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The World's most advanced Marine Monitoring and Control Technologies.

TC8000 Tank Monitor/Controller

INSTALLATION MANUAL | doc 002

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CONTENTS:

INTRODUCTION

Thank you for purchasing the TC-8000 Holding Tank Controller. Smartswitch Technologies are proud of the quality and innovation that goes into all of our industry leading products.

Our Research and Development team has spent considerable time and effort designing a quality range of monitors and controllers that allow our customers to monitor and control the fluid levels of up to eight tanks - *accurately, reliably and **simply***.

It's simple because Smartswitch have developed **IDD™** or Intelligent Descriptive Display.
IDD™ is our industry leading technology that allows you to program each monitor with the tank's name and/or description eg. 'PRIMARY FUEL' 'FRESH WATER' or 'GREY WATER', instead of the numeric description, 'TANK 1' 'TANK 2' etc that other manufacturers are limited to.

It's this kind of thinking that makes Smartswitch the provider of the Worlds most advanced Marine Monitoring and Control Technologies.

Smartswitch recommends installation of this product be carried out by a suitably qualified Marine or Auto-Electrician. This document contains information and tips to ensure accuracy and safety in the operation of your vessels equipment. For further information or queries please contact your Smartswitch distributor or visit **www.smartswitch.co.nz**

8 Channel Tank Controller

TC 8000

Actual Size = 126 x 116 x 21mm

Monitor and Control up to 8 tanks from one location.

☐ **The TC-8000 Controller** provides an intelligent networked solution for the monitoring and control of up to eight tanks. The diagram (right) shows a typical system layout. The system consists of the TC-8000 display controller (as seen above) up to eight HT-100 or HT-100/P tank controllers and any number of optional RD-800 repeater displays communicating via a 2-wire network cable with a maximum cable length of 1000 meters.

☐ **TC- 8000 DISPLAY CONTROLLER:** Is a powerful tank monitor and control system.

- Full control from one central location on your boat.
- Visual indication of tank level, seacock position & pump status.
- Turn holding tank macerator pump on/off manually or automatically.
- Turn water maker on/off manually or automatically.
- Visual & audible tank full and fault alarms.
- Three modes of operation: manual, auto grey or auto all.
- Mode change is key switch selectable.
- Displays in Litres or Gallons and Percentage.
- Three display modes available. (see page 14).
- All tanks are name programmable giving tank location and type, e.g. Aft Port, Grey Tank.

☐ **HT-100 or HT-100/P:** Is a controller which managers the tank pump, the electric seacock, tank high output and provides an input for the fluid level sensor.

- Teach-in for level sensor with four point interpolation for irregular shaped tanks.
- Controls the pump, the electric seacock (if fitted) and provides the input for the level sensor.
- Reversed output for tanks programmed as either fresh water or fuel, enabling water maker or fuel transfer pumps to turn on when empty and off when full.
- Tank high level output which can be connected to the Aus/Sea toilet controller which disables the toilet when the holding tank is full.
- Interface to electric seacock, or standard seacock interlock switch.
- Internal pump on/off override switch for tank servicing and cleaning.

- HT-100/P features level sensor, tank high output, pump & electric seacock control .
- HT-100 features level sensor and tank high output.

☐ **RD-800:** Repeater Display (optional extra). Connect any number of these to allow convenient tank monitoring from anywhere on the vessel.

Supply Voltage: 12 ~ 32 Volts DC (Auto sensing) | Quiescent Current: 5 Milliamps (without backlight)
Backlight | Reverse polarity protected | Network cable length=1000m | Voltage & EMI Protected
Data Retention: 50 years (without power)

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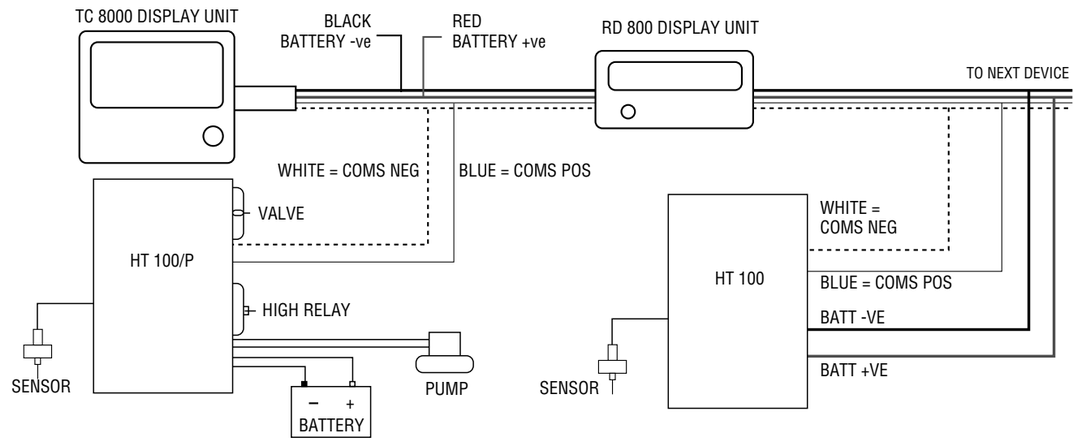
Wiring Block Diagram

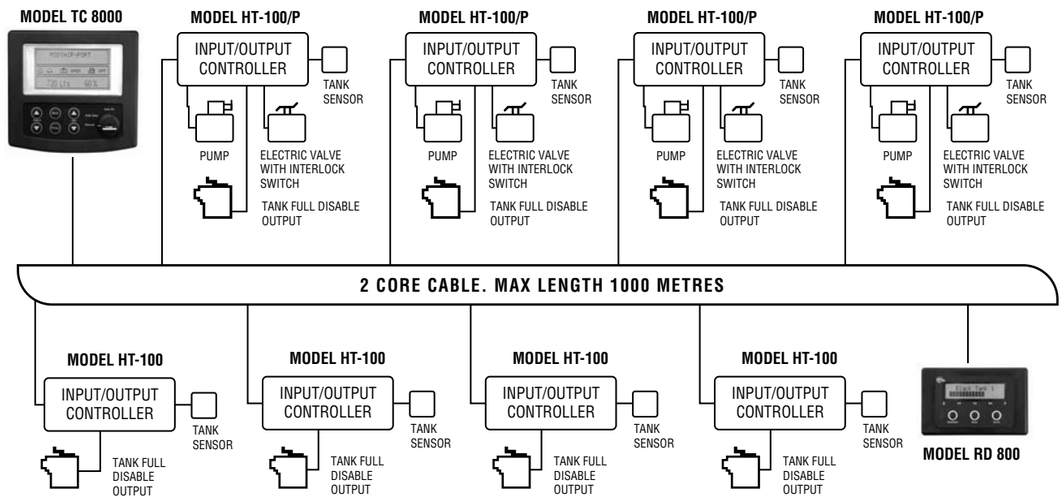
BLACK (BATTERY -ve)
RED (BATTERY +ve)
BLUE
WHITE



NOTE: As the HT-100/P supplies power for the pump, the supply cables and fuse need to be rated as per the pump manufacturers specifications.

TC 8000 System Layout

EIGHT CHANNEL HOLDING TANK CONTROLLER SYSTEM LAYOUT FOR MODEL TC-8000: Any device can sit anywhere on this two core Bus cable. Any combination of HT-100/P and or HT-100 (up to eight) can be connected plus, any number of repeater displays (model RD-800). **NOTE:** The HT-100/P has the pump and valve option while the HT-100 does not.



Installation Steps

Step 1: Install and connect the display unit .

Step 2: Install and connect the tank sensors.

Step 3: Install and connect the I/O units (HT-100 or HT-100/P) units.

Step 4: Calibrate Tanks

Step 5: Setup rotary switches.

Step 6: Connect Aquavalve or Seacock Interlock Switch or Jumper

Step 7: Setup pump sensing.

Step 8: Program the display unit.

Step 9: Test system

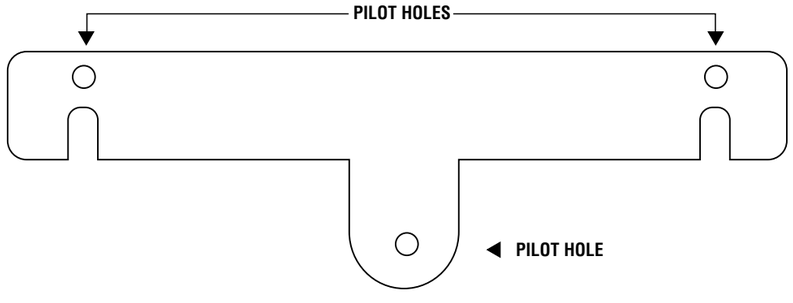
Mounting the TC 8000 Display Unit

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 tool (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.



Installation Sensor

NOTE: For sensor Model SEN-100 **THE MAXIMUM TANK HEIGHT IS 1 METRE**
NOTE: For sensor Model SEN-250 **THE MAXIMUM TANK HEIGHT IS 2.5 METRES**
The maximum surge and safe pressure is 28psi.

For more information see “Calibration Tips & Tricks” enclosed or on our web site **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.**

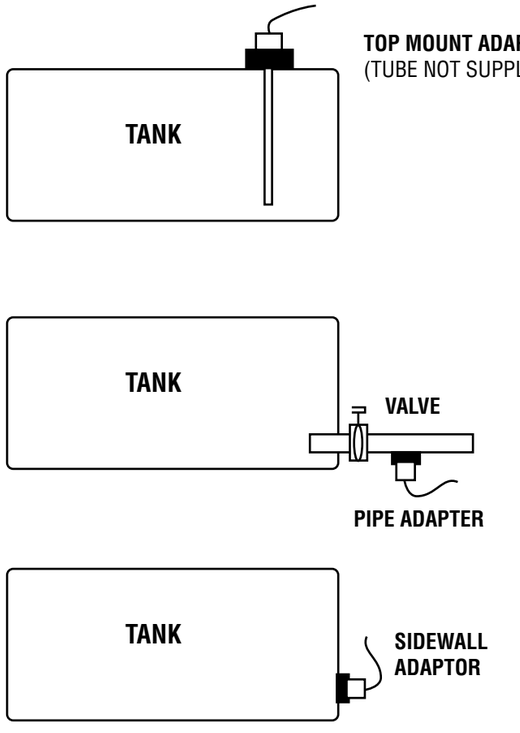
Should a 4 to 20 milliamp loop sensor supplied by another manufacturer be used, then the adaptor (part number SM-420) will need to be installed.

Sensor Installation:

The sensor should be mounted as low in the sidewall as possible using a 3/4” 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 1/2” 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 allow debris to collect making it difficult to flush out the tank later.



The top-mounting adaptor requires 3/4" ABS or PVC pipe cut to the proper length so that the pipe is about 1/2" from the bottom of the tank. This pipe glues into the adaptor and the sensor screws into the top of the adaptor. It is held on with 2 self-tapping screws.

Care must be taken that the sensor threads are sealed with Teflon tape and screwed in tight to ensure no air leaks, as the tube must remain pressurized.

The sensor will be damaged if subject to over pressure during installation, caused by compressing the small air gap between the sensor and the ball valve.
DO NOT PRESSURE TEST TANK WITH SENSOR FITTED

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

☐ **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.

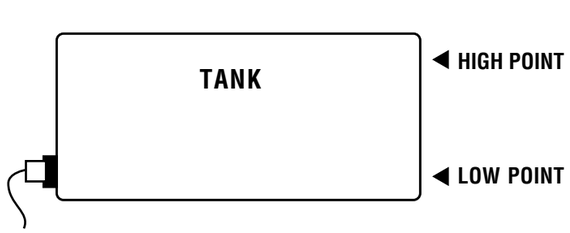
Method 1:

☐ **Turn Rotary switch to position 0**

Fill the tank to the required TANK LOW LEVEL; minimum suggested is liquid just covering the sensor. 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.

☐ **Turn Rotary switch to correct position (See Setting Rotary Switch Page 9)**



Note: The 'Low Point', 'High Point T' and setting 'one system from another' only applies to HT-100 or HT-100P units with manufacture dates after March 2007.

☐ **The 'Low Point Only' setting can be done by turning the rotary switch to position A**

Fill the tank to the required TANK LOW LEVEL minimum suggested is liquid just covering the sensor, 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.
Turn Rotary switch to correct position (see Setting Rotary Switch page 9)

☐ **The 'High Point 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.

☐ **Turn Rotary switch to correct position (see Setting Rotary Switch page 9)**

Sensor Programming
Instructions

Method 2

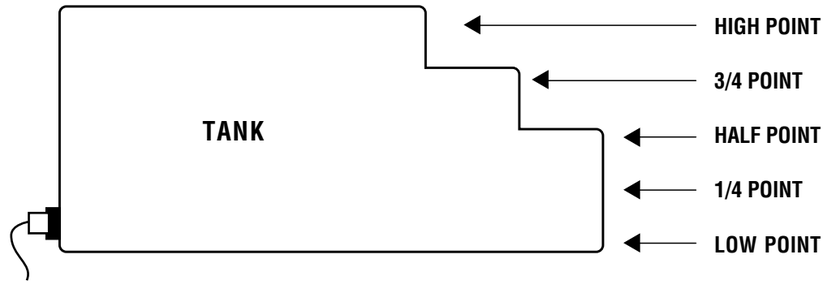
☐ **Turn Rotary switch to position F**

Fill the tank to the required TANK LOW LEVEL, minimum suggested is liquid just covering the sensor. 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. **Turn Rotary switch to correct position (See Setting Rotary Switch Page 9)**



☐ **Setting One System From Another**

Once one HT-100 or HT-100/P 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). The HT-100 can transmit or receive from or to HT-100/P and vice versa.

Note: This must be done independently from the complete system setup (only the two units connected) Connect the power and network cable to both units:

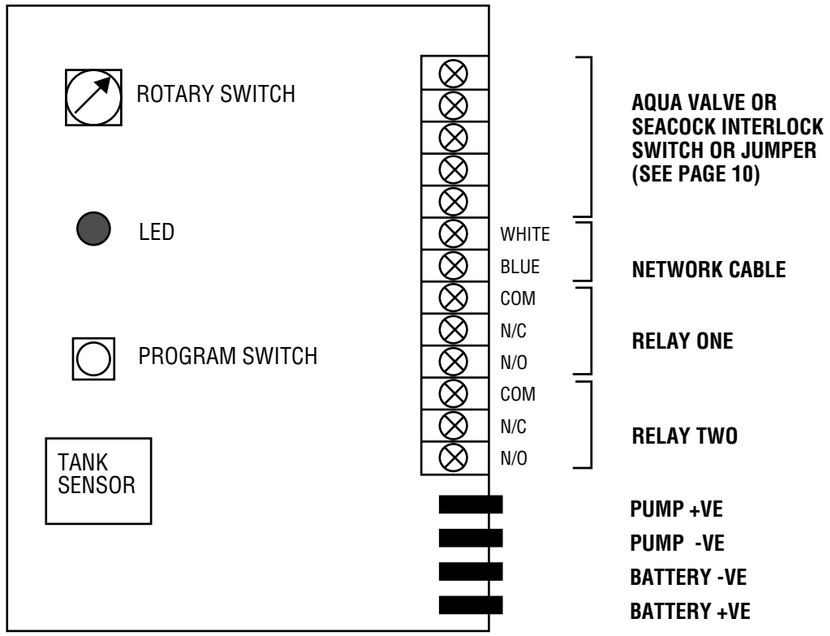
☐ **Step 1:** Turn the rotary switch to position C for the master transmitter (the unit that is calibrated).

☐ **Step 2:** Turn the rotary switch to position D for the slave receiver (the unit that needs calibrating).

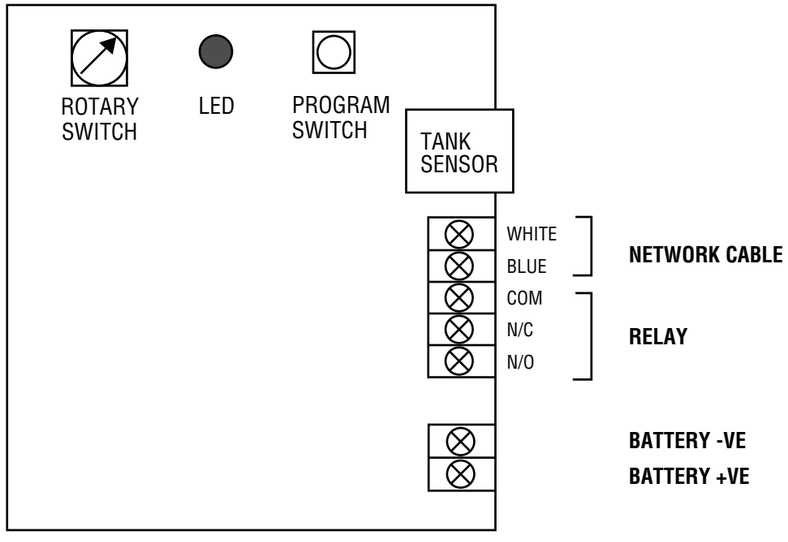
You will see both LED'S flashing, please wait (approx 20 seconds) for the LED's to stop flashing, the slave receiver now has the same calibration setting as the master transmitter.

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

Wiring Diagram
for HT-100/P



Wiring Diagram
for HT-100



Setting Rotary Switch
(Network Address)

☐ **Each Input/Output Unit: HT-100/P or HT-100 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.**

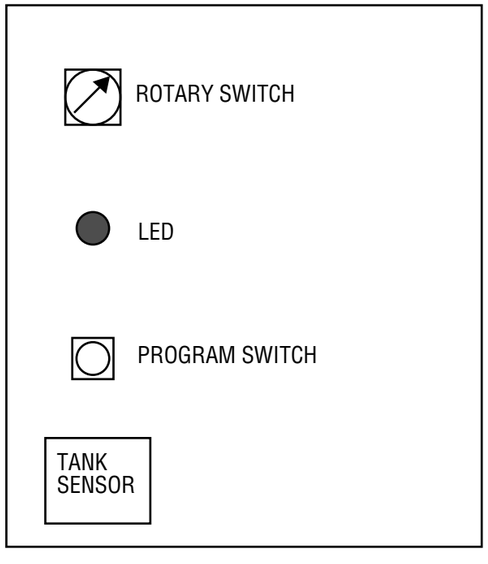
This Rotary Switch is situated inside the box of the Input/Output Unit (see below for position).

For ease of reference please use the chart provided as this will enable quick reference when programming the Display Unit. See example below.

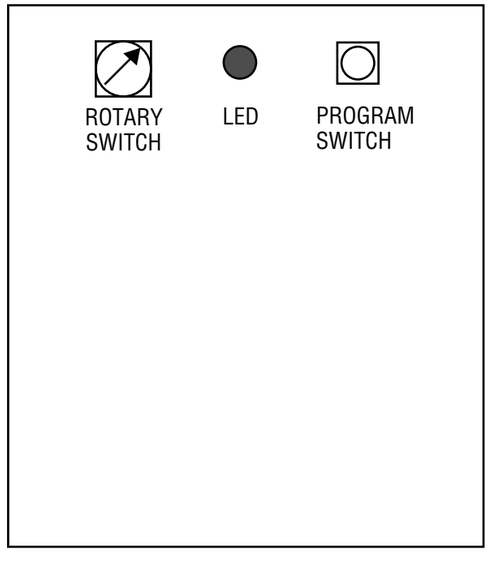
TABLE 1 (Example)

SWITCH No.	TANK POSITION	TANK TYPE	TANK VOL
2	AFTPORT	GREY	400L

HT-100/P



HT-100



Aquavalve™ or Seacock Interlock
Switch Installation

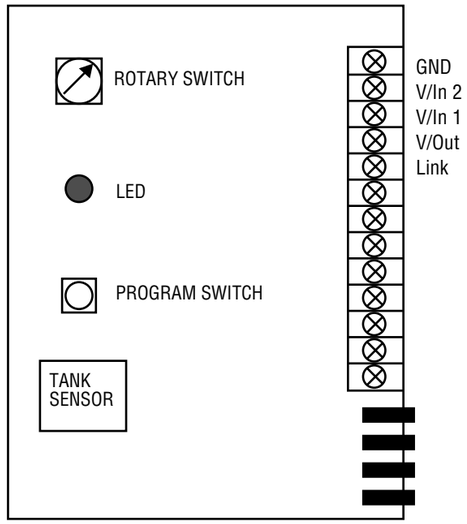
☐ **If NO Interlock switch or Aquavalve is fitted: Place a link wire between the Link & V/In 1 terminals.**

If an interlock switch is fitted then wire as follows. When the seacock valve is in the open position then connect N/C side of switch to V/In 1 and N/O side of switch to V/In 2. Connect the switch common to the Link terminal.

The Aquavalve is a electric diverting valve and if fitted connect as follows:

Aquavalve pin 2 (Red) to V/In 1
Aquavalve pin 3 (Orange) to V/In 2
Aquavalve pin 4 (Black) to V/Out
Aquavalve pin 6 (Blue, Green & Yellow) to GND

☐ **If NO Interlock switch is fitted: Place a link wire between the Link & V/In 1 terminals.**
If an interlock switch is fitted then wire as above. When the seacock **valve** is in the open position the **switch** needs to be in the closed position.



Pump Current Setting

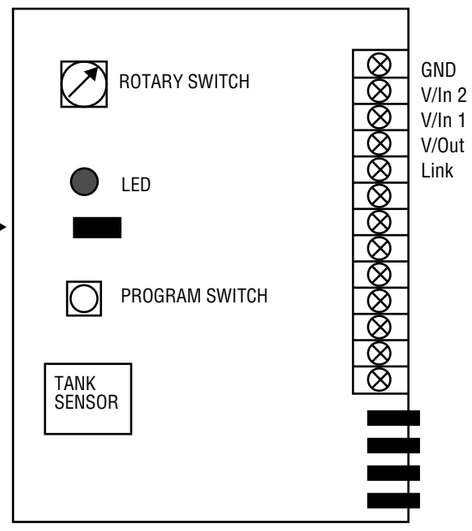
☐ **The HT-100/P is equipped with special current sensing circuitry to detect if, after a pump is turned on, it is in fact running.**

If the pump is turned on either Manually or Automatically and the pump fails to start due to short or open circuit, the pump icon for that tank will flash and the alarm will sound indicating a fault. Pushing the mute button will mute the alarm.

If the attached load/pump is below the current sensing range, or the output is connected to a relay, then this feature will need to be disabled.

This option can be enabled or disabled by the position of the Current Sensing Control Jumper.

To **Enable** this feature Remove the Jumpers
To **Disable** this feature Insert the Jumpers



Programming
Instructions

☐ **Step 1: Placing the unit in Program Mode**
Press and hold down the Mute & Select Up keys together for three seconds. This will place the unit in program mode.

☐ **Step 2: Selecting the tank to program**
Once the unit is in program mode the display will show "Select Switch ♦ " use the Select Up or Down keys to change the switch number which corresponds to the I/O unit being programmed (refer to table 1 on page 9) for switch number. Once the switch number has been selected push the "Mute" key.

☐ **Step 3: Program or Erase**
The display will now show "Prog ▲" "Erase▼" use the Select Up key to program or the Select Down key to erase. If Select Up is pushed go to step 4 if Select Down is pushed.
(see Erase Tanks Step 9).

☐ **Step 4: Selecting Tank Name (Position)**
The display will now show "Select Position ♦" use the Select Up or Down key to scroll through the pre-programmed tank positions. Once you have found the one required, push the Mute key.

☐ **Step 4a: Changing Tank Name Text**
The tank name text may be changed. After selecting position (name) as above follow the on screen instructions.

☐ **Step 5: Selecting Tank Type**
Note: Selecting tank type ONLY sets the way the Alarm, Relay 1, Pump and Relay 2 behave. Select the tank type that best suits the options you require. See Operating Instructions page 12.

The display will now show "Select Tank Type ♦ " use the Select Up or Down key to scroll to the number that corresponds to the tank type (as per screen). Push the Mute key to enter.

If the tank type is **Grey or Black** the display will now show "Set Hi Point 8" use the Select Up or Down key to scroll through the tank levels 8 to 16. (8 = Half 16 = Full). Once you have selected the level push the Mute key. This sets the alarm and relay 1 trigger point.

If the tank type is **Fuel** the display will now show "Set Low Point 0" use the Select Up or Down key to scroll through the levels 0 to 8. (0 = Empty 8 = Half) (1 = one bar from empty, 2 = two bars from empty etc.) Once you have selected the level push the Mute key. This sets the alarm and relay1 trigger point.

If the tank type is **Fresh** the display will now show "Set Low Point 0" use the Select Up or Down key to scroll through the levels 0 to 8. (0 = Empty 8 = Half) (1 = one bar from empty, 2 = two bars from empty etc.) Once you have selected the level push the Mute key. This sets the alarm trigger point. Relay1 will turn ON when the tank is Full and OFF two bars less than Full.

☐ **Step 6: Audible Alarm**
The screen will now display 'Do you want an audible alarm'. If YES is selected the audible alarm will sound based on the trigger points as above.

☐ **Step 7: Tank Volume** (see Note 1 page 14)
The screen will now display "Do you want to set Tank Volume". This allows for displaying the tank volume in either Litres or Gallons. If this feature is required answer yes. Next select 'Lts' for Litres or 'Gal' for Gallons.

The display will now show "Set Volume 00000". Use the select up and down keys to scroll and the mute key to enter and move to the next digit. When the last digit is reached and the mute button is pushed you will go to step 8.

Programming Instructions Continued...

☐ **Step 8: Next or End**

The display will now show "Next ▲ End ▼ " use the Select Up key to program the next I/O unit or push the Select Down key to exit from program mode.

☐ **Step 9: Erase Tanks:**

The display will now show "ARE U SURE Y N" use the Select Up key for NO or the Select Down button for YES. If NO is selected the unit will return back to Step 2 if YES is selected the Tank Position and Type will be erased for that switch position and the unit will return back to Step 5.

Operating Instructions

☐ **Keyboard:**

The Select Up and Down allows for scrolling between tanks.
The Mute button mutes the alarm.
The Pump button turns the pump on and off (see details below).
Dim Up and Down adjusts the display contrast.

☐ **The Grey and Black tanks have three modes of operation:**
Key Switch = Manual Mode:

When any tank programmed as either Grey or Black reaches the programmed high-level point relay 1 will activate. If the alarm is **ON** the alarm will activate and show a flashing bell beside the tank icon. Push the Mute button to mute the alarm. If the alarm is **OFF** it will only show a flashing bell beside the tank icon. Simply push the Select Up or Down button to scroll through the tanks looking for the full one (the bar graph at the bottom will show the full tank).

The alarm and relay 1will turn will turn **ON** when the tank reaches the programmed high-level point and **OFF** when the tank has been emptied by two bars. This output could be used (for example) to disable the toilet controller. Pushing the Mute button will mute the alarm.

☐ **To operate the pump manually**, scroll to the tank requiring pumping. If the tank is a Grey Tank, turn the Key Switch to Auto Grey if the tank is a Black Tank, turn the Key Switch to Auto All and push the Pump button. The pump will turn **ON**, and will turn **OFF** automatically when the tank reaches empty or it can be turned off at any time by pushing the Pump button again or switching the key back to Manual.

☐ **Key Switch = Auto Grey Mode:**

Depending on your I/O box, in auto grey mode any tank programmed as a **Grey** tank, once full, will automatically do the following:

HT-100/P: The pump and relay 2 will turn **ON,** and turn **OFF** automatically when the tank is empty.

HT-100: The alarm and relay 1 will turn will turn **ON** when the tank reaches the programmed high-level point and **OFF** when the tank has been emptied by two bars. Pushing the Mute key will mute the alarm. If the tank is **empty** the pump will stay activated while the pump button is pushed and held.

☐ **Key Switch = Auto All Mode:**

Depending on your I/O box, in Auto All mode any tank programmed as either a **Black or Grey** tank, once full, will automatically do the following:

HT-100/P: The Pump and relay 2 will turn **ON,** and turn **OFF** automatically when the tank is empty.
HT-100: The alarm and relay 1 will turn **ON** when the tank reaches the programmed high-level point and **OFF** when the tank has been emptied by two bars. Pushing the Mute button will mute the alarm. If the tank is **empty** the Pump will stay activated while the Pump button is pushed and held.

Operating Instructions Continued

☐ **Fresh tanks have two modes of operation**
Manual Mode:

On the HT-100 and HT-100/P, the alarm will automatically turn **ON** when the tank reaches the programmed low-level value and **OFF** when the tank has been filled by three bars. The pump and relay 2 can also be stopped and started at any time with the Pump button. Relay 1 will turn **ON** when the tank is full and **OFF** two bars from full.

☐ **Auto Mode:** (HT-100/P only)

HT-100/P: Pump output and relay 2 will automatically turn **ON** when the tank reaches the programmed low-level value. The pump output and relay 2 will turn **OFF** when the tank is full. The pump and relay 2 can also be stopped and started at any time with the Pump button. Relay 1 will turn **ON** when the tank is full and **OFF** two bars from full. The alarm will turn **ON** if the tank reaches 2 bars less than the programmed low-level value and **OFF** when the tank has been filled by three bars.

☐ **Changing between Auto and Manual Mode** (Fresh tanks)**:**

While holding down the pump key, push the mute key this will change modes. The mode will be displayed in the right corner of the second line and will be either Auto or Man.

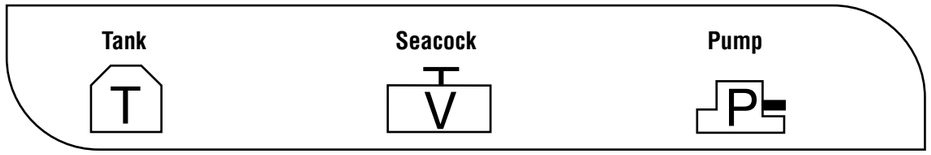
☐ **Fuel or Day Fuel tanks have one mode of operation (automatic)**

Note: Fuel and day fuel tanks are permanently in auto mode.

HT-100: The alarm and relay 1 will turn **ON** when the tank reaches the programmed low-level value and will turn **OFF** when the tank has been filled by three bars.

HT-100/P: Pump output and relay 2 will automatically turn **ON** when the tank reaches the programmed low-level value. The pump output and relay 2 will turn **OFF** when the tank is full. The pump and relay 2 can also be stopped and started at any time with the Pump button. The alarm and relay 1 will turn **ON** if the tank reaches 2 bars less than the programmed low-level value and **OFF** when the tank has been filled by three bars.

☐ **Alarms:**



If any one of these features are in alarm the alarm bell will **be flashing**, if another tank is being displayed other than the one in alarm the bell will **not be flashing.**

Tank= either full or empty (depending on type step 5 page 11)
Seacock = Seacock open or link not connected (see page 10)
Pump = Pump failure (see page 10)

Pushing the Mute button will mute the alarm.

☐ **Turning Tank Alarm Off:**

Push and hold the Mute button for 4 seconds (the buzzer will bleep every second). If the alarm is **ON** the small bell at the bottom right corner will be displayed, if **OFF** the bell will disappear.

Tank Alarm Functions

- If the alarm is **ON** and (Grey or Black reached the programmed high level) **or** (Fresh or Fuel has reached the programmed low level) then the alarm will sound. Push the Mute key to mute the alarm. The bell icon will stay flashing until (Grey or Black) the tank level is three bars less than fill **or** (Fresh or Fuel) the tank level is three bars higher than the programmed low level).

  If the alarm is **OFF** and (Grey or Black reached the programmed high level) **or** (Fresh or Fuel has reached the programmed low level) only the bell icon will flash. The bell icon will stay flashing until (Grey or Black) the tank level is three bars less the programmed high level **or** (Fresh or Fuel) the tank level is three bars higher than the programmed low level).

- **Changing tank display modes: -** The system has three display modes.
  Mode 1: Displays tank name and a bar graph at the bottom of the screen.
  Mode 2: Displays all tanks on one screen.
  Mode 3: Displays tank name, percentage and Lts or Gals at the bottom of the screen.

  Note 1: The Lts/Gal & Percentage will ONLY work with HT-100/P & HT-100 with a manufacture date from 1st July 2007.

  Push and hold the Mute key, now push the Select Down key. This will change to mode 2. Repeating this will change back to mode 1. **Note:** The number at the bottom of each bar graph corresponds to the tank number displayed in the multi display screen just above the " E " symbol.

  Push and hold the Mute key, now push the Dim Down key. This will change to mode 3. Repeating this will change back to mode 1.

Display Mode **1.**

Display Mode **2.**

Display Mode **3.**

- **Errors:**
  Should a programmed tank either loose 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.

  If the TC-8000 Head Unit can not find any, either HT-100 or HT-100/P units due to a comms cable fault the system will keep rebooting itself until the problem is rectified.

Electrical Specifications TC-8000

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

Electrical Specifications RD-800

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.03 Amps
Data Retention	50 years (without power)

Electrical Specifications HT-100/P

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.024 Amps
Pump Output Load	88 amps @ 12 Volts
Relay 1& 2	3 amps Inductive
Data Retention	50 years (without power)

Electrical Specifications HT-100

Supply Voltage	12 to 32 Volts DC (Auto-sensing)
Quiescent Current	0.024 Amps
Relay 1	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.