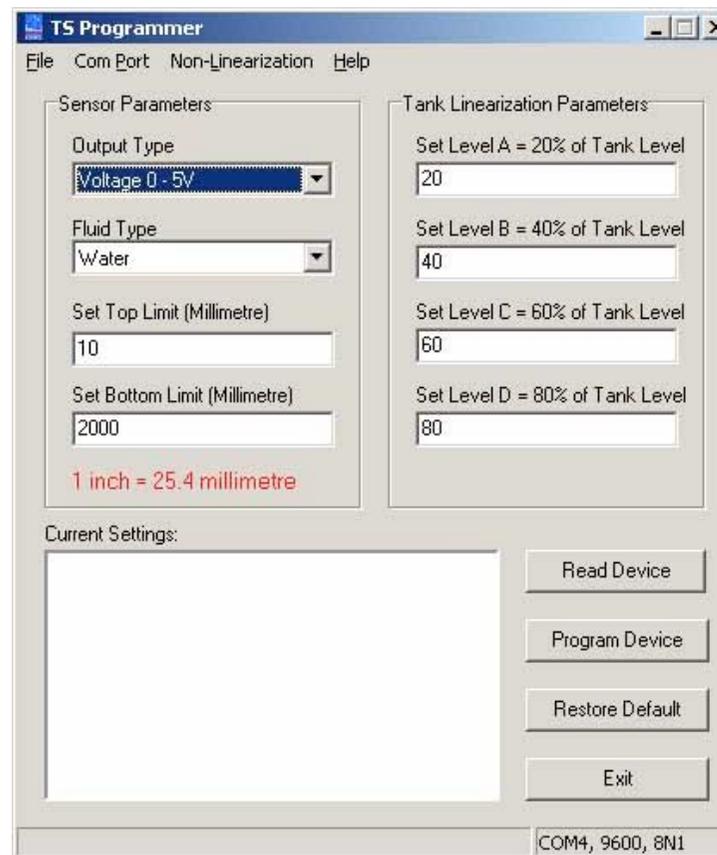


# USB Driver

- USB Driver needs to be installed on the computer for the USB-to-Serial cable.
- Available for download from the BEP website [www.bepmarine.com](http://www.bepmarine.com) under *Technical Information and Downloads*.
- USB Driver Installation
  - DO NOT plug in the cable before installation.
  - Runs under Win98, 2K, XP and Vista.
  - Double-click the installation file and follow the on screen instructions.
  - Detailed instruction is also available from *Technical Information and Downloads*.



# TS1 Programming Software



# TS Programmer

- TS Programmer is a 32-bit Windows application that runs on a computer to pre-program the parameters of TS1 via TS1-PK.
- Parameters include:
  - Output Type: *0-5V, 240-33R, 10-180R*
  - Fluid Type: *water, petrol, diesel, waste*
  - Top Limit in Millimetres
  - Bottom Limit in Millimetres
  - Linearization Parameters



# Obtaining TS Programmer

- Available for download from the BEP Marine website [www.bepmarine.com](http://www.bepmarine.com) under *Technical Information and Downloads*.
- TS Programmer Installation
  - REMOVE any old version before installation
  - Runs under Win98, 2K, XP and Vista.
  - Double-click the installation file and follow the on screen instructions.



# Running TS Programmer

- After installation, a shortcut called “TS Programmer” will be created on the Windows desktop.
- The “TS Programmer” shortcut can also be accessed from the Windows Start menu under Programs BEP Marine.
- Double-click the shortcut to start the TS Programmer software.





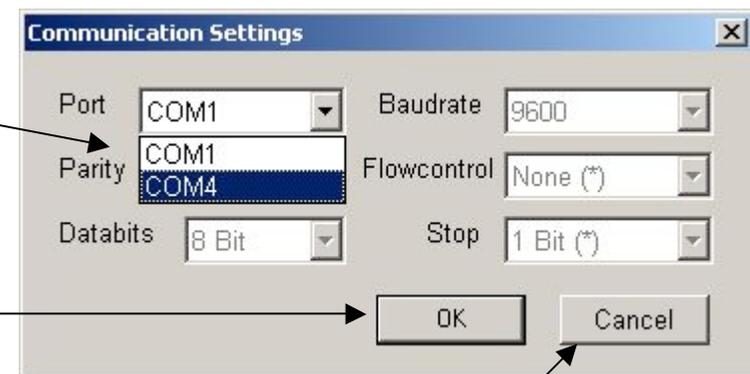
# Selecting Com Port

- At start-up, you will be prompted to select a COM port for TS Programmer.
- If the USB-to-Serial cable has not been plugged into the computer's USB port, click the Cancel button. Otherwise, select the COM port with the highest number and click the OK button. \*

Select the **COM** port from the pull-down list

Click the **OK** button to open the COM port

Click the **Cancel** button to NOT select a COM port



\* You may need to select a different COM port if the one you selected does not work.

# User Interface

## Three Output Types:

- Voltage 0-5V
- Resistive 240 – 33R
- Resistive 10-180R

## Four Fluid Types:

- Water
- Petrol
- Diesel
- Waste

**Top Limit (TL)** is the distance from the tank top to the fluid surface that will be considered as full tank.

**Bottom Limit (BL)** is the distance from the tank top to the fluid surface that will be considered as full tank.

The screenshot shows the 'TS Programmer' software window. It has a menu bar with 'File', 'Com Port', 'Non-Linearization', and 'Help'. The main area is divided into two columns of settings.

**Sensor Parameters:**

- Output Type: Voltage 0 - 5V
- Fluid Type: Water
- Set Top Limit (Millimetre): 10
- Set Bottom Limit (Millimetre): 1315
- Conversion: 1 inch = 25.4 millimetre

**Tank Linearization Parameters:**

- Set Level A = 20% of Tank Level: 11
- Set Level B = 40% of Tank Level: 23
- Set Level C = 60% of Tank Level: 35
- Set Level D = 80% of Tank Level: 49

**Current Settings:**

```

BEP TS1
Appl: 1.31
Output Type = 0 = Voltage
Fluid Type = 0 = Water
Top Limit = 10
Bottom Limit = 1315
Lin_levels = 0, 11, 23, 35, 49, 100,
  
```

Buttons on the right: Read Device, Program Device, Restore Default, Exit.

Status bar: Device read successfully! COM4, 9600, 8N1

# User Interface (cont)



**TS Programmer**

File Com Port Non-Linearization Help

**Sensor Parameters**

Output Type  
Voltage 0 - 5V

Fluid Type  
Water

Set Top Limit (Millimetre)  
10

Set Bottom Limit (Millimetre)  
1315

1 inch = 25.4 millimetre

**Tank Linearization Parameters**

Set Level A = 20% of Tank Level  
11

Set Level B = 40% of Tank Level  
23

Set Level C = 60% of Tank Level  
35

Set Level D = 80% of Tank Level  
49

**Current Settings:**

BEP TS1  
Appl: 1.31  
Output Type = 0 = Voltage  
Fluid Type = 0 = Water  
Top Limit = 10  
Bottom Limit = 1315  
Lin\_levels = 0, 11, 23, 35, 49, 100,

Read Device

Program Device

Restore Default

Exit

Device read successfully! COM4, 9600, 8N1

## Linearization Parameters:

- A = % Volume @ 20% of BL
- B = % Volume @ 40% of BL
- C = % Volume @ 60% of BL
- D = % Volume @ 80% of BL

## Current Settings box

displays the communication status and readings from the target TS1 including firmware version.

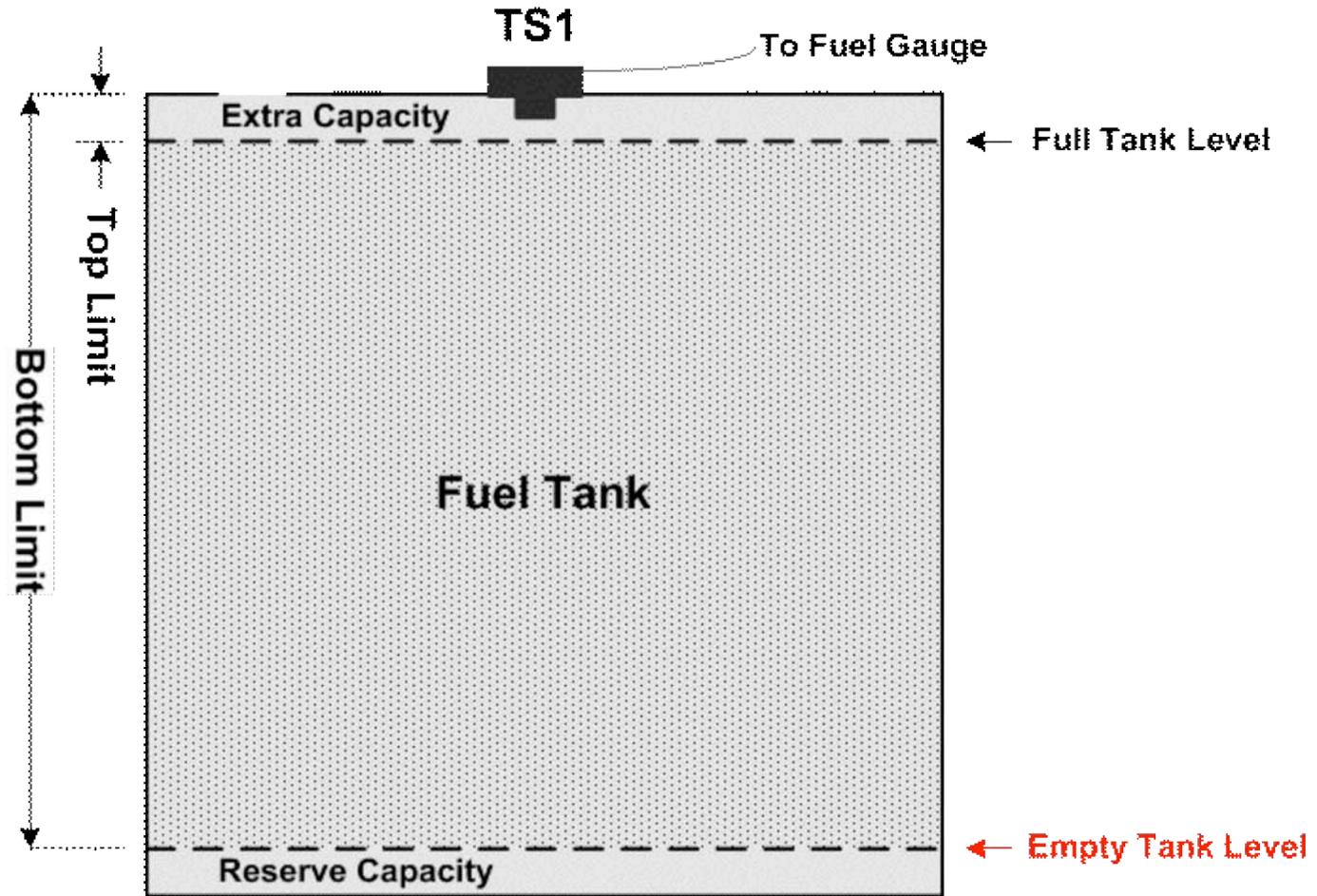
Press the **Read Device** button to retrieve the firmware version and parameter values from the target TS1.

Press the **Program Device** button to configure the target TS1 with the defined parameter values.

Press the **Restore Default** button to restore the target TS1 to its factory default values.

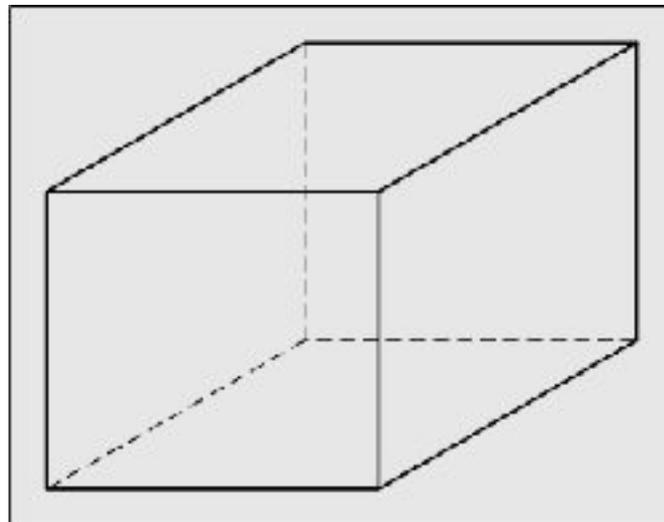
\* BL = Bottom Limit

# Top & Bottom Limits

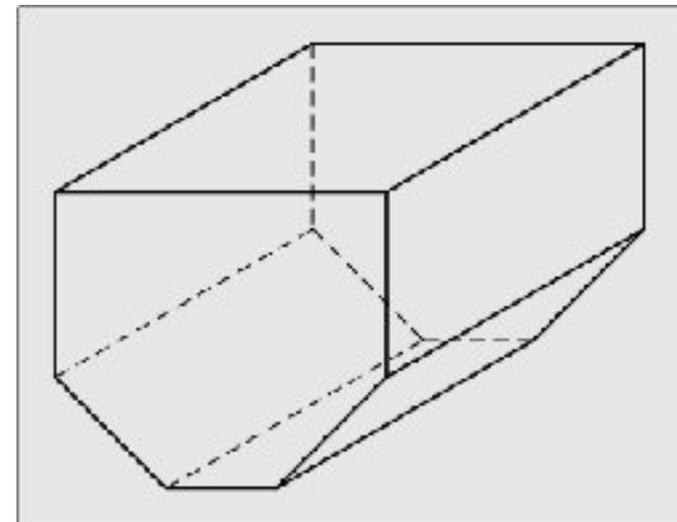


# Linearization Parameters

- Linearization parameters are used to adjust the measurement accuracy for non-linear fuel tanks.
- A fuel tank is non-linear if the tank height is not proportional to its capacity.



**Linear Fuel Tank**



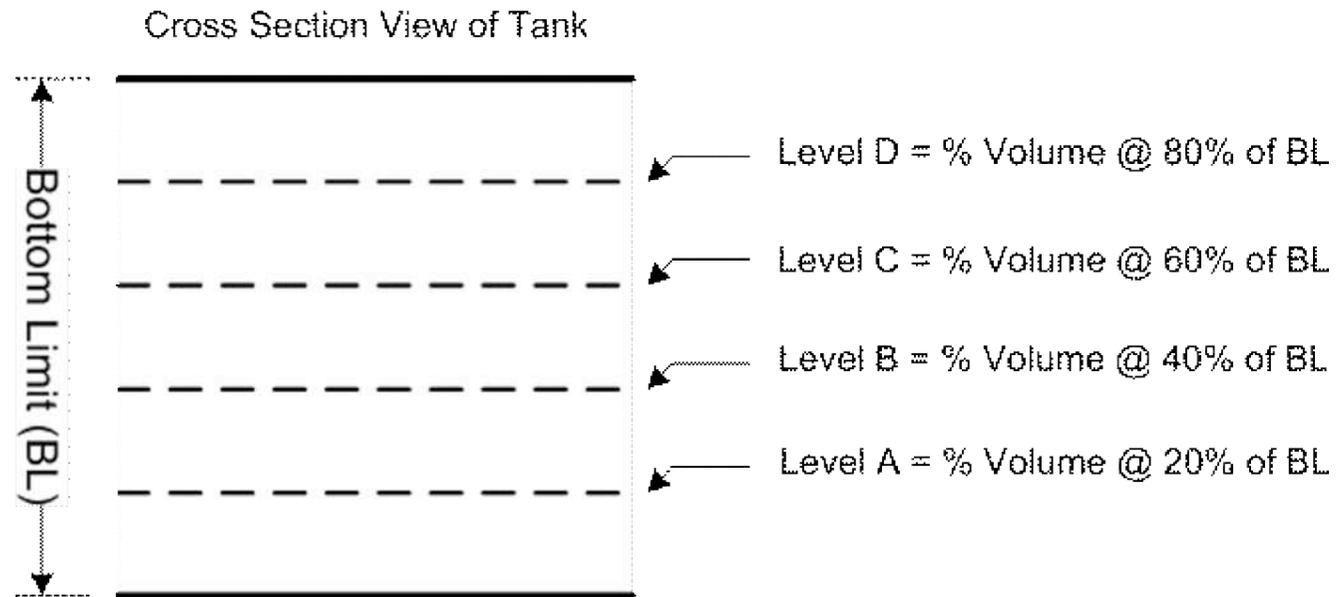
**Non-Linear Fuel Tank**





## Linearization Parameters (cont)

- Four level parameters, A, B, C, D, each represents the % fuel volume at 20%, 40%, 60% and 80% of the tank's bottom limit.
- For linear tank,  $A=20$ ,  $B=40$ ,  $C=60$ ,  $D=80$



\* Tank's bottom limit is a user setting and can be different from tank's depth or height!

# Linearization Parameters (cont)

- For non-linear tank, the linearization parameters are calculated as follows.

*Example:*

Assume full tank volume is 200 Litres and

Volume @ 20% BL is 30 Litres

$$\Rightarrow \% \text{ volume} = 30/200 = 15\% \Rightarrow \text{Level A} = 15$$

Volume @ 40% BL is 50 Litres

$$\Rightarrow \% \text{ volume} = 50/200 = 25\% \Rightarrow \text{Level B} = 25$$

Volume @ 60% BL is 110 Litres

$$\Rightarrow \% \text{ volume} = 110/200 = 55\% \Rightarrow \text{Level C} = 55$$

Volume @ 80% BL is 150 Litres

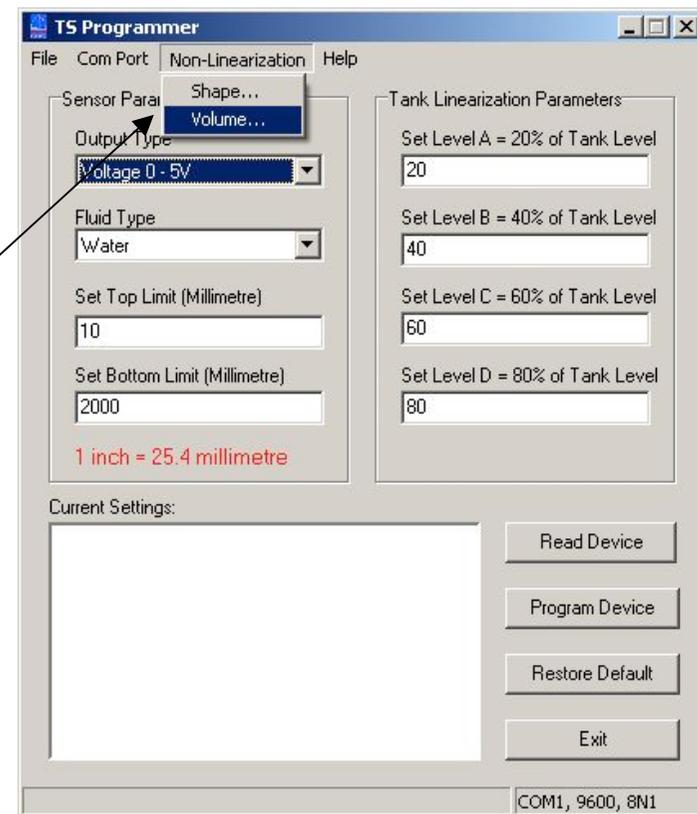
$$\Rightarrow \% \text{ volume} = 150/200 = 75\% \Rightarrow \text{Level D} = 75$$



# Linearization Calculation Tools

- TS Programmer provides two calculators to help the user calculate the linearization parameters
  - using tank shape
  - using tank volume

Select the calculator from the **Non-Linearization** menu



# Calculation by Shape



Enter your tank dimension.

If tank dimension unit is US inch, tick this box.

Tick this box if your tank is half size of the selected one.

Tick this box to enable 10% reserve. New BL will be calculated.

Non-linear Tank Parameter Calculation by Tank Shape

\* symmetrical about the vertical axis

Prev <   Next >   Shape No. 1/9

Enter Tank Dimension (Millimetre)

X Value	H Value
1000	500
Y Value	W Value
200	500
X1 Value	Z Value
100	300

Inch Unit  
 Half Tank  
 10% Reserve

Calculate

Non-Linear Calculated Values

Level A 20% =	11
Level B 40% =	27
Level C 60% =	48
Level D 80% =	72
Bottom Limit =	500.00

Volume in Litres

173

Save & Close   Close

Select your tank shape. Tick the **Half Tank** box if your tank is half size.

Calculated linearization parameter values and bottom limit (if 10% reserve is selected).

Calculated tank volume.

Click this button to save the calculated values to the main form.

Click this button to perform calculation

# Calculation by Volume



Enter your tank volume data.

Enter Tank Volume Information (Litre or Gallon)

Volume @ Full Tank	Volume @ 40% of H
200	50
Volume @ 80% H	Volume @ 20% of H
150	30
Volume @ 60% H	H (Millimetre)
110	500

Inch Unit

Calculate

Non-Linear Calculated Values

Level A 20% =	15
Level B 40% =	25
Level C 60% =	55
Level D 80% =	75
Bottom Limit =	500

Save & Close    Close

Click this button to save the calculated values to the main form.

Click this button to perform calculation

If tank dimension unit is US inch, tick this box.

Calculated linearization parameter values and bottom limit.

**Non-linear Tank Parameter Calculation by Tank Volume**

Cross Section View of Tank

Volume @ Full Tank

Volume @ 80% of H

Volume @ 60% of H

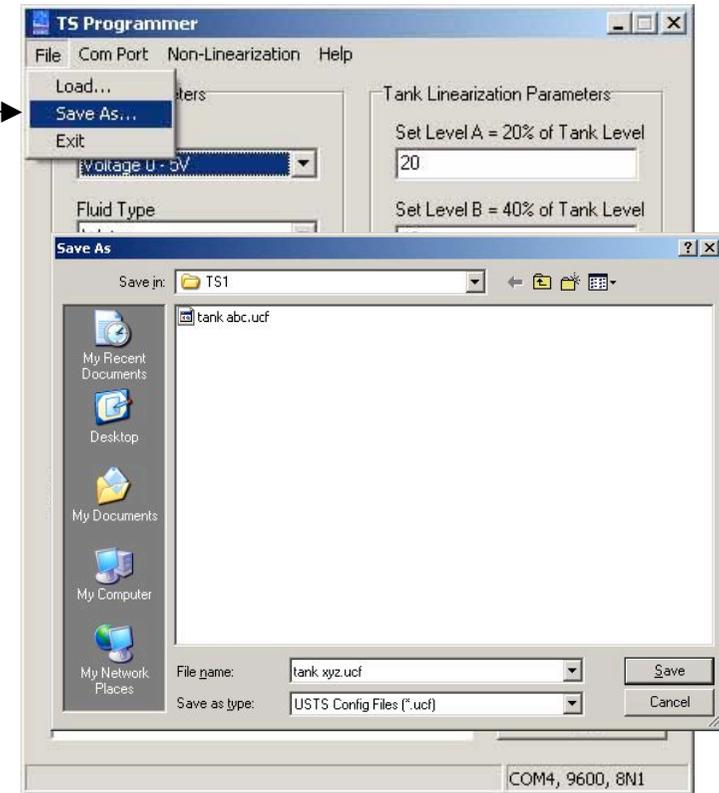
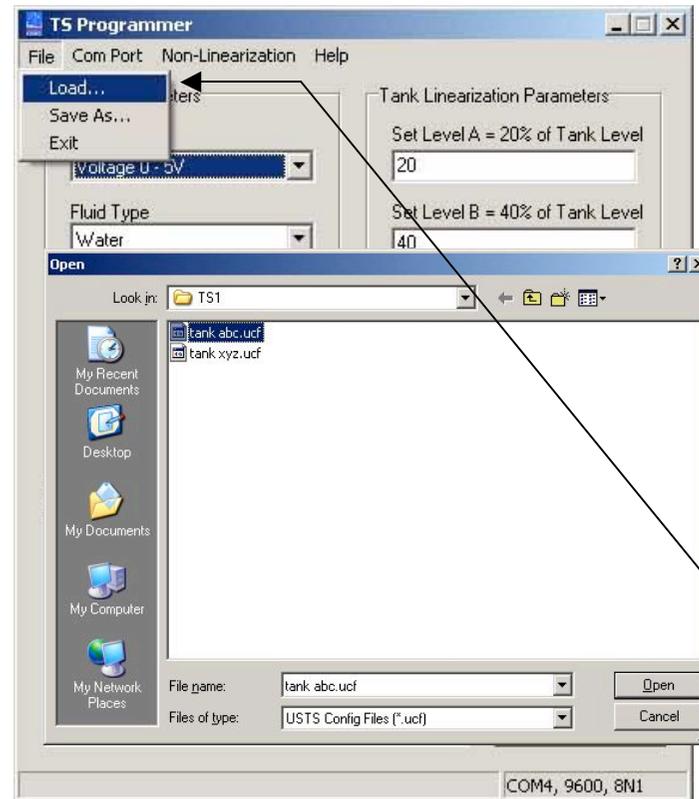
Volume @ 40% of H

Volume @ 20% of H

\* H is the maximum tank height.

# Save & Load Configuration

Click **File Save As...** to save the target tank parameter settings to a configuration file (.ucf), which can be loaded later. ∞



Click **File Load...** to load the saved target tank parameter settings from a configuration file (.ucf). ∞





# TS Programmer Help

A detailed help file is also available for TS Programmer and can be accessed from the **Help | Help** menu.

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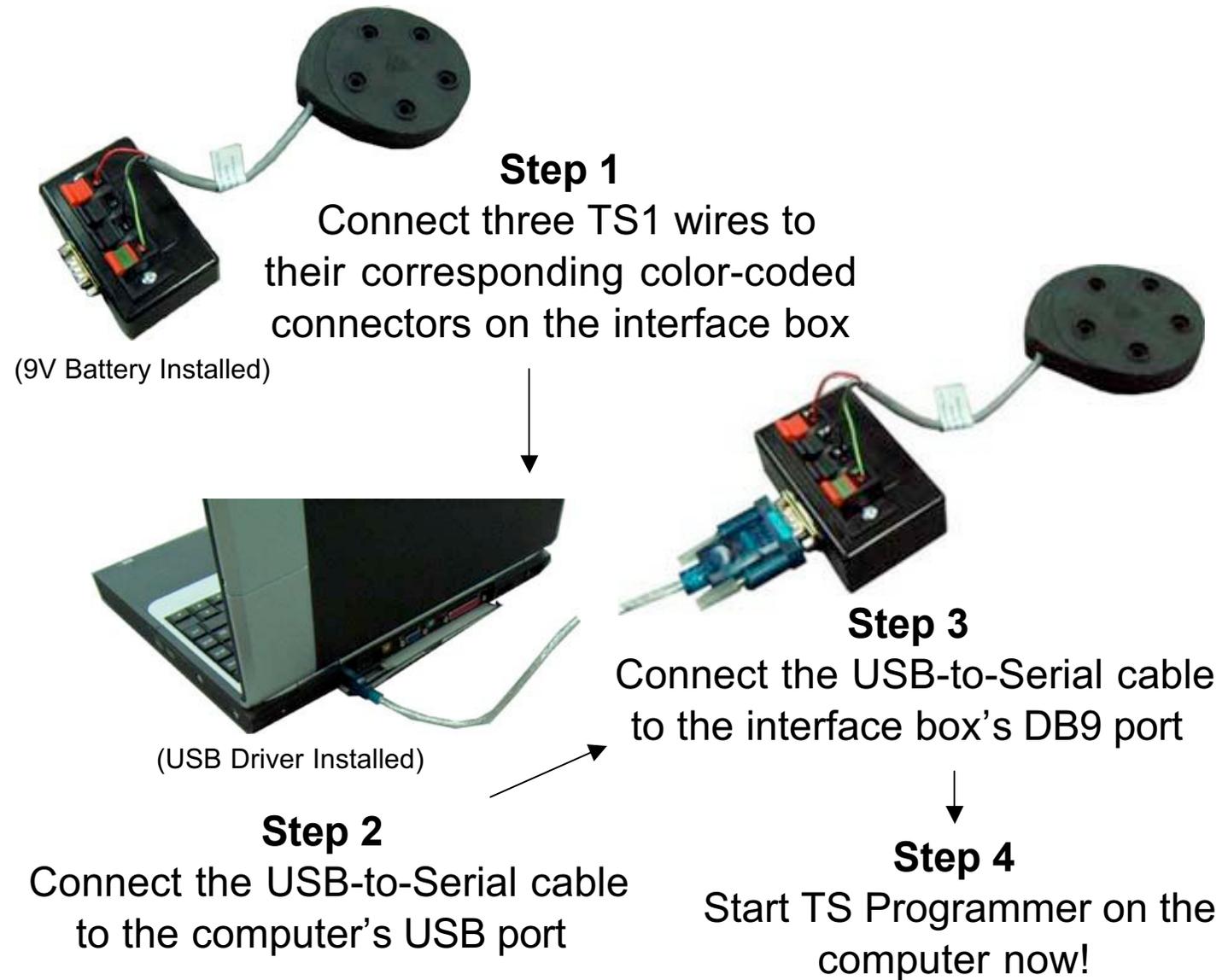
The image displays two screenshots related to the TS Programmer software. The top screenshot shows the 'TS Programmer' application window with the 'Help' menu open, highlighting the 'Help' option. The application window contains several configuration fields: 'Output Type' (Voltage 0 - 5V), 'Fluid Type' (Water), 'Set Top Limit (Millimetre)' (10), 'Set Bottom Limit (Millimetre)' (2000), and 'Tank Linearization Parameters' (Set Level A = 20%, Set Level B = 40%, Set Level C = 60%, Set Level D = 80%). The bottom screenshot shows the 'TS Programmer Help' window, which provides detailed information about the software, including its purpose as a 32-bit Windows application for pre-programming the TS1 ultrasonic tank sender. It also lists categories like 'Sensor Parameters' and 'Linearization Parameters' and includes a 'Screenshot of TS Programmer' section that shows a smaller version of the software interface.



# Programming TS1

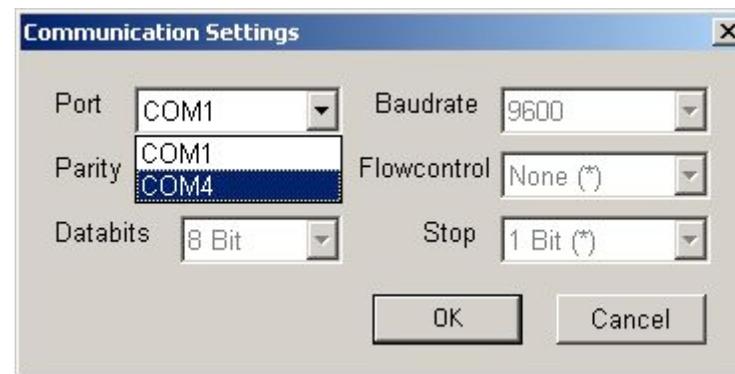


# Step-by-Step Connection



# Select COM Port

- When TS Programmer starts, it will prompt the user to select a COM port.
- If there are more than one COM ports, select the one with highest number as the USB-to-Serial cable normally has the highest number.
- If it does not work, please try the COM ports in the drop-down list from high to low.



# Read TS1

The screenshot shows the 'TS Programmer' application window. It has a menu bar with 'File', 'Com Port', 'Non-Linearization', and 'Help'. The main area is divided into two columns of settings:

- Sensor Parameters:**
  - Output Type: Voltage 0 - 5V
  - Fluid Type: Water
  - Set Top Limit (Millimetre): 10
  - Set Bottom Limit (Millimetre): 1315
  - Conversion: 1 inch = 25.4 millimetre
- Tank Linearization Parameters:**
  - Set Level A = 20% of Tank Level: 11
  - Set Level B = 40% of Tank Level: 23
  - Set Level C = 60% of Tank Level: 35
  - Set Level D = 80% of Tank Level: 49

At the bottom, there is a 'Current Settings' box and a vertical stack of buttons: 'Read Device', 'Program Device', 'Restore Default', and 'Exit'. A status bar at the very bottom shows 'Device read successfully!' and 'COM4, 9600, 8N1'.

Press the **Read Device** button to retrieve the firmware version and parameter values from the TS1.

Results will be displayed in the **Current Settings** box and updated in the parameter edit boxes.

# Restore Factory Default

The screenshot shows the 'TS Programmer' software window. The title bar reads 'TS Programmer'. The menu bar includes 'File', 'Com Port', 'Non-Linearization', and 'Help'. The interface is divided into several sections: 'Sensor Parameters' with dropdowns for 'Output Type' (Voltage 0 - 5V) and 'Fluid Type' (Water), and input fields for 'Set Top Limit (Millimetre)' (10) and 'Set Bottom Limit (Millimetre)' (2000); 'Tank Linearization Parameters' with four percentage-based levels (A: 20%, B: 40%, C: 60%, D: 80%) and corresponding input fields (20, 40, 60, 80); and a 'Current Settings' box at the bottom left containing the text 'Restoring default settings...'. On the right side, there are four buttons: 'Read Device', 'Program Device', 'Restore Default', and 'Exit'. At the bottom right, the status bar shows 'COM4, 9600, 8N1'. A red note at the bottom of the Sensor Parameters section states '1 inch = 25.4 millimetre'.

Press the **Restore Default** button to restore the target TS1 to its factory default values.

Restoring progress will be displayed in the **Current Settings** box.

# Program TS1



**TS Programmer**

File Com Port Non-Linearization Help

**Sensor Parameters:**

Output Type  
Voltage 0 - 5V

Fluid Type  
Water

Set Top Limit (Millimetre)  
10

Set Bottom Limit (Millimetre)  
2000

1 inch = 25.4 millimetre

**Tank Linearization Parameters:**

Set Level A = 20% of Tank Level  
20

Set Level B = 40% of Tank Level  
40

Set Level C = 60% of Tank Level  
60

Set Level D = 80% of Tank Level  
80

**Current Settings:**

Programming the device now...  
Output Type Updated  
Fluid Type Updated  
Top Limit Updated  
Bottom Limit Updated  
Level A Updated  
Level B Updated  
Level C Updated  
Level D Updated

Read Device

Program Device

Restore Default

Exit

COM4, 9600, 8N1

Enter the parameter values for the target TS1. You may use the **linearization calculator** to calculate the linearization parameters and bottom limit, or load the parameter values from a saved configuration file.

Press the **Program Device** button to configure the target TS1 with the above parameter values.

Programming progress will be displayed in the **Current Settings** box.



# Troubleshooting





# TS1 Issues

- My tank is one meter deep and when it is empty, the gauge still shows half full.

Ans: The bottom limit may have been set to two meters for the TS1. Read the setting from the TS1 and re-program it with the right values.

## TS1 Issues (cont)

- When connecting the TS1 to my gauge, the gauge shows full when the tank is empty and vice versa.

Ans: The gauge may be a 240-33ohm gauge but the TS1 output is set to 10-180ohm or vice versa. Read the settings from the TS1 and make sure that the output type has been set to the correct gauge type.



## TS1 Issues (cont)

- My gauge starts to swing between full and empty after certain time.

Ans: When TS1 cannot detect a valid fuel level from the tank, it will behave this way after 10 minutes. As soon as it detects a valid fuel level, the swing should stop. Fill up your tank and if the behavior persists, then you might have a faulty TS1.



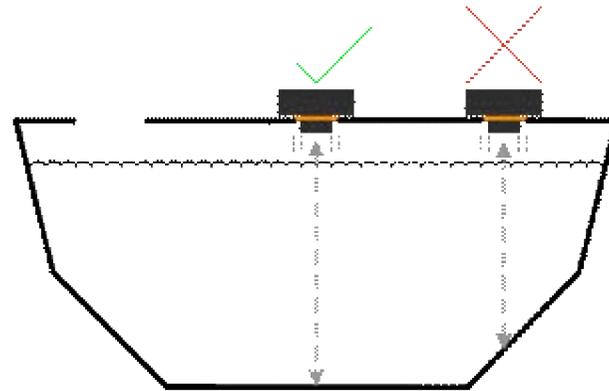
## TS1 Issues (cont)

- I can hear the ‘click’ sound from the TS1. My gauge shows empty though there are still fuel in the tank. Also, I cannot read or program the TS1.

Ans: The output driver of the TS1 may have been damaged. It could be caused by incorrect wiring, for example, connecting the green wire to negative and the black wire to the gauge input.

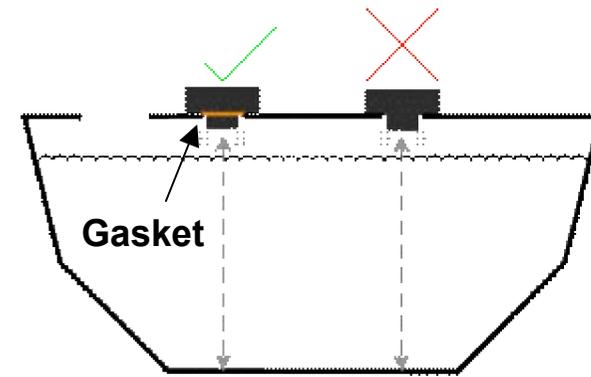


# TS1 Installation Issues



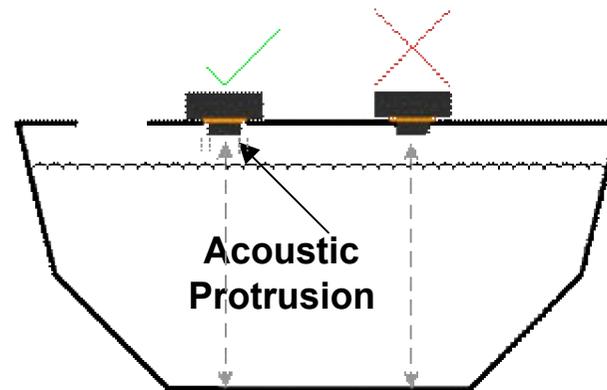
**Case 1**

TS1 must be mounted at the deepest tank point!



**Case 2**

Gasket must be used!



**Case 3**

Acoustic protrusion must not touch the tank frame.



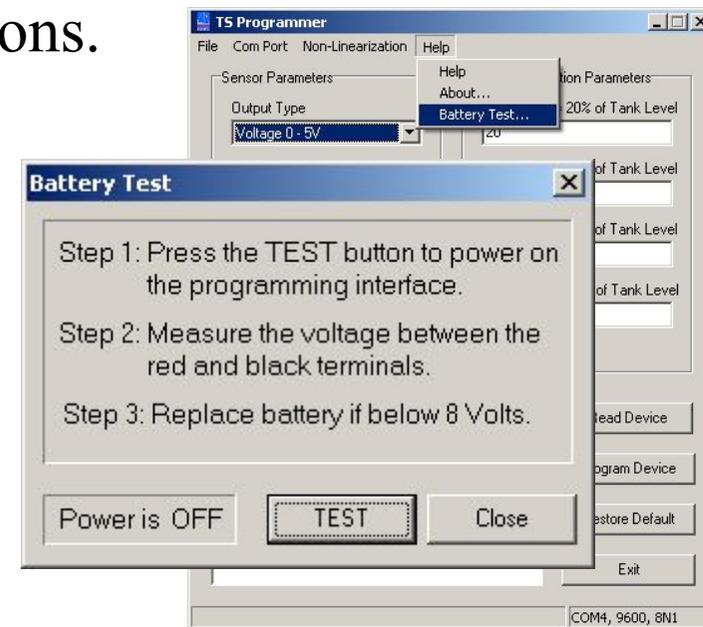


# TS1-PK Issues

- How do I check the condition of 9V battery in the interface box?

Ans: Connect a voltmeter to the red and black connectors on the interface box as shown below.

Open the **Battery Test** dialog from the **Help | Battery Test...** menu of TS Programmer. Follow the on screen instructions.



## TS1-PK Issues (cont)

- I was asked to install the driver for the USB-to-Serial cable every time I plugged the cable into my computer and the COM port number keeps changing!

Ans: For WinXP, if you plug the USB-to-Serial cable into a USB port for the first time, you will be asked to install the driver for this particular USB port (although you may have already installed the driver for the other USB port previously) and the COM port number will be different from different USB ports. This issue does not occur under Win98 or Win2K.



# TS Programmer Issues

- When TS Programmer starts, no COM port is shown in the Port drop-down list.

Ans: Please make sure that the USB-to-Serial cable is plugged into your computer and the driver has been installed correctly.

- When the correct COM port is selected, a warning dialog pops up, saying “Cannot Open COM port!”

Ans: Please make sure that no other software is using the COM port. Reboot your computer if necessary.



## TS Programmer Issues (cont)

- Cannot read or program TS1. An error dialog pops up, saying “Failed to connect with the device! Check battery or connection”

Ans: Please make sure that

1. All the physical connections are correct.
2. The correct COM port is selected.
3. The battery in the interface box is not depleted.
4. TS1 is not faulty due to incorrect wiring.





The End!