

Calibration Handbook

Content

Page 1	Introduction
Page 1	Conditions that must apply before calibrating
Page 2 to 5	Programming the connected tanks
Page 6	Calibrating, selecting the calibration process needed
Page 7 to 8	Calibrating using an existing calibration data file
Page 9 to 14	Calibrating manually
Page 15	Format of a Calibration data file
Page 16	Tools

Tanks calibrating with Route Collect

Introduction

Route Collect is the software that allows communication with the system control box and give access to the following operations:

- Programming all the required variables when installing the system control box.
- Calibrating the tanks connected to the system.
- Checking in real time that the system is working OK.
- Download to a PC the trip data file.
- Reset the trip memory for a new trip.

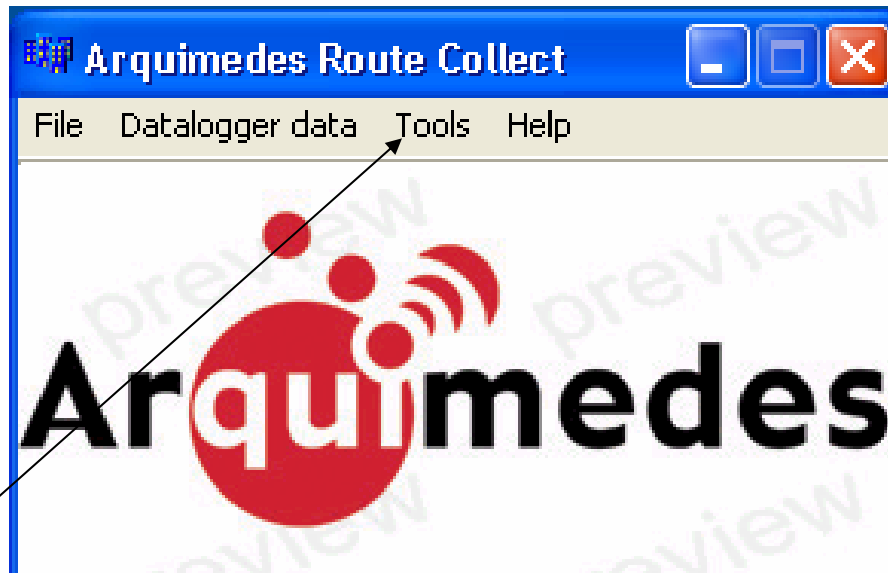
The calibration process require that:

- The fuel tanks connected to the system are recognized by the system.
- The calibration of all connected tanks.

Conditions that must apply before starting a new calibration process

- 1.- The fuel tank must be empty and disconnected from the other tanks of the vehicle in order to avoid that fuel enter the tank while calibrating.
- 2.- The system control box must be connected to its power source.
- 3.- The fuel sender must be correctly installed inside the tank. The arm of the fuel sender must be able to travel without obstacle from the bottom to the roof of the tank.
- 4.- The fuel sender must be connected to the system control box:
 - a) The electrical connections to the sender's terminal must be checked for parity (this can be done with a DC voltmeter – the voltage coming out of the senders terminal must always be positive. The voltage produced by the system control box is a fixed DC controlled voltage between 4.98 and 5.04 volts DC. Once the sender terminal are connected to the system control box the voltage at the sender's terminal will always be below 5.0 volts DC.
 - b) The tank position indicated in the Route Collect monitor window must correspond to the real physical position of the tank in the vehicle (Tank 1 = passenger's side, tank 2 = driver's side, tank three additional - left or right - or refri tank).

Programming the connected tanks



Select Tools

The following 2 sub menus will appear:

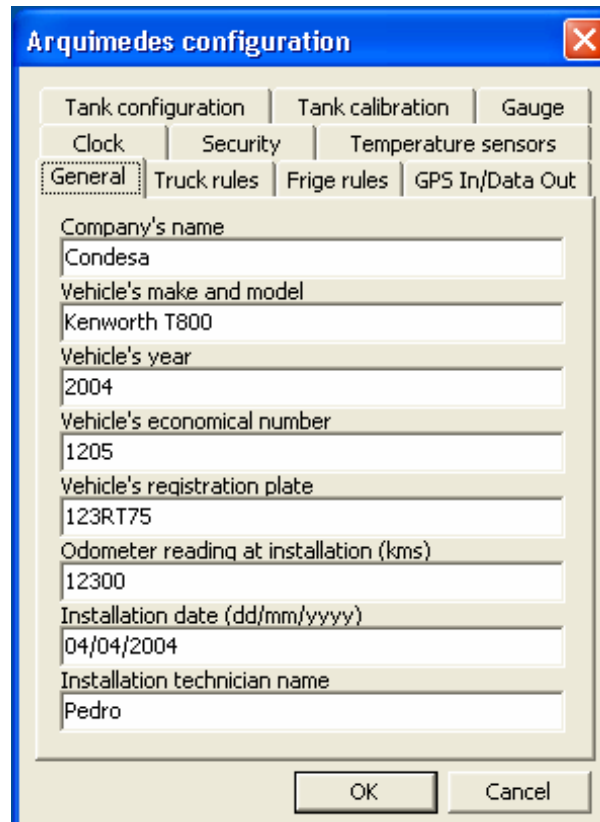
Tools

Arquimedes configuration

Arquimedes monitor

Select the Arquimedes Configuration submenu

When <Arquimedes Configuration> is selected the following window appears:

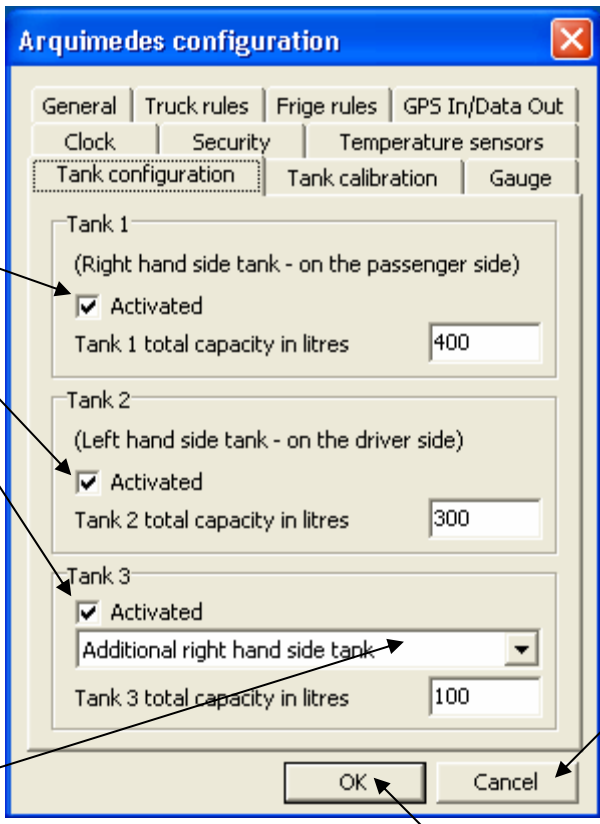


For the calibration process the following tabs are used:

- **Tank configuration:** Will allow to program which tanks are connected to the system control box indicating what is its maximum capacity and its position in the vehicle.
- **Tank calibration:** Will allow the calibration of the connected tanks:
 - 1.- By uploading an already existing calibration file to the system control box memory, or
 - 2.- By doing the tank calibration manually.

Select the Tank configuration tab

When <Tank Configuration> is selected, the following window appears:



Allows system activation of the tank

Will bring you back to the Route Collect main menu

Will upload the new configuration to the system control box

Indicate what is tank 3 and its position:
 Adicional tank on the right side (passenger)
 Adicional tank on the left side (driver)
 Refri box tank

This window will program the system control box, indicating which tanks are activated (connected), their maximum capacity and their position in the vehicle.

The system control box can monitor from 1 to 3 tanks.

Tank 1: is always the tank on the passenger's side

Tank 2: is always the tank on the driver's side

Tank 3: is either the additional tank of the vehicle (right if on passenger side, left if on driver's side) or is the tank which serves the engine of the refri box.

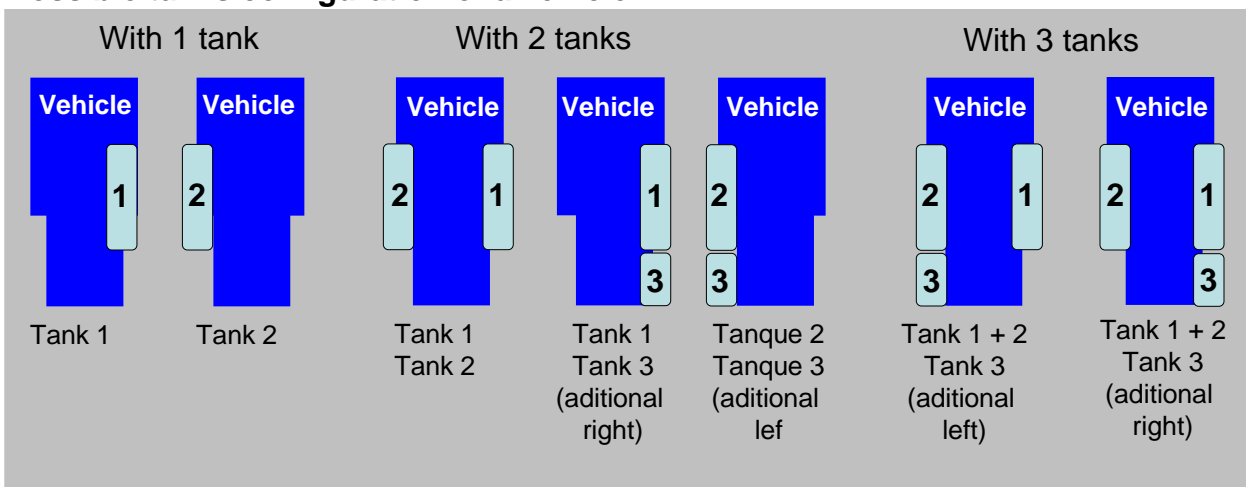
Each tank can be system activated or not.

When a tank is not activated, the system control box will not monitor its fuel level.

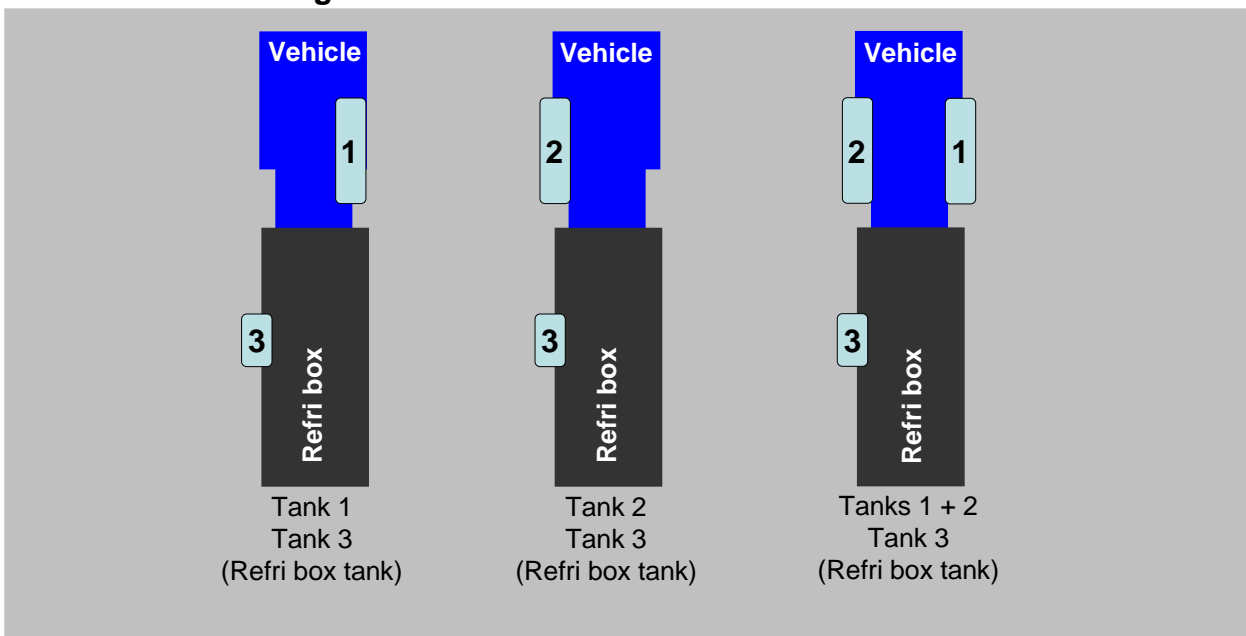
Important:

- It is recommended to activate only the positions which have a tank connected to it.
- It is recommended to double check that the indicated position is the real physical position of the tank in the vehicle.
- When the configuration process is finished it will only be uploaded to the system control box if the button **OK** is selected.

Possible tanks configuration of a vehicle:



Possible tanks configuration of a vehicle with a refri box:



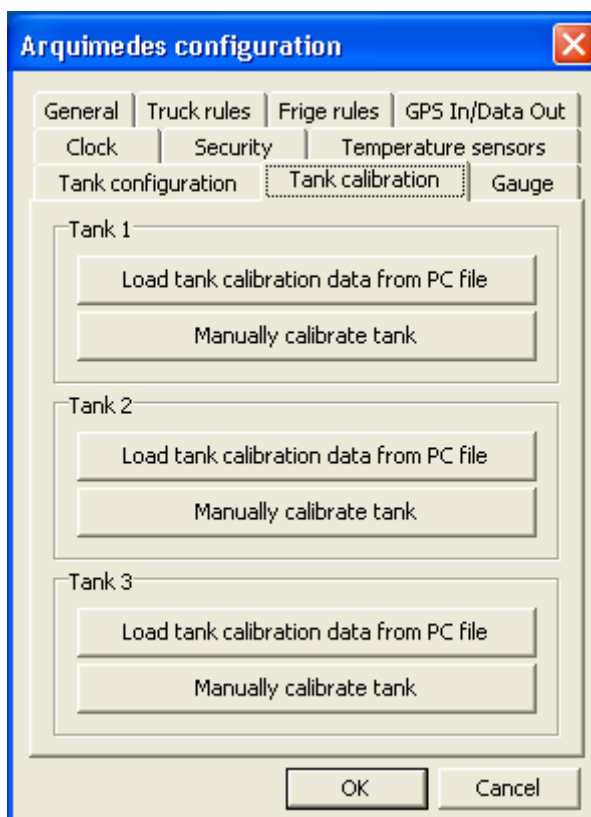
When the configuration is done press the **OK** button to upload the new configuration the system control box..

Once uploaded the new configuration the Route Collect main menu window opens.

To start with the tank calibration select: Tools / Arquimedes configuration .

From the window Arquimedes configuration select the Tank calibration tab.

The following window will open: (in this case 3 tanks are already activated)



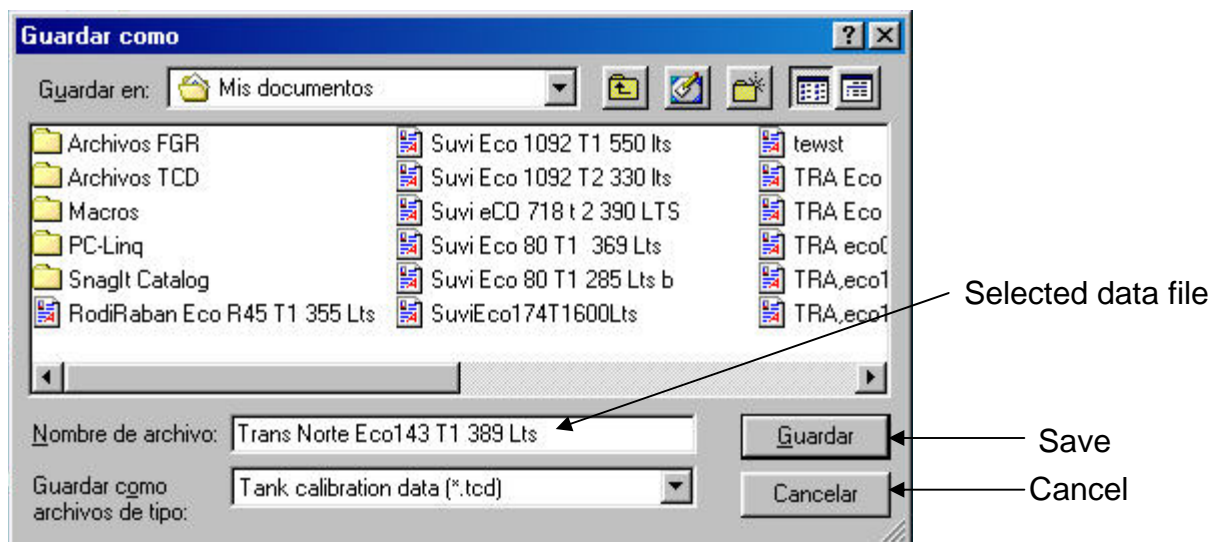
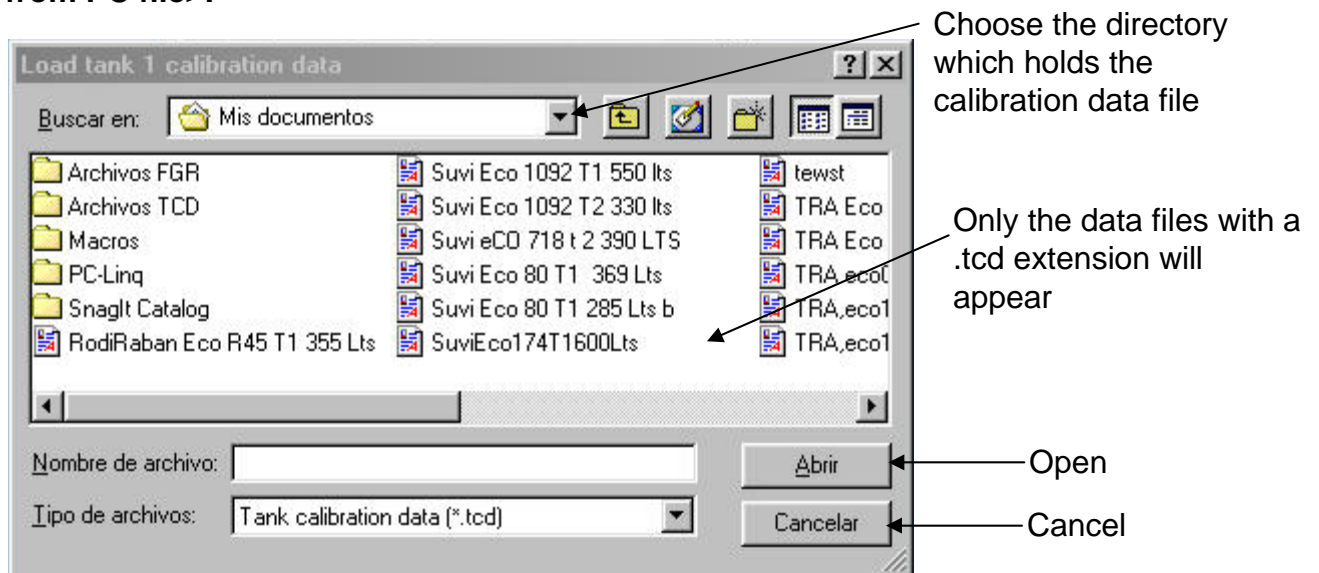
Each tank has 2 calibration options:

- Use an already existing calibration file and upload it directly to the system control box.
- Do manually the calibration (create a new calibration file).

Upload a calibration file to the system control box

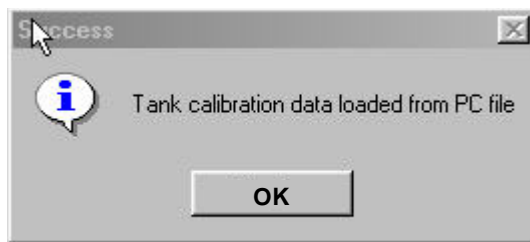
Use the calibration file of a tank identical to the vehicle's tank (same sizes same volumen). Valid calibration data files always have the same extension: **.tcd** (tank calibration data) If the calibration file do not correspond to the tank, fuel level readings will be incorrect.

The following window opens when selecting the button <Load tank calibration data from PC file>:

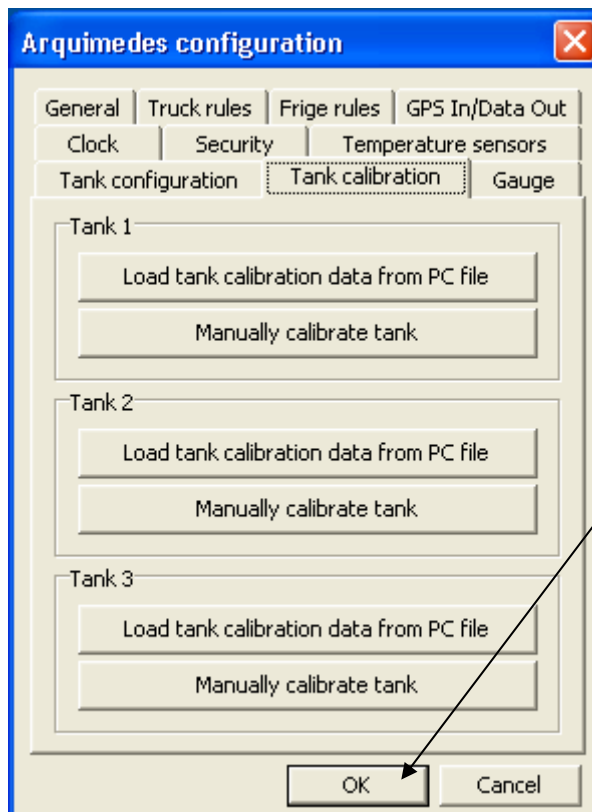


The calibration data files accepted by the system have the following extension: .tcd (t = tank, c = calibration, d = data) and the data inside is compiled with a strict format without which the system will not read the file.

When <Save> is selected, the following window appears:



When <OK> is selected the following window appears:

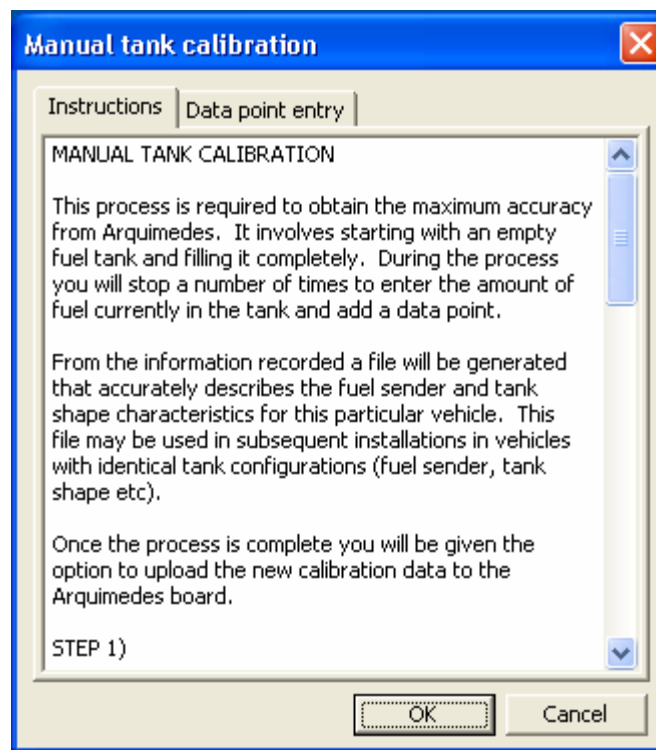


Important: For the calibration data file to be uploaded to the system control box the **OK** button must be selected

Calibrating manually

This option allow the manual calibration of the tank.

When <Manually calibrate tank> is selected, the following window opens:



We will reproduce hereafter the instructions for Manual tank calibration:

MANUAL TANK CALIBRATION

This process is required to obtain the maximum accuracy from Arquimedes.

It involves starting with an empty fuel tank and filing it completely.

During this process you will stop a number of times to enter the amount of fuel currently in the tank and add a data point.

From the information recorded a file will be generated that accurately describes the fuel sender and tank. This file may be used in subsequent installations in vehicles with identical configurations (fuel sender, tank shape, etc.)

Once the process is complete you will be given the option to upload the new calibration data to the Arquimedes board.

STEP 1)

Ensure the fuel tank is empty – if the tank isn't completely empty, fuel consumption and refueling below the current level will not be detected.

Wait for the "Sender position" reading to stabilise.

Once the number has stabilised, enter the amount of fuel currently in the tank into the "Fuel (litres)" input field and click the "Add data point" button.

STEP 2)

Pump fuel until the tank is approximately 1/16th full.

For example if you have a 1200 litres tank, pump approximately $1200/16 = 75$ litres in the tank. The exact number is not critical.

When you have pumped this amount into the tank, enter the actual amount of fuel currently in the tank into the "Fuel (litre)" field and click the "Add data point" button.

(Again note that you need to wait until the reported value settles down, this may take up to a minute after the fuel has been pumped in).

STEP 3)

Pump additional fuel into the tank so that the tank is approximately 2/16th full.

For example, if you have a 1200 litre tank, pump an additional 75 litres into the tank for a total of $75 + 75 = 150$ litres.

When you have pumped this amount into the tank, enter the actual amount of fuel currently in the tank into the "Fuel (litre)" field and click the "Add data point" button.

STEP 4)

Continue this process of filling and adding data points until the tank is completely full.

Ensure that you wait for the reported sender position to stabilise.

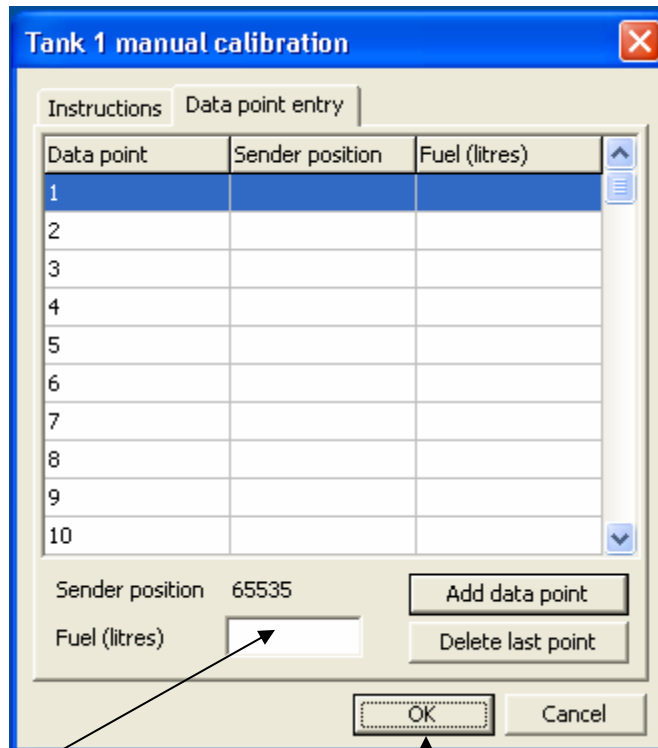
The total number of points gathered should be approximately 16 but between 12 and 20 is acceptable.

STEP 5)

Press the OK button. You will be prompted for a filename to save the new calibration data to the PC. This complete the process.

Create a calibration data file

When <Data point entry> is selected the following window opens:



Data point	Sender position	Fuel (litres)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Sender position: 65535

Fuel (litres):

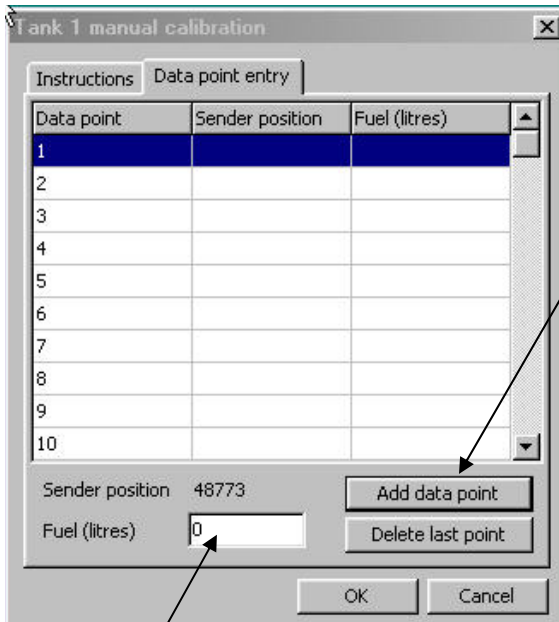
Buttons: Add data point, Delete last point, OK, Cancel

Box where the fuel in tank values are captured

OK will end the calibration process and allow to name and save the new caliabraiotn data file in the PC memory and then upload it to the system control box

The Sender position indicate the sender resistance value for a particular position of the sender arm inside the fuel tank. The sender position goes from 0 to 65,535. The typical arme sender will have a resistance with a range from 245 down to 30 Ohms (from full to empty) these resistance values correspond to the following sender positions 48,700 (empty) and 19,700 (full).

The tank calibration process start with an empty tank therefore the first sender position will correspond to 0.0 liters in tank.



Data point	Sender position	Fuel (litres)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Sender position: 48773
Fuel (litres): 0

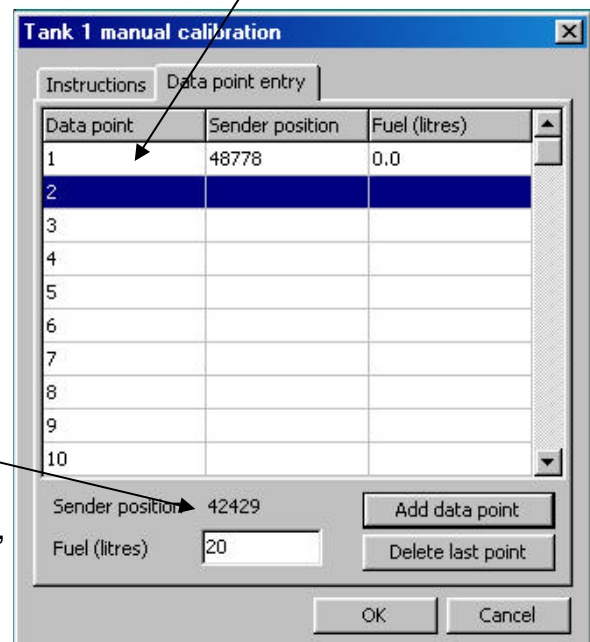
When **<Add data point>** is selected the data liters in tank and the data sender position are integrated in the same line.

The first line of the calibration data file is captured: 0.0 liter in tank.

Note: If you make a mistake you can always use **<Delete last point>**

When fuel is loaded inside the tank the sender position number will change.

In this box, always capture the total liters in tank, not the total liters that was just loaded.

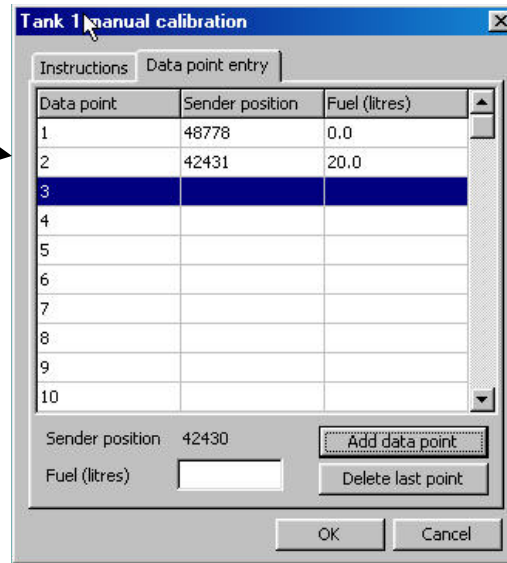


Data point	Sender position	Fuel (litres)
1	48778	0.0
2		
3		
4		
5		
6		
7		
8		
9		
10		

Sender position: 42429
Fuel (litres): 20

Once the sender position is stabilized and after the data liters in tanks has been captured select **<Add data point>** to integrate a line to the calibration data file.

The data of the file's second line where integrated



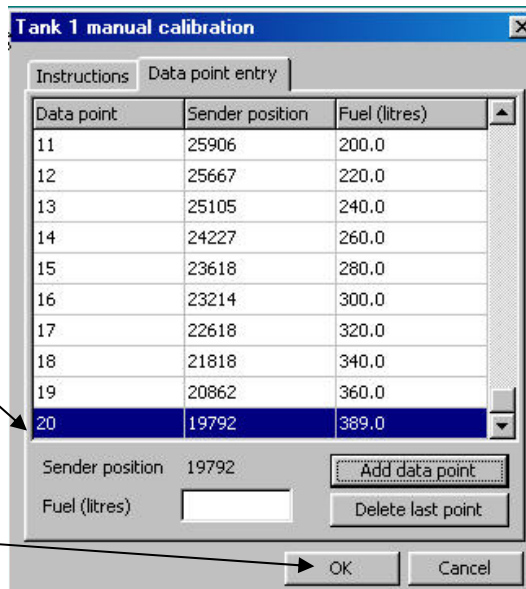
Data point	Sender position	Fuel (litres)
1	48778	0.0
2	42431	20.0
3		
4		
5		
6		
7		
8		
9		
10		

Sender position: 42430
 Fuel (litres):

Buttons: Add data point, Delete last point, OK, Cancel

The system will accept up to 20 lines per data file, each line with liters in tank and the sender position number. The first line should always be 0, the last line should indicate the full capacity of the tank in litres.

Last line of the file



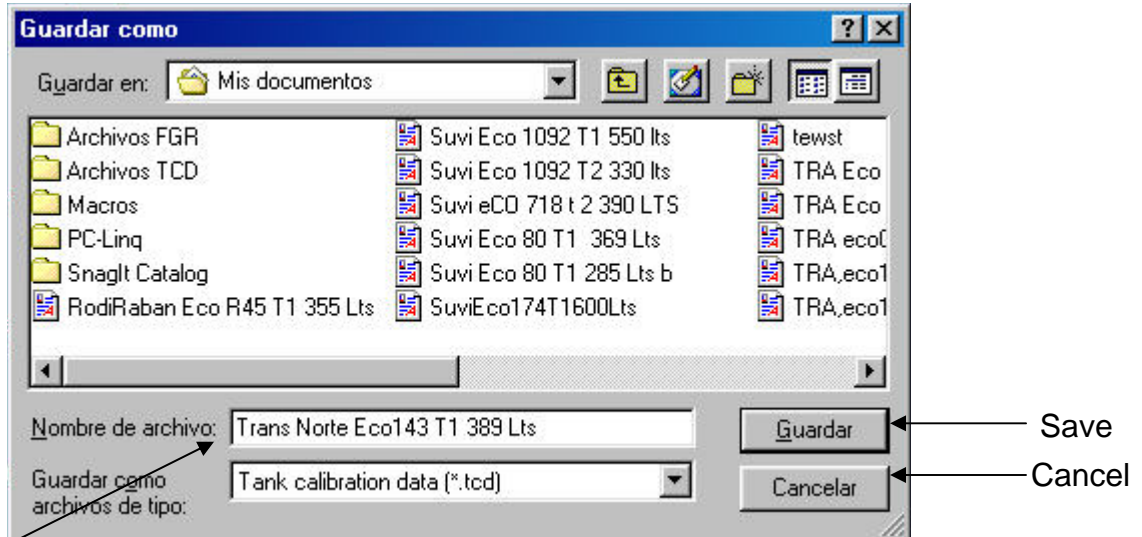
Data point	Sender position	Fuel (litres)
11	25906	200.0
12	25667	220.0
13	25105	240.0
14	24227	260.0
15	23618	280.0
16	23214	300.0
17	22618	320.0
18	21818	340.0
19	20862	360.0
20	19792	389.0

Sender position: 19792
 Fuel (litres):

Buttons: Add data point, Delete last point, OK, Cancel

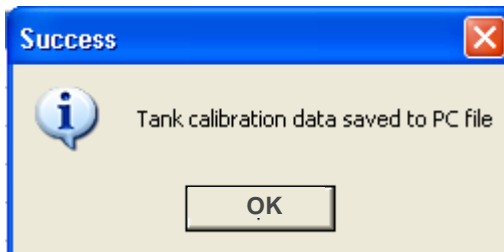
In order to save the calibration data file press <OK>

When <OK> is selected the following window opens:

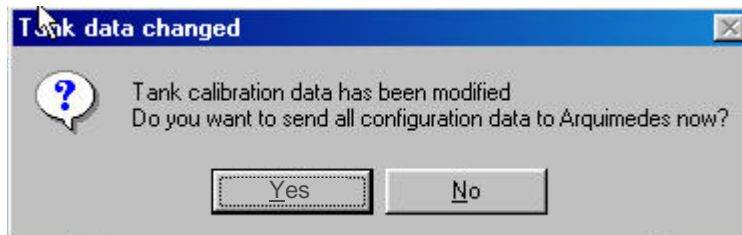


One has to name the calibration data file. It is recommended to name it with the following data: [Vehicle's band name][tank n°][Maximum capacity][tank measurements]

When <Save> is selected the following window opens:



When <OK> is selected the following window opens:



When <Yes> is selected the calibration data is uploaded to the system control box. There after the system control box will indicate the fuel level in this tank using the uploaded calibration file data.

The manual calibration process is now finished.

Calibration data file

The calibration data file is really a text file but with a .tcd extension instead of a .txt extension. The file can be opened with the Windows block note. indows.

The calibration data file is structured as follow

152.0,22013
142.0,23078
134.0,24419
128.0,26090
120.0,26897
112.0,28596
104.0,30133
96.0,30927
88.0,32644
80.0,34163
72.0,35005
64.0,36707
56.0,37524
48.0,39062
40.0,41293
32.0,42341
24.0,45468
16.0,47346
0.0,48415

It is very important the the data is captured in the right format::

The data in each line is in the following format: 0000.0,0000
(litres, sender position)

The left hand side data: 0000.0 correspond to the litres in tanks in the format 0000.0

If the litres are less than one thousand they must be captured as follow:

Exemple 5.0 is captured: [space] [space] [space]5.0

Exemple 55.0 is captured: [space] [space] 55.0

Exemple 555.0 is captured: [space]555.0

Exemple 5555.0 is captured: 5555.0

After the litre value is captured, a coma is captured.

This coma separates the 2 values.

After the coma, the sender position value is captured (as is).

The order in which the lines are captured is not importante, the format in which the data is captured is important.

Manual Calibration tools

Equipo de computo

PC or Laptop with internal and modem interno with RS 232 (9 pins) serial port

- Windows 98 or newer
- Route Collect

Extention cable RS232 Male/Female (to connect the PC or Laptop to the system control box)

Power source

To move the fuel

3 Barrils 200 litres each, empty and clean

1 12 VDC electric bomb (1/4 or 1/2 HP)

2 Hoses for fuel (each 4 meters long approx.)

1 Fuel despatching pistol

1 litre counter, calibrated with 4 digits capacity and a reset button

Vehicle preparation

It is better if the vehicle's tanks are full.

If the vehicle has more than 1 tank, the intertank hose must be shut down so that no fuel can enter or escape the tank except for the fuel used during the calibration proces.