smartswitch
INFORMATION = CONTROL

SMART SWITCH TECHNOLOGIES

FC-8000
Fuel Monitor/Controller

System Overview:

The FC-8000 Fuel Controller provides an intelligent networked solution for the monitoring and control of up to eight tanks. The block diagram on page 3 & 4 shows a typical system layout. The system consists of the FC-8000 display controller (as seen above) up to eight FT-100 tank controllers and the Pump Controller (either AC, DC or both). The system communicates via a 2-wire network cable with a maximum cable length of 1000 meters.

Note: The system can monitor and control up to eight tanks. The eight tanks can be any combination of fuel, fresh, grey or black. Any FT-100 controller or controller's may be replace with either a HB-200 or HB-200/P if either a fresh, grey or black tank or tanks would like to be monitored instead of fuel. Only fuel may be transferred.

Operation

Scroll to the tank (using the "Select Up or Down key") you want to pump fuel FROM, push the Transfer key a menu will pop-up asking which tank you want to transfer TO, push the Transfer key again the correct valves will open, and the pump will turn on.

The pump and valves will turn off given any of the following conditions:
1/ The tank fuel is being transferred FROM is empty.
2/ The tank fuel is being transferred TO is full.
3/ The pump on/off button is pushed again.

FC-8000 Display Unit:

Displays the tank level status, fuel transfer direction and pump status.

Features include:

- full control from one central location on your boat
- visual indication of tank level & pump status
- visual & audible tank EMPTY and fault alarms
- The system has two display modes:
- all tanks are name programmable giving tank location and type
  e.g. (Aft Port, Grey Tank) (Mid Ship Starboard, Black Tank)

RF-800 Remote Display Unit:

The RF-800 Repeater Display is an optional extra.
Up to three units may be connected throughout the vessel for convenient tank monitoring.
Note: The RF-800 is for monitoring only and will not allow control.

FT-100 Fuel Controller:

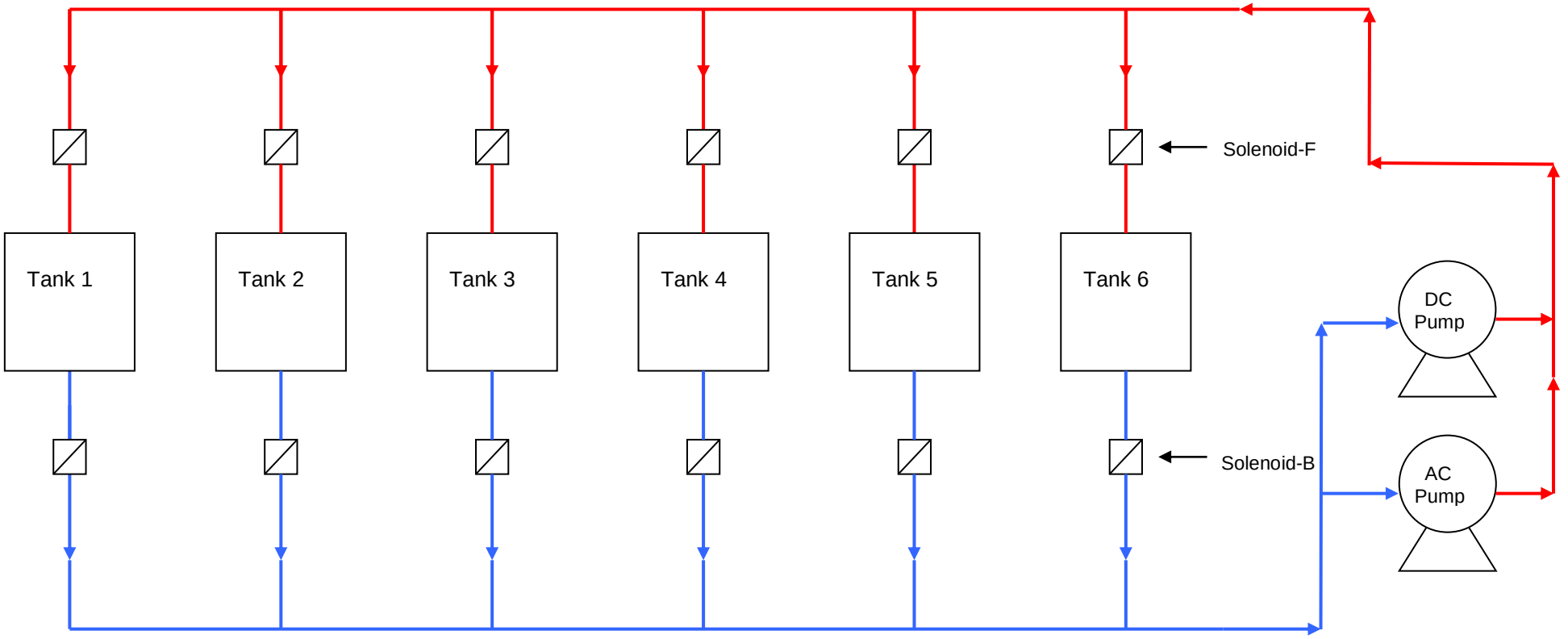
This controller is used to manager the fuel tanks Solenoid valve's (top & bottom) the safty top switch and provides an input for the fluid level sensor.

HB-200 Controller:

This controller is used for other tanks eg. Fresh, Grey or Black and provides an input for the fluid level sensor.

HB-200/P Controller:

This controller is used for other tanks eg. Grey or Black and provides an input for the fluid level sensor and a pump output.



Blue = Out Line, Red = In Line

System Operation:
Note: This lay-out only shows 6 tanks but the system will control up to 8 tanks.

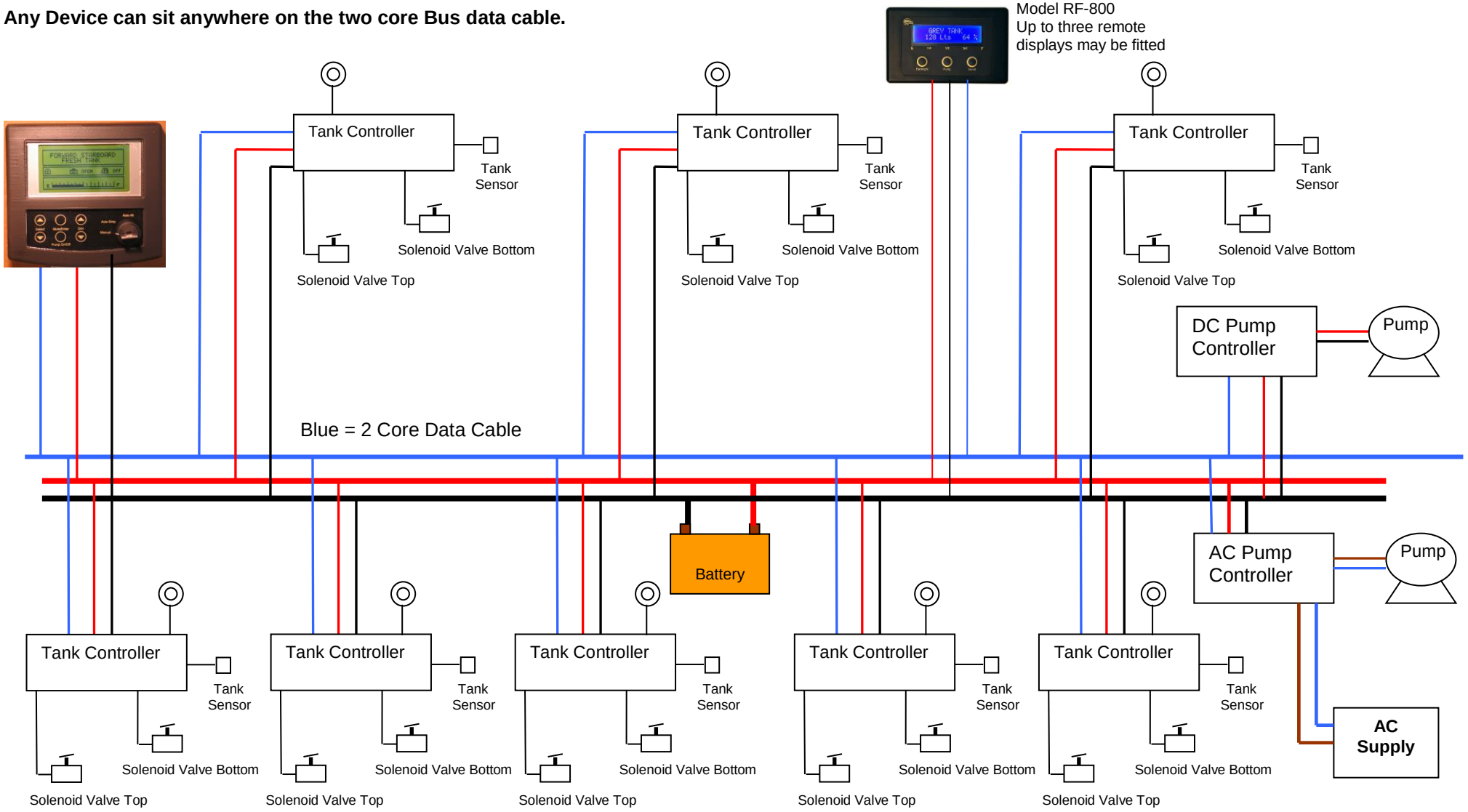
If for example you want to transfer from tank 2 to tank 5 then the following will happen: Tank 2 solenoid-E will open, Tank 5 solenoid-F will open and the Pump will turn on.

The pump will turn off given any of the following conditions:
1/ Tank 2 is empty.
2/ Tank 5 is full.
3/ The Transfer Stop button is pushed.
4/ If an amount was entered (e.g. 200lts) and that amount were transferred.
5/ All solenoids and pump are current monitored therefore if a solenoid or the pump failed to activate (blown circuit breaker, open circuit etc) the system will cut off and alarm with either a failed valve or pump icon.

Also see Tank Configurations Fig1, Fig 2, Fig 3 pages 23 & 24

Eight Channel Fuel Tank Controller System Layout for Model FC-8000:

Any Device can sit anywhere on the two core Bus data cable.



◎ = Emergency Stop Switch (Top Mounted)

Sensor Installation:

! WARNING !

PLEASE NOTE: For sensor Model SEN-100 The Maximum Tank Height is 1 Meter

PLEASE NOTE: For sensor Model SEN-250 The Maximum Tank Height is 2.5 Meter

The maximum surge and safe pressure is 28psi.

For more information see "Calibration Tips & Tricks" on our web site www.smartswitch.co.nz

Mounting Adaptors Available:

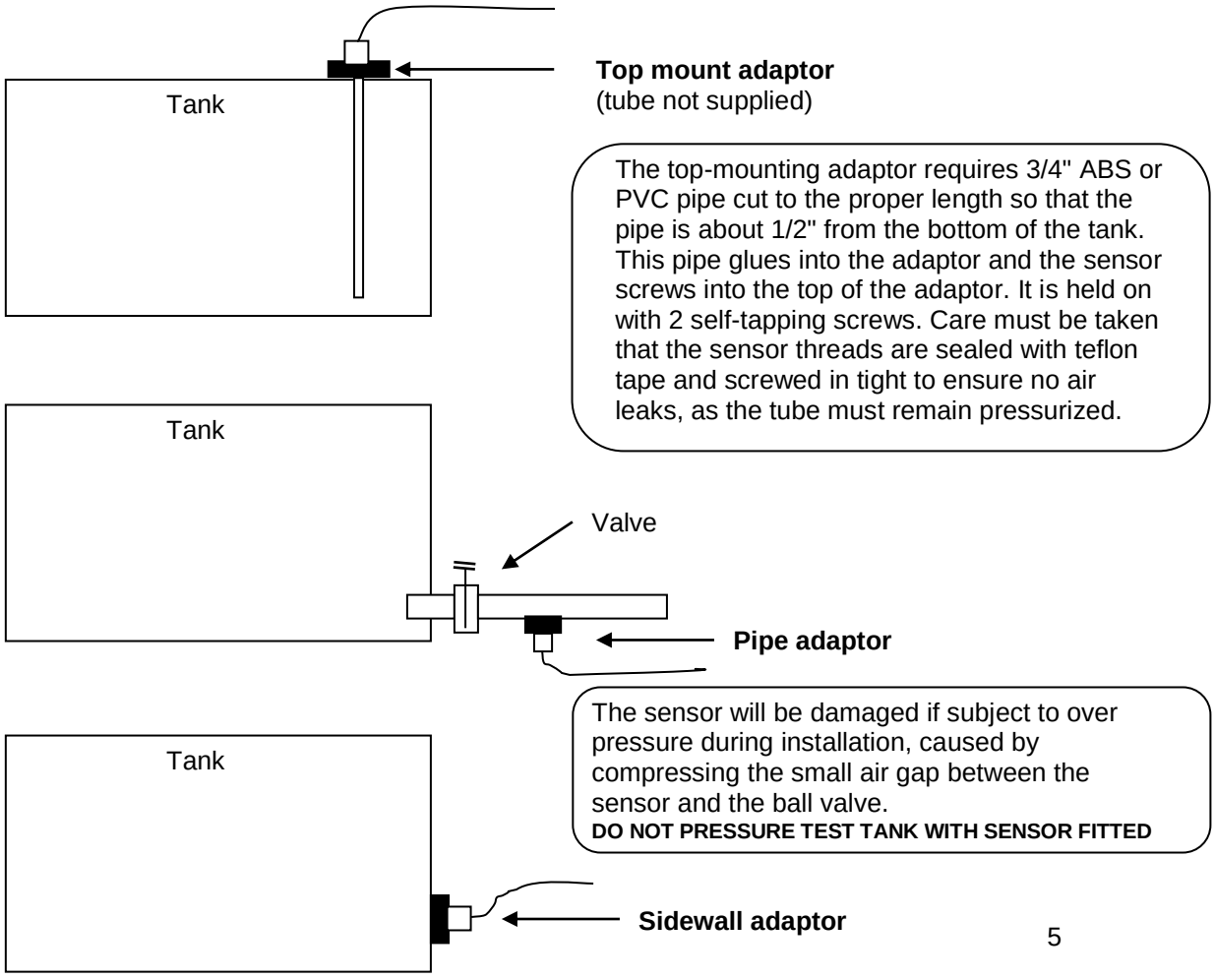
A range of mounting adaptors are available which include flat sidewall, top mount, 1.5" pipe, 2" pipe, 3" pipe and drain valve. **Ask your dealer for details.**

Interface Adaptors:

Should a 4 to 20 milliamp loop sensor supplied by another manufacturer be used, then the adaptor (part number SM-420) will need to be installed.
Should a 0 to 180 or 33 to 230 ohm sensor supplied by another manufacturer be used, then the adaptor (part number SM-180) will need to be installed.

Sensor Installation:

The sensor should be mounted as low in the sidewall as possible using a ¾" spin-in **or** the flat sensor adapter. If the sensor adapter is used it will require drilling a 5/8" hole in the sidewall. Apply silicon glue liberally to the bottom of the adapter. Using #10 x ½" stainless steel self-tapping screws attach the adapter to the sidewall. Once the adapter is attached make sure that the hole in the adapter is clear of any excess glue. Allow drying as per the instructions for the glue. Wrap the threads of the sensor using Teflon plumbers tape and install the sensor. Tighten by hand. It is not recommended to install the sensor in the bottom of the tank. Although the sensor will operate correctly it will provide an area for debris to collect which would be difficult to flush out.



Sensor Programming Instructions:

Two different methods of tank programming are available:

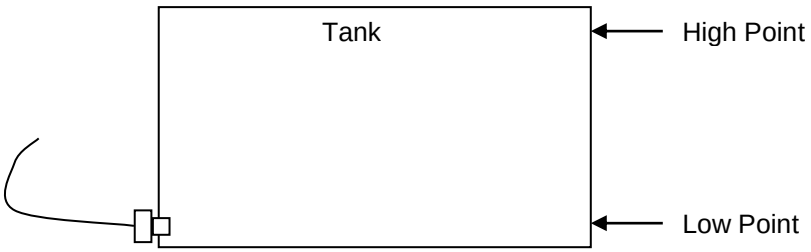
Method 1 sets tank low and tank high points only which can be used if the tank is a regular size and shape.

Method 2 sets tank low, tank quarter, tank half, tank three quarters and tank full points, offering more accuracy if the tank is an irregular size and shape.

Method 1:

Turn Rotary switch to position 0

Fill the tank to the required TANK LOW LEVEL; ensuring the sensor is covered with fluid. Wait for approx. 30 seconds for the fluid to settle. Press and hold down the program button until the LED comes on (approx. 3 seconds) this will set the tank low point. Fill the tank to the required TANK FULL LEVEL and wait approx. 30 seconds for the fluid to settle. Push and release the program button, the LED will give three quick flashes, the tank high point will be set and the unit will automatically leave program mode. The device is now ready for use.



The Bottom only setting can be done by turning the rotary switch to position A

Fill the tank to the required TANK LOW LEVEL and wait approx. 30 seconds for the fluid to settle. Press and hold down the program button until the LED comes on (approx. 3 seconds) this will set the tank low point. Push and release the program button, the LED will give three quick flashes, the tank low point will be set and the unit will automatically leave program mode. The device is now ready for use.

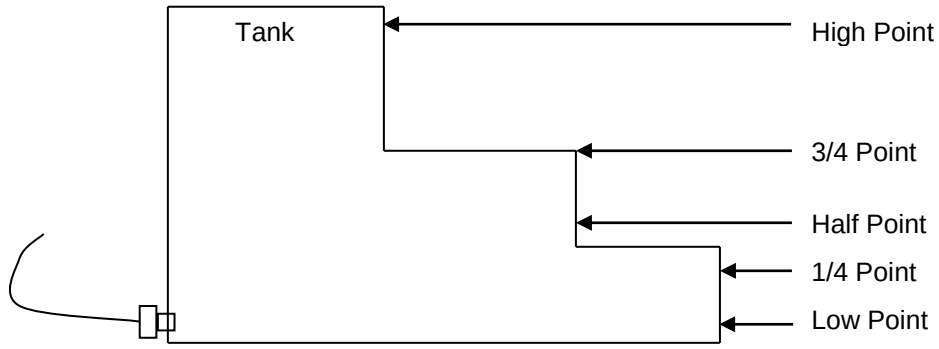
The Top only setting can be done by turning the rotary switch to position B

Fill the tank to the required TANK FULL LEVEL and wait approx. 30 seconds for the fluid to settle. Press and hold down the program button until the LED comes on (approx. 3 seconds) this will set the tank high point. Push and release the program button, the LED will give three quick flashes, the tank high point will be set and the unit will automatically leave program mode. The device is now ready for use.

Method 2:

Turn Rotary switch to position F

Fill the tank to the required TANK LOW LEVEL, ensuring the sensor is covered with fluid. Wait for approx. 30 seconds for the fluid to settle. Press and hold down the program button until the LED comes on (approx. 3 seconds) this will set the tank low point. Fill the tank to the required QUARTER LEVEL and wait approx. 30 seconds for the fluid to settle. Push and release the program button, the LED will give one quick flash. Fill the tank to the required HALF LEVEL and wait approx. 30 seconds for the fluid to settle. Push and release the program button, the LED will give one quick flash. Fill the tank to the required THREE QUARTERS LEVEL and wait approx. 30 seconds for the fluid to settle. Push and release the program button, the LED will give one quick flash. Fill the tank to the required FULL LEVEL and wait approx. 30 seconds for the fluid to settle. Push and release the program button, the LED will give three quick flashes. All tank points will be set and the unit will automatically leave program mode. The device is now ready for use.



Setting The Calibration From One Input/Output Unit To Another

Once an I/O Box has been calibrated you can transmit the calibration settings from that unit to as many more as required (tanks would need to be the same shape, size and content).

Note: This must be done independently from the complete system setup (only the 2 IOU's connected).
Step 1: Connect the power and network cable to both units.
Step 2: Turn the Rotary Switch to position C for the master transmitter (the unit that is calibrated).
Step 3: Turn the Rotary Switch to position D for the slave receiver (the unit that needs calibrating).

You will see both LED'S flashing, please wait (approx 20 seconds) for the LED'S to stop flashing, the slave receiver now has the same calibration setting as the master transmitter.

For more information see "Calibration Tips & Tricks" on our web site www.smartswitch.co.nz

Ultra-Sonic Sensor : The ultra-sonic sensor is calibrated to tank dimensions at the factory using a special programming device or by customer with optional programmer.

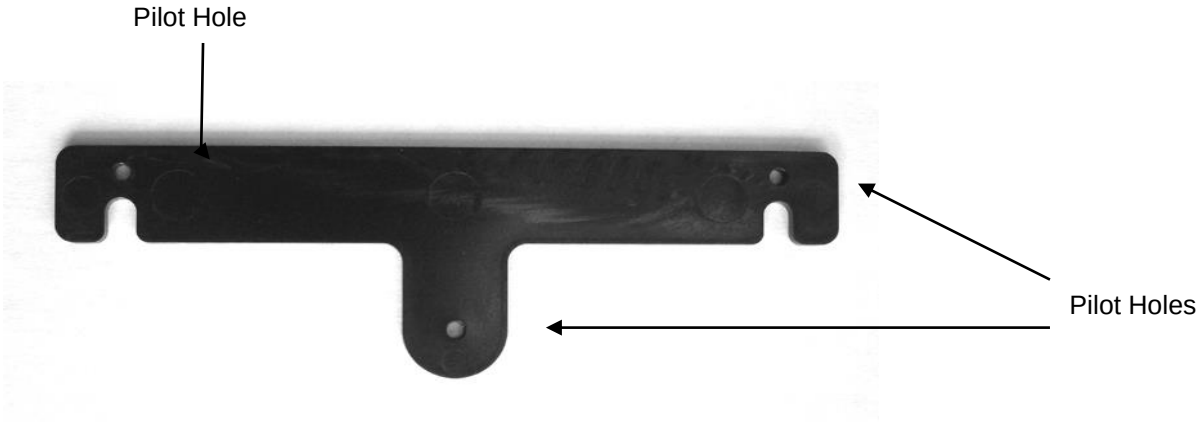
If using the Ultra-Sonic sensor turn the Rotary Switch to position 1
Press and hold down the Program Button for 3 seconds, the LED will flash 4 times and turn off.
The I/O box is now set for Ultra-Sonic.
Turn Rotary Switch to correct position (See Setting Rotary Switch page 12)

Mounting the FC-8000:

Position the mounting template tool provided and mark all three pilot holes. Drill a 3mm hole on the two outside holes and fit the mounting screws provided. Place the template tool back over the screws and tighten the screws until the template tool can just slip on and off the screws (ensure the tool in not too loose).

Drill the bottom hole to 12 mm (cable hole).

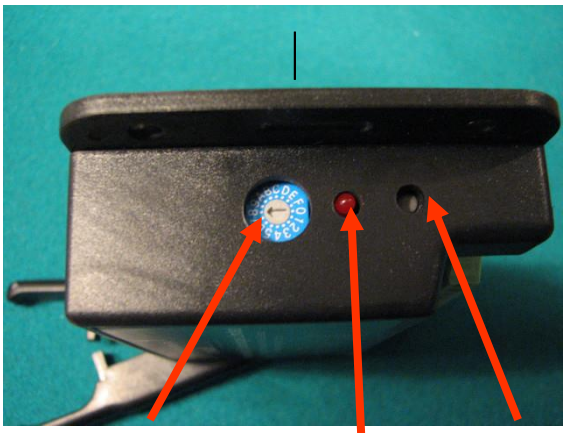
Place the Display Unit keyholes over the two screws and gently pull down. If the screws have been tightened to the correct depth the Display will clip down and self tighten.

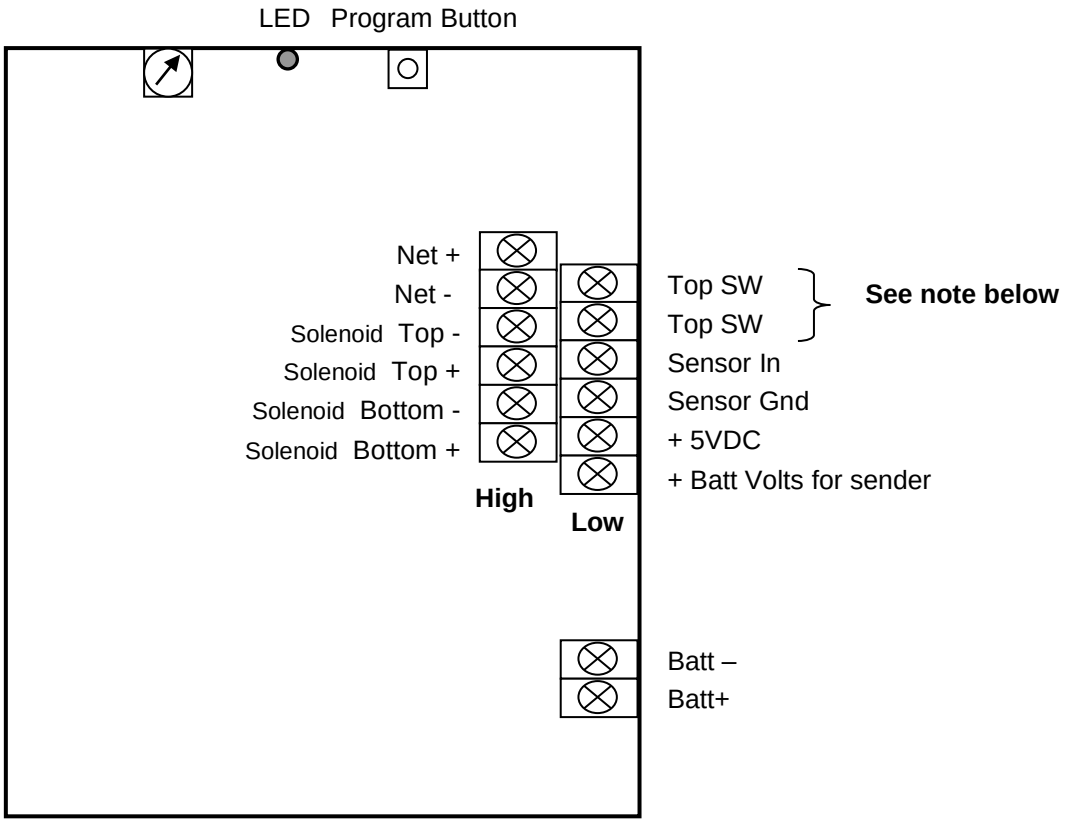


FC-8000 Wiring

Red = Battery +
Black = Battery -
Blue = Net +
White = Net -

Connection Diagram for FT-100 Controller:

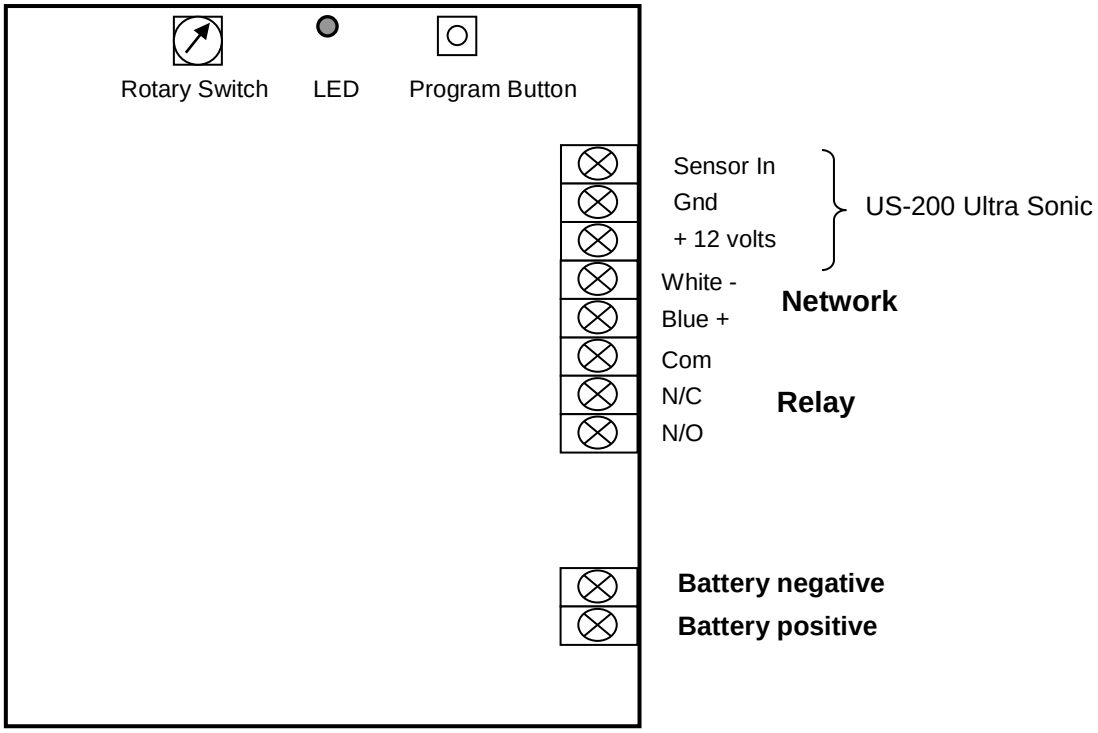




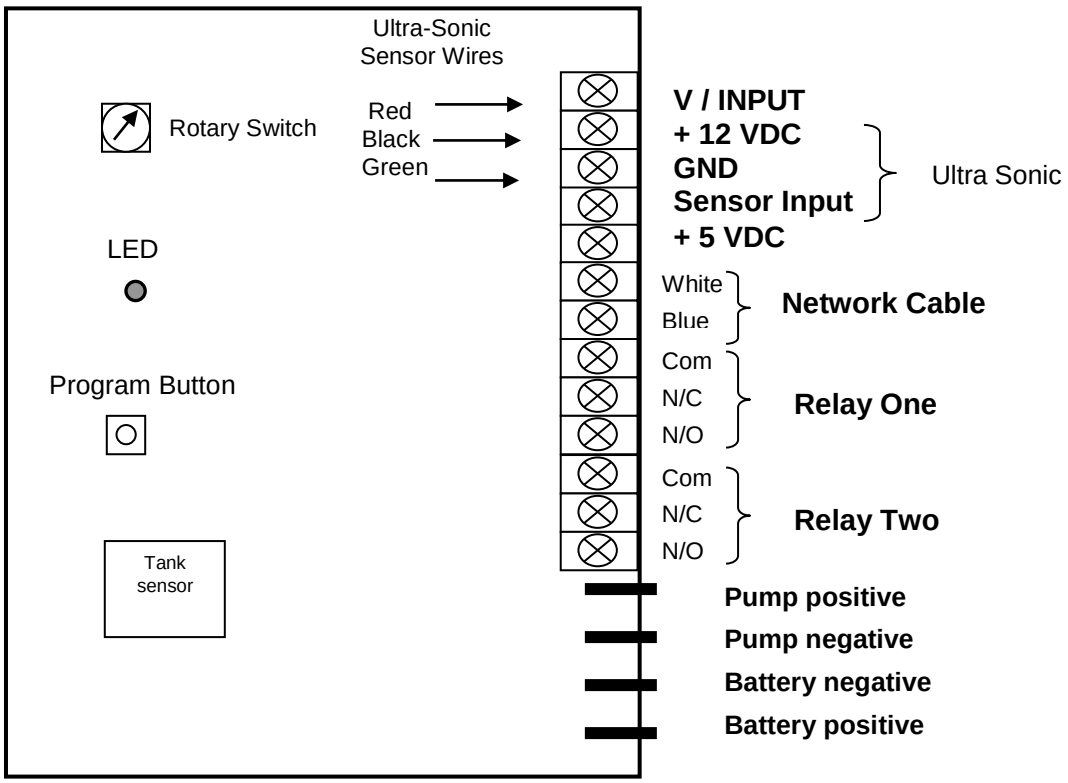
NOTE: If the tank emergency top switch is not fitted then a link must be placed between the two "Top Switch" terminals

NOTE: The HB-200 or HB-200/P are used for tanks other than fuel e.g. Fresh, Grey or Black

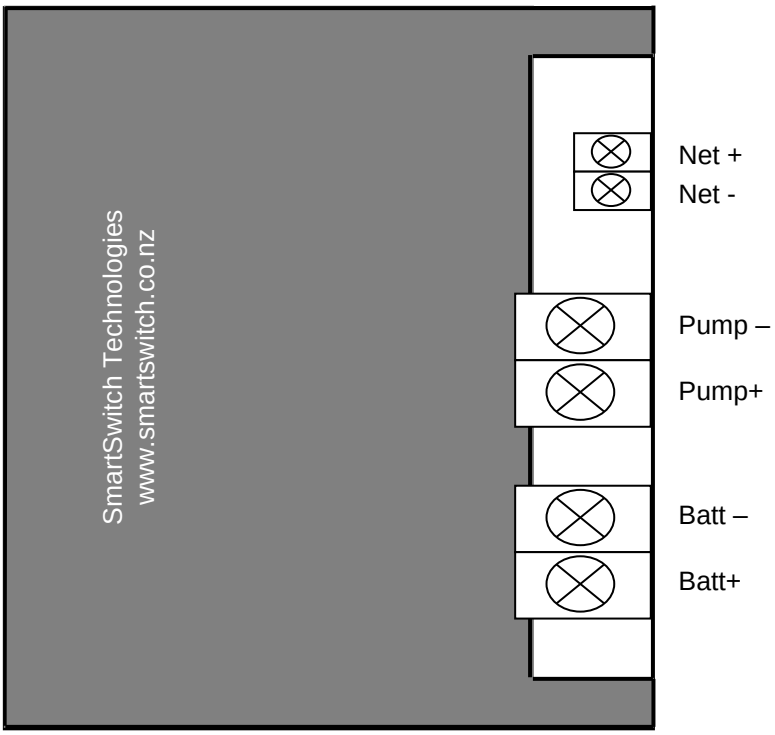
Connection Diagram for HB-200 Controller:



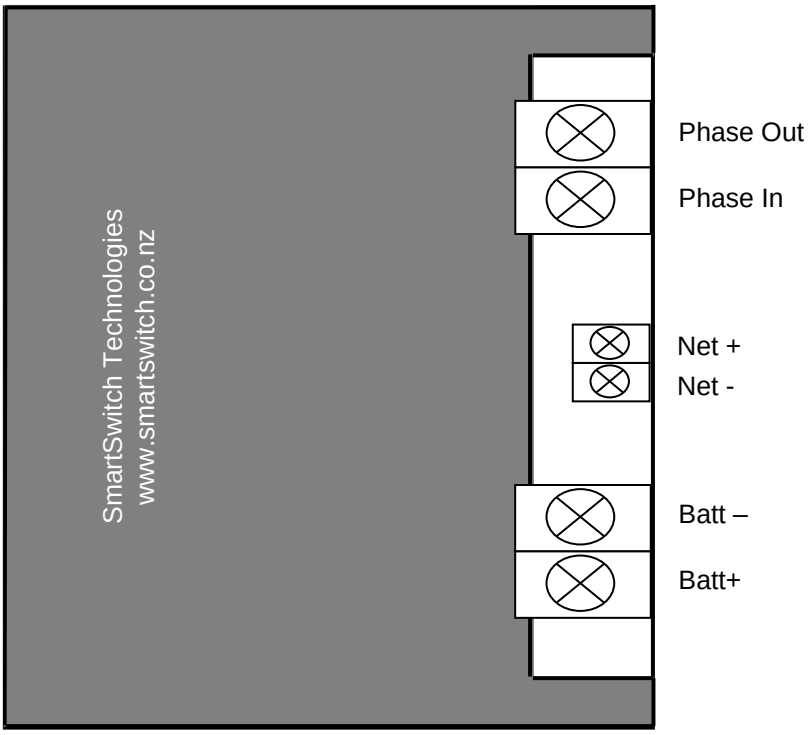
Connection Diagram for Model HB-200/P:



Connection Diagram for DC-P100 DC Pump Controller:



Connection Diagram for AC-P200 DC Pump Controller



!!!!!!!! WARNING !!!!!!!!

The AC-P200 Controller must be mounted in a separate insulated housing.
A registered electrician must be used when connecting to the mains supply voltage

Pump Control:

There are two pump controllers available, the AC-P200 which is a 30 amp AC Controller and the DC-P100 which is a 30 amp DC controller.

When a pump is turned on the system will default to the AC Pump Controller, if the controller is not present on the network or the pump is faulty the system will automatically switch over to the DC Pump Controller.

If the installation only requires the one DC Pump Controller the system will see there is no AC Pump Controller present on the network and automatically use the DC Pump Controller.

Please Note: Two DC Pump Controllers may be used instead of one AC and one DC controller.
Eg. The primary controller may also be a DC-P100 DC Pump Controller.

Setting Rotary Switch: (Network Address)

Each Input/Output Unit on the network must have the Rotary Switch set to a unique number (from 2 to 9). NO two devices may share the same Rotary Switch number.

The Rotary Switch is situated either on the inside the Box or on the side.

For ease of reference fill in Table 1 below prior to programming as this will enable quick reference when programming the Display Unit. See example below.

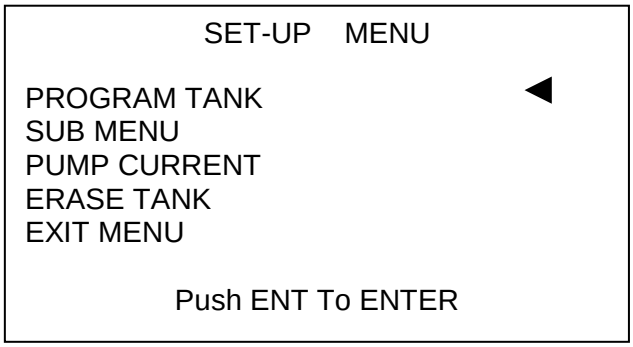
Table 1

Switch #	Tank Position	Tank Type	Tank Vol
2	*EXAMPLE*	*GREY*	*400L*

Programming Instructions:

Step 1: Placing the unit in Program Mode

Press and hold down the Mute & Select Up keys together for 3 seconds. This will bring you to the Set-Up Menu and place the unit in program mode.

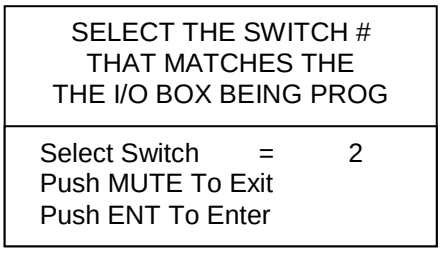


Scroll to PROGRAM TANK and press the ENT key.

Note: After a tank has been programmed any of the settings may be changed by scrolling to the SUB MENU option and pressing the ENT key.

Step 2: Programming a Tank

The display will now show:



Use the Select Up or Down key to change the Switch number which corresponds to the I/O unit you wish to program (refer to Table 1 on page 12) for Switch number.
Once the Switch number has been selected press the ENT key.

Step 3: Selecting Tank Name

The display will now show:

GREY TANK
Select TankText Push MUTE To Change Push ENT To Enter

NOTE: There is a list of pre-programmed names for you to choose from, if you want to change a name see step 3a below. Once a name has been used **DO NOT** use the same name again when programming another tank choose another name from the list to either use or change.

Use the Select Up or Down key to scroll through the pre-programmed tank names. Press the ENT key once the required name has been found. Otherwise if you would like to change the name, press the MUTE key and see next step 3a.

Step 3a: Changing Tank Name Text

The tank name text may be changed. After selecting the Tank (name), as above, use the Dim Up or Down key to move the cursor to each individual letter and the Select Up or Down key to scroll through the alphabet. Press the ENT key to enter, once you have finished.

Step 4: Selecting Tank Type

The display will now show:

Grey = 1 Black = 2 Fuel = 4 Water = 3 Day Fuel Tank = 5
Select TankType = # Push MUTE To Exit Push ENT To Enter

Use the Select Up or Down key to scroll through the tank various types (note this is not the tank name, it is the tank type). Press the ENT key once the appropriate tank type has been found.

Note: See FIG 2 page 23 for Day Fuel Tank explanation

If Day Tank Fuel is selected go to page 19

Step 5: Setting the Alarm Point

The display will now show:

DO YOU WANT TO SET THE ALARM
Use Select Keys ▲ Yes No ▼

If NO is selected go to Step 6 other wise continue:

The display will now show:

SET THE ALARM TRIGGER POINT
Set Alarm Point Push ENT To Enter E##############F

Use the Select Up or Down key to scroll through the tank levels 0 to 16 bars. (0 = Empty 16 = Full). Once you have selected the required level, of the alarm trigger point, press the ENT key.

Step 6: Setting Relay 1 On & Off Points

NOTE: This step will only be shown if the tank is Grey, Black or Fresh Water

This is a feature particularly useful for Black Tanks e.g. set the On point for 16 and Off point for 14. If Relay 1 was connected to a toilet disable input, then the relay would turn on when the tank reached 16 bars disabling the toilet. Once the tank had been discharged to 14 bars the toilet would be enabled again.

The display will now show:

SET RELAY ONE TRIGGER POINT
Relay ON Point Push ENT To Enter E##############F

Use the Select Up or Down key to move the Relay On point to the desired level. Press the ENT key to set this as the Relay On point (the point where the relay turns On).

The display will now show:

Set Relay Off Point
Relay OFF Point Push ENT To Enter E↓F

Note: the arrow is the On point marker which shows where the relay On point was set.

Use the Select Up or Down key to move the Relay Off point to the desired level. Press the ENT key to set this as the Relay Off point (the point where the relay turns Off).

Step 7: Tank Volume

The display will now show:

DO YOU WANT TO SET TANK VOLUME
Use Select Keys ▲ Yes No ▼

This allows for displaying the tank volume in either Litres or Gallons. If this feature is required press the Select Up key to select “Yes”. Next select “Ltrs” for Litres or “Gal” for Gallons.

If NO is selected go to Step 7 other wise continue:

The display will now show:

SELECT LITRES or GALLONS
Use Select Keys ▲ Lts Gal ▼

Se the Select Up key for Litres or Select Down Key for Gallons.

The display will now show:

SET AMMOUNT
Set Volume 00000 MUTE = Cursor Push ENT To Enter

Use the Select Up and Down key to change the value of each digit and the Mute key to move to the next digit. Press the ENT key to save the setting.

Erasing Tanks:

To erase a tank, from the Set-Up Menu scroll to ERASE TANK and press the ENT key.

The display will now show:

Tank Name	
Select Switch Push MUTE To Exit Push ENT To Enter	# ?

Use the Select Up or Down key to scroll through the Switch numbers to the tank that requires erasing. Once the tank is displayed press the Ent key. Or to exit this screen and return to the Set-Up Menu press the MUTE key.

Pump Current:

Both the AC and DC Pump Controllerl have current sensing to detect if the pump fails. The feature can be turn ON or OFF for eith or both pumps.

The AC will sense as low as 600 Milli-amps @ 230vac
The DC will sense as low as 800 Milli-amps @12VDC

If a AC Pump Controller is fitted (and current sensing is ON) and the pump fails the DC pump will be turned ON. If the DC PUMP fails (and current sensing is ON) the system will shut down and a “P” will be displayed in the tool bar

If a AC Pump Controller is fitted (and current sensing is OFF) NOTHING WILL HAPPEN AND THE USER IS NOT ALERTED.

If the DC Pump Controller is fitted (and current sensing is OFF) NOTHING WILL HAPPEN AND THE USER IS NOT ALERTED.

To turn this feature ON or OFF scroll down to PUMP CURRENT on the main menu and press the ENT key

The display will now show:

DO YOU WANT TO USE DC CURRENT SENSE	
Use Select Keys	
▲ Yes	No ▼

One this has been set you will be asked the same about the AC CURRENT SENSE.

Exit Menu:

Once all tanks have been programmed you will need to take the system out of Set-Up mode and into monitoring mode. From the Set-Up Menu scroll down to EXIT MENU and press the ENT key.
This will save all associated data that has been set and take the system out of program mode and into monitoring mode. The FC-8000 is now ready for use!

Sub Menu:

```
          SUB  MENU
SET PUMP OFF POINT      ◄
SET RELAY POINT
SET ALARM POINT
SET TRANSFER POINT
SET TANK VOLUME
SPECIAL FEATURE
EXIT MENU
```

Any of items listed in the Sub Menu may be changed at any time without having to re-program the entire tank.
Use the Select Up and Down to scroll to the feature requiring changing and press the ENT Key.
Follow the on screen instructions

SET RELAY ON POINT	see Step 6 above
SET ALARM POINT	see Step 5 above
SET TANK VOLUME	see Step 7 above

Setting Pump OFF Point

This feature allows you to set where you want the Pump to turn OFF

The display will now show:

```
SET THE PUMP OFF
  TRIGGER POINT

Set Off Point
Push ENT To Enter
E ##############  F
```

Use the Select Up or Down key to move the Pump Off point to the desired level. Press the ENT key to set this as the Pump OFF point.

Set Transfer Point:

If when programming a tank it is set as (Day Fuel Tank = 5) you will be asked to set a transfer level. This is the point (tank level) at which the automatic transfer will start
This transfer point may be changed at any time in this Sub Menu. Also see page 19

Special Feature:

This feature allows for one tank to be set as a special tank so that when you go to the transfer menu you will only be asked when you want the fuel to be transferred from as the fuel will always be transferred to the special tank and no other tank. Also see Fig 3 page 24

Exit Menu:

This will take you back to the main menu (page 13).

Day Fuel Tank:

If a Tank is programmed as a Day Fuel Tank (option 5)

The display will now show:

SELECT THE SWITCH NO 1ST PREFERED TANK
Select Switch # ? Push MUTE To Exit Push ENT To Enter

Note: The 1st and 2nd tanks can be the same

Use the Select Up or Down key to scroll through the switch numbers to the tank that you want the fuel to automatically transfer from. Note: This is the **1st preferred** tank. Once the tank is displayed press the Ent key. Or to exit this screen and return to the Set-Up Menu press the MUTE key.

The display will now show:

SELECT THE SWITCH NO 2nd PREFERED TANK
Select Switch # ? Push MUTE To Exit Push ENT To Enter

Use the Select Up or Down key to scroll through the switch numbers to the tank that you want the fuel to automatically transfer from. Note: This is the **2nd preferred** tank. Once the tank is displayed press the Ent key. Or to exit this screen and return to the Set-Up Menu press the MUTE key.

The display will now show:

SET THE TRANSFER TRIGGER POINT
Trigger point Push ENT To Enter E ############ F

Use the Select Up or Down key to move the Trigger Point to the desired level. Press the ENT key to set this as the Fuel Transfer Trigger Point. When the fuel reaches this point the transfer will start.

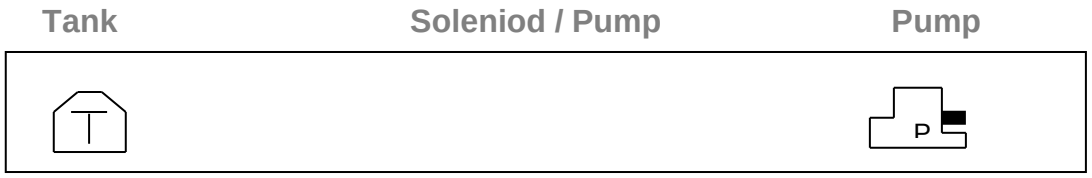
The display will now show:

DO YOU WANT TO USE ALTERNATE TANKS
Use Select Keys ▲ Yes No ▼

In alternate mode the day tank will be supplied from 1st and 2nd tanks alternating between the tanks at each fill.
If No is selected then the 1st preferred tank will supply the day tank until that tank is empty and then swap to the 2nd preferred tank. You will now be returned back to Step 5

NOTE: Also see Day Fuel Tank Auto / Manual on page 21

Alarms:



If any one of these features is in alarm and the tank being displayed is the one with the alarm the alarm bell will **be flashing**. If another tank is being displayed, the bell will be **ON solid** (not flashing).

Tank= either full or empty (depending on type of tank)
Soleniod / Pump = If a solenoid fails a “S” will appear or “P” if the pump fails
Pump = On or Off (showing if a pump is On or Of f)
Pressing the Mute button will mute the alarm.

Soleniod / Pump Alarm:

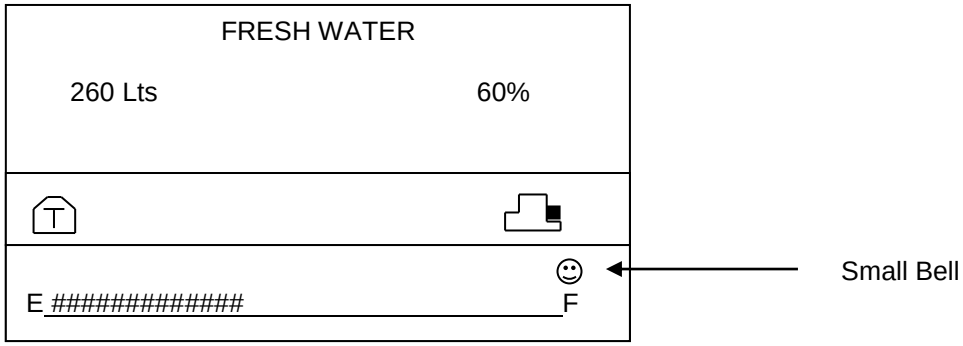
The FT-100 and both AC or DC pump controllers have current detection circuitry built in and will current sense the solenoid or pump.

If the Pump fails and current sensing has been turned on a the system will shut down and a “P” will be displayed in the above tool bar. See page 17 for explatnation.

Should a solenoid fail the system will shut down and a “S” will be displayed in the above tool bar. Beside the “S” an alarm bell will appear. If the tank being displayed is the one with the alarm the alarm bell will **be flashing**. If another tank is being displayed, the bell will be **ON solid** (not flashing).

Tank Alarm:

If the Tank alarm has been programmed On then a small bell at the bottom right corner will be displayed, if **OFF** the bell will disappear.



Day Fuel Tank Auto / Manual:

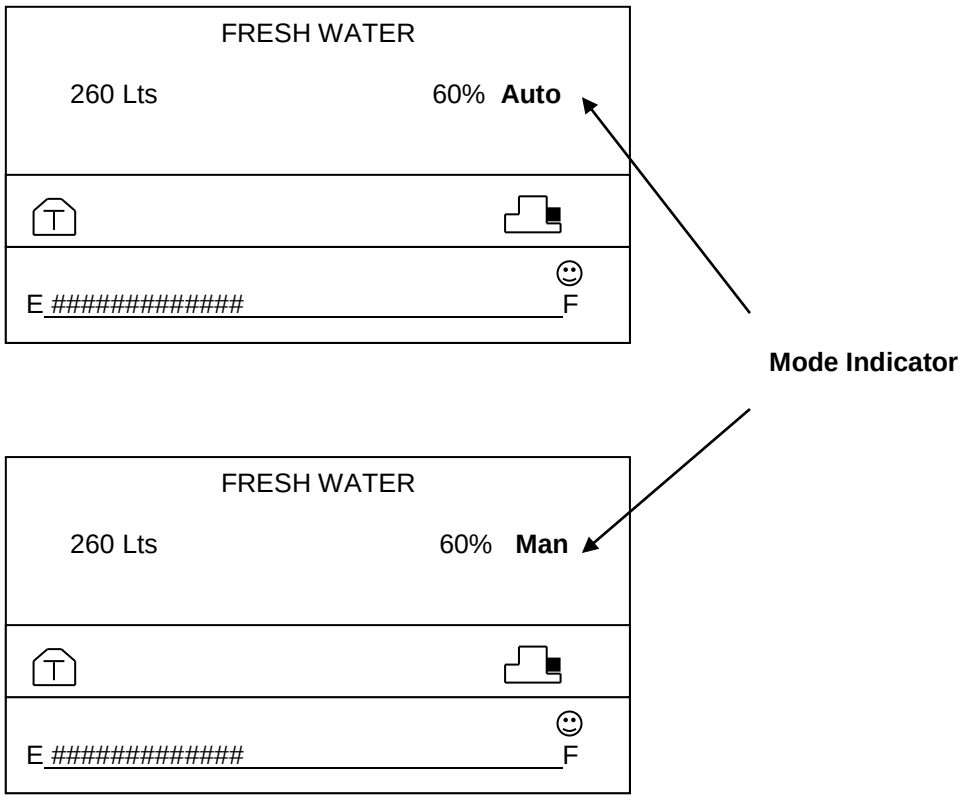
The Day Tank is under normal circumstances in “Auto” mode and will fill automatically when the day tank reaches the (programmed) trigger point, however it can be stopped (in case of emergency) by pressing the Transfer STOP key while a transfer is in progress.

If the stop key is pushed this will place the mode in “Man” (Manual) and the tank will NOT automatically fill.

The Mode will be automatically placed back into Auto once the tank has been filled just past the programmed “transfer trigger point”

OR

Press the Transfer “Start” key, from the menu scroll down to “Reset Auto-Day” and press the ENT key. This will reset the mode and return you back to the main display.



Display Modes:

The system has two Display Modes: Press the ENT to toggle between the modes

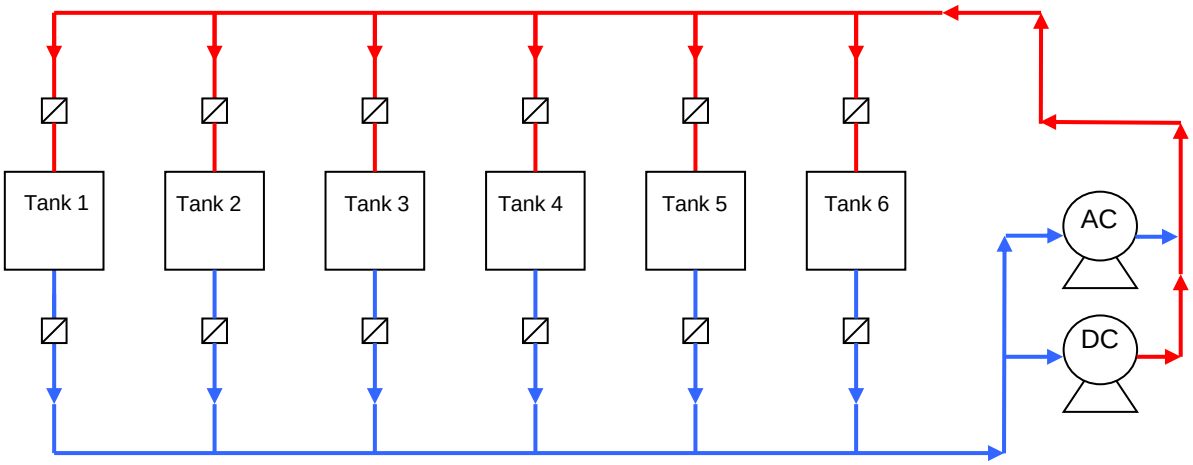
Mode 1: Displays tank name, percentage and Lts or Gals as well as a bar graph at the bottom of the screen.
Mode 2: Displays all tanks on one screen.

Errors

Should a programmed tank either lose communication, or power, the tank level indicator will display “----------COMMS FAULT----------“. The tank level indicator will resume normal operation once the problem has been rectified.

Tank configurations:

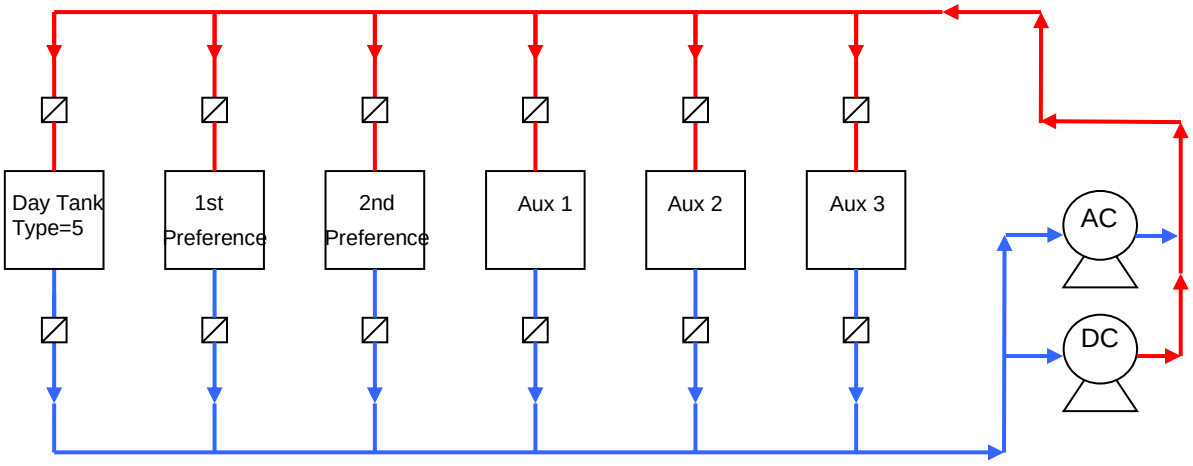
FIG 1



In this configuration when you go to the transfer menu to transfer fuel you will be asked when you want the fuel to **come from** and when you want the fuel to **go to.**
E.G. You can transfer fuel from any tank to any tank.

For this type of setup, when programming the tanks set all tanks as (Fuel = 4)

FIG 2

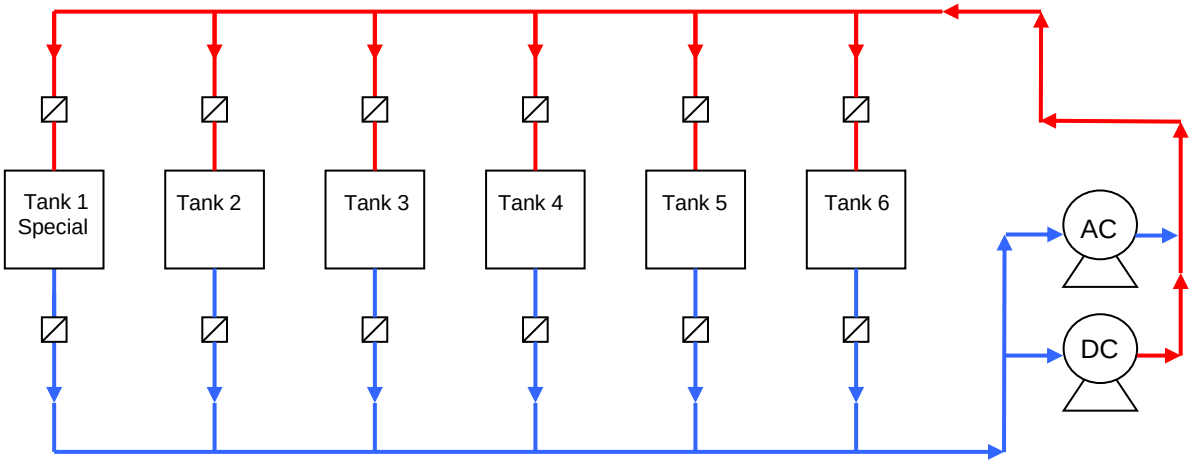


This configuration is a typical setup for an engine day tank with 1st and 2nd supply tanks.
In this configuration the day tank will be filled from either 1st or 2nd preferred tanks in either alternate mode or single mode.
In alternate mode the day tank will be supplied from 1st and 2nd tanks alternating between the tanks at each fill.
If not in alternate mode then the 1st preferred tank will supply the day tank until that tank is empty and then swap to the 2nd preferred tank.
Fuel can still be transferred from any tank to any tank manually; this setup is just for automatically filling the day tank.

For this type of setup, when programming the tanks set the day tank as
(Day Fuel Tank = 5) and set all other tanks as (Fuel = 4)

Tank configurations:

FIG 3



In this configuration when you go to the transfer menu to transfer fuel you will only be asked when you want the fuel to **come from** as it will always **go to** the Tank 1 Special.
Note: The Special Tank can be set as any tank.

For this type of setup, when programming the tanks set all tanks as (Fuel = 4)
In the Sub-Menu scroll down to SPECIAL FEATURE and press enter, follow the on screen instructions, for the example above Tank 1 would be chosen as the tank.

Electrical Specifications FC-8000

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.02 Amps
Data Retention	50 years (without power)

Electrical Specifications FT-100

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.024 Amps
Output Load	44 amps @ 12 Volts
Relay 1& 2	3 amps Inductive
Data Retention	50 years (without power)

Electrical Specifications DC-P100

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.024 Amps
Output Load	44 amps @ 12 Volts DC
Data Retention	50 years (without power)

Electrical Specifications AC-P200

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.024 Amps
Output Load	30 amps @ 230 Volts AC
Relay 1& 2	3 amps Inductive
Data Retention	50 years (without power)

Network Cable

The cable connecting the Display Unit to the Input/Output Units is referred to as the network cable and may run up to 1000 meters in total length.

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